2010–2012

ACADEMIA SINICA



2010–2012

ACADEMIA SINICA

A Message from the President

Academia Sinica, established in 1928, has flourished to become the most eminent research institution in Taiwan. From its inception, Academia Sinica has been committed to the unimpeded quest for knowledge and the pursuit of academic excellence. Today, Academia Sinica has expanded from its initial 5 research institutes to encompass 24 research institutes and preparatory offices and 7 research centers. Over the past years, dedicated researchers across the disciplines have made outstanding contributions to their fields of study, leading to path-breaking research discoveries, new knowledge paradigms, and innovative applications of newly acquired knowledge.

As the most prominent academic research institution in Taiwan, Academia Sinica has the mission to conduct cutting-edge research in the humanities and sciences, nurture academic talents, and issue policy advisories. Academia Sinica has been working wholeheartedly to formulate new approaches for academic research, assess research organization and reforms, facilitate academic cooperation and liaison between domestic and overseas institutes, as well as pursue projects to foster academic excellence.

In the past decade, researchers of Academia Sinica have demonstrated exceptional research capabilities. The number of papers published has steadily increased. According to the Institute for Scientific Information (ISI) of the US, 11 research fields of Academia Sinica rank in the top 1% of the world's research institutes for the number of times papers have been cited. The publications are remarkable both in terms of quality and quantity.

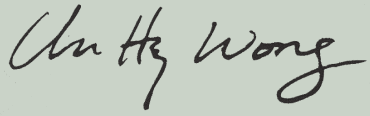
In order to promote closer international academic exchange, Academia Sinica held the Academy Presidents' Forum in 2008, inviting leaders of major scientific academies worldwide to combine their efforts to create a better future for humanity. Some of the key issues addressed at this forum were the restructuring of modern scientific academies to drive knowledge-based development and the role of science and technology in assuring sustainable development. In 2009, Academia Sinica held the International Forum on Technology Innovation and Social Responsibility. Internationally renowned scholars and entrepreneurs were invited to propose new directions for the role of scientific research and technological innovation in resolving

pressing ecological and economic challenges. Numerous other international conferences and lectures including the "Academia Sinica Lecture" given by two Nobel Prize laureates Dr. Roger Y. Tsien and Dr. Roger D. Kornberg were also held. In the past decades, Academia Sinica has advanced to the forefront of research in many areas of the humanities and the sciences, and has attracted many international collaborations and joint international conferences.

Creating an ideal climate for research and fostering young research talent has also been one of the primary goals of Academia Sinica. Over the past years, Academia Sinica has cooperated with research universities in Taiwan to establish Ph.D. programs in cutting-edge research fields, culminating in the establishment of the Taiwan International Graduate Program (TIGP) in 2002. Many Ph.D. dissertations published in leading international journals have received broad acclaim. Most graduates continue to pursue research at internationally renowned research institutions and biotechnology companies. Some join companies in other areas of industry. Regardless of which direction they embark upon, the vast majority of TIGP graduates show excellent performance in their chosen fields.

Academia Sinica is committed to making important contributions to society through its research achievements. By assuring the protection of intellectual property rights, encouraging patent applications, increasing technology transfer, and holding joint conferences on research achievements with other domestic research institutions, Academia Sinica hopes to strengthen the cooperation between research and industry and assist the government in developing emerging industries. Academia Sinica researchers also have the responsibility to guide policy direction and formulate social issues. To accomplish these tasks, Academicians as well as domestic and foreign scholars are commissioned to form teams to carry out research on the most important academic-related development issues and subjects of concern to society. Suitable policy advisories are then submitted to the government for reference. A number of policy advisories have been issued in recent years, including "Energy Strategies in Response to Global Warming," "Analysis of Academic Competitiveness of Academia Sinica and Prospective Planning for Scientific and Technological Developments in Taiwan," and "Recommendations for Health Care Policies." Other policy advisories are currently underway including "Recommendations for Population Policies," "Environmental Change and Land Use Planning Proposals," "Recommendations for Laws for Differentiating Professors and Researchers from Civil Servants," and "Coping Strategies for Emerging Infectious Diseases."

In the future, Academia Sinica will continue to make every effort to build a superior research environment and raise the quality of academic research in Taiwan. In addition to integrating the existing resources, Academia Sinica is also planning the establishment of the National Biotechnology Research Park including a biotech incubator and various other research centers for translational research. Using sustainable eco-green architecture, an excellent research environment will be created for the formation of a biotechnology platform. The spirit of innovation and dedication to excellence among our researchers will undoubtedly allow Academia Sinica to conduct further groundbreaking research in the upcoming years, making lasting contributions to developments in Taiwan and throughout the world.



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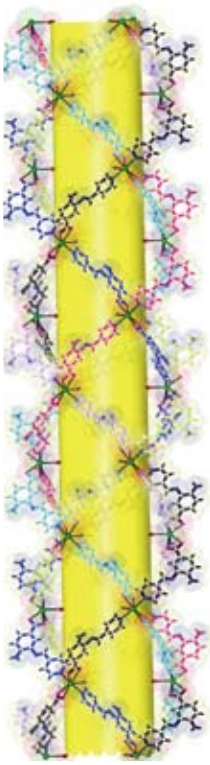


History and Mission

Academia Sinica, the most preeminent academic institution in the Republic of China, was founded in 1928 to promote and undertake scholarly research in the sciences and humanities. After the government moved to Taiwan in 1949, Academia Sinica was re-established on its current premises in Taipei. The growth of Academia Sinica during this transitional period was initially slow due to political instability and meager budgets.

Thanks to the strenuous efforts of the past presidents, especially former President Yuan-Tseh Lee, Academia Sinica overcame many difficulties to reach its present success. It is now a modern research institution with a worldwide reputation and a proud tradition. Under the leadership of current President Chi-Huey Wong, Academia Sinica is making further progress in improving research facilities and output. Many of the twenty-four research institutes and seven research centers are now headed by world-renowned scholars and staffed by highly trained, motivated, and creative young investigators. Major strides have also been made toward raising the standards of academic research, and Academia Sinica is presently positioning itself to move its research activities to the international level. Aside from placing greater emphasis on opening up new areas of intellectual endeavor, Academia Sinica is also taking a leading role in launching new initiatives in applied research to meet a broad spectrum of social needs in Taiwan.

In order to fulfill these goals, Academia Sinica has adopted various measures to promote the internal integration of research activities in the three research disciplines of mathematics and physical sciences, life sciences, and humanities and social sciences; to improve the planning, implementation, and evaluation of long-term projects in order to enhance the impact of the research activities; to harness basic research results for applications and technology transfer; to engage the entire academic and research community in Taiwan in a modern and forward-looking collective academic vision; to cultivate an intellectual environment that is conducive to the nurturing of young scholars and the recognition of outstanding scholarship in Taiwan; and to promote international cooperation and scholarly exchanges that will accelerate the overall development of academic research in Academia Sinica and the Republic of China.

Past Presidents

Yuan-Pei Tsai
（April 1928–March 1940）

Chia-Hua Chu
（Sept. 1940–Oct. 1957）

Shih Hu
（Dec. 1957–Feb. 1962）

Shih-Chieh Wang
（May 1962–April 1970）

Chi-Huey Wong
（Oct. 2006–Present）

Yuan-Tseh Lee
（Jan. 1994–Oct. 2006）

Ta-You Wu
（Oct. 1983–Jan. 1994）

Shih-liang Chien
（May 1970–Sept. 1983）

Organization

The current President of Academia Sinica is Dr. Chi-Huey Wong, and the Vice Presidents are Dr. Chao-Han Liu, Dr. Andrew H.-J. Wang, and Dr. Fan-Sen Wang.

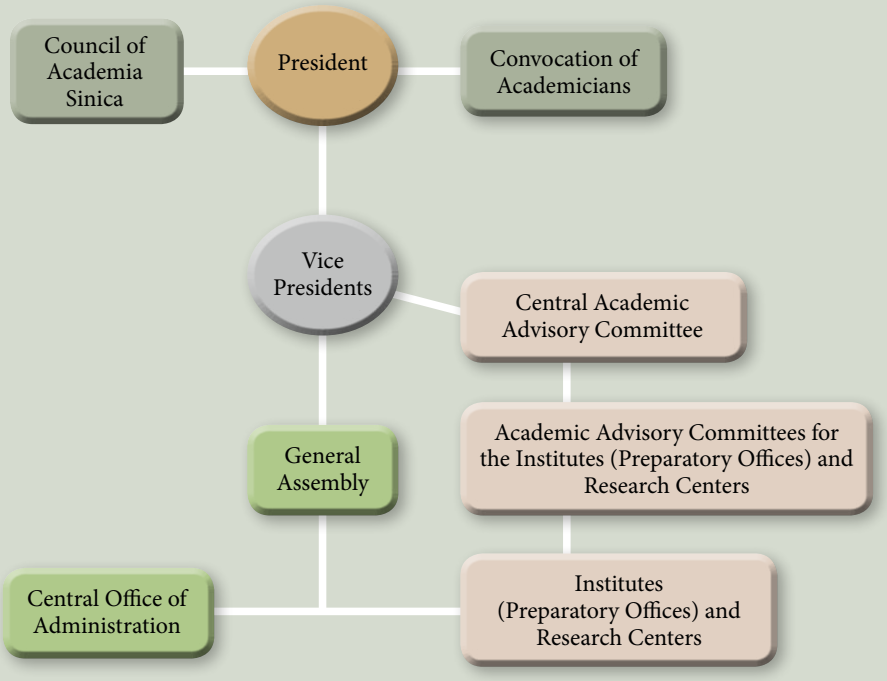
Convocation of Academicians

The Convocation of Academicians, consisting of all the academicians of Academia Sinica with the president serving as chairman, is held once every two years to elect new academicians with outstanding academic achievements.

As of January 2010, there are 241 academicians – 83 reside in Taiwan, 147 abroad, and 11 in mainland China. Academicians are grouped into three divisions according to their expertise: Mathematics and Physical Sciences (101), Life Sciences (81), and Humanities and Social Sciences (59).

The title of academician in Academia Sinica denotes an honorary position (with no remuneration). The duties of the academicians are as follows:

1. To elect academicians and honorary academicians.
2. To elect members to the Council of Academia Sinica.
3. To make policies on academic research.
4. To plan and carry out research at the government's request.



Council of Academia Sinica

The Council of Academia Sinica is a decision making body of 68 members, consisting of 32 ex officio members (the president, vice presidents, and directors of the institutes) and 36 members elected for three-year terms, as of January 2010. Of all the members, 24 members are from the Division of Mathematics and Physical Sciences, 21 members from the Division of Life Sciences, and 23 members from the Division of Humanities and Social Sciences. The council's functions are as follows:

1. To establish and review research policies.
2. To evaluate proposals concerning changes to the institutes and research projects.
3. To promote domestic and international academic cooperation.
4. To make plans for academic development when requested by the government.
5. To elect the candidates for the presidency of Academia Sinica when the presidency is vacated.
6. To formulate rules as authorized by the by-laws of Academia Sinica.

Central Academic Advisory Committee

The Central Academic Advisory Committee was set up on August 1, 1991. It is composed of the chairpersons of the advisory committees of individual institutes and six to nine distinguished scholars nominated by the president of Academia Sinica.

Dr. Andrew H.-J. Wang, Vice President of Academia Sinica, serves as the chairperson of the committee. The other two Vice Presidents, Dr. Chao-Han Lin and Dr. Fan-Sen Wang, serve as its vice chairpersons.

Dr. Ting-Kuo Lee of the Institute of Physics currently serves as the executive secretary of the committee, and is assisted by three vice executive secretaries – Dr. Y. Henry Sun of the Institute of Molecular Biology, Dr. Wan-Wen Chu of the Research Center for Humanities and Social Sciences, and Dr. Sue Lin-Chao of the Institute of Molecular Biology.

The committee fulfills its mission through:

1. Gathering the latest research information relevant to the academic development of Academia Sinica.
2. Undertaking in-depth review of research programs of institutes so as to promote research advancement at Academia Sinica.
3. Establishing standard academic review procedures, and assisting individual institutes with their recruitments, promotions, and reappointments of research fellows.
4. Promoting international academic cooperation and exchange.
5. Planning and implementing academic assignments as instructed by the president of Academia Sinica.

Institutes (Preparatory Offices) and Research Centers

At present, there are twenty-four institutes (including preparatory offices) and seven research centers in Academia Sinica under three divisions: The Division of Mathematics and Physical Sciences, Division of Life Sciences, and Division of Humanities and Social Sciences. Academia Sinica's annual budget is about NT$11.8 billion.

Division of Mathematics and Physical Sciences

1. Institute of Mathematics
2. Institute of Physics
3. Institute of Chemistry
4. Institute of Earth Sciences
5. Institute of Information Science
6. Institute of Statistical Science
7. Institute of Atomic and Molecular Sciences
8. Institute of Astronomy and Astrophysics
9. Research Center for Applied Sciences
10. Research Center for Environmental Changes
11. Research Center for Information Technology Innovation

Division of Life Sciences

1. Institute of Plant and Microbial Biology
2. Institute of Cellular and Organismic Biology
3. Institute of Biological Chemistry
4. Institute of Biomedical Sciences
5. Institute of Molecular Biology
6. Agricultural Biotechnology Research Center
7. Genomics Research Center
8. Biodiversity Research Center

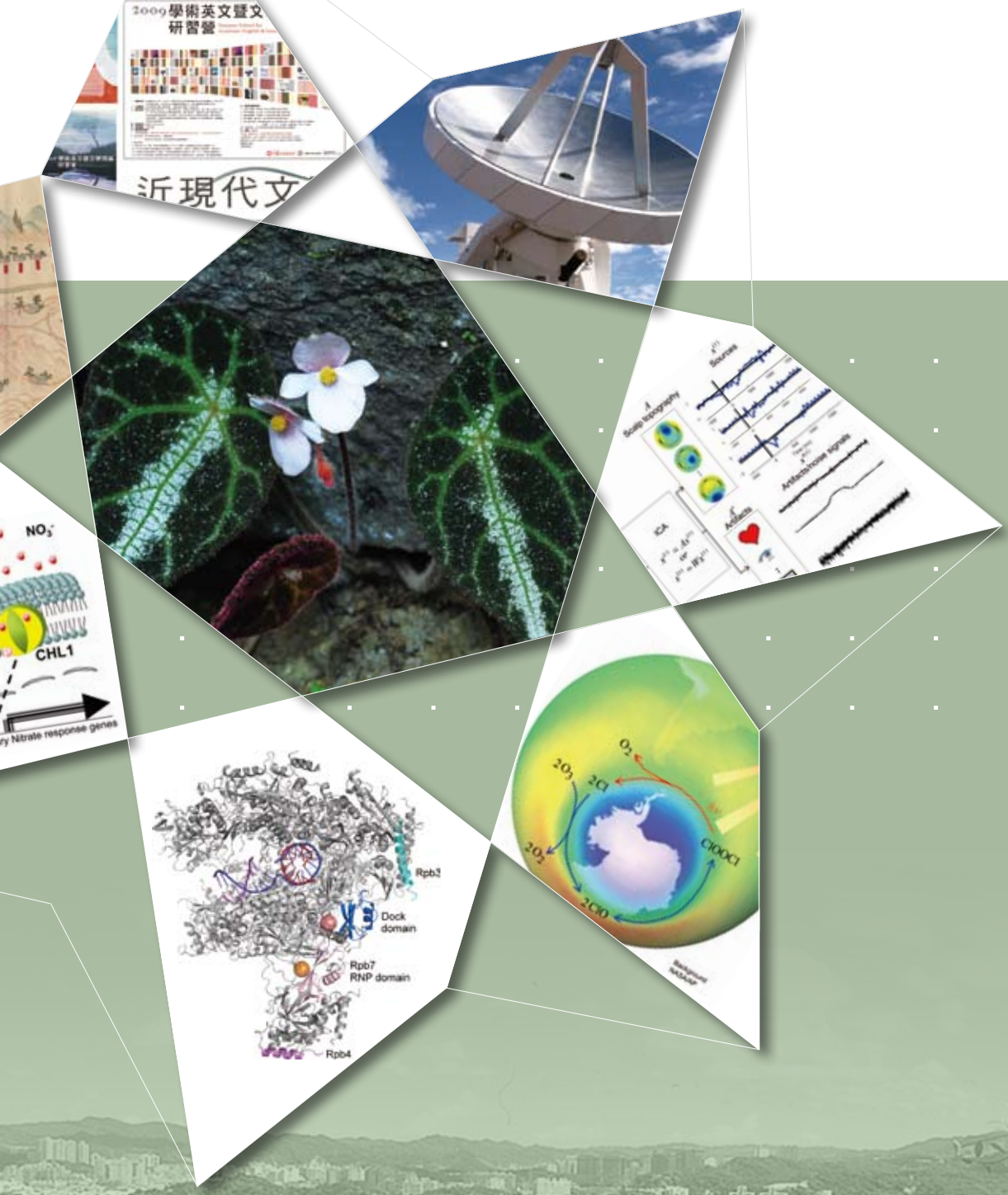
Division of Humanities and Social Sciences

1. Institute of History and Philology
2. Institute of Ethnology
3. Institute of Modern History
4. Institute of Economics
5. Institute of European and American Studies
6. Institute of Sociology
7. Institute of Chinese Literature and Philosophy
8. Institute of Taiwan History
9. Institute of Linguistics
10. Institute of Political Science (Preparatory Office)
11. Institutum Iurisprudentiae (Preparatory Office)
12. Research Center for Humanities and Social Sciences

Research Fellows and Research Specialists

As of December 2009, there are 961 research fellows and research specialists in Academia Sinica, including 68 distinguished research fellows, 318 research fellows, 222 associate research fellows, 182 assistant research fellows, 76 research assistants, 8 assistants, 13 research specialists, 22 associate research specialists, 50 assistant research specialists, and 2 research technicians.


CHL1
P
Primary Nitrate response genes



Institutes (Preparatory Offices), Research Centers, and Libraries

Institute of Mathematics

886-2-2368 5999 886-2-2368 9771 http://www.math.sinica.edu.tw

Foreword

The Institute of Mathematics was founded in 1947, though initial planning for its operation in China had already begun in 1941. It was eventually relocated to Taiwan in 1949. Despite the difficulties faced during its initial years, it managed to train talented young scholars and was the focal point of research for several areas of mathematics in Taiwan. The institute began major expansion the late '70s and early '80s as resources and funding increased. It currently has twenty-six research staff in a diverse range of fields including: Applied Mathematics and analysis, geometry and mathematical physics, combinatorial mathematics and applications, probability theory and applications, and number theory and algebra.

In recent years, the institute has actively promoted the coordination of mathematical research while also nurturing the next generation of mathematicians in Taiwan. These efforts include the provision of a number of postdoctoral and research assistant positions, six-week summer research projects for undergraduate students and offering a core curriculum for graduate study. In addition, the institute has invested its resources into sponsoring international conferences and hosting academic exchanges.

Research Projects

The Institute of Mathematics has 26 research staff specializing in the most important areas of mathematics. Recent research projects cover the following areas:

Applied Mathematics and Analysis: Non-linear partial differential equations, kinetic theory, geometric analysis, dynamical systems

Geometry and Mathematical physics: Complex geometry, knot theory, integrable systems

Combinatorial Mathematics and Applications: Graph theory, combinatorial model theory, finite group theory and applications

Computing Mathematics

Probability Theory and Applications: Stochastic analysis, financial mathematics

Number Theory and Algebra: Arithmetic geometry, diophantine problem, commutative algebra, representation theory

↑ *Mathmedia* and *Bulletin*, the official publications of the Institute of Mathematics.

Significant Research Achievements

Important research results from the past two years include:

1. Quantitative Analysis of the Boltzmann Equation

For the Boltzmann equation of kinetic theory, exact quantitative studies were conducted of the boundary layers. Of particular interest is the analysis of the rich bifurcation phenomena for the transonic condensation/bifurcation.

2. Heisenberg geometry and spherical CR manifolds

a. We deduced an ODE of p-area along the characteristic curves on a C1 surface in the Heisenberg group and used it to study the behavior of the singular set.

b. We proved the uniformability of spherical CR manifolds for either dimension $\geqq 7$ or dimension=5 with an integrability condition on the Green's function.

3. Connections between symmetry and super-symmetry

We proved that the general linear Lie algebras and the general linear Lie superalgebras share certain common important representation-theoretical invariants, called Kazhdan-Lusztig polynomials. Subsequently related results for infinite-dimensional Lie superalgebras were established.

↑ Poster for "2009 Workshop on Complex Geometry."

↑ Poster for "2009 Spring School & Workshop on Kinetic Theory."

↑ Poster for "2009 Fourth Trilateral Meeting on Analysis and Applications Australia-Italy-Taiwan."

Institute of Physics

886-2-2788 0058 886-2-2783 4187 http://www.phys.sinica.edu.tw/

Foreword

The Institute of Physics was founded in Shanghai in 1928 and was reestablished in Taiwan in 1962. The physics building was named the Ta-You Hall in 2000 to commemorate its first director, Dr. Ta-You Wu, who passed away on March 4th of that year. The logo for the Institute of Physics was created in 2003. The letters I.O.P display the additive primary colors blue, green, and red. Also shown are G, ε, h, k, the 4 fundamental constants which represent classical mechanics, electromagnetism, quantum mechanics, and statistical mechanics. At present, the Institute of Physics has 43 principle investigators. Currently the research activities cover three major areas: nanosciences, complex systems, and medium and high energy physics.

Research Projects

1. Theoretical and experimental nuclear physics
2. LHC (Large Hadron Collider) experiment in CERN
3. HEP World-wide LHC Computing Grid
4. CDF experiment in Fermi Lab
5. Neutrino physics
6. AMS experiment in the space shuttle
7. Particle phenomenology in B physics
8. Astro-particle physics and cosmology
9. Development of state-of-the-art research tools for nanoscience
10. Study on transport and thermoelectric properties in nanostructured materials
11. Manipulation and control of single atoms and single molecules
12. Theoretical modeling and simulations of nano-systems
13. Hydrodynamics and atmospheric physics
14. Physics of granular gas, granular flow and granular chain
15. Statistical and computational physics approach to complex systems
16. Biology-inspired physics
17. Macroporous 3D ordered structures for tissue engineering scaffolds
18. Single molecule studies of highly confined biological macromolecules
19. Dynamics of biological macromolecules and complex fluids

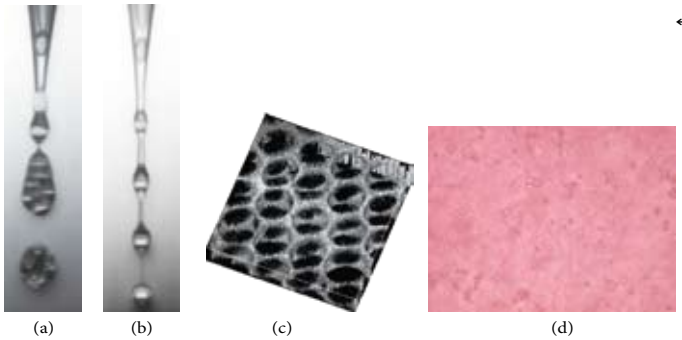
Long Term Research Areas

1. Nanoscience
2. Complex systems
3. Medium and high energy physics

Significant Research Achievements

In the past two years, the Institute of Physics has made important breakthroughs in several areas including:

1. Precision measurement of the neutrino anomalous magnetic moment—the world's best limit at the lowest threshold.
2. Explained the density perturbation in the inflationary universe.
3. Resolved the B-CP puzzles in QCD factorization.
4. Studied the mechanism of nonperturbative interactions between photon and quarks at few GeV.
5. The only Asia Tier-1 Centre in WLCG—ASGC is participating in the WLCG to build the biggest production Grid system in the world.
6. Observed that the energies of the empty quantum well states in Pb islands grown on Cu (111) surface are affected by the image potential.
7. Observed that the work function of the thin film can be precisely measured with high order Gundlach oscillation in scanning tunneling spectroscopy.
8. Development of high speed high resolution phase contrast X-ray microscopy and microradiology—achieved a world record resolution of 30nm with 8 keV photon.
9. Development of state-of-the-art nanoelectronic and nanofluidic devices—achieved sub-10nm features in size and channel height, respectively.
10. Studied novel physical properties of heavy fermion nanoparticles.
11. Fabricated nanoparticles, nanosphere lithography and inert gas condensation.
12. Development of the guiding algorithm for 3D x-ray diffraction microscopy of nanostructures—achieved a world record resolution of 17nm.
13. Development of the technique and setup for thermodynamic measurements for single nanowires.
14. Understood the mechanism of the stretching of DNA by the viscoelastic properties of the flow field.
15. Used replicators in a fine-grained environment to establish a theory of polymorphism.
16. By means of particle-based simulations, we obtained the phase diagram that separates the occurrence of marching, rotating and swamping state of flocking.
17. Chondrocytes were successfully cultured in the 3D ordered foam for more than a month.



(a) (b) (c) (d)

←We invented a simple, inexpensive and fast microfluidic method to fabricate three-dimensional ordered macroporous gel and use it as tissue engineering scaffolds. The microfluidic device consists of two concentric micropipettes where one is nested inside the other. Nitrogen gas and aqueous alginate solution with Pluronic F127 are pumped through the inner and the outer channel respectively. The bubble flow exhibits interesting dynamic patterns at different flow rates and gas pressures. Under appropriate conditions, bubbles of a uniform size are generated within the device at few thousand Hz. Monodispersed bubbles are collected and self-assembled into crystal structures as wet foam. The alginate solution between bubbles is cross-linked by divalent calcium ions and turns into 3D ordered macroporous gel where the pores are highly interconnected. Chondrocytes were successfully cultured in the 3D ordered foam for more than a month. (a) and (b), Flow patterns at different air pressures and liquid flow rates. (c) 3D confocal image of scaffold. (d) Chondrocytes cultured on the 3D scaffolds.

Institute of Chemistry

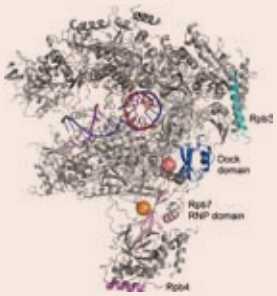
886-2-2782 1889 886-2-2783 1237 http://www.chem.sinica.edu.tw

Foreword

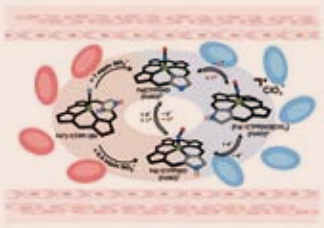
The Institute of Chemistry was established in 1928 in Shanghai, China. During the next two decades, despite difficulties encountered due to World War II, the institute managed to grow and contribute to chemistry research in China. In 1957, the Institute was reestablished in Nankang, Taiwan. The institute has expanded and evolved into a modern research center over the past 50 years. In the past decade, research efforts have focused on materials chemistry, chemical biology, and catalysis. Presently, the institute occupies 8000 m^2 and has 26 research laboratories and a total work force of 190, plus about 150 graduate students from various universities.

Research Projects

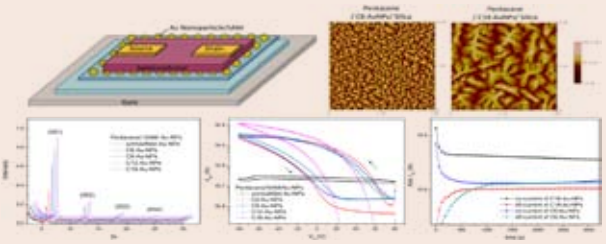
The Institute of Chemistry strives to play a major role in cutting-edge research in the 21st century. The current research areas cover important topics in chemistry with particular emphasis on materials chemistry and nanoscience/technology, chemical biology, and synthetic chemistry and catalysis. More specific topics include: Small molecule-biomacromolecule interactions, protein structure, biocatalysis, solar cells, OLED, OFET, surface chemistry, self-assembly, molecular electronics and machines, heterogeneous and homogeneous catalysis, organic catalysis and synthetic applications, etc.



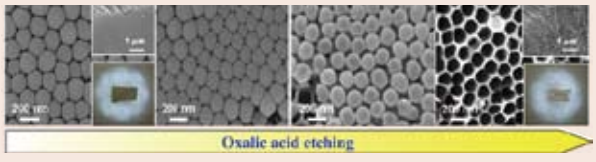
↑ The RNA exit channel on RNA polymerase II was located.



↑ Nitrite reduction reaction mechanism was established by N-confused porphyrin iron complex on nitrite reductase.



↑ Electrical bistability was observed in field-effect transistors based on pentacene embedding Au nanoparticles.

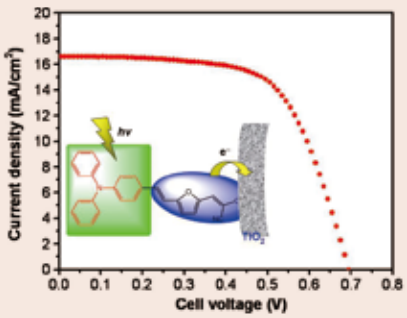


↑ A facile process involving flaking the anodic TiO_2-nanotube-array (TiNT) film off the Ti-metal substrate to obtain open-ended TiNT films.

Significant Research Achievements

In 2009, the institute published more than 110 research papers in more than 50 internationally renowned journals, including *Angew. Chem. Int. Ed., Pro. Natl. Acad. Sci. U. S. A., J. Am. Chem. Soc.,* etc.

1. Electrical bistability was observed in field-effect transistors based on pentacene embedding Au nanoparticles, with the memory window and retention ability depending on the size and the surface modification of the Au-NPs.
2. Non-metal containing organic dyes for high-performance dye-sensitized solar cells.
3. For the first time, high efficiency and brightness blue fluorescent Alq_3 derivatives were successfully developed in the application for organic light-emitting diodes.
4. Self-assembled luminescent organogels with tunable fluorescence and liquid crystalline properties.
5. Molecules with exceedingly small internal reorganization energies for charge transport can be realized with the design strategy of strong nonbonding character in frontier molecular orbitals.
6. Innovative development of self-assembled arrays of discrete single-walled metal–organic nanotubes.
7. A facile process involving flaking the anodic TiO_2-nanotube-array (TiNT) film off the Ti-metal substrate to obtain open-ended TiNT films that exhibit high energy conversion efficiency in both photoelectrocatalytic water splitting and dye-sensitized solar cells.
8. A new type of competitive human GST inhibitors has been developed; we report their discovery and synergetic effect upon chemotherapy drugs against breast cancer cells.
9. The RNA exit channel on RNA polymerase II was located by FRET analysis and the results are summarized by a model of RNA polymerase II.
10. Nitrite reduction on N-confused porphyrin iron complex provides supporting evidence for the reaction mechanism on nitrite reductase and establishes a new metalloporphyrin-based nitric oxide reaction cycle.



↑ Non-metal containing organic dyes for high-performance dye-sensitized solar cells.

Institute of Earth Sciences

886-2-2783 9910 886-2-2783 9871 http://www.earth.sinica.edu.tw

Foreword

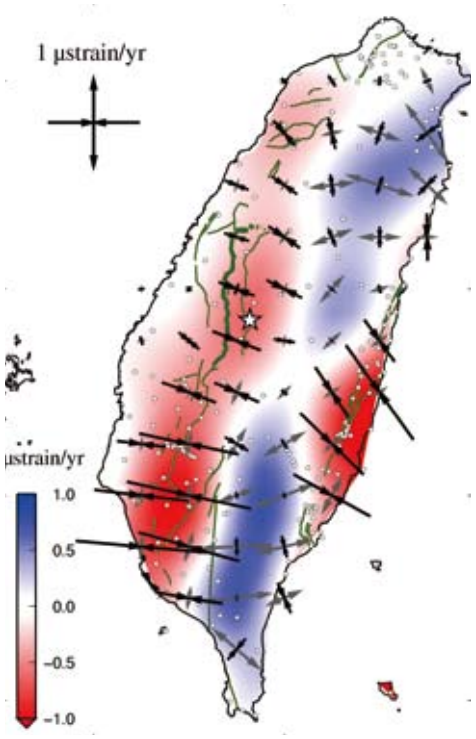
The principal mission of the Institute of Earth Sciences (IES) is two-fold: To promote fundamental research to enhance our knowledge of the earth and to apply the acquired knowledge to mitigation of loss by natural disasters and better management of natural resources. Taiwan is situated on a plate boundary, so it is tectonically highly active and prone to natural disasters. IES researchers are actively engaged in numerous relevant research programs.

Research Projects

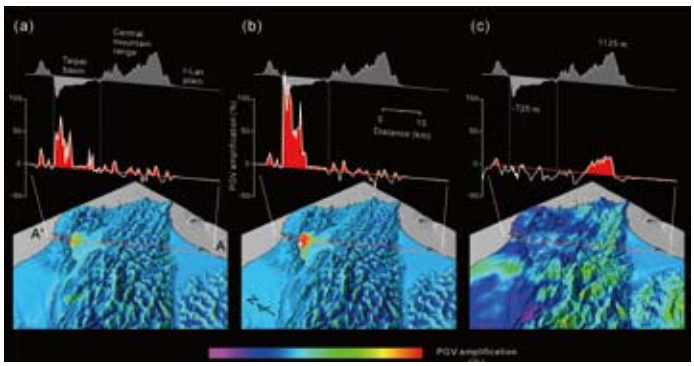
Study of the structure, dynamics and constitution of the earth's interior, phase transformation of minerals in high pressure conditions, origin of earthquakes, early history of the solar system, genesis and evolution of the continental crust, petrogenesis of magmatic rocks, paleo-environmental change in Asia, hydrology and neotectonics of Taiwan, etc.

Significant Research Achievements

Reconstruction of two-dimensional surface ground motions of the Chi-Chi earthquake. Documentation of the finite fault rupture sequences of the Chi-Chi mainshock and its large aftershocks. Study of co-, post- and inter-seismic slip distributions of the Chi-Chi earthquake. Proposition of a two-body dynamic model with viscous stresses to study earthquake rupture. Evaluation of the magnitudes of potential earthquakes rupturing along the Shangiao fault in the Taipei metropolitan area. Development of the algorithm for computing the sensitivity kernels of seismic waveform phase and amplitude anomalies to the earth's Q structure. Numerical modeling of three-dimensional wave propagation in the Taipei basin. Development of broadband ocean bottom seismometers. Seismic monitoring at the Tatun volcanic area. Discovery of the youngest volcanic eruption (~5.5 Ka) of the Tatun volcano. Derivation of a high spatial resolution structural and geomorphic map of the Hsincheng active fault region on the basis of field observations and LiDAR DEM analyses. Studying fault behaviors and seismotectonics in the longitudinal valley. Study of the characteristics of the summer and winter monsoon system in Taiwan and its vicinity and their impact on the paleo-climate and paleo-environmental changes in Taiwan. Established a very comprehensive database on fallout radionuclides in modern marine sediments around Taiwan. Examined the relationship between climate and hydrology in Taiwan in the last century. Studied the tectonic evolution of the Tananao metamorphic basement of Taiwan. Application of Ca isotope study of foraminifera to understanding paleoclimatic change. Extended the coral-based C14 age calibration curve to 50,000 years. Confirmation of significant crustal growth in the Phanerozoic era through studies of accretionary orogens. Discovery of Archean rocks in Vietnam. Studied the evolution of the continental lithosphere by analysis of Re-Os isotopes of mantle xenoliths in the Cenozoic basalt of the Central Asian Orogenic Belt. Analyzed the elastic properties and structure of aluminosilicate supercooled melts. Unraveled the early history of the solar system.



↑ Dilatation and principal strain rates derived from GPS (Global Positioning System) velocities. The color scale indicates dilatation rate in μstrian/yr. Black (contraction) and grey (extension) vectors denote the two principal strain-rate axes. Major faults are indicated as green lines. The star denotes the epicenter of 1999 Chi-Chi earthquake.



↑ PGV (Peak Ground Velocity) amplification depending on source depth: (a) 15 km, (b) 40 km, and (c) 2 km. The lower map shows the distribution of PGV amplification in northern Taiwan. The upper diagrams show the topography, basin structure, and relative change in PGV along Profile A-A'.

Institute of Information Science

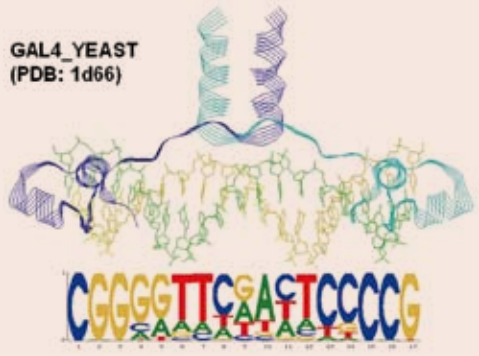
886-2-2788 3799 886-2-2782 4814 http://www.iis.sinica.edu.tw/

Foreword

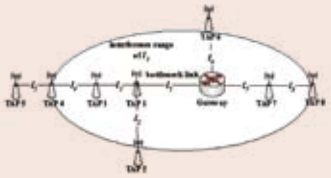
The Institute of Information Science (IIS) was formally established in September 1982 after a five-year preparation period, and is one of the ten institutes and research centers within the Division of Mathematics and Physical Sciences. The IIS presently has 37 full-time research fellows, 29 postdoctoral research fellows and over 300 full-time information technology specialists and part-time research assistants supporting research and development of information science and engineering. These are exciting and challenging times for IT research and the IT industry in Taiwan. Many emerging technologies and opportunities are on the horizon. The IIS, in working with the newly established CITI, looks forward to making concerted efforts in leading the fundamental and practical research in this important field. All members of the IIS prescribe to the motto, "Every job is a self-portrait of those who did it; autograph your work with quality," emphasizing excellence and synergistic teamwork effort.

Research Projects

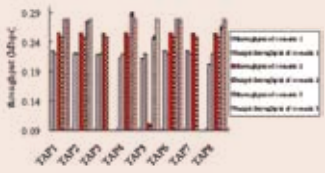
The mission of the IIS is to conduct fundamental but high quality research in the area of information science, and to develop advanced, application-driven systems that utilize and enhance cutting-edge technologies. Our research focuses on eight main categories that include bioinformatics, computer systems, information processing and discovery, multimedia technologies, natural language and knowledge processing, network systems and services, programming languages and formal methods, and theory and algorithm.



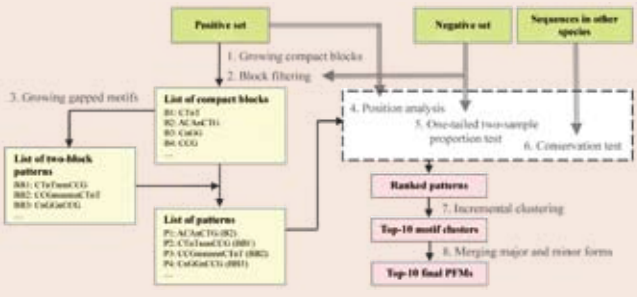
↑ Gapped motifs. The GAL4 motif contains CGG and CCG at two flanking regions respectively, but the in-between positions are degenerate.



↑ An illustration of a wireless backhaul network.



↑ Throughput of TAPs.



↑ The flow chart of the proposed method.

Significant Research Achievements

1. **BIOSMILE Web Search**: Biomedical literature is accumulating so rapidly that it has become impossible to keep track of important biological findings manually. To cope with this problem, we designed BIOSMILE web search (BWS), a web-based NCBI-PubMed search application, which can analyze and extract important semantic relations from sentences of biomedical abstracts, such as subject, object, negation, extent, location, manner, and time. After receiving keyword queries, BWS retrieves matched PubMed abstracts and lists them along with snippets by the order of relevancy to protein–protein interaction (PPI). Users can then select articles for further analysis, and the BWS will annotate biomedical relations in the selected text. The analyzed results can be viewed directly in text form or in a summary table. To date, the BWS has been tested by many biologists in several countries to measure user satisfaction, usefulness, practicability, and ease of use. Overall, our users are highly satisfied with BWS's capabilities and ease of use.
2. **An Incentive-based Fairness Mechanism for Multi-hop Wireless Backhaul Networks with Selfish Nodes:** In this paper, we examined the fairness problem from the game-theoretical perspective and proposed a monetary incentive mechanism to achieve fair resource sharing for wireless backhaul networks in the presence of selfish TAPs. The goal of a typical game theoretical design is to combine the preference of each player into the outcome which satisfies the "social choice": The desired outcome is that each player can optimize his/her profit according to the rules of the game. We proved that our mechanism is correct and truthful, and evaluated the performance of our mechanism via ns-2 simulations. To the best of our knowledge, this is the first work which achieves fair resource sharing and acts truthfully for wireless backhaul networks in the presence of selfish TAPs.
3. **Discovering Gapped Binding Sites of Yeast Transcription Factors:** The transcription of genes is mainly controlled by interaction between transcription factors (TFs) and their recognized binding sites (TFBSs). Transcription factors regulate gene expression by binding to specific cis-regulatory elements (TFBSs) in gene promoters that direct the initiation of transcription and expression rate. To identify and characterize the binding sites of a TF is a challenging issue since TFBSs are usually short and degenerate. A gapped transcription factor binding site (TFBS) contains one or more highly degenerate positions. Discovering gapped motifs is difficult, because allowing highly degenerate positions in a motif greatly enlarges the search space and complicates the discovery process. Therefore, we proposed a new method for discovering TFBSs, especially gapped motifs.

Institute of Statistical Science

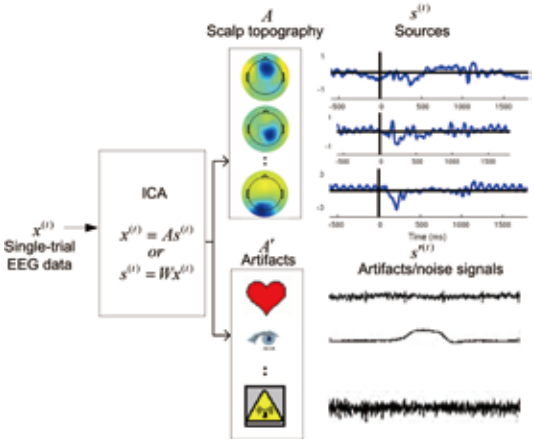
886-2-2783 5611 886-2-2783 1523 http://www.stat.sinica.edu.tw/english

Foreword

In July 1980, during the 14th Convocation of Academicians of Academia Sinica, a group of twenty-one academicians, including Professors Yuan-Shih Chow, George C. Tiao and Ching Chun Li, drafted a resolution calling for the establishment of an Institute of Statistics. On July 1, 1982, the Preparatory Office was founded with Dr. Min-Te Chao as the director. Five years later, on August 3, 1987, the Institute of Statistical Science was officially established and Dr. Chao served as the founding director from 1987 to 1993. The successive directors were Dr. Ching-Zong Wei (August 1993-August 1999), Dr. Chen-Hsin Chen (August 1999-December 2002) and Dr. Ching-Shui Cheng (January 2003-December 2005). Since January 2006, Dr. Gwo Dong Lin served as acting director from January to June 2006. Dr. Ker-Chau Li has assumed the directorship since July 2006.

Research Projects

The Institute of Statistical Science conducts fundamental research related to statistics and probability. The Institute currently has 38 research fellows, 14 postdoctoral fellows, and approximately 62 research assistants. Major research areas include probability and its applications, mathematical statistics, biostatistics, bioinformatics and genetics, functional brain images, educational and behavioral statistics, mathematical finance, time series, spatial and environmental statistics, experimental designs, statistical machine learning, and generalized association plots (GAP).

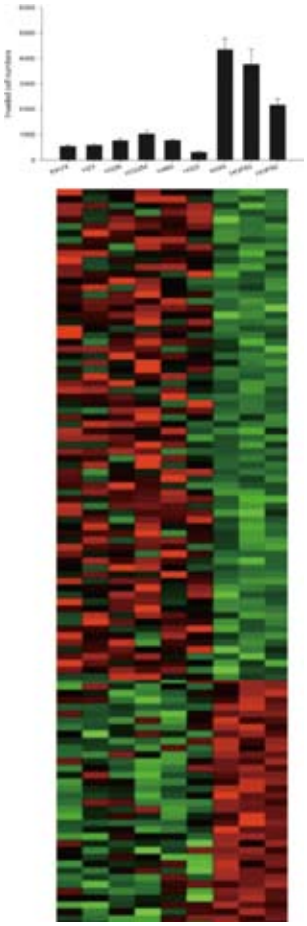


↑ EMSICA (electromagnetic spatiotemporal independent component analysis) decomposition finds a matrix of cortical maps using leadfield parameters that give their projections to the scalp sensors using a biophysical model. Thus, EMSICA separates EEG features into activities of fixed cortical maps rather than as activities of fixed scalp maps.

↑ *Statistica Sinica*

Significant Research Achievements

In the past 3 years, researchers of the institute have published some 161 articles in SCI journals. In addition, 174 other articles and monographs have been published. The international journal *Statistica Sinica* published by the institute has become one of the major statistical journals in the world.



↑ Novel invasion-associated genes from the nine lung cancer cell lines in the NCI-60 panel are identified and the invasion-associated four-gene signature (ANKRD49, LPHN1, RABAC1, and EGLN2) had good survival prediction power for NSCLC patients.

Institute of Atomic and Molecular Sciences

886-2-2362 0212 886-2-2362 0200 http://www.iams.sinica.edu.tw

Foreword

In July 1982 during the 15th Convocation of Academia Sinica, fifteen academicians led by Dr. Y. T. Lee recommended that an Institute of Atomic and Molecular Sciences be founded. After the proposal was approved, a preparatory office was inaugurated on September 23, 1982 to lay the foundation for the new institute. An advisory board, headed by Dr. Y. T. Lee, was organized to provide guidance for its future development. On December 11, 1982 Dr. C. T. Chang was appointed director of the Preparatory Office. Later, in July 1993, Dr. S. H. Lin replaced him as director of the Preparatory Office. In April 1995 the institute was formally established and Dr. S. H. Lin became the first director. In October of 2001, Dr. K. Liu took the helm. Since October 2004, Dr. Y. L. Wang has assumed the directorship.

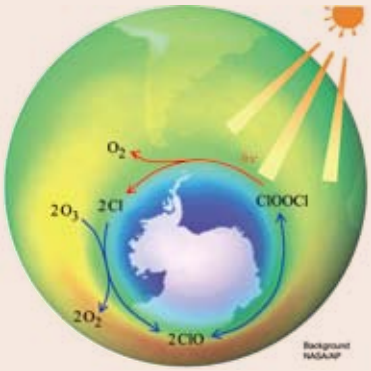
Research Projects

The Institute of Atomic and Molecular Sciences (IAMS) was established as an advanced institution for fundamental research related to the atomic and molecular sciences. The ultimate goal is to improve our understanding of the chemical and physical principles relevant to the development of the applied sciences, such as biophysical analysis, material science, energy research, and laser technology. At present, there are thirty-seven principal investigators (including 9 adjunct principle investigators) in four research groups: (1) Chemical Dynamics and Spectroscopy, (2) Advanced Materials and Surface Science, (3) Biophysics and Bio-analytical Technology, and (4) Atomic Physics and Optical Science.

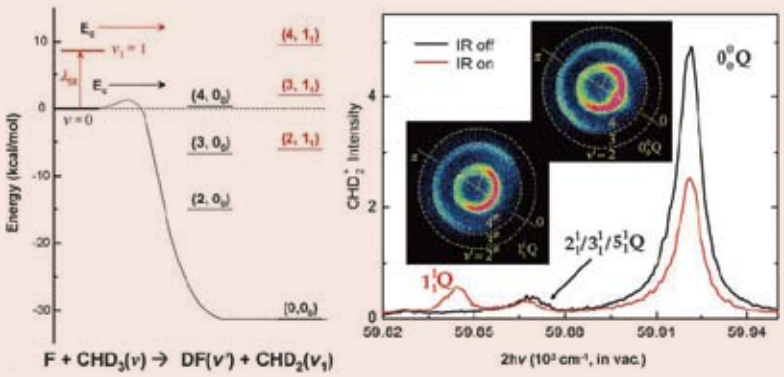
Significant Research Achievements

The IAMS has made significant progress in the following areas during the last few years. It has:

1. Probed a reactive resonance in the Cl+CHD_3 reaction by using cross-molecular beam and ion imaging techniques.
2. Fabricated anodic alumina films with custom-designed arrays of nanochannels by using focused-ion-beam lithographic techniques.
3. Fabricated nanomaterials for energy applications in fuel cells and solar cells.
4. Fabricated bright fluorescent nanodiamonds (FND) in large quantities by irradiating synthetic diamond with helium ions and proved FND is an ideal probe for long-term tracking and imaging in vivo with good temporal and spatial resolution.
5. Used an existing fluorescent dye that binds to the G-quadruplex structure of human telomeric structure, a common feature of several different cancers, to develop and manufacture a microarray for detecting cancerous cells.
6. Precisely measured the photodissociation cross sections of ClOOCl by used the molecule-beam technique to clarify ozone degradation models.
7. Used the crossed-molecule beam technique to discover that exciting the C-H stretching mode in the reaction F+CHD_3 leads to unexpected slow down of the reaction DF+CHD_2.



↑ The color indicates the ozone concentration and the Antarctic ozone hole; the chemical processes represent the ClOOCl catalytic cycle which contributes most to ozone hole formation. The precise measurement of UV absorption cross sections of ClOOCl consistent with ozone degradation models was published in *Science* 324: 781-784, 2009.



↑ (Left) Reaction path energetics for reactant CHD_3 initially in the ν = 0 (black arrow) and ν_1 = 1 (red) vibrational states. (Right) Two normalized REMPI spectra of the probed CHD_2 products, with IR-on (red) and IR-off (black), at Ec = 3.6 kcal/mol. Published in *Science* 325: 303-306, 2009.

Institute of Astronomy and Astrophysics

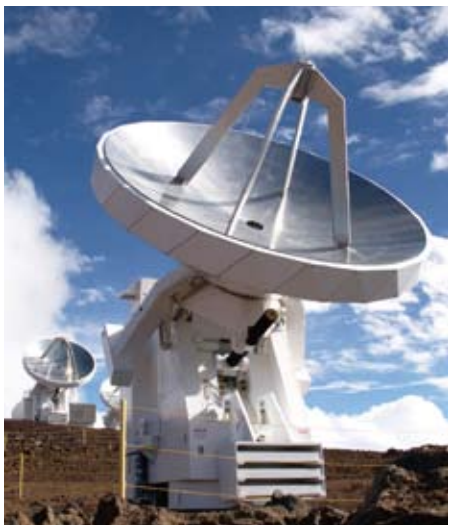
886-2-3365 2200 886-2-2367 7849 http://www.asiaa.sinica.edu.tw

Foreword

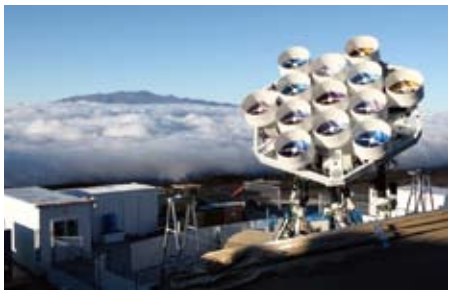
The Institute of Astronomy and Astrophysics (ASIAA) was established in 1993, with Frank H. Shu chairing the advisory panel, and with Typhoon Lee as the first director. Succeeding directors were Dr. Chi Yuan, Dr. Kwok-Yung Lo, Dr. Sun Kwok, and Dr. Paul T. P. Ho. The ASIAA currently has about 180 members. Research topics carried out at the ASIAA range from solar system studies to cosmology, with our staff utilizing many of the frontier ground-based and space-borne observing facilities.

Research Projects

The ASIAA conducts research in all important areas of astronomy and astrophysics with the aim of becoming one of the world's leading academic research institutions.



↑ The two elements of SMA built by Taiwan. (Photo by Ming-Tang Chen)



↑ AMiBA has been upgraded to its new 13-element 1.2m reflector configuration in 2009, and resumed operations on Mauna Loa in Hawaii. (Photo by Chia-You Shih)

↑ The four 12-meter diameter antennas built by ALMA-Japan. (Photo by The Joint ALMA Observatory)

Significant Research Achievements

1. The Submillimeter Array (SMA)

The SMA project has been carried out by the ASIAA in collaboration with the Smithsonian Astrophysical Observatory since 1996. It consists of eight 6-meter radio telescopes, with two of them delivered by the ASIAA in collaboration with universities and industries in Taiwan. Dedicated in November 2003, the SMA is the first submillimeter array in the world. As of November 2009, some 220 papers have been published, 100 of which have Taiwanese co-authors.

2. The Taiwan-America Occultation Survey (TAOS)

The TAOS is a system of four 0.5-meter optical telescopes located on Lulin Mountain in Taiwan. It is a joint project between the ASIAA, National Central University, the Harvard-Smithsonian Center for Astrophysics, and Yonsei University. The four telescopes automatically monitor 1,000 stars every clear night to search for Trans-Neptunian objects (TNOs) through stellar occultations. By studying the TNOs, we can better understand the early history of our solar system.

3. The Yuan Tseh Lee Array for Microwave Background Anisotropy (AMiBA)

The AMiBA is a platform-mounted interferometer sited on Mauna Loa in Hawaii to measure the polarization of the cosmic microwave background and to detect clusters of galaxies at high redshift. It is designed, constructed, and operated by the ASIAA, in major collaboration with National Taiwan University. A dedication ceremony of the initial 7-element interferometer was held in October 2006. Science operations have started. An expansion to the 13-element configuration has been completed in 2009.

4. The Optical and Infrared (OIR) Instrumentation Program

To support follow-up observations of high-redshift clusters, the ASIAA negotiated for the observing time on the 3.6-meter Canada-France-Hawaii Telescope (CFHT) from 2003. Financial contribution from the ASIAA is in the form of support for the development of the Wide Field Infrared Camera (WIRCam), which was installed on the CFHT. The ASIAA is now participating in the HyperSuprime Cam (HSC) project on the Subaru Telescope.

5. Theoretical Institute for Advanced Research in Astrophysics (TIARA)

The TIARA was established in 2004 to provide an integrated program of research and education in theoretical astrophysics. The concept of the TIARA was to take advantage of the growing body of observational data gathered by the astronomical community in Taiwan and elsewhere. At the institute, forefront theoretical research is carried out in a cooperative effort with National Tsing Hua University. The TIARA aims to facilitate the efforts of researchers and the training of future theoretical astrophysicists throughout Taiwan and Asia.

6. Atacama Large Millimeter/Submillimeter Array - Taiwan (ALMA-T)

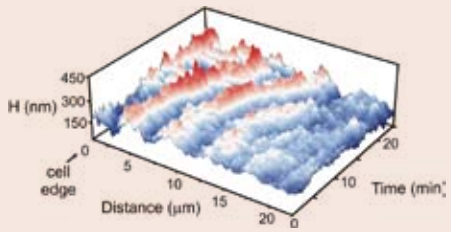
The ALMA is the largest ground-based astronomical telescope to be built. It will consist of up to 80 telescopes operating as an interferometer at millimeter and submillimeter wavelengths. This array is now under construction in the Atacama desert in Chile, scheduled to be completed in 2012. It will be the preeminent instrument for studies of relic radiation from the early universe, and of the formation and evolution of stars, planetary systems, and galaxies. The ALMA has three main partners: North America, Europe, and Japan. Taiwan has been invited to participate both by ALMA-Japan and ALMA-North America.

Research Center for Applied Sciences

886-2-2652 5200, 2789 8000 886-2-2782 6672, 2782 6680 http://www.rcas.sinica.edu.tw

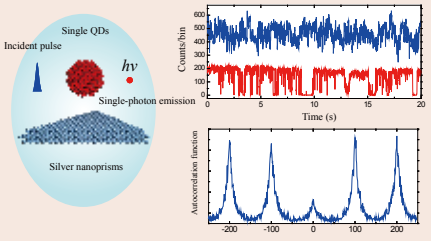
Foreword

The Institute of Applied Science and Engineering was inaugurated in June 1999. In 2003, Academia Sinica passed a by-law for establishing research centers. In February 2004, the institute was renamed as the Research Center for Applied Sciences (RCAS). Currently, the RCAS is an interdisciplinary research center, containing four research groups: Nano-biotechnology, Optoelectronics, Mechanics & Engineering Science, and Advanced Computation & Modeling. The center will continue to hire prominent research fellows, set up core facilities, and carry out interdisciplinary research projects.

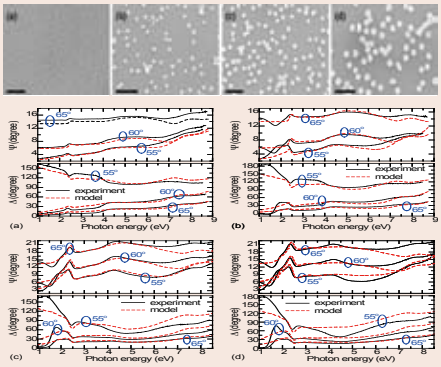


↑ The centrograde propagation of membrane waves on moving fibroblasts.

↑ (a) The optical and SEM images of a 10x10 gold nanoslit microarray. (b) The measured optical transmission images and real-time responses of antigen/antibody interactions.



↑ A single-photon emitter, with sandwiched layers of dispersed QDs, PMMA polymeric film and silver nanoprisms, showing suppressed blinking (blue trace) and single-photon emission with anti-bunching.



↑ SE measurements and model calculations of Au nanoparticles samples with nominal sizes of (a) 20 (b) 40 (c) 60 (d) 80 nm at incident angles of 55°, 60°, and 65°. The SEM image of these samples are shown on top.

Research Projects

The center pursues fundamental and innovative research with the potential for scientific and engineering applications in collaboration with industries, governmental institutions, and universities. Currently, nanotechnology is the major research area. Subjects of research interest include: bio-sensors and tags, nano-electronic and photonic devices, nanometrology, multiscale mechanics, biomedical mechanics, electronic structure calculations, electron transport, near- and far-filed optics simulation, etc.

Significant Research Achievements

1. The Nano-biotechnology Group

In nano-biotechnology group, we have developed super-resolution microscopes with lateral resolution superior to 20 nm. By a combination of a microfluidic system and office projector, integrated DNA microarray synthesis and hybridization have been achieved on a microfluidic device. In addition, we have synthesized multi-functional nanoparticles such as quantum dots and Raman probes for live imaging. The three dimensional trajectories of individual nanoparticles inside living cells have been investigated.

2. The Mechanics and Engineering Science Group

A new microarray for dynamical studies of surface biomolecular interactions without fluorescent labeling is proposed. We employed gold nanostructures to excite surface plasmons on the microarray surface and detected the intensity changes in the extraordinary transmission. The calculation and measurement results indicate that the nanoslit array has an intensity sensitivity much higher than the nanohole array due to its narrower resonant bandwidth. In addition, the sensitivity is increased as the slit width decreases. Using the intensity changes, we demonstrate a 10×10 microarray for real-time measurements of antigen-antibody and DNA-DNA interactions.

3. The Optoelectronics and Advanced Materials Group

High Performance Room-Temperature Single-Photon Sources

The most significant achievement of the optoelectronics group this year is the demonstration of blinking suppression of single quantum dots which could be used as high performance single-photon sources. Blinking is very common in single molecule/particle spectroscopy but is a hindrance as biological markers and single photon emitters. By surface plasmonic effects through coupling to silver nanoprisms, we demonstrated blinking suppression, increased fluorescence intensity and enhanced radiative decay rates.

4. The Advanced Computation and Modeling Group

Optical metrology of randomly-distributed Au colloids on a multilayer film. Spectroscopic ellipsometry (SE) measurements combined with efficient theoretical modeling based on finite-element Green's function approach were used to determine the size, shape, and average inter-particle distance of randomly-distributed gold nanoparticles on a glass substrate. The mean particle sizes of Au colloids analyzed cover a range from 20 to 80 nm. A multiple scattering theory for light scattering from randomly distributed particles on a substrate was developed, in which we introduce a "structure factor" in the scattering integral equation. The structure information of the scatterers is determined when our model calculations produce a best fit to the SE data. A comparison of theory and experiment is shown in the figure.

Research Center for Environmental Changes

886-2-2653 9885 886-2-2783 3584 http://www.rcec.sinica.edu.tw/

Foreword

Since the rapid economic development in the 1970's, the environment in Taiwan has deteriorated severely. Per unit area emissions of air pollutants now are among the highest countries of the world. Air and water pollutants are health hazards and can adversely affect the entire ecosystem. In addition, air pollutants and land use changes can perturb regional climate significantly. The environmental impacts and scientific questions involved are multi-disciplinary, region-specific and complex. In order to effectively address these questions, Academia Sinica initiated an Environmental Change Research Project hosted by the Institute of Earth Sciences in November 1999. After about four years of development, the Research Center for Environmental Changes (RCEC) was officially established on January 1, 2004.

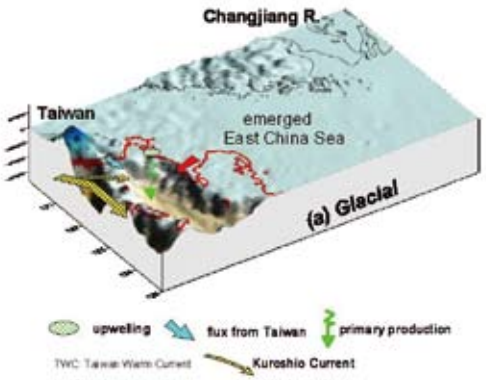
Research Projects

The major research projects of the RCEC are focused on atmospheric chemistry, air quality, biogeochemical cycles of fresh water systems in Taiwan and surrounding oceans, water resources, and regional climate changes.

Significant Research Achievements

1. Extreme Weather Changes in a Warming Globe

Scientists from the Research Center for Environmental Changes have successfully quantified the relation between precipitation extremes and global temperature changes. The top 10% bin of precipitation intensity increases by about 110% for each degree increase in global temperature, while 30%-60% bins decrease by about 20%, about one order of magnitude greater than results from the latest climate models. Global warming has a greater effect on Taiwan, causing more extreme rain falls. The top 10% bin of rain intensity almost doubled in the last 45 years, and will keep increasing with temperature, resulting in more floods. Droughts due to reduced light rain will also increase. New national strategies for land-use, flood control and water resource management are imperative.



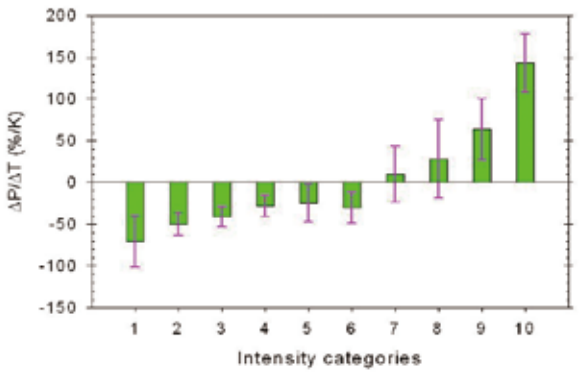
↑ Enhanced burial of fossil organics in the Okinawa Trough since the LGM, implying humid climate in Taiwan.

2. Urban Ozone Formation and Ozone Trends in East Asia

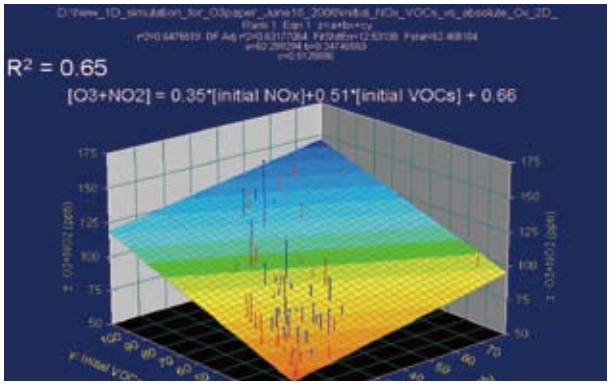
An observation constrained 3-dimensional photochemical-transport model should be able to use the measurements at Mauna Loa to "invert-model" the trends of background ozone in Asia. 3-dimensional OBM plots of Ox (O_3+NO_2) vs. initial VOC and NOx show that the concentration of O_3+NO_2 will decrease significantly when VOC is reduced. When NOx is reduced, O_3 will increase. Therefore, we conclude that O_3 levels in southern Taiwan are VOC-limited, but more data are needed.

3. Enhanced Burial of Fossil Organics in the Okinawa Trough since the LGM, Implying Humid Climate in Taiwan

Sea level rise and/or cotemporaneous climate change may account for substantial changes in the burial of terrestrial organic carbon in the Okinawa Trough, of which fossil organic matter is an important component. Sedimentary rock erosion from the highlands of Taiwan is the most likely source of the FOC. A wetter climate with higher runoff and bedrock incision on land are inferred for the Holocene. This is the first report of global climate-driven variations in the relative burial rates of fossils and modern organics, thus providing new insight into the carbon biogeochemical cycle over the glacial-interglacial timescale.



↑ Changes in rain intensity in Taiwan from 1961 to 2005.



↑ 3-dimensional depiction of the relationship between ozone and its precursors.

Research Center for Information Technology Innovation

886-2-2653 4010 886-2-2653 4030 http://www.citi.sinica.edu.tw/

Foreword

The Research Center for Information Technology Innovation (CITI) at Academia Sinica was founded in February 2007, and started to operate with its committees in September 2009. The CITI was founded to integrate research and development activities in information technologies among various organizations of Academia Sinica, and to promote IT-related multi-disciplinary research. The distinct features of the CITI can be summarized by the word of IMPACT where I means innovative (for technology, process, business model), M means multi-disciplinary (for interdisciplinary research topics), P means pragmatic (for the goals and deliverables), A means adaptive (for evaluation systems), C means choosing (in research areas), and T means teaming (for collaborating with others).

Research Projects

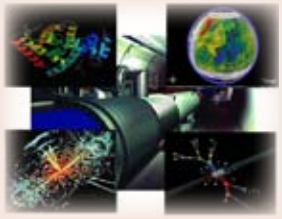
The CITI currently has four thematic centers, including (1) Digital Content & Technology Center (2) Grid & Scientific Computing Center (3) Taiwan Information Security Center and (4) Intelligent & Ubiquitous Computing Center.

In addition, the CITI also supports several mission-oriented projects. To meet the demands of the knowledge-based and service-based industries, the CITI aims to promote the innovation and application of information technologies, with emphases on multidisciplinary technology integration and value creation from pioneering technologies.

↑ Taiwan e-Learning & Digital Archives Portal
http://www.digitalarchives.tw/

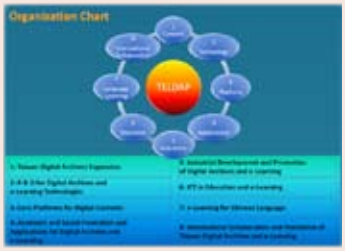
↑ Union Catalog of Digital Archives
http://catalog.digitalarchives.tw/dacs5/System/Main.jsp

↑ Exhibition of Cyber Island, Taiwan
http://cyberisland.teldap.tw/



↑ E-Learning Quality Certification Center
http://www.elq.org.tw/en/index.aspx

↑ Digital Taiwan – Culture & Nature
http://culture.teldap.tw/culture/



↑ Learning Object Repository in Taiwan
http://www.lort.org.tw/

Significant Research Achievements

1. Thematic Center for Digital Content & Technology

As a part of a National Science and Technology Program of the National Science Council, this thematic center has promoted the national digital archives using the newest information technologies. This includes the digitization of valuable collections and exploring the value-added possibilities derived from these collections. This thematic center is involved in the development of digital contents, including various rich collections of fishes, shells, plants, and aboriginal artifacts in Taiwan, as well as Chinese historical artifacts. The research and development of related information technologies, such as standards, the long-term preservation of digital collections and web 2.0 have been the main focus of our efforts.

2. Thematic Center for Grid & Scientific Computing

The concept of grid computing is an extension of the Internet used to share widespread computing power, storage capabilities, and many other resources. Over the past few years, it has gradually gained prominence in academic and research communities. Many fields, such as high energy physics, bio-informatics, and digital archives demand greater storage capacities due to the deluge of data and information being created. Grid computing has made the on-demand allocation and management of integrated computing resources possible.

3. Thematic Center for Taiwan Information Security

Founded to integrate the resources and expertise in information security scattered among the universities and research institutes in Taiwan, a research program entitled the Taiwan Information Security Center (TWISC), was initiated in April 2005. The TWISC is currently funded by the National Science Council, and reflects an integrated effort to boost research and development activities in information security, promote public awareness and foster partnership in information security among government, academia, and the private sector. Three regional centers have been established in northern, central, and southern Taiwan. Research results include those on cryptology, network security, software security, multimedia security, and information security management.

4. Thematic Center for Intelligent & Ubiquitous Computing

This thematic center was founded in February 2009 to meet the emerging demand for intelligent and ubiquitous computing. As the computing paradigm shifts to cloud, mobile devices tend to be slim and light-weight, and more values are expected from their solution, application, and service. Intelligent and ubiquitous computing has played an increasingly important role as an effective approach to acquire information, via human-computer interactions and various devices in our daily life. Major research results of this thematic center include those in mobile data mining, wireless networks, cloud computing, embedded systems, and multimedia technologies.

Institute of Plant and Microbial Biology

886-2-2789 9590 886-2-2782 7954 http://ipmb.sinica.edu.tw

Foreword

The forerunner of the Institute of Plant and Microbial Biology was the Natural History Museum of Academia Sinica, founded in Nanking in 1929. In 1934, the Natural History Museum was renamed the Institute of Botany and Zoology. In 1962, the Institute of Botany was formally reinaugurated in Taipei, with Dr. Hsien-Wen Li as its director. After Dr. Li's retirement in 1972, succeeding directors included: Drs. Tsung-Teh Kuo, Hong-Pang Wu, Ching-San Chen, Chang-Hung Chou, Shang-Fa Yang, Jei-Fu Shaw, Tuan-hua David Ho and Na-Sheng Lin. The current director is Dr. Anthony Hwoonchung Huang. The institute was renamed as the Institute of Plant and Microbial Biology in May 2005.

Research Projects

The institute largely conducts basic research in plant and microbial biology. Some applied research is also performed in the fields of agriculture and biotechnology.

The research in the institute is organized around three multi-disciplinary intellectual foci:

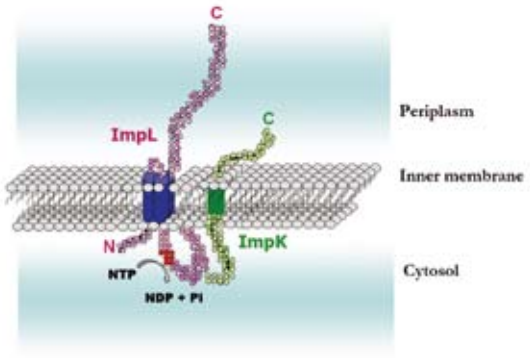
1. Plant and microbial growth and development
2. Mechanisms of plant and microbial responses to the environment
3. Plant and microbial biochemistry and secondary metabolism

These research programs will not only address challenging research in plants, but also allow a proper balance between basic research and the development of potential biotech applications. Ultimately, all research efforts will be centered around the main theme of the "Discovery, Utilization and Preservation of Unique Plant Resources in Taiwan".

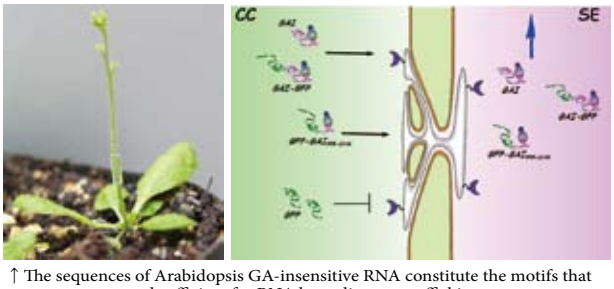
Currently, there are 26 principle investigators, 5 research specialists, 31 postdoctoral fellows, 61 graduate students, 115 research assistants, and 32 administrators and technicians, with a total staff of 274 working for the institute. The principle investigators engage in a diverse spectrum of research projects mainly supported by Academia Sinica, the National Science Council, and the Council of Agriculture.

Significant Research Achievements

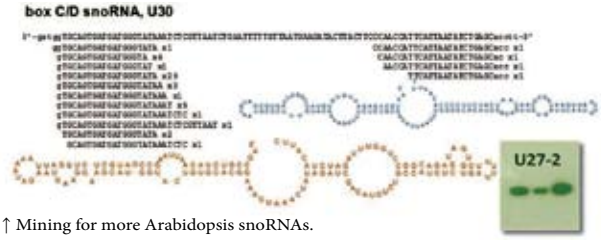
Research activities at the institute have resulted in more than 80 scientific papers each year. In addition, the institute has been granted many patents based on its research discoveries. The establishment of the Biotechnology Experimental Center in the Tainan Science-Based Industrial Park (now under the supervision of the ABRC) would further enhance the collaboration between the institute and the biotech industry in southern Taiwan. *Botanical Studies*, formerly the *Botanical Bulletin of Academia Sinica,* is an international journal, published by the Institute of Plant and Microbial Biology and co-published by the Research Center for Biodiversity and the Agricultural Biotechnology Research Center. The journal has been recognized by the National Science Council 15 times as one of the top three international journals in Taiwan. The institute also sponsors three to five domestic and international symposia every year.



↑ The study of the topology and interactions of the IcmF- and IcmH-family proteins ImpL and ImpK, which are two essential components of the *A. tumefaciens* T6SS, provided compelling evidence that both proteins are integral inner membrane proteins and interact with each other via their N-terminal cytoplasmic domains. ImpL may function as an NTP-binding/NTPase to mediate T6SS machine assembly and/or substrate secretion.



↑ The sequences of Arabidopsis GA-insensitive RNA constitute the motifs that are necessary and sufficient for RNA long-distance trafficking.



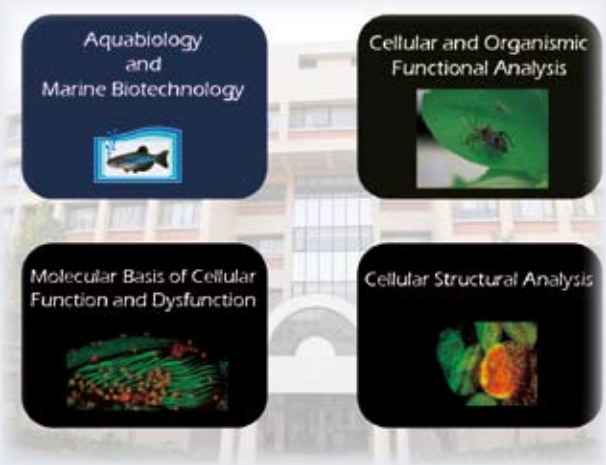
↑ Mining for more Arabidopsis snoRNAs.

Institute of Cellular and Organismic Biology

886-2-2789 9515 886-2-2785 8059 http://www.icob.sinica.edu.tw

Foreword

The predecessor of the ICOB is the Institute of Zoology with a tradition of investigating the behavior and physiology of a number of diverse animal systems. After the establishment of the Institute of Cellular and Organismic Biology in 2005, research emphasis shifted toward molecular and cell-based studies of cellular and organismic functions. However, concerted efforts have been made to integrate the study of cellular functions into the perspective of the whole organism. The four major areas of research illustrate this approach.



Research Projects

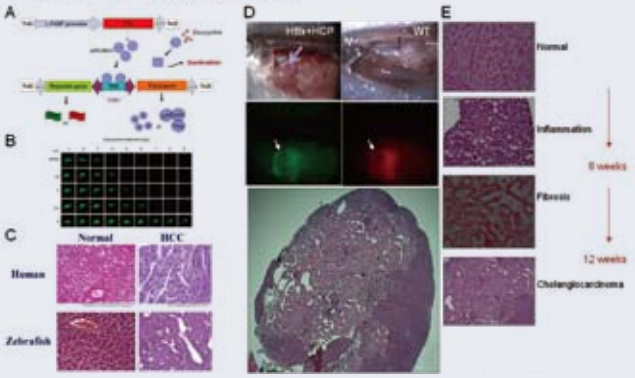
The overall focus of the Institute of Cellular and Organismic Biology is the investigation of basic mechanisms by which cellular function and cell/cell interactions can coordinate the growth and development of an organism, and its adaptation to an ever-changing environment. Current research efforts of the ICOB encompass the following four areas:

1. Aquabiology and marine biotechnology has the longest history in terms of its development and enjoys a strong reputation, and is greatly assisted by the Marine Research Station, located in Jiao-Shi, Ilan, which is equipped with facilities primed for breeding and investigating various marine organisms. Investigators at the ICOB were the first to introduce the use of zebrafish as a model system for aquabiology research to Taiwan's research communities.
2. The investigation of cellular and organismic function heavily relies on the use of model organisms and systems biology. In addition to zebrafish, our investigators also use mice, sea urchins, and drosophila for research on developmental biology, stem cell biology, DNA replication and repair, and human diseases.
3. The area of the molecular basis of cellular function and dysfunction covers a fairly diverse area at the ICOB. They include the functional studies of the DNA helicases that are responsible for several rare human diseases (Bloom syndrome and Rothmund Thomson syndrome), signaling process regulating γ-secretase in Alzheimer's disease, receptor-mediated delivery of cancer therapeutic agents, and cytotoxic action of arsenics.
4. The fourth area, cellular structural analysis, is currently covered in many research groups both in the ICOB and other institutes as well. The more advanced imaging analysis, aided by the state-of-the-art in-house imaging facility, could further propel ICOB investigators to reach scientific excellence.

Significant Research Achievements

The ICOB continues to strengthen its research efforts in aquabiology and marine biotechnology, and takes the lead in the country to promote the use of zebrafish as a valuable model system for biomedical research. In the post-genomic era, our researchers have explored the gene regulatory network in the growth and development of whole organisms using the systems biology approach. The development of targeted drug delivery has been heralded as the key breakthrough in cancer therapy. These academic achievements can be highlighted by the recent conferral of prestigious research awards on ICOB investigators. Major research accomplishments of ICOB investigators have been published in high-impact journals, such as *PNAS, PLoS One, Cancer Research, JBC, Molecular Biology of the Cell, American Journal of Pathology, Development, Developmental Biology,* etc. These research breakthroughs demonstrate the ICOB's highest standards in academic performance.

Generation of cancer models by co-expression of HCV core and HBV X in zebrafish liver



↑ (A) Schematic illustration of the plasmid constructs. (B) The doxycycline-induced GFP expression in the zebrafish F1 larvae deived from transgenic lines. (C) Expression of HBV X protein lead to hepatocellular carcinoma in zebrafish liver. (D) Co-expression of HCV core protein and HBV X protein lead to cholangiocarcinoma in zebrafish liver. (E)The progression of the diseases in double transgenic zebrafish developed colangiocarcinoma in 12 weeks.

Institute of Biological Chemistry

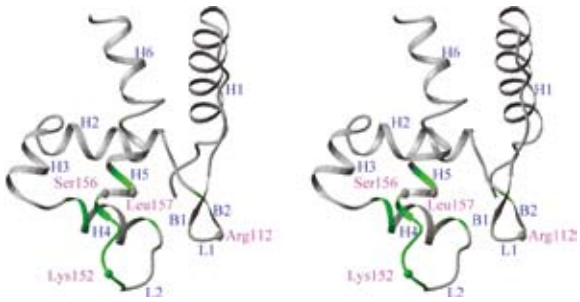
886-2-2785 5696 886-2-2788 9759 http://www.ibc.sinica.edu.tw/

Foreword

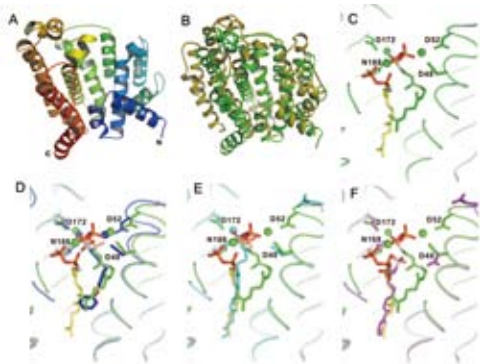
The Institute of Biological Chemistry (IBC) was established in 1977. At present, it comprises two research buildings, located on the Academia Sinica campus and the National Taiwan University (NTU) campus. The institute has maintained close ties with the Graduate Institute of Biochemical Sciences at NTU, sharing resources in both teaching and research. Currently the research staff consists of a total of about 300 persons, supported by 15 administrative personnel and technicians. Together, the research staff covers a diverse spectrum of research expertise, encompassing techniques in microsequencing of proteins, synthesis and analysis of biomolecules (including nucleic acids, peptides and carbohydrates), cellular confocal microscopy, mass spectrometry and nuclear magnetic resonance (NMR), macromolecular X-ray crystallography, proteomics and functional genomics.

Research Projects

The IBC has conducted extensive research in protein biochemistry, biophysics, molecular and cellular biology, with DNA-protein interactions, various enzymes, snake venom toxins, transcription factors, reproductive proteins and hormones as specific subjects of intensive investigation. At the same time, the institute continues to uncover new areas of research and seek opportunities to contribute to the overall effort of academia in promoting functional genomics and the biotechnology program in Taiwan. Areas that have been actively studied by our researchers include the enzymes of bacteria, plants and animal tissues, enzymes for use in bioorganic synthesis, venom toxins and their membrane receptor proteins, proteins of the reproduction system, crystallins of the eye lens, and transcription factors. In these studies the molecular and cellular approaches to various research problems are emphasized as well as the biophysical and biochemical aspects of various macromolecules involved. With the expansion of the institute into the new building in 1996, glycobiology research has been established to study the structure, function, and biosynthesis of glycoproteins and related glycoconjugates. Especially noteworthy are the research initiatives in areas including protein crystallography, systems biology, cancer biology and signal transduction, and chemical biology for drug discovery to face the challenges of the post-genomic era. More recently, NMR and single molecular imaging have been added to our expertise. We have begun the consolidation of diverse research disciplines into five main research areas: (1) Molecular and Cellular Biology, (2) Proteomics and Genomics, (3) Glycoscience, (4) Chemical Biology, and (5) Structural Biology and Molecular Biophysics. Throughout these studies, the institute adheres to the basic precepts of the pursuit of quality and excellence in research with a deep commitment to promoting mutual collaboration among fellow scientists.



↑ Stereoview of RBP2 ARID structure as a ribbon diagram with the secondary elements labeled; the residues with relatively large chemical shift changes upon DNA binding are highlighted in green, and key DNA binding residues are labeled. *Nature Structural & Molecular Biology* 15(4): 419-421, 2008.



↑ X-ray crystallographic structures. (A) X-ray structure of *S. aureus* CrtM. (B) Superposition of CrtM and human squalene synthase structures. (C) Close up view of FsPP bound to CrtM. (D) Close-up view of *S. aureus* CrtM with bound BPH-652. (E) *S. aureus* CrtM with bound BPH-698. (F) *S. aureus* CrtM with bound BPH-700. *Science* 319: 1391-1394, 2008.

Significant Research Achievements

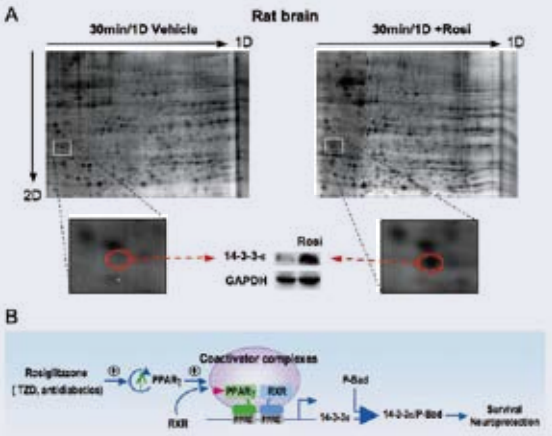
The IBC has played a leading role in several competitive research areas. In the recent 5 years between 2005 and 2009, more than 400 high-quality research papers have been published in international leading journals (including *Science, Nature Structural & Molecular Biology, Molecular Cell, Angewandte Chemie, Journal of the American Chemical Society, EMBO Journal, Proc. Natl. Acad. Sci. USA, Cancer Research, Molecular and Cellular Proteomics, Chemistry and Biology, Journal of Biological Chemistry,* etc.) by the members of the IBC. In addition, the research staff has been actively involved in teaching at universities and the Taiwan International Graduate Program, and has participated in both domestic and international academic activities. Besides serving on editorial boards and reviewing manuscripts, many have also been invited as speakers or chairs at domestic and international conferences, and participated in reviewing grant applications for the National Health Research Institutes, National Science Council, and international funding agencies.

Institute of Biomedical Sciences

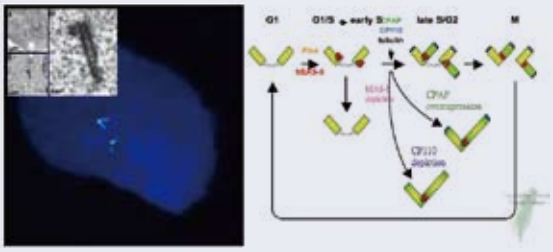
886-2-2789 9000 886-2-2785 3569 http:// www.ibms.sinica.edu.tw

Foreword

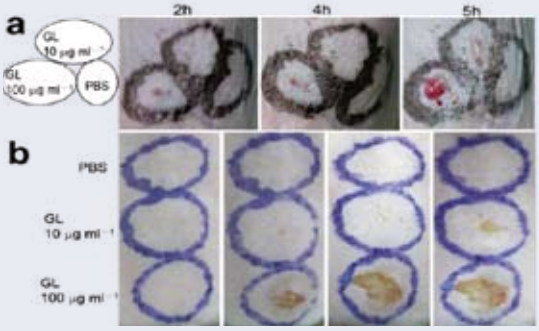
The Institute of Biomedical Sciences (IBMS) was founded in February 1981 with the establishment of a preparatory office and became a formal institute in December 1993. Currently, there are about 130 research scientists with Ph.D. degrees, 370 research assistants, 300 graduate students, and 100 administrative and technical staff at the IBMS. The director is Dr. Yuan-Tsong Chen, a physician, scientist, and a renowned human geneticist.



↑ Ligand-activated peroxisome proliferator-activated receptor-gamma protects against ischemic cerebral infarction and neuronal apoptosis by 14-3-3ε epsilon upregulation.



↑ CPAP is a cell-cycle regulated protein that controls centriole length. *Nature Cell Biology* 11: 825-831, 2009.



↑ Granulysin is a key mediator for disseminated keratinocyte death in Stevens-Johnson syndrome and toxic epidermal necrolysis. Chung WH et al. *Nature Medicine* 14(12): 1343-50, 2008.

Research Projects

In this post-genomic era, the IBMS aims to promote translational research — using approaches in genomic medicine to elucidate the molecular mechanisms underlying the physiological and pathological processes of human diseases, and apply the knowledge gained from basic research to prevent diseases, improve diagnosis, and develop new drugs and treatments. The IBMS has attained a high level of international recognition and a high reputation in the academic community.

Currently, the IBMS investigators are engaging in research in seven general areas: epidemiology and genetics, cell biology and signal transduction, cancer, cardiovascular disease, infectious diseases and immunology, neuroscience, and structural biology. Every investigator designs and plans his/her own research projects, such as exploring disease genes and risk factors, generating mouse models for human diseases, developing disease markers and new drugs, elucidating the molecular mechanisms underlying cell transformation and cancer metastasis, understanding the processes of virus and parasite infection, characterizing the cause and pathology of neural and cardiovascular diseases, and using NMR, MRI and computational methods to determine the structures of proteins and living organisms. Besides, the IBMS investigators are participating in four program projects to identify novel oncogenic microRNAs and ncRNAs in Taiwanese patients, to study the genetic epidemiology of alcoholism, to use a novel granulysin-mediated cytotoxic pathway as therapeutic targets for Stevens-Johnson syndrome and graft-versus-host disease, and to develop noninvasive MRI reporter platform for in vivo imaging of molecular and cellular events in therapeutic settings. In addition, the institute is leading a multi-center grant project to study single gene and multi-factoral disorders and genomics. Two IBMS teams have also joined international consortiums to map breast cancer susceptibility loci and the human genetic diversity in Asia, and to formulate a universal algorithm that can better predict an optimal warfarin dosage based on patients' clinical and genetic data to avoid bleeding complications.

Significant Research Achievements

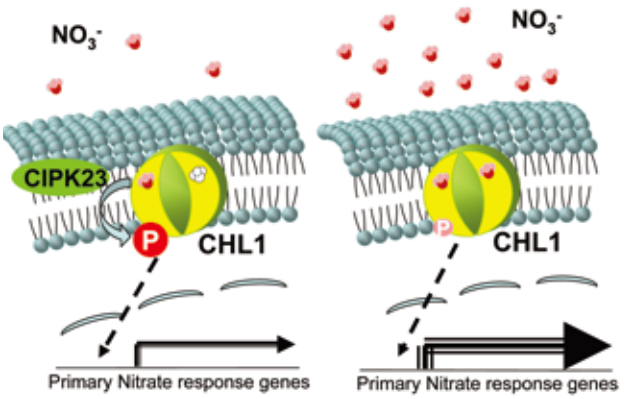
A multidisciplinary approach is critical for post-genomic research and has been adopted in many studies currently being conducted at the IBMS. On the average, each IBMS principal investigator publishes two to three scientific articles in international journals each year, with an average impact factor of 5. Several discoveries made in recent years by IBMS investigators have been published in first-rate journals and made headlines in local and international media, such as the association of Stevens-Johnson syndrome with specific HLA-B alleles and an unusual granulysin isoform, the molecular mechanisms underlying microcephaly caused by defects in the centrosomal protein CPAP, the identification of microRNA and gene signatures for the prediction of treatment outcomes in non-small-cell lung carcinoma, the association of ESR1 and PPAR genes with severe obesity in Han Chinese, and the protection of PPAR (against ischemic cerebral infarction and neuronal apoptosis). Numerous IBMS principal investigators have received the Outstanding Research Award or the Special Research Award of the National Science Council, the Academia Award of the Ministry of Education, and other awards conferred by private foundations. These figures rank the IBMS as one of the leading research institutes in the field of biomedical sciences in Taiwan.

Institute of Molecular Biology

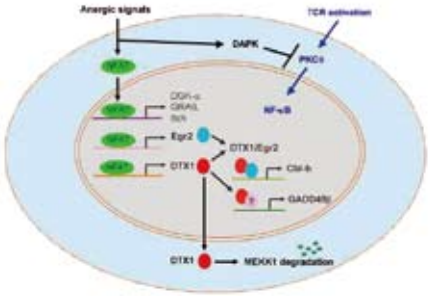
886-2-2789 9222 886-2-2782 6085 http://www.imb.sinica.edu.tw

Foreword

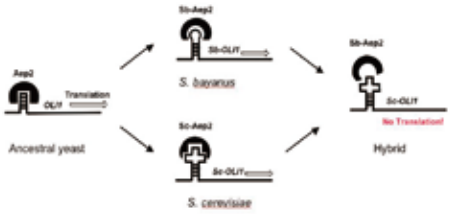
The explosive developments in molecular biology in the past few decades and the ensuing advancements in genetic engineering have opened vast new frontiers for research in the biological and medical sciences. In an effort to meet these research needs, a research institute in molecular biology in Taiwan was established in 1982, under the leadership of Professor Paul O. P. Tso. Scientists commenced their intensive research on July 1, 1986 under the directorship of Dr. James Wang. Drs. Ru-Chih C. Huang, Ray Wu, and Chien Ho served as interim directors from 1987 to 1990. Dr. C. C. Wang of UCSF assumed the directorship from 1991 to 1994. In the meantime, the institute completed its preparatory status and officially established itself as an institute on March 1, 1993. Dr. James C.-K. Shen served as the director from 1995 to January 2004. Dr. Meng-Chao Yao assumed the directorship from February 2004.



↑ CHL1, the first ion sensor identified in higher plants, exhibits dual functions: nitrate uptake and nitrate sensing. Using dual-affinity binding and phosphorylation switch, CHL1 can detect a wide range of soil nitrate concentration changes and lead to different levels of transcriptional responses. This study reveals a novel mechanism about how a sense can detect the concentration change of a substrate.



↑ DTX1 and DAPK are two new molecules critical for T cell anergy maintenance. DTX1 and DAPK coordinate to suppress multiple T cell activation signals.



↑ Hybrid sterility caused by incompatibility between a *S. bayanus*-nuclear gene (Sb-AEP2) and a *S. cerevisiae*-mitochondrial gene (Sc-OLI1).

Research Projects

At the Institute of Molecular Biology, extensive research is being conducted at the molecular and cellular levels in diverse fields of biology. Main themes of research interest at the institute include:

1. Nuclei acids and chromosome biology
2. Developmental biology
3. Neurobiology
4. Structural biology
5. Plant molecular biology
6. Virology

Significant Research Achievements

The goal of the institute has been to use molecular and structural biology as a tool to obtain advancements in biological research. Major efforts have been focused on chromosome biology, developmental biology, and neuroscience. Major research results of IMB principal investigators have been published in internationally renowned journals such as *Cell, Nature, Science, Nature Cell Biology, Genes & Development, Neuron, EMBO J., PNAS, Plant Cell, Molecular and Cellular Biology, PLoS Biology,* etc. These results are not confined to basic research; they may also be closely related to developments in biotechnology.

Genomics Research Center

886-2-2789 9930 886-2-2789 9931 http://www.genomics.sinica.edu.tw

Foreword

The Genomics Research Center (GRC) of Academia Sinica was established in January 2003, by former President Dr. Yuan-Tseh Lee, to focus on the discovery and validation of disease targets, and the development of innovative technologies. Through the commercialization of important discoveries and inventions of the center, the GRC will help to advance the development of the biomedical and pharmaceutical industry in Taiwan. Dr. Chi-Huey Wong was the founding director and Dr. Chung-Hsuan Chen has assumed the directorship since July 2007.

Research Projects

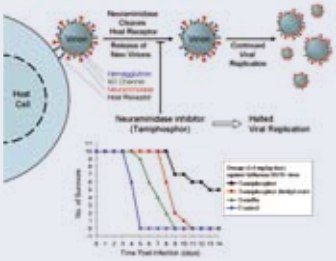
Major research efforts are focused on the following programs:

1. **Chemical Biology:** Major thrusts are (1) to identify and validate important targets associated with cancer and infectious diseases, (2) to understand the structure and function of these targets at the molecular level, and (3) to develop chemical and biological approaches to solve these problems in living systems. We will facilitate the applications of our discoveries and technologies in disease diagnosis, vaccine applications, and drug developments through technology transfer to solve emerging scientific, medical, and biotech problems.
2. **Medical Biology:** Major efforts are (1) molecular cancer biology, (2) epidemiology, (3) immunobiology, (4) stem cell biology, and (5) translational medicine. The ultimate goal is to develop new therapeutics based on small molecules, biologics, and cell-based approaches. Through concerted efforts, the following long term goals are expected to be achieved. They include (1) to understand the molecular mechanisms of genes associated with cancer and infectious diseases, (2) to facilitate platform technology transfer from academic institutes to biotech companies in Taiwan, and (3) to conduct enter into human (EIH) enabling studies so as to bridge the gap between laboratory research and clinical medicine.
3. **Physical & Computational Genomics:** The aims are to develop new tools for use in studying the dynamics of complex biological systems with improved sensitivity, resolution, convenience and cost. In addition to technology development, special emphasis will be placed on close collaboration with biomedical researchers to work on critical biomedical projects. The commercialization of some innovative technologies will be actively pursued.

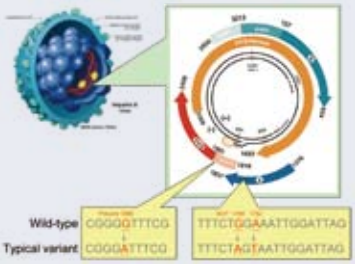
The GRC has established a Biotechnology Incubation Center to help nurture start-up companies to speed up the process of transforming new discoveries into commercial opportunities. The objective of the center is, by utilizing the scientific strength, international collaboration, and research talents of Academia Sinica to help start-up companies in the center, and facilitate the flourishing of the biotechnology industry in Taiwan.

Significant Research Achievements

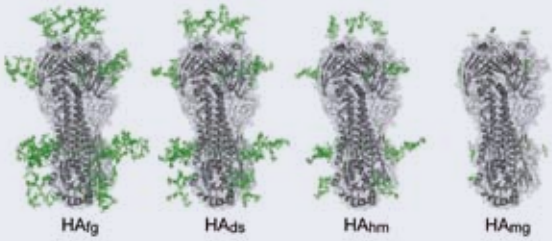
1. Novel polysaccharide synthesis and glycoarray development
2. Development of Tamiflu phosphonate cogeners and glycolipid adjuvant
3. Determination of structure of HA & M2 and inhibitors (amantadine and rimantadine)
4. Discovery of the lung stem cell in SARS infection
5. Completion of the genomics comparison between humans and chimpanzees
6. Development of a mass spectrometer with a broader mass range.
7. Installation and test of the ultra-high throughput drug screener
8. Potent immune-modulating and anticancer effects of NKT cell stimulatory glycolipids
9. Development of a charge-monitoring laser-induced acoustic desorption mass spectrometry for cell and microparticle mass distribution measurement
10. Discovery of histone demethylase RBP2 targets, a key mechanism of epigenetic regulation
11. A concise and flexible synthesis of the potent anti-influenza agents tamiflu and tamiphosphor
12. Discovery of expression of Globo H and SSEA3 in breast cancer stem cells and the involvement of fucosyl transferases 1 & 2 in Globo H synthesis
13. Discovery of the relationship between hepatitis B virus and the risk of hepatocellular carcinoma
14. Discovery that CLEC5A is critical for dengue virus-induced lethal disease
15. Removing the sugar coat of influenza hemagglutinin was proven to be a better strategy in vaccine design
16. Women with hepatitis B virus infection were found to have a higher risk of liver cancer
17. Key structures of membrane protein were unveiled for finding next-generation antibiotics
18. Pioneering immunotherapy was proven to be effective for childhood neuroblastoma in phase III trial



↑ Development of new drug candidates against influenza.



↑ Associations between hepatitis B virus genotype and mutants and the risk of hepatocellular carcinoma.



↑ Removing the sugar coat of influenza hemagglutinin (HA) proved to be a better strategy in vaccine design. From left, hemagglutinin glycoprotein structures on which the glycans are reduced in size.

Biodiversity Research Center

886-2-2789 9621 886-2-2789 9624 http://biodiv.sinica.edu.tw

Foreword

After two years of planning, the Biodiversity Research Center at Academia Sinica (BRCAS) was officially established in January 2004. In accordance with the "Convention on Biological Diversity," the BRCAS was formed with the hope of lowering species extinction, gene disappearance, resource reduction and ecosystem degradation on earth. In 2004, an advisory board co-chaired by Dr. Wen-Hsiung Li and Peter H. Raven was organized, comprising twelve distinguished members. The board was renamed as the Academic Advisory Committee in May 2005. In January 2008, the second-term advisory committee chaired by Dr. Nancy Knowlton was established, including ten distinguished scholars. Dr. Kwang-Tsao Shao, former director of the Institute of Zoology, has served as the acting director since the BRCAS was instituted. Dr. Wen-Hsiung Li became the director in January 2008.

Research Projects

The mission of the BRCAS is to promote, coordinate, and sponsor basic biodiversity research in Taiwan; to advance domestic and international research collaboration; to integrate biological, biotechnological, ecological, and socio-economical disciplines in pursuit of academic excellence and innovation; and to provide the scientific foundation for the conservation, education, and sustainable use of biodiversity. The center was formed also to render assistance to and enforce the Biodiversity Action Plan implemented by the Executive Yuan of Taiwan. The center has contributed to strategic governmental planning on ecological conservation, preservation, and sustainability.

Systematics and Biodiversity Informatics was designated as a thematic center aimed at promoting the integration of biodiversity information. The original museum of the Institute of Zoology and the herbarium of the Institute of Botany were transferred to the BRCAS in 2005 and were consolidated as the Biodiversity Research Museum on January 1, 2007. In order to enhance the public's understanding of the research collections, the museum is open to the public and school group visits.

The BRCAS focuses on four research areas:

- Marine Biodiversity and Ecosystems
- Terrestrial Biodiversity and Ecosystems
- Evolutionary Genetics and Genomics
- Microbial Diversity and Bioinformatics

Significant Research Achievements

The 19 researchers of the BRCAS have conducted many biodiversity-related research projects and made important contributions. They published papers in leading scientific journals, assisted the government in formulating biodiversity-related policies, and promoted biodiversity education. Research of the BRCAS encompasses the following categories: population genetics and molecular evolution; biological systematics; ecological and behavioral studies; preservation and restoration; and the integration of biodiversity databases and information networks in Taiwan.

In 2009, the BRCAS research faculty published about 52 SCI papers and held 5 conferences and 38 seminars both domestic and international. Research efforts ranged from basic research to applied fields that contributed to government policy-making.

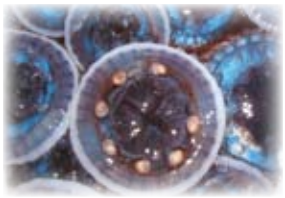
Zoological and Botanical Specimen Archives and Digitization in BRCAS

The Biodiversity Research Museum has maintained a collection of over 47,000 specimens. Included are fishes, birds, insects, corals, crustaceans, polychaetes, echinoderms, and mollusks. The museum also serves as the specimen deposition and database center of the national project for the cryobanking of wild animals. The herbarium (HAST) focuses mainly on collections of eastern Asia. Currently we have housed over 124,800 vascular plant specimens, with a growth rate of ca. 5,000 sheets per year. HAST has ca. 70,000 duplicate specimens for exchange with ca. 30 institutions worldwide.

↑ Anemone fish (*Amphiprion ocellaris*), a familiar coral reef fish due to the movie, Finding Nemo.

↑ Oriental Honey Buzzard with PTT for satellite tracking.

↑ Black-Backed Butterflyfish (*Chaetodon melannotus*), a fish commonly seen in the vicinity of Green Island.



↑ A kind of deep-sea jellyfish sometimes caught by beam trawl in the waters of eastern Taiwan.

↑ The spectacular karst limestone landform is home to many unique endemic plants. *Begonia pengii*, an attractive new species in Guangxi, China, was discovered by the Begonia research team led by Dr. Ching-I Peng and was named in his honor in 2008.

↑ An aggregation of the yellow chromis *Chromis analis* (Cuvier) in the subtidal waters of the Mian-Huea islet off the northern coast of Taiwan.

Agricultural Biotechnology Research Center

886-2-2651 5910 886-2-2651 5600 http://abrc.sinica.edu.tw/

Foreword

The Agricultural Biotechnology Research Center (ABRC) of Academia Sinica, formerly known as the Preparatory Office of the Institute of Bio Agricultural Sciences (IBS), was founded in January 1998 through the concerted efforts of Drs. Ray Wu and Yuan-Tseh Lee. Dr. Ning-Sun Yang was appointed as the founding director. The IBS was officially transformed and renamed as the ABRC in August 2006. Dr. Na-Shang Lin was appointed as the interim director. Starting from January 2008, Dr. Ming-Che Shih has served as the current director, with Drs. Shu-Mei Liang and Lie-Fen Shyur as deputy directors. The center currently has a total of 13 principal investigators and 6 research specialists, along with various supporting staffs working either at the Nankang main campus of Academia Sinica or at the Biotechnology Center in Tainan County, emphasizing integrated research themes, innovative technology development, and teamwork effort. The ABRC moved into the new Agricultural Technology Building in January 2010. The center has made strenuous attempts to consolidate its research activities and advance the development of agricultural biotechnology in Taiwan.

Research Projects

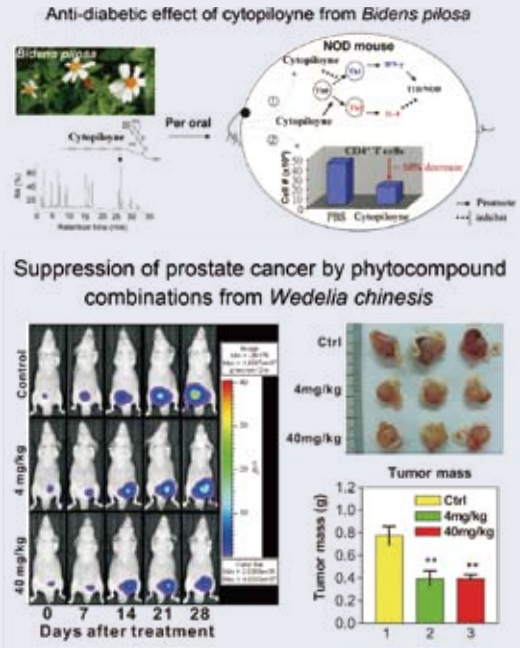
The ABRC pursues basic and mission-oriented research in agricultural biotechnology. The ABRC is actively engaged in theme-oriented and integrative research and currently has four major research programs including Integrative Plant Stress Biology, Herbal Medicine Research, Molecular Vaccine Technology, and Enzyme Biotechnology. We use a multidisciplinary approach that combines functional genomics, metabolomics, bioinformatics, and proteomics in our research. The ABRC emphasizes collaboration in research at both the national and international levels, and provides networking opportunities and information systems to serve the technological needs of the biotechnology industry in Taiwan.

Significant Research Achievements

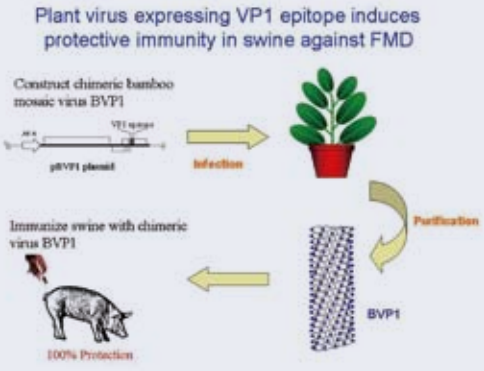
During the past few years, specific research projects designed to develop biotechnology-related agricultural programs have made very encouraging progress. Our key research areas are as follows:

1. The Integrative Plant Stress Biology Program has obtained good results in screening, characterization and use of drought-, chilling-, heat-, heavy metal-, phosphate- flooding-, or pathogen-tolerant genes from tomato or model plants, using plant physiology, cell and molecular biology, functional analysis and plant genetic engineering approaches.
2. The Herbal Medicine Research Program has defined promising experimental systems for studies of anti-inflamatory, immune-modulatory, and cancer-chemoprevention activities in response to phytocompounds from *Bidens pilosa, Wedelia chinesis, Echinacea purpurea* and other traditional medicinal plants.
3. The Molecular Vaccine Technology Program has established platform technologies for gene-based vaccines, plant virus vectors, and mammalian virus-like particles (VLP) against pig disease viruses and SARS viruses. Collaborations with the National Institute for Animal Health on field trials and commercialization of vaccine products are being actively discussed with a number of private sectors.
4. Three laboratories are now involved in a new R&D project, working on bio-mass conversion into energy or other cost-effective products.
5. Six research specialists are now planning several integrated R&D projects. Associated core facilities/technical units have also been set up, employing DNA micro-array, metabolomics, transgenic plants, experimental animal core facilities, and other technology systems.

Important research findings and potential biotechnology applications have resulted in publications in *Plant Cell, Plant Physiology, Cancer Research, BMC Genomics, J. Immunol.*, etc., and a series of applications for international patents.



↑ Significant results from Herbal Medicine Research Program.



↑ Strategic diagram for developing advanced vaccine technology.

Institute of History and Philology

886-2-2782 9555 886-2-2786 8834 http://www.ihp.sinica.edu.tw/

Foreword

The Institute of History and Philology (IHP) was founded by Fu Ssu-nien at Sun Yat-sen University, Canton in 1928. Under Fu's leadership, in less than a decade, the IHP advanced to the forefront in the fields of Chinese history, archaeology, linguistics, ethnology, and folk custom surveys. In the winter of 1948, the IHP moved from Nanjing to Taiwan. In 1954, the institute settled in its current premises in Nan-kang, Taipei.

The IHP is a research center dedicated to integrating multiple academic disciplines. Its members are currently undertaking studies of history, archaeology, anthropology, and philology. In the past eighty years, the institute's achievements in research have received the respect and attention of academics both in Taiwan and abroad. Additionally, the Fu Ssu-nien Library, the museum of the IHP, and the digitization of the IHP's special collections have all made enormous contributions to the academic community.

Research Projects

The IHP has two guiding principles for conducting research. First, the IHP respects the diversity of individual research and assists research fellows as much as possible to become leading scholars in their respective fields. Second, the institute facilitates research in several interdisciplinary subjects through the creation of special research units within the IHP. Simultaneously, the IHP strives to organize and publish academic materials written by its research fellows and to expand its digital holdings with the aim of establishing a platform for world-wide sinological research.

The IHP's four major research fields are as follows: 1) History, including the major areas of Chinese history as well as legal history, socio-cultural history, maritime history, world history, comparative history, and historical material, book, and record organization. 2) Archaeology, including research on the prehistoric cultures of Southeast Asian regions with Taiwan as a central focus, research of Asian continental regions with China proper as a focus, and the reconstruction of early Taiwanese history, archaeometry, etc. 3) Anthropology, including investigation into the culture of healing and medicine, religions and rituals, history of minority or ethnic groups, and cross-cultural comparative research. 4) Philology, including research on oracle bones, bronze wares, and bamboo slips as a major focus of study. In recent years, paleography and early Chinese history have become a core area of research at the IHP.

In order to promote integrated research, the IHP has established eight research units including Cultural and Intellectual History, Legal History, Ritual and Religion, History of Life and Healing, Archaeology of Taiwan and Southeast Asia, World History, Artifacts and Images, and Ancient Chinese Civilization. These research units or programs take specific topics as their basis for research, responding to changes in the academic world with flexibility.

Significant Research Achievements

The IHP has already claimed a stronghold in the fields of the history of life and healing, legal history, Ming and Ch'ing dynasty cities and cultures, artifacts and images, and other areas. The institute's noted publications in the last three years include the *Legal History Collection,* the *Medical History Collection,* and *Paleography and Early Chinese History*. Multiple volumes of *New Perspectives on Chinese History* and *Perspectives on Taiwanese Pre-History* are under preparation for publication. The IHP has done great service to the academic community in cataloging and publishing the Ming and Ch'ing imperial archives, Chinese popular literature collections, rare books, archaeological relics, and other important antique books, records, and historical materials. Scripta Sinica and the creation of other digitalized archives under the IHP's auspices have contributed even more to the convenience of academic research. Furthermore, the IHP is currently publishing four scholarly journals, including *The Bulletin of the Institute of History and Philology, Disquisitions on the Past and Present, Asia Major*, and the *Journal for Legal History Studies*. The books and periodicals published by the IHP already exceed 1,000 volumes.

↑ Tri-sectioned *Yu* Flask with a Swing Handle (Sacrificial Pit M1022, Hsi-pei-kang, Anyang, Honan)

↑ *Shui-hu Ssu-chuan Ch'üan-shu* (Compiled by Shih Nai-an, edited by Lo Kuan-chung, punctuated by Li Cho-wu; Ming dynasty)

↑ Ivory *Ssu* Spatula (Pit Horizontal 13 C, Hsiao-t'un, Anyang, Honan)

Institute of Ethnology

886-2-2652 3300 886-2-2785 5836 http://www.ioe.sinica.edu.tw/

Foreword

In 1928, Dr. Tsai Yuan-pei, a major exponent of ethnology in China and then president of Academia Sinica, established the ethnology section in the Institute of Social Sciences. In 1934, the ethnology section was transferred to the Institute of History and Philology. In 1955, after Academia Sinica moved to Taiwan, a preparatory office was established to conduct ethnographic research on the Han Chinese and the nearly 200,000 indigenous Austronesian people in Taiwan. This preparatory office finally led to the establishment of the Institute of Ethnology in 1965, with Professor Ling Shun-sheng serving as its first director.

Since its establishment, the institute has published more than ninety monographs. The bulletin was renamed the *Taiwan Journal of Anthropology* (*TJA*) in 2002. The journal's bilingual (Chinese and English) editorial committee is composed of anthropologists from Academia Sinica and overseas scholars. The *TJA* is published twice yearly.

Research Projects

There are four main research directions at the institute:

1. **Cultural History and Ethnicity:** This area includes two research orientations. The first one is to construct or reconstruct the historical and developmental processes of a group in order to understand its cultural components and meanings. The other is to compare and categorize cultural phenomena in order to construct or reconstruct people's movements and cultural dispersion.
2. **The Interface between Culture and Psychology:** The development of cultural psychology, under the rubric of Chinese indigenous psychology, has achieved major theoretical breakthroughs and has received international recognition lately. This approach starts from the unconscious levels of cultural phenomena, such as bodily senses and emotion, and moves towards social cognition and consciously constructed behaviorial patterns such as filial piety, conjugal relations, and the family.
3. **Contemporary Context of Socio-cultural Development:** Under the impact of globalization and modern nation-state formation, this area explores how societies (including both the Han Chinese and the indigenous peoples) have encountered new and controversial social issues, such as meanings of ethnicity, mental illness, cultural revivalism, and so on.
4. **Cultural Performance and Narration:** Expressive cultural performances include popular rituals (such as seasonal festivals, religious ceremonies, rites of passages, etc.) and performing arts (such as story-telling, theatrical performance, group games, etc.). Researchers can take the texts in performing art as a vantage point to understand culture, or conversely, to view performers as cultural transmitters in such performances.

Significant Research Achievements

Aside from individual research projects, the institute also develops integrated team projects in cooperation with other institutes of Academia Sinica and other colleges and universities. We hope to use teamwork to explore innovative research topics and conduct in-depth research. Cooperative research projects currently underway include:

1. Historical Anthropology
2. Popular Religions of the Han Chinese
3. Shamans and Ritual Performances in Contemporary Contexts
4. Taiwanese Families and Intergenerational Relationships: Changes and Continuities in a Globalizing Era
5. The Medical and Body Experience
6. Zang-Yi Corridor and its Ecosystem, Ethnic Culture, and Future Development
7. Formation and Reinvention of Cultures and Ethnic Groups among the Austronesians in Taiwan
8. The Dynamics of Expressive Culture
9. Culture, History, and Area: The History and Memory of the Peoples of Southwest China
10. Indigenous Mental Healing

↑ 2009 International Conference on Multiple Asian Perspectives. Lecture given by French scholar Maurice Godelier. (Photo by Wen-juan Yang)

↑ Manah Tainga ceremony of the Bunun Tribe (Photo by Yi-yi Zheng)

↑ Ai-ren (Pasu-taai) ritual of the Saisiyat Tribe in Wu-feng (Photo by Tai-li Hu)

Institute of Modern History

886-2-2782 4166 886-2-2786 1675 http://www.mh.sinica.edu.tw

Foreword

The Institute of Modern History was formally established in April 1965 with Professor Kuo Ting-yee as its director. Subsequent directors have included Professors Liang Ching-chun, Wang Yu-chun, Lu Shih-ch'iang, Chang Yu-fa, Chen San-ching, Lu Fang-shang, Chen Yung-fa, and Huang Ko-wu. Over the course of two five-year plans, the institute has recruited new members, held scholarly conferences, and carried out oral history interviews. It has also constructed a library, an archives building, research offices, and continuously enhanced its software and hardware capacities. Over these fifty years, the institute has become an international center for modern historical research.

Research Projects

Research conducted at the Institute of Modern History encompasses the transformations in modern Chinese politics, military affairs, foreign policy, society, economics, culture, thought, and other fields, and especially emphasizes exploration of the formation of modernity. The institute not only maintains solid traditions of historical research but has also intensified its concern with contemporary society, humanity, and world affairs. In order to effectively promote research into the important issues mentioned above, the institute's researchers have taken the initiative to organize nine research groups that are distinct but nevertheless correlate with one another. These are: 1) Post-war developments on both sides of the Taiwan Straits 2) Women's and gender history 3) The construction and dissemination of knowledge in modern China 4) Chinese urban history 5) Hu Shih 6) Chiang Kai-Shek 7) East Asia 8) Early modern history. On this basis, the institute intends to bring together colleagues with similar interests inside and outside of the institute to gather resources to carry out long-term and in-depth research on a number of important topics in modern history, as well as highlight the key features of research at the institute and gain a competitive advantage in international scholarly circles.

Significant Research Achievements

Thus far the institute has published 92 monographs, 30 conference volumes, 20 volumes of source materials, 51 collections of historical materials, 92 oral history interviews, and five diaries of prominent persons. The institute also publishes three journals, namely the *Bulletin of the Institute of Modern History Academia Sinica, Research on Women in Modern Chinese History,* and *Oral History*. The most important research includes that on the late Qing Self-strengthening Movement and the monograph series on regional modernization in China. Important research has been published as well on the history of China's foreign relations, cultural history, and women's and gender history, among other topics.

↑ MH Archives: Drawing of a coal mining area near a city.

↑ MH Archives: Memorandum

Institute of Economics

886-2-2789 9761 886-2-2785 3946 http://www.econ.sinica.edu.tw/

Foreword

The Institute of Economics was officially established in February 1970 in Nankang, Taipei, after eight years of preparation. The institute conducts scientific research in economics, and coordinates and promotes economic research activities in Taiwan. The institute has 33 researchers, including 3 distinguished research fellows, 18 research fellows, 5 associate research fellows, and 7 assistant research fellows.

Research Projects

The Institute of Economics pursues scientific research in economic theory and applications, paying special attention to economic development problems and related policy issues in Taiwan. Our research projects include: (1) Macroeconomics, Growth Theory, and Monetary Economics: Theory and Applications (2) Econometrics (3) Finance and their Applications (4) International Economics (5) Microeconomic Theory and Mathematical Economics (6) Population, Family, Labor, and Health Economics (7) Agricultural, Environmental, and Resource Economics (8) Industrial Organization, Regional Economics, and International Economics (9) Public and Legal Economics and (10) Public Policies.

↑ *Academia Economic Papers*

↑ Mo-Huan Auditorium

Significant Research Achievements

Our research achievements have been published in leading international scholarly journals including *American Economic Review, Econometrica, Journal of Econometrics, Journal of Economic Theory*, and *Journal of Political Economy*.

In terms of per capita publication in journals indexed by the SSCI in 2006, the institute is ranked top three in East Asia, being only behind the National Singapore University and the Chinese University of Hong Kong.

The institute publishes two scholarly journals: *Academia Economic Papers*, and *Taiwan Economic Forecast and Policy* (both are in Chinese). It also publishes a volume series in association with the Edward Elgar Publishing Co., called *Academia Studies in Asian Economies*. The 9th volume of the *Academia Studies in Asian Economies* was published in 2004, and is entitled *Human Capital, Trade and Public Policy in Rapidly Growing Economies: From Theory to Empirics*.

Institute of European and American Studies

886-2-2789 9390 886-2-2785 1787 http://www.ea.sinica.edu.tw/

Foreword

In August 1969, Dr. Shih-Chieh Wang, the late president of Academia Sinica, proposed the establishment of a permanent American studies institution in the Republic of China. In May 1972, the Center for American Studies was founded, and on July 1, 1974, the center was officially incorporated as the Institute of American Culture, Academia Sinica. Expanding its research scope to include European studies, the institute officially assumed its current title on August 3, 1991.

Research Projects

The institute specializes in area studies and interdisciplinary research. Its main foci include cultural studies, neo-pragmatism, European Union studies, Sino-American relations, and gender equality and public policy studies in Europe and the United States.

The researchers of the institute have explored the major areas of Western culture and civilization, including European and American literature and culture, American and German diplomatic history, the philosophy of language and mind, the structure and transformation of societies, history of art and sociology of culture, the role of education in society, major legal issues, EU law and politics, political systems and behavior, and American foreign policy and international relations.

Significant Research Achievements

Through sustained endeavor, the institute has distinguished itself in research on British and American authors and minorities' literature, public policy in Western societies, annual reports on Sino-American relations, and systems of government in the European Union. With an emphasis on the balance between critical reception and cultural differences, the institute has initiated a series of regular conferences, seminars, and lectures to promote and enhance European and American studies in the Republic of China on Taiwan. The institute's researchers publish about 100 papers per year, both in domestic and international journals.

Since its inception, the institute has published 60 monographs, 15 collections of selected papers, and 14 reports on specific issues. The institute's journal *EurAmerica*, a quarterly with more than 39 published volumes, is a prestigious forum for the study of Europe and the United States in the Asia Pacific region. *EurAmerica* (formerly *American Studies*) won the National Science Council Award for Superior Academic Journal in 1998, 2002, 2003, and 2004, respectively.

↑ *EurAmerica*

↑ Publications

↑ Conference posters

Institute of Sociology

886-2-2652 5100 886-2-2652 5050 http://www.ios.sinica.edu.tw

Foreword

The Institute of Sociology was established in January 2000 after a five-year preparatory period. Professor Chiu Hei-yuan was appointed as the institute's first director. He was succeeded by Dr. Ying-hwa Chang, Dr. Chih-ming Ka, and Dr. Yang-chih Fu. Currently the institute has twenty-six full time researchers with Dr. Hsin-Huang Michael Hsiao serving as director.

Research Projects

Since its establishment, the institute has developed six major objectives: to promote indigenous research and establish the identity of Taiwanese sociology, to advance research on neighboring societies, to foster cross-national and comparative studies, to systematize existing research, to explore new research areas, and to strengthen the professional status of sociology and actively participate in the community of sociologists. Major research themes in the upcoming years include organizations and networks, ethnicity and class, family and youth, Taiwan social change, economy and society, historical sociology, Asia-Pacific area studies, and the history of sociology.

To pursue the above-mentioned objectives, the institute has established the "Guidelines for the Thematic Research Teams" in December 2009. Currently, four thematic research teams have been formed: (1) Economy and Business (2) Family and Life Course (3) Ethnicity, Nation, and Modern States (4) China Impact Studies.

Significant Research Achievements

The institute's researchers actively publish their research results. In the past two years, the researchers of the institute have authored two and edited nine books respectively. In addition, 44 articles in refereed journals, 32 book chapters written in Chinese, and 12 book chapters written in English were published.

The institute organized numerous conferences and workshops at national and international levels, including:

I. International conferences

1. Conference on Social Capital: Its Origin and Consequence
2. Symposium on "Comparing Middle Classes in Ethnic Chinese Societies in Modern Asia-Pacific"
3. "Facing an Unequal World: Challenges for Sociology", Conference of the Council of National Associations of the International Sociological Association, Taipei, 2009
4. IOS-IASA Joint Workshop of Young Sociologists

II. National conferences

1. The Third Conference of Taiwan Youth Project, 2009
2. The 14th TSCS Conference and 2009 East Asian Social Survey Symposium
3. Conference on Social Integration and Conflict–Twenty Years after Ending Martial Law Rule in Taiwan
4. Conference on the Production, Reception and Innovation of Sociological Theories

III. Workshops

1. Workshop on Social Network Analysis
2. Workshop on Medicine, Technology, and Taiwanese Society
3. Workshop on Organization, Industries, and Market

↑ *Return to Reality: Political and Cultural Change in 1970s Taiwan and the Postwar Generation.*

↑ *Mental Disorders of the Tao Aboriginal Minority in Taiwan: Modernity, Social Change, and the Origin of Social Suffering.*

↑ Institute of Sociology

↑ Conference on Challenges for Sociology in an Unequal World, the International Sociological Association (Photo by I-hung Chen).

Institute of Chinese Literature and Philosophy

886-2-2788 3620 886-2-2651 0591 http://www.litphil.sinica.edu.tw/

Foreword

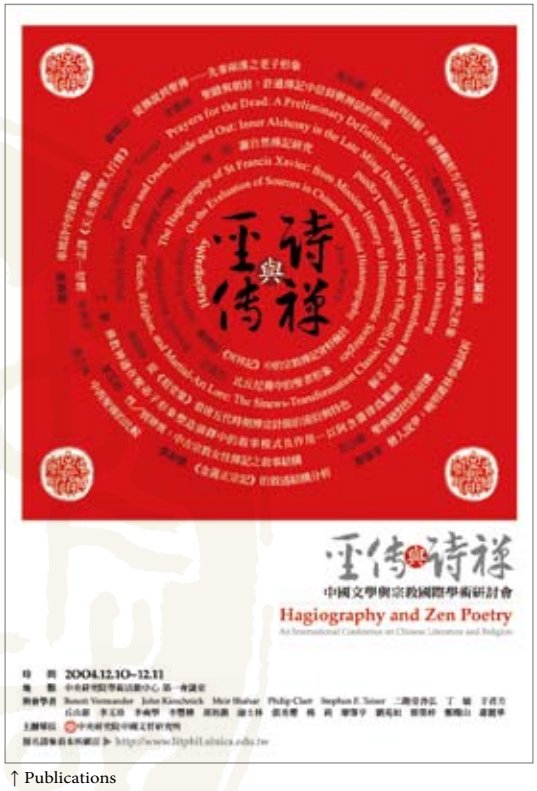
July 2002 saw the official inauguration of the Institute of Chinese Literature and Philosophy at Academia Sinica, after thirteen years of preparation. Dr. Tsai-chun Chung currently serves as its director.
In 1988, a proposal was made that Academia Sinica should include an Institute of Chinese Literature and Philosophy. As a result, a Preparatory Office of the institute was set up and Dr. Hung-i Wu was appointed director in the ensuing year. Research fellows began their appointments and work in August 1990. During its preparatory phase, Dr. Lian-chang Tai succeeded Dr. Wu as director in July 1992. Between 1997 and 2002, the institute was led by Dr. Tsai-chun Chung, who served as acting director. Dr. C. H. Wang joined the institute and became its founding director in 2002-2004. Dr. Ayling Wang served as its acting director after Dr. C. H. Wang left office. In February 2006, Dr. Tsai-chun Chung was appointed the second director of the institute.

Research Projects

The institute now boasts thirty well-selected research fellows, devoted to the studies of classical and modern Chinese literature, Chinese and comparative philosophy, and the Confucian classics. It includes five major research initiatives, namely Ming-Qing literature, modern literature, classical studies, contemporary Confucianism and religious studies. The institute encourages independent research by colleagues, and at the same time, promotes teamwork by motivating research fellows with different strengths and interests to collaborate on various research projects.

Significant Research Achievements

In the past twenty years, thanks to the active participation of its fellows, the institute has undertaken the following important projects: Ci poetry; Ming-Qing drama; the transmission and transformation of the Ming-Qing literary canon; Ming-Qing narrative theory and narrative literature; literature in historical dilemmas and crises; the Chinese literati's image of the self: construction and transformation; literature and religion; literary theory and popular culture in the mid-20th century; modern Taiwanese literature; Taiwanese literature in world perspective; the formation of the Confucian canon; hermeneutics and the Confucian tradition; Mencius studies; contemporary Confucianism; Liu Jishan studies; religion and 21st century Taiwan; the Yangzhou School in the Qianlong and Jiaqing eras; late Qing classical studies; Confucianism versus Taoism and Buddhism, and so forth. International scholarly conferences and conventions were held to make progressive developments on these projects and beyond.
The institute is also committed to creating and sharing digital databases for studies of ci poetry, classical drama, Confucianism, the Taoist canon, and Confucian classics. It publishes two journals: The *Bulletin of the Institute of Chinese Literature and Philosophy* and *Newsletter of the Institute of Chinese Literature and Philosophy*. The former was named one of the most respected journals in 2003 and 2004 by the National Science Council of Taiwan. The Institute's specialized publications include: *Chinese Literature and Philosophy Monographs, Collected Papers in Chinese Literature and Philosophy, Series in Mencius Studies, Series in Research on Contemporary Confucianism, Series in Research on Confucian Classics, Works of Contemporary Scholars in Literature and Philosophy, Series in Research on Ming-Qing literature, Series in Rare Ancient Books, Series in Ancient Books Edited*, and *Series in Bibliography*. To date we have published 143 books in 210 volumes in the above categories.



↑ Publications

↑ Publications of the Institute of Chinese Literature and Philosophy

Institute of Taiwan History

886-2-2652 5350 886-2-2788 1956 http://www.ith.sinica.edu.tw/

Foreword

In 1986, under the leadership of Academician K. C. Chang (1931-2001), Academia Sinica initiated a project on Taiwan Field Research. Two years later in 1988, the project was expanded to develop the Taiwan Field Research Office. On June 26, 1993, the Preparatory Office was established. The Institute of Taiwan History was officially founded on July 1, 2004.

↑ Institute of Taiwan History, Academia Sinica. Taiwan archives online (http://ithda.ith.sinica.edu.tw/?action=index

↑ Conference posters of past years

↑ Publications by the Institute of Taiwan History

Research Projects

The Institute of Taiwan History aims at building a world-class research institute that can serve as a leading force in Taiwan studies, while also striving to foster indigenous and international research on Taiwan. The institute has set up five research groups, devoted to major fields of research as well as various collaborative projects spanning from the seventeenth to the twentieth centuries. Each research group's thematic project and major activities are as follows:

1. Socio-Economic History: Thematic studies on land exploitation and ownership in agro-frontier society, commercial traditions, trading developments in Taiwanese economic history.
2. Colonial Studies: Major studies on colonial bureaucracy and administration, overseas Taiwanese during the Japanese colonial period.
3. Ethno-History: Themes include the history of plain aborigines, Han-Hakka sub-ethnic relations, discourses on local societies residing in the four-streams area (Fengshan, Touqian Xi, Zhonggang Xi, and Houlong) and the hill terrains.
4. Cultural History: Topics on colonial modernity, political thought and comparative politics, religious history in medicine, women's history of East Asia, etc.
5. Environmental History: Histories of diseases, natural disasters, and eco-environment.

Collaborative projects include regional studies on the Dan-shui River and the Ping-tung plains, changes and transformations of local societies in colonial Taiwan, comparative studies by region on Hakka societies and their cultures.

Significant Research Achievements

Various publications showcase the research contributions of the institute. The wealth of publications by the institute include monographs, journal articles, as well as edited oral histories, dietaries, collections of historical documents, local gazetteers, conference proceedings, source collections, reference books, and research references. The institute's leading journal is *Taiwan Historical Research*. These publications have received broad acclaim by academia. In addition, the institute regularly holds international symposiums and conferences, seminars, as well as group-initiated lectures and workshops. These activities not only attract international scholars but also arouse the interest of younger researchers at domestic universities. The institute also houses numerous archival collections. Presently, the institute holds archives of 43,000 private and 4,500 official documents. Upon completing the digitalization of these documents and the online databases, the institute has made its digitalized databases and related services available for public use. The digital databases integrate various resources to promote the history of Taiwan. Due to its outstanding archival collections, Academia Sinica has recently granted the institute's application for an archive hall.

Institute of Linguistics

886-2-2652 5000 886-2-2785 6622 http://www.ling.sinica.edu.tw/

Foreword

In accordance with Academia Sinica's long-term development policy of "establishing institutes for basic sciences and centers for interdisciplinary research", and in order to explore the common biological, mathematical, and cultural roots of human language with an aim to enhancing scientific and systematic knowledge, a preparatory office for the Institute of Linguistics was set up in 1997, resulting in a full-fledged institute in 2004. Currently, the institute has 16 full-time researchers. The overall objective of the institute is to achieve scientific and systematic knowledge about human language by conducting purely linguistic as well as interdisciplinary research on the languages of Taiwan and genetically and regionally related languages. Important contributions have been made especially in linguistic structure analyses, linguistic computation and simulation, language archiving, and interdisciplinary studies.

Research Projects

The major approaches to linguistic research conducted at this institute include the following:

1. **Structural research:** Descriptive and typological analysis, historical comparison
2. **Theoretical research:** Phonological, syntactic, and semantic theory
3. **Linguistic documentation:** Language archiving, corpus linguistics, geo-informatics
4. **Cognitive research:** Neurolinguistics and cognitive development of language
5. **Computational research:** Speech engineering, language anchor and ontology, WordNet
6. **Linguistic diversity research:** Documentation of endangered languages, language conservation, ecological linguistics.

Apart from conducting individual research, research fellows of the institute also join various research groups according to their research interests. Currently there are three research groups including the Linguistic Structure and Typology Research Group, Corpus and Computational Linguistics Research Group, and Phonetics, Phonology, and Speech Science Research Group. Research groups constitute cross-language and cross-discipline platforms allowing researchers to conduct issue-oriented collaborations. The two core laboratories of the institute, the Phonetics Lab and the Cognitive and Neural Linguistics Lab, enable researchers to probe into various linguistic phenomena by conducting experimental studies in the lab.

Significant Research Achievements

Academic Publications

Over the years, the institute has produced several hundred research works. Important research achievements receiving considerable international acclaim include studies of Sino-Tibetan reconstruction, migratory history of Formosan aboriginals, salvage work on endangered languages of Taiwan, discovery of new Tibeto-Burman languages and dialects, introduction of MARV theory in lexical semantics, application of geographic information system technology to dialectology, discourse prosody, discovery of cross-linguistic generalizations between word form and concept development, and neural correlates of Chinese language processing. In 2000, the institute began publication of the international journal entitled *Language and Linguistics*, which has since been recognized as one of the highest-quality linguistic journals in this country, indexed now inter alia by the SSCI and AHCI citation databases. The journal also has a series of accompanying monographs. Monographs published in the past two years include *A Grammar of Mantauran (Rukai), Studies on the Menggu Ziyun, Ritual Texts of the Last Traditional Practitioners of Nanwang Puyuma, Acquisition and Evolution of Phonological Systems, The Emergence of Language: Development and Evolution, Interfaces in Chinese Phonology, Mapping Taiwanese, Linguistics Patterns in Spontaneous Speech,* and *Computational Simulation in Evolutionary Linguistics: A Study on Language Emergence*.

Language Archiving

The Language Archiving Project of the institute has systematically created digital archives of language data. Since 2002, digital archival materials have been successively made available online for convenient searching. Our online digital archives have become basic research portals for researchers on Chinese and Austronesian languages. The second phase of the project was launched in 2007 with the following sub-projects: Southern Min and Hakka, Indigenous Austronesian Languages, Sociolinguistics of Spoken Taiwan Mandarin, Tagged Corpus of Old Chinese, and Lexicon of Pre-Qin Inscriptions on Bone, Bronze, and Bamboo Media.

Academic Activities

Each year, the institute hosts important international meetings and conferences on a range of linguistic themes. Conferences organized in the past two years include "The Past Meets the Present: A Dialogue Between Historical Linguistics and Theoretical Linguistics", "Workshop on Tibeto-Burman Languages of Sichuan", "Workshop on Chinese Directionals: History and Dialectal Variation in Conjunction with the 6th Cross-Strait Conference on Chinese Historical Grammar", "Workshop on Coordination and Comitativity in Austronesian Languages", and "International Conference on the Tangut Language and the Religions and Cultures of Northern China in the Age of the Xixia, the Liao, and the Jin".

Institute of Political Science (Preparatory Office)

886-2-2652 5300 886-2-2654 6011 http://www.ipsas.sinica.edu.tw

Foreword

In July 1994, the Council of Academicians advised Academia Sinica (AS) to set up an Institute of Political Science. In October 1999, a planning commission for the Institute of Political Science at Academia Sinica (IPSAS) was formed. It drew up a formal proposal that was later approved by the Presidential Office in March 2001. The Preparatory Office of the IPSAS was founded in August 2002. The founding director is Dr. Yu-Shan Wu (2002-). He is advised by an Academic Consultative Committee headed by Academician Fo Hu (2002-). By the end of 2009, the IPSAS had twelve full-time research fellows. It is located on the fifth and six floors in the north wing of the new Humanities and Social Sciences Building. The IPSAS is commissioned to explore carefully selected issues that are conducive to making basic theoretical contributions, meeting national priorities, and conducting cutting-edge research in mainstream political science.

The emblem of the IPSAS is a white ionic column from ancient Greece against a blue background with the abbreviation of the institute at the bottom, symbolizing the democratic spirit dating back to ancient Greece and the aspiration of traditional Chinese intellectuals to serve as the mainstay of society.

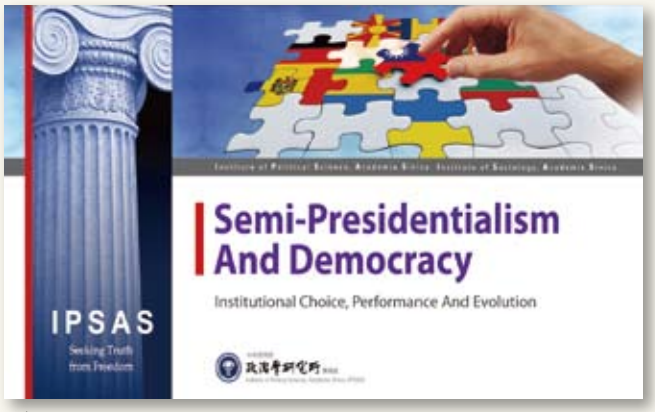
Research Projects

The research agenda of the IPSAS focuses on theory-oriented, area-based comparative politics and international relations studies. The IPSAS has five research groups:

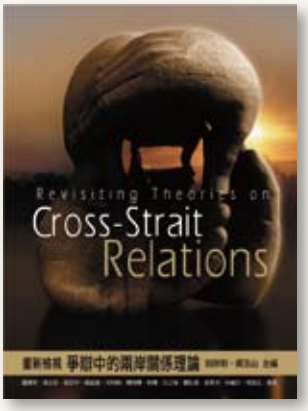
1. Taiwan Politics and Nascent Democracies
2. Political and Economic Transitions in Mainland China and Post-socialist Countries
3. Cross-Strait Relations and International Relations Theory
4. Political Value Change in East Asia and Global Democratic Development
5. Methodology

Significant Research Achievements

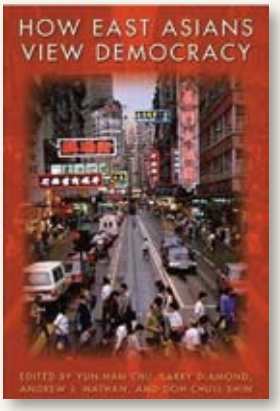
1. **Taiwan Politics and Nascent Democracies:** Researchers at the IPSAS have explored the relationship between semi-presidentialism and democracy globally; identified west European, post-Leninist, and post-colonial as the three main geographical/cultural clusters of semi-presidential countries; gauged the impact that constitutional design, electoral outcome, and geographical/cultural clustering has on the choice, operation, and performance of the sub-types of semi-presidential systems.
2. **Political and Economic Transitions in Mainland China and Post-socialist Countries:** Researchers at the IPSAS have discovered that the rise of China is closely related to its party-state developmentalism, as embodied in the tripartite structure of government, state-owned or state-invested enterprises, and government-related research institutes all geared toward rapid growth. China's surge has given rise to three images: An authoritarian development model, an unfair economic player, and a strategic and security concern.
3. **Cross-Strait Relations and International Relations Theory:** In *Revisiting Theories on Cross-Strait Relations*, authors have proposed a total of thirteen approaches in three dimensions (cross-Strait interaction, domestic politics, and international environment) to analyze transformations in cross-Strait relations. This study inherits the intellectual tradition established a decade ago, provides an inter-disciplinary perspective, and reviews the impact of the changing balance of power in East Asia and the world on cross-Strait relations. It is a new milestone in cross-Strait studies.
4. **Political Value Change in East Asia and Global Democratic Development:** In *How East Asians View Democracy*, we publish for the first time the research findings of Asian Barometer. Asian Barometer has put together a highly integrated international research team that conducted three rounds of surveys in 18 countries and collected their macro data, joined Global Barometer in its world-wide survey network, explored the transformation of democratic values in Asia, and gauged their impact on democratic transition, democratic consolidation, and governance quality.
5. **Methodology:** Researchers at the IPSAS have derived a composite game-theoretical legislative model that integrates the preferences of the legislators, institutional bias, and party influence to explore the hitherto understudied equilibrating behaviors. This game model can be used to gauge the impact of recent institutional reforms (such as on boycott) on legislative deadlock. The model proves to be of great value to the study of comparative institutional design and legislative deadlock.



↑ Semi-Presidentialism and Democracy



↑ *Revisiting Theories on Cross-Strait Relations*



↑ *How East Asians View Democracy*

Institutum Iurisprudentiae (Preparatory Office)

886-2-2652 5400 886-2-2785 9471 http://www.iias.sinica.edu.tw

Foreword

In order to fulfill the principle of "establishing institutes for each fundamental discipline while setting up research centers for interdisciplinary studies," Academia Sinica established the Institutum Iurisprudentiae (Preparatory Office) (hereinafter IIAS) on July 1st, 2004 and appointed Professor Dennis Te-Chung Tang as the inaugural director to lay down the foundation for the IIAS.

Research Projects

With the aims to assume a pivotal and leading role within the shortest time in Taiwan's legal studies community and to distinguish itself in the international legal academia in the near future, the IIAS designates six core research fields in its "Founding Proposal" and concentrates its resources on these research fields to facilitate significant academic breakthroughs. The six core research fields include: (1) Constitutional Structure and Human Rights, (2) Administrative Regulation and Judicial Remedies, (3) Law, Science and Technology, (4) Jurisprudence and Social Transformation, (5) Legal Development in China, Hong Kong, and Macau, and (6) Comparative Study of Judiciary Systems, Empirical Study of Judicial Behavior, and Legislative Studies.

↑ The IIAS has published 14 volumes of books as well as 7 issues of its law journal.

Significant Research Achievements

Since its founding, the IIAS has hosted 21 major academic conferences and published 14 volumes of books as well as 7 issues of its law journal. All published works have gone through double-blind peer reviews. Accomplishments have been made in every one of the six core research fields. Here is a sketch of each field:

1. In its earlier days, the Law Division of the Institute for Social Sciences and Philosophy, the institutional predecessor of the IIAS, had identified the study of constitutional law as one of its primary areas of research. Since 1997, it held seven Biennial Symposia on "Constitutional Interpretation: Theory and Practice." The papers from these symposia all were reviewed and published in a series of books. Thus far, eight books have been published under the series title *Constitutional Interpretation: Theory and Practice*. The 1st volume was published in 1988, the 2nd in 2000, the 3rd in 2002 (2 volumes), the 4th in 2005, the 5th in 2007, and the 6th in 2009 (2 volumes). The 7th Symposium was held on December 11 and 12, 2009, with two keynote speeches and 12 papers in total. These papers are currently in the process of revision and final submission for review for publication.
2. Since 2005, the IIAS has been holding the "Conference on Administrative Regulation and Judicial Remedies" in conjunction with the Supreme Administrative Courts and the High Administrative Courts in Taipei, Taichung, and Kaohsiung, respectively. Since 2006, this seminar conference has been expanded to be held twice per year (May and November). The conference papers are peer-reviewed and so far have been edited into four books under the series title *Administrative Regulation and Judicial Remedies*, which were published in 2006, 2007, 2008, and 2009, respectively. The papers presented in the 2009 Conference are now in the process of revision and final submission for consideration of publication.
3. The IIAS held the "First Symposium on Law, Science, and Technology" on December 16th, 2006 and the reviewed papers were edited into the *Biennial Review of Law, Science, and Technology 2007 -- Legal Construction of Risk in the System of Public Health* in 2008. In December 2008, the IIAS held the "Second Symposium on Law, Science, and Technology." The reviewed papers have gone through the process of revision and are currently in press.
4. The "First International Conference on Jurisprudence and Social Change" was held on October 27th, 2007. The papers presented in this conference were reviewed and published in 2008. The second conference is scheduled to be held in 2011.
5. On June 2nd and 3rd, 2006, the IIAS held the "Conference on the Law Developments in Taiwan, Mainland China, Hong Kong, and Macau." The conference papers were officially published as *2006 Cross-Strait, Four-Region: Law Developments in Taiwan, China, Hong Kong, and Macau (Volume One: Constitutional Review and Administrative Litigation; Volume Two: Civil Procedure and Criminal Procedure)* in 2007. This conference received high acclaim and widespread approval, so the participants from the four areas agreed to host this conference annually in turn. The 2007 conference was hosted by Sun Yat-Sen University in Guangzhou, China, on December 12 and 13, 2007. The University of Hong Kong and the University of Macao hosted the conferences on November 21 and 22, 2008, and November 16 and 17, 2009, respectively. In June 2010, the IIAS will hold the conference again, focusing on legal education reform in these areas.
6. In June 2008, the IIAS held the "First International Conference on Empirical Legal Studies of Judicial Systems" with participants coming from the United States, the United Kingdom and Japan. The conference papers were published under the title *2008 Empirical Studies of Judicial Systems* in 2009. In July 2009, the IIAS also held the symposium on "Judicial Reforms of the Past Decade: Retrospect and Prospects." The symposium records have been published as *The Tenth Anniversary of the National Conference on Judicial Reform: Retrospect and Prospects (Symposium Records)*. The "Second International Conference on Empirical Legal Studies of Judicial Systems" is scheduled to be held on June 24-25, 2011.

In addition, the inaugural issue of *Academia Sinica Law Journal* was launched in March 2007 with nine highly regarded articles submitted by renowned overseas scholars (including the United States, Germany, France, Japan, etc.). With this great start, the IIAS has been publishing the law journal twice a year since September 2007. So far, six issues have been published; the latest one just came out in March 2010. Since 2008, the journal has been holding an annual 2010 contest to confer the "Academia Sinica Law Journal Award."

Research Center for Humanities and Social Sciences

886-2-2782 1693 886-2-2785 4160 http://www.rchss.sinica.edu.tw/

Foreword

The Research Center for Humanities and Social Sciences (RCHSS) was established on July 1, 2004. Its major mission is to conduct interdisciplinary research in the humanities and social sciences. It currently has seven thematic centers and five research programs. The research center is headed by a director and a deputy director. Each thematic center has an executive director, and each research program has a convener. The executive director or convener leads a team of full-time, jointly appointed, adjunct and affiliated researchers to conduct well-defined research projects.

Research Projects

RCHSS has three research clusters: Specific thematic research, area studies, and data archiving and analysis. The thematic centers and research programs in the three clusters organize workshops, seminars and conferences regularly to promote and coordinate research in their specialized fields.

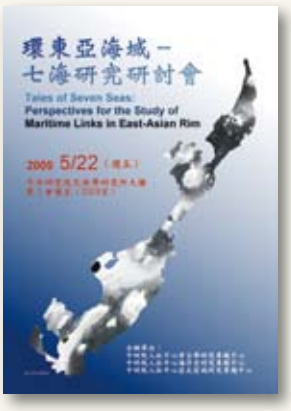
Significant Research Achievements

In the cluster of specific thematic research, the Center for Political Thought currently focuses on two research projects: "Taiwanese Citizenship: Theory and Practice", and "Constitutionalism and Its Fundamental Values". Several workshops and conferences have been held for each project since 2005. Two monographs related to the projects were published. The Center for Institution and Behavior Studies has issued publications on regulatory economics, empirical political studies, institutional formation and change, and network economics. In 2009, several conferences related to network economics and legal issues were held. The Program for History of Health has held related workshops. The Research Project on Data Mining and Archiving has shown outstanding performance in international competitions.

In the cluster of area studies, the Center for Maritime History explores issues concerning shipping, trade, port cities, maritime cultural intercourse, and migration. A conference of maritime history focusing on ports, cities and trading networks was held in 2009. The Center for Archeological Studies has conducted studies on various archaeological sites in Taiwan and developed collaborative work on the Lapita Site with experts at the University of Auckland in New Zealand. The Center for Asia-Pacific Area Studies supports individual and integrated projects on Asia-Pacific studies and develops substantial collaborations with related institutes in France and the United States. It publishes the bi-annual *Asia-Pacific Forum* and monographs on Asia-Pacific studies. The Program for Economic Development and Trade in East Asia has worked on building a solid foundation for the study of Chinese economic development after 1978.

In the cluster of data archiving and analysis, the Center for Survey Research regularly assists researchers at Academia Sinica in conducting face-to-face or telephone surveys. It has a Data Archive of Social Science for public use, perhaps the best in Asia. Its researchers' papers on survey methods have been published in domestic and international journals. It issues a bi-annual journal, *Survey Research*. The Center for Geographic Information Science has developed two historical GIS's: the Chinese Civilization in Time and Space (CCTS) and the Taiwan History and Culture in Time and Space (THCTS). The two systems function as a basic research platform characterized by temporal depth and spatial breadth, and provide a database for academic research in regional studies, environmental and epidemic history, and other spatial analyses. The Program for Historical Demography and the Program for the Study of the Family in Chinese Societies have both enriched their data, and promoted related studies through workshops and conferences.

The RCHSS publishes the quarterly *Journal of Social Sciences and Philosophy* and a monograph series.

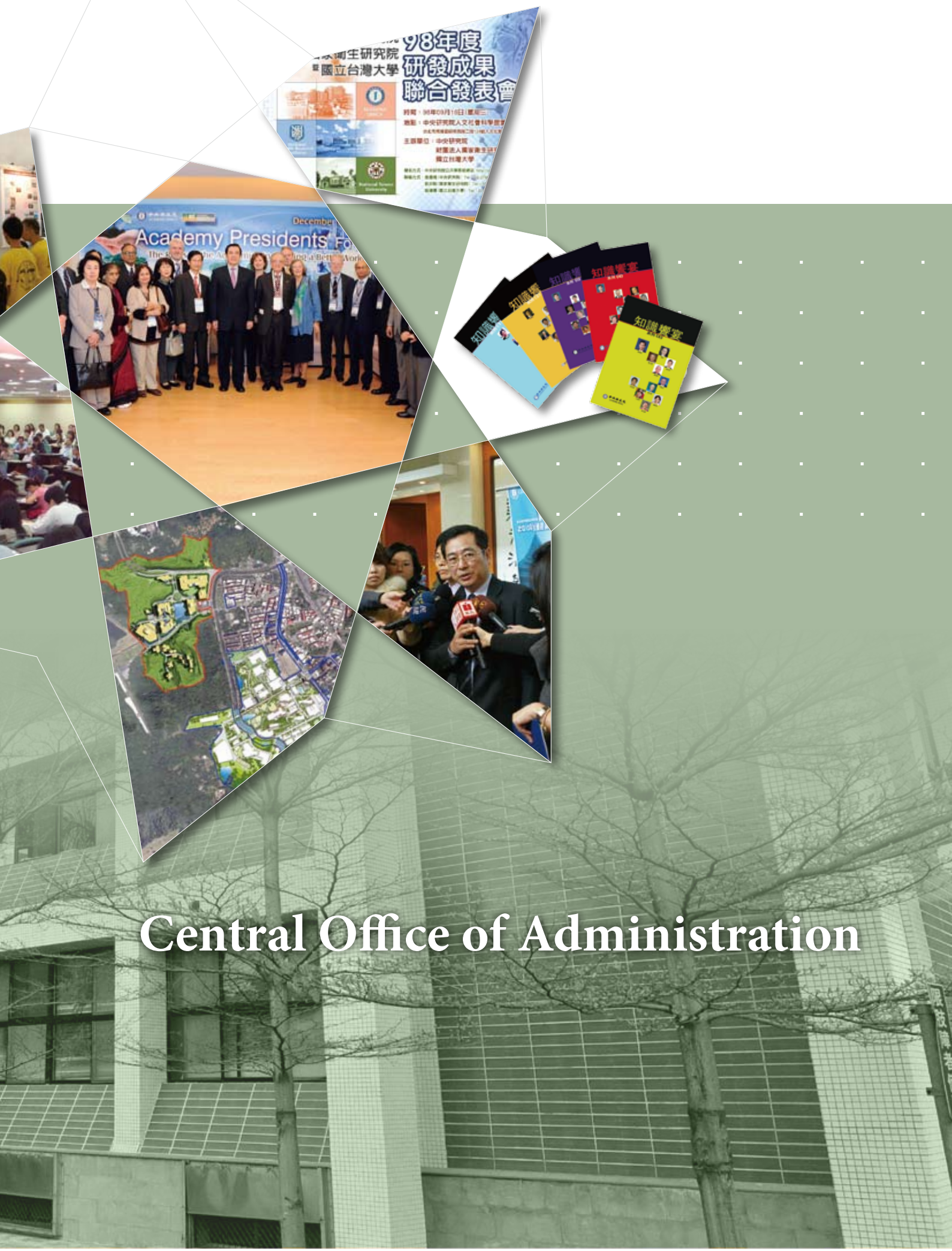


↑ Publications of the Research Center for Humanities and Social Sciences

Libraries

http://aslib.sinica.edu.tw/

Libraries	TEL	Mon. – Fri.	Saturday	Sunday
Mathematics and Physical Sciences				
Library of Institute of Mathematics	886-2-2368-5999 #441-443	8:10-21:00	13:00-17:00	13:00-17:00
Library of Institute of Physics	886-2-2789-6710	9:00-17:00	Closed	Closed
Library of Institute of Chemistry	886-2-2789-8590	8:30-17:00	Closed	Closed
Library of Institute of Earth Sciences	886-2-2789-9773	8:00-12:00 / 13:30-17:30	Closed	Closed
Library of Institute of Information Science	886-2-2788-3799 #1201-1202	9:00-17:30	Closed	Closed
Library of Institute of Statistical Science	886-2-2783-5611 #201	8:30-17:00	Closed	Closed
Library of Institute of Atomic and Molecular Sciences	886-2-2362-4915	8:30-20:50	9:00-17:00	Closed
Library of Institute of Astronomy and Astrophysics	886-2-2366-5470	9:00-12:00 / 13:30-17:00	Closed	Closed
Life Sciences				
Life Science Library	886-2-2789-9829	8:30-21:00	8:30-17:00	Closed
Humanities and Social Sciences				
Joint Library of Humanities and Social Sciences	886-2-2652-5284	8:30-17:00	Closed	Closed
Geographic Information Archives	886-2-2652-5284	Open on request	Closed	Closed
Fu Ssu-nien Library	886-2-2782-9555 #600-601	8:30-17:00	Closed	Closed
Library of Institute of Ethnology	886-2-2652-3369	8:30-17:00	Closed	Closed
Library of Institute of Modern History	886-2-2789-8291	8:30-17:00	Closed	Closed
Library of Institute of Economics	886-2-2782-2791 #500	8:30-17:00	Closed	Closed
Library of Institute of European and American Studies	886-2-2789-9390	8:20-17:20	Closed	Closed
Library of Institute of Chinese Literature and Philosophy	886-2-2789-5726	9:00-16:50	Closed	Closed
Library of Research Center for Humanities and Social Sciences	886-2-2782-1693 #208	8:30-17:00	Closed	Closed
Library of Center for Asia Pacific Area Study	886-2-2652-3369; 886-2-2652-3373	8:30-16:50	Closed	Closed



Central Office of Administration

Secretariat Office

886-2-2789 9408 886-2-2785 3847 http://sec.sinica.edu.tw/

The Secretariat Office includes the Divisions of Conference Affairs, Planning and Activities, and Records.

Summary of Key Duties

1. **Conference and Election Affairs:** Organizing the Convocation of Academicians, Council of Academia Sinica, General Assembly, quarterly meetings of domestic academicians, foresight planning meetings of academic and administrative chiefs, and executive meetings, as well as holding elections of Academicians, Honorary Academicians, Council Members, President, and Research Fellow Representatives for the General Assembly.
2. **Reports and Publications:** Compilation of presidential office reports, Academia Sinica annual budget and policy planning reports, general reports on the affairs of Academia Sinica, administrative reports, annual budget reports, and annual budget planning. Preparing medium-range plans, biennial summaries of the affairs of Academia Sinica, rosters of academicians and council members, ROC almanacs, lists of annual research achievements and theses, English and Chinese editions of the Academia Sinica Weekly Newsletter and E-news, Knowledge Feast book series, English and Chinese multi-media introductions to Academia Sinica, and the Academia Sinica Yearbook.
3. **Planning and Activities:** Organizing public functions such as the Knowledge Banquet, Lectures in Honor of Former Presidents, Open Campus Tours, Art and Cultural Activities, Popular Science Lectures, and other events. Collecting media reports related to Academia Sinica. Preparation of speeches and public announcements as well as the arrangement of visitors' receptions and the issuance of gifts and cards for social occasions.
4. **Public Announcements and Referrals:** In charge of making public announcements and receiving recommendations for academic awards and professional opinions. Managing the academic administration, academic activities, maintenance of the Academia Sinica calendar, the electronic bulletins sections, and compilation of special reports on Academia Sinica's homepage.
5. **Management of Official Documents:** In charge of the automation of official documents (e.g. the reception, verification, distribution, numbering, registration, proofreading, sealing, and delivery of documents, the electronic exchange of documents and electronic bulletin announcements.) The revision of document regulations, the affixing and safekeeping of official seals, the dispatch of documents, and the management of files (e.g. the receiving, archiving, cataloguing, filing, preservation, investigation, and lending of files).

Public Affairs Office

886-2-2789 9383 886-2-2651 8049 http://otl.sinica.edu.tw/

Office of Public Affairs is in charge of intellectual property management, technology transfer and legal affairs.

Summary of Key Duties

1. **Intellectual Property Management:**
   Responsible for protecting and managing Academia Sinica's intellectual property and encouraging the disclosure of new discoveries. Assists researchers in identifying the value of intangible and tangible research outcomes. Evaluates patentability and licensability of new inventions by conducting patent search, market and technology validation. Coordinates with patent attorneys to protect inventions through patent applications.
2. **Technology Transfer:**
   Responsible for marketing and licensing Academia Sinica's technologies and products to private sectors. Conducts technology assessment and market research for new inventions. Seeks and fosters contacts with potential licensees that are capable of developing and commercializing the innovations into products and services for the public benefit. Develops and negotiates license agreements. Cultivates relationships among industry, academia and government to foster partnerships and collaborations.
3. **Legal affairs:**
   Assists in dealing with matters related not only to intellectual property rights accruing in the course of technology transfer but also other legal affairs. Provides legal services to the institutes, preparatory offices, or research centers of Academia Sinica. Assists in drafting guidelines, by-laws, and regulations. Reviews contracts as well as compiles enactments and provides legal consultations.

General Affairs Office

886-2-2789 9418 886-2-2785 0719 http://proj1.sinica.edu.tw/~gao1018/index.htm

The General Affairs Office is made up of six sections: Construction and Maintenance, Business, Procurement, Cashier, Campus Security, and Environment and Safety.

Summary of Key Duties

1. Facility Maintenance: Repairing and maintaining campus buildings, dormitories, roads, landscapes, mechanical and electrical systems, fire fighting facilities, communication facilities, and public facilities.
2. Construction Management: Responsible for building construction, management and procurement of mechanical and electrical systems in buildings and any other construction-related affairs.
3. Business Management: Managing Academia Sinica properties, vehicles, dormitories, offices, meeting facilities, and landscapes.
4. Procurement: Handling the purchasing of general goods and services.
5. Cashier: Handling cash payments and receipts, accounts payable and accounts receivable, and the safekeeping of funds and fees.
6. Parking Services: Responsible for the enforcement of parking and traffic regulations.
7. Campus Security: Responsible for building access control, security patrol around campus and dormitories, resolving campus accidents and providing pertinent assistance, protecting the safety of head officers, and maintaining order at particular meetings.
8. Environment and Safety Management: Coordinating the operation, maintenance and management of environment, health, and safety issues. The Environment, Health & Safety section provides staff with access to essential services in the following areas: environmental protection, radiation protection, fire safety and protection, medical care, and waste management.
9. Center of Academic Activities: The center offers a versatile space for various academic activities, and comprises a lecture hall (700 seats), several conference rooms and a guesthouse (123 rooms) suitable for short visits to Academia Sinica. The center also incorporates three restaurants: a Chinese restaurant, a Western restaurant, and a coffee shop. The center offers live facilities and excellent service for all kinds of events.
10. Gymnasium: The Gymnasium was launched in 2001, incorporating a variety of modern facilities for top-notch sports that include a 6-lane indoor swimming pool (50m×16m×1.4m), a 140-meter jogging track, a fitness gym, a rhythmic gym, a basketball/volleyball court (720m^2), 2 tennis courts (1,188m^2), and 3 badminton courts (780m^2). It is open to the employees of Academia Sinica, neighboring residents, and public organizations.

Academic Affairs Office

886-2 2789 9823 886-2 2789 8045 http://aao.sinica.edu.tw/english/index.php

Established on January 1, 2002, the Academic Affairs Office (AAO) is comprised of the Academic Development Section and the Academic Review Section. It carries out administrative tasks assigned by the Central Academic Advisory Committee. Its duties include general administrative affairs concerning academic cooperation, academic evaluation, appointment and promotion of research fellows, cultivation of young scholars, and development of interdisciplinary research.

↑ The award ceremony of the 2009 Academia Sinica Research Award for Junior Research Investigators.

Summary of Key Duties

1. **Research and Development:** Collecting research information; promoting mid- and long-term academic development programs; founding new research institutes (preparatory offices) and centers.
2. **Review and Evaluation:** Establishing academic evaluation procedures; arranging review committees to assess recruitment and promotion of research fellows; formulating guidelines for assessing research institutes (preparatory offices) and centers and periodically evaluating their performance accordingly; reviewing the development of new research disciplines; undertaking administrative responsibilities of the Ethics Committee, Biosafety Committee, and Human Subject Research Ethics Committee.
3. **Cultivation and Award:** Reviewing applications for fellowships for doctoral candidates in the humanities and social sciences, Research Award for Junior Research Investigators, short-term domestic visiting scholars to Academia Sinica, postdoctoral fellowships, Career Development Award, and Investigator Award, reviewing applications for interdisciplinary or collective research projects such as the Thematic Research Program and Research Program on Nanoscience and Technology.
4. **Project Management:** Managing applications, signing of contracts, and reimbursement of expenditures in projects subsidized or commissioned by external institutions.
5. **Academic Services:** Promoting the Academic On-line Service System to process on-line applications and reviews of various programs; maintaining databases for easy access to research results, academic achievements, and reviewers' information.
6. **Others:** Ratifying the faculty's applications for attending international conferences; providing administrative support to the Publication Committee and the Taiwan Tech Trek Program.

Computing Center

886-2-2789 9244 886-2-2783 6444 http://www.ascc.sinica.edu.tw

The Computing Center provides the planning, establishment, maintenance and operation of information technology-related services including basic facilities (information networks, computing resources, and information security), application software development, e-library services, geographic information services, multimedia design, etc.

Summary of Key Duties

↑ 2009 Open House: Looking at the landscapes before and after natural disasters through remote sensing images and photos.

1. **Information Network:** Provides campus information network services and cooperates with Taiwan Academic Network to maintain quality global connections.
2. **Information Security:** Collaborates with each institute to establish a campus-wide information security framework, incident response mechanism, and relevant technical support.
3. **Common Facilities:** Provides campus-wide common IT application facilities such as email, web hosting, mass storage services, etc.
4. **Administrative Computing:** Develops and maintains administrative application systems to improve administration processing performance.
5. **Computing Resources:** Provides advanced HPC with mass storage environment and technical consultation support on establishing computing systems among labs/institutes.
6. **Digital Archives:** Assists in providing technical support and services for digital archive programs, database systems, GIS applications, metadata analysis, and metadata codes/standards localization.
7. **Research Databases:** Assists in development of database systems for research programs.
8. **Geospatial Information:** Provides geographic information application services, develops web-based geographic information system framework, and promotes the integration of research resources through the establishment of a map-sharing platform.
9. **IT Promotion:** Provides planning, training and consultation services to promote the applications of information technology throughout the campus.
10. **E-library:** Manages the campus library services web-portal, conducts inter-library exchanges of printed collections or digitized resources, and provides document delivery service in collaboration with global libraries.

Scientific Instrument Center

886-2-2789 9648 886-2-2789 8729 http://www.assic.sinica.edu.tw/english/index.php

Missions

1. Oversees the planning of precious instrument resources at Academia Sinica.
2. Promotes the sharing of precious instrument resources.
3. Establishes campus-wide core facilities, laboratories, as well as machine shops, electronic shops, and glass shops. Oversees the operation of these resources.

Summary of Key Duties

1. Assists in precious instrument planning: Responsible for the administrative affairs of the Precious Instrument Management Committee and its subcommittees.
2. Facilitates the establishment of campus-wide shared precious instrument core facilities, laboratories, and shops.
3. Oversees the operation of campus-wide shared instrument core facilities, laboratories, and shops.
4. Processes applications for using machine shops, glass shops, and electronic shops.

↑ The High-field Nuclear Magnetic Resonance Center at Academia Sinica was commissioned to support structural genomic and drug development studies. It currently houses several state-of-the-art NMR spectrometers, including one at 800 MHz (front), three at 600 MHz, and one at 500 MHz.

Personnel Office

886-2-2789 8039 886-2-2788 8459 http://www.sinica.edu.tw/~hro/

The Personnel Office comprises three divisions responsible for personnel laws and regulations, appointment and promotion; performance appraisal and training, attendance and leave; pay and allowance, retirement and survivor benefits.

Summary of Key Duties

1. **Organization:** Handling issues regarding organization, personnel administration, and related matters.
2. **Regulations:** Handling the drafts, reviews, and revisions of personnel regulations.
3. **Appointment, Promotion, and Transfer:** Handling the appointment of research personnel and research specialists; the examination, appointment, promotion, and transfer of administrative and technical personnel.
4. **Training:** Managing employee training, further education, lectures, and research.
5. **Performance Review:** Coordinating employee performance reviews, rewards, and disciplinary action.
6. **Remuneration:** Administering employee remuneration and benefits.
7. **Retirement, Compensation and Insurance:** Handling employee retirement, compensation, severance, and insurance.
8. **Personnel Management:** Maintaining personnel information and managing contract-based personnel.

↑ Conference on administrative affairs and theories of administrative impartiality.

Ethics Office

886-2-2789 9448 886-2-2782 4516 http://www.sinica.edu.tw/as/adm/anti-corru/index.htm

The Ethics Office is endowed with the mission to "maintain public servants' integrity, promote ethical politics, and safeguard the security of the institution." The Office is in charge of the institution's ethics and reports to the chief of the institution.

Summary of Key Duties

1. **Prevention of Corruption and Negligence:** Leading efforts to prevent corruption and negligence and report of public servants' property.
2. **Publicity of Regulations:** Publicizing ethics-related regulations.
3. **Inspection and Disciplinary Action:** Safeguarding confidential information and preventing damage or sabotage.

↑ Seminar on legal knowledge in daily life.

Accounting Office

886-2-2782 4515 886-2 2785 5849 http://proj1.sinica.edu.tw/~actweb/

The Accounting Office comprises the Budgeting, Auditing, and Accounts Affairs Divisions.

Summary of Key Duties

1. **Budgeting:** In charge of preparation, allocation of budgets, and application for use of reserve funds.
2. **Auditing:** In charge of examination of annual expenditure application documents, execution of annual revenue, examination of funding changes and project closing documents, application for the retaining of budgets and implementation of nonscheduled internal audits.
3. **Account Affairs:** In charge of submitting the monthly and final accounting report, submitting the performance report and semi-annual accounting report, accounting files, documents and account book sealing.
4. **Statistics:** In charge of drawing up public statistical programs, summary of public statistics, and preparation of timetable for publication of preliminary statistical data.
5. **Seminars:** In charge of accounting business seminars.

↑ Seminar on accounting business.

International Affairs Office

886-2-2789 9446 886-2-2783 4496 http://iao.sinica.edu.tw/

The Academia Sinica International Affairs Office is responsible for the promotion of higher education, international academic exchange, international organization affairs, organization of the Academia Sinica Lecture Series, international faculty services, and arranging the visits of international VIPs to Academia Sinica.

Summary of Key Duties

1. **Higher Education:** One of the three main missions of Academia Sinica is to conduct and encourage academic studies. Academia Sinica, with the aim of employing its world-class resources and faculty to help promote higher education in Taiwan, implements this important task by collaborating with a consortium of key national research universities to provide interdisciplinary Ph.D. programs. Academia Sinica hosts two graduate programs: the Taiwan International Graduate Program (TIGP), which is designed to create an unique educational environment serving both international and local students; and the Degree Program (DP), which provides a more advanced higher education environment for domestic students. Both programs are conducted in close collaboration with local universities. Currently, the TIGP offers 9 interdisciplinary Ph.D. programs and the DP offers 2 interdisciplinary Ph.D. programs.
2. **International Academic Exchange:** The Academic Exchange and Cooperation Committee develops close academic collaboration between prominent foreign research institutions and leading local universities. The committee oversees various academic cooperation agreements and promotes scholarly exchange and cooperative research projects. This section is also in charge of organizing academies-related international conferences, which can promote cooperation among academies on important subjects such as the role of the academies in creating a better world.
3. **International Organization Affairs:** Academia Sinica participates in several international scientific organizations, such as the International Council for Science (ICSU), the InterAcademy Panel (IAP) and the Academy of Sciences for the Developing World (TWAS). In addition the Academy sponsors domestic academic societies to join international scientific associations in order to promote domestic participation in the international scientific community.
4. **Academia Sinica Lectures:** As part of our effort to establish Academia Sinica as one of the best innovative research institutions in the world, President Wong inaugurated the "Academia Sinica Lecture Series" in 2009. The series invites the most eminent scholars from around the world to give talks on issues pertaining to their chosen field. Invitation to speak as an Academia Sinica Lecturer is the highest honor of Academia Sinica. The honor is bestowed on Nobel Laureates and scholars of similar caliber from across the world. The initial lectures are in the fields of mathematics and physical sciences and life sciences. Later the focus of the lectures will be expanded to cover the humanities and social sciences. The past Academia Sinica lecturers include Prof. Roger Y. Tsien and Prof. Roger D. Kornberg.
5. **International Faculty Services:** Academia Sinica provides various services to foreigners working at Academia Sinica. Services include: Visa/ARC processing, off-campus housing rental, babysitter introduction, free Chinese classes, arrangements for the primary education of foreigners' children, and publication of the handbook for foreigners.
6. **Arrangement of the Visits of International VIPs to Academia Sinica:** This section arranges visits to Academia Sinica of honorary academicians, foreign institution/academy presidents and other international VIPs including visiting lecturers and visitors for other academic activities.

↑ R.O.C. President Ma attended the Academy Presidents' Forum in celebration of Academia Sinica's 80th anniversary.

Public Relations Office

886-2-2789 8825 886-2-2789 1551

This office handles liaison between Academia Sinica, the Legislative Yuan, and the media. The office is made up of two divisions: The legislative liaison team is responsible for communicating with the Legislative Yuan by providing accurate and pertinent information about Academia Sinica to legislators and protecting the financial and legal interests of the Academy; the media liaison team maintains daily contact with domestic and foreign media and provides up-to-date bilingual information about Academia Sinica to the media.

Summary of Key Duties

1. Legislative liaison:
The legislative liaison team represents the Academy's interests in the Legislative Yuan. Duties include escorting the Academy's president and top officials to attend legislative committee meetings and public hearings; collecting information on legislative affairs, and organizing responses to legislator's inquires to facilitate the progress of approval of budget and acts relating to the Academy. The team also settles media disputes incurred by legislative inquires, provides legislators with information and publications, and handles public petitions related to the Academy.

2. Media liaison:
The media liaison team compiles press releases in Chinese and English on the latest academic achievements, activities and happenings at Academia Sinica; distributes information to members of the media, Academicians, and the Academia Sinica administrative directors; and offers reader follow-up services. The team is responsible for organizing press conferences, arranging interviews between Academia Sinica researchers and the media, receiving members of the media on campus and providing media crisis management and other media liaison. It also updates the news section of the Academia Sinica website.

Campus Planning Office

886-2-2789 9651 886-2-2789 8088

This Office handles the overall planning of the Academia Sinica campus to support and enhance academic, research and public service activities at Academia Sinica.

Missions

1. Enabling the necessary integration of old and new buildings.
2. Improving environmental space and landscape design.
3. Restructuring traffic and pedestrian circulation.

Summary of Key Duties

1. **Campus Planning:** Guiding development of the Academia Sinica campus, including the National Biotechnology Research Park.
2. **Facility Programming:** Managing the design process of Academia Sinica's new construction program, including the entrance and the surrounding facilities.
3. **Space Management:** Helping institutes and research centers find specific spatial solutions and analyzing space allocation proposals.

↑ National Biotechnology Research Park

National Science and Technology Programs, The Graduate Programs at Academia Sinica

Development Program of Industrialization for Agricultural Biotechnology

886-2-2787 2128 886-2-2782 6594 http://dpiab.sinica.edu.tw/index.php

Introduction

The agricultural industry, although accounting for only about 3% of our national GDP, is nevertheless vital to Taiwan's security and people's welfare. Today, the agricultural industry not only needs to provide sufficient and nutritious food to people; it also has the mission of protecting and preserving the environment and ecological system for the sustainable development of the country. In recent years, global trends toward free trade and international competitiveness have put great pressure on Taiwan's agricultural industry, especially after becoming a member of the WTO. To cope with this situation, the traditional model of agricultural business has to be transformed. Agri-biotech developments have made significant progress in recent years, and will play a key role in the needed transformation.

Thanks to the superior geographical location of Taiwan having both sub-tropical and temperate climates and the well-established system and solid training of agriculture R&D talents, Taiwan has accumulated various successful experiences in agricultural development. These constitute the basic conditions for advancing the agri-biotech industry in Taiwan and promoting the industrialization of these technologies.

Recognizing the critical role of biotech to the agricultural industry in Taiwan, the government implemented the National Science and Technology Program for Agricultural Biotechnology (NSTP/AB) during 1999-2008. After the completion of the NSTP/AB at the end of 2008, this inter-agency was transformed into the present five-year Development Program of Industrialization for Agricultural Biotechnology (DPIAB). Beginning in 2009, the DPIAB has primarily promoted the industrialization of agri-biotech results accumulated during the ten-year period of the NSTP/AB. The DPIAB also assesses global trends in agri-biotech development to forge integrated projects utilizing Taiwan's competitive edge in certain agricultural sectors. Academic-industrial cooperation at different levels will play a key role in the program and the DPIAB welcomes renowned domestic and international bio-tech enterprises to participate in this program.

Like the NSTP/AB, the present program is also supported by numerous agencies, including the Council of Agriculture, Department of Health, Ministry of Education, National Science Council, Academia Sinica, and Industry Bureau of the Ministry of Economic Affairs, with the COA as the major agency in charge of administrative coordination. The respective missions of different agencies are as follows:

Program Goals

In order to efficiently fulfill the mission of this program to make solid contributions to promoting the industrialization of agri-bio technology, the DPIAB has set the following practical and quantitative goals for the next five years:

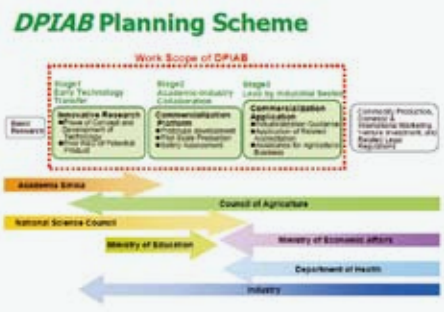
- 50% increase in agricultural industrial output value.
- Enhance pre-industrialization research, and focus on interdisciplinary integration projects with market potential to reach the following goals: ≧5 projects per year, with each project funding up to 10 million NT dollars per year, for up to 3 years.
- Develop or introduce at least 5 multi-functional bio-technologies.
- Assist at least 50 corporations to participate in developing new techniques and increasing product value by collaboration with industrial and academic research.
- Promote at least 10 cases, each with more than 50 million NT dollars in investment.
- Assist in the establishment of at least 5 international agricultural corporations, each with a total capital of above 100 million NT dollars. These corporations shall be internationally competitive.
- Promote at least 5 projects with industrial talent training plans to enhance agriculture R&D potential in agricultural research institutions.
- Establish a platform with assessment mechanisms to help commercialize R&D products.

Priority Areas

Based on global trends in biotech development and favorable factors already existing in Taiwan, the DPIAB has chosen six priority areas to invest a major part of its resources. These six priority areas are:

◎ Aquaculture
◎ Plant Seedlings
◎ Biopesticides & Biofertilizers
◎ Livestock and Poultry
◎ Orchids
◎ Chinese Herbs & Health Foods

↑ DPIAB six priority areas



↑ DPIAB planning scheme

↑ DPIAB strategy

National Research Program for Genomic Medicine

886-2-2789 8060 886-2-2789 8063 http://nrpgm.sinica.edu.tw

Introduction

In 2002, the National Science Council of Taiwan launched the National Research Program for Genomic Medicine (NRPGM) as a national priority program with the joint efforts of the Department of Health and the Ministry of Economic Affairs. The goals of the NRPGM are (1) to develop technologies that prevent, diagnose, and treat diseases based on the knowledge gained from genomics (2) to integrate fundamental research, animal model testing and clinical studies in promoting the development of research in genomic medicine (3) to combine the power of technology transfer and industrial collaboration to advance Taiwan's biotechnology industries and their international competitiveness. The current second phase (2006-2010) continues the above goals with specific focus on four disease-oriented topics namely, lung cancer, liver cancer, infectious diseases, and highly heritable diseases, which are particular health concerns in Taiwan. The other two important topics are innovative research and ELSI-related studies. The core facilities of the NRPGM were set up based on the concept of resource integration and management centralization with the objectives to establish and maintain nationwide facilities to support basic research related to genomic medicine by providing high-priced, high-throughput, and state-of-the-art instruments, along with analytical and consulting services. The core facilities also aim at developing multi-disciplinary technologies and encouraging collaborative research projects. In addition, the core facilities assume the responsibilities of propagating novel technologies and educating nationwide researchers, thus enhancing the standard of research in genomic medicine. National core facilities are open for use by researchers from academic and industrial institutions. They cover five major fields: (A) Animal models, phenotyping, and imaging facilities for diseases (B) Clinical sample banks for genomics (C) Facilities for basic genomics (D) Facilities for proteomics and structural genomics (E) Facilities for bioinformatics. There are nine NRPGM core facilities currently in operation in Academia Sinica:

1. **A1-National Mouse Mutagenesis Program Core Facility (MMPCF)** (Dr. John T. Kung, Research Fellow, Institute of Molecular Biology) http://mmp.sinica.edu.tw/mmp/english
2. **A2-Functional and Micro-Magnetic Resonance Imaging Center** (Dr. Chen Chang, Research Fellow, Institute of Biomedical Sciences) http://www.mri.ibms.sinica.edu.tw/index_e.html
3. **A7-Taiwan Mouse Clinic-National Phenotyping Center** (Dr. Jeffrey J. T. Yen, Research Fellow, Institute of Biomedical Sciences) http://tmc.sinica.edu.tw
4. **B1-National Clinical Core for Genomic Medicine (NCC)** (Dr. Yuan-Tsong Chen, Distinguished Research Fellow, Institute of Biomedical Sciences) http://ncc.sinica.edu.tw/newaim_e.htm
5. **C2-National Genotyping Center (NGC) (Dr. Yuan-Tsong Chen, Distinguished Research Fellow, Institute of Biomedical Sciences)** http://ngc.sinica.edu.tw/about_e.htm
6. **C6-RNAi Core Facility** (Dr. James C.-K. Shen, Distinguished Research Fellow, Institute of Molecular Biology) http://rnai.genmed.sinica.edu.tw/en
7. **D2-Core Facilities for Proteomics and Glycomics** (Dr. Kay-Hooi Khoo, Research Fellow, Institute of Biomedical Chemistry) http://proteome.sinica.edu.tw
8. **D3-Core facility for Protein Production and X-Ray Structural Analysis** (Dr. Andrew H.-J. Wang, Distinguished Research Fellow, Institute of Biomedical Chemistry) http://proj3.sinica.edu.tw/~xray/index_en.php
9. **D5-High-Field Nuclear Magnetic Resonance Center** (Dr. Tai-Huang Huang, Research Fellow, Institute of Molecular Biology) http://www.nmr.sinica.edu.tw/en


A1-National Mouse Mutagenesis Program Core Facility (MMPCF)


A2- Functional and Micro-Magnetic Resonance Imaging Center

A7-Taiwan Mouse Clinic-National Phenotyping Center


B1- National Clinical Core for Genomic Medicine (NCC)


C2-National Genotyping Center (NGC)

C6- RNAi Core Facility


D2-Core Facilities for Proteomics and Glycomics


D3-Core facility for Protein Production and X-Ray Structural Analysis


D5-High-Field Nuclear Magnetic Resonance Center

Taiwan National Science and Technology Program for Nanoscience and Nanotechnology

886-2-2789 8932 886-2-2653 2160 http://nano-taiwan.sinica.edu.tw

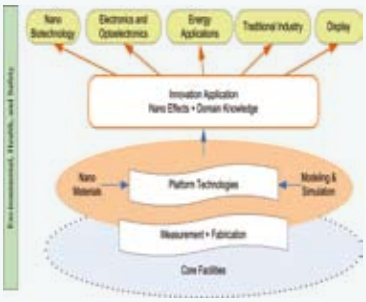
Origin

Taiwan initiated the National Nanoscience and Nanotechnology Program in 2003 and launched its second phase in 2009. The first phase has achieved the goal of academic excellence in basic research which will promote the industrialization of nanotechnology in the ongoing phase. There are four focuses in the initiative: Excellence in academic research, industrialization of nanotechnology, establishment of core research facilities, and an extensive education program. We anticipate the program will help achieve substantial economic growth and improve the quality of daily life by accelerating the commercial use of nanoscience and nanotechnology.

↑ Taiwan Nano 2008 opening ceremony

↑ Nanoscience research laboratory

↑ Distribution of core facilities



↑ Industrial technology plan for nanoscience and nanotechnology

Objectives

Through the establishment of common core facilities and educational programs, the goals of the program are to achieve academic excellence in basic research, create innovative industrial applications, and accelerate the commercialization of nanotechnology.

Scope

1. Academic Advanced Program

The objective of this program is to encourage researchers from different disciplines to establish close interactions and to form a strong interdisciplinary research team. There are seven research areas: (1) Nano-catalysts and Enzymes (2) Nano-Surface Research (3) Nano-Electronics and Optoelectronics (4) New Research Instrument Development for Nanostructures and Nano-Measurements (5) Advanced Biomedical Optoelectronics (6) Research on the Impact of Nanomaterial on Environment, Health, and Safety (7) Fundamental Material Research on Nanoelectronics, Nanophotonics, Bioelectronics, Molecular Electronics, and the Photoelectric Effect.

2. Industrial Application Technology Program

3. Establishment of Core Facilities Program

The core facility program, which oversees the establishment of facilities for nanofabrication, precision measurements, and expertise, will provide common support for research in nanotechnology.

4. Nanotechnology Education Program in Taiwan

(1) Enhance basic nanotechnology education from kindergarten to the 12th grade
(2) E-knowledge exchange platform
(3) Establish interdisciplinary nanoscience and technology curricula

Taiwan e-Learning and Digital Archives Program

886-2-2652 5276 886-2-2652 5280 http://teldap.tw

The Taiwan e-Learning and Digital Archives Program (TELDAP) is a national science and technology program sponsored by the National Science Council. It is a five-year program which started in 2008 and involves major content holders from 20 government agencies and public institutions. The overall objectives of the TELDAP are to digitize the diversity of Taiwan and enhance e-learning experiences in Taiwan. The sub-objectives are as follows:

1. To showcase the cultural, social, and biological diversity of Taiwan.
2. To promote the application of technologies and digital contents in cultural, academic, socio-economic, and educational development.
3. To establish digital archives and e-learning industries.
4. To improve the use of e-learning in formal education and lifelong learning.
5. To establish Taiwan as a global e-learning center of Chinese language.
6. To promote an international collaboration network of Chinese cultural heritage and e-learning.
7. The program office is located at the Research Center for Information Technology Innovation, Academia Sinica. It assumes the role of overall strategic planning and coordination of the program, and provides digital content, technical support, and digital resource integration to the participants.

Through this program, all digital collections will be made available to researchers around the world. The digital resources of Academia Sinica, contributed by the Institute of History and Philology, Biodiversity Research Center, Institute of Linguistics, Institute of Ethnology, Institute of Taiwan History, Institute of Modern History and Research Center for Humanities and Social Sciences, have been organized into various databases, including the Han Wooden Slips, Bronze Rubbings, Rare Books, Grand Secretariat Archives, Images of Native Plants in Taiwan, Formosan Language Archives, Diplomatic and Economic Archives, Historical Map and Aerial Photo Database of Modern China, etc. These databases, along with efficient search and retrieval tools, will allow researchers to find critical research materials quickly and comprehensively, thereby improving both the quality and efficiency of their research. We also adopt international metadata standards for domain specific contents in each individual project repository to facilitate the exchange of information and cooperation among academic and cultural institutions worldwide. For example, resources like the Fish Database of Taiwan are included in the databases of the Global Biodiversity Information Facility (GBIF). We have also produced a union catalog at an institutional level by adopting the Dublin Core metadata standard for cross-domain interoperability, and published fifteen handbooks on digital work flow, one for each content type.

Due to heavy technological demands, the Institute of Information Science and the Research Center for Information Technology Innovation of Academia Sinica have devoted an enormous amount of human resources to the research and development of key technologies, software tools, and systems. Core technologies developed include, among others, metadata, language processing, Chinese character encoding, multimedia processing, geographic and temporal information systems, and digital rights management. The research achievements have already been made available to the general public, and one technology has already been patented. Through the TELDAP, Academia Sinica hopes to integrate the national digital resources together with advanced information technologies to make the following impacts:

1. Cultural Impact: Create a new way to preserve cultural heritage and disseminate knowledge.
2. Academic Impact: Create a new environment for innovative research and development.
3. Socio-economic Impact: Create win-win opportunities for content holders and digital content industries.
4. Educational Impact: Build a knowledge repository for life-long learning and bridge the digital divide.

↑ Art & Architecture Thesaurus Taiwan

↑ *Ludwigia taiwanensis* Peng — Biodiversity Research Center

↑ *Tuberolabium kotoense* Yamam. — Biodiversity Research Center

↑ Digital image color reconstruction: Research Center for Information Technology Innovation

↑ A map of Taiwan in 1945 — Research Center for Humanities and Social Sciences

↑ Shoulder cape (Rukai, Taiwan) — Institute of Ethnology

The Graduate Programs at Academia Sinica

886-2-2789 9414 886-2-2785 8944 http://tigp.sinica.edu.tw

One of the three main missions of Academia Sinica is to conduct and encourage academic studies. Academia Sinica, with the aim of exploiting its world-class resources and faculty to help promote higher education in Taiwan, implements this important task by collaborating with a consortium of key national research universities to provide interdisciplinary Ph.D. programs. Currently, Academia Sinica hosts two graduate programs: the Taiwan International Graduate Program (TIGP), which is designed to create a unique educational environment serving both international and local students; and the Degree Program (DP), which provides a more advanced higher education environment for domestic students. Both programs are conducted in close collaboration with local universities.

The Taiwan International Graduate Program (TIGP)

The first in Taiwan to offer all-English graduate study environment, the TIGP has been established through a joint-effort of Academia Sinica and a consortium of domestic research universities. Aiming to promote higher education in Taiwan so as to keep up with the pace of today's fast evolving scientific and technological world, the TIGP offers the following 9 interdisciplinary Ph.D. programs in cutting-edge research fields of science and technology. (Table 1. Summary of TIGP's Ph.D. programs and partnerships)

↑ The international community of the TIGP: A group photo taken at the 2009 welcome party.

TIGP	Partner Universities	Departments/Institutes Involved
Chemical Biology and Molecular Biophysics (CBMB) (http://www.sinica.edu.tw/~tigpcbmb/)	National Taiwan University http://www.ntu.edu.tw	1. Institute of Biochemical Sciences 2. Department of Chemistry
	National Tsing Hua University http://www.nthu.edu.tw	1. Department of Life Sciences 2. Department of Chemistry
Molecular Science and Technology (MST) (http://tigp.iams.sinica.edu.tw/MST.htm)	National Tsing Hua University http://www.nthu.edu.tw	Department of Chemistry
	National Central University http://www.ncu.edu.tw/index.php	Department of Physics
Molecular and Biological Agricultural Sciences (MBAS) (http://www.sinica.edu.tw/~ibawww/mba/mba.html)	National Chung Hsing University http://www.nchu.edu.tw	1. Graduate Institute of Biotechnology 2. Department of Life Sciences
Molecular and Cell Biology (MCB) (http://www.imb.sinica.edu.tw/mcb/)	National Defense Medical Center http://www.ndmctsgh.edu.tw	Graduate Institute of Life Sciences
Bioinformatics (Bioinfo) (http://tigpbp.iis.sinica.edu.tw/)	National Yang-Ming University http://www.ym.edu.tw	Institute of Bioinformatics
	National Tsing Hua University http://www.nthu.edu.tw	Institute of Bioinformatics and Structural Biology
	National Chiao Tung University http://www.nctu.edu.tw	Institute of Bioinformatics and Systems Biology
Nano Science and Technology (NST) (http://www.phys.sinica.edu.tw/TIGP-NANO/)	National Taiwan University http://www.ntu.edu.tw	1. Department of Chemistry 2. Department of Physics
	National Tsing Hua University http://www.nthu.edu.tw	Department of Engineering and System Science
Molecular Medicine (MM) (http://www.ibms.sinica.edu.tw/mmp/)	National Yang-Ming University http://www.ym.edu.tw	Institute of Biochemistry and Molecular Biology
Computational Linguistics and Chinese Language Processing (CLCLP) (http://clclp.ling.sinica.edu.tw/)	National Tsing Hua University http://www.nthu.edu.tw	Institute of Information Systems and Applications
	National Taiwan University http://www.ntu.edu.tw	Graduate Institute of Linguistics
Earth System Science (ESS) (http://www.rcec.sinica.edu.tw/tigp-ess//)	National Central University http://www.ncu.edu.tw	College of Earth Sciences

↑ The 4th TIGP Certificate Conferral Ceremony.

↑ The TIGP Distinguished Lecture Series: The 2003 Nobel Laureate in Physics, Dr. Anthony Leggett delivers a speech to the TIGP students and faculty.

Since its inception in 2002, under the stewardship of the three successive directors – Dr. Sunney Chan (founding director), Dr. Ovid Tzeng, and Dr. Chao-Han Liu (current director) – the TIGP has grown and expanded both in terms of the number of interdisciplinary programs and the number and global distribution of students. As of January 2010, the TIGP has over 293 Ph.D. students from 29 nations, making it a truly international community.

In addition to mentorship by prestigious faculty members and access to the state-of-the-art facilities of Academia Sinica, the TIGP also offers the following benefits: a monthly stipend of NT$32,000 (ca. US$1,000) for up to 36 months, free mandarin language courses at the elementary level, and a convenient and fully-furnished on-campus student dormitory.

On top of the comprehensive curriculum offered to its Ph.D. students, the TIGP also provides exceptional opportunities to extend students' learning. For instance, the TIGP invites distinguished scholars to give presentations on their areas of expertise and life experience to provide guidance on students' career planning; the TIGP provides conference travel grants to encourage participation in international conferences so that students can acquire the most updated knowledge through interactions with distinguished scholars in their related fields; and through AS's substantial connections with top-notch overseas research institutions, the TIGP is able to make arrangements for students to visit and conduct research in renowned laboratories.

The Degree Program (DP)

More recently, in 2007, Academia Sinica established the Degree Program (DP) to provide a more advanced higher education environment for domestic students. Similar in design to the TIGP, the DP is also co-established with domestic universities. Currently the DP offers 2 interdisciplinary Ph.D. programs:

DP	Partner Universities	Departments/Institutes Involved
Cancer Biology and Drug Discovery Degree Program	China Medical University http://www.cmu.edu.tw/	1. College of Pharmacy 2. College of Medicine
Marine Biotechnology Degree Program	National Sun Yat-sen University http://www.nsysu.edu.tw/	1. College of Marine Sciences 2. College of Science

Memorial Halls and Museums

Hu Shih Memorial Hall

886-2-2782 1147, 2789 9720 886-2-2653 3302 http://www.mh.sinica.edu.tw/koteki/

Visitor Information

Opening Hours: Wednesday and Saturday, 9:00 a.m.–5:00 p.m. (Closed on national holidays)
Free Admission

Hu Shih, a famous scholar in modern China, served as Dean of the College of Humanities at Beijing University, ambassador to the United States, president of Beijing University, and president of Academia Sinica. Hu Shih played a central role in China's modernization, both as a pioneer of vernacular literature and as an advocate of the New Culture Movement. The Hu Shih Memorial Hall is located at the site of Dr. Hu Shih's residence on the Academia Sinica campus in Nankang, Taipei where he lived from 1958 to 1962 while serving as Academia Sinica's President. Following his death on February 24, 1962, Academia Sinica formed a Hu Shih Memorial Hall Management Committee, and the Hu Shih Memorial Hall was formally established on December 10 of that year. In January 1998, the memorial hall became formally affiliated with the Institute of Modern History. The memorial hall consists of three parts. The first part is former President Hu Shih's residence on the Academia Sinica campus in Nankang. The architecture, porticos, furnishings, and other features of Hu Shih's former residence basically preserve the original flavor of his living arrangements. The second part, the exhibition room (erected in 1964 with the financial assistance of Mr. C. V. Starr, an American insurance company executive) exhibits Hu Shih's writings, personal objects, hand-written drafts, photographs and tape recordings, as well as documentaries of his life in Taiwan, and other materials. The third part is Hu Shih's grave near the Academia Sinica campus. Academia Sinica and the Taipei City Government cooperated to construct the Hu Shih Park around the site of his grave, and the work was completed in February 1974.

Chien Shih-Liang Memorial Hall

☎ 886-2-2782 1889 FAX 886-2-2783 1237

Visitor Information

Hours: Monday to Friday, 9:00 a.m.–5:00 p.m. (Closed on national holidays)
Free Admission

Professor Shih-Liang Chien was a famous Chinese chemist who received his Ph.D. in Chemistry from the University of Illinois in 1934 and subsequently served as professor and chairman of the Department of Chemistry of Peking University.

In 1949, Professor Chien moved to Taiwan and became professor of the Chemistry Department and Dean of Studies at National Taiwan University. He was then appointed as president of National Taiwan University in 1951. During his term as president, he established Taiwan's university alliance enrollment system that served as an excellent framework for higher education in Taiwan.

Professor Chien was elected as an Academician of Academia Sinica in 1964 and served as the fifth president of Academia Sinica in 1970. During his presidency, he directed seven Convocations of Academicians and established the Institute of American Culture, Institute of Earth Science, Institute of Biological Chemistry, and Institute of Information Science. He also established four Preparatory Offices for Biomedical Sciences, Statistical Science, Atomic and Molecular Sciences and Molecular Biology. Professor Chien made enormous contributions to academic developments at Academia Sinica.

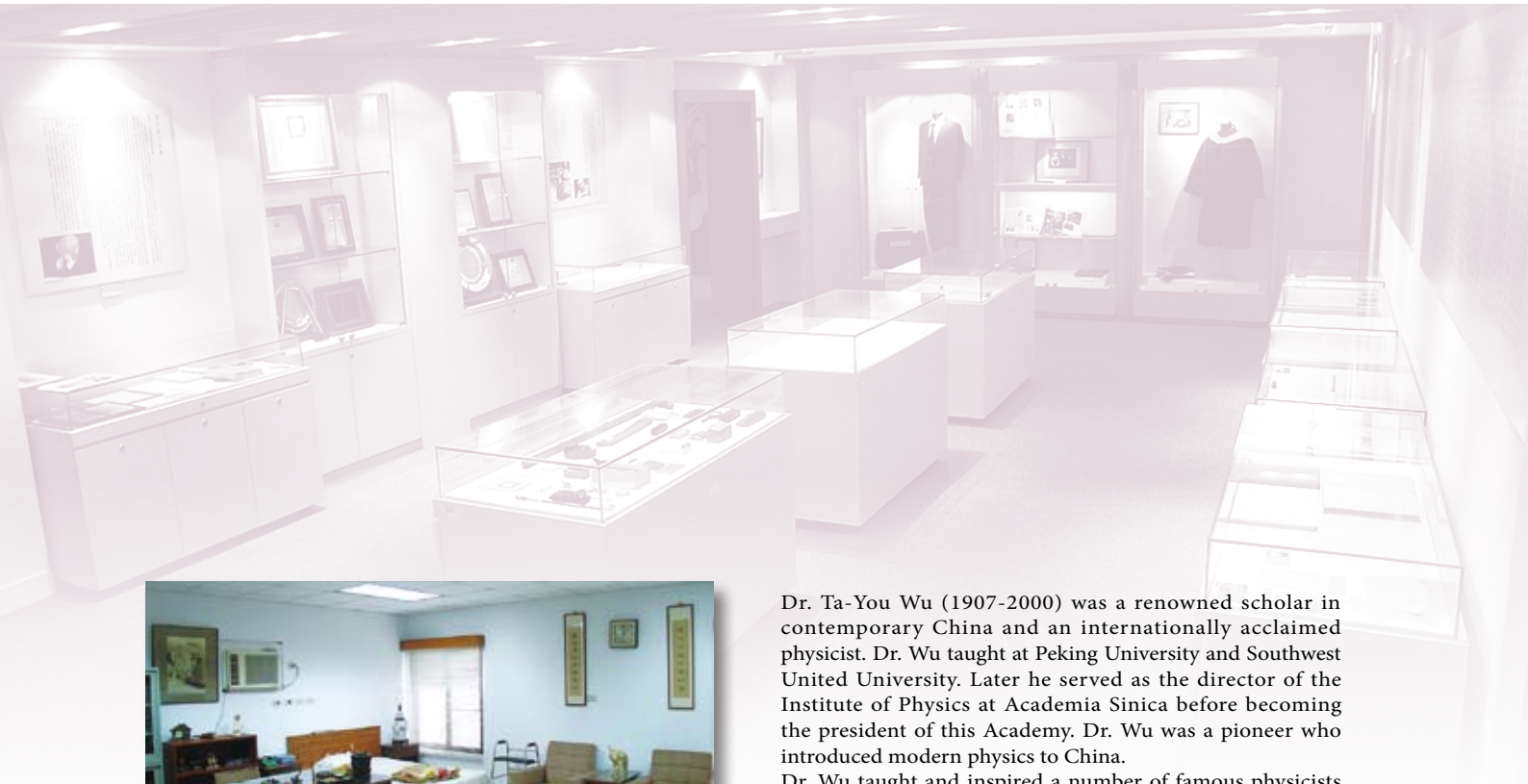
Professor Chien died of myocardial infarction in 1983 while he was the president of Academia Sinica. In memory of his academic achievements and contributions to Academia Sinica (especially to the Institute of Chemistry), the new laboratory building of the Institute of Chemistry was named as the Chien Shih-Liang Memorial Hall. The exhibition room (A107) in the memorial hall which displays Professor Chien's statue, documents, books, photos, and other materials is open to the public to commemorate Professor Shih-Liang Chien as the former president of Academia Sinica and honor his contributions to Taiwan.

Wu Ta-You Memorial Hall

886-2-2783 5386 886-2-2783 3654 http://www.phys.sinica.edu.tw/~tywufund/

Visitor Information

Opening Hours: Monday to Friday 9:00 a.m.–5:00 p.m. (Closed on national holidays)
Free Admission



Dr. Ta-You Wu (1907-2000) was a renowned scholar in contemporary China and an internationally acclaimed physicist. Dr. Wu taught at Peking University and Southwest United University. Later he served as the director of the Institute of Physics at Academia Sinica before becoming the president of this Academy. Dr. Wu was a pioneer who introduced modern physics to China.

Dr. Wu taught and inspired a number of famous physicists including Nobel Laureates Chen-Ning Yang and Tsung-Dao Lee. From his middle age years onwards, Dr. Wu began to lead scientific developments in Taiwan. In his capacity as chairperson of the National Science Council and the Science Education Advisory Committee for the Ministry of Education, Dr. Wu formulated many important policies to promote science and technology education in Taiwan.

Throughout his life, Dr. Wu made an enormous impact on the development of modern physics in China and Taiwan. He is thus regarded as the father of contemporary Chinese physics.

After Dr. Wu's passing away in 2000, the Institute of Physics at Academia Sinica appointed Dr. Erh Kang Lin, Dr. Ting Kuo Lee and Dr. Wan Sun Tse to establish the Wu Ta-You Memorial Hall, which is located on the 4th floor of the institute's building. The Wu Ta-You Memorial Hall was opened to the public on March 5, 2001. Dr. Wu's books, manuscripts, photographs and documentary films are exhibited. Also on display is Dr. Wu's private collection, his office and living room during his tenure as the director of the Institute of Physics.

Biodiversity Research Museum

886-2-2789 9621 # 250, 616 886-2-2789 9624 http://museum.biodiv.tw

Visitor Information

Opening Hours: Open only upon request. Please book at least one month in advance.

Free Admission

Combining the herbarium of the Institute of Botany and the Zoological Research Museum of the Institute of Zoology, the Biodiversity Research Museum was established in the Biodiversity Research Center, Academia Sinica (BRCAS) in 2007. The Museum's collections date back to 1961. The main goal of the museum is to preserve voucher specimens for scientific studies and to document biodiversity on earth. Currently, our collections consist of specimens from various taxonomic groups, including approximately 128,000 plants, 22,000 fishes, 3,000 birds, and 10,000 invertebrates (cnidarians, annelids, mollusks, arthropods and echinoderms). The fish collection, covering extensive local fish fauna, is the most comprehensive of its kind in Taiwan and adjacent areas.

The BRCAS has established a Collection Management Committee to oversee the policies and operation of the museum. Committee members are appointed from principal investigators within the institute. The chair of the committee serves as the museum director while principal investigators in various taxonomic disciplines at the institute are in charge of corresponding collections. More than 340 type collections are permanently housed at the museum. Specimen exchange and research collaboration are encouraged, which take place regularly between the museum and universities, herbaria, museums and botanical gardens worldwide.

The research museum develops cutting-edge information management systems and online databases for the collections. Information on the museum specimens can be accessed via the Internet (http://museum.biodiv.tw). In addition, the museum and its staff have developed and manage a number of biodiversity websites such as the Database for Native Plants in Taiwan (http://taiwanflora.sinica.edu.tw/); Discover Plants of Taiwan (http://taiwanplants.ndap.org.tw/); The Taiwan Malacofauna Database (http://shell.sinica.edu.tw/); Taiwan Biodiversity National Information Network (TaiBNET, http://taibnet.sinica.edu.tw/); Taiwan National Node (TaiBIF, http://taibif.org.tw/) for Global Biodiversity Information Facility (GBIF); The Fish Database of Taiwan (http://fishdb.sinica.edu.tw/); Digital Museum: The World of Fishes (http://fishdb.sinica.edu.tw/~fishdmp/index.htm); Digital Museum: Recovering the Freshwater Fishes in Taiwan (http://fishdb.sinica.edu.tw/~fhfresh/index.html). Particularly noteworthy is the Fish Database of Taiwan, which collaborates with the global FishBase that is considered the most comprehensive biodiversity database for fishes. To promote public education and various services, the research museum holds special exhibitions periodically and conducts museum tours for students, teachers, and civic organizations.

↑ X-ray photography of a spotted surgeonfish (*Acanthurus guttatus*).

↑ Pinned insect specimens in the Biodiversity Research Museum.

↑ Dr. Tetsuo Koyama (Director, Makino Botanical Garden) and Dr. Ching-I Peng (Director, Biodiversity Research Museum) at the museum.

↑ Holotype specimen of *Begonia ravenii*, a species endemic to Taiwan.

↓ Field photo of *Begonia ravenii* from Taiwan.

Museum of the Institute of History and Philology

886-2-2652 3180 886-2-2786 8834 http://www.ihp.sinica.edu.tw/~museum/tw/index.html

Visitor Information

Opening Hours: Wednesday and Saturday, 09:30 a.m.–04:30 p.m. (Closed on national holidays and election days)
Free Admission

↑ Monthly and Seasonal Records of Military Supplies from the Kuang-ti South Platoon in the Yung-yuan Era (A27 Tsakhortei, Edsen-gol, Inner Mongolia)

↑ Lu Fang-ting (Royal Tomb M1004, Hsi-pei-kang, Anyang, Honan)

↑ Zoo-anthropomorphic Jade Earrings (Chula, Pingtung, Taiwan)

Founded in 1928, the Institute of History and Philology (IHP) conducts research in various disciplines, including history, linguistics, archaeology, anthropology, and philology. In accordance with its guiding spirit of "traversing the summits and valleys in search of historical materials", the IHP has devoted various resources to archaeological excavations, field surveys, and the collection of historical relics. The institute currently preserves more than 120,000 northern Chinese artifact pieces, over 10,000 Han dynasty wooden slip pieces, over 2,000 artifacts originating from the ethnic groups of southwestern China, more than 7,000 artifacts donated by famous French collectors (the Mortillet family), over 310,000 documents from the Grand Secretariat Archives of the Ch'ing Dynasty, more than 200,000 volumes of rare texts, manuscripts, and folk literature, and a wealth of archaeological findings from excavations carried out across Taiwan in recent years.

In view of its mission and social responsibility to promote scientific research and educate the public, the IHP built a museum in 1986 dedicated to the preservation and organization of historical materials. In addition to holding regular exhibitions, annual special thematic exhibitions, and public lecture series, the Museum of the Institute of History and Philology (MIHP) has also become a means by which the general public better understands the tasks and research undertaken at the IHP. Instead of traditional museum display, the MIHP exhibits new historical resources and research results through an organic presentation of the academic contexts and excavation backgrounds to which they belong. This museum display method demonstrates the MIHP's continuing pursuit of new approaches to and new fields for historical research. The "Archaeological Space" on the first floor of the MIHP arranges artifacts chronologically. It displays, in detail, the excavations of graves from different eras, including the Neolithic Longshan, Shang dynasty, and Chou dynasty periods. The "Historical Space" on the second floor divides the exhibitions thematically. Topics presented include the "Han Dynasty Wooden Slips from Edson-gol", "Rare Texts", "Archives of the Grand Secretariat", "Artifacts from Ethnic Groups of Southwestern China", "Ink Rubbings", and "Taiwanese Materials". Each exhibition section is designed by IHP research fellows and provides detailed yet accessible introductions to the historical context and cultural significance of the artifacts displayed.

The MIHP publishes guide books, exhibition catalogues, and other brochures in both Chinese and English. In recent years, in order to propagate the scholarly value of its collections, the MIHP has further invited IHP research fellows to publish the *Introduction to the Museum of the Institute of History and Philology*, a series which relates to the special exhibitions held at the museum. Written in a lively and engaging manner, these introductions are intended for perusal by people from all walks of life.

Museum of the Institute of Ethnology

886-2-2652 3308 886-2-2652 3310 http://www.ioe.sinica.edu.tw/tool/museum/index.html

Visitor Information

Opening Hours: Wednesday and Saturday, 9:30 a.m.–4:30 p.m.
(Closed on national holidays and consecutive holidays)
Free Admission

Chronology of Events

1956 Institute of Ethnology Collection Room was established.
1978 The collection room was renamed as the Ling Shun-sheng Memorial Collection Room.
1988 The collection room was remodeled into the Museum of the Institute of Ethnology.

The Collection

In 1955, Dr. Ling Shun-sheng, the head of preparatory office of the Institute of Ethnology, led a research team to Tjaljaqavus Village (currently Lai-yi Village, Pingtung County, Taiwan) to study Paiwan culture and collect ethnographic artifacts. These artifacts constitute the museum's earliest collections.
In the ensuing years, the museum's collections steadily grew. Many artifacts were accumulated during extensive ethnographic research. The museum now holds more than 7,000 pieces including artifacts from Taiwan's indigenous groups, Han Chinese folk and religious artifacts, and artifacts from mainland China, Southeast Asia, and the Pacific.

Current Exhibitions

Permanent Exhibitions:
"Taiwan's Aboriginal Cultures"
"Ethnographic Collections of China's Southwestern Minorities in the 1930's"

Theme-related Exhibitions:
"Legacy of Dr. Shun-Sheng Ling"
"The Exhibition of the Pacific Collections"

Special Exhibitions:
"Taiwan's Han Chinese Folk Religions and Matzu Culture"

↑ Short Cape for Women (Rukai, Taiwan)

↑ Water Containers (Yami / Tao, Taiwan)

↑ Carved House Post (Paiwan, Taiwan)

Lingnan Fine Arts Museum

886-2-2789 9937 886-2-2789 9938 http://proj1.sinica.edu.tw/~lnfam/index/

Visitor Information

Opening Hours: Tuesday to Friday, 12:00 a.m.–05:00 p.m. Saturday, 10:00 a.m.–05:00 p.m. (Closed on Sunday, Monday, and national holidays)

Free Admission

↑ *Riverside,* 1995, Au Ho-Nien

↑ *A Couplet in Calligraphy,* 1984, Zhao Shao-Ang

↑ *Mother and Son,* 1955, Au Ho-Nien

Although best known as a research institution, Academia Sinica has been striving to promote art and culture. In 2002, the institution redesigned its interior so as to accommodate the Lingnan Fine Arts Museum after receiving a generous donation of more than a hundred Lingnan paintings from the well-established Lingnan painter, Au Ho-nien. The Lingnan School is famous for innovation in modern Chinese art history. Its core values include advocating the regeneration of traditional Chinese painting and developing a modern style by combining techniques of Western painting and Chinese ink painting. The school was named after its region (namely "South of the Five Mountains" in Chinese), yet some critics believe that in view of its arduous efforts to integrate Chinese and Western art techniques, it is more appropriate to call it the "School of Compromise".

The Lingnan Fine Arts Museum's collection includes works by Ju Lian (the founder of the Lingnan school), Gao Jian-fu, Gao Qi-feng and Chen Shu-ren (the three masters of the Lingnan School), Au Ho-nien, and other Lingnan artists. The museum features the first professional archive of Lingnan paintings in Taiwan, documenting changes in the history of Chinese painting.

↑ Activities

↑ Artistic activities

2009
Significant Research Achievements

2009 Significant Research Achievements

In 2009, Academia Sinica had more than 4,100 scientific publications including journal articles, books and proceedings papers. Among them, 1,702 papers have been listed in SCI, SSCI and A&HCI, with an average of 2.15 papers per researcher. This current issue of research achievements highlights a selection of seventeen key papers published in the last twelve months, covering a wide range of topics presented by each of the following divisions: Mathematics and Physical Sciences, Life Sciences, and Humanities and Social Sciences.

The Division of Mathematics and Physical Sciences is currently comprised of seven institutes, one preparatory office and three research centers. According to the Web of Science, the division's researchers published an average of 3.71 papers listed in SCI, SSCI and A&HCI in 2009. The total number of journal articles, books and proceedings papers has amounted to more than 1,500, with an average of 5.2 publications per researcher. Over the years, the division has accumulated strengths in fundamental research. Several remarkable achievements have made a profound impact on society and technological developments. A few good examples are the accurate measurements of UV absorption cross-sections of CIOOCI that are consistent with ozone degradation models, the risk of extreme precipitation due to global warming which is substantially greater than that estimated by climate models, and three-dimensional characterization of active membrane waves on living cells by using a microscopy technique developed by the laboratory itself.

The Division of Life Sciences has five research institutes and three research centers. In 2009, researchers in this division published an average of 3.11 papers listed in SCI, SSCI and A&HCI. The total number of journal articles, books and proceedings papers has amounted to more than 800, with an average of 4.2 publications per researcher. Major accomplishments range from basic discoveries to translational studies, including understanding the mechanism of important human diseases, drug discovery and structural/mechanistic studies, vaccine development and identification of cancer biomarkers, mechanisms of immune response, molecular mechanisms of gene regulation and mutation repair, regulation of cell division, regulation of absorption and transport of phosphorus and nitrogen in plants, and mechanisms of speciation.

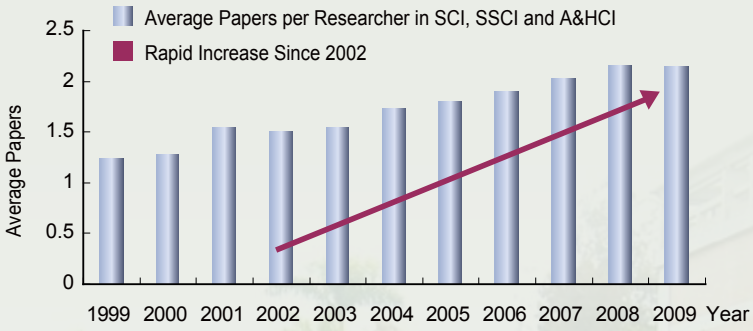
The Division of Humanities and Social Sciences is comprised of nine research institutes, two preparatory offices and one research center. In 2009, researchers in this division altogether produced over 1,700 publications including journal articles, books and proceedings papers. On average, each researcher had 5.5 publications. Their research interests are wide-ranging and cover Chinese medical history, Taiwan under Japanese colonial rule, the Ming-Qing dynastic transition, etc. The highlights of their work include the study of how northern nomads encountered imperial China from anthropological and historical perspectives, an institutional approach to Japanese colonial engineering, the use of ethnographic methods to explore mental disorder among the Tao aboriginal minority, observations on Burma's politics through the trans-border trade among the migrant Yunnanese, the constitution's fundamental values in political philosophy, and a new understanding of eighteenth-century Chinese landscape paintings.

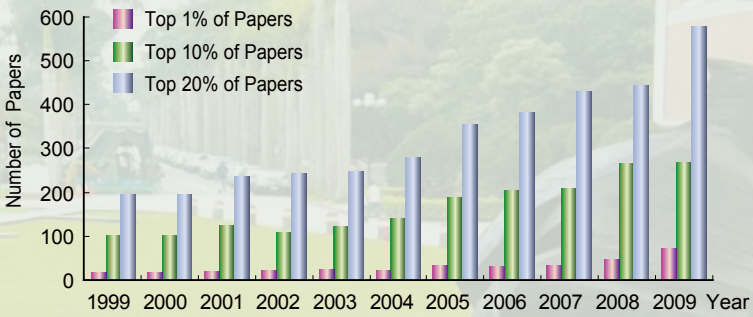
Analysis of Published Papers

Academia Sinica strives to achieve excellence in research. The papers published by Academia Sinica's researchers are remarkable both in terms of quality and quantity. The number of papers has been rapidly increasing:

In 2009, there were 1,702 papers listed in SCI, SSCI and A&HCI, 868 more than in 1999. The average number of papers per researcher in 2009 was 2.15, higher than 1.24 in 1999. In addition, the number of highly cited papers has more than doubled since 1999. According to an analysis of Thomson's Essential Science Indicators data, Academia Sinica was ranked among the top 1% of research institutions in 11 fields from 1999-2009. Physics, Chemistry and Biology & Biochemistry were the top 3 fields which attracted the highest total citations.

In 2009, institutes in the Division of Humanities and Social Sciences produced more than 50 books published by domestic and international publishers, such as *Mental Disorder of the Tao Aboriginal Minority in Taiwan: Modernity, Social change, and the Origin of Social Suffering* (Taipei: Linking Publishing Company), *The Nomad's Choice: The First Encounter Between Northern Nomads and Imperial China* (Taipei: Academia Sinica and Linking Publishing Company), *The EU Human Rights Policies* (Taipei: IEAS, Academia Sinica), *Taiwan in Japan's Empire-Building: An Institutional Approach to Colonial Engineering* (Oxford: Routledge), *Prescribing Colonization: The Role of Medical Practice and Policy in Japan-Ruled Taiwan* (Michigan: AAS), *and The Poet-historian Qian Qianyi* (London & New York: Routledge).





Academia Sinica Ranked among Top 1% of Research Institutions in 11 Fields, 1999-2009

Field	Citations
Physics	27,736
Chemistry	23,957
Biology & Biochemistry	13,443
Clinical Medicine	11,049
Molecular Biology & Genetics	9,369
Plant & Animal Science	8,819
Geosciences	5,700
Materials Science	5,062
Engineering	2,522
Computer Science	1,274
Agricultural Sciences	1,052

Intellectual Property Management and Technology Transfer

Academia Sinica attempts to benefit society through its outstanding research achievements. The Office of Public Affairs is responsible for protecting and managing Academia Sinica's intellectual property rights, encouraging the disclosure of new discoveries, developing partnerships and collaborations with private sectors, and promoting technology transfer. In 2009, Academia Sinica filed 137 patent applications, was granted 27 patents, and signed 53 licenses as well as 25 cooperative research and development agreements (CRADA). The licensing deals have reached 449 in the past 12 years. By technology transfer, Academia Sinica has assisted the establishment of start-up companies and provided them with crucial support for the commercialization and development of research outcomes of Academia Sinica with the goal of improving the development of Taiwan's industry and its international competitiveness.

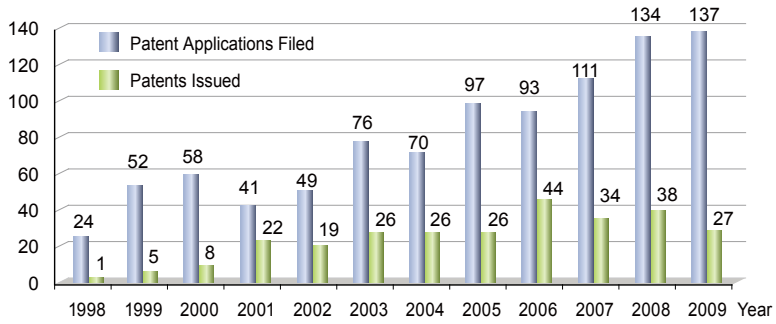
License Agreements Executed in 2009

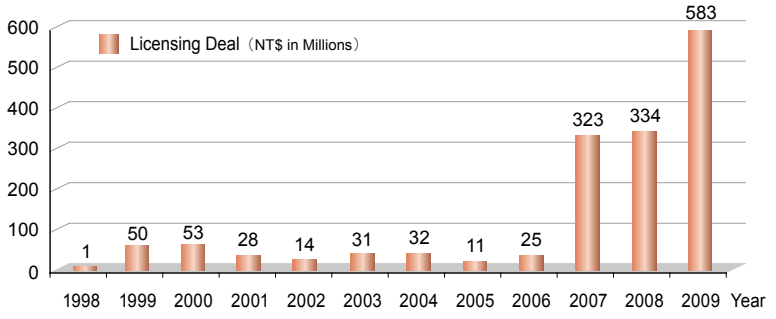
- G-CSF with Autologous Mobilized Peripheral Blood-Hematopoietic Stem Cell Transplantation in Chronic Stroke Animal Models
- Breast Cancer-Specific Peptides and Development of Ligand-Targeted Therapy for Breast Cancer
- Lung Cancer-Specific Peptides and Development of Ligand-Targeted Therapy for Lung Cancer
- Tumor Vessels-Specific Peptides and Development of Ligand-Targeted Therapy for Cancer
- New Drug Development of CLEC5A, Critical for Dengue Virus-Induced Lethal Disease
- Alpha-Galactosyl Ceramide Analogs as New Anti-Cancer Agents
- Methods for the Preparation of Polyclonal Antibodies and Monoclonal Hybridoma
- Development of Vaccines in the Prevention of Viral Infection
- Development of the Anti Liver Disease Drug R-YEEE
- Knockout-Transgenic Mouse Model of Spinal Muscular Atrophy
- AGP4 Anti-PEG Monoclonal Antibodies and its Applications
- Longevity-Promoting Effects of Acetic Acid and Reishi Polysaccharide
- Evaluation of Medicinal Herbs Endemic to Taiwan used for Anti-Inflammatory and Immune-Modulatory Bioactivities and the Establishment of Biotechnology Platforms
- SERS-Active Substrate made of Nanoparticle-Array on Porous Anodic Aluminum Oxide Film
- Multi-Platform Multi-Mode Scanning Probe Microscope

Intellectual Property Rights and Technology Transfer in 2009

Patent Applications Filed	137.0
Patents Issued	27（15）*
License Executed	53.0
Licensing Deal (NT$ in Millions)	582.9
Licensing Revenue (NT$ in Millions)	36.4
Stock	27.8
Royalties (NT$ in Millions)	4.3
CRADA Executed	25.0
CRADA Grant (NT$ in Millions)	28.2
Start-Up	3.0

( )* Cases of US patents





Awards and Honors

The outstanding academic competitiveness of Academia Sinica is demonstrated by the range of prestigious honors and prizes bestowed upon its researchers. In 2009, many researchers of Academia Sinica received important international honors and awards. For example, Frank Shu was conferred the Shaw Prize; Wen-Hsiung Li was awarded the Mendel Medal by the Genetics Society; Tai-Ping Liu received the Angiola Gili and Cataldo Agostinelli International Prize. Many Academia Sinica researchers have also been recognized for their stellar research accomplishments through domestic awards and honors. For example, Paul Jen-Kuei Li received the Presidential Science Prize of Taiwan; Su-May Yu received the Teco Award. Many researchers were also recipients of the National Science Council awards: In the past five years, 26 Academia Sinica researchers were conferred the Outstanding Research Award, 15 won the Merit Research Fellow Award and 20 researchers were presented with the Ta-You Wu Memorial Award.

Academician Frank Shu has been awarded on Oct. 7, 2009 the Shaw Prize in Astronomy. Prof. Shu won the prize for his outstanding achievements in theoretical astronomy as well as for his significant contributions to humanity.

Academician Wen-Hsiung Li has been awarded on Nov. 13, 2009 the Mendel Medal by the Genetics Society, UK. It is a tribute to Dr. Li's lifetime achievement in genetics and evolutionary biology.

List of Awards and Honors bestowed on Academia Sinica Researchers in 2009

International

Awards and Honors	Academia Sinica Researchers
American Association for the Advancement of Science (AAAS) Fellow	Yue-Ie Hsing, Chung-Hsuan Chen, Su-May Yu
Angiola Gili and Cataldo Agostinelli International Prize	Tai-Ping Liu
American Political Science Association (APSA) Council Member	Yun-Han Chu
Catherine Wolfe Bruce Gold Medal	Frank Shu
International Union of Biological Sciences (IUBS) Executive Committee Members	Jen-Leih Wu
Khwarizmi International Award	Su-May Yu, Yue-Ie Hsing
Mendel Medal	Wen-Hsiung Li
Officier dans l' Ordre des Palmes Academiques, Ministry of Education, France	Chien-Jen Chen
Shaw Prize	Frank Shu
Taiwanese-American Foundation (TAF) Science and Engineering Achievement Award	Maw-Kuen Wu, Chien-Jen Chen
TWAS Members	Che-Kun James Shen, Wen-Hsiung Li
TWAS Young Affiliate	Che Alex Ma
Honorary Doctorate, University of Ottawa	Yuan Tseh Lee
Honorary Doctorate of Science, City University of Hong Kong	Chi-Huey Wong

Domestic

Awards and Honors	Academia Sinica Researchers
Presidential Science Prize of Taiwan	Paul Jen-Kuei Li
Outstanding Honorary Award, Education Foundation of Ho C.T	Ming-Zong Lai
Taiwan / France Science & Technology Award	Cheng-Ting Chien
Outstanding Research Award, National Science Council	Chi-Kung Ni, Ming-Syan Chen, Yi-Fang Tsay, Cheng-Ting Chien, Carmay Lim, Chung-li Wu, Cheng-Horng Lin, Jeng-Min Chiou, Te-Hsing Shan, Shang-Cheng Hung, Jianmin Li
Merit Research Fellow Award, National Science Council	Su-May Yu, Ming-Zong Lai
Ta-You Wu Memorial Award, National Science Council	Chih-Ming Wang, Tzu-Ching Meng, Mao-Chang Liang, Szu-yuan Chen, Horng-Tay Jeng, Li-Chuan Tai
Executive Yuan Award for Outstanding Contributions in Science and Technology	Yuh-Lin Wang
Academic Award, Ministry of Education	Ki-Che A. Leung, Kong-Pin Chen, Shin-Kun Peng, Carmay Lim, Sue Lin-Chao, Ming-Syan Chen
Outstanding Scholar Award, Foundation for the Advancement of Outstanding Scholarship	Chien C. Chang
Teco Award	Su-May Yu
Outstanding Medical and Pharmaceutical Science and Technology Award, Tien-Te Lee Foundation	Li-Jung Juan
Y. Z. Hsu Science and Technology Lecture	Yuh-Lin Wang
Wang Ming-Ning Award	Alice Yu
Lecture in Honor of Former President Hu Shih	Ko-Wu Huang
Award for Junior Research Investigators, Academia Sinica	Chao-Ping Hsu, Horng-Tay Jeng, Jun-Yi Leu, Tzu-Ching Meng, Chih-Yen King, Fabian Heubel, Chin-Tao Wu, Li-Chuan Tai
Honorary Doctorate, National Chung Cheng University	Ovid J.L.Tzeng
Honorary Doctorate of Science, National Chengchi University	Ovid J.L.Tzeng
Honorary Doctorate, National Yang-Ming University	Ovid J.L.Tzeng

UV Absorption Cross Sections of ClOOCl Are Consistent with Ozone Degradation Models

Abstract

Recently, discrepancies in laboratory measurements of ClOOCl absorption cross sections have cast doubt on the validity of current photochemical models for stratospheric ozone degradation. Whereas previous ClOOCl absorption measurements all suffered from uncertainties due to absorption by impurities, we demonstrate here a unique method based on molecular beam and mass-selected detection that circumvents such interference. The cross sections of ClOOCl were determined at two critical wavelengths (351 and 308 nm). Our results are sufficient to resolve the controversial issue originated from the ClOOCl laboratory cross sections and suggest that the highest laboratory estimates for atmospheric photolysis rates of ClOOCl, which best explain the field measurements via current chemical models, are reasonable.

Hsueh-Ying Chen[1], Chien-Yu Lien[1], Wei-Yen Lin[1,2], Yuan T. Lee[1,2], and Jim J. Lin[1,3*]

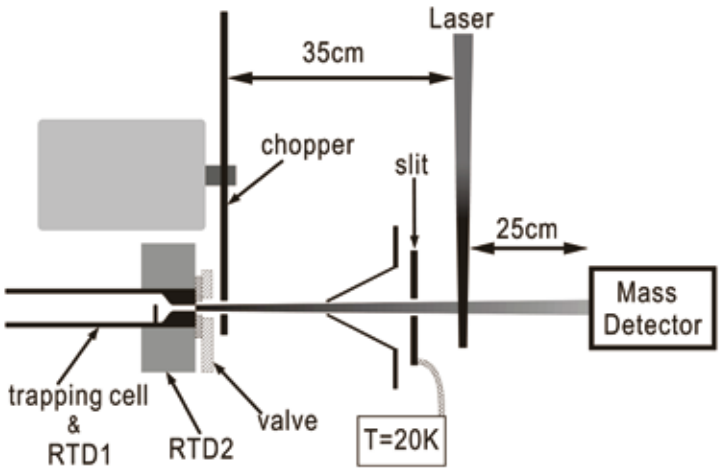
[1]Institute of Atomic and Molecular Sciences, Academia Sinica, Taipei, Taiwan [2]Department of Chemistry, National Taiwan University, Taipei, Taiwan [3]Department of Applied Chemistry, National Chiao Tung University, Hsinchu, Taiwan

The ozone in the stratosphere (commonly known as the Ozone Layer) absorbs harmful ultraviolet radiation from sunlight and thus protects the earth. Since the discovery of the Antarctic ozone hole back in 1985 there has been increasing concern over the disappearance of ozone and its effects on the earth. In 1989 an international treaty, the Montreal Protocol, was enacted to phase out the production of substances thought to be depleting ozone. In 1995, the Nobel Prize in Chemistry was awarded to three scientists for their contributions to understanding the formation and decomposition of ozone further highlighting the importance of the issue.

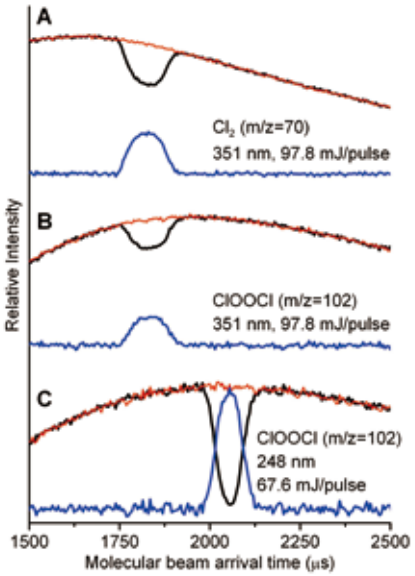
Until recently, scientists believed that the chemical processes responsible for the formation of the ozone hole were reasonably well understood. However, laboratory data on the ultraviolet absorption spectrum of chlorine peroxide published in 2007 by Dr. F. D. Pope and coworkers from the Jet Propulsion Laboratory at the California Institute of Technology [JPC A 111(2007): 4322-4332] cast doubt on that understanding. Pope et al. measured chlorine peroxide absorption cross sections with new methods of sample preparation and purification; but the resulting cross sections were about ten times smaller than previously accepted values, meaning that it would be impossible to produce enough chlorine atoms to explain the observed ozone loss via known chemical mechanisms. As a result, in 2007, top scientific journals Nature [Nature 449 (Sep. 2007): 382] and Science [Science 318 (Dec. 2007): 1878] reported concerns about the validity of current scientific models for the ozone hole formation.

The molecule under debate, ClOOCl, is formed in the atmosphere due to the chlorine photochemistry; the major chlorine sources are from human emissions of chlorofluorocarbons (CFCs), ingredients in refrigerants and propellants. Cl atoms react with ozone (O_3) to form O_2 and ClO; two ClO radicals can then dimerize to form ClOOCl; most importantly, the photolysis of ClOOCl produces Cl atoms. That is, Cl atoms are recycled through ClOOCl and sunlight and O_3 is converted to O_2 catalytically. The larger the absorption cross section of chlorine peroxide, the faster chlorine peroxide absorbs sunlight, then the faster the chlorine atoms are generated, and thus the faster the ozone is destroyed.

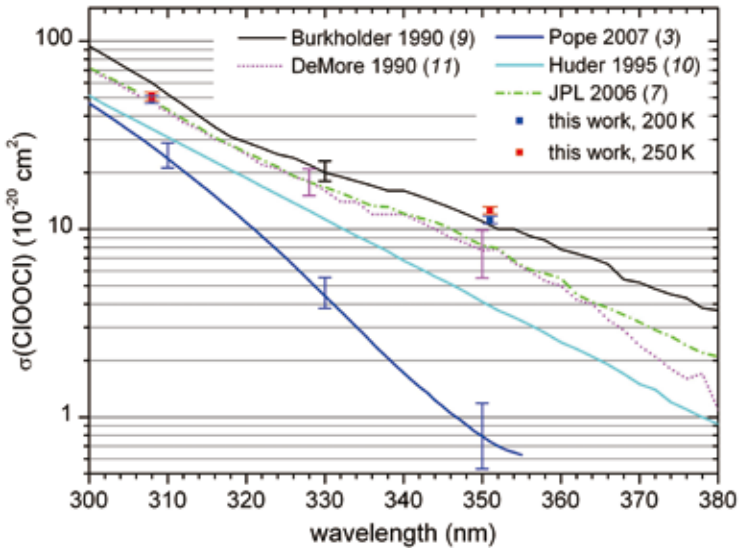
The ultraviolet absorption spectrum of ClOOCl shows a relatively strong and broad feature with a maximum at about 245 nm and a long tail extending to 300 nm and longer wavelengths. Because ozone strongly absorbs and therefore



1 | Schematic of the experimental setup (not to scale). The exit of the trapping cell (fused silica) connects to a capillary array (fused silica) which serves as the nozzle of an effusive molecular beam. The temperatures are monitored with resistance temperature detectors (RTD1, 2). The valve (stainless steel and Teflon) isolates the trapping cell from the vacuum chamber during the high pressure period of the ClOOCl condensation.



2 | **Time profiles of the molecular beams showing the photo-depletion of molecules. Black and red lines represent the molecular beam signals with and without laser irradiation, respectively; the blue line is the difference. The laser spot size and delay time are the same in (A) and (B) but different in (C). Therefore the photo-depletion signal in (C) appears at a different time.**



3 | **Comparison of different laboratory measurements of absorption cross sections of ClOOCl. Error bars (if available) are also shown at selected wavelengths. Note that the error bars of this work are about the size of the symbols.**

depletes sunlight of λ<300 nm, it is the weak absorption of ClOOCl at λ>300 nm that is responsible for its photodecomposition to Cl atoms. In this atmospherically relevant region of λ>300 nm, however, it is difficult to determine accurately the small absorption cross sections of ClOOCl, and there are substantial discrepancies between different laboratory studies. These discrepancies in turn result in large uncertainties in the partitioning of Cl, ClO and ClOOCl; in the resulting ozone loss rate; and, hence, in our basic understanding of ozone degradation chemistry.

A review of the literature on both ClOOCl synthesis and its ultraviolet absorption spectrum reveals that it is extremely difficult to prepare a pure ClOOCl sample at high enough concentration for an absorption measurement in the gas phase. Aware of the impurity problem, we designed an elegant experiment using a chlorine peroxide molecular beam, and determined the photodissociation probability (the probability of the chlorine peroxide being split into chlorine atoms and oxygen by light) by measuring the decrease in beam intensity after laser irradiation. By precisely measuring the ratio of the molecules before and after laser irradiation, we were able to quantify the absorption cross section without knowing the absolute concentration.

Figure 1 shows the schematic setup. The ClOOCl sample is prepared in a pulsed effusive molecular beam and detected downstream with a mass detector at its parent mass. The mass detector is equipped with an electron impact ionizer, a quadrupole mass filter, and a Daly-type ion counter. Before the mass detector, the molecular beam is intersected by a pulsed laser beam which photo-dissociates and thus depletes the ClOOCl molecules with a probability that is proportional to their absorption cross section. By comparing the photo-depletion signal of ClOOCl to that of a reference molecule (see Figure 2), one only requires the ratio of the laser fluences (which can be easily measured) to obtain the cross section ratio as in Equation (1).

$$\frac{[\sigma\phi]_{ClOOCl}}{[\sigma\phi]_{ref}} = \frac{I_{ref}}{I_{ClOOCl}} \frac{\ln(N/N_0)_{ClOOCl}}{\ln(N/N_0)_{ref}} \quad (1)$$

With a known cross section of the reference molecule, the absolute cross section of ClOOCl can then be obtained.

Using currently accepted kinetic models, our new results (Figure 3) can well explain the ozone-hole formation as well as the partition of ClO/ClOOCl from field measurements, indicating that the current atmospheric models are in fact still valid. The results set new and stringent constraints for atmospheric chemistry allowing scientists in the future to investigate more deeply and more accurately on the Ozone Hole Chemistry.

Publication

Science **324** (2009): 781-784.

CH Stretching Excitation in the Early Barrier F+ CHD_3 Reaction Inhibits CH Bond Cleavage

Abstract

Most studies of the impact of vibrational excitation on molecular reactivity have focused on reactions with a late barrier (that is, a transition-state structure resembling the products). For an early barrier reaction, conventional wisdom predicts that a reactant's vibration should not couple efficiently to the reaction coordinate and thus should have little impact on the outcome. We report here an in-depth experimental study of the reactivity effects exerted by reactant C-H stretching excitation in a prototypical early-barrier reaction, F + CHD_3. Rather counterintuitively, we find that the vibration hinders the overall reaction rate, inhibits scission of the excited bond itself (favoring the DF + CHD_2 product channel), and influences the coproduct vibrational distribution despite being conserved in the CHD_2 product. The results highlight substantial gaps in our predictive framework for mode-selective polyatomic reactivity.

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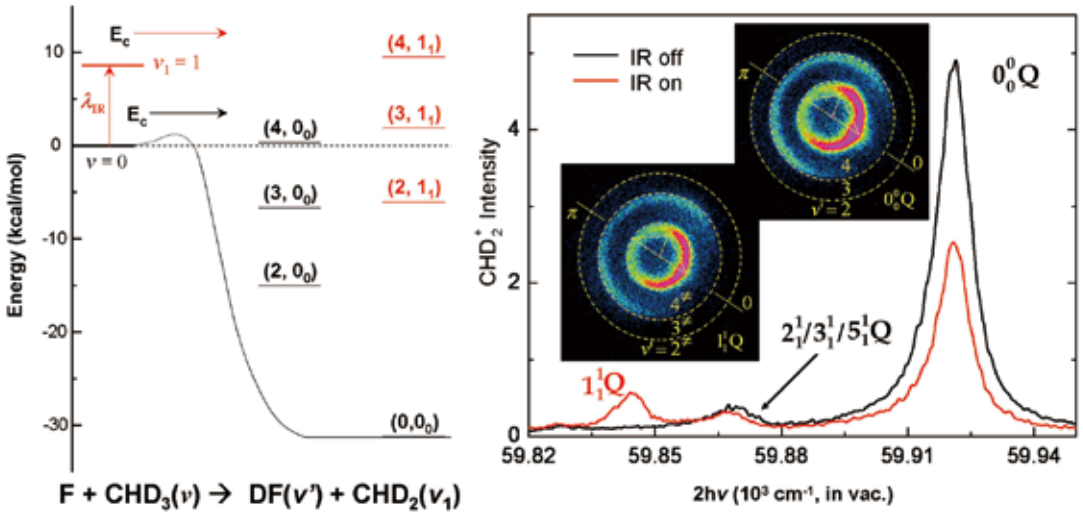
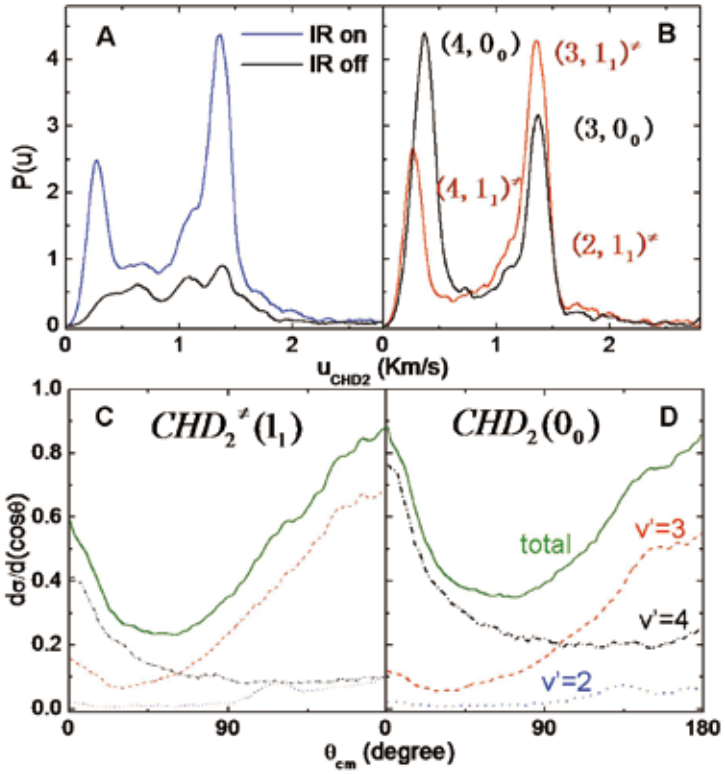
We studied the reaction between atomic fluorine (F) and a methane molecule in which three of hydrogen was substituted by deuterium, CHD_3. The experiment was conducted in a crossed molecular beam apparatus at IAMS. The F-atomic beam was generated by discharge; the reaction products were detected by a laser-based, time-sliced ion velocity imaging technique that provides all detailed information at the product pair-correlated level. Using an infra-red laser tuned to the frequency of the C-H vibration, the C-H bond of the CHD_3 reactant was exclusively excited prior to reaction. We then compared the reaction outcomes with and without exciting the C-H bond.

Intuitively, one would have thought that exciting a stretching mode of a chemical bond in a reactant should increase the likelihood of the bond breaking during a chemical reaction or, at the very least, have little impact on the reaction. Even on a more technical basis, the reaction of F+CHD_3 is a so-called "early-barrier" reaction, in which the structure of the transition state resembles the reactants more than the products (as opposed to a late-barrier reaction,



1 | (Left) Reaction path energetics for reactant CHD_3 initially in the $v = 0$ (black arrow) and $v_1 = 1$ (red) vibrational states. The curve represents schematically a cut through the multidimensional potential energy surface governing reactivity. The numbers in the parentheses indicate the vibrational quanta of the product pairs relevant to this study. (Right) Two normalized REMPI spectra of the probed CHD_2 products, with IR-on (red) and IR-off (black), at E_c = 3.6 kcal/mol. Two product images, both with IR-on, are shown for probing of the 1_1^1Q and 0_0^0Q bands, respectively. Superimposed on the images are the scattering directions; the 0° angle refers to the initial CHD_3 beam direction in the center-of-mass frame.



2 | (A) The normalized product speed distributions P(μ) deduced from the IR-on and IR-off images of the $CHD_2(1_1^1)$ band at E_c= 1.2 kcal/mol. (B) The genuine speed distribution of the F+CHD_3(υ1 = 1) → DF(υ) + CHD_2(υ1 = 1) reaction depicted in red after analysis. The distribution in black is derived from the IR-off image of the $CHD_2(0_0^0)$ band, corresponding to the ground state reaction. On energetic grounds, the peak features can be assigned to the state-pairs of the two products, as labeled. The small energetic difference of the two reactions is evident from the slight shift of the peak positions of the (4, 0_0) and (4, 1_1)* product pairs. (C, D) Pair-correlated angular distributions from the stretch-excited reaction and ground state reaction, respectively; the quantum number υ' refers to the DF coproduct.

for which the reverse applies). According to a set of chemical rules of thumb called the Polanyi rules, vibration of a molecular bond in an early-barrier reaction will not couple efficiently to the reaction coordinate, thus is unlikely to make a significant contribution to the reaction rate (i.e., should act as a spectator bond). Experimentally, we found that precisely the opposite can happen: Excitation of the C-H bond actually blocks the production of HF + CD_3 rather than the intuitively expected increase in reaction rate. Furthermore, the excited C-H bond is not a mere spectator, even though it does not react. Its excitation is still able to influence the other isotopic product channel, DF + CHD_2, by slowing down the rate (Figure 1) and altering the vibrational energy of the DF product (Figure 2).

We interpreted those counterintuitive findings as a result of the stereodynamical effect in the reaction entrance valley. Upon vibrational excitation, the long range anisotropic interactions between the F-atom and a stretched/compressed C-H bond must change in such a way that it effectively steers the trajectory away from the transition state, practically shutting down the C-H bond scission channel.

[Footnotes]

(1) The proposed interpretation has recently been confirmed by theoretical simulation, see *J. Am. Chem. Soc.* 131 (2009) 17534-17535.

(2) One of the motivations for pursuing mode-selective chemistry is to find ways of influencing reaction rates and products by exciting specific bonds in reactant molecules, which ultimately could have potential practical and technological importance. This study is perhaps one of the best examples of using light to control and steer a chemical reaction, let alone its simplicity. For these reasons, the work has, since its publication, received a wide publicity in *C&E News, RSC Chemistry World*, and *Nature Chemistry*.

Science **325** (2009): 303-306.

Three-dimensional Characterization of Active Membrane Waves on Living Cells

Abstract

Centripetally propagating membrane waves occur on the leading edges of migrating cells, but the characteristics of these waves are not very clear yet. We characterize these active membrane waves by using a microscopy technique called "non-interferometric wide-field optical profilometry." On fibroblasts, the amplitudes of these waves are smaller than 300 nm, the wave speeds increase from 10 nm/s at the edges to 25 nm/s after ~20 μm of centripetal propagation. The wavelengths approach a steady-state value, but the amplitudes decrease gradually. The dispersion relation and amplitude frequency response of these waves are consistent to a simple mathematical model. We also verify that these active membrane waves are driven by the interactions between myosin II and actin polymerization in the cytoplasm.

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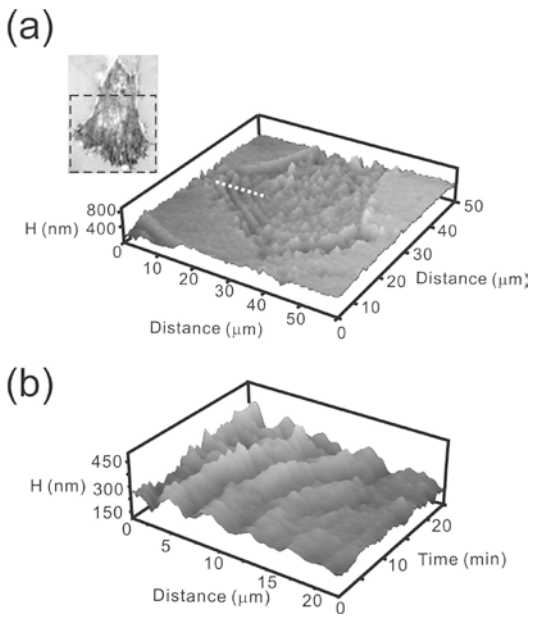
Many physiological processes–including the healing of a wound and the metastasis of cancers–involve the active motion of cells. A motile cell such as a fibroblast would extend a specific lamellipodium, called the leading edge, driving the cell to a direction determined by some special chemical gradients. The leading edge contains large amounts of motile proteins including actin and myosin. In some cases, the interactions of these proteins lead to ruffles at the leading edge, and the undulations of the ruffles could generate centripetally propagating membrane waves. A few research groups have observed this kind of membrane waves along with actin density flows. Researchers believe that these waves can be used as a feature to understand cellular responses to external mechanical properties. Because the amplitudes of these membrane waves are of the 100 nm order and cell membranes are nearly transparent in the culture medium, it is difficult to measure the propagation of these waves precisely. In addition, the measurement technique must not cause extra changes in the membrane topography.

We characterize the membrane waves by using a microscopy technique called "non-interferometric wide-field optical profilometry (NIWOP)," which was developed in our laboratory in 2002. On living cells, the NIWOP technique provides depth profiling accuracy around 20 nm and lateral resolution about 290 nm. Because the NIWOP technique profiles sample surface by light waves, it does not induce variations of the membrane topography. In this work we use the human skin fibroblast as the sample because this cell adheres on the bottom of a culture dish and exhibits evident lamellipodia and leading edges. Hence it is very suitable for the studies on membrane waves.

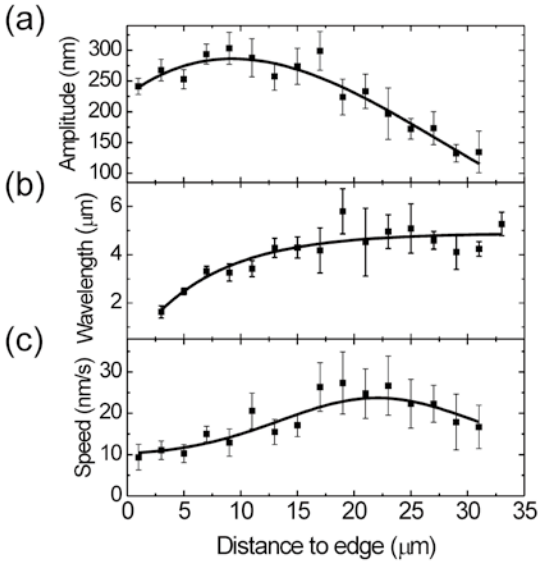
Figure 1(a) shows the membrane topography of a living fibroblast obtained by NIWOP. We see obvious membrane waves on this cell. Figure 1(b) shows the kymograph of the membrane topography along the white dashed line in Figure 1(a). The origin of the distance axis in Figure 1(b) represents the cell edge. We find that the membrane waves propagate away from the cell edge with decaying amplitudes. Figure 2 shows the amplitudes, wavelengths and speeds of membrane waves from 23 cells. The amplitudes increase to the maximum value about 300 nm at a distance of 9 μm and then decrease. After a propagation distance of 31 μm it is difficult to obtain the amplitudes precisely. The wavelengths increase to a steady-state value about 4.9 μm. The speeds are nearly 10 nm/s at the edges, reach a maximum value of 25 nm/s and then start to decrease at about 23 μm. This trend reveals that, although the energy of



1 | (a) Membrane topography of a fibroblast obtained by NIWOP. The inset shows a bright-field reflection image of this cell and the dashed square labels the observation area. (b) Kymograph of the membrane topography along the white dashed line in (a). On the distance axis, the origin represents the cell edge.

membrane waves dissipates along with the propagation, the speed may be determined by actin flows that are not directly related to the undulations of edge ruffles.

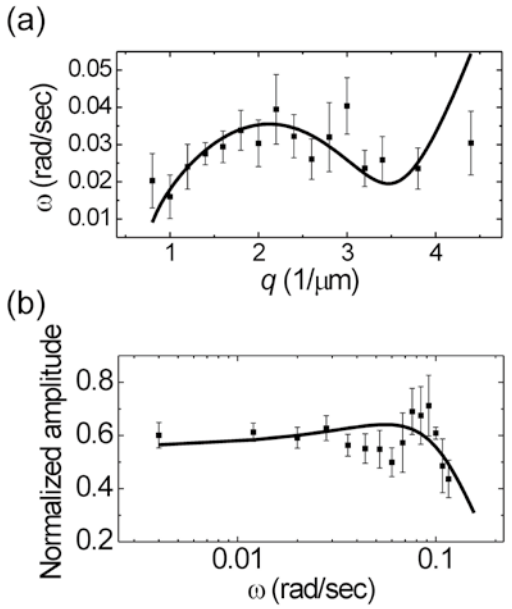
We compare the measured dispersion relation and amplitude frequency response with the active membrane wave model proposed by Nir S. Gov at Weizmann Institute of Science, Israel. In Figure 3 we see that the active membrane wave model agrees well with our experimental data. This result indicates that the propagation characteristics of membrane waves are mainly determined by the mechanical parameters such as the protrusion force of actin polymerization, the contractile force of myosin movements, as well as the bending rigidity and tension of cell membranes. Therefore these membrane waves can represent the cellular responses to mechanical properties in the microenvironment.



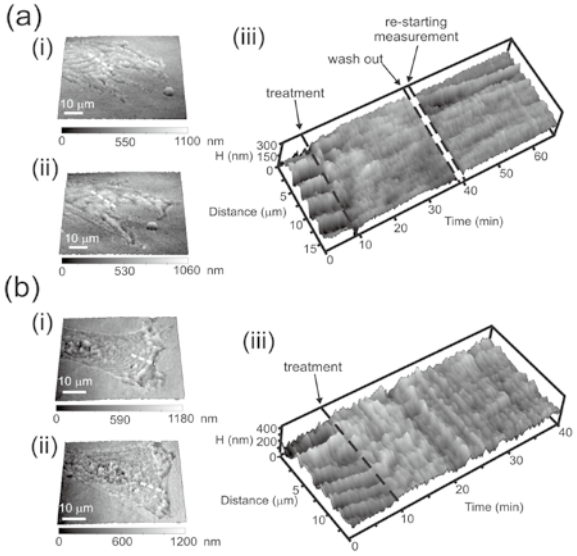
2 | (a) Peak-to-valley amplitudes of membrane waves versus the distances to cell edges. Solid curve is a guide to the eye. (b) Wavelengths versus the distances to cell edges. Solid curve is a fitting of $\lambda(x)=\lambda_a\left[1-\exp(-x/x_c)\right]$, where $\lambda_a = 4.9\,\mu m$ and $x_c = 7.0\,\mu m$ (c) Wave speeds versus the distances to cell edges. Solid curve is a guide to the eye.

In order to check the driving sources of the membrane waves, we also treat the cells with blebbistatin (BBI) and latrunculin A (LA). BBI inhibits the activities of myosin II, while LA impedes the polymerization of actin filaments. In the kymograph of Figure 4(a), the waves disappear right after the treatment of 75 μM BBI. Because the effect of BBI is reversible, a propagating peak of the membrane wave recovers from the edge after we wash out the BBI. In Figure 4(b), the membrane waves are flattened by the treatment of 100 nM LA. These results verify that the generation and propagation of membrane waves require both the myosin II activities and the actin polymerization.

We shall continue these studies in microfluidic cell culture chips for more precise control of the microenvironment. We hope to find the external chemical and mechanical parameters that determine the features of these membrane waves. Moreover, we will also cooperate with theorists for developing cell mechanical models with better quantification accuracy.



3 | (a) Dispersion relation of membrane waves. In this figure, q is the wave number and ω is the angular frequency. (b) Frequency response of the peak-to-valley amplitudes, normalized to the maximum values of each cell. The curves are calculated by the active membrane wave model proposed by Nir S. Gov.



4 | (a) Membrane topography of a cell (i) before and (ii) 23 min after the treatment of 75 μ M BBI. (iii) Kymograph of the membrane topography along the white dashed line. We treated the cell at the 9th min, washed out the reagent at the 39th min, and re-started the measurement at the 41st min. A peak re-occurs after washing out BBI. (b) Membrane topography of a cell (i) before and (ii) 25 min after the treatment of 100 nM LA. (iii) Kymograph of the membrane topography along the white dashed line.

Physical Review Letters **103** (2009): 238101.

Temperature Dependence of Global Precipitation Extremes

Abstract

Data from the Global Precipitation Climatology Project (GPCP) covering the period 1979-2007 are examined for changes of precipitation extremes as a function of global mean temperature by using a new method which focuses on interannual differences rather than time series. This work finds that the very heavy precipitation (top 10% bin of precipitation intensity) increases by about 95% for each degree Kelvin (K) increase in global mean temperature, while 30%-60% bins decrease by about 20% K^{-1}. The global average precipitation intensity increases by about 23% K^{-1}, substantially greater than the increase of about 7% K^{-1} in atmospheric water-holding capacity estimated by the Clausius-Clapeyron equation. The large increase of precipitation intensity is qualitatively consistent with the hypothesis that the precipitation intensity should increase more than 7% K^{-1} because of the positive feedback from additional latent heat released. Our results also provide an independent evidence in support for significant increases in the number and/or size of global tropical cyclones. However an ensemble of 17 latest generation climate models estimates an increase of only about 2% K^{-1} in precipitation intensity, about one order of magnitude smaller than our value, suggesting that the risk of extreme precipitation events due to global warming is substantially greater than that estimated by the climate models. Global warming has a greater effect on Taiwan's extreme rain falls. The top 10% bin of rain intensity almost doubled in the last 45 years, and will keep increasing with temperature, resulting in more floods. Droughts due to reduced light rain will also increase. New national strategies for land-use, flood control and water resource management are imperative.

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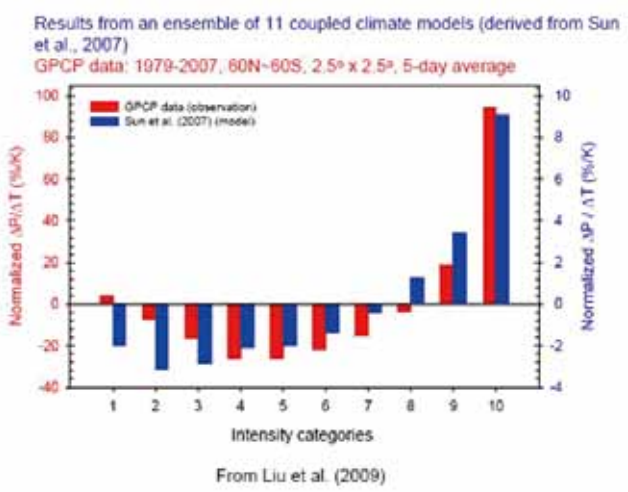
Long-term changes in precipitation extremes are of great importance to the welfare of human beings as well as the entire ecosystem. Increases in heavy precipitation can lead to more and worse floods, while persistent chronic decreases of light and moderate precipitation pose a serious threat to the drought problem because light and moderate precipitation are a critical source of water for the replenishment and retention of soil moisture.

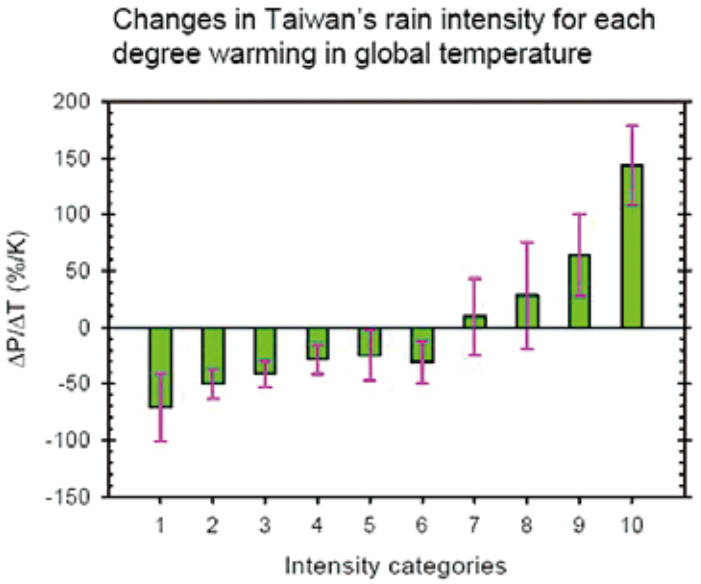
In regard to the impact of climate changes, most people mainly notice the increasing global temperature and rising sea level. Many people also think that these changes are gradual, long term, and even remote. They often overlook that extreme weather events can also be affected by climate changes. One of the reasons is that extreme weather events affected by climate changes are very difficult to forecast, especially on the regional scale. As a result the United Nations 2007 IPCC Report (Intergovernmental Panel on Climate Change) was very conservative in the projection of changes in extreme weather events due to global warming.



1 | Changes of 10 bins of global precipitation intensity for each degree K increase in global temperature. Red bars denote values of derived from the GPCP data in this study. Blue bars are values derived from results of an ensemble of 17 latest generation climate models used by IPCC. Note that the scales are different by a factor of 10.

Significant increases of the very heavy precipitation and decreases of light and moderate precipitation have been observed over most land areas of the globe in the last few decades. Over the oceans, analyses of satellite data at tropical/low latitudes in 1979-2003 also found similar changes. The widespread increases of heavy precipitation have been

attributed to global warming by Trenberth et al. [2003]. These authors point out that, according to the Clausius-Clapeyron equation (C-C), tropospheric warming can lead to an increase of about 7% K^{-1} in the atmospheric water-holding capacity. This is supported by available observations of recent decades. They hypothesized that the precipitation intensity should increase at about the same rate as atmospheric moisture because precipitation rates from storms were determined by low-level moisture convergence. Furthermore, they argued that the increase in heavy rainfall could even exceed the moisture increase because additional latent heat released from the increased water vapor could feed back and invigorate the storms. However, they did not give a quantitative estimate of the changes in precipitation extremes due to global warming. Furthermore their hypothesis was not corroborated by a study of results from an ensemble of 17 latest generation climate models used by IPCC, which shows that, under global warming driven by increasing greenhouse gases in the models, the global mean increase of precipitation intensity is only about 2% K^{-1} for the ensemble average, substantially less than the 7% K^{-1} of C-C. This is another reason that IPCC has been very conservative in assessing the risk of changes in precipitation extremes due to global warming.



2 | Changes of precipitation intensity (ΔP) in Taiwan for each degree Kelvin increase in global temperature (ΔT). Solid green bars denote values of ΔP/ΔT derived from observations at 15 Central Weather Bureau stations over the period 1961-2005. The vertical red line on top of each bar denotes the one standard deviation.

By using a new analysis methodology, this work finds that the top 10% bin of precipitation intensity increases by about 95% for each degree Kelvin (K) increase in global mean temperature, while lower 30%-60% bins decrease by about 20% K^{-1} (Figure 1, red bars). The global average precipitation intensity increases by about 23% K^{-1}, qualitatively consistent with the hypothesis that the precipitation intensity should increase by more than the 7% K^{-1} water vapor increase because of the additional latent heat released from the increased moisture. However an ensemble of 17 latest generation climate models estimates an increase of only about 2% K^{-1} in precipitation intensity (blue bars), about one order of magnitude smaller than our value, suggesting that the risk of extreme precipitation events due to global warming is substantially greater than that estimated by the climate models. In this regard, our findings will enable a significant improvement in the assessment of the risk of changes in precipitation extremes in the next IPCC report.

For Taiwan, this study finds that the top 10% bin of precipitation intensity increases by about 140% for each degree increase in global temperature, while the lower 20% bins decrease by about 70% K^{-1}(Figure 2). With global temperature increases by about 0.7K in the last 45 years, the top 10% bin of precipitation intensity in Taiwan has increased by about 100% in that period, and the corresponding decrease in bottom 20% light precipitation has been about 50%. Moreover, since the global temperature will increase by another 0.7K in about 30 years, another round of similar changes are expected. This implies that heavy rain in typhoons has doubled in last 45 years, and will triple in about 30 years, severely increasing the risk of floods and mudslides. Droughts will get worse and more frequent too. Since mitigation of the greenhouse warming by reducing CO_2 emissions will take decades to be effective (because the CO_2 residence time in the atmosphere is about 80 years), it is imperative that adaptation strategies in Taiwan such as flood control, water resource policy and land use plans are developed and implemented quickly.

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Mapping RNA Exit Channel on Transcribing RNA Polymerase II by FRET Analysis

Abstract

A simple genetic-tag based labeling method that permits specific attachment of a fluorescence probe near the C-terminus of virtually any subunit of a protein complex is implemented. Its immediate application to yeast RNA polymerase II (Pol II) enables us to test various hypotheses of RNA exit channel by using fluorescence resonance energy transfer (FRET) analysis. The donor dye is labeled on a site near subunit Rpb3 or Rpb4 and the acceptor dye attached to the 5' -end of RNA transcript in the Pol II elongation complex. Both *in-gel* and single-molecule FRET analysis show that the growing RNA is leading toward Rpb4, not Rpb3, supporting the notion that RNA exits through the previously proposed channel 1. Distance constraints derived from our FRET results, in conjunction with triangulation, reveal the exit track of RNA transcript on core Pol II by identifying amino acids in the vicinity of the 5' -end of RNA, and show that the extending RNA forms contacts with the Rpb7 subunit.

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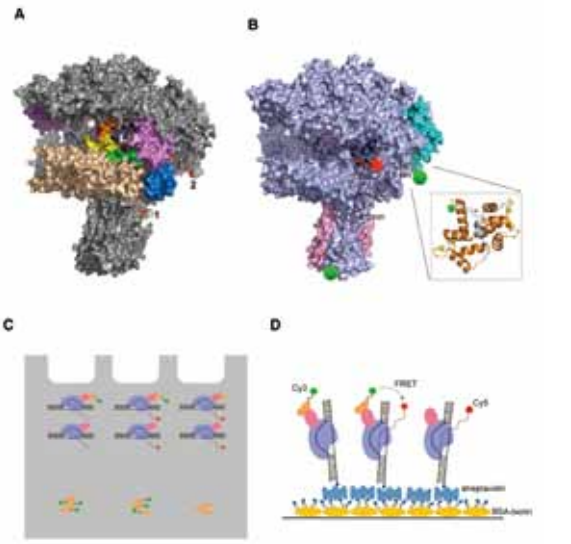
RNA polymerase II (Pol II), a protein complex containing 12 subunits, Rpb1 to Rpb12, of total mass ~500 Kd and size ~100-140Å, is the enzyme machinery synthesizing mRNA in all eukaryotes. X-ray studies of Pol II complexes led to an atomic model containing structural elements with functional implications (Fig. 1A). An outstanding question for RNA synthesis by pol II is if there exists a unique path on Pol II connecting the active-center to its exterior that a nascent RNA may follow. So far, the notion of RNA exit is speculated based on the Pol II surface charge distribution: two positively-charged grooves, lying on either side of the "dock domain" (Fig. 1A), can accommodate ssRNA. One groove, putatively referred as "exit channel 1" , runs around the base of the clamp, leading toward the stalk of sub-complex Rpb4-Rpb7, which can bind RNA via its ribonucleo-protein fold. The other groove, termed "exit channel 2" , runs down the back side of Pol II, through Rpb3 and Rpb11, and leads toward Rpb8, a subunit equally competent in RNA binding by its single strand nucleic acid binding motif.

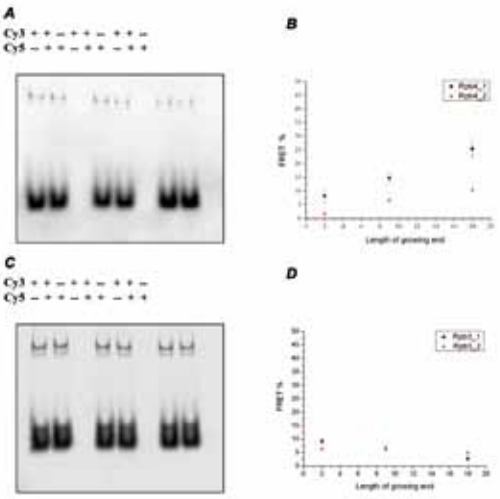
Attempts to identify the exit channel by X-ray studies of Pol II elongation complex failed to detect RNA longer than 10 nucleotides. An alternative approach using fluorescence resonance energy transfer (FRET), a spectral ruler to gauge distance between 1 nm to 10 nm, is ideal for mapping pairs of probes on a complex as large as Pol II. In this study, we introduce a simple scheme for specifically labeling virtually any subunit in a TAP-tagged (tandem affinity purification) protein complex to facilitate FRET measurement on pol II. Briefly, Cy3-conjugated calmodulin (CaM) is used to poise a Cy3 dye near the C-terminus of a TAP-tagged Pol II subunit by its binding to the calmodulin-binding-peptide (CBP) on the subunit (Fig. 1B). With a Cy5 dye attached to the 5' -end of RNA, our scheme allows us to test the hypothesis about RNA exit channel on Pol II by FRET analysis. Two independent FRET measurements are performed: "in-gel FRET" (Fig. 1C) and "single-molecule FRET" (Fig. 1D). The former is a bulk measurement, facilitated by separation of Pol II from unbound Cy3-calmodulin or Cy5-RNA in a native gel (Fig. 2), whereas the latter allows real-time recording of the "doubly-labeled" complex to reveal dynamics and distributions.



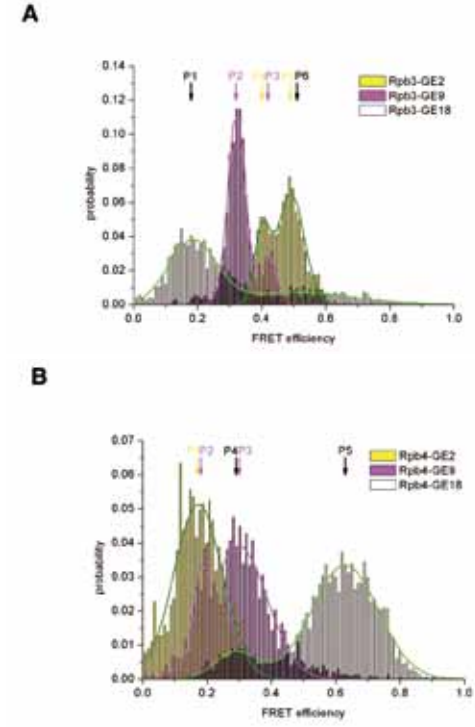
1 | Pol II elongation complex. (A) Surface representation of a Pol II elongation complex (PDB #: 1Y1W) with structural elements highlighted: clamp in wheat, wall in violet, lid in green, rudder in yellow, fork loop1 in orange, jaw in purple, and dock domain in marine. Two putative RNA exit channels are indicated by red dash, labeled with 1 and 2. (B) The red star denotes a Cy5 on 10 nt RNA (GE2), situated next to the saddle. Green beads denote the Cy3 near the C-terminus of Rpb4 in light pink, or that of Rpb3 in cyan. The distance of Rpb4-GE2 is 82 Å and that of Rpb3-GE2 is 65 Å respectively (PDB#: 1Y1W). The inbox zooms in a Cy3-CaM (orange) bound to CBP (light gray) extended from the C-terminus of Rpb3 or Rpb4 in the presence of Ca2+ ions (yellow). (C) A design of triplet used for *in-gel* FRET: upper band is mixture of labeled and unlabeled Pol II elongation complexes. Rpb3 or Rpb4 subunit is highlighted in pink; CaM is an orange dumbbell; Cy3 in green and Cy5 in red. Left lane: Pol II elongation complex with RNA unlabeled, a mixture of Cy3-CaM bound or unbound in the upper band, free Cy3-CaM in the lower band. Middle lane: Pol II elongation complexes labeled with Cy5 -RNA and Cy3-CaM. Right lane: same as middle except unlabeled CaM is used. (D) Immobilized single molecules of Pol II elongation complexes on a coated-slide. Left: "Donor only", labeled with Cy3-CaM. Middle: "Donor-and-acceptor", with Cy3-CaM and Cy5-RNA. Right: "Acceptor only", with Cy5-RNA. The figures (A, B) were prepared by PyMOL (http://www.pymol.org).

In immobilized single-molecule scheme, dual labeled complexes are selected, thus the information of dye labeling efficiency, a bulk quantity, is dispensable. For Rpb3-10 nt RNA, the single molecule FRET histogram (Fig. 3A) can be fitted to two Gaussian distributions, centering at 0.49 (Fig. 3A P5) and 0.40 (Fig. 3A P4) respectively. As the RNA extends to 17 nt, the FRET histogram shifts toward the low FRET regime with the major distribution centering at 0.32 (Fig. 3A P2), indicating that the distance between Rpb3 and 17 nt is longer than that between Rpb3 and 10 nt. For Rpb4-10 nt, the FRET histogram shows a major distribution centering at 0.17 (Fig. 3B P1). As the RNA extends to17 nt, the FRET histogram shifts toward the high FRET regime, and it can be fitted to two Gaussian distributions with the major one centering at 0.3 (Fig. 3B P3), indicating that Rpb4 is closer to 17 nt than to 10 nt. As the RNA extends further to 26 nt, changes of FRET values follow the same trend. Thus, single-molecule FRET data also support that majority of nascent RNA molecules, if not all, exit through channel 1 on Pol II, approaching the Rpb4-Rpb7 sub-complex.

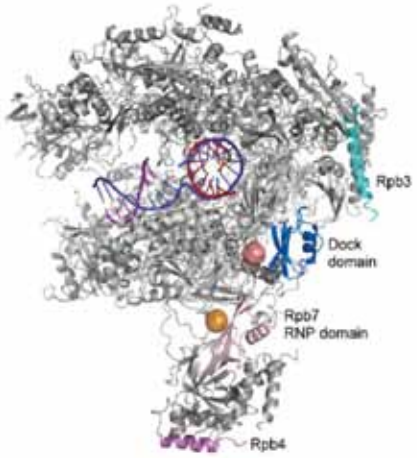
Using single-molecule FRET efficiencies: 0.49 for Rpb3-10 nt and 0.17 for Rpb4-10 nt, and a Förster distance R_0~60Å for Cy3-Cy5, distances of 61 Å (1.01 R_0) and 78Å (1.30 R_0) are obtained for Rpb3-10 nt and Rpb4-10 nt respectively, agreeing well with 64 Å and 82 Å, the corresponding distances in the crystal structure. Assuming that Förster distance R_0~60Å is applicable, distances of 68Å and 69Å are obtained for Rpb3-17 nt and Rpb4-17 nt respectively, and summarized. By allowing a ±5Å error, a unique site defined by a set of amino acids residing in the presumed exit channel 1 on core Pol II is found by triangulation (salmon sphere in Fig. 4). The distance from the 5' -end of the 10nt to that of 17 nt is determined to be 25-30Å. As expected, this span is capable of accommodating 7-11 nt. Henceforth, we refer to "exit channel 1" as the "exit channel" . Using single-molecule FRET values: 0.18 for Rpb3-26 nt (Fig. 3A P1) and 0.62 for Rpb4-26 nt (Fig. 3B P5), distances of 77Å and 55Å are obtained respectively. Triangulation with these distances identifies a site on the ribonucleo-protein binding domain of Rpb7, shown with an orange sphere (Fig. 4). The finding that RNA of 26 nt contacts Rpb7 lines up with the previous study of the 5' -end of nascent RNA of 23-29 nt cross-linking to Rpb7. The trajectory from the exit pore to the Rpb7 site deviates slightly from that of the exit channel, which would produce an energy penalty that could be compensated by RNA interacting with the ribonucleo-protein binding domain. Interestingly, as the RNA extends to 26 nt, the distribution in the FRET histogram exhibits a broadening (Fig. 3 A & 3B), regardless on which subunit Cy3 is placed. Such broadening, originating from fluctuations in the time traces, can be a signature of RNA flexibility due to its dislodging from Pol II.



2 | ***In-gel*** **FRET efficiencies as a function of the length of RNA. (A) A gel image of "triplets" scanned in the Cy3 channel: upper bands come from Cy3-CaM on Rpb3 subunit in Pol II elongation complex, and lower bands from unbound Cy3-CaM. Lane 1-3, 4-6, and 7-9 represent three triplets of elongation complexes containing GE2 (10 nt), GE9 (17 nt), and GE18 (26 nt) respectively. (B) X-Y plot of FRET efficiencies between Cy3 on Rpb3 and Cy5 on RNA, extracted from images in (A), as a function of the length of RNA: *black block* (■) for Rpb3_1: Cy3-CaM labeling on Pol II is 10% and RNA binding 40% (fB); *black dot* (●) for Rpb3_2: Cy3 labeling is 30% and RNA binding 40% (f_B). (C) Same as in (A) except Cy3-CaM is on Rpb4. (D) Extracted from (C). *Black block* (■) for Rpb4_1: Cy3 labeling was 5% and RNA binding 55% (f_B). *black dot* (●) for Rpb4_2: Cy3 labeling was 12% and RNA binding 40% (f_B).**



3 | **Single-molecule FRET histograms. (A) Reconstructed from many leakage-QE-corrected time traces of FRET efficiencies, between Cy3-Rpb3 and Cy5 attached to the 5' -end of RNA of various lengths: GE2 (10 nt), GE9 (17 nt), and GE18 (26 nt). (B) Same as (A) except Cy3-CaM is on Rpb4.**



4 | **Locations of the 5' -end of RNA. The 5' -end of GE9 (17 nt) is in salmon, next to the dock domain in marine; the 5' -end of GE18 (26 nt) is in orange, on the Rpb7 ribonucleo-protein binding domain in pink; also the 5' -end of GE2 (10 nt) in red, the C-terminus of Rpb3 in cyan, and that of Rpb4 in violet. The figure was generated by PyMOL (http://www.pymol.org) and the program O.**

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CHL1 Functions as a Nitrate Sensor in Plants

Abstract

Ions serve as essential nutrients in higher plants and can also act as signaling molecules. Little is known about how plants sense changes in soil nutrient concentrations. Previous studies showed that T101-phosphorylated CHL1 is a high-affinity nitrate transporter, whereas T101-dephosphorylated CHL1 is a low-affinity transporter. In this study, analysis of an uptake- and sensing-decoupled mutant showed that the nitrate transporter CHL1 functions as a nitrate sensor. Primary nitrate responses in CHL1T101D and CHLT101A transgenic plants showed that phosphorylated and dephosphorylated CHL1 lead to a low- and high-level response, respectively. In vitro and in vivo studies showed that, in response to low nitrate concentrations, protein kinase CIPK23 can phosphorylate T101 of CHL1 to maintain a low-level primary response . Thus, CHL1 uses dual-affinity binding and a phosphorylation switch to sense a wide range of nitrate concentrations in the soil, thereby functioning as an ion sensor in higher plants.

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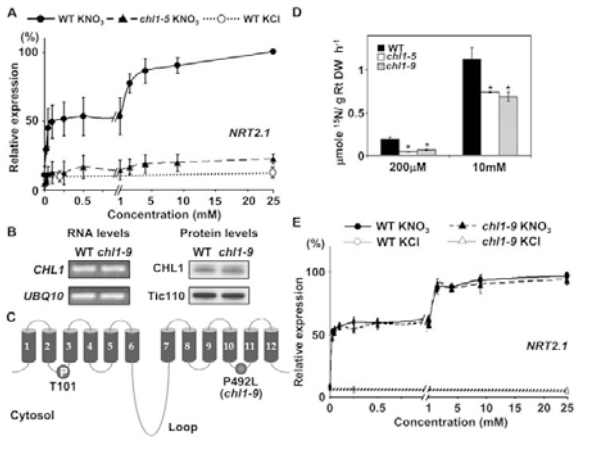
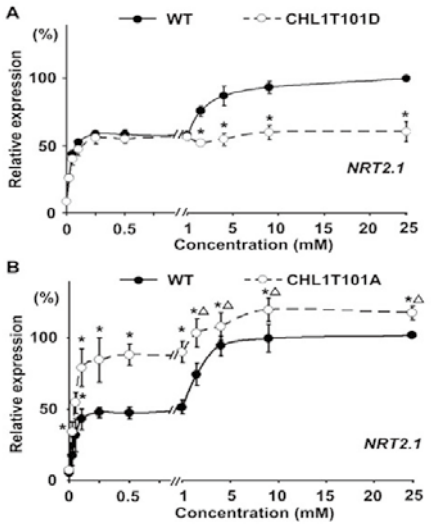
To determine whether CHL1 is involved in the primary nitrate response, changes in the expression of the primary nitrate response gene *AtNRT2.1* were examined by Q-PCR in wild-type and *chl1-5* mutant plants after exposure to various concentrations of nitrate for 30 min. As shown in Figure 1A, increased expression of *AtNRT2.1* was seen in wild-type plants, which displayed a biphasic pattern. However, in the *chl1-5* mutant, only basal expression of *AtNRT2.1* was seen in both the high-affinity and low-affinity nitrate concentration range, the level of expression being similar to that of *AtNRT2.1* in the wild-type treated with KCl (as a control for nitrate). These data show that CHL1 is required for the primary nitrate response.

chl1-5 is a deletion mutant in which no CHL1 protein or transcript is expressed and both nitrate uptake and the primary nitrate response are defective. The primary nitrate response defect in the *chl1-5* mutant could be due to either reduced nitrate uptake into the plant or direct involvement of CHL1 as a nitrate sensor. To determine whether the sensor function of CHL1 could be decoupled from its uptake function, the primary nitrate responses of additional CHL1 mutants were examined. One of these mutants, *chl1-9* was found to have normal levels of CHL1 mRNA and protein (Figure 1B). Sequence analysis showed that a point mutation in *chl1-9* resulted in Leu replacing Pro492 in the loop region (Figure 1C). A nitrate uptake defect of *chl1-9* was confirmed using a short-term ^{15}N-labeling approach, *chl1-9* being shown to be defective in both high- and low-affinity nitrate uptake (Figure 1D), as the same as *chl1-5*. Interestingly, despite the nitrate uptake defect, *chl1-9* still showed a typical biphasic primary nitrate response and K_M values in both affinity ranges (Figure 1E). Consistent with this, when the *chl1-9* genomic fragment was introduced into *chl1-5*, the signaling defect but not the uptake defect was rescued. These data show that transporter activity is not required for the sensing function of CHL1 and that CHL1 functions directly as a nitrate sensor. The two modes of action of CHL1 in nitrate transport are switched by phosphorylation/ dephosphorylation of Thr101 (Figure 1C). To determine whether this phosphorylation regulatory mechanism is also involved in the primary nitrate response, transgenic plants expressing T101D or T101A, mimicking, respectively, phosphorylated or dephosphorylated CHL1, were generated. In contrast to the primary nitrate response in the wild-type, the response in transgenic *chl1-5* plants expressing T101D (CHL1T101D) was monophasic, showing that T101D could recover the high-affinity, but not the low-affinity, primary nitrate response (Figure 2A). In contrast, expression of CHL1T101A in *chl1-5* mutants resulted in an increased primary nitrate response with a high-affinity K_M of 51±14 mM but with a high-affinity phase V_{max} twice that of the wild-type and similar to the wild-type low-affinity V_{max} (Figure 2B). These results show that T101 phosphorylation/ dephosphorylation is also involved in regulating the primary nitrate response and that phosphorylation of CHL1T101 is required to reduce the primary nitrate response to low levels.

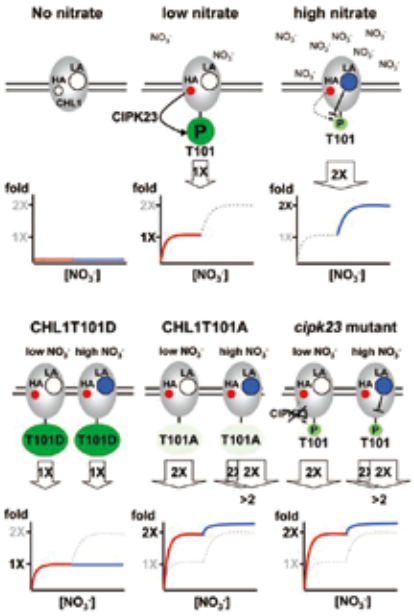


1 | Decoupled Mutant *chl1-9* Is Defective in Nitrate Uptake but Shows a Normal Primary Nitrate Response

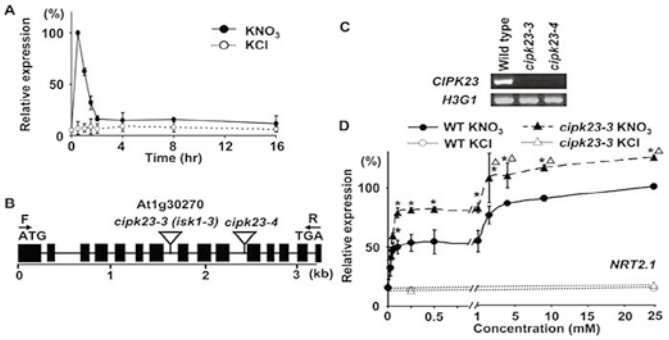
(A) The primary nitrate response is defective in *chl1-5* mutant plants. *NRT2.1* expression was analyzed by Q-PCR. The plants were grown for 10 days in NO^{3-}-free medium using NH^{4+} as the sole N source, treated with fresh medium overnight and again for an additional 3 hr, and then exposed for 30 min to the indicated concentrations of KNO_3 or KCl. (B) CHL1 mRNA and protein levels in the *chl1-9* mutant. The RNA and protein were isolated from wild-type and *chl1-9* plants grown in NH^{4+} as the sole N source. Tic110, a non-NO^{3-}-inducible chloroplast membrane protein, or UBQ10 was used as the loading control for protein and RNA, respectively. (C) Schematic diagram showing the *chl1-9* mutation (492 Pro/Leu), the phosphorylation site T101, and the putative membrane topology of CHL1. (D) Defective nitrate uptake in *chl1-9* plants. Nitrate uptake of wild-type plants and the *chl1-5* and *chl1-9* mutants measured using 10 mM or 200 μM $K^{15}NO_3$ for 30 min. (E) Q-PCR analysis of *AtNRT2.1* expression in the *chl1-9* mutant. The plants were grown as in (A).



2 | CHL1T101D and T101A Transgenic Plants Show, Respectively, a Low or a High Primary Nitrate Response
Q-PCR analysis of *NRT2.1* expression in CHL1 T101D plants (A) or CHL1 T101A plants (B). See the legend to Figure 1 for the seedling growth and data analysis.



4 | Schematic Model for CIPK23- and CHL1-Mediated Nitrate Sensing in the Primary Nitrate Response
The top panel shows the nitrate sensing mechanism, while the bottom panel shows gene expression during the primary nitrate response. The gray ovals represent CHL1 in the plasma membrane. The small and large empty circles represent the high- and low-affinity nitrate binding sites, respectively. The red and blue circles indicate nitrate binding to the high- and low-affinity binding site, respectively. P denotes phosphorylated CHL1T101 and the green color gradient represents the level of CHL1T101 phosphorylation. The panels below the cartoons represent the level of gene expression in the primary nitrate response, with red for the high-affinity phase and blue for the low-affinity phase.



3 | CIPK23 Is a Negative Regulator of the Primary Nitrate Response
(A) Q-PCR analysis of nitrate-induced expression of *CIPK23*. Wild-type plants were exposed to 25 mM KNO_3 or to 25 mM KCl as a control for the indicated time. The relative expression is the expression normalized to that of plants exposed to 25 mM KNO_3 for 30 min. (B) Schematic maps of the *cipk23-3* and *cipk23-4* mutants with T-DNA inserted in the seventh or tenth intron, respectively, of the *CIPK23* gene. The filled box represents exons and the line introns. F, *CIPK23* forward primer; R, *CIPK23* reverse primer. (C) RT-PCR analysis of *CIPK23* transcript levels in *cipk23-3* and *cipk23-4* mutants using primers F and R. *H3G1* was used as the loading control. (D) Primary nitrate response in *cipk23-3* mutant. Plant growth conditions and data analysis were as described in Figure 1.

To determine how the phosphorylation of T101 is regulated and how it is involved in nitrate sensing, protein kinase genes showing an interesting expression pattern in a microarray analysis of the chl1-5 mutant were identified as candidates for further analysis. In our microarray analysis, CIPK23 (CBL-interacting protein kinase 23), was found to be downregulated in the *chl1-5* mutant. In addition, Q-PCR analysis showed that expression of *CIPK23* was transiently induced by nitrate (Figure 3A). To determine whether CIPK23 is involved in the primary nitrate response, two mutants, *cipk23-3* and *cipk23-4* were obtained from the ABRC (Figure 3B). RT-PCR analyses showed that no full-length *CIPK23* transcript was expressed in either mutant (Figure 3C). The expression of the primary nitrate response gene *AtNRT2.1* in the mutants exposed for 30 min to various concentrations of nitrate was examined by Q-PCR (Figure 3D) and found to be quite similar to that in T101A transgenic plants, with increased expression at all concentrations tested. The increased high-affinity phase of primary nitrate response in the *cipk23* mutants suggests that in low nitrate, CIPK23 is a negative regulator of the primary nitrate response. The observation of similar phenotypes in the *cipk23* mutants and T101A plants suggests that CHL1 is a potential target of CIPK23.

We propose a working model to illustrate how CHL1 might sense a wide range of nitrate concentrations in the external environment and thus generate different levels of the primary nitrate response (Figure 4). Nitrate binding is required to trigger signals: in CHL1, this could occur at two separate sites with different affinities or at a single binding site, the affinity being modified by conformational changes. For the purpose of illustration, two binding sites are shown in Figure 4. Nitrate binding to CHL1 is required to trigger the primary nitrate response, and phosphorylation of T101 by CIPK23 could modulate the levels of primary response. When exposed to low concentrations of nitrate, nitrate binds to the high-affinity site. This high-affinity binding then activates or recruits CIPK23 to phosphorylate CHL1 at T101, and phosphorylated CHL1 prevents higher primary nitrate response at low-nitrate concentrations. In contrast, at high concentrations, nitrate can bind to the low affinity site, which inhibits the phosphorylation of CHL1T101, and the unphosphorylated CHL1 then generates a high primary nitrate response. In the transgenic CHL1T101D plants, CHL1 was fixed in the phosphorylated form, whereas, in CHL1T101A plants, it was fixed in the unphosphorylated form, leading to low or high monophasic primary responses, respectively. In the *cipk23* mutants, CHL1 could not be phosphorylated in response to low concentrations of nitrate and, as with the transgenic CHL1T101A plants, there was a monophasic, high-level primary response. Thus, using dual-affinity binding and T101 phosphorylation, CHL1 can sense a wide range of nitrate concentrations in the soil and trigger different levels of response.

Publication

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CPAP Is a Cell-cycle Regulated Protein that Controls Centriole Length

Abstract

Centriole duplication involves the growing of a procentriole (daughter centriole) next to the proximal end of each pre-existing centriole (mother centriole). The molecular mechanisms that regulate procentriole elongation remain obscure. We show here that the expression of the centriolar protein CPAP was tightly regulated during the cell cycle, with the protein being degraded in late mitosis. During mitotic exit CPAP is recognized by the APC/C-Cdh1 system, which targets it for degradation by the 26S proteosome. Depletion of CPAP inhibited centrosome duplication, while excess CPAP induced the formation of elongated procentriole-like structures (PLSs), which contain stable microtubules and several centriolar proteins. Ultrast ructural analysis reveals that these structures are similar to procentrioles with elongated microtubules. Overexpression of a CPAP mutant (CPAP-377EE) deficient in tubulin-dimer binding significantly inhibited the formation of CPAP-induced PLSs. Together, these results suggest that CPAP is a novel regulator of centriole length and its intrinsic tubulin-dimer binding activity is required for procentriole elongation.

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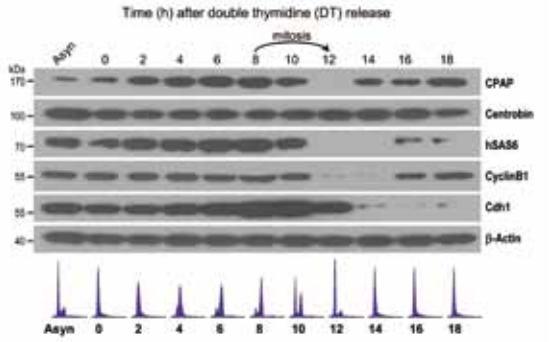
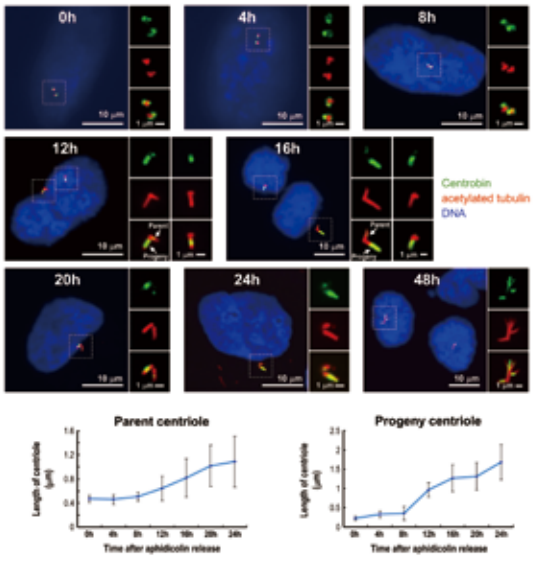
The centrosome is the primary microtubule-organizing center (MTOC), which is composed of two centrioles surrounded by pericentriolar material. The major function of the centrosome is to organize dynamic arrays of microtubules (MTs) within cells. Centriole duplication involves the growing of a nascent centriole (procentriole) formed orthogonally to each of the two pre-existing (parental) centrioles. These two new procentrioles begin to grow during late S-G2 and reach full length during the following cell cycle. Recent studies have identified at least five centrosome-associated proteins (SPD-2, ZYG-1/Plk4, SAS-5, SAS-6, and SAS-4/CPAP), which are essential for centrosome duplication. Yet, how these proteins cooperate to regulate centriole duplication is not clear.

To systematically address this question, we first performed a comparative analysis of the protein expression pattern between CPAP and hSAS-6 (a known cell-cycle regulated centriole protein) in synchronized cells. Our results showed that CPAP levels increased gradually from early S phase until mitosis (Fig. 1, 0~8h). When cells exited mitosis, both hSAS-6 and CPAP levels decreased significantly (Fig. 1, 8~12h). The cell-cycle regulated pattern of CPAP was further confirmed in nocodazole (NZ)-synchronized cells. We also demonstrated that CPAP is recognized by the APC/C-Cdh1 system during mitotic exit and is targeted for degradation by the 26S proteasome. Together, our results indicate that CPAP is a cell-cycle regulated protein.

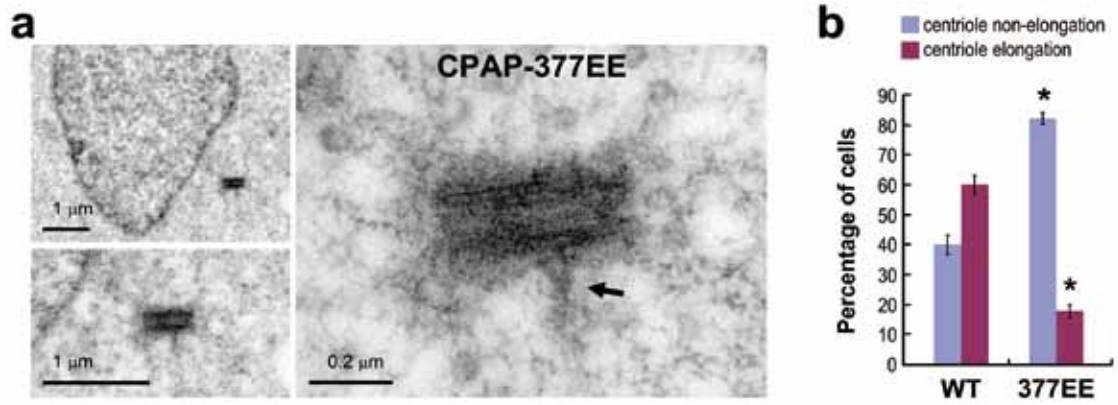
We next investigated the potential biological functions of CPAP by depleting or overexpressing CPAP in cells. CPAP depletion significantly suppressed centriole duplication, while overexpressing CPAP induced procentriole-like structures (PLSs) in cells, which appeared to be extended from the end of the centriole. Interestingly, a biphasic growth pattern was commonly observed in these



1 | CPAP protein levels are cell-cycle regulated
HeLa cells released from a double thymidine (DT) treatment were analyzed at the indicated time points by immunoblotting (upper panel) using indicated antibodies or by FACS (lower panel).



2 | Excess CPAP induced the formation of procentriole-like structures (PLSs). The timing of the growth of CPAP-induced PLSs during the cell cycle.



3 | The CPAP-377EE mutant inhibits daughter centriole duplication and CPAP-induced PLSs.
(a) The CPAP-377EE-myc inducible cells were treated with tetracycline and analyzed by electron microscopy (EM). The percentage of elongated or non-elongated centrioles induced by excess CPAP-WT or CPAP-377EE is shown in (b)

4 | Model of CPAP in regulating the centriole length during centriole biogenesis in human cells

CPAP-induced PLSs during the cell cycle. The lengths of these PLSs gradually increase starting at S phase (Fig. 2, 0~8h after TC induction), followed by rapid growth during the G2 and M stages (Fig. 2, 8~12h). Further EM analysis demonstrated that excess CPAP can induce centriole elongation possibly through the assembly of centriolar microtubules during centriole duplication.

We next asked what is the molecular mechanism that controls the assembly of centriolar microtubules during centriole elongation? We previously reported that the mutations (KR377EE) that alter the charge property of CPAP significantly inhibited CPAP binding to a tubulin dimer. We then generated CPAP-377EE inducible lines to test whether the tubulin dimer binding activity is critical for this process. Our EM study showed that CPAP-377EE can inhibit daughter centriole duplication (Fig. 3a). Furthermore, CPAP-induced PLSs were significantly reduced in the CPAP-377EE mutant (<20%) as compared with CPAP-WT (~58%) (Fig. 3b), indicating that the tubulin-dimer binding activity of CPAP is required for the assembly of centriolar microtubules during centriole elongation.

Our present results showed that hSAS-6 localized at the proximal end of CPAP-induced PLSs and its depletion inhibited normal procentriole formation, suggesting that the correct recruitment of hSAS-6 at the base of the procentriole is required to initiate CPAP-induced PLSs. To test this possibility, we examined the formation of these CPAP-induced PLSs in hSAS-6 depleted cells. Our results showed that hSAS-6 depletion mostly affects the CPAP-induced PLSs growing from the newly formed "procentriole", but not from the preexisting "parental" centriole. These results suggest that CPAP induced the assembly of centriolar microtubules occurring at a step after the recruitment of hSAS-6 to the proximal end of procentriole.

The key findings in this study suggest a model of how CPAP regulates centriole length and centriole duplication (Fig. 4). Following activation of Plk4 (yellow) on the surface of the parental centriole, hSAS-6 is recruited to a site in an asymmetric position next to the proximal end of the centriole. CPAP (green) accumulates gradually through S and G2 phase and promotes the assembly of centriolar microtubules possibly via its intrinsic tubulin-dimer binding activity during procentriole elongation. CP110 targets to the growing end of centriole during centriole biogenesis. When cells exit mitosis, CPAP is degraded by the 26S proteosome in an APC/C-Cdh1-dependent pathway. Excess CPAP induces centriole elongation and hSAS-6 depletion inhibits CPAP-induced PLSs growing from progeny centrioles. Furthermore, depletion of CP110 appears to induce centriole elongation from both parental and nascent centrioles, suggesting that CPAP and CP110 may play opposing roles in controlling centriole length.

Finally, *CPAP* (also known as *CENPJ*) is one of seven recently identified autosomal recessive primary microcephaly (MCPH) genes. MCPH is a human neurodevelopmental disorder and has been hypothesized to be due to a primary defect in neurogenic mitosis that leads to a great reduction in brain size. The molecular basis of how these genes cause MCPH is not clear. It is possible that CPAP may regulate cerebral cortical size by controlling neurogenic mitosis, possibly through CPAP's functions in regulating microtubule assembly/disassembly, centriole duplication, or other unidentified centrosomal functions in neural precursor cells.

Publication
Nature Cell Biology **11** (2009): 825-31.

Deltex1 Is a Target of the Transcription Factor NFAT That Promotes T Cell Anergy

Abstract

The molecular mechanism underlying the generation and maintenance of T cell anergy remains poorly understood. Deltex1 is a Notch target with unknown physiological function. In this study we show that *Dtx1* was directly transcriptionally activated by NFAT and was involved in T cell anergy. Deltex1 protein was induced during T cell anergy generation, and transgenic expression of Dtx1 prevented T cell activation. As an E3 ligase, Deltex1 suppressed T cell activation by both E3-mediated and E3-independent processes. In addition, Notch-binding domain was not required for Deltex1 to inhibit T cell activation. In E3-independent manner, Deltex1 promoted the expression of two anergy-associated molecules, Gadd45β and Cbl-b. Furthermore, deficiency of DTX1 augmented T cell activation, conferred resistance to anergy induction, enhanced autoantibody generation, and increased inflammation. Deltex1 therefore represents a novel component downstream of calcium-NFAT signaling that regulates T cell anergy.

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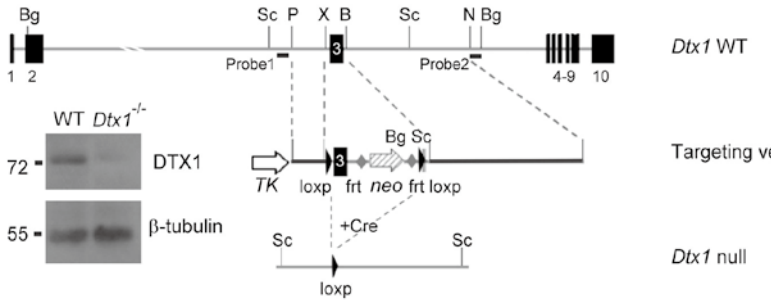
Immune tolerance prevents the adaptive immune system from attacking the body's own tissues. One of the major mechanisms of immune tolerance is the induction of T-cell anergy in which T-cell cannot be re-activated upon antigen stimulation. The molecular processes of T-cell anergy remain incompletely understood. In this study, we have advanced understanding of these processes by discovering that a molecule called Deltex1 functions to suppress T cell activation. Deltex1 is first identified in Drosophila as a mediator of Notch signaling. Deltex1 binds Notch through the N-terminal WWE domains. Its physiological function in mammalian, however, is unclear. We have previously indentified a potential role of Deltex1 in T cell signaling through demonstration that RING finger-containing Deltex1 acts as an E3 ligase to promote the ubiquitination and degradation of active MEKK1 in T cells.

In this study, we found that Deltex1 was induced in T cells upon the generation of anergy by persistent calcium signaling or co-stimulation blockage. The induction of Deltex1 was found to be mediated by NFAT, the transcription factor pivotal to T cell anergy generation. We identified a NFAT element on the promoter of Deltex1, and demonstrated that expression of NFATp or NFATc led to activation of *Dtx1* promoter and expression of *Dtx1*. In addition, chromatin immunoprecipitation analysis revealed the situation of NFAT on *Dtx1* promoter.

By using *Dtx1*-transgenic mice, we demonstrated that Deltex1 profoundly suppressed the proliferation and IL-2 production of T cells, further confirming the anergic nature of Deltex1. Two previous studies, however, reported that deletion of the RING finger domain or removal of WWE domain from Deltex1 did not affect T cell development and activity. We examined the Deltex1 mutants lacking RING finger domain or WWE domain, and found that both mutants were not as effective as wild-type Deltex1 in the suppression of T cell activation, yet both mutants retained partial ability to inhibit T cell activation. These results indicate that Deltex1 antagonizes T cell activation in both E3-dependent and E3-independent pathways.

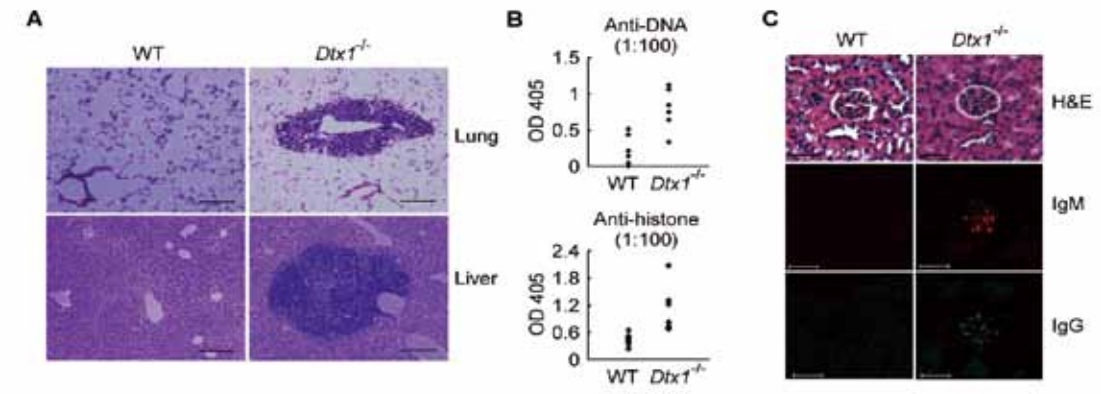
We therefore generated a new Deltex1-knockout mouse line that did not express any truncated forms of Deltex1 (Fig. 1). Consistent with prediction, Deltex1-deficient T cells were hyper-active. The proliferation and IL-2 production of *Dtx1*$^{-/-}$ T cells doubled relative to those of normal littermate control T cells. Production of IFN-γ and IL-4 increased by nearly 100% in Deltex1-deficient T cells. The deletion of the *Dtx1* gene altered the sensitivity of T cells to anergy induction. In T cell anergy triggered by calcium ionophore or co-stimulation blockage, Deltex1 deficiency prevented the generation of T cell tolerance.



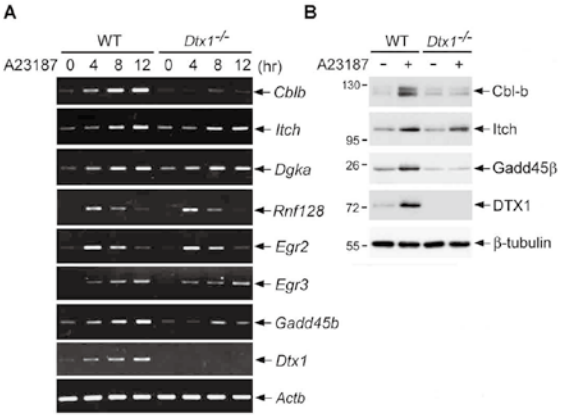
1 | Targeted disruption of *Dtx1*. Upper panel illustrates the genomic structure of *Dtx1* (*Dtx1* WT). Middle panel depicts the structure of the targeting construct. Bottom panel shows the null allele. B, *Bam*HI; Bg, *Bg*lII; N, *Nhe*I; P, *Pm*lI; Sc, *Sca*I; X, *Xmn*I. (Lower Left) Absence of Deltex1 protein in *Dtx1*$^{-/-}$ mice.

In older mice lacking Deltex1, hematoxylin and eosin (H&E) staining of paraffin-embedded sections of lung and liver revealed extensive mononuclear cell infiltrations (Fig. 2A), indicating inflammation in the lung and liver. Autoantibodies were spontaneously produced in *Dtx1*$^{-/-}$ mice, shown by elevated anti-DNA and anti-histone in the serum of *Dtx1*$^{-/-}$ mice (Fig. 2B). There was no apparent abnormality in the morphology of kidney glomeruli of *Dtx1*$^{-/-}$ mice, yet immunoglobulin complex was deposited onto the kidney glomeruli of *Dtx1*$^{-/-}$ mice (Fig. 2C). Taken together, these disparate findings demonstrate that Deltex1 deficiency in T cells led to increased inflammation and development of autoimmune diseases, supporting the physiological role of Dletex1 in maintaining T cell anergy.

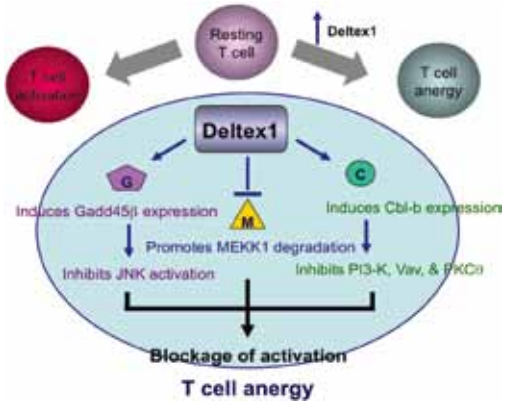
The availability of a Deltex1-deficient T cell enabled us to search for the signaling defects caused by Deltex1 deficiency. The expression of most anergy-associated molecules was not affected by the absence of Deltex1, yet Ca^{++}-mediated upregulation of Gadd45β and Cbl-b mRNA and protein were largely abolished in *Dtx1*$^{-/-}$ T cells (Fig. 3). Gadd45β binds and inhibits MKK7, leading to inactivation of JNK. Cbl-b is well known for its anergic role in the inhibition of PI 3-kinase p85, Vav, and PKCθ. We confirmed that Deltex1 promoted the expression of Gadd45β and Cbl-b mRNA, respectively. Therefore, Deltex1 utilizes at least three distinct mechanisms to prevent T-cell activation: Deltex1 promotes the degradation of MEKK1 that is required for MAPK activation, stimulates the expression of Gadd45β that inactivates JNK, and activates the expression of Cbl-b targeting to PI 3-kinase, Vav, and PKCθ. Using these three inhibitory processes, Deltex1 blocks several major activation signals in T cells (Fig. 4), keeping them in inactive status. Deltex1 therefore represent a new component in T cell anergic network that is induced by NFAT-mediated anergic signaling, whereas coordinate with other anergy molecules for effective shutdown of T cell activation to attain full T cell anergy.



2 | Deficiency in Deltex1 leads to inflammation and autoimmunity. (A) Inflammation in Deltex1-deficient mouse. Paraffin sections of lung and liver from 9-month-old *Dtx1*$^{-/-}$ mice and normal littermate controls (WT) were stained with hematoxylin and eosin (H&E) to reveal infiltrated leukocytes. Bar indicates 100 μm in lung sections, and 200 μm in liver sections. (B) Serum anti-DNA and anti-histone antibodies in *Dtx1*$^{-/-}$ mice. Sera from *Dtx1*$^{-/-}$ mice and WT littermates older than 5 months were analyzed for anti-DNA and anti-histone antibodies. (C) Immunoglobulin deposits in kidney glomeruli in *Dtx1*$^{-/-}$ mice. Kidney frozen sections from *Dtx1*$^{-/-}$ mice and WT littermates were stained with anti-mouse IgM or anti-mouse IgG. Bar indicates 50 μm. The morphology of glomeruli was examined by H&E staining.



3 | Diminished expression of Cbl-b and Gadd45β in *Dtx1*$^{-/-}$ T cells. Th1 cells from control (WT) and *Dtx1*$^{-/-}$ mice were induced to anergic state by treating with A23187 (200 ng/ml). The expression of *Cblb, Itch, Dgka, Rnf128, Egr2, Egr3,* and *Gadd45b* mRNA (A), and Cbl-b, Itch, Gadd45β protein (B) was determined.



4 | Deltex1 extends the anergic network in T cells. Deltex1 is induced by NFAT during T cell anergy. Deltex1 promotes the degradation of MEKK1, stimulates Cbl-b expression to target to PI 3-kinase, Vav, and PKCθ, and activates GADD45β expression for inhibition of JNK. Through these mechanisms, Deltex1 suppresses major T cell activation signals and maintains T cell in anergic status.

Ligand-activated Peroxisome Proliferator-activated Receptor-gamma (PPAR-γ) Protects Against Ischemic Cerebral Infarction and Neuronal Apoptosis by 14-3-3 ε Upregulation

Abstract

Thiazolidinediones (TZDs) have been reported to protect against ischemia-reperfusion (I/R) injury. Their protective actions are considered to be PPAR-γ-dependent; however, it is unclear how PPAR-γ activation confers resistance to I/R injury.

Here we reported that Rosiglitazone or PPAR-γ over-expression significantly reduced infarct volume. The protective effect was abrogated by PPAR-γ siRNA. Proteomic analysis revealed that brain 14-3-3ε was highly upregulated in rats treated with Rosiglitazone. Upregulation of 14-3-3ε was abrogated by PPAR-γ siRNA or antagonist. Promoter analysis and chromatin immuno-precipitation (ChIP) revealed that rosiglitazone induced PPAR-γ binding to specific regulatory elements on the 14-3-3ε promoter and thereby increased 14-3-3ε transcription. 14-3-3ε siRNA abrogated the antiapoptotic actions of rosiglitazone or PPAR-γ overexpression, whereas 14-3-3ε recombinant proteins rescued brain tissues from ischemia-induced damage.

In summary, ligand-activated PPAR-γ confers resistance to neuronal apoptosis and cerebral infarction by driving 14-3-3ε transcription. 14-3-3ε Upregulation enhances sequestration of phosphorylated Bad and thereby suppresses apoptosis.

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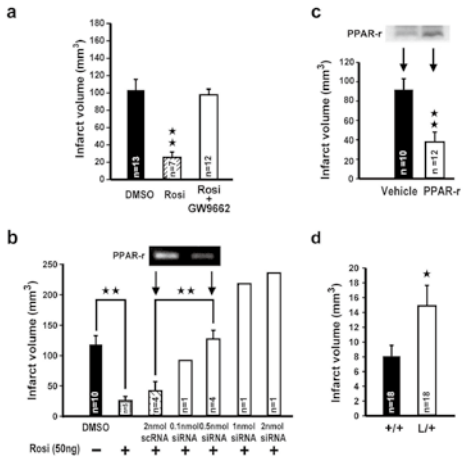
Peroxisome proliferator-activated receptor-γ (PPAR-γ), a member of the PPAR nuclear receptor family, is a ligand-activated transcription factor that regulates diverse biological activities and plays major roles in important human diseases such as diabetes mellitus, metabolic syndrome, and atherosclerosis.

Several classes of PPAR-γ ligands have been identified. Naturally occurring fatty acid derivatives such as 15 deoxy-$\Delta^{12,14}$ prostaglandin J_2 (15d-PGJ_2) bind and activate PPAR-γ. Synthetic PPAR-γ ligands such as thiazolidinediones (TZDs) are clinically efficacious in treating type 2 diabetes mellitus. Ligand-activated PPAR-γ forms heterodimers with the retinoid X receptor, which binds PPAR response elements (PPREs) situated at the promoter region of target genes and regulates gene expression. Extensive investigations have reported that ligand-activated PPAR-γ suppresses proinflammatory genes at the transcriptional level. This anti-inflammatory action of PPAR-γ ligands was considered to contribute to tissue protection.

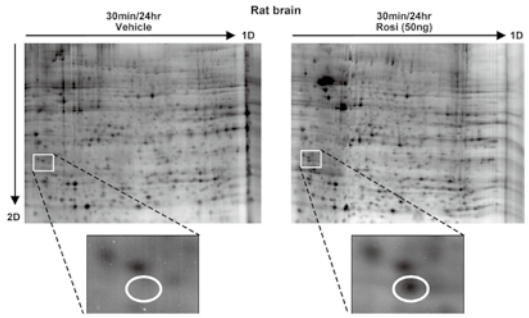
Although, it is commonly believed that PPAR-γ ligands reduce ischemic infarct by activation of PPAR-γ, there are possibilities for the involvement of PPAR-γ-independent (non-receptor) signals. For example, TZD's receptor independent effects include suppression of inflammatory gene expression, modification of energy and fuel metabolism, perturbation of mitochondrial function and others. And 15d-PGJ_2 may engage distinct PGD_2 receptors (DP_1, DP_2) to activate PKA (anti-inflammatory) and stimulate Ca^{2+} influx (inflammatory). In the cytosol, PGJ_2 may directly activate the Ras/Erk MAP kinase pathway, and bind to and inhibit IκB kinase (IKK), the activator of NF-κB. In fact, there is no definitive evidence indicating that activated PPAR-γ pathways are critical for the beneficial effects of PGJ_2 and TZDs. Therefore, the extent of PPAR-γ stimulation contributes to the neuro-protective effect of PPAR-γ agonists, and the underlying molecular mechanisms remain to be elucidated.

Rosiglitazone-PPAR-γ protects brain against I/R injury in a rat model.

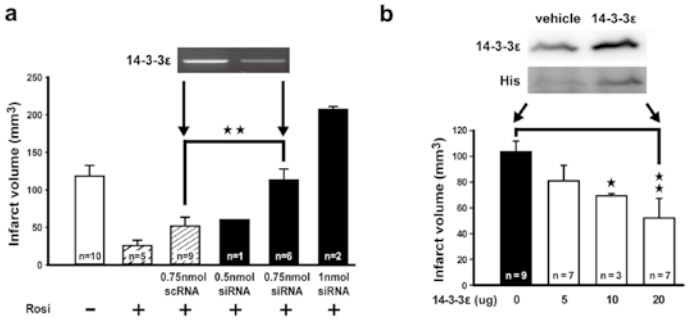
To evaluate the *in vivo* neuroprotective effect, Rosiglitazone was injected intraventricularly immediately after 30-min ischemia. Rosiglitazone



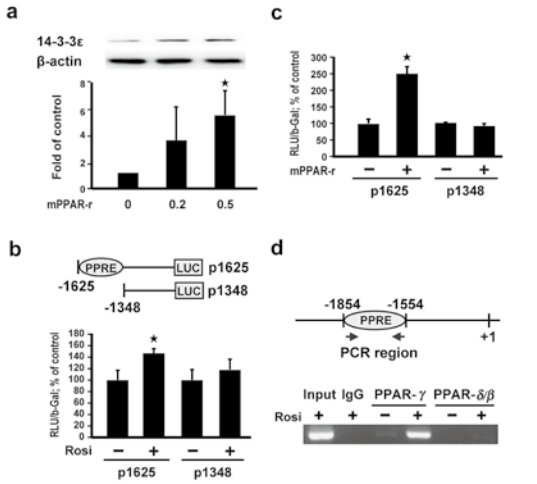
1 | Rosiglitazone and PPAR-γ reduce ischemic brain injury in vivo. (a) Rosiglitazone with or without GW9662 was injected intraventricularly immediately after 30-min ischemia. Infarct volumes were determined after 24 h reperfusion. (b) Rosiglitazone with or without PPAR-γ siRNA was infused immediately after 30-min ischemia, and infarct volume was measured 24 h later. (c) Recombinant PPAR-γ protein (5 μg) was infused intraventricularly for 72 h before a 30-min ischemia. The inset indicates cortical PPAR-γ protein levels at 24 h after reperfusion. (d) PPAR-γ P465L dominant negative mutant mice (L/+) and wild type littermate controls (+/+) were subjected to 30-min ischemia and 24 h reperfusoin.



2 | 14-3-3ε is increased in rosiglitazone-treated ischemic brain. Rats were subjected to I/R with or without Rosiglitazone treatment. Proteins in rat brains were analyzed with 2-DGE. The insets show a spot with increased density in Rosiglitazone-treated vs. control brain. Analysis by LC-MS/MS identified this spot to be 14-3-3ε.



4 | Control of cerebral infarction by 14-3-3ε *in vivo*. (a) Rosiglitazone with or without 14-3-3ε siRNA or scRNA was injected immediately after 30-min ischemia. Inset shows cortical 14-3-3ε mRNA levels. (b) His-tagged 14-3-3ε recombinant proteins (20 μg) were infused 72 h before I/R. Inset shows 14-3-3ε and His analyzed by Western blotting. Each bar denotes mean ± SD. *P<0.05. **P<0.01.



3 | Ligand-activated PPAR-γ increases 14-3-3ε transcription. (a) 14-3-3ε proteins were analyzed by Western blotting in N2-A cells treated with PPAR-γ expression vectors (mPPAR-γ). (b) & (c) N2-A cells transfected with 14-3-3ε promoter constructs p1625 or p1348 were treated with rosiglitazone (b) or PPAR-γ (c). (d) ChIP analysis of PPAR-γ binding to the PPRE region (upper panel) of 14-3-3ε promoter. Binding of PPAR-β/δ was included as a control.

significantly reduced the infarct volume (Fig. 1a). Rosiglitazone's protective effect was blocked by GW9662 (PPAR-γ antagonist; Fig. 1a); as well as PPAR-γ siRNA (Fig. 1b). Intraventricular infusion of recombinant PPAR-γ proteins reduced the infarct volume (Fig. 1c). Furthermore, the infarct volume in heterozygous knockin of a PPAR-γ dominant negative mutant mice, P465L (L/+), was increased (Fig. 1d).

Proteomic analysis identifies 14-3-3ε upregulation by Rosiglitazone in ischemic brain.

To identify proteins important in the Rosiglitazone-PPAR-γ signaling pathway, we analyzed ischemic brain tissues by proteomics. Brain was isolated, homogenized and proteins were analyzed by two-dimensional gel electrophoresis. A spot with a huge increase in density in Rosiglitazone-treated brain was identified (Fig. 2). Protein identity was further analyzed by tandem LC-MS/MS, which matches with 14-3-3ε. Western blot analysis confirmed that Rosiglitazone pretreatment restored the suppressed 14-3-3ε protein in ischemic brain. Rosiglitazone increased 14-3-3ε protein level by >3-fold in normal brain. This increase was inhibited by PPAR-γ siRNA. Infusion of recombinant PPAR-γ protein also increased 14-3-3ε level. Furthermore, 14-3-3ε level in L/+ mouse brain were reduced by ~50%.

Rosiglitazone upregulates 14-3-3ε transcription

To elucidate the mechanism by which 14-3-3ε expression is upregulated, we employed N2-A neuroblastoma cells as a model. Rosiglitazone concentration-dependently increased 14-3-3ε protein. This increase was blocked by GW9662 or PPAR-γ siRNA. Transfection with PPAR-γ plasmids increased 14-3-3ε protein (Fig. 3a). To determine the involvement of PPREs in Rosiglitazone-induced 14-3-3ε upregulation, we transfected N2-A cells with this promoter fragment (p1625-LUC) or a 5' -deletion mutant in which the PPREs were removed (p1348-LUC). Rosiglitazone increased the p1625 promoter activity, but did not increase p1348 activity (Fig. 3b). Overexpressoin of PPAR-γ also increased the p1625 promoter activity, which was abrogated when the PPRE region was deleted (Fig. 3c). ChIP assays show that Rosiglitazone induced binding of PPAR-γ but not PPAR-δ/β to PPRE-harboring region between -1554 and -1854 of 14-3-3ε promoter (Fig. 3d). These results indicate that rosiglitazone selectively induced binding of PPAR-γ to 14-3-3ε PPREs, thereby activating 14-3-3ε promoter and upregulating 14-3-3ε protein expression.

14-3-3ε protects brain from ischemia-reperfusion (I/R) injury

To determine the role of 14-3-3ε upregulation in controlling I/R induced infarction, we infused Rosiglitazone with 14-3-3ε siRNA or control scRNA immediately after the 30-min ischemia. Reduction of the infarct volume by Rosiglitazone was abrogated by 14-3-3ε siRNA (Fig. 4a). 14-3-3ε mRNA in siRNA treated brain was reduced when compared to scRNA control (Fig. 4a, inset). Conversely, overexpression of 14-3-3ε (Fig. 4b, inset) by infusion of recombinant 14-3-3ε proteins reduced infarct volume (Fig. 4b).

In summary, we have discovered a transcriptional pathway that is critical for protection against neuronal apoptosis and cerebral infarction. PPAR-γ-mediated 14-3-3ε upregulation represents an important transcription mechanism by which PPAR-γ agonists protect tissues from I/R injury. PPAR-γ and 14-3-3ε are potential therapeutic targets for important human diseases such as ischemic stroke and myocardial infarction.

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Hepatitis B Virus Infection and Hepatocellular Carcinoma Among Parous Taiwanese Women: Nationwide Cohort Study

Abstract

A nationwide cohort of parous women was followed to examine the predictability of hepatitis B virus (HBV) infection and parity for hepatocellular carcinoma (HCC). Prenatal tests for HBV surface antigen (HBsAg) and e antigen (HBeAg) were available for 1,782,401 pregnant women. Totally, 306 newly diagnosed HCC women were ascertained during 15,901,722 person-years of follow-up through linkage with National Cancer Registry. Compared with women who were HBsAg-seronegative (non-carriers), age-adjusted hazard ratio [HR] (95% confidence interval, [CI]) of developing HCC was 17.31 (12.08-24.81) for HBsAg-seropositive and HBeAg-seropositive women; and 13.94 (10.34-18.79) for HBsAg-seropositive but HBeAg-seronegative women. Compared with non-carriers, the age-adjusted HR (95% CI) was 7.95 (3.50-18.04) for HBsAg-serocleared carriers; and 23.13 (14.23-37.61) for HBsAg-persistent women. Women had only one child had a higher risk of HCC than those with two or more children.

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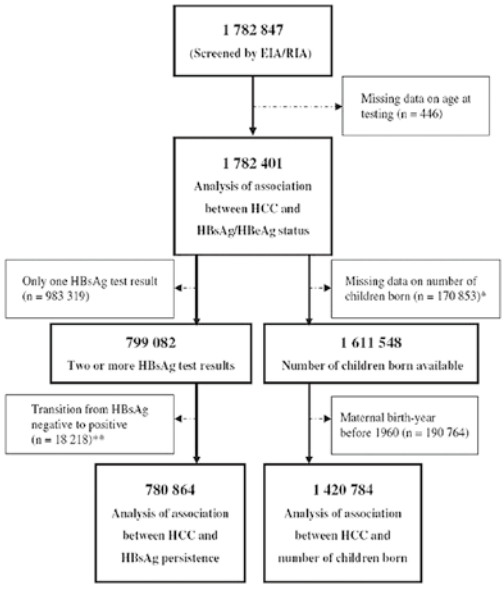
Few long-term studies of hepatitis B virus (HBV) infection and hepatocellular carcinoma (HCC) have focused on women. Taiwan has one of the earliest national hepatitis B vaccination programs, which was introduced in 1984; this program provided us with the opportunity to examine associations of HBV seromarkers with HCC risk among pregnant women.

Figure 1 shows a flow diagram of women included in each analysis in this study. The study population included all women in the National Hepatitis B Vaccination Registry whose prenatal HBV serological tests were performed by enzyme immunoassay or radioimmunoassay before births of their children between October 1, 1983, and March 31, 2000. Prenatal test results were available for hepatitis B surface antigen (HBsAg) and e antigen (HBeAg) from 1,782,401 pregnant women. Among the 799,082 women who had two or more HBsAg test results, we excluded 18,218 (2%) from analysis because they first tested HBsAg negative and then tested positive and so could have been borderline positive. Thus, we identified 780,864 women who had multiple testing records and could be categorized as persistent HBsAg carriers, noncarriers, or HBsAg-serocleared individuals. We included all women whose birth year was 1960 or later (n = 1,420,784) in the analysis of parity and the risk of HCC to reduce underascertainment of the children who were born before 1984 among older maternal birth cohorts.



1 | Flow diagram of parous women in this study. EIA/RIA = enzyme immunoassay and radioimmunoassay; HBsAg = hepatitis B surface antigen; HBeAg = hepatitis B e antigen; HCC = hepatocellular carcinoma; * = records of maternal HBsAg testing could not be linked to neonatal information; ** = initial HBsAg-negative test result was followed by an HBsAg-positive test result.

Data from the 306 women who were diagnosed with HCC were ascertained during 15,901,722 person-years of follow-up through linkage with National Cancer Registry and National Death Certification Registry. The time of follow-up for each subject was calculated from the date of her last HBV test to the date of one of the following events, as listed in descending order of priority: the date of diagnosis of incident HCC, the date

Table 1. Prevalence of hepatitis B surface antigen (HBsAg) and hepatitis B e antigeng (HBeAg) by age among parous women in Taiwan

	Prevalence of HBsAg among all parous women		Prevalence of HBeAg among HBsAg-positive women	
Group	Total No. of women	No. of women with HBsAg-positive status (% of total in group)	No. of women*	No. of women with HBeAg-positive status (% of HBsAg-positive women with available HBeAg status)
Age at the last test, y				
≤25	476114	79946 (16.79)	63970	25264 (39.49)
26–30	760999	126086 (16.57)	99720	28701 (28.78)
31–35	439215	68588 (15.62)	56962	12338 (21.66)
≥36	106073	15372 (14.49)	13264	2087 (15.73)
Total	1782401	289992 (16.27)	233916	68390 (29.24)

* HBsAg-positive women with available HBeAg status.

of death, or the date of censoring on December 31, 2003. Cox proportional hazards models were used to investigate the association of age and reproductive and serological parameters with the risk of HCC. The models calculated multivariable-adjusted hazard ratios (HRs) and their corresponding 95% confidence intervals (CIs) to assess the independent contribution of each risk factor.

In the total population of 1,782,401 women, the mean age at the last HBV test was 28.29 ± 4.57 years (±SD; median = 28 years). The prevalence of women with an HBsAg-positive status was 16.27% (Table 1), which is consistent with previous prevalence estimates in Taiwan. As shown in Table2, HCC incidence rates for women with an HBsAg-negative (noncarriers), HBsAg-positive plus HBeAgnegative, and HBsAg-positive plus HBeAg-positive status were 0.55, 7.91, and 8.76 per 100,000 person-years, respectively. An HBsAg-positive plus HBeAg-positive status, compared with an HBsAg-negative status, was associated with an increased risk for HCC (age-adjusted HR = 17.31, 95% CI = 12.08 to 24.81), as was an HBsAg-positive plus HBeAg-negative status (HR = 13.94, 95% CI = 10.34 to 18.79). In an analysis stratified by the age at the last test (≤ 30 or >30 years), an HBeAg-positive status, compared with an HBeAg-negative status, was associated with increased risk of HCC (HR = 1.74, 95% CI = 1.01 to 3.01) among older women. However, among younger women, no statistically signifi cant difference in HCC risk was found between HBeAg-positive status and HBeAg-negative status (HR = 1.04, 95% CI = 0.68 to 1.59). The age-adjusted cumulative incidence of HCC for the three status groups is shown in Figure 2, A.

We identified 780,864 women who had multiple HBsAg test results that we could use to evaluate their longer-term carrier status. As shown in Table 2, the HCC incidence rates were 0.39, 3.10, and 9.01 per 100,000 person-years, respectively, for persistently HBsAg-negative women, HBsAg-serocleared carriers, and persistent HBsAg carriers. An HBsAg-serocleared status, compared with an HBsAg-negative status, was associated with an increased risk of HCC (age-adjusted HR = 7.95, 95% CI = 3.50 to 18.04) as was a persistently HBsAg-positive status (HR = 23.13, 95% CI = 14.23 to 37.61). The age-adjusted cumulative incidence of HCC was substantially higher with a persistent HBsAg-positive status and moderately higher with an HBsAg-serocleared status, than for an HBsAg-negative status (Figure 2, B).

There were 1,420,784 women who were born in 1960 or later and delivered live children during the study period. HCC incidence rates were 2.04, 1.55, and 1.66 per 100,000 person-years for women who had one, two, or three or more children, respectively (Table 3). Women with one child had a consistently higher cumulative incidence of HCC than women with multiple children. The increased risk was most notable after a decade of follow-up (Figure 2, C).

In conclusion, the risk for HCC was statistically significantly higher among women with chronic or active HBV infections and among those with persistent HBV infection or who underwent HBsAg seroclearance during follow-up than among HBV-unexposed women. There was a statistically significant inverse relationship between parity and the risk of HCC.

Table 2. Incidence of hepatocellular carcinoma during follow-up and the association of hepatitis B virus status with risk of hepatocellular carcinoma*

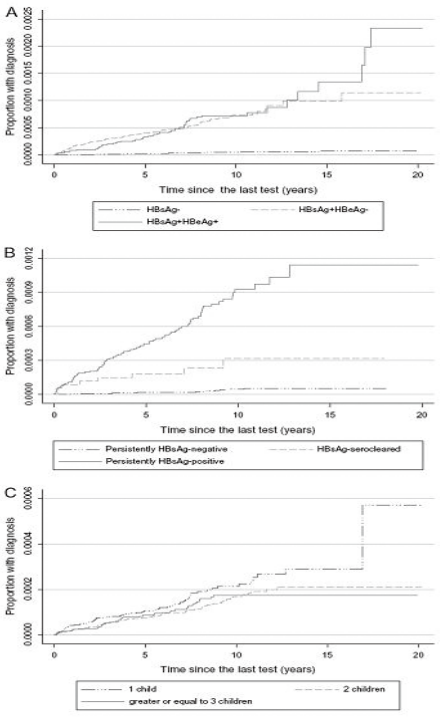
Status	No. of women (%)	No. of women with HCC	Follow-up, person-years	Incidence rate, HCC diagnoses per 100 000 person-years (95% CI)	Age-adjusted HR† (95% CI) Model 1	Model 2
HBsAg and HBeAg status at the last test (n = 1 782 401)						
Negative for HBsAg	1 492 409 (83.73)	73	13 211 878	0.55 (0.44 to 0.70)	1.00 (referent)	
Positive for HBsAg, negative for HBeAg	165 526 (9.29)	106	1 339 829	7.91 (6.54 to 9.57)	13.94 (10.34 to 18.79)‡	1.00 (referent)
Positive for HBsAg, positive for HBeAg	68 390 (3.84)	51	582 152	8.76 (6.66 to 11.53)	17.31 (12.08 to 24.81)‡	1.24 (0.89 to 1.75)
Positive for HBsAg, HBeAg unknown	56 076 (3.15)	76	767 863	9.90 (7.90 to 12.39)	18.54 (13.36 to 25.73)‡	
HBsAg status in repeated tests (n = 780 864)						
Persistently negative for HBsAg	632 781 (81.04)	20	5 078 699	0.39 (0.25 to 0.61)	1.00 (referent)	
HBsAg serocleared	31 088 (3.98)	8	258 242	3.10 (1.55 to 6.19)	7.95 (3.50 to 18.04)‡	1.00 (referent)
Persistently positive for HBsAg	116 995 (14.98)	87	965 752	9.01 (7.30 to 11.12)	23.13 (14.23 to 37.61)‡	2.93 (1.42 to 6.04)

* HCC = hepatocellular carcinoma; HR = hazard ratio; CI = confidence interval; HBsAg = hepatitis B surface antigen; HBeAg = hepatitis B e antigen.
† Age at the last test (continuous variable) was included in Cox proportional hazards models.
‡ $P < .001$. P values (two-sided) were from Cox proportional hazards models.

Table 3. Incidence of hepatocellular carcinoma (HCC) during follow-up by hepatitis B virus status, age, and number of children and association between variables and HCC risk (n=1420784)*

Variable	Total No. of women (%)	No. of women with HCC	Follow-up, person-years	Incidence rate, HCC diagnoses per 100 000 person-years (95% CI)	Adjusted HR (95% CI)	P†
HBsAg status at the last test						
Negative	1 191 886 (83.89)	53	9 833 494	0.54 (0.41 to 0.71)	1.00 (referent)	
Positive	228 898 (16.11)	149	1 941 979	7.67 (6.53 to 9.01)	14.70 (10.74 to 20.12)	<.001
Age at the last test, y						
≤25	427 888 (30.12)	50	3 658 569	1.37 (1.04 to 1.80)	1.00 (referent)	.003‡
26–30	659 866 (46.44)	101	5 738 875	1.76 (1.45 to 2.14)	1.41 (1.00 to 1.98)	.050
≥31	333 030 (23.44)	51	2 378 030	2.15 (1.63 to 2.82)	1.80 (1.21 to 2.68)	.004
No. of children						
1	450 804 (31.73)	70	3 432 054	2.04 (1.61 to 2.58)	1.00 (referent)	.012§
2	673 180 (47.38)	90	5 812 451	1.55 (1.26 to 1.90)	0.68 (0.50 to 0.93)	.016
≥3	296 800 (20.89)	42	2 530 969	1.66 (1.23 to 2.25)	0.63 (0.42 to 0.92)	.018

* HR = hazard ratio; CI = confidence interval; HBsAg = hepatitis B surface antigen.
† P values (two-sided) were from Cox proportional hazards models. All statistical tests were two-sided.
‡ P_{trend} for age at the last test.
§ P_{trend} for number of children.



2 | Kaplan – Meier estimates of cumulative incidence of hepatocellular carcinoma during follow-up among parous women in Taiwan. A) Estimates of cumulative incidence of hepatocellular carcinoma according to the presence or absence of hepatitis B surface antigen (HBsAg) and hepatitis B e antigen (HBeAg). B) Estimates of cumulative incidence of hepatocellular carcinoma according to the longer-term HBsAg status. C) Estimates of cumulative incidence of hepatocellular carcinoma according to parity.

The Nomad's Choice: The First Encounter Between Northern Nomads and Imperial China

Abstract

During the Han Dynasty (206 BCE-220 CE), three groups of pastoral nomads appeared along imperial China's northern frontier: the Xiongnu steppe nomads, the Xianbei steppe-forest nomads, and the western Qiang highland-valley nomads. Taking anthropological knowledge of modern pastoral nomadic societies as a basis for discussion, the author of this work reinterprets ancient Chinese historical materials so as to provide a new explanation for the diverse economies and social organizations of these early nomads. The author discusses why the Xiongnu unified within a state organization, the Xianbei formed several tribal confederations, and the Qiang were characterized by a number of nomadic tribes. These three types of nomadic society emerged during the Han period, and their modes of interaction with the Chinese empire became paradigms which repeatedly appeared throughout the history of the northern Chinese border areas.

Ming-Ke Wang
Institute of History and Philology, Academia Sinica

During the Han Dynasty period (206 BCE-220 CE), China interacted closely with three kinds of nomadic people, the Xiongnu, Xianbei, and western Qiang, and left behind numerous documents recording these interactions. However, these documents evince many of the prejudices held by the Huaxia authors at the time. Taking anthropological knowledge of modern pastoral nomadic societies and the correspondence which exists between text and context as a basis for discussion, the author of this work reinterprets these ancient Chinese documents, providing a new explanation of the diverse economic ecologies and social organizations developed by the early nomads.

The diversities apparent among the Xiongnu, Xianbei, and western Qiang nomadic groups are a major theme in this work. The author analyses the respective natural environments, pastoral economy and social organization, and specific modes of interaction with Han China based upon pastoral economy and social organization which relate to these three groups. From a macro or long-term perspective, the relationships between these northern nomads and the Han Empire are placed in a wider historical context— that of the emergence, persistence, and transformation of the Huaxia (ancient Chinese) border in northern China. In this way, the author suggests a new interpretation for the history of the northern Chinese border, traced from the late Neolithic period up until modern times.

In this work, the author starts by introducing issues in anthropological studies of modern pastoral nomadic societies, such as the significance of pastoral nomadic economy in the historical development of human ecology, the importance of animal types within nomadic economies, nomadic migration patterns and the rhythms of the seasons, and the economic and political functions of nomadic migrations. The author explains that nomadic pastoralism is a non-self-sufficient mode of production which must be supplemented by other subsistence activities. Because supplementary subsistence strategies differ, nomadic societies' interactions with people in the outside world also vary, and, as a result, some nomadic societies are composed of segmentary tribes which evince internal egalitarian human relationships, and others possess state organizations with coercive powers over subordinate peoples. The author goes on to introduce the formative processes of various pastoral nomadic economies in northern China against the background of both the emergence and diffusion of this type of economy on the Euro-Asian steppe and the establishment of the Qin (221-206 BCE) and the Han empires (and the formation of the identity of the Huaxia, the ancient Han Chinese) in response to this massive human ecological trend.

Qinghai-Tibetan Plateau Nomads (Hongyuan/Marthang, Western Sichuan)


Hehuang Highland Nomads (Seda/Sertha, Western Sichuan)


Steppe-forest Nomadic Region (Keshenketengqi, Inner Mongolia)


Mongolian Steppe Nomads (Xinbaerhuyouqi, Inner Mongolia)

With the formation of the Qin and Han empires, the northern resource boundary of the Huaxia was strengthened, and the Great Wall became the concrete symbol of this boundary enhancement. In order to adapt to this new situation, groups outside of the Great Wall were forced to develop suitable pastoral economies and concomitant social organizations within which peoples shared, allocated, and strove for very limited living resources or tried to obtain resources by breaking through the Great Wall. It was against this background that the Xiongnu, the steppe nomads living north of the Great Wall, established their "state" organization; the Xianbei, the steppe-forest nomads living beyond the northeast part of the Great Wall, organized themselves into several large tribal confederacies; and the Qiang, the highland-valley nomads living on the northwest frontier of the Han Empire and composed of numerous tribes, transformed only temporarily into alliances for the purposes of war and battle. The Xiongnu state successfully gained resources from the Han Empire through its military activities, but these state-level military campaigns often resulted in massive livestock losses during times of war. Furthermore, Xiongnu tribes near the Great Wall became increasingly dependent on resources coming from the Han Empire, and this eventually caused the division of the Xiongnu state. The confederacies of the Xianbei and Wuhuan, with their flexibility in absorbing other peoples and adapting to new environments, were more successful in penetrating the Great Wall and northern steppe, and later established regimes to govern nomads and sedentary farmers on both sides of the Great Wall. For the Han Empire, the most difficult to overcome enemy was most likely the western Qiang, a loosely-organized group within which every small nomadic unit was able to make its own decision to surrender or fight with the Han army. In order to resolve the problem of the western Qiang, the Han Empire adopted a policy of moving defeated Qiang tribes into the empire's northwestern prefectures, but this resulted in long-term warfare and social turmoil in this resource-scarce zone.

The above-mentioned three types of nomadic society formed during the Han period, and their modes of interaction with the Chinese empire became paradigms which repeatedly appeared throughout Chinese history. Nevertheless, the choices made by many individuals to disobey these paradigms, to cross over tribe, state, and ethnic boundaries, finally caused the dissolution of the resource blockade represented by the Great Wall.

Through these studies, the author endeavors to deepen and expend our understanding of early pastoral nomads, and suggests a method combining history and anthropology for the research of ancient nomads and their relations with sedentary states throughout history. The Chinese subtitle of the book: "northern Asian nomads who faced the Han Empire," reveals an attempt to explore how nomads confronted the Han Empire and reacted to it (instead of how the Han Empire dealt with the invasions of nomadic peoples). In conclusion, this work stresses the idea that, even when living within and besieged by various boundaries, every individual has the ability to move, to make decisions to cross borders, and, thus, to change history.

Publication

Taipei: Academia Sinica and Linking Publishing Company, 2009.

Mental Disorder of the Tao Aboriginal Minority in Taiwan: Modernity, Social Change, and the Origin of Social Suffering

Abstract

Why do the Tao aboriginal people have a high rate of mental disorder in the last three decades? The proportion of the Han Taiwanese who have mental disorder is typically 0.3%, while that of the Tao people is 1.6%. It has been assumed that there is a significant correlation between the Tao people's genetic background and the high rate of mental disorder. In this book, the author mainly adopts the social constructionist approach but avoids its disadvantages, especially its cultural relativistic leanings, by integrating the analyses of a variety of effects of social change on the Tao people's mental health. In the book the mental disorder prevailing among the Tao minority is viewed as a form of social suffering, an effect of the long-term uneasy interaction between the Tao people and the outside world. Also the book makes a criticism that either genetic medicine or the socio-environmental theory downplays the subjective experience of suffering from mental disorder. Moreover, the book shows that cultural essentialism and the idea of cultural homogeneity that many empirical studies on aboriginal mental health usually possess have blinded researchers to the fact that aboriginal cultures have been changed by a variety of forces of modernity. The book focuses on how the different life experience of three generations of the Tao people and the three paradigms of world view – traditional Tao belief, Christianity, and modern psychiatry – have influenced mental disorder process and the patients' subjective experience and their daily social situation. The study of these issues is intended as a contribution to the combination of knowledge with practice.

Yu-Yueh Tsai
Institute of Sociology, Academia Sinica

The cover of *Mental Disorder of the Tao Aboriginal Minority in Taiwan: Modernity, Social Change, and the Origin of Social Suffering*.

A total of 3,000 Tao people inhabit Lan-yu（蘭嶼）, an isle to the southeast of Taiwan. An isolated minority isle, Lan-yu is a typical low-income and medically under-served community, with a small district health center as the only institution providing medical care. The rate of mental disorder among the Tao people has been increasing in recent three decades. The proportion of the Han Taiwanese who have mental illness is typically 0.3%, while that of the Tao people is 1.6%. It has been assumed that there is a significant correlation between the Tao people's genetic background and the high rate of mental disorder.

Why do the Tao aboriginal people have a high rate of mental disorder in the last three decades? This book argues that the high rate of mental disorder among the Tao people has to be explained in terms of social/economic/cultural influences that are highly related to their ethnic background. The book reviews three theoretical approaches to mental disorder -- genetic medicine, the socio-environmental theory and social constructionism and examines their respective advantages and disadvantages. Inspired by the concept and theory of "social suffering," the book mainly adopts the social constructionist approach but avoids its disadvantages, especially its cultural relativistic leanings, by integrating the analyses of a variety of effects of social change on the Tao people's mental health. In this book the mental disorder prevailing among the Tao minority is viewed as a form of social suffering, an effect of the long-term uneasy interaction between the Tao people and the outside world. Also the book makes a criticism that either genetic medicine or the socio-environmental theory downplays the subjective experience of suffering from mental illness. The book regards mental disorder as a "phenomenal reality" and carefully examines the Tao mental patients' subjective experience.

The possibility that the biological, genetic factor plays a significant role in causing the Tao people's mental disorder probably cannot be excluded. A great many of studies in Medical Sociology have shown that diseases have its social roots, however. Social inequalities based on social class, race, ethnicity, gender, and global relations contribute to inequalities in health conditions and access to care. In the Tao case, how the prevalence of mental disorder has been related to the socially/economically/culturally marginalized condition of their isle community is analyzed in the study. The fact that almost all those who unfortunately have mental disorder are people with the experience of migrating to Taiwan and


The Tao people's daily alcohol drinking.


The retailing of one of the most popular alcoholic beverages in a Tao village – rice wine.

A placard displaying a government-supported project of promoting employment of the Tao people.


The doctor and patient at the only public clinic on the Orchid Island.


The tribe care service of the public clinic.


A Tao receiving the service provided by the Orchid Island Association of Home Care Service.


A volunteer of the Orchid Island Association of Home Care Service helping a Tao.

of suffering from the difficult adjustment to a predominantly Han Taiwanese society speaks volume to the mutual relationship between the prevalence of mental disorder and their socially marginal situation intimately related to their ethnic background. The analysis of this relationship constitutes the first part of the book.

Moreover, the book argues that how the Tao people have accommodated themselves to the prevalence of mental disorder in their community is highly related to their particular culture in the context of social change. Empirical studies in Medical Sociology and Medical Anthropology have also contributed to understanding of how cultural, ethnic, class, and gender differences shape the experience of illness and responses to care. They describe and analyze how local forms of suffering are culturally and socially constructed, pointing out that illness is typically an interpersonal experience created out of cultural values and social practices. However, the second part of the book points out that cultural essentialism and the idea of cultural homogeneity that these empirical studies usually possess have blinded researchers to the fact that aboriginal cultures have been changed by a variety of forces of modernity. Thus the significance of the changing Tao culture to the Tao people's experience of mental disorder should be examined. The book focuses on how the different life experience of three generations of the Tao people and the three paradigms of world view – traditional Tao belief, Christianity, and modern psychiatry – have influenced mental disorder process and the patients' subjective experience and their daily social situation. It also analyzes Tao mental patients' illness narratives, the cultural aspects of their suffering, and their social course of disease in order to understand how the social institutions, dynamics of social power, and collective meanings in their community have shaped the experience of mental disorder. The analysis of these aspects constitutes the second part of the book.

Finally, the book studies how the Tao community has accommodated itself to the prevalence of mental disorder and makes a criticism of the recent promotion of "de-instutionalized" and "de-medicalized" care of mental patients in contemporary psychiatry. As a case study of the complicated relationship between modern medicine and a low-income community with a unique minority culture, the book further examines the moral aspects of modern medical practice and medical technologies with a view to obtaining a more sophisticated understanding of some questions and dilemmas in contemporary medicine, especially psychiatry. The discussion of these issues is intended as a contribution to the combination of knowledge with practice.

Publication

Taipei: Linking Publishing Company, 2009.

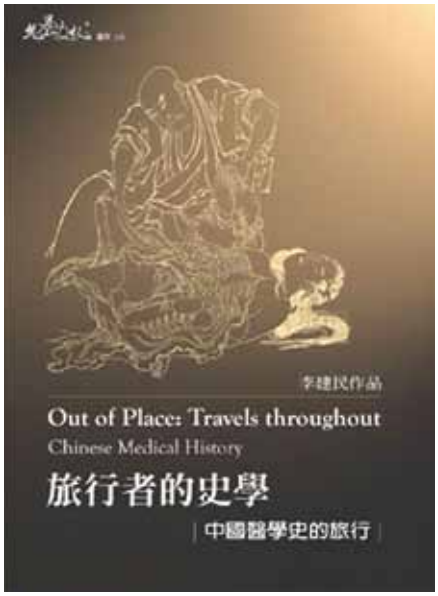
The World of Medicine in Chinese History

Abstract

Out of Place: Travels throughout Chinese Medical History **is a work divided into thirteen chapters. The content of the book pertains to Chinese medical history research methodologies, the history of disease, the history of the body, the history of technology, and other related fields. In the work, the author shares his own psychological process in the research of Chinese medical history and critiques the representative works and figures in this new field. Using a vast amount of medical and non-medical historical materials, the author has clarified and outlined the fears of the ancient Chinese towards disease as well as their imaginings of death. From case studies of "*meidao*" (methods and medicines for keeping women from falling out of favor at court) and "*mousha*" (murder), the author also evinces alternative applications of Chinese medicine and technology. At the same time, the work leads the reader on a tour of bodily conceptions inherent in the "*qijing bamai*" (eight extra channels), enriching the average reader's curiosity as to body culture. Furthermore, throughout history, Chinese medicine has shared an indissoluble bond with various skills and techniques, and this work takes the examples of moxibustion, surgery, and methods for dealing with shadows as means by which to explain the different faces of Chinese medicine and its development.**

Jianmin Li
Institute of History and Philology, Academia Sinica

The main purposes of the chapters in *Out of Place: Travels throughout Chinese Medical History* can be split among four areas. First: rewriting academic history. If the history of medicine can make a contribution to "regular" historical studies, a certain understanding of medicine's academic origins and development is the first step in this process. The author discusses the Chinese medical "canon" and its formation history. Documents and materials pertaining to Chinese medicine are vast in number and extremely hard to reduce to statistical analysis. However, those works which serve as the standard and authoritative "exemplary texts" of the Chinese medical studies community are quite limited. The processes of production, maintenance, and transformation seen through these "exemplary texts" relate to the important role played by written works in the establishment of identities within a discipline, the definition of the borders and boundaries of a discipline, and the foundation of an academic inheritance.



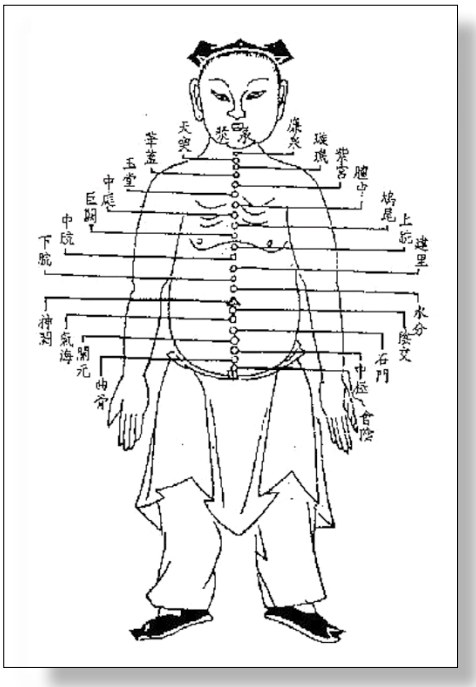
1 | Cover Art

Second: a new exploration of the history of disease and technology. Why do people develop diseases? *Out of Place: Travels throughout Chinese Medical History* discusses the several phases of transformation in the concept of "ghosts" as the cause of disease from the Warring States period to the Sui and Tang dynasties. The first phase involves the "internal cause theory" developed during the Warring States period, which incorporated the theory of "*qi*" and placed importance on the role of the "spirit" of the human body. Within the context of disease resulting from internal causes, ghosts were disregarded as fantastic fears caused by suspicion. The second phase is the renewed development of the external cause theory during the Han dynasty. External wind, cold, and other "evils," especially "*huore*" (fever) and other irregular diseases, were emphasized, and, for a time, ghosts were understood to be hot, poisonous "*qi*." In the middle and later periods of the Eastern Han, the discourses of "*youzhe*" (unseen culpability) and "*yuyang*" (disasters accompanying evil deeds) appeared repeatedly, and the theory that illness was caused by ghosts and haunting was once more championed, along with the belief that morality and ethics were the roots of health and illness. This represented the third phase. The ghost and haunting

theories formed during these three periods existed simultaneously, constituted different levels of the spectrum representing the causes of disease, and have even continued to exist up through the present time.

As to the history of technology, the author discusses the early practical applications of "surgery." There are those who believe that in order to implement surgical techniques certain types of knowledge, such as familiarity with anesthesia, dissection, blood clotting and staunching, disinfection and sterilization, etc., must be established. Unfortunately, before the nineteenth century, Western medical practices as well as medical practices in other civilizations were unable to meet the conditions necessary for surgery. Even in imperial China, where medical facilities and techniques were far worse than in other cultures, surgeries resorted to in cases of necessity or emergency were numerous.

Third: *Out of Place: Travels throughout Chinese Medical History* discusses the history of the medical treatments "*meidao*" (methods and medicines for keeping women from falling out of favor at court) and "*mousha*" (murder). Medicines can not only save people's lives, they can be put to other uses as well. The two chapters on "*meidao*" and "*mousha*" involve the intersection of imperial court, social, and medical histories. The history of medicine is not merely the "history of the lower classes," and there are many phenomena within medical treatment culture which defy boundaries. For example, the uses of medicine in "*meidao*" and "*mousha*" involve a mixture of academics, politics, and everyday habits, and can possibly be included under the headings of "social history of the imperial court" and "popular political history."



2 | Traditional images of bodily channels usually take the male form as a model. (Ming dynasty) Xu Chunfu, *Encyclopedia of Past and Present Medicine* (Beijing: People's Medical Publishing House, 1996), p. 435.

Four: imagining a history of the body. Concepts (and senses) of the body have always been a main current within research on the history of medicine. Compared with the majority of scholars who pay particular attention to the eleven channels or twelve regular channels and their formation histories, the author takes the "*qijing bamai*" (eight extra channels) as a new starting point from which to explore the history of the body. As a core cultural classification within ancient Chinese medicine, a "channeled" body was described as a moving or reacting body. Furthermore, the concept of the passages or channels of the body constitutes "a rhetoric of the unsayable" and is a classification unfamiliar within modern scientific knowledge.

Out of Place: Travels throughout Chinese Medical History takes different approaches in order to demonstrate the ways in which medicine has intervened in historical issues of birth, aging, sickness, and death and become involved in attitudes towards life and pursuits of health during different time periods, and includes discussions of imaginings of the universe and political significances integrated within medicine and the relationships between groups of doctors and other groups. In this way, the work evinces the multi-layered and unique features of Chinese history.

In *Out of Place: Travels throughout Chinese Medical History*, the use of palpable research achievements as a means for explanation, the search for new historical topics and questions, the provision of connections between the history of medicine and "regular" history, the deconstruction of already existing "social history" and "cultural history" categorizations, and the rejection of the "empirical mentality" held by most researchers in favor of the establishment of a richer "medical world" within the field of Chinese history are all burgeoning trends in the recent development of Taiwan's new historical studies.

Publication

Taipei: Yunchen Culture Corporation Ltd., 2009.

Prescribing Colonization: The Role of Medical Practice and Policy in Japan-Ruled Taiwan 1895-1945

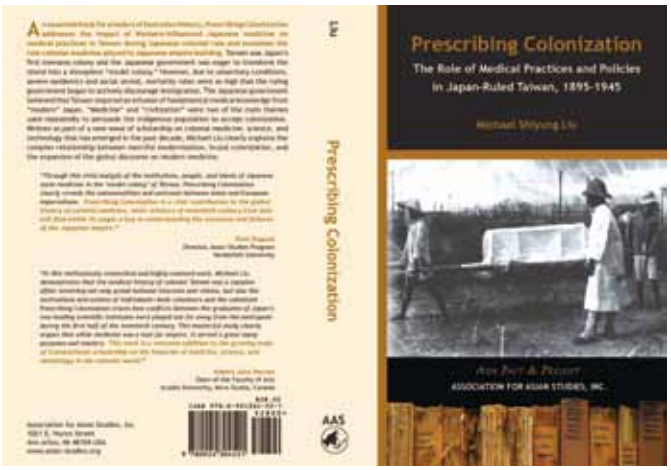
Abstract

The book aims to portray the transition of Japanese colonial medicine from German model, demonstrates the medical history of colonial Taiwan was a complex affair involving not only colonialist interest, but also the expansion of modern scientific medicine from the West. The author proposes that an unintentionally cooperation between the imperial center and the peripheral colonies resulted in the development of modern medicine in East Asia. Since Japan-ruled Taiwan served as havens for Japanese scientists after the mid-1910s, Taiwan served as laboratories for experimenting with various ideas in modern medicine. The development of modern medicine within the sphere of the Japanese empire can be seen in terms of a partnership model. Unveiling the complexity of Japanese colonial medicine may offer a stepping-stone for a more comprehensive study of modern medicine within the sphere of the Japanese empire as well as to the western studies of the history of modern medicine.

Michael Shiyung Liu
Institute of Taiwan History, Academia Sinica

The study of colonial medicine was broadened to include colonization of the mind as well as the body in the 1970s while British scholars portray it a sub-discipline to the history of modern medicine. However, to the mainstream of anglophone scholarship, studies on French and German colonies are much rare. Britain might have been the largest colonial empire but, in the late nineteenth century German medicine shared with French scientists the highest reputation for promoting modern medicine. The loss of colonies after World War I does not mean that German medicine had no colonial counterpart. During the 1870s, German set the standard for Japan in building medical system. When Japan occupied Taiwan in 1895, the newly learned German *Staatsmedizin* had to be transferred to a colonial format.

This is the first book-length treatment in English of Japanese medical endeavors in Taiwan, a rich and significant topic. Japanese colonialism is emerging as an important case-study in the comparative analysis of world colonialisms. And medicine is seen as one of the cornerstones of Japanese colonialism. *Prescribing Colonization* addresses the impact of Western-influenced Japanese medicine on medical practices in Taiwan during the colonial rule and examines the role colonial medicine played in Japanese empire building. Taiwan was Japan's first overseas colony and the Japanese government was eager to transform the island into a showpiece "model colony." However, due to unsanitary conditions, severe epidemics and social unrest, mortality rates were so high that the ruling government began to actively discourage immigration. The Japanese government believed that Taiwan required an infusion of fundamental medical knowledge from "modern" Japan. "Medicine" and "civilization"



Taiwanese carries and a keisatsu i (police physician) in the white robe moving a body infected with plague.

Mass cowpox vaccination


Isolation ward for cholera patients


Enforcing quarantine on patients' family

were two of the main themes used repeatedly to persuade the indigenous population to accept colonization. Written as part of a new wave of scholarship on colonial medicine, science, and technology that has emerged in the past decade, the author clearly explains the complex relationship between merciful modernization, brutal colonization, and the expansion of the global discourse on modern medicine.

During the colonial era (1895–1945), two related processes—the creation of medical resources and the establishment of a new medical system composed of clinical medicine, laboratory medicine, and new institutions—formed the main body of medical services in colonial Taiwan. An analysis of the procedures involved in establishing those services reveals two themes: the continuity of medical westernization in Japan since the 1870s and the role colonial medicine played in Japanese empire building between 1895 and 1945. As discussed in chapters 2 and 4, the motive and sequence of building Japanese colonial medicine in Taiwan may have differed from the models proposed in Western scholarship. Medicine was indeed a tool, but it served many purposes, not only the creation and maintenance of the Japanese empire. The purposes of the colonizers were never homogeneous. Various groups used Taiwan as a laboratory of Japanese modern medicine for their own good, which differed from the purposes of medical professionals in Japan.

In the context of the development of Japanese colonial medicine in Taiwan, the diffusionist model as well as interpretations from scientific colonialism would have some cracks. Focusing on the development of tropical medicine in European colonies, their models treat the spread of modern medicine from Japan to its colonies as a one-way route, usually implies a very top-down viewpoint. Beyond the cliché about modern medicine advancing colonial society in Taiwan, this book shows that understanding Japanese colonial medicine is more complex than has been recognized in existing interpretations. The case study of colonial Taiwan reveals this complexity and also reflects the local diversity among the colonies in Taiwan, Korea, Manchuria, and other Japanese-occupied areas. Eurocentric models are not adequate to judge the roles of these experts in the spread of modern medicine in the sphere of Japanese Empire. A more accurate description of Japanese colonial medicine is that the colonies served as laboratories for experimenting with various ideas in modern medicine. In fact, the development of modern medicine within the sphere of the Japanese empire can be seen in terms of a partnership model.

Generally speaking, the author demonstrates that the medical history of colonial Taiwan was a complex affair involving not only grand national interests and visions, but also the motivations and actions of individuals—both colonizers and the colonized. Through the analysis of the institutions, people, and ideals of Japanese state medicine in the 'model colony' of Taiwan, *Prescribing Colonization* reveals the commonalities and contrasts between Asian and European imperialisms. This book illuminates that while medicine was a tool for empire, it served a great many purposes and masters. This work is an addition to the growing body of transnational scholarship on the histories of medicine, science, and technology in the colonial world. Unveiling the complexity of Japanese colonial medicine in Taiwan offers a stepping-stone for a more comprehensive study of modern medicine.

Publication

Ann Arbor, Michigan: AAS, 2009.

Taiwan in Japan's Empire-Building: An Institutional Approach to Colonial Engineering

Abstract

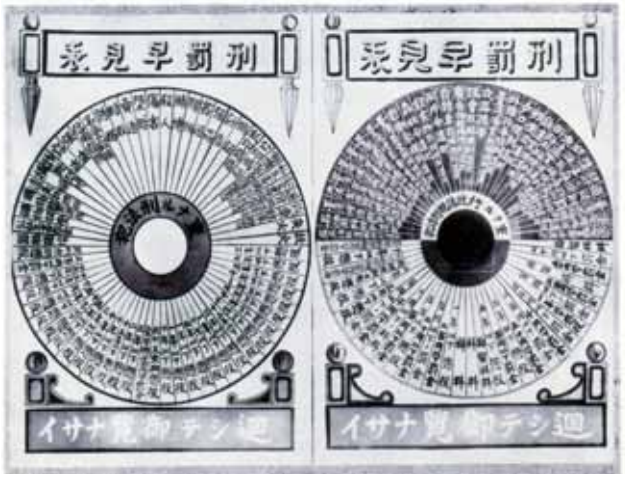
This book is about Taiwan under Japanese rule. It is a study of colonial engineering. I approach this issue by analyzing the main institutions through which Taiwan was governed. I examine how Japanese colonial governance restructured the colonial space of the island and how Japan's colonial rule contributed to the shaping of an imposed discipline of order in Taiwan. I look at how a combination of governance technology and socio-political grafting was able to shape the Japanese bureaucracy into a disciplined tool of social control.

Hui-yu Caroline Ts'ai
Institute of Taiwan History, Academia Sinica

Japan ruled Taiwan for fifty years (1895-1945). This book is written from the perspective of Japan's colonial technology in Taiwan. The book is composed of three parts or nine chapters: Part I, on law, order, and governance; Part II, on colonial engineering; and Part III, on war, mobilization, and legacy. In each chapter, I use a somewhat different approach to explore a major issue, which I summarily term "colonial engineering."

By "colonial engineering" I do not mean to repeat what we have already known about the control side of Japan's colonial rule, but rather I aim to explore how this rule could be engineered, what mechanisms were available, the crux that mediated the state and the society, and what made Taiwan colonial anyway. I make the point that total war forced palpable changes on the administrative machine without shaking the colonial administration. Meanwhile, however, I also attempt to bring total war back into the history by pointing to the changes exerted by total war on certain part of society. "Bringing war back into the history" thus means to take wartime seriously. The structural transformation of an extended period as Taiwan at war calls for an analytical framework that involves Taiwan in the long-term organizational build-up of imperial Japan.

In terms of colonial studies, the old historical paradigm of "control" points to the repressive aspects of Japan's colonial rule. Recent studies have begun to look into where this "great narrative" of the Meiji establishment fractures. The new trend seeks more subtle explanations for understanding the interactions between the core (Japan) and the



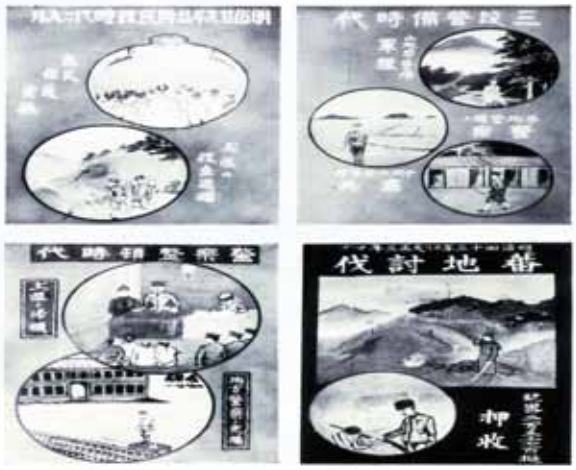
Tables of criminal penalties

Duties of *hosei* and *kōchō*: Guiding *hokō* people

Duties of household heads: Filfilling duties, securing household safety

Activities of the Able-bodies Corps:Self-policing and self-protecting

Filing household registers, etc.



The institutionalization of the police, etc.

peripheries (“overseas possessions”), an effort thus made in spite of a sense of postcolonial realization that the study of Japan is incomplete without embracing her colonies.

In this book, I thus look at how a combination of governance technology and socio-political grafting was able to shape the Japanese bureaucracy into a disciplined tool of social control. In the end, I argue that the Foucauldian approach does not sufficiently address the issues of resistance, theories of subjectification, and war.

The contagion of diseases by way of old clothes, etc.

Publication

Oxford, UK: Routledge (Academia Sinica on East Asia Series), 2009.

Venturing into "Barbarous" Regions: Trans-border Trade among Migrant Yunnanese between Thailand and Burma, 1960s – 1980s

Abstract

This paper examines the cross-border trade among the migrant Yunnanese between Burma and Thailand during the era of the Burmese socialist regime. It was a period when the Burmese government implemented a system of nationalized economy and strictly forbade free movement and private trade. With a transborder perspective, the paper looks beyond governmental institutions and probes the mercantile agency of the migrant Yunnanese traders that contributes to the formation of their socio-economic mechanisms. The findings suggest that the economic practices of the Yunnanese traders in effect constituted a *transnational popular realm* that formed an informal oppositional power against the Thai and Burmese national bureaucracies on the one hand, and incorporated varied state agencies on the other hand.

Wen-Chin Chang
Center for Asian-Pacific Area Studies, RCHSS, Academia Sinica

Mountainous societies have their own rules and knowledge to pass on. There's so much to learn..... Looking back upon my former experiences..... living with nature, and coming and going around the forests and mountains, life was indeed exciting !

-Zhang dadie

The concept of "borderland" has by and large been associated with periphery, wasteland, backwardness and lawlessness. It is in sharp contrast to the ideas of center, civilization, progress and law and order. Such dualistic thinking results from the political ideology underlying state building—designating the borderland as something to be tamed and controlled by the central state. This top-down ideology stresses absolute national sovereignty and rules out the ideas of flexible or negotiable boundaries. However since the early 1970s, the political discourses focusing solely on state-centeredness have been debated or subject to criticisms. It is from this angle that Rosaldo probes the complexities of the life-world and suggests that instead of living in the "supposedly transparent cultural selves", our everyday practices are intertwined with "structure" and "agency" (1993: 104). Borderlands, be they metaphorical or geographical, should therefore "be regarded not as analytically empty transitional zones but as sites of creative cultural production that require investigation", (Rosaldo 1993: 207-8), and the field of everyday practices should be the focus of inspection instead of the structures from above.

Major Caravan trade routes between Thailand and Burma from the 1960s to 1980s

Based on the aforesaid insights, this essay adopts a transborder perspective for the examination of the livelihood of a major part of the migrant Yunnanese Chinese (simply referred to as migrant Yunnanese) that formerly moved from southwestern China and are settled today in northern Thailand and Shan and Kachin States of Burma. Throughout history, the Yunnanese have been very mobile in the region of upper mainland Southeast Asia for economic pursuit in ordinary times or seeking political refuge when unrest occurs. Their mobility has resulted in the establishment of diasporic Yunnanese communities and transnational networks in this large stretch of land. The concerned period of the present study largely falls in the era of the Burmese socialist regime when the state implemented a system of nationalized economy and strictly forbade free movement and private trade. With a transborder perspective, the paper looks beyond governmental institutions and probes the mercantile agency of the migrant Yunnanese traders that contributes to the formation of their socio-economic mechanisms—consisting of widespread nexuses, integrating different regional communities and state apparatuses of Burma and Thailand.

The research focus is on the migrant Yunnanese themselves (and not the state policies or reports on them); and the methodology is allowing the people to tell their own stories while conducting participant observation in different places beyond border limits and officially permitted areas. The main discussion is drawn from the narrative accounts of three key informants, in both oral and written forms. Founded on the informants' narratives, I reconstruct the trajectories of their transnational economic movement, look into their mercantile agency interacting with different political entities and re-examine the knowledge of borderlands in this region. The issues of local knowledge, uncertainty of power relations, and economic and political appropriation and transgression recur in the discussion.

The findings suggest that despite an ethnocentric mentality among the Yunnanese traders that views borderlands as barbarous, their efforts to maintain reciprocity with autochthonous groups and respect their rules, in effect, negated this perception. Moreover, their movements for migration and traveling commerce constituted a *transnational popular realm* that formed an informal oppositional power against the Thai and Burmese national bureaucracies on the one hand, and incorporated varied state agencies on the other hand. While this popular realm enjoyed an informal power in comparison to power exercised by forces of the state in Burma and Thailand, they also incorporated the different official agencies in the course of their operations. Nevertheless, it was not a united popular realm, powerful enough to challenge the central states; rather it was criss-crossed with factions and characterized by intense competition. Its strength was derived from economic force rather than political power. Alongside the governmental institutions of these two countries, the mercantile spirit of the migrant Yunnanese created their own civil mechanisms, composed of prevailing networks. Their activity space was hence not defined by borders but by their transnational connectivity.

Geographically speaking, the migrant Yunnanese discussed here were located on the peripheral frontiers of Burma and Thailand. Yet economically speaking, they transformed the region into a central area for transnational trade from where the smuggled goods were further distributed to widespread locations. Their movements for migration and traveling commerce on the one hand transgressed the national boundaries of China, Burma and Thailand, while on the other hand connecting them to a wider market economy. The borderlands' liminality seen from this case study, therefore, embodies paradoxical features of periphery and center, separation and connection. Without a transborder perspective, one would easily miss the insights into this underground transnational trade and simply regard these Yunnanese traffickers as criminals.

Publication

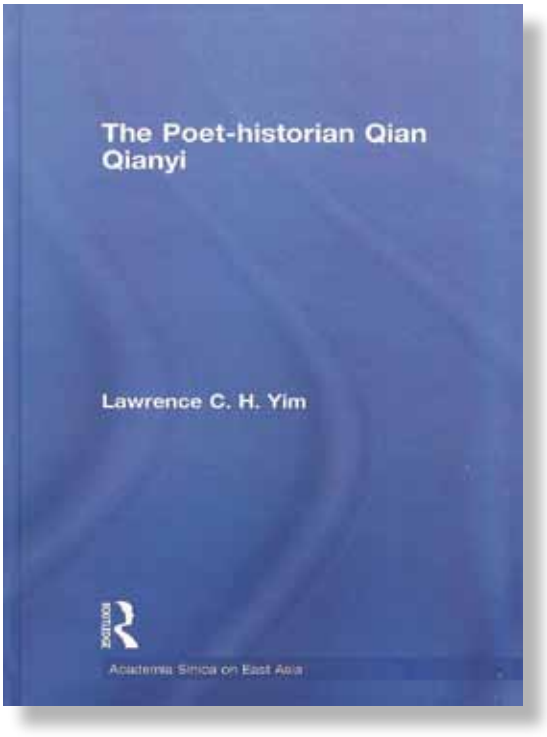
Journal of Asian Studies **68** (2009): 543-572.

The Poet-historian Qian Qianyi

Abstract

This book is the first English language study of Qian Qianyi 錢謙益 (1582-1664), a poet and literary critic during the Ming-Qing dynastic transition. Although Qian's works constitute some of the greatest achievements in pre-modern Chinese lyric poetry, they have been largely understudied and are poorly understood. Qian's name was branded with infamy for his disloyalty to the Ming dynasty when it dissolved. Consequently, his works were censored by the Qing court and have been forgotten by most critics until recently. This book focuses on Qian's poetic theory and practice, providing a critical study of Qian's theory of poetic-history (*shishi* 詩史) and a group of poems from his *Toubi ji* 投筆集. It also examines the role played by history in early-Qing verse, rethinking the nature of loyalism and historical memory in seventeenth-century China. Poetry of the Ming-Qing transition is distinguished by its manifest historical consciousness and the effort to give meaning to current historical events, an effort characterized by the pathos of introspection and mourning for the past. This pathos translates into what can be called a poetics of Ming loyalism, exemplified and championed by, intriguingly, the later works of Qian Qianyi himself.

Lawrence C. H. Yim
Institute of Chinese Literature & Philosophy, Academia Sinica



This book consists of two parts. Part I of this study is divided into two chapters. The first chapter discusses the historical and theoretical contexts which affected the poetics of Ming loyalism in early Qing. It examines a poetic theory advanced by Qian Qianyi which synthesizes the paramount values of both the historiographical and the poetic traditions. This theory revives the critical concept of *shishi*, which can mean either the poet who relates history, or the poem in which history is related, and hence the English translation "poet-historian" or "poetic-history," for want of better phraseology. The author discusses how Qian, armed with this theory, founds an aesthetic for the surviving Ming subjects. Chapter Two offers a historical survey of Qian's reception in Qing and early-Republican times. The author conducts a formal discussion of the Qianlong emperor's extended condemnation of Qian and of Qianlong's campaign of literary inquisition as part of his attempt to foster an ideal of morality in his officials in the 1770s and 80s.

Part II's three chapters present close readings of three cycles of poems. These are taken from Qian's last major poetic endeavor, the *Toubi ji*, a collection of thirteen cycles of poems bearing the title "Hou'Qiuxing'" 後秋興 or "After 'Autumn Thoughts' [by Du Fu]." They are discussed against the backdrop of the single most important moment of the Ming loyalist revival activities, Zheng Chenggong's 鄭成功 (1624-62) Yangzi military campaign against the Qing in 1659. The first cycle in the *Toubi ji* was written when Zheng's imposing fleet was closing in on Nanjing, and the second and the third resulted from Zheng's disastrous defeat in the same city. The author uses this specific historical context to illustrate Qian's use of history in poetry and his relation to the cause of Ming restoration.

Chapter Three explores the theme of war in the first cycle of the *Toubi ji*, and Qian's fervent response to the revival forces. Ethnic conflicts between the Chinese and the Manchu conquerors inform the idea of legitimate authority in these eight poems. This chapter also examines the different historical personae Qian adopts to justify his surrender to the Qing at the fall of the Ming. Chapter Four focuses on the second cycle of the *Toubi ji*, the earliest account of Zheng's defeat by Manchu forces at Nanjing. By investigating Qian's rhetoric of admonition and encouragement, the author analyzes the poems' depiction of Qian as a strategist and Zheng's mentor. Chapter Five examines the third cycle of the poems, where Qian registers his unswerving faith in the Ming revival movement and in its darkest phase assumes the role of participant. The author shows that this cycle expresses Qian's dedication to the Ming cause as much as his love for Liu Rushi. This chapter also argues against the conjecture that Qian and Zheng met during or shortly after the composition of this cycle.

The concluding chapter offers an appraisal of the theory and practice of *shishi* that Qian put forward.

Table of Contents

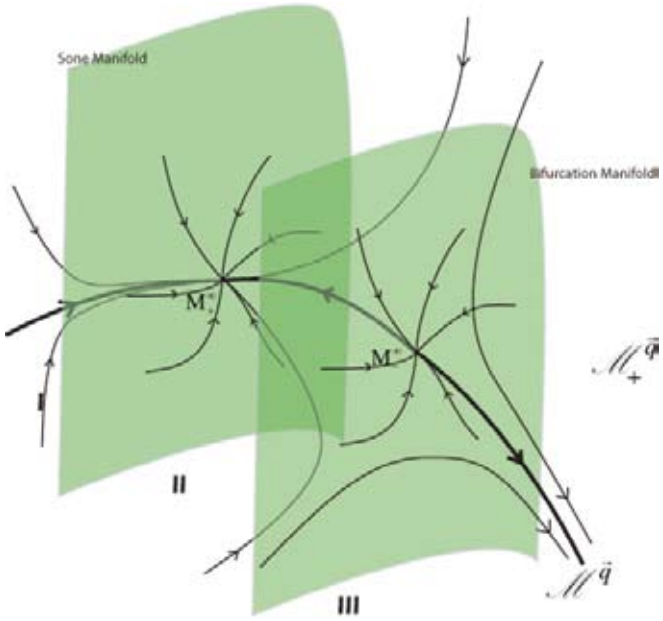
Publication

London and New York: Routledge (Academia Sinica on East Asia Series), 2009.

Boltzmann Equation, Boundary Effects

Tai-Ping Liu, Shih-Hsien Yu
Institute of Mathematics, Academia Sinica
Discrete and Continuous Dynamical Systems Series A **24** (2009): 145-157.

The Boltzmann equation offers richer and physically more realistic modelling of the boundary effects than the fluid dynamic equations. Important phenomena such as the thermal transpiration and some of the bifurcations due to curvature of the boundary can only modeled using the kinetic formulation. In this paper we survey the analytical ideas that have been introduced in recent years for the study of the boundary effects. The main point is that more quantitative estimates of the solutions are needed for such a study. A rich boundary effect is illustrated in the attached figure on the boundary bifurcation phenomena.

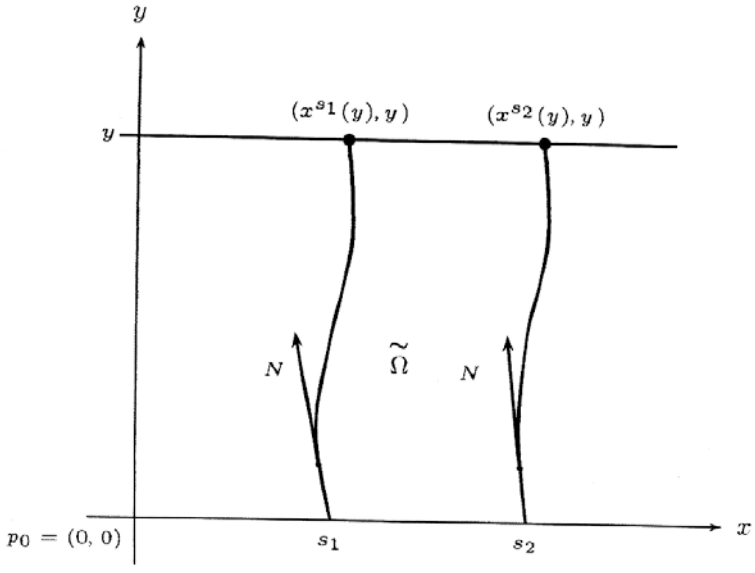


Bifurcation for transonic evaporation

Regularity of C^1 Smooth Solutions with Prescribed p-mean Curvature in the Heisenberg Group

Jih-Hsin Cheng, Jenn-Fang Hwang, Paul Yang
Institute of Mathematics, Academia Sinica
Mathematische Annalen **344** (2009): 1-35.

We consider a C^1 smooth surface with prescribed p (or H)-mean curvature in the 3-dimensional Heisenberg group. Assuming only the prescribed p-mean curvature H is C^0, we show that any characteristic curve is C^2 smooth and its (line) curvature equals-H in the nonsingular domain. By introducing characteristic coordinates and invoking the jump formulas along characteristic curves, we can prove that the Legendrian (or horizontal) normal gains one more derivative. Therefore the seed curves are C^2 smooth. We also obtain the uniqueness of characteristic and seed curves passing through a common point under some mild conditions, respectively. These results can be applied to more general situations.

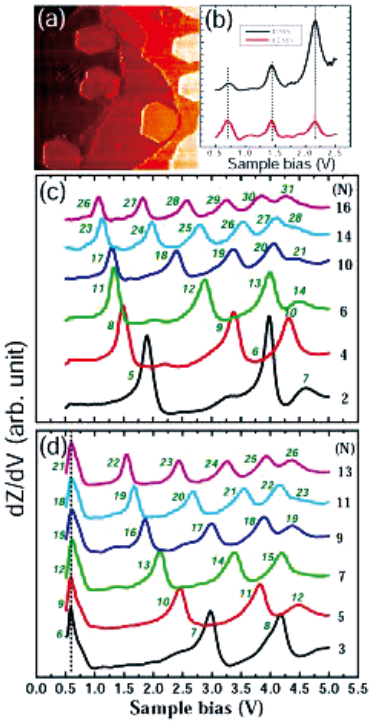


Introducing characteristic coordinates

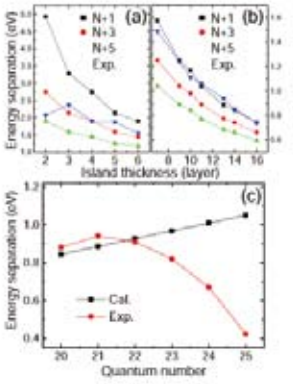
Phase Contribution of Image Potential on Empty Quantum Well States

Ming-Chi Yang, Chun-Liang Lin, Wei-Bin Su, Shih-Ping Lin, Shin-Ming Lu, Hsin-yu Lin, Chia-Seng Chang, Wen-Kuang Hsu, Tien T. Tsong
Institute of Physics, Academia Sinica
Physical Review Letters **102** (2009):196102.

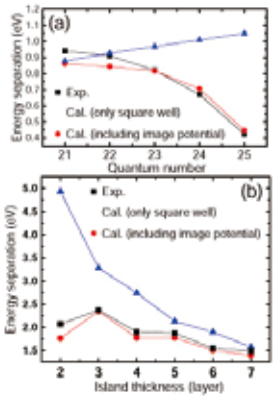
Previous studies on the quantum-well (QW) states in metal films by using scanning tunneling microscopy (STM) focused on the QW states appearing in the energy range of +-2 eV around the Fermi level. These studies have shown that QW states in this energy range can be well described by the square potential well in quantum mechanics. We use Z-V spectroscopy in STM to study the higher energy empty QW states that are in the range of 2-5 eV above Fermi level for the Pb/Cu(111) system. Our observation shows that the QW states in this energy range significantly deviated from the description of square potential well. We introduce a phase factor contributed by the image potential in the phase accumulation (PA) model to calculate the energy levels of higher energy QW states. The calculated results are in good agreement with the experimental measurement, revealing that the higher energy empty QW states are influenced by the image potential. Moreover, based on the PA model, we obtain an interesting and important point of view that there exists a quantum regime above the Pb surface in which the image potential is vanished. Owing to this quantum regime, the image potential will not become the infinity when the electron is at the metal surface.



1) (a) The growth of Pb islands on Cu(111) surface. (b), (c), (d) Spectra acquired on the island of different thickness. Spectra reveal peak features, indicating the existence of the quantum well states in Pb islands. The number and energies of States change with the island thickness.



2) The energy separation of adjacent states calculated with the square well model disagrees with experimental results.

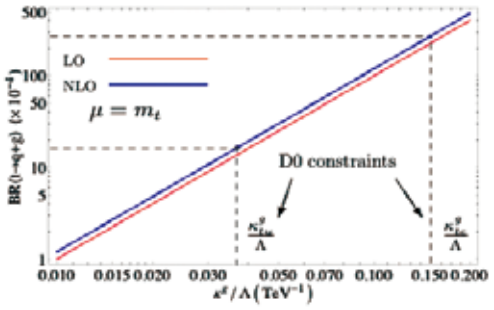


3) Calculated results using phase accumulation model including a phase contribution of image potential are consistent with measurements.

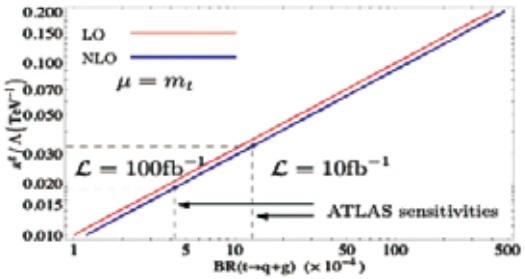
Next-to-Leading-Order QCD Corrections to the Top-Quark Decay via Model-Independent Flavor-Changing Neutral-Current Couplings

Jia Jun Zhang, Chong Sheng Li, Jun Gao, Hao Zhang, Zhao Li, C.-P. Yuan and Tzu-Chiang Yuan
Institute of Physics, Academia Sinica
Physical Review Letters **102** (2009): 072001.

Recently, D0 and CDF collaborations at the Fermilab Tevatron have searched for single top-quark production in nonstandard-model and have set upper limits on the anomalous top-quark flavor-changing neutral-current (FCNC) couplings κ^g_{tc}/Λ and κ^g_{tc}/Λ using the measurement of the total cross section calculated at the next-to-leading order (NLO) in Quantum Chromodynamics (QCD). In this Letter, we report on the effect of these anomalous FCNC couplings to various decay branching ratios of the top quark, calculated at the NLO. This result is not only mandatory for a consistent treatment of both the top-quark production and decay via FCNC couplings in the current experiments of D0 and CDF at the Tevatron, but is also important for the future studies of ATLAS and CMS sensitivities to these anomalous couplings at the CERN Large Hadron Collider (LHC).



1) D0 constraints



2) ATLAS sensitivities

Fabricating Scaffolds with Uniform Pores By Microfluidics

Kuo-Yuan Chung, Narayan Mishra, Chen-Chie Wang, Feng-Hui Lin, Keng-Hui Lin
Institute of Physics, Academia Sinica
Biomicrofluidics **3** (2009): 022403.

Tissue cells in the body grow in a three-dimensional (3D) mesh called an extracellular matrix. 3D cell culture studies are performed in wide varieties of porous matrices, so-called as scaffolds, which can support cell growth on or within the structures. We demonstrate the first microfluidic method in fabricating tissue engineering scaffolds of uniform pore sizes which allows the systematic studies on cell-matrix interactions.

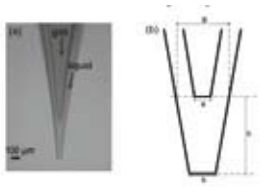
Our microfludic device shown in Fig. 1 was composed of two concentric micropipettes: one micropipette was made from a cylindrical capillary tube, nestled within the other one made from a square capillary whose inner dimension was close to the outer diameter of cylindrical tube. The bubbles were generated by injecting a filtered aqueous solution containing hydrogel polymer and 1\% Pluronic surfactant through the outer channel and nitrogen gas through the inner channel.

The gas pressure P and liquid flow rate Q_L determine the size of the bubbles and the liquid droplets coming from the outer orifice. The combination of patterns of bubbles enclosed in the liquid droplets were rich, ranging from periodic droplets containing bubbles to pearls in a thread, and foam ribbons shown in Fig. 2.

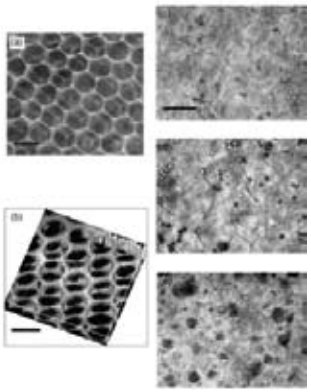
We collected monodisperse bubbles at the state where the bubbles were intact and stable, and also relative high in gas fraction.They self-assembled into crystalline foam structures spontaneously and were stable for a few minutes and then the liquid portion will be crosslinked. The crosslinked solid foam was placed in liquid and degassed under vacuum until the pores were filled with water shown in Fig. 3 (a) and (b).

We cultured chondrocytes on the hydrogel scaffolds. The cells were introduced to the scaffold by injection. Fig. 3(c-e) shows the proliferation of chondrocytes with time. The chondrocytes grew for more than a month in our scaffolds.

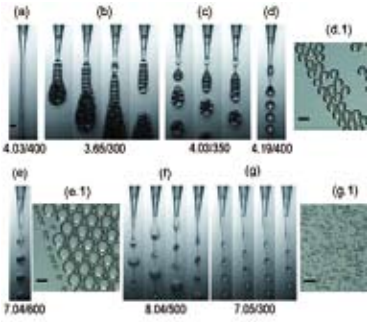
In summary, we developed a simple, fast and inexpensive method to fabricate ordered 3D scaffold.

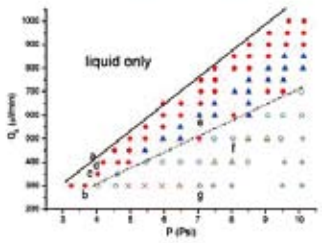


1) (a) Optical image and (b) schematic drawing of the microfluidic device. The typical dimensions of devices are: a=25 – 35 um b=60 – 75 um, h=350 450 um, and B=350 – 450 um.



3) (a) SEM image and (b) confocal image of the scaffold. The pores are highly ordered and interconnected. Chodrocytes cultured in a scaffold on (c) day 1, (d) day 3, and (e) day 7. The dark regions in (e) are clusters of cells.



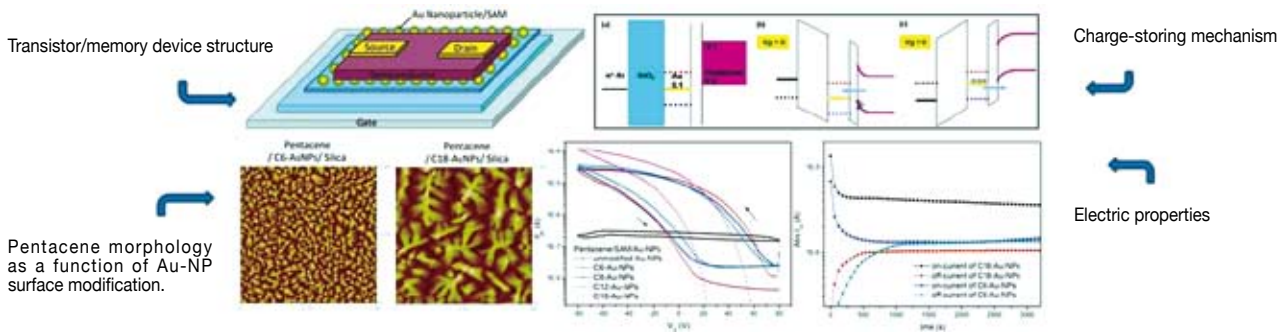


2) Patterns of bubbles in liquid droplets at the exit of the device at different gas pressure (psi)/liquid flow rate (ul/min) and the corresponding state diagram of the the Q_L and Pand bubble morphology. The patterns include (a) no bubbles (water jet), (b) and (c) continuous bubble train, (d) discontinued single bubble, (e) bidisperse bubbles, (f) broken bubbles and (g) tiny bubbles only. (d.1), (e.1) and (g.1) are optical images of collected bubbles corresponding to (d), (e), and (g) respectively. The solid line is used to draw the boundary where bubbles occur. The symbols describe: monodisperse bubbles (solid/open circle), bidisperse bubbles (open/solid triangles), no bubbles (cross), and polydisperse bubbles (star). The open symbol denotes burst bubbles occuring. All the scale bars shown here are 100 um.

Electric Bistability in Pentacene Film-based Transistor Embedding Gold Nanoparticles

Chiao-Wei Tseng and Yu-Tai Tao
Institute of Chemistry, Academia Sinica
Journal of American Chemical Society **131** (2009): 12441-12450.

Electronic devices based on organic materials are one important trend in the near future. Much progress has been made in areas like electroluminescent devices and thin film transistors in recent years. In this study, memory effect is imparted in a three-terminal thin film transistor. Gold nanoparticles(Au-NPs) are imbedded in a pentacene film and used as floating gate to give I-V hysteresis as a function of gate bias. The crystallinity and packing orientation of the pentacene film are critically dependent on the surface properties of the nanoparticles, which can be tuned systematically by a self-assembled monolayer (SAM) of organic thiolate on the nanoparticles. High performance field effect transistors can be prepared if the nanoparticles are made "hydrophobic" as well as "oleophobic" by appropriate SAMs. Electrical bistability is observed in these devices, with the memory window depending on the size and the surface modification of the Au-NPs. The work provides a new dimension in the rational design of organic memory devices.



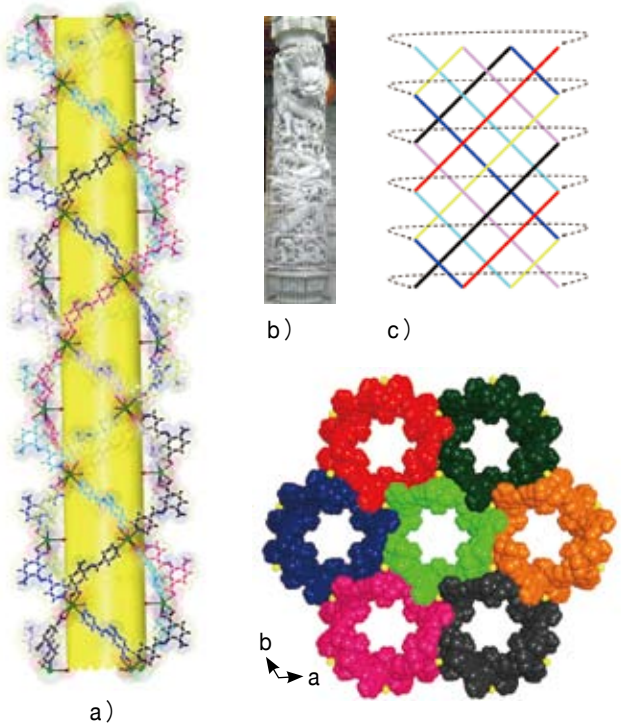
Self-Assembled Arrays of Single-Walled Metal–Organic Nanotubes

Tzuoo-Tsair Luo, Huang-Chun Wu, Yu-Chen Jao, Sheng-Ming Huang, Tien-Wen Tseng, Yuh-Sheng Wen, Gene-Hsiang Lee, Shie-Ming Peng, and Kuang-Lieh Lu
Institute of Chemistry, Academia Sinica
Angewwandte Chemie International Edition **48** (2009): 9461-9464.

A large single-walled metal–organic nanotube (MONT) with an exterior wall diameter of up to 3.2 nm and an internal channel diameter of 1.4 nm is reported. This tube can be depicted as hexa-stranded helices consisting of three right-handed and three left-handed helical chains, which resembles a rolled-up dragon column. This single-walled MONT with such a large diameter is currently unprecedented. In addition, these large MONTs are held together by alkaline cations, analogous to a packet of densely packed straws, leading to unique supramolecular nanotubular arrays.

Compared with CNTs and other synthetic nanotubes, it is surprising that less effort has been directed to the preparation of metal–organic nanotubes (MONTs). In particular, discrete MONT structures are extremely rare to date. Conceptually, to roll up a selected 2D layer and glue its adjacent edges appropriately, an open-ended hollow tube with variable diameters will be generated. Thus, this single-walled MONT can be regarded as a nanotube which is folded from a (4,4)-topology sheet.

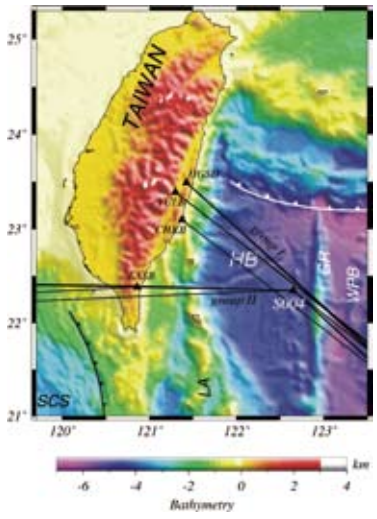
Our innovative results highlight an important research topic and provide vision for the development of discrete metal–organic nanotube-based materials that have been largely unexplored. This work has been immediately highlighted by Asia Materials after publication in Angew. Chem.



Two-station Measurement of Rayleigh-wave Phase Velocities for the Huatung Basin, the Westernmost Philippine Sea, with OBS: Implications for Regional Tectonics

Kuo, B. Y., W. C. Chi, C. R. Lin, E. Chang, J. Collins, and C. S. Liu (2009)
Institute of Earth Sciences, Academia Sinica
Geophysical Journal International **179** (2009): 1859-1869, doi:10.1111/j.1365-246X.2009.04391.x

A broadband ocean-bottom seismometer (OBS) deployed ~180 km east of Taiwan provides a first glimpse into the upper mantle beneath the westernmost section of the Philippine Sea or the Huatung basin. We measured inter-station phase velocities of Rayleigh waves between the OBS and stations on the eastern coast of Taiwan. The phase velocities show smooth variations from 3.8 to 3.9 km/s for periods of 25-40 s. In this short period range, phase velocities are comparable to those characterizing the 15-30 Ma Parece-Vela basin of the Philippine Sea. Modeling of the finite-frequency effect proves the validity of the measurement for the average Huatung basin. The shear-wave velocity models inverted from the 25-40 s dispersion show a velocity at lithospheric depths about 0.1 km/s lower than that of the west Philippine Sea, which agrees with the age effect derived from the Pacific pure-path model. Inversions incorporating the less reliable data above 40 s yield a shear velocity < 4.0 km/s below 150 km, an unrealistic value even for a hotspot plume environment. The seismological evidence, together with the correlation in seafloor depth, suggests that the HB and the Parece-Vela basin may have a similar age. This is at odds with the previous geochronological study suggesting an early-Cretaceous age for the HB. Thermal rejuvenation of the lithosphere was examined as a potential solution to reconciling the two age models.

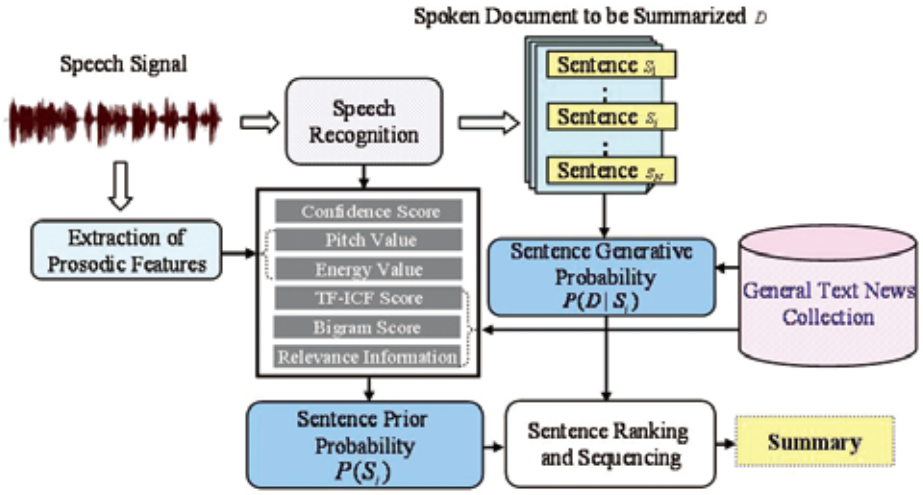


Map of the region of Taiwan and the Huatung basin (HB) in the westernmost Philippine Sea, showing relevant tectonic elements and great-circle paths of Rayleigh waves and station names used in this study. S004 is the OBS station. Group I refers to the 5 pairs of paths to S004 and HGSD, YULB and CHKB. The sawtooth denotes the Ryukyu (white) trench and the Manila (black) trench.

A Probabilistic Generative Framework for Extractive Broadcast News Speech Summarization

Yi-Ting Chen, Berlin Chen, Hsin-Min Wang
Institute of Information Science, Academia Sinica
IEEE Transactions on Audio, Speech, and Language Processing **17** (2009): 95-106.

In this paper, we consider extractive summarization of broadcast news speech and propose a unified probabilistic generative framework that combines the sentence generative probability and the sentence prior probability for sentence ranking. Each sentence of a spoken document to be summarized is treated as a probabilistic generative model for predicting the document. Two matching strategies, namely literal term matching and concept matching, are thoroughly investigated. We explore the use of the language model (LM) and the relevance model (RM) for literal term matching, while the sentence topical mixture model (STMM) and the word topical mixture model (WTMM) are used for concept matching. In addition, the lexical and prosodic features, as well as the relevance information of spoken sentences, are properly incorporated for the estimation of the sentence prior probability. An elegant feature of our proposed framework is that both the sentence generative probability and the sentence prior probability can be estimated in an unsupervised manner, without the need for handcrafted document-summary pairs. The experiments were performed on Chinese broadcast news collected in Taiwan, and very encouraging results were obtained.



Extractive spoken document summarization using the probabilistic generative framework.

A Crowdsourceable QoE Evaluation Framework for Multimedia Content

Sheng-Wei (Kuan-Ta) Chen, Chen-Chi Wu, Yu-Chun Chang, and Chin-Laung Lei
Institute of Information Science, Academia Sinica
Proceedings of ACM Multimedia (2009): 491-500.

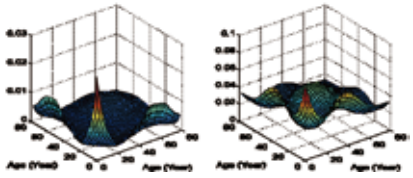
In the design of computer systems, user satisfaction is an important factor (if not the most important factor) in determining the effectiveness of a system's design. In this paper, we consider how to measure user satisfaction systematically and efficiently. Traditionally, researchers have used the Mean Opinion Score (MOS) to measure user satisfaction with multimedia content; that is, experiment participants are asked to rate certain multimedia content with an integer score from 1 to 5. Then, the average score is taken as the quality of the content. However, this approach is inefficient for three reasons: 1) rating content quality by an absolute score is a difficult process; 2) experiments are expensive in terms of monetary costs (rewards for experiment participants) and labor costs (supervision of participants); and 3) there are limitations in terms of time (it is difficult to hire participants at night), computer hardware, and space. To solve these three problems, we have proposed a novel experiment framework. By using paired comparison and an algorithm to verify the consistency of each participant's input, the proposed framework reduces the difficulty of obtaining quality judgments, and enables researchers to invite Internet users to participate in their quality assessment experiments. The evaluation results demonstrate the proposed framework enables researchers to outsource their experiments to an Internet crowd without risking the quality of the results; and, at the same time, obtain a higher level of participant diversity at a lower monetary cost.

Case Study	Participant Source	Total Cost (dollar)	# Rounds	# Person	Qualified Rate	Cost / Round (cent)	Time / Round (sec)	Avg. TSR
MP3 Bit Rate	Laboratory	50.97	1,440	10	67%	3.54	16	0.96
	MTurk	7.50	750	24	47%	1.00	9	0.96
	Community	1.03	1,470	93	54%	0.07	25	0.96
VoIP Quality	Laboratory	22.95	675	10	67%	3.40	16	0.98
	MTurk	3.00	300	15	74%	1.00	19	0.98
	Community	0.40	570	37	86%	0.07	24	0.98

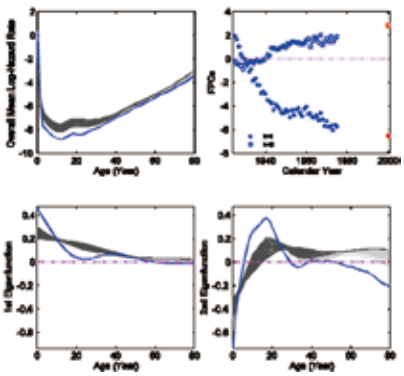
Modeling Hazard Rates as Functional Data for Analysis of Cohort Lifetables and Mortality Forecasts

Jeng-Min Chiou and Hans-Georg Müller
Institute of Statistical Sciences, Academia Sinica
Journal of the American Statistical Association **104** (2009): 572-585.

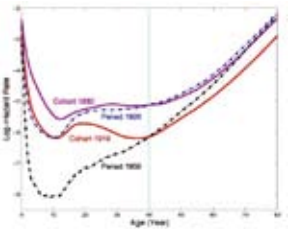
As world populations age, the analysis of demographic mortality data and demographic predictions of future mortality have met with increasing interest. The study of mortality patterns and the forecasting of future mortality with its associated impacts on social welfare, health care, and societal planning has become a more pressing issue. An ideal set of data to study patterns of change in long-term mortality is the well-known historical Swedish cohort mortality data, because of its high quality and long span of more than two centuries. We explore the use of functional data analysis to model these data and to derive mortality forecasts. Specifically, we address the challenge of flexibly modeling these data while including the effect of the birth year by regarding log-hazard functions, derived from observed cohort lifetables, as random functions. A functional model for the analysis of these cohort log-hazard functions, extending functional principal component approaches by introducing time-varying eigenfunctions, is found to adequately address these challenges. The associated analysis of the dependency structure of the cohort log-hazard functions leads to the concept of time-varying principal components of mortality. We then extend this analysis to mortality forecasting, by combining prediction of incompletely observed log-hazard functions with functional local extrapolation, and demonstrate these functional approaches for the Swedish cohort mortality data.



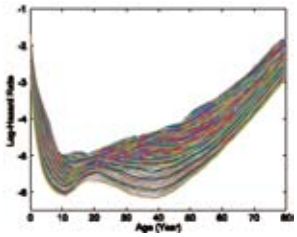
1) Estimated smooth covariance functions for cohorts born in 1800 (left) and 1920 (right).



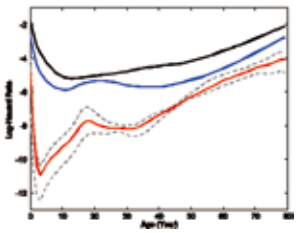
2) Predicted and forecast model components for time-varying principal modes of mortality.



3) Comparison of predicted log-hazard trajectories between approaches based on cohort and period lifetables.



4) Fitted log-hazard functions for cohorts 1751-1910.



5) Forecast of log-hazard rate for year 2000 cohort (95% confidence band) in comparison with fitted log-hazard rate of year 1800 and 1900 cohorts.

A Four-Gene Signature from NCI-60 Cell Line for Survival Predictionin Non-Small Cell Lung Cancer

Yi-Chiung Hsu, Shinsheng Yuan, Hsuan-Yu Chen, Sung-Liang Yu, Chia-Hsin Liu, Pin-Yen Hsu, Guani Wu, Chia-Hung Lin, Gee-Chen Chang, Ker-Chau Li and Pan-Chyr Yang

Institute of Statistical Science, Academia Sinica
Clinical Cancer Research **15** (2009): 7309-7315.

We identify novel invasion-associated genes from the nine lung cancer cell lines in the NCI-60 panel and validate the results thrice: twice with large-scale western lung cancer cohorts (n = 257 and 186) and once by our own oriental data (n = 69). The invasion-associated four-gene signature (ANKRD49, LPHN1, RABAC1, and EGLN2) derived from cellular level had good survival prediction power for NSCLC patients. Our study may provide clues to the mechanism of cancer metastasis and pave ways for effective clinical outcome prediction of lung cancer.

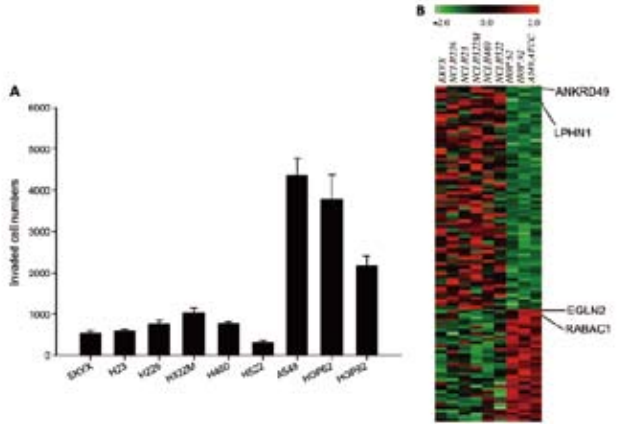


Table 2. Multivariate Cox regression analysis

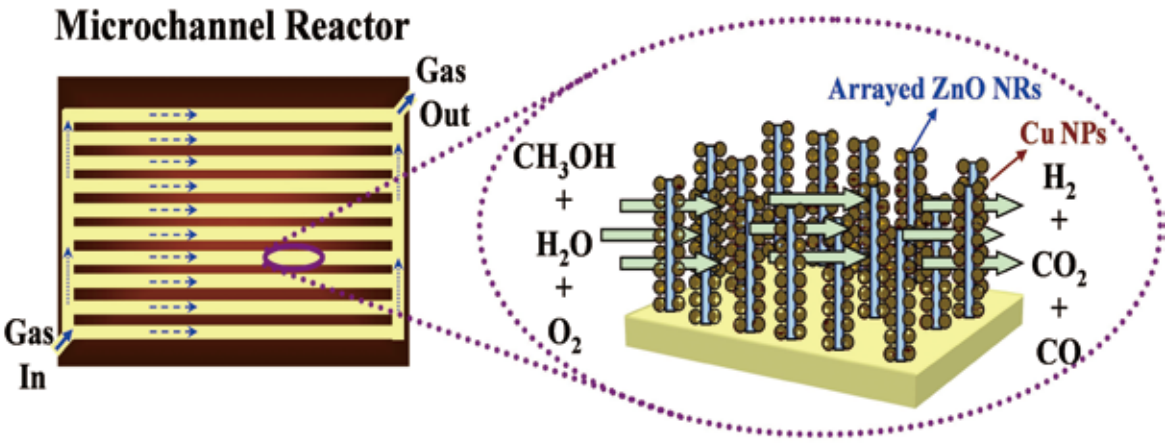
Variable	HR (95% CI)	P
A		
Original cohort (*n* = 111)		
Four-gene signature	2.346 (1.367-4.025)	0.002
Stage	1.466 (1.128-1.905)	0.004
VGHTC cohort (*n* = 69)		
Four-gene signature	2.354 (1.098-5.046)	0.028
Age	1.065 (1.014-1.119)	0.013
Stage	1.943 (1.332-2.835)	<0.001
B		
UM and HLM cohort (*n* = 257)		
Four-gene signature	1.480 (1.083-2.024)	0.014
Age	1.024 (1.008-1.041)	0.003
Stage	2.140 (1.775-2.58)	<0.001
CAN/DF and MSK cohort (*n* = 186)		
Four-gene signature	1.670 (1.042-2.678)	0.033
Age	1.029 (1.004-1.056)	0.025
Stage	2.161 (1.625-2.874)	<0.001
C		
Low risk in both signatures	1.000	
High risk in any signatures	5.140 (1.091-24.203)	0.038
High risk in both signatures	7.547 (1.599-35.623)	0.011
Stage	2.423 (1.388-4.229)	0.002
Age	1.081 (1.013-1.153)	0.019

NOTE: Four-gene signature for (A) Duke and VGHTC and (B) UM+HLM and CAN/DF+MSK NSCLC patients. (C) Multivariate Cox regression of concomitant four-gene and five-gene signatures as prognostic predictors in overall survival of VGHTC patients. Variables were selected through stepwise selection method.

Nanostructured ZnO@Cu as Catalyst for Microreformers

Y.G. Lin, Y.K. Hsu, Y.K. Lin, S.Y. Chen, L. C. Chen, and K. H. Chen
Institute of Atmoic and Molecular Sciences
Angewandte Chemie International Editional **48** (2009): 7586-7590.

Superb catalytic performance of the Cu NP-decorated ZnO NR nano-structures for methanol reforming in a microreformer has been reported. The breakthrough can be attributed to the larger surface area and enhanced dispersion of fine Cu NPs, formation of microstrain, the modification of electronic structure of Cu species, and the existence of SMSI effect. These results present new opportunities in the development of highly active and selective NR@NP nanoarchitectures for a wide range of catalytic reaction systems. This work has been published in *Angewandte Chemie International Editional* (2009).



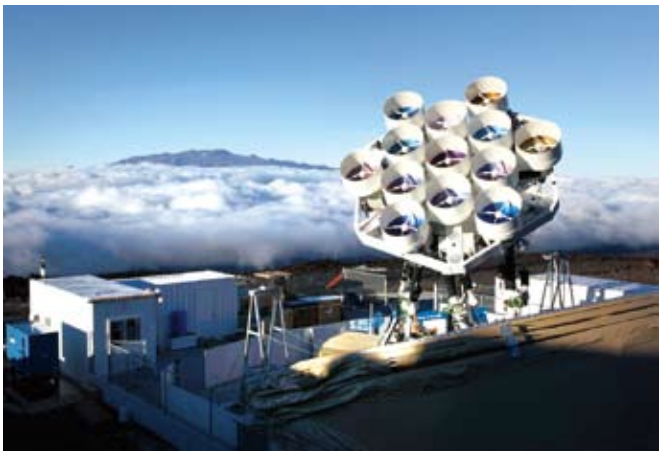
Schematic diagram of the novel catalyst ZnO NR@Cu NP arrays grown on the inner surface of microchannel reactor.

The Yuan-Tseh Lee Array for Microwave Background Anisotropy

Paul T. P. Ho, Pablo Altamirano, Chia-Hao Chang, et al.
Institute of Astronomy and Astrophysics, Academia Sinica
Astrophysical Journal **694** (2009): 1610-1618.

The AMiBA (Ho et al. 2009) was dedicated on Mauna Loa in Hawaii during October 2006. This frontier instrument for cosmology is led, designed, constructed, and operated by the ASIAA. It is the first and only telescope dedicated to studying cosmology in Asia.

Located at 3400m elevation, the AMiBA has a very sensitive view of the structures of the cosmic microwave background (CMB) radiation that accompanied the initial expansion of the Universe. The CMB structures, as the remnant radiation from the Big Bang, carry the information on the structure of the early universe, when the radiation separated from the matter. The AMiBA also detects and maps distant clusters of galaxies via their inverse Compton scattering of the CMB photons. These signatures of the galaxy clusters, which show up as a slight cooling of the radiation at a wavelength of 3mm, known as the Sunyaev Zeldovich Effect (SZE), are independent of the distance to the clusters. This is therefore a very powerful way to map the structures of the distant Universe which would otherwise be too faint to be detectable.



AMiBA was upgraded from its 7-element 0.6m reflector configuration to its new 13-element 1.2m reflector configuration during 2009, and resumed operations on Mauna Loa in Hawaii.
The SMA is Located on Mauna Kea, which is seen in the distance across the cloud tops.

The array of reflectors, mounted on the hexapod mount, operates at 3mm wavelength which is an ideal wavelength region for study because of the minimum contribution from Galactic and extragalactic synchrotron radiation as well as Galactic dust emission.

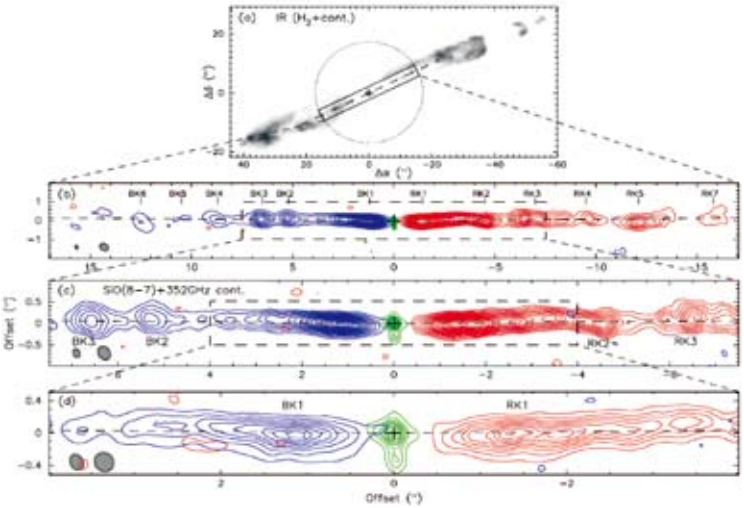
The first AMiBA results were published in a series of 7 papers in 2009, including this one which introduces the instrument. Since the publication of this paper in 2009, we completed the expansion of the AMiBA to its 13-element configuration with 1.2m reflectors. This increased the collecting area by a factor of 8, and the speed by about a factor of 60. In the next three years, we will be concentrating on science operations while we develop broader bandwidth response for the receivers.

Rotation and Outflow Motions in the Very Low-Mass Class 0 Protostellar System HH 211 at Subarcsecond Resolution

Chin-Fei Lee, Naomi Hirano, Aina Palau, Paul T. P. Ho, Tyler L. Bourke, Qizhou Zhang and Hsien Shang
Institute of Astronomy and Astrophysics, Academia Sinica
Astrophysical Journal **699** (2009): 1584-1594.

The Submillimeter Array (SMA) continues to produce important forefront scientific results during 2009. It is a joint project between the Smithsonian Astrophysical Observatory and the Academia Sinica Institute of Astronomy and Astrophysics, and is funded by the Smithsonian Institution and the Academia Sinica. It is an 8-element interferometer that has been operating on top of Mauna Kea in Hawaii since Nov 2003. It is currently the only interferometer operating at submillimeter wavelengths in the world, probing warm molecular gas and dust in the universe at the highest angular resolution.

One of our highlights this year is the detection of the very slow rotation (spin) of the protostellar jet in the low-mass protostellar system HH211. The very high angular resolution of the SMA allowed for the first time the detection of this motion, which shows that the ejection must arise very close to the central protostar (baby star). This result has pushed the launching radius of the jet to be close to that predicted in the X-wind model as opposed to the disk-wind model, which are the two competing models for jet launching.



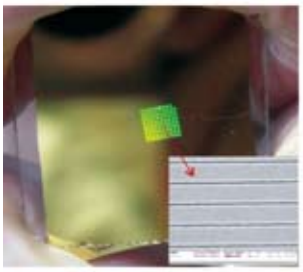
(a) Infrared image of HH 211 adopted from Hirano et al. (2006). The dotted circle outlines our observed region with the SMA. The dashed line indicates the jet axis. The cross marks the position of the protostar SMM1 that powers the jet. (b)–(d) Again, the cross marks the position of the protostar SMM1. Green contours show the thermal emission from a dusty envelope-disk around the protostar. Red and blue contours show the SiO gas emission from the receding and approaching sides of the jet, respectively. The images are rotated by 26°6 clockwise. The angular resolutions indicated in the lower left corners are 0.46" × 0.36" in (b), 0.35" × 0.25" in (c), and 0.24" × 0.22" in (d).

Intensity Sensitivity of Gold Nanostructures and Its Application for High-throughput Biosensing

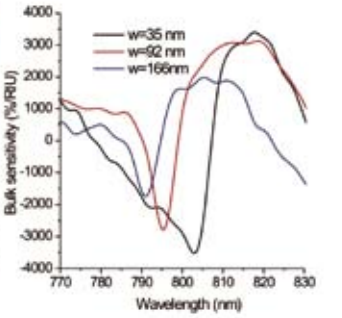
Kuang-Li Lee, Shu-Han Wu and Pei-Kuen Wei
Research Center for Applied Sciences, Academia Sinica
Optics Express **17** (2009): 23104-23113.

DNA Microarrays are important technologies in genomic research. Modern microarrays have to use fluorescent labeling. The labeling not only substantially increases the cost of using microarrays, but also meets some difficulties in post-genomic research in the protein-DNA and protein-protein interactions. This work presents a high-sensitivity, high-throughput microarrays that meet the requirements for post-genomic studies.

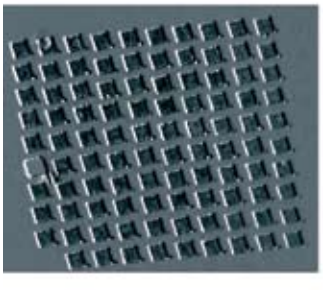
Our method is based on the nano-plasmonic effect in periodic metallic nanostructures. Recent studies in nano-optics show that gold nanostructures fabricated on a glass slide can be used as high-sensitive label-free biosensors. The size of a sensor is the same as those in DNA microarray. High throughput detection is achievable by uisng these nanostructures. We made gold nanoslit and nanohole arrays, excited surface plasmons on the microarray surface and detected their intensity changes in the extraordinary transmission. The finite-difference time-domain calculations and measurement results indicate that the nanoslit array has an intensity sensitivity much higher than the nanohole array due to its narrower resonant bandwidth. In addition, the sensitivity is increased as the slit width decreases. For 35 nm slit width, the intensity sensitivity reaches to ~ 4000 %/RIU, two times larger than the slit width larger than 150 nm. Using the intensity changes, we demonstrate a 10×10 microarray for real-time measurements of antigen-antibody and DNA-DNA interactions.



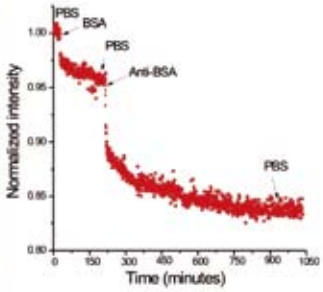
1) 10x10 nanoslit arrays with 50 nm slit width and 600 nm period on a 150 nm gold film.



2) The measured sensitivities for different slit widths.



3) The transmission optical image of the nanoslit arrays, measured at 830nm wavelength.



d) The real-time intensity change of a single array during the antigen-antibody interaction. PBS: buffer, BSA: antigen, Anti-BSA: antibody.

Flexible Fullerene Field-Effect Transistors Fabricated Through Solution Processing

Chao-Feng Sung, Dhananjay Kekuda, Li Fen Chu, Yuh-Zheng Lee, Fang-Chung Chen, Meng-Chyi Wu, and Chih-Wei Chu

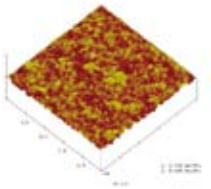
Research Center for Applied Sciences, Academia Sinica

Advanced Materials **21** (2009): 1-5.

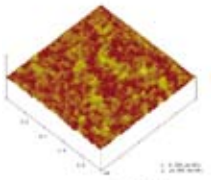
We fabricated fullerene C60 thin-film transistors (TFTs) by using solution process. The solution-processed C60 thin film showed amorphous phase, which was determined with XRD and AFM. It was observed that the crystalline nature of C60 is a not an essential condition to achieve a highest field-effect mobility. Although crystallinity generally favors an enhancement in mobility, the opposite trend is observed in our case, presumably because of pronounced grain-boundary effects, which act as carrier scattering centers across the drain–source interface. Because such scattering seriously affects transport across the drain–source interface, the mobility decreases at high temperatures. Solution-processed C60 TFTs exhibited large carrier mobility of more than 0.21 cm^2/Vs, on/off ratio of exceeding $5x10^5$. Our results demonstrate that complementary circuits can be fabricated using solution-processed small-molecule organic semiconductors.

Atomic Force Microscopy

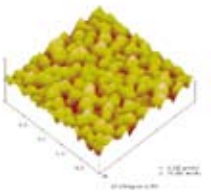
(a). 50oC RMS : 0.28 nm



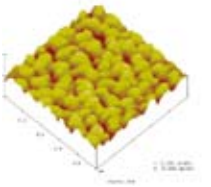
(b). 90oC RMS : 0.28 nm



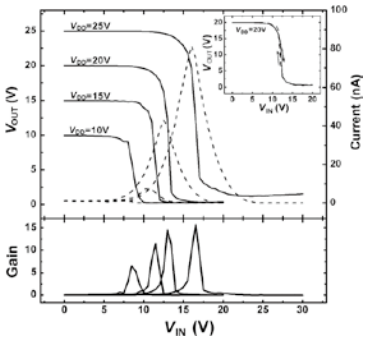
(c).130oC RMS : 7.08 nm



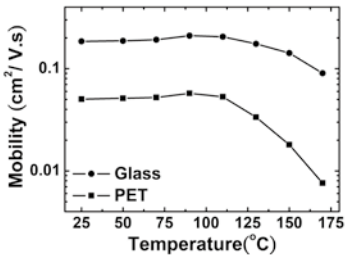
(d). 150oC RMS = 12.45 nm



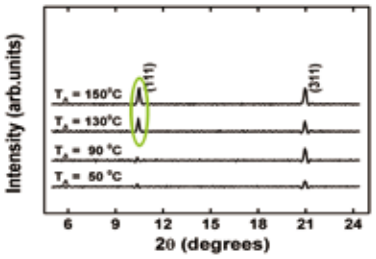
Organic complementary inverter incorporating pentacene and C60



Mobilities of OTFTs featuring C60 annealed



X-Ray Diffractometer

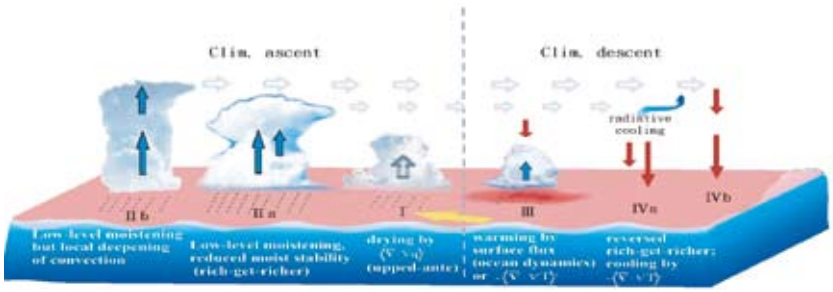


Evaluating the "Rich-Get-Richer" Mechanism in Tropical Precipitation Change under Global Warming

Chia Chou, J David Neelin, Chao-An Chen and Jien-Yi Tu

Research Center for Environmental Changes, Academia Sinica

Journal of Climate **22** (2009): 1982-2005.



A schematic diagram summarizing the main mechanisms of tropical precipitation change in 6 subregions. In area II, the rich-get-richer mechanism tends to yield increased precipitation associated with moisture increase in a climatological convergence region, however in region IIa this is enhanced by convergence feedback associated with reduced moist stability, while in region IIb, the increased depth of convection more than compensates moisture effects causing a weakening of the ascent and reducing precipitation anomalies. Region I has negative precipitation anomalies due substantially to the upped-ante mechanism, in which inflow from less-moistened descent regions reduces the fraction of time that the convective threshold is met, thus tending to shift the margin of the convergence zone. Region III descent zone precipitation increases are associated with either surface fluxes supported by ocean dynamics, or warm advection. Descent zone precipitation decreases can occur by the rich-get-richer mechanism (with sign reversed) or balances involving cold advection.

Examining tropical regional precipitation anomalies under global warming in 10 coupled global climate models, several mechanisms are consistently found. The tendency of rainfall to increase in convergence zones with large climatological precipitation, and to decrease in subsidence regions—the rich-get-richer mechanism—has previously been examined in different approximations by Chou and Neelin, and Held and Soden. The effect of increased moisture transported by the mean circulation (the "direct moisture effect" or "thermodynamic component" in respective terminology) is relatively robust, while dynamic feedback is poorly understood and differs among models. The argument outlined states that the thermodynamic component should be a good approximation for large-scale averages; this is confirmed for averages across convection zones and descent regions, respectively. Within the convergence zones, however, dynamic feedback can substantially increase or decrease precipitation anomalies. Regions of negative precipitation anomalies within the convergence zones are associated with local weakening of ascent, and some of these exhibit horizontal dry advection associated with the "upped-ante" mechanism. Regions of increased ascent have strong positive precipitation anomalies enhanced by moisture convergence.

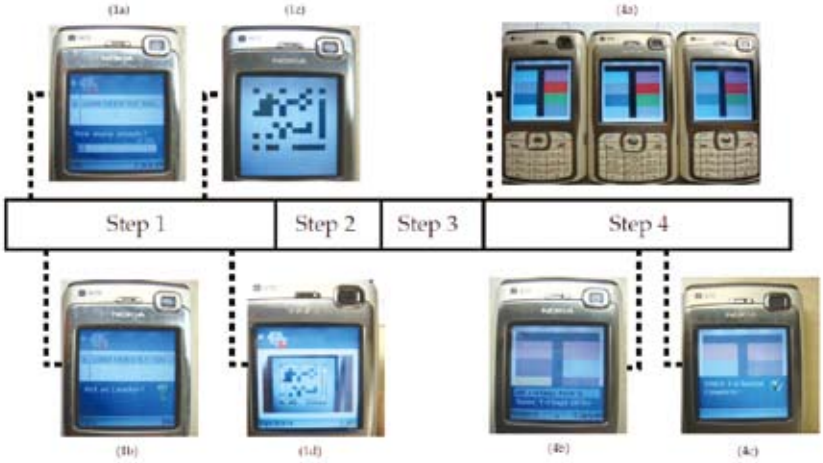
This dynamic feedback is consistent with reduced gross moist stability due to increased moisture not being entirely compensated by effects of tropospheric warming and a vertical extent of convection. Regions of reduced ascent with positive precipitation anomalies are on average associated with changes in the vertical structure of vertical velocity, which extends to higher levels. This yields an increase in the gross moist stability that opposes ascent. The reductions in ascent associated with gross moist stability and upped-ante effects, respectively, combine to yield reduced ascent averaged across the convergence zones.

SPATE: Small-group PKI-less Authenticated Trust Establishment

Y.-H. Lin, A. Studer, H.-C. Hsiao, E. L.-H. Kuo, J. McCune, K.-H. Wang, M. Krohn, P.-L. Lin, A. Perrig, H.-M. Sun, B.-Y. Yang

Research Center for Information Technology Innovation / Institute of Information Science, Academia Sinica

Appeared in *Proc.* MobiSys 2009 (7th Int'l Conference on Mobile Systems, Applications, and Services, June 22-25, Wroclaw, Poland), pp. 1-14, best paper award of the conference. To appear in *IEEE Transactions on Mobile Computing.*



Execution Flow of SPATE Exchange. Step 1: Selection and Counting, Step 2: Commitment, Step 3: Distribution, Step 4: Verification. We need Steps 1b, 1c and 1d because Bluetooth does not support broadcast.

Establishing trust between a group of individuals is a difficult problem. We may simplistically reduce trust establishment to exchange of authenticated public keys. But it remains a very difficult problem. Prior works often assume trusted infrastructure or require an individual to trust unknown entities. The iCAST project by TWISC and CMU's CyLab proposed GAnGS (Gather, Authenticate,'n Group Securely), the first practical and scalable scheme implemented that used physical proximity as a token of trust. However, it provides relatively low probabilistic guarantees of authenticity (95% in some realistic settings).This work also by the iCAST project presents SPATE, a primitive that allows users to establish trust via device mobility and physical interaction. Once the SPATE protocol runs to completion, its participants' mobile devices have authentic data that their applications can use to interact securely (i.e., the probability of a successful attack is 2^{-24}). For this work, we leverage SPATE as part of a larger system to facilitate efficient, secure, and user-friendly collaboration via email, file-sharing, and text messaging services. We have implemented SPATE on iPhones and much less powerful Nokia N70 smartphones. The N70 implementation allows users to establish trust in small groups of up to eight users in less than one minute. The bundled Secure SMS system is a "cool" operation that is easy to operate. Secure SMS and the other example SPATE applications provide increased security with little overhead noticeable to users once keys are established.

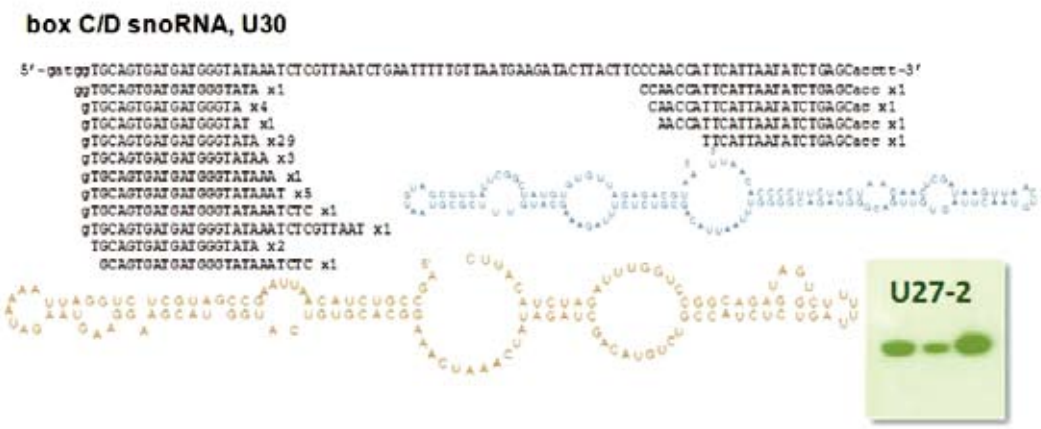
Mining Small RNA Sequencing Data: A New Approach to Identify Small Nucleolar RNAs in Arabidopsis

Ho-Ming Chen and Shu-Hsing Wu

Institute of Plant and Microbial Biology, Academia Sinica

Nucleic Acids Research **37** (2009): e69.

Small nucleolar RNAs (snoRNAs) are non-coding RNAs that direct 2' -O-methylation or pseudouridylation on ribosomal RNAs or spliceosomal small nuclear RNAs. These modifications are needed to modulate the activity of ribosomes and spliceosomes. The analyses of small RNA sequencing data revealed the enrichment of small RNAs at Arabidopsis snoRNA termini. We reported the development of a computational approach to identify snoRNAs on the basis of this characteristic (Nucleic Acids Research 2009). This study demonstrated that the use of small RNA sequencing data can increase the complexity and the accuracy of snoRNA annotation.



An IcmF Family Protein, $ImpL_M$, Is an Integral Inner Membrane Protein Interacting with $ImpK_L$, and Its Walker A Motif Is Required for Type VI Secretion System-Mediated Hcp Secretion in *Agrobacterium tumefaciens*

Lay-Sun Ma, Jer-Sheng Lin, and Erh-Min Lai
Institute of Plant and Microbial Biology, Academia Sinica
Journal of Bacteriology **191** (2009):4316-4329.

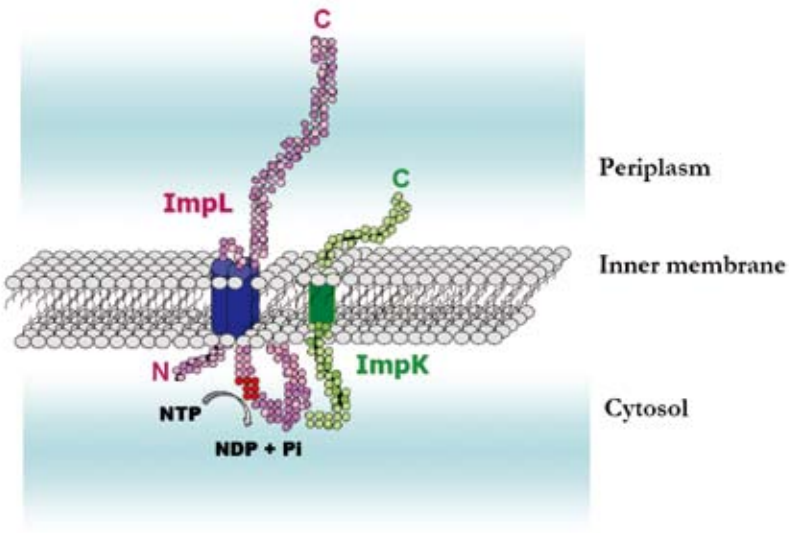
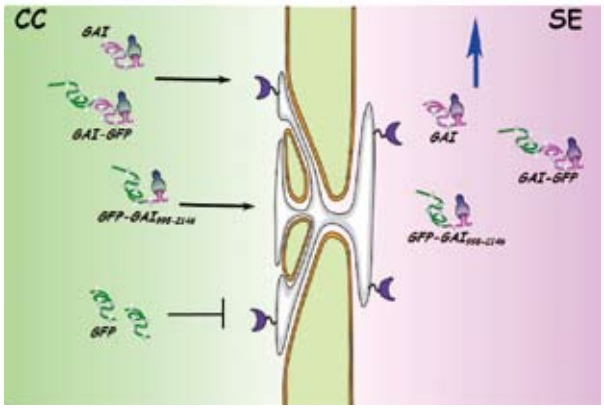


Figure. The study on the topology and interactions of the IcmF- and IcmH-family proteins ImpL and ImpK, which are two essential components of the *A. tumefaciens* T6SS, provided compelling evidence that both proteins are integral inner membrane proteins and interact with each other via their N-terminal cytoplasmic domains. ImpL may function as an NTP-binding/NTPase to mediate T6SS machine assembly and/or substrate secretion.

Pathogenic gram-negative bacteria employ various protein secretion systems formed by macromolecular complexes to deliver proteins or protein-DNA complexes across the bacterial membranes. Previous work in Erh-Min Lai's laboratory has identified a novel but conserved protein secretion system, named type VI secretion system (T6SS), in *Agrobacterium tumefaciens* (Wu et al., 2008, J Bacteriology), a plant pathogenic bacterium uniquely adapted for conducting plant transformation by horizontal transmission of DNA. In this study, we further characterized the topology and interactions of the IcmF- and IcmH-family proteins $ImpL_M$ and $ImpK_L$, which are two essential components of the *A. tumefaciens* T6SS. We provided compelling evidence that both proteins are integral inner membrane proteins and interact with each other via their N-terminal cytoplasmic domains. Importantly, we demonstrated the first genetic evidence that T6SS IcmF protein may function as an NTP-binding/NTPase to mediate T6SS machine assembly and/or substrate secretion. We suggested that the inner membrane localization of the T6SS IcmF–IcmH complex may serve as a scaffold for linking the T6SS cytoplasmic and outer membrane components through the peptidoglycan layer to build a transmembrane protein channel for substrate translocation.

The Sequences of Arabidopsis GA-INSENSITIVE RNA Constitute the Motifs that Are Necessary and Sufficient for RNA Long-distance Trafficking

Nien-Chen Huang and Tien-Shin Yu
Institute of Plant and Microbial Biology, Academia Sinica
Plant Journal **59** (2009): 921-929.

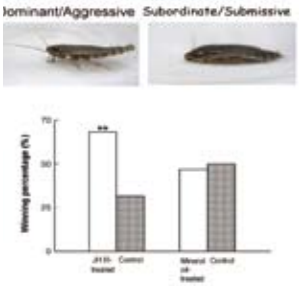


In higher plants, a number of physiological processes are regulated by systemic RNA signaling molecules. This phloem-mediated remote-control system provides specific and efficient regulation to fine-tune many plant developmental programs. However, the molecular mechanism underlying RNA long-distance movement remains to be elucidated. To this end, we examined the long-distance movement of GA-insensitive (GAI) RNA by Arabidopsis inflorescence grafting and RT-PCR analysis. Our results demonstrated that the RNA long-distance movement occurred only in specific transcripts. In addition, the sequences of GAI RNA are necessary and sufficient to target GREEN FLUORESCENT PROTEIN (GFP) RNA for long-distance movement, which indicates that the trafficking of GAI RNA is mediated by specific RNA motifs. Further analyses revealed that the motifs at coding sequences and 3' UTR of GAI RNA play important roles during RNA movement. In addition, the RNA's structure rather than its specific sequence may also be important in GAI RNA trafficking. However, the secondary structure of GAI RNA is not the only factor to target RNA for long-distance movement, because the recovery of secondary structure of movement-defective GAI RNA only partially rescued RNA movement. Taken together, our results show that long-distance movement of non-cell autonomous RNA operates by specific RNA mobile element.

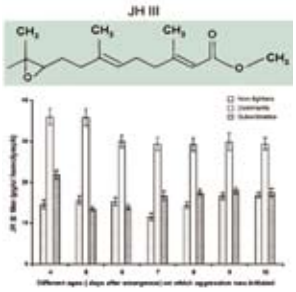
Juvenile Hormone and the Ontogeny of Cockroach Aggression

Rong Kou, Szu-Ying Chou, Shu-Chun Chen, Zachary Y. Huang
Institute of Cellular and Organismic Biology, Academia Sinica
Hormones and Behavior **56** (2009): 332–338.

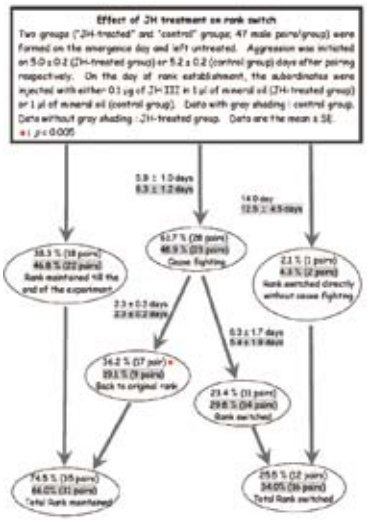
In N. cinerea, newly emerged males usually show no aggressiveness towards each other and aggression is only initiated after several days of close contact. To investigate the development of aggression from an early age, in the present study, newly emerged males were paired to investigate the relationship between JH levels and aggression. The results showed that injection of JH III significantly increased the probability of the young males being fight winners. In each age group in which aggression was initiated, the dominants had significantly higher JH levels than either the subordinates or the same aged non-fighters. JH injection of subordinates on the day of rank establishment had no effect on the probability of rank switch. These results indicate that, (i) in newly emerged male pairs, JH plays a decisive role in rank establishment and the fact that dominant status is significantly associated with a higher JH titer and subordinate status with a lower JH titer is consistent with the basic principle of the challenge hypothesis, and (ii) after rank establishment, the lack of effect of JH treatment on rank change is consistent with the idea of "social inertia" in vertebrates.



1) Percentage of winners with and without JH III treatment. Males were treated and paired on the 2nd day after emergence. Two groups of pairs were formed. In the JH IIItreated group, one of the males in each pair was injected with 1 μl of JH III (0.1 μg in 1 μl of mineral oil). In the mineral oil-treated group, one of the males in each pair was injected with 1 μl of mineral oil. **: pb0.0001 between the JH III-treated male and its control.



2) Comparison of JH III titers in dominants, subordinates, and non-fighters in each age group.Maleswere paired on the emergence day. On the day fighting was initiated, hemolymph was collected fromindividualdominants, subordinates, and the same agedindividuals innon-fightingmale pairs.Datawere log transformed for statistical analysis and back transformed for graphical depiction.Within each age group, the sample size for the non-fighters, dominants and subordinates was 18–20 respectively. The values are the mean±SE.

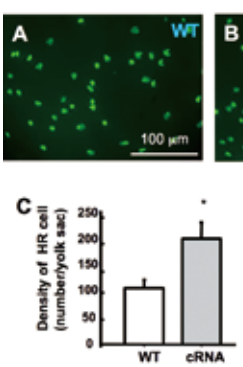


3) Effect of JH III treatment on the dominant/subordinate relationship after rank establishment. The days shown on each line are the days between the previous event and the next. Males were paired on their first emergence day. Two groups (47 male pairs/group) were formed. On the day of initiation of aggression (rank establishment), the subordinates in the JH group were injected with 0.1 μg of JH III (in 1 μl mineral oil) and those in the control group injected with 1 μl of mineral oil. After treatment, the dominant/subordinate relationship in all male pairs was observed for 30 consecutive days or until rank switch.

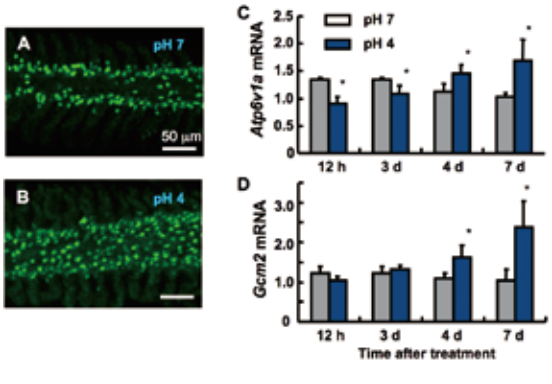
The Transcription Factor, Glial Cell Missing 2, is Involved in Differentiation and Functional Regulation of H^+-ATPase-rich Cells in Zebrafish (Danio rerio)

Wei-Jen Chang, Jiun-Lin Horng, Jia-Jiun Yan, Chung-Der Hsiao, Pung-Pung Hwang
Institute of Cellular and Organismic Biology, Academia Sinica
American Journal of Physiology-Regulatory, Integrative and Comparative Physiology **296** (2009):1192-1201.

The present study explored a cellular mechanism behind the functional regulation in zebrafish during acclimation to an acidic environment. H^+-ATPase-rich (HR) cells in zebrafish are known to be involved in acid secretion and Na^+ uptake mechanisms in zebrafish gills/skin. We studied the roles of Drosophila glial cell missing (*gcm*), a cell fate-related transcription factor, in the differentiation and functional regulation of zebrafish HR cells. Double fluorescence in situ hybridization demonstrated specific colocalization of zebrafish *gcm2* (*zgcm2*) mRNA in HR cells in zebrafish embryos. Knockdown of zgcm2 with a specific morpholino oligonucleotide caused the complete disappearance of HR cells with a concomitant decrease in H^+ activity at the apical surface of HR cells. Gain-of-function experiment further proved that *zgcm2* controls the differentiation of HR cells. Both the expression of H^+-ATPase subunit A (*zatp6v1a*) and zgcm2 in zebrafish gills were increased after transfer to acidic fresh water for 4 days. In conclusion, functional regulation of HR cells is probably achieved by enhancing cell differentiation via zGCM2 activation. (selected as an "Editorial Focus" by AJP)



1) Over-expression of *zgcm2* increased the density of HR cells in zebrafish embryos.



2) Acclimation to acidic environment caused the increases of HR cell density (A, B) and *zatp6v1a* and *zgcm2* transcripts (C, D) in zebrafish gills.

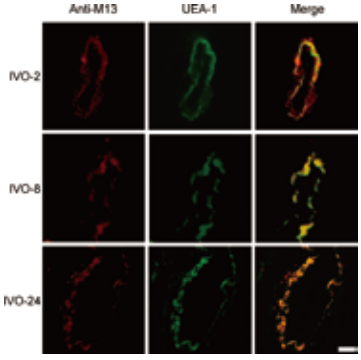
Anti-angiogenic Targeting Liposomes Increase Therapeutic Efficacy of Solid Tumors

De-Kuan Chang, Chien-Yu Chiu, Szu-Yao Kuo, Wei-Cuan Lin, Albert Lo, Yi-Ping Wang, Pi-Chun Li and Han-Chung Wu

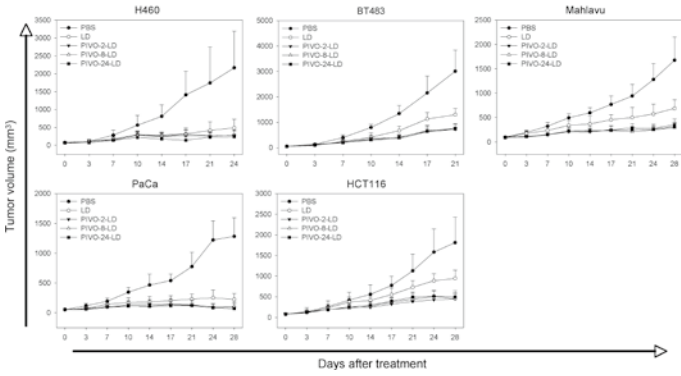
Institute of Cellular and Organismic Biology, Academia Sinica

Journal of Biological Chemistry **284** (2009): 12905-12916.

It is known that solid tumors recruit new blood vessels to support tumor growth, but the molecular diversity of receptors in tumor angiogenic vessels might also be used clinically to develop better targeted therapy. Several novel peptides were identified as being able to recognize tumor vasculature but not normal blood vessels in mice bearing human tumors and in surgical specimens of various human cancers. The peptide-linked liposomes containing fluorescent substance were capable translocating across plasma membrane through endocytosis. With the conjugation of peptides and liposomal doxorubicin, the targeted drug delivery systems enhanced the therapeutic efficacy of the chemotherapeutic agent against human cancer xenografts by decreasing tumor angiogenesis and increasing cancer cell apoptosis. Furthermore, the peptide-mediated targeting liposomes improved the pharmacokinetics and pharmacodynamics of the drug they delivered compared with non-targeting liposomes or free drugs. Our results indicate that the tumor-homing peptides can be used specifically target tumor vasculature and have the potential to improve the systemic treatment of patients with solid tumors. Academia Sinica has licensing-out this patent to a biotechnology company for development of anti-cancer drugs.



1) The tumor homing peptides target tumor vasculature of human cancer.



2) IVO-conjugated targeting liposomes increased the therapeutic efficacy of drug against human cancer xenografts.

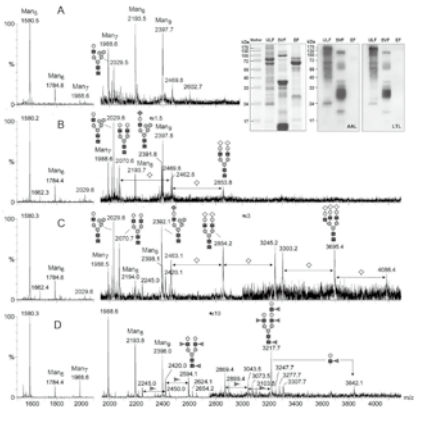
Glycomics and Proteomics Analyses of Mouse Uterine Luminal Fluid Revealed a Predominance of Lewis Y and X Epitopes on Specific Protein Carriers

Chu-Wei Kuo, Chin-Mei Chen, Ying-Chu Lee, Sin-Tak Chu, and Kay-Hooi Khoo

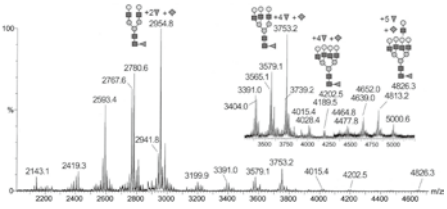
Institute of Biological Chemistry, Academia Sinica

Molecular and Cellular Proteomics **8** (2009): 325-342.

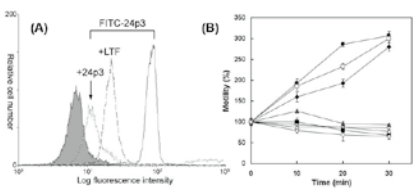
Sperm motility and maturation are known to be affected by a host of factors encountered en route in both male and female genital tracts prior to fertilization. Using a concerted proteomics and glycomics approach with advanced mass spectrometry-based glycan sequencing capability, we show in this work that 24p3, an abundant mouse uterine luminal fluid (ULF) glycoprotein also called lipocalin 2 (Lcn2), is highly fucosylated in the context of carrying multiple Lewis X and Y epitopes on complex type N-glycans at its single glycosylation site. The predominance of Lewis X/Y along with Neu5Ac2–6 sialylation was found to be a salient feature of the ULF glycome, and several other protein carriers were additionally identified including the highly abundant lactotransferrin. A comparative glycomics analysis of the male genital tract fluids revealed that there is a gradient of glycomic complexity from the cauda to caput regions of the epididymis (EF), varying from high mannose to sialylated complex type N-glycans but mostly devoid of fucosylation. The seminal vesicle fluid (SVF) glycome, on the other hand, carries equally abundant multimeric Lewis X structures but is distinctively the Lewis Y epitope typifying the glycome of female ULF. One-dimensional shotgun proteomics analysis identified over 40 proteins in the latter, many of which are reported for the first time, and a majority are notably involved in immune defense and antigen processing. Further sperm binding and motility assays suggest that the Lewis X/Y epitopes do contribute to the sperm motility-enhancing activity of 24p3, whereas lactotransferrin is largely inactive in this context despite being similarly glycosylated. These findings underline the importance of glycoproteomics in delineating both the specific glycan structures and their carriers in assigning glycobiological functions.



2) Terminal Lewis Y epitope is a characteristic of female ULF glycome but not that of male SVF and EF



1) MALDI MS profiles from Lcn2 indicated N-glycans with multi- fucosylation and monosialylation



3) Lewis X/Y epitopes contribute to the sperm motility-enhancing activity of 24p3

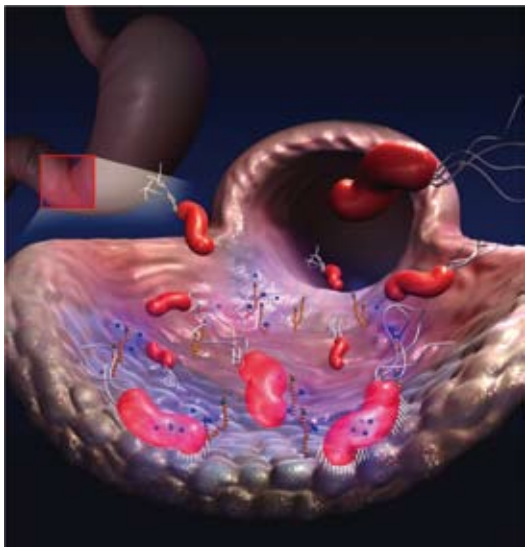
Role for α L-fucosidase in the Control of *Helicobacter Pylori*-infected Gastric Cancer Cells

Ta-Wei Liu, Ching-Wen Ho, Hsin-Hung Huang, Sue-Ming Chang, Shide D. Popat, Yi-Ting Wang, Ming-Shiang Wu, Yu-Ju Chen, and Chun-Hung Lin

Institute of Biological Chemistry, Academia Sinica

Proceedings of the National Academy of Sciences of the U.S.A **106** (2009): 14581-6.

Dr. Chun-Hung Lin and colleagues from the Institute of Biological Chemistry discovered that a specific human fucosidase (FUCA2) play a critical role in the interplay between gastric epithelial cells and *Helicobacter pylori*. The findings support the idea that FUCA2 is potential target for clinical diagnosis and therapeutic intervention. FUCA2 was released when gastric epithelial cells were infected by *H. pylori*. In addition to affecting the adhesion of *H. pylori* to the stomach wall, as well as its growth and its virulence, the release of FUCA2 is linked to duodenal ulcer and gastric carcinoma. The blockade of the FUCA2 function would be an effective strategy to eradicate the *H. pylori* infection. Interestingly, L-fucose, the product of the fucosidase-catalyzed reaction, was transferred to *H. pylori* where it become an extra source of energy and carbon and also promoted the release of Lewis antigens (a class of oligosaccharides) on the bacteria's surface. The discovery of this sugar-degrading enzyme and its interaction with *H. pylori* will now be able to be used by researchers as a target for new therapies for *H. pylori* related gastric diseases and also help in diagnosis.



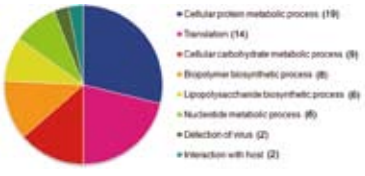
Phosphoproteomics of *Klebsiella pneumoniae* NTUH-K2044 Reveals a Tight Link between Tyrosine Phosphorylation and Virulence

Miao-Hsia Lin, Tung-Li Hsu, Shu-Yu Lin, Yi-Jiun Pan, Jia-Tsrong Jan, Jin-Town Wang, Kay-Hooi Khoo and Shih-Hsiung Wu

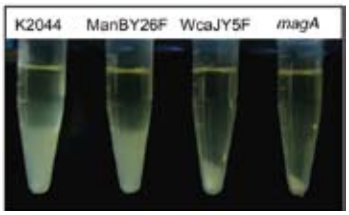
Institute of Biological Chemistry, Academia Sinica

Molecular Cellular Proteomics **8** (2009); 2613-23.

Encapsulated *Klebsiella pneumoniae* is the predominant causative agent of pyogenic liver abscess, an emerging infectious disease often complicates with metastatic meningitis or endophthalmitis. The capsular polysaccharide on *K. pneumoniae* surface is determined as the key to virulence. Although the regulation of capsular polysaccharide biosynthesis is largely unclear, it was found protein tyrosine kinases and phosphatases are involved. Therefore, the identification and characterization of such kinases, phosphatases and their substrates would advance our knowledge of the underlying mechanism in capsule formation and could contribute to the development of new therapeutic strategies. Here, we analyzed the phosphoproteome of *K. pneumoniae* NTUH-K2044 with a shotgun approach and identified 117 unique phosphopeptides along with 93 *in vivo* phosphorylated sites corresponding to 81 proteins. According to gene ontology analysis with Blast2GO, most identified phosphorylated proteins belonged to house-keeping genes. Interestingly, three of the identified tyrosine phosphorylated proteins, namely protein tyrosine kinase (Wzc), phosphomannomutase (ManB) and undecaprenolphosphate glycosyltransferase (WcaJ), were found to distribute in the *cps locus* and thus were speculated to involve in the converging signal transduction of capsule biosynthesis. Consequently, we decided to focus on the lesser studied ManB and WcaJ for mutation analysis. And as a result, the capsular polysaccharides on WcaJ mutant (WcaJY5F) was dramatically reduced quantitatively and the LD_{50} increased by 200 fold in mouse peritonitis model comparing to the wild-type strain. While the capsular polysaccharides of ManB mutant (ManBY26F) showed no difference in quantity and the LD_{50} increased by merely 6 fold in mice test. Our study provided a clear trend that WcaJ tyrosine phosphorylation can regulate the biosynthesis of capsular polysaccharides and result in the pathogenicity of *K. pneumoniae* NTUH-K2044.



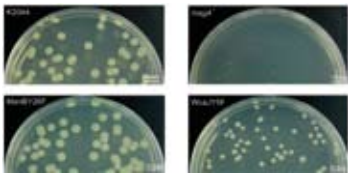
1) The annotation of biological process of the identified phosphoproteins.



3) The capsule-deficient WcaJY5F mutant showed a more compact pellet, in contrast to K2044 and ManBY26F.

Strain	LD_{50} (CFU)
K2004	250
WcaJY5F	5×10^4

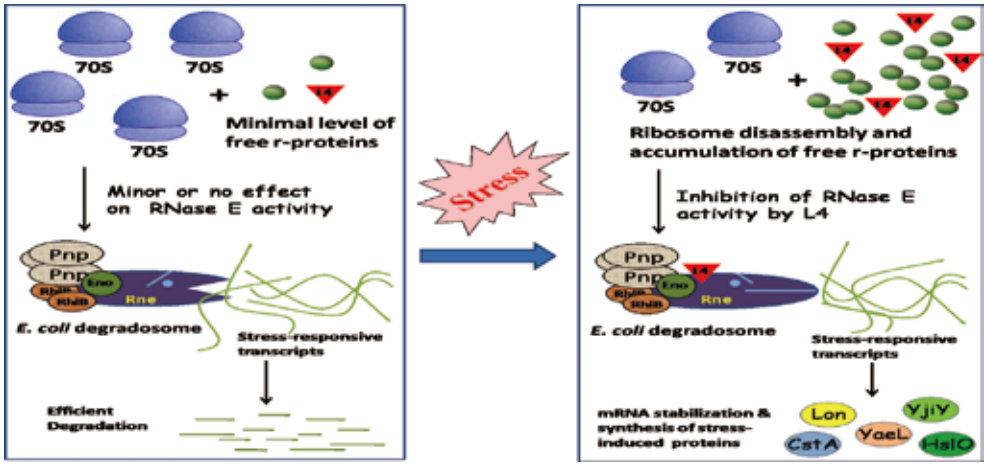
4) The LD_{50} of WcaJY5F mutant showed a significant 200-fold higher LD_{50} comparing to the wild-type positive control (K2044).



2) WcaJY5F mutant exhibited reduction in colony size with decreased CPS amount.

Regulation of Ribonuclease E Activity by the L4 Ribosomal Protein of *Escherichia coli*

Dharam Singh, Ssu-Jean Chang, Pei-Hsun Lin, Olga V. Averina, Vladimir R. Kaberdin, and Sue Lin-Chao
Institute of Molecular Biology, Academia Sinica
Proceedings of the National Academy of Sciences of the U.S.A. **106** (2009): 864–869.



Whereas ribosomal proteins (r-proteins) are known primarily as components of the translational machinery, certain of these r-proteins have been found to also have extraribosomal functions. Here we report the novel ability of an r-protein, L4, to regulate RNA degradation in *Escherichia coli*. We show by affinity purification, immunoprecipitation analysis, and *E. coli* two-hybrid screening that L4 interacts with a site outside of the catalytic domain of RNase E to regulate the endoribonucleolytic functions of the enzyme, thus inhibiting RNase E-specific cleavage in vitro, stabilizing mRNAs targeted by RNase E in vivo, and controlling plasmid DNA replication by stabilizing an antisense regulatory RNA normally attacked by RNase E. Broader effects of the L4-RNase E interaction on *E. coli* transcripts were shown by DNA microarray analysis, which revealed changes in the abundance of 65 mRNAs encoding the stress response proteins HslO, Lon, CstA, YjiY, and YaeL, as well as proteins involved in carbohydrate and amino acid metabolism and transport, transcription/translation, and DNA/RNA synthesis. Analysis of mRNA stability showed that the half lives of stress-responsive transcripts were increased by ectopic expression of L4, which normally increases along with other r-proteins in *E. coli* under stress conditions, and also by inactivation of RNase E. Our finding that L4 can inhibit RNase E-dependent decay may account at least in part for the elevated production of stress-induced proteins during bacterial adaptation to adverse environments.

Estimation of the Warfarin Dose with Clinical and Pharmacogenetic Data

The International Warfarin Pharmacogenetics Consortium
Ming Ta Michael Lee, Ming-Shien Wen, Yuan-Tsong Chen (collaborators)
Institute of Biomedical Sciences, Academia Sinica
The New England Journal of Medicine **360** (2009): 753-764.

Genetic variability among patients plays an important role in determining the dose of warfarin that should be used when oral anticoagulation is initiated, but practical methods of using genetic information have not been evaluated in a diverse and large population. We developed and used an algorithm for estimating the appropriate warfarin dose that is based on both clinical and genetic data from a broad population base.

Clinical and genetic data from 4043 patients were used to create a dose algorithm that was based on clinical variables only and an algorithm in which genetic information was added to the clinical variables. In a validation cohort of 1009 subjects, we evaluated the potential clinical value of each algorithm by calculating the percentage of patients whose predicted dose of warfarin was within 20% of the actual stable therapeutic dose; we also evaluated other clinically relevant indicators.

In the validation cohort, the pharmacogenetic algorithm accurately identified larger proportions of patients who required 21 mg of warfarin or less per week and of those who required 49 mg or more per week to achieve the target international normalized ratio than did the clinical algorithm (49.4% vs. 33.3%, P<0.001, among patients requiring ≤21 mg per week; and 24.8% vs. 7.2%, P<0.001, among those requiring ≥49 mg per week).

The use of a pharmacogenetic algorithm for estimating the appropriate initial dose of warfarin produces recommendations that are significantly closer to the required stable therapeutic dose than those derived from a clinical algorithm or a fixed-dose approach. The greatest benefits were observed in the 46.2% of the population that required 21 mg or less of warfarin per week or 49 mg or more per week for therapeutic anticoagulation.

Warfarin pharmacogenetic dosing algorithm			
		5.6044	
-		0.2614 x	Age in decades
+		0.0087 x	Height in cm
+		0.0128 x	Weight in kg
-		0.8677 x	*VKORC1* A/G
-		1.6974 x	*VKORC1* A/A
-		0.4854 x	*VKORC1* genotype unknown
-		0.5211 x	*CYP2C9* *1/*2
-		0.9357 x	*CYP2C9* *1/*3
-		1.0616 x	*CYP2C9* *2/*2
-		1.9206 x	*CYP2C9* *2/*3
-		2.3312 x	*CYP2C9* *3/*3
-		0.2188 x	*CYP2C9* genotype unknown
-		0.1092 x	Asian race
-		0.2760 x	Black or African American
-		0.1032 x	Missing or Mixed race
+		1.1816 x	Enzyme inducer status
-		0.5503 x	Amiodarone status
=	Square root of weekly warfarin dose**		

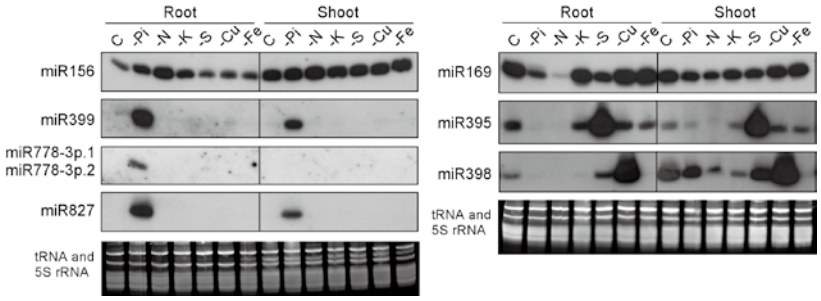
Uncovering Small RNA-mediated Responses to Phosphate-deficiency in Arabidopsis by Deep Sequencing

Li-Ching Hsieh, Shu-I Lin, Arthur Chun-Chieh Shih, June-Wei Chen, Wei-Yi Lin, Ching-Ying Tseng, Wen-Hsiung Li and Tzyy-Jen Chiou

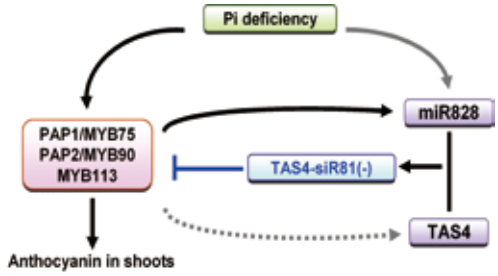
Agricultural Biotechnology Research Center, Academia Sinica

Plant Physiology **151** (2009): 2120-2132.

In this study, deep sequencing of Arabidopsis thaliana small RNAs was conducted to reveal microRNAs (miRNAs) and other small RNAs that were differentially expressed in response to phosphate (Pi) deficiency. About 3.5 million sequence reads corresponding to 0.6-1.2 million unique sequence tags from each Pi-sufficient or -deficient root or shoot sample were mapped to the Arabidopsis genome. We showed that upon Pi deprivation, the expression of miR156, miR399, miR778, miR827 and miR2111 was induced, whereas the expression of miR169, miR395 and miR398 was repressed. We found crosstalks coordinated by these miRNAs under different nutrient deficiencies. In addition to miRNAs, we identified one Pi starvation-induced DCL1-dependent small RNA derived from the long terminal repeat of a retrotransposon and a group of 19-nucleotide small RNAs corresponding to the 5' end of tRNA and expressed at a high level in Pi-starved roots. Importantly, we observed an increased abundance of TAS4-derived trans-acting siRNAs (ta-siRNAs) in Pi-deficient shoots and uncovered an autoregulatory mechanism of PAP1/MYB75 via miR828 and TAS4-siR81(-) that regulates the biosynthesis of anthocyanin. This finding sheds light on the regulatory network between miRNA/ta-siRNA and its target gene. Of note, a substantial amount of miR399* accumulated under Pi deficiency. Like miR399, miR399* can move across the graft junction, implying a potential biological role for miR399*. This study represents a comprehensive expression profiling of Pi-responsive small RNAs and advances our understanding of the regulation of Pi homeostasis mediated by small RNAs.



Nutrient-deficient responsive microRNAs



Autoregulation of PAP1/MYB75 via miR828 and TAS4-siR81(-)

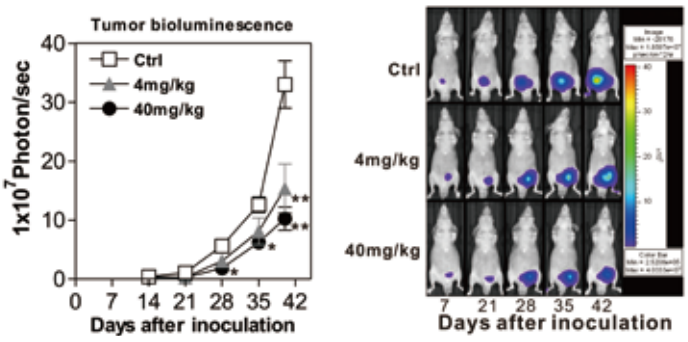
Herbal Extract of Wedelia Chinensis Attenuates Androgen Receptor Activity and Orthotopic Growth of Prostate Cancer in Nude Mice

Chin-Hsien Tsai, Feng-Min Lin, Yu-Chih Yang, Ming-Ting Lee, Tai-Lung Cha, Guan-James Wu, Shih-Chuan Hsieh, and Pei-Wen Hsiao

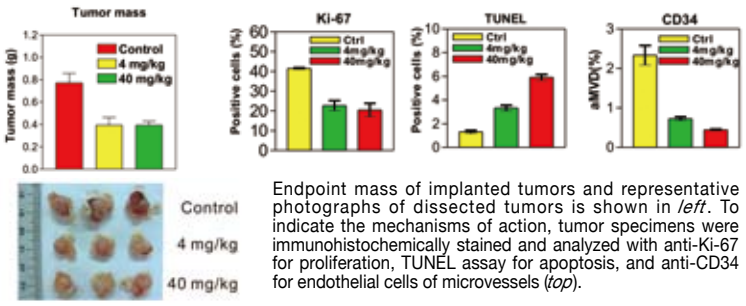
Agricultural Biotechnology Research Center, Academia Sinica

Clinical Cancer Research **15** (2009): 5435-5444.

Herbal remedies are the most accepted complementary and alternative medicines used among patients with prostate cancer. Plant extracts contain various compounds that have been shown to inhibit many different process of inflammation. It is intriguing that Wedelia chinensis, an ingredient of anti-inflammatory herbal medicines, also contains a set of compounds that inhibit androgen receptor signaling and in vitro growth of prostate cancer cell lines. This study examines the use of an herbal extract to treat a clinically advanced prostate cancer in animal models with castration-resistant tumors. The herbal extract restrained the prostatic tumor growth and decreased angiogenesis without observable toxicity. This preclinical study thus provides strong evidence that Wedelia chinensis is a good candidate for chemoprevention or complementary medicine.



Orthotopic xenografts of human prostate tumors were established in nude mice and mice were treated orally with *W.* chinensis extract once daily for 28 days. Bioluminescence intensities in each treatment group were measured weekly and are presented as growth curves.



Endpoint mass of implanted tumors and representative photographs of dissected tumors is shown in *left*. To indicate the mechanisms of action, tumor specimens were immunohistochemically stained and analyzed with anti-Ki-67 for proliferation, TUNEL assay for apoptosis, and anti-CD34 for endothelial cells of microvessels (*top*).

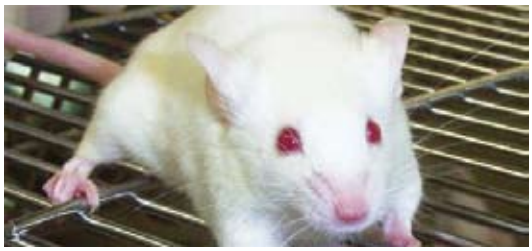
Glycans on Influenza Hemagglutinin Affect Receptor Binding and Immune Response

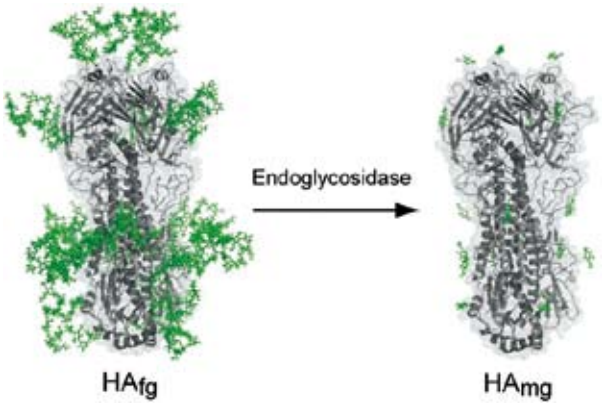
Cheng-Chi Wang, Juine-Ruey Chen, Yung-Chieh Tseng, Che-Hsiung Hsu, Yu-Fu Hung, Shih-Wei Chen, Chin-Mei Chen, Kay-Hooi, Khoo Ting-Jen Cheng, Yih-Shyun E. Cheng, Jia-Tsrong Jan, Chung-Yi Wu, Che Ma & Chi-Huey Wong

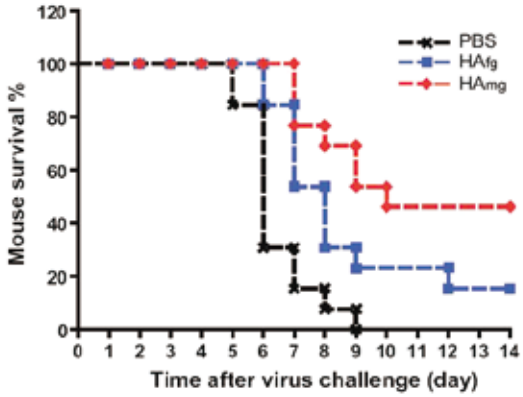
Genomics Research Center, Academia Sinica

Proceedings of the National Academy of Sciences of the U. S. A. **106** (2009): 18137-18142.

In an effort to discover new drugs against pandemic flu, we studied the functional roles of glycans on influenza viral surface glycoprotein – hemagglutinin. We found that glycans on hemagglutinin affect host cell-surface receptor binding and host immune response. Successive simplification of the N-glycans on hemagglutinin enhanced the affinity and relaxed the specificity of binding for a-2,3 sialosides. Furthermore, mono-glycosylated HA, with the simplest possible glycans attached, was a superior immunogen: the antiserum generated showed stronger neutralization of the virus, and it increased the protection of mice in a viral challenge study. This opens up a new strategy of using mono-glycosylated viral surface proteins as vaccines against human viruses, such as HIV and HCV.







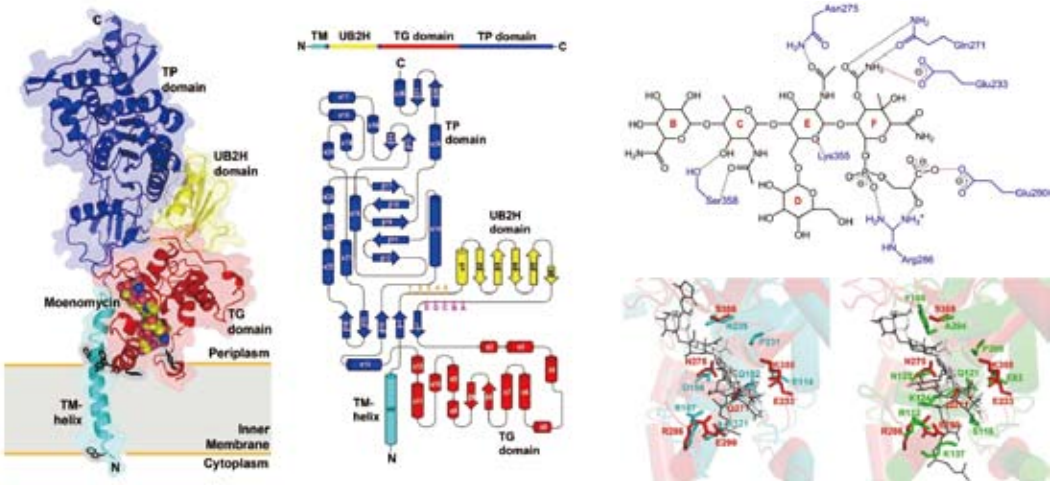
Crystal Structure of the Membrane-bound Bifunctional Transglycosylase PBP1b from Escherichia Coli

Ming-Ta Sung, Yen-Ting Lai, Chia-Ying Huang, Lien-Yang Chou, Hao-Wei Shih, Wei-Chieh Cheng, Chi-Huey Wong and Che Ma

Genomics Research Center, Academia Sinica

Proceedings of the National Academy of Science of the U. S. A. **106** (2009): 8824-8828.

Drug-resistant bacteria have caused serious medical problems in recent years and the need for new antibacterial agents is undisputed. Transglycosylase, a multidomain membrane protein essential for cell wall synthesis, is an excellent target for the development of new antibiotics. Here we determined the X-ray crystal structure of the bifunctional transglycosylase penicillin-binding protein 1b (PBP1b) from *E. coli* in complex with its inhibitor moenomycin to 2.16 Å resolution. In addition to the transglycosylase and transpeptidase domains, our structure provides a complete visualization of this important antibacterial target, and reveals a novel domain for protein-protein interaction and a transmembrane helix domain essential for substrate binding, enzymatic activity and membrane orientation.

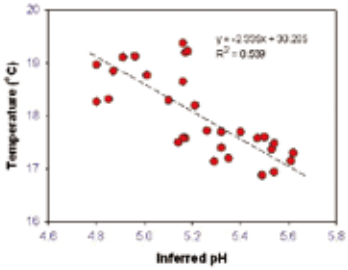


Late Holocene paleoenvironmental changes in subtropical Taiwan inferred from pollen and diatoms in lake sediments

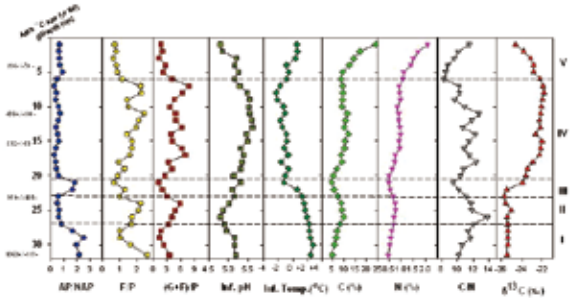
S.H. Chen, J.T. Wu, T.N. Yang, P.P. Chuang, S.Y. Huang, Y.S. Wang
Biodiversity Research Center, Academia Sinica
Journal of Paleolimnology **41** (2009): 315-327.

We analyzed pollen, spores, diatoms, organic carbon, nitrogen, and $\delta^{13}C$ of organic matter in the sediments of Duck Pond to infer climate changes and reconstruct the paleo-environment of subtropical Taiwan over the past ~1300 years. Fluctuations in the relative abundance of arboreal taxa, herbaceous plants, and ferns reflects changes in the relative amounts of woody versus grassland vegetation, and are a result of changes in temperature and humidity, which consistent with climatic periods in central China. Pollen data were in good agreement with the pH inferred from diatom assemblages. This study suggests that climate can be inferred from the ratio of arboreal to non-arboreal pollen and from the pH of the aquatic environment.

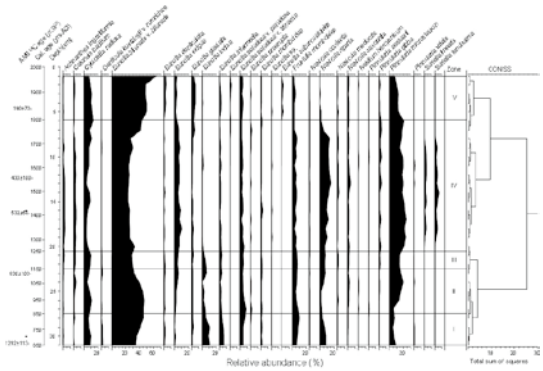
1) The locality of Duck Pond.



2) The relation of diatom-inferred pH to temperature.



3) The fluctuation of various parameters throughout the studied sediment core of Duck Pond.



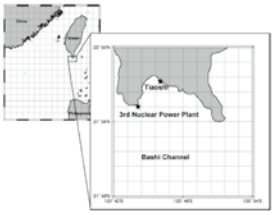
4) Diatom diagram of dominant species in the studied sediment core of Duck Pond.

Influence of Species Specificity on Bacteria Associated with *Stylophora pistillata* in Taiwan

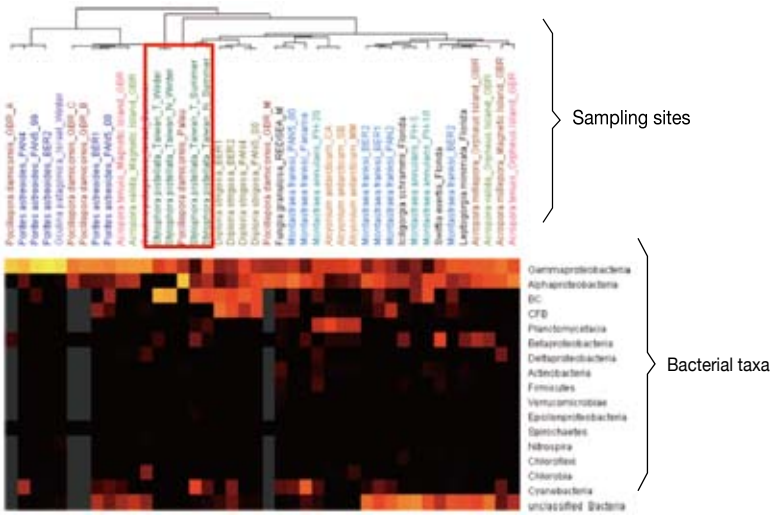
Mei-Jhu Hong, Yi-Ting Yu, Chaolun A. Chen, Pei-Wen Chiang, Sen-Lin Tang
Biodiversity Research Center, Academia Sinica
Applied and Environmental Microbiology **75** (2009): 7797-7806.

By the culture-independent molecular approach, we assessed effect of species specificity of coral on the composition of *Stylophora*-associated bacteria. This report is the first report for the composition analysis of coral-associated microbes in Taiwan. Our study reveals that the effect of species specificity is much weaker than that of environmental factors in driving the structure of the bacterial community. Furthermore we also presented a comparison analysis among most of published coral-associated bacterial communities (including Ken-Ding's sample) and provided convincing evidences for which the effect of environmental factors to the community structure of coral associated bacteria is more significant than species specificity. Besides the comparison result supports our observation on *Stylophora*-associated bacterial community in Ken-Ding; more importantly, it is one of the most comprehensive comparison analysis of coral-associated bacterial community.

1) *Stylophora* sp. at Ken-Ting, Taiwan.



2) Two sampling sites, 3rd Nuclear Power Plant and Tiaoshi. Samples were collected from three tagged coral colonies at each site in the winter and summer.

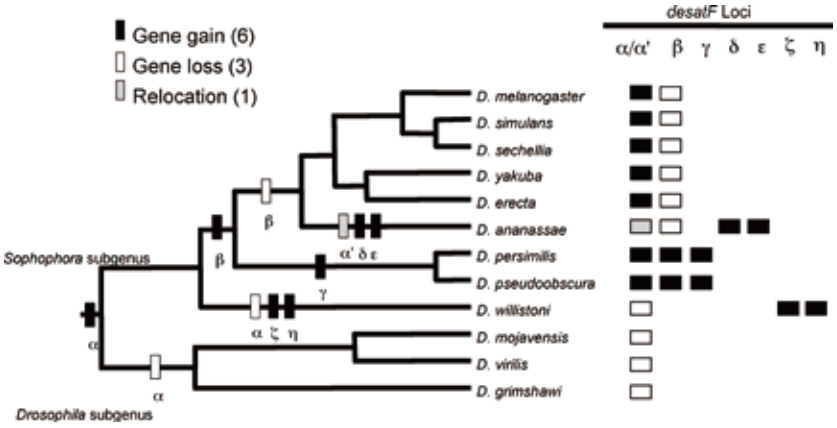


3) Two-way clustering analysis of various coral-associated bacterial community. Fourty-four samples from West Pacific Ocean, East Pacific Ocean, Mediterranean Ocean, Caribbean Sea, Red Sea and Antarctic Ocean were analyzed. Taiwan's samples are in the red box.

Molecular Evolution and Functional Diversification of Fatty Acid Desaturases after Recurrent Gene Duplication in *Drosophila*

Shu Fang, Chau-Ti Ting, Cheng-Ruei Lee, Kuang-Hsi Chu, Chuan-Chan Wang and Shun-Chern Tsaur
Biodiversity Research Center, Academia Sinica
Molecular Biology and Evolution **26** (2009): 1447-1456.

In this study, we use fatty acid desaturases as a model to demonstrate how frequent gene duplications in the genome incessantly supply new genetic materials for functional innovation. With the recent completion of a dozen *Drosophila genomes*, it provides a genome-wide perspective on the evolutionary patterns of desaturase genes. We found that both gene gains and losses were frequent in the *desat1-desat2-desatF* clade. Both *desat2* and *desatF* gained novel desaturation functions to change substrate specificity after duplicated from *desat1*. Additionally, the gene expression of *desatF* was altered from bisexual to female-specific expression or no expression in some *Drosophila species*. The rapid evolution of this gene family pays an important role in pheromonal diversity, adaptation to various environments, and speciation of *Drosophila*.



Gene gains and losses of *desatF* genes in Drosophila.

Reorienting Brushwork to Harmonize with the Creation of Nature: Toward a New Understanding of the Eighteenth-Century Chinese Landscape Painting

Shou-Chien Shih
Iinstitute of History and Phiology, Academia Sinica
Taida Journal of Art History **26** (2009): 1-36.

In most of the writings on the history of Chinese landscape painting, the eighteenth century has been considered as a period of decline for its lacking of distinctive stylistic innovations. This study tries to reexamine landscape works from the period, especially those executed at the court under enthusiastic supports from the imperial house, adopting a viewpoint which no longer treats innovation as the only criteria but focuses on the interactive relationship between painting and the creation of nature as the primary concern.

With an active participation of the imperial house of the early Qing dynasty, the development of the landscape painting at court reoriented the relationship between "brushwork" (*bimo*) and natural landscape from competitive to harmonious. It led to the emergence of landscape paintings with very different formal structures as well as expression from that of the seventeenth century. Works by painters from Manchuria region and scholar-court officials used to be classified as "the followers of the orthodox school" are discussed in detail with special attention on their representations of natural scenery. The result of this study hopes to redefine the long neglected significance in the history of Chinese landscape painting.

Tung Pang-ta 1699-1769, Traveling Over Rivers and Mountain Passes, National Palace Museum, Taipei

On and Off the Playing Fields: A Modern History of Physical Education for Girls in Eastern China (1895-1937)

Chien-Ming Yu
Institute of Modern History, Academia Sinica
Taipei: Institute of Modern History, Academia Sinica (2009)

Analyzing from a gender lens, this book investigates the relationship of female physical education, the state, and the socio-cultural sphere during the period examined. Instead of adopting a conventional state-centered approach to study the history of physical education for girls, the book illuminates the meanings that physical education for girls have brought to public opinion, school education, student lives, sports competition, audience reception, mass media, and visual culture through meticulous use of written and non-written historical sources. More specifically, this book intends to provide a gender interpretation of the history of modern Chinese physical education. At the same time, the author also elucidate some debates emerged during this particular historical trajectory. This undoubtedly broadens our understanding of the research on women in modern Chinese history but also brings into light the complementary and reflexive nature of histories of physical education, women, and modern China.

Religion as a Means of Cultural Reproduction: Popular Rituals in a Yunnan Chinese Village in Northern Thailand

Shu-Min Huang
Institute of Ethnology, Academia Sinica
Asian Ethnicity **10** (2009): 155-176.

This paper discusses how popular rituals are used to achieve cultural reproduction in Banmai, a Yunnan Chinese village in northern Thailand where I conducted empirical fieldwork between 2002 and 2007. Most Banmai villagers were local militias originally associated with the Chinese Nationalist Party in western Yunnan Province. They went into exile on the Burmese side of the Golden Triangle in or shortly after 1949 when the People's Liberation Army swept through this region and they ultimately settled in northern Thailand's hill regions in early 1960s. As the self-proclaimed preservers of authentic Chinese culture, Banmai villagers vigorously instituted many traditional practices, following the imagined Confucian orthodoxy, to build a reified community that represents an idealized Chinese spiritual world. Through their participation in popular rituals, we see clearly how villagers have been able to attain the cultural unification that has played a crucial role in meeting their spiritual needs at various levels: the individual, the family, the kin group, and the community.

Guanyin Temple

Mr. Li performing rituals to pacify the wondering ghost on the 15th of the 7th month.

(In) determinacy, Increasing Returns, and the Optimality of the Friedman Rule in an Endogenously Growing Open Economy

Ching-Chong Lai and Chi-Ting Chin
Institute of Economics, Academia Sinica
Economic Theory, Published on line: April 2009, DOI: 10.1007/s00199-009-0457-x

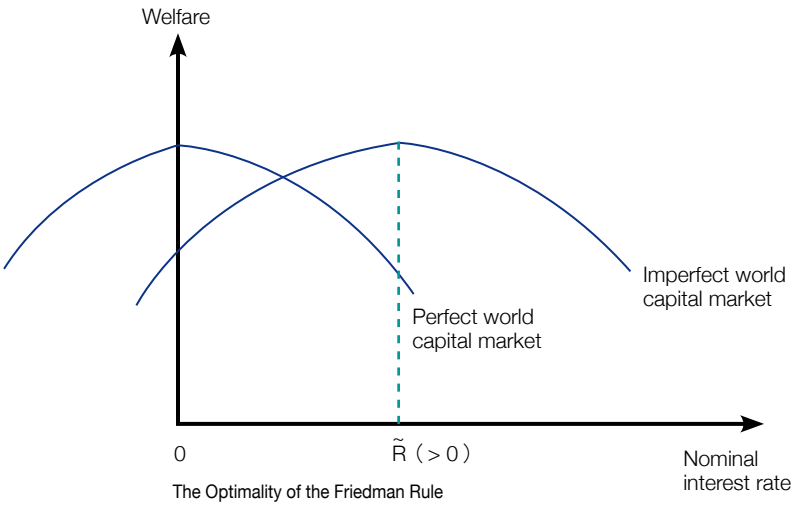
This paper sets up a monetary endogenous growth model with production externalities for an open economy, and then uses it to investigate the possibility of indeterminacy. Moreover, the paper examines how the monetary authorities will set its optimal anchor of the money growth rate from the viewpoint of welfare maximization. Several main findings emerge from the analysis.

First, when investment does not involve adjustment costs, the monetary equilibrium is locally determinate regardless of the strength of production externalities and the extent of world capital market imperfections.

Second, in the presence of investment adjustment costs, the monetary equilibrium may exhibit indeterminacy when the aggregate increasing returns-to-scale in production is sufficiently strong.

Third, in the presence of world capital market imperfections, the Friedman rule of a zero nominal interest rate fails to be optimal.

Fourth, in the face of perfect world capital markets, the optimal nominal money growth rate is maintained at the rate that is conformable to the Friedman rule, regardless of whether investment involves adjustment costs or not.



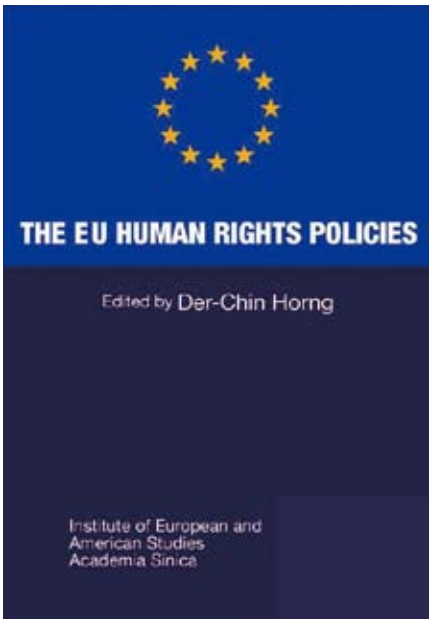
The Optimality of the Friedman Rule

The EU Human Rights Policies

Der-Chin Horng (editor)
Institute of European and American Studies, Academia Sinica
Taipei: IEAS, Academia Sinica (2009)

Human rights is a core value of the European Union. The Charter of Fundamental Rights of the European Union has a constitutional effect after the Treaty of Lisbon came into force on 1December 2009. The EU has recently paid more attention to the implementation of human rights. A high level of human rights protection shall be ensured in the definition and implementation of all EU policies and activities. This book examines and illuminates the following subjects relating to the practice of EU human rights: EU Agency for Fundamental Rights, Biometerics Data Protection, Consumer Rights in GM Food Labelling, Property Right, Marriage and Family Rights, Movement Right and Social Welfare, Sexual Orientation Discrimination in Employment, Illegal Migrants, Cultural Rights, among others. All these issues have a long-term impact on the EU democracy and the future of European integration.

The human rights policy has permit the EU to seize the initiative on human progress once again. On the basis of advancing human rights, the EU might consider taking the opportunity to transform itself from "a Union of Member States" to "a Union of European people". Externally, the EU is one of the rule makers in the new international order. It exerts a tremendous influence over global trends in human rights policies, for instance, towards rule- or power-oriented cooperative relations. These human right policies confer prestige and soft authority on the EU. Give global trends, the EU is not only acting as a European union, but as a global leader. It is contributing to the common good of humanity by advocating the universalization of human rights and promoting innovations supportive of a new civilization with EU characteristics.



Race of the Interviewer and the Black-White Test Score Gap

Min-Hsiung Huang
Institute of European and American Studies, Academia Sinica
Social Science Research **38** (2009): 29-38.

There is a frequently demonstrated test score gap between African Americans (blacks) and European Americans (whites) in the United States. Several explanations have been proposed for the black-white test score gap. These explanations include black-white differences in socioeconomic status and family structure, genetic endowment, school quality, culture, and racial bias in testing. The present study pertains to the last explanation which suggests that the black-white test score gap may partly be accounted for by systematic errors in measurement. Specifically, I examine whether or not the race of the examiner is a source of bias in measuring the black-white test score gap.

A key hypothesis is that the race of the examiner provides an alternate explanation for the poor test performance of blacks. If blacks perform less well on cognitive measures when tested by whites than by blacks, and if a large proportion of black respondents in a survey were tested by white rather than black interviewers, then an underestimation of blacks' test scores is expected. Such a bias against black respondents due to a mismatch between the race of the respondent and the race of the interviewer would lead to an overestimation of the black-white test score gap.

In this study, I assess the effects of interviewer race on the test performance of black and white respondents, using data from the General Social Survey (GSS) which is a national household survey for adults aged 18 and over. Vocabulary testing in the GSS is conducted at the home of the respondent, and it involves face-to-face and one-on-one interaction between the respondent and the interviewer.

Data from the 1998 GSS indicate that black respondents, in comparison to white respondents, were much more likely to be tested by interviewers of a different race. For whites, interviewer race does not appear to affect test performance significantly. For blacks, however, there is a negative effect on test performance when tested by a white interviewer. Consequently, the black-white test score gap is substantially overestimated when the effects of interviewer race are not taken into account. For example, for black and white respondents with comparable socioeconomic background and years of schooling completed, the test score gap between black and white respondents tested by white interviewers was about two-fifths of a standard deviation unit in GSS vocabulary test scores. This gap, however, was nearly closed for black and white respondents who were tested by interviewers of their own race.

Stereotype threat seems a plausible explanation for the results observed in this study because white respondents were not negatively affected by having a black interviewer. According to the theory of stereotype threat, black students, when taking a test which claims to measure intellectual ability or when their racial identity is revealed in taking a test, face the threat of being judged by a negative societal stereotype about their group's intellectual ability. The stereotype threat causes anxiety and worry, interfering self-consciousness, and overcautiousness, which impair the test performance of black students.

The Washington Post covered this research in its Feb. 2, 2009 article, "How a Self-Fulfilling Stereotype Can Drag Down Performance" on page A5.

The Individual in Modern Chinese Political Thought

Chen-De Yang
Institute of Chinese Literature and Philosophy, Academia Sinica
Taipei: Institute of Chinese Literature and Philosophy, Academia Sinica (2009)

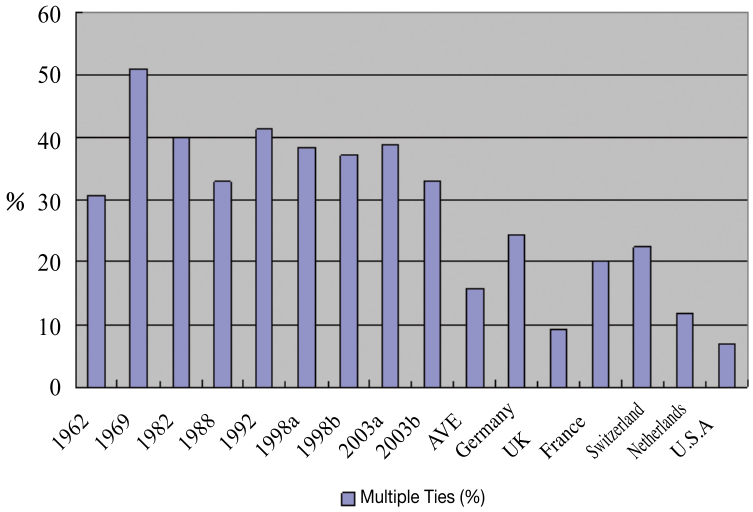
Modern Chinese intellectuals have adopted a specific mode of thinking while dealing with social and political matters; that is, they were inclined to attribute, in the final analysis, the essence of social and political problems to culture, in particular to the individual's ideas and attitudes. In their programs of change, to improve China's fate in the modern world requires, most of all, the making of the new citizen and the new people. In order to create the new individual, furthermore, these intellectuals have turned from the external social and political arena to the individual's internal self, asking the individual to enlighten and cultivate himself or herself. Such a mode of thinking has underlined modern Chinese reception of Western liberalism and social evolutionism, and has in consequence marked modern Chinese political discourse of the individual with the emphases on liberty, self-cultivation, and an evolutionary view of history.

My book has reconstructed this political discourse of the individual. Chapter one identifies the basic features and implications of modern Chinese intellectuals' turning to the self in the face of social and political issues. Chapter two introduces the approach of discourse analysis by discussing J. G. A. Pocock's reflection on the study of Western political thought. Chapter three discloses the prototype of this particular mode of turning to the self with Hu Shi's efforts of reinterpretation of John Dewey's ideas of science and scientific method. Chapter four and five present Liang Qichao's and Hu Shi's efforts of explicating the idea of freedom in terms of self-cultivation. Chapters six, seven and eight examine respectively the ways in which Hu Shi the liberal, Chen Duxiu the radical, and Liang Shuming the conservative, operated with this political discourse of the individual.

Institutional Transition and Market Networks: An Historical Investigation of Interlocking Directorates of Big Business in Taiwan, 1962-2003

Zong-Rong Lee
Institute of Sociology, Academia Sinica
Taiwanese Sociology **17** (2009): 101-160.

This study outlines the historical contours of market networks in Taiwan from an institutional perspective. By utilizing comprehensive historical data on the boards of directors for all listed private firms and state-owned enterprises from 1962 to 2003, this study investigates the extent to which macro-structural factors, such as market growth, state transformation, and cultural practices of Chinese familism, have driven the changing dynamics of interlocking directorates in Taiwan. In the early industrializing period, director networks in Taiwan resembled the corporatist structure of oligopolistic cartels, only on a smaller scale, when state enterprises played an important role and the overall integration of networks was relatively high. Besides, the Taiwanese market holds a strong local flavor in its network structure. In particular, the proportions of multiple relationships of director networks are exceptionally high and have persisted for almost half a century. After a transition period in the late-1980s, the influence of state enterprises on intercorporate networks declined enormously, mainly owing to the private sector's continuous growth and a series of deregulations of economic policies that loosened the control on private businesses' horizontal expansion. The localized clustering dynamics of familism, however, has since disintegrated the network structure; extraordinarily low centralization and a high proportion of multiple ties have become trademarks of Taiwanese corporate networks. Considering the existing legal regulation of corporate governance and the prevalence of cultural practices associated with familism, this study foresees the resilience of the Taiwanese market's current network structure.

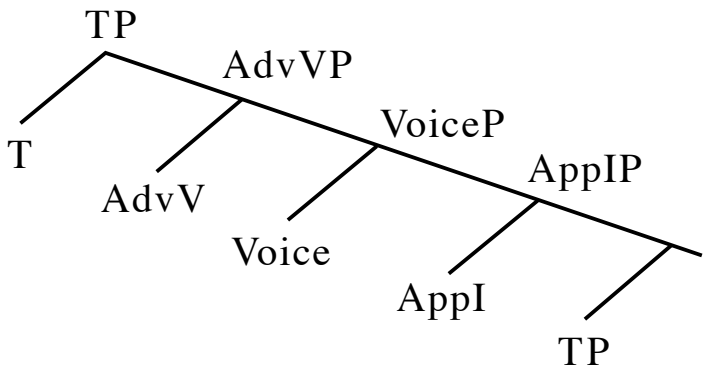


The proportions of multiple relationships of Taiwanese director networks are exceptionally high and have persisted for almost half a century. AVE indicates the average of six major industrial nations.

Adverbial Verbs and Adverbial Compounds in Tsou: A Syntactic Analysis

Henry Yungli Chang
Institute of Linguistics, Academia Sinica
Oceanic Linguistics **48** (2009): 339-376.

The aim of this paper is twofold. On the one hand, it gives a systematic description of adverbials in Tsou. On the other, it illustrates how adverbials are syntactically represented and derived in Tsou. Two types of adverbial constructions can be identified. In one type, adverbials are realized as adverbial verbs and situated between a temporal/modal auxiliary and a lexical verb, and they take the prefixes a-/i' -. In the other type, adverbials occur as bound roots and combine with an event-denoting lexical prefix, yielding an adverbial compound. It is argued that adverbial verbs are generated as functional heads above Voice/vP, whereas adverbial compounds are generated as lexical heads under Voice/vP. This analysis accounts for a number of otherwise puzzling asymmetries, including the following: (i) an adverbial compound can stand alone and take nominal arguments but an adverbial verb cannot; (ii) an adverbial compound can be marked for Locative Voice and Referential Voice but an adverbial verb cannot; (iii) the root of an adverbial compound is restricted to event adverbials, but the root of an adverbial verb is free from this restriction; (iv) the prefix of an adverbial compound can be voice-marked, but the prefix of an adverbial verb is invariant; and (v) adverbial verbs must precede adverbial compounds, not the other way around.

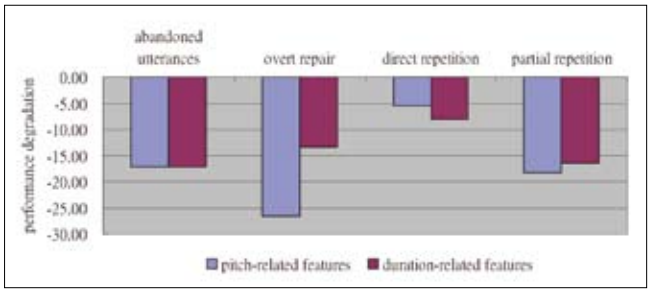


Linguistic Patterns in Spontaneous Speech

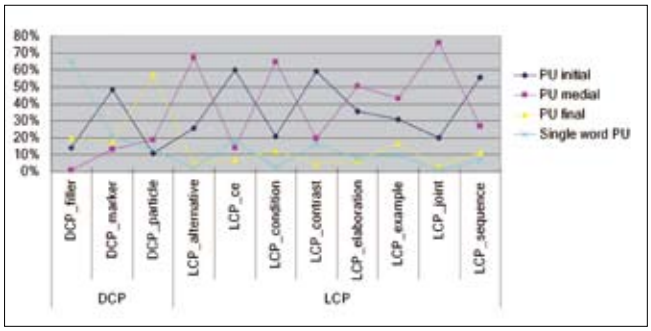
Shu-Chuan Tseng (editor)
Institute of Linguistics, Academia Sinica
Taipei: Institute of Linguistics, Academia Sinica (2009)

Spontaneous speech is the most frequently used speech form. Language experiences, cultural conventions, and also background knowledge about topics and speakers are necessary for human beings to understand and produce spontaneous speech. It seems to be a simple task for human beings; listening, processing, searching, planning, and speaking all happen in an extremely short period of time. But it is difficult to build a system which is capable of doing similar tasks. The reason is that we know too little about the form and function of spontaneous speech. It is likely that the main problem is not the size of data we are obtaining. But more importantly, we should learn to recognize the knowledge and capabilities we use to solve problems and carry out tasks. Understanding and producing spontaneous speech is only one of the many tasks we perform everyday. The solution to this problem lies not only with engineers or linguists. We need an interdisciplinary approach.

This volume points out a number of important aspects of spontaneous speech, including the definition of spontaneity, forms of speech variation, features of prosody, patterns of disfluency, and the communicative function in spoken dialogues. The contributions of this volume have also revealed the importance of shared language resources, as corpus creation and sharing provide system developers with a good basis for designing and testing their systems. Prosperous insights into linguistic patterns in natural speech are raised by linguists and engineers. To name an example, an automatic speech recognition system cannot be practically used in real life, if linguistic patterns like disfluencies and rhetorical relations in discourse and their phonetic-prosodic representations in spontaneous speech are not taken into consideration.



1）Performance degradation for the four disfluency types with respect to pitch- and duration-related feature categories (P. 204)

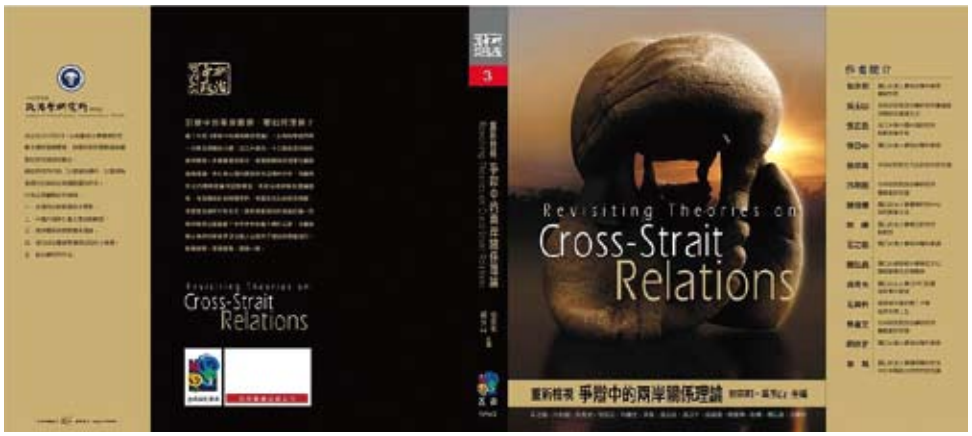


2）Distribution of prosodic units and rhetorical relations (P. 163)

Revisiting Theories on Cross-Strait Relations

Tzong-Ho Bau and Yu-Shan Wu (editors)
Institute of Political Science (Preparatory Office), Academia Sinica
Taipei: Wu Nan (2009)

In order to provide theoretical explanation of the epochal changes in cross-Strait relations and look into their future development, we co-organized a conference with National Taiwan University and published Revisiting Theories on Cross-Strait Relations. This volume demonstrates the collective effort by Taiwan's academic community to approach a pressing issue that has drawn great journalistic attention but little scientific investigation. It contains three dimensions and a total of thirteen approaches in the field, reviews cross-Strait relations in a decade, and explains the radical permutations of the relations in recent years. Rising power asymmetry and its impact on both domestic and international factors receives great attention in the volume.



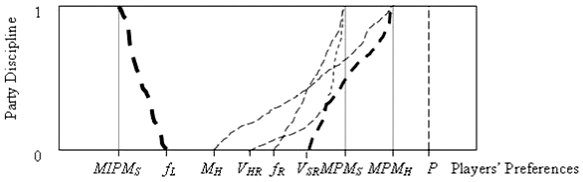
A Unified Theory of U.S. Lawmaking: Preferences, Institutions, and Party Discipline

Fang-Yi Chiou and Lawrence Rothenberg
Institute of Political Science (Preparatory Office), Academia Sinica
Journal of Politics **71** (2009): 1257-1272.

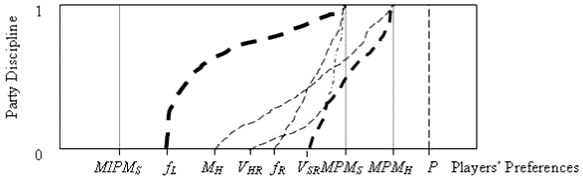
We develop a unified theory of lawmaking that integrates preferences, institutional features, and imperfect party discipline. This model both parsimoniously subsumes numerous extant models and allows for examination of heretofore unexplored equilibria behavior. To demonstrate this, we pinpoint what effects the kinds of changes that reformers often focus on—strengthening parties and loosening the filibuster rule—might have on the equilibrium gridlock interval and generate a number of non-intuitive results. We also find that our unified model's empirical implications are consistent with the gridlock pattern found in the data. We conclude that this model is theoretically important and empirically relevant.

Figure 1: Impact of Party Discipline on the Equilibrium Gridlock Interval

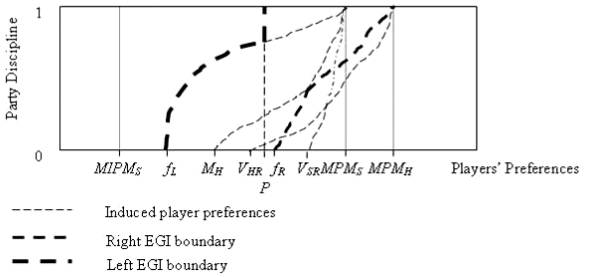
(a) Senate majority party lacking filibuster-proof majority



(b) Unified government with extreme president and filibuster-proof Senate majority party



(c) Moderate president, filibuster-proof Senate supermajority, and House lacking supermajority



Constructing Coherent Standards of Constitutional Review: On the Idea of "Hierarchical Proportionality Principle"

Dennis Te-Chung Tang
Institutm Iurisprudentiae (Preparatory Office), Academia Sinica
Constitutional Interpretation: Theory and Practice Vol.6, Part II (Taipei: Institutm Iurisprudentiae, Academia Sinica, 2009), pp.581-660.

Article 23 of the ROC Constitution prescribing that "All the freedoms and rights enumerated in the preceding Articles shall not be restricted by law except such as may be necessary to prevent infringement upon the freedoms of other persons, to avert an imminent emergency, to maintain social order or to advance public welfare" is aimed at setting limits on statutes which restrict the human rights enshrined by the Constitution. It is commonly referred to as "proportionality principle."

This thesis analyzes the standards of constitutional review developed in the USA, Germany and Canada from a comparative constitutional law perspective, and tries to integrate them into the "Hierarchical Proportionality Principle," in order to enhance the coherence and predictability of the constitutional review conducted by the Council of Grand Justices (CGJ), Judicial Yuan.

The Hierarchical Proportionality Principle, in essence, integrates the various, dynamic and hierarchical standards of judicial review developed in the US with the linear, mechanical and unitary Proportionality Principle cultivated in Germany to form a comprehensive system of a total of six review standards at three levels. The three levels are the mere rationality test, the intermediate level review and the strict scrutiny, constructed on both the weight of "the purpose" (of restricting a constitutional right) and "the nexus between the purpose to be pursued and the means adopted." The six standards are shaped by taking two more criteria, i.e., "burden of proof" and "less restrictive alternative test," into consideration and by further dividing the mere rationality test into three, i.e., minimum rationality, basic rationality and rational review with bite, while further dividing the intermediate level review into two -- basic intermediate level review and intermediate level review with bite.

In contrast to the traditional Proportionality Principle, the application of the Hierarchical Proportionality Principle puts foremost emphasis on standard selection. The procedures following the standard selection are inquiries of the constitutionality of the purpose, of the suitability of the means, of the necessity of the means, and of the proportionality principle in a narrow sense, i.e., inquiring whether the benefits pursued by imposing restrictions on constitutional rights are wholly proportionate to the costs derived from (or damage incurred by) the restrictive means. The means necessity inquiry requires a coordination between the "weight of the purpose" and the "nexus between the purpose to be pursued and the means adopted." Precisely speaking, the rationality test requires rational means to legitimate governmental ends, the intermediate review requires substantially related means to important governmental ends, and the strict scrutiny requires directly related means to compelling or overriding governmental ends. Finally, the author creatively applies the Hierarchical Proportionality Principle to three leading cases of the CGJ, i.e., Interpretations No. 584, 603 and 618, respectively, to demonstrate how the result obtained may be different than the majority opinion and separate opinions of each of these Interpretations.

Legal Immunity? Wrong Diagnosis, Wrong Prescription: Another Lesson from Enterovirus Vaccines

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Journal of the Formosan Medical Association **108** (2009): 177-179.

It has been a commonplace among physician-scientists in Taiwan to blame inexorable legal liability for thwarting the practice of medicine and hampering the progress of medical science. When no vaccine has been so far developed to prevent the repetitive outbreaks of non-polio enterovirus infection with severe complications in the past 10 years in Taiwan, many people again attributed the problem to the legal system that fails to provide friendly environment for biomedical researchers. Against this backdrop, the author argues that the above common senses among physician-scientists are actually grounded on two erroneous presumptions. First, the common senses wrongly presume that because civil liability in human subject research could be willfully waived in an informed consent, criminal law without the possibility for exemption thus, in comparison, constitute an inextricable threat to researchers. However, asking subjects to waive liability is in fact a clear violation of international ethics guidelines in human research. Second, the common senses mistakenly assume that because biomedical investigators in the United States and European countries are granted general immunity from criminal charges, jurisdictions that do not offer the same pose an uncivilized threat to researchers. Yet, even the United States, the country often thought to be exemplary of the most generous band, does not actually grant such general immunity from criminal charges even in a public health emergency when immunity from civil liability for non-willful misconducts is sometimes granted. Indeed, while the US system largely relies upon the accountability mechanisms such as peer review and professional discipline to correct unintended error in medicine and research in a systematic way, criminal liability remains to punish, among others, failure to perform risk assessment or to manage foreseeable risk before conducting trials. Unless alternative accountability mechanisms are in place in Taiwan to correct unintended error in medicine and research in a systematic, effective, and reliable way, there is no reason on equal protection grounds that the same negligence criteria that apply to all other walks of life in daily and professional life should not be applied to doctors and biomedical researchers. The author further argues that the real cause behind the current predicament lies not in a legal system unfriendly to researchers but in a legal system unjust to human subjects. Because liability is not imposed on researchers for honest ignorance or unknown uncertainty, subjects are indeed more vulnerable than researchers when society fumbles for a light in the dark. A stand-alone no-fault compensation mechanism thus should be established to compensate injured subjects for their special sacrifice to society. The society shall recognize that medical progress, which necessarily requires healthy subjects to participate in clinical trials, would needs not only a heroically altruist public but also a just and trustworthy legal infrastructure, which prevents and corrects error effectively and redresses loss justly, upon which true altruism can securely rest.

Fundamental Values for Constitution

Carl K. Y. Shaw (editor)
Research Center for Humanities and Social Sciences, Academia Sinica
Taipei: Research Center for Humanities and Social Sciences, Academia Sinica (2009)

Constitution is the fundamental law of the state, and the arena wherein social values and political reality interact. On the one hand, civic consensus on core political values is institutionalized via constitutional politics; on the other hand, political forces would be mobilized to shape public opinion. In Taiwan, since the nineties of the last century till the second party turnover in 2008, constitutional values are hotly debated, so much so that constitution underwent seven time of revision. This anthology is published by "Center for Political Thought," a division of the Research Center for Humanities and Social Sciences, Academia Sinica. The ten articles collected in this book studies the historical formation of constitutional values in the modern world, their justifications in contemporary normative theories, and the realities of Taiwanese constitutional politics. Because of the interdisciplinary orientation, this book would influence the future research as well as the real-world political discourses.

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5 Institute of Molecular Biology
6 Institute of Biological Chemistry
6 Life Science Library
7 National Laboratory Animal Center, NLAC
8 Interdisciplinary Research Building for Science and Technology (under construction)
9 Greenhouse
10 Central Office of Administration
11 Biodiversity Research Center
11 Biodiversity Research Museum
12 Institute of Plant and Microbial Biology
13 Research Center for Information Technology Innovation
14 Tsai Yuan-Pei Memorial Hall
14 Center for Survey Research
15 Institute of Statistical Science
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17 Ecological Pond
18 Genomics Research Center
19 Agricultural Technology Building
19 Agricultural Biotechnology Research Center (Agricultural Technology Building 1st-2nd Floor and 5-7th Floor)
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33 Research Center for Applied Sciences (Laboratories)
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34 Hu Shih Memorial Hall
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37 Institute of History and Philology
37 Museum of the Institute of History and Philology
38 Fu Ssu-nien Library
39 Institute of Economics
40 Institute of Ethnology
40 Museum of the Institute of Ethnology
41 Lingnan Fine Arts Museum (Jin Mei Building)
42 Archive Building, Institute of Modern History
43 Building of Taiwan Archaeological Studies
50 Taiwan International Graduate Program (TIGP) Student Dormitory
60 Teaching and Administration Building (TA Building)
60 Administrative office for TIGP, Degree Program, and Foreigners Services (2nd-3rd Floor of TA Building)
60 Kindergarten (1st Floor of TA Building)

* The Institute of Mathematics, Institute of Atomic and Molecular Sciences, Institute of Astronomy and Astrophysics and some biochemistry institutes are located on the National Taiwan University campus.

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