

National Tsing Hua University

2013 R&D Report

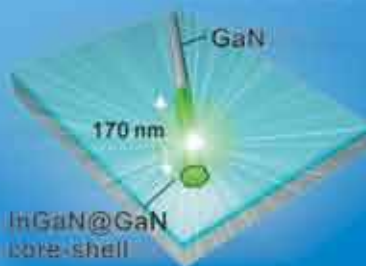


Visualizing the Brain Memory Pathway in Two Neurons of the *Drosophila* Brain

Crystal Structure of Membrane-associated Receptor

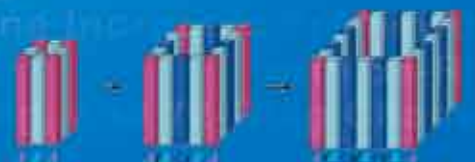


High-resolution Structure of Gallate Bound to a Protein



InGaN@GaN core-shell

Crystalline InGaN





National Tsing Hua University

National Tsing Hua University (NTHU) has a long and proud history. First established as the Tsing Hua Academy at Tsing Hua Garden in Beijing in 1911, the Academy was renamed as National Tsing Hua University in 1928 when its curricula were expanded to that of a full-fledged university. In 1956, National Tsing Hua University was reinstalled on its current campus in Hsinchu, Taiwan. Since its reinstallation, NTHU has developed from an institute focusing on Nuclear Science and Technology to that of a comprehensive research university offering degree programs ranging from baccalaureate to doctorate in science, technology, engineering, humanities and social sciences, as well as management. NTHU has been consistently ranked as one of the premier universities in Taiwan and is widely recognized as the best incubator for future leaders in industries as well as academics. Such stellar records are particular exemplified by the outstanding achievements of our alumni, including two Nobel laureates in physics Drs. Cheng-Ning Yang and Tsung-Dao Lee, one Nobel laureate in chemistry Dr. Yuan-Tseh Lee and one Wolf Prize winner in mathematics Dr. Shiing–Shen Chern.



NTHU

2013 R&D Report

自強不息 德載物



Foreword



National Tsing Hua University (NTHU) is a research university with a long and proud tradition. Since the re-establishment in Hsinchu in 1956, NTHU has been known for excellent academic programs as well as outstanding alumni. Over the last fifty-seven years, NTHU has transformed herself into a comprehensive university and is recognized in all disciplines.

NTHU provides a stimulating and nurturing environment within which our faculty can offer quality teaching and conduct innovative research. In Taiwan, we have been regarded as one of the top-tier research universities. For example, ever since the National Science Council established the Outstanding Research Awards, our faculty members have won a large number of the awards in all major research fields. The Ministry of Education also recognizes our research excellence by granting a large share of the prestigious Academic Awards and National Chair Professorships to our faculty members every year.

In particular, our research and development activities across the University emphasize fundamental discoveries at the forefronts of basic sciences and exploration of breakthrough technologies with a high potential for real applications. These can be reflected from our publications in the world's preeminent journals, awarded international patents, and technology transfer cases. In the 2013 R&D annual report, we highlight several key papers published in *Science* and *Nature* during 2012 and the first half of 2013. Also, we provide some facts and figures related to our other important R&D activities. It is undoubtedly too limited to give the full scope of R&D at NTHU, but a glimpse into our recent achievements. Hopefully, this can serve as a catalyst for further interactions, exchange of ideas, and establishment of collaborations.

Building on our proud heritage, NTHU will continue to promote excellent teaching and innovative research with the goal of ascending the University into the cradle of human accomplishments, important scientific discoveries and innovative technologies. I hope that you will find this R&D annual report useful and give us your precious opinions and suggestions.

Lih-Juann Chen
President
National Tsing Hua University
Hsinchu, Taiwan
July 2013

A handwritten signature in black ink that reads "L. J. Chen". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

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NTHU Today

Location

National Tsing Hua University is located in Hsinchu, a city 72 kilometers south of Taipei. The campus covers an area of over 105 hectares (260 acres) scenic land with lakes and trees. The campus is conveniently located, neighboring research institutes and universities such as the Hsinchu Science Park (HSP), the Industrial Technology Research Institute (ITRI), National Synchrotron Radiation Research Center (NSRRC), National Center for High-Performance Computing (NCHC), Food Industry Research and Development Institute (FIRDI), National Chiao Tung University (NCTU), Chung Hua University (CHU), and National Hsinchu University of Education (NHCUE). These establishments have made Hsinchu known as 'the Science City of Taiwan'.

Academics

(7 Colleges, 1 Commission, 17 Departments, and 24 Institutes)

-  College of Science
-  College of Engineering
-  College of Nuclear Science
-  College of Life Science
-  College of Electrical Engineering and Computer Science
-  College of Humanities and Social Sciences
-  College of Technology Management
-  Commission of General Education

College of Science	Degree Program(s) offered
Department of Mathematics	B / M / D
Department of Physics	B / M / D
Department of Chemistry	B / M / D
Interdisciplinary Program of Science	B
Institute of Statistics	M / D
Institute of Astronomy	M / D
Program of Science and Technology of Synchrotron Light	M / D
Biochemistry Program	D
College of Engineering	Degree Program(s) offered
Department of Chemical Engineering	B / M / D
Department of Materials Science and Engineering	B / M / D
Department of Power Mechanical Engineering	B / M / D
Department of Industrial Engineering and Engineering Management	B / M / D
Interdisciplinary Program of Engineering	B
Institute of NanoEngineering and MicroSystems	M / D
Industrial Engineering and Engineering Management Master Program	M
Institute of Biomedical Engineering	M
Program of Advanced Energy	D
College of Nuclear Science	Degree Program(s) offered
Department of Engineering and System Science	B / M / D
Department of Biomedical Engineering and Environmental Sciences	B / M / D
Interdisciplinary Program of Nuclear Science	B
Institute of Nuclear Engineering and Science	M / D
Program of Science and Technology of Synchrotron Light	M / D
College of Humanities and Social Sciences	Degree Program(s) offered
Department of Chinese Literature	B / M / D
Department of Foreign Languages and Literature	B / M
Interdisciplinary Program of Humanities and Social Sciences	B
Institute of History	M / D
Institute of Linguistics	M / D
Institute of Anthropology	M / D
Institute of Sociology	M / D
Institute of Philosophy	M
Institute of Taiwan Literature	M / D
Taiwan Studies MA Programs	M

B: Baccalaureate / M: Master / D: Doctorate

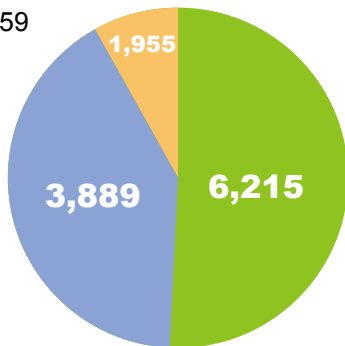
College of Life Science	Degree Program(s) offered
Department of Life Science	B
Department of Medical Science	B
Interdisciplinary Program of Life Science	B
Institute of Molecular and Cellular Biology	M / D
Institute of Molecular Medicine	M / D
Institute of Bioinformatics and Structural Biology	M / D
Institute of Biotechnology	M / D
Institute of Systems Neuroscience	M
Medicine Biotechnology Program	D
Structural Biology Program	D
Physician PhD Program	D
College of Electrical Engineering and Computer Science	Degree Program(s) offered
Department of Electrical Engineering	B / M / D
Department of Computer Science	B / M / D
Interdisciplinary Program of Electrical Engineering and Computer Science	B
Institute of Communications Engineering	M / D
Institute of Electronics Engineering	M / D
Institute of Information Systems and Applications	M / D
Institute of Photonics Technologies	M / D
Communications Engineering and Biology Information Program	D
College of Technology Management	Degree Program(s) offered
Department of Quantitative Finance	B / M
Department of Economics	B / M / D
Double Specialty Program of Management and Technology	B
Institute of Technology Management	M / D
MBA	M
Institute of Law for Science and Technology	M
EMBA	M
IMBA	M
Institute of Service Science	M
Commission of General Education	Degree Program(s) offered
Institute of Learning Sciences	M

B: Baccalaureate / M: Master / D: Doctorate

Statistics

Number of domestic student enrollment, as of March 2013

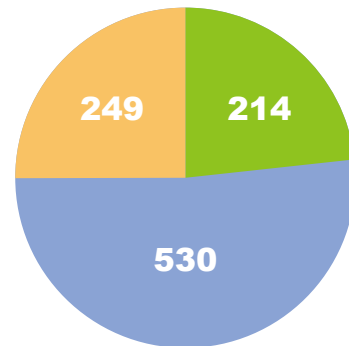
Total: 12,059



- B.S 6,215
- M.S 3,889
- Ph.D 1,955

Number of international students, as of February 2013

Total: 993



- Outgoing visiting student 214
- International student enrolled in degree programs 530
- Exchange student on campus 249

Number of faculty / staff, as of May 2013

Full-time faculty	638	<div style="width: 63.8%;"></div>
Research fellow	258	<div style="width: 25.8%;"></div>
Part-time faculty	313	<div style="width: 31.3%;"></div>
Administrative staff	688	<div style="width: 68.8%;"></div>

Number of graduates (2012)

B.S.	1,443	<div style="width: 144.3%;"></div>
M.S.	1,504	<div style="width: 150.4%;"></div>
Ph.D.	311	<div style="width: 31.1%;"></div>
Total	3,258	<div style="width: 325.8%;"></div>

Highlighted Research 2012-2013

- **Visualizing Long-Term Memory Formation in Two Neurons of the *Drosophila* Brain**
Science, vol. 335, pp. 678–685 (2012)
- **Crystal Structure of a Membrane-embedded H⁺-translocating Pyrophosphatase**
Nature, vol. 484, pp. 399–403 (2012)
- **‘Big Bang’ Tomography as a New Route to Atomic-Resolution Electron Tomography**
Nature, vol. 486, pp. 243–246 (2012)
- **Plasmonic Nanolaser Using Epitaxially Grown Silver Film**
Science, vol. 337, pp. 450–453 (2012)

- **Crystalline Inorganic Frameworks with 56-Ring, 64-Ring, and 72-Ring Channels**

Science, vol. 339, pp. 811–813 (2013)

- **Proton Structure from the Measurement of 2S-2P Transition Frequencies of Muonic Hydrogen**

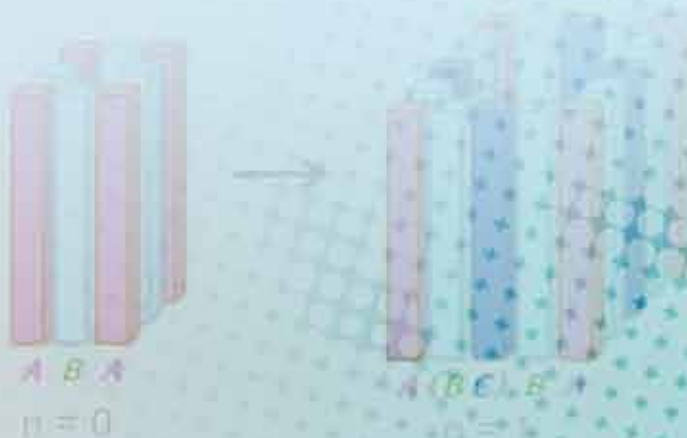
Science, vol. 339, pp. 417–420 (2013)

- **Structural Biological Materials: Critical Mechanics-Materials Connections**

Science, vol. 339, pp. 773–779 (2013)

- **Parallel Neural Pathways Mediate CO₂ Avoidance Responses in *Drosophila***

Science, vol. 340, pp. 1338–1341 (2013)



Visualizing Long-Term Memory Formation in Two Neurons of the *Drosophila* Brain

Long-term memory (LTM) depends on the synthesis of new proteins. Using a temperature-sensitive ribosome-inactivating toxin to acutely inhibit protein synthesis, we screened individual neurons making new proteins after olfactory associative conditioning in *Drosophila*. Surprisingly, LTM was impaired after inhibiting protein synthesis in two dorsal-anterior-lateral (DAL) neurons but not in the mushroom body (MB), which is considered the adult learning and memory center. Using a photoconvertible fluorescent protein KAEDE to report de novo protein synthesis, we have directly visualized cyclic adenosine monophosphate (cAMP) response element-binding protein (CREB)-dependent transcriptional activation of *calcium/calmodulin-dependent protein kinase II* and *period* genes in the DAL neurons after spaced but not massed training. Memory retention was impaired by blocking neural output in DAL during retrieval but not during acquisition or consolidation. These findings suggest an extra-MB memory circuit in *Drosophila*: LTM consolidation (MB to DAL), storage (DAL), and retrieval (DAL to MB).

Chun-Chao Chen (陳俊朝), Jie-Kai Wu (吳介凱), Hsuan-Wen Lin (林萱文), Tsung-Pin Pai (白宗彬), Tsai-Feng Fu (傅在峰), Chia-Lin Wu (吳嘉霖), Tully, Tim, Ann-Shyn Chiang (江安世)*

Science, vol. 335, pp. 678–685 (2012)

Web link: <http://www.sciencemag.org/content/335/6069/678.long>

Prof. Ann-Shyn Chiang
(Institute of Biotechnology / Department of Life Science / Brain Research Center)

Taiwanese scientists find “memory cells” in the brain

After 7 years of diligent research, a team of multi-disciplinary Taiwan scientists led by Professor Ann-Shyn Chiang of National Tsing Hua University have found that the formation of long-term memory requires the manufacture of new proteins in only a few cells in the brain. The discovery is reported as a full article in the February 10, 2012 edition of Science magazine.

According to Professor Chiang, “A long-standing goal in the field of neuroscience is to understand how learning and memory register in the brain. Where in the brain does a new experience first reside? How does a labile, fresh memory become stable and long-lasting?”

In humans, neuroscientists have known for a long time that the storage of memories of facts and events requires a neuroanatomical structure called the hippocampus. Once activated by an experience, the hippocampus then facilitates long-term memory formation in the cortex. With approximately 100 billion neurons in the human brain, however, it is extremely difficult to identify exactly which cells and circuits participate in any particular memory.

Surprisingly, fruit flies and humans show many similar behaviors required for the basic demands of daily life (learning, memory, attention, sleep, exploration, etc), using many similar genes and proteins. Yet, their brain circuitries are enormously less complex than those of humans. Fruit flies also have an impressive armamentarium of genetic tools, which have been used quite successfully to study the molecular mechanisms of many diseases, including Alzheimer’s, Parkinson’s and Huntington’s diseases.

One experimental observation seen widely among animal species is that the formation of long-term memory requires protein synthesis. To discover where in the fruit fly brain protein synthesis was required, we engineered a genetic tool to block the production of new proteins in individual neurons and then systematically screened neurons in the brain to identify those few in which protein synthesis was necessary during long-term memory formation.



Unexpectedly, long-term memory was impaired after inhibiting protein synthesis in just two cells, called the “dorsal-anterior-lateral (DAL) neurons”! Moreover, long-term memory remained normal when protein synthesis was inhibited in that part of the fruit fly brain, “the mushroom body,” which previously was thought to be the insect’s “learning/memory center.”

The formation of long-term memory depends on repetitive learning with spaced rest intervals, whether in fruit flies or humans. Using this spaced training procedure to identify mutant strains of the fruit fly with impaired long-term memory, this group of Taiwan scientists, in collaboration with Dr. Tim Tully at Dart Neuroscience in San Diego, were able to previously identify many mutants required for long-term memory. When this team of scientists looked to see where the corresponding genes were expressed in the brain, many did so in the DAL neurons. Using genetic engineering to prevent the activation of these genes selectively in the DAL neurons, Chun-Chao Chen, the lead author of the Science publication, discovered that protein synthesis in DAL neurons was required for the formation of long-term memory.

Together with Tsai-Feng Fu at National Chi Nan University in Taiwan, another new genetically engineered tool was also developed to visualize new protein synthesis in a single neuron in real time. It was found that at least two genes, *calcium/calmodulin-dependent protein kinase II* and *period*, were synthesized in the DAL neurons specifically in response to spaced training.

How could the two DAL neurons encode complex memories? Chen and his colleagues showed that memory retrieval was impaired when the electrical activity of DAL neurons was blocked. They also showed that DAL neurons connect directly to neurons of the mushroom body, which is a structure consisting of thousands of neurons.

These findings suggest a simple model for the formation and retrieval of long-term memory formation. During memory formation sustained electrical activity in the mushroom body initiates electrical activity in DAL neurons. This electrical activity then initiates the synthesis of new proteins in DAL neurons, which then alters the function (and/or structure) of DAL neurons. During memory retrieval, DAL neurons facilitate electrical activity in the mushroom body after re-exposure to the original stimulus. Thus, by changing the activities (via new protein synthesis) in only a few nodes (DAL neurons) in a complex network, a previous experience (memory)

can change a fly’s behavioral choices.

“The identification of individual “memory neurons” also will enable the identification of additional “memory proteins”, thereby contributing to a more complete understanding of the molecular mechanisms of learning and memory and diseases thereof. We will also use our new genetic tools to make a more complete map of the brain circuits involved in learning and memory. It waits to be confirmed whether human brains also store long-term memories via the manufacture of new proteins in only a few nodes in complex circuits.” concluded Professor Chiang.

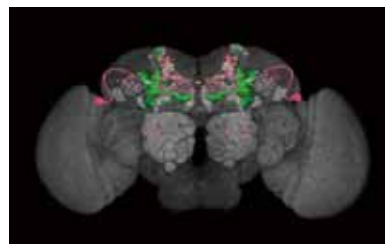


Figure 1. Anterior view of a *Drosophila* brain showing a part of olfactory associative long-term memory (LTM) retrieval circuits. New protein synthesis for storing LTM occurs in the two dorsal-anterior-lateral (DAL) neurons (magenta) with axonal terminals (light blue) linking to the pioneer α/β neurons (green) at the K5 region (white) of the mushroom body. The DAL neurons give numerous dendrites (yellow) at dorsal frontal protocerebrum where they may receive inputs. The brain was counterstained with anti-disc large immunostaining (grey).

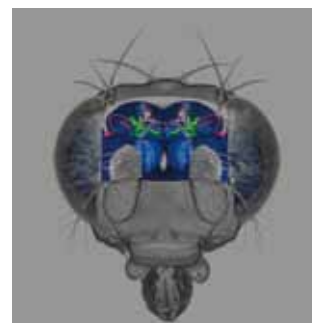


Figure 2. Anterior montage view of a *Drosophila* brain within its head capsule showing a part of olfactory associative long-term memory (LTM) retrieval circuits. New protein synthesis for storing LTM occurs in the two dorsal-anterior-lateral (DAL) neurons (magenta) with axonal terminals (light blue) linking to the pioneer α/β neurons (green) at the K5 region (white) of the mushroom body. The DAL neurons give numerous dendrites (yellow) at dorsal frontal protocerebrum where they may receive inputs. The head capsule and brain were counterstained with DiD (grey) and anti-disc large immunostaining (deep blue), respectively.

Crystal Structure of a Membrane-embedded H⁺-translocating Pyrophosphatase

H⁺-translocating pyrophosphatases (H⁺-PPases) are active proton transporters that establish a proton gradient across the endomembrane by means of pyrophosphate (PP_i) hydrolysis. H⁺-PPases are found primarily as homodimers in the vacuolar membrane of plants and the plasma membrane of several protozoa and prokaryotes. The three-dimensional structure and detailed mechanisms underlying the enzymatic and proton translocation reactions of H⁺-PPases are unclear. Here we report the crystal structure of a *Vigna radiata* H⁺-PPase (VrH⁺-PPase) in complex with a non-hydrolyzable substrate analogue, imidodiphosphate (IDP), at 2.35 Å resolution. Each VrH⁺-PPase subunit consists of an integral membrane domain formed by 16 transmembrane helices. IDP is bound in the cytosolic region of each subunit and trapped by numerous charged residues and five Mg²⁺ ions. A previously undescribed proton translocation pathway is formed by six core transmembrane helices. Proton pumping can be initialized by PP_i hydrolysis, and H⁺ is then transported into the vacuolar lumen through a pathway consisting of Arg 242, Asp 294, Lys 742 and Glu 301. We propose a working model of the mechanism for the coupling between proton pumping and PP_i hydrolysis by H⁺-PPases.

Prof. Yuh-Ju Sun and Prof. Rong-Long Pan
(Institute of Bioinformatics and Structural Biology /
Department of Life Science)

H⁺-PPases are primarily found as homodimers in the vacuolar membrane of plants and the plasma membrane of several protozoa and prokaryotes. They display a high degree of amino acid sequence homology (86-91% identity in land plants), and can be divided into two subfamilies: type I (K⁺-dependent) and type II (K⁺-independent). A PP_i binding motif, (E/D)(X)₇KXE and two acidic motifs, DX₃DX₃D, have been suggested as essential for the H⁺-PPase enzymatic function. Nevertheless, the three-dimensional structure of H⁺-PPase is unknown. To understand the three-dimensional structure and detailed mechanisms underlying the enzymatic mechanism and proton translocation reactions of H⁺-PPases, we have reported the first crystal structure of a *Vigna radiata* H⁺-PPase (VrH⁺-PPase) in complex with a non-hydrolyzable substrate analogue, imidodiphosphate (IDP), at 2.35 Å resolution.

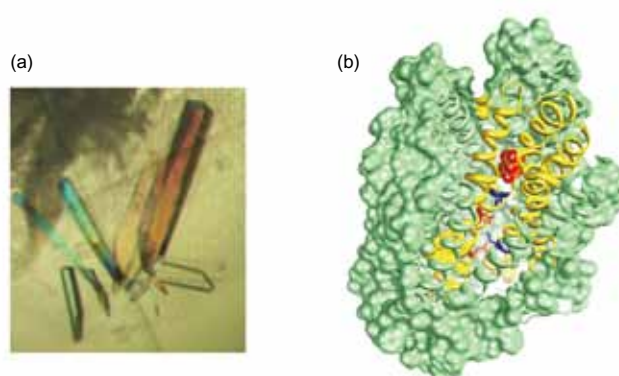


Figure 1. (a) VrH⁺-PPase crystal. (b) The overall structure of VrH⁺-PPase monomer in complex with its non-hydrolyzed analog, IDP (in sphere). The centre six core TMs are shown in yellow ribbon and the outer ten TMs are drawn in green surface. Four lined-up charged residues (colored in red and blue sticks) within the centre six TMs provide a path for proton translocation.

Shih-Ming Lin (林士鳴), Jia-Yin Tsai (蔡佳吟), Chwan-Deng Hsiao (蕭傳鐙), Yun-Tzu Huang (黃蘊慈), Chen-Liang Chiu (邱振良), Mu-Hsuan Liu (劉慕萱), Jung-Yu Tung (董容羽), Tseng-Huang Liu (劉振凰), Rong-Long Pan (潘榮隆)* & Yuh-Ju Sun (孫玉珠)*

Nature, v484, pp. 399–403 (2012)

Web link: <http://www.nature.com/nature/journal/v484/n7394/full/nature10963.html>



As shown in Figure 1, H^+ -pyrophosphatase structure reveals a rosette manner folding with 16 transmembrane helices (TMs) within two concentric walls: six and ten helices at inner and outer circle in a counterclockwise manner. The substrate/IDP binding site is a funnel-shaped pocket formed by six core TMs with a solvent accessible volume of 1521 \AA^3 . Following PP_i hydrolysis, the proton translocation will be carried on in H^+ -PPase. A unique proton translocation pathway was made by six centre transmembrane helices in each monomer. In the VrH^+ -PPase complex, four acidic and basic amino acid residues, R242-D294-K742-E301, are sequentially lined up and buried in the transmembrane domain exactly beneath the PP_i binding pocket. Glu301 was completely embedded inside the transmembrane region acting as a constricted neck. Beyond this glutamate several hydrophobic residues keep protons of high concentration inside vacuole for the consumption by the secondary transporters.

Based on the structural and biochemical studies of VrH^+ -PPase, a working model for proton translocation was

suggested (Figure 2). In the resting state (R-state/ligand free), the structure of binding pocket in H^+ -PPase (Figure 2a) is more flexible and rather open to the solvent. Upon the substrate (or IDP in our structure) access to the binding site, an initiated state for PP_i hydrolysis (I-state/ PP_i bound) was formed (Figure 2b). The centre transmembrane helices (such as M6 and M16) on the cytosolic side transform into a closed conformation to lock PP_i in the substrate binding pocket. Meanwhile, the luminal portion of these TMs would be changed to a semi-open conformation for the following H^+ -translocation. The hydrolysis of pyrophosphate at the transient state (T-state/ PP_i hydrolyzed) generates the free phosphate, subsequently followed by the proton producing (Figure 2c). Our structure presents the H^+ -PPase-IDP complex in an I-state. This proton-pumping mechanism gives researchers the first-hand information in understanding the working of plant vacuole.

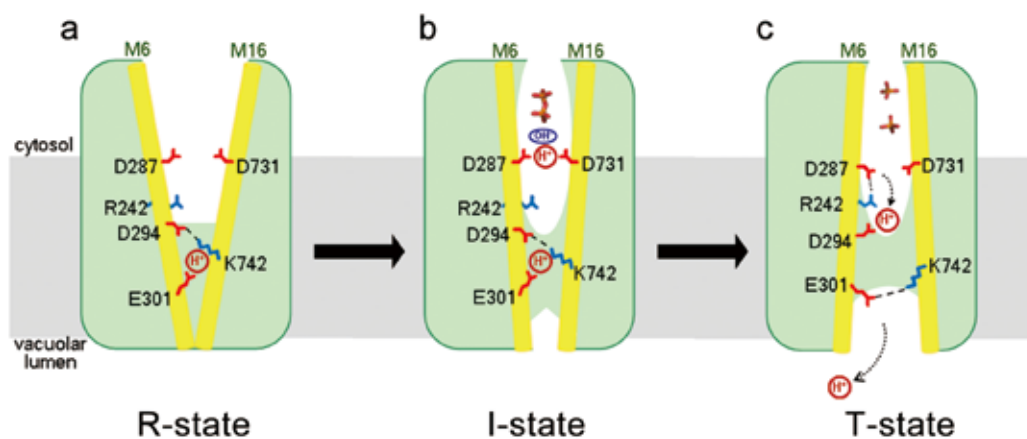


Figure 2. A proton-translocating mechanism in H^+ -PPase. Three possible states are indicated: resting state (R-state/ligand free), initiated state (I-state/ PP_i bound) and transient state (T-state/ PP_i hydrolyzed).

'Big Bang' Tomography as a New Route to Atomic-Resolution Electron Tomography

Until now it has not been possible to image at atomic resolution using classical electron tomographic methods, except when the target is a perfectly crystalline nano-object imaged along a few zone axes. The main reasons are that mechanical tilting in an electron microscope with sub-ångström precision over a very large angular range is difficult, that many real-life objects such as dielectric layers in microelectronic devices impose geometrical constraints and that many radiation-sensitive objects such as proteins limit the total electron dose. Hence, there is a need for a new tomographic scheme that is able to deduce three-dimensional information from only one or a few projections. Here we present an electron tomographic method that can be used to determine, from only one viewing direction and with sub-ångström precision, both the position of individual atoms in the plane of observation and their vertical position. The concept is based on the fact that an experimentally reconstructed exit wave consists of the superposition of the spherical waves that have been scattered by the individual atoms of the object. Furthermore, the phase of a Fourier component of a spherical wave increases with the distance of propagation at a known 'phase speed'. If we assume that an atom is a point-like object, the relationship between the phase and the phase speed of each Fourier component is linear, and the distance between the atom and the plane of observation can therefore be determined by linear fitting. This picture has similarities with Big Bang cosmology, in which the Universe expands from a point-like origin such that the distance of any galaxy from the origin is linearly proportional to the speed at which it moves away from the origin (Hubble expansion). The proof of concept of the method has been demonstrated experimentally for graphene with a two-layer structure and it will work optimally for similar layered materials, such as boron nitride and molybdenum disulphide.

Prof. Fu-Rong Chen
(Department of Engineering and System Science)

Consider a coherent plane electron wave that interacts with a single atom. If we assume the atom to be a single point, it acts as a source for a spherical wave (Ewald sphere) that propagates to the plane of detection (the image plane), where it interferes with the spherical waves emitted by the other atoms. Using focal series reconstruction or off-axis holography, it is possible to reconstruct the exit wave of the object (in the future this might even be possible using phase plates). The challenge is how to determine the three-dimensional position of every individual atom of the object from the exit wave. Every spherical wave can be decomposed in terms of Fourier components. In the Fresnel approximation for the spherical wave, which is valid for high-energy electrons, the phase of each Fourier component varies linearly with increasing distance from the source and is given by $\pi\lambda g^2 f$, where λ is the wavelength, g is the spatial frequency and f is the focal distance between the atom and the plane at which the exit wave is reconstructed. Thus, if we select the exit wave around the projection of a particular atom, Fourier transform the wave and plot the respective phases of the Fourier components as function of the square of the spatial frequency, we obtain a straight line. This plot is analogous with the Hubble plot in cosmology, which shows that the distance and recessional speed of a distant galaxy are related linearly. By linear fitting of our plot, we obtain the vertical distance from the atom to the plane of observation (the reconstructed exit wave). In our analogy, this distance is the counterpart of the time between the Big Bang and the present. Please see the attached figure.

Dirk Van Dyck*, Joerg R. Jinschek & Fu-Rong Chen (陳福榮)*

Nature, vol. 486, pp. 243–246 (2012)

Web link: <http://www.nature.com/nature/journal/v486/n7402/full/nature11074.html>

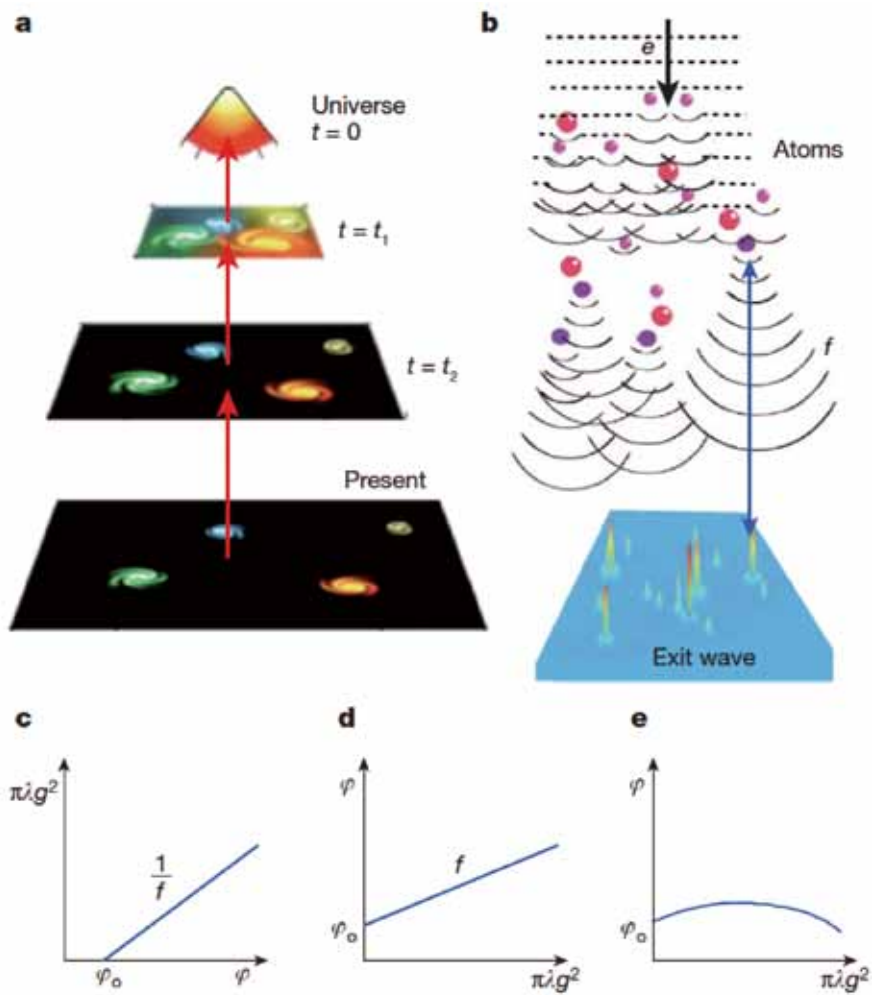


Figure 1.

Big Bang analogy. a, b, Comparison between the Big Bang (a) and the point-atom 'big bang' (b). c, Phase speed plotted against phase. The relationship between the two is the same as that expressed in cosmology by Hubble's law, which gives the linear relationship between the distance and the speed of a distant galaxy. Here the slope is the reciprocal focal distance, $1/f$. Note that at the position of the atom, the phase of the atom wave does not start from zero; instead, it has a value, φ_0 , characteristic of the atom., Phase plotted against phase speed, which we refer to as the Hubble plot here. The slope gives the focal distance between the emitting atom and the plane of reconstruction of the exit wave. e, Same as in d, but with a minor residual spherical aberration with Cs50.3 mm (see text).

Plasmonic Nanolaser Using Epitaxially Grown Silver Film

A nanolaser is a key component for on-chip optical communications and computing systems. Here, we report on the low-threshold, continuous-wave operation of a subdiffraction nanolaser based on surface plasmon amplification by stimulated emission of radiation. The plasmonic nanocavity is formed between an atomically smooth epitaxial silver film and a single optically pumped nanorod consisting of an epitaxial gallium nitride shell and an indium gallium nitride core acting as gain medium. The atomic smoothness of the metallic film is crucial for reducing the modal volume and plasmonic losses. Bimodal lasing with similar pumping thresholds was experimentally observed, and polarization properties of the two modes were used to unambiguously identify them with theoretically predicted modes. The all-epitaxial approach opens a scalable platform for low-loss, active nanoplasmonics.

Yu-Jung Lu (呂 宥 蓉), Jisun Kim, Hung-Ying Chen (陳虹穎), Chihhui Wu, Nima Dabidian, Charlotte E. Sanders, Chun-Yuan Wang (王 俊 元), Ming-Yen Lu (呂 明 諺), Bo-Hong Li, Xianggang Qiu, Wen-Hao Chang, Lih-Juann Chen (陳 力 俊), Gennady Shevets, Chih-Kang Shih*, Shangjr Gwo (果尚志)*

Science, vol. 337, pp. 450–453 (2012)

Web link: <http://www.sciencemag.org/content/337/6093/450.full>

Prof. Shangjr Gwo
(Department of Physics)

Significantly reducing the size of semiconductor lasers in all three dimensions is the ultimate challenge for the development of nanolasers, which is a key component for long-awaited on-chip optical communications and computing systems. However, the minimum size of conventional semiconductor lasers utilizing dielectric cavity resonators is governed by the optical diffraction limit.

Professor Shangjr Gwo (Department of physics) and Professor Lih J. Chen (Department of Materials Science and Engineering) of National Tsing Hua University, in collaboration with Professor Chih-Kang Shih of the University of Texas at Austin, led a team of researchers, recently demonstrated the record-small nanolaser based on a new lasing mechanism.

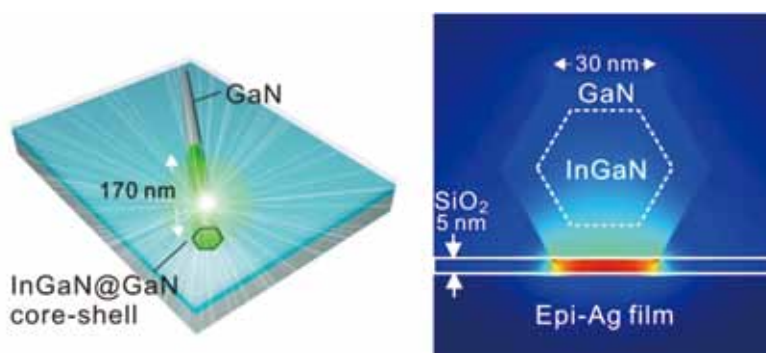


Figure 1. (a) Schematic of metal-oxide-semiconductor (MOS) plasmonic laser, containing a single InGaN@GaN core-shell nanorod on a SiO₂-covered epitaxial Ag film. (b) Scanning transmission electron microscopy (STEM) of a single-crystalline InGaN@GaN core-shell nanorod. (c) Calculated energy-density distribution, the sandwich structure is utilized to confine SPPs within the low-k dielectric nanogaps layer.residual spherical aberration with Cs50.3 mm (see text).



This new class of lasers is based on surface plasmon amplification by stimulated emission of radiation (spaser), which was proposed in 2003 by D. J. Bergman and Mark I. Stockman. In such lasers, instead of conventional photonic cavities, the coupling of photons and plasmons on noble metal surfaces at optical frequencies constitutes the necessary laser feedback mechanism, as shown in Figure 1. However, it remains whether one indeed can overcome the high losses in three-dimensional (3D)-confined, deep-subwavelength plasmonic cavities with the currently noble metals and semiconductor gain materials.

In this work, some important breakthroughs are reported. First, the atomically smooth, epitaxial Ag film grown

on Si substrate based on a novel quantum growth mode has been successfully utilized as a platform material to fabricate low-loss plasmonic cavities. Second, by using single, shape-controlled InGaN/GaN core-shell nanorods as the gain media with a very large gain coefficient in the green spectral region, it is shown that diffraction-unlimited nanolasers under continuous-wave (CW) optical pumping can be operated with an ultralow threshold power above liquid nitrogen temperature (Figure 2). These nanolasers, with record-small cavity and mode volumes are orders of magnitude smaller than the 3D diffraction limit and the feature sizes are comparable with that of the state-of-the-art CMOS transistors in nanoelectronics.

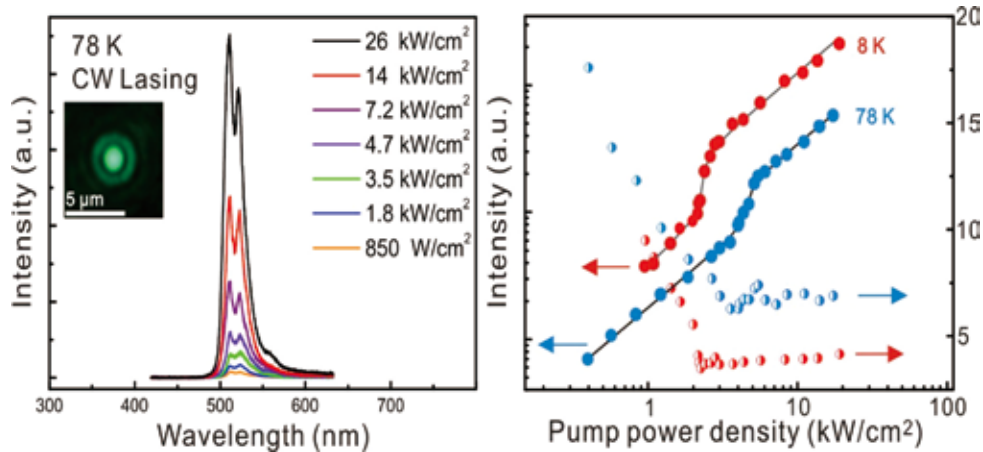


Figure 2. On the left, continuous wave (CW) lasing spectra from a single nanorod at 78 K under varying optical power densities excited by a CW semiconductor diode laser at 405 nm. Clear lasing signatures are also identified, including the concurrent lasing thresholds of output intensity kink and spectra linewidth narrowing.

Size mismatches between electronics and photonics have been a huge barrier to realize on-chip optical communications and computing systems. The recent surge of research interest in nanoplasmonics has been largely due to its capability to break the diffraction limit. However, the lossy nature of conventional plasmonic

materials requires a remedy to overcome this difficulty. The results reported in this work represent a significant step toward low-loss, active nanoplasmonics, which can have great advantages in both feature size and operation speed.

Crystalline Inorganic Frameworks with 56-Ring, 64-Ring, and 72-Ring Channels

The development of zeolite-like structures with extra-large pores (>12-membered rings, 12R) has been sporadic and is currently at 30R. In general, templating via molecules leads to crystalline frameworks, whereas the use of organized assemblies that permit much larger pores produces noncrystalline frameworks. Synthetic methods that generate crystallinity from both discrete templates and organized assemblies represent a viable design strategy for developing crystalline porous inorganic frameworks spanning the micro and meso regimes. We show that by integrating templating mechanisms for both zeolites and mesoporous silica in a single system, the channel size for gallium zincophosphites can be systematically tuned from 24R and 28R to 40R, 48R, 56R, 64R, and 72R. Although the materials have low thermal stability and retain their templating agents, single-activator doping of Mn^{2+} can create white-light photoluminescence.

Hsin-Yau Lin (林新堯), Chih-Yuan Chin (秦志遠), Hui-Lin Huang (黃惠琳), Wen-Yen Huang (黃文彥), Ming-Jhe Sie (謝明哲), Li-Hsun Huang (黃莉勛), Yuan-Han Lee (李元翰), Chia-Her Lin (林嘉和), Kwang-Hwa Lii (李光華), Xianhui Bu, Sue-Lein Wang (王素蘭)*

Science, vol. 339, pp. 811–813 (2013)

Web link: <http://www.sciencemag.org/content/339/6121/811.full>

Prof. Sue-Lein Wang
(Department of Chemistry)

Zeolite-like structures with extra-large pores (>12-membered rings, 12R) are always the focus of attention as they may promise new properties and applications. Relative to the more recent metal-organic frameworks, progress in the expansion of inorganic channels has tended to be slow, sporadic, and is currently at 30R, without any way to predict the next channel-ring size. This difficulty could be attributed to the lack of tunable spacer units (e.g., organic linkers) and an inability to control the linkages of the inorganic units. In addition, limitations in channel or pore size may result from the fact that organized assemblies such as surfactant-based templates, while capable of creating large pore sizes, generally lead to disordered wall structures as exemplified by the mesoporous silicates. Thus far, the rational design of microporous and mesoporous inorganic frameworks with ordered wall structures has not been reported.

Synthetic methods that generate crystallinity from both discrete templates and organized assemblies represent a viable design strategy for developing crystalline porous inorganic frameworks spanning the micro and meso regimes. We show that by integrating templating mechanisms for both zeolites and mesoporous silica in a single system, the channel size for gallium zincophosphites (referred to as NTHU-13 family) can be systematically tuned from 24R and 28R to 40R, 48R, 56R, 64R, and 72R (Figure 1).



Figure 1. Systematic expansion of structures with extra-large channels with ring size ranging from 24R to 72R.



Previous efforts that used monoamines with long straight carbon chains (>8C) in microporous material synthesis often led to lamellar-phased products. We found that we could increase the likelihood of larger channels by using heterometal centers. In single-metal systems, an increase in template size led to different structures rather than the expansion of ring sizes in the channels. In this study, we used the zinc-gallium bimetallic system and found that increasing the template from 4C-containing (4C') butylamine to 6C' hexylamine was sufficient to enlarge the channel sizes from 24R to 28R, creating 28R-NTHU-13 with a channel diameter exceeding 1 nm. In subsequent reactions, the use of longer amine (8C' octylamine, 10C' decylamine, or 12C' dodecylamine) created the larger ring products 40R- and 48R-NTHU-13, respectively. The use of 14C' tetradecylamine, 16C' hexadecylamine, and 18C' octadecylamine led to the synthesis of 56R-NTHU-13, 64R-NTHU-13, and 72R-NTHU-13 in which pore sizes were as large as 3.5 nm.

We used single-crystal x-ray diffraction to characterize all six structures in the NTHU-13 family. Four channels were determined in the unit cells for 40R-, 48R-, 56R-, 64R-, and 72R-NTHU-13, and eight channels were found in the orthorhombic cell for 28R-NTHU-13. Except for the latter, the channel walls were constructed exclusively

from the following three building blocks: anionic chains of $\infty[\text{GaF}(\text{HPO}_3)_2]^{2-}$ (block A), neutral chains of $\infty[\text{Zn}(\text{HPO}_3)]$ (block B), and an anionic trimeric cluster of $[\text{Zn}(\text{HPO}_3)_2(\text{H}_2\text{O})_4]^{2-}$ (block C) (Figure 2). Block A was located at the four corners of the square-shaped channels both A and C were linked only to B and they were never adjacent. A generalized formula of $[\text{A}(\text{BC})_n\text{BA}]$ describes the stoichiometry and connectivity of the four faces or edges of the inorganic walls: $n = 1$ for each face or edge of the 40R channel, $n = 2$ for the 56R channel, and $n = 3$ for the 72R channel. When $n = 0$, the corresponding channel face is ABA and is observed to form 24R channels. Hence, the 40R, 56R, and 72R square-windowed channels can be viewed as the systematic expansion of the 24R channel by inserting one or more BC pairs as the proliferation unit. The rectangular-windowed 48R and 64R channels contain two mixed n values (n and $n + 1$) to describe the shorter and longer window edges. An increase of one BC pair would add four polyhedra to each channel edge, leading to an expansion by 16 rings for square-windowed channels (24R to 40R; 40R to 56R; 56R to 72R) and 8 rings for rectangular-windowed channels (40R to 48R; 48R to 56R; 56R to 64R; 64R to 72R).

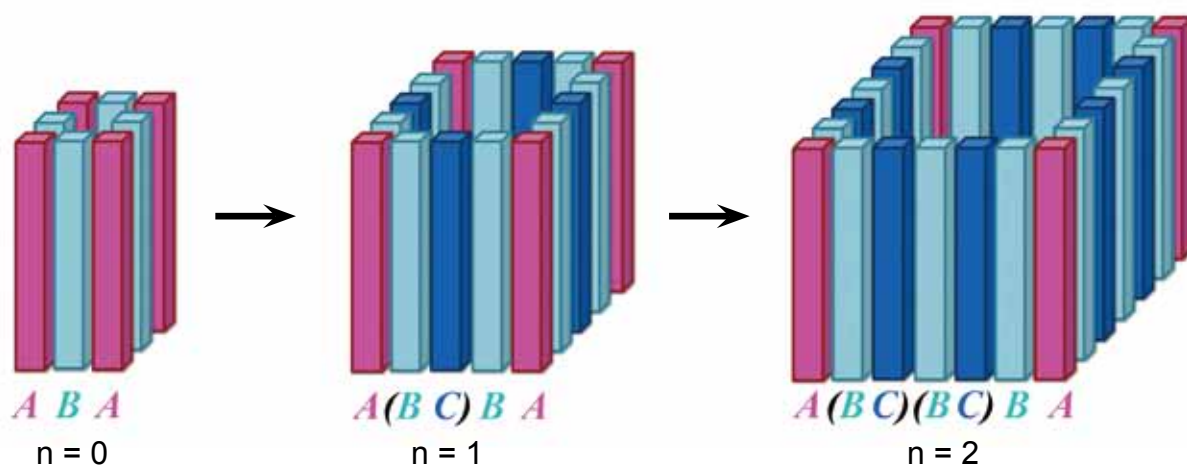


Figure 2. An increase of one BC pair would add four polyhedral to each channel edge, leading to an expansion by 16 rings for square-windowed channels; for the 16-ring expansion, there was an approximate 0.8-nm increase in the channel diameter.

Proton Structure from the Measurement of 2S-2P Transition Frequencies of Muonic Hydrogen

Accurate knowledge of the charge and Zemach radii of the proton is essential, not only for understanding its structure but also as input for tests of bound-state quantum electrodynamics and its predictions for the energy levels of hydrogen. These radii may be extracted from the laser spectroscopy of muonic hydrogen (μp , that is, a proton orbited by a muon). We measured the $2S_{1/2}^{F=0} - 2P_{3/2}^{F=1}$ transition frequency in μp to be 54611.16(1.05) gigahertz (numbers in parentheses indicate one standard deviation of uncertainty) and reevaluated the $2S_{1/2}^{F=1} - 2P_{3/2}^{F=2}$ transition frequency, yielding 49881.35(65) gigahertz. From the measurements, we determined the Zemach radius, $r_Z = 1.082(37)$ femtometers, and the magnetic radius, $r_M = 0.87(6)$ femtometer, of the proton. We also extracted the charge radius, $r_E = 0.84087(39)$ femtometer, with an order of magnitude more precision than the 2010-CODATA value and at 7σ variance with respect to it, thus reinforcing the proton radius puzzle.

Prof. Yi-Wei Liu
(Department of Physics)

Proton size puzzle reinforced

Taiwanese Physicists and their International collaborators confirm surprisingly small proton radius with laser spectroscopy of exotic hydrogen.

The hydrogen atom has played a key role in the investigation of the fundamental laws of physics. Its nucleus consists of a single positively charged proton orbited by a negatively charged electron. The energy levels of this most simple atom can be predicted with excellent precision from the theory of quantum electrodynamics. However, the calculations have to take into account that – in contrast to the point-like electron – the proton is an extended object, made of three quarks bound by so-called ‘gluons’. Therefore the electric charge as well as the magnetism of the proton is distributed over a certain area. The extension of the proton causes a shift of the energy levels in hydrogen. Hence the electric and the magnetic charge radii can be deduced from a measurement of the level shifts.

In 2010, the first results on the spectroscopic determination of the shift of the so-called 2S energy level in muonic hydrogen were published. The exotic atoms were generated by bombarding a target of regular hydrogen with muons from an accelerator at the PSI. Muons behave a lot like electrons, except for their mass: muons are 200 times heavier than electrons. The atomic orbit of the muon is therefore much closer to the proton than the electron’s orbit in a regular hydrogen atom. This results in a much larger sensitivity of the muon’s energy level to the proton size and hence to a stronger shift of the energy levels. Measuring the level shifts is very demanding for technology: muonic hydrogen is very short-lived (muons decay after about two millionths of a second), so the light pulses for the excitation of the resonance have to be fired onto the hydrogen target only nanoseconds after the detection of a muon.

Aldo Antognini, François Nez, Karsten Schuhmann, Fernando D. Amaro, François Biraben, João M. R. Cardoso, Daniel S. Covita, Andreas Dax, Satish Dhawan, Marc Diepold, Luis M. P. Fernandes, Adolf Giesen, Andrea L. Gouvea, Thomas Graf, Theodor W. Hänsch, Paul Indelicato, Lucile Julien, Cheng-Yang Kao (高政揚), Paul Knowles, Franz Kottmann, Eric-Olivier Le Bigot, Yi-Wei Liu (劉怡維), José A. M. Lopes, Livia Ludhova, Cristina M. B. Monteiro, Françoise Mulhauser, Tobias Nebel, Paul Rabinowitz, Joaquim M. F. dos Santos, Lukas A. Schaller, Catherine Schwob, David Taqqu, João F. C. A. Veloso, Jan Vogelsang, Randolph Pohl

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Web link: <http://www.sciencemag.org/content/339/6118/417.full>



In the experiment described in the newly published Science article, the energy shift was determined for another transition. This leads to a new measurement of the electric charge radius of the proton. Its value of 0.84087(39) femtometres (1 fm = 0.000 000 000 000 001 metre) is in good agreement with the group published in 2010, but 1.7 times as precise. The discrepancy to measurements in regular hydrogen or to electron-proton-scattering has thus been reinforced. In addition, the new measurement allows a determination of the magnetic radius of the proton for the first time by laser spectroscopy of muonic hydrogen. A value of 0.87(6) femtometres is determined, which is in agreement with previous measurements. Though the precision is, at present, of the same order as in other experiments, laser spectroscopy of muonic hydrogen has the potential of achieving a much better accuracy in the determination of the magnetic proton radius in the future.

Physicists around the world are seeking a solution to the proton puzzle. Previous measurements in regular hydrogen or electron-proton-scattering are reanalyzed or even repeated. Theorists of various disciplines suggested ways to explain the discrepancy. Very interesting proposals explain the discrepancies by physics beyond the standard

model. Other explanations suggest a proton structure of higher complexity than assumed today. The complex structure is expected to reveal itself under the influence of the heavy muon. New measurements are needed to confirm these speculations. Muon-proton-scattering experiments are being developed at PSI. Meanwhile, new precision measurements at the electron accelerator in Mainz are also being considered. The PSI team plans to apply for the first time ever laser spectroscopy to muonic helium in the course of this year as well.

The Taiwan team from National Tsing Hau University (Yi-Wei Liu, professor of physics) participates this experiment for over ten years, with close collaboration with all the international teams. They contributed in various aspects of the experiment, especially the laser system and the precision measurement technique. Under the support from National Science, Taiwan and National Tsing Hau University, They are looking forward to unveiling the secret of proton size and exploring the possibility of the “New Physics”.

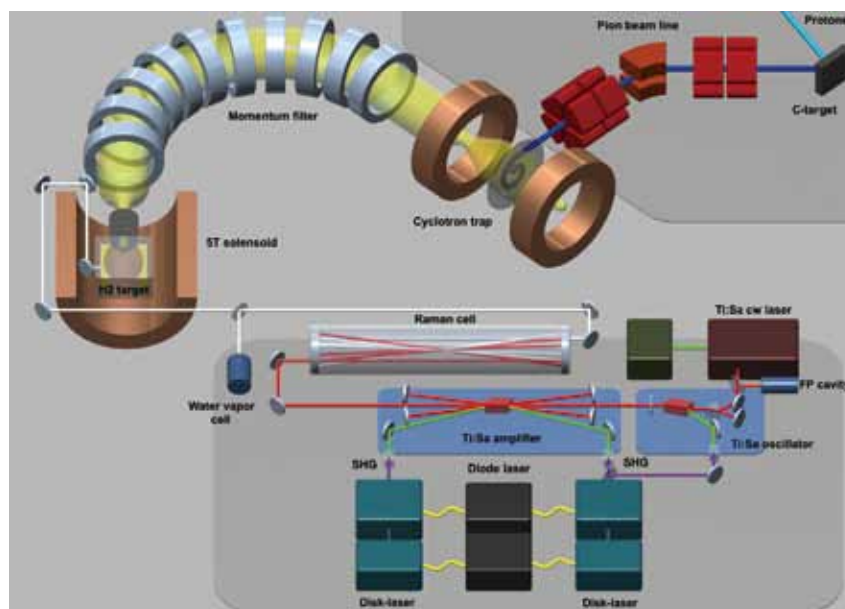


Figure 1. The experimental setup for the laser spectroscopy of muonic hydrogen. Slow muon beam from PSI accelerator interacting with hydrogen atoms form metastable muonic hydrogens. The laser system is composed of a Ti:Sapphire pulse laser and a Raman cell to excite the 2S-2P transition.

Structural Biological Materials: Critical Mechanics-Materials Connections

Spider silk is extraordinarily strong, mollusk shells and bone are tough, and porcupine quills and feathers resist buckling. How are these notable properties achieved? The building blocks of the materials listed above are primarily minerals and biopolymers, mostly in combination; the first weak in tension and the second weak in compression. The intricate and ingenious hierarchical structures are responsible for the outstanding performance of each material. Toughness is conferred by the presence of controlled interfacial features (friction, hydrogen bonds, chain straightening and stretching); buckling resistance can be achieved by filling a slender column with a lightweight foam. Here, we present and interpret selected examples of these and other biological materials. Structural bio-inspired materials design makes use of the biological structures by inserting synthetic materials and processes that augment the structures' capability while retaining their essential features. In this Review, we explain this idea through some unusual concepts.

Marc André Meyers*, Joanna McKittrick, Po-Yu Chen (陳柏宇)

Science, vol. 339, pp. 773–779 (2013)

Web link: <http://www.sciencemag.org/content/339/6121/773.full>

Prof. Po-Yu Chen
(Department of Materials Science and Engineering)

*M*ost biological (natural) materials are composites whose mechanical properties are often outstanding, considering the weak constituents from which they are assembled. These biological composites, which have risen from hundreds of millions of years of evolution, are inspiring scientists and engineers in the design of novel materials. In this invited review, these three authors presented and interpreted selected examples using Materials Science and Engineering approaches, focusing on the structure-mechanical property relationships. Three bio-inspired concepts are discussed in this review:

1. Structures in Tension: Importance of Biopolymers

Spider silk is a fascinating material with high tensile strength and extensibility. The ability to sustain tensile forces requires a specific set of molecular and configurational conformations. It is composed of beta-sheet nano-crystals embedded in a disordered matrix. Under tensile stress, several deformation mechanisms take place: the low-stress region corresponds to uncoiling and straightening of the protein strands, followed by entropic unfolding of the amorphous strands and then stiffening due to load transfer to the crystalline beta-sheets. This type of deformation mechanism is also utilized by other biological soft materials such as wool, whelk eggs, and other silks.

2. Imparting Toughness: Importance of Interfaces

Ceramics are hard yet brittle. Surprisingly, ceramic-based composites found in nature are usually tough and can sustain high compressive strength without fracture. This is due to their sophisticated hierarchical structure and the presence of interfaces. As a crack impinges on an interface or discontinuity in the biological material, it can be deflected around the interface, requiring more energy to propagate than a straight crack and enhancing toughness or fracture resistance. Examples are the brick-and-mortar microstructure of abalone shell, twisted plywood structure of crustacean exoskeleton and concentric layered structure of sponge spicules.



3. Lightweight Structures Resistant to Buckling—Shells and Foams

Bird feathers, toucan beaks, porcupine quills need to be lightweight and stiff, and able to resist bending, torsion and buckling. This is achieved by filling a slender columnar shell with lightweight foam. This sandwich structure demonstrates a synergistic effect on mechanical properties and may inspire future design in aircraft and aerospace vehicles.

The application of the mechanics and materials science methodologies is promoting a new understanding of biological materials and guiding the design of biologically inspired materials, which will extend to sustainable development by employing more energy efficient and “greener” designs.”

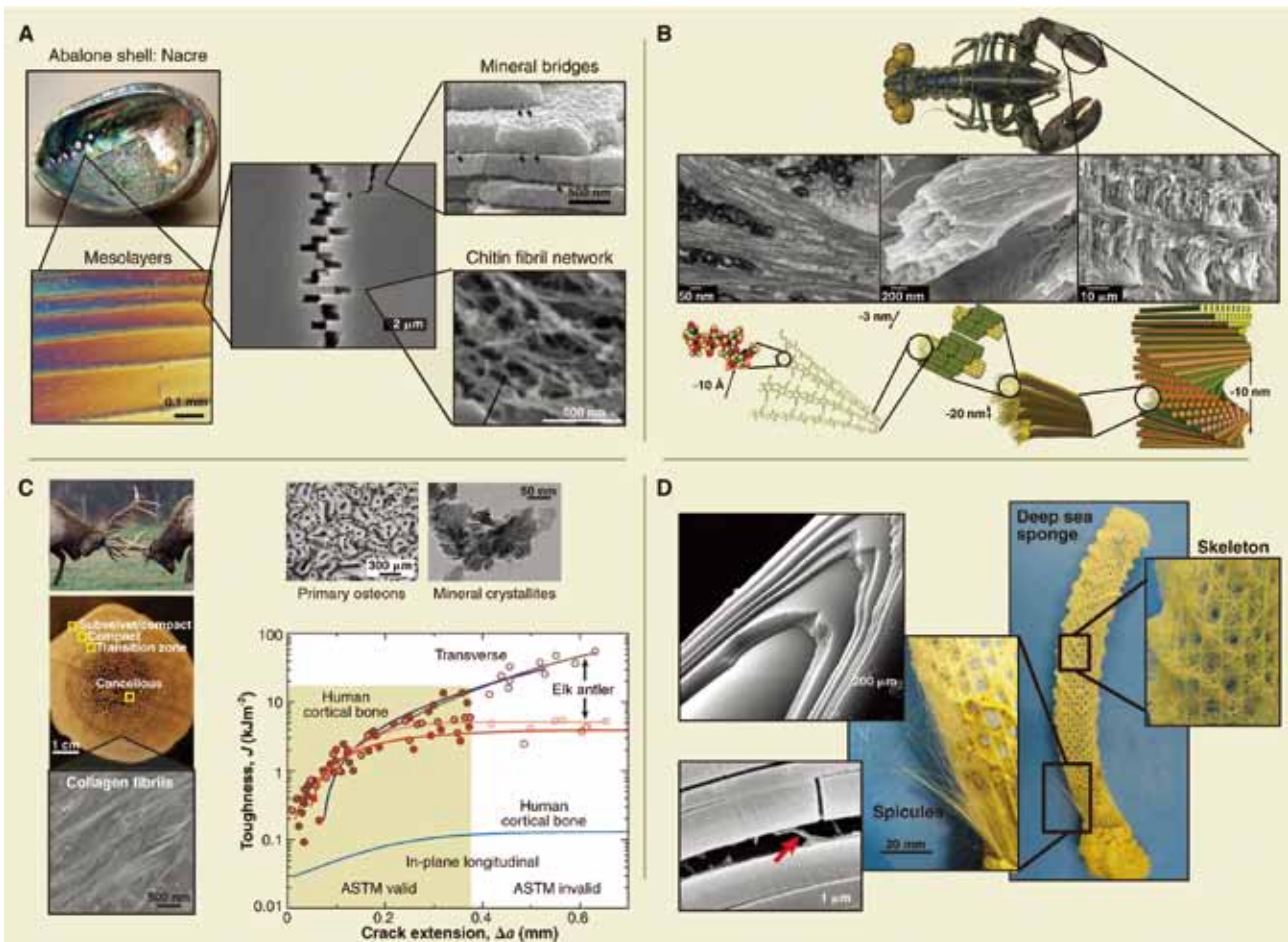


Figure 1. Hierarchical structures of tough biological materials demonstrating the heterogeneous interfaces that provide crack deflection: (A) Abalone shell; (B) Deer antler; (C) Lobster exoskeleton; (D) Sea sponge spicule.

Parallel Neural Pathways Mediate CO₂ Avoidance Responses in *Drosophila*

Different stimulus intensities elicit distinct perceptions, implying that input signals are either conveyed through an overlapping but unique sub-population of sensory neurons or channeled into divergent brain circuits according to intensity. In *Drosophila*, CO₂ is detected by a single type of olfactory sensory neuron but information is conveyed to higher brain centers through second-order projection neurons (PNs). Two distinct pathways, PNv-1 and PNv-2, are necessary and sufficient for avoidance responses to low and high CO₂ concentrations, respectively. While low concentrations activate PNv-1, high concentrations activate both PNvs and GABAergic PNv-3, which may inhibit PNv-1 pathway-mediated avoidance behavior. Channeling a sensory input into distinct neural pathways allows the perception of an odor to be further modulated by both stimulus intensity and context.

Prof. Ann-Shyn Chiang
(Institute of Biotechnology / Department of Life Science / Brain Research Center)

Taiwanese scientists discover shunting mechanism to direct information flow in the complex brain networks

A research group led by Professor Ann-Shyn Chiang of National Tsing Hua University in Taiwan has discovered a shunting mechanism for gating information flow in parallel neural circuits. Using FlyCircuit, a virtual fly brain database containing thousands of single neurons, Chiang's team predicted and validated neural circuits relaying olfactory information to higher brain centers in the *Drosophila* brain. They found that odor information takes specific pathways in the brain, depending on concentration context in order to orchestrate locomotion behavior.

"A grand challenge in neuroscience is to understand how the internal brain circuits represent external world and eventually result in memory underlying learning and behaviors. To this end, understanding how the information flows and turns in the complex brain networks has great and fundamental implication in not only biomedicine but also neuro-inspired engineering," exclaimed by Chiang.

The finding was reported in the 2013/6/14 issue of Science.

Neuroscientists have long realized the value of using animals to model and understand how the billions of neurons in the human brain function. The brain of the adult *Drosophila*, commonly known as fruit fly, contains only approximately 100,000 neurons and uses the same set of neurotransmitters such as acetylcholine, GABA, glutamate, dopamine, serotonin, histamine, octopamine, and tyramine. While significantly different in gross anatomy, both insect and mammalian brains are composed of neural circuits

Hui-Hao Lin (林暉皓), Li-An Chu (朱麗安), Tsai-Feng Fu (傅在峰), Barry J. Dickson, Ann-Shyn Chiang (江安世)*

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with a cohort of shared gene products governing normal function of sensory modalities and complex behavior. A sophisticated genetic tool box, simple brain circuits for intricate behaviors, and complete genomics and proteomics information make *Drosophila* an ideal model system for studying basic mechanisms underlying brain operation.

Humans are often attracted to certain smells at low concentrations but repelled by the same scents if they become too strong. Each odorant is detected by specific receptor neurons that relay information to particular brain regions. How the brain interprets the same sense in differing context remains unclear; however, research carried out by Chiang's team on the *Drosophila* brain sheds light on this question.

Carbon dioxide generated by stressed flies alerts surrounding flies, causing them to move away. On the other hand, flies in flight are attracted to the CO₂ released by yeast in fermented fruits. How does the same odor produce two opposite behaviors?

Hui-Hao Lin, a graduate student in Chiang's lab, demonstrated that the CO₂ signal detected by specific olfactory sensory neurons is sent to a small spherical region underneath the antennal lobe and then relayed to higher brain centers through multiple parallel pathways. Lin first traced all projection neurons linking between antennal lobe and the brain with a mutated protein that turns into a regular green fluorescent protein after UV irradiation, developed by Tsai-Fung Fu at the National Chi Nan University. Following FlyCircuit analysis, the team predicted that perception of the CO₂ signal involves six brain regions and utilizes three different pathways. Next, in collaboration with Barry Dickson at the Institute of Molecular Pathology in Vienna, they developed a set of specific genetic drivers to manipulate these putative CO₂ pathways. Calcium imaging with GCaMP fluorescent probes showed that all projection neurons connected structurally are functionally responsive to CO₂. Blocking neurotransmission with a temperature sensitive dynamin, a mutant protein stops neurotransmitter retrieval at high temperature, showed that two independent neural pathways are required for avoidance behavior under low or high concentrations of CO₂, respectively. Interestingly, the third inhibitory GABA-transmitting pathway blocks the low CO₂ pathway when flies are exposed to high levels of CO₂.

To verify this information shunting model, a graduate

student Li-An Chu of Chiang's lab developed an optogenetic device that uses an intense blue light to trigger channelrhodopsin induced activation of specific neural pathways. Optogenetic activation of the first and second pathways triggered avoidance behavior, which mimics the stimulation of low and high CO₂ concentrations, respectively. In contrast, these flies did not respond to the activation of the third pathway alone. What is particularly surprising was the discovery that blocking both the second and third pathways under high CO₂ stimulation triggered avoidance behavior via the first pathway.

According to Chiang, "our finding is the first time to show that there are parallel neuronal pathways for signal processing and mechanisms that allow information shunting in the brain. What remains unknown is whether such a shunting phenomenon occurs in other sensory modalities and how often it is executed as an intermediary step between sensory stimulus and behavioral output in the complex brain networks. It would be truly exciting if such a shunting mechanism, which greatly increases the flexibility of behavioral responses, also occur in the human brain."

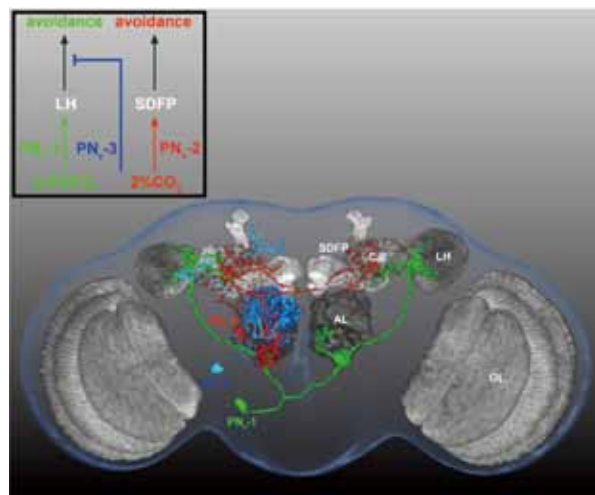
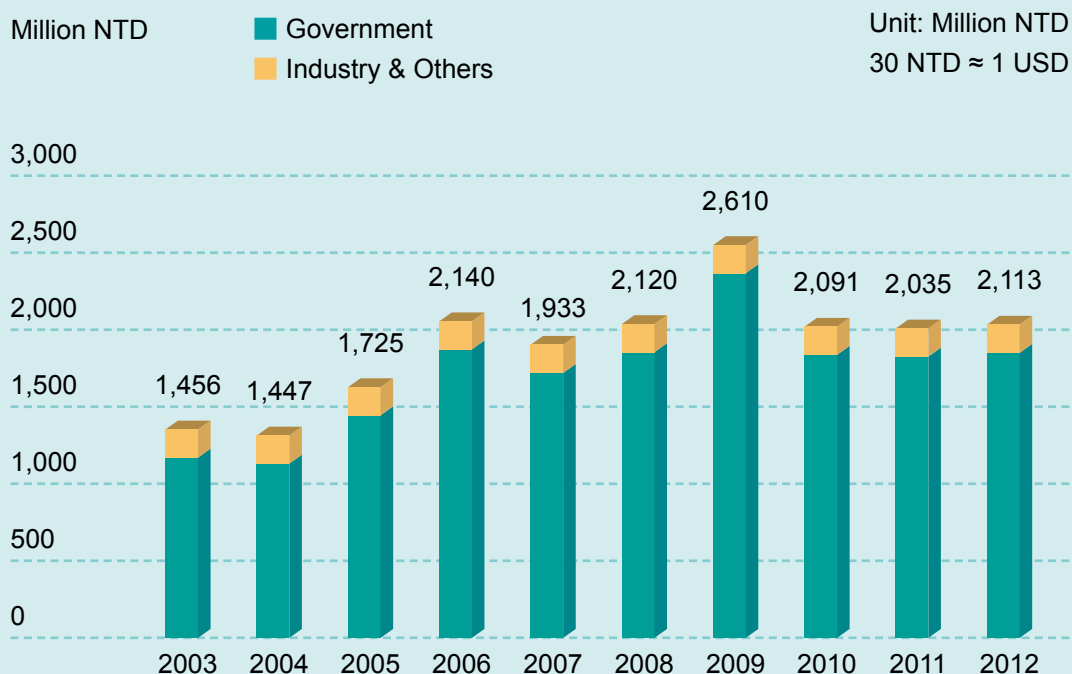


Figure 1. Information routing for fruitfly avoidance behavior. Two distinct neural pathways, PNv-1 (green) and PNv-2 (red), are integral for avoidance behavior in response to low (0.5%) and high (2%) concentrations of carbon dioxide, respectively. While 0.5% activates only PNv-1, 2% triggers PNv-1, PNv-2, and a third class of inhibitory PNv-3 neurons (blue) that blocks the PNv-1 downstream pathway, leaving PNv-2 as the final output. AL, antennal lobe; Cal, calyx; LH, lateral horn; OL, optic lobe; SDFP, superior dorsofrontal protocerebrum.

Facts and Figures

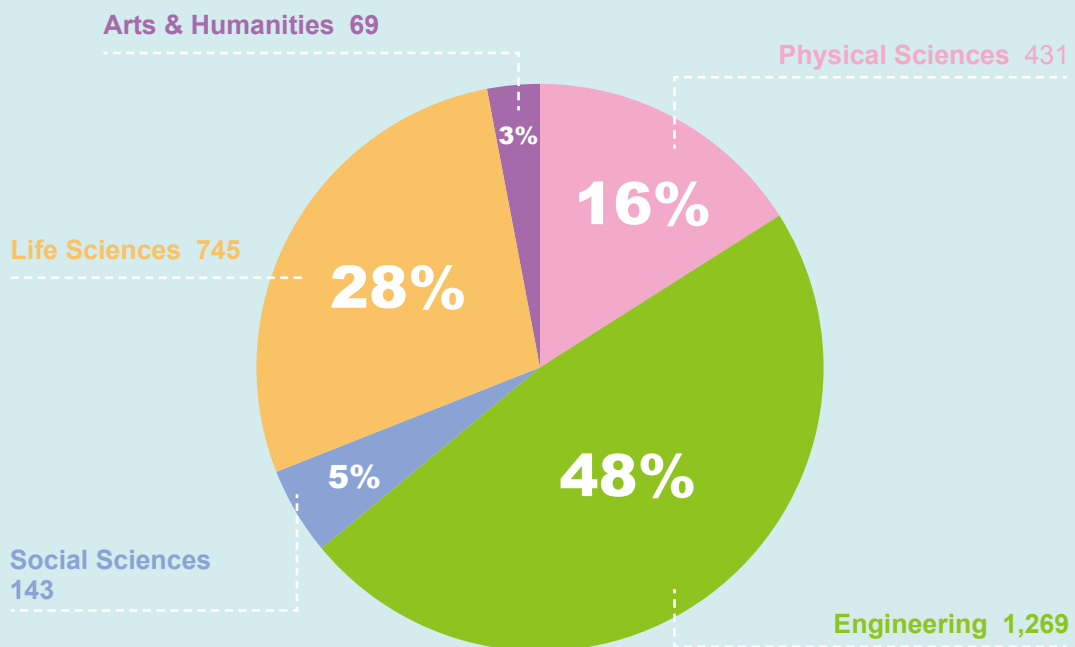
Research Fund (2003-2012)



Funding Distribution by Discipline (2012)

Discipline	Million NTD
Physical Sciences	431
Engineering	1,269
Social Sciences	143
Life Sciences	745
Arts & Humanities	69

Unit: Million NTD
30 NTD ≈ 1 USD

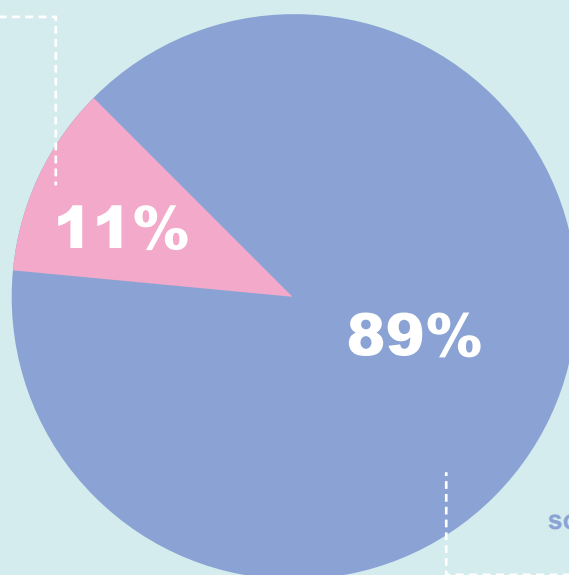


Sponsored Research Fund (2012)

Year	2012
Research grant income from public sources and charities	1,888
Research contract income from industry and commerce	225
Total research incomes.....	2,113

Unit: Million NTD
30 NTD ≈ 1 USD

Research contract
income from industry
and commerce
225

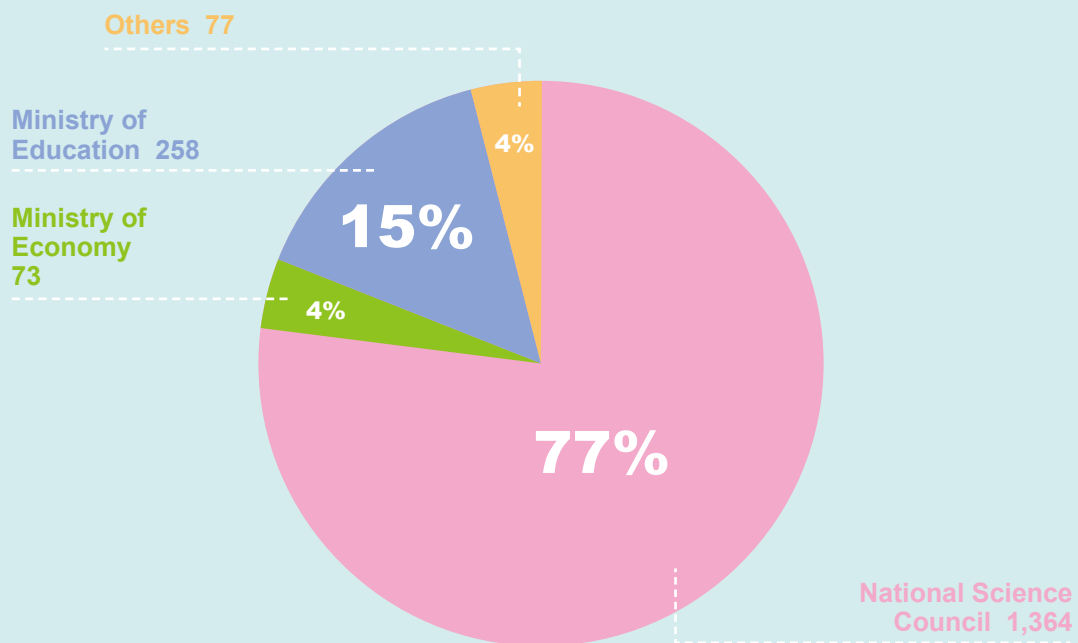


Research grant
income from public
sources and charities
1,888

Government-Sponsored Research Fund (2012)

Year	2012
 National Science Council.....	1,364
 Ministry of Economy	73
 Ministry of Education	258
 Others	77

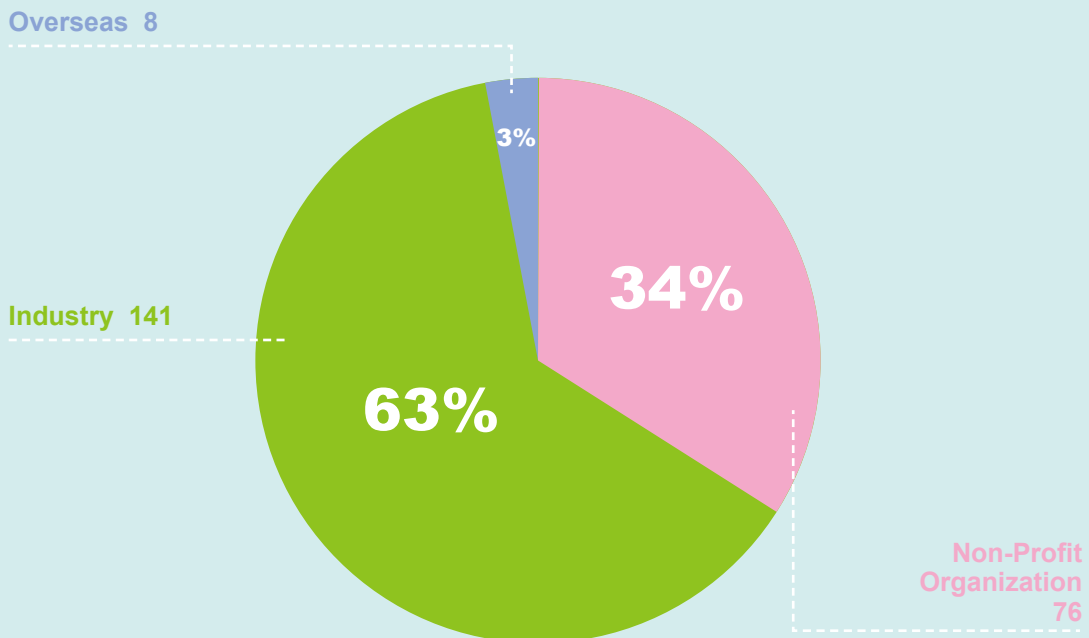
Unit: Million NTD
30 NTD ≈ 1 USD



Non-Government Sponsored Research Fund (2012)

Year	2012
Non-Profit Organization	76
Industry	141
Overseas	8

Unit: Million NTD
30 NTD ≈ 1 USD



Number of SCI/ SSCI Journal Papers (2008-2012)

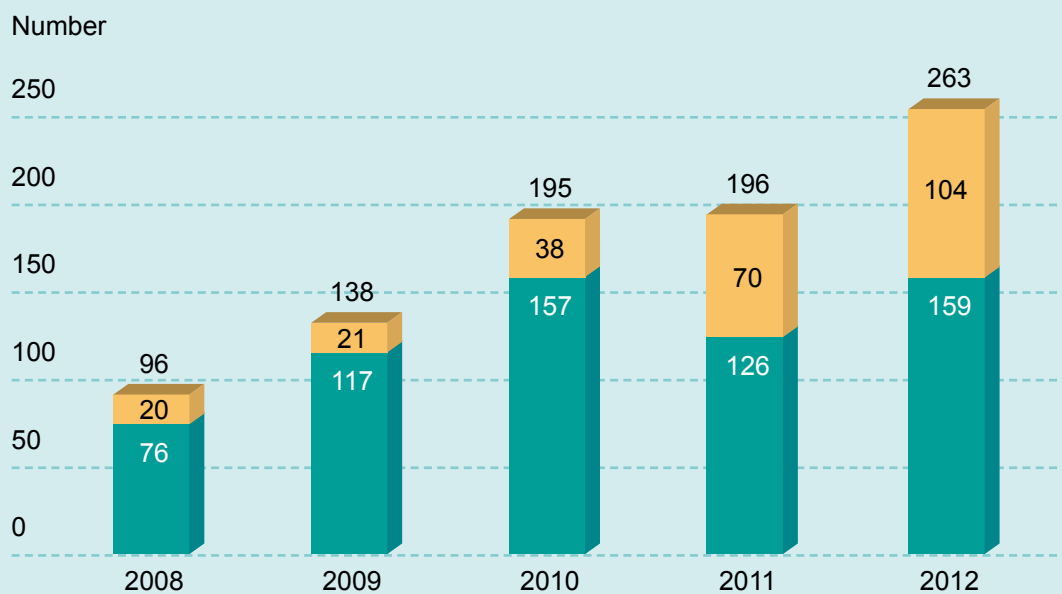


Number of SCI/ SSCI Papers Published in Journals with Impact Factors Ranked in Top 15% (2005-2012)

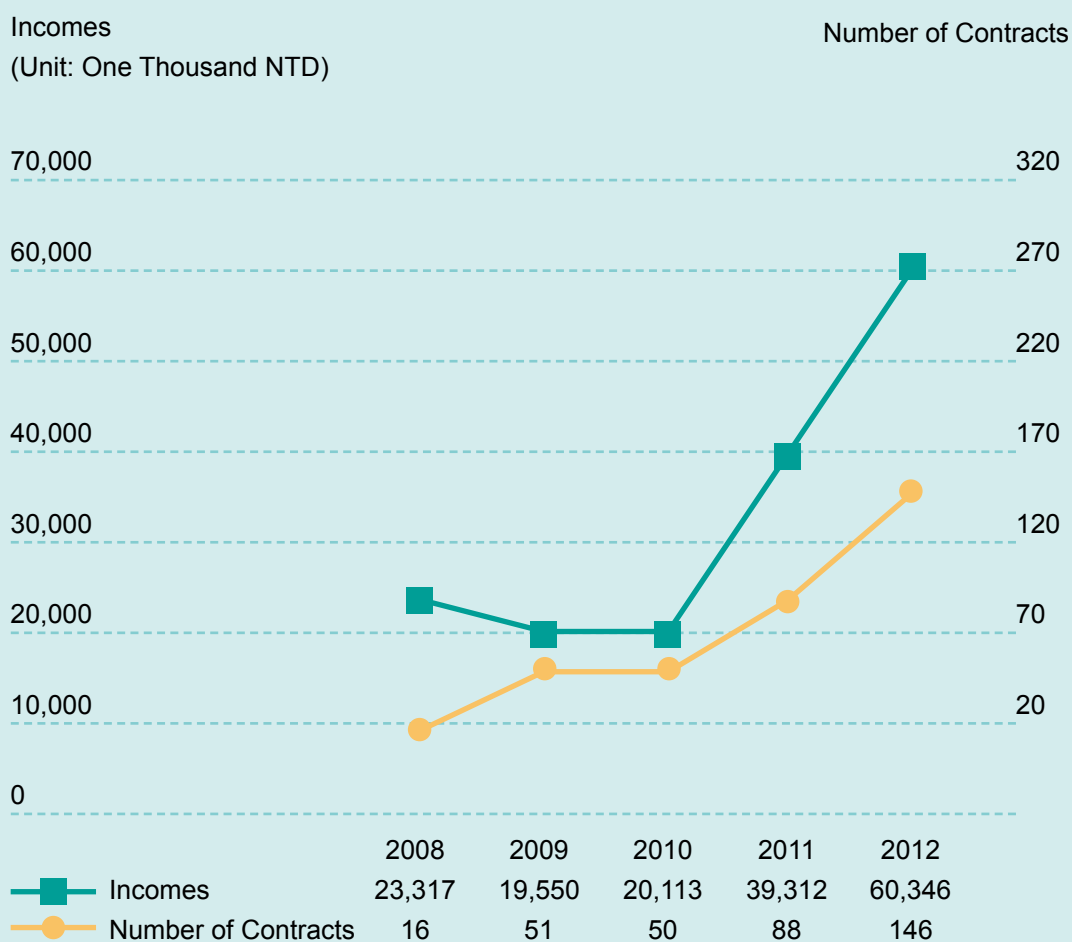


Numbers of US Patents Applied and Awarded (2008-2012)

- Number of applied US patents
- Number of awarded US patents



Technology Transfer Incomes (2008-2012)



Representative Journal Publications (2010)

Journal	Title	Corresponding Author
ACS NANO	A Dual-Emission Forster Resonance Energy Transfer Nanoprobe for Sensing/Imaging pH Changes in the Biological Environment	Hsin-Lung Chen (陳信龍)
	Biofunctionalized Phospholipid-Capped Mesoporous Silica Nanoshuttles for Targeted Drug Delivery: Improved Water Susceptibility and Decreased Nonspecific Protein Binding	Chia-Min Yang (楊家銘)
	Highly Efficient Restoration of Graphitic Structure in Graphene Oxide Using Alcohol Vapors	Chuen-Horng Tsai (蔡春鴻)
	Iridescence of Patterned Carbon Nanotube Forests on Flexible Substrates: From Darkest Materials to Colorful Films	Nyan-Hwa Tai (戴念華)
	Plasmon Resonance Spectroscopy of Gold-in-Gallium Oxide Peapod and Core/Shell Nanowires	Li-Jen Chou (周立人)
	Robust Block Copolymer Mask for Nanopatterning Polymer Films	Rong-Ming Ho (何榮銘)
	Vascular Labeling of Luminescent Gold Nanorods Enables 3-D Microscopy of Mouse Intestinal Capillaries	Hsing-Yu Tuan (段興宇)
ADVANCED FUNCTIONAL MATERIALS	Galactose Encapsulated Multifunctional Nanoparticle for HepG2 Cell Internalization	Chun-Cheng Lin (林俊成)
	Hysteresis in Conjugated Polymer Thin Film Transistors Generated by Chain Relaxation	Show-An Chen (陳壽安)
	Self-Assembled pH-Sensitive Nanoparticles: A Platform for Oral Delivery of Protein Drugs	Hsing-Wen Sung (宋信文)
ADVANCED MATERIALS	A Cost-Effective Supercapacitor Material of Ultrahigh Specific Capacitances: Spinel Nickel Cobaltite Aerogels from an Epoxide-Driven Sol-Gel Process	Shih-Yuan Lu (呂世源)
	A Highly Efficient Universal Bipolar Host for Blue, Green, and Red Phosphorescent OLEDs	Chien-Hong Cheng (鄭建鴻)
	Direct Growth of Aligned Zinc Oxide Nanorods on Paper Substrates for Low-Cost Flexible Electronics	Lih J. Chen (陳力俊)
	Flexible UV-Ozone-Modified Carbon Nanotube Electrodes for Neuronal Recording	Tri-Rung Yew (游萃蓉)
	Single-InN-Nanowire Nanogenerator with Upto 1 V Output Voltage	Lih J. Chen (陳力俊)
ADVANCED SYNTHESIS & CATALYSIS	Gold-Catalyzed Synthesis of Bicyclo[3.2.0]heptenes via a Formal [3+2]/[2+2]-Annulation of Allylsilane with 4-Methoxybut-2-yn-1-ols	Rai-Shung Liu (劉瑞雄)
ANALYTICAL CHEMISTRY	In Vivo Monitoring of Quantum Dots in the Extracellular Space Using Push-Pull Perfusion Sampling, Online In-Tube Solid Phase Extraction, and Inductively Coupled Plasma Mass Spectrometry	Yuh-Chang Sun (孫毓璋)
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	Gold-Catalyzed Oxidative Ring Expansions and Ring Cleavages of Alkynylcyclopropanes by Intermolecular Reactions Oxidized by Diphenylsulfoxide	Rai-Shung Liu (劉瑞雄)

Representative Journal Publications (2010)

Journal	Title	Corresponding Author
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	Layered Zinc Phosphates with Photoluminescence and Photochromism: Chemistry in Deep Eutectic Solvents	Sue-Lein Wang (王素蘭)
APPLIED CATALYSIS B-ENVIRONMENTAL	Dechlorination and photodegradation of trichloroethylene by Fe/TiO ₂ nanocomposites in the presence of nickel ions under anoxic conditions	Ruey-An Doong (董瑞安)
	Removal of dimethylsulfide by adsorption on ion-exchanged zeolites	Nyan-Hwa Tai (戴念華)
BIOMATERIALS	Biodistribution, pharmacodynamics and pharmacokinetics of insulin analogues in a rat model: Oral delivery using pH-Responsive nanoparticles vs. subcutaneous injection	Hsing-Wen Sung (宋信文)
	Effects of the nanostructure of dendrimer/DNA complexes on their endocytosis and gene expression	Hsin-Lung Chen (陳信龍)
	Enhancement of efficiencies of the cellular uptake and gene silencing of chitosan/siRNA complexes via the inclusion of a negatively charged poly(γ -glutamic acid)	Hsing-Wen Sung (宋信文)
	Enteric-coated capsules filled with freeze-dried chitosan/poly(γ -glutamic acid) nanoparticles for oral insulin delivery	Hsing-Wen Sung (宋信文)
	In situ real-time investigation of cancer cell photothermolysis mediated by excited gold nanorod surface plasmons	Su-Jien Lin (林樹均)
	Induction and regulation of differentiation in neural stem cells on ultra-nanocrystalline diamond films	Nyan-Hwa Tai (戴念華)
	Multifunctional core-shell polymeric nanoparticles for transdermal DNA delivery and epidermal Langerhans cells tracking	Hsing-Wen Sung (宋信文)
	Neutron capture nuclei-containing carbon nanoparticles for destruction of cancer cells	Kuo Chu Hwang (黃國柱)
	The characteristics, biodistribution, magnetic resonance imaging and biodegradability of superparamagnetic core-shell nanoparticles	Hsing-Wen Sung (宋信文)
	The down regulation of target genes by photo activated DNA nanoscissors	Jih-Ru Hwu (胡紀如)
	The healing of critical-sized femoral segmental bone defects in rabbits using baculovirus-engineered mesenchymal stem cells	Yu-Chen Hu (胡育誠)
	BIOSENSORS & BIOELECTRONICS	5 x 5 CMOS capacitive sensor array for detection of the neurotransmitter dopamine
A cone-shaped 3D carbon nanotube probe for neural recording		Tri-Rung Yew (游萃蓉)
A disposable microfluidic biochip with on-chip molecularly imprinted biosensors for optical detection of anesthetic propofol		Chien-Chong Hong (洪健中)
Array-based titanium dioxide biosensors for ratiometric determination of glucose, glutamate and urea		Ruey-An Doong (董瑞安)

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Journal	Title	Corresponding Author
BIOSENSORS & BIOELECTRONICS	Arrayed CNT-Ni nanocomposites grown directly on Si substrate for amperometric detection of ethanol	Jin-Hua Huang (黃金花)
	Simultaneous determination of biomarkers for Alzheimer's disease using sol-gel-derived optical array biosensor	Ruey-An Doong (董瑞安)
CHEMICAL SOCIETY REVIEWS	Transition-metal phosphors with cyclometalating ligands: fundamentals and applications	Chi, Yun (季昀)
COMPUTATIONAL INTELLIGENCE	Automatic Complexity Reduction in Reinforcement Learning	Von-Wun Soo (蘇豐文)
COMPUTERS & OPERATIONS RESEARCH	A closed-loop logistic model with a spanning-tree based genetic algorithm	Hsiao-Fan Wang (王小璠)
CORROSION SCIENCE	Electrochemical passive properties of Al _x CoCrFeNi (x=0, 0.25, 0.50, 1.00) alloys in sulfuric acids	Swe-Kai Chen (陳瑞凱)
DECISION SUPPORT SYSTEMS	An employee performance estimation model for the logistics industry	Jiang-Liang Hou (侯建良)
DEVELOPMENT	Echinoid regulates Flamingo endocytosis to control ommatidial rotation in the Drosophila eye	Jui-Chou Hsu (徐瑞洲)
GASTROENTEROLOGY	At the Movies: 3-Dimensional Technology and Gastrointestinal Histology	Shiue-Cheng (Tony) Tang (湯學成)
IEEE JOURNAL OF SOLID-STATE CIRCUITS	A Differential Data-Aware Power-Supplied (D-2 AP) 8T SRAM Cell With Expanded Write/Read Stabilities for Lower VDDmin Applications	Meng-Fan Chang (張孟凡)
	A Quantization Error Minimization Method Using DDS-DAC for Wideband Fractional-N Frequency Synthesizer	Po-Chiun Huang (黃柏鈞)
	An Integrated Linear Regulator With Fast Output Voltage Transition for Dual-Supply SRAMs in DVFS Systems	Po-Chiun Huang (黃柏鈞)
	Noise-Immune Embedded NAND-ROM Using a Dynamic Split Source-Line Scheme for VDDmin and Speed Improvements	Meng-Fan Chang (張孟凡)
IEEE TRANSACTIONS ON COMMUNICATIONS	Intercarrier Interference Cancellation Using General Phase Rotated Conjugate Transmission for OFDM Systems	Chin-Liang Wang (王晉良)
	Two Low-Complexity Reliability-Based Message-Passing Algorithms for Decoding Non-Binary LDPC Codes	Chi-chao Chao (趙啓超)
IEEE TRANSACTIONS ON ENERGY CONVERSION	A Novel Sensorless MPPT Controller for a High-Efficiency Microscale Wind Power Generation System	Ching-Tsai Pan (潘晴財)
IEEE TRANSACTIONS ON FUZZY SYSTEMS	A Fuzzy Approach for Robust Reference-Tracking-Control Design of Nonlinear Distributed Parameter Time-Delayed Systems and Its Application	Bor-Sen Chen (陳博現)
	Robust Optimal Reference-Tracking Design Method for Stochastic Synthetic Biology Systems: T-S Fuzzy Approach	Bor-Sen Chen (陳博現)
IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS	A High-Efficiency High Step-Up Converter With Low Switch Voltage Stress for Fuel-Cell System Applications	Ching-Tsai Pan (潘晴財)

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Journal	Title	Corresponding Author
IEEE TRANSACTIONS ON INFORMATION THEORY	A Random Search Framework for Convergence Analysis of Distributed Beamforming With Feedback	Che Lin (林澤)
	Exploiting Cooperative Advantages in Slotted ALOHA Random Access Networks	Yao-Win Hong (洪樂文)
IEEE TRANSACTIONS ON MEDICAL IMAGING	Classification of Benign and Malignant Breast Tumors by 2-D Analysis Based on Contour Description and Scatterer Characterization	Chih-Kuang Yeh (葉秩光)
IEEE TRANSACTIONS ON MOBILE COMPUTING	A Mixed-Norm Approach Using Simulated Annealing with Changeable Neighborhood for Mobile Location Estimation	Bor-Sen Chen (陳博現)
	Distributed Localization Scheme for Mobile Sensor Networks	Jang-Ping Sheu (許健平)
	SPATE: Small-Group PKI-Less Authenticated Trust Establishment	Hung-Min Sun (孫宏民)
IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE	Nonnegative Least-Correlated Component Analysis for Separation of Dependent Sources by Volume Maximization	Chong-Yung Chi (祁忠勇)
IEEE TRANSACTIONS ON POWER ELECTRONICS	A Novel Integrated Single-Phase Inverter With Auxiliary Step-Up Circuit for Low-Voltage Alternative Energy Source Applications	Ching-Tsai Pan (潘晴財)
	An Inrush Mitigation Technique of Load Transformers for the Series Voltage Sag Compensator	Po-Tai Chen (鄭博泰)
	On the Switched-Reluctance Motor Drive With Three-Phase Single-Switch Switch-Mode Rectifier Front-End	Chang-Ming Liaw (廖聰明)
JOURNAL OF COMPARATIVE NEUROLOGY	Quantitative Study of the Developmental Changes in Calcium-Permeable AMPA Receptor-Expressing Neurons in the Rat Somatosensory Cortex	Yen-Chung Chang (張兗君)
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	Au Nanocube-Directed Fabrication of Au-Pd Core-Shell Nanocrystals with Tetrahedral, Concave Octahedral, and Octahedral Structures and Their Electrocatalytic Activity	Hsuan-Yi Huang (黃暄益)
	Gold-Catalyzed Stereocontrolled Oxacyclization/[4+2]-Cycloaddition Cascade of Ketone-Allene Substrates	Rai-Shung Liu (劉瑞雄)
	Gold-Catalyzed Stereoselective Synthesis of 9-Oxabicyclo[3.3.1]nona-4,7-dienes from Diverse 1-Oxo-4-oxy-5-yne: A Viable Formal [4+2] Cycloaddition on an s-trans-Heterodiene Framework	Rai-Shung Liu (劉瑞雄)
	Layer-by-Layer Assembly of Three-Dimensional Colloidal Supercrystals with Tunable Plasmonic Properties	Shangjr Gwo (果尚志)
	Roles of the Distinct Electronic Structures of the $\{\text{Fe}(\text{NO})_2\}_9$ and $\{\text{Fe}(\text{NO})_2\}_{10}$ Dinitrosyliron Complexes in Modulating Nitrite Binding Modes and Nitrite Activation Pathways	Wen-Feng Liaw (廖文峯)

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Journal	Title	Corresponding Author
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	Synthesis of Phenanthrone Derivatives from sec-Alkyl Aryl Ketones and Aryl Halides via a Palladium-Catalyzed Dual C-H Bond Activation and Enolate Cyclization	Chien-Hong Cheng (鄭建鴻)
MASS SPECTROMETRY REVIEWS	IN VIVO MONITORING OF THE TRANSFER KINETICS OF TRACE ELEMENTS IN ANIMAL BRAINS WITH HYPHENATED INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY TECHNIQUES	Yuh-Chang Sun (孫毓璋)
MATERIALS SCIENCE & ENGINEERING R-REPORTS	In situ TEM investigation of dynamical changes of nanostructures	Lih J. Chen (陳力俊)
MICROFLUIDICS AND NANOFUIDICS	Effects of actuating waveform, ink property, and nozzle size on piezoelectrically driven inkjet droplets	Tong-Miin Liou (劉通敏)
	Efficient transfer and concentration of energy between explosive dual bubbles via time-delayed interactions	Fan-Gang Tseng (曾繁根)
	High throughput micro droplet generator array controlled by two-dimensional dynamic virtual walls	Fan-Gang Tseng (曾繁根)
	On-demand double emulsification utilizing pneumatically actuated, selectively surface-modified PDMS micro-devices	Yu-Chuan Su (蘇育全)
NANO LETTERS	Direct Observation of Au/Ga ₂ O ₃ Peapodded Nanowires and Their Plasmonic Behaviors	Li-Jen Chou (周立人)
	Growth of Multiple Metal/Semiconductor Nanoheterostructures through Point and Line Contact Reactions	Lih J. Chen (陳力俊)
	Inorganic Gyroid with Exceptionally Low Refractive Index from Block Copolymer Templating	Rong-Ming Ho (何榮銘)
	Near UV LEDs Made with in Situ Doped p-n Homojunction ZnO Nanowire Arrays	Lih J. Chen (陳力俊)
	Plasmon Hybridization in individual Gold Nanocrystal Dimers: Direct Observation of Bright and Dark Modes	Shangjr Gwo (果尚志)
NANO TODAY	Morphologically controlled synthesis of Cu ₂ O nanocrystals and their properties	Hsuan-Yi Huang (黃暄益)
NUCLEIC ACIDS RESEARCH	DSAP: deep-sequencing small RNA analysis pipeline	Ping-Chiang Lyu (呂平江)
PROGRESS IN ELECTROMAGNETICS RESEARCH-PIER	EFFECT OF HIGH-ORDER MODES ON TUNNELING CHARACTERISTICS	Tsun-Hsu Chang (張存續)
SCRIPTA MATERIALIA	Inhibition of grain coarsening up to 1000 degrees C in (AlCrNbSiTiV)N superhard coatings	Jien-Wei Yeh (葉均蔚)
SOFT MATTER	Silicon oxy carbide nanorings from polystyrene-b-polydimethylsiloxane diblock copolymer thin films	Rong-Ming Ho (何榮銘)

Representative Journal Publications (2011)

Journal	Title	Corresponding Author	
SCIENCE	Synthesis and Measurement of Ultrafast Waveforms from Five Discrete Optical Harmonics	A. H. Kung (孔慶昌)	
ACS NANO	Clean Transfer of Graphene for Isolation and Suspension	Po-Wen Chiu (邱博文)	
	Electrical Properties and Magnetic Response of Cobalt Germanosilicide Nanowires	Lih J. Chen (陳力俊)	
	Enhancing the Electrical Conductivity of Carbon-Nanotube-Based Transparent Conductive Films Using Functionalized Few- Walled Carbon Nanotubes Decorated with Palladium Nanoparticles as Fillers	Nyan-Hwa Tai (戴念華)	
	Far-Field Optical Imaging of a Linear Array of Coupled Gold Nanocubes: Direct Visualization of Dark Plasmon Propagating Modes	Shangjr Gwo (果尚志)	
	Kinetic Growth of Self-Formed In ₂ O ₃ Nanodots via Phase Segregation: Ni/InAs System	Yu-Lun Chueh (闕郁倫)	
	Large Enhancements in Optoelectronic Efficiencies of Nano-plastically Stressed Conjugated Polymer Strands	Arnold C. M. Yang (楊長謀)	
	Low Resistivity Metal Silicide Nanowires with Extraordinarily High Aspect Ratio for Future Nanoelectronic Devices	Lih J. Chen (陳力俊)	
	Misorientation Control and Functionality Design of Nanopillars in Self-Assembled Perovskite-Spinel Heteroepitaxial Nanostructures	Su-Jien Lin (林樹均)	
	Near-Infrared Light-Responsive Core-Shell Nanogels for Targeted Drug Delivery	Yu-Fen Huang (黃郁榮)	
	Oxide-Confined Formation of Germanium Nanowire Heterostructures for High- Performance Transistors	Lih J. Chen (陳力俊)	
	Release of Photoactivatable Drugs from Plasmonic Nanoparticles for Targeted Cancer Therapy	Yu-Fen Huang (黃郁榮)	
	ACTA MATERIALIA	Microstructure and wear behavior of Al _x Co _{1.5} CrFeNi _{1.5} Ti _y high-entropy alloys	Su-Jien Lin (林樹均)
		Nucleation mechanisms and their influences on characteristics of ZnO nanorod arrays prepared by a hydrothermal method	Jenn-Ming Wu (吳振名)
Phase equilibria of Ag-Sb-Te thermoelectric materials		Sinn-Wen Chen (陳信文)	
ADVANCED FUNCTIONAL MATERIALS	Induced Chain Alignment of Conjugated Polymers Within Nanoporous Template	Rong-Ming Ho (何榮銘)	
	Tuning of Charge Densities in Graphene by Molecule Doping	Po-Wen Chiu (邱博文)	
	Cu ₂ O Nanocrystal-Templated Growth of Cu ₂ S Nanocages with Encapsulated Au Nanoparticles and In-Situ Transmission X-ray Microscopy Study	Hsuan-Yi Huang (黃暄益)	
	Platinum Phosphors Containing an Arylmodified beta-Diketonate: Unusual Effect of Molecular Packing on Photo- and Electroluminescence	Chien-Hong Cheng (鄭建鴻)	

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Journal	Title	Corresponding Author
ADVANCED MATERIALS	Flexible Organic Thin-Film Transistors with Silk Fibroin as the Gate Dielectric	Jenn-Chang Hwang (黃振昌)
	Host and Dopant Materials for Idealized Deep-Red Organic Electrophosphorescence Devices	Chien-Hong Cheng (鄭建鴻)
	Nanoporous Gyroid Nickel from Block Copolymer Templates via Electroless Plating	Rong-Ming Ho (何榮銘)
	Wide-Range Color Tuning of Iridium Biscarbene Complexes from Blue to Red by Different N boolean AND N Ligands: an Alternative Route for Adjusting the Emission Colors	I-Chia Chen (陳益佳)
	ZnO-Coated Carbon Nanotubes: Flexible Piezoelectric Generators	Wen-Kuang Hsu (徐文光)
ADVANCED SYNTHESIS & CATALYSIS	Asymmetric Aerobic Oxidation of alpha- Hydroxy Acid Derivatives Catalyzed by Reusable, Polystyrene-Supported Chiral N-Salicylidene Oxidovanadium tert-Leucinates	Chien-Tien Chen (陳建添)
	Gold-Catalyzed Oxidative Cyclizations of 2- Oxiranyl-1-alkynylbenzenes for Diastereoselective Synthesis of Highly Substituted 2-Hydroxyindanones	Rai-Shung Liu (劉瑞雄)
	Silver-Catalyzed exo-dig- Azacyclization/[3+2] Cycloaddition Cascades on 1-Tosylhydrazon-4-oxy-5-yne Substrates: Applicability to Diverse Alkenes	Rai-Shung Liu (劉瑞雄)
	Synthesis of alpha-Hydroxy Carboxylic Acids via a Nickel(II)-Catalyzed Hydrogen Transfer Process	Chien-Hong Cheng (鄭建鴻)
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	Gold-Catalyzed Oxidative Cyclization of 1,5-Enynes Using External Oxidants	Rai-Shung Liu (劉瑞雄)
	Iridium(III) Complexes of a Dicyclopentylphosphite Tripod Ligand: Strategy to Achieve Blue Phosphorescence Without Fluorine Substituents and Fabrication of OLEDs	Chi, Yun (季昀)
	Metal Nanoparticles Sensitize the Formation of Singlet Oxygen	Kuo Chu Hwang (黃國柱)
	Regioselective Synthesis of Indenols by Rhodium-Catalyzed C-H Activation and Carbocyclization of Aryl Ketones and Alkynes	Chien-Hong Cheng (鄭建鴻)
	Ruthenium(II) Sensitizers with Heteroleptic Tridentate Chelates for Dye-Sensitized Solar Cells	Chi, Yun (季昀)
	Smart Multifunctional Hollow Microspheres for the Quick Release of Drugs in Intracellular Lysosomal Compartments	Hsing-Wen Sung (宋信文)
	Synthesis of Phenanthridinones from N-Methoxybenzamides and Arenes by Multiple Palladium-Catalyzed C-H Activation Steps at Room Temperature	Chien-Hong Cheng (鄭建鴻)
	Theory-Guided Experiments on the Mechanistic Elucidation of the Reduction of Dinuclear Zinc, Manganese, and Cadmium Complexes	Yi-Chou Tsai (蔡易州)

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Journal	Title	Corresponding Author
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	Tris(thiocyanate) Ruthenium(II) Sensitizers with Functionalized Dicarboxyterpyridine for Dye-Sensitized Solar Cells	Chi, Yun (季昀)
	Variation Luminescence from an Organic- Inorganic Hybrid Structure with an Isolated 4-Ring Zinc Phosphate Tecton	Sue-Lein Wang (王素蘭)
APPLIED CATALYSIS B:ENVIRONMENTAL	Electrochemical-catalytic conversion for simultaneous NO _x and hydrocarbons emissions control of lean-burn gasoline engine	Ta-Jen Huang (黃大仁)
BIOMATERIALS	Core-shell cell bodies composed of human cbMSCs and HUVECs for functional vasculogenesis	Hsing-Wen Sung (宋信文)
	Enhancement of cell retention and functional benefits in myocardial infarction using human amniotic-fluid stem-cell bodies enriched with endogenous ECM	Hsing-Wen Sung (宋信文)
	Intracellularly monitoring/imaging the release of doxorubicin from pH-responsive nanoparticles using Forster resonance energy transfer	Hsing-Wen Sung (宋信文)
	Mechanism and consequence of chitosan-mediated reversible epithelial tight junction opening	Hsing-Wen Sung (宋信文)
	The glucose-lowering potential of exendin-4 orally delivered via a pH-sensitive nanoparticle vehicle and effects on subsequent insulin secretion in vivo	Hsing-Wen Sung (宋信文)
	The role of adipose-derived stem cells engineered with the persistently expressing hybrid baculovirus in the healing of massive bone defects	Yu-Chen Hu (胡育誠)
BIOSENSORS & BIOELECTRONICS	A bio-inspired two-layer multiple-walled carbon nanotube-polymer composite sensor array and a bio-inspired fast-adaptive readout circuit for a portable electronic nose	Kea-Tiong Tang (鄭桂忠)
	A microfluidic chip platform with electrochemical carbon nanotube electrodes for pre-clinical evaluation of antibiotics nanocapsules	Chien-Chong Hong (洪健中)
	Electrical impedimetric biosensors for liver function detection	Tri-Rung Yew (游萃蓉)
	Gold-nanoparticle-based graphite furnace atomic absorption spectrometry amplification and magnetic separation method for sensitive detection of mercuric ions	Yuh-Chang Sun (孫毓璋)
	Integration of silicon-via electrodes with different recording characteristics on a glass microprobe using a glass reflowing process	Wei-Leun Fang (方維倫)
	Rapid detection of influenza A virus infection utilizing an immunomagnetic bead-based microfluidic system	Gwo-Bin Lee (李國賓)
BIOTECHNOLOGY ADVANCES	Review of dengue virus and the development of a vaccine	Suh-Chin Wu (吳夙欽)
	Baculovirus as a gene delivery vector: Recent understandings of molecular alterations in transduced cells and latest applications	Yu-Chen Hu (胡育誠)

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Journal	Title	Corresponding Author
CELLULOSE	Application of heparinized cellulose matrices for substrate-mediated bFGF peptide and transgene delivery to stimulate cellular proliferation	Shiue-Cheng (Tony) Tang (湯學成)
COMPUTERS & EDUCATION	Perceived values and prospective users' acceptance of prospective technology: The case of a career eportfolio system	Jeng-Yi Tzeng (曾正宜)
COORDINATION CHEMISTRY REVIEWS	Harvesting luminescence via harnessing the photophysical properties of transition metal complexes	Chi, Yun (季昀)
CURRENT BIOLOGY	Ann-Shyn Chiang	Ann-Shyn Chiang (江安世)
	Heterotypic Gap Junctions between Two Neurons in the Drosophila Brain Are Critical for Memory	Ann-Shyn Chiang (江安世)
	Three-Dimensional Reconstruction of Brain-wide Wiring Networks in Drosophila at Single-Cell Resolution	Ann-Shyn Chiang (江安世)
ENERGY & ENVIRONMENTAL SCIENCE	Complete emissions control for highly fuel-efficient automobiles via a simulated stack of electrochemical-catalytic cells	Ta-Jen Huang (黃大仁)
	Facile colloidal synthesis of quinary CuIn _{1-x} Ga _x (SySe _{1-y}) ₂ (CIGSSe) nanocrystal inks with tunable band gaps for use in low-cost photovoltaics	Hsing-Yu Tuan (段興宇)
	Polypropylene-grafted multi-walled carbon nanotube reinforced polypropylene composite bipolar plates in polymer electrolyte membrane fuel cells	Chen-Chi Ma (馬振基)
ENVIRONMENTAL SCIENCE & TECHNOLOGY	Electrochemical Enhancement of Nitric Oxide Removal from Simulated Lean-Burn Engine Exhaust via Solid Oxide Fuel Cells	Ta-Jen Huang (黃大仁)
	Using Rhodamine 6G-Modified Gold Nanoparticles To Detect Organic Mercury Species in Highly Saline Solutions	Yu-Fen Huang (黃郁棻)
	Enhanced Dechlorination of Tetrachloroethylene by Zerovalent Silicon in the Presence of Polyethylene Glycol under Anoxic Conditions	Ruey-An Doong (董瑞安)
IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS	Monolithic Integration of 2-D Multimode Interference Couplers and Silicon Photonic Wires	Ming-Chang M. Lee (李明昌)
IEEE JOURNAL OF SOLID-STATE CIRCUITS	A 130 mV SRAM With Expanded Write and Read Margins for Subthreshold Applications	Meng-Fan Chang (張孟凡)
	A Large σ V _{TH} /VDD Tolerant Zigzag 8T SRAM With Area-Efficient Decoupled Differential Sensing and Fast Write-Back Scheme	Meng-Fan Chang (張孟凡)
	P-P-N Based 10T SRAM Cell for Low- Leakage and Resilient Subthreshold Operation	Shi-Yu Huang (黃錫瑜)
IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS	Collaborative Wakeup in Clustered Ad Hoc Networks	Shan-Hung Wu (吳尚鴻)
	Anti-Forensics with Steganographic Data Embedding in Digital Images	Hung-Min Sun (孫宏民)

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Journal	Title	Corresponding Author
IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS	Location Privacy in Unattended Wireless Sensor Networks upon the Requirement of Data Survivability	Yuh-Ren Tsai (蔡育仁)
IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS	A Flyback Rectifier With Spread Harmonic Spectrum	Chang-Ming Liaw (廖聰明)
	An Integrated Driving/Charging Switched Reluctance Motor Drive Using Three-Phase Power Module	Chang-Ming Liaw (廖聰明)
	Dynamic Control and Diagnostic Friction Estimation for an SPMSM-Driven Satellite Reaction Wheel	Chang-Ming Liaw (廖聰明)
IEEE TRANSACTIONS ON INFORMATION THEORY	Constructions of Optical Priority Queues With Multiple Inputs and Multiple Outputs	Jay Cheng (鄭傑)
IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE	Reconstructing 3D Face Model with Associated Expression Deformation from a Single Face Image via Constructing a Low- Dimensional Expression Deformation	Shang-Hong Lai (賴尚宏)
IEEE TRANSACTIONS ON POWER ELECTRONICS	Establishment of a Switched-Reluctance Generator-Based Common DC Microgrid System	Chang-Ming Liaw (廖聰明)
	A Multicarrier Pulse Width Modulator for the Auxiliary Converter and the Diode Rectifier	Po-Tai Chen (鄭博泰)
	Experimental Verification of the Active Front-End Converters Dynamic Model and Control Designs	Po-Tai Chen (鄭博泰)
IEEE TRANSACTIONS ON SYSTEMS MAN AND CYBERNETICS PART B-CYBERNETICS	Knowledge Discovery Employing Grid Scheme Least Squares Support Vector Machines Based on Orthogonal Design Bee Colony Algorithm	Wei-Chang Yeh (葉維彰)
INTERNATIONAL JOURNAL OF PLASTICITY	Transient and steady-state nanoindentation creep of polymeric materials	Sanboh Lee (李三保)
INTERNATIONAL JOURNAL OF ROBOTICS RESEARCH	Trajectory Planning of a One-Legged Robot Performing a Stable Hop	Ting-Jen Yeh (葉廷仁)
INVERSE PROBLEMS	An isospectral problem related to the Dirichlet eigenvalues and the Neumann eigenvalues of a string equation and some related problems	Chao-Liang Shen (沈昭亮)
JOURNAL OF CATALYSIS	Au/TiO ₂ @SBA-15 nanocomposites as catalysts for direct propylene epoxidation with O-2 and H-2 mixtures	Chia-Min Yang (楊家銘)
JOURNAL OF HAZARDOUS MATERIALS	Characterization and application of Ti-containing mesoporous silica for dye removal with synergistic effect of coupled adsorption and photocatalytic oxidation	Chu-Fang Wang (王竹方)
JOURNAL OF MICROELECTROMECHANICAL SYSTEMS	Development of a CMOS-Based Capacitive Tactile Sensor With Adjustable Sensing Range and Sensitivity Using Polymer Fill-In	Wei-Leun Fang (方維倫)
	Dynamic Behavior of Liquid Microlenses Actuated Using Dielectric Force	J. Andrew Yeh (葉哲良)
	Strengthening for sc-Si Solar Cells by Surface Modification With Nanowires	J. Andrew Yeh (葉哲良)

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Journal	Title	Corresponding Author
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	Enantioselective Synthesis of beta- Substituted Cyclic Ketones via Cobalt- Catalyzed Asymmetric Reductive Coupling of Alkynes with Alkenes	Chien-Hong Cheng (鄭建鴻)
	Fabrication of Au-Pd Core-Shell Heterostructures with Systematic Shape Evolution Using Octahedral Nanocrystal Cores and Their Catalytic Activity	Hsuan-Yi Huang (黃暄益)
	Facet-Dependent and Au Nanocrystal- Enhanced Electrical and Photocatalytic Properties of Au-Cu ₂ O Core-Shell Heterostructures	Hsuan-Yi Huang (黃暄益)
	Gold-Catalyzed 1,2-Difunctionalizations of Aminoalkynes Using Only N- and OContaining Oxidants	Rai-Shung Liu (劉瑞雄)
	Gold-Catalyzed Formal [3+3] and [4+2] Cycloaddition Reactions of Nitrosobenzenes with Alkenylgold Carbenoids	Rai-Shung Liu (劉瑞雄)
	Gold-Catalyzed Stereoselective Synthesis of Azacyclic Compounds through a Redox/[2+2+1] Cycloaddition Cascade of Nitroalkyne Substrates	Rai-Shung Liu (劉瑞雄)
	Systematic Investigation of the Metal- Structure- Photophysics Relationship of Emissive d(10)- Complexes of Group 11 Elements: The Prospect of Application in Organic Light Emitting Devices	Chi, Yun (季昀)
MACROMOLECULES	Phase Behavior and Color Tuning of Poly(4-vinylpyridine)-b-poly(epsilon-caprolactone) Complexed with Chromophores	Rong-Ming Ho (何榮銘)
	Scrolled Polymer Single Crystals Driven by Unbalanced Surface Stresses: Rational Design and Experimental Evidence	Rong-Ming Ho (何榮銘)
	Stereoregular Diblock Copolymers of Syndiotactic Polystyrene Derivatives and Polylactide: Syntheses and Self-Assembled Nanostructures	Rong-Ming Ho (何榮銘)
	Phase Segregation of Polymethylsilsequioxane in Antireflection	Chen-Chi Ma (馬振基)
	Lower Critical Ordering Transition of Poly(ethylene oxide)-block-poly(2- vinylpyridine)	Hsin-Lung Chen (陳信龍)
	Manipulation on the Morphology and Electrical Properties of Aligned Electrospun Nanofibers of Poly(3-hexylthiophene) for Field-Effect Transistor Applications	Hsin-Lung Chen (陳信龍)
	Orthogonal Crystal Orientation in Double-Crystalline Block Copolymer	Hsin-Lung Chen (陳信龍)
MICROFLUIDICS AND NANOFLUIDICS	A microfluidic device for chemical and mechanical stimulation of mesenchymal stem cells	Gwo-Bin Lee (李國賓)
	Pre-programmable polymer transformers as on-chip microfluidic vacuum generators	Chien-Chong Hong (洪健中)
	On-demand micro-encapsulation utilizing on-chip synthesis of semi-permeable alginate- PLL capsules	Yu-Chuan Su (蘇育全)
MOLECULAR & CELLULAR PROTEOMICS	A Study of the Spatial Protein Organization of the Postsynaptic Density Isolated from Porcine Cerebral Cortex and Cerebellum	Yen-Chung Chang (張充君)

Representative Journal Publications (2011)

Journal	Title	Corresponding Author
NANO LETTERS	Growth of CuInSe ₂ and In ₂ Se ₃ /CuInSe ₂ Nano-Heterostructures through Solid State Reactions	Lih J. Chen (陳力俊)
	Large Scale Single-Crystal Cu(In,Ga)Se-2 Nanotip Arrays For High Efficiency Solar Cell	Yu-Lun Chueh (闕郁倫)
	Plasmonic Green Nanolaser Based on a Metal-Oxide-Semiconductor Structure	Shangjr Gwo (果尚志)
	The Influence of Surface Oxide on the Growth of Metal/Semiconductor Nanowires	Lih J. Chen (陳力俊)
NUCLEIC ACIDS RESEARCH	R3D-BLAST: a search tool for similar RNA 3D substructures	Chin Lung Lu (盧錦隆)
PHYSICAL REVIEW LETTERS	Crescent Waves in Optical Cavities	Ray-Kuang Lee (李瑞光)
	Electronic versus Lattice Match for Metal-Semiconductor Epitaxial Growth: Pb on Ge(111)	Shu-Jung Tang (唐述中)
	Baryonic Z' Explanation for the CDF Wjj Excess	Kingman Cheung (張敬民)
PLOS GENETICS	Pathogenic VCP/TER94 Alleles Are Dominant Actives and Contribute to Neurodegeneration by Altering Cellular ATP Level in a Drosophila IBMPFD Model	Tzu-Kang Sang (桑自剛)
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	Serotonin-mushroom body circuit modulating the formation of anesthiareistant memory in Drosophila	Ann-Shyn Chiang (江安世)
	Mesopores provide an amorphous state suitable for studying biomolecular structures at cryogenic temperatures	Yun-Wei Chiang (江昀緯)
	Hyperspectral imaging of cuttlefish camouflage indicates good color match in the eyes of fish predators	Chuan-Chin Chiao (焦傳金)
PROGRESS IN ELECTROMAGNETICS RESEARCH-PIER	MODAL ANALYSIS OF METAL-STUB PHOTONIC BAND GAP STRUCTURES IN A PARALLEL-PLATE WAVEGUIDE	Tsun-Hsu Chang (張存續)
PROGRESS IN POLYMER SCIENCE	Helical architectures from self-assembly of chiral polymers and block copolymers	Rong-Ming Ho (何榮銘)
SCRIPTA MATERIALIA	Stabilization of hexagonal Cu-6(Sn,Zn)(5) by minor Zn doping of Sn-based solder joints	Jenq-Gong Duh (杜正恭)
TOXICOLOGICAL SCIENCES	Delay of Gap Filling during Nucleotide Excision Repair by Base Excision Repair: The Concept of Competition Exemplified by the Effect of Propolis	Yin-Chang Liu (劉銀樟)
WATER RESEARCH	Synergistic effect of nickel ions on the coupled dechlorination of trichloroethylene and 2,4-dichlorophenol by Fe/TiO ₂ nanocomposites in the presence of UV light under anoxic conditions	Ruey-An Doong (董瑞安)

Representative Journal Publications (2012)

Journal	Title	Corresponding Author
NATURE	Crystal structure of a membrane-embedded H ⁺ -translocating pyrophosphatase	Yuh-Ju Sun (孫玉珠)
	'Big Bang' tomography as a new route to atomic-resolution electron tomography	Rong-Long Pan (潘榮隆)
SCIENCE	Visualizing Long-Term Memory Formation in Two Neurons of the Drosophila Brain	Ann-Shyn Chiang (江安世)
	Plasmonic Nanolaser Using Epitaxially Grown Silver Film	Shangjr Gwo (果尚志)
ACCOUNTS OF CHEMICAL RESEARCH	pH-Responsive Nanoparticles Shelled with Chitosan for Oral Delivery of Insulin: From Mechanism to Therapeutic Applications	Hsing-Wen Sung (宋信文)
ACS NANO	Alkanethiol-Passivated Ge Nanowires as High-Performance Anode Materials for Lithium-Ion Batteries: The Role of Chemical Surface Functionalization	Hsing-Yu Tuan (段興宇)
	Ferromagnetic Germanide in Ge Nanowire Transistors for Spintronics Application	Lih J. Chen (陳力俊)
	Free-Standing and Single-Crystalline Fe _{1-x} Mn _x Si Nanowires with Room-Temperature Ferromagnetism and Excellent Magnetic Response	Lih J. Chen (陳力俊)
	Gallium Nitride Nanowire Based Nanogenerators and Light-Emitting Diodes	Li-Jen Chou (周立人)
	High Mobility Flexible Graphene Field-Effect Transistors with Self-Healing Gate Dielectrics	Po-Wen Chiu (邱博文)
	Taper PbZr _{0.2} Ti _{0.8} O ₃ Nanowire Arrays: From Controlled Growth by Pulsed Laser Deposition to Piezopotential Measurements	Yu-Lun Chueh (闕郁倫)
	ZnO _{1-x} Nanorod Arrays/ZnO Thin Film Bilayer Structure: From Homojunction Diode and High-Performance Memristor to Complementary 1D1R Application	Yu-Lun Chueh (闕郁倫)
ACTA CRYSTALLOGRAPHICA SECTION D-BIOLOGICAL CRYSTALLOGRAPHY	Structures of Helicobacter pylori uridylylate kinase: insight into release of the product UDP	Yuh-Ju Sun (孫玉珠)
ACTA MATERIALIA	Formation of ordered nano-wire microstructures in thermoelectric Pb-Ag-Sb-Te	Sinn-Wen Chen (陳信文)
	Reduced thermal conductivity in Pb-alloyed AgSbTe ₂ thermoelectric materials	Sinn-Wen Chen (陳信文)
	Thermal stability of sol-gel p-type Al-N codoped ZnO films and electric properties of nanostructured ZnO homojunctions fabricated by spin-coating them on ZnO nanorods	Jenn-Ming Wu (吳振名)
	Accelerating disorder-order transitions of FePt by performing a metastable AgPt phase	Chih-Huang Lai (賴志煌)
	Phase field crystal simulations of nanocrystalline grain growth in two dimensions	Kuo-An Wu (吳國安)
ADVANCED FUNCTIONAL MATERIALS	Lipid-Containing Polymer Vesicles with pH/Ca ²⁺ -Ion-Manipulated, Size-Selective Permeability	Hsin-Cheng Chiu (邱信程)

Representative Journal Publications (2012)

Journal	Title	Corresponding Author
ADVANCED FUNCTIONAL MATERIALS	Metal-Free Growth of Nanographene on Silicon Oxides for Transparent Conducting Applications	Po-Wen Chiu (邱博文)
	Os(II) Based Green to Red Phosphors: A Great Prospect for Solution-Processed, Highly Efficient Organic Light-Emitting Diodes	Hao-Wu Lin (林皓武)
	Shape-Controlled Synthesis of Polyhedral Nanocrystals and Their Facet-Dependent Properties	Hsuan-Yi Huang (黃暄益)
	Ultrahigh Specific Capacitances for Supercapacitors Achieved by Nickel Cobaltite/Carbon Aerogel Composites	Shih-Yuan Lu (呂世源)
ADVANCED MATERIALS	Device Engineering for Highly Efficient Top-Illuminated Organic Solar Cells with Microcavity Structures	Hao-Wu Lin (林皓武)
	Label-Free, Coupler-Free, Scalable and Intracellular Bio-imaging by Multimode Plasmonic Resonances in Split-Ring Resonators	Ta-Jen Yen (嚴大任)
	Synthesis of Diimidazolylstilbenes as n-Type Blue Fluorophores: Alternative Dopant Materials for Highly Efficient Electroluminescent Devices	Chien-Hong Cheng (鄭建鴻)
ADVANCED SYNTHESIS & CATALYSIS	Glucose 1-Phosphate Thymidyltransferase in the Synthesis of Uridine 5'-Diphosphate Galactose and its Application in the Synthesis of N-Acetyllactosamine	Chun-Cheng Lin (林俊成)
	Photo-Induced Sonogashira C-C Coupling Reaction Catalyzed by Simple Copper(I) Chloride Salt at Room Temperature	Kuo Chu Hwang (黃國柱)
	Oxy Effects on the Platinum-Catalyzed Carbo- and Oxacyclizations of 2-Oxiranyl-1-(1-oxoalk-2-ynyl) benzenes	Rai-Shung Liu (劉瑞雄)
	Iron-Catalyzed Synthesis of α,β -Chlorovinyl and α,β -Alkynyl Ketones from Terminal and Silylated Alkynes with Acid Chlorides	Chien-Hong Cheng (鄭建鴻)
AGING CELL	Reduced neuronal expression of ribose-5-phosphate isomerase enhances tolerance to oxidative stress, extends lifespan, and attenuates polyglutamine toxicity in <i>Drosophila</i>	Horng-Dar Wang (汪宏達)
ANALYTICAL CHEMISTRY	Quantitative Characterization of Nanoparticles in Blood by Transmission Electron Microscopy with a Window-Type Microchip Nanopipet	Tri-Rung Yew (游萃蓉)
	Rational Design of Fluorescent Phosgene Sensors	Kuo Chu Hwang (黃國柱)
ANGEWANDTE CHEMIE-INTERNATIONAL EDITION	A Liposomal System Capable of Generating CO ₂ Bubbles to Induce Transient Cavitation, Lysosomal Rupturing, and Cell Necrosis	Hsing-Wen Sung (宋信文)
	Engineering of Osmium(II)-Based Light Absorbers for Dye-Sensitized Solar Cells	Chi, Yun (季昀)
	Development of a Povarov Reaction/Carbene Generation Sequence for Alkenyldiazocarbonyl Compounds	Rai-Shung Liu (劉瑞雄)

Representative Journal Publications (2012)

Journal	Title	Corresponding Author
ANGEWANDTE CHEMIE- INTERNATIONAL EDITION	Gold-Catalyzed Intermolecular [4+2] and [2+2+2] Cycloadditions of Ynamides with Alkenes	Rai-Shung Liu (劉瑞雄)
	Gold-Catalyzed Oxidative Cyclizations of cis-3-En-1-yne To Form Cyclopentenone Derivatives	Rai-Shung Liu (劉瑞雄)
	Intermolecular Gold-Catalyzed Diastereo- and Enantioselective [2+2+3] Cycloadditions of 1,6-Enynes with Nitrones	Rai-Shung Liu (劉瑞雄)
	Retention of Stereochemistry in Gold-Catalyzed Formal [4+3] Cycloaddition of Epoxides with Arenynamides	Rai-Shung Liu (劉瑞雄)
	An Electron-Rich Molybdenum-Molybdenum Quintuple Bond Spanned by One Lithium Atom	Yi-Chou Tsai (蔡易州)
	Reactions of Metal-Metal Quintuple Bonds with Alkynes: [2+2+2] and [2+2] Cycloadditions	Yi-Chou Tsai (蔡易州)
	Stepwise Construction of the Cr-Cr Quintuple Bond and Its Destruction upon Axial Coordination	Yi-Chou Tsai (蔡易州)
	One-Pot Synthesis of Isoquinolinium Salts by Rhodium-Catalyzed C-H Bond Activation: Application to the Total Synthesis of Oxychelerythrine	Chien-Hong Cheng (鄭建鴻)
	Regio- and Enantioselective Cobalt-Catalyzed Reductive [3+2] Cycloaddition Reaction of Alkynes with Cyclic Enones: A Route to Bicyclic Tertiary Alcohols	Chien-Hong Cheng (鄭建鴻)
	Rhodium(III)-Catalyzed Oxidative C-H Coupling of N-Methoxybenzamides with Aryl Boronic Acids: One-Pot Synthesis of Phenanthridinones	Chien-Hong Cheng (鄭建鴻)
APPLIED CATALYSIS B:ENVIRONMENTAL	Novel synthesis of N-doped porous carbons from collagen for electrocatalytic production of H ₂ O ₂	Chi-Chang Hu (胡啓章)
	Surface-modified anatase nanocrystalline building blocks for constructing catalytically highly active nanoporous titania materials	Chia-Min Yang (楊家銘)
BIOINFORMATICS	On the calculation of signal transduction ability of signaling transduction pathways in intracellular communication: systematic approach	Bor-Sen Chen (陳博現)
BIOMATERIALS	A graphene-based platform for induced pluripotent stem cells culture and differentiation	Yu-Chen Hu (胡育誠)
	Aptamer-conjugated and drug-loaded acoustic droplets for ultrasound theranosis	Chih-Kuang Yeh (葉秩光)
	Augmented healing of critical-size calvarial defects by baculovirus-engineered MSCs that persistently express growth factors	Yu-Chen Hu (胡育誠)
	Concurrent blood-brain barrier opening and local drug delivery using drug-carrying microbubbles and focused ultrasound for brain glioma treatment	Chih-Kuang Yeh (葉秩光)
	Elucidating the signaling mechanism of an epithelial tight-junction opening induced by chitosan	Hsing-Wen Sung (宋信文)

Representative Journal Publications (2012)

Journal	Title	Corresponding Author
BIOMATERIALS	Immune responses during healing of massive segmental femoral bone defects mediated by hybrid baculovirus-engineered ASCs	Yu-Chen Hu (胡育誠)
	Micropatterning of mammalian cells on inorganic-based nanosponges	Chao-Min Cheng (鄭兆珉)
	Multidrug release based on microneedle arrays filled with pH-responsive PLGA hollow microspheres	Hsing-Wen Sung (宋信文)
	Multi-functional graphene as an in vitro and in vivo imaging probe	Yong-Chien Ling (凌永健)
	Protease inhibition and absorption enhancement by functional nanoparticles for effective oral insulin delivery	Hsing-Wen Sung (宋信文)
	Regulation of the fate of human mesenchymal stem cells by mechanical and stereo-topographical cues provided by silicon nanowires	Ta-Jen Yen (嚴大任)
	Simultaneous induction of autophagy and toll-like receptor signaling pathways by graphene oxide	Yu-Chen Hu (胡育誠)
BIOSENSORS & BIOELECTRONICS	A quantum dot-based optical immunosensor for human serum albumin detection	Tri-Rung Yew (游萃蓉)
	Ag/Au bi-metallic film based color surface plasmon resonance biosensor with enhanced sensitivity, color contrast and great linearity	Ta-Jen Yen (嚴大任)
	An integrated microfluidic system for rapid screening of alpha-fetoprotein-specific aptamers	Gwo-Bin Lee (李國賓)
	Ultrasensitive and label-free detection of pathogenic avian influenza DNA by using CMOS impedimetric sensors	Shiang-Cheng Lu (盧向成)
CHEMISTRY OF MATERIALS	One-Step, Surfactant-Free Hydrothermal Method for Syntheses of Mesoporous TiO ₂ Nanoparticle Aggregates and Their Applications in High Efficiency Dye-Sensitized Solar Cells	Shih-Yuan Lu (呂世源)
	Reply to Comment on "Chemical-Composition-Dependent Metastability of Tetragonal ZrO ₂ in Sol-Gel-Derived Films under Different Calcination Conditions"	Ruey-An Doong (董瑞安)
COMPOSITES SCIENCE AND TECHNOLOGY	Preparation of polybenzoxazine-functionalized Fe ₃ O ₄ nanoparticles through in situ Diels-Alder polymerization for high performance magnetic polybenzoxazine/Fe ₃ O ₄ nanocomposites	Ying-Ling Liu (劉英麟)
	Optimization of processing parameters of the chemical vapor deposition process for synthesizing high-quality single-walled carbon nanotube fluff and roving	Nyan-Hwa Tai (戴念華)
COORDINATION CHEMISTRY REVIEWS	The chemistry of univalent metal beta-diketiminates	Yi-Chou Tsai (蔡易州)
ENERGY & ENVIRONMENTAL SCIENCE	Enhanced photovoltaic performance with co-sensitization of porphyrin and an organic dye in dye-sensitized solar cells	Chien-Tien Chen (陳建添)

Representative Journal Publications (2012)

Journal	Title	Corresponding Author
ENERGY & ENVIRONMENTAL SCIENCE	Molecular engineering of cocktail co-sensitization for efficient panchromatic porphyrin-sensitized solar cells	Chien-Tien Chen (陳建添)
	Ru(II) sensitizers with a tridentate heterocyclic cyclometalate for dye-sensitized solar cells	Chi, Yun (季昀)
	Superhydrophobic and superoleophilic properties of graphene-based sponges fabricated using a facile dip coating method	Nyan-Hwa Tai (戴念華)
ENVIRONMENTAL SCIENCE & TECHNOLOGY	Simultaneous NO _x and Hydrocarbon Emissions Control for Lean-Burn Engines Using Low-Temperature Solid Oxide Fuel Cell at Open Circuit	Ta-Jen Huang (黃大仁)
HUMAN BRAIN MAPPING	Physiological noise reduction using volumetric functional magnetic resonance inverse imaging	Fu-Nien Wang (王福年)
IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS	Fiber Bragg Grating-Based Three- Dimensional Multipoint Ring-Mesh Sensing System With Robust Self-Healing Function	Kai-Ming Feng (馮開明)
IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS	Cooperative Geographic Routing with Radio Coverage Extension for SER-Constrained Wireless Relay Networks	Chin-Liang Wang (王晉良)
IEEE TRANSACTIONS ON FUZZY SYSTEMS	Robust Filter for Nonlinear Stochastic Partial Differential Systems in Sensor Signal Processing: Fuzzy Approach	Bor-Sen Chen (陳博琨)
IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION	An Efficient Traffic Information Forwarding Solution for Vehicle Safety Communications on Highways	Nen-Fu Huang (黃能富)
IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS	VLSI Implementation of a Bio-Inspired Olfactory Spiking Neural Network	Kea-Tiong Tang (鄭桂忠)
INTERNATIONAL JOURNAL OF GREENHOUSE GAS CONTROL	CO ₂ capture by alkanolamine solutions containing diethylenetriamine and piperazine in a rotating packed bed	Chung-Sung Tan (談駿嵩)
INTERNATIONAL JOURNAL OF HEAT AND MASS TRANSFER	Visualization and evaporator resistance measurement for a groove-wicked flat-plate heat pipe	Shwin-Chung Wong (王訓忠)
	Influences of a confined elliptic cylinder at different aspect ratios and inclinations on the laminar natural and mixed convection flows	Chao-An Lin (林昭安)
	Boiling heat transfer and critical heat flux of ethanol-water mixtures flowing through a diverging microchannel with artificial cavities	Chin Pan (潘欽)
	Boiling two-phase flow and efficiency of co-and counter-current microchannel heat exchangers with gas heating	Chin Pan (潘欽)
	Flow pattern maps and transition criteria for flow boiling of binary mixtures in a diverging microchannel	Chin Pan (潘欽)
JOURNAL OF CHEMICAL INFORMATION AND MODELING	Design of Novel FLT-3 Inhibitors Based on Dual-Layer 3D-QSAR Model and Fragment-Based Compounds in Silico	Chuan Yi Tang (唐傳義)

Representative Journal Publications (2012)

Journal	Title	Corresponding Author
JOURNAL OF THE AMERICAN CHEMICAL SOCIETY	Allylic Carbon-Carbon Double Bond Directed Pd-Catalyzed Oxidative ortho-Olefination of Arenes	Chien-Hong Cheng (鄭建鴻)
	Dye Molecular Structure Device Open-Circuit Voltage Correlation in Ru(II) Sensitizers with Heteroleptic Tridentate Chelates for Dye-Sensitized Solar Cells	Chi, Yun (季昀)
	From Stimuli-Responsive Polymorphic Organic Dye Crystals to Photoluminescent Cationic Open-Framework Metal Phosphate	Sue-Lein Wang (王素蘭)
	Harvesting Highly Electronically Excited Energy to Triplet Manifolds: State-Dependent Intersystem Crossing Rate in Os(II) and Ag(I) Complexes	Chi, Yun (季昀)
	Stereoselective Synthesis of S-Linked $\alpha(2 \rightarrow 8)$ and $\alpha(2 \rightarrow 8)/\alpha(2 \rightarrow 9)$ Hexasialic Acids	Chun-Cheng Lin (林俊成)
	Synthesis of Cu ₂ O Nanocrystals from Cubic to Rhombic Dodecahedral Structures and Their Comparative Photocatalytic Activity	Hsuan-Yi Huang (黃暄益)
	Thermally-Induced Phase Transition of Pseudorotaxane Crystals: Changes in Conformation and Interaction of the Molecules and Optical Properties of the Crystals	Masaki Horie (堀江正樹)
	Transfer of Chirality from Molecule to Phase in Self-Assembled Chiral Block Copolymers	Rong-Ming Ho (何榮銘)
	Vacuum-Deposited Small-Molecule Organic Solar Cells with High Power Conversion Efficiencies by Judicious Molecular Design and Device Optimization	Hao-Wu Lin (林皓武)
LASER PHYSICS LETTERS	Attosecond pulse synthesis and arbitrary waveform generation with cascaded harmonics of an injection-seeded high-power Q-switched Nd:YAG laser	Ci-Ling Pan (潘犀靈)
MACROMOLECULES	Helical Phase Driven by Solvent Evaporation in Self-Assembly of Poly(4-vinylpyridine)- block-poly(L-lactide) Chiral Block Copolymers	Rong-Ming Ho (何榮銘)
	Syndiotactic Polyallyltrimethylsilane-Based Stereoregular Diblock Copolymers: Syntheses and Self-Assembled Nanostructures	Rong-Ming Ho (何榮銘)
	Interactive Crystallization Kinetics in Double-Crystalline Block Copolymer	Hsin-Lung Chen (陳信龍)
	Nucleosome-like Structure from Dendrimer-Induced DNA Compaction	Hsin-Lung Chen (陳信龍)
	Order-Order Transition between Equilibrium Ordered Bicontinuous Nanostructures of Double Diamond and Double Gyroid in Stereoregular Block Copolymer	Hsin-Lung Chen (陳信龍)
	Extensive Development of Precursory Helical Pairs Prior to Formation of Stereocomplex Crystals in Racemic Polylactide Melt Mixture	An-Chung Su (蘇安仲)
	Enhanced Piezoelectricity of Nanoimprinted Sub-20 nm Poly(vinylidene fluoride-trifluoroethylene) Copolymer Nanoglass	Chien-Chong Hong (洪健中)

Representative Journal Publications (2012)

Journal	Title	Corresponding Author
MATERIALS SCIENCE & ENGINEERING R-REPORTS	Thermomigration in solder joints	Fan-Yi Ouyang (歐陽汎怡)
MATHEMATISCHE ANNALEN	Special values of Drinfeld modular forms and algebraic independence	Chieh-Yu Chang (張介玉)
NANO LETTERS	Bipolar Resistive Switching of Single Gold-in-Ga ₂ O ₃ Nanowire	Li-Jen Chou (周立人)
	Coaxial Metal-Silicide Ni ₂ Si/C54-TiSi ₂ Nanowires	Li-Jen Chou (周立人)
	Electrical Probing of Magnetic Phase Transition and Domain Wall Motion in Single-Crystalline Mn ₅ Ge ₃ Nanowire	Lih J. Chen (陳力俊)
	Graphene Annealing: How Clean Can It Be?	Po-Wen Chiu (邱博文)
	Remote Catalyzation for Direct Formation of Graphene Layers on Oxides	Po-Wen Chiu (邱博文)
NEUROIMAGE	A large deformation diffeomorphic metric mapping solution for diffusion spectrum imaging datasets	Ching-Han Hsu (許靖涵)
NUCLEIC ACIDS RESEARCH	CPred: a web server for predicting viable circular permutations in proteins	Ping-Chiang Lyu (呂平江)
PHYSICAL REVIEW LETTERS	Demonstration of the Interaction between Two Stopped Light Pulses	Ite A. Yu (余怡德)
	High-Resolution Sub-Doppler Lamb Dips of the nu(2) Fundamental Band of H-3(+)	Jow-Tsong Shy (施宙聰)
	Could the Excess Seen at 124-126 GeV Be due to the Randall-Sundrum Radion?	Kingman Cheung (張敬民)
PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA	Auditory circuit in the Drosophila brain	Ann-Shyn Chiang (江安世)
PROGRESS IN ELECTROMAGNETICS RESEARCH-PIER	EXPERIMENTAL AND THEORETICAL STUDIES OF A BROADBAND SUPERLUMINALITY IN FABRY-PEROT INTERFEROMETER	Tsun-Hsu Chang (張存續)
PROGRESS IN MATERIALS SCIENCE	Biological materials: Functional adaptations and bioinspired designs	Po-Yu Chen (陳柏宇)
RENEWABLE & SUSTAINABLE ENERGY REVIEWS	The analysis of renewable energy policies for the Taiwan Penghu island administrative region	Amy J. C. Trappey (張瑞芬)
SMALL	Carbon Nanotube Rope with Electrical Stimulation Promotes the Differentiation and Maturity of Neural Stem Cells	Tzu-Wei Wang (王子威)
	Pulsatile Drug Release from PLGA Hollow Microspheres by Controlling the Permeability of Their Walls with a Magnetic Field	Hsing-Wen Sung (宋信文)
TECHNOVATION	How do established firms improve radical innovation performance? The organizational capabilities view	Yuan-Chieh Chang (張元杰)
	Introduction to the special cluster on managing technology-service fusion innovation	Yuan-Chieh Chang (張元杰)



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2013 NTHU R&D Report

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