

Sustainable Chemical Science and Technology Program (SCST)

Sustainable Chemical Science and Technology Program (SCST)

Taiwan International Graduate Program (TIGP)

Academia Sinica has established the Taiwan International Graduate Program (TIGP) in collaboration with a consortium of several key research universities in Taiwan. The purpose of the program is to develop the research manpower pool in those modern multidisciplinary fields that are important in the future economical and social development and to enhance the innovative potential and academic standards of research in these and related fields.

TIGP offers Ph.D. programs in only selected disciplines to be agreed upon between Academia Sinica and these research universities. It is the intent of the Program to offer Ph.D. education programs only in interdisciplinary areas in the physical sciences, applied sciences, engineering, biological and agricultural sciences, health and medical sciences, and humanities and social sciences.

Academia Sinica assumes principal oversight of the academic options of the Program, and provides the intellectual leadership, the research resources, and the research and physical facilities. Qualified faculty members of the participating research universities are involved in various programs as affiliated faculties of the Program, and participate in the teaching of courses, supervision of research, and mentoring of the international graduate students.



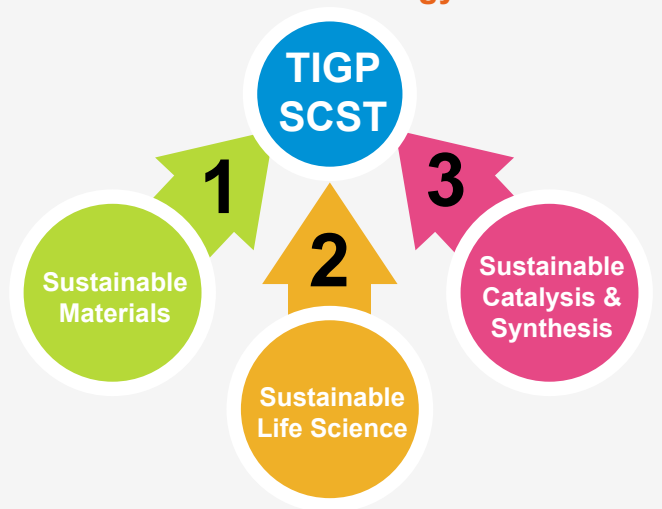
TIGP Program on Sustainable Chemical Science & Technology

Within this context, the international Ph.D. program of Sustainable Chemical Science and Technology is designed to offer specific training and research opportunities to Ph.D. students who are interested in the following areas: 1. develop optoelectronic materials and their applications related to sustainable energy, 2. construction of supramolecular materials for recognition, self-assembly, and identification of chemical species, 3. new drug development related to human diseases, 4. understanding of disease mechanisms, 5. study in cell structure and function, 6. development of biosensors, 7. green technology of organic synthesis, 8. energy related catalysis, 9. technology for environmental monitoring and therapy. This program is a collaborative effort between Academia Sinica and National Chiao Tung University. In accordance with these research areas, the sustainable chemical science and technology program is divided into three categories, namely, sustainable materials, sustainable life science and sustainable catalysis & synthesis. The number of total students admitted to

Sustainable Chemical Science and Technology Program every year is limited to twenty. The bulk of these students are international students with reasonable proficiency in the use of the English language. However, highly qualified Taiwanese students (up to 10 people) with adequate English proficiency are also considered. Students may do their thesis research with faculty whose principal appointments are associated with the National Chiao Tung University.

A whole array of laboratory equipments and facilities for teaching and research are available within the participating units. The following is a list of some examples -- Device Fabrication Facilities; NMR Spectrometers: 200 MHz, 300 MHz, 400 MHz, 500 MHz, 600 MHz and a 300 MHz Solid state; Mass Spectrometers: GC/MS, Ion Trap, Q-TOF, ESI-TOF, Sector, MALDI-TOF/ TOF; Single Crystal X-ray Diffractometer & Powder X-ray Diffractometer; Microscopes: AFM, STM, SEM, and TEM, Dip-pen Nanolithography System; EPR Spectrometer with ESEEM and ENDOR; Time-resolved Measurements; Magnetic CD; Physical Vapor Deposition System; Solar Cell Measurement System; SQUID; Ultra-high Speed Centrifuges.

Sustainable Chemical Science and Technology



Collaboration Institutions

Academia Sinica

Institute of Chemistry (<http://www.chem.sinica.edu.tw/>)

Research Center for Environmental Changes (<http://www.rcec.sinica.edu.tw/>)

Institute of Biological Chemistry (<http://www.abc.sinica.edu.tw/>)

National Chiao Tung University

Department of Applied Chemistry (<http://www.ac.nctu.edu.tw/>)

Partner Institutions at National Chiao Tung University

Department of Applied Chemistry

The Department of Applied Chemistry was established in 1982, starting with Master Program to cope with the nation's increasing demand for experts in the fields related to applied chemistry. In 1991, B.S. program was added. Since 1992, Ph.D. education has been offered. Now, the department is one of the leading research institutes and provides students with excellent education in advanced topics related to fundamental and applied chemistry in the country. The department has 29 full-time faculty members and several adjunct appointments. The department is well funded by both governmental and industrial agencies. The faculty members now carry out interdisciplinary research projects in the six major categories. More specifically, these include drug design and synthesis, supramolecular chemistry, photochemistry, enzyme chemistry, protein engineering, micro-fluidic analysis, bio-analysis, single molecular detection, molecular dynamics, laser chemistry, ultra- fast kinetics, nano-materials, photoelectronic materials, polymer materials, polymer science and technology, materials for energy regeneration and storage, computer simulation and theoretical calculation.

Institute of Molecular Science (IMS)

The Institute of Molecular Science (IMS) was established in 2005 for the purpose of training excellent graduate students and researchers and integrating research groups for frontier interdisciplinary research. IMS welcomes students in physics, chemistry, biosciences, materials, photonics, and other related disciplines to join its graduate program. The academic staff in IMS include three Academicians (S. H. Lin, M. C. Lin, and Y.-P. Lee) of Academia Sinica. IMS is also highly international, with many members of academic staff from Japan and other countries, including H. Masuhara (Foreign member of Belgium Academy of Sciences and The India National Academy of Sciences, Fellow of Japanese Chemical Society) who is leading the Laser Bio/Nano Science Laboratory and H. Hamaguchi (Fellow of Society for Applied Spectroscopy, USA) who is directing the Ultimate Spectroscopy and Imaging Laboratory. IMS focuses on five major research directions to develop a unique interdisciplinary program for frontier fundamental research involving physics, chemistry, biotechnology, photonics and material science.

Research Topics

Sustainable Materials:

Develop optoelectronic materials and their applications related to sustainable energy

Optoelectronic materials aiming for energy-saving or energy conversion is one of primary goals. Developing materials for white organic light-emitting diodes (WOLEDs) in lighting application is one way to achieve energy-saving compared with traditional lighting method. For effectively utilizing solar energy, organic material-based solar cells including organic photovoltaic (OPV), dye sensitized solar cell (DSSC), and perovskite solar cell (PSC) are alternatives in the conversion of photo energy to electrical energy. Molecular electronics, such as organic transistor/memory devices, requires judicious design of organic semiconductive materials for manipulating electrical current and saving energy.

Construction of supramolecular materials for recognition, self-assembly, and identification of chemical species

Self-assembly of nanometer-scale inorganic materials having metal organic framework (MOF) is one typical approach of preparing supramolecular materials to serve the purpose. Design, synthesize, and identify organic gelating materials or assembly nanomaterials are the other approaches. The corresponding ratiometric or fluorescent recognition of chemical species is an analytical sensing method for protecting environment, a practical realization of green chemistry.

Sustainable Life Science:

Novel drug development for human diseases

- (1) Drug discovery in antimetastatic and antiproliferative agents; (2) New therapeutic strategies against different neurodegenerative disorders, ALS and FTLD; (3) Specific materials for drug delivery; (4) Total synthesis of natural products for drug development in diabetes and neurodegenerative disease.

Develop novel biosensors against human diseases

- (1) Synthesis of various fluorescent biosensors and development of new calibration methods and fluorescence-reporting biosensors; (2) Surface functionalized nanoprobe-based affinity mass spectrometry for multiplexed quantitation of disease-associated protein markers.

Understand disease mechanisms

- (1) The role of membrane proteome, phosphoproteome, and nitrosylproteome associated with disease; (2) Mechanistic study and development of inhibitors for HIV-1 and influenza infections; (3) Study of interactions between glycoconjugates and envelop proteins of viruses; (4) Elucidation of NO sensing for redox regulation by transcriptional factors in E. coli.

Characterize protein structure and function

- (1) Investigate the structure and function of RNA polymerases and DNA repair enzymes; (2) Study protein folding and bioenergetics; (3) Elucidate protein self-assembly formation and structural/functional relationship between vaccinia viral proteins and glycosaminoglycan; (4) Establish artificial enzymes (metalloproteins) with the catalytic power; (5) Tune the prominent regio- and stereo-selective hydroxylation of cytochrome P450 BM-3 variants.

Sustainable Catalysis & Synthesis:

Green chemistry for chemical synthesis

We aim to develop green synthetic technology for the synthesis of carbohydrates, nature products, therapeutic drugs, and optoelectronic materials.

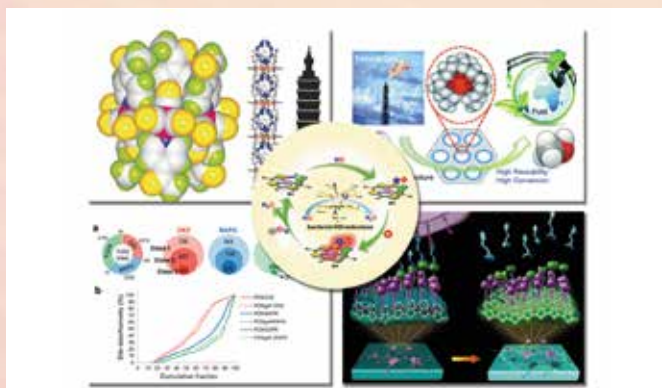
- Developing highly efficient and enantioselective procedures for atom economy organic synthesis.
- Developing homogeneous and heterogeneous catalysts which can catalyze C-H bond activation and C-C, C-N, C-O, or C-S bond formation.
- Developing synthetic methodology using environmental-friendly solvents and reagents.

Sustainable fuels and decarbonization

- Development of catalysts for water splitting, CO² activation, and hydrogen evolution.
- Combining nanotechnology and novel catalysts to develop sustainable energy-driven fuel generation devices.
- Developing catalysts for converting CO², methane, or hydrocarbons to alcohols for liquid fuel production.
- New biomass technology for the generation of renewable fuels and fine chemicals.

Technology for environmental monitoring and remediation

(1) Developing novel sensing probes for the detection of heavy metals and environmental toxins. (2) Developing nano-technology and nano-porous materials for environmental remediation. (3) Bacterial and enzyme-based degradation of organic toxins.



Cheduled Courses

Required Courses:

Courses to be taken by all students

- Introduction to Sustainable Chemical Science and Technology
- Seminar
- Lab Rotation
- Colloquium
- Elementary Chinese

Elective Courses:

Core Courses: Select at least one course

- Advanced Organic Chemistry
- Advanced Analytical Chemistry
- Advanced Physical Chemistry I
- Advanced Inorganic Chemistry
- Discussion in Advanced Chemical Biology I

Non-core Courses:

- Advanced Physical Chemistry II
- Advanced Physical Chemistry III
- Advanced Chemical Kinetics
- Advanced Chemical Thermodynamics
- Advanced Chemistry of Materials
- Advanced Group Theory
- Advanced Nanotechnology A
- Advanced Nanotechnology B
- Advanced Spectroscopy
- Atmospheric Chemistry and Climate Changes
- Basic Scientific Writing and Presentation in English
- Biochemical Analysis
- Chemical Thermodynamics
- Chromatography
- Computational Materials Science
- Computational Quantum Chemistry
- Computer Modeling for Drug Design
- Discussion in Advanced Chemical Biology II
- Experimental Molecular Biophysics

- Introduction of Synchrotron & Laser Techniques in Biomedical Research
- Introduction to Molecular Imaging and Analysis
- Laser Bio/Nano Science
- Linear Algebra for Scientist
- Mass Spectrometry
- Modern Experimental Techniques – Chemistry
- Molecular Spectroscopy
- Organometallic Chemistry
- Pharmaceutical Chemistry
- Principle of Photochemistry
- Quantum Chemistry
- Research Techniques in Physical Chemistry
- Seminar on Instrumental Analysis I
- Seminar on Instrumental Analysis II
- Special Topic - Into Supramolecular Photo Science
- The Methods of Computational Chemistry
- Transferable Skills for Chemists
- Writing Skills for Chemists

Faculty Members

Institute of Chemistry, Academia Sinica

Chang, Wei-Hau

Single Molecule Biophysics, Single Particle Cryo-Electron Microscopy, Chemical Biology for Bio-Conjugation

Chen, Chin-Ti

Materials Chemistry

Chen, Yu-Ju

Proteomics and Mass Spectrometry

Chen, Rong-Jie

Asymmetric Organocatalysis and Natural Products Synthesis

Chiang, Ming-Hsi

Bioinorganic Chemistry and Catalysis

Chung, Cedric Po-Wen

Material, Catalysis and Sustainable Chemistry

Hsu, Chao-Ping

Theoretical Chemistry

Huang, Joseph Jen-Tse

Biophysical Chemistry and Chemical Biology

Hung, Chen-Hsiung

Porphyrin Chemistry and Bioinorganic Chemistry

Kuo, Chun-Hong

Nanoporous Materials & Nanocrystals

Lee, Hsien-Ming

Chemical Biology and Bioorganic Chemistry

Li, Wen-Shan

Medicinal and Bioorganic Chemistry

Lin, Chih-Hsiu

Organic Material Chemistry

Lin, Jiann-T'suen

Organometallic Chemistry and Material Chemistry

Lu, Kuang-Lieh

Supramolecular Chemistry and Nanomaterials

Luo, Fen-Tair

Advanced Materials, Biomass Super torrefaction and Supergasification, Catalysis, Metallo-Organic Chemistry

Ong, Tiow-Gan

Organometallic Chemistry with Catalysis Implication in C-H Bond Activation and Organic Synthesis

Shie, Jiun-Jie

Organic Chemistry and Chemical Biology

Sun, Shih-Sheng

Supramolecular Materials Chemistry

Tao, Yu-Tai

Materials Chemistry and Surface Chemistry

Tzou, Der-Lii M.

NMR Spectroscopy and Biophysical Chemistry

Wang, Cheng-Chung

Carbohydrate Chemistry, Automated Synthesis of Glycocojugates and Glycobiology

Yu, Hsiao-hua

Organic and Polymer Materials, Nanobiotechnology, Cell Materials Interface

Yu, Steve Sheng-Fa

Bioorganic Chemistry and Bioinorganic Chemistry

Tu, Hsiung-Lin

Surface Physical and Materials Chemistry, Chemical and Systems Biology

Yen, Hung-Ju

Materials Chemistry

Sustainable Chemical Science and Technology Program, National Chiao Tung University

Chen, Jiun-Tai

Polymer Chemistry, Polymer Nanomaterials, Optoelectronic

Chung, Wen-Sheng

Physical Organic Chemistry, Host-Guest Chemistry, Organic Photochemistry

Diau, Eric

Femto chemistry, Nano chemistry, Spectroscopy and Photochemistry

Hsieh, You-Zung

Analytical Chemistry, Microchip Capillary Electrophoresis
Lee, Yuan-Pern
Physical Chemistry, Laser Chemistry, Spectroscopy

Liau, Ian

Biophysical chemistry, Biomedical photonics, Cardiovascular research

Mong, Tony

Organic Synthesis, Carbohydrate Chemistry, Synthesis and Design of Biomacromolecule

Sun, Chung-Ming

Combinatorial Drug Discovery, Microwave-Assisted Polymer Supported Synthesis, Chemicalgenetics
Urban, Pawel

Analytical Chemistry, Microscale Biochemical Analysis, Forensic Chemistry, Mass Spectrometry, Separation Science

Wang, Chien-Lung

Polymer Physics, Conjugated Molecules, Self-assemble Functional Materials, Supramolecular Chemistry

Wu, Yen-Ku

Organic Chemistry, Natural Product Synthesis, Photochemical Synthesis, Catalytic Methodology Development

Witek, Henryk

Quantum and Computational Chemistry, Applied Linear Algebra, Perturbation Theory

Research Center for Environmental Changes, Academia Sinica

Chou, Charles C.-K.

Aerosol Physics and Chemistry, Air Quality Monitoring, Urban Air Pollution Control

Institute of Biological Chemistry, Academia Sinica

Liang, Po-Huang

Enzymology, Drug Discovery, Chemical Biology

Lin, Chun-Hung

Drug Discovery, Chemical Biology, Carbohydrate Synthesis and Glycobiology

Agricultural Biotechnology Research Center, Academia Sinica

Chen, Yet-Ran

Integrative Plant Stress Biology Enzyme Biotechnology

Institute of Atomic and Molecular Sciences, Academia Sinica

Chen, Kuei-Hsien

Advanced Materials and Surface Science

Yang, Dah-Yen

Biophysics and Bioanalytical Technology

Requirements for the Ph.D. Degree

(1) Course Work

All courses will be offered in English. Basically, during the first two years. Students are also required to take a one-credit course on Seminar and Colloquium during each semester of the first academic years. In addition, it is the responsibility of the advisor to assist each student in formulating a program of study that will best satisfy his or her personal needs as well as fulfilling the graduate requirements.

(2) Selection of Research Advisor

Once you have identified your thesis advisor, you do not need to do rotation anymore. Each lab rotation period shall not exceed three months and must be carried out under the supervision of different professors. Consultation from the Academic and Student Affairs Committee will be provided to students who have difficulty finishing 2 lab rotations or identifying a thesis advisor. By September 1st of the second academic year, students must have identified your thesis advisor.

(3) Qualifying Written Examination

There are three written examinations of each academic year in November, March, and July. Student can choose one subject approved by the Advisor. Students must pass the written exam three times within three academic years. A passing grade is 70 out of 100.

(4) Qualifying Oral Examination

PhD student must have a research plan approved by his/her advisor before the end of third academic year. A passing grade is 70 out of 100. If student does not pass, he/she must retake his/her oral exam 3 within one year up to one time.

(5) Advancement to Candidacy

The criteria for advancement to candidacy include: (1) completing course work and meeting the minimum credit requirement; (2) passing the qualifying examinations (both written and oral examinations). Once a student has been advanced to candidacy, he or she will begin to devote full time to independent study and research on his or her thesis topic.

(6) Thesis Defense

A Ph.D. candidate defends his or her thesis research before a thesis committee. This defense will take the form of a thesis seminar followed by an oral examination on the research. The examination committee shall consist of faculty members familiar with the candidate's area of research. Some of the thesis examining committee must come from another institution.

Application to SCST Program

The Program offers admissions to the fall semester

only. Application can be submitted through the on-line application system: <http://db1x.sinica.edu.tw/tigp/>, or by post to:

Admissions Office, Taiwan International Graduate Program, Academia Sinica
No. 128, Sec.2, Academia Road, Nankang, Taipei 11529, Taiwan

We strongly suggest online application.

The submitted application materials will not be returned to applicants under any circumstances. The complete application materials should be received by TIGP before March 31.

The following criteria will be the basis on which an application's qualification for admission is evaluated:

(1) Formal undergraduate and graduate academic records or transcripts

(2) Graduate Record Examination (GRE) scores in General Test

GRE is highly recommended. However, an applicant who fails to meet this requirement may submit additional criteria for committee evaluation. The GRE Subject Test is optional and one of the following subjects: Chemistry, Physics, Mathematics, or Biology is strongly recommended.

GRE substitution: If under special circumstances the test is not taken, some proof of applicant's competency might be considered. This proof should be more than just recommendation letters and transcripts, for example, documents like the award records, exam scores of national or international level, scientific publications, etc. will be helpful.

The admission committee will decide whether the proof is strong enough to support the application.

(3) English proficiency

Applicants whose first or native language is not English are required to submit one of following English proficiency test report (the listed scores are strongly recommended):

Applicants who have completed a degree program in an English speaking country, or who graduated from university where English is the primary language of instruction, maybe be exempted from the test of English proficiency with an official certification issued by the Office of Registrar.

TOEFL		IELTS	GEPT
Internet-Based TOEFL	79	5.5	High Intermediate Level
Computer-Based TOEFL	213		
Paper-Based TOEFL	550		

(4) Three letters of recommendation

Each letter comments on the applicant's personal character, and qualifications for independent study, including intellectual ability, research potential, and scientific motivation. One of the letters should be

(5) The admission for Students with a B.S. degree

First, students should have five or more years of work experience related to their undergraduate study. Second, any publication of which content is comparable with the thesis of M.S. should be included in the application package. Otherwise, a written report of achievement from previous working job(s) is

(6) Statement of purpose (plan for graduate study) in English

Specifically, we would like to see following items/questions being addressed.

- What area/topics do you want to study and research?
- Why do you want to study and research in this area/topics?
- How can SCST program help you pursue this research area/topics?

Cost of Study

The payment of tuition fees (basic fee + credits fee, about NT\$55,000/US\$1,718 per semester) for international students should be made on Student Registration Day. Partial subsidies for the tuition fees will later be provided (by Academia Sinica) to all international students.

Fellowship Support and Stipends

Fellowship will be granted for applicants who receive admission. The stipend levels are about NT\$34,000/month (~US\$1,060/month) for the first year. Additionally, the support will be extended to two more years for those students who perform well academically. In subsequent years, the financial support will be provided by the student's thesis advisor with his/her research grant. The amount of the support will be under the discretion of the advisor.

Medical Insurance

For international students only. Six months after the student receives the Alien Resident Certificate (ARC), the student will be qualified for Taiwan's National Health Insurance Program. The students are expected to pay the same premium as all the Taiwan citizens and will be entitled to the same medical coverage.

Living and Housing Costs

Options include on-campus housing and off-campus housing. On-campus self-catering student dormitory providing single study bedrooms is available to TIGP students at reasonable costs (for details, please visit our website:<http://tigp.sinica.edu.tw/Accommodation.html>).

Off-campus private housing is generally more expensive.

Correspondence and Information

For general information of TIGP

TIGP website: <http://tigrp.sinica.edu.tw/>

Ms. Huan-Yi Shen (tigrp@gate.sinica.edu.tw) Administrative Assistant, TIGP, Academia Sinica

128 Academia Road Sec.2, Nankang, Taipei 11529, Taiwan

For general information of SCST program

SCST website: <http://tigrp-scst.chem.sinica.edu.tw>

Dr. Chin-Ti Chen (chintchen@gate.sinica.edu.tw) Program Coordinator,

Institute of Chemistry, Academia Sinica

Tel.: 886-2-2789-8542; Fax: 886-2-2783-1237

Ms. Juliet Lee (kyo7647@gate.sinica.edu.tw) Administrative Assistant,

Institute of Chemistry, Academia Sinica

Tel.: 886-2-2789-8510; Fax: 886-2-2783-1237

Ms. Meng-Ru Chiang (chiangmengru@nctu.edu.tw) Administrative Assistant,

Department of Applied Chemistry, National Chiao Tung University

1001 University Road, Hsinchu 30050, Taiwan

Tel.: 886-3-5731-643; Fax: 886-3-5723-764



This program is sponsored by
Institute of Chemistry, **Academia Sinica**
in cooperation with
National Chiao Tung University