Canada Learning Initiative in China
CLIC
Canada Liaisons Internationales Chine

Research Internship Name: International undergraduate research training program

Chinese Host University and Department: Nankai University - College of Chemistry

Eligibility Requirements: Open to all chemistry major undergraduate students. Students must have completed at least one year of an undergraduate program and be enrolled as a current undergraduate. It is open to junior and senior undergraduates who have completed all major basic chemistry classes (organic, inorganic, physical, and analytical).

Research Internship Description: The internship covers research in almost all fields of chemistry: organic, inorganic, physical, analytical, material science, medicinal, polymer, supermolecular, etc.

Research Internship Objectives: Students will learn how to do research while working on cutting-edge research projects in world class research labs. Hands on research will strengthen their ability to think critically, apply what they have learned in classes to real scientific problems, improve their lab skills, open their eyes to frontiers of research in the fields they choose to work in.

Student Roles and Responsibilities: Students will work in research labs and serve as undergraduate research assistants. Initially, they will work with graduate students to undergo basic lab trainings. Later on, they can work on their own projects if they prove to be qualified to work independently.

Hours per week: 20 hours/week in the lab and 3 hours per week in language and culture courses.

Grading: Grading will be based on students' efforts and the level of the goals individuals will have met.

Number of Internship Positions: 30

Research Internship Location: Chemistry buildings, Nankai University, Tianjin, China

Research Internship Dates: All year.

Are the dates flexible: Yes

Supervisor(s) Name(s) and Contact Information:

Prof. Gong Chen (gongchen@nankai.edu.cn), Dean Assistant of the College of Chemistry, Research field: Peptide chemistry, carbohydrates, synthetic methodologies using metals or lights

Prof. Jun Chen (chenabc@nankai.edu.cn), Academician of Chinese academy of Science, Dean of the College of Chemistry, Research field: Energy chemistry, battery material

Prof. Langxing Chen (lxchen@nankai.edu.cn), Research field: Sensing technology, molecular recognition and molecular imprinting technology

Prof. Dongsheng Guo (dshguo@nankai.edu.cn), Research field: Supramolecular chemistry of calixarenes

Prof. Zhengjie He (zhengjiehe@nankai.edu.cn), Research field: nucleophilic catalysis using phosphines

Prof. Guangxin Liang (lianggx@nankai.edu.cn), Deputy Dean of the College of Chemistry, Research field: Organic synthetic chemistry, especially complex natural product total synthesis.

Prof. Qian Peng (qpeng@nankai.edu.cn), Research field: Computational chemistry, reaction mechanisms

Prof. Pingping Tang (ptang@nankai.edu.cn), Research field: Fluorine chemistry, natural product total synthesis

Prof. Yijing Wang (wangyj@nankai.edu.cn), Research field: Energy materials

Prof. Mengchun Ye (mcye@nankai.edu.cn), Research field: Inert bond activation, synthetic methodologies

Prof. Mingjian Yuan (016162@nankai.edu.cn), Research field: Solar cells and photodetectors; quantum dots; heterogeneous nano catalytisis

Prof. Shoufei Zhu (sfzhu@nankai.edu.cn), Deputy Dean of the College of Chemistry, Research field: Asymmetric catalysis, catalysis using cheap metals such as iron

Administrative Contact Information (International Students Office):

International Student Section
Office for International Academic Exchanges
Nankai University

Tel: 0086 22 2350 8686

E-mai address：studyinnankai@nankai.edu.cn

Administrative Contact Information (Lab):

Mr. Liang, E-mai address：lianggx@nankai.edu.cn

Research Internship Code: (course code for the research internship at your university)

Website address:

http://study.nankai.edu.cn/cn/index

http://chem.nankai.edu.cn/

Host university application: Yes, https://nankai.17gz.org/

Tuition fee: Waived tuition fee for partner-university though nomination

Dormitory accommodation available: Yes

Accommodations fee: Free NKU International Students Dormitory

Additional fees: None

NKU 2019 Research Internship Program

A key multidisciplinary and research-oriented university directly under the jurisdiction of the Ministry of Education, Nankai University, located in Tianjin on the coast of the sea of Bohai, is also the alma mater of Premier Zhou Enlai. Since 2000, Nankai has been listed among the universities to receive priority development in the twenty-first century. It features a balance between the humanities and the sciences, a solid foundation and a combination of application and creativity. Nankai University is a center for both education and academic research. A large number of academic achievements have been made and acknowledged at home and abroad.

NKU Research Internship Program aims to promote international research collaboration and enhance the academic environment at Nankai University. It offers excellent undergraduate students from around the world the opportunity to spend several months studying at world-class research laboratories, alongside prominent research professors. It will prepare undergraduate students for further study through intensive research experience with faculty mentors and enrichment activities.

In addition, participants will develop their research skills by enjoying lectures in related topics in the areas. Participants will also learn about Chinese language and culture which will enhance their intercultural awareness and communication.

What Participants Will Receive?

1. Knowledge of the top research projects in China
2. The opportunity to work with top Chinese professors, fellows, and students
3. A good basis for a career in academic research
4. The opportunity to co-author a scientific paper
5. Knowledge of Chinese language and culture
6. A rewarding and unforgettable experience in China

Credit	3 Credits
Program duration	In-Lab Hours: 20 hours/week Chinese Language and culture course: 3 hours/week[1]
Assessment	There are three grading sections in this program: Attendance ＝30% Midterm presentation ＝30% Final written report ＝40%

Application Procedures

1. Create ID and password
2. Complete Online Application
3. Receive the result on the website(In 2 weeks after application)
4. Confirmation of Admission on the website

The following items shall be uploaded alongside the online application:
1. A scan of the identification page of your passport. The passport must be valid for at least 6 more months for the visa application.
2. ID photo (similar to a passport photo)
3. Curriculum vitae (CV)
4. Copy of your most recent academic transcript
5. Motivation letter
6. Recommendation letter
7. Report of your past research experience (if available)
8. Language proficiency certificate (if available)

LIST OF RESEARCH PROJECTS

Project 1
Synthesis of Cyclic Organoborons through B-H Bond Insertion Reactions

Project 2
Computational Modelling on the Molecular Mechanism of CRISPR-Cas9 for Gene Editing

Project 3
Synthetic Study towards Glycinoeclepin A, a Potent Messenger Molecule Stimulating Hatch of Soybean Cyst Nematode

Project 4
Total Synthesis of Natural Products and Fluorine Chemistry

Project 5
Detection of X-ray Photons by Solution-processed Lead Halide Perovskites

Project 6
Phosphorus Reagents-Mediated Organic Synthetic Reactions

Project 7
In Situ Coating of Na-In alloy Layer to Protect Sodium Anode in Na-Metal Batteries

Project 8
Enantioselective intramolecular C (sp3) âˆ’H Amidation Based on Chiral Ligands Design

Project 9
The Enrichment of Proteins/Peptides Based on IMAC (MOAC)-Functionalized Magnetic Nanocomposites

Project 10
Supramolecular Tandem Assay of Biomarkers

Project 11
Biomimetic Catalysis

Project 1

Synthesis of Cyclic Organoborons through B-H Bond Insertion Reactions

Contact Information

Prof. Shou-Fei Zhu
Email: sfzhu@nankai.edu.cn

Project Description and Objectives

Organoborons are widely used in synthetic chemistry, material sciences, as well as pharmaceutical sciences. Preparation of organoborons with novel structures will advance the above-mentioned areas. Our group recently developed a new C-B bond forming reaction named transition-metal-catalyzed carbenes insertion into B-H bonds. This method bridges carbene chemistry with organoboron chemistry and thus brings new possibilities for the synthesis of organoborons with novel structures. This project will develop new methodologies on the synthesis of cyclic organoborons with various ring sizes by means of intramolecular B-H bond insertion. The cyclic organoborons are difficult to prepare through the other reactions and have many potential utilities.

Eligibility Requirements

- The applicants should have basic knowledge on organic chemistry.
- The applicants should have experiences on organic synthesis.

Main Tasks

- Preparation of borane-contained substrates.
- Studies on transition-metal-catalyzed intramolecular B-H bond insertion reactions.
- Write a research report on the experimental results.

Project 2

Computational Modelling on the Molecular Mechanism of CRISPR-Cas9 for Gene Editing

Contact Information

Prof. Qian Peng
Email: qpeng@nankai.edu.cn

Project Description and Objectives

Clustered regularly interspaced short palindromic repeats (CRISPR) and CRISPR-associated system 9 (Cas9) involve in the bacterial defense mechanism against phage infection and plasmid transfer in nature. CRISPR and Cas have been repurposed as a powerful RNA-guided DNA targeting platform for genome editing, transcriptional perturbation, epigenetic modulation, and genome imaging. CRISPR–Cas9-mediated genome engineering holds immense promise to treat or even cure genetic disorders, including many forms of cancer and neurodegeneration, as well as sickle cell anemia, cystic fibrosis, Duchenne muscular dystrophy, viral infections, immunological disorders, and cardiovascular diseases. Little theoretical investigations have been carried out to mimic the detailed enzymatic reactions in physiological environment. In this research program, we would like to apply state-of-the-art computational biology methodologies to investigate thoroughly the mechanism of CRISPR- Cas9 system at atomic level.

Eligibility Requirements

- Basic knowledge of computational biochemistry.
- Basic knowledge of Gaussian or other quantum chemistry program.
- Coding ability is preferred.

Main Tasks

- Paper reading.
- Get some insight into the mechanism study of DNA cleavage.
- Finish a report of the internship.

Project 3

Synthetic Study towards Glycinoeclepin A, a Potent Messenger Molecule Stimulating Hatch of Soybean Cyst Nematode

Contact Information

Prof. Guangxin Liang
Email: lianggx@nankai.edu.cn

Project Description and Objectives

Nematode, a kind of parasite, is a major threat to important economic crops and vegetables all over the world. Globally, the infection with nematodes causes $157 billion loss each year. A messenger molecule isolated from the root of soybeans named glycinoeclepin A has been demonstrated to stimulate the hatch of soybean cyst nematode with a concentration of 10^{-11} to 10^{-12}g/mL. One can imagine that such an extremely potent molecule can be applied to protect soybean plants from the damage of nematodes by stimulating their hatching before the crops are even planted. This project aims to develop efficient chemical synthesis towards glycinoeclepin A as well as its analogs so that to study the application of such a magic molecule to crop protections.

Eligibility Requirements

- Attend group meetings and project meetings for discussions.
- Work with senior graduate students to help scale up important intermediates leading to the synthesis of glycinoeclepin A and its anologs.
- Learn all the major lab techniques and use of analytical instruments for organic chemistry researches.

Man Tasks

- Attend group meetings and project meetings for discussions.
- Work with senior graduate students to help scale up important intermediates leading to the synthesis of glycinoeclepin A and its anologs.
- Learn all the major lab techniques and use of analytical instruments for organic chemistry researches.

Project 4

Total Synthesis of Natural Products and Fluorine Chemistry

Contact Information

Prof. Pingping Tang
Email: ptang@nankai.edu.cn

Project Description and Objectives

The Tang group was established in 2012 by Professor Pingping Tang. His research interests include fluorine chemistry and total synthesis of biologically important small molecules. The growing importance of fluorinated organic compounds in pharmaceuticals, agrochemicals and materials has driven the development of new methods for the introduction of fluorine into small molecules. In particularly, the trifluoromethoxy group (OCF3) has received much attention due to its strongly electron-withdrawing effect and high lipophilicity. These projects are aimed to develop a new trifluoromethoxylation method based on our new trifluoromethoxylation reagent —trifluoromethyl arylsulfonate (TFMS).

Eligibility Requirements

Interested students should have basic knowledge of organic chemistry and technology.

Main Tasks

- Experimental work.
- Analysis of results.
- Produce a technical report.

Project 5

Detection of X-ray Photons by Solution-processed Lead Halide *Perovskites*

Contact Information
Prof. Mingjian Yuan
Email: yuanmj@nankai.edu.cn

Project Description and Objectives
The evolution of real-time medical diagnostic tools such as angiography and computer tomography from radiography based on photographic plates was enabled by the development of integrated solid-state X-ray photon detectors made from conventional solid-state semiconductors. Recently, for optoelectronic devices operating in the visible and near-infrared spectral regions, solution-processed organic and inorganic semiconductors have also attracted a great deal of attention. We want to demonstrate a possibility to use such inexpensive semiconductors for the sensitive detection of X-ray photons by direct photon-to-current conversion. In particular, methylammonium lead iodide perovskite ($CH_3NH_3PbI_3$) offers a compelling combination of fast photoresponse and a high absorption cross-section for X-rays, owing to the heavy Pb and I atoms. Solution-processed photodiodes as well as photoconductors will be investigated in the project, to get high values of X-ray sensitivity.

Eligibility Requirements
Interested students should have basic knowledge of semiconductor or chemistry.

Main Tasks
Finish a program and write a research report.
Give (technical) research presentations.

Project 6

Phosphorus Reagents-Mediated Organic Synthetic Reactions

Contact: Prof. Zhengjie He
Email: zhengjiehe@nankai.edu.cn

Project Description and Objectives

The development of new and efficient organic synthetic reactions is one of long-term and attractive tasks in the area of organic chemistry. In this research project, we aim to develop new synthetic methods for important heterocyclic and polycyclic compounds by utilizing the unique reactivity of Kukhtin-Ramirez adducts, namely, the 1:1 adducts of trivalent phosphorus reagents and 1, 2-dicarbonyls. Recent investigations have unveiled that Kukhtin-Ramirez adducts possess rich and appealing reactivity, particularly serving as nucleophiles, carbene surrogates or 1,1-dipoles, and successfully effect a series of important organic reactions including insertion reaction, cyclopropanation reaction and formal (1+4) annulation reaction. This project will continue such success in the development of new and efficient chemical transformations.

Eligibility Requirements

- Interested students should have basic knowledge of organic chemistry.
- Interested students should have basic skills of organic chemistry experiments.
  Enthusiasm and curiosity for chemistry.

Main Tasks

- Developing new Kukhtin-Ramirez adducts-mediated organic reactions and relevant organic synthetic methods.
- Coulombic efficiency, dendrite growth, and safety issues. So it is important to

Project 7

In Situ Coating of Na-In alloy Layer to Protect Sodium Anode in Na-Metal Batteries

Contact: Prof. Jun Chen
Email: chenabc@nankai.edu.cn

Project Description and Objectives

Sodium metal anode is considered as a promising alternative candidate for Na-based batteries due to its high specific capacity, and low potential. However, the unstable solid electrolyte interphase layer caused by serious corrosion and side reaction in electrolyte will lead to lowexplore
effective methods to protect the sodium metal anode and inhibit the dendrite formation. We discover that the formation of artificial interphases by alloying Na anode with another metal is a good protection strategy. By using the difference of redox potential between In and Na, metal indium can form alloy layer with sodium

such as InNa, $InNa_2$, $In_{12}Na_7$ or $In_{27}Na_{15}$. So we plan to in situ forming an In-Na alloy layer to protect the sodium metal anode. And use the characterization technique of XRD, SEM, Raman, EIS, and CV etc. to verify the effectiveness of the protection strategy. The objective of this project is let the students know about the hot spots of battery and some conventional testing techniques for materials.

Eligibility Requirements

- Majors in electrochemistry, chemical engineering, inorganic chemistry or physical chemistry are preferred.

Main Tasks

- Explore a simple and effective method to protective the Sodium anode electrode and inhibit the formation of dendrites. Screen different In salts
- and solvents for optimal electrochemical performance.
  Use XRD, ICP, EDS, FTIR to analysis the phase and compose of the alloy layer.
  Assemble symmetric sodium cell to verify the protection effect of the method.
  Use SEM to observe morphology evolution of the composite anode and
- bare sodium anode before and after cycling.
  Assemble Sodium-Oxygen battery to evaluate the performance of the protected sodium anode.

Project 8

Enantioselective Intramolecular C (sp3) −H Amidation Based on Chiral Ligands Design

Contact Information

Prof. Gong Chen
Email: gongchen@nankai.edu.cn

Project Description and Objectives

Over the past decade, transition-metal-catalyzed C (sp3) -H activation reactions have been quickly developed. However, few generally applicable asymmetric C (sp3) -H activation reactions have been reported, and the realization of this goal will likely require the development of new chiral ligands. In this project we are going to develop a general access to Î³-lactams via iridium catalyzed enantioselective intramolecular C (sp3) -H amidation reaction. The enantioselective C−H insertion step would be controlled by well-designed bidentate chiral ligands based on amino acid skeleton.

Eligibility Requirements

- Applicants must have basic knowledge of organic chemistry.
- Students majoring in organic chemistry, organic synthesis are preferred.

Main Tasks

- The student will be involved in all stages of the project:
    - Design an experimental scheme, e.g. ligands design, substrates design and reactions design.
    - Perform chemical experiments, including TLC analysis and flash chromatography.
    - Analyze experimental results by GC-MS, Chiral HPLC, LC-MS and NMR technology.
    - Write the research report.

Project 9

The Enrichment of Proteins/Peptides Based on IMAC (MOAC)-Functionalized Magnetic Nanocomposites

Contact:Prof. Langxing Chen
Email: lxchen@nankai.edu.cn

Project Description and Objectives

The alterations of proteins have been linked to various diseases such as cancers. The research on the field of diagnosis and monitoring of many diseases demands an efficient proteins enrichment platform. In this research project, we aim to develop a strategy for preparation of
immobilized metal affinity chromatography (IMAC), metal oxide affinity chromatography (MOAC)-functionalized magnetic graphene nanocomposites. The methods for separation, enrichment and mass spectrometry analysis of the target protein/peptide from the complex biological samples (human serum, human saliva, cells etc.) are established on the basis of the synthesized materials.

Eligibility Requirements

Interested students should have basic knowledge of chemistry

Main Tasks

- Preparation and characterization of IMAC (MOAC)-Functionalized
- Magnetic Nanocomposites.
  Development of enrichment of Proteins/Peptides from biological samples (human serum, human saliva, cells etc.)

Project 10
Supramolecular Tandem Assay of Biomarkers

Contact Information
Prof. Dong-Sheng Guo
Email: dshguo@nankai.edu.cn

Project Description and Objectives

Gastro-esophageal reflux disease (GERD) is a condition in which retrograde movement of gastric contents results in objective pathologic sequelae. In children, GERD has an estimated prevalence of up to 20%. The routine diagnostic testing is multichannel intraluminal impedance pH testing, which necessitates esophageal placement of a monitoring catheter long enough to provide sufficient data to adequately assess GERD. However, this method is invasive and uncomfortable for patient. Therefore, detection of salivary pepsin has been regarded as a new and noninvasive tool for GERD diagnosis. Very recently, we focused our research interest on biomedical applications by molecular recognition and self-assembly of calixarene macrocycles. We has developed supramolecular tandem assays and put forward a conceptually new substrate-selective enzyme-coupled tandem assay for acetylcholinesterase. The goal of the project is to construct a robust and facile approach for the real-time, continuous monitoring of pepsin activity by using the supramolecular tandem assays principle.

Eligibility Requirements

- Applicants must have basic knowledge of chemistry.
- Experience in research in chemistry would be in advantage.

Main Tasks

- The student will be involved in all stages of the project:
    - Design an experimental scheme.
    - Perform experiments.
    - Analyze experimental results.
    - Write the experiment report.

Project 11

Biomimetic Catalysis

Contact Information
Dr. Mengchun Ye
Email: mcye@nankai.edu.cn

Project Description and Objectives
As catalysis plays a critical role in organic synthesis, the development of new catalytic method is very important in achieving high efficient reactions. In this project we are going to develop new bimetallic catalysis for some transformation of inert chemical bonds.
Main tasks during the internship will be: 1) Found a bimetallic catalytic system for inert bond activation and 2) explore a new reaction.

Eligibility Requirements
Interested students should have basic knowledge of organic chemistry and basic experimental technique of organic chemistry.

Main Tasks
- Finish a research report
- Give two research presentations (technical presentation in the lab; a final presentation in the College of Chemistry)