2017 SJTU Summer Research Internship

General Information

Program Name: 2017 SJTU Summer Research Internship

Program Dates: 8 weeks

Chinese Host University: Shanghai Jiao Tong University

Language of Instruction: English

In-lab Instructional Hours： 20 hours per week (5 hours of lecture and 15 hours of lab work)

Chinese language and culture course: 4.5 hours per week

Eligibility Criteria:

Having completed at least one year of an undergraduate program;

Meet the specific skills required by the instructor if any;

Contact Information:

Lili Shen (lilishen@sjtu.edu.cn)

Shushu Li(lss@sjtu.edu.cn)

Course Credit: 4 SJTU credits

Grade Distribution:

Attendance 10%

Team Project 30%

Mid term presentation 30%

Final written report 30%

Grading: Letter grade

Electronic Information and Electrical Engineering

Project 8　Emotion recognition using multimodal deep learning and transfer learning

Project Title

Emotion recognition using multimodal deep learning and transfer learning

Instructor Name and Contact Information

Bao-Liang LU (Professor, Ph.D.)
Email：bllu@sjtu.edu.cn

Project Description and Objectives

Emotion plays an essential part in natural communication among humans. In recent years, there has been a rising tendency in affective Brain-computer Interactions (aBCIs) research to enhance the systems with the ability to detect, process, and respond to users emotional states. In this project, we focus on emotion recognition with EEG and eye movements using machine learning algorithms.

Since emotions are complex psycho-physiological phenomena associated with many nonverbal cues, it is difficult to build robust emotion recognition models using just a single modality. Signals from different modalities represent

different aspects of emotion and the complementary information from different modalities can be integrated to build a more robust emotion recognition model compared to the existing unimodel approaches. Multimodal deep learning is a recent developed approach, which can extract shared representations among different modalities. The complementary characteristics of EEG and eye movements for different emotions are also interesting research topic, since they reflect users' internal cognitive states and external subconscious behaviors, respectively.

Individual differences across subjects and non-stationary characteristic of EEG limit the generalization of aBCIs in real-world applications. Transfer learning methods are promising approaches to dealing with this problem. Transfer learning methods try to transfer knowledge from source domain to target domain with few or no labeled samples available from subjects of interest.

The objectives of the project are to study several transfer learning methods and systematically compared for EEG-based emotion recognition.

Eligibility Requirements

- The interested students with related background of machine learning, signal processing and linear algebra would be preferred.

Main Tasks during the Internship:

Emotion experiments to collect EEG and eye tracking data
EEG and eye movement data analysis
Learn and implement multimodal deep learning and transfer learning
Presentation and reports

Website

Lab: http://bcmi.sjtu.edu.cn/
School: http://english.seiee.sjtu.edu.cn/

Project 9 Content-Aware Software-Defined Security Mechanism Against Threat Propagation in Smart Grid

Project Title

Content-Aware Software-Defined Security Mechanism Against Threat Propagation in Smart Grid

Instructor Name and Contact Information:

Jianhua Li
E-mail: lijh888@sjtu.edu.cn
Jun Wu
E-mail: junwuhn@sjtu.edu.cn

Project Description and Objectives

This program focuses on the application of next generation networking in smart grid. Firstly, participators will be assigned to investigate the research evolution of information-centric networking (ICN), software-defined networking (SDN) in smart grid. Secondly, participators should try to design and realize a dynamic multicast scheduling algorithm based on ICN or SDN to mitigate security threat propagation in smart grid, some tests or simulations should be done to demonstrate feasibility of the proposed algorithm. Besides, dynamic security service configuration is another available sub-project, participators can select to develop an application to enforce a network security involved (such as access control, data encryption and authentication protocol) based on SDN, each application should be designed to

provided guarantees for smart grid security.

Eligibility Requirements

- The interested student should have basic knowledge of Mathematical modeling, Network and computer knowledge
- Excellent writing and speaking communication are mandatory.

Main Tasks during the Internship

Literature reading
Programmable assignments
Necessary experiments
PPT presentation

Website

Lab: http://nelcat.sjtu.edu.cn/
School: http://infosec.sjtu.edu.cn/

Project 10 Smart UAVs for Complicate Tasks in Complex scenes

Project Title

Smart UAVs for Complicate Tasks in Complex scenes

Instructor Name and Contact Information:

Prof. Zou Danping
Email: dpzou@sjtu.edu.cn

Project Description and Objectives

In complex scenes such as indoor environments, woods, canyons, caves, UAVs are extremely difficult to be manually controlled to accomplish complicate tasks like scouting and mapping. To solve this problem, NLS is developing a Smart UAV system that is designed to achieve autonomous flight in complex scenes carrying out complicate tasks.
The objectives of the project are to build a platform for running the time-consuming integrated navigation algorithms.

Eligibility Requirements

- The interested students from related field would be preferred.

Main Tasks during the Internship:

Learn framework of smart UAVs

Build a platform for running the time-consuming integrated navigation algorithms.

Website

Lab: ast.sjtu.edu.cn

School: http://www.seiee.sjtu.edu.cn/

Project 11 Location Information Processing and Spatial Behavior Analysis

Project Title

Location Information Processing and Spatial Behavior Analysis

Instructor Name and Contact Information

Prof. Pan Changchun
Email: pan_cc@sjtu.edu.cn

Project Description and Objectives

With the increasing popularity of mobile terminals, location-based services (LBS) and car networking application, big data of different kinds including GIS data, trajectory data and location-involved searching records have been one of important strategic resources. Application of big data technology will provide deep insight about social running laws and its trends. It can enhance the service level of social position, providing intelligence support to optimize the government's planning, disaster prevention and emergency response.

The objectives of the project are to strengthen the semantic of the involving location data.

Eligibility Requirements

- The interested students from related field would be preferred.

Main Tasks during the Internship

Learn how to reduce the amount of data and make it easily for analysis

Strengthen the semantic of the involving location data.

Website

Lab: ast.sjtu.edu.cn

School: http://www.seiee.sjtu.edu.cn/

Project 12 Designing and Testing Services for Navigation Terminals

Project Title

Designing and Testing Services for Navigation Terminals

Instructor Name and Contact Information

Prof. Chen Xin
Email: xin.chen@sjtu.edu.cn

Project Description and Objectives

To manage high-precision position calibration in complex environments, NLS has proposed a new method of classifying and representing typical scenes in navigation and developed a new approach to analyzing their properties.

The objectives of the project is to provide complete data service for GNSS signal analysis, which is of high precision acquisition, high precision calibration.

Eligibility Requirements

- The interested students from related field would be preferred.

Main Tasks during the Internship:

Learn to provide complete data service for GNSS signal analysis

Website

Lab: ast.sjtu.edu.cn

School: http://www.seiee.sjtu.edu.cn/

Project 13 Design of high performance antennas using novel microwave structures and materials

Project Title

Design of high performance antennas using novel microwave structures and materials

Instructor Name and Contact Information

Prof. Li Dongying
Email: Dongying.li@sjtu.edu.cn

Project Description and Objectives

Modern wireless communication requires design of novel antennas with high performance such as increased gain and high directivity. To that end, the application of novel concepts such as metamaterials and gradient surfaces offers a promising possibility to enhance the performance of antennas. The project offers a chance for students to apply cutting edge microwave concept in the design of practical antennas.

Eligibility Requirements

- The interested students from related field would be preferred.

Main Tasks during the Internship

Get familiar with CAD microwave design tools
Design antennas using metamaterial concepts.

Website

Lab: ast.sjtu.edu.cn
School: http://www.seiee.sjtu.edu.cn/

Project 14 Superpixel Generation for SAR Images Based on Probability Models

Project Title

Superpixel Generation for SAR Images Based on Probability Models

Instructor Name and Contact Information

Bin Liu
Email: bliu.rsti@sjtu.edu.cn

Project Description and Objectives

Superpixel generation is a widely accepted idea for synthetic aperture radar (SAR) image understanding, which uses the spatial context of images. The superpixel is the elementary unit in the following processes, and can provide additional information for image understanding. In the current state, superpixel generation for SAR images is still an open problem. In this project, the student will develop a superpixel generation method for SAR images, which exploits the inherent statistical information of SAR images. The method should be suitable for both homogeneous and heterogeneous areas in the image. Particularly, the method should provide competitive performance in the heterogeneous areas, considering specific applications.

Eligibility Requirements

- The interested student should have knowledge of Statistical Modeling, Digital Image Processing and Matlab.

Main Tasks during the Internship:

Understanding statistical modelling for SAR images

Developing a superpixel generation method for SAR images based on the statistical information

Evaluating the performance of the developed superpixel generation method, especially in the heterogeneous areas

Website

Lab: ast.sjtu.edu.cn

School: http://www.seiee.sjtu.edu.cn/

Project 15 Design of real-time information processing technique for optical remote sensing

Project Title

Design of real-time information processing technique for optical remote sensing

Instructor Name and Contact Information:

Jin He,
Emal: jinhe@sjtu.edu.cn

Project Description and Objectives

The objective of this project is to develop an on-board real-time processing system for remote sensing. The satellite constellation contains about 200 small optical satellites. For different applications, we focus on the developing of the following algorithms:

1. Algorithms for remote sensing image pre-processing;
2. Algorithms for remote sensing data compression;
3. Algorithms for extraction of target of interesting.

Eligibility Requirements

- The interested student should have basic knowledge of coding in C++;

- The interested student should have basic knowledge about remote sensing and signal processing;
- Priority will be given to candidates enrolled in a computer science program or an electrical engineering program.

Main Tasks during the Internship

Get familiar with the various remote sensing processing technologies;

Design remote sensing algorithms in DSP/FPGA platform;

Website

Lab: ast.sjtu.edu.cn

School: http://www.seiee.sjtu.edu.cn/

Project 16 Compressive Sensing Based Tomographic SAR Imaging in Urban Environment

Project Title

Compressive Sensing Based Tomographic SAR Imaging in Urban Environment

Instructor Name and Contact Information

Prof. Zhang Zenghui,
Email: zenghui.zhang.@sjtu.edu.cn

Project Description and Objectives

A conventional space- or airborne synthetic aperture radar (SAR) maps the 3-D reflectivity distribution of a scene to be imaged into the 2-D azimuth–range (x–r) plane. This can be seen as a projection along the third radar coordinate, namely, elevation (s). Synthetic aperture radar tomography (TomoSAR)extends the synthetic aperture principle into the elevation direction for 3-D imaging. It uses stacks of several acquisitions from slightly different viewing angles (the elevation aperture) to reconstruct the reflectivity function along the elevation direction by means of spectral analysis for every azimuth–range pixel.

The objectives of the project are to demonstrate the tomographic potential and the achievable imaging quality on the basis of TerraSAR-X spotlight data of urban environment

Eligibility Requirements

- The interested students from related field would be preferred.

Main Tasks during the Internship

Three-dimensional reconstruction of urban buildings based on TomoSAR

Website

Lab: ast.sjtu.edu.cn

School: http://www.seiee.sjtu.edu.cn/

Agriculture and Biology

Project 24 Metabolic regulation and engineering of medicinal plants

Project Title

Metabolic regulation and engineering of medicinal plants

Instructor Name and Contact Information

Prof Kexuan Tang
Email: kxtang@sjtu.edu.cn or kxtang1@163.com

Qifang Pan
Email: panqf@sjtu.edu.cn

Project Description and Objectives

China has a great resource of medicinal plants. Our project mainly focuses on metabolic regulation and engineering of medicinal plants, such as Artemisia annua and Catharanthus roseus. Among them A. annua has obtained great attention due to the antimalarial agents artemisin and its derivatives. Malaria is one of the most serious health problems in

human history, which is responsible for more than 600,000 deaths last year. Artemisinin-based combination therapies (ACTs) are recommended by WHO to be the best choice for acute malaria. It has saved millions of lives in Africa countries. The Chinese pharmacologist Youyou Tu received the 2015 Nobel Prize in Physiology or Medicine for her contribution to the artemisinin isolation. Moreover, artemisinin and its derivatives have been found to have antiviral, anticancer, and antischistosomal activities, which makes artemisinin a promising natural product with multifunction. Plant of A. annua is the main commercial source of artemisinin. However, the supply is restricted by the low amounts of artemisinin at a range of 0.1%-1 % dry leaf weight of A. annua, which results in a high cost of this effective product that most of the poor population of malarial victins in Africa could not afford.

In order to improve the artemisinin content in A. annua for reducing its production cost, our project focuses on metabolic engineering of A. annua plants by three main strategies: overexpressing artemisinin biosynthetic pathway key enzyme genes in A. annua, blocking artemisinin biosynthesis competitive pathway key enzyme genes, transcriptional regulation of artemisinin biosynthesis.

Eligibility Requirements

- The interested student should have basic knowledge of molecular biology
- Having a good experience in plant biotechnology would be preferred.

Main Tasks during the Internship

To obtain an artemisinin-high-producing transgenic *A. annua* plant by metabolic engineering strategies

Website

Lab: N/A

School: http://www.agri.sjtu.edu.cn/eng/

Project 25 Stoichiometric traits of leaves and seeds and the relationships in the warm temperate and north subtropical ecotone

Project Title

Stoichiometric traits of leaves and seeds and the relationships in the warm temperate and north subtropical ecotone

Instructor Name and Contact Information

Prof. Liu Chunjiang,
Email: chjliu@sjtu.edu.cn

Project Description and Objectives

The ecosystems in transition zones, being sensitive to climate changes is one hotpot of global change ecology researches. Baotianman Forest Ecosystem Research Station in Henan Province is located in the temperate – subtropical ecotone there are the mixed evergreen and deciduous forests with aboundance tree species. The plants display a great difference in physiological and ecological traits. In this area, the sample stands for 10 dominant tree species are selected, and for these tree species. The concentrations of macroelements （carbon, nitrogen, phosphorus, potasium, calsium, magenesium and sulfer ） both in the vegetative organs (fresh leaves and senesed leaves) and reproductive organs (seeds) are continuously measured for four years. For these tree species, the stoichiometric traits of leaves and

seeds and their relationships are investigated, and the inter-annual variations are studied in relation to the variation in annual climate factors.

The objectives of the project are to study The stoichiometric traits of retranslocated nutrients in senesed leaves . The results will have great implications both in understanding the responses of plants to climate change in the ecotone and underlying mechanisms and managing forests in reasonable manner.

Eligibility Requirements

- The interested student should have basic knowledge of ecology, forest or environmental science.
- Excellent writing and speaking communication are mandatory

Main Tasks during the Internship

Experimental and numerical work
Analysis of results
Produce a technical report

Website

Lab: N/A
School: http://www.agri.sjtu.edu.cn/

Project 26 PM2.5 dry deposition velocity and influential factors on leaf surface of typical urban tree species in Shanghai

Project Title

PM2.5 dry deposition velocity and influential factors on leaf surface of typical urban tree species in Shanghai

Instructor Name and Contact Information

Dr. Yin Shan
Email: yinshan@sjtu.edu.cn

Project Description and Objectives

Fine particles ($PM_{2.5}$) became the primary pollutant of urban atmospheric environment in China, which led significant health risks to human being. Leaves of plants with special surface structures and features could block, absorb and remove particles from atmosphere; therefore the prevention of $PM_{2.5}$ by vegetation was now seen as one of the most important ways to alleviate urban air pollution. Presenting the research of $PM_{2.5}$ dry deposition process and influential factors, and developing an in-situ measurement of dry deposition velocity, will indeed benefit the air quality improvement by urban plants.

The objectives of the project are as following: first, developing the observed $PM_{2.5}$ dry deposition velocity（Vd’）in-

situ measurement; second, monitoring the intensity and characterizing the emission features of different $PM_{2.5}$ polluted area by CMB model, and quantifying microscopic characters of leaf such as physiological, physical and thermodynamic indicators; third, performing a mixed effect model to discuss the impact of PM2.5 emission features and leaf surface characters on variation of Vd' and address the key factor system of plant characters on $PM_{2.5}$ deposition. The results could provide scientific basis for benefiting the pollution control and air quality improvement due to urban vegetation, which is of great theoretical and social significance.

Eligibility Requirements

- The interested student should have basic knowledge of ecology, forest or environmental science.
- Excellent writing and speaking communication are mandatory

Main Tasks during the Internship

Experimental and numerical work
Analysis of results
Produce a technical report

Website

Lab: N/A
School: http://www.agri.sjtu.edu.cn/

Life Sciences and Biotechnology

Project 27 Antibody isolation from a yeast display library

Project Title

Antibody isolation from a yeast display library

Instructor Name and Contact Information

Prof. XIE, Zhiping , Ph.D.
Email: zxie@sjtu.edu.cn

Project Description and Objectives

Antibodies are indispensable tools in modern biomedical research and applications. The yeast display method enables the selection and production of an antibody of interest in one single host system. It avoids the potential complications of different protein post-translational modifications when antibody isolation and production are performed in two hosts. The use of yeast also provides clear advantages in production cost and biosafety.

Eligibility Requirements

- The interested student should have basic knowledge of biology or biomedical sciences;
- Prior experiences in molecular cloning, protein expression and purification would be preferred.

Main Tasks during the Internship

Clone, express and purify protein of interest.

Label protein of interest and isolate yeast cells displaying binding antibodies.

Purify antibodies and verify binding specificity.

Website

Lab: N/A

School: http://life.sjtu.edu.cn/english/

Project 28 Cloning and functional characterization of rice male sterile genes

Project Title

Cloning and functional characterization of rice male sterile genes

Instructor Name and Contact Information

Prof. Dabing Zhang
Email: zhangdb@sjtu.edu.cn

Project Description and Objectives

The life cycle of flowering plants alternates between diploid sporophyte and haploid gametophyte generations. Male gametophytes develop in the anther compartment of the stamen within the flower, and require cooperative functional interactions between gametophytic and sporophytic tissues. During the male reproductive development, there are numerous biological events including cell division, differentiation and degeneration of somatic tissues consisting of four concentric cell layers surrounding and supporting reproductive cells as they form mature pollen grains through meiosis and mitosis.

The objective of the project is o understand the mechanism of plant male reproduction. we are combining systematic biology (genomics, transcriptomics, proteomics, metabonomics) with other approaches such as genetics, cell biology,

biochemistry, and structure biology to elucidate the molecular mechanism underlying each biological process of male reproduction, such as cell-to-cell communications, programmed cell death, and fatty acids metabolism.

Eligibility Requirements

- Opportunities are available for majors on computer science, biology and plant science.
- The interested student should have basic knowledge of biology ;
- Prior experiences in biology research would be preferred.

Main Tasks during the Internship

Design experimental scheme
Perform experiment
Analyze experimental result
Write the experiment report

Website

Lab: http://zhanglab.sjtu.edu.cn/
School: http://life.sjtu.edu.cn/english/

Project 29 Molecular Mechanism of Inflorescence and Spikelet Development in Rice

Project Title

Molecular Mechanism of Inflorescence and Spikelet Development in Rice

Instructor Name and Contact Information

Prof. Dabing Zhang
Email: zhangdb@sjtu.edu.cn

Project Description and Objectives

Rice (*Oryza sativa* L.), the model grass plant, has a specialized morphology of inflorescence and spikelet, which determines grain yield. Using various approaches such as forward and reverse genetics, biochemistry, cell biology etc we are investigating the molecular mechanisms such as MADS box genes and the regulatory network involved in the morphogenesis and development of inflorescence and spikelet in rice.

Eligibility Requirements

- Opportunities are available for majors on computer science, biology and plant science.
- The interested student should have basic knowledge of biology ;
- Prior experiences in biology research would be preferred.

Main Tasks during the Internship

Design experimental scheme

Perform experiment

Analyze experimental result

Write the experiment report

Website

Lab: http://zhanglab.sjtu.edu.cn/

School: http://life.sjtu.edu.cn/english/

Project 30 Molecular characterziation of GMOs

Project Title

Molecular characterziation of GMOs

Instructor Name and Contact Information

Prof. Dabing Zhang
Email: zhangdb@sjtu.edu.cn

Project Description and Objectives

As more and more transgenic crops such as transgenic maize and soybean have been approved and consumed as foods and feeds, more and more people concern about the safety of transgenic organisms. Molecular characterization of transgenic organisms is the base for the safety assessment of transgenic organisms.

The objective of the project is to developing new detection methods to identify the changes occurred at genomic, transcriptomics, proteomics and metabolic levels, and to compare those changes between transgenic line and non-transgenic control line and between transgenic line and conventional cultivated lines, laying a foundation for safety assessment.

Eligibility Requirements

- Opportunities are available for majors on computer science, biology and plant science.
- The interested student should have basic knowledge of biology ;
- Prior experiences in biology research would be preferred.

Main Tasks during the Internship

Design experimental scheme

Perform experiment

Analyze experimental result

Write the experiment report

Website

Lab: http://zhanglab.sjtu.edu.cn/

School: http://life.sjtu.edu.cn/english/

Project 31 Epigenetic effects and molecular mechanisms of Pebp1 gene in Spermatogenesis

Project Title

Epigenetic effects and molecular mechanisms of Pebp1 gene in Spermatogenesis

Instructor Name and Contact Information:

Prof. Dr. Zhongdong Qiao
Email: zdqiao@sjtu.edu.cn

Associated Professor Dr. Wangjie Xu
Email: hover_xwj@sjtu.edu.cn

Project Description and Objectives

Previous studies have demonstrated testicular Pebp1 gene defects in male mice can lead to a significant decline (90%) of fertility; our preliminary experiments also found that nicotine-induced hypermethylation of pebp1 gene leads to reduced expression levels, thereby affecting the ERK1 / 2 activity, its expression level was positively correlated abnormal sperm development, but little is known about the molecular mechanism. Based on the results, the project intends to research PEBP1regulational pathway, PEBP1- signaling pathways - molecule effectors - cellular events, in spermatogenesis events such as, migration, division, apoptosis and sperm decapacitation using pebp1 over-expression, RNA interference, fluorescence

in situ hybridization, spermatogonial stem cell transplantation, and knockout technical methods. Finally we will systematically explain PEBP1 regulation and mechanisms in spermatogenesis events on the cells, in vivo, knockout mice levels.

The objective of the project is to investigate the effects of environmental factors and epigenetic mechanisms in spermatogenesis, provide molecular targets for clinical diagnosis and treatment of male infertility sperm. And it is available for innovative theory and practical application.

Eligibility Requirements

- The interested student should have basic knowledge and skills of molecular biology.

Main Tasks during the Internship

Join in research group

Being trained in all kinds of molecular biology skills

Website

Lab: N/A

School: http://life.sjtu.edu.cn/english/

Project 32 The study of the parternal transgenerational effects of tobacco smoking/nicotine via the underlying epigenetic mechanisms

Project Title

The study of the parternal transgenerational effects of tobacco smoking/nicotine via the underlying epigenetic mechanisms

Instructor Name and Contact Information:

Prof. Dr. Zhongdong Qiao
Email: zdqiao@sjtu.edu.cn

Associated Professor Dr. Wangjie Xu
Email: hover_xwj@sjtu.edu.cn

Project Description and Objectives

According to the present studies, some paternal acquired traits induced by environmental factors can be retained in gametes and passed down to the offspring. The underlying molecular mechanism underlying this phenomenon remains clear yet. Our previous studies showed that tobacco smoking / nicotine treatment can lead to abnormal sperm function, and these

abnormalities are associated with the DNA methylation changes within some gene promoter regions. We also found that nicotine induced a depression-like phonotype in mice and elevated the DNA methylation level within the CpG island shore region of mmu-miR-15b in murine sperm. This epigenetic information then passed down to the offspring and imprinted in the brain tissue leading to hyperactivity in the filial generation mice.

The objective of the project is to firstly establish mouse smoking and nicotine treatment model and then analysis the DNA methylation patterns and sncRNAs expressive profile in the spermatozoa of smoking and nicotine treatment mice and in the brain tissue of the offspring. Our project mainly involves in the epigenetic information retained in murine mature spermatozoa after nicotine treatment, such as DNA methylation and sncRNAs which may influence the embryonic development of the offspring. The molecular mechanism underlying this paternal transgenerational effects on the offspring mice will also be illustrated which can provide new valid evidences of the effects of paternal smoking on the physical and mental health of the offspring

Eligibility Requirements

- The interested student should have basic knowledge and skills of molecular biology.

Main Tasks during the Internship

Join in research group

Being trained in all kinds of molecular biology skills

Website

Lab: N/A

School: http://life.sjtu.edu.cn/english/

Project 33 Screen and Identify Ovule Identity Mutants from Mutant Population

Project Title

Screen and Identify Ovule Identity Mutants from Mutant Population

Instructor Name and Contact Information:

Dr. Yanjie Zhang
Email: ljj307@sjtu.edu.cn

Project Description and Objectives

Ovule, being the precursor of seed, ovule number regulation is a very important scientific question and provides potential application in crop yield enhancement. Ovule number determines by ovule identity, initiation and development, which the mechanism remains largely unknown.

The objective of the project is to investigate the functions and regulations of key genes and pathways in ovule identity by forward genetics study; and hopefully gives clues to increase the ovule number and seed yield in crop productions.

Eligibility Requirements

- The interested students should have a background of plant biology or molecular biology

Main Tasks during the Internship

Screen the putative mutants of ovule identity from EMS mutant population

Identify the mutant by genotyping.

Website

Lab: N/A

School: http://life.sjtu.edu.cn/english/

Project 35 Comparative genomics

Project Title

Comparative genomics

Instructor Name and Contact Information:

Chaochun Wei
Email: ccwei@sjtu.edu.cn

Project Description and Objectives

With the rapid growth of genomics sequence data, it is get more and more challenging to compare tens or hundreds of genomes. Therefore, new methods are demand to improve the comparison of many genomes.

The objective of the project is to develop new methods to compare and visualize many big eukaryotic genomes.

Eligibility Requirements

- The interested student should have basic information about biology.
- The interested students should familiar with the programing language

Main Tasks during the Internship

Compare a model organism genome to more than 10 other genomes
Visualize the comparison results

Website

Lab: http://cgm.sjtu.edu.cn
School: http://life.sjtu.edu.cn/english/

Project 36 Crystallization of Sphingolipid Ceramide N-deacylase and Probing the Structural Basis for Its Specific Enzymatic Catalysis

Project Title

Crystallization of Sphingolipid Ceramide N-deacylase and Probing the Structural Basis for Its Specific Enzymatic Catalysis

Instructor Name and Contact Information

Dr. Yong Zhang
Email: yzhang2011@sjtu.edu.cn

Project Description and Objectives

Glycosphingolipids (GSLs) are a class of amphipathic compounds on the cell surface that play extremely important roles in cellular signaling. They are involved in a range of pathological processes and some GSLs have even shown potential therapeutic effects on cancer and neuronal degenerative diseases. Sphingolipid ceramide N-deacylase (SCDase) catalyzes reversible reactions in which the amide linkage in glycosphingolipids is hydrolyzed or synthesized. While SCDases show great value for the enzymatic synthesis of glycosphingolipids. The enzymatic properties of SCDase from Shewanella alga G8 (SA_SCD) have been systematically characterized. The optimal pH values for the hydrolytic and synthetic activity of SA_SCD were pH 6.0 and pH 7.5, respectively. SA_SCD showed very broad substrate specificity both in hydrolysis and

synthesis. Importantly, SA_SCD has a broad specificity for acyl donor acceptance, especially for unsaturated fatty acids and fatty acids with very short or long acyl chains. The broad fatty acid specificity and high catalytic efficiency make it a suitable biocatalyst for the synthesis and structural remodeling of glycosphingolipids.

The objective of the project is to solve the crystallization problem of SCDase and probe the structure basis of its both hydrolytic and synthetic activity.

Eligibility Requirements

- The interested student should from Chemistry, Biochemistry, or other related majors

Main Tasks during the Internship:

Employ multiply biochemical and biophysic techniques to solve the crystallization problem of SCDase
Probe the structure basis of its both hydrolytic and synthetic activity

Website

Lab: http://enzyme.sjtu.edu.cn/eng/index.asp
School: http://life.sjtu.edu.cn/english/

Project 37 Fluorescence-activated Droplet Sorting System for Enzyme Directed Evolution

Project Title

Fluorescence-activated Droplet Sorting System for Enzyme Directed Evolution

Instructor Name and Contact Information

Dr. Guangyu Yang,
Email: yanggy@sjtu.edu.cn

Project Description and Objectives

Directed evolution is a powerful tool for the engineering of enzymes. By mimicking natural evolution process in test tubes, random mutagenesis libraries of the target enzyme are created and then screened for desired properties. Directed evolution has been successful in improving enzyme activity, stability, and tolerance against organic solvent and substrate selectivity. However, since the libraries produced by random mutagenesis are extremely huge (e.g. by introducing 3 mutations in a protein of 200 amino acids, theoretically there would be 9 billion mutants), the success of enzyme direct evolution relies severely on the efficiency and accuracy of the screening method used. The traditional screening platforms, based on monitoring mutant activity on agar plates or in microtiter plates, are relatively low throughput (103~105/d) and laborious. Thus, screening method comprises the bottleneck of directed evolution and high throughput screening methods with high efficiency and high versatility are desired.

Eligibility Requirements

- The interested student should from Chemistry, Biochemistry, or other related majors

Main Tasks during the Internship

Integrate of multi-band fluorescence excitation and

Detection optics in a microfluidic droplet screening chip

Establish a new droplet sorting mechanism that operates with high fidelity at a high droplet manipulation frequency

Validate the devices' performance towards realizing the aimed on-chip MC-FADS for enzyme directed evolution.

Website

Lab: http://enzyme.sjtu.edu.cn/eng/index.asp

School: http://life.sjtu.edu.cn/english/

Project 44 Ribosome specific protein-protein interaction network construction for Mycobacterium tuberculosis

Project Title

Ribosome specific protein-protein interaction network construction for Mycobacterium tuberculosis

Instructor Name and Contact Information

Pro. Sheng-ce Tao
Email: taosc@sjtu.edu.cn

Project Description and Objectives

Tuberculosis ranks No.1 of infectious diseases according to the directly and indirectly mortality. *Mycobacterium tuberculosis* (Mtb) is the single causative agent of tuberculosis, which caused 9.6 million newly identified active cases and 1.5 million died from the disease in 2014. Moreover, the emergence of multidrug resistant (MDR) and extensively drug resistant (XDR) strains of Mtb has increased the threat that this disease imposes to global public health. Therefore, it is deadly require effective vaccines and drugs for reducing the global burden of TB. Discouragingly, the progress in discovering and characterizing appropriate vaccine candidates and drug targets has been severely impeded by a general lack of knowledge about the Mtb biology and how it is regulated.

For *Mtb*, ribosome is one of the most important target for antibiotics development. Though the core structure of bacteria ribosome is similar to that of eukaryote, there are significant differences of the overall structure and regulation mechanism. And because of this, the ribosome of bacteria has been used as the direct target for drug screening. In turn, there are a variety of effective antibiotics that targeting ribosome directly thus disrupting the bacteria protein synthesis machinery. For example, antibiotics of aminoglycoside, macrolides and tetracyclines. However, there is limited studies about ribosome regulation, thus the ribosome regulation mechanism is still not well studied. This is the bottleneck of ribosome specific antibiotics development. It is not just a challenge, but also a chance.

In lieu of the above situation, we will try to reveal the ribosome regulation systematically through global protein-protein interaction discovery. By using bioinformatics analysis and initial validation and function study, we aim to identify 1-2 Mtb specific ribosomal protein-protein interactions as potential drug targets.

The objectives of the project are 1. Construct the first protein-protein interaction network for all the *Mycobacterium tuberculosis* (Mtb) ribosomal proteins.2. Identify 1-2 Mtb specific ribosomal protein-protein interaction as potential drug targets.

Eligibility Requirements

- The interested student should have basic knowledge of molecular biology and proteomics
- Skills recommended but not required: molecular cloning, protein purification.

Main Tasks during the Internship

Clone 2-3 ribosomal genes
Expression 2-3 ribosomal proteins
Profile the global protein-protein interaction using the proteome microarray
Construct a protein-protein interaction network for at least one ribosomal protein

Website

Lab: http://taolab.sjtu.edu.cn
School: http://scsb.sjtu.edu.cn