Research Experiences for Students of Honours College (RESHC) Programme 2017

RESHC Ref. no	Faculty	Department	Mentor	Email	Project Title	Level	Duarations	Commencement month	Project Description	Internship Requirement
RESHC/2017/016	FHS	N/A	Jun Zheng	junzheng@umac.mo	Studies of infection machanism of Vibrio species for food safety improvement and thrapeutics applications	L3 - 60 hours/month	6 months	May	Infectious diseases are common problems throughout the world, including the developed countries. The rise of resistance of pathogenic bacteria to antibiotics constitutes an increasing risk to public health. Even in the United States, bacteria that are resistant to antibiotics infect at least 2 million people every year, making bacterial infections more common than cancer in terms of population. Importantly, at least 23,000 of those infected with antibiotic-resistant germs die (1). Thus development of new antibacterial reagent has become urgent. Antivirulence drugs that disarm bacterial pathogens have the potential to be an important alternative or addition to classical antibiotics in future. This novel strategy is attractive as these drugs only target pathogenic bacteria and will not develop resistance as the classical antibiotics. Important progress has been made to target type III secretion systems (T3SS) that are used by many different Gram-negative pathogens. Type VI secretion system (T6SS) is another important virulence determinant in many pathogenic bacteria, including vibrios. Investigation of T6SS and other virulence factors in the food and water borne pathogens can reveal many novel potential targets and thus contribute to the developments of anti-virulence drugs. Thus the projects aims to investigate the virulence factors in the most important food and water borne pathogenic vibrio parahaemolyticus. Our multiple approaches including in vivo infection studies, knockouts construction, RNA-Seq, and host response will be very powerful to understand T6SS and other virulence factors and to generate results of high impact. The information we generate here will lead to rapid and sensitive diagnosis, water and food safety and quality control, and screening of new drugs against human diseases. This research, therefore, has global importance.	Basic knowledge of molecular biology
RESHC/2017/017	FHS	N/A	Xuanjun Zhang	xuanjunzhang@umac.mo	Energy-transfer metal-organic nanosenor	L3 - 60 hours/month	3 months	June	The aim of this project is to design and synthesize metal-organic nanosensor for the monitoring of biological microenvironment, including local pH value, reactive oxygen species, enzymes, etc. The student can get training in molecular design, the basic chemical synthesis, analysis, many equipment for optical property measurement.	Students have basic knowledge of chemistry, know how to operate equipment such as UV-Vis spectrometer, have interest in the project.
RESHC/2017/018	FHS	N/A	Kathy Qian Luo	kluo@umac.mo	Generating Transgenic Zebrafish Sensors for Detecting Toxic Agents	L3 - 60 hours/month	6 months	June	Human cells can be damaged by abnormal physical conditions, chemical, and biological agents. Among all the cell damaging agents, the DNA damaging agents are the most dangerous ones as they can cause cancer. Thus it will be greatly beneficial to human health, if we can develop sensitive assays to detect DNA dama-ging or carcinogenic compounds in vivo. In this project, we propose to generate transgenic zebrafish sensor that can overcome the two limitations of current zebrafish model:(1) not specific for DNA damaging agents, (2) not sensitive for toxic agents. To achieve this goal, we will introduce an in-house patented, DNA-based biosensor into zebrafish genome and generate transgenic zebrafish. The sensor will show green fluorescence in live cells, and change to blue color when their DNA is damaged by toxic agents. Different toxic agents especially DNA damaging agents will be applied in the transgenic zebrafish and fluorescence color change of zebrafish cells will be analyzed. Final goal of this project is to build an in vivo sensitive platform for DNA damaging agents detection.	(1) Learn the basic knowledge of genetic engineering; (2) Learn the basic knowledge of zebrafish maintenance and help to screen transgenic zebrafish; (3) Learn how to do fluorescence resonance energy transfer (FRET) imaging with fluorescence microscope and confocal microscope. Help to do FRET imaging and related data analysis; (4) Learn other general techniques frequently used in molecular biology laboratories including DNA gel electrophoresis, Western bolt and immunostaining.
RESHC/2017/019	FHS	N/A	QI ZHAO	qizhao@umac.mo	Development of fully human monoclonal antibody drugs for therapy of breast cancer	L1 - 40 hours/month	3 months	June	Breast cancer kills nearly 400,000 people annually worldwide. The stage of breast cancer when it is diagnosed has a great influence on 5-year survival rate. The antibody-based therapeutics against tumor-associated antigens in the present study will discover and develop drug candidates for the treatment of breast cancers. Monoclonal antibodies typically IgGs can destroy tumor cells by utilizing mechanisms of antibody-dependent cellular cytotoxicity (ADCC) or antibody-drug conjugation (ADC).By using these antibodies as vehicles, bispecific antibodies directed at tumor antigens and human CD3 can engage T cells to lyse tumors.	The applicants will be trained in fields of molecule biology, protein expression and purification, cell culture, and animal xenografts.
RESHC/2017/020	FHS	N/A	XIAOHUA DOUGLAS	douglaszhang@umac.mo	Explore and Develop Quantitative Methods for Analyzing Single-Cell RNA-Seq Experiments 人血糖數據複雜度研究及其在糖尿病診斷和預後中的應用	L1 - 40 hours/month	6 months	May	本項目中，研究對象將通過電話採訪或實驗室訪問來確定他們是否滿足入選標準。如果對象符合入選標準，即可簽寫同意書。本研究將持續14天，一共需要60名研究對象，並且均勻的分配到相應的年齡組：18～30歲，30～45歲，45～60歲。每個對象將會領取一個Freestyle Libre傳感器和Fitbit腕帶，並連續收集14天的血糖、心率、飲食和運動數據。14天後受試者會回到實驗室導出設備數據。	1. 協助招募受試者。 2. 協助受試者儀器正確配帶。 3. 協助受試者及研究人員導出設備數據。 4. 協助研究人員對數據的初步處理和分析。 5. 協助研究人員撰寫研究論文及發表。

RESHC/2017/021	FHS	N/A	Guokai Chen	guokaichen@umac.mo	The technology development and application of endoderm differentiation from human pluripotent stem cells in defined culture conditions	L3 - 60 hours/month	6 months	May	Endoderm progenitor cells (EPCs) can be used to produce liver, lung and pancreas cells, and they have a lot of value in different applications. This project will try to use human embryonic stem cells to generate EPCs, and then expand them in defined conditions. We will develop a novel formula for the EPCs maintenance and further differentiation to liver, lung and pancreas cells.	There no specific requirement for techniques. However, the project need a passionate and intelligent researcher who is willing to try new things. The person should also have good work habit and curiosity.
RESHC/2017/041	FHS	N/A	Wen Hua Zheng	wenhuazheng@umac.mo	The effect of FoxO transcription factors on the expression of Gap-43 and its underlying mechanisms	L3 - 60 hours/month	6 months	May	FoxO transcription factor (FoxO1 (FKHR), FoxO3a (FKHRL1), FoxO4 (AFX) and FoxO6) are key members of FoxO family transcription factors involved in cell growth, metabolism, differentiation and apoptosis. These are downstream targets of the PI3K/Akt pathway and also hotspots of bioscience study (about 30 articles in Nature, Science and Cell). We have shown that FoxO's are having an important role in NGF-induced neuronal differentiation and we are investigating the underlying mechanisms by studying the effect of FoxO proteins in the neuronal differentiation such as Gap-43 using electric transfection, DNA microarray, PCR, siRNA, Western blot, immune fluorescense, in vitro kinase assay, fluorescent double reporter gene assay, immuno–coprecipitation, ChIP and the transgenic animals.	1.Knowledge of laboratory safety and warning information 2. Stick to the working hours 3. Hard working and respectful to mentor and other lab members 4. Follow supervisor's arrangement and lab discipline/rules