First Taste of Research Experience for Undergraduates

Undergraduate research experiences enrich students’ lives in disparate aspects — discovering where their genuine interests lie, projecting the collaborative work of researchers as a team, and enabling them to tolerate and learn from failures along the way. From which, the next generation of young researchers are equipped for challenges ahead.

As a strong, research-oriented Faculty with top-rated scientists and modern research laboratories and facilities, the Faculty of Science is committed to providing our students the best education in science and be a nursery for future scientists. It has always been the Faculty’s strategy to nurture undergraduate research. Since 2007, the Faculty has implemented the Overseas Research Fellowship (ORF) and the Summer Research Fellowship (SRF) Schemes, providing financial support to students to go to overseas laboratories or institutes or to do research in a supervisor’s laboratory in the Faculty. To enhance students’ learning experiences, the Faculty has increased both stipend and opportunities available for students this year. Together with the University Undergraduate Research Fellowship Programme (URFP), students are exposed to ample authentic learning opportunities of research internships, of which an extensive array of professional and personal benefits are revealed.

Dear readers,

Nowadays, a lot of research opportunities are waiting for talented undergraduates. In this issue of Science@HKU, we report some of the research work done by our undergraduates and hear from them their views on our undergraduate research opportunity programme.

Yours sincerely,
Professor Hoi Fung CHAU
Chief Editor

HIGHLIGHTS

My project title: A metagenomic approach to study the microbial ecology of the gut of Giant Panda (Ailuropoda melanoleuca)

Supervisor: Professor Frederick C.C. Leung, School of Biological Sciences, HKU

SRF has provided me with the opportunity to get hands-on laboratory research experience for the first time. 

My experience

SRF made me realize how different research work is compared to studying science in textbooks or preparing for examinations. In fact, it has also helped me appreciate and understand the subtle but profound differences between research work and carrying out experiments for laboratory courses. Rather than just learning lab techniques, students awarded the SRF need to work on a project of their own. I believe this helps them get a better understanding of what research work is like.

Upon completion of the project, students need to make a poster in order to present their research work. This requires drawing up conclusions on the project and their work in summer. I personally felt that the whole process of making the poster and presenting it made me think critically about the project and processes involved in it, allowing me to better reflect on the project itself. Also, I believe that presenting the poster to the faculty members and students has made me well prepared for such future events.

Through my research project, I have gained a better understanding of the thought processes scientists go through in professional life. This has thoroughly inspired me in research work and to find a career in it. Although there were hints of disappointments in times of failure, I believe overall I have learned a lot through the scheme. All in all, the SRF scheme has allowed me to have a productive summer full of learning, joy and experiences that I will certainly cherish in times to come.

Thus, for those who are interested in science and scientific research, SRF provides an excellent opportunity to experience research-based learning and is a scheme that will surely heighten one’s interest in and appreciation towards science.

About SRF

Format Students awarded with SRF are expected to work in the Faculty on a specific research project.

Time At least 2 months during the summer.

Stipend HK$16,000 (from 2014-15 onwards)

HASSAN Ayon Ahmed
Year 3 BSc student (major in Molecular Biology & Biotechnology)
ORF Participant at School of Biological Sciences in summer, 2014

About my research project

My project involved using metagenomics to perform detailed analysis of microbial communities inside the Giant Panda (Ailuropoda melanoleuca) gut. I got an in-depth understanding of how microbial communities in the Giant Panda gut affect their health and digestion; and how their diet and environment in turn affects microbial communities.

AA What Our Students Say
**Quantifying diversity of aerosol populations across the US using long-term data from the aerodyne aerosol mass spectrometer**

*Supervisor: Professor Nicole Riemer, University of Illinois at Urbana-Champaign*

*My project title:*

**Implementing quantum fingerprinting protocol with error correction codes based on random toeplitz matrices**

*Supervisor: Professor Hoi Kwong Lo, University of Toronto*

*My project title:*

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**My experience**

The weather report has been on my daily must-watch list amongst all the cartoons since I was a young boy in primary school. I was curious as to how scientists make predictions. Thanks to the generous support of ORF Scheme, I was able to have a taste of this particular branch of science – Meteorology. During the summer break in 2014, I worked as a Research Assistant in the Atmospheric Sciences Department of University of Illinois at Urbana-Champaign (UIUC), exposed to frontier technology concerning atmospheric modeling. After the programme, I got the chance to present my results at the Poster Presentation held by the Faculty.

Nonetheless, life in US is not just studying and working. I have also made new friends during my brief stay. With the connections established by professors in Science Faculty, I soon befriended some PhD mentors. The World Cup season added a lot of spice in our academic life. Aside from the daily research, my friends and I often gathered in the University Community Hall to watch live broadcast. The hall was packed with students around the world, dressed up and cheering for their nation. These are some of the beautiful memories that I will treasure.

The trip is inspiring and enjoyable. I am truly grateful for having such a precious opportunity to work with leading scientists overseas. The lifelong friendship I have made and this unique experience of immersing myself in a foreign culture are something that I would hold dear for the rest of my life.

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**About ORF**

**Format**

Students conducting research projects under the joint supervision of overseas academics and internal faculty members.

**Time**

At least 2 months during the summer.

**Stipend**

HK$16,000, plus airfare on a reimbursement basis (from 2014-15 onwards).
Undergraduate Research Fellowship Programme (URFP)

CHENG Tsz Fung Fergus
Year 3 BSc student (major in Biochemistry)
URFP Participant at Department of Biochemistry in summer 2014

My project title:
Roles of BART microRNAs (miR-BART) in Epstein-Barr virus-induced epithelial transformation

About my research project
Talking about cancers such as Nasopharyngeal Carcinoma (NPC), people would probably be horrified by this lethal disease that requires lengthy and painful medical treatment. As a biochemistry student, I am interested in studying how to prevent or treat carcinoma in such a way that many cancer patients can benefit and relieve their pain. The idea behind is to understand the mechanisms of factors or biomolecules affecting the normal cells.

When it came to the poster presentation in October, I found it quite difficult to present the findings to the others, especially to audience without much scientific background. However, it did strengthen my presentation skills through this question-answering process.

It offers me golden opportunities to experience and understand the operations of a world-class laboratory.

My experience
As a participant of URFP and an awardee of the university research internship award, I would like to thank both HKU and the Faculty for giving me a treasurable chance to work in the virologist lab of Professor Dong-Tan Jin and be guided by an experienced tutor Dr. Kit-San Yuen.

During my research internship in the summer, I was glad to learn how to use those advanced equipment in Biochemistry Department. My tutor taught me some crucial techniques to knock out the BART region of EBV and validate the generation of a mutant virus. I also had an invaluable experience in designing a feasible experiment and interpreting the results on my own. From which, I learnt the most important lesson – never give up easily, even if you experience repeated failures in the laboratory. Instead, we should go through each step carefully and examine what has gone wrong before we give another try. The project is indeed a useful training of my logical skill and is a definitely a lifetime benefit for me.

About URFP
The URFP is a prestigious programme that offers opportunities for academically outstanding students to undertake research under the guidance and supervision of academic staff who have a strong research track record and experience in training research postgraduate students.

Format
The URFP is a prestigious programme that offers opportunities for academically outstanding students to undertake research under the guidance and supervision of academic staff who have a strong research track record and experience in training research postgraduate students.

Time
Research internship: during summer; project or directed studies: during final year.

Stipend
Overseas research internships: Up to HK$40,000 (covering economy return airfare and part of overseas accommodation and living costs for internship not less than 8 weeks on a full-time basis)
Research internships in Hong Kong or the Mainland: HK$15,000

Research
A ~1.8 billion years old supercontinent

by Professor Guochun ZHAO, Department of Earth Sciences

A supercontinent is a large landmass encompassing almost all continental blocks during a period in Earth’s history. Continental blocks came together to assemble a supercontinent by collision as a result of plate tectonics. Available data indicates that during the 4.57 billion-year long history, the Earth saw only a few supercontinents, of which the youngest one is Pangea that formed about ~250 million years (Ma) ago. Since the 1990s, geologists have confirmed that Pangea’s components were drifted fragments of a ~1.0 billion years (Ga) old supercontinent, named “Rodinia”, which was believed to be the first supercontinent in Earth’s history. Later, however, Professor Guochun Zhao at HKU and his collaborators found that Rodinia was not the first supercontinent in Earth’s history; there was a pre-Rodinia supercontinent that formed about ~1.8 billion years ago, based on an extensive review and comparison of the 2.1-1.8 Ga continent-continent collisional belts combined with paleomagnetic data. This proposal was initially stemmed from their discoveries of two 1.95-1.85 Ga Himalaya-type continent-continent collisional belts in North China. Later, they found that similar aged continent-continent collisional belts exist in all other cratonic blocks in the world. This led Professor Zhao and his colleagues propose that these collisional belts recorded global-scale collisional events that led to the assembly of a pre-Rodinia supercontinent. In 2001 and 2004, Professor Zhao and his collaborators presented comprehensive overviews on the assembly, outgrowth and breakup of the proposed pre-Rodinia supercontinent in two classic papers published in Earth-Science Reviews, a leading international journal in earth sciences. Later, this pre-Rodinia supercontinent was named “Columbia” or “Nuna”, and its existence has been confirmed by more and more geological and paleomagnetic data. So far, this supercontinent has been widely accepted by earth scientists and their papers have been totally cited by others for more than 10,000 times, and the configuration of the Columbia (Nuna) supercontinent they proposed has been presented and introduced in American university textbooks Global Tectonics. (3rd Edition, Wiley Blackwell 2008)

Recently, Professors Zhao Guochun, together with Professors Min Sun (HKU) and Sanzhong Li (Ocean University of China) were awarded “2014 State Natural Science Award (Second Class Prize)” for their project entitled “Paleoprotorezoan amalgamation of the North China Craton and the assembly of the Columbia supercontinent”. Professor Zhao was recognized as the “Highly Cited Researchers” and “World’s Most Influential Scientific Minds 2014” by Thomson Reuters. At present, he is the editor-in-chief of Precambrian Research (IF = 6.03) and the Chief Principal Investigator of NSFC Major Project “Reconstruction of East Asian continents in Pangea” (Punds. 20M RMB, Duration: 1/1/2012 - 31/12/2016). In 2014, Professor Zhao was elected to be the Fellow of Geological Society of American (GSA) and the President of the International Association for Gondwana Research (IAGR).
Behind the News

The Hong Kong EIA System Needs to be Reviewed

by Dr Billy HAU, School of Biological Sciences

A member of the EIA Subcommittee of the Advisory Council on the Environment

Environmental impact assessment (EIA) is a systematic planning tool in public administration. It aims to assess the potential impacts of a proposed policy, plan, programme or project on the environment using the best scientific methods. Depending on the nature of the proposed action, an EIA may include assessments on pollution (air, water and noise), ecology, fisheries, landscape and archaeology. In recent years, some more advanced EIA cover climate change and have included environmental risk assessments. The EIA process should be transparent to ensure wider public acceptance which is often achieved through proper public engagement in the process. The result of an EIA is one of the important considerations of the relevant government authority in approving or moving ahead with a proposed policy, plan, programme or project.

EIA has been evolved from the National Environmental Policy Act of the United States since 1969. Nowadays, most of the countries in the world have either a legal or administrative EIA system. Hong Kong started with an administrative EIA system in the late 1970s. After nearly two decades, the EIA Ordinance Cap. 499 came into effect in 1998. However, Hong Kong’s EIA Ordinance is primarily project based i.e. it only governs developments projects. For strategic EIA on policies, plans or programmes, it largely remains an administrative requirement of the Hong Kong SAR Government. Is our EIA system effective in making sure that our environment is not impacted upon by many of the developments in Hong Kong? I believe many environmentalists would say no.

Given the increasing number of judicial reviews on approved EIA reports by environmentalists would say no. In over 16 years of the EIA Ordinance, 226 EIA reports have been prepared. Yet, only one EIA was rejected and a couple of others were withdrawn by the proponents. All of the other EIA’s were approved with conditions.

In most cases, the controversial issues are related to ecology. This is because pollution impact assessments have objective criteria for judgment but ecological impact assessment often has to depend on professional judgment. Sometimes, the best scientific methods are not deployed. For example, in the case of the Third Runway EIA, the extensive existing data on the Chinese White Dolphins were surprisingly not used in the ecological impact assessment. The over-reliance on the views of the overseas experts of the consultancy team has made the ecological impact assessment on Chinese White Dolphins unconvincing. On the other hand, the Third Runway EIA remains a project level study. Despite the fact that cumulative impact assessment was said to be included, it is unable to address issues such as the carrying capacity of the North Lantau Waters for the dolphins taking into account the numerous on-going and planned projects in the area, for example, Hong Kong-Zhuhai-Macau Bridge, Tuen Mun-Chap Kok Link Road, and various coastal reclamation projects in North Lantau and Tuen Mun. A strategic EIA has long been needed ever since the planning stage of the Hong Kong-Zhuhai-Macau Bridge. Sadly, the Government has been refusing to do it due to the lack of a legal requirement on Strategic EIA.

The Hong Kong EIA System in Practice

In the case of the Artificial Beach at Lung Mei, the ecological impact assessment was indeed poorly done. Whilst the additional ecological impact assessment done after the public outcry has shown that Lung Mei has more than 200 species of fish and that inclusion of Midfield Freighter of Hong Kong International Airport. Whilst the lack of trust between the civil society and the Government may have a role to play, there are rooms for improvement in our EIA system with respect to public engagement in the EIA process? After over 15 years of operation, a comprehensive review of our EIA system seems needed.

The Hong Kong EIA System Needs to be Reviewed

The Faculty of Science of The University of Hong Kong (HKU) and the Faculty of Science and Technology of the University of Macau (UM) jointly organized the 2014 UM and HKU Joint Workshop on Science and Technology Innovation on 5th December 2014 (Friday). At this important occasion, HKU and UM signed a Memorandum of Understanding (MoU) to further advance the two Universities’ collaboration in teaching and research in areas of mutual interest.

More than 10 distinguished guests including Professor San Kwok, Dean of HKU Faculty of Science; Professor Philip Chan, Dean of UM Faculty of Science and Technology; and many other professors and colleagues around the occasion.

Professor Kwok hopes the signing of the MoU will further strengthen the exchange between the two Facilities that HKU can continue to work closely with the best minds who share HKU’s passion in scientific research and support complement HKU’s efforts in teaching and research.

Public Lecture of Distinguished Visiting Professor sheds light on PM2.5 pollutants mitigation in Mainland China

Professor David Y H Pui, Distinguished Visiting Professor of the Faculty, gave an inspiring and insightful public lecture on “An Integrative Approach to the Study of PM2.5 Pollutants in China: Rationale, Instrumentation, Effects, Sources, and Mitigation by Filtration” on October 20, 2014, which was well-received by academics, researchers from industries, environmental specialists and general public.

In China, pollution is the price paid for the rapid economic development. There is growing concern about air pollution by PM2.5 pollutants which mainly come from coal burning and vehicle emissions. The fine particles of less than 2.5 micrometers in diameter can lodge deeply into the lungs and cause many heart and respiratory diseases. How to mitigate the PM2.5 pollutants effectively in China poses a great challenge to the government, industries and scientists.

In this lecture, Professor Pui proposed a disruptive innovation of Solar-Assisted Large-Scale Cleaning System (SALSCS) to filter the PM2.5 pollutants and to supply clean air. He elaborated the working principles of SALSCS and presented many brand new numerical studies about the SALSCS, such as design and location of the system. The proposition of the SALSCS changed the conceptual thinking how to fix PM2.5 pollutants in future studies.

We thank Professor Pui for his intriguing and terrific talk.

Question of last issue

In your opinion, what would be the most amazing or unexpected thing you would experience if you were to live in an hypothetical world whose speed of light was 4 m/s? A book coupon will be awarded to each of the five contestans with most creative and original answers.

Answer

In addition to all kinds of weird things in special relativity such as time dilation and length contraction, the fact that one could not move faster than 1 m/s in this hypothetical world would alone leads to a lot of “surprises”. For instance, it would take the most determined couple, one in Hong Kong and the other in the USA, to maintain their long distance relation for it would take about two months for a living voice of “I miss you” to be heard over the phone and another two months for the “I miss you, too” response to be sent back. Actually, all long distance telephone companies should go bankrupt as a result.

Brainteaser

It is necessary for chemists to use a variety of glasswares to conduct different kinds of experiments. Even laymen can recognize some commonly used glasswares such as beaker, test tube, and conical flask. However, there are many other specially designed glasswares that are intended to special experiment. Can you name the glassware shown on the left? What is the use of this piece of glassware and how does it work?

Please email your answer together with your name and school (for students), toSciawow@hkbu.edu.hk. FIVE winners will be drawn randomly from the contestants who give the correct answer.

Faculty News

2014 UM and HKU Joint Workshop on Science and Technology Innovation

It is necessary for chemists to use a variety of glasswares to conduct different kinds of experiments. Even laymen can recognize some commonly used glasswares such as beaker, test tube, and conical flask. However, there are many other specially designed glasswares that are intended to special experiment. Can you name the glassware shown on the left? What is the use of this piece of glassware and how does it work?

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Faculty News
HKU ranks high in science disciplines in U.S. News Subject Rankings of Best Global Universities.

According to U.S. News & World Report 2014, HKU ranks high in many science subjects in the “Best Global Universities Rankings” of which HKU Mathematics and Statistics rank the 9th in the “Best Global Universities Rankings for Mathematics”. Rankings of HKU in science disciplines:

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<th>Subject</th>
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<tr>
<td>Biology and Biochemistry</td>
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<tr>
<td>Geoscience</td>
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<td>Chemistry</td>
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<td>Material Science</td>
<td>36th</td>
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<tr>
<td>Environment/Ecology</td>
<td>97th</td>
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<tr>
<td>Mathematics and Statistics</td>
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HKU Faculty of Science has built up strong reputation for excellence in science education and research, and has developed itself into a world-class science school. The good news brings immense encouragement to us and drives us to continue to strive for the highest qualities in education and research.

**University Awards**

**Professor Hailiang YANG**, Department of Statistics & Actuarial Science, was granted the University Outstanding Researcher Award 2013-14, of which the highly-coveted award is made to researchers of distinction and of international merit.

**Professor Xiaodong CUI and Dr Wang YAO**, Department of Physics, received the University Research Output Prize (Faculty of Science) 2013-14 for their research published in a journal entitled “Magnetoelastic effects and valley-controlled spin quantum gates in transition metal dichalcogenide bilayers” in Nature Communications, Volume 4, article no. 2053, June 2013. Zhirui GONG, Gui-Bin LIU, Hongyi YU, Di XIAO and Xiaodong XU are the co-authors of the research paper.

**Dr Benny NG and his team members Dr William CHEUNG, Dr Chi-wang CHAN, Dr Rachel LUI and Dr Jessica LEUNG** received the Faculty Knowledge Exchange Award 2014 for their project ‘Science and Art Crossover Project - Visualizing Science via Creative Lens & Interactive Art’.

**Mr Jack Chi Ho IP**, an MPhil student working on ecotoxicology and environmental genomics under the supervision of Professor Kenneth Leung in School of Biological Sciences, had won the Outstanding Oral Presentation Award at the 11th International Symposium on Persistent Toxic Substances (ISPTS) which was held in Hong Kong during October 27-30, 2014. The title of Jack Ip’s presentation is “Establishing a Platform of Environmental Omics for the Green-lipped Mussel Perna viridis”.

**Students**

Dr CHEUNG Pak Leong, Department of Mathematics, received the Faculty Excellent Teaching Assistant Award 2013-14, for his contributions in outstanding performance in providing teaching support and interaction with students.

**Others**

Ms Lillian NG, Department of Earth Sciences, received the Faculty Award of Outstanding Non-academic Staff 2013-14, for her excellent performance among non-academic staff.

**External Awards & Achievements**

**Professors Guochun ZHAO and Min SUN** from Department of Earth Sciences, received the 2014 State Natural Science Award (Second Class Prize) for research project of their team entitled “Paleoproterozoic Amalgamation of the North China Craton and the Assembly of the Columbia Supercontinent”.

**Professor Guanhua CHEN**, Head of Chemistry, was recently elected as Fellow of the American Physical Society (APS) for his singular contributions in the development of quantum mechanical simulation methods for complex electronic systems, including O(N) methods for excited states and the multiscale QM/EM method for emerging electronics. Election to Fellowship in the APS is limited to no more than one half of one percent of the membership.

**Faculty Awards**

**Dr Eddy K LAM**, Department of Statistics & Actuarial Science, received the Faculty of Science Award for Teaching Excellence 2013-14, for his outstanding teaching performance and the continuous efforts he has put in arousing students’ learning interests.

**Dr Edmund T S LI**, School of Biological Sciences, received the Faculty Award for Service Contribution 2013-14, for his contributions in service, departmental administration, and outreach activities in the Faculty.

**Other**

Ms Cindy CHAN, Miss Venus CHU, Mrs Angela TSANG, Miss Monica NG and Dr Philip Leung Ho YU are the editorial board members of science@HKU.

**EDITORIAL BOARD**

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