香港中文大學理學院
Faculty of Science, The Chinese University of Hong Kong

Science Faculty Research Day 2010

Outstanding Research in Science Faculty

DATE: Thursday, 20 May 2010
TIME: 09:30 - 17:15
VENUE: Lecture Theatre 2, Science Centre,
The Chinese University of Hong Kong

Outstanding Research Event

Morning Session:

09:30 - 09:45	**Opening Ceremony**
09:45 - 10:15	**"Recent Progress in the Studies of Convective Thermal Turbulence"** Professor XIA Ke-qing, Department of Physics Recipient of *2009 State Natural Science Award*
10:15 - 10:45	**"Plant Endocytosis and Exocytosis"** Professor JIANG Liwen, Department of Biology Recipient of *2009 Ministry of Education (MoE) Higher Education Outstanding Scientific Research Output Award*
10:45 - 11:05	**Tea Break**
11:05 - 11:35	**"A Journey to the Fantasy of Functional Dyes"** Professor Dennis NG Kee-pui, Department of Chemistry Recipient of *Vice-Chancellor's Exemplary Teaching Award 2009*
11:35 - 12:05	**"Seeing Ourselves in the Fruitfly *Drosophila*"** Professor Edwin CHAN Ho-yin, Department of Biochemistry Recipient of *Young Researcher Award 2009 - 2010*

Afternoon Session:

14:00 - 14:15	**"Bisphenol A Downregulates CYP19 Transcription in JEG-3 Cells"** HUANG Hui, Ph.D. Candidate, Department of Biochemistry
14:15 - 14:30	**"Anti-aging Activity of Apple Polyphenols (AP) and its Alleviated Effects on Paraquat Induced-mortality in *Drosophila melanogaster*"** PENG Cheng, Ph.D. Candidate, Department of Biochemistry
14:30 - 14:45	**"Hermit to King, or Hermit to All: Multiple transitions to crab-like Forms from Hermit Crab Ancestors"** TSANG Ling-ming, Ph.D. Candidate, Department of Biology

in Science Faculty

Programme

14:45 - 15:00	**"Novel Nano/micromaterials for Visible-light-driven Photocatalysis: Syntheses, Characterizations and Applications"** ZHANG Lisha, Ph.D. Candidate, Department of Biology
15:00 - 15:15	**"The Chemistry of Divalent Lanthanide Complexes Derived from a Pyridine-functionalized Amido Ligand"** KU Ka-wai, Ph.D. Candidate, Department of Chemistry
15:15 - 15:30	**"Nickel-Mediated/Catalyzed Reactions of Carboryne with Alkenes and Alkynes"** QIU Zaozao, Ph.D. Candidate, Department of Chemistry
15:30 - 15:50	**Tea Break**
15:50 - 16:05	**"Significance of Chrysin as a Neuroprotective Agent for Glaucoma and its Pathological Factor Glutamate Excitotoxicity"** Brenda HONG Sijia, Ph.D. Candidate, School of Chinese Medicine
16:05 - 16:20	**"Some Partial Differential Equations From Fluid Mechanics"** WANG Yun, Ph.D. Candidate, Department of Mathematics
16:20 - 16:35	**"Au Nanocrystal Plasmonics: Plasmon Coupling and Interactions with Molecules"** CHEN Huanjun, Ph.D. Candidate, Department of Physics
16:35 - 16:50	**"Broadband Electromagnetic Transparency by Graded Metamaterial Spheres"** SUN Lei, Ph.D. Candidate, Department of Physics
16:50 - 17:05	**"Bayesian Variable Selection for Disease Classification using Gene Expression Data"** YANG Aijun, Ph.D. Candidate, Department of Statistics
17:05 - 17:15	**Closing Ceremony**

Message from the Dean of Science

This is the 5th year the Faculty of Science has held a Faculty Research Day. Each spring, our faculty members and postgraduate students gather to showcase their recent advances in research, and we are glad to have you with us today. Like previous years, the Science Faculty Research Day aims to promote and foster interaction and collaboration among faculty members. Today we will also take the opportunity to highlight the work done by our own research postgraduate students, members of the next generation of scientists.

The theme for this year's event is entitled "Outstanding Research in Science Faculty", and we have invited some of our award-winning faculty members to share with us the fruits of their labour, the research that has earned them distinction in their field. Some of our Ph.D. candidates will also make a research presentation; their dedication to and creativity in research will give us a glimpse into future developments in various fields of science.

We at the Faculty of Science are committed to nurturing a new generation of scientists and improving the overall quality of research as our Faculty leads Hong Kong in scientific innovation. We hope that today's event will serve to stimulate discussions and collaborations in scientific research, while giving due recognition to our outstanding staff and students. Thank you for being a part of our celebration of excellence in research.

Yours sincerely,

NG Cheuk-yiu

Presentation Abstracts & Speaker Introductions

Award-winning Faculty Members

Professor XIA Ke-qing

Department of Physics,
The Chinese University of Hong Kong

Professor Xia graduated from Lanzhou University in 1981 with a B.Sc. degree in Physics. He went to the United States in the same year to pursue graduate study under the sponsorship of the China-US Physics Examination and Admission (CUSPEA) programme. In 1987, he received a Ph.D. degree in Physics from the University of Pittsburgh. He then conducted postdoctoral research at the University of North Carolina at Chapel Hill and Cornell University respectively. Professor Xia joined the Chinese University of Hong Kong in 1992 as a Lecturer and is now a Professor in the Physics Department.

Professor Xia has published over 80 papers in leading international journals and has been invited to deliver over 30 lectures and invited talks at international conferences. Over the years, he has trained a number of excellent postgraduate students, among them two have been selected by the Hundred Scholar Program of the Chinese Academy of Sciences and one has been awarded the Hong Kong Young Scientist Award (2006) by the Hong Kong Institution of Science. He was awarded the Croucher Senior Research Fellowship (2005-2006) from the Croucher Foundation. More recently, he received China's State Natural Science Award (2009).

Recent Progress in the Studies of Convective Thermal Turbulence

The phenomenon of thermal convection occurs widely in nature, such as atmospheric and oceanic circulations; convection in the Earth mantel and its outer core; stellar convection like that in the Sun. As an important class of turbulent flows, convective thermal turbulence differs from other types of turbulence in many ways and its study would provide new insight and perspectives on the general turbulence problem itself. A paradigm for the study of turbulent thermal convection is the Rayleigh-Bénard system. In this talk I will report some of the recent results from my laboratory that shed light on the problem of turbulent RB convection. Specifically, I will present the properties of a self-organized coherent flow, called the large-scale circulation, in this otherwise turbulent system. I will also talk about the role of thermal plume, a coherent structure, in turbulent convection.

Professor JIANG Liwen

Department of Biology,
Centre for Cell and Developmental Biology,
The Chinese University of Hong Kong

Professor Jiang joined the Department of Biology of CUHK as an Assistant Professor in 2000 and was promoted as Professor in 2007. Professor Jiang's research focuses on the molecular mechanisms of protein trafficking and organelle biogenesis in the plant secretory and endocytic pathways, as well as their potential applications in plant biotechnology. Professor Jiang received awards for teaching and research achievements, including the CUHK Science Faculty Exemplary Teaching Award 2008, the CUHK Research Excellence Award (2006-2007), the Croucher Senior Research Fellowship (2009-2010), and the 2009 Ministry of Education (MoE) Higher Education Outstanding Scientific Research Output Awards. Postgraduate students of Professor Jiang's laboratory have also received prestigious awards, including three times winning the Award for the Best Research Output by Research Postgraduate Students of CUHK (2004, 2006 & 2009) and twice winning the Human Frontier Science Program (HFSP) Long-Term Fellowship Awards (2009 & 2010).

Plant Endocytosis and Exocytosis

Endocytosis and exocytosis are two important biological process in eukaryotic cells. Over the past years, one of our research programs has been focused on understanding the molecular mechanisms of plant endocytosis and exocytosis. In this talk, I will present our progress towards our understanding about protein trafficking, organelle biogenesis and organelle function in the plant secretory and endocytic pathways.

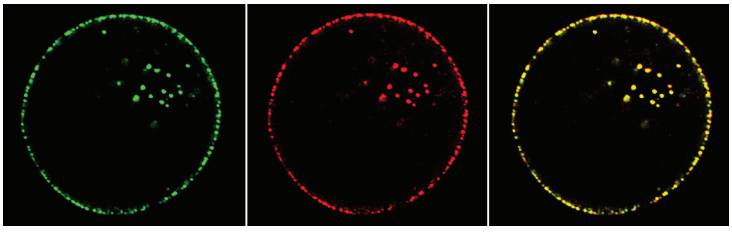


Figure: Shown are confocal images of a plant protoplast (lacks its cell wall) expressing GFP-tagged (leaf panel) and RFP-tagged (middle panel) proteins that is believed to be responsible for plant exocytosis. The merged image (right panel) shows the full colocalization of these two XFP-tagged proteins (as indicated by the appearance of yellow color) in punctate organelles found in the plasma membrane and cytosol. GFP, green fluorescent protein; RFP, red fluorescent protein.

Professor Dennis NG Kee-pui

Department of Chemistry,
The Chinese University of Hong Kong

Professor Ng studied Chemistry at The Chinese University of Hong Kong, where he obtained his B.Sc. with first class honors in 1988 and his M.Phil. in 1990. He then received the Croucher Foundation Scholarship to pursue his D.Phil. in Inorganic Chemistry at the University of Oxford during 1990-1993. He became a Research Fellow in Chemistry at the California Institute of Technology before returning to his alma mater in 1994. He is presently a Professor at the Department of Chemistry and concurrently holding the position of University Dean of Students. Over the years, he has received a number of awards in teaching and research from the University, including the Faculty Exemplary Teaching Award (1999 & 2009), Vice-Chancellor's Exemplary Teaching Award (2009), and Young Researcher Award (2005-2006). His current research interests lie in the chemistry of functional dyes, particularly phthalocyanines, focusing on their biomedical applications and supramolecular chemistry.

A Journey to the Fantasy of Functional Dyes

Dyes are chromophores that absorb in the visible region. Traditionally, they are used as colorants in industry. However, owing to their high stability and many intriguing properties, these compounds have enjoyed a renaissance over the last few decades. Many classes of dyes have been explored and tailored chemically to optimize their characteristics for different applications, which currently extend to materials science, nanotechnology, catalysis, and medicine, etc. We have long been interested in the chemistry of various functional dyes such as phthalocyanines, porphyrins, boron dipyrromethenes, and coumarins focusing on their syntheses, structure-property-activity relationships, and applications. In this talk, we will take the audience to a journey to see the fantasy of these molecules. Some of our recent findings in areas such as development of efficient and selective photosensitizers for photodynamic therapy, exploration of molecular probes for metal ions and complex logic gates, and construction of artificial photosynthetic models will be highlighted.

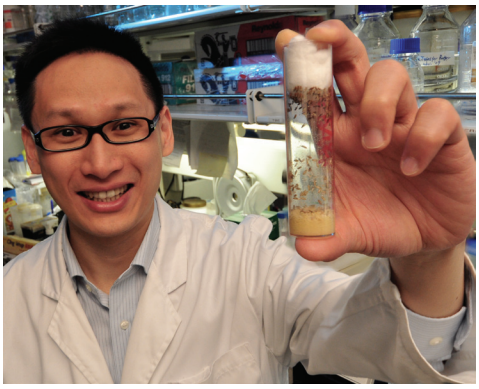


Photo credit: LEE Tak-sang

Professor Edwin CHAN Ho-yin

Department of Biochemistry,
Cell and Molecular Biology Programme,
Molecular Biotechnology Programme,
The Chinese University of Hong Kong

Professor Chan is Associate Professor at the Biochemistry Department. He is also affiliated to the Molecular Biotechnology and Cell & Molecular Biology Programmes. He obtained his B.Sc. (Hons.) degree in Biochemistry from The Chinese University of Hong Kong and his Ph.D. degree in Genetics from The University of Cambridge, UK. He then received postdoctoral training at The University of Pennsylvania, USA and University of Cambridge, UK. Professor Chan is the recipient of a number of awards, including the prestigious Human Frontier Science Program Long-term Fellowship (1999), The Wellcome International Traveling Research Fellowship (1999), CUHK Faculty of Science Exemplary Teaching Award (2009) and CUHK Young Researcher Award (2009-2010). His main research interest is on the mechanistic studies of human degenerative brain diseases including Parkinson's and Alzheimer's Diseases, and his investigations open up new therapeutic directions for these currently incurable diseases.

Seeing Ourselves in the Fruitfly *Drosophila*

About a century ago, some pioneer scientists adopted the fruit fly *Drosophila*, a kind of tiny insect that are commonly found in local fruit markets, as an experimental model to study the principles of genetic inheritance. With the development of innovative research tools/techniques over the years, "fly pushers" are now able to perform essentially any kind of life sciences-related experiments on this little creature, ranging from transgenics, RNAi, gene knock-out/knock-in to electrophysiology and behaviour etc... At the post-genomic era, we now know that there exist a large number of orthologous human disease genes in the fly genome, including those that cause developmental disorders, cancer, Parkinson's and Alzheimer's Diseases. Studying the function of these genes residing in the fly genome allow us to better understand both the physiological and/or pathological roles of their human counterparts. All of the above highlight the usefulness of Drosophila, as an experimental model, in life sciences and biomedical research. In this talk, I shall share some of our recent findings on spinocerebellar ataxia (小腦萎縮症), a currently incurable progressive neurodegenerative disorder.

Presentation Abstracts & Speaker Introductions

Outstanding Ph.D. Candidates

HUANG Hui

Supervisor: Professor LEUNG Lai-kwok
Department of Biochemistry,
The Chinese University of Hong Kong

HUANG Hui is currently a Ph.D. student of the Department of Biochemistry at CUHK. She obtained her M.Sc. degree from Jinan University of Guangzhou in 2006. She worked as Research Assistant at the Guangzhou Institute of Biomedicine and Health, Chinese Academy of Sciences in 2007. She then joined the Department of Biochemistry at the Chinese University of Hong Kong the same year. She has co-authored around 8 papers and received an Excellent Oral Presentation Award in the National Ph.D. Student Forum on Food Safety and Human Health in 2009. Her research interest focuses on chemopreventive natural products, nutrition, and cancer.

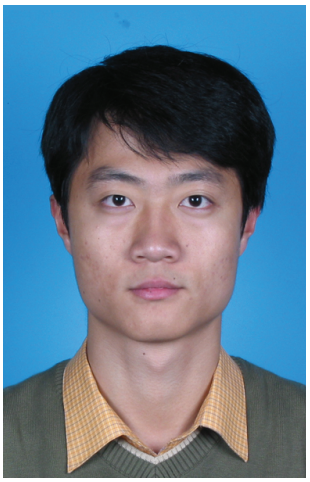
Bisphenol A Downregulates CYP19 Transcription in JEG-3 Cells

HUANG Hui and LEUNG Lai-kwok

Bisphenol A is an industrial contaminant and is considered to be an endocrine disruptor; its estrogenic property has been reported in many studies. Because of its ubiquitous existence in our environment, bisphenol A has drawn much discussion on its safety issues. Estrogen is important in the maintenance of human pregnancy, and the placenta is the major site of synthesis during this period of time. Aromatase or CYP19 catalyses the conversion of estrogen from its precursor, and is highly expressed in placental cells. In the present study, we examined the ability of the toxicant in suppressing the transcription of CYP19 in JEG-3 cells. Cells treated with bisphenol A displayed a reduced aromatase activity. Real-time PCR analysis indicated that 5M of the compound significantly reduced the mRNA expression in these cells. As the transcriptional activity of CYP19 gene is controlled by the proximal promoter region of exon I.1 in placental cells, the promoter activity of this gene fragment and exon-I.1-splicedmRNA abundancewere also evaluated. Both results indicated that bisphenol A repressed the transcriptional control of promoter I.1. The present study showed that bisphenol A potentially reduced estrogen synthesis by downregulating CYP of placental cells. This information could be useful for evaluating the exposure limit of bisphenol A.

PENG Cheng

Supervisor: Professor CHEN Zhenyu
Department of Biochemistry,
The Chinese University of Hong Kong



PENG Cheng is currently a Ph.D. student under the supervision of Professor CHEN Zhenyu in the Department of Biochemistry, Faculty of Science at The Chinese University of Hong Kong. After receiving his B.S. degree from the Department of Chinese Pharmacology in Beijing University of Chinese Medicine, he came to CUHK to pursue his Ph.D. degree. His current research interests are anti-aging activities of nutraceuticals. Using *Drosophila* as an experimental model, he is trying to develop and modify an efficient *in vivo* model to screen anti-aging candidate nutraceuticals, as well as figure out how those natural antioxidants combat free radicals, how they influence the expression of longevity related genes, and eventually lead to lifespan extension. Meanwhile, he is also interested in exploring the potential ability of the natural compounds to rescue neurodegeneration.

Anti-aging Activity of Apple Polyphenols (AP) and its Alleviated Effects on Paraquat Induced-mortality in *Drosophila melanogaster*

PENG Cheng, CHAN Edwin Ho-yin, LEE Yuk-man, HUANG Yu and CHEN Zhenyu

Age-related accumulation of oxidative damage is one of the most widely accepted mechanisms for aging. Therefore, augmentation of antioxidant defenses by genetic or dietary manipulations shall extend lifespan. As a conventionally used herbicide, paraquat has been demonstrated to be a competent free radical generator and employed in the model Parkinson's Disease. Apples have long been recognized as an excellent source of antioxidants. However, few reports investigated its anti-aging activity and the potential property in antagonizing age related neurodegeneration.

Investigating the effects of AP on the life span of *Drosophila melanogaster*, it was observed that flies treated by AP at the dosage of 10mg/mL significantly outlived their control peers. Moreover, supplementation of 10mg/mL AP diet increased the survival time only in wild type Oregon-R-C yet not in the two mutant fly lines, i.e. $SOD^{n108}/TM3$ and $Cat^{n1}/TM3$, when the flies were intensively challenged with paraquat or H_2O_2. Real Time PCR analysis showed that the gene for catalase and CuZnSOD were up-regulated in the AP supplemented groups while the gene for Mth was down-regulated compared with the control one. Accordingly, protein abundance for catalase and CuZnSOD were increased. It was concluded that SOD, catalase and Mth be at least in part to influence the lifespan of fruit flies. Meanwhile, AP could reduce paraquat induced-mortality in fruit flies and helped retain their climbing ability. Future study will explore AP's potential ability to rescue neurodegeneration and to extend this model to screen more anti-aging candidate compounds.

References

[1] Lee FK, Wong AK, Lee YW, Wan OW, Chan HY and Chung KK. (2009) The role of ubiquitin linkages on alpha-synuclein induced-toxicity in a *Drosophila* model of Parkinson's disease. *J. Neurochem.* 110: 208-219;

[2] Li YM, Chan HY, Huang Y and Chen ZY. (2007) Green tea catechins upregulate superoxide dismutase and catalase in fruit flies. *Mol Nutr Food Res.* 51: 546-554.

TSANG Ling-ming

Supervisor: Professor CHU Ka-hou
Department of Biology,
The Chinese University of Hong Kong

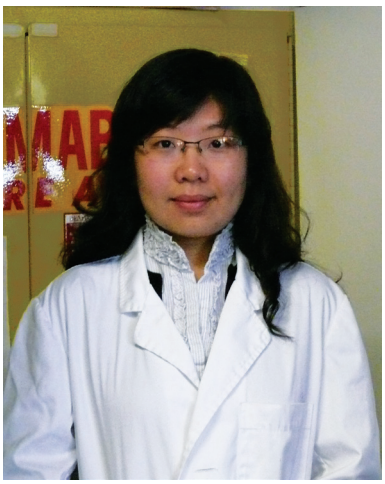
TSANG Ling-ming received his B.Sc. (2005) and M.Phil. (2007) degree from the Chinese University of Hong Kong. Since then, he has been pursuing his Ph.D. degree under the supervision Professor CHU Ka-hou. His research interests focus on the phylogeography of NW Pacific region and phylogeny of decapods crustaceans using molecular markers. During his M.Phil. study, he investigated the genetic diversity of intertidal acorn barnacles in the NW Pacific region. He revealed unexpected high hidden species diversity of barnacles in the region. Moreover, hybridization between barnacle species is found to be promoted by elevated seawater temperature driven by global climatic change, is also noticed. His Ph.D. thesis research aims to reconstruct the evolutionary history of decapod crustaceans using nuclear protein-coding gene markers newly developed by his research group. His results have given new insights into the evolutionary history and origin of the major groups of decapods, including lobsters, crabs and hermit crabs. He is trying to incorporate more samples and molecular markers in order to attain a "Tree of Life" for decapods.

Hermit to King, or Hermit to All: Multiple Transitions to Crab-like Forms from Hermit Crab Ancestors

TSANG Ling-ming and CHU Ka-hou

Comprising more than 1,000 species, hermit crabs of the superfamily Paguroidea (Crustacea: Decapoda: Anomura) are a diverse group of decapods. They occur in shallow waters, the deep sea, and even on land. Hermit crabs are so named because they use a hollow object to protect their abdomen, which in most members is asymmetrically coiled to fit into gastropod shells. The close relatives of hermit crabs include squat lobsters and various crab-like creatures like porcelain crabs, king crabs and mole crabs. Given this great discrepancies in body forms, the phylogeny of hermit crabs and it relatives, however, is controversial. Classical morphological studies and an early molecular study based on mitochondrial DNA suggest that king crabs evolved from an asymmetrical hermit crab ancestor (the 'hermit to king' hypothesis). This hypothesis, however, is strongly opposed by some morphological cladistic analyses which indicate hermit crab monophyly. By phylogenetic analysis of five nuclear protein-coding gene sequences, I show that hermit crabs have a single evolutionary origin, and surprisingly, that almost all other major clades and body forms within the Anomura, are derived from within the hermit crabs, i.e., 'hermit to all'. The crab-like form and squat lobster form have each evolved at least twice from separate symmetrical hermit crab ancestors. In each case, a carcinization (becoming crab-like) trend can be posited via a transition series from the initial symmetrical, long-tailed hermit crab form, through the intermediate squat lobster or asymmetrical hermit crab form, to the final crab-like form. Adaptation to dextral shell habitation also evolved at least twice. These remarkable cases of multiple parallelisms suggest considerable phenotypic flexibility within the hermit crab ground plan, with a general tendency towards carcinization. Rather than having a separate origin from other major clades, hermit crabs have given rise to most other major anomuran body types.

ZHANG Lisha



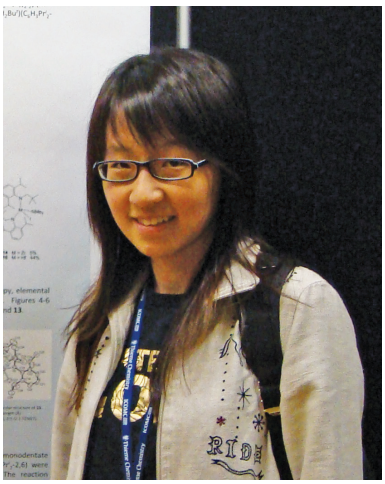
Supervisor: Professor WONG Po-keung
Department of Biology,
The Chinese University of Hong Kong

ZHANG Lisha is a final-year Ph.D. candidate from the Department of Biology. Her research area is Environmental Science and Technology, and her supervisor is Professor WONG Po-keung. During her Ph.D. study, Ms. Zhang has been devoted to research on photocatalysis, which is a promising technology to solve environmental problems and energy crisis. Till now, Ms. Zhang has developed two kinds of novel photocatalysts which exhibit excellent performances on the degradation of organic pollutants and the disinfection of bacteria under visible light irradiation. Besides, she has provided some deep understandings for the fundamental mechanism of photocatalysis, under the assistance of the new and simple partition setup she has constructed. These innovative scientific results and findings have been published in 3 papers. One has been published in Applied Catalysis A: General. Two of them have been published in Environmental Science and Technology, the top journal in the field of environmental science and technology.

Novel Nano/micro-materials for Visible-light-driven Photocatalysis: Syntheses, Characterizations and Applications

ZHANG Li-sha, WONG Kin-hang, YIP Ho-yin, HU Chun, YU Jimmy C., CHAN Chiu-yeung, WONG Po-keung

In recent years, environmental problems related to organic pollutants and pathogenic microorganisms have emerged as a high national and international priority. To address these significant problems, photocatalysis causes an increasing interest as a kind of green and energy saving technology. However, the traditional photocatalyst TiO_2 can only be excited by ultraviolet or near-ultraviolet radiation, which merely occupies about 4% of the solar light spectrum. Notably, the visible region (400 nm $<\lambda<$750nm) covers the largest proportion of the solar spectrum (about 48%). In order to efficiently utilize solar light, the development of visible-light-driven (VLD) photocatalysts has been urged. Several kinds of VLD photocatalysts with novel structure and component have been synthesized in my research work. These photocatalysts exhibit excellent photocatalytic performances for the degradation of organic pollutants and the disinfection of bacteria under visible light, potentially realizing the effective solar-energy-conversion in photocatalytic process. Moreover, a novel and simple partition setup has been constructed to investigate the fundamental mechanism of photocatalysis. Thus, my work not only provides several kind of effective VLD photocatalyst but also provides some insight into the investigation of photocatalytic process.



KU Ka-wai

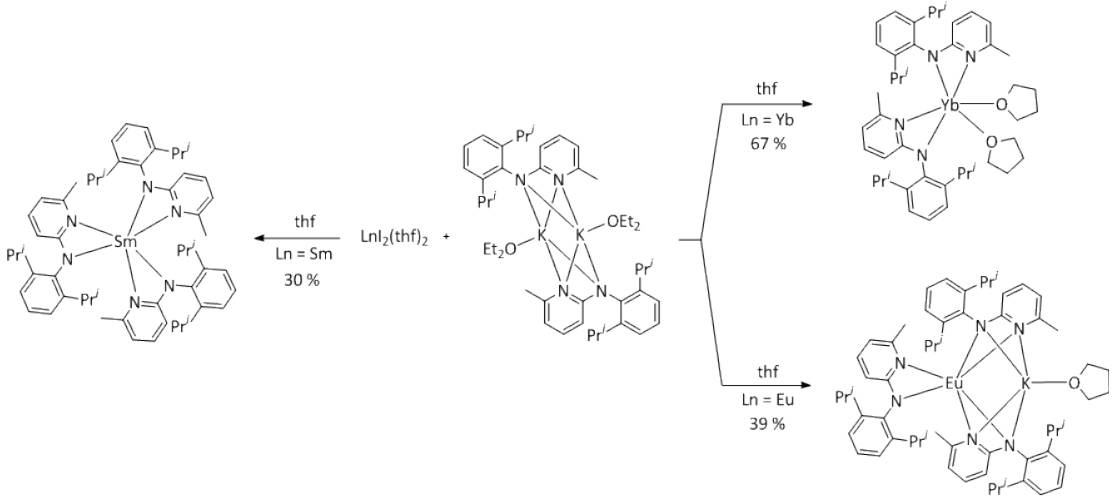
Supervisor: Professor LEE Hung-kay
Department of Chemistry,
The Chinese University of Hong Kong

KU Ka-wai received her B.Sc. degree in Chemistry from The Chinese University of Hong Kong in 2006. She then started her Ph.D. studies in the same department under the supervision of Professor LEE Hung-kay. Her research interest focuses on the chemistry of group 4 and lanthanide metal amides.

The Chemistry of Divalent Lanthanide Complexes Derived from a Pyridine-functionalized Amido Ligand

KU Ka-wai and LEE Hung-kay

The organometallic chemistry of lanthanide metals has been a fast growing field over past decades. Two common oxidation states, namely +2 and +3, are known for the lanthanides. The majority of work reported in the literature has been focused on the chemistry of lanthanide(III) ions.[1,2] In contrast, studies of lanthanide(II) complexes have received relatively less attention. My current research work has been focused on the chemistry of metal amides (M–NR_2). In this presentation, the coordination chemistry of a bulky pyridine-functionalized amido ligand, [N($C_6H_3Pr^i_2$-2,6)(2-C_5H_3N-6-Me)]$^-$, towards divalent lanthanide metal ions (samarium(II), europium(II) and ytterbium(II)) is reported (Scheme 1). The reaction chemistry of the europium(II) and ytterbium(II) amido complexes is also discussed.



Scheme 1

References

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QIU Zaozao

Supervisor: Professor XIE Zuowei
Department of Chemistry,
The Chinese University of Hong Kong

QIU Zaozao received her B.Sc. degree in Chemistry (2002) and M.Sc. degree in Organic Chemistry (2005) from Lanzhou University. After spending one year as a Research Assistant with Professor YU Biao at Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences, she joined Professor XIE Zuowei's group as a Ph.D. student in 2006 at The Chinese University of Hong Kong. In the meantime, she received a short-term student delegation scholarship sponsored by the Japan Society for the Promotion of Science (JSPS) to work with Professor MASHIMA Kazushi at Osaka University as a visiting student from May 2008 to July 2008. Currently, her research focuses on late transition metal-carboryne complexes and their reactions with alkenes and alkynes.

Nickel-Mediated/Catalyzed Reactions of Carboryne with Alkenes and Alkynes

QIU Zaozao, WANG Sunewang R., and XIE Zuowei

Carboryne (1,2-dehydro-o-carborane) is a three-dimensional relative of benzyne. Nickel-carboryne complex (η^2-$C_2B_{10}H_{10}$)Ni(PPh_3)$_2$ can react with alkenes to give alkenylcarboranes in moderate to very good isolated yields with excellent regio- and stereoselectivity. A reaction mechanism involved alkene insertion, β-H elimination followed by reductive elimination was supported by experimental data. When methyl acrylate or 2-vinylpyridine was used as the starting material, the intramolecular coordination of the heteroatom in alkenes can suppress β-H elimination reactions, leading to the isolation of the thermodynamically stable inserted nickelacyclopentane intermediates. These intermediates can react readily with alkynes, and thereby a nickel-mediated three-component cycloaddition reaction of carboryne with alkenes and alkynes was developed to give corresponding dihydrobenzocarboranes. Catalytic version of [2+2+2] cycloaddition reaction of carboryne with alkynes was achieved using 1-iodo-2-lithiocarborane as precursor and $NiCl_2(PPh_3)_2$ as catalyst. The mechanism was also proposed after the NMR study and the structural confirmation of the key intermediate, nickelacyclopentene, from the reaction of n-butyl-2-pyridinylacetylene. These methodologies provide exceptionally efficient routes from readily available starting materials to a wide variety of substituted carboranes, which have potential use in medicinal and materials chemistry.[1-3]

References:

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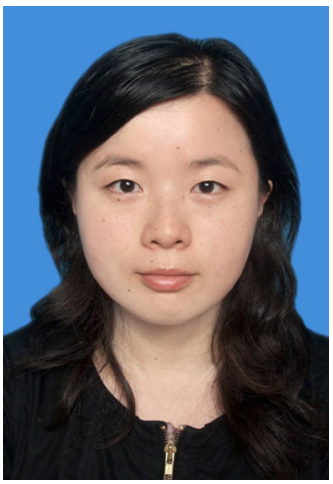


Brenda HONG Sijia

Supervisors: **Professor CHE Chun-tao**
and Professor LIN Zhixiu
School of Chinese Medicine,
The Chinese University of Hong Kong

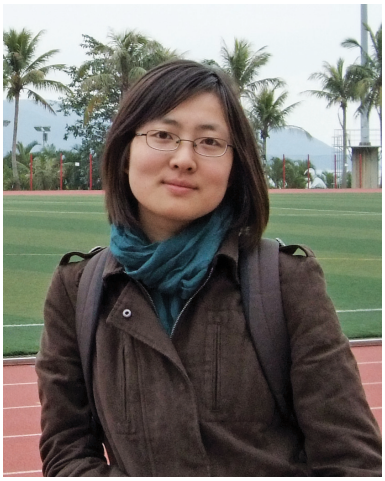
Brenda HONG Sijia graduated with a B.Sc. degree (2005) from Chengdu University of Chinese Medicine, and subsequently obtained her Master's degree in natural product research from the University of Macau (2007). She joined the School of Chinese Medicine of CUHK as a Ph.D. student in the same year. Ms. Hong's research focuses on the neuroprotective effects of Chinese medicine on neurodegenerative diseases, such as glaucoma and Alzheimer's disease, and the elucidation of the underlying mechanisms. During her study at CUHK, Ms. Hong has attended a number of regional and international conferences such as the 9th international AD/PD conference in Prague, Czech Republic in 2009 and the Society for Neuroscience (SFN) - 2009 annual meeting in Chicago, U.S.A. Ms. Hong was the Chair of the Organizing Committee of the 2009 Hong Kong–Macau Postgraduate Symposium on Chinese Medicine, which was held successfully in the Hong Kong Conference and Exhibition Centre and attracted over 100 postgraduate students from Hong Kong, Macau and Singapore.

Significance of Chrysin as a Neuroprotective Agent for Glaucoma and its Pathological Factor Glutamate Excitotoxicity

HONG Sijia, CHIU Kin, HO Yuen-shan, HE Yi, CHE Chun-Tao, SO Kwok-fai, CHANG Raymond Chuen-chung and LIN Zhi-xiu

Increasing lines of evidence have shown that neuroprotective measures can protect the brain against aging-associated neurodegeneration in the central nervous system such as glaucoma, Alzheimer's disease (AD) and Parkinson's disease (PD). The present study aimed to elucidate the neuroprotective effects of chrysin, a flavonoid commonly found in high quantity in Chinese herb Fructus *Alpinae Oxyphyllae* (AOF) 益智仁, honey and propolis. Chronic ocular hypertensive glaucoma rat model was employed. Our data showed that intravitreous application of chrysin resulted in a significant reduction of retinal ganglion cell (RGC) loss when compared to the PBS-treated control in ocular hypertension (OH) eyes 2 and 4 weeks after cauterization. Neuroprotective effect of chrysin was further confirmed by experiments involving glutamate excitotoxicity in primary culture of cortical neurons of rat. Our results showed that chrysin was able to significantly reduce glutamate-triggered LDH release and activation of caspase-3. In addition, we have also demonstrated that chrysin could significantly reduce H_2O_2-induced neurotoxicity and oxidative stress triggered by glutamate. Taken together, our *in vivo* and *in vitro* results indicate that chrysin is a potential neuroprotective agent worthy of further development into pharmaceutical for aging-associated neurodegenerative diseases.

WANG Yun



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WANG Yun received her B.Sc. degree in Mathematics (2004) from Beijing Normal University and her M.Sc. degree in Mathematics (2007) from the Chinese Academy of Sciences. She is currently a Ph.D. student in the Department of Mathematics under the supervision of Professor XIN Zhouping of the Institute of Mathematical Sciences. Her research focuses on partial differential equations, with an emphasis on equations from fluid mechanics.

Some Partial Differential Equations From Fluid Mechanics

WANG Yun and XIN Zhouping

In the early ages of sciences, there is no distinct borderline between mathematics and mechanics. In particular, partial differential equations, an important branch of mathematics, initially arise from mechanics. Nowadays, scientists find that they exist in almost every discipline of sciences. Among them, PDEs from fluid mechanics are still one of the central topics.

An interesting problem in fluid mechanics is the motion of a rigid body immersed in a fluid. The motion of both fluid and solid can be described by a system consisting of partial differential equations. Therein, the motion of the fluid is governed by the classical Navier-Stokes equations or Euler equations, which are the basic equations describing the fluid dynamics. And the motion of the rigid body is ruled by the conservation of linear and angular momentum. The force imposed on the rigid body is pressure and deformation tensor of the fluid. We call the system "Fluid-Rigid Body System". In this talk, I will present some recent advances about this system and show the joint work with Prof. XIN Zhouping.

CHEN Huanjun

Supervisor: Professor WANG Jianfang
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CHEN Huanjun is a Ph.D. candidate in Professor WANG Jianfang's group in the Department of Physics. He obtained his B.Sc. degree (2004) and M.Sc. degree (2007) from Sun Yat-sen University in Guangzhou. His current research interest is the localized surface plasmon resonances of noble metal nanocrystals and their related applications, especially exploring the sensing applications of gold nanostructures. Based on his previous studies, he has published and co-published 14 academic papers.

Au Nanocrystal Plasmonics: Plasmon Coupling and Interactions with Molecules

CHEN Huanjun and WANG Jianfang

Noble metal nanocrystals exhibit rich plasmonic properties. Surface plasmons are collective electron oscillations in metals. Different from the propagating surface plasmons that are associated with metal–dielectric interfaces, the plasmons of metal nanocrystals are localized and confined in nanoscale systems. The nanoscale confinement of surface plasmons not only introduces higher flexibility in tailoring the localized plasmonic properties by controlling the morphologies, chemical compositions, and spatial arrangements of metal nanocrystals, but also allows for the conjugation of metal nanocrystals with other nanoscale components, such as chemical and biological molecules, semiconductor nanocrystals and nanowires, to study and utilize the interactions of the plasmons with other physical properties.

Localized surface plasmon resonances (LSPR) of noble metal nanocrystals are highly dependent on the dielectric nanorenvironment surrounding them, which makes them excellent candidate for utilizing in chemical, biological, and environmental sensing applications. On the other hand, resonant excitation of the LSPR will lead to large light absorption and scattering cross sections, giving rise to many fascinating applications in photothermal cancer therapy, bioimaging, and biological labeling. Moreover, the very huge near-field enhancement associated with the excitation of LSPR will lead to their great potentials in plasmon enhanced spectroscopies (such as surface enhanced Raman spectroscopy, plasmon enhanced infrared absorption, and plasmon enhanced fluorescence) and fabrication of novel photonic devices. In this short report I will briefly introduce some recent progresses in Professor WANG Jianfang's group on studying the plasmon–molecule interactions and localized plasmon coupling in Au nanostructures.

SUN Lei

Supervisor: Professor YU Kin-wah
Department of Physics,
The Chinese University of Hong Kong

SUN Lei graduated from the Institute of Physics of Nankai University in 2006, and got both his B.Sc. and M.Sc. degrees there by studying the photorefractive effect in iron and manganese doped near-stoichiometric lithium niobate crystal. He joined the Department of Physics at the CUHK to pursue his doctoral studies in 2007 under the supervision of Professor YU Kin-wah. His research is concentrated on controlling the electromagnetic waves by using artificial materials, known as metamaterials, especially on electromagnetic transparency. His notable achievement is broadband electromagnetic transparency in which the object can be invisible in a broad frequency band by introducing a proper graded metamaterial structure.

Broadband Electromagnetic Transparency by Graded Metamaterial Spheres

SUN Lei and YU Kin-wah

Electromagnetic wave phenomena are important in our daily life. In this research, we focus on the technique on controlling the electromagnetic waves by using an artificial material known as metamaterial, which has peculiar electromagnetic properties that do not exist in nature. In particular, we propose an isotropic radially inhomogeneous spherical structure with dielectric permittivity being described by the graded Drude model, and investigate the scattering of electromagnetic waves from it. The electromagnetic field distribution has been calculated within the generalized Mie scattering theory, and exact analytic solutions can be obtained in terms of confluent Heun function and confluent hyper-geometric function of Kummer under a certain gradient profile. That allows us to obtain the full-wave scattering cross section (FWSCS) analytically from the scattering field amplitudes. It is found that the FWSCS can achieve extremely small values over a broad frequency band by tuning the gradient parameters. This allows us to assess the conditions for making things transparent or nearly invisible over a broad frequency band. In view of the success, we extend our study to more complex structures, e.g., the anisotropic profile, to achieve a better broadband transparency over a broad range of parameters.

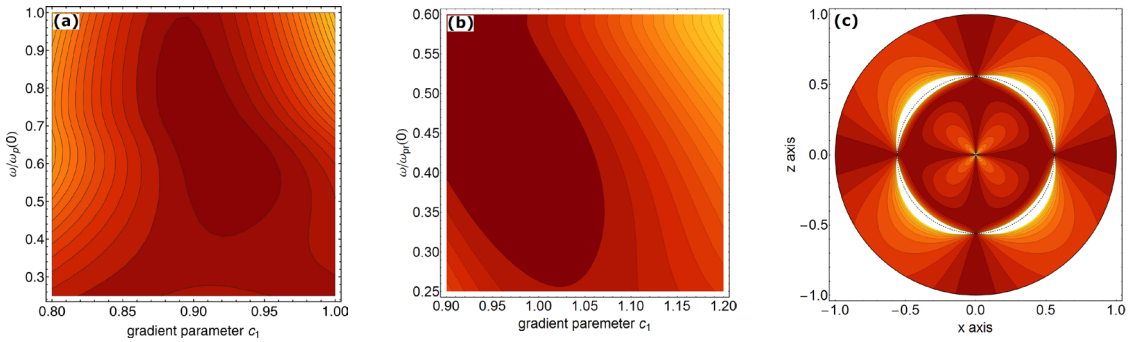

Figure 1. Results (a) The full-wave scattering cross section of an isotropic graded sphere, (b) the Rayleigh scattering cross section of an anisotropic graded sphere under the quasi-static conditions, and (c) the distribution of the electric field inside an anisotropic graded sphere.

YANG Aijun

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YANG Aijun received his B.Sc. degree (2004) from Nanjing Normal University and his M.Sc. degree (2007) Southeast University, Nanjing, China. Currently, he is working towards his Ph.D. degree at the Department of Statistics, The Chinese University of Hong Kong. His Ph.D. thesis is entitled "Bayesian Variable Selection for High Dimensional Data Analysis", focusing on selecting important genes for disease classification using microarray data. His current research interests include Bayesian Variable Selection and Bayesian Econometrics.

Bayesian Variable Selection for Disease Classification using Gene Expression Data

YANG Aijun and SONG Xinyuan

An important application of gene expression microarray data is the classification of samples into categories. Accurate classification depends upon the method used to identify the most relevant genes. Owing to the large number of genes and relatively small sample size, the selection process can be unstable. Modification of existing methods for achieving better analysis of microarray data is needed. We propose a Bayesian stochastic variable selection approach for gene selection based on a probit regression model with a generalized singular g-prior distribution for regression coefficients. Using simulation-based MCMC methods for simulating parameters from the posterior distribution, an efficient and dependable algorithm is implemented. It is also shown that this algorithm is robust to the choices of initial values, and produces posterior probabilities of related genes for biological interpretation. The performance of the proposed approach is compared with other popular methods in gene selection and classification via the well known colon cancer and leukemia data sets in microarray literature.

Notes:

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