

## RESEARCH PROJECTS

✉ SHUM Kar Ping

---

Please refer to previous issues of this publication for more details of the following ongoing research at the department:

2003-04 The Integral and Modular Properties of C-algebras (CU03023)

✉ SHUM Kar Ping • LEUNG Chi Wai (Mathematics)

Edition      Title/Investigators

2002-03 Formation Theory of Finite Groups and Algebras (CU02031)

## RESEARCH PROJECTS

---

### Structural and Functional Studies of SUMO E3 Ligases and SUMO Specific Proteases

✉ AU Wing Ngor Shannon • BARFORD, David\*  
• CHAN Wood Yee (Anatomy) • WAYE Mary Miu Yee (Biochemistry)

☐ 1 January 2005

❖ Research Grants Council (Earmarked Grants)

Sumoylation has emerged as important new protein post-translational modification that can mediate physiological and pathological responses in humans. Its biological roles are diverse, including modulation of transcriptional activity, protein stability, protein-protein interaction and nuclear transport. As in ubiquitination, sumoylation is a dynamic and reversible process; conjugation of SUMO to target substrates is catalyzed by a cascade of SUMO E1, E2 and E3 ligases, whereas deconjugation from its precursor protein and from its conjugated target is catalyzed by SUMO specific proteases. It is believed that the E3 ligases and proteases confer substrate specificity and that the physiological consequences of sumoylation and desumoylation are related to their intracellular localization. In the present study, we plan to determine the crystal structures of the E3 ligases and proteases by x-ray crystallography. We will also apply immunohistochemistry and cellular biochemistry approaches to characterize the intracellular localization of the modification. Knowledge gained from the proposed research will provide key information regarding the structural basis of sumoylation/desumoylation and its physiological importance behind.

(CU04409)

### Molecular and Genetic Characterization of the SARS Coronavirus Auxilliary Protein X1 in *Drosophila*

✉ CHAN Ho Yin Edwin • TSUI Stephen Kwok Wing (Biochemistry)

☐ 1 January 2005

❖ Research Fund for the Control of Infectious Diseases - Health, Welfare and Food Bureau

#### *Purpose:*

The SARS Coronavirus (SARS-CoV) genome is predicted to encode more than ten open reading frames including the surface spike glycoprotein (S), and a number of auxiliary proteins such as the X proteins. The S protein is believed to mediate the entry of the virus into cells. Current research direction has mainly focused on the characterization of the “structural genes” such as the S gene. The proposed study aims to study the functions of the SARS-CoV auxiliary protein X1 in an in vivo model. This study would lead to a better understanding of the pathogenetic consequences after the entry of SARS-CoV into cells.

#### *Objectives:*

1) To determine the subcellular localization of the X1 protein, 2) to determine the cellular effects of X1 in both in vitro and in vivo models, and 3) to elucidate protein domains that are essential for X1 to mediate its effects in cells.

#### *Experimental design:*

*Drosophila* fly lines, and African green monkey kidney cell line Vera E6 will be used to express the X1 transgene. *Drosophila* has successfully been used to study viral infection, and to elucidate cellular functions of certain HIV-1 auxiliary proteins. It is therefore an ideal in vivo model to study SARS-CoV

auxiliary proteins. The Vero E6 cell line is an ideal mammalian in vitro cell culture system to validate findings obtained in the Drosophila model.

*Main outcome measures and analysis:*

Preliminary results obtained from the transgenic Drosophila model indicated that the X1 protein expression caused disruption of cell function. Molecular and cell biological techniques will be employed to delineate its functions.

(BL04684)

---

**Nucleocytoplasmic Transport and Polyglutamine Toxicity: A Cellular Genetic Study**

✉ CHAN Ho Yin Edwin

□ 1 January 2005

❖ Research Grants Council (Earmarked Grants)

Triplet-repeat diseases are genetic disorders caused by abnormal expansion of trinucleotide repeats in the genome. Polyglutaminopathies define a group of diseases characterized by expansion of an existing CAG trinucleotide repeat that encodes tandem glutamine residues in a protein. The expanded CAG repeat is translated into an elongated polyglutamine domain in the disease protein. Expanded polyglutamine proteins have been shown to cause neuronal dysfunction and cell death. Although polyglutamine disease proteins display diverse expression patterns and subcellular localizations in the nervous system, formation of intracellular insoluble protein aggregates is a common feature of polyglutaminopathies. Apart from the polyglutamine domain, no other sequence homology is found among the different disease proteins. It has been demonstrated by independent studies that the cell nucleus appears to be a major site for polyglutamine toxicity in most polyglutamine diseases. Nuclear translocation of expanded disease

protein is believed to play a pivotal role in pathogenesis. To investigate this, a combined cell-based, transgenic approach is proposed to 1) study the nucleocytoplasmic movements of expanded polyglutamine protein, and 2) to identify cellular factors that govern these movements. This study will lead to a better understanding of the roles of nuclear transport in polyglutaminopathies, and in other diseases such as oculopharyngeal muscular dystrophy which is also characterized by abnormal nuclear protein aggregate formation of polyalanine protein.

(CU04413)

---

**Effect of Egg Consumption on Blood Cholesterol Levels in SD Rats and Hamsters**

✉ CHEN Zhenyu

□ 1 February 2005

❖ CUHK Research Committee Funding (Direct Grants)

Egg and domestic animal foods are a major source of dietary cholesterol. We have studied effects of egg consumption on serum cholesterol level in SD rats and hamsters (*Mesocricetus auratus*). It was found that the rats were resistant to elevation of serum cholesterol but hamsters developed hypercholesterolemia. It is also known that some humans are resistant while the others are hyper-responders to dietary cholesterol. The present study will investigate the mechanisms by which the rats and hamsters have different response to dietary cholesterol derived from egg. We hypothesize in general that SD rats metabolize or excrete excessive dietary cholesterol more efficiently than hamsters. We will examine the differences between the SD rats and hamsters in the following proteins/enzymes and their mRNA, which involve in cholesterol

metabolism. These include (a) sterol regulatory element-binding proteins (SREBP), that regulate gene expression of enzymes involved in cholesterol biosynthesis; (b) low-density lipoprotein (LDL) receptor, which mediates the removal of circulating cholesterol; (c) HMG-CoA reductase; which is a key enzyme in cholesterol synthesis; (d) cholesterol 7 $\alpha$ -hydroxylase, which is a regulatory enzyme in conversion of cholesterol to bile acids; and (e) acyl CoA cholesterol acyltransferase (ACAT), which may play a role in intestinal absorption of dietary cholesterol. The data from this project will provide insight information in putative mechanism why some individuals and species are resistant to atherosclerosis. (This project was marked as "Fundable but not funded" by RGC)  
(BL04469)

---

**Effect of Active Ingredients of Traditional Chinese Medicine on the Induction of Apoptosis and Drug-Resistance in R-HepG2 Cells**

✍ KONG Siu Kai

□ 1 January 2005

❖ CUHK Research Committee Funding (Direct Grants)

Tumours of the liver represent the second most common malignancy in Hong Kong. In the liver cancer patients, chemotherapy is the only choice of treatment. Unfortunately, no single drug given has palliative benefits. The overall median survival time of the patients is less than 3 months from the time of diagnosis. Therefore, the identification of a more effective treatment protocol for liver cancer is urgently needed.

Now, it is clear that mitochondria not only produce energy, but also hold the secrets of life and death. In this model, mitochondria play a key role in

triggering the active and passive cell death. They act as an integrator to execute the cell death program triggered by many death stimuli. Yet, the role of the mitochondria in the induction of cell death in the liver carcinoma and its drug-resistant counterpart remain unclear. Therefore, work in this aspect is crucial for our understanding and design of a better anti-cancer agent for liver cancer. Towards this goal we purpose to examine the role of mitochondria of a human liver cancer cell line, HepG2 and its drug-resistant subline (R-HepG2), under the treatment with anti-cancer agents including those from traditional Chinese medicine (TCM) such as Polyphyllin D. We believe that a better understanding of the complex activities of mitochondria and their response to anti-cancer agents and TCM will give us more insights on the safety and efficacy of using TCM for tumour destruction.

(BL04841)

---

**Studies on the Anti-Leukemic and Immunomodulatory Activities of Selected Coumarins**

✍ LEUNG Kwok Nam

□ 1 March 2005

❖ CUHK Research Committee Funding (Direct Grants)

Coumarins are naturally-occurring non-nutrient phytochemicals with important medicinal values, as they exhibit diverse biological and pharmacological properties, such as anti-edema, anti-inflammatory, cardiovascular-protective, immuno-enhancing and anti-cancer activities. They can be isolated from a number of medicinal plants and officinal herbs. A high content of coumarins is also present in our daily foods, such as soybeans and cruciferous vegetables. Although accumulating evidences have shown that

coumarin and its derivatives can exhibit anti-tumor activity both *in vitro* and *in vivo*, however, the precise mechanisms by which coumarins can exert their anti-tumor activity as well as their therapeutic potentials remain poorly understood. Moreover, the modulatory effects of coumarins on different subpopulations of immunocytes, their action mechanisms and their relationship to anti-tumor activity have not yet been thoroughly investigated. Preliminary studies have shown that certain coumarin derivatives (including 7-hydroxycoumarin, esculetin and esculin) displayed much more potent anti-leukemic activity than their parental compound. The proposed research attempts to define the anti-leukemic and immunomodulatory activities of these four selected coumarins, both *in vitro* and *in vivo*. The main objectives of this project are (i) to study the direct anti-leukemic activity of coumarins, both *in vitro* and *in vivo*; and (ii) to examine the immunomodulatory effect of coumarins on various non-specific and specific immune functions. It is anticipated that the results of this proposed study will provide better understanding of the biological and pharmacological activities of coumarins and hopefully more effective strategies can be developed for the treatment of some forms of leukemia.

(BL04706)

---

### Optimization of Cephamecins - Producing Enzymes by DNA Shuffling

✉ TSANG Wai Kei

☐ 1 March 2005

❖ CUHK Research Committee Funding (Direct Grants)

Cephamecins (7- $\alpha$ -methoxycephalosporins) are produced by actinomycetes such as *Streptomyces clavuligerus* and *Nocardia lactamdurans*. With

respect to cephalosporins, cephamycins are more resistant to  $\beta$ -lactamases and therefore are clinically useful against Gram-negative and anaerobic pathogens. Contemporary chemical syntheses of cephamycins use toxic and environmental-damaging reagents. We project to produce cephamycins from cephalosporins via a dual-protein system, which include P7 (7- $\alpha$ -hydroxylase) and P8 (7- $\alpha$ -methoxylase), encoded by *cmcI* and *cmcJ* respectively.

The intrinsic low activities of wild-type P7 and P8 render them unsuitable for biotechnological applications, we propose to enhance their activities by implementing DNA shuffling technique. DNA shuffling is an efficient strategy to reshape both functional and structural properties of proteins. It involves recursive generation of a diverse gene library and screening of improved chimeric proteins. Cycles of fragmentation and re-assembly enrich "good" mutations and eliminate "bad" mutations simultaneously in the population. In this project, homologs of P7 and P8 isolated from several actinomycetes will be used as parental templates. The DNA segments will be fragmented and re-assembled by modified PCR and enzyme variants with improved activities will be screened by HPLC. Mutations and regions of recombination in the variants will be analyzed by DNA sequencing and computer software (Shuffled). The ultimate goal of this project is the generation of P7 and P8 chimeras of higher conversion rates and specific activities, which can be employed for large-scale production of cephamycins.

(BL04541)

---

### Structural Basis of Thermostability and Enzymatic Activities of a Thermophilic Acylphosphatase from *Pyrococcus Horikoshii*

✉ WONG Kam Bo

❑ 1 January 2005

❖ CUHK Research Committee Funding (Direct Grants)

Acylphosphatase (AcP, ~90-100 residues) is one of the smallest enzymes known. To our knowledge, there has been no AcP from archaea characterized so far. We have cloned the coding sequence of AcP from *Pyrococcus horikoshii* and expressed the protein in *E. coli*. The purified recombinant AcP is active and is able to cleave acetyl phosphate and benzoyl phosphate. Preliminary experiments demonstrated that AcP from *P. horikoshii* is extremely thermostable, which resists unfolding at >90°C. We propose to use AcP from *P. horikoshii* as a model to study the stability, activity and dynamics of thermophilic enzymes. To investigate the structural and dynamical change upon binding of phosphate to the active site, we shall determine the structure of *P. horikoshii* AcP-phosphate complex by X-ray crystallography. We shall also characterize the conformational stability and enzyme kinetics of AcP from *P. horikoshii* at a range of temperatures to see how the thermophilic protein maintains a balance between catalysis and stability.  
(BL04783)

2002-03 Biochemical Analysis of Dribble, a Single KH Domain-Containing Protein (BL02693)

✉ CHAN Ho Yin Edwin • NGAI Sai Ming (Biology)

2003-04 Genetic and Proteomic Studies of Chaperone-Mediated Suppression of Polyglutamine Toxicity in Drosophila (CU03314)

✉ CHAN Ho Yin Edwin • LILLEY Kathryn S.\* • RAZZAQ\*

2003-04 To Establish a Drosophila Model for Traditional Chinese Medicine Testing (BL03977)

✉ CHAN Ho Yin Edwin • LIANG Songming (School of Chinese Medicine) • CHEN Shuying (School of Chinese Medicine) • CHAN Kam Leung (School of Chinese Medicine)

2003-04 Antioxidant Activity of Green Tea Catechin Metabolites (BL03434)

✉ CHEN Zhenyu

---

**Please refer to previous issues of this publication for more details of the following ongoing research at the department:**

2003-04 Molecular and Functional Studies of Antiquitin in Fish (CU03305)

✉ FONG Wing Ping • CHENG Hon Ki Christopher (Biochemistry)

Edition      Title/Investigators

2003-04 Characterization of Sumoylation and Desumoylation Pathways in Ovary (BL03832)

✉ AU Wing Ngor Shannon • CHAN Wood Yee (Anatomy) • NGAI Sai Ming (Biology)

2003-04 Food Consumption Survey of the People of Hong Kong (MD03882)

✉ GULDAN Georgia Sue • SHUM Kwok Cheung (Hong Kong Institute of Asia-Pacific Studies) • AU YEUNG Kit Mei • HO CHAN

	Suzanne (Community and Family Medicine)		Glycyrrhizin and Its Major Metabolite on Neuroblastoma Cells (BL03804) ✍ LEUNG Kwok Nam
2003-04	Effects of Herbal Agrimonia on Hepatocarcinogenesis in Rats (BL03980) ✍ HO Wing Shing John	2001-02	Interaction of Ribosomal Proteins P0 and P1 with Trichosanthin (BL01145) ✍ SHAW Pang Chui • SZE Kong Hung* • WONG Kam Bo • ZHU Guang*
2003-04	Selection of Aptamer against Apoptotic Protein Cytochrome c (BL03806) ✍ KONG Siu Kai		
2001-02	Identification of Genes Involved in Carbon Tetrachloride-Induced Liver Injury: A Model for Chemical Toxicity-Mediated by Free Radicals (BL01135) ✍ LEE Sau Tuen Susanna	2001-02	An Infrastructure for Efficient Protein Expression, Purification and Structural Studies (BL02763) ✍ SHAW Pang Chui • WONG Kam Bo • WAYE Mary Miu Yee (Biochemistry) • TSUI Kwok Wing (Biochemistry) • LAM Sik Lok (Chemistry) • HUANG POON Wai Sin Dolly (Hong Kong Cancer Institute)# • LO Kwok Wai (Anatomical & Cellular Pathology) • CHUI Yiu Loon (Clinical Immunology Unit)
2002-03	Functional Characterization of a Novel Peroxisome Proliferator-activated Receptor Regulating Gene, SIP-1 – Identification of a Functional Peroxisome Proliferator Response Element, Subcellular Localization, and Its Role in Lipid Metabolism (BL02732) ✍ LEE Sau Tuen Susanna	2003-04	Authentication and Quality Assessment of Chinese Medicinal Materials by DNA and Chemical Technologies (BL03409) ✍ SHAW Pang Chui • BUT Pui Hay Paul (Biology)
2003-04	Functional Characterization of a Novel Peroxisome Proliferator-Activated Receptor Regulating Gene, SIP-1 - Identification of a Functional Peroxisome Proliferator Response Element, Subcellular Localization, and Its Role in Lipid Metabolism (CU03328) ✍ LEE Sau Tuen Susanna • CHEUNG Wing Tai (Biochemistry)	2003-04	Interaction of Trichosanthin with $\alpha$ -2 Macroglobulin Receptor (BL03839) ✍ SHAW Pang Chui
2003-04	In vitro Studies on the Growth-Inhibitory and Differentiation-Inducing Activities of	2001-02	Interactions between Tumor Necrosis Factor-Alpha and Beta-Adrenergic Mechanism in Cultured Rat Astrocytes (BL01139)

- |         |  |         |  |
|---------|--|---------|--|
|         | ✍ TSANG David Sau Cheuk •<br>LEUNG Kwok Nam  |         | Hyperthermophilic Archaea<br>Thermococcus celer (CU02254)<br>✍ WONG Kam Bo   |
| 2003-04 | Geng-Shu Capsule as a Safer and More<br>Natural Alternative for Patients of<br>Menopausal Symptoms (MD03699)<br>✍ WANG Jun • LEUNG Lai Kwok<br>(Biochemistry) • SUN Quanzhong* | 2003-04 | Structure-Function of Ribosomal Protein<br>P2 - Structure Determination of Human<br>P2 by NMR Spectroscopy (CU03301)<br>✍ WONG Kam Bo • SHAW Pang<br>Chui • SZE Kong Hung* |
| 2002-03 | Structural Basis of Thermostability of<br>Proteins - Protein Engineering of a<br>Thermophilic Protein from a   |         |  |



## RESEARCH PROJECTS

---

### **Provision of Services for a Study on Ecological Monitoring, Biodiversity Mapping and Visitors Impact Assessment in Hoi Ha Wan, Yan Chau Tong and Tung Ping Chau Marine Park**

✍ ANG Put Jr.

☐ 1 November 2004

❖ AFCD, HKSAR Government

Hoi Ha Wan, Yan Chau Tong and Tung Ping Chau Marine Parks are the main marine parks established in NE Hong Kong. Periodic monitoring of changes in the biodiversity of these marine parks is necessary. This project will monitor changes in the coral diversity within the marine parks, assess the impact of visitors in Coral Beach within Hoi Ha Wan Marine Park and the diversity of other organisms found within five sites in Hoi Ha Wan and two sites in Tung Ping Chau Marine Park. The results will be compared with those collected in the previous years. Methods used in marine park monitoring will be tested and the appropriate one that could be applied for future monitoring of the marine parks will be recommended.

(BL04777)

### **Mushroom Non-Digestible Carbohydrates as Novel $\beta$ -Glucan Type Prebiotics: Their Preparation and In Vitro Microbial Fermentation**

✍ CHEUNG Chi Keung Peter

☐ 1 February 2005

❖ CUHK Research Committee Funding (Direct Grants)

Non-digestible carbohydrates (NDCs) are nonstarch polysaccharides (NSPs) and oligosaccharides as well as resistant starch that escape digestion in the upper gastrointestinal tract. These NDCs belong to the group of prebiotics which are nondigestible food ingredient, that beneficially affect the host by selective stimulating the growth and/or activity of one or a limited number of bacteria in the colon and thus improve health. Although there are several prebiotics that are mainly oligosaccharides such as fructo-oligosaccharides (FOS) and galacto-oligosaccharides as well as NSPs such as inulin on the functional food market, there is much interest in the potential for development of novel prebiotics. Mushroom cell wall has substantial amount of dietary fiber (DF) which is composed of NDCs with NSPs as the major component. Our preliminary results on the chemical and toxicological studies of mushroom DF have shown that edible mushroom sclerotium (a dry solid mass of fungal hyphae) is extremely rich in NSPs (mainly  $\beta$ -glucan) that are fermentable and thus is a potential source of prebiotics. In this proposal, the preparation of novel mushroom DF ( $\beta$ -glucan type NSPs) and  $\beta$ -D-gluco-oligosaccharides ( $\beta$ -GOS) from the sclerotium by enzymatic methods and controlled partial hydrolysis, respectively will be investigated together with a comprehensive evaluation on their biochemical and structural properties. The selective fermentation of the NSPs and  $\beta$ -GOS produced from mushroom sclerotium will be studied by batch fermentation using human intestinal bacteria. The structure-function relationships of prebiotic mushroom NSPs and  $\beta$ -GOS will be delineated and their fermentation properties will be compared with those of commercial prebiotics for the purpose of developing a novel prebiotics from mushroom sclerotium.

(BL04750)

---

### Experimental Approach on Food Studies

- ✉ CHEUNG Chi Keung Peter
- 19 February 2005
- ❖ Education & Manpower Bureau, HKSAR Government

The workshop “Experimental Approach on Food Studies” includes a seminar and two laboratory sessions. The topic of the seminar is “Introduction to Food Science and Technology”, while that of the laboratory sessions are “Food Colloids: Emulsions” and “Enzymatic Browning of Fruits and Vegetables”. (BL04751)

---

### Extension of Shelf Life of a Mango-Based Dessert Drink

- ✉ CHEUNG Chi Keung Peter • WONG Ka Hing
- 15 March 2005
- ❖ Gold Hill Trading Limited

The shelf life of a mango-based dessert drink will be extended by incorporating with an appropriate anti-microbial preservative(s), taken into consideration of some of the physico-chemical properties (e.g. pH, emulsion stability) and sensory attributes (e.g. texture, after-taste) of the product. (BL04759)

---

### Mould Sampling and Analysis for Tsz Wan Shan Markets

- ✉ CHIU Siu Wai
- 22 December 2004
- ❖ The Link Management Limited

Two market venues in Tsz Wan Shan will be examined for the mould diversity. The mould diversity will be analysed and their relevance to environmental health will be addressed in a report. The risk and hazard of toxic mould as requested by the sponsor will be reported. Preventive and remedial measures if appropriate will be provided to the Sponsor.

(BL04966)

---

### Feasibility of Using a White Rot Fungus and Its Cultivation Substrates for Treatment of Contaminants in Soil

- ✉ CHIU Siu Wai
- 1 February 2005
- ❖ CUHK Research Committee Funding (Direct Grants)

Resource consumption and pollution are unavoidable features of human economic growth and cause disturbances to the Nature. This study proposes to develop a sustainable technology of reducing the nature's burden of pollution by remediation. White rot fungi secrete ligninolytic enzymes which degrade natural polymer lignin in plant matter for nutrition and breakdown various types of organopollutants via highly reactive radicals. These enzymes can be optimised for production by solid-state-fermentation and submerged fermentation. Spent substrates of the solid-state-fermentation have been recycled as conditioners for soil restoration. Thus white rot fungi and their cultivation substrates have been researched on and recently applied in bioremediation. However, soil contamination is a local/regional environmental problem. This study aims at testing the feasibility of using a white rot fungus and its cultivation substrates for remediation of local contaminated soil. Many artificially cultivated

mushrooms are white rot fungi, and some are commercially produced by solid-state-fermentation in Hong Kong. Effectiveness is to be assessed by the removal efficiencies and decrease in toxicities. This basic research has direct relevance for environmental protection.

(BL04992)

---

**Molecular Barcodes of Decapod Crustaceans: The Development of a DNA-Based Taxonomic Identification System**

✍ CHU Ka Hou • CHAN Tin Yam\*

□ 1 December 2004

❖ Research Grants Council (Earmarked Grants)

Efforts in biodiversity conservation are often hindered by ‘taxonomic impediment’, which reflects the lack of taxonomic expertise in many groups of living organisms. It has been suggested that DNA sequences can serve as a criterion in taxonomic identification and a web-based database incorporating DNA sequences as species barcodes would facilitate studies in ecology and conservation biology. The applicability of DNA barcodes has recently been demonstrated in a number of animal groups, particularly insects. The proposed study will examine the use of mitochondrial DNA sequences in identification of decapod crustaceans, one of the major and diverse groups of marine invertebrates. Preliminary studies have shown that the genes encoding for 16S ribosomal RNA and cytochrome oxidase I are good candidates of DNA barcodes in this group. To firmly establish their applicability in taxonomic identification at the family level, sequences of the genes from representative members of a majority of the decapod families will be determined and analyzed. Moreover, the applicability of the two genes at the genus/species

level will be documented through the analysis of sequences from members of the economically important families of Penaeidae, Nephropidae, and Palinuridae. Results from this study will establish the technology and provide a framework for the development of a DNA-based identification system that represents a convenient and reliable approach in crustacean taxonomy.

(CU04419)

---

**Landscaping of Cutslopes: An Ecological Approach**

✍ CHU LM

□ 1 February 2005

❖ CUHK Research Committee Funding (Direct Grants)

Stability of cutslopes which are liable to geotechnical failure has been a major concern in Hong Kong. As a preventive measure, these cutslopes were usually covered by impermeable material to reduce the risk of landslide. However, such practice is no longer acceptable as the surface is so artificial and not visually pleasing. Landscaping of cutslopes has become a highly preferred option, but the emphasis is on the creation of an instant greening effect that is purely cosmetic rather than the establishment of a functionally sustainable vegetation layer. This is why most proprietary soft landscaping systems use exotic grass species that work well in terms of germination rate and ground coverage. As slope protection is more an engineering-oriented issue, not much is known about the long-term effectiveness of these proprietary slope revegetation techniques to justify their expensiveness. There is virtually no information on the performance of other potential species and the development of belowground parts in the shallow layer of artificial rooting material sprayed

on slopes. This proposed project emphasizes on the ecological aspects of commonly used cutslope landscaping techniques. It attempts to study plant performance and growth attributes on vegetated cutslopes and to select suitable ground cover species which include grasses and forbs for slope revegetation. Findings obtained can bridge the missing link between the art and the science of slope revegetation and provide a better knowledge of the value of the soft structure on the long-term workability of the various revegetation techniques.

(BL04900)

---

#### **Parallel Investigation on Microbiological Quality of Some Canned Meat Products**

✉ CHUNG Hau Yin • WONG Ka Hing

□ 23 May 2005

❖ Eagle Coin (Hong Kong) Limited

The microbiological quality of some canned meat products will be evaluated in parallel with the Quality Assurance Department of ParknShop.

(BL04909)

---

#### **Intrafollicular Communication in the Zebrafish Ovary - Roles of GDF-9 from the Oocyte in Orchestrating Follicle Development**

✉ GE Wei

□ 1 January 2005

❖ Research Grants Council (Earmarked Grants)

Growth and differentiation factor-9 (GDF-9) is specifically produced in the vertebrate oocyte and has been shown to control folliculogenesis by regulating the function of the follicle cells. Using zebrafish as the model, the proposed project will address the following questions: (1) is GDF-9 present in fish and

also specifically expressed by the oocyte? (2) What is the role of oocyte-derived GDF-9 in zebrafish folliculogenesis? (3) Is GDF-9 in the oocyte subject to endocrine or paracrine regulation? And how? The cDNA of zebrafish GDF-9 will be cloned followed by examination of its expression profiles during follicle development. To study the biological activities of GDF-9, recombinant zebrafish GDF-9 will be produced. The effects of recombinant GDF-9 on the follicle cells will be tested in cultured zebrafish follicle cells, and the transcriptional responses of a variety of genes that are expressed in the follicle cells will be assessed. To further confirm the effects of GDF-9, both over-expression and inhibition of GDF-9 in the oocyte will be adopted by microinjecting capped GDF-9 mRNA or antisense morpholinos into the oocyte. The present study will also investigate the regulation of GDF-9 by gonadotropins and other ovarian growth factors. With the advantages of zebrafish model such as large size and number of oocytes produced daily and a firm basis we have established in this model on endocrine and paracrine regulation of follicle development, this study will make significant contribution to our understanding of the fundamental and diverse aspects of GDF-9 function across vertebrates.

(CU04422)

---

#### **Genes and Molecular Markers Involved in the Control of Erect Flag Leaf in Rice**

✉ KWAN Hoi Shan

□ 1 February 2005

❖ CUHK Research Committee Funding (Direct Grants)

The long term goal is establish molecular markers for breeding programmes to improve rice plant agronomic traits. One of the most significant

characteristics of super hybrid rice is the erected leaf. Leaf morphology of rice is important to efficiency of photosynthesis, biomass production, and structural support of the plant. The objectives of the project are (1) to establish sequence length polymorphism (SSLP) markers, leaf specific gene markers, and arbitrarily primed polymerase chain reaction markers to form a genetic map of super hybrid rice and (2) to locate quantitative trait loci related to rice leaf morphology. The molecular markers can then be used in a breeding programme. Leaf specific gene markers from our functional genomic studies will be used and more of the same kind of markers will be obtained. The wrap-up part of this project will repeat the genetic studies in the field in China and collect more samples from F2 progenies for marker fine-gene mapping. We also hope to identify putative genes that determine the morphology of the erect flag leaf morphology.

(BL04676)

---

#### **Characterization and Functional Analysis of a Novel NaCl-Inducible Purple Acid Phosphatase-Like Gene**

✉ LAM Hon Ming • YAN Xiao-Long\* • LIAO Hong\*

☐ 1 December 2004

❖ Research Grants Council (Earmarked Grants)

We recently cloned a novel purple acid phosphatase (PAP)-like gene from soybean (*GmPAP3*). PAPs catalyze the release of “free” inorganic phosphorous from their “unavailable” forms (as orthophosphate monoesters). Some important properties of the *GmPAP3* gene distinguish it from many other plant purple acid phosphatases: (1) the *GmPAP3* gene is induced by NaCl stress and oxidative stress, but not phosphorus starvation; and (2) the gene product of

*GmPAP3* is predicted to be mitochondrial located. These special properties of the *GmPAP3* gene suggest that it may play a critical role in the interaction among NaCl stress, oxidative stress, and phosphorus metabolism. To thoroughly understand the roles and explore potential applications of *GmPAP3*, we propose to delineate its functions at molecular, biochemical, cell biology, and physiological levels. The specific objectives of this research are: (1) to physically demonstrate the mitochondrial localization of the *GmPAP3* protein; (2) to study possible enzymatic reactions exhibited by the *GmPAP3* protein (including phosphatase and peroxidase activities); and (3) to perform gain-of-function tests to examine possible roles of *GmPAP3* in relation to NaCl stress, oxidative stress, and phosphorus metabolism.

(CU04434)

---

#### **Sustainable Nitrogen Utilization in Soybean Continuous Cropping From Physiological and Molecular Mechanisms to Effective Management**

✉ LAM Hon Ming • CHIU Siu Wai • FUNG Ming Chiu

☐ 30 June 2005

❖ Supplementary Funding for RGC Central Allocation

Due to its ability to perform symbiotic nitrogen fixation, soybean plays a critical role in sustainable nitrogen utilization. Soybean is also an important cash crop that provides a major source of dietary protein and vegetable oil. Some major soybean cultivation regions in China (e.g. Heilongjiang) have a very short “warm” period and hence soybean is the only crop that can make reasonable profit for farmers. Continuous cropping of soybean in these areas leads to drastic yield reduction, implying a net reduction of

nitrogen from the system. To tackle this problem, the long term strategy includes: (i) achieving a better understanding of the inhibitory mechanism on nitrogen assimilation and plant growth, and (ii) optimizing the management process for sustainable nitrogen utilization. In this project, we will focus on (i) establishing a system to study the inhibitory mechanism on nitrogen assimilation during soybean continuous cropping and (ii) evaluating soybean germplasms exhibiting diverse degree of growth reduction imposed by continuous cropping.

(BL04723)

---

#### The Cell Death Induced by SARS-CoV

✉ SUN Sai Ming Samuel • CHIU Chi Ming Lawrence • CHAN Kay Sheung Paul (Microbiology) • OOI Vincent Eng Choon

□ 1 February 2005

❖ CUHK Research Committee Funding (Direct Grants)

Severe Acute Respiratory Syndrome (SARS) is an acute and potentially fatal respiratory illness caused by a newly discovered RNA virus, the SARS-associated coronavirus (SARS-CoV). Previous studies have shown that the SARS patients are associated with cell and tissue death abnormalities, including lymphopenia, leucopenia, thrombocytopenia, and elevated plasma levels of lactate dehydrogenase and creatine kinase. These suggest that SARS-CoV may kill its infected cells, causing the pathological damages; however, the mode of cell death induced by the virus is still not clear. Apoptosis is a genetically controlled cell death process and is one of the important causes of cytopathogenesis that would appear as cytopathic effect (CPE) in the virus-infected cells. The other coronaviruses, particularly porcine transmissible

gastroenteritis virus (TGEV) and murine hepatitis virus (MHV), are known to induce apoptosis in the infected cells. We therefore hypothesize that, similar to the other coronaviruses and RNA viruses that cause severe respiratory diseases, apoptosis may also be involved in the SARS-CoV-induced cytopathogenesis. Genomic DNA fragmentation and laddering, and caspase activations are some of the remarkable features of apoptosis. This study is to investigate the cell death induced by SARS-CoV in the cultured Vero cells with flow cytometry and DNA gel electrophoresis; any SARS-CoV-induced apoptosis will further be validated using different caspase inhibitors. We anticipate that the results from this study would allow better understanding on the cytopathology of SARS-CoV, which is fundamental for the future development of specific and efficacious therapeutic strategies.

(BL04415)

---

#### An Advance Combined Chemical-Biomagnetic System to Remove and Recover of Metal Ions from Electroplating Effluent

✉ WONG Po Keung

□ 1 February 2005

❖ CUHK Research Committee Funding (Direct Grants)

A chemical-biomagnetic system was developed in which  $\text{Ca}(\text{OH})_2$  precipitation was used to concentrate metal ions including  $\text{Cu}^{2+}$  and  $\text{Ni}^{2+}$  in electroplating effluent in order to minimize the fluctuation of the physico-chemical conditions of the metal ion solution. Then  $\text{Cu}^{2+}$  and  $\text{Ni}^{2+}$  in electroplating effluent were selectively, efficiently and completely removed and recovered by respective bioreactors with magnetite-immobilized bacterial cells, which can specifically adsorb respective metal ion at unique pH

in a sequential manner. The recovered  $\text{CuSO}_4$  and  $\text{NiSO}_4$  solutions were concentrated to the levels suitable for the direct reuse in electroplating industry. However, there are three major problems of this developed chemical-biomagnetic system: (1) the cost of preparing bacterial cells specific for individual metal ions ( $\text{Cu}^{2+}$  and  $\text{Ni}^{2+}$ ) are too expensive to make the chemical-biomagnetic system economically viable, (2) the instability of immobilized bacterial cells after treated by acidic and alkaline solutions during adsorption-desorption cycles and (3)  $\text{Zn}^{2+}$ , which level is very high in electroplating effluent, was not dealt with. These problems render the application of the system since the scaling-up of the system will be very limited. Therefore there is an urgent need to search for a more stable and low cost metal ion adsorbent to replace the metal ion-adsorbing bacterial cells so that system can be applicable to large-scale operation.

In the last few years, the study on the use of a chitin A in the PI's laboratory indicated that this material is the most suitable adsorbent to replace bacterial cells to remove and recover the all metal ions from aqueous solution and electroplating effluent. This chitin A contains 60% chitin and is specially made from shrimp shell waste by ICP Inc. Preliminary results indicate that this biosorbent has good metal ion adsorption ability and can remove  $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$  and  $\text{Zn}^{2+}$  from aqueous solution with different pH. These metal ions can be removed and recovered by sequentially adjusting the pH of the solution or effluent. Besides, its cost is much less than preparing metal ion adsorbing-bacterial cells, In addition, chitin A can be also immobilized by magnetite. The most important advantage of chitin A is its extreme stability as compared to bacterial cells, even during multiple washing with acidic and alkaline solutions during the adsorption-desorption cycles. In the proposed study the feasibility and

conditions of using immobilized-chitin A to remove and recover  $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$  and  $\text{Zn}^{2+}$  in aqueous solution and then from electroplating effluent will be studied.

(BL04383)

---

### Bioactive Substances from Marine Microbes

✉ WONG Po Keung • QIAN P Y\*

☐ 1 June 2005

❖ Research Grants Council (Earmarked Grants)

Marine microorganisms are the important source of pharmacologically active metabolites. A diverse array of secondary metabolites have been isolated and characterized from marine-derived bacteria and fungi in the last 3 decades. With the support of RGC, over the last 3 years, we have established a Center for Marine Bioactive Substance, in which we developed a large culture collection (> 4000 bacterial isolates and 123 fungal strains) and database of marine bacteria. We have been screening for antifouling compounds, biotoxins, and the bacteria involving in degradation of pollutants. Over 10 bioactive compounds have been isolated, purified, and characterized from marine bacteria. More importantly, during the course of our study, we isolated about 20 novel strains of marine bacteria and fungi with the potential to produce new bioactive compounds. In the next three years, we will aim at: (1) consolidating culture collection and database of marine microbes by completing the identification (using partial 16S rDNA and ITS sequence) of unknown marine bacteria and fungal strains in our collection and integrating the culture collection and database of >120 strains of marine-derived fungi in hand, (2) characterizing novel (new) bacterial and fungal species using advanced biochemical and molecular techniques, (3) isolating, purifying, and chemically characterizing the bioactive antifouling

(anti-larval settlement and anti-microbe) compounds from at least 5 species of bioactive marine bacteria and 5 species of bioactive marine fungi; and (4) elucidation of biotransformation processes of pollutants (metals and organics) by selected marine bacteria and fungi. We will explore the possibility of collaboration with industrial sectors to develop the novel bioactive substances for antifouling and remediation agents for marine pollutants as commercial products.

\*The CUHK team will involve in the Tasks (1), (2) and (3)  
(BL04318)

---

### The Absorption and Anticancer Activity of Flavonoids

✉ WONG Yum Shing

☐ 1 March 2005

❖ CUHK Research Committee Funding (Direct Grants)

The health-beneficial property of dietary plant polyphenols is suggested to be associated with their antioxidant activities. Epidemiological studies support a prominent role of flavonoid antioxidants in preventing many chronic diseases such as cancer and cardiovascular disease. Quercetin, a flavonoid widely distributed in food plants, exhibits strong antioxidant activity. This flavonoid has been shown to have a wide spectrum of anticancer properties. Our previous studies indicated that morin, gossypetin and myricetin, three flavonoids closely related to quercetin in structure, also possess high antioxidant activities. We attempt to carry out a comparative study on these four flavonoids on their anticancer activities. Four human cancer cell lines will be tested in this study. Gossypetin will be used as a model compound for the study of flavonoid

absorption in human Caco-2 cell monolayer system. The possible role of flavonoids in altering cellular protein tyrosine kinase activities involved in signal transduction pathway will be investigated.

(BL04528)

---

**Please refer to previous issues of this publication for more details of the following ongoing research at the department:**

<u>Edition</u>	<u>Title/Investigators</u>
1998-99	Pharmaceutical, Nutritional and Biotechnological Application of Seaweed Resources in Hong Kong (BL98027) ✉ ANG Put Jr. • CHEUNG Chi Keung Peter • CHUNG Hau Yin • OOI Vincent Eng Choon
2002-03	Recovery of Corals form Lesion and Injuries (BL02430) ✉ ANG Put Jr.
2003-04	Provision of Services on Biological Monitoring in Sha Chau & Lung Kwu Chau Marine Park (BL03572) ✉ ANG Put Jr. • WONG Chong Kim • HUNG Samuel*
2003-04	Photosynthesis in Corals (BL03744) ✉ ANG Put Jr.
2003-04	Provision of Services of Underwater Photography of Coral Communities in Hong Kong Waters (BL03357) ✉ ANG Put Jr.



- 2003-04 Multi-School Collaboration in the Information Technology for Hong Kong Flora and Vegetation (BL03846)  
 ✍ BUT Pui Hay Paul • CHU LM • ANG Put Jr. • CHIU Siu Wai • WONG Yum Shing • CHANG Michael (Information Engineering)
- 2002-03 A Mechanistic Study of the Immunopotentiating and Antitumor Effects of Native and Chemically Modified Nonstarch Polysaccharides [(1 → 3)- $\beta$ -D-glucans] from Mushroom Sclerotia (CU02255)  
 ✍ CHEUNG Chi Keung Peter • CHIU Chi Ming Lawrence • OOI Vincent Eng Choon
- 2003-04 Non-Digestible Carbohydrates as a Novel Functional Food Ingredient (BL03351)  
 ✍ CHEUNG Chi Keung Peter • WONG Ka Hing
- 2002-03 Quantitative Analysis for Antiviral Activity of *Prunella vulgaris* and Related Medicinal Herbs with Flow Cytometry (BL02597)  
 ✍ CHIU Chi Ming Lawrence • OOI Vincent Eng Choon
- 2003-04 Mechanistic Studies of Apoptotic Cell Death Induced by Respiratory Syncytial Virus (RSV) in Human Lung Epithelium Cells (BL03859)  
 ✍ CHIU Chi Ming Lawrence • OOI Vincent Eng Choon
- 2001-02 Biotechnological Improvement of a Microbial Cultivar and Evidence-Based Diversification of Microbial Products (BL01812)  
 ✍ CHIU Siu Wai • NG Tzi Bun (Biochemistry)
- 2001-02 Molecular Population Structure of Penaeid Shrimp in the Indo-West Pacific (BL01157)  
 ✍ CHU Ka Hou
- 2002-03 Development of an Animal Model of Shrimp Allergy (CU02256)  
 ✍ CHU Ka Hou • CHIANG Bor Luen\* • FUNG Ming Chiu • LEUNG Sai Cheong Patrick\*
- 2003-04 Gene Expression During Ovarian Maturation in Penaeid Shrimp (CU03323)  
 ✍ CHU Ka Hou • CHAN Siu Ming\* • KWAN Hoi Shan
- 2003-04 Population Genetics of Mitten Crabs in Eriocheir (BL03941)  
 ✍ CHU Ka Hou
- 2000-01 Revegetation of Newly Restored Landfills: Site Environmental Conditions and the Role of Native Species (CU00250)  
 ✍ CHU LM
- 2003-04 Reedbed System for Treating Urban Runoff (BL03617)  
 ✍ CHU LM
- 2003-04 Evaluation of Modified Fish Diets on the Flavor Quality of an Aquaculture Fish (BL03503)

- |         |   |         |  |
|---------|---|---------|--|
|         | ✍ CHUNG Hau Yin   |         | ✍ JIANG Liwen  |
| 2003-04 | Immunological and Molecular Mechanisms of Natural Resistance in <i>Microtus Fortis</i> to <i>Schistosoma Japonicum</i> Infection (BL03710)<br>✍ FUNG Ming Chiu • YI Xinyuan* • WU Zhongdao* | 2002-03 | Identification of Ultrastructural Components of the Secretory Pathway for Endoglucanase in the Edible Mushroom, <i>Volvariella volvacea</i> (BL02956)<br>✍ JIANG Liwen • BUSWELL John Anthony (College Office, SC) |
| 2001-02 | Activin System in the Pituitary: How Important is It in the Differential Expression of Fish FSH and LH? (BL01150)<br>✍ GE Wei   | 2003-04 | Characterization of Plant Prevacuolar Compartments (BL03949)<br>✍ JIANG Liwen  |
| 2002-03 | Epidermal Growth Factor (EGF) in the Ovary of Zebrafish - How is It Related to the Ovarian Activin System in Controlling Oocyte Development? (CU02258)<br>✍ GE Wei                          | 2003-04 | Biogenesis of the Compound Protein Storage Vacuole (CU03307)<br>✍ JIANG Liwen  |
| 2003-04 | Signal Transduction Mechanism of Gonadotropin Inhibition of Activin $\beta$ B Expression in the Zebrafish Ovary (BL03676)<br>✍ GE Wei   | 2001-02 | Identification and Characterization of Genes Differentially Expressed in Dikaryotic Mycelium of Shiitake Mushroom <i>Lentinula Edodes</i> by cDNA Microarray Hybridization (BL01147)<br>✍ KWAN Hoi Shan            |
| 2001-02 | Sorting of Proteins to the Protein Storage Vacuole in Plant Cells (BL01156)<br>✍ JIANG Liwen • SUN Sai Ming Samuel  | 2002-03 | Molecular Authentication of Traditional Chinese Medicinal Plants (BL02977)<br>✍ KWAN Hoi Shan  |
| 2002-03 | Molecular Characterization of Plant Prevacuolar Compartments (CU02260)<br>✍ JIANG Liwen   | 2003-04 | Identification of Genes Related to Selected Agronomic Traits of Shiitake Mushroom (BL03770)<br>✍ KWAN Hoi Shan   |
| 2002-03 | Molecular Mechanism of Plant Prevacuolar Compartments (BL02622)   | 2002-03 | Gene Regulation in the Signal Transduction Pathways of Broad-Spectrum Bacterial Blight Resistance Loci in Rice (CU02273)   |

- ✉ LAM Hon Ming • LING Zhong Zhuan\* • ZHANG Qi\* • ZHAO Kai Jun\*
- 2003-04 Interaction between NaCl Stress and P Metabolism in Soybean (BL03467)  
✉ LAM Hon Ming
- 2002-03 In Vitro and In Vivo Anticancer Studies of Novel Polyunsaturated Fatty Acids (DHA, EPA) Purified and Characterized from Several Enriched Microalgae (CU02261)  
✉ OOI Vincent Eng Choon • CHEN Feng Steven\* • CHEUNG Chi Keung Peter • CHIU Chi Ming Lawrence
- 2003-04 Molecular Cloning of cDNA Encoding a Novel Potent Antiviral Protein Isolated from the Chinese Medicinal Herb and Its Transgenic Expression in Plants (CU03324)  
✉ OOI Vincent Eng Choon • CHIU Chi Ming Lawrence • OOI Shiou Mei Linda • SUN Sai Ming Samuel
- 2002-03 Nursery Functions of Mangrove Habitats for Marine Fishes (BL02478)  
✉ WONG Chong Kim
- 2003-04 Diets and Trophic Guild of Larval and Juvenile Marine Fishes in Mangrove Habitats in Hong Kong (BL03847)  
✉ WONG Chong Kim
- 2003-04 Provision of Services on Water Quality Monitoring in Marine Parks, Marine Reserve and Other Ecological Significant Areas (BL03593)  
✉ WONG Chong Kim • CHU LM
- 2002-03 A Comparative Study on the Application of Prolonged-Photochemical and Integrated Photochemical-Biological Processes to Degrade and Detoxify Polychlorinated-Dibenzo-Dioxins/Furans in Contaminated Sediments (BL02775)  
✉ WONG Po Keung
- 2003-04 Integrated Photochemical-Biological Treatment of Dye-Containing Effluent of Textile and Dyeing Industry (CU03325)  
✉ WONG Po Keung • HU Chun\* • YU Jimmy C. (Chemistry)
- 2003-04 Adsorption of Di(2-ethylhexyl)phthalate by Spent Shrimp Shell (BL03994)  
✉ WONG Po Keung
- 1995-96 A Study of the Nutritional Quality and Potential Food Use of Some Underutilized Legumes (BL95043)  
✉ WONG Yum Shing
- 2002-03 Isolation and Characterization of Flavonoid Antioxidants in Vigna sinensis Seeds (CU02263)  
✉ WONG Yum Shing • CHUNG Hau Yin
- 2002-03 Study on the Biological Activities of Narciclasine (BL02437)  
✉ WONG Yum Shing
- 2003-04 Anti-Proliferative Effects of Selected Flavonoids (BL03842)

- ✍ WONG Yum Shing
- 2001-02 Stimulation of Glucose-6-Phosphate Dehydrogenase Activity in Sea Bream: Metabolic Significance and Potential Applications (BL01146)  
✍ WOO Norman Ying Shiu
- 2002-03 Growth Hormone and Insulin-Like Growth Factor-I as Anti-Apoptotic Factors via Modulated HSP70 Expression in Seabream (CU02264)  
✍ WOO Norman Ying Shiu
- 2002-03 Effects of Steroid Hormones on Seabream Macrophages (BL02640)  
✍ WOO Norman Ying Shiu • NG Tzi Bun (Biochemistry)
- 2003-04 Role of Aquaporin Water Channels in the Osmoregulatory Strategy of the Euryhaline Marine Teleost Sparus Sarba (CU03318)
- ✍ WOO Norman Ying Shiu
- 2003-04 Validation of an In vitro System for Assessing the Effects of Mitogenic Hormones on Stress Protein Expression (BL03484)  
✍ WOO Norman Ying Shiu • DEANE Eddie Edward
- 2003-04 Centre for Marine Environmental Research and Innovative Technology - Establishment of Biochemical, Endocrinological and Molecular Markers for Exposure to Xenobiotics and Red Tide Toxins in Fish (BL03544)  
✍ WOO Norman Ying Shiu • AU Doris W T\* • WONG Christopher K C\*

## RESEARCH PROJECTS

---

### Activation of Carbon-Carbon Bonds of Carbonyls by Metalloporphyrins

✍ CHAN Kin Shing

☐ 1 January 2005

❖ Research Grants Council (Earmarked Grants)

Activation of carbon-carbon bonds, especially aliphatic ones, by transition metal complexes is a fundamentally and industrially important chemical process. The intermolecular activation of aliphatic and non-strained carbon-carbon bonds in homogeneous media by transition metal complexes has been seldom reported. Study of this process will deepen our understanding of the interaction of carbon-carbon bonds with transition metal complexes. The activation of aliphatic bond in carbonyl compounds are related to environmental chemistry. As a result, development or improvement of industrially important processes such as oil reforming, hydrocarbon cracking and polymer depolymerization will be benefited.

(CU04001)

### Supercritical Fluid Extraction of Natural Products with Industrial Applications

✍ CHAN Man Chor

☐ 1 April 2005

❖ CUHK Research Committee Funding (Direct Grants)

Research proposed here aims at developing the supercritical fluid extraction (SFE) technology using CO<sub>2</sub> in the production of two important molecules in

natural products, namely, artemisinin and lycopene. Comparing to the conventional solvent extraction techniques such as Soxhlet and ultrasonic extraction, SFE presents a number of advantages such as (1) minimizing liquid waste generation, (2) easy separation of extraction products, and (3) fast extraction rate. However, the application of SFE in industries has been limited to only a few products due to the fact that the transfer of results obtained in research laboratories to the production lines in factories is in most cases unsuccessful as a result of the great scaling factor between the extractors used in research laboratories (on the milliliter level) and those used in factories (on the thousands of liter level). In addressing this issue, we plan to use an SFE machine at the mini-factory scale for this study. The technique of uniform design will be used to effectively reduce the number of experiments required for obtaining the optimized extraction conditions. If successful, not only the production costs of these compounds will be significantly lowered but also a general and cost-effective approach to optimizing the SFE conditions will be developed. We have no doubt that there are unforeseeable difficulties at this stage and this is by no means a short-term project. We plan to initiate the work with presently available instruments to test some crucial points and obtain some preliminary results so that further funding from outside agency can be requested in the future.

(PS04428)

### Dendritic Necklaces: An Investigation of the Nature of the Dendritic Beads and Linker Groups on the Polymerization Efficiency

✍ CHOW Hak Fun

☐ 1 January 2005

❖ Research Grants Council (Earmarked Grants)

The preparation of highly specialized polymers has always been one of the important goals in polymer research. Among the various types of specialty polymers, those possess some degree of structural regularity and of nanoscopic size are particularly useful candidates for nanotechnology applications. Hyperbranched dendrimer molecules have long been known for their highly organized internal architecture and can be synthetically tailored to possess functional groups that can be used for specific applications. It is therefore logical to use them as simple building blocks towards the construction of ordered dendritic network systems. This project is an extension of a completed one proposed by us several years ago. In the previous project, we demonstrated that a new class of dendritic network, also named dendritic necklaces due to their structural similarity to un-tied necklaces, could be conveniently prepared by a new construction strategy. The result of this work was published in a prestigious journal and was considered a very important development in this research area by the referees. In this new proposal we wish to capitalize on our initial findings and to thoroughly examine the scope of this new synthetic strategy by varying the structures of the dendritic monomers and the polymerization/co - polymerization conditions.

(CU04004)

---

**Structure and Thermodynamic Studies of Mutagenic Hydantoin Lesions in DNA**

✉ LAM Sik Lok

□ 31 December 2004

❖ Research Grants Council (Earmarked Grants)

Oxidative DNA damage is associated with aging and cancers. 7,8-dihydro-8-oxo-2'-deoxyguanine

(8-oxoG) is one of the major mutagenic lesions resulted from oxidation of guanine base by reactive oxygen species (ROS) or ionizing radiation. Guanidinohydantoin (Gh) and spiroiminodihydantoin (Sp), which are the major oxidized products of 8-oxoG, have been shown to be more mutagenic than 8-oxoG. In addition, these hydantoin lesions have been suggested to be the potent sources of replication errors *in vivo*. The reasons for the observed difference between the transversion mutation frequency of the hydantoin lesions and 8-oxoG remain unclear. In this proposal, high resolution nuclear magnetic resonance (NMR) spectroscopy will be used to determine the solution structures of DNA oligomers containing Gh and Sp lesion base pairs. The solution structure information of the lesion base pairs will enhance the understanding of the mechanistic pathways for oxidative DNA damage and repair. In order to determine if sequence context participates in governing the stabilities of the lesion base pairs, thermodynamic studies of the Gh and Sp lesion base pairs with different types of nearest neighbors will be performed by ultra-violet (UV) absorption spectrophotometry.

(CU04007)

---

**Modeling Catechol Cleavage Reactions with Metal Complexes Containing Tripodal Tridentate Ligands**

✉ LEE Hung Kay

□ 1 February 2005

❖ CUHK Research Committee Funding (Direct Grants)

Bacterial catechol dioxygenases are non-heme iron enzymes which catalyze the oxidative cleavage of catechols to muconic acid (*intradiol* cleavage) or muconic semialdehyde (*extradiol* cleavage). These

enzymes play a vital role in the degradation of aromatic compounds in the biosphere. The *intradiol* dioxygenases contain an Fe(III) active center, whereas the *extradiol* cleaving enzymes require an Fe(II) or Mn(II) ion as a cofactor. Although various synthetic analogues for the active site of the enzymes have been studied, the mechanism of the catechol cleavage reactions, with that of the *extradiol* cleavage in particular, and the factors that determine the regioselectivity of the cleavage positions require a further investigation.

The proposed research work focuses on biomimetic studies of catechol dioxygenases, utilizing Fe(II)-, Fe(III)- and Mn(II)-catecholate complexes supported by the *tripodal tridentate* tris(pyrazolyl)borate ligands [HB(3,5-Me<sub>2</sub>pz)<sub>3</sub>]<sup>-</sup> and [HB(3,4,5-Br<sub>3</sub>pz)<sub>3</sub>]<sup>-</sup>, and the isoelectronic neutral tris(pyrazolyl)methane ligands [HC(3,5-Me<sub>2</sub>pz)<sub>3</sub>] and [HC(3,4,5-Br<sub>3</sub>pz)<sub>3</sub>]. Besides, metal-catecholate complexes containing *tridentate* calix[6]arene-based N<sub>3</sub>-donor ligands will also be investigated. The molecular structure of the catecholate complexes will be determined mainly by X-ray crystallography. The complexes will also be characterized by UV-Vis, EPR and cyclic voltammetry. Their reactivity towards dioxygen will be investigated and the degradation products of the oxygenation reaction will be identified using NMR, HPLC and GCMS analyses. It is our intention to further investigate the mechanisms of the catechol cleavages and to understand the factors that determine the regioselectivity of the cleavage reactions (*i.e.* selectivity for *intradiol* versus *extradiol* cleavages).

(PS04936)

---

### Synthetic and Reactivity Studies of Group 14 Metallavinylidene

✉ LEUNG Wing Por Kevin

□ 1 September 2004

❖ Research Grants Council (Earmarked Grants)

The bisgermavinylidene and 1,3-bimetalacyclobutanes synthesized in our group which were believed to be formed from the unstable intermediate metallavinylidene. Metallavinylidenes are low-valent group 14 compounds containing a :M=C< moiety which can be considered as vinylidene (:C=C<) analogues. They are unstable and have not been isolated and structurally characterized. This project is to develop a viable synthesis of some group 14 metallavinylidenes and study their structures and reactivities. Bisgermavinylidene synthesized is potentially a source of germavinylidene for studying its reactivities. We will explore the reactivities of bisgermavinylidene complex and other metallavinylidenes extensively. The reactivities of metallavinylidene as a Lewis acid, a Lewis base, a two-electron ligands and a electrophile will be investigated. It has been found that bisgermavinylidene can be employed as a carbene transfer reagent in the synthesis of other transition metal carbene complexes. It is anticipated that metallavinylidene can be stabilized by the synthesis of metal-metallavinylidene complexes. This work will explore the synthesis of transition and lanthanide metal-metallavinylidene complexes.

(CU04014)

---

### Size-Dependent Intra-Cluster Reactivity Controlled by Electron Solvation: A Study by AB Initio Modelling

✉ LIU Zhifeng

□ 1 October 2004

❖ Research Grants Council (Earmarked Grants)

The clusters formed by solute and solvent molecules provide an ideal medium to study the energetics, solvation structure, and ultimately, reactivity in a solution environment, which is of fundamental importance to the understanding of wet chemistry and biological processes. Developments in computational methodology and rapid advances in computer power have now made it possible to study, from first principles, the mechanisms of intra-cluster reactions that can be switched on and off according to cluster sizes. Our group have recently discovered in the well-known model system of  $\text{Mg}^+(\text{H}_2\text{O})_n$  that the salvation of the unpaired electron originally on  $\text{Mg}^+$  controls both the activation of O-H bond at  $n > 6$ , and its subsequent deactivation at  $n > 15$ . Based on this insight, it is now imperative to systematically investigate the reactivity, or the lack of it, for a number of clusters containing an unpaired electron, including (1).  $e^-(\text{H}_2\text{O})_n$ ; (2).  $\text{Na}(\text{H}_2\text{O})_n$ ; (3).  $\text{Ca}^+(\text{H}_2\text{O})_n$ ; (4).  $\text{Mg}^+(\text{CH}_3\text{OH})_n$ ; (5).  $\text{Ca}^+(\text{CH}_3\text{OH})_n$  and  $\text{Sr}^+(\text{H}_2\text{O})_n$  for C-O bond activation; and finally, (6). detailed study on the dynamics of electron salvation in  $\text{Mg}^+(\text{H}_2\text{O})_n$ . The expected results shall establish the important links between electron salvation and chemical reactivity.

(CU04016)

---

#### Coordination Chemistry of the Acetylide Dianion

✉ MAK Thomas Chung Wai

☐ 1 August 2004

❖ Research Grants Council (Earmarked Grants)

The acetylide dianion,  $(\text{C}_2)^{2-}$ , is iso-electronic with well-known diatomic ligands such as  $\text{CN}^-$ ,  $\text{CO}$ ,  $\text{N}_2$  and  $\text{NO}^+$ . In our previous project CHUHK 4268/00P, we synthesized a novel series of double/multiple salts of  $\text{Ag}_2\text{C}_2$  in which the  $\text{C}_2$ -dumbbell is invariably embedded inside a  $\text{Ag}_n$

polyhedron with ionic, s, p and/or mixed metal-ligand binding, additional stability being provided by  $d_{10}$ - $d_{10}$  closed-shell attractive interactions between the  $\text{Ag}(\text{I})$  ions, i.e. argentophilicity.

This proposal is concerned with the design, synthesis, and structural characterization of new metal-acetylide compounds in order to explore a broader palette of structural motifs. However, owing to the interplay of many subtle interactions in supramolecular assembly, the construction of  $\text{C}_2@(\text{Ag})_n$  cage motifs and extended structures based on specific acetylide coordination modes is still at a primitive stage and lacks predictability. We wish to conduct a detailed and systematic study using a variety of bridging ligands, co-ligands, and other metals to shed some light on the rational synthesis of metal-acetylide containing systems. Hopefully this will lead to a better understanding of the controlling factors required for the crystal engineering of hybrid organic/inorganic solids for potential application in fields such as catalysis and separation, magnetic and opto-electronic materials, and biomineralization.

(CU04017)

---

#### Development of Efficient and Recyclable Phthalocyanine Catalysts for Photooxidation Reactions

✉ NG Kee Pui Dennis

☐ 1 February 2005

❖ CUHK Research Committee Funding (Direct Grants)

Phthalocyanines are traditional pigments, which were discovered accidentally more than 70 years ago. Due to the intriguing electrical and optical properties, these compounds have found a wide range of applications in materials science including optical recording, electrochromic displays, photovoltaics, and gas



sensing. Although phthalocyanines are also well-known for their use as photosensitizers in photodynamic therapy, in which the cytotoxic singlet oxygen is generated, surprisingly, the use of these compounds as photooxidation catalysts in organic synthesis remains little studied. This proposal seeks to secure fund to develop efficient phthalocyanine-based catalysts for various photooxidation reactions. Special emphasis will be placed on environmentally benign and recyclable systems. To this end, two approaches will be explored including (i) the use of polymeric phthalocyanines to facilitate the recycling of the catalysts and (ii) the incorporation of ionic tags to phthalocyanines, allowing the catalytic reactions to be performed in ionic liquids, which represent a new class of “green” solvents. The proposed works involve design and synthesis of phthalocyanine-based photocatalysts, study of their photophysical properties, and evaluation of their catalytic efficiency and recyclability toward the synthetically useful ene and [4+2] cycloaddition reactions.  
(PS04398)

---

#### **Total Syntheses of Anticancer Agents Simalikalactone D and Quassimarin: the Epilogue**

- ✉ SHING Kung Ming Tony
- ☐ 1 December 2004
- ❖ CUHK Research Committee Funding (Direct Grants)

The quassinoids constitute a large and constantly expanding family of terpenoid bitter principles found in *Simaroubaceae* of pantropical distribution. The discovery of a wide spectrum of biological properties of the quassinoids has enormously increased interests of synthetic organic chemists in recent years. Among the quassinoids, simalikalactone D and

quassimarin are of considerable interest because they are cytotoxic and display potent activity *in vivo* against the P-388 lymphocytic leukemia in mice (PS). Recent findings have indicated that simalikalactone D and quassimarin possess marked differential solid tumour selectivity. As a continuation of our synthetic endeavour on the construction of quassinoids, this research programme proposes to complete the syntheses of optically active simalikalactone D and quassimarin as cancer chemopreventive as well as cancer chemotherapeutic agents.  
(PS04349)

---

#### **Chiral Metal Complexes as Catalysts and Building Blocks of Molecular Scaffolds**

- ✉ WONG Nai Ching Henry • WU Chi • XIE Zuowei • HOU Xue-long\* • CHE Chi-ming\* • WONG Man-kin\* • YU Wing-yiu\*
- ☐ 1 September 2004
- ❖ CAS-Croucher Funding Scheme for Joint Laboratories

This is a joint project between Shanghai Institute of Organic Chemistry and The University of Hong Kong. The physical location of the Shanghai-Hong Kong Joint Laboratory in Chemical Synthesis is in the Shanghai Institute of Organic chemistry. For this reason, there is no research activities in Hong Kong. The main objectives of this project is to synthesize and to study various metal complexes for asymmetric synthesis, as chiral building blocks, and as probes for biological reactions.  
(PS04972)

---

#### **Reexamination of Slow Dynamics of Semidilute Polymer Solutions**

✉ WU Chi

□ 31 December 2004

❖ Research Grants Council (Earmarked Grants)

In semidilute solutions, polymer chains are overlapped with each other. The dynamics of such solutions is an old, but very important, problem. It has been generally accepted that there exist two kinds of chain movements; namely, the fast cooperative diffusion of the chain segments between two neighboring entanglement points and the slow chain reptation in the maze of other chains. However, some of previous dynamic light-scattering studies showed that there also existed an additional slow relaxation. Our recent preliminary results indicated that such a slow relaxation is not necessarily related to the existence of real clusters (inter-chain association), but due to large spatial density fluctuation. In this study, we propose to reexamine 1) whether such an additional slow relaxation is universal; 2) its nature; and 3) under which condition it appears if it is not universal. The notching point here is that we will use reversible chain-end coupling to in-situ alternate the chain length and induce a dilute-to-semidilute-to-gel transition so that we can study the effect of chain length, conformation, polydispersity, and crosslinking on the chain dynamic. This fundamental research will provide a better understanding of the chain dynamics not only in semidilute solution, but also during the sol-gel transition.

(CU04025)

---

**Linked Carborane-(Hetero) Cyclics Compounds and Their Applications in Organometallic Chemistry**

✉ XIE Zuwei

□ 1 January 2005

❖ CUHK Research Committee Funding (Direct Grants)

Ligands are an essential part of coordination/organometallic compounds. They impose a dominant control over both the chemical and physical properties of the resultant complexes. Therefore, it comes as no surprise that ligand design has become a central theme in the development of the chemistry of coordination/organometallic compounds, particularly in their roles as catalysts for asymmetric synthesis and olefin polymerization. In recent decades, various types of ligands have been synthesized for different purposes, among which the cyclopentadienyl and carboranyl groups stand out in the foreground. We have developed a methodology to link these two moieties together to examine the synergistic effects derivable from this novel system. We propose in this project to expand this idea to include heterocycles with or without chiral substituents and to use various kinds of linkages. These versatile ligand systems are expected to find many applications in organometallic/catalysis chemistry. Systematic investigation on this chemistry will allow us to study the substituent and linkage effects on the chemical properties of the resulting metal complexes and structure/reactivity relationships, which would certainly help us to design better ligands for chemical transformations.

(PS04678)

---

**Highly Dispersed Noble Metal Nanoclusters in Mesoporous Titanium Dioxide**

✉ YU Jimmy C.

□ 1 September 2004

❖ Research Grants Council (Earmarked Grants)

Photocatalytic oxidation is a very attractive pollution treatment method. We have demonstrated successfully the degradation of many persistent pollutants using this technique. Mesoporous photocatalysts are very attractive as they provide a large surface area for reactions to occur. Various porous TiO<sub>2</sub> -based catalysts have been prepared, and they exhibit improved photocatalytic activity.

Coupling of noble metals to mesoporous titanium dioxide can make the photocatalyst even more effective because more reaction pathways become possible. However, the dispersion of nanosized metal particles onto TiO<sub>2</sub> is not an easy task. We here propose a new approach for the uniform deposition of noble metals into a highly ordered mesoporous TiO<sub>2</sub> network. This is done by the clever utilization of sonochemical and photochemical processes. The proposed method avoids the problem of metal aggregation and it does not require tedious surface modification. The effectiveness of the resulting mesoporous noble metal/TiO<sub>2</sub> materials for the degradation of pollutants and disinfection will be investigated.

(CU04029)

---

**Please refer to previous issues of this publication for more details of the following ongoing research at the department:**

Edition      Title/Investigators

2003-04      Study of Cross-Stranded Hydrogen Bonds in DNA (CU03001)

✉ AU-YEUNG Chik Fun Steve

1994-95      Asymmetric Catalysis by Metal Complexes of Chiral Pyridyl Phenols and Their Derivatives (PS94010)

✉ CHAN Kin Shing

2001-02      1,2 Rearrangements of Beta-Aminoalkyl Rhodium Porphyrins (PS01251)

✉ CHAN Kin Shing

2001-02      Catalytic Asymmetric Hydrogenation, Transfer Hydrogenation and Suzuki Cross Coupling Reactions (AoE Scheme - Institute of Molecular Technology for Drug Discovery & Synthesis) (PS01305)

✉ CHAN Kin Shing

2003-04      Activation of Carbon-Carbon Bonds of Nitriles by Metalloporphyrins (CU03002)

✉ CHAN Kin Shing

2000-01      High-resolution Spectroscopy of CH<sub>2</sub><sup>+</sup> and NH<sub>2</sub><sup>+</sup>: The Study of Rovibronic Interactions of Quasilinear Molecules (CU00272)

✉ CHAN Man Chor

2001-02      Double Resonance Spectroscopy of Solid Hydrogen: Studies of Vibrational Relaxation (PS01258)

✉ CHAN Man Chor

2002-03      Concentration-Modulated Cavity-Enhanced Absorption Spectroscopy in Gaseous Plasmas (PS02864)

✉ CHAN Man Chor

2003-04      Spectroscopic Study of Molecules in Very Strong DC Electric Fields: An Attempt at Controlling Molecular Dynamics (CU03003)

✉ CHAN Man Chor

2000-01	Dissociation of Large Ions in a Fourier-transform Ion-Cyclotron-Resonance Mass Spectrometer (CU00274) ✉ CHAN Tak Wah Dominic	2002-03	Base Pair Selectivity of Low-Fidelity DNA Polymerases - Structural and Dynamics Perspectives (CU02047) ✉ LAM Sik Lok
2003-04	Exploring Electron Capture as a Novel Dissociation Technique in Tandem Mass Spectrometry of Biomolecules (CU03006) ✉ CHAN Tak Wah Dominic	2003-04	Investigation of Nucleic Acid Binding Properties of the HPV E6 Oncogenic Protein (PS03762) ✉ LAM Sik Lok • BURGER Alain* • KIEFFER Bruno* • TRAVE Gilles*
2001-02	Synthesis and Properties of a Dendritic Analog of Poly(olefins) (PS01249) ✉ CHOW Hak Fun	2003-04	Structures and Dynamics of Catalytic Deoxyribozymes (PS03370) ✉ LAM Sik Lok
2001-02	Asymmetric Synthesis Using Chiral Dendritic Catalysts (AoE Scheme - Institute of Molecular Technology for Drug Discovery & Synthesis) (PS01402) ✉ CHOW Hak Fun	2001-02	Synthetic and Structural Studies of Lanthanide Metal Amides (PS01946) ✉ LEE Hung Kay
2002-03	Self Assembling Properties of 1, 3, 5-Triaminobenzene Derivatives (PS02667) ✉ CHOW Hak Fun	2002-03	Group 4 Metal Chemistry Involving Amides and Amidinates (PS02783) ✉ LEE Hung Kay
2003-04	Amino Acid-Based Organic Gelators: Design, Synthesis and Structural Optimization (PS03429) ✉ CHOW Hak Fun	2003-04	Amides of Low-Valent Iron, Cobalt, and Nickel: Syntheses, Structure, and Reactivities (PS03425) ✉ LEE Hung Kay
2001-02	Structures and Dynamics of Mismatches in Trinucleotide Repeats (PS01255) ✉ LAM Sik Lok	1990-91	Synthesis of Novel Transition-Metal Alkyls (BP90039) ✉ LEUNG Wing Por Kevin
		1990-91	Synthesis of Organometallic Compounds of Alkali Metals (BP90040) ✉ LEUNG Wing Por Kevin
		2002-03	Metal Phosphoranimine Complexes; Synthesis, Structure and Reactivity (CU02023)

	✍ LEUNG Wing Por Kevin	1989-90	Metal Coordination by Betaines (BP88025)	
2003-04	Synthesis of Lithium Complexes from a Multidentate Iminophosphoranyl Ligand (PS03328)		✍ MAK Thomas Chung Wai	
	✍ LEUNG Wing Por Kevin	2000-01	Studies on the Coordination Chemistry of Acetylenediide and Pseudohalide Anions (CU00268)	
2000-01	Gaussian-3 Study on the Structures, Reactions, and Energetics of Some Interesting Chemical Systems (CU00275)		✍ MAK Thomas Chung Wai	
	✍ LI Wai Kee	2003-04	Host Network Assembly and Stabilization of Elusive Species (CU03020)	
2000-01	Theoretical Study on Solvation Dynamics and Intracuster Reactions for $Al^+(H_2O)_n$ Ion Clusters (CU00276)		✍ MAK Thomas Chung Wai	
	✍ LIU Zhifeng • TSE John S.*	2002-03	Conjugation of Phthalocyanines with Biodegradable Polymers, Development of Efficient Delivery and Release Systems for Phthalocyanine-Based Photosensitizers in Photodynamic Therapy (PS02686)	
2001-02	Computational Studies on the Adsorption and Reaction of Small Molecules on Arrays of Carbon Nanotubes (PS01252)		✍ NG Kee Pui Dennis • XUE Jinping*	
	✍ LIU Zhifeng • GONG Xin Gao*			
2002-03	Exploring Mechanisms for the Thermal Dissociation and Desorption of Small Molecules adsorbed on Surfaces from First Principles (CU02022)	2002-03	Glycoconjugated Phthalocyanines – A Novel Class of Photosensitizers for Photodynamic Therapy (PS02342)	
	✍ LIU Zhifeng		✍ NG Kee Pui Dennis	
2003-04	Ab Initio Studies on the Clusters of Hydrated Sulfate and Oxalate Anions $[SO_4^{2-}(H_2O)_n]$ and $[C_2O_4^{2-}(H_2O)_n]$ (CU03018)	2003-04	Synthetic Studies of Amphiphilic Phthalocyanines Bearing Cationic Moieties (CU03021)	
	✍ LIU Zhifeng		✍ NG Kee Pui Dennis	
1989-90	X-Ray Analysis of Crystal Structures (BP72001)	2003-04	Pseudo-Aminodisaccharides: Syntheses and Evaluation as Glycosidase Inhibitors (PS03677)	
	✍ MAK Thomas Chung Wai		✍ SHING Kung Ming Tony	

1989-90	Synthesis of Novel Aromatic Compounds (BP83001) ✉ WONG Nai Ching Henry	2002-03	The Chemistry of Novel Carbons-Adjacent Carborane Anions of C <sub>2</sub> B <sub>10</sub> System (CU02026) ✉ XIE Zuowei
2000-01	Synthesis of Compounds by Solution Phase Chemistry (PS20007) ✉ WONG Nai Ching Henry	2002-03	Novel Catalysts for Polymerization of Olefins and Polar Monomers (PS02757) ✉ XIE Zuowei • OKUDA Jun*
2001-02	Biomimetic Total Synthesis of Novel Diterpenes from Liverwort Pallavicinia subciliata (PS01250) ✉ WONG Nai Ching Henry	2002-03	Novel Catalysts for C-C/C=C Bond-Forming Reactions and Fine Chemistry (PS02866) ✉ XIE Zuowei • Pierre H DIXNEUF*
2001-02	The Mesoglobular Phase of Dilute Heteropolymer Solutions (PS01257) ✉ WU Chi	2003-04	The Chemistry of a New Class of Early Transition Metal Carborane Complexes Bearing ansa-Carborane-Cyclopentadienyl Ligands (CU03031) ✉ XIE Zuowei
2002-03	Controllable and Reversible Aggregation of Soft Particles in Dispersion (CU02025) ✉ WU Chi	2003-04	Multi-Sandwich Metallocarborane Oligomers and Polymers (PS03340) ✉ XIE Zuowei
2003-04	The Folding of Individual Copolymer Chains in Dilute Solution (CU03029) ✉ WU Chi	2001-02	Development of Advanced Photocatalytic Nano-Coating Technologies for Environmental and Health Industries (PS01871) ✉ YU Jimmy C. • WONG Po Keung (Biology)
2003-04	Preparation of Multi-Block Copolymers by Self-Assembly Assisted Polymerization (SAAP) (PS03610) ✉ WU Chi	2002-03	Sonochemical Preparation of Mesoporous Metal Oxide Catalysts for Environmental Applications (CU02027) ✉ YU Jimmy C.
2001-02	A New Class of Metallocarboranes Incorporating the n <sup>7</sup> -Carboranyl Ligand (PS01254) ✉ XIE Zuowei	2001-02	Novel Ruthenium Catalysts for Fine Chemistry (PS01513) ✉ XIE Zuowei • Pierre H DIXNEUF*

2003-04 Semiconductor-Sensitized Photocatalysts  
for Pollution Treatment (PS03747)

✉ YU Jimmy C.

## RESEARCH PROJECTS

---

### Development of a Formulation Based on Ganoderma "Lingzhi (靈芝)" Compound

✉ CHE Chun Tao

☐ 1 September 2004

❖ GreenScience International Limited

This is a contract research to develop a formulation composed of Ganoderma (Lingzhi) and other Chinese medicinal herbal ingredients. The product will be tested for *in vitro* and *in vivo* anti-oxidant effects.

(BL04388)

---

### Protective Effect of a Traditional Chinese Prescription on Liver Damage

✉ CHE Chun Tao

☐ 1 February 2005

❖ CUHK Research Committee Funding (Direct Grants)

This is a continuation of a previous project supported by Direct Grant, entitled "Hepatoprotective effects of Wu-zi-yan-zong-wan formulation". We have obtained preliminary data to modify the traditional formula and to show its anti-oxidant effect in damaged liver. The next phase of study will include the use of an animal model to test for *in vivo* effects. Initially a carbon tetrachloride model will be used. During the course of this study, the establishment of an alcohol-induced liver damage model will be attempted.

(BL04927)

---

### Biological and Chemical Studies of Selected Chinese Anticancer Herbs for Compounds with Anti-Pancreatic Cancer Properties

✉ LIN Zhixiu

☐ 15 January 2005

❖ CUHK Research Committee Funding (Direct Grants)

Pancreatic cancer is one of the most deadly cancers in humans, and is the 10th, 5th and 4th leading cause of cancer mortality in Hong Kong, China and the USA, respectively. Despite recent advances in cancer therapy, it remains recalcitrant to available conventional cancer treatments. Recently, Chinese medicine has been extensively used to treat pancreatic cancer, with some degree of success in various outcome measurements, such as reduction in tumor size, amelioration of symptoms, enhancement of quality of life and prolongation of survival. There are 6 essential alterations in cell physiology for pancreatic carcinogenesis: (1) evasion of apoptosis, (2) sustained angiogenesis, (3) self-sufficiency in growth signals, (4) insensitivity to antigrowth signals, (5) limitless replicative potential, and (6) tissue invasion and metastasis. Among these, apoptosis and angiogenesis, which are closely related, are believed to play a critical role in pancreatic cancer. This proposal is, therefore, intended to study several selected common anticancer Chinese herbs in an attempt to discover molecules that are cytotoxic, apoptotic or anti-angiogenic to pancreatic cancer using the established *in vitro* and *in vivo* pancreatic neoplasm-relevant models. Any positive response will prompt the isolation and chemical elucidation of the active compounds by means of chromatography and spectroscopy. Further mechanistic work will also be carried out on these molecules to illustrate the underlying molecular and biochemical mechanisms



of action. The rational identification and characterization of such bioactive molecules will potentially add new therapeutic dimensions to the presently limited approach in the management of the pancreatic carcinoma.

(BL04580)

---

**Investigation of the Anti-Proliferative Effects of Selected Chinese Herbal Medicine on Cultured HaCat Cells**

✉ LIN Zhixiu • CHE Chun Tao

☐ 15 May 2005

❖ CUHK Research Committee Funding (Direct Grants)

Investigation of the Anti-proliferative Effects of Selected Chinese Herbal Medicine on Cultured HaCat Cells

Psoriasis is a common skin condition that is characterized by hyperproliferation of keratinocytes associated with an inflammatory infiltrate in the epidermis. Currently, pharmacological treatments of psoriasis are mainly based on anti-proliferative, anti-inflammatory, or differentiation modifying activity; however, the clinical results of the commonly available therapeutic agents remain unsatisfactory. Traditional Chinese herbal medicine has been widely used in China to treat psoriasis with varying degree of success. This proposed project aims to evaluate the anti-proliferative potential of selected Chinese herbs that commonly used for psoriasis treatment using a cultured HaCat cell line as an *in vitro* psoriasis-relevant model. Fifty selected Chinese herbs will be extracted with various organic solvents. The anti-proliferative effects of these herbal extracts on HaCat cells will be determined by MTT assay to measure metabolic activity and BrdU incorporation colorimetric assay to measure DNA

synthesis. Further mechanistic studies will also be conducted on those extracts that show significant proliferation-inhibiting effects in order to elucidate whether the observed effects are due to apoptosis or necrosis. The successful implementation of this project is the first step in the quest of identifying leads for potential drug candidates in the treatment of psoriasis.

(BL04971)

---

**Please refer to previous issues of this publication for more details of the following ongoing research at the department:**

<u>Edition</u>	<u>Title/Investigators</u>
2001-02	Cancer Drugs Active against Signal Transduction Targets (BL01514) ✉ CHE Chun Tao
2002-03	Research on Traditional Chinese Medicines and Botanical Dietary Supplements (BL02503) ✉ CHE Chun Tao
2003-04	Collection of Herb Samples and Herbarium Specimens (BL03692) ✉ CHE Chun Tao
2003-04	Anti-Tuberculosis Ingredients from Chinese Medicines (CU03316) ✉ CHE Chun Tao • CHAN Chiu Yeung Raphael (Microbiology) • LAU Bik San Clara (School of Pharmacy) • LIANG Songming

- |  |   |
|--|---|
| <p>2003-04 Research and Laboratory Work on the Chinese Medicinal Herb, Namely Radix Paeoniae Alba (BL03755)</p> <p>✎ CHE Chun Tao • KWAN Hoi Shan (Biology)</p>            | <p>✎ CHE Chun Tao • LEUNG Po Sing (Physiology)</p>  |
| <p>2003-04 Research and Laboratory Work on the Chinese Medicinal Herb, Namely Radix Aucklandiae (BL03844)</p> <p>✎ CHE Chun Tao • KWAN Hoi Shan (Biology)</p>              | <p>2003-04 Research and Laboratory Work on the Chinese Medicinal Herb, Namely Radix Achyranthis Bidentatae (BL03514)</p> <p>✎ CHE Chun Tao • LEUNG Po Sing (Physiology)</p> |
| <p>2003-04 Research and Laboratory Work on the Chinese Medicinal Herb, Namely Radix Paeoniae Rubra (BL03862)</p> <p>✎ CHE Chun Tao • KWAN Hoi Shan (Biology)</p>           | <p>2003-04 Research and Laboratory Work on the Chinese Medicinal Herb, Namely Rhizoma Cimicifugae (BL03772)</p> <p>✎ CHE Chun Tao • KWAN Hoi Shan (Biology)</p>             |
| <p>2003-04 Research and Laboratory Work on the Chinese Medicinal Herb, Namely Rhizoma Coptidis (BL03523)</p> <p>✎ CHE Chun Tao • LEUNG Po Sing (Physiology)</p>            | <p>2003-04 HPLC Analysis of Luo-Han-Guo (Momordica grosvenorii Fruits) (BL03715)</p> <p>✎ LIANG Songming • CHE Chun Tao</p>   |
| <p>2003-04 Research and Laboratory Work on the Chinese Medicinal Herb, Namely Herba Desmodii Styracifolii (BL03626)</p> <p>✎ CHE Chun Tao • LEUNG Po Sing (Physiology)</p> | <p>2003-04 Chinese Herbal Medicine in Asthma: A Randomized, Double-blind, Placebo-Controlled Clinical Trial (BL03836)</p> <p>✎ LIN Zhixiu • CHE Chun Tao • LIN Lin*</p>     |
| <p>2003-04 Research and Laboratory Work on the Chinese Medicinal Herb, Namely Radix Saposhnikoviae (BL03840)</p>   | <p>2003-04 應用分子功能影像技術研究針灸治療心絞痛的原理 (BL03797)</p> <p>✎ 孫外主 SUN Waizhu • JIA Shaoci* • ZHOU Gao* • CUN Wang*</p>   |

## RESEARCH PROJECTS

---

### A Study of Self-Affine Tiles

✉ LAU Ka Sing

☐ 31 December 2004

❖ Research Grants Council (Earmarked Grants)

Tiling is an arrangement of congruent geometric objects (tiles) to fill up the plane or the space with repeated patterns and allows no overlap or gap. The art of designing tiles and patterns is as old as human history. On the other hand a precise mathematical investigation only come up very recently and many parts of the subject remain unexplored. The major motivations of this development is due to the creation of the Penrose tiling in the seventies, the discovery of quasicrystals in solid state sciences in the eighties, and the advance of the diffraction geometry and tomography. Our study on the special class of self-affine tiles further linked up the topic with fractal geometry and wavelet theory.

Our long term goal is to get a better understanding of this fascinating, yet unexplored area. We will employ algebraic, topological and analytic techniques for the investigation. The results should have potential impact in image processing due to the wavelet theory, and on the other hand, in the solid state physics, quasicrystal materials and crystallography.

(CU04008)

---

### Regularity, Constraint Qualifications, the Strong CHIP and Jameson

✉ NG Kung Fu

☐ 1 October 2004

❖ Research Grants Council (Earmarked Grants)

Consider a collection  $\{C_i: i \in I\}$  of closed convex sets in a Banach space  $X$  with nonempty intersection. The regularity referred to in the title means that when points in  $X$  come near to each  $C_i$  then they come near to the intersection. One quantitative version to reflect this phenomenon is the “linear regularity” of Bauschke et al. The main purpose of the present project is to study this property in relation to other fundamental notions in approximation theory and optimization. These include: the strong conical hull intersection property (the strong CHIP for short) of Deutsch, Li and Ward, the (G) property of Jameson, the metric regularity of Robinson as well as the basic constraint qualification (BCQ) and the perturbation property in approximation theory. Applications are to be given to study infinite systems of convex inequalities, and also in approximation problems.

(CU04019)

---

### Analytical Study of Reaction-Diffusion Systems Modeling Block Copolymers

✉ WEI Juncheng

☐ 1 December 2004

❖ Research Grants Council (Earmarked Grants)

Recently there is a huge demand in applied mathematics (math-biology, math-physics) to gain deeper in-sight into various phenomena in pattern formation systems, such as spikes and transition layers and their transients. In this proposal, we study a particular elliptic system which arises from the study of Di-block materials, with particular emphasis on the layered solutions.

A di-block copolymer is a soft condensed material. A di-block copolymer molecule is a linear-chain con-sisting of two sub-chains grafted covalently to

each other. In polymer systems even a weak repulsion between unlike monomers induces a strong repulsion between sub-chains. With a large number of chain molecules in a polymer melt the different type sub-chains tend to segregate below some critical temperature, but as they are chemically bonded in chain molecules, even a complete segregation of sub-chains cannot lead to a macroscopic phase separation. Only a local micro-phase separation occurs: micro-domains rich in A and B are formed. These micro-domains form morphology patterns/phases in a larger scale. The most commonly observed phases are the spherical, cylindrical and lamellar.

The first objective is to show the existence and to analyze the stability of defective lamellar states by bifurcation analysis. The group invariant bifurcation theory will be applied when defects are sought on the concentric ring pattern. The resulting bifurcation solutions will have a wriggled concentric ring pattern. This will explain the phenomenon of symmetry breakdown in exchange for maintaining system stability. The second objective is to construct stable, near periodic cylindrical and spherical phases by a two scale Lyapunov-Schmidt reduction process. The location of the cylinders and spheres in these two patterns will be determined from some reduced finitely dimensional problems. The third objective is to show the existence of nucleation solutions of various types. The last objective is then to apply the techniques developed to study other system with competing interactions, such as charged monolayer problem, bending membrane system, FitzHugh-Nagumo system, Gray-Scott model, etc. The outcome of this project will have direct applications to many other physical systems that exhibit self-organization and pattern formation, such as weakly charged polyelectrolytes solutions,

amphiphile solutions, phase-separating ceramic compounds, photostimulated phase transitions.  
(CU04023)

---

### Theory on Multi-Dimensional Shock Waves

✉ XIN Zhouping

☐ 4 September 2004

❖ Research Grants Council (Earmarked Grants)

One of the fundamental and challenging topics in the mathematical theory of shock waves is the theory of well-posedness and qualitative behavior of the multi-dimensional gas-dynamical shock waves. The better understanding the dynamics and structure of the gas dynamical shock waves is not only important in physical applications in fluid dynamics, but also crucial for the development of the theory for multi-dimensional conservation laws. Compared to the rather satisfactory one-dimensional theory, the multi-dimensional shock wave theory has not been fully developed. Even a local existence of weak solutions to the Compressible Euler equation has not been established for general data yet. This is so partly due to the great complexities and lack of understanding of the evolution of the basic waves. Indeed, such a problem often involves a combination of free-boundary problems, mixed-type equations, degeneracies, strong nonlinearities, and boundary-singularities etc., which are difficult topics in the theory of partial differential equations. The major goal of the present project to analysis some basic physically relevant wave patterns where a lot of experimental data, numerical simulations; and asymptotic results are available, to gain better understanding on the existence, qualitative structure, and dynamics of a shock wave solutions. In particular, it is proposed to investigate the following specific problems: First, we will investigate the

supersonic flow past a solid body, for both stationary and unsteady flows. We will focus on the case that the solid body is either a curved cone or curved sharp wedge where different phenomena appear. The existence of weak solutions with shocks will be investigated. Next, we will study the supersonic flow through a nozzle with variable sections. The main goal is to establish existence and stability of transonic shocks in a nozzle. Finally, the shock reflection problem will also be investigated.

(CU04028)

---

**Mathematical Study of Some Interface Problems**

✉ ZOU Jun • HU Qiya\* • HUANG Jianguo\*

□ 1 January 2005

❖ CUHK Research Committee Funding (Direct Grants)

Interface problems are widely encountered in physical, engineering and industrial applications. For instance, when a diffusive or heat conductive system is occupied by some distinct physical materials or fluids, the physical process can be modeled by an interface diffusion or interface heat conduction equation.

Compared with non-interface problems, interface problems are much more difficult to solve and analyse. One of the major difficulties comes from the discontinuities of coefficients and non-homogeneous interface conditions, which often lead to very low regularities of solutions over the entire physical domain.

Interface problems have been widely studied, but all existing theories did not study or reveal how solutions depend on discontinuous physical parameters and their jumps across interfaces, especially when the jumps are large in magnitude,

which are physically more interesting and mathematically more challenging.

The aim of this project is to establish some new theory to analyse behaviours of solutions to three-dimensional interface problems which can be modeled by interface diffusive equations and interface heat conductive equations.

The novelty of the new theory lies in the explicit appearance of the discontinuous coefficients and their jumps in all the estimates and bounds. The new results may reveal some interesting new physical phenomena, help improve error estimates of existing methods for interface problems and thus construct more efficient numerical methods for interface problem.

(PS04859)

---

**Please refer to previous issues of this publication for more details of the following ongoing research at the department:**

<u>Edition</u>	<u>Title/Investigators</u>
2003-04	Enrichment Programme for Young Mathematics Talents (PS04504) ✉ AU Kwok Keung Thomas • LAU Ka Sing • CHEUNG Ka Luen
2003-04	The Study of Mahler Measure of Knots (PS03969) ✉ AU Kwok Keung Thomas • LIN Xiao Song*
2001-02	New Applications of Iterative Toeplitz Solvers (PS01243) ✉ CHAN Hon Fu Raymond • NG Kwok Po*

2003-04	Wavelet Algorithms for High-Resolution Multichannel Images (CU03005) ✉ CHAN Hon Fu Raymond • CHAN Tony* • SHEN Zuowei*	2002-03	Geometry of CR Manifolds and Applications (CU02033) ✉ LUK Hing Sun • YAU Shing Toung Stephen*
2003-04	Inexact Methods for Inverse Eigenvalue and Singular Value Problems (PS03706) ✉ CHAN Hon Fu Raymond • XU Shu Fang* • MORINI Benedetta*	2002-03	Error Bounds in Mathematical Programming (CU02029) ✉ NG Kung Fu • PANG Jong Shi*
2002-03	The Thin Film Equation: Rupture, Blow-up and Regularity (CU02028) ✉ CHOU Kai Seng	2002-03	Analytic Problems on Riemannian and Kähler Manifolds (CU02032) ✉ TAM Luen Fai
2002-03	Harmonic Analysis of Fractal Measures (CU02030) ✉ LAU Ka Sing	2003-04	Harmonic Maps between Non-Compact Manifolds and Its Applications (CU03024) ✉ WAN Yau Heng Tom
2003-04	On the Laplacians on Fractals and Application to Some Diffusion Models (CU03012) ✉ LAU Ka Sing • ANH Vo Van*	2001-02	Existence and Stability of Multiple Spikes (PS01238) ✉ WEI Juncheng
2003-04	Self-Affine Tiles and Spectral Sets (PS03326) ✉ LAU Ka Sing • HE Xing Gang* • WANG Xiang-Yang* • RAO Hui*	2003-04	Mathematical Analysis of Localized Solutions in Elliptic Systems (CU03025) ✉ WEI Juncheng
2002-03	C*-uniqueness of Locally Compact Groups (PS02862) ✉ LEUNG Chi Wai • NG Chi Keung*	2003-04	Mathematical Analysis of Diblock Copolymer Problem (PS03372) ✉ WEI Juncheng
2000-01	Explicit Construction and Decoding Algorithms of Algebraic-Geometric Codes (CU00295) ✉ LUK Hing Sun • YAU Shing Toung Stephen*	2002-03	Mathematical Theory of Boundary Layers and the Prandtl's System (CU02040) ✉ XIN Zhouping
		2003-04	Detonation Models in Two-Phase Flows: Mathematical Analysis (PS03931)

- ✍ XIN Zhouping • WEI Juncheng • 2003-04 Mathematical and Numerical Study of a  
ROQUEJOFFRE Jean-Michael\* • Nonlinear Kinematic Dynamo Problem  
DOMELEVO Komla\* (CU03034)  
✍ ZOU Jun
- 2002-03 Efficient Numerical Methods for Solving  
Electromagnetic Maxwell's Systems  
(CU02048)  
✍ ZOU Jun

## RESEARCH PROJECTS

---

### A Shell-Model Study of Turbulence: Drag Reduction and Thermal Convection

✉ CHING Shuk Chi Emily

☐ 1 August 2004

❖ Research Grants Council (Earmarked Grants)

Understanding fluid turbulence has practical importance and is challenging from the fundamental point of view. One example is drag reduction, the intriguing observation that the addition of a minute amount of long-chain polymers to turbulent flows can bring about a significant reduction of the friction drag. The phenomenon is well documented but the fundamental mechanism has remained under debate. Another example is turbulent thermal convection in which fluid motion is driven by buoyancy. Shell models are simplified dynamical models that have been used extensively to study turbulent flows without polymers and not driven by buoyancy. Recently, we have successfully constructed a shell model which exhibits drag reduction with characteristics same as those observed in experiments. In this project, we propose to further our shell-model study of drag reduction and turbulent thermal convection. One known effect of the polymers on turbulent flows is that the effective viscosity becomes scale dependent. We shall focus particularly on exploring whether and how drag reduction can be understood in terms of a scale-dependent viscosity. We shall also attempt to understand better the signature of an active scalar and the effect of polymers on the various aspects of turbulent thermal convection.

(CU04003)

---

### Entanglement Production in Interacting Massive Two-Particle Systems

✉ CHU Ming Chung

☐ 31 December 2004

❖ Research Grants Council (Earmarked Grants)

At the core of many intriguing and counter-intuitive behaviours of quantum mechanical systems is the property of quantum entanglement, which exists generally in systems containing two or more particles and puts a sharp distinction between quantum and classical worlds. Quantum entanglement is now recognized as the key to performing tasks exceeding the limits imposed by classical physical laws. We propose a theoretical investigation of entanglement production in massive two-particle systems. In particular, we will address two generic interaction processes: (A) Quantum scattering and (B) Quantum dissociation. We will analyze nonclassical correlations and determine physical parameters to achieve high entanglement. We expect that our research will bring new insights on entanglement production mechanisms as well as the content of quantum information created in the two processes.

(CU04005)

---

### Surface Effects on the Exciton Luminescence of Quasi-1D Semiconductor Nanostructures

✉ HARK Sui Kong

☐ 1 January 2005

❖ CUHK Research Committee Funding (Direct Grants)

New and interesting two dimensional quantum confinement effects are expected to show up in quasi-one-dimensional nanostructures. Such effects



have yet to be unequivocally demonstrated in wide band gap semiconductor nanostructures obtained by the direct growth methods. To see quantum confinement, the characteristic dimension of the nanostructure must be reduced to close to the exciton Bohr radius. At this scale, the surface effects often overwhelm the exciton luminescence. Based on our previous studies, we learned that the optical properties of ZnSe nanowires grown directly by MOCVD do not suffer as strong the influence from the surface as those obtained by other CVD methods. The much stronger band edge luminescence allowed us to observe excitons not previously thought exist. Moreover, we had discovered a simple method to further suppress the residual surface defects. Under above band gap photon irradiation, the band edge luminescence of the nanowires responded differently in gases of N<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub> and Ar. The sensitivity of the response could be enhanced by chemical pretreatments or H-plasma pre-cleaning of their surface. We propose to extend the study to other vapors and to determine, quantitatively, the sensitivity of nanowires. Through an understanding of how the adsorbed vapors may reduce the surface recombination rates, we aim to bring out predominantly exciton luminescence in the very fine nanowires and to study confinement effects on exciton recombinations. A by product of the study is to investigate the feasibility of the nanowires as a re-useable, remote sensing, toxic gas sensors.

(PS04358)

---

### Dynamical Processes in Complex Networks

✉ HUI Pak Ming

□ 1 April 2005

❖ CUHK Research Committee Funding (Direct Grants)

Recent work on the geometrical nature of networks reveal that many real-world networks exhibit properties such as the small-world effect, large clustering coefficient, and scale-free behavior in the degree distribution. This project aims at investigating the properties of dynamical processes in models of real-world complex networks. In particular, we will study the dynamics of models of opinion formation, cluster formation mechanisms, and self-organized phenomena on complex networks. We will focus on the effects of the underlying geometrical properties of networks on the dynamical aspects of these models. The proposed work, therefore, enriches our understanding on the functionality of networks.

(PS04442)

---

### Crystallization Kinetics in Undercooled Liquid Mixture

✉ KUI Hin Wing

□ 1 April 2005

❖ CUHK Research Committee Funding (Direct Grants)

Recently, we discovered that nanostructures can be prepared by a liquid phase spinodal mechanism. In the synthesis process, a homogeneous eutectic alloy melt is undercooled substantially below its liquidus. When the temperature reaches a critical temperature  $T_c$ , it splits into a number of spinodals or subnetworks of compositions different from that of the original homogenous melt. They are still liquids, but undercooled/metastable, with a physical dimension falling in the range of 1 - 300 nanometers. One can imagine the morphology resembles that of a bowl of spaghetti of different colors, with each color representing one kind of spinodal. Since they are metastable, crystallization follows. Upon

crystallization, a nanostructure emerges. A system of metastable liquid spindals is novel to everyone. Up to this moment we are the only group who are able to synthesize this novel structure. We propose in this project to study the crystallization kinetics of these nanometer scale metastable liquid spinodals. This is an interesting topic because during crystallization, a growth front moves forward in a very narrow network (nanometer sized) and in the presence of numerous interfaces. Such crystallization conditions are never realized before. The physical properties of a material are determined by its microstructure. The crystallization behavior of undercooled liquid spinodals will provide us invaluable information about how this class of bulk nanostructures is formed and why their physical properties can be so attractive.

(PS04767)

---

**Case-Based Learning for High School Science Subjects to Support Learning to Learn**

✉ LAU Leo Woon Ming • KWAN Hoi Shan (Biology) • TSANG David Sau Cheuk (Biochemistry) • POON Wai Yin (Statistics) • KONG Siu Kai (Biochemistry) • WONG Yum Shing (Biology) • NG Kee Pui Dennis (Chemistry) • TONG Shiu Sing Dominic

□ 1 August 2004

❖ Quality Education Fund, HKSAR Government

*Goal:* To establish a case-based teaching group to lead and promote case-based learning of science subjects, and to develop a portfolio of interesting and content-rich cases about decision making in locally relevant science issues.

*Objective:* Most students will experience case-based learning and understand the process of decision

making of real-life issues before they graduate from school.

*Targets and Deliverables:* For the development of teaching-cases and teaching/learning processes of these cases, 12 teachers from different high schools covering physics, chemistry and biology will work with 10 members from CUHK as the case-based teaching group (with colleagues from CLEAR of CUHK and Science Education Section, EMB as external advisors).

In the project, >1000 teachers are expected to be trained in workshops and at least half will become comfortable to adopt our case-based method and materials in their own classes (assuming 40 students per class, two groups per term). 24,000 students will learn learning skills and attitudes from our case-learning materials in the first five years with an addition of > 10,000 student beneficiaries per year in subsequent years.

(ED04678)

---

**Experimental Studies of Light Scattering from Optical Cavities Formed by Emulsion Droplets**

✉ LEE Wing Kee

□ 1 April 2005

❖ CUHK Research Committee Funding (Direct Grants)

Light waves trapped inside an optical cavity behave very differently from light waves that we commonly see, except those from lasers. In this proposed research, relationships between shapes and refractive indices of optical cavities formed by emulsion particles and properties of scattered light waves, both elastic and inelastic, from spherical or slightly deformed optical cavities, ranging from millimeter to micrometer in size, will be investigated by several techniques that exploit morphology-dependent

resonances (MDR), fluorescence, and high-order rainbows. MDR refers to, among other things, the phenomenon of enhanced scattered optical signal due to the change in shape and refractive index, etc. of the optical cavities;  $n^{\text{th}}$ -order rainbow refers to rainbow formed after  $n$ -reflections within the optical cavity. (PS04389)

---

### **Multifunctional Nanocomposite Coatings based on Isotropic Metal (Nanocrystalline)/Ceramics (Matrix) Configurations**

- ✉ LI Quan • WONG Sai Peng Joseph (Electronic Engineering) • BELLO Igor\*
- 1 January 2005
- ❖ Research Grants Council (Earmarked Grants)

In the proposed project, we focus our research on a specific type of nanocomposite coatings—high uniaxial magnetocrystalline anisotropy ( $K_u$ ) metallic phases embedded in  $B_4C$  matrix, for ultrahigh-density magnetic recording applications. The proposed nanocomposite film is expected to provide required magnetic, mechanical, and tribological properties required for ultrahigh-density magnetic recording. With this “single layer” multifunctional coating, no additional protective overcoat and lubricant are required. This not only simplifies the deposition process, but also improves the recording areal density by reducing the head-media distance. As the magnetic, mechanical, and tribological properties of these thin coatings strongly depend on engineering specifics of the deposition process as well as various microstructural details, we therefore propose to carry out a comprehensive and systematic study on the deposition, composition/structural characterization, and property analysis of nc-high  $K_u$  materials/ $B_4C$  composite coatings. The study will not only result in novel multifunctional coatings, but also shed light on

the general understanding of the evolution of various properties as a function of microstructural change in nanocomposite coatings employing nc-metal (alloy) /ceramic configuration, which can have applications beyond magnetic recording. (CU04182)

---

### **Phase Separation in the Extended Falicov-Kimball Model**

- ✉ LIN Hai Qing
- 1 September 2004
- ❖ Research Grants Council (Earmarked Grants)

Phase separation is a common phenomena observed in novel materials such as cuprates and colossal magnetoresistance manganites. Although many theoretical investigations were carried out, the existence of phase separation in systems where interactions are purely repulsive such as the Hubbard model is still controversial. On the other hand, the spinless Falicov-Kimball model (itinerant electrons interact with dispersionless ions) was proven to phase separate. To exploit our theoretical capability to address the issue whether phase separation can be induced by strong electron correlation, we propose to systematically study the extended Falicov-Kimball model which bridges the two models by introducing dispersion to ions. We will employ a variety analytic methods (bosonization, unrestricted Hartree-Fock) and numerical techniques (exact diagonalization, quantum Monte Carlo simulation) to determine boundaries of phase separation and investigate effects of Coulomb repulsion, hybridization between electrons and ions, and dimensionality on phase separation. (CU04015)

**Fabrication and Characterization of Nanometer-Sized Sialon Whiskers**

✉ NG Hang Leung Dickon • ONG Hock Chun Daniel

☐ 1 August 2004

❖ Research Grants Council (Earmarked Grants)

Silicon nitride ( $\text{Si}_3\text{N}_4$ ) provides outstanding oxidation resistance at high temperature even above the melting point of steel. Sialon is formed when silicon and nitrogen in  $\text{Si}_3\text{N}_4$  are partially replaced by aluminum and oxygen at high temperature. General form of sialon is  $\text{Si}_{6-z}\text{Al}_z\text{O}_z\text{N}_{8-z}$ . It is a lightweight ceramic having high thermal shock resistance and corrosion resistance. It also has a higher fracture toughness and strength than many of the common advanced ceramics. A new technique is developed to produce high quality sialon at temperature below  $1600^\circ\text{C}$ . The process involves sintering of a powder mixture of Al and  $\text{SiO}_2$  in an  $\text{N}_2$  atmosphere. In this development, we find that 1-D nanometer-sized (nm-sized) whiskers that contain Si, Al, O, and N are formed. Detailed investigation shows that when Al and  $\text{SiO}_2$  are allowed to react at  $1000^\circ\text{C}$  in argon,  $\text{Al}_2\text{O}_3$  nm-sized whiskers are readily formed. Further sintering of these  $\text{Al}_2\text{O}_3$  whiskers at higher temperature in  $\text{N}_2$  can transform them to 1-D nm-sized sialon or alon. The process of producing these structures is a new invention. It is simple, and time, energy and cost effective. We expect the nm-sized sialon or alon to be superior in mechanical properties than  $\text{Al}_2\text{O}_3$  and SiC whiskers. The proposed project aims to: (a) study the mechanism in the formation of nm-sized sialon or alon, (b) determine the crystal structures of the products, (c) characterize the thermal, chemical and mechanical properties of the products, and (d) investigate their potentials in industrial applications.

(CU04233)

**The Effects of Metallic Cap Layer on the Light Emissions of ZnO Films**

✉ ONG Hock Chun Daniel • LAU Leo Woon Ming

☐ 1 October 2004

❖ Research Grants Council (Earmarked Grants)

My research team has established a vigorous research program on studies of ZnO films because ZnO is a versatile semiconductor which can give and sense light emissions in UV and visible spectral regions. Recently we have reported a series of discoveries on using various metal overlayers and relevant surface/interface treatments to drastically alter the luminescence properties of our ZnO films. Currently we are exploring their technology applications in the production of display devices. One of our discoveries, that charge injected into the metal/ ZnO interface stays persistently and largely changes the emission properties, may also find applications in the optical storage industry. In this grant application, we propose to find the underlying physics in these materials behaviors with technological impacts. With our data and knowledge, we hypothesize that the root causes lie with the band structure and the nature of defect states in the near-surface region of the ZnO sample and their changes induced by metal deposition under different conditions. As such, we have designed systematic experiments to clarify them. In preparation, we have already constructed and insitu sample preparation (metal deposition) and characterization chamber where a wide range of spectroscopic and electrical measurements can be conducted.

(CU04020)

---

**Study of Morphological Evolution of Plumes**

✉ XIA Keqing

□ 1 April 2005

❖ CUHK Research Committee Funding (Direct Grants)

In this project, we investigate experimentally how plumes change their morphology from sheets to mushrooms. Specifically, we plan measure the two-dimensional velocity field parallel to the conductive plates of the system, both inside and outside boundary layer region, using transparent sapphire as conductive plate of the cell. The result will provide us a quantitative knowledge about the morphology of thermal plumes and how this morphology changes as the plumes enter the bulk fluid from the boundary layer. We will also determine whether there exist convective rolls or vortices near or inside the boundary layer region. In addition, the study will help us to better understand the dynamics of plume grouping.

For details, please see the attached "Proposal for Direct Grant".  
(PS04404)

---

**First-Principles Approach to Graded-Particle Composites**

✉ YU Kin Wah

□ 1 August 2004

❖ Research Grants Council (Earmarked Grants)

We aim at developing new theories to account for the effects of gradation and dielectric anisotropy on the effective dielectric response of composites. In these composites, the material properties of the particles can vary continuously in space, and have attracted much interest as one of the advanced inhomogeneous

composite materials in various engineering applications. We will focus on the electrokinetic behaviors of graded cells, as well as the nonlinear optical properties of composites of graded particles. These problems have wide practical applications and importance, since identification and analysis of cell populations and (micro) biological particles are essential in diverse applications ranging from cancer research to chemical analysis of environmental pollutants. In addition to biological and environmental applications, electrokinetic phenomena have been suggested as possible mechanisms for nanomotors. The composite of graded particles with dielectric anisotropy possesses a large optical nonlinearity and thus can be a good candidate for nonlinear optical switching devices in photonics and real-time coherent optical processors.

(CU04030)

---

**Nonlinear Optical Properties of Left-Handed Matamaterials with Spatial Gradation and Physical Anisotropy**

✉ YU Kin Wah

□ 1 April 2005

❖ CUHK Research Committee Funding (Direct Grants)

To create tunable metamaterials with negative refractive index and to realize the perfect lens solutions with magnified images, the left-handed metamaterials need to be spatially graded, and even electromagnetic field dependent. This makes electromagnetic propagation properties of the composite metamaterials more complex and diversity. We shall systematically investigate the nonlinear surface waves, optical bistability as well as spatial solitons in nonlinear left-handed metamaterials. Our focus is put on the effects of dielectric (or/and

magnetic) gradation and anisotropy, by developing the effective methods for dealing with the nonlinear properties in left-handed metamaterials. In addition, the nonlinear electromagnetic properties in single-negative (permittivity or permeability negative) metamaterials will be also investigated.

(PS04918)

---

**Please refer to previous issues of this publication for more details of the following ongoing research at the department:**

Edition      Title/Investigators

2002-03      Turbulent Convection: Statistics, Large-Scale Circulating Wind, and Heat Transport (CU02046)

✉ CHING Shuk Chi Emily

2001-02      Dynamics of a Driven Bose-Einstein Condensate: Coherent Structures and Control (PS01237)

✉ CHU Ming Chung • LEUNG Pui Tang

2003-04      Probing the Early Universe with Cosmic Microwave Background Anisotropies (CU03008)

✉ CHU Ming Chung

2003-04      Effects of Phase Transitions on the Expansion of the Universe (PS03999)

✉ CHU Ming Chung

2003-04      Micro-Raman Scattering Studies of Nanostructures (CU03010)

✉ HARK Sui Kong • ZHANG, Shu-ling\*

2001-02      Physics of Adaptive Behaviour in a Population of Competing Agents (PS01241)

✉ HUI Pak Ming

1989-90      Microstructure of Undercooled Ge and Si (BP87003)

✉ KUI Hin Wing

1989-90      The Viscosity of Easy Glass Formers (BP87004)

✉ KUI Hin Wing

2000-01      Mechanical Behavior of Bulk Nanostructured Alloys Synthesized by Rapid Solidification (CU00170)

✉ KUI Hin Wing

2001-02      Thermal Stability of Nanostructured Alloys Prepared by Metastable Liquid Spindol Decomposition and the Search for High-Temperature Nanostructures (MP01184)

✉ KUI Hin Wing

2003-04      Complex Fluoride Crystals of Alkali and Rare-earth Elements for TL Dosimetry and VUV/Deep UV Up-conversion (CU03234)

✉ KUI Hin Wing • LO Yam Kuen Dennis#

2003-04      Incorporating Skills in Metacognition and Case-Based Teaching and Learning into Tertiary Science Education (PS02522)

✉ LAU Leo Woon Ming

2003-04	Establishment of the Product Analysis Laboratory at HKSTP (PS03824) ✉ LAU Leo Woon Ming • YEUNG Peter*	2003-04	Studies of Multi-Band Hubbard Model (PS03833) ✉ LIN Hai Qing • TIAN G S* • GONG C. D.* • WANG H L*
2002-03	Spatial Solutions in Photovoltaic Photorefractive Crystals and Their Interactions (CU02035) ✉ LEE Wing Kee	2001-02	Fabrication and Characterization of Alumina Whiskers and Intermetallics Reinforced Aluminum-Based Metal Matrix Composites (MP01235) ✉ NG Hang Leung Dickon • CHAN Lap Ip Sammy*
2003-04	Quantum Entanglement in Nonclassical Light Sources (CU03016) ✉ LEUNG Pui Tang	2003-04	Fabrication and Characterization of In-Situ Formed Nanometer-Sized Sialon Whiskers (PS03828) ✉ NG Hang Leung Dickon
2003-04	Gravitational Wave Spectra of Neutron Stars (PS03829) ✉ LEUNG Pui Tang	2001-02	The Study of ZnO Doped with Erbium and Its Electroluminescent Applications (EE01648) ✉ ONG Hock Chun Daniel • XU Jianbin (Electronic Engineering) • LUO Enzhou (Electronic Engineering)#
2002-03	Synthesis of Uniform II-VI One Dimensional Nanostructures and Their Growth Mechanism Study (PS02431) ✉ LI Quan	2003-04	The Study of Light Emissions in Polycrystalline Superlattices (PS03697) ✉ ONG Hock Chun Daniel
2003-04	Fabrication, Microstructure and Mechanical Properties of Aligned Nanorod/Matrix Composite Coatings (PS03366) ✉ LI Quan	2003-04	Development of a Course Module "Astronomy" for S4-6 Students in Hong Kong (ED03793) ✉ TONG Shiu Sing Dominic
2002-03	A Parallel Quantum Monte Carlo Study of Magnetic and Electronic Properties of Strongly Correlated Electron Materials (CU02037) ✉ LIN Hai Qing • GUBERNATIS J E*	2003-04	Production of Web-Based Education Kit on Energy Efficiency for Secondary Schools in Hong Kong (ED03348) ✉ LIN Hai Qing • GUBERNATIS J E*

	<p>✍ TONG Shiu Sing Dominic • LEE Kwok San • POON Sai Chiu • PUN Pui Yung Sara • YAM Henry</p>		<p>✍ WONG King Young • LAU Leo Woon Ming • WONG Ka Wai</p>
2003-04	<p>Extraordinary Low-Field Magnetoresistance in Manganite Multilayers (CU03027)</p> <p>✍ WONG Hong Kuen</p>	1993-94	<p>Study of Statistical Nature of Particle Motion in Fluids (BP00101)</p> <p>✍ XIA Keqing</p>
2001-02	<p>Technology and Materials Innovations in Using Electrically Luminous Plastics in the Display Industry (PS01645)</p> <p>✍ WONG King Young • CHOW Hak Fun (Chemistry) • XU Jianbin (Electronic Engineering) • LAU Leo Woon Ming • WONG Sai Peng Joseph (Electronic Engineering) • HARK Sui Kong • ONG Hock Chun Daniel</p>	1994-95	<p>Experimental Studies of Turbulent Convection (PS94012)</p> <p>✍ XIA Keqing</p>
		2003-04	<p>Turbulent Mixing of Active and Passive Scalars in a Convective System (CU03030)</p> <p>✍ XIA Keqing</p>
2003-04	<p>De-Doping of Poly (3,4-ethylene dioxythiophene) in Polymeric Electroluminescence Devices by Indium Diffusion and Its Prevention Using Self-Assembly Monolayers (CU03028)</p>	2002-03	<p>Field-Induced Structural Transformation of Self-Assembled Colloids (PS02545)</p> <p>✍ YU Kin Wah</p>
		2003-04	<p>Electrokinetic Behavior of Suspensions under AC Applied Fields (CU03033)</p> <p>✍ YU Kin Wah</p>



## RESEARCH PROJECTS

---

### Hypothesis Testing and Interval Construction for Epidemiologic Indices under Inverse Sampling

✉ CHAN Ping Shing Ben • TANG Man Lai\* • NG Hon Keung\*

☐ 1 October 2004

❖ Research Grants Council (Earmarked Grants)

Inverse sampling is considered to be the more appropriate sampling scheme than the usual binomial sampling when the subjects arrives sequentially, when the underlying response of interest is acute, and when maximum likelihood estimators of some epidemiological indices. This method has been adopted in various case-control, epidemiological, haematological and environment studies for rare disease. Asymptotic and exact testing procedures for the equivalence/non-inferiority of two populations under inverse sampling will be studied. The restricted maximum likelihood estimators and score-type statistics will be developed. Fully worked applications from haematological, AIDS and case control studies for rare diseases will be illustrated.

(CU04371)

### Multiple Comparisons of Treatments in Clinical Studies with Adaptive Treatment Allocation Schemes

✉ CHEUNG Siu Hung • CHAN Wai Sum\* • HU Fei Fang\*

☐ 1 November 2004

❖ Research Grants Council (Earmarked Grants)

In clinical trials, patients usually arrive sequentially. One of the fundamental concerns is related to treatment allocation. It is of immense interest to determine which treatment should be assigned to the next patient. The general consensus is that a randomization scheme should be adopted to minimize selection bias and provide a solid basis for statistical inference. Adaptive designs are valuable and ethical randomization procedures that formulate treatment allocation as a function of previous responses. The two major objectives of adaptive designs are (1) to develop early stopping rules for clinical studies, so as to reduce the overall required number of patients, (2) to maximize the total number of patients receiving the better treatment.

Among various adaptive designs, the doubly adaptive biased coin designs (DBCD) are renowned clinical randomization procedures that allocate treatments according to an optimal allocation target. In this research, we seek to investigate the DBCD with delayed response. Delayed response is a popular and practical concern in clinical studies when individual patient responses may not be instantaneously available prior to the randomization of the next patient. Another important aspect of this project is to establish treatment allocation rules for multiple treatment scenarios, applicable to popular multiple comparison procedures.

(CU04002)

### Development and Application of Structural Equation Models with Exponential Family, Dichotomous, and Ordered Categorical Variables

✉ LEE Sik Yum

☐ 1 December 2004

❖ CUHK Research Committee Funding (Direct Grants)

Almost all substantive research involves manifest variables (such as income, and price, etc.) and latent variables (such as psychological stress, customers attitude, and personality, etc). It is important to establish an appropriate model to evaluate a series of simultaneous hypotheses about the impacts of latent variables and manifest variables on the other variables. Motivated by many real problems that involve more complicated models and/or data structures, the growth of SEMs has been very rapid. However, methods cannot be used to analyzing the commonly encountered discrete data without the underlying normal distributions, such as those coming from the binomial, and/or Poisson distributions. To increase the potential of applicability of SEMs, and to release their crucial normality assumption, the main objective of this project is to develop efficient statistical methods for a general SEM with exponential family, dichotomous and ordered categorical variables. The newly developed framework will accommodate many useful SEMs in social and psychological research to some important latent variable models in applied statistics that have been widely used in biological and medical research. With the help with recently developed powerful tools in statistical computing, both maximum likelihood and Bayesian approaches will be developed for estimation, local and global influences, hypothesis testing and model comparison. The methodologies developed will be applied for achieving novel contributions in the educational, medical and social sciences.

(PS04823)

---

### **Analysis of Structural Equation Models with Missing Data**

✍ SONG Xinyuan

□ 1 January 2005

❖ CUHK Research Committee Funding (Direct Grants)

Structural equation models (SEMs) are well-recognized as important techniques in behavioral, social and psychological research to explore the relationships among latent and manifest variables in establishing plausible models. In recent years, the growth of SEMs for analyzing fully observed data is very rapid. To cope with the strong demands in various fields, more than a dozen of standard SEMs packages have been developed, and complex SEMs have been established on the basis of more advanced statistical computing methods. Comparatively, contributions to analyze SEMs with missing data are limited.

However, in practice, missing data are frequently encountered. Moreover, a lot of publications indicated that the commonly used "Listwise deletion" approach gives inaccurate and theoretically inferior estimates. More importantly, incorrect treatment of missing data might select a wrong model in the model selection and give very misleading conclusion. Hence, developing sound statistical methods for handling missing data is very important. The objective of this project is to develop statistical methods for analyzing SEMs with missing data. Our development will be based on the maximum likelihood approach, which is well recognized to have optimal statistical properties. Efficient computing algorithms that are based on powerful methods in statistical computing will be developed to obtain the estimates of the parameters, and the observed-data log-likelihood function value for model comparison. In addition to the development in relation to the standard SEM, we will also paid attention to the more complex SEMs and data structures, such as the nonlinear SEMs with ordered categorical outcomes,

etc. The newly developed methodology will significantly enlarge the scope of applicability of SEMs.

(PS04407)

---

### **Efficient Bayesian Implementation of Stochastic Neural Networks and Hierarchical Mixtures of Experts**

✉ WONG Po Shing

☐ 31 December 2002

❖ Research Grants Council (Earmarked Grants)

Hierarchical Mixtures of Experts (HME) and Stochastic Neural Networks (SNN) are pattern recognition tools developed in the disciplines of Machine Learning and Statistics. They divide the input (predictor) space softly into regions. For each region, the expert is defined as a simple (linear) function of the predictors. The output of HME/SNN is a linear combination of the experts' response. The applications of the methodology include pattern recognition, nonlinear time series forecasting, non-parametric regression and speech recognition. To apply HME/SNN for specific problems, several HME/SNN are estimated from the observed data and the one corresponds to the optimal performance measure is chosen for forecasting/prediction. The usual estimation procedure employs Expectation-Maximization (EM) algorithm for maximizing the likelihood function. EM is very handy for HME/SNN because the likelihood decouples into a sum of independent terms if the experts' (neurons') responses are observed. Each term can be optimized individually. Also, the formula of estimating the experts' (neurons') responses jointly from the data is explicitly found. The main concern of using EM is its well-known slow convergence. Long computational time is

unavoidable except only for small data sets. Moreover, since estimating the hidden responses jointly requires heavy computation that is exponentially related to the number of neurons, SNN with 10 neurons is already the upper limit in practice.

Under Bayesian framework, Gibbs Sampling reduces the computational burden significantly. Since Gibbs Sampling is sequential in nature, the hidden responses of the experts are estimated sequentially instead of jointly. That provides a feasible algorithm for large networks. In addition, by putting a prior distribution on the HME/SNN structure, the selection of structure is implicitly performed within the estimation. There is no need to estimate another model. Although there are many advantages in Gibbs Sampling, the slow mixing rate remains an unresolved issue.

The purpose of this project is to develop a fast Bayesian training procedure for medium to large HME and SNN. There are at least 3 significant improvements over the previous Bayesian algorithms. First, to avoid running the time-consuming Metropolis-within-Gibbs steps, we give up the logistic link and use probit function in combining experts. Second, the variance in the probit link is invoked. Instead of setting the variance to be one, an improper prior is imposed. This new technique is known as the parameter expansion. It can be justified by group-theoretic argument that it increases the mixing rate of Gibbs Sampler remarkably. Third, prior distributions for the parameters are chosen such that the model selection is achieved within the estimation process. The selection criterion is implicitly defined which makes the process of implementation much simpler. The output of this project includes 1) several journal articles that provide the details and the theory of the algorithm and, 2) a computer software demonstrates the ease of applying the technology in various areas.

This project will provide a faster tool in training HME/SNN. In particular, it will make HME/SNN much more applicable to those disciplines such as data mining and DNA sequencing in which relatively complicated HME/SNN are built upon large data sets. (EE02845)

2002-03 New Development on Semiparametric Techniques (PS02324)  
 ✍ FAN Jianqing

2002-03 Inference for General Non-Linear Random Effects Models with MCMC Stochastic Approximation (CU02041)  
 ✍ GU Ming Gao

---

**Please refer to previous issues of this publication for more details of the following ongoing research at the department:**

1989-90 Analysis of Continuous and Polytomous Variables (CS85001)  
 ✍ LEE Sik Yum • POON Wai Yin

Edition      Title/Investigators

2002-03 Long-Memory Time Series Analysis for Bursty Data in I/O Performance and Finance (CU02043)  
 ✍ CHAN Ngai Hang

1989-90 Analysis of Incomplete Data (CS88002)  
 ✍ LEE Sik Yum • POON Wai Yin

2003-04 Fractional Black-Scholes Models and Malliavin Calculus (PS03375)  
 ✍ CHAN Ngai Hang

1989-90 Analysis of Structural Equation Models with Correlated Data (CS89006)  
 ✍ LEE Sik Yum • POON Wai Yin

2002-03 Sensitivity Analysis of Family Selection in Multiple Inferences (CU02042)  
 ✍ CHEUNG Siu Hung • WU Ka Ho Eden

2000-01 Influence Diagnostics for Statistical Models with Missing Data and Their Applications to Models with Latent Variables (CU00356)  
 ✍ LEE Sik Yum

2003-04 Multiple Comparisons with a Control in Two-Way Designs with Directional-Mixed Families (PS03403)  
 ✍ CHEUNG Siu Hung

2001-02 Development of a General Model Selection Procedure for Complex Structural Equation Models (SS01346)  
 ✍ LEE Sik Yum

2001-02 Nonparametric Techniques for Multivariate Failure Time Data (PS01262)  
 ✍ FAN Jianqing

2002-03 Development of Statistical Methods and Computer Programs for a Two-Level Nonlinear Structural Equation Model with Fixed Covariates and Binary, Ordinal Categorical and Continuous Variables (CU02243)  
 ✍ LEE Sik Yum

2003-04	Statistical Analyses of Structural Equation Models with Missing Data (CU03243)	✍ LEE Sik Yum	2003-04	A Structural Model of Credit Migrations (CU03026)	✍ WONG Hoi Ying
1989-90	Analysis of Fuzzy Data (CS89005)	✍ POON Wai Yin • LEE Sik Yum • LEUNG Y P*	2003-04	Valuing General American Style Options with Sub-Replication and Replenishing Premium Approach (PS03495)	✍ WONG Hoi Ying
2001-02	Practice and Influence Analysis of Structural Equation Modeling with Ordinal Data (SS01347)	✍ POON Wai Yin	2002-03	Benchmarking Socio-Economic Time Series with Survey Error Modelling (CU02314)	✍ WU Ka Ho Eden • CHEN Zhao Guo* • CHEUNG Siu Hung
2002-03	Analysis of Ranking Data with Structural Equation Modeling (PS02911)	✍ POON Wai Yin			
2003-04	Maximum Likelihood and Influence Analysis of a Unified Model for Ranking Data (CU03242)				

