



**Faculty of
Science**

RESEARCH PROJECTS

Cellular Expression of UDP-glucuronyltransferase and Its Regulation by Aromatic Hydrocarbons

- ✉ HO Wing Shing John
- 1 April 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

UDP-glucuronyltransferase is an activator of several xenobiotics and is induced in the liver upon experimental exposure to aromatic hydrocarbons. Since its regulation is incompletely clarified, its expression and inducibility by 9,10-dimethyl-1,2-benzanthracene are investigated in human hepatocellular carcinoma and hepatoblastoma cell lines. Although some of the genes have been assigned to UDP-glucuronyltransferase, the roles they play in the enzyme expression have yet to be elucidated. An important step toward understanding these roles is defining gene expression profiles by comparing patterns of expression in distinct *in vitro* conditions. This is planned to be accomplished using RT-PCR, RNase protection assays, or Northern blot analysis. Expression of UDP-transferase is studied by Northern blot analysis in hepatic cells at various time points of cultures. Enzyme inducibility is assessed by incubation of cells with 9,10-dimethyl-1,2-benzanthracene. The expression of UDP-transferase messengers will be examined. An *in vitro* expression system coupled with the RT-PCR methodology will be developed as a valuable tool for the identification and characterization of the gene. In addition, a more promising approach for analyzing multiple genes simultaneously is the hybridization of entire cDNA populations to nuclei acid arrays. A method will be adopted for high-throughput analysis of gene expression. The study will provide useful information on genes and the proteins they encode. The application of *in vitro* expression methodology will allow us to identify the gene products and subsequent understanding of function, regulation and its transcriptional control. The methodology will be valuable tools for screening aromatic environmental pollutants for inhibition of transcription and translation. These basic cellular functions are common targets for aromatic compounds. Initial screens may be performed much faster because there is no need for cellular uptake to evaluate the effect of the test compound. The study will have a wide range of applications, including investigating normal biological and disease processes, profiling differential gene expression, and discovering potential therapeutic and diagnostic drug targets. (BL99018)

Identification of Peroxisome Proliferator-activated Receptor- α (PPAR α)-dependent Genes

Involved in Peroxisome Proliferator-induced Hepatomegaly and Hepatocarcinogenesis

- ✉ LEE Sau Tuen Susanna • CHAN Wood Yee (Dept of Anatomy)
- 1 December 1999
- ❖ Research Grants Council (Earmarked Grants)

Peroxisome proliferators (PPs) are a large class of structurally diverse chemicals, which include hypolipidemic (lipid-lowering) drugs clofibrate and Wy-14, 643, plasticizers, herbicides and industrial solvents. In rats and mice exposure to PPs leads to hepatocyte peroxisome proliferation (increase in the number and size of peroxisomes), hepatomegaly (liver enlargement due to both hypertrophy and hyperplasia) and hepatocarcinogenesis (liver cancer). The fact that PPs are very potent rodent hepatocarcinogens is of concern to the chemical and pharmaceutical industries and government agencies because hypolipidemic drugs are still prescribed to humans for prevention of coronary heart disease. Evidence indicates that peroxisome proliferator-activated receptor- α (PPAR α) a nuclear hormone receptor and a ligand-dependent transcription factor, are required in PP-induced peroxisome proliferation, hepatomegaly and hepatocarcinogenesis. However, the underlying mechanisms by which PPAR α mediates these pleiotropic responses are still not clear. It is suggested that the activation of PPAR α by PPs will lead to alter transcription of some gene(s) involved in hepatocyte growth regulation. Identification of such PPAR α -dependent gene(s) may provide insight into some of the mechanisms involved in PP-induced hepatomegaly and hepatocarcinogenesis. The aim of the proposed research is to identify the PPAR α -dependent gene(s) involved in PP-induced hepatomegaly and hepatocarcinogenesis using differential display techniques. Identification of such gene(s) might provide early markers for prediction of tumor development, improvements in new hypolipidemic drug development and human risk assessment from PP exposure. (CU99157)

Studies on the Immunomodulatory and Anti-tumour Activities of Green Tea Catechins

- ✉ LEUNG Kwok Nam • CHEN Zhen Yu
- 1 October 1999
- ❖ Research Grants Council (Earmarked Grants)

There has been an increasing interest in the search of naturally occurring anti-tumour compounds with immunomodulatory properties for experimental and clinical testing. Both epidemiological and animal studies have suggested that consumption of green tea may help to prevent certain cancers in humans and

experimental animals. Although accumulating evidence has shown that green tea contains potentially useful anti-carcinogenic components, nevertheless, the direct anti-tumour properties of green tea components remain poorly understood. Green tea contains about 30% polyphenolic compounds and the most abundant are the flavanols or tea catechins. The proposed research attempts to study the immunomodulatory and anti-tumour effects of green tea catechins and to elucidate the possible mechanisms of such effects. The major objectives of this project are (i) to examine the immunomodulatory activity of green tea catechins on various non-specific and specific immune functions; (ii) to study the effects of purified green tea epicatechin isomers on the proliferation, differentiation and apoptosis of tumour cells; and (iii) to define the possible mechanisms by which green tea catechins can exert their anti-tumour effect *in vitro* and *in vivo*. It is anticipated that the results of this proposed study not only provides valuable insights into the beneficial health-promoting effects of green tea but may also lead to the identification and characterization of naturally-occurring immunomodulators or anti-cancer compounds that are more efficacious and have minimal side effects for the treatment of various immunological and malignant diseases. (CU99160)

Structure-function Relationship Study of M.EcoHK31I, a C5-cytosine Methyltransferase with Two Polypeptides

- ✉ SHAW Pang Chui • LEE Kai Fai*
- ☐ 1 January 2000
- ❖ Research Grants Council (Earmarked Grants)

C5-cytosine methyltransferase (5mC-MTase) is an enzyme that catalyzes the transfer of a methyl-group from S-adenosyl-L-methionine to cytosine residues in the target DNA molecules. In bacteria, 5mC-MTase is used to protect bacterial DNA against self-restriction. Eukaryotic 5mC-MTases, on the other hand, play important roles in the regulation of gene expression, determination of chromatin structure and compartmentalization of DNA. 5mC-MTases in prokaryotes and eukaryotes share ten conserved motifs along the amino acid sequence. Recently, the researchers have discovered a novel *EcoHK31I* methyltransferase from *Escherichia coli* strain HK31 that contains two polypeptides, α and β . Polypeptide β is coded in an alternative reading frame within polypeptide α and the ten conserved motifs are distributed in between them. Both polypeptides α and β are needed for methylation activity. Characterization of this novel system will provide insight on the flexibility of motif organization in this family of proteins and enrich our understanding on protein-protein and protein-DNA interactions. Therefore, the researchers propose to use molecular

and biochemical methods to investigate how the two polypeptides interact between themselves and with the DNA substrate. In the future, they will also attempt to generate crystal structures for this protein and the individual polypeptides. (CU99177)

Protein-protein Interactions of Hepatitis B Virus X Antigen – A Structural Approach

- ✉ WONG Kam Bo
- ☐ 1 March 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Hepatitis B virus (HBV) infection is associated with chronic liver damage and liver cancer. The 3.2kb genome of HBV encodes core antigens, surface antigens, a polymerase and an X antigen (HBx). The biological functions of HBx are not fully understood. It activates transcription of many cellular and viral promoters indirectly by protein-protein interactions. This transactivating activities of HBx may contribute to the development of hepatocellular carcinoma. The studies of protein-protein interactions of HBx and its targets are, therefore, important in a better understanding of the biology of HBV and may help us in the future to devise a better anti-HBV therapy. The researchers aim to use a battery of biochemical and structural techniques to elucidate the structural mechanism of protein-protein interactions of HBx. As a first step towards this goal, they will establish an efficient expression and purification systems for HBx and its target proteins. Multi-dimensional NMR experiments will then be used to study the structure of HBx and its interactions with target proteins. (BL99019)

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>
1997-98	Investigation of Mechanisms of Cholesterol-Lowering Effect of Green Tea Epicatechin Isomers (CU97307) ✉ CHEN Zhen Yu • FONG Wing Ping
1996-97	Monoclonal Antibodies against Polysaccharides in Herbal Medicines: Production and Development of Affinity Chromatography and Immunoassay (CU96315) ✉ CHOY Yuen Min • NG M. H.* • FUNG Kwok Pui (Biochemistry)
1998-99	Healthy Eating Movements (BL98036) ✉ GULDAN Georgia Sue • CHAN, Vivian* • WONG, Christine* •

- TSANG, C. Y. Chester* • FUNG, Y. K. Anne* • MA, Maggie* • HO, S. K. Winnie*
 Cheong David (Biochemistry) • CHAN Wood Yee (Dept of Anatomy)
- 1997-98 Preclinical and Clinical Validation of Fructus Crataegi and Green Tea in Lowering Blood Lipids (BL97006)
 ✎ HO Walter K. K. • CRITCHLEY Julian A J H (Dept of Medicine & Therapeutics) • MARK Tony* • TOMLINSON Brian (Dept of Medicine & Therapeutics) • CHEN Zhen Yu • WONG Nai Ching Henry (Dept of Chemistry) • WAN Chi Cheong David (Biochemistry) • LAM Wai Kei Christopher (Dept of Chemical Pathology) • ZHU Min (School of Pharmacy)#
- 1998-99 Bioactivation and Detoxification of 4-(Methylnitrosamino)-1-(3-Pyridyl)-1-Butanone (BL98007)
 ✎ HO Wing Shing John
- 1998-99 Evaluation of Major Phytochemical Constituents in Radix Pseudostellariae and Glycyrrhizae in Detoxification and Anticancer Activity (BL98028)
 ✎ HO Wing Shing John • KWOK Tim Tak (Biochemistry) • LEE Hung Kay (Dept of Chemistry)
- 1996-97 Use of Developed Gene Knockout Transgenic Mouse Models for Identification, Evaluation, and Define the Mechanisms of Chemical Toxicity and Human Diseases (BL96026)
 ✎ LEE Sau Tuen Susanna • TSANG David Sau Cheuk • WAN Chi
- 1997-98 Production of Transgenic Mice Lacking the Fatty Acid-Activated Receptor: An Animal Model to Study Adipose Cell Differentiation and Obesity (CU97318)
 ✎ LEE Sau Tuen Susanna • CHAN Wood Yee (Dept of Anatomy) • CHEUNG Wing Tai (Biochemistry)
- 1998-99 Isolation of Marker Genes for Prediction of Peroxisome Proliferator Chemical-Induced Hepatocarcinogenesis (BL98009)
 ✎ LEE Sau Tuen Susanna
- 1998-99 Studies on the *In Vitro* Anti-Tumour Activities of Green Tea Epicatechin Isomers (BL98010)
 ✎ LEUNG Kwok Nam
- 1998-99 Screening and Characterisation of Proteins that Interact with Trichosanthin (CU98039)
 ✎ SHAW Pang Chui
- 1998-99 Conservation of Endangered Species Used in Chinese Medicine through Identification by Molecular and Chemical Approaches (BL98032C)
 ✎ SHAW Pang Chui • WANG Jun (Biochemistry) • BUT Pui Hay Paul (Dept of Biology)
- 1998-99 Compilation of IQ Contest Materials (Qs & As) for Publication (ED98024)
 ✎ TSO Wung Wai

RESEARCH OUTPUTS AND PUBLICATIONS

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- <P000803> **Fong, W.P.; W.Y. Mock and T.B. Ng.** "Intrinsic Ribonuclease Activities in Ribonuclease and Ribosome-Inactivating Proteins from the Seeds of Bitter Gourd". *The International Journal of Biochemistry and Cell Biology* vol.32 no.5, pp.571-577. UK, 2000.05.01.
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<P991338>, <P992432>, <P992465>, <P992696>, <P993437>, <P993522>, <P994060>, <P994585>, <P994586>, <P994587>, <P994608>, <P994610>, <P994614>, <P994615>, <P994621>, <P994624>

RESEARCH PROJECTS

Reproductive Ecology of *Sargassum Siliquastrum* in Ping Chau, Hong Kong

- ✉ ANG Put Jr.
- 1 March 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Two populations of the brown alga *Sargassum siliquastrum*, one in water between 5 to 6 m depth, and one in shallower water between 2 to 3 m depth can be found in Lung Luk Shui of Tung Ping Chau, Hong Kong. These two populations appear to exhibit very different phenology and reproductive seasonality. This research monitors the detailed differences in the phenology and reproductive seasonality of these two populations and evaluate differences in resource allocation to growth and reproduction in these two populations as well as environmental factors which may be responsible for these differences.
(BL99021)

The Role of Chloromethane in the Fungal Degradation of Chloro- and Nitroaromatic Environmental Pollutants

- ✉ BUSWELL John Anthony
- 1 March 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Numerous chloro- and nitroaromatic compounds, produced on a large scale for various industrial and agricultural purposes, are classified as priority pollutants and constitute major hazards to biological systems. These compounds are degraded in the biosphere by lignin-degrading white-rot fungi (e.g. *Phanerochaete chrysosporium*) by multistep pathways which involve a key methylation step. Chloromethane, a natural gaseous product produced by these fungi, serves as a general methyl donor in the methylation of a wide range of aromatic compounds similar to several catabolic intermediates produced during the mineralisation of chloro- and nitroaromatics. Therefore, this investigation will examine the role of chloromethane in the formation of methylated intermediates generated during the degradation of selected polychlorinated phenols and nitroaromatics by the fungus, *P. chrysosporium*.
(BL99022)

Novel Anti-herpes Agent from Natural Product

- ✉ BUT Pui Hay Paul • XU Hongxi# • OOI Vincent Eng Choon

- 1 November 1999
- ❖ Research Grants Council (Earmarked Grants)

This project focuses on the chemistry and further characterization of a polysaccharide obtained from *Prunella vulgaris*, effective against herpes simplex viruses (HSV) Significant research results have led to the submission for application of a US Patent (Appl. No. 2,209, 222) by Xu in our research team. The product was very active, with an IC₅₀ of 10 µg/ml, against both HSV-1 (causative agent for disease such as cold sores and keratitis) and HSV-2 (causative agent for genital herpes). The product was also active against acyclovir-resistant HSV. Furthermore, this product apparently works by preventing viral binding/penetration as well as viral replication. This mode of action appears to be completely different from that of acyclovir (the current drug-of-choice for herpes infections). This different mode of action is a tremendous advantage for our product as an alternative or a complement to acyclovir.

The researchers plan to (a) purify the active compound(s) to homogeneity and determine its chemical and biological characteristics, and (b) determine the *in vitro* toxicity of the purified compound. The long-term objective of the research is to develop the product into a new, therapeutically useful anti-herpes drug.

There are tremendous market potentials for the researchers' anti-herpes compound. Approximately 16-35%, 40- 80% and over 90% of the US population are seropositive for, or infected by, HSV-1, HSV-2, and varicella zoster virus, respectively. A self-applicable cream/ointment for cold sores and genital herpes containing their product can potentially find the market in a reasonably short time frame.
(CU99171)

Correlation Between Antitumor Activities and Structural Characteristics of Mushroom Polysaccharides

- ✉ CHEUNG Chi Keung Peter • OOI Vincent Eng Choon • ZHANG Lina*
- 1 October 1999
- ❖ Research Grants Council (Earmarked Grants)

Mushrooms, which are rich in polysaccharides, proteins, minerals and vitamins, have a long history of medicinal usage in the Orient in addition to their nutritional value. Recently, the biological activities of polysaccharides from mushrooms have attracted more and more attention. Chief among the most promising pharmacological activities of mushroom polysaccharides is their antitumor effect. Although antitumor polysaccharides have been reported in a number of mushroom species, the antitumor mechanisms of these polysaccharides in relation to their chemical structures and molecular chain

conformation in aqueous solution remain largely unknown. This is a major impediment to the development and application of mushroom polysaccharides as potential anticancer agents.

This project will try to correlate the structural characteristics and the antitumor activity of the polysaccharides from one or two local Chinese edible mushroom species through purification, structural analysis, study on solution properties and chemical modifications of the mushroom polysaccharides. The researchers anticipate that the result of this proposed project will give us a deeper insight towards understanding the essential structural requirements of mushroom polysaccharides to function as a tumor inhibitor and hence provide the critical steps in the development of novel antitumor mushroom polysaccharides and improvement of existing ones. (CU99161)

The Antioxidative Activity of Some Edible Mushrooms

✉ CHEUNG Chi Keung Peter

□ 1 March 2000

❖ CUHK Research Committee Funding (Direct Grants)

Lipid peroxidation is a major cause of the decrease in the flavor and nutritive value of fat and oil products. This reaction generates very reactive oxygen compounds which in humans are responsible for causing or accelerating chronic disease states such as cardiovascular, neoplastic, inflammatory, and aging. Antioxidants are compounds that inhibit or delay lipid peroxidation. There are two basic categories of antioxidants, namely, synthetic and natural. In recent years the use of synthetic antioxidants has been restricted because of the possibility of their toxic and carcinogenic effects. It has also been realized that compounds derived from lipid peroxidation and their degradation products have harmful effects on biological systems. Furthermore, a number of plant constituents such as flavonoids, flavonols, tannins, etc. have been recognized to have positive effects against the oxygen reactive compounds in biological systems. The aim of this project is to assess the antioxidant activity of some common edible mushrooms widely consumed in Asia. Extracts from the mushroom will be tested for their antioxidative activity by both chemical as well as biological models. It is anticipated that a more in-depth knowledge about the plant food properties can help to discover natural components that can act as antioxidants *in vitro* and *in vivo*. (BL99023)

Assessment of Environmental Safety of Aquaculture Farms Using Biochemical Indicators of Distress

✉ CHU Ka Hou • WOO Norman Ying Shiu • WONG Chong Kim • TAM Pui Fun#

□ 1 October 1999

❖ Asia-Pacific Economic Cooperation Secretariat

Aquaculture is a rapidly expanding industry in many Asia-Pacific countries. In recent years, with increasing pollution of coastal areas, the aquaculture industry is threatened by environmental degradation encountered in many coastal environments. Land-based pollutants can exert both short-term and long-term impacts on aquacultural farms. The Marine Resources Conservation Working Group (MRC) of the Asia-Pacific Economic Cooperation (APEC) plans to initiate a study on assessment of the environmental safety of aquaculture farms using biochemical indicators of distress. This study is crucial for the sustainable development of the aquacultural industry in APEC economies. The present project represents the first phase of this study. The scope of the project includes: (1) to identify and inventory major land-based contaminants in aquacultural farms by collecting data on the levels of contaminants in fish and sediments in three study areas selected as demonstration sites; and (2) to review the use of biochemical indicators of distress in environmental monitoring with a view to recommending a set of appropriate indicators to be used for assessment of the adverse effects of land-based pollutants on aquacultural organisms.

The objectives of the project are: (1) to support the management of coastal zone by determining the effects of land-based pollutants to marine resources; (2) to support the management action of APEC-MRC on coastal waters in relation to exploitation of aquaculture and pollutants cycling; and (3) to support the follow-up actions of APEC Osaka Action Agenda and APEC Action Plan for Sustainability of Marine Environment. (BL99002)

Evolutionary and Population Genetics of Mitten Crabs, *Eriocheir* spp.

✉ CHU Ka Hou • CHAN Tin Yam* • SHEN Qi*

□ 1 October 1999

❖ Research Grants Council (Earmarked Grants)

The Chinese mitten crab *Eriocheir sinensis* is of major importance in fisheries and aquaculture of China. Yet the taxonomy of the genus *Eriocheir* has been problematic. The proposed study aims to elucidate the phylogenetic relationships between *E. sinensis* and other mitten crab taxa by PCR (polymerase chain reaction)-based analyses of nuclear and mitochondrial DNA. The evolutionary genetics of the species will be further studied by investigating the genetic divergence of *E. sinensis* populations, including the introduced populations in

Europe and North America. The study will clarify the pattern of genetic differentiation and speciation of the mitten crabs. Understanding the genetic structure of *E. sinensis* and its related taxa is crucial to sustainable utilization and conservation of this important biological resource. Moreover, the results of the study as well as the molecular techniques and markers developed during the study will be applicable in practical issues of fisheries and aquaculture of the mitten crabs, including stock identification of larvae and adults for fisheries management, monitoring of genetic diversity of cultured stocks, and genetic tagging in stock enhancement and genetic improvement programmes. (CU99162)

Development of a Bioassay System for the Action of Androgenic Hormone in the Mud Crab *Scylla*

✉ CHU Ka Hou

☐ 1 March 2000

❖ CUHK Research Committee Funding (Direct Grants)

Aquaculture of the mud crab *Scylla* spp. is expanding in many Asian countries. Males of *Scylla* attain a bigger size than females, but females with ripe ovaries command a much higher market price in Chinese markets. Thus in different countries either all-male or all-female culture is more profitable than mixed sex culture. Mud crab culture will thus benefit greatly from sex control biotechnology. It is well known that the androgenic hormone secreted by the androgenic gland in the male controls male sexual differentiation in crustaceans. Identification and characterization of the androgenic hormone and subsequent molecular cloning of its gene are essential for the development of sex control technology in mud crab. A major difficulty in the isolation of the hormone is the lack of a bioassay system for its bioactivity. The present study aims to develop a rapid and reliable bioassay for the action of the hormone on female mud crab. Attempts will be made based on inhibition of ovarian development in adult female crabs as well as sex reversal of juvenile female crabs after implantation of androgenic gland or injection of gland extract. This study represents the first step towards the isolation, characterization and cloning of the androgenic hormone in mud crab with the goal to develop commercial monosex crab culture.

(BL99024)

Chemical Characterization and Toxicological Studies of Landfill Leachate

✉ CHU Lee Man

☐ 1 February 2000

❖ CUHK Research Committee Funding (Direct Grants)

Landfill leachate is considered a serious long-term threat of contamination to our environment. With tightened pollution control, the discharge of leachate without any treatment is no longer acceptable. However, landfill leachates are toxic and are not always amenable to biological degradation. Toxicity affects treatment efficiency of conventional biological systems. Consequently, characterization of the chemical properties and toxicological effects of landfill leachates is essential for the understanding of leachate quality and design of treatment facilities. In this present project, the chemical composition of leachates from operating landfills, and restored and unrestored old landfills will be characterized and their genotoxic, cytotoxic and ecotoxic effects assessed using various biochemical or biological toxicity tests. The chemical constituent(s) responsible for the toxicity will be identified. (BL99025)

Origin and Mechanisms of the Formation of the Common Character Impact Volatile and Semi-volatile Flavor Components in Salted-dried Fishes for Nutrition and Food Safety Improvement

✉ CHUNG Hau Yin

☐ 1 December 1999

❖ Research Grants Council (Earmarked Grants)

Among various fish preservation processes, salting and drying of fish is the most common and has a long history. Though public health studies have related the risk of cancer to the consumption of these preserved products, yet consumers in Hong Kong are attracted by the products mainly due to their characteristic flavor rather than their nutrients. There is little information in the scientific literature on the flavor volatile and semi-volatile components of salted-dried fishes nor on the mechanisms of their formations. The present research will provide such information. Furthermore, it is hoped that food scientists will utilize the flavor markers to evaluate and develop modified processes to produce dietary products of Hong Kong and regional importance, with better nutrition and flavor.

(CU99164)

Headspace Analysis of Fermented Soybean Curds

✉ CHUNG Hau Yin

☐ 1 May 2000

❖ CUHK Research Committee Funding (Direct Grants)

Fermented soybean curds (FSCs) are one kind of fermented products prepared from soybeans. They

are commonly used as an ingredient in many Chinese dishes or as a condiment. FSCs can be roughly divided into two types according to their color, namely, the plain or the white ones, and the red ones. The latter requires the addition of red starter containing *Monascus* species to make the product having a reddish color. Both types contain large quantity of alcohols and esters. Other classes of components are also present but with less numbers. Investigations of the aroma in the FSCs mostly relied on high temperature extractions of the samples. It is likely that artifacts could have been produced due to such temperature effects. In the present project, a mild purge-and-trap extraction technique will be used, and the objectives are: (1) to determine the composition of the headspace volatile components in FSCs; and (2) to quantify them. (BL99026)

Molecular Analysis of Different Interferon Alpha Subtypes

- ✉ FUNG Ming Chiu
- 1 April 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Interferon alpha belongs to the type I interferons, which have potent antiviral, immunomodulatory and antiproliferative effects. Interferons have been characterized at both the cellular and molecular levels. Human expresses about fifteen interferon alpha subtypes, while mouse expresses about ten subtypes. Due to the very high homology between the interferon alpha subtypes, some scientists suggested that the multiple interferon alpha subtypes are a series of evolutionary duplications of an original gene. However, recently it was reported that the alpha 8 subtype demonstrated a more potent antiviral effect. Therefore it has been hypothesized that each subtype may have evolved specific functions. Given the high degree of homology between the alpha subtypes, it would be difficult to distinguish at both the protein and nucleic acid level. At the protein level, differentiation of the interferon alpha sub-types by antibodies would require highly specific monoclonal antibodies for each sub-type, which at present are not available. The researcher therefore proposed to develop a molecular method to distinguish the mRNAs of different interferon alpha subtypes. With this method, we are going to measure the expression level of different subtypes in response to a particular inducer such as virus, parasite or immunomodulators. This study may lead to a better understanding of the functions of each interferon alpha subtypes. (BL99009)

Transcriptional Regulation of Gonadotropin-I & II (GTH-I & II) b Genes in the Goldfish by Activin - Functional Analysis of Cis-acting Elements that

Mediate Activin Stimulation of GTH-Ib & Inhibition of GTH-IIb Expression in the Goldfish, *Carassius auratus*

- ✉ GE Wei
- 31 December 1999
- ❖ Research Grants Council (Earmarked Grants)

Activin is an important dimeric protein growth factor implicated in a vast array of physiological and developmental processes, among which its regulation of pituitary follicle-stimulating hormone (FSH) biosynthesis and secretion has been the most extensively studied. Using goldfish as a model, the researchers have recently demonstrated that recombinant goldfish activin B stimulates gonadotropin-I β (GTH - I β) but surprisingly suppresses gonadotropin-II β (GTH - II β) gene expression, a phenomenon that has never been reported in any other vertebrates. This makes goldfish a very interesting and attractive model to study the mechanisms by which activin differentially regulates the two gonadotropins. This project is a continuation of their current research, and the researchers propose to clone the promoters of the two gonadotropin β -subunit genes in the goldfish and carry out systematic analysis of the promoters with the aim of identifying and characterizing the activin responsive elements (AREs) that mediate the novel opposite effects of activin on the two GTH β subunits. These studies, together with those in other vertebrate systems, will provide important information on the diversity and evolution of the mechanisms that mediate activin actions. The project consists of the following three parts:

- (1) Transcriptional and posttranscriptional regulation of GTH- I β and II β mRNA by activin;
- (2) Cloning of promoter-regulatory regions of goldfish GTH-I β and II β genes; and
- (3) Functional analysis of GTH-I β and II β promoters for activin responsive elements (AREs). (CU99176)

Growth Hormone Regulation of Oocyte Development and Maturation in the Zebrafish

- ✉ GE Wei
- 1 April 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Production of mature oocytes for fertilization is the fundamental function of female reproduction in vertebrates. The principal regulators of vertebrate ovarian development and functions are the gonadotropins (GTHs) from the pituitary. However, in addition to GTHs, there has been an increasing body of evidence for the involvement of other pituitary hormones such as growth hormone (GH) in

the ovarian functions. In fish, it has been reported that before the onset of oocyte maturation and ovulation when there is a preovulatory surge of GTHs, there is a concurrent surge of GH release, strongly suggesting a role for GH in the process of oocyte maturation and ovulation. Using a well-established zebrafish oocyte maturation assay as the system, the present study aims at examining the effect of GH on the oocyte maturation *in vitro*. Considering that most of GH actions are mediated through the insulin-like growth factor-I (IGF-I) system, and that most of activities of the pituitary hormones in the ovary are mediated by local ovarian factors, particularly growth factors, the research will also investigate the effect of GH on the expression of ovarian IGF-I and activin, the two best studied ovarian growth factor systems that play important paracrine roles in the development and functions of the ovary. (BL99010)

Germplasm Bank, Chemical and Molecular Characterization of Chinese Medicinal Plants Commonly Used in Hong Kong

- ✉ KWAN Hoi Shan • CHE Chun Tao (School of Chinese Medicine) • WONG Yum Shing
- ☐ 1 December 1999
- ❖ CUHK Strategic Research Program

The objective of this programme is to create the baseline data required for compilation of the Monographs of Chinese Medicinal (CM) Herbs, as well as to establish scientific methods for quality assurance of the CM products. The major parts included in this programme are:

- (1) Construction of a germplasm bank for several commonly used CM herbal plants. We will identify and develop a standard reference plant for a CM herb to provide the standard for the monograph for this herb. We will collect plants from different sources, e.g., from different localities, as different cultivars, etc. to understand the variability of a particular herbal plant.
- (2) Establishment of comprehensive chemical analysis technologies for CM plants. The methods to be used are infrared spectrometry, high performance liquid chromatography, and capillary electrophoresis. Analytical data for standard reference herbs will be established for identification purpose.
- (3) Establishment and evaluation of modern molecular biological analyses for use as standard methods in the authentication and standardization of CM herbal plants.

(BL99004)

Analysis of Mitogen Activated Protein Kinase (MAPK) Cascades Isolated During Fruit Body

Development of Shiitake Mushroom *Lentinula edodes* Using Yeast Two-hybrid System

- ✉ KWAN Hoi Shan
- ☐ 1 June 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

The researchers' laboratory aims to elucidate the molecular aspects of fruit body development, the most important and conspicuous developmental process in the life cycle of the cultivated mushroom *Lentinula edodes*. An understanding of the molecular aspects of the fruiting process would allow the mushroom biologists to design rational mushroom breeding programmes using molecular tools. The researchers have isolated genes encoding components of signal transduction Mitogen-Activated Protein Kinase (MAPK) cascade from *L. edodes* fruit body at early development. Some of these genes were shown to express higher at the early fruit body stages and they thus hypothesize that MAPK cascades have roles in fruit body development. The long-term goal of this project is to study the roles of the MAPK cascade in the fruit body development of *L. edodes* and mushrooms in general. The specific aims are to characterize the *L. edodes* MAPKs (LeMAPKs) in detail by (1) examining the tissue specific expression patterns of LeMAPKs as compared to the other putative components of the cascade and (2) using the yeast 2-hybrid system, test the interaction of known proteins with LeMAPKs and isolate genes encoding cognate proteins to LeMAPKs. At the conclusion of this project the researchers will have some understanding of the roles of LeMAPKs. (BL99011)

Molecular and Biochemical Characterization of a Salt-tolerant Soybean Variety

- ✉ LAM Hon Ming • SHAO Gui Hua*
- ☐ 1 December 1999
- ❖ Research Grants Council (Earmarked Grants)

Salt stress severely reduces crop yields in the affected lands and causes the amount of usable cropland to decline dramatically each year. In search of a solution to these alarming environmental and agricultural ramifications, this research targets at the understanding of salt tolerance in higher plants and ultimately cloning the genes involved and delineating the molecular mechanism. A salt tolerant soybean variety (Wenfeng 7) was previously identified in China. Genetic cross to a salt sensitive variety (Union) showed that the salt tolerance of Wenfeng 7 is inheritable via a single dominant gene. Comparative analysis of the segregating salt tolerant and salt sensitive progenies of the genetic cross with reference to their parents will provide the researchers a simple and trackable system to understand the

biochemical and molecular mechanisms involved in the salt tolerance conferred by the single dominant gene. Their studies focus on:

- (1) differential distribution of ions such as sodium, chloride, and potassium in different plant tissues;
- (2) metabolic changes related to salt stress and tolerance; and
- (3) cloning of genes related to salt tolerance using various techniques such as cDNA library screening and differential display of mRNA.

(CU99180)

Salt Stress-induced Senescence in Soybean

✉ LAM Hon Ming • SHAO Gui Hua*

☐ 1 March 2000

❖ CUHK Research Committee Funding (Direct Grants)

Senescence in plants has drawn much attention lately because it may represent a type of programmed cell death (PCD) that occurs in plant. PCD, which is originally thought to exist only in animals and invertebrates, involved very sophisticated signal transduction mechanisms. Besides, during plant senescence, there will be a complicated reallocation of resources which is very important for plant growth and development. Plant senescence can occur as a natural developmental program or can be induced by biotic and abiotic stresses. In this research, the researchers will explore the metabolism during salt stress-induced senescence. One salt sensitive and one salt tolerant soybean varieties will be used for the comparative studies. They will analyze metabolic changes (such as progressive variations in amino acid profiles, etc.) and alteration of gene expression patterns (by differential display or RAP-PCR technologies). To test if there is a common signaling pathway of senescence induced by different stimuli, they will use the cloned genes related to the natural senescence process (such as the senescence-associated genes from *Arabidopsis thaliana*) to probe the changes in expression level of the corresponding genes in soybeans under salt stress-induced senescence.

(BL99012)

Development of Two Potent Novel Antiviral Drugs from Traditional Chinese Medicines

✉ OOI Vincent Eng Choon • BUT Pui Hay Paul • XU Hongxi# • CHAN Kay Sheung Paul (Dept of Microbiology)

☐ 1 October 1999

❖ Industrial Support Fund, Industry & Technology Development Council

Many traditional Chinese medicines (TCM) have been used for centuries for treatment of oral and respiratory tract viral infections. Recently, members of the research team have identified and characterized a potent novel antiviral drug based on a refined TCM formulation (composed of four herbal ingredients) for treatment of acute upper respiratory tract viral infections and influenza. The researchers have developed the production protocol and assessment schemes as monitored by specific bio-pharmacological assays and safety evaluation. Preliminary clinical trials in China have confirmed its prominent therapeutic efficacy with effective antipyretic and antiviral properties. Furthermore, they have screened several herbal extracts that can effectively inhibit the replication and growth of HSV (herpes simplex viruses causing cold sores or genital herpes). They have identified and characterized the active antiviral component of one of these herbs (*Prunella vulgaris*) as a potent nutraceutical and therapeutic agent for treatment of these viral infections. They plan to further evaluate the therapeutic efficacy of single and various combinations of these antiviral products to provide new formulations for tangible product development. Deliverables of this project are:

- (1) improved production technology and standardization schemes for manufacturing a potent antiviral agent for treatment of acute respiratory tract viral infections and influenza based on the refined formulation of only four TCM ingredients; and
- (2) development of a novel TCM therapeutic product derived from a well-characterized component of *Prunella* for treatment of cold sores or genital herpes caused by herpes simplex viruses.

(BL99001)

Expression of cDNA Encoding a Mannose-binding Lectin (NTL) from *Narcissus tazetta* in Transgenic Tobacco Plant

✉ OOI Vincent Eng Choon • SUN Sai Ming Samuel

☐ 1 December 1999

❖ Research Grants Council (Earmarked Grants)

The researchers have isolated, characterized and cloned a mannose-binding lectin from the Chinese daffodil *Narcissus tazetta* var. *chinensis* (designated NTL). NTL induces the production of various immunomodulatory cytokines in mice. It also inhibits growth of bovine immunodeficiency virus. It is not toxic to normal cultured cells and certain human cancer cell lines. NTL exhibits extensive homology (78%) to the snowdrop lectin (*Galanthus nivalis* agglutinin, GNA), which has been identified as an insecticidal protein. The GNA gene has been successfully expressed in high levels in transgenic plants with enhanced resistance to several important

insects. As NTL is highly homologous to GNA in N-terminal amino acid sequence and cDNA sequences, it may also possess some insecticidal effect. Therefore, they propose to initially test the purified NTL for insecticidal activity against two local insect pests, the green peach aphid *Myzus persicae* and the termite *Reticulitermes fukienensis*. They also plan to use a full-length cDNA clone encoding for NTL for transfer into tobacco plants and to characterize the expression of the NTL in transgenic tobacco plants. Subsequently they will test the transformed plants for enhanced inhibitory activity to the two insect pests. Insect damage causes major loss to crop yields worldwide and insect development of resistance to insecticides has been a problem in pest control. Searching for alternative insecticides is a continuous and needed effort. This study aims at expanding our biotechnological capability in combating insect pests and contributing to agriculture productivity. (CU99182)

Apoptosis-induced Cancer Regression by Certain Active Components from TCM and Natural Products – A Flow Cytometric Study

- ✉ OOI Vincent Eng Choon
- ☐ 1 March 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Cancer cell growth involves dynamic interactions between cell proliferation and apoptosis. It is important to consider the effects of anticancer agents on both processes. Apoptosis is a complex process whereby intrinsic and extrinsic stimuli activate a molecular program to implement a specific series of events that culminate in cell death. The induction of apoptosis is probably due to effects on the cell cycle or due to DNA integrity and the presence of several factors that promote cell cycle progression also induce apoptosis. A number of molecules that might regulate apoptosis have been identified in T cells, including the survival factor Bcl-2. When overexpressed in tumor cell lines, the Bcl-2 protein blocks apoptosis induced by nearly all cytotoxic anticancer drugs, irradiation, growth factor deprivation and tumour necrosis factor.

Flow cytometry is a novel analytical technique in research of cancer biology since it provides diverse means of studying cancer cell proliferation and death. It is also important in anticancer pharmaceutical and nutraceutical research and development as it can address both the proliferative and cytotoxic responses of cancer cells to potential antitumor agents.

The researchers have recently found that some polyunsaturated fatty acids (PUFAs, such as DHA and EPA) can inhibit the growth of human leukemic HL-60 cells *in vitro*. With the help of various flow cytometric methods, they show that EPA prohibits cell-cycle G1/S transition and cell proliferation by

downregulating cyclin E expression. Besides, they have also found that the EPA could induce apoptosis in HL-60 cells by suppressing the apoptosis-inhibitory bcl-2 expression. In the present project, they plan to extend their research to evaluate some potent bioactive proteins (e.g. ribosome-inactivating proteins and lectins) and polysaccharides that we have isolated from TCM (Traditional Chinese Medicines) and mushrooms and shown to have antitumor activity. The researchers would like to see whether they have similar anticancer effects as those PUFAs and to determine their antitumor mechanisms of action by applying the powerful techniques of flow cytometry.

The researchers hope the results from the present proposed study will provide us a more holistic picture about the anticancer and immunological properties of these natural products, and a better foundation to satisfactorily exploit their potential development as anticancer nutraceuticals. (BL99013)

Data Disc of the Zooplankton Identification List for Hong Kong Waters in Spring and Summer Season 1999

- ✉ WONG Chong Kim
- ☐ 1 July 1999
- ❖ Environmental Protection Department, HKSAR Government

To prepare and develop a data disc containing a species list, numerical abundance and digital photos of marine zooplankton collected in the northwestern waters of Hong Kong during spring and summer of 1999. (BL99003)

Data Disc of the Zooplankton Identification List for Hong Kong Waters in Autumn and Winter Season 1999

- ✉ WONG Chong Kim
- ☐ 30 November 1999
- ❖ Environmental Protection Department, HKSAR Government

To prepare and develop a data disc containing a species list, numerical abundance and digital photos of marine zooplankton collected in the northwestern waters of Hong Kong during autumn and winter of 1999. (BL99006)

Development of Methods for Conducting Sediment Toxicity Tests with Amphipods from Hong Kong Waters

- ✉ WONG Chong Kim

□ 1 March 2000

❖ CUHK Research Committee Funding (Direct Grants)

The use of amphipods for estimating the environmental impact of sediments intended for marine disposal has been emphasised by the Environmental Protection Department, HKSAR Government. The amphipod *E. rapax* is local to coastal waters around Hong Kong. It meets many criteria for ideal test organism for sediment toxicity assessment. However, additional information on the effects of temperature, salinity and oxygen on sensitivity is still needed before effective test protocols can be developed to make this organism an effective tool for assessing the toxicity of marine sediments. The objectives of this research are:

- (1) to identify the optimal temperature, salinity and oxygen regimes for the culture of *E. rapax*;
- (2) to test the response of *E. rapax* to 'reference' sediments collected from unpolluted sites in Hong Kong;
- (3) to determine the effects of temperature, salinity and oxygen on the response of *E. rapax* to marine sediments;
- (4) to develop test procedures, including QA/QC requirement and test acceptability criteria, for sediment toxicity test using *E. rapax*; and
- (5) to identify other species of amphipods for further development of sediment toxicity test protocols for future use in Hong Kong.

(BL99014)

Services on Water Quality Monitoring in Marine Parks & Marine Reserve

✉ WONG Chong Kim • CHU Lee Man • CHU Ka Hou • WONG Po Keung

□ 1 April 2000

❖ Agriculture, Fisheries & Conservation Dept, HKSAR Government

To carry out water quality monitoring at existing marine parks/reserve and the proposed marine park at Tung Ping Chau. To provide data analysis and report of water quality. The results will allow the Agriculture, Fisheries & Conservation Department to further improve management, visitor services and environmental monitoring in marine parks/reserve. (BL99027)

Integrated Chemical-Biological Treatment of Dye-Containing Effluent of Textile and Dyeing Industry

✉ WONG Po Keung • YU Chai Mei (Dept of Chemistry)

□ 1 November 1999

❖ Research Grants Council (Earmarked Grants)

Large quantity of synthetic dyes, mainly azo dyes, are being used in textile and dyeing industries in Hong Kong. Their high persistence and toxicity make them one of the most hazardous pollutants in industrial effluent. The presence of excessive amount of azo dyes will be harmful to living organisms in the aquatic environment. There is an urgent need to remove the dyes from industrial effluent before discharge.

Microorganisms with the ability to adsorb selected azo dyes were isolated from various dye-contaminated environmental samples. Cells of the selected *Pseudomonas* sp. K-1, which has azo dye adsorption capacity higher than that of activated carbon, can be immobilized by appropriate agent and the azo dye removal capacity of the immobilized cells will be optimized by controlling the physical and chemical parameters.

Photocatalytic degradation with hydrogen peroxide under ultra-violet (UV) light irradiation will be used to completely degrade azo dyes adsorbed onto bacterial cells co-immobilized with titanium dioxide. The degradative product(s) of photocatalytic oxidation can be identified by diffuse-reflectance Fourier-transform infrared (DRFT-IR) spectroscopy and nuclear magnetic resonance (NMR) spectroscopy. These degradative products will be tested by simple, fast and precise bioassays Microtox[®] test and Mutatox[®] test -to ensure the complete detoxification of azo dyes. The optimal physico-chemical conditions for azo dyes degradation by photocatalytic oxidation method will also be established.

Finally, the integration of biosorption and photocatalytic oxidation to remove and degrade azo dyes in synthetic solution and industrial effluent will be upgraded for bioreactors under controlled laboratory conditions. (CU99174)

Degradation of Pentachlorophenol by Photocatalytic Oxidation

✉ WONG Po Keung

□ 1 February 2000

❖ CUHK Research Committee Funding (Direct Grants)

Pentachlorophenol (PCP) is a colorless crystal but with strong odor under high temperature. It has been commonly used as a wood preservative and precursor of pesticides. It is toxic, mutagenic and even carcinogenic to living organisms. Its toxicity is due to its inhibition of cellular enzyme such as ATPase in living organisms. Its stable and toxic properties makes PCP one of the priority pollutants. However, due to the uncontrolled disposal and massive use of PCP as water disinfectant and pesticides, relatively large amount of PCP remains in terrestrial and especially aquatic environments. Biological degradation in natural contaminated environment is

too slow to completely and timely detoxify PCP, other methods include physical and chemical treatments have been used and no satisfactory results have been obtained.

In the present study, photochemical oxidation (PCO), a photochemical reaction combining UV irradiation on TiO_2 and H_2O_2 to produce powerful oxidant - hydroxyl radical ($\text{OH} \cdot$) to oxidize and detoxify PCP will be attempted. The degradation products will be characterized chemically and toxicologically in order to ensure nontoxic products generated by PCO treatment. The results obtained will form a base for the development of a pilotscale PCO reactor to degrade and detoxify PCP in aquatic environmental samples.

(BL99015)

Free Radical Scavenging Activities and Antioxidative Properties of Plant Flavonoids

✉ WONG Yum Shing

☐ 1 March 2000

❖ CUHK Research Committee Funding (Direct Grants)

Lipid peroxidation is a free radical chain reaction which involves three processes: initiation, propagation and termination. Antioxidants, according to their mode of action, may function as free radical scavengers. In this study, free radical scavenging activities of different plant flavonoids are studied using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay method. The kinetic behavior of DPPH decrease is a parameter to define the free radical scavenging capacity of the tested compound. Coupled oxidation of linoleic acid and beta-carotene is commonly used to determine lipid peroxidation. The correlation between lipid peroxidation inhibitory activities and free radical scavenging activities of various flavonoids is examined.

(BL99016)

Protective Effects of Heat Shock Protein 70 (HSP70) against Environmental and Pathogenic Stress in the Marine Teleost *Sparus sarba*

✉ WOO Norman Ying Shiu

☐ 1 December 1999

❖ Research Grants Council (Earmarked Grants)

The silver sea bream (*Sparus sarba*) is a commonly cultured marine food fish in Hong Kong. Major obstacles encountered in its intensive culture are its susceptibility to prevalent environmental stressors and bacterial infections. Sea bream are potentially stressed by high summer temperatures, salinity fluctuations, hypoxia and pathogenic infections (vibriosis). Heat shock protein (HSP) expression is a crucial step in the stress response as the HSPs are

involved in the protection of the organisms against the lethal effects of stressors. The present work assesses the feasibility of prior HSP induction (accumulation) in conferring survival benefits to subsequent severe environmental and pathogenic stress. The effect of the pathogen (*Vibrio alginolyticus*) HSP 70 on modulating the immune response of the host will be addressed and related to a proposed experimental use of *Vibrio* HSP as a vaccine against vibriosis. The tripartite relationship between HSP expression, immune competence and the stress hormone, cortisol, will also be elucidated. A clear understanding of the induction profile of HSP70 in the sea bream and the elucidation of the immunomodulatory effect of pathogen HSP70 on its host will provide us with an armory for design of strategies for maximizing stress tolerance and disease resistance in the sea bream.

(CU99168)

Strategies for the Improvement of Marine Fish and Shrimp Culture: A Molecular Biological Approach

✉ WOO Norman Ying Shiu • CHU Ka Hou • WONG Chong Kim • GE Wei • CHAN King Ming (Biochemistry) • CHENG Hon Ki Christopher (Biochemistry) • HO Walter K. K. (Biochemistry)

☐ 1 January 2000

❖ CUHK Strategic Research Program

Mariculture is a plausible answer to meet the global demand for seafood in view of the decline in captive fisheries. However, a void in the mariculture industry exists in the area of the basic biology of the cultured organisms. This project explores the application of molecular methods to the understanding of basic biological mechanisms of cultured species (sea bream and penaeid shrimp) which will be strategic for advancing the mariculture industry in Hong Kong, Greater China and Asia. Three factors are crucial in any mariculture setting: (1) the regulation of growth, (2) control and regulation of the reproductive process, and (3) recognition and control of pathogenic organisms. Specifically, the researchers plan to use RAPD-PCR to identify the bacterial pathogens of seabream and characterize the virulent-specific fingerprinting patterns of virulent strains. This work will open up an avenue for tracking the distribution of virulent bacterial pathogens in fish culture zones and offer insight for implementing control measures. They will attempt to clone the gonadotropin-II β and gonadotropin-II β subunits of the seabream and study the regulation of their gene expression. This work promises to provide critical information on the regulation of seabream reproduction and enhance our capability of manipulating the reproductive process of this species under culture conditions. Growth enhancement will

be attempted through production and administration of homologous growth hormone (GH). Genes encoding the protein portion of seabream growth hormone (GH) will be cloned and expressed in bacteria and in silkworm to be manufactured in large quantities ready for administration to seabream. Manipulation of ovarian maturation in shrimp will be attempted via a study on the vitellogenin gene. The present study is a comprehensive approach to answering the most pressing problems in mariculture and promises to provide critical information which will enhance seabream and shrimp mariculture practice.
(BL99005)

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>
1996-97	Dynamics of the Brown Alga <i>Sargassum</i> Populations in Ping Chau Island, New Territory and an Assessment of Variations in Their Morphological Characteristics (CU96316) ✉ ANG Put Jr.
1998-99	Meta-Population Dynamics of Red Alga <i>Hypnea charoides</i> in Tung Ping Chau, New Territories, Hong Kong (BL98013) ✉ ANG Put Jr.
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
1990-91	Elucidation of Biochemical Events Regulating Secondary Metabolism in the Ligninolytic Fungus <i>Phanerochaete chrysosporium</i> (BP91015) ✉ BUSWELL John Anthony
1991-92	Enzymic Evaluation of Starch Availability in Foodstuffs (BP92007) ✉ BUSWELL John Anthony
1997-98	Production and Distribution of Cellulolytic Enzymes in the Edible Straw Mushroom, <i>Volvariella volvacea</i> , during Substrate Colonisation and Fruit Body Morphogenesis (CU97329) ✉ BUSWELL John Anthony
1998-99	Distribution of Lignocellulolytic Enzymes in Mangrove Fungi and Physiological

	Parameters Affecting Their Production and Activity (BL98004) ✉ BUSWELL John Anthony • VRIJMOED L. L. P.*
1998-99	Isolation, Identification and Biotechnological Characterisation of Hyperthermophilic Bacteria from Hot-Spring Environments in China (BL98031) ✉ BUSWELL John Anthony • WILLIAMS R.A.D.*
1997-98	Chemical Quality Control of Chinese Medicines as a Support for Export of Proprietary Chinese Medicines (BL97003) ✉ BUT Pui Hay Paul • CHAN Tak Wah Dominic (Dept of Chemistry) • WANG Mu-zhou*
1997-98	The Development of Chinese Medicines and Dietary Supplements for Treating Gastrointestinal Disorders and Coughing (MD97131) ✉ BUT Pui Hay Paul • FUNG Kwok Pui (Biochemistry) • CHAN Tak Wah Dominic (Dept of Chemistry) • HO Yee Ping (School of Pharmacy) • WOO Jean (Dept of Medicine & Therapeutics) • CHOW Hee Lum Albert (School of Pharmacy) • LI Chi Keung Ronald (School of Pharmacy)# • ZHU Min (School of Pharmacy)# • KWAN Yiu Wa (Dept of Pharmacology) • LIN Ge (Dept of Pharmacology) • CHAN Hsiao Chang (Dept of Physiology) • KO Wing Hung (Dept of Physiology)
1997-98	International Ginseng Conference '99 – Biotechnology, Medicinal Uses and Marketing of Ginseng (BL97042) ✉ BUT Pui Hay Paul • SHAW Pang Chui (Biochemistry)
1997-98	Characterization of Pharmacologically Active Substances and Nutritional Evaluation of Selected Seaweeds in Hong Kong (CU97314) ✉ CHEUNG Chi Keung Peter • OOI Vincent Eng Choon • ANG Put Jr.
1998-99	The Hypocholesterolemic Effect of Mushroom Dietary Fibre in Hamsters (BL98014) ✉ CHEUNG Chi Keung Peter
1997-98	Screening Natural Populations of Chinese Shiitake Strains for Present and Future Commercial Potential (CU97326)

	<p>✉ CHIU Siu Wai • MOORE David* • LIN Fang Can*</p>	1996-97	Development of a Species Genetic Linkage Map of the Shiitake Mushroom <i>Lentinula edodes</i> with Sequence-tagged-site, Expressed-sequence-tag, and Gene Markers (CU96310)
1998-99	<p>Using Spent Substrate of the Oyster Mushroom to Biodegrade Aromatic Pesticides (BL98015)</p> <p>✉ CHIU Siu Wai</p>		<p>✉ KWAN Hoi Shan</p>
1997-98	<p>Molecular Studies on Shellfish Allergens: Cloning, Sequencing, Expression and Immunological Responses (CU97321)</p> <p>✉ CHU Ka Hou • LEUNG P.S.C.* • KWAN Hoi Shan • FUNG Ming Chiu</p>	1997-98	<p>Yeast Complementation Analyses of Signal Transduction Genes Isolated from Early Fruit Body Development of Shiitake Mushroom <i>Lentinula edodes</i> (CU97322)</p> <p>✉ KWAN Hoi Shan</p>
1998-99	<p>A Review of the Control of Exotic Species in Ballast Water Discharges (BL98026)</p> <p>✉ CHU Ka Hou • TAM Pui Fun#</p>	1998-99	<p>Elucidation of Gene Expression Profiles during Fruit Body Development of Shiitake Mushroom <i>Lentinula edodes</i> using Expressed Sequence Tags and Serial Analysis of Gene Expression (CU98139)</p> <p>✉ KWAN Hoi Shan</p>
1998-99	<p>Development of Molecular Markers for Genome Mapping in Penaeid Shrimp (CU98062)</p> <p>✉ CHU Ka Hou • KWAN Hoi Shan</p>	1998-99	<p>Asparagine Synthetase Genes: Their Roles in Plant Growth and Development (CU98292)</p> <p>✉ LAM Hon Ming</p>
1998-99	<p>Nutrient Availability as Factor Affecting Ecosystem Development on Restored Landfills (BL98016)</p> <p>✉ CHU Lee Man</p>	1998-99	<p>Molecular Cloning of a Salt-inducible Gene Encoding a Putative RNA-binding Protein in Arabidopsis Thaliana (BL98019)</p> <p>✉ LAM Hon Ming</p>
1998-99	<p>Comparison of Volatile Components Between Authentic and Imitation Crabmeats (BL98017)</p> <p>✉ CHUNG Hau Yin</p>	1998-99	<p>Production of Vaccines against Lymphocytic Choriomeningitis Virus (LCMV) in Transgenic Plants (BL98025)</p> <p>✉ LAM Hon Ming • SUN Sai Ming Samuel • FUNG Ming Chiu • SARON Marie-Francoise*</p>
1998-99	<p>Genetic Immunization Against <i>Toxoplasma gondii</i> (CU98142)</p> <p>✉ FUNG Ming Chiu • LEUNG Kwok Nam (Biochemistry) • CHEN Xiao Guang*</p>	1997-98	<p>Characterization and Expression of Ribosome Inactivating Proteins in Plants and Mushrooms (CU97325)</p> <p>✉ OOI Vincent Eng Choon • SUN Sai Ming Samuel • NG Tzi Bun (Biochemistry)</p>
1998-99	<p>The Role of Prostaglandin D Synthase and Prostaglandin D JCS Cell and Normal Bone Marrow Cell Differentiation (BL98003)</p> <p>✉ FUNG Ming Chiu • MAK Nai Ki*</p>	1998-99	<p>A Study on Mushroom and Plant Products with Protective Effects Against Genotoxicity Using Single Cell Gel Electrophoresis Assay (BL98002)</p> <p>✉ OOI Vincent Eng Choon</p>
1996-97	<p>Activin Regulation of Pituitary Gonadotropin Gene Expression and Oocyte Development in the Goldfish, <i>Carassius auratus</i> (CU96308)</p> <p>✉ GE Wei</p>	1996-97	<p>Genetic Engineering of Rapeseed for Enhanced Nutritional Quality (CU96301)</p> <p>✉ SUN Sai Ming Samuel</p>
1998-99	<p>Identification of Activin-Regulated Genes in the Differentiation of Mouse Leukemia Cell Line F5-5 by Representational Difference Analysis (RDA) (BL98018)</p> <p>✉ GE Wei</p>	1997-98	<p>Genetic Engineering of Sweet Protein Mabinlin for Increased Stability (CU97327)</p>

	☞ SUN Sai Ming Samuel • WONG Yum Shing	1998-99	Provision of Services for Development of Sediment Toxicity Test Protocol Using Local Species (BL98037)
1998-99	Production of High Value Pharmaceutical Proteins in Transgenic Seeds (BL98035C) ☞ SUN Sai Ming Samuel • FUNG Ming Chiu • LAM Hon Ming • CHEN Xiao Guang* • HAN Wei*		☞ WONG Po Keung • WONG Chong Kim • CHU Ka Hou
1998-99	Engineering the Brazil Nut Met-rich Protein for Reduced Allergenic Activity (CU98351) ☞ SUN Sai Ming Samuel • LAM Wai Kei Christopher (Dept of Chemical Pathology)	1995-96	A Study of the Nutritional Quality and Potential Food Use of Some Underutilized Legumes (BL95043) ☞ WONG Yum Shing
1997-98	An <i>in situ</i> study of the phytoplankton-zooplankton trophic transfer in the Zhujiang River estuary (CU97313) ☞ WONG Chong Kim	1997-98	An Evaluation of the Nutritional Value and Potential Food Use of Some Underutilized Asiatic Pulses (BL97037) ☞ WONG Yum Shing • CHEUNG Chi Keung Peter
1998-99	Feeding Ecology of Marine Cladocerans in Tolo Harbour (BL98021) ☞ WONG Chong Kim	1998-99	Study of Natural Antioxidants from Legume Seeds (BL98022) ☞ WONG Yum Shing
1997-98	Incorporation of Biosorption to Enhance Photocatalytical Oxidation of Synthetic Dyes (BL97036) ☞ WONG Po Keung	1997-98	Evaluation of Novel Microencapsulated Formulations for the Improved Survival and Development of Cultured Marine Fish Larvae (CU97302) ☞ WOO Norman Ying Shiu • COLLINS Peter M.*
1997-98	Enhancement of Metal Bioremediation by Rhizospheric Plant and Microbial Components (BL97014) ☞ WONG Po Keung • OW David*	1997-98	A Pioneering Study on Gene Regulation During Larval Development of the Sea Bream, <i>Sparus sarba</i> (BL97038) ☞ WOO Norman Ying Shiu • Eddie Edward DEANE
1998-99	Toxicological Study of Polycyclic Aromatic Hydrocarbon (PAHs) in MARPOL Wastes (BL98020) ☞ WONG Po Keung	1998-99	Effect of Prolactin and Growth Hormone on Heat Shock Protein 70 Expression in the Sea Bream <i>Sparus sarba</i> (BL98023) ☞ WOO Norman Ying Shiu • Eddie Edward DEANE
1998-99	Removal and Recovery of Metal Ions from Electroplating Effluent by A Combined Chemical-Biomagnetic System (CU98134) ☞ WONG Po Keung • CHUA H.*	1998-99	Enhancing Immunological Competence of Silver Sea Bream (<i>Sparus sarba</i>) Through the Combined Application of Salinity Adaptation, Hormonal Factors and Specific Vaccines (CU98135) ☞ WOO Norman Ying Shiu

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RESEARCH PROJECTS

Effects of Tandem Base Pair Mismatches on Local DNA Dynamics

- ✉ AU-YEUNG Chik Fun Steve
- ☐ 1 April 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Different types of tandem base pair mismatches in a DNA duplex affect the target site selectivity of DNA-bending proteins. These proteins function as architectural elements by bending DNA to facilitate the formation of specific protein-DNA complexes required for the regulation of DNA replication, recombination and gene expression. It remains unclear how tandem base pair mismatches affect the local (sequence-specific) DNA dynamics and thus the local flexibility. In this research project, the use of high-resolution nuclear magnetic resonance (NMR) spectroscopy is proposed to investigate the role of inherent dynamic properties of tandem base pair mismatches in affecting the target site selectivity of DNA-bending proteins. With the presently available DNA synthesizer and gel electrophoresis apparatus in the laboratory, high concentration of purified DNA samples can be prepared feasibly. Heteronuclear NMR techniques will be applied to determine the sequencespecific dynamic behavior of tandem base pair mismatches in DNA oligomers and their importance in affecting the local DNA flexibility. Natural abundance ^{13}C relaxation measurements will be conducted in order to determine the order parameters, which associate with the dynamic behavior (the amplitude and frequency of local motions) of each individual nucleotide. The results from this study will yield insights into specific physical properties of DNA that can be exploited for developing potential new therapeutics. (PS99004)

Activation of Carbon-Carbon Bonds by Transition Metal Complexes

- ✉ CHAN Kin Shing
- ☐ 1 December 1999
- ❖ Research Grants Council (Earmarked Grants)

Activation of carbon-carbon bonds by transition metal complexes is a fundamentally and industrially important chemical process. The activation of aliphatic and unstrained carbon-carbon bonds by transition metal complexes has never been reported before. Study of this process will deepen our understanding of the interaction of carbon-carbon bonds with transition metal complexes. As a result, development or improvement of industrially important processes such as oil reforming,

hydrocarbon cracking and catalytic functionalization of hydrocarbons by transition metal complexes will be benefited. (CU99202)

Synthesis of 1, 10-Phenanthrolines

- ✉ CHAN Kin Shing
- ☐ 1 January 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Lipophilic 1,10-phenanthrolines will be synthesized through bromination and transition metal-catalyzed cross coupling reaction of Stille, Suzuki, and Kumada types. (PS99005)

Forbidden Transitions of H_2 Studied by Cavity Ring Down Spectroscopy

- ✉ CHAN Man Chor
- ☐ 1 January 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

The researchers propose here to study the electric-dipole forbidden transitions of H_2 molecules using cavity ring down (CRD) spectroscopy in the near infrared region. The sensitivity of this scheme compensates for the weakness of the transitions. This work will be one of the first experiments taken place at the laser spectroscopy laboratory in the chemistry Department. A new experimental setup including the CRD cell and data acquisition system will be implemented into their high resolution spectrometer for this study. Rotationally resolved transitions in the second vibrational overtone band of H_2 in the 850 nm region will be studied. The information obtained from this work will provide rigorous tests for high level *ab initio* calculations, which have been extensively applied to predict the quantum mechanical properties of H_2 . As no experiment of similar nature has been done at the Chinese University, this work will no doubt introduce a new research discipline in physical chemistry to our graduate students. (PS99010)

Structural and Dynamic Studies of van der Waals Molecules Using High Resolution Spectroscopy

- ✉ CHAN Man Chor
- ☐ 1 April 2000
- ❖ CUHK Mainline Research Scheme

Van der Waals molecules (also referred as van der Waals complexes) are ideal systems for studying intermolecular potentials and the types of large

amplitude motions found in reacting systems. By studying their structure and dynamics, one may obtain necessary information on controlling pathways and products of chemical reactions. The combination of laser spectroscopy and supersonic expansion has been demonstrated as a powerful means in the study of van der Waals complexes. The high-resolution spectra provide very detailed information on the structure and dynamics of the complexes. The researchers propose here, in collaboration with National Research Council of Canada and Ibaraki University of Japan, to construct an apparatus implementing their near infrared laser spectrometer for the spectroscopic study of van der Waals complexes. Theoretical prediction of the high-resolution spectra based on *ab initio* potentials will also be pursued. It is hoped that this collaboration will initiate a world class research program for the Department of Chemistry as well as establish for the University an international reputation in the research of experimental Chemical Physics. (PS99017)

Synthesis and Characterization of Dendritic Networks

- ✉ CHOW Hak Fun
- ☐ 1 September 1999
- ❖ Research Grants Council (Earmarked Grants)

The synthesis of highly specialized polymeric macromolecules has been one of the important developments in polymer and material research. Hyperbranched polymer molecules, also known as dendrimers, are structurally defined macromolecules with controlled architecture. Furthermore, they can be synthetically engineered to become functional polymers with unique magnetic, electrochemical, photochemical, biological and catalytic properties. Whilst most of the research reports in the literature are concerned with the design of such functional dendritic molecules, there has been little effort to use simple dendritic polymers as basic units for the construction of larger dendritic networks with molecular dimensions approaching those of nanomaterials. In this project we plan to synthesize a number of dendritic "lego" units from which nanoscopic-size dendritic networks could be constructed. These basic units, each having one or several reactive functionalities (or handles), will be constructed by an accelerated convergent synthetic strategy. These spherical lego units are then connected in a controlled manner via the reactive handles to provide an order, nanoscopic dendritic network. The assembly of spherical dendritic subunits in an orderly fashion represents a logical extension of classical organic synthesis wherein individual atoms or functional groups are linked in a defined sequence to provide molecules with specific functions or properties. Realisation of such

nanoscopic networks comprising of dendritic building blocks thus provides the material scientists with a potent mechanism for the construction of molecular devices that possess higher order architectures and unusual physical/chemical properties. (CU99201)

Materials Characterization and Failure Analysis for Electrodeposition

- ✉ KWOK Wai Man Raymund
- ☐ 1 June 2000
- ❖ Shipley Asia Limited • University-Industry Collaboration Prog.: Industrial Research Chair Scheme, ITF, Innovation & Tech. Commission

In electroplating, development of new products and improvement of existing products now require many sophisticated and reliable characterization techniques to obtain physical, chemical, mechanical and electrical properties of the deposits. In the present project, an industrial research chair will be installed for the development of characterization techniques specific for the needs in the Hong Kong and the nearby region. Reliable procedures for the characterizations of chemical compositions, layer thickness, microstructures, density, impurity traps, porosity, surface roughness, and solderability will be developed or adopted. The procedures for reliability testing of the new lead-free processes in the company, the analytical procedures for the control of product quality, and the general procedures for failure analyses of semiconductor, printed circuit board, and decorative products will be developed. With these characterization techniques, experts in Shipley will acquire detailed information about their electroplating processes and products, so that they can develop new or upgrade existing products and processes. In order to achieve these goals, the chairholder will supervise the testing laboratories in Shipley Fanling site and use the instruments at The Chinese University of Hong Kong through ASMAC. He will supervise about twenty staff in Shipley and one in ASMAC to develop and use a wide range of characterization techniques for Shipley product R&D. (PS99027)

Piezoelectric Sensors for Chiral Biomolecules

- ✉ LAU Oi Wah
- ☐ 1 October 1999
- ❖ CUHK Research Committee Funding (Direct Grants)

In nature, chirality is a common feature among biomolecules. The determination of biomolecules in a chiral manner constitutes an important scientific area of research. The key/lock principle sheds light

on the chiral discrimination. A stable matrix with chiral recognition ligands acts as a host. When the guest molecules, i.e. the biomolecules to be determined, are brought to close proximity, rapid and reversible specific binding occurs. This complementary matching can be read out easily and sensitively by piezoelectric devices. For this purpose, chiral boronic acids will be synthesized as recognition ligands to sense sugar and amino-alcohol. The host matrix will be conveniently prepared in one step by sol-gel method. The marriage of piezoelectric device and sol-gel technology will offer a powerful and economical tool for sensing chiral biomolecules.
(PS99011)

Zinc Complexes with Sterically Demanding Chalcogenato Ligands

- ✉ LEE Hung Kay
 □ 1 June 2000
 ❖ CUHK Research Committee Funding (Direct Grants)

The study of low-coordinate chalcogenato complexes of zinc has attracted much interest owing to their relevance to the active sites of a number of zinc-containing enzymes and their importance as single source precursors for II-VI semiconducting materials. However, the tendency of these complexes to associate and form insoluble polymeric species renders their characterizations difficult to be carried out. Recently, it has been proved that the degree of association of metal chalcogenato complexes can be reduced by employing chalcogenato ligands containing bulky alkyl or aryl substituents.

The objective of the proposed research work is synthesis and characterizations of neutral zinc chalcogenato complexes with low coordination number at the metal center. The complexes are to be prepared by protolysis of zinc amides $[\text{Zn}(\text{L}^n)_2][\text{L}^1=\tilde{\text{N}}(\text{SiMe}_3)(2\text{-C}_5\text{H}_3\text{N-6-Me})]$, $\text{L}_2=\tilde{\text{N}}(\text{Si}^t\text{BuMe}_2)(2\text{-C}_5\text{H}_3\text{N-6-Me})$, $\text{L}^3=\tilde{\text{N}}(\text{Si}^i\text{BuMe}_2)(8\text{-C}_9\text{H}_6\text{N})$ with the sterically demanding benzene-thiol and -selenol $2,4,6\text{-}^t\text{Bu}_3\text{C}_6\text{H}_2\text{EH}$ (E=S, Se). The molecular structures of these complexes are to be determined by X-ray crystallography.
(PS99021)

Studies in Supramolecular Chemistry

- ✉ MAK Thomas Chung Wai
 □ 1 August 1999
 ❖ Research Grants Council (Earmarked Grants)

Chemistry is a "language of science" using atoms as "alphabets" to construct molecules, which are the "words". An assembly of molecules consolidated by non-covalent forces constitutes a supermolecule,

which is like a "sentence", and sets of supermolecules make up a "paragraph". The design of molecular assemblies that contain and express information is the essence of Supramolecular Chemistry, which is analogous to a "chapter". Chemists are adept at writing complete "books" on specialized topics such as the synthesis of drugs and the making of novel materials, but mother nature is the unrivaled author of the "book of life" using the language of chemistry. The conceptual progression from conventional molecular chemistry to supramolecular chemistry is best illustrated by Jean-Marie Lehn's statement that "as atoms and covalent bonds are to molecules, so are molecules and non-covalent interactions to supermolecules".

The investigator plans to carry out fundamental research on the design, synthesis, structural characterization, and function of stable assemblies of discrete chemical species, serving as "modules", leading to ordered supramolecular structures in one, two, or three dimensions. For example, one important "module" to be used is urea, which together with various anions and neutral molecules constitute a host network (analogous to a hotel) that can accommodate cationic species (like guests who occupy the rooms).
(CU99206)

Development of Porphyrin-based Nonlinear Optical Materials

- ✉ NG Kee Pui Dennis
 □ 1 January 2000
 ❖ CUHK Research Committee Funding (Direct Grants)

Nonlinear optical (NLO) chromophores have aroused great interest recently because of their potential applications for optical communication, information storage, optical switching and electrooptical signal processing. Among the various classes of NLO chromophores, porphyrins, with their large polarizable π conjugated systems, appear to have unique characteristics that render them superior as NLO materials. To date, a substantial number of porphyrin-based NLO chromophores showing third-order NLO effects have been reported. Unsymmetrical push-pull porphyrins exhibiting second-order NLO properties, however, remain relatively rare. This proposal seeks to secure funds to explore the chemistry of these novel materials. The proposed work includes (i) the synthesis of push-pull bis (porphyrin) and tris (porphyrin) systems which contain highly soluble mono-porphyrin units linked together with either an ethynyl or arylolethynyl bridge at the *meso* positions, and various electron donor and acceptor groups at the remaining (terminal) *meso* positions, (ii) the study of their liquid crystalline and NLO properties. The latter will be carried out with

electric-field-induced second-harmonic generation (EFISH) technique at 1907 nm. (PS99012)

Enantiospecific Synthesis of Taxol Analogues as Potential Anticancer Agents

- ✉ SHING Kung Ming Tony
- ☐ 2 January 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Modern natural product synthesis has placed an added requirement for the organic chemists, i.e. the target molecules should be harvested in optically active form due to the different pharmacological response of the enantiomers. Taxol and the related taxotere are established anticancer drugs, particularly toward ovarian and breast cancers. Taxol is extracted from a plant, but the poor yield of its isolation procedure and limited availability renders the drug costly. Existing chemical syntheses (preparation) of taxol involve many steps and hence industrial scale production is not economical or practical. This research programme proposes to construct simplified taxol analogues for biological testing which can provide further insight into the structure-activity relationship. These endeavors may facilitate the discovery of a structurally simplified, readily accessible by chemical synthesis, and hence commercially viable taxol analogue whose bioactivity may equal or exceed that of the naturally occurring taxol. (PS99006)

Asymmetric Reduction and Alkylation of Chiral Furanoboronates

- ✉ WONG Nai Ching Henry
- ☐ 1 March 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Four chiral furanoboronates containing formyl or keto groups at the furan 2 or 3 position will be synthesized. These chiral carbonylfuranoboronates will then be subjected to reduction or nucleophilic addition reactions using various reducing agents or carbon nucleophiles, respectively. It is anticipated that the appending chiral boronate groups will lead to an asymmetric reduction or alkylation possibility. The furanylmethanols so obtained will then be allowed to go through the Suzuki coupling reaction catalyzed by palladium(0) catalysts. In this manner, many chiral furanylmethanols will be obtained. These chiral furanylmethanols are useful precursors in many synthetic organic manipulations. (PS99022)

Tracer Diffusion in Confined Geometry

- ✉ WU Chi • SCHMIDT, Manfred*
- ☐ 1 September 1999
- ❖ Germany/Hong Kong Joint Research Scheme

Diffusion of substances inside porous media is a very interesting problem in basic science because many processes are dependent on it, such as chemical and biological reactions. It is also useful in various applications, such as controllable drug delivery and filtration. This study helped us to understand how a confined environment can affect the diffusion process, so that the diffusion can be better regulated. (PS99001)

Design, Synthesis and Assembly of "Intelligent" Macromolecules

- ✉ WU Chi • PAN Cai Yuan* • LEUNG May Lay Louis*
- ☐ 31 December 1999
- ❖ Research Grants Council (Earmarked Grants)

The emergence of synthetic polymers with their manifold use has affected modern life so profoundly that our world is hardly imaginable without them. One recent finding is that certain synthetic polymers can "intelligently" change their chain conformation in response to a small change in environment. In this project, we will design and synthesize several novel block copolymers in which one block can "intelligently" and gradually vary its chain conformation or/and structure to become insoluble in a given solvent, while another block remains soluble. The aggregation of the insoluble block will lead to the self-assembly of the copolymer chains into polymeric nanostructures in a *controllable fashion*. The formation kinetics and composition of these nanostructures will be investigated by using the state-of-the-art *in-situ* laser light scattering instrumentation established in our laboratory. The success of this project will not only provide a novel way to study the association and interaction of polymer chains in solution, but also lead to potential materials with some defined nanostructures. (CU99209)

Study of *n*-clustering Induced Collapse of Densely Grafted Polymer Brushes

- ✉ WU Chi
- ☐ 1 January 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

A polymer brush can be prepared by grafting linear macromolecules onto a substrate, i.e., each chain has only one end attached onto the substrate. Polymer

brushes can modify the surface of a given material and lead to many physicochemical applications, such as colloid stabilization, adhesion, chromatography, biocompatibility and wetting. A number of theoretical models have been developed to describe the grafted chain density profile under various conditions, but only a few experimental results have been reported because it is difficult, if not impossible, to make dense polymer brushes. It is generally known that the grafted chains are extended in a good solvent, but collapsed when the solvent quality becomes poor. In this study, we propose to graft linear chains onto a thermally sensitive microgel surface so that the grafting density can be continuously increased via the shrinking of the microgel at higher temperatures. We intend to verify a long predicted grafting density induced phase transition on surface. On the other hand, by grafting thermally sensitive polymer chains onto a hydrophilic microgel surface, we hope to differentiate various existing polymer brush models and have a better understanding of the phase behavior of the grafted chains. One of the envisioned applications of this study will be the preparation of polymeric nanoparticles with an "intelligent" surface. (PS99007)

Organolanthanide Compounds with a New Class of Versatile Ligands

- ✉ XIE Zuwei
- ☐ 1 September 1999
- ❖ Research Grants Council (Earmarked Grants)

Organolanthanide compounds are efficient catalysts for alkene, alkyne and C-N bond-forming transformations that are some of the most important reactions in the chemical industry. We propose to develop a new class of organolanthanide catalysts with newly designed versatile ligands, making these processes more smooth, efficient, and selective, and to explore some new reactions such as C-H bonds, CO and N₂ activation reactions with these organolanthanide compounds. The versatile ligands are designed by taking the advantages of the bridged cyclic π ligands and unique properties of the carborane molecules. These ligands would possess properties of both units. It is anticipated that this new class of bridged versatile ligands could afford organolanthanide complexes not only with advantageous solubility, crystallizability, thermal stability, and resistance to ligand redistribution, but also with more open metal coordination sphere, higher reactivity and versatility. The chemistry of this class of organolanthanide complexes is expected to be significant and varied. (CU99210)

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	Thermodynamic Studies of Sequence Specific Local Structure of DNA by UV Spectroscopy (PS98017) ✉ AU-YEUNG Chik Fun Steve
1994-95	Asymmetric Catalysis by Metal Complexes of Chiral Pyridyl Phenols and Their Derivatives (PS94010) ✉ CHAN Kin Shing
1996-97	Mechanistic Studies of 1,2-Rearrangement of Alkyl Rhodium Porphyrins (CU96702) ✉ CHAN Kin Shing
1998-99	Biological Evaluation Agreement: Obtaining Compounds to Evaluate for Agriculture Utility (PS98016) ✉ CHAN Kin Shing
1998-99	Asymmetric Catalytic Carbon-Carbon Forming Reactions Via Chiral Biaryls (CU98023) ✉ CHAN Kin Shing
1998-99	Mass Spectrometry of Carbohydrates (CU98345) ✉ CHAN Tak Wah Dominic
1996-97	Further Exploration of a Recently Developed One-flask Ramberg-Backlund Reaction (CU96712) ✉ CHAN Tze Lock
1998-99	Synthesis of [n]Paracyclophane-based Oligo[p-phenylene-(E)-vinylene]s with Configurational Chirality Residing in the Backbones (CU98121) ✉ CHAN Tze Lock
1997-98	Optically Active, Axially Chiral, Binaphthol-based Conjugated Oligomers: Synthesis, Characterization, Properties and Applications (CU97726) ✉ CHOW Hak Fun
1998-99	Molecular Metamorphosis: A New Approach to the Synthesis and Dendritic Macromolecules via Post-Dendrimerization Modifications (PS98005) ✉ CHOW Hak Fun

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| 1998-99 | Preparation of Nanocrystals-Doped SiO ₂ Thin Films by RF-Sputtering Method (PS98002)
✍ HUI Ka Chung | 1989-90 | X-Ray Analysis of Crystal Structures (BP72001)
✍ MAK Thomas Chung Wai |
| 1997-98 | Interaction of Low Energy Ions and III-V Semiconductors (CU97705)
✍ KWOK Wai Man Raymund • BELLO Igor* • LAU Leo Woon Ming (Dept of Physics) | 1989-90 | Metal Coordination by Betaines (BP88025)
✍ MAK Thomas Chung Wai |
| 1998-99 | Functionalization of Backbone Carbon on Polymer Surfaces with -COOH (CU98106)
✍ KWOK Wai Man Raymund • LAU Leo Woon Ming (Dept of Physics) • WU Chi • CHAN Chi Ming* | 1996-97 | Synthesis and Characterization of Functional Rare Earth Complexes with Organic Ligands (CU96705)
✍ MAK Thomas Chung Wai • ZHANG Hong-jie* • NI Jia-zuan* |
| 1998-99 | Transition Metal Thiolate and Selenolate Complexes with Unusual Coordination Geometry as Mimics to the Active Sites of Metalloproteins (PS98018)
✍ LEE Hung Kay | 1997-98 | Synthesis and Structural Studies of New Betaine Ligands and Their Metal Complexes (CU97702)
✍ MAK Thomas Chung Wai |
| 1990-91 | Synthesis of Novel Transition-Metal Alkyls (BP90039)
✍ LEUNG Wing Por Kevin | 1998-99 | Synthetic and Structural Studies on Homo- and Heterometallic Complexes (CU98022)
✍ MAK Thomas Chung Wai • TANG Wen Xia* |
| 1990-91 | Synthesis of Organometallic Compounds of Alkali Metals (BP90040)
✍ LEUNG Wing Por Kevin | 1998-99 | Studies of Hydrophilic and Non-aggregated 2, 3-Naphthalocyanines and Phthalocyanines (CU98117)
✍ NG Kee Pui Dennis |
| 1996-97 | Synthesis and Application of Organo-transition Metal and -Lanthanide Compounds in Olefin Polymerisation and Asymmetric Catalysis (CU96720)
✍ LEUNG Wing Por Kevin | 1998-99 | Sandwich-Like Metal Bis(tetrapyrroles) (PS98025)
✍ NG Kee Pui Dennis • Johann W. BUCHLER* |
| 1998-99 | Syntheses, Structures and Reactivities of Metal Aza-allyl Complexes (CU98126)
✍ LEUNG Wing Por Kevin | 1996-97 | Syntheses and Biological Evaluation of Pseudo-disaccharides as Potential Glycosidase Inhibitors (CU96711)
✍ SHING Kung Ming Tony |
| 1998-99 | Ab Initio Molecular Orbital Studies on the Structures, Energetics, and Potential Energy Surfaces of Novel Chemical Species (PS98006)
✍ LI Wai Kee | 1997-98 | Enantiospecific Total Syntheses of Anticancer Agents Simalikalactone D and Quassamarin (CU97708)
✍ SHING Kung Ming Tony |
| 1997-98 | First Principle Molecular Dynamics Study on the Reaction Mechanisms of Thermal Dissociation for Molecules and Energetic Materials (CU97711)
✍ LIU Zhifeng • TSE John S.* | 1989-90 | Theoretical Studies of (a) Aluminium-Ethylene Complexes (b) CH ₃ SOH ⁺ (c) Ge Compounds (d) HPOH and HNOH (BP89048)
✍ SO Suk Ping |
| 1998-99 | A First Principle Study on the Bimolecular Reaction F ₂ +C ₂ H ₄ (CU98122)
✍ LIU Zhifeng • TSE John S.* | 1989-90 | Synthesis of Novel Aromatic Compounds (BP83001)
✍ WONG Nai Ching Henry |
| | | 1995-96 | Synthesis of Sesquiterpenoids Furanoeudesmanes by Utilizing a 3, 4 Disubstituted Furan as a Pivotal Precursor (CU95704)
✍ WONG Nai Ching Henry |

1997-98	The Use of Chiral Furanboronates in Organic Synthesis (CU97701) ✍ WONG Nai Ching Henry	1996-97	The Chemistry of Highly Electrophilic Cationic Organolanthanide Complexes (CU96708) ✍ XIE Zuwei
1997-98	Total Synthesis of Plakortones A and B (PS97010) ✍ WONG Nai Ching Henry	1997-98	Lanthanacarborane Complexes: Synthesis, Structure and Reactivity (CU97706) ✍ XIE Zuwei
1998-99	Synthesis and Reactions of 5,6-Bis(trimethylsilyl) benzo [c] furan (CU98014) ✍ WONG Nai Ching Henry	1998-99	Synthesis, Structure and Reactivity Studies of Organoactinide Complexes (PS98007) ✍ XIE Zuwei
1997-98	Laser Light-Scattering Studies on Biodegradable Polymers (CU97704) ✍ WU Chi	1997-98	Development of New Methods for the Direct Determination of Heavy Metals in Atmospheric Particulate Matter by Graphite Furnace Atomic Absorption Spectrometry (CU97710) ✍ YU Chai Mei
1997-98	Novel Fast Response Polymers and their Biomedical Applications (BL97009) ✍ WU Chi • LEUNG Ping Chung (Dept of Orthopaedics & Traumatology)	1998-99	Enhanced Photocatalysts for the Degradation of Volatile Organic Compounds (CU98124) ✍ YU Chai Mei
1998-99	The Formation and Stabilization of Surfactant-Free Polymer Nanoparticles (CU98123) ✍ WU Chi		

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see also <P001474>, <P001577>, <P993907>, <P994078>

RESEARCH PROJECTS

Cytotoxic and Potential Anti-Tumour Compounds from the Chinese Drug "Lang-Du" and Their Mechanisms of Action

- ✉ CHE Chun Tao • KONG Yun Cheung • LIU Wing Keung Ken (Dept of Anatomy)
- ☐ 1 December 1999
- ❖ Research Grants Council (Earmarked Grants)

In Chinese medicine, many botanical drugs well known for their violent and toxic side-effects are often useful for treating tumours and cancers. One of these drugs, Lang-Du (天 七 厘), is derived from the roots of *Euphorbia fischeriana*, *Euphorbia ebiacteolata*, or *Stellera chamaejasme*. The cytotoxic and antitumour effects of these drugs have been demonstrated. The investigators shall study the diterpenoid and other constituents of these botanical drugs, isolate the active ingredients, conduct mechanistic studies, and more importantly, discover new structures with promising antitumour activity. (CU99169)

Standardization of Chinese Medicines Using An Analytical Data Management System

- ✉ CHE Chun Tao
- ☐ 1 February 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Most Chinese medicinal products lack sufficient quality control and proper standardization in the course of preparation and production. Such deficiencies have seriously hampered the modern development of botanical drugs into mainstream pharmaceuticals and health foods. It is high time to improve the Chinese medicinal products in order to achieve a high standard of efficacy and safety, and to enhance their introduction into the international markets.

Standardization is an essential means to ensure the quality of drugs by defining the identity and quantity of their composition. Due to the complexity of ingredients in botanical drugs, no single analytical

method seems to be able to serve the purpose well. The researchers propose to apply three powerful analytical techniques, namely, high-performance liquid chromatography (HPLC), capillary electrophoresis (CE), and infrared spectroscopy (IR), to produce standard profiles for herbal medicines. Results of these analyses will provide chromatographic profiles which are characteristic for each medicinal plant. A data management system is then designed to store, analyze, and compare the results. A particular feature of this system is its capability to register the data of each drug item by integrating the results obtained from all three analytical methods. The integrative pool of data will serve as the overall parameters for standardization and comparison. By using this approach, not only the drug identities can be established (based on signal patterns), their qualities can also be compared (based on signal intensities). This approach can be further applied to medicinal formulae containing multi-components. In order to test for the feasibility and define the applicability of this data management system, commonly used Chinese herbs such as Dong-Gui and Shao-Wu will be studied in this project. (BL99020)

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>
1997-98	Development of Over-the-Counter Pharmaceutical Products Based on Local Medicinal Plants (BL97039) ✉ KONG Yun Cheung • KWAN Hoi Shan (Dept of Biology)
1996-97	Detection and Clinical Relevance of Genetic Abnormalities (E2A/PBX1 and BCR/ABL) in Pediatric Acute Lymphoblastic Leukemia by Multiplex Polymerase Chain Reaction (MD96030) ✉ LEE Chuen Kwun Joseph • NG Heung Ling Margaret (Dept of Anatomical & Cellular Pathology)

RESEARCH OUTPUTS AND PUBLICATIONS

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see also <P000717>, <P001761>, <P001766>, <P992259>, <P993412>, <P993428>, <P994217>, <P994284>, <P994437>

RESEARCH PROJECTS

Iterative Method for Ill-Conditioned Toeplitz Systems

✉ CHAN Hon Fu Raymond • NG Kwok Po*

□ 1 September 1999

❖ Research Grants Council (Earmarked Grants)

This research proposal is centered on the development of fast iterative methods for solving linear systems where the coefficient matrices are ill-conditioned Toeplitz matrices. Such systems arise in many applications, e.g. integral equations, signal processing and queueing networks. The preconditioned conjugate gradient method is proposed as the main tool for solving such systems. For a large class of Toeplitz systems including the well-conditioned ones, researchers have already shown that the method with either circulant preconditioners or band-Toeplitz preconditioners is faster than existing direct methods by a factor of $O(\log n)$. The band-Toeplitz preconditioners work especially well for ill-conditioned systems but have a drawback of requiring explicit formula of the generating functions of the Toeplitz matrices. The purpose of this research is to extend the circulant preconditioner idea to general ill-conditioned Toeplitz systems. The researchers will focus on designing good circulant preconditioners that incorporate the band-Toeplitz preconditioner idea but without requiring the explicit knowledge of the generating functions. They will establish theoretically the convergence rate of the method. Applications to integral equations and queueing networks will be considered. Parallel versions of the algorithm will be implemented on the origin 2000 to take advantage of the parallel structure of the algorithms. (CU99212)

Total Variation Image Restoration

✉ CHAN Hon Fu Raymond • STROHMER Thomas* • KILMER Misha* • YU Wai Kuen*

□ 1 January 2000

❖ CUHK Research Committee Funding (Direct Grants)

Image processing has many important applications in biological, physical and medical sciences. Problems such as image restoration are computationally intensive and efficient algorithms are needed. On the other hand, high quality restorations are often essential. The purpose of this research is to develop and implement fast iterative methods for solving image restoration problems with high quality using partial information about the degradation sources and imaging system. The researchers will use the newly

developed total-variation techniques in their regularization process. They will develop highly specialized iterative solvers for the sum of convolution-like operator and elliptic operator equations arising from total variational image restoration method. Testing of the algorithms on the Origin 2000 will also be carried out. (PS99008)

Lie Symmetry Related Properties of Some Curvature Flows

✉ CHOU Kai Seng • QU Chang Zheng*

□ 1 March 2000

❖ CUHK Research Committee Funding (Direct Grants)

Differential equations describing curvature driven flows usually admit rich Lie symmetries. Group invariant solutions with respect to these symmetries are important in the study of singularities formation and long time behavior of these flows. In this project the researchers study the classification problem for the group invariant solutions as well as the implication of symmetries on the solvability of these solutions. (PS99009)

Multifractals, Iterated Function Systems and Stochastic Models

✉ LAU Ka Sing • ANH Vo Van*

□ 1 September 1999

❖ Research Grants Council (Earmarked Grants)

Fractals were first introduced by Mandelbrot as a general framework to understand a variety of natural phenomena. One of the basic concepts is that of scaling. When an object possesses a spectrum of scaling, we call it a *multifractal*.

The attractor generated by an iterated function system often possesses a multifractal structure. Data in turbulence, geophysical fields and financial markets have also been found to display multifractal behavior. In this project, the researchers will study the mathematical characteristics of the multifractals in detail, particularly when the iterated function system has overlaps. As an application they will re-examine the multiplicative cascade model of fully developed turbulence from the stochastic point wavelet analysis. The principal investigator has a long research track record on fractals and wavelets and the same for the co-investigator in stochastic processes and modelling. The researchers plan to blend their skills in these areas to understand and model multifractals. (CU99215)

Semigroups and Combinatorics Applications

- ✉ SHUM Kar Ping
□ 1 October 1999
❖ Research Grants Council (Earmarked Grants)

The structure of regular semigroups, quasi-regular semigroups and defining identities of semirings will be investigated. Prefix codes and codes with delays will be studied. Combinatorics applications of semigroups will be explored.
(CU99216)

Harmonic Maps and Harmonic Functions on Noncompact Manifolds

- ✉ TAM Luen Fai
□ 1 September 1999
❖ Research Grants Council (Earmarked Grants)

In this project the principal investigator will study the problems of existence, uniqueness and the properties of harmonic maps from a complete manifold into a Cartan-Hadamard manifold. He will study sufficient conditions for maps on the geometric boundaries between hyperbolic spaces to be extendable to proper harmonic maps on the manifolds. In particular, he will study the relationship between quasi-conformal maps and harmonic maps on hyperbolic spaces. He will also study similar problems for more general negatively curved manifolds. He will study the phenomena of uniqueness and nonuniqueness of proper harmonic maps on hyperbolic spaces. In this project, the principal investigator will also study unbounded harmonic maps from a manifold with nonnegative curvature into Cartan-Hadamard manifolds. In particular, he plans to understand how to construct unbounded harmonic maps with given properties, and to understand the relationship between the images and the Hopf differential of a harmonic diffeomorphism from the complex plane into the hyperbolic two planes. The principal investigator will also study relationship between the geometry and topology of a manifold and the properties of Green's functions and harmonic functions on the manifold.
(CU99217)

Point Condensations Generated by Reaction-Diffusion Systems

- ✉ WEI Juncheng
□ 15 December 1999
❖ Research Grants Council (Earmarked Grants)

Many mathematicians tend to believe that diffusion is a smoothing and trivializing process. In fact, this is the case for single diffusion equations (with or without source terms). However the situation becomes *drastically different* when we come to *systems* of diffusion equations. Back in 1952, Alan

Turing argued that a system of equations modeling two interactive substances, *different diffusion rates* could lead to nonhomogeneous distributions of such reactants. Since then several models in morphogenesis have developed Turing's idea. One distinctive characteristic of many of those models is that at least one of the reactants is often *highly concentrated* in small areas (*point condensations*) and thereby exhibits strikingly different patterns. In this research project, the researchers will study one particular model-Gierer-Meinhardt system-which was proposed by biologists Gierer and Meinhardt in 1972 to model biological pattern formation. It is a system of reaction-diffusion equations of activator-inhibitor type and has generated considerable interests in both mathematics and biology. They propose to study the effect of domain properties (such as geometry and domain topology), and diffusion coefficients on the existence, multiplicity, the profile and the (structural or dynamical) stability of *noncontant steady states* for this system. The techniques and the methods in studying the Gierer-Meinhardt system are useful, mathematically and practically. They can be applied to a large class of mathematical problems, such as the well-known Cahn-Hilliard equation in phase transition, Ginzberg-Landau equation in superconductor, nonlinear Schrodinger equations in mathematical physics and the Yamabe problem in conformal geometry. The results obtained can explain many interesting biological and physical phenomenon and discover some new patterns.
(CU99218)

Analysis of Nonlinear Evolution Partial Differential Equations in Compressible Fluids

- ✉ XIN Zhouping
□ 1 September 1999
❖ Research Grants Council (Earmarked Grants)

The governing equations in the continuum mechanics and many other branches of science are nonlinear evolution partial differential equations. Important examples include the Euler and Navler-Stokes equations for compressible fluids, the Boltzmann equations in kinetic theory, and equations for magneto-hydro-dynamics, etc. The study and interpretations of solutions to these nonlinear partial differential equations have important applications in many fields such as astrophysics, meteology, chemical engineering, geophysics, and image processing, etc. The analysis and understanding of the dynamics and interactions of basic wave patterns such as shock waves, rarefaction waves, diffusion waves, and boundary layers play a fundamental role in the study of general flows governed by such nonlinear systems. The main objectives of this research project are to attack some outstanding problems in this field which are both physically important and mathematically challenging, such as,

the effects of the small scale dissipations or relaxation processes on large scale fluid motions, global well-posedness of strong and weak solutions, nonlinear stability and interaction of basic waves, design and analysis of numerical methods for large scale calculations of discontinuous flows, and fluid-dynamics limits for various kinetic models. One of the main idea is to refine the conventional methods designed to study smooth flows or unrelaxed systems by taking into account more internal structures of the underlying discontinuous flows, and study these problems both theoretically and numerically. (CU99219)

Groups and Their Applications (CU97720)
 ✎ SHUM Kar Ping

1998-99 Burside Type Problems Related to Semigroups (PS98012)
 ✎ SHUM Kar Ping • GUO Yuqi* • STRUKOV Segy P.* • NGUEYH Van Sanh* • SEN M K*

1996-97 Analytic Problems on Complete Manifolds (CU96704)
 ✎ TAM Luen Fai

1997-98 Some Contributions to Linear & Nonlinear Analysis (PS97025)
 ✎ TAM Ping Kwan • TAN Kok Keong*

1997-98 Harmonic Maps and Structures of Manifolds (CU97722)
 ✎ WAN Yau Heng Tom

1996-97 Concentration Phenomena in Nonlinear Elliptic Equations (CU96721)
 ✎ WEI Juncheng • CHOU Kai Seng

1997-98 On the Effect of Domain Geometry and Topology in Nonlinear Elliptic Equations (CU97723)
 ✎ WEI Juncheng

1998-99 Mathematical Study of A Chemotaxis System (PS98013)
 ✎ WEI Juncheng

1998-99 Efficient Numerical Methods for Solving Inverse Problems (CU98004)
 ✎ ZOU Jun

1998-99 Numerical Identification of Parameters in Physical and Engineering Systems (PS98014)
 ✎ ZOU Jun • YAMAMOTO Masahiro*

1998-99 Numerical Methods for Ill-Posed Problems in Computed Tomography (PS98027)
 ✎ ZOU Jun • Peter MAASS* • Dicken VOLKER*

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>
1997-98	Fast Iterative Methods for Integral Equations (CU97730) ✎ CHAN Hon Fu Raymond
1998-99	Preconditioners for Ill-Conditioned Toeplitz Matrices (PS98026) ✎ CHAN Hon Fu Raymond • Gabriele STEIDL* • Daniel POTTS*
1997-98	Multifractal Structure and Self-similarity (CU97703) ✎ LAU Ka Sing
1998-99	Convolution Equations Associated with Scalings (CU98057) ✎ LAU Ka Sing • LEUNG Chi Wai
1998-99	Harmonic Functions on Groups and Homogeneous Spaces (PS98003) ✎ LEUNG Chi Wai • CHU Cho Ho*
1998-99	Invariants of Compact Strongly Pseudoconvex CR Manifolds and Applications (CU98051) ✎ LUK Hing Sun • YAU S. T. Stephen*
1998-99	Asymptotic Analysis of Optimization and Variational Problems (CU98002) ✎ NG Kung Fu • PANG Jong Shi*
1997-98	General Theory of Morita Equivalence for Rings, Semigroups, General Classical

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- <P999910> **NG Kung Fu and ZHENG Xi Yin.** “Global Error Bounds with Fractional Exponents”. *Math.Program., Ser B* vol.88, pp.357-370. 2000.

RESEARCH PROJECTS

Materials Studies of Chemical Nickel Bumping for Enhancing the Reliability of Low-cost Flipchip Technology

- ✉ LAU Leo Woon Ming
- 1 April 1999
- ❖ LeaRonal Asia Ltd.

LeaRonal is in the process of developing a low-cost flip-chip technology, and accepts this Research Agreement to fund The Chinese University of Hong Kong (CUHK) a research project ("Project") in this subject. The Project will deliver data on the effects of the preparation of the chemical nickel bumping on the reliability of the resultant solder bumping of the low-cost flip-chip technology. LeaRonal will facilitate an Master of Philosophy (MPhil.) student, from CUHK, to conduct the Project at LeaRonal, with an understanding that the student will use the research results from the Project to complete an MPhil. thesis. Dr. Zaheed Karim of LeaRonal will be the chief supervisor for her work at LeaRonal, and Professor Leo Lau W. M. will be the chief supervisor for her thesis research and thesis preparation. In addition to other arrangements of research interactions, regular progress review meetings will be held at LeaRonal or CUHK for, Professor Lau, and Dr. Karim to go over the student's research progress and define her remaining work plan on the Project. Such work planning will take into account of the student's MPhil. degree requirements. (PS98029)

Reliability of Spin Valve GMR Devices

- ✉ LAU Leo Woon Ming
- 1 June 1999
- ❖ SAE Magnetics (H.K.) Ltd.

SAE is in the process of establishing a methodology to determine the reliability and life time of spin valve GMR devices, and accepts this Research Agreement to fund The Chinese University of Hong Kong (CUHK) a research project ("Project") in this subject. The Project will deliver data on the relationships among life time, materials structure and head design of spin valve GMR devices. SAE will facilitate an MPhil. student from CUHK to conduct the Project at SAE, with an understanding that the student will use the research results from the Project to complete an MPhil. thesis. Dr. Yong Shen of SAE will be the chief supervisor for her work at SAE, and Professor Leo W.M. Lau will be the chief supervisor for her thesis research and preparation. In addition to other arrangements of research interactions, regular progress review meetings will be held at SAE or CUHK for the student, Professor Lau, and Dr. Shen

to go over the student's research progress and define her remaining work plan on the Project. Such work planning will take into account of the student's MPhil. degree requirements. (PS98028)

Promotion of Creativity with a "Student-Centred" Approach in Teaching and Learning Experimental Science and Engineering

- ✉ LAU Leo Woon Ming • WONG Hong Kuen • KUI Hin Wing • Ian Howard WILSON (Dept of Electronic Engineering) • CHU Ming Chung • TONG Shiu Sing Dominic • LEE Yuk Yan • WONG Wing Hung • MAK Se Yuen (Dept of Curriculum & Instruction) • CHAN Jimmy S F* • SHIN Franklin G*
- 1 September 1999
- ❖ UGC Teaching Development Grants

The current global competition in industrial productivity has driven many countries, including Hong Kong, to re-examine their education policies and systems for the promotion of science education, creativity and innovation. In reviewing our current situation in teaching experimental science and engineering at schools and universities, we find that limitations in time, space, and budget have led to a compromise in the demonstration of knowledge creation and inventions. Often, class work simply means lectures with students as passive objects. In lab courses, the availability of only a few sets of equipment does not allow students to use lab learning to clarify or verify what they learn in class.

This project aims at stimulating students' creativity in science and engineering education. Class work in experimental science and engineering will be enriched by frequent in-class demonstration to show how modern science and engineering knowledge and inventions have been created. An exhibition and forum will be organised to collect actual demonstration kits and models and innovative methodologies of in-class activities, from teachers of universities and schools in Hong Kong and nearby regions, for a "student-centred" approach in teaching science and engineering. In addition, a first-year Physics lab course will be overhauled with more equipment and new computer technology to demonstrate how lab learning can be coupled with class learning to stimulate students to discover knowledge by themselves. Virtual experiments will be animated by computers, stored on CD ROMs and distributed to students to encourage self-learning. These results will be promoted to schools and other universities. (PS99028)

Engineering Homoepitaxial Growth of cBN

- ✉ LAU Leo Woon Ming

□ 1 October 1999

❖ Research Grants Council (Earmarked Grants)

Cubic boron nitride is a man-made compound suitable for making novel electronic devices and durable cutting tools. Currently cBN products are made by cBN powder synthesized via the conventional high-pressure approach. Their production costs will be largely reduced if a low-pressure thin film technology for growing cBN can be developed. However, the progress in such a technology development has been slow, which is at least partially caused by the lack of accurate data on cBN surfaces and on the conditions for cBN growth on a cBN crystal. Although conventional materials research techniques for studying surface crystallography and engineering surface reactions require a sample size larger than the sub-millimeter cBN crystals in the market, the researchers have recently confirmed that with their new micro-beam research facilities at CUHK, the surface composition and surface reactions can be measured accurately from a (111) facet of a 0.8mm cBN powder. In the present project, they will study cBN growth on such cBN (111) facets. First, they will develop analysis and preparation techniques for the production of (111) cBN surfaces. Then, they will search for and optimize the key engineering parameters for homoepitaxial growth of cBN on such (111) surfaces. (CU99440)

Frontiers in Surface Analysis and Their Novel Applications

✉ LAU Leo Woon Ming

□ 1 December 1999

❖ Croucher Advanced Study Institute

To clarify the current status in surface analysis technologies, and to define their future developments. To survey recent novel applications of surface analysis and to raise ideas on how to use surface analysis in other R&D activities, particularly for assisting the development of indigenous high-value added industrial sectors in new materials. (PS99020)

Phase Segregation in Manganeses

✉ LIN Hai Qing

□ 1 October 1999

❖ CUHK Research Committee Funding (Direct Grants)

The researchers propose to conduct a theoretical investigation of phase separation phenomenon observed in colossal magnetoresistance materials. The physically relevant model to be used consists of Zener's double exchange model plus superexchange

between localized manganite spins and Coulomb interactions between electrons. They will employ a variety of numerical techniques (exact diagonalizations, quantum Monte Carlo simulations) and analytic methods (low density approximation, unrestricted Hartree-Fock, functional integral, 1/S expansion) to tackle the subtle many-body correlations that arise from the complex interplay of electron-electron and electron-spin interactions, and obtain the phase diagram of these materials as a function of chemical substitution. Effects of Jahn-Teller distortion will also be discussed. Their studies will reveal the physical nature of phase separation in colossal magnetoresistance materials and shed light on the understanding of other magnetic systems. (PS99013)

Valuation of European Options Subject to Default Risk Using Signaling Process

✉ LO Chi Fai • HUI Cho Hoi*

□ 1 April 2000

❖ CUHK Research Committee Funding (Direct Grants)

The project will extend the defaultable bond valuation with drifted default barrier recently developed by Lo and Hui (1999) to the valuation of European options subject to default risk and interest rate risk. By using the signaling process, the possibility of early default before option maturity can be studied. Furthermore, since the project is characterized by a risk adjustable default barrier, more realistic default scenarios can be put into the valuation model via the adjustable parameter. (PS99023)

Dye-doped Sol-gel Materials for Low Power Optical Processing Applications

✉ LO Yam Kuen Dennis

□ 31 December 1999

❖ Research Grants Council (Earmarked Grants)

The fabrication and characterization of dye-doped sol-gel materials in bulk or thin film form will be carried out in this proposed research. The need of real-time, holographic materials for optical communication and information processing are strong as the world demand for fast and accurate information grows. Such need has been filled by inorganic crystals or sensitized polymers. However, the use of inorganic crystals in large quantity presents integration problem in optical fiber based communication system. As for polymeric materials, the long-term stability is suspected. As the market demand grows, new materials more compatible with fiber optics and semiconductor-manufacturing technology must be developed. Sol-gel derived

inorganic glasses doped with dye molecules hold good promises. Dye-doped inorganic glasses derived from sol-gel technology is much more inexpensive than photorefractive crystals. Compared to polymers, they are mechanically stronger and more superior in terms of optical properties. The researchers have successfully fabricated free standing eosin Y-doped silica-gel-glass films and demonstrated optical phase conjugation with transient diffraction efficiency of 1×10^{-5} at pump power as low as 6 mW. This research would extend their efforts to fabricate sol-gel materials of higher efficiency and broader spectral range. Fundamental data such as triplet state lifetime and state to state branching ratio will be studied by time-integrated and transient spectroscopy for selected dye/gel-glass systems. Degenerate four-wave mixing and/or self-diffraction experiments will be performed on the more promising dye/gel-glass systems. Simple devices for optical communication or optical computing will be designed and constructed to reveal the capability of the sol-gel materials. In view of the vast market potential of telecommunication in Greater China in the decades to come, the research and development of new photonic materials is of much importance to the local industry. (CU99366)

An IT-based Resource Package for Secondary Schools in Hong Kong (Subject: Physics)

- ✍ TONG Shiu Sing Dominic • WONG Wing Hung • CHU Ming Chung • LAU Leo Woon Ming • MAK Se Yuen (Dept of Curriculum & Instruction)
- 18 February 2000
- ❖ Education Department, Hong Kong SAR Government

The project aims at establishing a web-based physics teaching resource package for secondary schools. It comprises the following components:

Physics teaching resources:

- (1) PowerPoint presentations covering selected topics in the subject syllabuses;
- (2) Interactive exercises (MC questions) with auto-marking, score recording and reporting features;
- (3) Animations, interactive simulations, and educational games (using Java, Flash and other standard animation tools) which help to convey physical concepts and stimulate interest in learning;
- (4) A mirror web site to the Virtual Physics Laboratory of the National Taiwan University;
- (5) A collection of images useful to the teaching of physics;
- (6) Trial teaching materials of proposed physics curriculum;
- (7) A dictionary that provides the explanations and pronunciations of glossary terms, physical constants, units and formulae;

- (8) Links to interactive teaching resources worldwide.

Support to a quality circle:

- (1) A password-protected web page accessible by registered physics teachers only, including a web-based discussion forum for physics teachers to share teaching experience and resources;
- (2) A notice board and an e-mail system for disseminating news on educational activities to registered physics teachers.

Resources which promote the learning and teaching of physics:

- (1) Biographies of famous physicists, their scientific and human aspects;
- (2) Frequently asked, interesting physics questions;
- (3) Articles on interesting topics or the latest discoveries of physics, in daily contexts relating to social and current issues.

Detailed teachers' guide to the package (totally 2,500 sets) will be delivered to the Education Department and all the secondary schools in Hong Kong. (ED99035)

Non-destructive Dating of Ancient Ceramics by Laser Induced Thermoluminescence

- ✍ WONG King Young • LO Yam Kuen Dennis • LEE Chung Kay • LAU Leo Woon Ming • KWOK Wai Man Raymond (Dept of Chemistry) • NING Hung Pun Gary (Art Museum)
- 1 September 1999
- ❖ Research Grants Council (Earmarked Grants)

Non-destructive dating of ancient ceramics by laser induced thermoluminescence (TL) will be investigated experimentally and theoretically in this proposed research. Conventional TL dating of ancient pottery, porcelain or ceramics in general requires physical extraction of specimen from the artifact to be tested. The process of physical removal of specimen without exception causes damage, with the result that both the aesthetic style and the commercial value are compromised. If the artifact is small in size, the physical damage done could be catastrophic. TL induced by laser heating is totally non-destructive. Laser beam can be guided by optical fiber to focus on any area of the artifact not easily accessible. The TL signal so induced can be collected by optical fiber bundle which is interfaced with computerized detection instrumentation for real time analysis. The time required of TL dating using laser could be a matter of minutes, instead of weeks often required by the conventional TL dating technique. When successfully developed, laser induced TL dating offers reduction in processing time and the capability to completely preserve the physical integrity of the artifacts. These qualities are unmatched by the conventional TL techniques. The antiquity market in Hong Kong, one of the most robust in the world, should stand to gain much when

the laser TL dating technique becomes fully developed.
(CU99009)

Experimental Investigation of Turbulent Convection at High Rayleigh Numbers and in Large Aspect-Ratio Cells

- ✉ XIA Keqing
- ☐ 1 December 1999
- ❖ Research Grants Council (Earmarked Grants)

Rayleigh-Benard (RB) convection is the motion of fluids confined in-between two horizontally parallel conducting surfaces across which a constant temperature difference is maintained. When the temperature difference is large enough, the fluid motion becomes turbulent, a state that appears to be random in both space and time. Understanding turbulence is not only important to the study of non-linear dynamics, but also has a myriad of practical applications in engineering and meteorology. As a model system for turbulence studies, RB convection has attracted much attention in recent years, and considerable progress has been made.

In this study, the researchers present a program of experimental investigations which involve (1) measurements of the spatial structures and scaling properties of both the thermal and the viscous boundary layers in three convection cells with a combined range of the Rayleigh number (Ra) that spans from 10^8 to 10^{13} ; (2) measurements of boundary layer properties and flow visualization in cells with very large aspect ratios (~10-20) and at sufficiently large Ra ($\sim 10^8$ - 10^9). Their aims are (1) to find a detailed picture of both the velocity and the temperature fields in the boundary layer region and their relations with the large-scale circulation; and (2) to determine the connective state and flow patterns in turbulent convection in the central part of the cell when there is a minimal influence from the sidewall.
(CU99224)

Laterally Confined Surface Plasmons and Electron Image States in Corrugated Metal Surface

- ✉ YU Kin Wah
- ☐ 1 November 1999
- ❖ CUHK Research Committee Funding (Direct Grants)

A theory will be developed to investigate surface plasmons near (periodic) corrugated metal surfaces. The lateral modulation is expected to break the dispersions of the surface plasmons into mini-bands with energy gaps appearing at the edge of the first Brillouin zone associated with the periodic interfaces. The surface modes are confined on the corrugated

surface such that they show a standing wave character in the lateral direction of the corrugated surface. The researchers will further study the interaction of an exterior electron with the surface plasmon fields, and obtain the (dynamic) electron image potential near the corrugated metal surface. The theoretical calculations will be compared with recent experimental results obtained with angle-resolved two-photon photoemission techniques.
(PS99014)

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>
1996-97	Model Study of Fracture Propagation in Solids (CU96718) ✉ CHING Shuk Chi Emily • NAKANISHI Hiizu* • LANGER James S.*
1997-98	Large Scale Flow and Heat Flux in Turbulent Convection (PS97011) ✉ CHING Shuk Chi Emily
1998-99	Statistics and Scaling in Turbulence (CU98119) ✉ CHING Shuk Chi Emily
1997-98	General Relativistic Astrophysics: Coalescences of Neutron Star Binaries (CU97712) ✉ CHU Ming Chung • LEUNG Pui Tang • SUEN Wai Mo*
1998-99	Structure and Dynamics of Multi-Component Bose-Einstein Condensates (PS98008) ✉ CHU Ming Chung
1998-99	Pattern Recognition of Radar Echoes for Rainstorm Forecasting (PS98024) ✉ CHU Ming Chung • WONG Wing Hung
1993-94	Novel Optical Materials for Photonics Technologies (BP94012) ✉ HARK Sui Kong • HUI Pak Ming • LEE Wing Kee • LO Yam Kuen Dennis • NG Hang Leung Dickon • WONG King Young • CHAN Kam Tai (Dept of Electronic Engineering) • HSU Chung Chi (Dept of Electronic Engineering)
1997-98	Vehicular Traffic Flow Problems: Statistical Physics Approaches (CU97714) ✉ HUI Pak Ming

1997-98	Financial Markets as Complex Dynamical Systems (PS97006) ✍ HUI Pak Ming • JOHNSON Neil F.*	1997-98	Quantum Monte Carlo Simulations of Three Band Hubbard Model (CU97713) ✍ LIN Hai Qing • GUBERNATIS J.E.*
1998-99	Theory of harmonic generations in random composites of nonlinear dielectrics (CU98129) ✍ HUI Pak Ming	1998-99	Electron-Phonon Interactions in Highly Correlated, Quasi-One-Dimensional Electronic Materials (CU98120) ✍ LIN Hai Qing • CAMPBELL David Kelly*
1989-90	Microstructure of Undercooled Ge and Si (BP87003) ✍ KUI Hin Wing	1997-98	Option Valuation of Constant Elasticity of Variance Process with Absorbing Boundaries and Its Applications to the Hong Kong Equity Market (PS97015) ✍ LO Chi Fai • HUI Cho Hoi*
1989-90	The Viscosity of Easy Glass Formers (BP87004) ✍ KUI Hin Wing	1997-98	Experimental Study of Dye-Doped Sol-Gel Derived Silica as Tunable Solid State Laser Materials (CU97504) ✍ LO Yam Kuen Dennis
1996-97	Properties of Undercooled Molten Eutectic Alloys (CU96719) ✍ KUI Hin Wing	1998-99	Tunable solid state lasers in the VUV pumped by discharge excimer lamp (CU98024) ✍ LO Yam Kuen Dennis
1997-98	Grain Refinement in Undercooled Metals (PS97020) ✍ KUI Hin Wing	1998-99	Processing and Properties of Al-Based Metal Matrix Composites Reinforced by Ceramic Particles and Intermetallic Compounds (PS98011) ✍ NG Hang Leung Dickon
1998-99	Unusual Electromagnetic Radiation Characteristics in Media (PS98009) ✍ LAI Hon Ming	1995-96	Interplay of Magnetic and Superconducting Properties of Oxide Multilayers (PS95016) ✍ WONG Hong Kuen
1998-99	Development of Advanced Surface Analysis and Engineering Technologies for the Metal Finishing and Related Industries (PS98023) ✍ LAU Leo Woon Ming • KWOK Wai Man Raymund (Dept of Chemistry) • Ian Howard WILSON (Dept of Electronic Engineering) • YEUNG L. K. Kinny* • LO W. Y.*	1997-98	Oxygen Effects in Colossal Magnetoresistance Materials (CU97718) ✍ WONG Hong Kuen
1998-99	Engineering New Etching Processes for Semiconductors with Hyperthermal Ion Bombardment (CU98315) ✍ LAU Leo Woon Ming	1993-94	Study of Statistical Nature of Particle Motion in Fluids (BP00101) ✍ XIA Keqing
1998-99	Service Engineer for the Advanced Surface and Materials Analysis Centre (EE98047C) ✍ LAU Leo Woon Ming	1994-95	Experimental Studies of Turbulent Convection (PS94012) ✍ XIA Keqing
1998-99	Studies of Spatial Soliton in a Photorefractive Crystal Induced by a Laser Beam (PS98019) ✍ LEE Wing Kee	1996-97	Measurements of Boundary Layer Properties in Turbulent Convection (CU96724) ✍ XIA Keqing
1998-99	Decoherence Effects of Quantum Computers (PS98010) ✍ LEUNG Pui Tang	1998-99	Experimental Investigation of the Relationship Between the Temperature Power Spectrum and the Viscous Shear in Turbulent Rayleigh-Benard Convection (PS98020)

	✉ XIA Keqing	1998-99	The Inversion Problem for Quasinormal Modes (CU98006)
1998-99	Weathering and Aging of Modified Concrete (EE98035) ✉ YAU Kwok Fung		✉ YOUNG Kenneth • LEUNG Pui Tang • LING Siu Hing* • SUEN Wai Mo* • WONG Samuel S. M.*
1998-99	Manufacture of High Temperature Superconducting Cables (PS98022) ✉ YAU Kwok Fung • LAU Leo Woon Ming	1998-99	Optical Nonlinearity Enhancement via Electric Field Induced Aggregation (CU98290) ✉ YU Kin Wah

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- <P000234> **Lin, Hai-Qing.** "Introduction to Quantum Monte Carlo Simulations". *Purple Mountain Workshop on Science and Technology of Microstructures* vol.7, p.24. Nanjing, China: CASSTM, 2000.04.
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see also <P993440>

RESEARCH PROJECTS

Bayesian Computation in Software Reliability

- ✉ CHAN Ping Shing Ben • CHAN Siu Fung Ivan*
- 1 December 1999
- ❖ CUHK Research Committee Funding (Direct Grants)

In software development, it is helpful to have a good estimate on the number of bugs. The estimate is usually made during the testing phase by recording the timing of the discovery of each bug. The aim of this project is to model the observed times as order statistics of independent non-identical exponential random variables with different failure rates. By adopting a Bayesian point of view, the posterior distribution of a failure rate is computed by the Markov Chain Monte Carlo methods. The predictive distribution of the time to discovery of the next bug is also computed. This distribution is very important because it specifies the reliability of the software. The same analysis will be carried out when N , which is the total number of bugs in the software, is also a random variable.
(EE99027)

Multiple Comparison with a Control in Partially One-sided Families

- ✉ CHEUNG Siu Hung • Dr KWONG Koon Shing*
- 1 April 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Multiple comparison procedures (MCPs) are commonly used statistical techniques in various scientific fields such as physiology and agrobiolgy. Among different MCPs, techniques related to multiple comparison with a control is frequently applied in data analysis. For instance, in clinical trials, the objective is to compare three new drugs (Drugs A, B, and C) to a popular drug (Drug D) to treat high blood pressure. Thus the inferential family consists of 3 comparisons (A versus D, B versus D and C versus D). However, in such cases, standard statistical techniques are available just for inferential families which contain:

- (1) only two-sided hypotheses (to test if Drugs A, B, C are different from the control), or
- (2) only one-sided hypotheses (to test if Drugs A, B, C are better (worse) than the control when prior knowledge on the superiority (inferiority) of Drugs A, B, C to Drug D has been established).

In this project, the researchers will develop procedures which deal with *mixed* inferential families that contains both one-sided and two-sided hypotheses. Methods which provide simultaneous

confidence intervals in such cases will also be investigated.
(PS99024)

Markov Chain Monte Carlo and Stochastic Approximation Methods for Statistical Computing

- ✉ GU Ming Gao
- 1 October 1999
- ❖ Research Grants Council (Earmarked Grants)

Recently, much research efforts in Statistics have been devoted to the area of Statistical computing. The emergence of Monte Carlo methodologies has provided tools for realistic modeling of applications in fields like finance, economics, Biomedical research and industrial quality control. Many progresses have been made for the Bayesian Statistical computing. The impact of Monte Carlo methods on classical non-Baysian Statistical setting is far less significant. This research project aims to fill this gap by employing the method of stochastic approximation.
(CU99226)

The Review of the Central Registry of Drug Abuse

- ✉ LAU Tai Shing • Mr CHAN Char Nie*
- 28 February 2000
- ❖ Action Committee Against Narcotics

The researchers plan to EVALUATE the current data collection method employed by Central Registry of Drug Abuse (CRDA).
(PS99025)

Analysis of Structural Equation Models with Functional Data

- ✉ LEE Sik Yum
- 1 December 1999
- ❖ CUHK Research Committee Funding (Direct Grants)

Structural equation modeling (Jöreskog, 1978; Bentler, 1980) is a multivariate technique in studying covariances and other relationships among observed and latent variables. Based on observed point-wise data that satisfy a number of assumptions, it has been applied widely in behavioral, medical and social sciences. However, in practice, there are a lot of problems in which the data are not single points, but are functions observed continuously. The objective of this research project is to develop an estimation procedure to analyze structural equation models with functional data. Powerful statistical techniques in structural equation modeling and nonparametric methods will be coupled together in the estimation procedure. The developed procedure will be applied

to some important areas in financial medical and social sciences, such as longitudinal studies, growth curves analysis, etc.
(PS99015)

Statistical Developments of Nonlinear Structural Equation Models

- ✉ LEE Sik Yum
- ☐ 31 December 1999
- ❖ Research Grants Council (Earmarked Grants)

At present, almost all statistical theory and computer software in structural equation modeling are developed based on models that involved only linear relationships among the manifest and the latent variables. However, in many areas, nonlinear relationships, such as the quadratic and interaction effects among the latent variables, are very important in establishing a correct model. The main objective of this project is to investigate the maximum likelihood and the Bayesian approaches for analysis of a nonlinear structural equation model. It will be shown that the proposed nonlinear model is very general. Efficient computational methods based on various types of Markov Chain Monte Carlo (MCMC) procedures, the accelerated EM algorithm, and/or their combinations will be developed. Maximum likelihood and Bayesian estimates of the structural parameters as well as direct estimates of the latent variables will be produced for both continuous and polytomous types of data. Statistical properties, including standard errors estimates and goodness of fit assessment of the posited model, will be derived. The newly developed methodologies will be applied to solve substantive problems in business, education, psychology and social science.
(CU99088)

Influence Analysis with Ordinal Categorical Variables

- ✉ POON Wai Yin
- ☐ 1 November 1999
- ❖ CUHK Research Committee Funding (Direct Grants)

Influential observations have tremendous effects on the results of statistical analyses and their identification has received considerable attention. Available procedures for identifying influential observations are usually based on the assumption that the data are continuous in scale. However, when data are collected through interviews or questionnaires, the overwhelming proportion of data is ordinal categorical. Nowadays, it is well known that the convenient approach of assuming a continuous scale for the ordinal observations will lead to misleading results. Fortunately, various statistical methods

designated for analyzing data sets with ordered categorical variables continue to emerge and some of these methods have been incorporated into popular softwares such as PRELIS & LISREL, LISCOMP and EQS. However, little has been achieved in the literature for detecting influential observations to complement these methods. In light of this, the objective of this project is to develop procedures for identifying influential observations in data sets consisting ordinal categorical variables. The local influence perturbation approach will be utilized to develop diagnostic procedure and the practical applicability of the procedure will be investigated by analyzing real data sets.
(PS99016)

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	Causal Relationship (MD98067) ✉ LAU Tai Shing
1989-90	Analysis of Continuous and Polytomous Variables (CS85001) ✉ LEE Sik Yum • POON Wai Yin
1989-90	Analysis of Incomplete Data (CS88002) ✉ LEE Sik Yum • POON Wai Yin
1989-90	Analysis of Structural Equation Models with Correlated Data (CS89006) ✉ LEE Sik Yum • POON Wai Yin
1997-98	Analysis of Structural Equation Models via the Bayesian Approach (CU97217) ✉ LEE Sik Yum • POON Wai Yin
1989-90	Analysis of Fuzzy Data (CS89005) ✉ POON Wai Yin • LEE Sik Yum • LEUNG Y. P.*
1998-99	Further Developments on the Local Influence Approach (CU98186) ✉ POON Wai Yin • POON Yat Sun* • LEE Sik Yum
1997-98	Multiple Forecasts and Causality Analysis in Time Series Modelling (CU97401) ✉ WU Ka Ho Eden • CHEUNG Siu Hung • CHAN Ping Shing Ben
1998-99	Third Analysis of Survey Error (PS98021) ✉ WU Ka Ho Eden • CHEN Zhao Guo*

RESEARCH OUTPUTS AND PUBLICATIONS

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see also <P992064>, <P992082>, <P992231>

