RESEARCH PROJECTS

"Representations and Structures of Regular Semigroups, Regular Rings and Related Topics"

- ✍ SHUM Kar Ping
- ❑ 30 October 2001
- ❖ Research Grants Council (Earmarked Grants)

We investigate the structure of regular semigroups, regular rings and their matrix representations of regular semigroups and regular rings. We shall use the replacement technique of free modules, developed by Xu Yonghua and Shum in 1993, to deal with the infinite matrix subrings FM_Γ (R) which consists of all $\Gamma \times \Gamma$-matrices with only finitely many non-zero entries. We shall also study some classes of generalized regular semigroups and semirings, in particular, the variety of abundant semigroups and the variety of idempotent semirings.
(PS01260)

Fuzzy Mathematics with Applications in Algebra and Automata

- ✍ SHUM Kar Ping ● WU Congxin* ● SEN M.K.*
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Fuzzy Logics and Fuzzy Mathematics were firstly introduced by L.A. Zadea in 1965. This kind of mathematics has been rapidly developed in recent years, especially it has board applications in Engineering Mathematics, Industrial Engineering and Information Science. However, very few mathematicians in Hong Kong have done research in this new area.
The P.I. has recently worked with Professor M.K. Sen, University of Calcutta and Wu Congxin, Director of Harbin Institute of Mathematics on Fuzzy Algebras since 1997. He has obtained some interesting results and has published a number of papers in international journal of Fuzzy Mathematics.
In this project, we aim to investigate the properties of fuzzy ideals of semigroups and to study the represenatation of fuzzy semigroups on strong semilattices. This would provide useful information on the structure theory of fuzzy semigoups. Also, with the collaboration of Professor Sen and Wu, we hope to find some applications of Fuzzy algebra in the theory of automata. The results would be useful in Information Science.
(PS01477)

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

Edition	Title/Investigators
1999-00	Semigroups and Combinatorics Applications (CU99216) ✍ SHUM Kar Ping
2000-01	On Von Neumann Regularity of Infinite Matrix Subrings (PS00587) ✍ SHUM Kar Ping ● GUO Yuqi* ● NGUEYH Van Sanh* ● SEN M K* ● STRUKOV Segy P.*

RESEARCH OUTPUTS AND PUBLICATIONS

<P006231> **SHUM Kar Ping; Guo X.J. and REN Xueming.** "(l)-Green's Relations and Perfect rpp Semigroups". *Proceedings of the Third Asian Mathematical Conference 2000* pp.604-613. World Scientific, 2000.10.

<P016862> **S.P. STRUNKOV and SHUM Kar Ping.** "Asymptotic Properties of Elementary in Group Rings of Finite Groups". *Communications in Algebra, Marcel Dekker* vol.29 no.9, pp. 3741-3746. USA: Marcel Dekker, Inc., 2001.

<P017225> **KONG X.Z. and SHUM Kar Ping.** "On the Structure of Regular Crypto Semigroups". *Communications in Algebra* vol.29 no.6, pp.2461-2479. NY, USA: Marcel Dekker, 2001.

<P017767> **WANG Guixiang; WU Congxin and SHUM Kar Ping.** "The Concept of n-cut Cube Fuzzy Numbers and Embedding Theorem". *IEEE - Conference Proceedings* vol. 1, pp.145-149. Vancouver, Canada: Joint 9th IFSA World Congress and 20th NAFIPS International Conference, 2001.

<P018773> **GUO Wenbin and SHUM Kar Ping.** "Minimal Formations of Universal Algebras". *Discussiones Mathematicae General Algebra and Applications* vol.21, pp.201-205. Poland, 2001.

<P019635> **SHUM Kar Ping and CHEN Yu Qun.** "Morita Equivalence for Factorisable Semigroups". *Acta Mathematica Sinica* vol. 17 no.3, pp.437-454. 2001.07.

<P026021> **SHUM Kar Ping and GUO Wenbin.** "Formation Operators on Classes of Algebras". *Communication in Algebra* vol.30 no.7, pp.3457-3472. Marcel Dekker, Inc., 2002.

<P026217> **SHUM Kar Ping and GUO Wenbin.** "Problems on Product of Formations". *Manuscripta Mathematica* vol.108, pp.205-215. Springer - Verlag, 2002.

<P026377> **SHUM Kar Ping and LEUNG Chi Kwan.** "New Characterization Theorems of Semisimple Artinian Rings". *International Mathematical Journal* vol.2 no.9, pp.943-950. 2002.

<P026793> **SHUM Kar Ping and GUO Wenbin.** "On Totally Local Formations of Groups". *Communications in Algebra* vol.30 no.5, pp.2117-2131. Marcel Dekker, 2002.

<P026995> **Xiaoli CHEN, Wenbin GUO and SHUM Kar Ping.** "Bounds of the Nilpotent Lengths of Finite Groups with Given Sylow Normalizers ". *Intern. Math. Journal* vol 2. no. 3, pp.289 - 295. 2002.

<P02728> **GUO Xiu Yun and SHUM Kar Ping.** "On P-nilpotency and Minimal Subgroups of Finite Groups". Paper presented in the International Conference on Algebra and its Applications (ICAA 2002), organized by Chulalongkorn University, Bangkok, Thailand, 2002.

<P027655> **SHUM Kar Ping; GUO Yuqi and ZHAO Xianzhong.** "Sturdy Frame of Type (2,2) Algebras With Application to Semigroup Structure of Semirings". *Advances in Mathematics* vol.31 no.3, pp.290-292. 2002.06.

<P028308> **ZHAO Xianzhong; GUO Yuqi and SHUM Kar Ping.** "D-Subvarieties of the Variety of Idempotent Semirings". *Algebra Colloquium* vol.9 no.1, pp.15-28. 2002.

<P028736> **SHUM Kar Ping; GUO Wenbin and SKIBA A.N.** "On F-Residuals of Finite Groups". *Bull. Austral. Math. Soc.* vol. 65, pp. 271-275. 2002.

<P028853> **SHUM Kar Ping and GUO Xiuyun.** "The Influence of Minimal Subgroups of Focal Subgroups on the Structure of Finite Groups". *Journal of Pure and Applied Algebra* 169, pp.43-50. The Netherlands: Elsevier Science BV, 2002.

<P029962> **CHEN Yuqun and SHUM Kar Ping.** "Rees Short Exact Sequences of S-systems". *Semigroup Forum* vol.65, pp.141-148. NY, USA: Springer-Verlag New York Inc., 2002.

RESEARCH PROJECTS

Biochemical Characterization of Chaperone-Mediated Suppression of Polyglutamine Neurodegeneration: Identification of Proteins Required for Neurodegeneration Suppression

- ✍ CHAN Ho Yin Edwin ● TUNG Kit Ching (Biochemistry) ● BONINI Nancy M*
- ❑ 1 July 2002
- ❖ CUHK Mainline Research Scheme

Polyglutamine disease is a group of human degenerative brain disorder caused by CAG trinucleotide repeat expansion in the coding region of disease genes. Mutated disease genes encode proteins with an elongated polyglutamine domain which, in turn, leads to neural dysfunction and neuronal cell death. To date, CAG expansion has been shown to be the cause of eight neurodegenerative diseases. Polyglutamine disease successfully been modeled in the fruit fly *Drosophila melanogaster*. Flies expressing expanded disease proteins display characteristic features of the human disease including late-onset progressive degeneration and formation of insoluble nuclear inclusions (NIs) in affected neurons. NIs are heterogeneous in nature. In addition to expanded polyglutamine disease proteins, a number of cellular proteins including certain transcriptional regulators are found in NIs. Yet, cellular activities of these proteins are found to be compromised are believed to be caused by protein denaturation. Molecular chaperones are among the various suppressors indentified from genetic modifier screens in polyglutamine disease transgenic models. Molecular chaperones are a class of proteins that are involved in the protein folding process. Their over-expression both suppresses neurodegeneration and alters the solubility properties of disease proteins in transgenic models while leaving the macroscopic structure of NIs intact. Particular molecular chaperones are also found in NIs of human patients. The present proposed project is to determine identities of cellular proteins in NIs, especially those that are released upon chaperone suppression. Identification and characterization of these proteins will shed light on the pathogenesis of polyglutamine disease and may open up new avenues to disease intervention and prevention.

(BL02445)

Serine Protease Inhibitors from Cucurbitaceous Seeds

- ✍ FONG Wing Ping ● NG Tzi Bun (Biochemistry)
- ❑ 1 December 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

Extensive investigations on inhibitors of the serine protease trypsin as cancer chemopreventive agents have been conducted since trypsin inhibitors suppress two-stage carcinogenesis and breast cancer in cell culture and animal studies. Epidemiologic evidence also shows that trypsin inhibitors diminish the incidence of major human cancers in populations that consume foods containing them. Since serine protease inhibitors can prolong the clotting time of human blood and inhibit the amidolytic activities of coagulation factors which are implicated in cardiovascular diseases, they appear to be good candidates for developing cardiovascular drugs. The strong anti-insect effect of serine protease inhibitors makes them potentially useful in agriculture. Trypsin inhibitors are divided into three main categories. The Kunitz type comprises proteins such as soybean trypsin inhibitors with about 170 amino acid residues and 2 disulfide bonds. The Bowman-Birk type consists of peptides with about 80 amino acids and 7 disulfide bridges. The most recently established category, the squash type, is made up of peptides with about 30 amino acid residues and 3 disulfide bonds. The squash type inhibitors were all isolated from seeds. To date no chymotrypsin inhibitors have been isolated from the squash (Cucurbitaceae) family. The intent of the proposed investigation is to isolate and characterize, from the seeds of Cucurbitaceae plants, chymotrypsin inhibitors and trypsin inhibitors. Their specificity, serine protease-binding ratio, and possible cleavage by trypsin/chymotrypsin will be investigated. The possible antioxidant, antitumor and antiproliferative activities of the trypsin inhibitors and chymotrypsin inhibitors will also be examined.
(BL01816)

Expression of His-Tag Plasmodium Falciparum Merizoite Surface Protein MSP1-42 in Baculovirus Using Silkworm as the Host

- ✍ HO Walter K. K. ● HUI George*
- ❑ 1 November 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

Malaria is a protozoan (Plasmodium sp.) disease transmitted by mosquitoes. It infects nearly 200 million people each year in the tropics and subtropical areas. Although malaria can be treated by drugs, it still kills roughly one million people, particularly children, every year. This is because of the world wide resurgence of drug resistant strains of malaria. There is no effective vaccine against malaria at the moment. The malaria parasite can exist either in sporozoites or merozoite form in the infected subject. It is the latter form that will infect erythrocytes and bring about the clinical symptoms associated with the disease. Targeting a vaccine against the merozoites will protect the patient by preventing the multiplication of the parasites in the bloodstream. From our previous research, one of us (GH) has identified a surface protein on the merozoite, called MSP1-42, which can be used as an antigen to elicit an immune response that can neutralize the infectious cycle of the malaria protozoa. Thus, this protein would be a good candidate as a malaria vaccine. Using recombinant DNA technique, the gene of this protein has been cloned and has been expressed in yeast and insect cells. Unfortunately, attempts to produce the protein in large quantity in these systems were not satisfactory because the yield was low. In order to make a vaccine economical enough for use in undeveloped countries, where malaria is prevalent, means have to be found to express the protein more efficiently. To do this, we have successfully used the silkworm larvae as the host for production of the MSP1-42 protein by infecting it with a recombinant baculovirus. An expression level reaching 0.2 mg protein per silkworm was achieved. The recombination MSP1-42 was purified by immunoaffinity chromatorgraphy to almost homogeneity and its partial N-terminal sequence was determined to be exactly identical to the expected sequence. The protein was used to immunize rabbits and antibody level reaching a titer of greater than 4 million could be obtained after the third booster. The anti-sera were evaluated with respect to their specificity and ability to neutralize the malaria parasite *in vitro*. The results obtained were most encouraging and over 90% inhibition of growth was observed using the quaternary bled anti-sera. Based on these experimental results, the use of BmNPV infected silkworm to produce a MSP1-42-based vaccine against malaria appears to be feasible and economical. Although the expression level observed in our previous study was adequate for evaluation and characterization, higher expression level of the recombinant protein is desirable because a significant loss of material has been observed during purification. In the proposed study, we plan to improve expression by modifying the promoter and translation efficiency of the virus so that expression level approaching those of the native polyherin gene (approximately 3 mg per larvae) could be achieved. Moreover, we will also evaluate the possibility of adding a hexa-histidine tail on the MSP1-42 protein and see if it can improve purification efficiency.
(BL01994)

Identification of Genes Involved in Carbon Tetrachloride-induced Liver Injury: A Model for Chemical Toxicity-mediated by Free Radicals

- ✍ LEE Sau Tuen Susanna
- ❑ 1 December 2001
- ❖ Research Grants Council (Earmarked Grants)

Carbon tetrachloride (CCl_4) is the classic model for liver injury-mediated by free radicals. Through the investigation of acute CCl_4-induced liver damage in animals models in the past 25 years, it is now generally accepted that reactive free radicals can exert cellular damage through a variety of mechanisms including lipid peroxidation, covalent binding, depletion of glutathione and protein thiols, derangement of intracellular free calcium homeostasis and DNA fragmentations. A complex interaction among these primary and various secondary molecular mechanisms of injury is responsible for the amplification and spreading of the injury itself with its eventual expression at the cellular level in terms of abnormal fatty accumulation and death. However, little is known of the changes in gene expression that are fundamental to the mechanisms of free radical-mediated liver toxicity. Identification of novel gene changes associated with the primary and secondary molecular mechanisms of injury might provide insight into some of the mechanisms involved in free radical-mediated liver damage. The aim of the proposed research is to identify the spectrum of gene(s) associated with the

liver toxicity caused by the hepatotoxicant CCl_4 using a CCl_4-insensitive transgenic mouse line and the fluorescent differential display technique. Identification of such gene(s) might extend our understanding in free radical-mediated chemical toxicity and toxic injury similar to that associated with the aging process.
(BL01135)

Technology Development for Assessing Chinese Medicinal Materials for Treating Alzheimer's Disease

- ✍ SHAW Pang Chui ● FUNG Kwok Pui (Biochemistry) ● WAN Chi Cheong David (Biochemistry) ● Ronald Ray FISCUS (Dept of Physiology) ● CHEUNG Chun Yung Thomas*
- ❑ 1 September 2001
- ❖ BioEngine Innovation Limited ● University-Industry Collaboration Prog.: Matching Grant for Joint Research, ITF, Innovation & Tech. Commission

Alzheimer's disease is the most common cause of dementia in the elderly In Chinese medicine, there are a number of formulae for treating Alzheimer's disease, for anti-aging and improving memory We propose to systematically screen aqueous and organic extracts of 50 herbal materials that appear frequently in the Chinese medicine prescriptions, for their ability to perturb markers related to aging and Alzheimer's disease These markers include tau protein phosphorylation, amyloid precursor protein and its cleaved products, acetylcholinesterase inhibitor, apoptotic effect on neuronal cells Extracts with the most promising activity will be further purified and DNA array assay will be used to find the effect on the expression of other related or unrelated genes Our work will further explore the value of Chinese medicinal materials for treating Alzheimer's disease The sponsoring company will acquire the improved screening technologies and may further develop the medicinal materials into health food or pharmaceutical products.
(BL01490)

Interaction of Ribosomal Proteins P0 and P1 with Trichosanthin

- ✍ SHAW Pang Chui ● SZE Kong Hung* ● WONG Kam Bo ● ZHU Guang*
- ❑ 1 December 2001
- ❖ Research Grants Council (Earmarked Grants)

Trichosanthin (TCS) is a Chinese medicinal protein with abortifacient, anti-tumor and anti-HIV properties, It is a ribosome-inactivating protein (RIP) that depurinates adenine 4324 of 28S rRNA. By yeast two hybrid screening and *in vitro* binding assay, we have found that TCS interacts with mammalian ribosomal proteins P0 and P1. P0 forms a P-complex ($P0(P1)_2(P2)_2$) with homedimers of P1 and P2 which constitutes the stalk of large ribosomal subunit. This stalk interacts with elongation factors and is involved in the elongation step of protein synthesis.
To investigate the significance of the interaction of TCS, P0 and P1, we propose to find the amino acids in TCS, P0 and P1 that are involved in the interaction, by differential chemical modification and by nuclear magnetic resonance. Then, the importance of these amino acids is confirmed by site directed mutagenesis. The interaction is quantified by surface plasmon resonance and isothermal titration calorimetry.
The proposed work will help us to understand the ribosome inactivating activity of TCS and serve as a model for future study of ribosomal protein-RIP interaction. Our work will also contribute to the research and development of Chinese medicinal in Hong Kong and the modernization of Chinese medicine.
(BL01145)

Screening of Chinese Medicinal Materials for Lowering the Accumulation of Amyloid-beta Peptide

- ✍ SHAW Pang Chui ● LEE Wing Cheung
- ❑ 20 May 2002
- ❖ MAYO Foundation For Medical Education and Research

Alzheimer's disease (AD) is the most common cause of dementia in the elderly. In Chinese medicine, there are a number of formulae for treating dementia, for anti-aging and improving memory. In this project, the researchers propose to screen aqueous and organic extracts of 50 herbal materials that appear frequently in the Chinese medicine prescription, for their ability to lower the accumulation of the amyloid-beta (Aβ) peptide. Dr. Eckman Christopher of the Mayo Clinic USA, has

established a high throughput and cell-based assay system for the detection of Aβ accumulation. The system can sensitively and selectively quantify the amount of Aβ40 and the more amyloidogenic form of Aβ, Aβ42. In collaboration with Dr. Eckman, the researchers are going to utilize the system for their screening process. Amyloid-beta peptide is the major component of senile plaques, which is a pathological hallmark in AD. Compounds capable of reducing the Aβ accumulation may be of great value therapeutically.
(BL01565)

An Infrastructure for Efficient Protein Expression, Purification and Structural Studies

- ✍ SHAW Pang Chui ● WONG Kam Bo ● WAYE Mary Miu Yee (Biochemistry) ● TSUI Kwok Wing (Biochemistry) ● LAM Sik Lok (Dept of Chemistry) ● HUANG POON Wai Sin Dolly (Hong Kong Cancer Institute) ● LO Kwok Wai (Dept of Anatomical & Cellular Pathology) ● CHUI Yiu Loon (Clinical Immunology Unit)
- ❑ 1 September 2002
- ❖ CUHK Strategic Research Program

With the complete sequencing of the genomes of human and other model organisms, there is an ample supply of new DNA sequences encoding different classes of proteins. Therefore, the next step is to characterize the biochemical, biophysical and structure-function relationship of selected proteins, for understanding their roles in the biochemical processes and for rational design to alter a biochemical pathway or even an organism. Before further understanding the protein properties, it is essential to clone the encoding gene to an appropriate expression vector, transform the vector to bacterial, yeast or mammalian host and purify the protein by a number of chromatographic steps.
This initiative pools the expertise of different groups and provides personnel to develop common protocols for protein expression, purification and structural analyses, so as to facilitate the work on protein analysis. A number of biologically or medically significant proteins will be dealt with. The work is part of the plan for enhancing structural biology research for: (1) crystallization of proteins, (2) X-ray diffraction and (3) analysis of protein structures and their interaction with substrate or ligand molecules by crystallography and molecular modeling.
(BL02763)

Interactions between Tumor Necrosis Factor-alpha and Beta-adrenergic Mechanism in Cultured Rat Astrocytes

- ✍ TSANG David Sau Cheuk ● LEUNG Kwok Nam
- ❑ 1 September 2001
- ❖ Research Grants Council (Earmarked Grants)

Astrocytes, the major cell type in the central nervous system (CNS), play a critical role in determining the regenerative outcome following CNS insults as they have been shown to undergo proliferation, a process leading to scar formation. Accumulated evidence revealed that the level of tumor necrosis factor-α (TNF-α), mainly secreted by astrocytes, was greatly elevated at the injured site and that inhibitors of TNF-α significantly improved the outcome of injury, suggesting that TNF-α mediates astrogliosis and other pathological events following brain injury. Indeed, TNF-α has been shown to induce astrocyte proliferation *in vitro*. In addition, it has been shown that β-adrenergic blockade reduces, while β-adrenergic receptor (β-AR) agonists promote, astrogliosis and that β-AR antagonists reduce specific glial marker protein level, indicating that β-AR substances regulate astrocyte proliferation. Though interactions between cytokines and β-adrenergic mechanism have been reported in the heart and macrophages, the relationship and/or interaction between the TNF-α and the β-adrenergic mechanism in astrocytes remains unclear. This study attempts to elucidate (1) the role played by TNF-α (and other cytokines found in the injured site) and β-AR agonists/antagonists on astrocyte proliferation, and the interaction between them; and (2) the signaling pathways mediating TNF-α-induced proliferation and the expressions of TNF-α and β-AR receptors in cultured astrocytes. Cultured astrocytes have been shown to function very much like astrocytes *in situ* and that TNF-α, its receptors and β-ARs are found in cultured astrocytes. We believe that elucidation of the relationship between TNF-α elevation, β-AR expression and astrocyte proliferation as well as the messengers involved should provide novel molecular targets for the therapeutic manipulation of CNS disorders ranging from brain injury to neurodegenerative diseases.
(BL01139)

Efficient, Economical and Environmentally-friendly Production of Key Intermediates of Major Antibiotics

- ✍ WANG Jun
- ❑ 15 August 2001
- ❖ GeneHarbor Technologies Inc. ● University-Industry Collaboration Prog.: Matching Grant for Joint Research, ITF, Innovation & Tech. Commission

The project is to develop new manufacture procedures for the production of major antibiotics. (BL01619)

Structural Basis of Thermostability of a Protein from a Hyperthermophilic Archaea *Thermococcus Celer* - Protein Engineering and High Resolution Structure by Crystallography

- ✍ WONG Kam Bo
- ❑ 1 November 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

How some proteins remain stable at high temperatures is an unresolved issue. *Thermococcus celer* is a hyperthemophilic archaea growing at an optimal temperature of 85℃. The ribosomal protein L30e from *T. celer* is highly thermostable. We propose to use the L30e protein as a model system to delineate the structural basis of thermostability of proteins. The contribution of individual residues to the thermostability will be probed by the protein engineering approach. We shall determine the crystal structure of L30e from *T. celer* and compare it to the structure of its mesophilic homologue, yeast L30e. high resolution structure information obtained will be usded to design mutants that affect protein stability. The effect of mutation on thermostability will be quantified by thermodynamics parameters such melting temperature and free energy of unfolding. Results obtained on the L30e model will provide lessons of how to engineer a heat labile protein to a thermostable one. (BL01645)

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

Edition	Title/Investigators
1997-98	Investigation of Mechanisms of Cholesterol-Lowering Effect of Green Tea Epicatechin Isomers (CU97307) ✍ CHEN Zhenyu ● FONG Wing Ping
2000-01	Hypolipidemic and Antioxidant Activity of Theaflvains and Thearubigins from Oolong and Black Tea (CU00237) ✍ CHEN Zhenyu ● HUANG Yu (Dept of Physiology)
2000-01	Isolation and Characterization of Plant Ribonucleases (BL00721) ✍ FONG Wing Ping
2000-01	Children's Healthy Lifestyle KAP Research (BL20011) ✍ Georgia Sue GULDAN ● HOWDEN Julie* ● KIJBOONCHOO Kallaya* ● POH Bee Koon* ● BARBA Corazon*
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)
2000-01	Induction of UDP-glucuronyltransferase and Its Regulation in Rats by Licorice Extracts (BL00746) ✍ HO Wing Shing John
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)
1999-00	Identification of Peroxisome Proliferator-activated Receptor-a

(PPARa)-dependent Genes Involved in Peroxisome Proliferator-induced Hepatomegaly and Hepatocarcinogenesis (CU99157)
✍ LEE Sau Tuen Susanna ● CHAN Wood Yee (Dept of Anatomy)

2000-01 Identification of Peroxisome Proliferator-activated Receptor-alpha (PPARalpha)-dependent Genes Involved in Hepatic Lipid Metabolism (CU00241)
✍ LEE Sau Tuen Susanna

1999-00 Studies on the Immunomodulatory and Anti-tumour Activities of Green Tea Catechins (CU99160)
✍ LEUNG Kwok Nam ● CHEN Zhenyu

1999-00 Structure-function Relationship Study of M.EcoHK31I, a C5-cytosine Methyltransferase with Two Polypeptides (CU99177)
✍ SHAW Pang Chui ● LEE Kai Fai*

2000-01 Crystallisation and Structural Study of EcohK31I DNA Methylase (BL20010)
✍ SHAW Pang Chui

2000-01 Second Messenger Mediating the Interaction between Tumor Necrosis Factor- α and β-adrenergic Mechanism in C6 Glioma Cells (BL00734)
✍ TSANG David Sau Cheuk

1999-00 Mitotic Gene Conversion in Asexual Diploid Candida Albicans (CU99158)
✍ WANG Jun

2000-01 Biochemical Engineering of New Pathways for Antibiotics Production (BL00736)
✍ WANG Jun

2000-01 Structure-function of a Novel RNA-binding Motif-structure Determination of a Ribosomal Protein L30e From Thermococcus celer by Multi-dimensional NMR Spectroscopy (CU00243)
✍ WONG Kam Bo

RESEARCH OUTPUTS AND PUBLICATIONS

<P004188> **TSE L.Y. Dicky; CHOW K.C. Billy; CHAN C.B.; LEE T.O. Leo and CHENG H.K. Christopher.** "Molecular Cloning and Expression Studies of a Prolactin Receptor in Goldfish (*Carassius Auratus)*". *Life Sciences* vol.66, pp.593-605. USA, 2000.01.07.

<P004189> **LI Yan Chun and KONG Siu Kai.** "Anticancer Drugs Caused Different Mitochondrial Responses in Doxorubicin (Dox)-sensitive (S-) and Dox-Resistant (R-) HepG2 Cells". Paper presented in the 2001 American Association of Pharmaceutical Scientists (AAPS) Annual Meeting and Exposition. 2001.10.21.

<P008990> **LEUNG Kwok Nam; LI Ho Kin; FUNG Ming Chiu; MAK N. K.; FUNG Kwok Pui and CHOY Yuen Min.** "Macrophage-Activiting and Differentiation-Inducing Activities of Klebsiella K7 Capsular Antigen". *Proceedings of the 2nd Congress of the Federation of Immunological Scoieties of Asia-Oceania (FIMSA)* ed. by Sirisinha, S., Chaiyaroj, S.C. and Tapchaisri, P. pp.79-84. Bangkok, Thailand: Monduzzi Editore, 2000.09.

<P009651> **LEUNG Kwok Nam.** "Cytokines in the Differentiation Therapy of Leukemia: Perspectives in the 21st Century". *Abstracts of the Third Bilateral Scientific Meeting* pp.44-45. Guangzhou,

China: The Chinese Medical Association, the Federation of Medical Societies of Hong Kong, 2000.11.

<P011800> **LEUNG Y.K. and HO J.W.** "Effects of Vitamins and Common Drugs on Reduction of 4-(Methylnitrosamino)-1-(3-Pyridyl)-1-Butanone in Rat Microsomes". *Archives of Physiology and Biochemistry* vol.109 no.2, pp.175-179. The Netherlands: Swets & Zeitlinger, 2001.07.

<P011858> **CHEN Zhen-Yu; KWAN Kwok Yiu and HUANG Yu.** "Accumulation and Apparent Oxidation of *Cis, Trans*-18:2 Isomers Relative to Linoleic Acid in Rats". *British Journal of Nutrition* vol.86 no.2, pp.249-255. UK, 2001.08.03.

<P011911> **LEE Suk-Fan; CHEN Zhen-Yu and FONG Wing-Ping.** "Gender Difference in Enzymes Related with Alcohol Consumption in Hamster, an Avid Consumer of Alcohol". *Comparative Biochemistry and PhysiologyPart C* vol.129 no.3, pp.285-293. Elsevier, 2001.07.

<P011928> **CHEN Zhen-Yu; WANG Shu; LEE Man Simon, Kwong; HUANG Yu and HO K.K., Walter.** "Preparation of Flavanol-Rich Green Tea Extract by Precipitation with $AICI_3$". *Journal of the Science of Food and Agriculture* vol.81 no.10, pp.1034-1038. USA: Society of Chemical Industry, USA, 2001.07.

<P012176> **LEE T.O. Leo; NONG G.; CHAN Y.H.; TSE L.Y. Dicky and CHENG H.K. Christopher.** "Molecular Cloning of a Teleost Growth Hormone Receptor and Its Functional Interaction with Human Growth Hormone". *Gene* vol.270, pp.121-129. The Netherlands, 2001.05.30.

<P012460> **AKIYAMA E., Taro, NICOL J., Christopher, FIEVET Catherine, STAELS Bart, WARD M., Jerrold, AUWERX Johan, LEE Sau Tuen Susanna, GONZALEZ J., Frank and JEFFREY M. Peters**. "Peroxisome Proliferator-Activated Receptor-α Regulates Lipid Homeostasis, But Is Not Associated with Obesity". *The Journal of Biological Chemistry* vol.276 no.42, pp.39088-39093. USA, 2001.10.19.

<P012493> **CHEN Z.Y.; WONG I.Y.F; LAU C.W.; HE Z.D.; YAO X.Q. and HUANG Y.** "Vasorelaxant, Anti-Proliferative, and Antioxidant Activities of Ligustrum Purpurascens Extract and Phenylethanoid Glycosides". *Journal of the Hong Kong College of Cardiology* vol.9, p.114(CP4). Hong Kong: Hong Kong College of Cardiology, 2001.12.

<P012550> **TSANG Suk Ying, CHEN Zhenyu, YAO Xiaoqiang, LAU Chi Wai and HUANG Yu.** "Inhibition of Endothelial No-Mediated Relaxation by Baicalin and Baicalein in Rat Aorta". Paper presented in the 4th Joint Meeting of the Chinese & French Pharmaco Logical Societies, organized by the Universite Claude Bernard, Faculte de Medecine Laennec. Lyon, France, 2001.07.

<P012664> **LEUNG Yuet Kin and HO W.S., John.** "Induced Expression of UDP-Ghecuronesyltransferace IAS in Yat Liver Cells by Aqueouo Licorice Root extract". *Abstract of the 15th Symposium of the Protein Society Protein Science* vol.10(suppl 2), p.105. PA, USA: The Protein Society, 2001.07.29.

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RESEARCH PROJECTS

Biodiversity of Marine Algae in Hong Kong

- ✍ ANG Put Jr.
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Algae are key components of the marine environment. Although several species of algae were first discovered from Hong Kong waters, there is a general lack of detailed information on the diversity and distribution of algae in Hong Kong coastal environment. Rapid deterioration of Hong Kong marine environment is having an impact on Hong Kong marine biodiversity so there is an urgent need to assess the species diversity of algae and their distribution within Hong Kong waters. This baseline information is important in identifying potential sites of high marine biodiversity where more conservation effort should be focused. Marine algae are also important resources with substantial economic importance. Preliminary studies conducted by our research team at the Biology Department of the Chinese University of Hong Kong indicated the potentials of many Hong Kong algal species as anti-tumor, antiviral, anti-coagulant and hepatoprotective agents as well as nutraceutical food. This research aims to evaluate the algal biodiversity in Hong Kong and to understand the general biology, distribution and stock availability of economically important algal species within Hong Kong waters. A balance could be achieved where marine algal biodiversity could be protected as well as properly managed.
(BL01416)

Dietary Fiber from Mushroom: An Evaluation of Their Biochemical, Physico-chemical, Nutritional, Toxicological, and Sensory Properties

- ✍ CHEUNG Chi Keung Peter ● MASUYAMA Ritsuko*
- ❑ 1 October 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

Since the middle of the 1970s, the role of dietary fiber in health and nutrition has stimulated a wide range of research activities and caught public attention. Accumulation evidence favors the view that increased intake of dietary fiber can have beneficial effects against chronic diseases, such as cardiovascular diseases, diverticulosis, diabetes and colon cancer. In view of the therapeutic potential of dietary fiber, more fiber incorporated food products are being developed. Addition of dietary fiber and dietary fiber-rich materials as a food ingredient to a wide range of products contributes to the development of value-added foods or functional foods that are currently high in demand. In addition to the physiological benefits provided by high fiber foods, studies have shown that fiber components can give texture, gelling, thickening, emulsifying and stabilizing properties to certain foods. Conventional fiber sources are mainly from cereal grains, vegetables and fruits. Edible mushroom or fungi are widely consumed as human foods, especially in Asia, because of their nutritional and health benefits. Mushrooms also contain high levels of dietary fiber that has important physiological functions and is unique in its chemical composition when compared to other plant fibers. Hence mushrooms can be considered as an alternative source of functional food fibers. This proposed research project will investigate the production of dietary fiber from some common edible mushroom and characterize the biochemical, physico-chemical, nutritional, toxicological, and sensory properties of the mushroom fiber material obtained. It is envisaged that mushroom fiber material will become a new food ingredient to formulate future functional food products.
(BL01322)

Toxicity of Cadmium-Contaminated Soil towards Wheat and Cleanup by Splent Mushroom Compost of Pleurotus Pulmonarius

- ✍ CHIU Siu Wai ● NG Tzi Bun (Biochemistry)
- ❑ 2 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Mainland China, which is a major agricultural country in the pace of rapid modernization, suffers from a common phenomenon of soil pollution with toxic heavy metals and organic pollutants including

residues of pesticides. Evaluation of toxicities of these pollutants towards agricultural crops is of environmental importance. The previous and recent results have shown that there are public health implications if edible crops accumulate high concentrations of these toxicants. In this study, the second most commonly cultivated monocotyledonous crop in the world, *Triticum aestivum* (wheat), which is grown throughout China, will be used. A laboratory study is proposed by spiking a clean garden soil with these pollutants. The purposes of my study are to: (1) investigate the toxicities of pollutants on wheat and the tolerance of wheat to these pollutants; (2) analyze the bioaccumulation of pollutants in wheat and the effect of pollutants on crop qualities; and (3) establish any prospective remediation for contaminated soil using spent mushroom compost.
(BL01623)

Biotechnological Improvement of a Microbial Cultivar and Evidence-based Diversification of Microbial Products

- ✍ CHIU Siu Wai ● NG Tzi Bun (Biochemistry)
- ❑ 1 April 2002
- ❖ Peninsular Innovations Limited ● University-Industry Collaboration Prog.: Matching Grant for Joint Research, ITF, Innovation & Tech. Commission

An imported microbial cultivar owned by Peninsular Innovations Limited has been commercially used for generating edible products locally for 20 years. A breeding programme of the cultivar with wild germplasm collected and preserved in the Chinese University of Hong Kong is proposed here so that a screened artificially constructed hybrid will extend the range of fruiting temperatures favouring crop production throughout the year as well as the range of substrates practically available in Hong Kong. Identity of the hybrid to be constructed will also be confirmed by DNA fingerprints and sequences of specific nuclear and mitochondrial genes. Modernization of the current solid-state-fermentation protocol will be designed and implemented as an environmentally-friendly farming system practical in Hong Kong. Further, the different combinations of experimental conditions under solid-state-fermentation and/or submerged fermentation for modulating the desirable outcomes of product qualities to fulfill the dynamic consumer demand will be determined. The quality (nutritive values and bioactivities) and safety of the diversified microbial products to be generated from both fermentation technologies will be assessed and optimized during production with or without supplementation. Further, a thorough nutrition, bioactivity and toxicity assessment will be carried out with different developmental phases of the micro-organism such that the study will provide a scientific basis for the choice of microbial products for a particular desirable quality besides the criteria set by consumers.
(BL01812)

Population Genetics of the Pearl Oyster *Pinctada Fucata* in Southern China

- ✍ CHU Ka Hou
- ❑ 1 November 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

The pearl oyster *Pinctada fucata* is of major economic importance for pearl production in many Indo-Pacific countries, including China and Japan. Yet the genetic resources of the pearl oyster and the effect of cultivation on its genetic diversity are little known. The proposed study aims to elucidate the genetic variations in wild and cultured populations of this species in southern China using amplified fragment length polymorphism (AFLP). The results as well as the molecular techniques and markets developed in this study will play a crucial role in the sustainable development of the pearl culture industry, such as stock identification, monitoring of genetic diversity, and development of genetic manipulation programs.
(BL02919)

Molecular Population Structure of Penaeid Shrimp in the Indo-West Pacific

- ✍ CHU Ka Hou
- ❑ 1 December 2001
- ❖ Research Grants Council (Earmarked Grants)

Penaeid shrimp are of major economical importance in fisheries and aquaculture of the Indo-West Pacific. The understanding of the population structure of

penaeid species is crucial to the sustainable utilization and conservation of this biological resource. The proposed study aims to elucidate the population divergence of commercially important species over their geographical range, using PCR-based nuclear and mitochondrial DNA analyses. The genetic variation between wild and cultured stocks will also be compared in order to assess the effect of culture on genetic variability. The experimental results as well as the molecular techniques and markers developed from the study will play an important role in practical issues of shrimp fisheries and aquaculture, such as 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. Moreover, results from the present study will also provide new insights into the evolutionary history and biogeography of marine fauna in the Indo-West Pacific.
(BL01157)

A Web-based Database and Training for Hong Kong Flora and Vegetation

- ✍ CHU Lee Man ● BUT Pui Hay Paul ● CHIU Siu Wai ● WONG Yum Shing ● ANG Put Jr. ● HU Shiu Ying (School of Chinese Medicine) ● CHANG Michael (Dept of Information Engineering)
- ❑ 1 September 2001
- ❖ Quality Education Fund, HKSAR Government

Objectives:
(1) To establish an interactive, update and informative web-based Database for Hong Kong Flora and Vegetation so as to assist teachers and students in plant identification and in search for information on the ecology, conservation and economic application of local Euphorbiaceae plants and other common plants through multiple entry searching technology;
(2) To offer teacher training and development through workshops, field trips and internet database; and
(3) To develop students' ability in active learning, logical thinking, searching information through self-guided projects, internet database and exposure to interacting with university researchers.

Implementation method, process with time schedule:
Phase 1 (July to September 2001)
(1) recruit administrative, computer and botanical staff; and
(2) design and establish the Part I of a Database of Hong Kong Flora and Vegetation (as demonstrated by the plant family Euphorbiacese and some common local plants in Hong Kong), by project staff and teachers who have relevant skills and desire to contribute.
Phase 2 (October 2001 to February 2002)
(1) photo-taking, species identification and information compilation and manipulation;
(2) major portion of contents of the Euphorbiaceae is completed and loaded on website for access via internet on desktop PC;
(3) 5 training workshops / field trips for interested teachers; and
tests on access to database and student project manuals.
Phase 3 (March to June 2002)
(1) 5 training workshops / field trips for interested teachers; and
(2) students' self-guided projects
(ED01912)

Value of Water Storage Ash Lagoon for Wildlife Conservation

- ✍ CHU Lee Man
- ❑ 1 December 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

The disposal of fly ash from coal-fired power stations is and continues to be an environmental problem. Ash is usually dumped in lagoon for temporary storage or final disposal. In the lagoons at Tsang Tusi, ash disposed of from the Castle Peak Power Station has been excavated for recycling, and the middle lagoon is being used for storage of used water. With the development of vegetation on peripheral ash, the lagoon has been converted to a man-made wetland that attracts wildlife especially birds possibly from the nearby Mai Po Marshes. However, it is not sure if the toxic elements in the ash will dissolve in water and accumulate in the aquatic organisms that can be food for birds. The proposed project attempts a) to study the quality and ecotoxicity of water in the middle lagoon, b) to examine the populations of phytoplankton and zooplankton, c) to

investigate metal contents in fish growing in the lagoon, and d) to conduct a wildlife census with emphasis on dragonflies and birds in the lagoonara. Literautre on the ecological status of water-filled fly ash disposals lagoons is scanty, and no scientific research has been done for the local situation. The results of the project will provide basic information for the evaluation of the conservation value of water storage ash lagoons both in Hong Kong and nearby regions.
(BL01794)

Preliminary Characterization of Exudate from Fungal Mass

- ✍ CHUNG Hau Yin
- ❑ 1 December 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

In the cultivation of fungal mass, we observed brown exudate produced in some of the agar plate. The pigment will spread through the agar and stain the originally opaque agar when incubated for sufficient amount of time. Since the spreading of the pigment in the agar is very even, we believe it could be a water-soluble material. However, other properties of the pigment such as whether it is a composite mixture or a pure component, structural information, etc. are not known. Therefore, in this exploratory study, we try to characterize the pigment.
(BL01383)

Cercariae Stage Sepecific and Immunogenic Antigen of Schistosoma japonicum

- ✍ FUNG Ming Chiu ● CHEN Xiao Guang*
- ❑ 1 September 2001
- ❖ Research Grants Council (Earmarked Grants)

Schistosomiasis is caused by the infection of *Schistosoma*, a parasite that inhabits our bloodstream. It is the second most prevalent tropical disease in the world. Schistosomiasis is endemic along the Yangtze River and the 12 provinces in China. This disease was controlled in the past by chemotherapy and killing the snails, its intermediate host. Due to flooding and the development of drug resistant worms (the schistosomes), schistosomiasis has a tendency to become epidemic again in China. Vaccination against the Schistosomoa is the best way to prevent and control this tropical disease. Until now there is still no good vaccine candidate that can give a consistent induction of 40% protection or better for the immunized animals. The attack of the parasite at its early stages of the life cycle, i.e. the cercariae and lung stage schistosomula, will have a better chance to protect the host from infection. It has been reported that animals vaccinated with irradiated cercariae (the young stage of the worm) could prevent further infection. Irradiated cercariae are therefore an excellent vaccine candidate. However it is not practical to use irradiated cercariae as vaccine. In this project, we propose to identify and molecularly clone the cercariae stage specific and immunogenic antigens of the *Schistosoma japonica.* We will further study the protective ability of these antigens using the genetic immunization method. Our results may lead to the development of an effective schistosome vaccine against schistosomiasis.
(BL01154)

Interferon Alpha Subtypes and Antiviral Drugs

- ✍ FUNG Ming Chiu
- ❑ 1 November 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

The type I interferon is a family of proteins that includes many interferon-α subtypes, a single interferon-β, interferon-τ and interferon-ω. Interferons have been characterized at both the cellular and molecular levels. Human express about fifteen interferon-α subtypes and mouse express 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. Currently, interferon-α and antiviral drugs are used in combinations to treat the virus-infected diseases. However, many antiviral drugs do not show direct antiviral activities. It is suggested that antiviral drugs may regulate the expression of interferons. In this study, the effect of antiviral drugs on the expression of interferon alpha

subtypes and the interferon α/β receptors will be analyzed.
(BL01885)

Activin System in the Pituitary: How Important is It in the Differential Expression of Fish FSH and LH?

- ✍ GE Wei
- ❑ 31 December 2001
- ❖ Research Grants Council (Earmarked Grants)

Regulation of gonadotropin (FSH and LH) biosynthesis has always been the most important area of vertebrate reproductive endocrinology because of their fundamental roles in controlling gonadal development and function. In addition to the well-known neuroendocrine factors from the hypothalamus such as GnRH and endocrine inputs from the gonads such as steroids, increasing attention has been paid to the regulatory role played by the intrapituitary activin system in the secretion and expression of FSH and LH. In the goldfish, the evidence accumulated in our laboratory has led us to hypothesize that there also exists an intrapituitary activin system in fish consisting of activin and its binding protein follistatin that serves as a sensor to perceive, integrate and transduce information from the brain, the gonads and the pituitary itself. Since activin stimulates FSHβ but suppresses LHβ expression in the goldfish, any disturbance of the intrapituitary activin system will change the relative levels of FSH and LH. The main objective of the present project is to test this hypothesis by performing the following experiments: (1) Molecular cloning of goldfish follistatin and production of recombinant follistatin. The recombinant follistatin will be a valuable tool for elucidating the activity of activin in the pituitary because of its capability of neutralizing activin with high binding affinity; (2) Analysis of seasonal expression profiles of pituitary activin and follistatin and their correlation with the levels of FSHβ and LHβ expression. This part will provide important information about the potential regulatory roles of pituitary activin and its binding protein in the controlling of gonadotropin expression; (3) Regulation of activin and follistatin expression by gonads and gonadal steroids. Both *in vivo* and *in vitro* approaches will be adopted in this part. Results from this part will provide direct evidence for the mediating role of pituitary activin system in the gonadal regulation of FSH and LH.
(BL01150)

Sorting of Proteins to the Protein Storage Vacuole in Plant Cells

- ✍ JIANG Liwen ● SUN Sai Ming Samuel
- ❑ 1 September 2001
- ❖ Research Grants Council (Earmarked Grants)

Plant cells compartment proteins and store products in vacuoles. Protein storage vacuoles (PSVs) in most plant seeds are well-organized organelles with three distinct subcompartments: the crystalloid, the matrix, and the globoid. However, the functions and origins of these PSV subcompartments remain unknown. Here we propose to characterize the molecular pathways leading to the PSV by developing integral membrane reporter proteins for the PSV. We also propose to study the function and biogenesis of the PSV subcompartments using approaches of cellular and molecular biology, as well as reverse genetics. Our long-term goal is to elucidate the molecular mechanisms by which membrane proteins in the secretory pathway are sorted into separate vesicular pathways leading to the PSV in plant cells, and to elucidate the origins and specific functions of PSV subcompartments. This research is important in plant biotechnology because plants can be used as natural bioreactors for producing value-added and pharmaceutical proteins.
(BL01156)

Dynamic Localization of a Plant Vacuolar Sorting Receptor

- ✍ JIANG Liwen
- ❑ 30 December 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

BP-80 is a type integral membrance protein that belongs to a family of plant vacuolar sorting receptor (VSR) protein that are responsible for sorting certain soluble proteins from the Golgi apparatus to the lytic prevacuolar compartment (PVC). BP-80 has been shown to locate to both Golgi apparatus and the lytic PVC, but the distribution of BP-80 and its homologs between Golgi and the lytic PVC remains unknown.

Here we propose to test the hypothesis that VSR proteins are unevenly distributed between Golgi and the lytic PVC. Antibodies specific for BP-80 and Golgi-resident proteins will be used in double-labeling of confocal immunofluorescence, so that the relative distribution of VSR proteins between the lytic PVC and Golgi stacks can be determined. Transgenic tobacco cells expressing both RFP (red fluorescent protein)-tagged VSR and GFP (green fluorescent protein)-tagged Golgi proteins will also be established, which will allow us to study the *in vivo* dynamic relationship between Golgi and the lytic PVCs via confocal immunofluorescence.
(BL01307)

Protein Sorting in the Plant Golgi

- ✍ JIANG Liwen ● ROBINSON David G*
- ❑ 1 January 2002
- ❖ Germany/Hong Kong Joint Research Scheme

The Golgi apparatus in plant cells consists of numerous independent Golgi stacks that appear to be randomly distributed throughout the cytoplasm. BP-80, a vacuolar sorting receptor, has been shown to locate to both Golgi and the prevacuole for lytic vacuole. However, our recent studies demonstrate that BP-80 and homologs are predominantly concentrated on the lytic prevacuolar compartments. Here we propose to test the hypothesis that two functionally distinct Golgi stacks are responsible for sorting lytic and storage proteins respectively into two different vesicular transport pathways and to test the hypothesis that these two functionally distinct Golgi stacks have their own unique prevacuolar compartments. The long-term goal of our research is to illustrate the molecular mechanisms by which proteins are sorted in the plant secretory pathway, in particular, to elucidate the molecular mechanisms by which proteins are sorted away from the Golgi into different vesicular pathways leading to lytic vacuole and protein storage vacuoles.
(BL01648)

Expression of Genes Encoding for Celluloytic Enzymes and Laccase in Volvariella volvacea during Substrate Colonisation and Fruit Body Morphogenesis

- ✍ John Anthony BUSWELL ● GE Wei
- ❑ 1 September 2001
- ❖ Research Grants Council (Earmarked Grants)

Volvariella volvacea, the edible straw mushroom, is grown on a commercial scale in many tropical and subtropical countries and currently ranks fifth among cultivated mushrooms in terms of annual production worldwide. Although earlier fructification and higher mushroom yields have been achieved following the introduction of high cellulose cotton waste "composts" to replace the traditional rice straw substrate, yields are still very low compared with many other commercially-grown mushrooms. In order to better understand the nutrional and physiological events which occur during the life cycle of the fungus, we have investigated the production by the mushroom of various enzymes which are expressed during the utilisation and colonisation of the cellulosic growth substrate (cellulases) and fruit body development (laccase). However, in order to obtain a more accurate assessment of enzyme production patterns, we propose to examine the expression of the genes encoding for these enzymes at different stages of the complete developmental cycle of *V. volvacea* during cultivation on miniaturised cotton waste compost systems using standard conditions adopted for industrial-scale mushroom production. The knowledge gained will help formulate strain selection strategies for improved bioconversion of the growth substrate and higher production efficiency.
(BL01163)

Sequence Analysis of Malate Dehydrogenase from Thermus Spp.

- ✍ John Anthony BUSWELL
- ❑ 1 November 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

Eight species of the genus *Thermus (T. aquaticus, T. thermophilus, T. filiformis, T. scotoductus, T. brockianus, T. oshimai, T. antranikianii and T. ignaeterrae)* have been described using taxonomic tools based on DNA-DNA homology and 16SrDNA sequences. These bacteria are the source of important thermostable enzymes with many applications in biotechnological processes. Several of the many strains of these species at our disposal

have been used to clone and sequence the DNA polymerase genes with a view to identifying novel properties for the application of the enzymes (J. Rozelle, personal communication). Comparison of the gene sequences have revealed a number of surprising features which are the subject of a patent application. In this study, it is proposed to determine the sequence of another gene encoding for malate dehydrogenase in strains representing all these species in order to compare its divergence amongst the species with that of DNA polymerase. Malate dehydrogenase has been chosen because it is an enzyme central to the metabolism of *Thermus*, and because it has been already been sequenced in *T. thermophilus* and used in a new vector. The hypothsis to be tested is "DNA homology is more reliable than the gene sequences for enzymes in taxonomy of *Thermus*".
(BL01931)

Identification and Characterization of Genes Differentially Expressed in Dikaryotic Mycelium of Shiitake Mushroom Lentinula edodes by cDNA Microarray Hybridization

- ✍ KWAN Hoi Shan
- ❑ 1 November 2001
- ❖ Research Grants Council (Earmarked Grants)

The long-term goal of this proposal is to elucidate the molecular aspects of the sexual cycle of *L. edodes*. This would allow the mushroom biologists to design rational mushroom breeding programmes using molecular tools. The immediate objectives in this project are to characterize the transcription profile of the *L. edodes* dikaryotic mycelium in detail. I propose to (1) analyze the transcription profiles of the dikaryotic mycelium of *Lentinula edodes* by using microarrays of cDNA libraries and Expressed Sequence Tags, (2) identify and characterize genes that are expressed differentially in the dikaryotic mycelium, (3) confirm the differential expression of the genes, (4) formulate a model on the molecular basis on the dikaryotic characteristics of *L. edodes* and (5) co-relate the differentially expressed gene profiles with fruiting yields and time required for fruiting of strains in our germplasm collection. The major method to use is cDNA microarray hybridization analysis. The identified differentially expressed genes co-related with the fruiting properties will be useful for Shiitake mushroom breeders to characterize new-bred strains at the dikaryotic mycelial stage as the first screening, minimizing the need for laborious and time-consuming cultivation experiments.
(BL01147)

Molecular Regulation of Sugar Transportation During Flowering of Soybean

- ✍ LAM Hon Ming
- ❑ 1 December 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

Soybean seeds provide staple dietary protein and oil for human consumption. Since seed formation is a development process following flowering, the metabolism during flowering may play an important role in controlling seed development and quality. Moreover, there are some previous evidences suggesting that metabolites such as sugars and amino acids may act as florigen to initiate floral evocation. Currently, most molecular, physiological and biochemical studies relating to the flowering process are based mainly on genetic model systems such as *Arabidopsis thaliana*. A thorough understanding of the molecular regulation associated with metabolic changes during soybean flower development is not available. We have recently cloned a partial cDNA fragment that encodes for a putative sugar transporter in soybean. Preliminary studies indicate that the expression of this gene may be correlated with the flower development process. In this study, we propose to obtain the full-length clone and further analyze the gene expression kinetics of this soybean sugar transporter.
(BL01803)

"Isolation, Characterization and Mode of Action of Novel Antiviral Agents from Seaweeds in Hong Kong"

- ✍ OOI Vincent Eng Choon ● ANG Put Jr. ● CHIU Chi Ming Lawrence
- ❑ 1 October 2001
- ❖ Research Grants Council (Earmarked Grants)

Many of the 200 species of seaweeds reported from Hong Kong waters are known for use as human food, animal feeds and traditional medicines. In a

screening study in our laboratories on the bio-pharmacological properties of these marine algal products, the polysaccharide fractions extracted from three seaweed species have proved to be potent inhibitors of some enveloped viruses. This present proposal focuses on further chemical and biological characterization of a lead product, a polysaccharide obtained from *Sargassum* sp., which is effective against herpes simplex viruses (HSV-1 and HSV-2). The partially purified polysaccharide was very active against both HSV-1 (causative agent for cold sores and keratitis) with an IC_{50} of 6.2 µg/ml and HSV-2 (causative agent for genital herpes) with an IC_{50} of 3.1 µg/ml as well as against acyclovir-resistant HSV-1 strain with an IC_{50} of 6.2 µg/ml. Preliminary studies show that this polysaccharide fraction works apparently by preventing viral binding/penetration and viral replication. This mode of action appears to be quite different from that of acyclovir (the current drug-of-choice for herpes infections), and thus provides an advantage for its development as an alternative or a complement drug to acyclovir. Our short term central objectives are to purify the active fraction(s) to homogeneity and determine its chemical and biological characteristics and study its mode of action, using various standard antiviral assays as well as flow cytometric analysis. The long term objective of the research is to develop the compound into a new, effective and safe anti-herpes therapeutic product.
(BL01367)

Agents Against Dermatophytes from Traditional Chinese Medicine (TCM)

- ✍ OOI Vincent Eng Choon ● OOI Shiou Mei Linda
- ❑ 1 February 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Hundreds of TCM have been recorded effective for the treatment of skin infections. Most of them are bacteria-static, and some are anti-fungal. Perhaps they are both bacteria-static and fungi-static in general. However, there is little scientific research and serious experiments to search and discover the specificity and efficacy of potent active ingredients or agents from these TCM against fungi that cause human skin diseases. TCM herbs may provide a rich potential source of novel anti-fungal drugs. As certain pathogenic dermatophytes and yeasts develop resistance to the current anti-fungal drugs, such as Griseofulvin, Ketoconazole (the imidazole derivitive) when applied topically and orally, these drugs may further have disadvantages in terms of side effects and toxicity. It is necessary to search for new chemical families with anti-fungal effect other than Griseofulvin, imidazoles or triazoles derivatives. An ideal topical anti-fungal agent should be effective at very low concentration with a broad range of fungi-static efficacy and no or limited side effect.
The aim of this project is to explore TCM as an alternative medicine possible for practical treatment of superficial fungal infections in human. Such common human etilogical agents are mainly yeasts and dermatophytes. The best example for the former is *Candida albicans*, while the latter group includes *Trichophyton rubrum, T. mentagrophytes, Microsporum canis* and *M. gypseum* as well as *Epidermophyton floccosum.* Most of them are common causes of tinea pedis (foot), corporis (body), capitis (head), and/or cruris (groin) to a certain extent, though some infection sites such as nails and hair shafts may also be affected. In this study, those traditional medicinal herbs that have been well recorded in the Chinese medicinal liternature, for example, *Melia* sp., *Dimocarpus* sp., *Impatiens* sp., *Begonia* sp., *Lagenaria* sp., *Momordica* sp., *punica* sp., *lantana* sp., *Nicotiana* sp., and some species in family Liliaceae (e.g. *Allium* sp., *Aloe* sp., *Asparagus* sp., etc.), will first be screened for anti-dermatophye activity. Further isolation and characterization of the active fractions will be carried out as guided by bioactivity.
(BL01632)

The Croucher Foundation - Advanced Study Institute "Biotechnology and Crop Improvement: Recent Development and Impacts on Developing World"

- ✍ SUN Sai Ming Samuel ● LAM Hon Ming ● LIU Pui Shan Lucia ● ZHANG J H* ● CHYE M L* ● ROCK C*
- ❑ 1 March 2002
- ❖ The Croucher Advanced Study Institute

In this symposium, eight high standard lectures will be delivered by world renowned scientists on major and latest developments in biotechnology and crop improvement. Emphases will also include assessing

the impacts of this newly developed technology on developing world.

World renowned scientists and experts in plant molecular biology and biotechnology have accepted the invitation to be the ASI lecturers. They include, Prof. XU, Zhi-Hong, the President of Peking University and Vice-president of the Chinese Academy of Sciences, Prof. Long-Ping YUAN, the Director of China National Hybrid Rice Research and Development Center from China and Prof. Shang-Fa YANG, member, US Academy of Sciences and Academia Sinica and former Vice-president, Academia Sinica, Taiwan, who will cover the needs, up-to-date, progress and future prospects of agriculture biotechnology especially in the cross-strait areas. For global status and perspectives, Prof. Brian LARKINS, member of US NAS and immediate Past President of the American Society of Plant Physiology, Prof. Timothy HALL, distinguished Professor of Texas & M University and Prof. Ray WU, Chairman, Advisory Board for the Development of Agricultural Biotechnology Program/Institute, Academia Sinica, Taiwan; and Professor of the Cornell University will delivery lectures on the current advancements of the technology. Prof. Marc VAN MONTAGU, previous director of the Department of Genetics at the University of Gent, Belgium, a pioneer in discovering and assembling the first practical system for plant genetic engineering and Prof. Ingo POTRYKUS, Professor Emeritus at the Swiss Federal Institute of Technology, who invented the vitaman A enriched Golden Rice through genetic engineering, will discuss the impacts of this technology on the developing world.

Thirty leading scientists in the field from China, Europe, USA and Hong Kong (SAR), will join this event (see appendix II for tentative list of ASI lecturers and students). Seminars and discussion sessions are planned to provide opportunities for exchange.

Though this lecture series can be viewed as an important and integral part of the ongoing exchanges in Hong Kong including prominent scientists from worldwide, it is the first time that such an advanced, selective and focused lecture series addressing agricultural biotechnology is planned and will be held in Hong Kong. Besides facilitating the scientific advances of the participating institutes, it will certainly promote the academic standards of Hong Kong as a whole.

(BL01517)

Study of Benthic Faunal Species in Marine Sediment Monitoring for SSDS Stage one

- ✍ WONG Chong Kim ● WONG Po Keung
- ❑ 1 February 2002
- ❖ Hong Kong Productivity Council

The project is part of the Marine Sediment Monitoring Programme for SSDS Stage one. Marine sediments samples delivered to the Marine Science Laboratory will be sorted and all marine benthic organisms in the samples will be identified to species and counted. Data will be analyzed to determine faunal species composition and community diversity. Results will be used to evaluate impacts on benthic fauna caused by SSDS Stage one projects.
(BL01595)

Heavy Metal Concentrations in Tilapia Collected from Hong Kong Rivers

- ✍ WONG Chong Kim
- ❑ 1 February 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Many of Hong Kong's rivers and nullahs are heavily polluted by heavy metals. Concern has been raised about heavy metal contamination when *Tilapia* in Hong Kong rivers was captured by local people for consumption. This project investigates the level of heavy metals in the muscle of *Tilapia* collected in Hong Kong rivers.
(BL01616)

Provision of Services on Water Quality Monitoring in Marine Parks, Marine Reserve & Other Ecological Significant Areas

- ✍ WONG Chong Kim ● CHU Lee Man ● WONG Po Keung ● CHU Ka Hou
- ❑ 1 June 2002
- ❖ Agriculture, Fisheries & Conservation Dept, HKSAR Government

To conduct water quality monitoring at existing marine parks, marine reserve and other ecological significant areas in Hong Kong. Physico-chemical

and biological water quality parameters will be analyzed in the field and laboratory. Data will be analyzed to detect annual trends in water quality parameters and evaluate the rate of compliance with water quality objectives. Results from the study will be used by the Agriculutre, Fisheries and Conservation Department to further improve management, visitor services and environmental monitoring in marine parks and marine reserve.
(BL01892)

Sewage Treatment Sampling and Analysis

- ✍ WONG Po Keung ● CHUA Hong*
- ❑ 1 January 2000
- ❖ Drainage Service Department/PolyU Technology & Consultancy Co. Ltd.

Sewage Samples were collected from selected area and the chemcial and microbiological properties of the the samples were determined and compiled.
(BL99570)

Degradation of Pentatchlorophenol by Photocatalytic Oxidation

- ✍ WONG Po Keung
- ❑ 1 November 2000
- ❖ CUHK Research Committee Funding (Direct Grants)

Pentachlorophenol (PCP) has been used a wood preservative and precursor of pesticids. Its stable chemical and physical properties and reported highly toxicity, mutagenicity and carcinogenicity make PCP one of the hazardous pollutants in terrestrial and aquatic environments. Although its hazardous property, there is still numerous reports on the uncontrolled disposals and accidentally releases of PCP into environment due to the failure of using physical and chemical methods to treat PCP.
In the proposed study, a photochemical method – photocatalytic oxidation (PCO) will be used to degrade (and detoxify) PCP in aqueous solution. In order to proof PCO can completely degrade and detoxify PCP, chemically and toxicologically characterization of the degradation product(s) of PCP after PCO treatment will be conducted. Gas chromatograph coupled with mass selective detector (GS-MS) and diffuse reflectant Fourir transform-infra red (DRFT-IT) analyses will be used to identify the degradation products, while Microtox® test and Mutatox® test will be used to detect the toxicity and mutagenicity, respectively of PCP and its degradation product(s).
(BL00824)

Bioactive Substances from Marine Bacteria

- ✍ WONG Po Keung
- ❑ 1 September 2001
- ❖ Distribution from a project supported by RGC Central Allocation Vote

Research Plan:
(1) The chlorinated biphenyl (CB) and chlorinated dioxin (CD)-degrading abilities of isolated marine bacteria will be screened. The selected bacteria with high biodegradation abilities of these toxic xenobiotic compounds will be identified and characterized.
(2) To provide bioassays (such as Microtox tests) for the bioactive substances isolated by other teams.
Deliverables (12 months from November 2001):
(1) Isolation and characterization of CB- and/or CD-degrading marine bacterial strain(s).
(2) Toxicological assessment of bioactive substances isolated from other teams of the CAV group research project.
(BL01535)

Polycyclic Aromatic Hydrocarbons (PAHs) in Marine Sediment

- ✍ WONG Po Keung
- ❑ 1 November 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

Massive industrial activities in Hong Kong produce solid and liquid wastes containing organic pollutants such as polycyclic aromatic hydrocarbons (PAHs) that will be discharge or dispose into our environment. Even though Hong Kong Government has implemented very stringent discharge standards, there are numerous reports indicate that there are significant levels of PAHs in solid environmental samples. PAHs are xenobiotic compounds and they are extremely resistant to degradation by biological and chemical means. They are accumulated along

food chains and eventually reach human and cause intoxification.

Due to highly toxic nature of PAHs, trace amount of PAHs will cause toxicity to living organisms. Although there are many methods developed to detect PAHs in environmental samples, there have been reported that the precision of the measurement is highly dependent on efficiency of extraction of PAHs from environmental samples. In order to tackle the pollution problem of PAHs, a monitoring problem to continuously measure the levels of PAHs in environmental samples is urgently needed. The objective of the present study is to assess various available extraction methods of PAHs from marine. The comparison of the efficiency of these methods will provide a precise protocol to measure PAHs in environmental samples.

(BL01436)

Evaluation of Castanea Mollissima Pigment as Natural Food Additive

- ✍ WONG Yum Shing
- ❑ 1 November 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

Colors are added to food items to give consumers the appetizing and attractive qualities they desire. Recent studies indicated that the class III caramel, a synthetic brown color used in a wide variety of foods, may have undesirable effects on the immune system of experimental animals. The consumers' concern on the safety of synthetic food additives remains and the demand for natural pigments as food colors increases. We have prepared a brown pigment from the shells of Castanea mollissima fruit. Preliminary studies indicated that this pigment preparation is very stable. In addition to its coloring property, the Castanea pigment preparation exhibits antioxidative activity in different assay systems. This property suggests the potential use of the pigment as a natural food preservative (antioxidant). This project focuses on the evaluation of the Castanea pigment as a natural food additive in terms of its suitability as a coloring agent and as a food antioxidant. The toxicity of the pigment preparation will also be assessed.

(BL01654)

Stimulation of Glucose-6-Phosphate Dehydrogenase Activity in Sea Bream: Metabolic Significance and Potential Applications

- ✍ WOO Norman Ying Shiu
- ❑ 1 December 2001
- ❖ Research Grants Council (Earmarked Grants)

The pentose phosphate pathway in fish is essential for the production of key metabolites necessary for proper growth, biosynthesis (e.g. lipids and DNA) and maintenance of correct cellular redox potential. The efficient functioning of the pentose phosphate pathway is highly dependent on the expression and activity of the first and rate-limiting enzyme of this pathway (glucose-6-phosphate dehydrogenase, G6PDH). Since G6PDH levels may be critical in determining the amount of end products generated, it is of potential value to fish culture that we explore methods in order to increase its expression. Surprisingly this conjecture has never been adequately investigated although we have already shown from preliminary experiments that sea bream maintained in an iso-osmotic salinity display enhanced growth and disease resistance, which is correlated with increased G6PDH mRNA levels and enzyme activity. The present proposal aims to understand the mechanism and significance of G6PDH stimulation by salinity (and other factors), and to formulate strategies to enhance G6PDH in sea bream, cultured in iso-osmotic salinity, fed higher carbohydrate diets and administered with hormones. We will then relate this to the overall survival strategy of fish. A major role that G6PDH also plays is protection of cells against pathogenic stress. Thus we also propose to study the effect of enhanced G6PDH expression using both *in vivo* and *in vitro* experiments, and relate this to the ability of sea bream to withstand disease. In order to perform a comprehensive study we propose to study G6PDH expression at mRNA, protein and functional activity levels. Our proposed work will enable a better understanding of the basic mechanisms underlying G6PDH stimulation, and to explore the feasibility of exploiting the phenomenon to the benefit of developing novel fish culture strategies.

(BL01146)

Effect of Grass Carp Lectin on Teleost Macrophages and Lymphocytes

✍ WOO Norman Ying Shiu ● NG Tzi Bun (Biochemistry)

❑ 1 December 2001

❖ CUHK Research Committee Funding (Direct Grants)

A rhamnose-binding lectin, purified by affinity chromatography of grass carp ovaries on immobilized rhamnose, and possessing an N-terminal sequence with some similarity to other fish lectins, has been shown to stimulate murine splenocyte proliferation and cytokine gene expression. Hormones including prolactin and growth hormone have been reported to stimulate the phagocytic activity of seabream macrophages and the blood lymphocyte count. The aim of the present investigation is to test grass carp lectin for a possible stimulatory effect on phagocytic activity of seabream macrophages and blood lymphocytes, and to examine whether such effect can be reversed by rhamnose. The effect of grass carp lectin will be compared with that of the well-known lectin concanavalin A.
(BL01353)

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

Edition	Title/Investigators
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
1999-00	Reproductive Ecology of Sargassum Siliquastrum in Ping Chau, Hong Kong (BL99021) ✍ ANG Put Jr.
2000-01	Resource Assessment of Marine Alga *Hypnea charoides* in Hong Kong (BL00425) ✍ ANG Put Jr.
1999-00	Novel Anti-herpes Agent from Natural Product (CU99171) ✍ BUT Pui Hay Paul ● XU Hongxi (Institute of Chinese Medicine)# ● OOI Vincent Eng Choon
1999-00	Correlation Between Antitumor Activities and Structural Characteristics of Mushroom Polysaccharides (CU99161) ✍ CHEUNG Chi Keung Peter ● OOI Vincent Eng Choon ● ZHANG Lina*
1999-00	The Antioxidative Activity of Some Edible Mushrooms (BL99023) ✍ CHEUNG Chi Keung Peter
2000-01	Nutritional Evaluation of Edible Mushrooms (BL00678) ✍ CHEUNG Chi Keung Peter ● HUANG Nian Lai*
2000-01	Molecular, Genetical and Physiological Characterization of Hong Kong Lingzhi, *Ganoderma Lucidum* (BL00395) ✍ CHIU Siu Wai
1998-99	Development of Molecular Markers for Genome Mapping in Penaeid Shrimp (CU98062) ✍ CHU Ka Hou ● KWAN Hoi Shan
1999-00	Evolutionary and Population Genetics of Mitten Crabs, *Eriocheir* spp. (CU99162) ✍ CHU Ka Hou ● CHAN Tin Yam* ● SHEN Qi*
1999-00	Development of a Bioassay System for the Action of Androgenic Hormone in the Mud Crab *Scylla* (BL99024) ✍ CHU Ka Hou
2000-01	Isolation, Characterization, and Molecular Cloning of the Androgenic Hormone of the Mud Crab Scylla spp.: Development of Monosex Crab Aquaculture (CU00254) ✍ CHU Ka Hou ● SUN Piera S* ● 凌鈍* ● HONG Liu*

2000-01 Morphological and Molecular Variations Among Populations of the Brown Alga *Sargassum hemiphylum* (BL00537)
✍ CHU Ka Hou ● ANG Put Jr.

2000-01 Revegetation of Newly Restored Landfills: Site Environmental Conditions and the Role of Native Species (CU00250)
✍ CHU Lee Man

2000-01 The Use of Landfill Leachate as Irrigation Water for Plant Growth (BL00501)
✍ CHU Lee Man

1999-00 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 (CU99164)
✍ CHUNG Hau Yin

2000-01 Repulsive Odor in Chaw Tofu (BL00327)
✍ CHUNG Hau Yin

1998-99 Genetic Immunization Against Toxoplasma gondii (CU98142)
✍ FUNG Ming Chiu ● LEUNG Kwok Nam (Biochemistry) ● CHEN Xiao Guang*

2000-01 Cloning and Expression of a Gene Enconding Sj16, an Anti-inflammatory Protein from *Schistosoma japonicum* (BL00473)
✍ FUNG Ming Chiu

1999-00 Transciptional Regulation of Gonadotropin-I & II (GTH-I & II) β Genes in the Goldfish by Activin - Functional Analysis of Cis-acting Elements that Mediate Activin Stimulation of GTH-Iβ & Inhibition of GTH-IIβ Expression in the Goldfish, *Carassius auratus* (CU99176)
✍ GE Wei

2000-01 Gonadotropin Regulation of the Expression of Activin and Its Receptors in the Zebrafish Ovary (BL00820)
✍ GE Wei

2000-01 Compartmentation of Proteins in the Protein Storage Vacuole of Plant Cells (BL00823)
✍ JIANG Liwen

1990-91 Elucidation of Biochemical Events Regulating Secondary Metabolism in the Ligninolytic Fungus *Phanerochaete chrysosporium* (BP91015)
✍ John Anthony BUSWELL

1991-92 Enzymic Evaluation of Starch Availability in Foodstuffs (BP92007)
✍ John Anthony BUSWELL

1997-98 Production and Distribution of Cellulolytic Enzymes in the Edible Straw Mushroom, *Volvariella volvacea*, during Substrate Colonisation and Fruit Body Morphogenesis (CU97329)
✍ John Anthony BUSWELL

2000-01 An Investigation of the Physiological Functions of Different Laccase Components Produced by the Edible Mushroom, Pleurotus Sajor-caju (CU00260)
✍ John Anthony BUSWELL ● GE Wei

1998-99 Elucidation of Gene Expression Profiles during Fruit Body Development of Shiitake Mushroom Lentinula edodes using Expressed Sequence Tags and Serial Analysis of Gene Expression (CU98139)
✍ KWAN Hoi Shan

1999-00 Germplasm Bank, Chemical and Molecular Characterization of Chinese Medicinal Plants Commonly Used in Hong Kong (BL99004)
✍ KWAN Hoi Shan ● CHE Chun Tao (School of Chinese Medicine) ● WONG Yum Shing

1999-00 Analysis of Mitogen Activated Protein Kinase (MAPK) Cascades Isolated During Fruit Body Development of Shiitake Mushroom *Lentinula edodes* Using Yeast Two-hybrid System (BL99011)
✍ KWAN Hoi Shan

2000-01 Isolation and Differential Expression Analysis of Hydrophobin Genes of Shitake Mushroom *Lentinula edodes* (BL00642)
✍ KWAN Hoi Shan

1998-99 Asparagine Synthetase Genes: Their Roles in Plant Growth and Development (CU98292)
✍ LAM Hon Ming

1999-00 Molecular and Biochemical Characterization of a Salt-tolerant Soybean Variety (CU99180)
✍ LAM Hon Ming ● SHAO Gui Hua*

2000-01 Sink-Source Relationship During Seed Development in Arabidopsis Thaliana - Molecular Regulation of Aspartate Family Amino Acids (CU00263)
✍ LAM Hon Ming ● SUN Sai Ming Samuel

2000-01 Cloning of Floral Homeotic MADS-box Genes in the Short-day Dicot, *Glycine max* (BL00806)
✍ LAM Hon Ming ● HAN Tianfu*

1999-00 Development of Two Potent Novel Antiviral Drugs from Traditional Chinese Medicinies (BL99001)
✍ OOI Vincent Eng Choon ● BUT Pui Hay Paul ● XU Hongxi (Institute of Chinese Medicine)# ● CHAN Kay Sheung Paul (Dept of Microbiology)

1999-00 Expression of cDNA Encoding a Mannose-binding Lectin (NTL) from Narcissus tazetta in Transgenic Tobacco Plant (CU99182)
✍ OOI Vincent Eng Choon ● SUN Sai Ming Samuel

1999-00 Apoptosis-induced Cancer Regression by Certain Active Components from TCM and Natural Products – A Flow Cytometric Study (BL99013)
✍ OOI Vincent Eng Choon

2000-01 Flow Cytometric Studies on Anticancer and Immunomodulatory Activities of Microalgal DHA and EPA (BL00540)
✍ OOI Vincent Eng Choon ● CHIU Chi Ming Lawrence

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*

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)

1999-00 Development of Methods for Conducting Sediment Toxicity Tests with Amphipods from Hong Kong Waters (BL99014)
✍ WONG Chong Kim

2000-01 Development of a Rapid Toxicity Screening Test Based on the Filtering Behaviour of the Green Mussel *Perna viridis* (BL00330)
✍ WONG Chong Kim

2000-01 Water Quality Monitoring in Marine Park and Marine Reserve (BL00633)
✍ WONG Chong Kim ● CHU Lee Man ● WONG Po Keung ● CHU Ka Hou

1998-99 Removal and Recovery of Metal Ions from Electroplating Effluent by A Combined Chemical-Biomagnetic System (CU98134)
✍ WONG Po Keung ● CHUA H.*

1999-00 Integrated Chemical-Biological Treatment of Dye-Containing Effluent of Textile and Dyeing Industry (CU99174)
✍ WONG Po Keung ● YU Chai Mei (Dept of Chemistry)

1999-00 Degradation of Pentachlorophenol by Photocatalytic Oxidaton (BL99015)
✍ WONG Po Keung

2000-01 Removal of Pentachlorophenol by Adsorption by Chitin from Shrimp Shell Waste (BL00518)
✍ WONG Po Keung

1995-96 A Study of the Nutritional Quality and Potential Food Use of Some Underutilized Legumes (BL95043)
✍ WONG Yum Shing

1999-00 Free Radical Scavenging Activities and Antioxidative Properties of Plant Flavonoids (BL99016)
✍ WONG Yum Shing

2000-01 The Effects of Narciclasine on the Greening of Etiolated Wheat Leaves (BL00656)
✍ WONG Yum Shing

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.*

1998-99 Enhancing Immunological Competence of Silver Sea Bream (*Sparus sarba*) Through the Combined Application of Salinity Adaptation, Hormonal Factors and Specific Vaccines (CU98135)
✍ WOO Norman Ying Shiu

1999-00 Protective Effects of Heat Shock Protein 70 (HSP70) against Environmental and Pathogenic Stress in the Marine Teleost *Sparus sarba* (CU99168)
✍ WOO Norman Ying Shiu

1999-00 Strategies for the Improvement of Marine Fish and Shrimp Culture: A Molecular Biological Approach (BL99005)
✍ 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)

2000-01 Modulation of Gill Na^+-K^+-ATPhase Expression by Salinity and Hormonal Factors in the Sea Bream, Sparus sarba (CU00252)
✍ WOO Norman Ying Shiu

2000-01 An Investigation into the Effects of Growth Hormone, Prolactin and Cortisol on Branchial HSP90, HSP70 and HSP60 Expression in Silver Sea Bream (BL00859)
✍ WOO Norman Ying Shiu ● Eddie Edward DEANE

RESEARCH OUTPUTS AND PUBLICATIONS

<P004263> **ZHANG Siyi and SUM S.S.M.** "The Effects of Phosphorus on Tomato Growth and Purple Acid and Acid Phosphatase Gene Expression". *Plant Biology 2000, Annual Meeting of the American Society of Plant Physiology* vol.2000, p.185. San Diego, USA, 2000.07.15.

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RESEARCH PROJECTS

1,2 Rearrangements of Beta-Aminoalkyl Rhodium Porphyrins

- ✍ CHAN Kin Shing
- ❑ 1 December 2001
- ❖ Research Grants Council (Earmarked Grants)

1,2-Rearrangements in organometallic compounds bear much bioinorganic and catalytic significance. Vitamin B_{12} is an important vitamin and its role in metabolism is not yet fully understood. We propose to develop a chemical model to study the role of vitamin B_{12}. In catalytic processes involving organometallic complexes, the properties and possible rearrangements of these intermediates will alter the product selectivity and strongly affect the efficiency. Unraveling the mechanistic features and understanding the properties of the organometallic complexes will increase our knowledge of this fundamentally important class of rearrangement processes and possibly aid us to design more efficient catalysts.
(PS01251)

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

- ✍ CHAN Kin Shing
- ❑ 1 February 2002
- ❖ Area of Excellence Funding from Hong Kong Polytechnic University

Arsine ligands unlike the phosphine analogues, are relatively much less explored. We will prepare the bidentate optically active *N, As* ligands. The catalytic asymmetric hydrogenation, transfer hydrogenation and Suzuki cross coupling reactions based on the metal complexes of ligands L_1 and L_2 will be investigated. The asymmetric hydrogenation will be examined by the rhodium and iridium complexes. The asymmetric transfer hydrogenation of ketones into alcohols will be examined by the ruthenium complexes. The asymmetric Suzuki cross coupling reactions of biaryl synthesis will be examined by the palladium complexes.
(PS01305)

Double Resonance Spectroscopy of Solid Hydrogen: Studies of Vibrational Relaxation

- ✍ CHAN Man Chor
- ❑ 1 November 2001
- ❖ Research Grants Council (Earmarked Grants)

We propose here experiments to initiate spectroscopic studies of solid hydrogen, a novel system for high resolution laser spectroscopy. As shown in our recent experiments, the linewidths observed in solid hydrogen are comparable to those for gas molecules. The narrowness of spectral linewidths in solid hydrogen allows us to resolve the very fine details of the rovibrational spectra due to intermolecular interactions, which are of interests in various fields such as phase transition and dynamics of chemical reactions. Since the quantitative interpretation of the spectral linewidths of the system is far from satisfactory, we propose here to investigate the origin of the narrowness of the spectral transitions using double resonance spectroscopy, a technique has yet to be applied to solid hydrogen. By using infrared-infrared and infrared-microwave double resonance of the vibrational transitions, we hope to obtain information on the vibrational relaxation time, which will no doubt shed some light on establishing a realistic model to interpret the homogeneous linewidths of the system based on intermolecular interactions. In addition to its academic interest, this work also form an integral part of our developing program on experimental Chemical Physics at the Chinese University of Hong Kong.
(PS01258)

Development of Novel Electron Emitter for Electron Capture Dissociation of Biomolecules in a Fourier-transform Mass Spectrometer

- ✍ CHAN Tak Wah Dominic
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Electron Capture Dissociation (ECD) is a relatively new dissociation technique for multiply-charged ions. By irradiating the multiply-protonated protein ions

with low-energy (<=0.2 eV) electrons, the protein ions would undergo exothermic capture of electrons and thus leading to the formation of a reduced radical ion, $[M+nH]^{(n-1)+\cdot}$, which rapidly dissociates via backbone N-C_α cleavage to form series of c-type and z-type ions. As a result of the non-ergodic nature of ECD process, strong backbone bonds are preferentially cleaved even in the presence of much weaker bonds. It has been demonstrated that this dissociation technique offers more extensive and nonspecific fragmentation, resulting in greater peptide sequence coverage. Although it has previously been shown that this dissociation technique can provide important structural information for characterization of labile post-translational modifications and for *de novo* sequencing, it has not been widely practiced in scientific community. The lack of positive feedback on this dissociation is tentatively attributed to (i) the low intensity of the ECD fragment peaks; and (ii) the long electron irradiation time of 3-10 s for obtaining sufficient intensities for ECD fragment-ions. The current ECD protocol remains tedious and time-consuming. The low duty-cycle has also prohibited the implementation of the ECD technique for use in on-line liquid chromatography MS/MS analysis. Having conducted systematic studies on factors affecting the efficiency of the electron capture dissociation of protein standards, we have evidence to believe that the bottleneck of ECD method lies on the low electron emission efficiency of the conventional filament-type emitter. In this proposal, we attempt to develop a novel electron emitter based on *"field desorption / ionization emitter"* for ECD of proteins in a Fourier-transform mass spectrometer.
(PS01359)

Synthesis and Properties of a Dendritic Analog of Poly(olefins)

- ✍ CHOW Hak Fun
- ❑ 31 December 2001
- ❖ Research Grants Council (Earmarked Grants)

Poly(olefins) such as polyethylene and polypropylene, are one of the most important class of polymers in the plastic industry. They are macromolecules with a linear, long-chained carbon backbone and are used as packaging films, container bottles, coatings and lubricants in our daily life. This proposal is concerned with the preparation and property studies of a hyperbranched analog of this useful class of saturated aliphatic hydrocarbon polymers. Hyperbranched polymers have recently become a topic of current interest because of their unusual structural and property features. They have been used in a number of medicinal, electrochemical, photochemical, biological and catalytic applications. In this project we plan to develop a new methodology towards the preparation of a new homologous series of hyperbranched poly(olefins) and to investigate the effect of branching on their physical properties. Previous experience has shown that the branching pattern of poly(olefins) can significantly affect their physical properties. It is believed that the results of this study will aid our understanind of polymer and dendrimer chemistry.
(PS01249)

Asymmetric Synthesis Using Chiral Dendritic Catalysts (AoE Scheme - Institute of Molecular Technology for Drug Discovery & Synthesis)

- ✍ CHOW Hak Fun
- ❑ 1 February 2002
- ❖ Area of Excellence Funding from Hong Kong Polytechnic University

The use of dendrimers as macromolecular catalysts is a topic of current interest. In addition to improved reactivity, dendritic catalysts may offer better substrate selectivity as compared to conventional small molecular catalyst. This is mainly due to the presence of a dendritic scaffolding whose function is similar to the active site pocket found in many natural enzyme molecules. Our group has been engaged in the design and synthesis of catalytically active dendrimers. In this proposal we wish to extend the scope of the research by preparing chiral dendritic ligands having a catalytic site encapsulated within a chiral active site pocket. Upon activation with copper(II) ion, the resulting metal complex may be used to catalyze the Diels-Alder reaction. We envisage this kind of catalytically active dendrimers may be able to provide better reaction enantioselectivity and substrate selectivity.
(PS01402)

Micrometallurgy in the Electroplated Bumps for Flip-chip Applications

- ✍ KWOK Wai Man Raymund

- 1 August 2001
- Shipley Asia Limited ● University-Industry Collaboration Programme: Teaching Company Scheme, ITF, Innovation & Technology Commission

Many IC pakaging companies in Hong Kong and the nearby region have been applying flip chip processes for their products. It is expected that the rapid growth in this area will last for at least three years, especially due to the manufacturing of portable devices. In this area, Shipley has invested into a bump plating laboratory in Hong Kong for the R&D of the process development of the flip chip technology using Shipley chemicals and materials.
The proposed project aims at the acquiring the knowledge of micrometallurgy in electroplated bumps and the metals in contact with the bumps. The knowledge will be used to invent new or improve existing products in Shipley. The proposed project will train one MPhil students in the area of flip-chip technology. The student will be trained to use the advanced processing equipment in Shipley and the advanced characterization equipment in CUHK.
(PS01583)

R&D of New Process Chemicals for the Electronic Industry

- KWOK Wai Man Raymund
- 1 December 2001
- Shipley Asia Limited ● University-Industry Collaboration Prog.: Industrial Research Chair Scheme, ITF, Innovation & Tech. Commission

Many printed wire board (PWB) manufacturers have been investing new factories in Mainland China since 2000. In a few years, China will produce 30 million square meters of PWB products per annum and will be the largest in the world. With this trend, Shipley plans to strength the overall support for this industry in China and build a regional R&D component in Hong Kong to support the customers in China and nearby countries. The R&D component in Hong Kong has the advantages of understanding the needs of the electronic packaging industry in Mainland and response to their needs in a short period of time while communicating well with other Shipley R&D groups in the world and utilizing their resources.
Currently, Shipley Asia Limited, the head quarter of Shipley in South East Asia, has a Technology Division which employs 32 staff. Four of them have PhD degrees and about 15 have master degrees. About 10 staff in this team will be allocated to the R&D component.
Prof. Raymund Kwok has been involved in the work with Shipley since 1997. Initially, Prof. Kwok mainly assisted Shipley in surface characterization through the Advanced Surface and Materials Analysis Centre (ASMAC) in CUHK. Staring from June 2000, Prof. Kwok with the support from the Industrial Research Chair Scheme of ITF led the Technology Division of Shipley in developing various analysis techniques for the electronic packaging industry and implemented the techniques in Shipley. He also gained experience in Shipley products and processes.
The proposed project will assist Shipley in establishing the R&D component in Hong Kong and develop several specific processes and products for Shipley.
(PS01346)

Structures and Dynamics of Mismatches in Trinucleotide Repeats

- LAM Sik Lok
- 1 August 2001
- Research Grants Council (Earmarked Grants)

Trinucleotide repeat (TR) is a class of unstable deoxyribonucleic acid (DNA) structures that undergoes large-scale expansion during DNA replication. The onset of hereditary neurological diseases like Huntington's disease, Machado Joseph disease and Friedreich's ataxia are related to the expansion of these repeats but the mechanism of the expansion process is not fully understood. Several TR sequences have been found to be inherently flexible and adopt the hairpin conformation with mismatched base pairs in the stem region during replication. The presence of such mismatched base pairs has been hypothesized to be the origin contributing to genetic instabilities that lead to DNA mutations. In this research, I propose to utilize high-resolution nuclear magnetic resonance (NMR) and ultraviolet (UV) absorption spectroscopy to investigate the structures and motional behaviors of mismatched base pairs in TR sequences as well as to determine how their nearest-neighboring base pairs

affect their stabilities, structures and motional behaviors. The biomedical implications of studying the structures and dynamical properties of mismatched base pairs in TR sequences include a better understanding of the mechanism by which large-scale TR expansion might occur, yielding insights into the relationships among structures, dynamics and loci-specific expansion, and potentially providing leads into the development of new therapeutics for curing hereditary neurological diseases.
(PS01255)

Correlation of Sequence Dependent Chemical Shifts and Local Structures of Deoxyribonucleic Acids

- ✍ LAM Sik Lok
- ❑ 1 June 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Chemical shift is a very sensitive probe to changes in the chemical environment of a nucleus. It has been successfully used to determine and predict protein and peptide secondary structures. However, due to the sequence effect and the crystal packing forces in deoxyribonucleic acid (DNA) crystal structures, no reliable correlation has been found between DNA chemical shifts and structures. As more reliable solution DNA structures have been determined, it becomes possible to re-investigate the correlation between DNA chemical shifts and structures without the crystal packing effect. In this project, I propose to study the sequence effect on chemical shifts and local structures of DNAs. Based on the chemical shift measurement of a series of single-strand DNA pentamers, a random coil DNA chemical shift database, which summarizes the chemical shift data of nucleotide X in the N_1XN_2 trimer block, will be established. This random coil chemical shift data will be useful to serve as reference shift values corresponding to unstructured DNAs. Chemical shift difference (CSD) analysis will then be carried out using these random coil values and the chemical shift data from DNAs with known solution structures to investigate the relationship between sequence dependent chemical shifts and local structures.
(PS01877)

Synthetic and Structural Studies of Lanthanide Metal Amides

- ✍ LEE Hung Kay
- ❑ 1 April 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

The studies of metal amides ($M\text{-}NR_2$) have attracted considerable attention due to their involvement in a number of important reactions, ranging from industrial processes to biological phenomena. Recently, the chemistry of pyridine-functionalized amido ligands has elicited much interest because of a high flexibility of these ligands in their coordination mode and their ability to stabilize metal complexes with unusual coordination geometries. A number of main-group and transition metal amides with interesting and unusual structures have been reported. Lanthanide metal amides derived from these ligands, on the other hands, are rare. We propose to undertake a research project on synthetic and structural studies of a series of lanthanide metal amides supported by pyridine-functionalized amido ligands. The structure of all complexes will be characterized by single-crystal X-ray diffraction studies, in addition to spectroscopic methods. The results of this work may provide insights and guide future design of polymerization catalysts for special uses.
(PS01946)

Computational Studies on the Adsorption and Reaction of Small Molecules on Arrays of Carbon Nanotubes

- ✍ LIU Zhifeng ● GONG Xin Gao*
- ❑ 1 October 2001
- ❖ Research Grants Council (Earmarked Grants)

The study of carbon nanotube is at the forefront of material sciences, the exciting new area of nano-materials. Carbon nanotubes have many promising potentials for application as electronic devices, quantum wires, gas storage and catalyst supports. In our proposal, we plan to perform first principle computational studies on the interaction between small molecules (H_2, O_2, O_3; H_2O, H_2O_2, HNO_3, H_2SO_4) and arrays of carbon nanotubes, using the density functional theory method with a

planewave basis set and pseudopotentials. By these simulations, we hope to explore the physical and chemical nature of these interactions and elucidate the mechanisms of the possible chemical reactions involved, either in high pressure or in aqueous solution conditions. Such studies will enhance our understanding of the gas storage process, the sensitivity of carbon nanotubes to air exposure, chemical reactions in the purificiation processes, and chemical modification of carbon nanotubes.
(PS01252)

Dendritic Phthalocyanines with Cationic Surface Groups. Synthesis, Aggregation Behavior, and Photophysical Properties

- ✍ NG Kee Pui Dennis
- ❑ 1 February 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Owing to their high stability and intriguing electronic and optical properties, phthalocyanines have found widespread applications in various disciplines ranging from materials science, catalysis to medicine. Numerous studies have been performed to modify the macrocyclic compounds with the goal of tuning their physico-chemical characteristics and optimizing their performance as advanced materials. This proposal seeks to secure funds to explore novel phthalocyanines substituted with tree-like dendritic fragments with cationic terminal groups. This virtually unknown class of macrocycles, having sterically bulky substituents and a cationic surface, should be relatively non-aggregated and photoactive in aqueous media, which render them useful as efficient photosensitizers in photodynamic therapy. The intrinsic aggregation tendency of these compounds, in particular for the lower generation analogues, is susceptible to the environment and can be readily monitored by various spectroscopic methods. This enables the new macrocycles to serve as sensors for substances which can perturb their self-association. The proposed work involves the preparation and characterization of a series of zinc(II) phthalocyanines substituted with various cationic dendritic fragments. The aggregation and photophysical properties of these novel macrocycles in aqueous media together with their response to fatty acids will also be studied with a range of spectroscopic techniques.
(PS01387)

The Study of Uloses in Asymmeric Epoxidation

- ✍ SHING Kung Ming Tony
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Chiral epoxides are versatile starting materials for making optically active pharmaceuticals. Methods for preparing chiral epoxides efficiently from simple alkenes are therefore important and of commercial value. The project aims at developing inexpensive sugar derivatives as catalysts for making chiral epoxides. The successful research results will provide economical avenue towards optically active epoxides from unfunctionalised alkenes and will allow the synthetic chemists to devise viable routes to target pharmaceuticals. In summary, our successful research results are (a) important for the advancement of the science of synthetic organic chemistry, (b) useful for the chemical industry that may employ the developed sugar catalysts for the preparation of chemicals of pharmaceutical interest or of other industrial applications.
(PS01617)

Biomimetic Total Synthesis of Novel Diterpenes from Liverwort Pallavicinia subciliata

- ✍ WONG Nai Ching Henry
- ❑ 1 October 2001
- ❖ Research Grants Council (Earmarked Grants)

A stereoselective Michael cyclization step will be used as the pivotal step in the quest of the novel diterpenes isolated recently from liverwort *Pallavicinia subciliata*.
(PS01250)

The Self-assembly of Polymeric Surfactants in Water

- ✍ WU Chi ● Avraham Halpesin*
- ❑ 1 July 2001
- ❖ France/Hong Kong Joint Research Scheme

The proposed research focuses on three systems based on the neutral and water soluble polymer poly

(N-isopropylacrylamide), PNIPAM: (1) PNIMPAM grafted with side chains of the water-soluble polymer poly (ethylene oxide) (PEO); (2) PNIPAM microgels grafted with PEO chains; (3) copolymers of NIPAM and styrene. The three systems are especially interesting because PNIPAM exhibits a lower critical point around 32℃. At higher temperatures the polymer collapses and eventually precipitates. This allows for the tuning of the configurational properties and the solubility of these polymers by a change of temperature at a convenient range. The planned experiments will be carried out both above and below the critical point.
(PS01001)

The Mesoglobular Phase of Dilute Heteropolymer Solutions

- ✍ WU Chi
- ❑ 31 December 2001
- ❖ Research Grants Council (Earmarked Grants)

In a good solvent, polymers exist as individual chains. The change of either the chain itself or solvent could induce the interchain association, often leading to macroscopic precipitation. Such interchain association has many technological implications and even happens in our daily life, e.g., the aggregation of denaturalized protein in spoiled milk and the association of gelatin in jelly dessert. Typical interchain association in a poor solvent is *irreversible* and *uncontrollable*. Recently, it has been shown that for heteropolymers in dilute solutions, there exists a new phase between a single chain and precipitate, in which the association of a limited number of chains could form small mesoglobules stable in solution. Such mesoglobules have been observed in our previous studies. In order to have a better understanding of the underlying physics that controls the size and formation of these mesoglobules, we propose a systematic investigation in a *controllable* and *reversible* fashion by using thermally sensitive poly(*N*-vinylcaprolactam) (PVCL) copolymerized with other monomers because PVCL can gradually change from being soluble to insoluble in water when the temperature increases in the range 25-33℃. A combination of static and dynamic laser light scattering will be used to study the formation and structure of the mesoglobules, especially the effect of the spatial arrangement of different monomers within a heteropolymer chain. The outcome of this study will not only gain insight into the mesoglobule phase of heteropolymer solutions, but also have a direct application in the development of novel polymeric nanomaterials.
(PS01257)

The Orderly Folding of a Single Heteopolymer Chain in Solution

- ✍ WU Chi
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

It is known that a homophoymer chain can undergo a coil-to-globule conformation transition in a dilute solution if the solvent quality gradually changes from good to poor. Unlike the protein folding, the transition leads to a random packing of the chain segments because of the lack of specific interaction in a homopolymer chain. In this project, we propose to synthesize a heteropolymer made of two different monomers with a defined monomer distribution by using a newly developed micelle polymerization. More specifically, we will use monomer *N*-isopropylacrylamide (NIPAM) as the main component to make the chaim backbone (PNIPAM) and evently insert 1-5 mol% of the second monomer styrene (St) on it. As a thermally sensitive polymer, PNIPAM can change from soluble (hydrophilic) to insoluble (hydrophobic) in water when the temperature increases from 25℃ to 32℃. It is expected that as the temperature increases, the contraction of the heteropolymer chain in solution will lead to an ordered coil conformation with the insoluble hydrophobic St blocks in the center. Further increase of the temperature will eventually result in a flower-like core-shell nanostructure with the condensed St blocks as the core and the collapsed PNIPAM segments as the shell. A combination of static and dynamic laser light scattering will be used to study how such an orderly folding depends on the chain composition, such as the length of the St block and the distance between the St blocks. This study will be one step forward to understand and protein folding.
(PS01912)

A New Class of Metallacarboranes Incorporating the n7-Carboranyl Ligand

- ✍ XIE Zuowei
- ❑ 31 December 2001
- ❖ Research Grants Council (Earmarked Grants)

The chemistry of metallacarboranes has witnessed an explosive growth since the first metallacarborane was reported in 1965. A large number of metallacarboranes of s-, p-, d-, and f-block elements are known, however, the highest hapticity of carboranyl ligands in these compounds has been six until the recent report from our laboratory. A novel metallacarborane containing the η^7-carboranyl ligand is prepared and structurally characterized for the first time in our laboratory. This is a brand new bonding mode for carborane molecules. We plan in this proposal to explore this new chemistry. Various types of carboranes and a series of f- and d-block transition metal ions will be examined. A new class of metallacarboranes are expected to be prepared. Their molecular structures and chemical properties will be investigated in detail. The chemistry of this class of metallacarboranes is expected to be significant and varied. The findings from this research will break some significant new ground in the exploration of η^7-metal binding to metallacarborane ligands and enhance our basic understanding in the chemistry of carboranes and metallacarboranes.
(PS01254)

Novel Ruthenium Catalysts for Fine Chemistry

- ✍ XIE Zuowei ● Pierre H Dixneuf*
- ❑ 1 March 2002
- ❖ CUHK Mainline Research Scheme

The development of chemical processes in industry is associated with the discovery of clean tolerance for the environment processes, and the combination of several simple substrates into one useful high value product under mild conditions, thus with energy and atom economy. In this direction *catalysis* is at the center of research and development for the large-scale production of chemicals including polymers as well as for the synthesis of high value intermediates for fine chemistry or health products. Modern catalysis requires both the discovery of catalytic systems performing new combinations of molecules and the improvement of known catalyst efficiency. Consequently, the understanding of catalytic processes is now crucial for designing significant modification and improvement of catalysts and new combinations of reagents. Organoruthenium catalysts have shown recently a tremendous power in fine chemistry by selectively forming C-C bonds and coupling of unsaturated molecules or activating inert bonds. The first attempts to understand these catalytic processes show that increase in regioselectivity and catalytic efficiency is closely related to the steric hindrance around the Ru site and the electron-richness of the site to favor oxidative coupling [Ru(II) → Ru(IV)] by lowering activation energy. It is our goal to develop new ruthenium catalysts with recently developed bulky carborane ligands to find applications for C-C bond formation and fine chemistry.
(PS01513)

Development of Advanced Photocatalytic Nano-coating Technologies for Environmental and Health Industries

- ✍ YU Chai Mei ● WONG Po Keung (Dept of Biology)
- ❑ 1 February 2002
- ❖ Funding from Other Sponsors ● Innovation and Technology Support Programme, ITF, Innovation & Technology Commission

Titanium dioxide based photocatalytic coatings have immense industrial potential because they possess many desirable properties. A nanometer TiO2 coating absorbs harmful ultraviolet radiation, degrades pollutants, and kills bacteria on contact. This material is also anti-fogging and self-cleaning. Thousands of cmmercial products can be developed with this new technology. We have been conducting research on photocatalysis since 1996, and we were very successful in preparing a series of novel TiO2-metal oxide photocatalysts. We have also discovered efficient ways to make highly effective and durable thin film coatings. Our track record shows that we are maintaining a competitive edge against researchers in other countries.
With support from the ITF, the application aspect of this technology will be explored. The objective of this project is to nurture a new industry in Hong Kong that manufactures high value-added products with photocatalytic coatings. These include building materials that break down air pollutants and

clean themselves, advanced air filtration systems that improve indoor air quality, and even bactericidal hospital/household wares. This academic-industrial liasion will forge a one-stop service centre to support the local industry in developing advanced nano-coatings that offer significant for the environmental and health sectors.
(PS01871)

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

Edition	Title/Investigators
1994-95	Asymmetric Catalysis by Metal Complexes of Chiral Pyridyl Phenols and Their Derivatives (PS94010) ✍ 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
1999-00	Activation of Carbon-Carbon Bonds by Transition Metal Complexes (CU99202) ✍ CHAN Kin Shing
2000-01	Transition Metal-catalyzed Phosphinylation by Catalytic Phorsphorus-carbon Bond Activation (PS00806) ✍ CHAN Kin Shing
1999-00	Forbidden Transitions of H_2 Studied by Cavity Ring Down Spectroscopy (PS99010) ✍ CHAN Man Chor
1999-00	Structural and Dynamic Studies of van der Waals Molecules Using High Resolution Spectroscopy (PS99017) ✍ CHAN Man Chor
2000-01	High-resolution Spectroscopy of CH_2^+ and NH_2^+: The Study of Rovibronic Interactions of Quasilinear Molecules (CU00272) ✍ CHAN Man Chor
2000-01	Dissociation of Large Ions in a Fourier-transform Ion-Cyclotron-Resonance Mass Spectrometer (CU00274) ✍ CHAN Tak Wah Dominic
1999-00	Synthesis and Characterization of Dendritic Networks (CU99201) ✍ CHOW Hak Fun
2000-01	Artificial Globular Proteins: Synthesis and Characterization of alpha-Amino Acid-based Peptide Dendrimers (CU00273) ✍ CHOW Hak Fun
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*
1999-00	Materials Characterization and Failure Analysis for Electrodeposition (PS99027) ✍ KWOK Wai Man Raymund
2000-01	Development of Analysis Techniques for Deposits and Baths for the Electroplating Industry (PS20005) ✍ KWOK Wai Man Raymund ● HARK Sui Kong (Dept of Physics)
2000-01	A Novel Technique for the Analyses of Depth Distribuitons of Chemical States and Compositions in Semiconductor Materials with Sub-nanometer Resolution (CU00230) ✍ KWOK Wai Man Raymund
2000-01	Solution Structure Studies of Nuclear Localization Signals in Viral and Disease Proteins (PS00431) ✍ LAM Sik Lok

1999-00 Zinc Complexes with Sterically Demanding Chalcogenato Ligands (PS99021)
✍ LEE Hung Kay

1990-91 Synthesis of Novel Transition-Metal Alkyls (BP90039)
✍ LEUNG Wing Por Kevin

1990-91 Synthesis of Organometallic Compounds of Alkali Metals (BP90040)
✍ LEUNG Wing Por Kevin

2000-01 Metal Complexes of a Tridentate Diamide Ligand (CU00265)
✍ LEUNG Wing Por Kevin

2000-01 "Gaussian-3 Study on the Structures, Reactions, and Energetics of Some Interesting Chemical Systems" (CU00275)
✍ LI Wai Kee

1998-99 A First Principle Study on the Bimolecular Reaction F2+C2H4 (CU98122)
✍ LIU Zhifeng ● TSE John S.*

2000-01 Theoretical Study on Solvation Dynamics and Intracluster Reactions for $Al^{+}(H_2O)n$ Ion Clusters (CU00276)
✍ LIU Zhifeng ● TSE John S.*

1989-90 X-Ray Analysis of Crystal Structures (BP72001)
✍ MAK Thomas Chung Wai

1989-90 Metal Coordination by Betaines (BP88025)
✍ MAK Thomas Chung Wai

1998-99 Synthetic and Structural Studies on Homo- and Heterometallic Complexes (CU98022)
✍ MAK Thomas Chung Wai ● TANG Wen Xia*

1999-00 Studies in Supramolecular Chemistry (CU99206)
✍ MAK Thomas Chung Wai

2000-01 Studies on the Coordination Chemistry of Acetylenediide and Pseudohalide Anions (CU00268)
✍ MAK Thomas Chung Wai

1998-99 Sandwich-Like Metal Bis(tetrapyrroles) (PS98025)
✍ NG Kee Pui Dennis ● Johann W. BUCHLER*

2000-01 Sandwich-like Metal Bis (tetrapyrroles) (PS20001)
✍ NG Kee Pui Dennis

2000-01 Bioconjugation of Phthalocyanines with Amino Acids and Peptides, Synthesis and Photophysical Properties in Micellar Systems (PS00397)
✍ NG Kee Pui Dennis

1997-98 Enantiospecific Total Syntheses of Anticancer Agents Simalikalactone D and Quassimarin (CU97708)
✍ SHING Kung Ming Tony

2000-01 Synthetic Studies Toward Taxol: Contruction of an Optically Active ABC Ring from (+)-Carvone (PS00598)
✍ SHING Kung Ming Tony

1989-90 Theoretical Studies of (a) Aluminium-Ethylene Complexes (b) CH_3SOH^{+} (c) Ge Compounds (d) HPOH and HNOH (BP89048)
✍ SO Suk Ping

1989-90 Synthesis of Novel Aromatic Compounds (BP83001)
✍ WONG Nai Ching Henry

1998-99 Synthesis and Reactions of 5,6-Bis (trimethylsily) benzo [c] furan (CU98014)
✍ WONG Nai Ching Henry

2000-01 The Construction of Chiral 3-Dimensional Molecular Scaffolds Using Tetraphenylenols as Building Blocks (CU00264)
✍ WONG Nai Ching Henry ● MAK Thomas Chung Wai

2000-01 Synthesis of Compounds by Solution Phase Chemistry (PS20007)
✍ WONG Nai Ching Henry

1998-99 The Formation and Stabilization of Surfactant-Free Polymer Nanoparticles (CU98123)
✍ WU Chi

1999-00 Design, Synthesis and Assembly of "Intelligent" Macromolecules (CU99209)
✍ WU Chi ● PAN Cai Yuan* ● LEUNG May Lay Louis*

2000-01 Phase Transitions of Novel Polymer Brushes (CU00266)
✍ WU Chi

1999-00 Organolanthanide Compounds with a New Class of Versatile Ligands (CU99210)
✍ XIE Zuowei

2000-01 "Group 4 Metal Carborane Complexes: Synthesis, Structure, and Reactivity" (CU00267)
✍ XIE Zuowei

1998-99 Enhanced Photocatalysts for the Degradation of Volatile Organic Compounds (CU98124)
✍ YU Chai Mei

2000-01 Applications and Mechanisms of Photochemical Oxidation of Persistent Organic Pollutants (CU00033N)
✍ YU Chai Mei ● ZHAO Jincai*

2000-01 Coating of Titanium Dioxide on Solid Substrates by Sol-Gel Method (PS00408)
✍ YU Chai Mei

2000-01 Technical Evaluation on Ambient Air Treatment by Titanium Dioxide Based Photocatalyst in Hong Kong (PS20008)
✍ YU Chai Mei ● YU Jiaguo#

RESEARCH OUTPUTS AND PUBLICATIONS

<P004191> **PENG Shu Fu and WU Chi.** "Ca^{2}+- Induced Therwore Uersible and Controlable complexatin of Poly (N-ving\Carprolatam-co-Sadium Acrylate) Microgels in Water". Paper presented in the Southeast/Southwest Combined Regional Meeting of the American Chemical Society, organized by ACS. New Orleans, Louisiana, USA, 2000.12.05.

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<P004274> **ZHAO Q.; DENG Z.W.; KWOK R.W.M. and LAU W.M.** "Damage of InP (110) induced by Low Energy Ar+ and He+ Bombardment". *Journal of Vacuum Science & Technology A-Vacuum Surfaces and Films* vol.18 no.5, pp.2271-2276. Melville, 2000.

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<P011769> **SHING K.M. Tony; LEE M. Chi and LO Y. Ho.** "Synthesis of the CD Ring in Taxol from (*S*)-(+)-Carvone". *Tetrahedron Letters* vol.42, pp.8361-8363. Elsevier Science Ltd, 2001.

<P011770> **WANG Haiping; WANG Yaorong; LI Hung-Wing and XIE Zuowei.** "Synthesis, Structural Characterization, and Olefin Polymerization Behavior of Group 4 Metal Complexes with Constrained-Geometry Carborane Ligands". *Organometallics* vol.20, pp.5110-5118. USA: American Chemical Society, 2001.11.

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<P012142> **YU C., Jimmy.** "Testing the Efficacy of Photocatalytic Building Materials on the Treatment of Ambient Air Pollution". Paper Presented in the American Chemical Society 222nd National Meeting. Chicago, USA, 2001.08.

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<P012587> **PAL Indrani; BASULI Falguni; MAK C.W., Thomas and BHATTACHARYA Samaresh.** "Synthesis, Structure, and Properties of a Novel Heterooctametallic Complex Containing a Cyclic Ru_4Ni_4 Core". *Angew. Chem. Int. Ed.* vol.40 no.15, pp.2923-2925. Wiley-VCH, 2001.

<P012588> **WANG Quang-Ming and MAK C.W., Thomas.** "Induced Assembly of a Caternated Chain of Edge-Sharing Silver(I) Dodecahedra with Embedded Acetylide by Silver(II)-Tmc (Tmc = 1,4,8,11-Tetramethyl-1,4,8,11-Tetraazacyclotetradecane)". *Chem. Commun.* pp.807-808. The Royal Society of Chemistry, 2001.

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<P012743> **PENG Shufu and WU Chi.** "Comparison of the Ca^{2}+/COO- Complexation Induced Controllable Aggregation of P(VCL-*co*NaA) Spherical Microgels and Linear Chains". *Macromolecules* vol.34, pp.6795-6801. American Chemical Society, 2001.

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RESEARCH PROJECTS

Cancer Drugs Active against Signal Transduction Targets

- ✍ CHE Chun Tao
- ❑ 1 November 2001
- ❖ Georgia Institute of Technology Funding from NIH/National Cancer Institute

The plant kingdom is a rich source of biologically active substances. This project aims at discovering active extracts and/or chemical compounds from Chinese medicine which interfere the cellular signal transduction pathways.
(BL01514)

Chemical and Molecular Analyses of Rhubarb

- ✍ CHE Chun Tao
- ❑ 2 February 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Rhubarb, Radix Rhei, is a common medicinal material used in Chinese medicine. We propose to study the chemical composition of the standardized extract of this herb and establish a fingerprint chromatogram for standardization purpose. In addition, DNA analysis of the crude drug will be performed in order to work out an DNA fingerprint for authentication of the plant drug.
(BL99851)

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

Edition	Title/Investigators
1999-00	Cytotoxic and Potential Anti-Tumour Compounds from the Chinese Drug "Lang-Du" and Their Mechanisms of Action (CU99169) ✍ CHE Chun Tao ● KONG Yun Cheung# ● LIU Wing Keung Ken (Dept of Anatomy)
2000-01	Applications of Supercritical Fluid Extraction Techniques in Chinese Medicines (BL00903) ✍ CHE Chun Tao ● LIU Wing Keung Ken (Dept of Anatomy)
2000-01	Extraction Technology and Pharmacological Properties of Chai-Ge-Jie-Ji Preparation (BL00841) ✍ LIANG Songming ● CHE Chun Tao ● RONG Xiang Tao*

RESEARCH OUTPUTS AND PUBLICATIONS

<P012175> **KONG Ling Dong; TAN Ren Xiang; WOO Yiu Ho, Anthony and CHENG Hon Ki, Christopher.** "Inhibition of Rat Brain Monoamine Oxidase Activities by Psoralen and Isopsoralen: Implications for the Treatment of Affective Disorders". *Pharmacology and Toxicology* vol.88, pp.75-80. Denmark, 2001.02.

<P012507> **YE Wencai; ZHANG Qingwen; PAN Guoshi; ZHAO Shouxun and CHE Chun-Tao.** "Two Unusual Oleanane Saponins from *Anemone Anhuiensis".* *Planta Medica* vol.67 no.6, pp.590-592. Stuttgart, New York: Georg Thieme Verlag, 2001.08.

<P012508> **張慶文、葉文才、車鎮濤、趙守訓.** <安徽銀蓮花的化學成分研究>. 《中國中藥雜誌》 中國, 2001.09.

<P012616> **ZHANG Qing-Wen; YE Wen-Cai; HSIAO W.L., Wendy; ZHAO Shou-Xun and CHE Chun-Tao.** "Cycloartane Glycosides from *Cimicifuga Dahurica". Chemical & Pharmaceutical Bulletin* vol.49 no.11, pp.1468-1470. Tokyo, Japan: Pharmaceutical Society of Japan, 2001.

<P012617> **張慶文、葉文才、車鎮濤、趙守訓.** <小升麻中的環菠蘿蜜烷型三 及其糖 成分>. 《藥學學報》 第 36 卷 第 4 期, 頁 287-291. 中國北京, 2001.

<P012831> **WOO Y.H. Anthony; JIANG Jian Min; CHAU Chi Fai; WAYE M.Y. Mary; CHEUNG Wing Tai; KWAN Hoi Shan and CHENG H.K. Christopher.** "Inotropic and Chronotropic Actions of *Ilex Latifolia* Inhibition of Adenosine-5'-Triphosphatases as a Possible Mechanism". *Life Sciences* vol.68, pp.1259-1270. 2001.

<P016315> **DUAN Zhi Fang; HUANG Zhi Shu; MA Lin; CHE Chun Tao and GU Lian Quan.** "Covalent Modification of Lactate Dehydrogenase and Alcohol Dehydrogenase by Alkannin Derivatives". *Chinese Journal of Organic Chemistry* vol.21 no.9, pp.668-671. 2001.

<P017612> **ZHANG Wei han and CHE Chun Tao.** "Isomalabaricane - Type Nortriterpenoids and Other Constituents of the Marine Sponge Geodia Japonica". *Journal of Natural Products* vol.64 no.12, pp.1489-92. 2001.12.

<P018741> **QIU Feng; MA Zhong Ze; XU Sui Xu; YAO Xin Sheng and CHE Chun Tao.** "A Pair of 24-Hydroperoxyl Epimeric Dammarane Saponins from Flower-buds of Panax Ginseng". *Journal of Asian Natural Products Research* vol.3 no.3, pp.235-240. 2001.

<P019697> **YE Wen Cai; LIU Xin; ZHAO Shou Xun and CHE Chun Tao.** "Triterpenes from Gymnema Sylvestre Growing in China". *Biochemical Systematics and Ecology* vol.29 no.11, pp.1193-1195. 2001.12.

<P027249> **YE Wencai; ZHANG Qingwen; HSIAO Wendy WL; ZHAO Shouxun and CHE Chun Tao.** "New Lupane Glycosides from Pulsatilla Chinensis". *Planta Medica* vol.68 no.2, pp.183-186. 2002.

<P02770> **IP S.P.; CHAN Y.W.; CHE C.T. and LEUNG P.S.** "Effect of Chronic Hypoxia on Glutathione Status and Membrane Integrity in the Pancreas". *Pancreatology* vol.2 no.1, pp.34-39. Switzerland: S. Karger AG, Basel, 2002.01.

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see also <P027994>, <P028061>, <P028969>

RESEARCH PROJECTS

New Applications of Iterative Toeplitz Solvers

- ✍ CHAN Hon Fu Raymond ● NG Kwok Po*
- ❑ 1 August 2001
- ❖ Research Grants Council (Earmarked Grants)

Stochastic automata networks are widely used in modeling and analyzing queueing systems, communication systems, manufacturing systems, and computer networks. Super-resolution image reconstruction refers to obtaining an image at a resolution higher than that of the camera (sensor) used in recording the image and is important in applications like aerial or facilities surveillance, medical and scientific imaging. Both problems require the solutions of a special type of matrix systems - the banded Toeplitz-like systems. This research proposal is centered on the development of fast iterative methods for solving systems arising from these two applications. Multilevel methods, such as the multigrid method and the wavelet decomposition method, are proposed as the main tools here. For a class of Toeplitz systems, we have already proved that the multigrid method with suitable projection operators is faster than existing direct methods by a factor of $O(\log n)$, where n is the size of the given matrix. We will focus on designing fast multilevel methods for the two applications by exploiting both the band and Toeplitz-like structures in the matrices. We will also establish theoretically the convergence rate of the methods we develop.
(PS01243)

Multigrid Toeplitz-like Solvers and Applications

- ✍ CHAN Hon Fu Raymond ● STEFANO Serra-Capizzano* ● CRISTINA Tablino-Possio* ● EVGENIJ Tyrtyshnikov*
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

This research proposal focuses on the numerical treatment of banded multilevel Toeplitz-like matrix structures coming from important applications such as the superresolution image reconstruction arising in medical and scientific imaging and the numerical solution of elliptic/parabolic partial differential equations arising in various engineering problems. Despite the wider theoretical interest of this problem, recent results by us have shown that many popular techniques, including preconditioned conjugate gradient methods, are not quite effective. Motivated by our preliminary results in the area, the goal of this proposal is to devise suitable multigrid strategies for these problems. We expect to establish a theoretical convergence analysis, to give a unified and simplified treatment of several different problems and to perform a wide numerical experimentation in order to validate our analysis.
(PS01539)

On Some Problems in Tilings

- ✍ LAU Ka Sing ● WANG Yang*
- ❑ 1 December 2001
- ❖ Research Grants Council (Earmarked Grants)

The art of tilings was developed in architectural designs since human history. It involves of arranging congruent geometric objects (tiles) to fill up the plane or space with repeated patterns and allow no overlap or gap (tilings). Despite this simple idea, it appears to be a difficult subject. The modern development of tilings was motivated by the advance of the solid state science of crystals and quasicrystals, diffraction geometry and tomography. Our study further linked up the topic with the fractal geometry and wavelet theory.
Our main interest is on the class of *self-affine tiles* which are generated systematically by certain iterated function system (IFS). Self-affine tiles can have fractal look and self-similar behavior (i.e., a small part is similar to a large part). They arise naturally in the construction of fractals and wavelets. We propose to use the analytic and algebraic methods to study such tiles and the closely related topics of scaling functions in wavelet theory. Our investigation will include the more complicate *k-replicating tiles*, which generalize self-affine tiles by allowing more than one prototile. Furthermore we will use the Fourier analytic methods to study the spectral set, spectral measures in connection with the tilings.
(PS01240)

On a Certain Class of Group Algebras

✍ LEUNG Chi Wai ● NG Chi Keung*

❑ 1 January 2002

❖ CUHK Research Committee Funding (Direct Grants)

In 1929, D. Pompeiu posed the following problem. Let *D* be a bounded region in the *xy*-plane and let Σ be the group of all rigid motions. Suppose that *f* is continuous on the plane satisfying

$\int_{\sigma(D)} \int f(x, y)\, dxdy = 0, \sigma \in \Sigma$

Does this imply $f(x, y) \equiv 0$?

This problem has been studied by many mathematicians with various techniques from harmonic analysis, functional analysis and geometry.

To study the Pompeiu problems on groups, it was found that the solution is closely related to a special type of locally compact group called Fourier groups. Coincidentally, this type of groups were also studied briefly by J. Boidol for another reason and through another angle. It is therefore interesting to give a further study on these Fourier groups. In this research work, we would like to answer the following questions:

(1) Will the semi-direct product of a Fourier group with an abelian group again a Fourier group?

(2) Will a closed normal subgroup of a Fourier group again a Fourier group? How about the quotient group?

(3) Is it possible to embed any amenable group into a Fourier group?

(4) Does these exist a maximum Fourier normal subgroup of any locally compact group?

(PS01598)

Localized Structures of Reaction-diffusion Systems

✍ WEI Juncheng

❑ 20 December 2001

❖ CUHK Research Committee Funding (Direct Grants)

We plan to study reaction-diffusion systems

$U_t = \varepsilon^2 \triangle U + F(U, V)$, in Ω,

$\tau V_t = D \triangle V + G(U, V)$, in$\Omega$.

Several important examples are: Gierer-Meinhardt system in biological pattern formation, nonlocal model in di-block copolymer, Gray-Scoot model in chemical-reactor theory, Eigan-Schuster's hycycle system etc. Localized structures are solutions which become uniformly small outside some small regions, as ε is small. These structures arise naturally in many situations, and they include spikes, bubbles, vortices, etc. We are mainly concerned on the existence, the properties and the dynamics of these structures, in the hope of explaining old phenomenon, discovering new phenomenon and opening new fields.

(PS01594)

Existence and Stability of Multiple Spikes

✍ WEI Juncheng

❑ 30 December 2001

❖ Research Grants Council (Earmarked Grants)

The Turing bifurcation is the basic bifurcation generating spatial patterns, and lies at the heart of almost all mathematical models for patterning in embryology, ecology and elsewhere in biology and chemistry. The purpose of this research project is to study the existence and stability for nontrivial, inhomogeneous Turing patterns generated by some Turing systems. Central to our study is the so-called multiples spike layer solutions which have been studied extensively in the past 10 years. Since Turing systems are non-variational, few analytical results are available. It is hoped that this project will open some new fields and develop some useful techniques in dealing with biological systems

(PS01238)

Simultaneous Reconstruction of Initial Temperature Distributions and Heat Radiative Coefficients

✍ ZOU Jun

❑ 1 October 2001

❖ Research Grants Council (Earmarked Grants)

Knowing the initial temperature distribution and heat radiative coefficient profile of some physical process has wide applications in engineering, geology, archaeology, seismological observation. The aim of this proposal is to explore some effective methods for simultaneous reconstruction of initial temperatures and heat radiative coefficients, assuming certain temperature data is measured at the current or terminal time, plus some temperature data on part of

the surface or a small subset of the considered physical domain.
Such problems involve backward heat conduction processes, the reconstructions are known to be highly ill-posed, and in fact impossible in many cases.
Our first effort in this project is to understand the stability behaviour and establish some stability analyses for the reconstruction problem.
Then we will propose some efficient numerical reconstruction methods and some effective finite element methods for the discretization of the continuous nonlinear optimization system involved, and the resulting large-scale nonlinear finite element optimization problem will be solved by our newly formulated nonlinear multigrid gradient method.
(PS01244)

Numerical Reconstruction of Initial Temperature Distributions

- ✍ ZOU Jun ● HU Qiya* ● HUANG Jianguo*
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

In many applications, such as in engineering, geology, archaeology and seismology, it is extremely important and helpful to know the initial temperature distribution of some material or some physical process. This proposal is to explore some effective and stable methods for numerical reconstruction of initial temperature distributions.
Such problems involve backward heat conduction processes, so the inverse problems are ill-posed and the reconstructions are highly unstable.
We plan to carry out the numerical reconstruction process in such a way that the temperature of the heat conduction system matches its observation data optimally in the L^2-norm or the energy-norm sense, incorporated with some effective regularization techniques. Then some efficient finite element methods will be proposed to discretize the continuous nonlinear optimization system involved, and the resulting large-scale nonlinear finite element optimization problem will be solved by some nonlinear iterative methods.
(PS01811)

Uniformization and Moduli Spaces of Algebraic Manifolds

- ✍ ZUO Kang
- ❑ 1 September 2001
- ❖ Research Grants Council (Earmarked Grants)

We plan to investigate the relation between Yau's criterion that when an algebraic manifold will be uniformized and topology and complex geometry on algebraic manifolds, and plan to use topological conditions to formulate and study some general forms of the uniformization problem and the related geometry problems.
We also plan to investigate the following question asked by Viehweg recently. Namely, Does a parameter space of a family of algebraic manifolds always have some extra geometry and complex analysis properties?
(PS01239)

Cohomological Theory with Coefficients in Local Systems and Applications to Algebraic Geometry

- ✍ ZUO Kang ● YANG Yihu*
- ❑ 1 May 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

In this research programme, we shall mainly concern various kinds of cohomologies on quasi-compact Kähler manifolds with coefficients in certain locally constant sheaf and Higgs bundle and their applications to algebraic geometry problems.
We shall choose appropriate cohomologeis and an L^2-holomorphic Dolbeault complex corresponding to the above sheaf and bundle. The choice of the latter must be algebraic though it may be explained in terms of L^2-forms. Associated to the L^2-holomorphic Dolbeault complex is the hypercohomology. (As usual, one calls it the Dolbeault cohomology) Then we will show that one can identities all these cohomologies. When the coefficients are in variations of Hodge structure, the results will be more delicate. We also plan to work this out.
One of the technique steps is to establish a (not necessarily canonical) isomorphism between the residues corresponding to various bundles; equivalently, in a sense, all filtrations from these residues are same. As a result, one can establish some norm's estimetes for various kinds of sections near divisors. This is essential in defining the

L^2-holomorphic Dolbeault complex. In addition, in order to establish a quasi-isomorphism between the holomorpic Dolbeaut complex and some complex of appropriate bundles-valued measurable L^2-forms, one must solve some ?–equations near the divisors.
One of the hyproducts of this study is to give the L^2-cohomology geometrical significance. Theoretically, this is an important fact, since it establishes a link between topology and analysis in the present setting. We also plan to pursue its implicition further. We expect that this study will give rise to some restrictions of the fundamental groups of quasi-compact Kähler manifolds.
(PS01791)

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

Edition	Title/Investigators
1999-00	Iterative Method for Ill-Conditioned Toeplitz Systems (CU99212) ✍ CHAN Hon Fu Raymond ● NG Kwok Po*
2000-01	Topics in Curvature Flows (CU00294) ✍ CHOU Kai Seng
1998-99	Convolution Equations Associated with Scalings (CU98057) ✍ LAU Ka Sing ● LEUNG Chi Wai
1999-00	Multifractals, Iterated Function Systems and Stochastic Models (CU99215) ✍ LAU Ka Sing ● ANH Vo Van*
2000-01	Ruelle Operators and Dynamical Systems (CU00293) ✍ LAU Ka Sing ● FAN Ai Hua* ● LEUNG Chi Wai
1998-99	Invariants of Compact Strongly Pseudoconvex CR Manifolds and Applications (CU98051) ✍ LUK Hing Sun ● YAU S. T. Stephen*
2000-01	Explicit Construction and Decoding Algorithms of Algebraic-geometric Codes (CU00295) ✍ LUK Hing Sun ● YAU Shing Toung Stephen*
1998-99	Asymptotic Analysis of Optimization and Variational Problems (CU98002) ✍ NG Kung Fu ● PANG Jong Shi*
2000-01	Partial Ordering and Convexity in Applied Functional Analysis and Applications (CU00290) ✍ NG Kung Fu
2000-01	On Hoffman's Error Bound and Vector Optimization (PS00674) ✍ NG Kung Fu ● HAN Zhiqing* ● WEN Song* ● HUANG L R*
1999-00	Harmonic Maps and Harmonic Functions on Noncompact Manifolds (CU99217) ✍ TAM Luen Fai
2000-01	Analysis on Complete Manifolds (CU00291) ✍ WAN Yau Heng Tom ● LI Wai Kwong Peter*
1999-00	Point Condensations Generated by Reaction-Diffusion Systems (CU99218) ✍ WEI Juncheng
1999-00	Analysis of Nonlinear Evolution Partial Differential Equations in Compressible Fluids (CU99219) ✍ XIN Zhouping
2000-01	Analysis of Some Problems for Incompressible Euler and Navier-Stokes Equations (CU00279) ✍ XIN Zhouping
1998-99	Efficient Numerical Methods for Solving Inverse Problems (CU98004) ✍ ZOU Jun
2000-01	A Finite Element Method for Nonlinear Convection Problems in Rapidly Rotating Spherical Shells with Applications to Planetary Fluid Systems (CU00292) ✍ ZOU Jun ● ZHANG Keke*

2000-01 Numerical Methods for Solving the Singular Maxwell Equations (PS20006)
✍ ZOU Jun ● Ciarlet Patrick* ● Garcia Emmanuelle*

2000-01 Cohomology of Moduli Spaces of Vector Bundles and Fundamental Groups of Quasi-Compat Kahler Manifolds (PS00538)
✍ ZUO Kang ● SUN Xiaotao* ● YANG Yihu*

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<P006160> **CHAN Hon Fu Raymond and TYRTYSHNIKOV E.E.** "Spectral Equivalence and Proper Clusters for Matrices from the Boundary Element Method". *International Journal for Numerical Methods in Engineering* vol.49, pp.1211-1224. England, UK: John Wiley, 2000.

<P006254> **CHAN Hon Fu Raymond. ed.** *The Asian Journal of Mathematics*. vol. 4 no. 1, 279 pgs. International Press, 2000.03.

<P006837> **CHAN Hon Fu Raymond and CHING Wai Ki.** "Circulant Preconditioners for Stochastic Automata Networks". *Numerische Mathemtik* vol.87, pp.35-57. New York, USA: Springer - Verlag, 2000.

<P008081> **Michael K. Ng, Wilson C. Kwan and CHAN Hon Fu Raymond.** "A Fast Algorithm for High-Resolution Color Image Reconstruction with Multisensors". *Lecture Notes in Computer Science: Numerical Analysis and Its Applications, Seco* pp.615-627. Heidelberg, Germany: Springer - Verlag, 2001.

<P008635> **CHAN Hon Fu Raymond; Michael K. Ng and Tony F. Chan.** "Cosine Transform Preconditioners for High Resolution Image Reconstruction". *Linear Algebra and its Applications* vol.316, pp.89-104. NY, USA: Elsevier Science Inc, 2000.

<P008720> **CHAN Hon Fu Raymond. ed.** "The Asian Journal of Mathematics". vol.4 no.2, pp.303-437. International Press, 2000.06.

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<P016559> **Yang Wei Hong and NG Kung Fu.** Error Bounds for convex inclusions *Proc. of the 5th International Conference on Optim.: Techniques and App.* page 47. Hong Kong SAR, 2001.12.

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<P016855> **LAU Ka Sing, RAO Hui and YE Yuanling.** "Corrigendum to the Article "Iterated Function System and Ruelle Operator" by Ai Hua Fan and Ka-Sing Lau". *Journal of Mathematical Analysis and Applications* vol.262 (no. 1), pp.446-451. USA: Academic Press, 2001.10.01.

<P017047> **LEUNG C. Nai Chung and WAN Yau Heng Tom.** "Harmonic Maps and the Topology of Conformally Compact Einstein Manifolds". *Mathematical Research Letters* vol.8, pp.1-12. USA: INT Press Boston, 2001.

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<P017558> **CHAN Hon Fu Raymond; NG Michael K. and YIP Andy M. .** "The Best Circulant Preconditioners for Hermitian Toeplitz Systems II: The Multiple-Zero Case". *Numer. Math.* vol.92, pp.17-40. Springer - Verlag, 2001.10.17.

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<P017899> **HE Cheng and XIN Zhouping.** "On The Decay Properties Of Solutions To The Non-Stationary Navier-Stokes Equations In R3". *Proceedings of the Royal Society of Edinburgh* vol.131A, pp.597-619. The Royal Society of Edinburgh, 2001.

<P017927> **ZOU Jun and CHUNG Tsz Shun.** "A Finite Volume Method for Maxwell's Equations with Discontinuous Physical Coefficients". *International Journal of Applied Mathematics* vol.7 no.2, pp.201-223. Academic Publications, 2001.

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<P018189> **HU Qiya and ZOU Jun.** "An Iterative Method With Variable Relaxation Parameters For Saddle-Point Problems". *SIAM J. MATRIX ANAL. APPL.* vol. 23 no.2, pp.317-338. USA: SIAM Publications, 2001.

<P018357> **WEI Juncheng and WINTER Matthias.** "Spikes for the Two-Dimensional Gierer-Meinhardt System: The Weak Coupling Case". *Journal of Nonlinear Science* vol.11, pp.415-458. New York, USA: Springer - Verlag, 2001.

<P018556> **CHOU Kai Seng, WEI Juncheng and AI Jun.** "Self-similar Solutions for the Anisotropic Affine Curve Shortening Problem". *Calc. Var. Partial Differ. Equ.* vol.13, pp.311-337. NY, USA: Springer - Verlag, 2001.

<P018579> **JOST Jurgen and ZUO Kang.** "Representations of Fundamental Groups of Algebraic Manifolds and Their Restrictions to Fibers of a Fiberation". *Mathematical Research Letters* vol.8, pp.569-575. USA: INT Press Boston, 2001.

<P018590> **WEI Juncheng.** "Pattern Formations in Two-Dimensional Gray-Scott Model: Existence of Single-spot Solutions and Their Stability". *Physica D* vol.148, pp.20-48. 2001.

<P018609> **ZOU Jun and YAMAMOTO Masahiro.** "Simultaneous Reconstruction of the Initial Temperature and Heat Radiative Coefficient". *Inverse Problems* vol.17, pp.1181-1202. Institute of Physics Publishing Ltd, 2001.

<P018791> **JIA Rong-Qing; LAU Ka Sing and ZHOU Ding-Xuan.** "Lp Solutions of Refinement Equations". *The Journal of Fourier Analysis and Applications* vol. 7 Issue 2, pp.143-167. USA: Birkhauser Boston INC., 2001.

<P018852> **CHOU Kai Seng and QU Changzheng.** "A Note On Optimal Systems for the Heat Equation". *Journal of Mathematical Analysis and Applications* vol.261, pp.741-751. 2001.

<P018901> **VIEHWEG Eckart and ZUO Kang.** "On the Isotriviality of Families of Projective Manifolds Over Curves". *J. Algebraic Geometry* vol.10, pp.781-799. USA: American Mathematical Society, 2001.

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see also <P006231>, <P026377>

RESEARCH PROJECTS

Dynamics of a Driven Bose-Einstein Condensate: Coherent Structures and Control

- ✍ CHU Ming Chung ● LEUNG Pui Tang
- ❑ 15 December 2001
- ❖ Research Grants Council (Earmarked Grants)

Gaseous Bose-Einstein condensates (BECs) are macroscopically coherent matter in which almost all atoms share the same quantum state. Such a remarkable form of matter has now become a new resource of quantum coherence available in worldwide laboratories. The new challenge is to control and exploit such a quantum resource for useful applications and devices. The understanding of the dynamical properties of BEC coupled to external fields will be an important first step in this regard. Our proposed research program covers a range of topics in order to provide a detailed picture of various effects of external fields on BEC. In particular, we will study the generation of dynamic coherent structure and examine the robustness of quantum coherence as a condensate is driven in time. We will also explore new methods to engineer collective internal spin states suitable for precision measurement purposes.
(PS01237)

Optical Properties of Wide Band Gap II-VI Semiconductor Quantum Dots

- ✍ HARK Sui Kong ● LAU Leo Woon Ming
- ❑ 15 December 2001
- ❖ Research Grants Council (Earmarked Grants)

Semiconductor quantum dots possess properties that are very different from those present in matters of ordinary sizes. In these meso-systems, bordering between the atomic and the macroscopic dimensions, size and shape are of fundamental importance in addition to the composition and structure. Quantum effects play the central role in these systems and can be manipulated experimentally. II VI semiconductor quantum dots will be grown and their optical properties studied. We hope to learn about the influence of the size, morphology and composition of the quantum dots on the confinement of carriers and their recombinations.
(PS01247)

Physics of Adaptive Behaviour in a Population of Competing Agents

- ✍ HUI Pak Ming
- ❑ 1 December 2001
- ❖ Research Grants Council (Earmarked Grants)

The physics of adaptive behaviour in a variety of microscopic multi-agent models in which agents are competing for limited resources will be studied. These models typically involve a population in which agents adapt their behaviour according to past performance and continually adjust their strategies in order to compete. We seek to understand the physics of a few existing models, including the minority game, the evolutionary minority game and their variations. In particular, the crowd effect or herd behaviour in these and other models will be investigated.
(PS01241)

Thermal Stability of Nanostructured Alloys Prepared by Metastable Liquid Spindoal Decomposition and the Search for High-temperature Nanostructures

- ✍ KUI Hin Wing
- ❑ 31 December 2001
- ❖ Research Grants Council (Earmarked Grants)

The nanostructured materials (a material with average grain size, d, in the range of, $1 \leq d \leq 100$ nm) prepared by conventional methods are most vulnerable to thermal attack. For some nanostructures of a single pure element, grain growth is severe even at room temperature. Thermal stability, however, is enhanced when large number of pores and solute inclusions are incorporated into these systems. Improve thermal stability is also found in nanostructured alloys that consist of multiple phases. Recently, the PI and his students discovered a new method to fabricate nanostructured metallic alloys, which are bulk, porosity-free, of uniform grain size, and also of high purity. Contrary to intuition, they resist strongly against grain growth even at high temperatures. Since pores

and impurity inclusions are absent in our specimens, the enhanced high thermal stability is most probably caused by a unique structure in its grain boundaries. In this project, we probe into the interfacial structure of this novel class of nanostructures.
(MP01184)

Mie's Scattering from Imperfect Spheres

- ✍ LEUNG Pui Tang
- ❑ 1 December 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

The interactions of light waves with homogeneous dielectric shpere, termed Mie's scattering, have attracted extensive attention for many years. Recently many interesting optical phenomena have been observed in the scattering of intense laser light from micrometer-sized droplets containing tiny dielectric inclusions and also from other asymmetric microsphere. However, theoretical understanding to these processes has so far been scanty. In this project, we propose to develop efficient mathematical and computational tools to study the scattering of light from such imperfect dielectric spheres, thus lending support to experimentalists to interpret relevant phenomena.
(PS01910)

Fabricaton of Zn-based One-dimensional Nanostructures and Their Optical Properties

- ✍ LI Quan
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Zn-based one-dimensional (1D) nanostructures including nanowires and nanocables will be fabricated by combining chemical reaction and thermal evaporation. Different processing parameters including the source materials and the growth temperature are expected to affect the resulting nanostructures, which will be characterizing using x-ray diffraction, scanning electron microscopy and transmission electron microscopy. The growth mechanisms of the specific 1D nanomaterial will be discussed based on the microstructure analysis of the as-synthesized nanowire/nanocable as a function of the processing parameters. The optical properties of different Zn-based 1D nanostructures will be compared to those in two-dimensional films in order to study the dimensionality and size effect.
(PS01746)

Exact Diagnoalization Studies of Quantum Spin Models

- ✍ LIN Hai Qing ● BETTS Donald D*
- ❑ 1 August 2001
- ❖ Research Grants Council (Earmarked Grants)

We propose to apply the exact diagonalization technique to quantum spin models on the triangular lattice and the two-dimensional square lattice XXZ model with frustration Both class of models are believed to exhibit properties of a quantum disordered ground state a state not only of great interest in its own right, but it also relates to high transition temperature superconductors. We will perform exact diagonalization of model Hamiltonians on all possible finite size lattices to compute eigenvalues and eigenvectors, magnetic susceptibilities, magnetizations and nueleardattice relaxation time, so to reveal the thermodynamic properties of underline physical systems. Because we are among the leaders of exact diagonalization studies of many-body problems and with overwhelming technical advantages, our results will be very likely the best one can get in this field.
(PS01246)

Exact Diagonalization Studies of Antiferromagnetic Heisenbery Model with Frustration on Square Lattice

- ✍ LIN Hai Qing ● TIAN G.S.* ● YAO, K. L.* ● Wan S.L.*
- ❑ 1 October 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

We apply the exact diagonalization technique to study the two-dimensional square lattice heisenberg model with frustration. The model is believed to exhibit properties of a quantum disordered ground state (also called spin liquid state), a state not only of great interest in its own right, but also relates to high transition temperature superconductors. The 2D

Heisenberg model with frustration will be investigated by a well documented exact diagonalization technique, implemented in a novel way by us, on all possible finite size lattices to computer eigenvalues and eigenvectors, magnetic susceptibilities and magnetizations, phases of various broken symmetry, so to reveal the thermodynamic properties of under line physical systems.
(PS01567)

Compact Long-pulse Vacuum Ultra-violet Source for Micro-fabrications

- ✍ LO Yam Kuen Dennis
- ❑ 31 December 2001
- ❖ Research Grants Council (Earmarked Grants)

We propose to photometrically and spectroscopically study a compact vacuum ultra-violet (VUV) source excited by electrical discharge in this research project. VUV photons with energies of the order of 10 eV are capable of breaking chemical bonds of most compounds. Narrowband VUV radiation finds applications in photo-assisted micro-fabrication of large-scale intergrated circuits and in the breaking-down of chemical wastes. Broadband VUV radiation is useful in absorption spectroscopy and for large area plasma display panel. Relativistic electron-beam pumped device is bulky and expensive. VUV output from deuterium lamp and mercury lamp is too weak to fulfill the need of many applications. Intense and high efficiency VUV emissions attributed to homonuclear or heteronuclear rare-gas dimers have been observed in gaseous discharge. High-pressure gaseous discharge of rare-gas can be achieved by ralatively simple electrical circuit and optical arrangement. Long-pulse discharge (100-200 ns) is advantageous for efficient VUV output and for the build-up of stimulated emission. Both the broadband (fluorescence) and narrowband (stimulated emission) output from the discharge-excited VUV light source will be characterized. The entire VUV device can be made to be very compact, easily fitted on the bench-top in a fab.
(EE01218)

Fabrication and Characterization of Alumina Whiskers and Intermetallics Reinforced Aluminum-based Metal Matrix Composites

- ✍ NG Hang Leung Dickon ● CHAN Lap Ip Sammy*
- ❑ 1 December 2001
- ❖ Research Grants Council (Earmarked Grants)

The utilization of lightweight materials is an effective way to reduce fuel consumption in industry. We have developed a new type of Aluminum-based metal matrix composite (A1-MMC) material with ceramic whiskers and intermetallic lumps reinforcements that are in-situ formed during sintering. The material is light thus possesses higher specific properties than those of the conventional materials. However, large pores are found in many of these products, an investigation has to be launched in order to find ways to improve the quality of this material. We will investigate the mechanism in the formation of the composite, the results will tell us how, when and what types of the reinforcing phases are formed in the different sintering stages. Upon the understanding of the mechanism and the properties of the products, we will adjust the various parameters and processing conditions accordingly to obtain optimal properties for these products.
In the initial part of the project, A1 powder mixture compacts containing different concentration of MoO_3, WO_3, or other metallic oxides will be prepared and sintered. During sintering, the temperatures at which the chemical reactions occur will be recorded, the reaction products will be identified, and the microstructures will be examined. In the second part, the physical, mechanical and thermal properties of the products will be measured. In the later stage, the relationships between the fabrication procedures, microstructures, and their corresponding properties will be established. Based on these results, we aim to find an optimal route to manufacture high quality A1-MMC products.
(MP01235)

The Study of ZnO Doped with Erbium and Its Electroluminescent Applications

- ✍ ONG Hock Chun Daniel ● XU Jianbin (Dept of Electronic Engineering) ● LUO Enzhou (Dept of Electronic Engineering)#
- ❑ 1 October 2001
- ❖ Research Grants Council (Earmarked Grants)

With its emission of 1.54 μm coinciding with the minima in the loss of silica-based optical fibers, erbium (Er) doped semiconductor is ideal for the development of photonic devices utilized in laser technologies, computer industries as well as telecommunications. However, most of the Er doped semiconductors suffer from a serious thermal quenching of which its infrared luminescence decreases rapidly as a function of temperature. Recently, it is proposed that the use of wide band gap host material and co-doping with oxygen can reduce the effect of thermal quenching. ZnO, being an oxidic phase and a wide band gap semiconductor, may be a potential host material for erbium. To date, only a few studies concern the doping of erbium in ZnO although impressive results have been demonstrated. In addition, most of them are not conducted in a systematic approach. In view of this, we propose in this project to carry out a comprehensive and in-depth study on the growth of ZnO:Er. We will focus on several aspects which we expect to have a strong influence on the optical and electrical properties of ZnO:Er. Finally, simple electroluminescence devices based on ZnO:Er will be fabricated for evaluating the practical feasibility.
(EE01648)

The Defect Characterizations of ZnO Thin Films

- ✍ ONG Hock Chun Daniel
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

ZnO is receiving a great deal of attention due to its potential applications in short wavelength light emitting devices. However, the effects of defects on the optical properties of ZnO are not fully understood and controversies still exist over the light emission mechanism. In particular, recent reports on the observation of deep level (DL) free emissions in polycrystalline ZnO have been somewhat unexpected according to the history of semiconductor. To date, it is of little knowledge concerning the exact role of point as well as extended defects such as the grain boundary on the optical properties of ZnO. Even less is known is whether the defects are the sites to generate DL defects although a few claims have been made in the literature. Hence, it is essential to study the connection between the structure and the optical properties of ZnO in a systematic manner so that proper control can be achieved. In this project, we propose to carry out a comprehensive and in-depth study on the growth and characterization of ZnO. In particular, we will focus on the light emission of ZnO as a function of various types of point and extended defects. Optimal growth conditions that exhibit desirable optical and electrical properties will be searched.
(PS01315)

Isotope Effect in Single-crystal Manganite Thin Films

- ✍ WONG Hong Kuen
- ❑ 1 March 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

We will perform an experiment to replace ^{16}O by ^{18}O in manganite thin films and study the isotope effect on their magneto-transport properties. Such isotope effect can give valuate information about the physical processes (in particular the electron-phonon coupling) in the crystals. The manganite (including (La, Ca)MnO_{δ} (LCMO) and related compounds) is a family of ferromagnetic perovskite oxides possessing colossal magnetoresistance (CMR) effects. Existing/published results of isotope effect on LCMO are subject to great controversy. The giant isotope effect on LCMO discovered by Zhao *et al* (Nature 381, 676 (1996)) was criticized by Nagaev (Phys. Rep. 346, 387 (2001)) using an off-stoichiometry mechanism. The discrepancy has been blamed to be due to gas exchange procedure. I notice that all existing isotope experiments on LCMO were done using bulk samples and it is well known that bulk samples have grain boundary problems. For reliable oxygen exchange experiments, thin film samples should be used because of the large surface area. We have demonstrated that single crystal manganite thin films with excellent crystal quality can be prepared using facing-target sputtering technique (Zeng and Wong, App. Phys. Lett. 66, 3371 (1995)). Such samples exhibit ultrasharp transition and are thus good candidates for isotope experiments.
(PS01752)

Technology and Materials Innovations in Using Electrically Luminous Plastics in the Display Industry

- ✍ WONG King Young ● CHOW Hak Fun (Dept of Chemistry) ● XU Jianbin (Dept of Electronic Engineering) ● LAU Leo Woon Ming ● WONG Sai Peng Joseph (Dept of Electronic Engineering) ● HARK Sui Kong ● ONG Hock Chun Daniel
- ❑ 1 January 2002
- ❖ University-Industry Collaboration Prog.: Matching Grant for Joint Research, ITF, Innovation & Tech. Commission ● Varitronix Limited

Polymer has long been recognised as a commodity material for its insulating properties and unique mechanical properties. The first polymeric light-emitting device (PLED) was invented in 1990 using a sandwiched structure containing the conductive poly (p-phenylene vinylene) polymer, PPV. These PLEDs are formed by simple spin-casting of polymers under atmospheric pressure. In comparison with other flat-panel display technologies such as liquid crystal display (LCD) and plasma display (PD) technologies, the PLED technology possesses many advantages. Unlike LCDs which need other technological accessories such as colour filters and polarized backlight, PLEDs are luminous devices which offer a full colour range and large viewing angles. In addition, PLEDs can function in cold weather that disables LCDs. When compared with PDs, PLEDs work under a milder electrical driving condition (driven voltage: < 10 V; current: ~ 10 mA/cm2). In principle, PLEDs should have a longer lifetime, better stability, and lower production cost. The project team consolidates the surface science laboratory in Department of Physics, polymer synthesis laboratory in Department of Chemistry, the solid state laboratory in Department of Electronic Engineering and also the newly built PLED laboratory in Varitronix Limited. An integrated fabrication and characterization facility dedicated to PLED R&D will be built at CUHK. PLED prototypes bases on current PLED structures and materials will be fabricated and analyzed, and the result will be used as bench-marking data. After the initial analyses and studies on conventional PLED structures, the proposed R&D works will cover areas on novel device configurations, novel materials designs, and novel characterization techniques and methodologies. The research findings and output will be conveyed to Varitronix as the basis for realistic device fabrication and production. Varitronix will in turn provide expertise and technology know-hows with their well established facilities in display devices and experience in device fabrication, which serve as rapid feedbacks to the university team for further technological improvement and refinement.
(PS01645)

Turbulent Thermal Convection in Low and High Prandtl Number Fluids over Rough Surfaces

- ✍ XIA Keqing ● TONG Penger*
- ❑ 31 December 2001
- ❖ Research Grants Council (Earmarked Grants)

We study in this project the heat transport in a fluid layer heated from below, which is bounded by parallel conducting plates that have rough surfaces. Fluids with low and high Prandt1 Pr) numbers will be used in the experiment.
The objectives of the experiments are (1) to investigate the heat transfer mechanism in rough surface cells with different Pr numbers and (2) to further understand the dynamics of the plume emission near the rough surfaces.
The proposed experiments are of fundamental interest for the physical understanding of convective turbulence, and they are also relevant to many practical applications in engineering, geography, and meteorology. The study of turbulent convection over a rough surface is directly related to the convection in the atmosphere and oceans, where the underlying surfaces are almost always rough. Understanding the heat transport in turbulent convection will shed new light on technological improvements for more efficient heat transfer in various industrial applications ranging from heat exchangers to reentry vehicles in the space flight.
(PS01242)

Experimental Investigation of Chaotic Modes in Turbulent Rayleigh-Benard Convection

- ✍ XIA Keqing
- ❑ 1 March 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

We propose to carry out a systematic investigation on the local temperature fluctuations and the correlations of these fluctuations among different spatial locations

in a convection cell with modified boundaries and to corroborate these with results from flow visualization studies. The objective is pinpoint the relationship between the heat transport and the coherent oscillations that were observed by flow visualizations in the convection cell. Through these studies, we will gain insight into the chaotic but coherent modes existing in the system. The results obtained in this study will have important implications on the relevance of coherent chaotic modes in turbulent convection.
(PS01447)

First-principles Approach to Dielectric Dispersion of Nonspherical Cells

- ✍ YU Kin Wah
- ❑ 1 August 2001
- ❖ Research Grants Council (Earmarked Grants)

There is an increasing evidence that the study of dielectric properties of cells in radio-frequencies leads to new applications in biotechnology. Recent dielectric measurements revealed that the dielectric dispersion spectrum of rod-like cells in a suspension depends strongly on the cell length. However, no model calculations can explain such experimental data satisfactorily, which indicates that new theories are required. In this project, we will develop a first-principles approach for rod-like cells which enables us to calculate the spectral representation of cell suspension needed for the description of the dielectric dispersion data. The project will generate an appropriate theory for the explanation and prediction of dielectric properties of cells in radiofrequencies. Such a theory will be a powerful tool in the development of biotechnology.
(PS01245)

Computer Simulation of Electrorheological Fluids in the Dipole-Induced-Dipole Model

- ✍ YU Kin Wah
- ❑ 1 November 2001
- ❖ CUHK Research Committee Funding (Direct Grants)

We propose to extend the multiple image method to compute the interparticle force for a polydisperse electrorheological (ER) fluid in which the suspended particles can have various sizes and different permittivites. The point-dipole (PD) approximation being routinely adopted in computer simulation of ER fluids is known to err considerably when the particles approach and finally touch due to multipolar interactions. The PD approximation becomes even worse when the dielectric contrast between the particles and the host medium is large. As our previous calculations for the case of different sizes showed that the dipole-induced-dipole (DID) model yields very good agreements with the multiple image results for a wide range of polydispersity, we naturally expect that the DID model works well for the case of different dielectric contrasts. As an application of our results, we will employ the DID model to simulate the athermal aggregation of particles in ER fluids. We will investigate the effects of multipolar interactions on the aggregation time as well as on the morphology of the aggregation. The simulation calculations will be used to assess the quality of the previous results with the PD model.
(PS01705)

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

Edition	Title/Investigators
1998-99	Statistics and Scaling in Turbulence (CU98119) ✍ CHING Shuk Chi Emily
2000-01	Velocity and Temperature Statistics in Turbulent Convection (CU00286) ✍ CHING Shuk Chi Emily
1998-99	Pattern Recognition of Radar Echoes for Rainstorm Forecasting (PS98024) ✍ CHU Ming Chung ● WONG Wing Hung
2000-01	Cosmic Ray Telescope (PS20004) ✍ CHU Ming Chung ● LEE Yuk Yan ● CHENG Kai Ming ● TONG Shiu Sing Dominic ● WONG Wing Hung ● LAU Leo Woon Ming ● Chan Ki Hung*
2000-01	Energy Focusing of Waves in a Cavity with Oscillating Boundaries (PS00566)

✍ CHU Ming Chung

1998-99 Theory of Harmonic Generations in Random Composites of Nonlinear Dielectrics (CU98129)
✍ HUI Pak Ming

1989-90 Microstructure of Undercooled Ge and Si (BP87003)
✍ KUI Hin Wing

1989-90 The Viscosity of Easy Glass Formers (BP87004)
✍ KUI Hin Wing

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

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.*

1998-99 Engineering New Etching Processes for Semiconductors with Hyperthermal Ion Bombardment (CU98315)
✍ LAU Leo Woon Ming

1999-00 Promotion of Creativity with a "Student-Centred" Approach in Teaching and Learning Experimental Science and Engineering (PS99028)
✍ 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*

1999-00 Engineering Homoepitaxial Growth Of cBN (CU99440)
✍ LAU Leo Woon Ming

2000-01 Studies of Laser-induced Voltage in Rare Earth Doped Manganite Thin Films (PS00585)
✍ LEE Wing Kee ● ZHANG Peng Xiang*

2000-01 Applications of Quasinormal-Mode Expansion in Open Wave Systems (CU00282)
✍ LEUNG Pui Tang

2000-01 Phase Separation in Colossal Magnetoresistance Materials (CU00288)
✍ LIN Hai Qing ● CAMPBELL David Kelly*

2000-01 New Developments in High Temperature Superconductivity Theory (PS20009)
✍ LIN Hai Qing ● YU Kin Wah ● LAU Leo Woon Ming ● HU Bambi* ● NG Tai Kai* ● LEUNG Pak Wo*

1999-00 Valuation of European Options Subject to Default Risk Using Signaling Process (PS99023)
✍ LO Chi Fai ● HUI Cho Hoi*

1998-99 Tunable Solid State Lasers in the VUV Pumped by Discharge Excimer Lamp (CU98024)
✍ LO Yam Kuen Dennis

1999-00 Dye-doped Sol-gel Materials for Low Power Optical Processing Applications (CU99366)
✍ LO Yam Kuen Dennis

2000-01 Advanced Dye-doped Sol-gel Silica Lasers (PS00448)
✍ LO Yam Kuen Dennis

2000-01 Study of In-site Reactions During the Sintering Process of Aluminum-based Metal Matrix Composites (PS00664)
✍ NG Hang Leung Dickon

2000-01 The Development of Polycrystalline Light-emitting Device in Ultra-violet Region (EE99660)
✍ ONG Hock Chun Daniel ● HO S T* ● CHAN Y C*

2000-01 The Study of ZnO for the Use of Polycrystalline Optoelectronic Devices (EE99461)
✍ ONG Hock Chun Daniel ● DU G T* ● HO S T* ● DAI J Y*

1999-00 An IT-based Resource Package for Secondary Schools in Hong Kong (Subject: Physics) (ED99035)
✍ TONG Shiu Sing Dominic ● WONG Wing Hung ● CHU Ming Chung ● LAU Leo Woon Ming

2000-01 Production a Web-based Self-Learning Package for Secondary School Teachers in Hong Kong: Using Contextual Themes in the Teaching of Physics in Secondary Schools (ED20020)
✍ TONG Shiu Sing Dominic ● WONG Wing Hung ● LAU Leo Woon Ming

1997-98 Oxygen Effects in Colossal Magnetoresistance Materials (CU97718)
✍ WONG Hong Kuen

1999-00 Non-destructive Dating of Ancient Ceramics by Laser Induced Thermoluminescence (CU99009)
✍ WONG King Young ● LO Yam Kuen Dennis ● LEE Chung Kay ● LAU Leo Woon Ming ● KWOK Wai Man Raymund (Dept of Chemistry) ● NING Hung Pun Gary (Art Museum)

1993-94 Study of Statistical Nature of Particle Motion in Fluids (BP00101)
✍ XIA Keqing

1994-95 Experimental Studies of Turbulent Convection (PS94012)
✍ XIA Keqing

1999-00 Experimental Investigation of Turbulent Convection at High Rayleigh Numbers and in Large Aspect-Ratio Cells (CU99224)
✍ XIA Keqing

2000-01 Development of a Technique for and the Determination of the Viscous Boundary Layers in Low Prandtl Number Turbulent Convection (CU00281)
✍ XIA Keqing

1998-99 The Inversion Problem for Quasinormal Modes (CU98006)
✍ YOUNG Kenneth ● LEUNG Pui Tang ● LING Siu Hing* ● SUEN Wai Mo* ● WONG Samuel S. M.*

2000-01 First-Principles Approach to Dynamic ER Effects in Complex Fluids (CU00284)
✍ YU Kin Wah

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<P004825> **HUI Pak Ming and JOHNSON N F.** "Global Behavior in a Competing and Evolving Population". *Paper presented in the Third Joint Meeting of Chinese Physicists Worldwide,* organized by Oversea Chinese Physics Association and The Chinese University of Hong Kong, Hong Kong SAR, 2000.07.31.

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RESEARCH PROJECTS

Resilience Indicators: Measures of an Economy's Ability to Withstand Financial Shocks

- ✍ CHAN Ngai Hang ● WONG Hoi Ying
- ❑ 1 January 2002
- ❖ Hong Kong Monetary Authority

Contrary to the common practice of looking into possible signals to predict a crisis, the main objective of this project aims at developing a scheme of measures to indicate the capacity of an economy to withstand a crisis, given that a crisis occurs. In order to measure the sustainability of an economy to a crisis, one has to identify possible relevant factors for indicating different types of shocks arising from different economical or political conditions. Once the identification is conducted, one has to translate the relevant factors into quantifiable entitles so that a resilience measure can be constructed based on these quantifiable factors. In this proposal, three stages are proposed to achieve this goal: identification of factors through data mining procedures, quantification of factors by statistical techniques, and development of a resilience measurement system.
(PS01681)

Multiple Comparisons and Bioequivalence Studies in Two-way Designs

- ✍ CHEUNG Siu Hung ● WU Ka Ho Eden
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

For over 50 years, multiple comparison procedures (MCPs) have been standard components of the statistician's toolkit for performing simultaneous testing or interval estimation in a family of related inferences. The focus of this project is to address important issues in MCPs which are useful and essential techniques in various disciplines such as physiology and agrobiology.
In clinical studies, a common objective is to compare several experimental treatments. However, classical MCPs (including bioequivalence techniques) were mostly developed to cater single factor analysis, ignoring the multi-dimensionality of the data and the interaction effects among various factors.
Our study is to provide a comprehensive framework for comparing treatment in two-way designs, with straightforward potential extensions to multi-way designs. Our utmost task is to equip practitioners in the realm of medical researches with solid statistical tools in multi-factor multiple testing environments.
(PS01561)

Nonparametric Techniques for Multivariate Failure Time Data

- ✍ FAN Jianqing
- ❑ 15 August 2001
- ❖ Research Grants Council (Earmarked Grants)

In biomedical studies, multivariate failure data are frequently collected, in order to examine the effects of risk factors and their risk contributions. In epidemiological cohort studies, for example, the ages of disease occurrence are recorded for members of families. These failure times are correlated because families members share similar genetic makeup and environment. Further, data are often censored due to termination of studies and other causes. We proposed a new class of marginal models to assess the effects of covariate variables on the failure time. Newly developed nonparametric techniques are introduced for estimation and inferences. Our objectives are to develop and evaluate these nonparametric techniques via theoretical studies and statistical simulations. Our techniques are significantly more flexible than the methods in use, which allow investigators drawing more objective conclusions without incurring much modeling biases. Our techniques and ideas can readily be extended to other statistical problems arising from biomedical studies. Data sets from ongoing epidemiological studies on cancer and cardiovascular disease will be analyzed using the methods developed in this proposal.
(PS01262)

Development of a General Model Selection Procedure for Complex Structural Equation Models

- ✍ LEE Sik Yum
- ❑ 1 November 2001

❖ Research Grants Council (Earmarked Grants)

Since the development of structural equation (SEQ) models in early 1970s' there has been a tremendous growth in their use in behavioral, educational, and social research. At present, there are more than ten packages in standard SEQ modeling to cope with the needs in various fields. Because there is a strong demand for some sophisticated models for more complicated theories and data structures, a number of useful generalizations have been proposed. The most important representatives are nonlinear models, mixture models and various models with mixed continuous and polytomous variables. Owing to the complexity of these models, the underlying statistical inferences are highly non-trivial. Thanks to the recent powerful tools in statistical computing, a number of important methods on estimation have been developed. Model selection (we use this term to include hypothesis testing and model comparison) is a very important topic beyond estimation. For example, very often investigators are required to identify a number of plausible models and choose the best one among them, and to compare different structures in cross cultural studies, etc. However, existing methods on hypothesis testing cannot be applied to the above mentioned important models, and moreover they are based on frequentist tests that have a number of key disadvantages. To overcome their difficulties and deficiencies, we will develop a Bayesian approach for model selection that can be applied effectively to these complicated models. The statistic will be based on the *Bayes factor*. Efficient algorithms for computing the Bayes factors for various models will be developed using recent powerful tools in statistical computing. Good properties of the proposed approach will be established and demonstrated. The newly developed methodology will be applied to substantive research behavioral science.
(SS01346)

Sampling Correlated Varieties from Partially-specified Distributions

✍ LI Kim Hung

❑ 1 April 2002

❖ CUHK Research Committee Funding (Direct Grants)

In system simulation, it is common that we do not have complete knowledge about the distribution of some stochastic components of a system. Instead, we may have vague information in the form of expert opinions or some incomplete observations that can only provide ideas about the marginal distributions or certain second order relations. Therefore, a simulation of the system requires sampling correlated random variables from partial information. In this project we consider the simulation of system multivariate inputs which have known marginal distributions and correlation martrix. Special interest goes to the case when all marginal distributions are uniform distribution on (0, 1). It is because (1) traditionally U (0, 1) distribution plays a very important role in random number generation, and (2) it faces the difficulty inherent in this kind of problems and thus solution to this special case will be heuristic to general cases. Falk (1999) made a simple and practical attempt to the problem. TES processes are another device to simulate correlated uniform variates. However, both approaches do not give a complete solution to the problem. The main difficulty lies on the situations when the correlation matrix is almost singular. Two directions will be taken to tackle the problem in this project. The first one generates variates through suitable conditioning. The second one creates correlation through nonrandom matching of U (0, 1) variates.
(PS01989)

Practice and Influence Analysis of Structural Equation Modeling with Ordinal Data

✍ POON Wai Yin

❑ 1 October 2001

❖ Research Grants Council (Earmarked Grants)

Social and behavioral science researchers have become increasingly interested in using Structural Equation Modeling (SEM) to address and verify substantive theories. The commonly used SEM approaches operate on the assumption that measured variables are on a continuous scale and are distributed as multivariate normal. However, many variables used in social and behavioral science research are ordinal categorical in nature. In the last decade, a number of innovative approaches concerning the treatment of ordinal categorical variables have been developed. Although these advanced approaches could in fact be applicable to a wide range of general

situations. they were first introduced in a technical manner under the context of specific models. Many users find these latest developments too technical and intractable. As a result, the diffusion of these advanced approaches from specialized journals to applied audience is slow. *In view* of this, one purpose of this research project is to bridge the gap. We first examine the possible means of implementing these recent advanced approaches in widely available software programs and applying them in various diversified situations. We then employ a didactic approach to present the findings and to highlight the practical issues relevant to users, avoiding use of technical jargon. The objective is to enhance the accessibility to the approaches for use by a broad group of SEM users.
Furthermore, influence analysis addressing those observations in a data set that exert disproportionate impact on the results of SEM analysis merits attention and is to be further developed.
(SS01347)

A Model for Credit Migrating Risk

- ✍ WONG Hoi Ying
- ❑ 1 January 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Managing credit risk is an important issue in the financial industry, especially in the high yield bond market and the bank loan market. One major type of credit risk is the downgrade risk or credit migrating risk. Downgrade risk is the risk that a nationally recognized statistical rating organization lowers its credit rating for an issuer based on the perceived earning capacity. This project focuses on modeling the downgrade risk. The model is based on the Vasicek-Kealhofer (VK) model, the fundamental element of KMV Corporation to analyze default risk, under which the default variable becomes the distance-to-default (DD) of firms. By counting the time of a firm staying in any credit rating categories, we are able to describe the "general" credit performance of a firm in a specified horizon not just its terminal credit quality. This will allow us to produce an analytical credit transition matrix and explain the overlap in default probability range for different letter grades. The model can also be used to filter out the subjective thinking towards credit performance of individual rating agencies in term of occupation time.
(PS01664)

Multiple Forecasts with Autoregressive Time Series Models

- ✍ WU Ka Ho Eden ● CHEUNG Siu Hung
- ❑ 1 February 2002
- ❖ CUHK Research Committee Funding (Direct Grants)

Multiple forecasting is extremely useful in the areas such as business and economics. In many circumstances, instead of a single forecast, simultaneous prediction intervals for multiple forecasts are more useful to decision-makers. For example, based on previous monthly sales records, a production manager would be interested in the next twelve interval forecasts of the monthly sales using for the annual inventory and manpower planning. For Gaussian autoregressive time series processes, several procedures for obtaining simultaneous prediction intervals have been proposed in the literature. These methods assume a normal error distribution and can be adversely affected by departures from normality which are commonly encountered in business and economic time series. In this project, we will propose the bootstrap methods for the construction of multiple interval forecasts. To understand the mechanisms and characteristics of the proposed bootstrap procedures, several macro-economic time series will be selected for illustrative purposes. The major ideas discussed in this project with autoregressive processes can be extended to other more complicated time series models.
(PS01414)

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

Edition	Title/Investigators
2000-01	Statistical Inference for Long Memory Processes (CU98082) ✍ CHAN Ngai Hang

2000-01 Long-memory Time Series Analysis of Disk Access Patterns (PS00494)
✍ CHAN Ngai Hang

2000-01 Testing Equivalence in Paired-sample Design: An Exact Unconditional Approach (CU00261)
✍ CHAN Ping Shing Ben ● CHAN Siu Fung Ivan* ● TANG Man Lai

2000-01 Wavelets in Statistical Function Estimation and Nonparametric Inferences (CU00299)
✍ FAN Jianqing

2000-01 Nonparametric Techniques in Financial Modeling (PS00997)
✍ FAN Jianqing

1999-00 Markov Chain Monte Carlo and Stochastic Approximation Methods for Statistical Computing (CU99226)
✍ GU Ming Gao

2000-01 Linear Dynamic Models for Ranking Data (PS00963)
✍ GU Ming Gao

1999-00 The Review of the Central Registry of Drug Abuse (PS99025)
✍ LAU Tai Shing ● Mr CHAN Char Nie*

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

1999-00 Statistical Developments of Nonlinear Structural Equation Models (CU99088)
✍ LEE Sik Yum

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

1989-90 Analysis of Fuzzy Data (CS89005)
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1998-99 Further Developments on the Local Influence Approach (CU98186)
✍ POON Wai Yin ● POON Yat Sun* ● LEE Sik Yum

1999-00 Influence Analysis with Ordinal Categorical Variables (PS99016)
✍ POON Wai Yin

2000-01 A Graphical Approach for Determining the Order of Non-stationary Time Series (PS00661)
✍ WU Ka Ho Eden ● CHEN Zhao Guo*

RESEARCH OUTPUTS AND PUBLICATIONS

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see also <P021014>