

The background of the entire page is a grayscale marbled paper pattern with intricate, swirling, and wavy lines in various shades of gray, creating a complex, organic texture.

Faculty of

Science

RESEARCH PROJECTS

Breastmilk Fatty Acid Composition in Chinese

- ✉ CHEN Zhen Yu ● LEUNG Suk Fong Sophie (Paediatrics)
- ☐ 1 October 1996
- ❖ CUHK Research Committee Funding

There is no published work on human milk of Hong Kong and Mainland Chinese. Hong Kong has reached a stage of westernization and industrialization. At a time when breast feeding is being promoted, it is important for us to know the characteristics of the local breastmilk compared with that of mainland Chinese. The present study aims to investigate if westernization of maternal diet has compromised the beneficial effect of breastmilk. The content of the essential fatty acids and their very long chain polyunsaturated fatty acids in breastmilk, which reflect the nature of dietary fat, will be measured. A total of 100 samples (50 from Hong Kong and 50 from Chongqing, China) will be studied. (BL96001)

Identification and Evaluation of Biologically Active Compounds Present in Chinese Green Tea

- ✉ CHEN Zhen Yu ● FONG Wing Ping ● FUNG Kwok Pui ● HUANG Yu (Physiology) ● KWOK Tim Tak ● LEUNG Kwok Nam
- ☐ 20 December 1996
- ❖ Wei Lun Education Endowment Fund

Tea is the most popular beverage consumed among Chinese. To explore the various health aspects of drinking green tea, particularly local Chinese green tea, the present study describes six related projects to study the possible activity of green tea polyphenols against various diseases including hyperlipidemia, coronary heart disease, hypertension, immunological disorders, cancer and the free-radical related diseases. The six projects are: (1) Investigation of the biochemical mechanism of plasma cholesterol-lowering compounds in Chinese green tea; (2) Effect of green tea epicatechin isomers on oxidation of low-density lipoprotein; (3) Effect of green epicatechin isomers on alcohol metabolism in hamster; (4) Anti-hypertensive activity of some compounds isolated from green tea; (5) Studies on the immunomodulatory activity of compounds isolated from green tea and their effects on leukemia cells; and (6) Green tea epicatechin isomers in cancer prevention and therapy. The objective of this research team will be focused on isolation, purification and evaluation of various compounds with these biological activities. (BL96030)

Structure-function Studies on Fish Growth Hormone and Prolactin: A Protein Engineering Approach

- ✉ CHENG Hon Ki Christopher ● CHAN King Ming ● NG Tzi Bun
- ☐ 1 September 1996
- ❖ Research Grants Council

Growth hormones (GH) and prolactin (PRL), normally secreted from the fish pituitary in small quantities, control various aspects of fish growth and mineral metabolism. In this project the researchers will apply the techniques of recombinant DNA technology to study the structure-function relationship of fish GH and PRL. Using complementary DNA (cDNAs) of goldfish (*Carassius auratus*) GH and PRL recently cloned, the wildtype cDNAs and their mutants will be cloned into expression vectors to drive the production of recombinant hormones in microorganisms. The biological activities of the purified recombinant proteins will be examined using an array of receptor binding assays and bioassays. In this study, the researchers would focus on the site-directed mutagenesis of the extra cysteine residue in one form of goldfish GH, and the deletion and swapping of the highly conserved domain D in goldfish GH and PRL. The ultimate aim is to ascertain the relative contributions of the protein domains of the hormone molecule towards the biological activity of the hormone. (CU96320)

Regulation of Hepatic Growth Hormone Receptor and Serum IGF-I in Guinea Pig

- ✉ CHENG Hon Ki Christopher ● NG Tzi Bun
- ☐ 1 January 1997
- ❖ CUHK Research Committee Funding

Whilst removal of the pituitary from animals would induce cessation of somatic growth, hypophysectomized guinea pigs continue to grow. This peculiar mammal provides a unique animal model to study the hormonal regulation of hepatic growth hormone receptor and serum IGF-I level. Growth hormone receptor level will be measured in guinea pig liver membranes by radioreceptor assay. Serum IGF-I level will be measured by radioimmunoassay. The hepatic growth hormone receptor level and the serum IGF-I level in guinea pigs will be monitored with respect to sex difference and response to hormone administration such as steroid hormone, thyroid hormone and growth hormone. Information thus gained will provide a better understanding of the growth hormone-growth hormone receptor-IGF axis in mammals. (BL96002)

Monoclonal Antibodies against Polysaccharides in Herbal Medicines: Production and Development of Affinity Chromatography and Immunoassay

✉ CHOY Yuen Min ● NG M. H.* ● FUNG Kwok Pui

□ 1 September 1996

❖ Research Grants Council

Many herbal medicines exhibit stimulatory effect on the immune system in our bodies. Most of them have been found to contain polysaccharide in nature. In carbohydrate research, polysaccharides are difficult to be purified by conventional chromatographic methods since they always have similar charges and molecular weights. On the other hand, it is also difficult to identify or even quantify the immunostimulatory active principles which are polysaccharide in nature in herbal medicines. These difficulties should be solved if we can produce monoclonal antibodies against the polysaccharides which have been partially purified by conventional chromatographic method. Hybridoma method will be used to produce antibodies. The titers of these antibodies will be monitored by their abilities to neutralize the immunological activities of the respective active component. The researchers will then try to use these monoclonal antibodies to produce affinity chromatography and an immunoassay which might then be used to purify or quantify the respective polysaccharides in herbal preparations. The researchers will also test the possibility of using a specific monoclonal antibody to cross-react with polysaccharides derived from other herbal medicines. It is hoped that a better tool in carbohydrate research and herbal medicinal research will accrue from present proposal which might lead to the development of new measure in assessing the beneficial effects of herbal medicines. (CU96315)

A Pilot Nutrition Education Campaign for Hong Kong Secondary School Students

✉ GULDAN Georgia

□ 1 September 1996

❖ CUHK Research Committee Funding

Health habits established in adolescence are of great importance in determining adult morbidity and life span. Hong Kong has undergone a "Health Transition", with chronic diseases making up much of the territory's morbidity and mortality. Surveys of Hong Kong children and adolescents have already revealed the presence of chronic disease risk factors among these groups: elevated cholesterol levels; obesity rates approaching those of adolescents in Western countries; dietary meat, protein, and cholesterol levels above these recommended; dietary

fiber intakes below recommend levels; much eating out for breakfast and lunch; and preferences for sedentary activities. The author of this proposal just conducted a needs assessment survey to characterize a random sample of 4,030 Form 2 and Form 4 students' nutrition knowledge, attitudes toward nutrition, and some diet and health behaviors. The findings revealed much about the current secondary students' meal and health behavior patterns and reasons for them. Using these results as a basis, the aim of the proposed research is to test a pilot nutrition education program in two secondary schools. Key features of this two-group experimental pre/post intervention include the involvement of students and staff in each school in the design of the campaign and attention to the school meal and snack arrangements in order to change the school food environment. The main objective of the research is to increase the students' awareness of health eating and lifestyle, leading to improved health behaviors, and ultimately improved health. It is hoped that the evaluation of this nutrition promotion program will enable us to decide to expand it throughout the territory's secondary schools next year. (BL96021)

Cytotoxicity of Herbicides by Fibroblasts

✉ HO Wing Shing John

□ 20 October 1996

❖ CUHK Research Committee Funding

Dipyridyl derivatives such as paraquat, picloram and triazines (e.g. atrazine) will be examined for their cytotoxicity in fibroblast cells. Herbicides are potent cytotoxins with LD₅₀ values for lab animals at a low level (a fraction of a gram per kg). Fibroblast cell line will be used to study cellular response and its viability as well as the threshold concentration for a safer use of herbicides. Dipyridyl derivatives will also be tested for their mutagenicity. Formation of possible metabolite-DNA adducts in fibroblasts after treatment with one or two of the test compounds in experiments will be investigated. The study is expected to provide information on the mechanism of toxicity and the synergistic effects of herbicides in a living organism. (BL96003)

Signal Transduction in Normal Macrophages and Macrophages Cell Line

✉ KONG Siu Kai

□ 15 October 1996

❖ CUHK Research Committee Funding

Mononuclear phagocytes constitute a major host defense regulatory and effector system. These very versatile cells, populating all body tissues, are not

only highly phagocytic but are avid secretory cells whose products possess the potential to destroy microbes and neoplastic cells or stimulate other immunocytes to do the same. Among the immunocytes, macrophages are arguably the most important and versatile.

The overall aim of the research project is to examine the cellular mechanisms which govern macrophage development, activation and cell death with the view to stimulate the defensive role of these cells in resisting infection and combating neoplasm while ameliorating their deleterious effect in such immune disorders as rheumatoid arthritis and multiple sclerosis.

In the researchers' previous work, they have defined some extracellular stimuli which induce macrophage activities and recorded in detail their transducing pathways. For example, they found that concanavalin A, a mitogen for T-lymphocytes, and nitric oxide are apoptosis-causing agents in murine and human macrophages. In this study, the researchers plan to further examine the transducing pathways which initiate, modulate and terminate the cell proliferation and programmed cell death.

(BL96004)

New Drug for Breast Cancer

✉ KONG Yun Cheung ● LEUNG Wai Tong
Thomas (Clinical Oncology)

☐ 1 January 1996

❖ One-time Support, CUHK

This is a continuation of our research on yuehchukene. The current project looks into the effect of yuehchukene and its precursors to stimulate estradiol-2-hydroxylase, thus lowering the risk of developing breast cancer.

(MD95264)

Use of Developed Gene Knockout Transgenic Mouse Model for Identification, Evaluation, and Define the Mechanisms of Chemical Toxicity and Human Diseases

✉ LEE Susanna Sau Tuen ● TSANG David Sau Cheuk ● WAN David Chi Cheong ● CHAN Wood Yee (Anatomy)

☐ 1 October 1996

❖ CUHK Strategic Research Program

Mouse lines with defined genetic alterations that result in inactivation of a gene (knockout) intrinsic to toxicity, carcinogenesis, or etiology of diseases have been shown promising for identification, evaluation, and define the mechanism leading to toxic effects. The principal investigator had developed two of these gene knockout transgenic mouse lines which include the cytochrome P450 2E1 (CYP2E1) - and

peroxisome proliferator-activated receptor, alpha isoform (PPAR α)-deficient mouse lines.

CYP2E1 is the clinically important cytochrome P450 which converts many drugs and alcohols into highly toxic metabolites. CYP2E1 has been implicated in mediating the alcohol liver disease (ALD), fetal alcohol syndrome (FAS), and ethanol intoxication in brain. If CYP2E1 is in fact the major factors mediating ALD, FAS, and alcohol related effects in brain, chronic administration of ethanol to CYP2E1-deficient mice should not produce these conditions, thus CYP2E1-deficient mice should be an excellent model to elucidate the pathophysiology of ALD, FAS, and alcohol related effects in brain.

A family of receptor called PPAR α has been linked to involve in fuel production during diabetics and fasting. If PPAR α is indeed important for survival during these pathological conditions, mice lacking PPAR α should be at an adverse condition for survival during diabetes and starvation. Thus, PPAR α -deficient mouse should provide an excellent model for this study.

The major goals of the research are: (1) use of CYP2E1 knockout mouse model to study the role of CYP2E1 in ALD, FAS, and ethanol toxicity in brain; and (2) use of PPAR α knockout mouse model to study the role of PPAR α in diabetic ketogenesis and starvation.

(BL96026)

Production of Transgenic Mice Lacking the Fatty-Acid Activated Receptor: An Animal Model to Study Adipocyte Differentiation and Obesity

✉ LEE Susanna Sau Tuen

☐ 1 November 1996

❖ CUHK Research Committee Funding

Obesity is the cause of many major diseases including heart disease and diabetes. It is characterized by an excessive accumulation of adipose tissue that required *de novo* differentiation of adipocytes from preadipocytes. An understanding of the regulation of adipocyte differentiation is necessary for development of strategies to prevent obesity. Experimental evidence has shown that the fatty acid-activated receptor, FAAR, could play an important role in adipocyte differentiation *in vitro*. However, it is not clear if the physiological roles of FAAR are to regulate adipocyte differentiation and lipid homeostasis in an intact animal. In order to explore these roles of FAAR, the researchers intend to develop a mouse model which lacks FAAR by targeted disruption of the FAAR gene. They will then examine the possible effects of FAAR deficiency during adipocyte differentiation and lipid homeostasis.

Six major steps will be involved in the generation and characterization of FAAR knockout mice: (1)

construction of the FAAR targeting vector; (2) electroporation and selection of targeted embryonic stem (ES) cell clones; (3) microinjection of targeted ES cell clones into mouse embryos to produce germline chimeras; (4) F1 heterozygote and F2 homozygote mating to produce FAAR knockout mice; (5) confirmation for targeted disruption of FAAR gene; (6) characterization of FAAR knockout mice with regards to adipocyte differentiation and lipid homeostasis.
(BL96006)

Effect of Tumour Necrosis Factor on Intracellular Calcium Mobilization in Glioma Cells

- ✉ TSANG David Sau Cheuk
- ☐ 15 October 1996
- ❖ CUHK Research Committee Funding

Tumor necrosis factor- α (TNF), secreted primarily by activated macrophages, is an important cytokine in our immune system. Interestingly, TNF has been shown to play important roles in the development, maturation and pathophysiology of the central nervous system (CNS). For example, TNF is able to induce glial cell proliferation; glial cells are the most abundant cell types in the CNS. In other cell types, several mechanisms of the TNF action, such as the activation of nitric oxide, protein kinase A, tyrosine kinase, phospholipase A2 and ceramide-activated protein kinase have been identified. However, the signalling pathway for TNF effect in glial cells is unclear. Since cellular calcium is a key messenger for many cellular processes, such as cytokine secretion, cytoskeleton alteration, gene transcription, cell proliferation and cell death, the researchers attempted to investigate the effect of TNF on intracellular calcium movement in glial cells. Recently, they have shown that C6 glioma cells contain three intracellular calcium stores [1], and that TNF affects the intracellular free calcium distribution in a dose- and time-dependent manner. In this proposed study, the researchers will examine in detail the pathway mediating the effect of TNF on cellular calcium. This study will provide much needed information; such as the effect of the TNF on the free calcium concentration in the cytosolic and nuclear compartment; the site of the intracellular calcium stores which are activated by TNF; and the contribution of extracellular calcium to the changes of internal calcium changes. The results obtained will provide a better understanding of TNF on the development and pathophysiology of the CNS.
[1] Kong, S.K., D.Tsang, Leung, K.N. and Lee, C.Y. (1996) Nuclear envelope acts as a calcium barrier in C6 glioma cells. *Biochem. Biophys. Res. Commun.*, 218, 595-600
(BL96007)

Summary for more details of the following ongoing research at the department:

<u>Edition</u>	<u>Title/Investigators</u>
1995-96	On the Use of Fish Metallothionein Levels as Biomarker(I): Development of Sensitive Immunoassay and Polymerase Chain Reaction Based Assay to Detect Metallothionein Gene Expression in Tilapia Tissues (CU95305) ✉ CHAN King Ming
1995-96	Metabolic Fate of Trans/Cis Fatty Acids Present in High-Trans Milk and Their Effect on Metabolism of Essential Fatty Acids (CU95302) ✉ CHEN Zhen Yu ● GULDAN Georgia
1990-91	Comparative Endocrinology of Prolactin, Growth Hormone, and Their Receptors (BP88031) ✉ CHENG Hon Ki Christopher ● NG Tzi Bun ● WONG Chun Cheung (Physiology)
1995-96	Molecular Cloning and Functional Expression of the Growth Hormone Receptor cDNA from Dace (<i>Cirrhinus molitorella</i>) Liver (CU93305) ✉ CHENG Hon Ki Christopher ● SHAW Pang Chui ● TSIM Karl W. K.*
1995-96	Molecular Studies on Fish Insulin-like Growth Factors (BL95033) ✉ CHENG Hon Ki Christopher ● CHAN King Ming
1995-96	Regulation of Prolactin Receptor Expression in the Male Reproductive System of Golden Hamster (MD95122) ✉ CHENG Hon Ki Christopher ● CHAN King Ming ● CHOW Pak Ham Patricia (Anatomy)
1995-96	Adoptive Immunotherapy of Tumour-Bearing Mice Using Natural Polysaccharides (CU94318) ✉ CHOY Yuen Min ● LEUNG Kwok Nam
1995-96	Immunopotentiating and Anti-Tumour Effect of Klebsiella K7 Capsular Antigen (CU95315) ✉ CHOY Yuen Min ● FUNG Kwok Pui

Please refer to previous issues of *Research Projects*

- 1995-96 Study on the Regulatory Elements of the Grass Carp Growth Hormone Gene (CU93301)
✍ HO Walter K. K.
- 1995-96 Formation of a Task Force in The Development of Enzyme Immunodiagnostic Tests (BL95010)
✍ HO Walter K. K. ● LAM Wai Kei Christopher (Chemical Pathology) ● LEUNG Kwok Nam ● CHOW Hak Fun (Chemistry) ● FONG Wing Ping ● WONG Patrick C. L.* ● TAM Joseph W. O.*
- 1995-96 Application of Recombinant Fish Growth Hormone in Fish Culture (BL95029)
✍ HO Walter K. K.
- 1995-96 Expression of Recombinant Proteins in Baculovirus and the Application of Recombinant Fish Growth Hormone in Fish Culture (BL95015)
✍ HO Walter K. K. ● KWONG Simon*
- 1995-96 Effects of Pesticides and Herbicides on Proton Flux Through the CFO.CF1 Complex in Chloroplasts (CU95321)
✍ HO Wing Shing John
- 1995-96 *In Vitro* Study of Atrazine by Rat Liver (BL95030)
✍ HO Wing Shing John
- 1995-96 Signal Transduction in Normal Macrophages and Macrophage Cell Line (CU94308)
✍ KONG Siu Kai ● LEE Cheuk Yu
- 1995-96 Studies on the Regulation of Nuclear Calcium in C6 Giloma Cells (BL95028)
✍ KONG Siu Kai ● TSANG David Sau Cheuk
- 1995-96 Role of Cytochrome P450 (CYP2E1) in Alcohol Liver Pathogenesis (BL95016)
✍ LEE Susanna Sau Tuen ● GONZALEZ Frank J.*
- 1995-96 Studies on the Anti-leukemia Effects of Pro-inflammatory Cytokines, Interleukin 1 α and 1 β (BL95019)
✍ LEUNG Kwok Nam
- 1993-94 Studies on the Signal Transduction Mechanisms of Tumour Necrosis Factor- α (TNF- α) in Cultured Astrocytes (BP93030)
✍ TSANG David Sau Cheuk
- 1995-96 The Mechanism of Action of Tumour Necrosis Factor- α on Taurine Transport in Cultured Rat Astrocytes (CU95322)
✍ TSANG David Sau Cheuk ● LEUNG Kwok Nam ● STADLIN Alfreda (Anatomy)
- 1995-96 Natural and Synthetic Anti-human Immunodeficiency Virus and Anti-Lymphoma Compounds (BL95036)
✍ YEUNG Hin Wing ● NG Tzi Bun ● WONG Nai Ching Henry (Chemistry) ● FONG Wing Ping ● WAN David Chi Cheong

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- <P961673> **Guldan, Georgia S.** "Obstacles to Community Health Promotion". *Social Science & Medicine* vol.43 no.5, pp.689-695. UK, 1996.
- <P961891> **Wang, En Si; Yuen Min Choy and Henry N.C. Wong.** "Synthetic Studies on Prehispanolone and 14,15-Dihydroprehispanolone". *Tetrahedron* vol.52 no.37, pp.12137-12158. Amsterdam, 1996.

- <P962220> **Jian, Haoran and Wung-Wai Tso.** "DNA Recombination, Plasmid Dissemination, Enzymatic 'Combustion' and Cell Immobilization: Their Potential Effect on Environmental Biotechnology". *Environmental Biotechnology: Principles and Applications* ed. by Moo-Young M. Anderson W.A. and Chakrabarty A.M. pp.28-37. The Netherlands: Kluwer Academic Publishers, 1996.
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- <P970247> **Kong, S.K.; Fung K.P.; Choy Y.M. and C.Y. Lee.** "Slow Increase in Intranuclear and Cytosolic Free Calcium Concentrations in L929 Cells is Important in Tumour Necrosis Factor-Alpha-Mediated Cell Death". *Oncology* vol.54, pp.55-62. Basel, 1997.01.
- <P970385> **Cheung R.; Lee F.; Chan K.M.; Shen, L.H.; Zhou, H.Y. and Wong, M.H.** "Concentration of Cadmium, Chromium, Copper, Lead, Nickel and Zinc in *Tilapia Mossambica* Collected in Inland Waters of Hong Kong". *Abstracts of the 4th International Conference on Trace Metals in the Aquatic Environment* p.78. Kuala Lumpur, Malaysia: University of Malaysia, 1997.05.19.
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- <P971151> **Li, H.K.; Y.M. Choy; K.P. Fung and K.N. Leung.** "The Hematopoietic and Anti-Leukemia Activities of *Klebsiella* Capsular Polysaccharide Antigen (K7)". *Asian Pacific Journal of Allergy and Immunology* vol.15, p.56. Thailand, 1997.03.
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see also <P961743>, <P962540>, <P962542>, <P962766>, <P962862>, <P970043>, <P970585>, <P970586>, <P970754>, <P970765>, <P970796>, <P971135>, <P971137>, <P971152>

RESEARCH PROJECTS

Dynamics of the Brown Alga *Sargassum* Populations in Ping Chau Island, New Territory and an Assessment of Variations in Their Morphological Characteristics

- ✉ ANG Put Jr.
- ☐ 15 September 1996
- ❖ Research Grants Council

Marine algae are the most important primary producers of coastal marine environment. In spite of this, however, there has never been detailed study on the growth, reproduction and recruitment of algal populations in Hong Kong waters. This research aims to fill up this gap by monitoring the growth and reproductive seasonality of individuals belonging to the brown alga *Sargassum*. Populations of *Sargassum* are the dominant features of many rocky shores exposed to strong or moderately strong waves. Recruitment, or how population re-establishes itself, and the interaction of the population with biotic and abiotic factors will also be assessed. By following the growth of individuals, this research will also try to monitor how plant morphology, like shape and sizes of the leaves and vesicles, could change with time and how these could be used to help ascertain the specific identity of these algae. (CU96316)

Reproductive Ecology of the Green Alga *Ulva* Spp. in Tolo Harbour and Channel, New Territories, Hong Kong

- ✉ ANG Put Jr.
- ☐ 1 December 1996
- ❖ CUHK Research Committee Funding

Tolo Harbour, located in the northeastern part of the New Territories, is a semi-enclosed bay. It is connected to Mirs Bay (Tai Pang Wan) by a narrow Tolo Channel. It receives all the organic sewage, as well as the industrial waste from the two fast growing new towns, Shatin and Tai Po. It is hence a highly eutrophied environment. The diversity of marine organism within the harbour as well as along the Tolo Channel is greatly reduced. Among the surviving marine plants are species of the green alga belonging to the genera *Ulva* and possibly *Enteromorpha*. How do these algae survive in such an environment and how do they propagate are addressed in this research. Specifically, this research examines the reproductive ecology of the green alga *Ulva* spp. within the Tolo Harbour and Channel along a gradient of organic eutrophication and assesses the relative proportion of the different life history stages of the algae along this

gradient as a possible indicator of the adaptation of these algae to different degrees of organic pollution. (BL96009)

Evaluation and Characterisation of the Anti-oxidant Potential of Edible Mushrooms and Mushroom Products for Use in Dietary Repression of Cellular Sensitivity to Ionizing Radiation and to Oxidative DNA Damage

- ✉ BUSWELL John Anthony ● STRAIN J. J.*
- ☐ 1 November 1996
- ❖ CUHK Research Committee Funding

Oxidative processes orchestrated by "reactive oxygen species" produced during normal metabolic processes, inflammation and smoking, and after ingestion of certain drugs and pollutants, have been implicated in coronary heart disease and cancer. The proposed research aims to determine the potential of edible mushrooms and mushroom products as a source of dietary anti-oxidants for the repression of cellular sensitivity to ionizing radiation and to oxidative DNA damage. The experimental objectives are: to assess the anti-oxidant properties of selected mushrooms and mushroom products using *in vitro* assay systems, to determine whether dietary supplementation with mushroom-derived products moderates radiation-induced DNA damage in *ex vivo* test systems, and to isolate and identify individual anti-oxidant species. (BL96022)

Research and Development of a Standard Set of Medical Subject Headings for Indexing and Searching Information in Database of Traditional Chinese Medicine Literature

- ✉ BUT Paul Pui Hay ● KAN Wing Kay (Computer Science & Engineering) ● CHEN C. F.* ● HSIEH Richard* ● SIU Yuk Tai (Institute of Science & Technology)
- ☐ 1 July 1996
- ❖ Chiang Ching-Kuo Foundation for International Scholarly Exchange

Information of clinical experience from our ancestors and recent research can provide a good basis for searching leads for pharmaceutical development and for guidance and precautions in the application of traditional Chinese medicine (TCM). To facilitate fast access to such valuable information, this project aims at: (1) developing a system of standard subject headings for organizing the rich source of information in TCM literature computer databases; (2) promoting such a standard as the mechanism for searching and sharing of information on the diverse TCM databases; (3) providing a bridge necessary for supporting the exchange of information between Chinese and Western medicine.

Building a common set of TCM subject headings upon the Western Medical Subject Headings (MeSH) system will also provide the West with a consistent and familiar method for tapping into the valuable sources of TCM information. This could undoubtedly help increase the respect for traditional Chinese medicine across the world as better exposure and understanding of the culture is made more easily accessible.
(CS96020)

Chemical Composition and Nutritional Evaluation of Hong Kong Seaweeds

- ✍ CHEUNG Chi Keung
 ☐ 1 December 1996
 ❖ CUHK Research Committee Funding

Traditionally, seaweeds have been used as human food since ancient times in Asia. Apart from being as valuable sources of food nutrients to humans, seaweeds are also used world-wide as animal feeds, industrial chemicals and pharmaceutical ingredients. However, the potential use of seaweeds as food in many regions has not been fully exploited. This is due to and in fact also hindered by the lack of a comprehensive information on the detailed chemical composition and nutritional evaluation of seaweed species in those regions. In this project, the chemical composition of the major edible seaweeds found in Hong Kong will be assessed with emphasis on the seasonal variation in the nutrient content of these seaweeds. Nutritional values on some seaweeds will be evaluated using animal models and potential health benefits such as cholesterol-lowering effects of some seaweeds will also be investigated. The data gathered will be significant in the further development of the food applications of seaweeds in the local region and will contribute to the knowledge of international research in seaweeds.
(BL96010)

Dissecting the Carbon Metabolism in Fruiting of Oyster Mushroom

- ✍ CHIU Siu Wai
 ☐ 1 December 1996
 ❖ CUHK Research Committee Funding

Oyster mushroom is the second most popular fresh mushroom in the world. Recently, 2-deoxy-D-glucose was found to induce fruiting, and strains tolerant to this sugar analogue are more productive. Therefore, this study aims to dissect the carbon metabolism in fruiting initiation and morphogenesis. The basic information to be obtained will determine whether the analogue can be applied to conventional cultivation substrate to enhance crop yield and whether developmental-specific enzymes could be

identified for further manipulation in modulating mushroom appearance.
(BL96011)

Evolutionary and Population Genetics and Penaeid Shrimps in the Indo-West Pacific: Allozyme and Mitochondrial DNA Analyses

- ✍ CHU Ka Hou
 ☐ 1 September 1996
 ❖ Research Grants Council

Penaeid shrimp are of major economical importance in fisheries and aquaculture of the Indo-West Pacific. The understanding of the genetic structure of penaeid species and populations is crucial to the sustainable utilization and conservation of this biological resource. The proposed study aims to elucidate the phylogenetic relationships of penaeid genera in the Indo-West Pacific by allozyme and PCR (polymerase chain reaction)-based mitochondrial DNA analyses. The population divergence of selected widespread species, including a comparison of genetic variation between wild and cultured stocks, will also be investigated. The study will not only clarify the pattern of genetic differentiation and speciation of penaeid shrimp but also provide new insights into the evolution and paleogeography of estuarine fauna in the Indo-West Pacific. Moreover, 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.
(CU96327)

Ecological Studies of Completed Landfills for Enhancing Natural Succession on the Man-made Habitats

- ✍ CHU Lee Man ● WONG M. H.*
 ☐ 1 September 1996
 ❖ Research Grants Council

Completed landfills are usually covered with a final soil layer for revegetation and overall restoration. However, plant deterioration is common because of the low quality soil used and the adverse effects of landfill leachate and gas which are continuously produced after the completion of landfilling. The researchers propose to carry out a comprehensive study on the ecology of old landfills in Hong Kong. Their goals are to identify the major ecological and edaphic factors which limit vegetation performance, microbial activities and nutrient cycling on the soil layer and to develop procedures that can assist in the

reconstruction of ecosystems on the revegetated landfills. The objectives of the proposed research project are to:

- (1) examine the soil physical and chemical status on selected landfills,
- (2) study microbial activity and invertebrate diversity in plant litter and soil cover material,
- (3) examine the species composition and physiological vigour of the vegetation established on the landfills, and
- (4) investigate nitrogen accumulation and cycling in the cover soil. It is hoped that findings obtained will benefit revegetation and aftercare procedures, and enhance the ecological succession on these man-made habitats in Hong Kong and nearby countries. (CU96324)

Potent Odorants in Fermented Soybean Curds

- ✉ CHUNG Hau Yin
□ 1 November 1996
❖ CUHK Research Committee Funding

Fermented soybean curds are popularly consumed in Hong Kong, China and other Asian countries. The products have distinct taste and flavor and are used as condiment in the preparation of a number of Chinese dishes. Information on the volatile composition and the potent flavor components of various types of fermented soybean curds are scarce in scientific literature.

The objectives of this experiment are to: (1) determine the volatile components in two types of fermented soybean curds that are sold in Hong Kong, and (2) identify those common principle odorants that contribute to the characteristic flavor of these products. Significant findings could provide clues to the mechanisms of the formation of those important flavor components, and provide food scientists with flavor markers to optimize processing parameters to produce products with the best quality. (BL96012)

Ribosomal RNA Sequence to Test Monophyly in the Evolution of Higher Termites

- ✉ CROSLAND Michael W. J.
□ 15 October 1996
❖ CUHK Research Committee Funding

DNA will be extracted, amplified and sequenced from termite specimens of the subfamily Apicotermatinae for 550 base pairs of the 16S rRNA gene. This will provide the data for the fourth and final subfamily of the higher termites (family Termitidae). (Sequences from the other three subfamilies have been obtained.) Consensus trees will be produced after computer data analysis of the four subfamilies using parsimony and nearest-

neighbour analysis following different types of sequence alignments including a new direct alignment technique. This data will be used to determine the evolutionary relationships amongst the four subfamilies of termites which make up the higher termites (75% of all termites). This will help answer fundamental questions in many aspects of termite ecology (e.g. evolution of nest structure, secondary loss of symbionts, multiple evolution of the worker caste etc.), with the aim of leading to a successful UGC earmarked grant proposal to produce such a phylogeny for the whole termite order. (BL96013)

Molecular Cloning of the Chitinase Gene from a Local Fungal Strain

- ✉ FUNG Ming Chiu
□ 1 January 1996
❖ CUHK Research Committee Funding

Chitin is an abundant polysaccharide in nature. Its linear polymer structure of β -1-4-N-acetylglucosamine can be cleaved by chitinolytic enzymes. Chitinolytic enzymes are found in bacteria, fungi, plants and invertebrates. In fungi, chitinase is not just a morphogenetic enzyme but also plays a role in various aspects of fungal physiology. In plants, chitinase is a key factor in defense against the fungal pathogens. It can be induced to express during pathogen attack. Besides of its natural biological roles in different organisms, chitinase has several important applications in biotechnology. It has been implicated in the biological control of plant pathogenic fungi and insects. It is also used in degradation of chitin-containing waste.

We have earlier isolated several fungal strains that can utilise chitin as the only carbon source. They all produce chitinase in the culture medium. The chitinase produced by one of the strain, *Doratomyces*, is different from that the *Trichoderma* chitinase. In this project we will purify this chitinase and also clone the cDNA coding for this protein. This recombinant cDNA will provide the tool for the large scale production of the recombinant chitinase. Moreover the chitinase gene can be inserted into the genome of a plant needing protection from a chitinase-containing pest or into the genome of a microorganism to provide transgenic microorganism as a biocontrol agent. (BL96014)

Activin Regulation of Pituitary Gonadotropin Gene Expression and Oocyte Development in the Goldfish, *Carassius auratus*

- ✉ GE Wei
□ 1 September 1996
❖ Research Grants Council

Activin is an important dimeric protein growth factor that is involved in the regulation of mammalian reproduction and many other physiological and developmental processes. Although activin involvement in reproductive regulation has been extensively studied in mammalian species, very little is known about its actions in lower vertebrates. The overall purpose of the present study is to examine the roles of activin in the regulation of reproduction of fish, the largest and most diverse group of vertebrates, using goldfish as a model. The specific issues addressed in the project include:

- (1) cloning of goldfish activin cDNAs;
- (2) recombinant production of goldfish activin with biological activity;
- (3) effects of recombinant activin on goldfish pituitary gonadotropin (GTH) gene expression;
- (4) effects of recombinant activin on goldfish oocyte growth and maturation.

These studies will not only enhance our understanding of fish reproductive regulation, which will eventually benefit aquaculture, but also provide important information about the structural and functional evolution of activin family of growth factors during vertebrate evolution.
(CU96308)

Molecular Cloning of Activin β_A Subunit in the Goldfish, *Carassius auratus*

✉ GE Wei

☐ 1 November 1996

❖ CUHK Research Committee Funding

Activin is an important protein growth factor that is involved in the regulation of many physiological and developmental processes, some of which are fundamental to vertebrate life. Activin is a dimeric protein ($\beta_A\beta_A$, $\beta_A\beta_B$ and $\beta_B\beta_B$) derived from different combination of two distinct but related subunits, β_A and β_B . Studies on activin have shown that this protein growth factor is highly conserved during vertebrate evolution. Because fish represents the largest and most diverse group of vertebrates, the proposed research will provide important evolutionary reference point for studies in other vertebrate species including human beings and enhance our understanding of the fundamental roles for activin in vertebrate life.

The objective of the proposed project is to clone the complementary DNA encoding activin β_A subunit in the goldfish, *Carassius auratus*, and study the expression of its messenger RNA in the ovary and pituitary. The reasons for choosing goldfish as the model include: (1) goldfish is one of the best studied fish models in endocrinology and reproductive biology; (2) goldfish belongs to Cyprinidae, a group that is important in aquaculture in China and Southeast Asian countries; therefore, the information obtained from the studies on goldfish may be applied

to other species of aquacultural importance in this region. The specific issues addressed in the research are: (a) Cloning of goldfish activin β_A subunit; (b) Regulation of activin β_A expression in the ovary and pituitary.
(BL96020)

Molecular Analysis of Anaerobic Ribonucleotide Reductase, *nrdD*, in *Salmonella Typhimurium*

✉ KWAN Hoi Shan

☐ 1 October 1996

❖ CUHK Research Committee Funding

Anaerobic ribonucleotide reductase is the key enzyme that reduces ribonucleotides into deoxyribonucleotides, which are the substrates of DNA synthesis. The gene encoding this enzyme was isolated in *E. coli* and assigned as *nrdD*. A 2kb genomic DNA fragment from *Salmonella typhimurium* was cloned in the promoterprobe plasmid, pFZY1. It shows homology to the 5' end of *nrdD*. Expression of this clone is up-regulated in anaerobic environment. The purposes of this investigation are (1) to clone and sequence the *nrdD* gene of *S. typhimurium*, (2) to determine the 5' untranslated regulatory sequence and (3) to study the expression of this gene. The results will provide further understanding of gene regulations in the facultative anaerobic metabolism of enteric bacteria.
(BL96023)

Development of a Species Genetic Linkage Map of the Shiitake Mushroom *Lentinula edodes* with Sequence-tagged-site, Expressed-sequence-tag, and Gene Markers

✉ KWAN Hoi Shan

☐ 1 October 1996

❖ Research Grants Council

The long term goal is to develop, for *Lentinula edodes* (Shiitake mushroom), a species genetic linkage map which contains molecular markers including genetic determinants of agronomically important characteristics for general use in breeding programs. The specific aims are to:

- (1) characterize existing RAPD markers of *Lentinula edodes* genome by cloning and sequencing,
- (2) map sequenced cDNA fragments from our laboratory collection,
- (3) use the mapped and sequenced markers to develop a species linkage map of *L. edodes*, and
- (4) compile a database of the materials and procedures for the utilization of the map and markers in breeding programs. The methods to be used are polymerase chain reaction followed by single-stranded conformational polymorphism and denaturing gradient gel electrophoresis analyses. The

allelic forms of the markers will be identified. Markers will be classified into sequence-tagged-site, expressed sequence tag, and gene markers. Map locations of the markers will be determined with the computer program MAPMAKER. The map, the markers, and the database can be used for Shiitake breeding programs for many different kinds of strains. (CU96310)

Analysis of Fermented Shrimp Sauce and Fermented Soybean Sauce

- ✉ KWAN Hoi Shan
- ☐ 15 November 1996
- ❖ Lee Kum Kee Co. Ltd.

The project is a limited analysis of amino acid profiles, protease and microbial population in fermented shrimp sauce and fermented soybean sauce. The ultimate aim is to understand the fermentation process of these fermented food products. (BL96028)

Studies on the Antiviral Properties of Bioactive Polysaccharides and Proteins Isolated from Mushrooms

- ✉ OOI Vincent E. C. ● NG Tzi Bun (Biochemistry)
● YAO Qi-Zhi* ● CHANG Shu Ting
- ☐ 1 August 1996
- ❖ Research Grants Council

The integral parts of this proposal are characterization of the antiviral properties of bioactive polysaccharides and proteins isolated from selected mushrooms. In the course of previous and ongoing studies on biological/medicinal properties of many mushroom species, the researchers have found several potential fractions of the mushroom extracts for the study of their bioactivities and possible mechanisms. The researchers have isolated and partially characterized some very interesting polysaccharide-protein complexes (PSPC) and two distinct lectins from the cultured mycelia of a few selected mushroom species. These PSPC and lectins have been shown to possess antitumor and immunopotentiating activities. In their preliminary studies, the researchers have also isolated and purified two proteins from the fruiting bodies of *Volvariella volvacea* and a local *Amanita* sp. respectively, which have some specific activities of ribosome-inactivating proteins. Many known immunomodulatory polysaccharides and ribosome-inactivating proteins have antiviral activity. In this study, the researchers will more fully characterize the novel substances obtained from selected mushrooms which may be potent anti-HBV candidates, by using an *in vitro* model system for screening anti-hepatitis B virus (anti-HBV) drugs. It is anticipated that the

proposed study will give us a deeper insight towards understanding the biologically active components in mushrooms and provide a basis for potential application of the novel substances as adjunctive drugs in chemotherapy or as potent agents in antiviral therapy. Through integrated investigations on various aspects of biological/medicinal properties of mushrooms together with improvement of the culture technology and strain selection, it is possible to develop the selected mushroom species into better nutraceutical and pharmaceutical products. (CU96330)

Characterization of Hypotensive Substances from Selected Medicinal Herbs

- ✉ OOI Vincent E. C.
- ☐ 1 December 1996
- ❖ CUHK Research Committee Funding

Hypertension is considered as the most widespread cardiovascular disease. It causes secondary diseases if it is not suppressed immediately, such as hypertrophy of the heart, coronary occlusion, arteriosclerosis, renal disease and cerebral hemorrhage. According to traditional Chinese folk remedies, many herbs have been used in the prevention and treatment of hypertension and hypercholesterolemia. Mushrooms including *Grifola frondosa* and *Volvariella volvacea* have been reported to have hypotensive effects. Aqueous extracts of some seaweeds such as *Laminaria japonica* and *Padina australis* could lower the blood pressure in rats. A lectin isolated from the edible mushroom *Tricholoma mongolicum*, has also been shown to possess cardiovascular activity in normotensive rats. This proposed study aims to investigate the hypotensive effects of a medicinal mushroom, *Ganoderma lucidum*, and an edible seaweed, *Laminaria japonica*, and identify the potential antihypertensive substances from the extracts. The specific objectives are to (1) develop a bioassay using *in vivo* blood pressure measurement in normotensive rat model and adenosine receptor binding assays to determine the hypotensive and related cardiovascular activities of the extracts and chromatographic fractions, (2) isolate and characterize any potential cardiovascular active components from these two medicinal herbs, and (3) assess their possible mechanisms of action. The study may provide a sound basis for the potential development of antihypertensive drugs or nutraceuticals from the bioactive substances of traditional medicinal herbs. (BL96015)

Genetic Engineering of Rapeseed for Enhanced Nutritional Quality

✉ SUN Sai Ming Samuel

☐ 1 October 1996

❖ Research Grants Council

Plants are the primary source of all protein consumed by humans and livestock. However, most plant proteins are nutritionally incomplete. In general, cereal proteins are deficient in the essential amino acid lysine (Lys) and tryptophan while legumes proteins are low in methionine (Met) and cysteine. Much effort has been made by plant breeders for the past 30 years to overcome this nutritional shortcoming, but with little agronomic success.

The researchers had demonstrated earlier that by expressing a Met-rich protein gene in transgenic seeds, it is feasible to significantly enhance the Met of the seed proteins. There is a lack of parallel progress, however, in the isolation of Lys-rich protein genes for Lys enhancement.

In this application, the researchers proposed to transfer a Lys-rich seed protein, recently isolated from winged bean in our lab, into rapeseed for increased Lys content. This research represents a first to investigate the capacity of a plant to synthesize and accumulate a heterologous Lys-rich protein. The project also aims at generating additional value to the rapeseed oilcake and meal, a major protein source of animal feeds in Asia especially China, and at developing plant molecular biology and biotechnology research capability in the Biology Department and at The Chinese University of Hong Kong.
(CU96301)

Development of a Plant Bioreactor for the Production of High Value Proteins

✉ SUN Sai Ming Samuel

☐ 1 January 1997

❖ CUHK Research Committee Funding

Recent developments in plant molecular biology and biotechnology allow the use of plants to produce proteins, carbohydrates, and oils of industry, pharmaceutical and agricultural importance. The advantages of using plants as bioreactors include its economy of production; free of contamination by animal virus, such as AIDS virus; capably of processing, modification and folding of proteins; and large scale (kilograms) production. A major contribution to the advancement of this technology will be to develop a strong gene expression system capable of producing large quantities of the products. The researchers have earlier cloned a seed-specific gene from French bean encoding the most abundant protein in legume seeds. Its promoter has been

demonstrated capable of driven the expression of a target protein up to 8% of the total seed protein. The researchers now propose to construct an expression cassette using the promoter and terminator of this gene for high level of expression, and the use of *Agrobacterium* vector system for its delivery into the cells. To test the efficiency of this expression system, the researchers will use cellulase as the target enzyme and tobacco plant as bioreactor for production. Cellulase has many industrial use including laundry detergents, treatment of denim fabric, fabric conditioner, pretreatment of biomass for alcohol production, and other food industrial uses. The establishment of this bioreactor system will open the door to the production of many high value protein products.

(BL96016)

Ecotoxicology of Organic Metals in Waste Engine Oil

✉ WONG Po Keung

☐ 1 October 1996

❖ CUHK Research Committee Funding

The proposed project will use nitrogen evaporation systems to concentrate organic metals in waste engine oil extracted by seawater. This new concentration process will achieve much better recovery of organic metals from the extract. Then high performance liquid chromatography and inductively coupled plasma-emission spectrometry (ICP-ES) will be used to fractionate and preliminary identify various species of organic metals in the concentrated extract. The toxicity of HPLC fractions with organic metals will then be assessed by a battery of bioassays using bacteria, algae, cladoceran, limpets and seed. The HPLC fractions showing toxicity in at least two bioassays will be further characterised. The species and levels of organic metals in these fractions will be determined by ICP-ES or atomic absorption spectrophotometry (AAS), and gas chromatography coupled with a mass selective detector (GC-MS).

(BL96017)

A Study of *Vigna Unguiculata* Pigment as Natural Food Color

✉ WONG Yum Shing

☐ 1 October 1996

❖ CUHK Research Committee Funding

Colors are added to many food items to give consumers the appetizing and attractive qualities they desire. In recent years, consumers have become more aware of the safety of food additives and the demand for natural food colors has increased. An anthocyanin-like red pigment(s) has been found in

seed coats of a local variety of *Vigna unguiculata*, a commonly consumed legume. Since seed coats are waste product in the bean flour industry, the pigmented seed coats of this *V. unguiculata* variety would be a costless source of anthocyanin pigment. In this project, the red pigment from *V. unguiculata* is isolated and characterized. Since good stability is essential for any food color to be practically useful, the stabilities of the *Vigna* pigment under different physical and chemical conditions are studied. The potential use of this red pigment as a natural food color is assessed.

(BL96018)

Cloning and Tissue Specific Expression Studies of the Genes Encoding the Na⁺-K⁺-ATPase α and β Subunits in the Sea Bream, Sparus Sarba

✉ WOO Norman Ying Shiu

☐ 1 November 1996

❖ CUHK Research Committee Funding

Marine teleosts exhibit considerable euryhalinity by regulating their internal ionic and osmotic milieu to relative constancy. In seawater, internal ionic concentration is maintained at a level below that of seawater by actively driving the branchial ionic pumps which results in a net efflux of monovalent ions. In a hypo-osmotic environment, the internal ionic concentration is maintained at a level higher than the surrounding medium by active uptake of salts from the dilute environment. Adaptation from seawater to hypo-osmotic salinities involves a switch from ion extrusion to ion uptake. Central to hypo-osmotic adaptation is the marked stimulation of the enzyme Na⁺-K⁺-ATPase in the gills. Na⁺-K⁺-ATPase exists in the plasma membrane as a heterodimer comprised of an α and a β subunit, which together actively pump K⁺ into and Na⁺ out of the cell against their concentration gradients. Both subunits can exhibit different isoforms and these are differentially expressed in a tissue specific manner. Since no information is available for the molecular aspects of Na⁺-K⁺-ATPase regulation for hypo-osmotic adaptation in marine teleosts, the present experiments will develop a pioneering study on the regulation of the branchial ion transporter at the molecular level. The specific aims of this proposed study are to: (1) clone and sequence the Na⁺-K⁺-ATPase α and β subunit genes in the sea bream *Sparus sarba*, (2) compare the expression of the Na⁺-K⁺-ATPase gene in the branchial cells of sea bream cultured in various salinities, (3) identify and confirm the other accessory sites of ionoregulation in sea bream by studying the tissue specific expression of the Na⁺-K⁺-ATPase gene. Molecular data obtained in this proposed study will complement the existing biochemical and physiological data to provide a deeper understanding of the mechanisms of ionoregulation in marine teleosts.

(BL96019)

Please refer to previous issues of *Research Projects Summary* for more details of the following ongoing research at the department:

<u>Edition</u>	<u>Title/Investigators</u>
1994-95	Baseline Studies on Algal Species Diversity in Selected Coastal Environment in North Eastern New Territory and the Development of Rapid Appraisal Systems for Algal Community Structure Evaluation (BL95005) ✉ ANG Put Jr.
1995-96	Phenology of the Red Algae <i>Hypnea charoides</i> and <i>H. japonica</i> in Ping Chau Island, New Territory and an Experimental Verification of Their Taxonomic Identity (BL95025) ✉ ANG Put Jr.
1990-91	Elucidation of Biochemical Events Regulating Secondary Metabolism in the Ligninolytic Fungus <i>Phanerochaete chrysosporium</i> (BP91015) ✉ BUSWELL John Anthony
1991-92	Enzymic Evaluation of Starch Availability in Foodstuffs (BP92007) ✉ BUSWELL John Anthony
1993-94	Establishment of an International Network of Institutions in Developing Countries and Centres for Research, Development and Training to Advance Mushroom and Bioconversion Technologies (BP94011) ✉ BUSWELL John Anthony
1995-96	Evaluation and Characterisation of the Anti-Oxidant Potential of Edible Mushrooms and Mushroom Products for Use in Dietary Repression of Cellular Sensitivity to Ionising Radiation and to Oxidative DNA Damage (BL95002) ✉ BUSWELL John Anthony ● STRAIN J. J.*
1995-96	Production and Secretion of Cellulolytic Enzymes by the Edible Mushroom, <i>Volvariella Volvacea</i> , and Their Significance to the Utilization of Lignocellulosic Substrates and Mushroom Growth Yields (CU95328) ✉ BUSWELL John Anthony ● PEBERDY John Frederick*

- 1995-96 A Computer Database on Toxicity and Adverse Effects of Chinese Foods and Chinese Medicines (BP92008)
✍ BUT Paul Pui Hay ● KAN Wing Kay (Computer Science & Engineering)
- 1995-96 A Floristic Study on the Biodiversity of Bryophytes in Hong Kong (CU94302)
✍ BUT Paul Pui Hay
- 1995-96 Laboratory for Quality Control of Chinese Medicines and Health Foods Based on Chemical Components (MD95056)
✍ BUT Paul Pui Hay ● LAU Oi Wah (Chemistry) ● CHAN Tak Wah Dominic (Chemistry)
- 1995-96 Isolation and Characterization of Dietary Fiber Fraction from Edible Fungi (BL95024)
✍ CHEUNG Chi Keung
- 1995-96 Pathological Studies of Homopteran Body Tissues with Congenital Bacterial Infections (CU94316)
✍ CHEUNG Wai Kuen Wilkin
- 1995-96 A Study of the Genetic Mechanisms which Generate Diversity in a Self-fertile Mushroom, *Volvariella* (CU94311)
✍ CHIU Siu Wai ● MOORE David*
- 1995-96 Feasibility of Using Spent Mushroom Compost to Treat Wastewater and Solid Waste (BL95023)
✍ CHIU Siu Wai
- 1995-96 An Electron Microscopic Analysis of the Effect of Metallic Pollutants on Fungal Propagation (BL95013)
✍ CHIU Siu Wai ● MOORE David*
- 1995-96 A Molecular Analysis on the Ecological Impact of an Introduced Isolate on the Natural Population of *Armillaria* (BL95011)
✍ CHIU Siu Wai ● ANDERSON James B.*
- 1995-96 Molecular Cloning and Expression of Crustacean Allergens (BL94005)
✍ CHU Ka Hou ● KWAN Hoi Shan
- 1995-96 Fisheries Biology and Population Genetics of Brachyuran Crabs in the Zhujiang Estuary (CU94312)
✍ CHU Ka Hou ● WONG Chong Kim
- 1995-96 Reclamation of Fly Ash Lagoons: An Ecological and Microbiological Approach (CU94304)
✍ CHU Lee Man ● CHAN Wing Kuen*
- 1995-96 Water Quality of Gei Wais at the Mai Po Marshes (BL95018)
✍ CHU Lee Man
- 1995-96 The Importance of Temporal Polyethism in Termites (CU95311)
✍ CROSLAND Michael W. J. ● TRANIELLO James F. A.*
- 1995-96 Field Sampling and Scanning Electron Microscopy of Hong Kong Termites (BL95012)
✍ CROSLAND Michael W. J. ● BIGNELL David E.*
- 1995-96 Molecular Cloning and Expression of the Helminth Excretory/Secretory Antigen (and Interleukin-5 Like Molecule) (CU95326)
✍ FUNG Ming Chiu ● MAK Nai Ki*
- 1995-96 Isolation of Chitinase Producing Soil Microbes and the Characterization of the Chitinolytic Enzymes (BL95022)
✍ FUNG Ming Chiu
- 1995-96 Cloning and Characterization of Activin Type II Receptors in Goldfish (BL95017)
✍ GE Wei
- 1995-96 Identification and Molecular Cloning of Differentially Expressed Genes involved in Lignocellulose Utilization in Shiitake Mushroom *Lentinula edodes* (CU94317)
✍ KWAN Hoi Shan ● PEBERDY John
- 1995-96 Molecular Cloning and Time Course Studies of Genes Specially Expressed During Fruit Body Development in Shiitake Mushroom *Lentinula Edodes* (CU95314)
✍ KWAN Hoi Shan
- 1994-95 Studies on Toxic Effects of Thallium and Potential Antidotes Against Thallium Toxicity (BL94020)
✍ OOI Vincent E. C.
- 1995-96 Studies on Cardiovascular, Hepatoprotective and Cytokine Potentiating Activities of the Cultured Mycelial Products of Selected Mushroom Species (CU94325)

- ✎ OOI Vincent E. C. ● CHIU Kam Wai ● FUNG Ming Chiu ● CHANG Shu Ting
 1995-96 Protective Effect of Glycyrrhizin on Paracetamol-Induced Liver Injury in Rats (BL95021)
 ✎ OOI Vincent E. C.
- 1994-95 Characterization and Toxicological Assessment of Organic Leads in Air (BL94022)
 ✎ WONG Po Keung
- 1995-96 Study of Magnetite-immobilised Bacterial-cell System for Removal and Recovery of Metals from Electroplating Effluent (CU95309)
 ✎ WONG Po Keung ● CHUA Hong*
- 1995-96 Integration of Biosorption and Biodegradation for the Treatment of Synthetic Dyes in Industrial Wastewater (BL95034)
 ✎ WONG Po Keung
- 1995-96 Characterization of Polycyclic Aromatic Hydrocarbons in Waste Engine Oil (BL95037)
 ✎ WONG Po Keung ● JIA Chongrong (Centre for Environmental Studies)
- 1995-96 Characterization of Organic Lead in Air (BL95038)
 ✎ WONG Po Keung ● WANG Yonghua (Centre for Environmental Studies)
- 1995-96 A Study of the Nutritional Quality and Potential Food Use of Some Underutilized Legumes (BL95043)
 ✎ WONG Yum Shing
- 1995-96 A Study on the Thermal Stability of Staphylococcal Enterotoxin and the Evaluation of the Renaturation Process for Thermally Processed Staph. Enterotoxin (BL95035)
 ✎ WONG Yum Shing
- 1989-90 Environmental Physiology of Marine Teleosts (BP77001)
 ✎ WOO Norman Ying Shiu
- 1989-90 General Biology and Culture of Pomacanthids (BP88021)
 ✎ WOO Norman Ying Shiu ● CHUNG Kwok Cheong
- 1989-90 Induced Spawning and Larval Rearing of Marine Fish (BP89042)
 ✎ WOO Norman Ying Shiu
- 1990-91 The Rearing of Marine Fish Larvae (BP89060)
 ✎ WOO Norman Ying Shiu
- 1994-95 Epidemiological Survey of Bacterial Diseases in Cultured Marine Fish (BL95007)
 ✎ WOO Norman Ying Shiu
- 1994-95 Expression of Heat Shock Proteins in Cultured Hepatocytes from the Sea Bream: A Sensitive Biological Model for Detecting Environmental Stress (BL95008)
 ✎ WOO Norman Ying Shiu
- 1995-96 An Iso-osmotic Marine Fish Factory (CU95303)
 ✎ WOO Norman Ying Shiu

RESEARCH OUTPUTS AND PUBLICATIONS

- <P953384> **Lee, P.K.; Buswell, J.A. and Shinagawa, K.** "Distribution of Toxigenic *Bacillus Cereus* in Rice Samples Marketed in Hong Kong". *World Journal of Microbiology and Biotechnology* vol.11, pp.696-698. UK, 1995.
- <P953385> **Buswell, J.A.; Cai, Y.J.; Chang, S.T. and Peberdy, J.F.** "Ligninolytic Enzyme Profiles of Edible Mushroom Fungi". *Proceedings of the 10th International Conference on Global Impacts of Applied Microbiology* p.83. Elsinore, Denmark, 1995.
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see also <P961933>, <P961934>, <P962520>, <P962521>, <P962700>, <P970387>, <P970548>, <P970794>, <P971136>

RESEARCH PROJECTS

Mechanistic Studies of 1,2-Rearrangement of Alkyl Rhodium Porphyrins

- ✉ CHAN Kin Shing
- ☐ 1 October 1996
- ❖ Research Grants Council

The understanding of the 1,2-rearrangement of metal alkyl bears great implication on the basic organometallic chemistry as well as the relevant 1,2-shift of vitamin B₁₂ dependent enzymatic reactions. Functionalization of olefins in catalytic processes such as hydrogenation, hydrosilylation, hydroformylation, hydrocarboxylation and hydroboration involves the intermediacy of metal alkyl species. If they undergo rearrangements to other metal alkyl complexes, the regiochemistry as well as the stereochemistry of the products will be affected. From investigating the basic features in influencing this 1,2-rearrangement, our fundamental knowledge of the properties of metal-alkyl bonds will be deepened. Consequently, the researchers are in a better position to control the ratio of the formation of different metal alkyl compounds through proper ligand design and choice of metals so that the efficiency of the catalytic processes will be enhanced. (CU96702)

Oxidation Catalyzed Ruthenium Porphyrins

- ✉ CHAN Kin Shing
- ☐ 1 November 1996
- ❖ CUHK Research Committee Funding

Efficient oxidation catalysts of ruthenium porphyrins are designed and synthesized for the controlled and mild oxidation of organic compounds. The selectivity and efficiency of the oxidation will be enhanced. Less desirable co-products, such as carbon dioxide, could be minimized. Ultimately, the successful application of molecular oxygen will make them environmental friendly catalysts with just the desired products and water formed in the oxidation reaction. (PS96005)

Asymmetric Metal-Catalysed Polymerisation

- ✉ CHAN Kin Shing ● HOLMES Andrew B.*
- ☐ 1 December 1996
- ❖ UK/Hong Kong Joint Research Scheme, the British Council

Stereoregular and optical active polymers possess extremely promising material properties including both mechanical and optical ones. The most efficient

synthesis utilizes chiral metal complexes as asymmetric catalysts for the polymerisation of monomer. This project aims to design and search efficient chiral catalysts for the polymerisation of olefins. (PS96003)

Development of New Methods to Perform Matrix-assisted Laser Desorption/Ionization (MALDI) Experiments in Fourier-Transform Ion-Cyclotron-Resonance Mass Spectrometer

- ✉ CHAN Tak Wah Dominic
- ☐ 1 October 1996
- ❖ Research Grants Council

The main objective of this research proposal is to develop better coupling system(s) for transferring high-mass molecule-ions derived under MALDI conditions to the trap cell of Fourier-transform ion-resonance mass spectrometer. It is an attempt to improve the trapping of high mass ions by narrowing the energy distribution of the laser desorbed molecule-ions. With the knowledge gained, a mass spectrometer with high sensitivity and resolution for high mass molecules can be developed. The researchers propose to conduct experiments to study the possibility of eliminating or reducing the axial kinetic energy of ions desorbed under MALDI conditions. This includes construction and testing of new MALDI ion sources. Two designs are proposed in this project. They are (1) an orthogonal pulse ion extraction source; and (2) an atmospheric laser desorption source. (CU96727)

Sequence Analysis of Natural and Modified Oligonucleotides using Ultra-high Resolution Fourier Transform Ion Cyclotron Resonance Mass Spectrometry

- ✉ CHAN Tak Wah Dominic ● DERRICK Peter J.*
- ☐ 1 January 1997
- ❖ UK/Hong Kong Joint Research Scheme, the British Council

This project involves the development of rapid and reliable structural characterization methods for sequence analysis of natural and modified oligonucleotides using the state-of-the-arts mass spectrometry techniques. The objectives of this project are: (1) design and construction of matrix-assisted laser desorption/ionization (MALDI) ion source and related accessories for performing MALDI experiments in Fourier Transform Ion Cyclotron Resonance Mass Spectrometer.

(2) evaluation and optimization of experimental parameters for the study of Homopolymer and mixed-base oligonucleotides using MALDI-FTICRMS.

(3) evaluation and optimization of experimental parameters for the study of Homopolymer and mixed-base oligonucleotides using ESI-FTICRMS.

(4) compare and contrast MALDI- and ESI-FTICRMS methods for use in the analysis of oligonucleotides of different (i) base compositions; (ii) molecular weights; and (iii) sample purities.

Special attentions will be paid on their relative speed and accuracy of measurements; and also their abilities in analyzing multi-component systems.

(PS96004)

Further Exploration of a Recently Developed One-flask Ramberg-Backlund Reaction

✉ CHAN Tze Lock

☐ 1 January 1997

❖ Research Grants Council

The researchers recently developed an effective one-flask Ramberg-Backlund reaction for carbon-carbon double bond formation by treatment of α - and α -hydrogen-containing sulfones with a mixture of KOH-on- Al_2O_3 and CBr_2F_2 in *t*-BuOH or CH_2Cl_2 . In view of the ease with which these sulfones can be assembled from readily available starting materials and the encouraging results emerging from previous investigations, this newly uncovered procedure merits scrutiny as a tool for organic synthesis. The present project is directed to broaden its scope as a method of carbon-carbon double bond construction in four areas:

- (1) search for alternative halogen transfer agents in place of CBr_2F_2 ,
- (2) synthesize stereo- and oligo-defined extendedly conjugated oligomers incorporating both aromatic and polyenic moieties and their saturated counterparts,
- (3) synthesize terminally functionalized dienes, and
- (4) re-investigate a non-pyrolytic route to corannulene.

(CU96712)

Synthesis and Properties of Novel Metallo-dendrimers: Controlling the Redox Behaviour of Metal Complexes by Dendritic Modification

✉ CHOW Hak Fun

☐ 1 October 1996

❖ Research Grants Council

Electron transfer is a central issue in chemistry and biology. Photosynthesis and respiration, two important biological processes that are vital to most living organisms, involve the transfer of electrons

between acceptor and donor molecules catalyzed by a class of natural occurring macromolecules called metalloproteins. A thorough understanding of the underlying principles that control the efficiency of this process is therefore of utmost importance to the understanding of the biological functions of these natural catalysts. The researchers propose to prepare a series of polymeric model compounds which bear close structural resemblance to these naturally occurring proteins and use them to unravel the factors that influence their electron transfer process. These metal-containing macromolecular models, also known as metallo-dendrimers, have a metal ion encapsulated inside a highly branched, topologically and structurally defined organic envelope. This organic capsule, which serves as the scaffolding for the metal ion as well as mimics of the polypeptide chains of a typical metalloprotein molecules, will therefore change the redox behaviour of the metal centre. By systematically varying the size and structure of the organic envelope, one should be able to probe the factors that control the redox behaviour and reversibility of the electron transfer processes of these compounds.

(CU96710)

Synthesis of Extremely Large Macrocycles by Transition Metal Catalyzed Metathesis

✉ CHOW Hak Fun

☐ 1 October 1996

❖ CUHK Research Committee Funding

The proposal plans to develop an efficient synthetic strategy for the synthesis of cyclic compounds of extremely large ring size (>100) by using a transition metal catalyzed metathesis procedure.

(PS96006)

Studies of Ultrathin SiO_2/Si Using Surface Charge Spectroscopy

✉ KWOK Wai Man Raymond

☐ 1 December 1996

❖ CUHK Research Committee Funding

In microelectronics, the dimension of electronic devices under current production has already passed the one-micron milestone and is heading to below 0.1 micron. Among all device structures, the insulator/semiconductor structure remains the most widely used and thus deserves the best effort in its optimisation. For the current production of SiO_2/Si devices, the switching gate oxide thickness is already about 100Å. The requirement of a high quality ultrathin insulator/semiconductor structure also raises the necessity of a surface sensitive technique for the determination of the chemical and electrical properties of the structures, particularly the physical

location, energy levels and density of the charge traps across the structure. In the proposed studies, surface charge spectroscopy (SCS) which satisfies all the previously mentioned analytical needs, will be further developed and used for the analysis of the ultrathin insulator/semiconductor structures. The studies will include the analysis of thermal SiO₂/Si, plasma enhanced chemical vapor deposition (PECVD) SiO₂/Si after forming gas annealing and thermal SiO₂/Si after forming gas annealing. In addition to the electrical information that will be obtained from SCS, chemical information will also be obtained by various analysis techniques. The results will give a much better picture on the fundamentals of the SiO₂/Si structure and will provide guidelines to improve its properties.
(PS96007)

Synthesis and Application of Organo-transition Metal and -Lanthanide Compounds in Olefin Polymerisation and Asymmetric Catalysis

- ✉ LEUNG Wing Por Kevin
□ 1 October 1996
❖ Research Grants Council

Organometallic complexes which can potentially act as catalysts for olefin polymerisation and asymmetric catalysis will be studied. This work will attempt to prepare Group 4 transition metal (Ti, Zr and Hf) compounds based on novel *N*-functionalised alkyl ligands and di-*N,N'*-centred ketiminato ligands recently developed in our group. It is anticipated that the variation of organic ligands and leaving groups on the metal centres will play a key role in optimising the activity of polymerisation and asymmetric transformations. Furthermore, the control of polymer properties by catalyst tuning will allow a wide range of polymers to be formed.

Likewise, syntheses of organolanthanide (La, Sm, Yb and Eu) compounds based on new cyclopentadienyl ligands with functionalised alkyl groups and/or chiral substituents will be attempted. Their applications in asymmetric catalysis will be explored. Novel compounds prepared in this work will be characterised by nmr spectroscopy, FAB mass spectrometry and X-ray crystallography.
(CU96720)

Synthesis and Characterization of Functional Rare Earth Complexes with Organic Ligands

- ✉ MAK Thomas Chung Wai ● ZHANG Hong-jie*
● NI Jia-zuan*
□ 1 August 1996
❖ Research Grants Council

The rare earth elements (or lanthanides) generally refer to lanthanum plus the fourteen elements, namely

cerium to lutetium, that follows it in the periodic table. Lanthanide research is expanding rapidly and pursued by numerous practitioners, especially in China which boasts one of the world's largest deposits of rare earth ores.

Although the simple inorganic compounds of the lanthanides (for example, their complex oxides and sulfides) have been widely explored for commercially useful properties such as luminescence, magnetism and high-temperature superconductivity, the study of their complexes with organic ligands as functional materials has received relatively little attention. In a collaborative project that combines the proven expertise at two research centers, namely the Department of Chemistry, The Chinese University of Hong Kong and the State Key Laboratory of Rare Earth Chemistry and Physics, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences (CCIAAC), the researchers propose to carry out synthetic studies using a variety of organic ligands and characterize the resulting complexes using x-ray crystallography and a range of modern physical methods. The spectroscopic, electric and magnetic properties of the complexes will be measured and correlated with their solid-state structural parameters, and hopefully the findings will provide a basis for the rational design of new rare earth materials with desirable physico-chemical properties.
(CU96705)

Syntheses and Biological Evaluation of Pseudo-disaccharides as Potential Glycosidase Inhibitors

- ✉ SHING Kung Ming Tony
□ 1 September 1996
❖ Research Grants Council

Valienamine is a natural pseudo-aminosugar and an important component of the powerful α -glucosidase inhibitors acarbose and adiposin (TAI-2). Acarbose and adiposin (TAI-2) are classified as pseudo-tetrasaccharides because they contain three sugar units and one valienamine unit linked together. On the basis of their bioactivity and medicinal potential, this research programme proposes to prepare, from quinic acid, valienamine-containing pseudo-disaccharides that will be tested for glycosidase inhibitory activities. Chemical preparation (synthesis) of pseudo-disaccharides will give substances {structurally related to acarbose and adiposin (TAI-2)} for biological tests as a means of providing improved drugs and novel structure-inhibitory activity relationship. Continued testing of synthetic compounds that may lead to useful medicines is essential to continuing progress in AIDS and diabetes chemotherapy and therein lies the significance of this project.
(CU96711)

Enantiospecific Synthesis of Antifertility Agent Zoapatanol

- ✉ SHING Kung Ming Tony
 ☐ 1 September 1996
 ❖ CUHK Research Committee Funding

This research programme is concerned with construction of enantiomerically pure zoapatanol from D-glucose via a novel strategy involving an intramolecular [3+2] nitronc cycloaddition to form the oxepane moiety.
 (PS96008)

Development of a Portable Fiber Optical Particle Sizing Sensor for Local Industrial Applications and Environmental Protection

- ✉ WU Chi
 ☐ 1 August 1996
 ❖ Industrial Support Fund, Industry & Technology Development Council

Since the establishment of the First Particle Size Analysis Laboratory in Hong Kong, the researchers have started to serve local companies. The response is very positive. However, instead of bringing samples to their laboratory, the researchers often face the request of analyzing the particle size and size distribution on a production or environmental testing site. Therefore, it is necessary to develop a portable particle size analysis instrument. Fortunately, recent developments in solid state laser, optical fiber, fast electronics and portable computer have provided them an opportunity to miniaturize their present dynamic laser light scattering particle sizing instrument into a portable fiber optical sensor.
 (PS96002)

Light-Scattering Studies of Optically Active Sugar-Containing Polyacrylates

- ✉ WU Chi ● SHING Kung Ming Tony
 ☐ 1 October 1996
 ❖ CUHK Research Committee Funding

Recently, a series of optically active sugar-containing polyacrylates have been developed. The laser light scattering studies of these novel polyacrylates will provide many molecular parameters, such as the weight-averaged molar mass, molar mass distribution, the chain conformation and the correlation between optical properties and the chain rigidity. Such obtained molecular properties can be used in further developments of better optically active polymer materials.
 (PS96009)

Diffusion Inside Nanocavities of Polymer Gel Networks

- ✉ WU Chi ● AU-YEUNG Chik Fun Steve ● LIN Ge (Pharmacology) ● HUNG Leung Kim (Orthopaedics & Traumatology)
 ☐ 1 January 1997
 ❖ Research Grants Council

Diffusion of molecules inside cavities is a commonly occurring process in nature, and has been observed for a large variety of systems including water in biological cells and oil in plants or sandstone. The investigation of the transportation inside and between small cavities with an average size comparable to the size of the diffusing molecules is not only fascinating and important in basic research, but it also has immense direct technological implications, e.g., in the controlled release of drug or pesticide. It is well known that polymer chains can be interconnected to form a three-dimensional gel network containing small cavities (meshes, ~10 nanometers) filled with solvent molecules. The researchers intend to systematically study the diffusion of the probes with different sizes, such as drug molecules, nanoparticles and proteins inside poly(*N*-isopropylacrylamide) gel, whose cavity size can be readily controlled by temperature variation. To accomplish this goal, a range of modern methods, such as *laser light scattering*, *in-situ interferometry*, *holographic relaxation spectroscopy*, *Fraunhofer diffraction* and *nuclear magnetic resonance*, will be used. The objective is to obtain insights into the transport properties of the probes inside the gel networks and how they are influenced by both the sizes of the nanocavity and of the diffuser. If the diffusion process inside a confined space can be formulated, the researchers will be able to change the present time-consuming trial-and-error practice in the development of a controlled releasing device into a more efficient one.
 (CU96707)

The Chemistry of Highly Electrophilic Cationic Organolanthanide Complexes

- ✉ XIE Zuwei
 ☐ 1 September 1996
 ❖ Research Grants Council

The chemistry of electrophilic cationic organolanthanide complexes is virtually unexplored. In view of the dominant role of cationic organometallic complexes of d-block transition metals in a wide range of industrially important catalytic reactions, it is remarkable that the chemistry of the corresponding organolanthanide compounds is essentially unknown. It is anticipated that cationic organolanthanide complexes will participate in a

wide range of reactions, such as the activation of C-H, C-C and C-O bonds, as well as the activation of small molecules such as CO, NO, CO₂, SO₂, O₂ and N₂. It is further speculated that such complexes might be even more active than existing cationic d-block transition metal complexes in olefin and alkyne transformations including polymerizations and hydrogenations. It is proposed to explore cationic organolanthanide chemistry using recently developed carborane anions whose extreme inertness and low nucleophilicity should impart very high electrophilicity the cations. (CU96708)

Activation of Saturated Hydrocarbon C-H Bonds by Transition Metal Complexes

- ✉ XIE Zuowei
- 1 January 1997
- ❖ CUHK Research Committee Funding

The activation of saturated C-H bonds is a challenging problem. It would not only greatly enhance synthetic capabilities but would also significantly multiply the potential uses of hydrocarbon feedstocks. It has been known that certain transition metal complexes can react to break normally inert carbon-hydrogen bonds, but these processes typically require photochemistry or elevated temperatures and no chemical selectivity. As the development of no coordinating anion chemistry, a new cationic iridium (III) complex was recently reported to perform unusually mild and selective hydrocarbon C-H bond activation (*Science*, 1995,270, 1970). In this proposal, the researchers propose to develop a new system by using chiral and achiral three-coordinate phosphorus-bearing carborane anions or two-coordinate phosphonium-bearing carborane as ligands, so that the electron deficiency of the metal center would be increased. It is expected that the proposed system would be even more active than the existing one and may stereoselectively functionize hydrocarbon C-H bonds. (PS96022)

Pilot Investigations of a Photocatalytic System for the Degradation of Indoor Volatile Organic Compounds

- ✉ YU Chai Mei
- 16 December 1996
- ❖ CUHK Research Committee Funding

Pilot studies on a novel system for the treatment of indoor organic contaminants will be carried out. The system is based on an advanced oxidation process - photocatalysis. A photocatalyst interacts with light to generate highly reactive oxidizing agents that attack and destroy organic pollutants in air. Once the design

and conditions are optimised, this system has great potential in home and commercial applications. The effectiveness of this system will be tested by measuring its ability to degrade common volatile organic compounds, such as acetone and isopropyl alcohol, in a confined environment. (PS96010)

Please refer to previous issues of *Research Projects Summary* for more details of the following ongoing research at the department:

Edition	Title/Investigators
1995-96	Construction of Cobalt (III) Porphyrin Based Coordination Polymers and Its Application to the Synthesis of the Dimensional Organic Conductors (CU95726) ✉ AU-YEUNG Chik Fun Steve
1994-95	Asymmetric Catalysis by Metal Complexes of Chiral Pyridyl Phenols and Their Derivatives (PS94010) ✉ CHAN Kin Shing
1995-96	Synthesis and Properties of Non-bridged Rhodium[II] and Iridium[II] Metal Dimers (BP94001) ✉ CHAN Kin Shing
1995-96	Determination of Transition-Silyl Bond Dissociation Energies (CU94707) ✉ CHAN Kin Shing
1995-96	Studies of Chemical Dynamics of Ultraviolet Laser-induced Desorption/Ionization of Oligonucleotides (CU95727) ✉ CHAN Tak Wah Dominic
1995-96	Expanding the Uses of A New Version of the Ramberg-Backlund Reaction in Organic Synthesis (CU93714) ✉ CHAN Tze Lock
1994-95	Solubilization of Intractable Compounds by Dendritic Modifications (PS95007) ✉ CHOW Hak Fun
1995-96	The Role of the Electronic Factor on the Stereoselectivity of Organic Reactions: A Molecular Design and Artificial Intelligent Approach (CU93708) ✉ CHOW Hak Fun ● CHAN Lai Wan (Computer Science & Engineering)
1995-96	Synthesis and Physical Properties of Novel Polymeric Materials:

- Monodisperse, Homochiral Starburst Dendrimers (CU94709)
✉ CHOW Hak Fun
- 1995-96 Catalytic Dendrimers - Artificial Enzyme Mimics (CU95723)
✉ CHOW Hak Fun
- 1993-94 The Development of an Automated System for Rapid Screening of Radon Levels in the Environment (BP93024)
✉ HON Ping Kay ● YU Chai Mei ● LAU Oi Wah
- 1989-90 Study of Oxygen Chemisorption on Zr(0001) by LEED (BP89043)
✉ HUI Ka Chung
- 1995-96 Low-energy Ion Beam Deposition of High Quality Diamond (PS95031)
✉ HUI Ka Chung
- 1995-96 Surface Passivation of InP and Related Semiconductors by Polysulphides (CU94716)
✉ KWOK Wai Man Raymond ● WONG Sai Peng Joseph (Electronic Engineering) ● HUI Ka Chung
- 1995-96 Assessment of the Quality and Curative Effects of Epimedium Species by Chemical Pattern Recognition Techniques (PS95019)
✉ LAU Oi Wah ● YEUNG Hin Wing (Biochemistry) ● NG Tzi Bun (Biochemistry)
- 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
- 1995-96 Synthetic and Structural Studies of Metallacycles (CU93711)
✉ LEUNG Wing Por Kevin
- 1995-96 Synthesis and Reactivities of N-Functionalised and Sterically Hindered Metal Alkyl Complexes (CU94717)
✉ LEUNG Wing Por Kevin ● MAK Thomas Chung Wai
- 1995-96 *Ab initio* and Semi-empirical Studies of Novel Molecular Species (PS95034)
✉ LI Wai Kee ● SO Suk Ping
- 1995-96 First Principle Molecular Dynamics Study on HCl Water Cluster, HCl Adsorption on Ice Surface, and the Reaction Between HCl and HOCl on Ice Surface (PS95035)
✉ LIU Zhifeng
- 1989-90 X-Ray Analysis of Crystal Structures (BP72001)
✉ MAK Thomas Chung Wai
- 1989-90 Metal Coordination by Betaines (BP88025)
✉ MAK Thomas Chung Wai
- 1995-96 Synthesis and Structural Studies of Metal Complexes Containing Polyfunctional Carboxylate-like Ligands (CU93713)
✉ MAK Thomas Chung Wai
- 1995-96 Synthesis, Structures and Properties of Binuclear and Polynuclear Complexes (CU94722)
✉ MAK Thomas Chung Wai ● YOU Xiao Zeng* ● KANG Bei Sheng*
- 1995-96 Studies in Host-guest Chemistry (CU95711)
✉ MAK Thomas Chung Wai ● WONG Nai Ching Henry
- 1995-96 Synthesis of New Heterometallic Bi- and Tri-Nuclear Complexes Containing Metal-Metal Bonds (PS95009)
✉ MAK Thomas Chung Wai
- 1995-96 Exploratory Studies in Solid-state and Hydrothermal Synthesis (PS95036)
✉ MAK Thomas Chung Wai ● KWOK Wai Man Raymond
- 1995-96 Ring-opening Polymerization of Strained Molecules with n-Cycloheptatrienyl Molybdenum and Tungsten Complexes (PS95030)
✉ NG Kee Pui Dennis
- 1995-96 High-valent Oxo- and Thio-tungsten Complexes - Models for the Active Sites of Tungsten-containing enzymes (CU95721)
✉ NG Kee Pui Dennis
- 1995-96 Synthetic Studies on Quassinoids: Syntheses of Optically Active Simalikalactone D and Quassinarin (CU94712)
✉ SHING Kung Ming Tony

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|---------|---|--|
| 1995-96 | Studies on the Construction of O-heterocycles from Carbohydrates via Intramolecular Nitronc Cycloaddition (CU95712)
✍ SHING Kung Ming Tony | ✍ WONG Nai Ching Henry |
| 1989-90 | Theoretical Studies of (a) Aluminium-Ethylene Complexes (b) CH ₃ SOH ⁺ (c) Ge Compounds (d) HPOH and HNOH (BP89048)
✍ SO Suk Ping | 1995-96 Synthesis of Sesquiterpenoids Furanoedesmanes by Utilizing a 3, 4-Disubstituted Furan as a Pivotal Precursor (CU95704)
✍ WONG Nai Ching Henry |
| 1989-90 | Synthesis of Novel Aromatic Compounds (BP83001)
✍ WONG Nai Ching Henry | 1995-96 Total Synthesis of Sphydrofuran and Secosyrin 1 (PS95037)
✍ WONG Nai Ching Henry |
| 1995-96 | 3, 4-Bis(trimethylsilyl)- and 3, 4-Bis(trialkylstannyl)-furans, Pyrroles and Thiophenes: Versatile Building Blocks of 3, 4-Disubstituted Five-Membered Heterocycles (CU93701)
✍ WONG Nai Ching Henry | 1995-96 Laser Light Scattering Study of Polyelectrolytes in Solution (CU94705)
✍ WU Chi ● CHAN Sunney I.* |
| 1995-96 | Regiospecific Conversion of 3,4-Bis(trimethylsilyl) Furan to 2,3-Disubstituted, 2,4-Disubstituted, 2,3,4-Trisubstituted, and 2,3,5-Trisubstituted Furans (CU94701) | 1995-96 The Adsorption of Polyelectrolytes on Nanoparticles (CU95707)
✍ WU Chi |
| | | 1995-96 Synthesis, Structure and Reactivity Studies of f-Element Metallocarborane Complexes (PS95029)
✍ XIE Zuwei |

RESEARCH OUTPUTS AND PUBLICATIONS

- <P951710> **Song, Zhi-Zhong and Henry N.C. Wong.** "Regiospecific Displacement of the C-B Bond of Tris[4-(substituted)furan-3-yl]boroxines with C-Sn Bond and C-O Bond: Syntheses of 3,4-Disubstituted Furans and 4-Substituted-3(2*H*)-furanones1,2". *Journal of the Chinese Chemical Society* vol.42, pp.673-679. Taiwan, 1995.
- <P951712> 許遵東、黃乃正. <Azlactonos 在乙酸鈉催化下的酯交換反應>. 《有機化學》 第 15 期, 頁 292-295. 中國上海, 1995.
- <P951714> **Zhou, Shuiqin and Chi Wu.** "Laser Light Scattering Study of a Very Dilute Water/Sodium Bis(2-ethylhexyl)sulfosuccinate/*n*-Hexane Microemulsion Stabilized by Poly(*N*-isopropylacrylamide)". *Macromolecules* vol.28, pp.5225-5229. USA, 1995.
- <P952408> **Wu, Chi; Mohammad Siddiq and Ka Fai Woo.** "Laser Light-scattering Characterization of a Polymer Mixture Made of Individual Linear Chains and Clusters". *Macromolecules* vol.28, pp.4914-4919. USA, 1995.
- <P953229> **Wei, Ping-Rong; De-Dong Wu and Thomas C.W. Mak.** "Synthesis and Molecular Structures of (*N*-carboxymethyl)dimethylammonioacetate and its Hydrochloride: Me₂N(CH₂CO₂H)CH₂CO₂ and Me₂N(CH₂CO₂H)CH₂CO₂.HCl". *Journal of Molecular Structure* vol.372, pp.181-186. UK, 1995.
- <P953230> **Li, Qi; Wai Hing Yip and Thomas C.W. Mak.** "Hydrogen-Bonded Urea-Anion Host Lattices. Part 2. Crystal Structures of Inclusion Compounds of Urea with Tetraalkylammonium Bicarbonates". *Journal of Inclusion Phenomena and Molecular Recognition in Chemistry* vol.23, pp.233-244. The Netherlands, 1995.

- <P953231> **Wu, De-Dong and Thomas C.W. Mak.** "Molecular Structures and Hydrogen Bonding in the Crystalline Hydrates of Two Flexible Double Betaines with Different Quaternary Ammonio Groups in the Adipic Acid Skeleton". *Journal of Molecular Structure* vol.372, pp.187-193. UK, 1995.
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RESEARCH PROJECTS

Fast Iterative Methods for Wiener-Hopf Equations

- ✉ CHAN Hon Fu Raymond
- ☐ 1 December 1996
- ❖ CUHK Research Committee Funding

Wiener-Hopf equations arise in many scientific and industrial applications such as linear prediction problems, diffusion problems and scattering problems. Their solutions are usually obtained by discretizing the equations with quadrature rules and solving the resulting linear systems. If the lowest order rectangular rule is used, Toeplitz systems are obtained and for such systems, fast algorithms already exist. However, to improve the accuracy of the solution, higher order quadrature rules are usually employed and they lead to matrix equations that are in general no longer Toeplitz. The researchers propose to use preconditioned conjugate gradient methods to solve these systems. The preconditioner is constructed by approximating the Fourier transform of the kernel of the given equation by sinc functions. The best approximant is the solution to a minimax problem and can be obtained by the Remex method. Because the researchers' preconditioner is constructed from an approximation of the original equation, their algorithm will be independent of the quadrature rule used and the researchers expect it to give better performance than other preconditioners that are constructed directly from the discretized matrices. The researchers will compare their algorithms with other known ones in image deblurring problems and linear prediction problems. Convergence analysis of their method will also be carried out.
(PS96016)

Curvature Flows for Curves and Surfaces

- ✉ CHOU Kai Seng
- ☐ 1 August 1996
- ❖ Research Grants Council

A stone on the beach wears under waves. In an ideal setting its sharp part wears out faster than the blunt part. Eventually the surface of the rock becomes round and smooth. The Worn Stone exemplifies curvature flows in which curves or surfaces evolve with rates proportional to the curvature. A large portion of physical models are curvature flows. However, due to their analytical complexity a rigorous mathematical study on these flows did not exist until early eighties. Apart from their physical background, mathematicians also use them as a tool to find canonical objects in differential geometry.

Now the theory is exploding. Many important applications are expected. It is proposed to study some curvatures flows for curves or surfaces arising from interfacial motion. Outcome of the study could be used to test the correctness of the model. Also new insights into the structure of these flows are expected.
(CU96722)

Equivariant K-Theory and Equivariant REAL K-Theory

- ✉ LAM Siu Por
- ☐ 1 November 1996
- ❖ CUHK Research Committee Funding

The researchers intend to study the various variations of the equivariant K-theory constructed and studied by Atiyah and others. One notable variation is the equivariant REAL K-theory constructed by Atiyah for getting around the difficulty in generalising the Index Theorem to the orthogonal case. The REAL K-theory is a mixture of complex K-theory and K-theory with self-conjugacy property. They will take some important results about equivariant K-theory, and see if these results survive in the new setting. Some of the results to be examined include the Completion Conjecture and the detection result for equivariant K-theory by restrictions to finite subgroups. In the process, they will be studying the problem of existence of transfers in equivariant REAL K-theory and Brauer's induction theorem for REAL representations. In longer term, the researchers will also study another variation which is the equivariant K-theory associated with C^* -elliptic operators and the REAL analogue. These theories are related on one hand to C^* -elliptic operators and to algebraic K-theory of C^* -algebras on the other. They will carry out this project mainly from the standpoint of homotopy theory.
(PS96025)

Dilation Equations and Fourier Transformation

- ✉ LAU Ka Sing
- ☐ 1 October 1996
- ❖ CUHK Research Committee Funding

Dilation equation is a new type of functional equation. The solution is called a scaling function and it plays a central role in Wavelet theory and Fractal theory. The researchers propose to investigate the Fourier transformation of such solutions.
(PS96017)

Decoding Algorithms of Algebraic Geometric Codes

- ✉ LUK Hing Sun
□ 1 June 1997
❖ CUHK Research Committee Funding

An important development in the theory and practice of error-correcting codes in recent years is the construction of algebraic geometric codes which are more efficient and offer greater flexibility in the choice of code parameters. In particular, modular codes which exceed the Gilbert-Varshamov bound have been used in real channel transmission problems. Hence it is of great importance to derive efficient decoding procedures for algebraic geometric codes with strong error-correcting capacities. In 1993, Feng-Rao and Ehrhard published decoding algorithms to correct errors up to the designed minimum distance. Subsequently, Chen and Yau gave a new interpretation of the Ehrhard algorithm under a weaker condition, using the so-called basic algorithm in the pioneering work of Justesen et al. In this project, the researcher proposes to find the error-correcting capacities of the Feng-Rao and Ehrhard algorithms. This includes finding the exact number of correctable errors and the error patterns which can be corrected by these algorithms. Secondly he proposes to find a joint description of these algorithms with no restriction on the algebraic geometric codes and their parameters. The ultimate aim of his proposal is to find decoding algorithms for algebraic geometric codes up to the true minimum distance.
(PS96026)

Second-Order Generalized Derivatives of Nonsmooth Functions

- ✉ NG Kung Fu
□ 2 December 1996
❖ Research Grants Council

In the context of nonsmooth functions, the researchers study various versions of second-order derivatives with the aim of unification as well as applications to nonsmooth optimization.
(CU96706)

Mathematical Theory of Option Pricing

- ✉ SHUM Kar Ping
□ 1 October 1996
❖ CUHK Research Committee Funding

In this project, the pricing mechanism of interest rate exotic options in an arbitrage-free world will be explored. In particular, the researchers will conduct out work under the Heath, Jarrow and Morton (HJM)

framework. There are a lot of related work on pricing mechanisms on exotic options but most of them are based on the usual Black-Scholes assumptions. These methods do give good approximations for the equity, commodity and currency options but to the best of their knowledge no one claim that these methods also give and consistent approximations for interest rate options. Thus, in this project, they will explore the pricing mechanism of interest rate exotic options in an arbitrage-free way.
(PS96018)

Analytic Problems on Complete Manifolds

- ✉ TAM Luen Fai
□ 1 September 1996
❖ Research Grants Council

The researcher would like to continue his study of the problems for heat flow for harmonic maps various conditions on the manifolds and the initial maps. Namely, the problem of short time existence, long time existence and the convergence of the flow. He also proposes to study proper harmonic maps between noncompact Riemannian manifolds in general, and boundary value problem for proper harmonic maps between hyperbolic spaces in particular. The researcher would like to study a question on the existence of harmonic diffeomorphisms between noncompact oriented Riemannian surfaces which are not quasiconformal to each other. This is a question arises in the theory of deformation of Riemann surfaces. The researcher proposes to study the properties of hyperbolic Cartan-Hadamard manifolds, which are related to the above problems on harmonic maps. He also proposes to study some Liouville type properties on harmonic maps on manifolds. In particular, he would like to understand the image of harmonic maps from a manifold which is quasi-isometric to a complete manifold with nonnegative Ricci curvature into a Cartan-Hadamard manifold, under certain conditions on the maps or on the target manifold. The results and methods may conditions on the maps or on the target manifold. The results and methods may be useful in the study of harmonic maps on singular spaces.
(CU96704)

Concentration Phenomena in Nonlinear Elliptic Equations

- ✉ WEI Juncheng ● CHOU Kai Seng
□ 1 September 1996
❖ Research Grants Council

The goal of this project is to develop a unified mathematical approach to the study of various

concentration phenomena in nonlinear elliptic equations. These equations arise from diverse branches of physical sciences, ranging from phase transition in super conductors and superfluids, concentrations of thin plasma rings, movements of cells in chemotaxis, to the condensation of virus in certain populations. Concentration is anticipated when some parameters are very small. The researchers' main interest is to study how the concentration occurs, where it happens and how it looks like asymptotically. It will help to explain many significant physical as well as mathematical phenomena.
(CU96721)

Modern Numerical Methods for Industrial/Engineering Problems: Electro-magnetic Field, Oil Reservoir/Aquifer Simulations, and Queuing Networks

✉ ZOU Jun ● HON Benny Y.* ● CHAN Hon Fu Raymond

☐ 1 July 1996

❖ Research Grants Council

Modern numerical methods, mainly multilevel/multigrid and domain decomposition methods, combined with other preconditioning iterative techniques, will be developed for solving Maxwell's equations in the electro-magnetic field, inverse problems in identifying sources and parameters and queuing network problems. The researchers will first propose special decoupling and linearizing techniques to handle the coupling, non-linearity, singularity and ill-posedness, and techniques to related discrete queuing networks to continuous boundary value problems. The finite difference and finite elements methods combined with variational principles will be used to discretize these systems, along with implicit time discrete schemes. Finally multilevel/multigrid and domain decomposition *methods* will be constructed to solve all discrete systems. In addition to a large amount of numerical experiments, great effort will be made to develop a systematic convergence and stability theory for concerned algorithms.
(CU96513)

Please refer to previous issues of *Research Projects Summary* for more details of the following ongoing research at the department:

Edition Title/Investigators

1995-96 The Study of Topological Invariants on Knots and Planar Fronts and Their Relation with Integral Geometric Energies (PS95028)
✉ AU Kwok Keung Thomas

1995-96 Fast Iterative Methods for Signal Processing Problems (CU93178)
✉ CHAN Hon Fu Raymond

1995-96 Parallel Iterative Methods for Large Scale Scientific and Engineering Computing (CU94710)
✉ CHAN Hon Fu Raymond ● HUANG Hong Ci* ● SHIH Tsi Min*

1995-96 Calculus of Variations via Exterior Differential Systems (PS94014)
✉ CHAN Hon Fu Raymond ● CHEUNG Wing-Sum*

1995-96 Symmetry and Geometric Properties via Maximum Principles (CU92704)
✉ CHOU Kai Seng ● LUK Hing Sun ● WAN Yau Heng Tom ● CHAN Hon Fu Raymond ● YUNG S. P.*

1995-96 A Characterisation of the Image of the Atiyah Homomorphism in K-theory (PS95027)
✉ LAM Siu Por

1994-95 C*-Algebras of Real Rank Zero and the Generalized Calkin Algebras (PS94005)
✉ LEUNG Chi Wai ● TAM Ping Kwan

1995-96 Invariants and Classification of Compact Strongly Pseudoconvex CR Manifolds (CU94714)
✉ LUK Hing Sun ● YAU S. T. Stephen*

1995-96 Nonlinear Functional Analysis and Applications (CU94706)
✉ NG Kung Fu ● WONG Yau Chuen

1995-96 Variational Principle and Asymptotic Conditions (PS95026)
✉ NG Kung Fu

1995-96 Crossed Products: Hopf Algebras and Their Applications (CU94702)
✉ SHUM Kar Ping ● XU Yonghua*

1994-95 Non-Commutative Analysis (PS95011)
✉ TAM Ping Kwan

1995-96 Harmonic Maps between Hadamard Surfaces and Universal Teichmüller Space; Function Theory and Structures of Complete Manifolds (CU94708)
✉ WAN Yau Heng Tom ● TAM Luen Fai ● AU Kwok Keung Thomas

1995-96 Spike Layer Solutions To Some
Nonlinear Elliptic Equations (CS95014)
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1995-96 Numerical Solutions of Thermoelastic
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✉ ZOU Jun

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see also <P971325>

RESEARCH PROJECTS

Model Study of Fracture Propagation in Solids

✉ CHING Shuk Chi Emily ● NAKANISHI Hiizu*
● LANGER James S.*

□ 1 October 1996

❖ Research Grants Council

The propagation of fracture or crack in brittle solids under stress is a problem of obvious practical importance. Understanding how and when fracture propagates, especially when it propagates catastrophically, is crucial to the effective prevention of disasters resulting from breakage of, e.g. natural gas pipes and buildings, and is also relevant to the study of earthquakes. On the other hand, this problem is interesting, in its own right, as a special class of mathematical problems. Although fracture propagation in materials has been actively studied, especially in the engineering community, for many years, the mechanisms that govern the dynamics of cracks are not yet well understood. There is a fundamental unresolved puzzle as of why experimentally observed crack speeds are much slower than the theoretical maximum - the Rayleigh wave speed. Moreover, there have been recent experimental evidence indicating that fast-propagating fracture encounters some kind of oscillatory instability at velocities appreciably below the Rayleigh speed. In this project, the researchers propose to study fracture propagation in solids via a series of simple but complete mathematical models, with special focus on the stability problem. The mathematical models that the researchers use are highly idealized simplifications of the complex phenomena that take place in real-life fracture. But their simplicity allows the researchers to obtain analytic results and, from these, to learn what ingredients will be needed in more realistic theories. (CU96718)

Theoretical and Computational Study of Sonoluminescence

✉ CHU Ming Chung ● LEUNG Pui Tang

□ 1 September 1996

❖ Research Grants Council

Under certain conditions, an air bubble in water driven to oscillation by ultrasound emits a narrow pulse of light in each cycle. This conversion of sound into light, thus-called sonoluminescence, represents a trillion-fold concentration of energy, and an extraordinarily high temperature and density, exceeding a million degree Kelvin and a hundred million ATM according to some estimates, could be reached at the center of the bubble. The Physics of

sonoluminescence is not only interesting in its own right, but may also find applications in many fields ranging from chemistry to materials science, where an efficient mechanism of energy concentration can be useful. Many aspects of the phenomenon are not currently understood, including the stability conditions, the light emission mechanism, as well as its sensitivity to experimental conditions such as the water temperature. The researchers propose to seek a better understanding of these aspects by studying the phenomenon within the hydrodynamical framework. The temperature, pressure, and density profiles inside the bubble throughout an oscillation cycle will be obtained by solving the hydrodynamic equations and then used to compute various observables that can be compared with experiments and hypothetical models. (CU96715)

Coalescences of Neutron Star Binaries: Effects of Nuclear Physics

✉ CHU Ming Chung

□ 1 November 1996

❖ CUHK Research Committee Funding

A major research program to study the coalescences of binary neutron star systems using numerical general relativistic hydrodynamic simulations is being developed by our University's astrophysics group, as part of an international collaboration. The study of such coalescences is important to the understanding of observations in gamma ray astronomy and gravitational wave astronomy, two major new fields in astrophysics. Our local team will focus particularly on the nuclear physics input, i.e., properties of hadron matter at high densities and temperatures attained in the coalescences. Three classes of hadron matter equation of state (EOS) will be considered: EOS with traditional nuclear matter, EOS with quark-gluon components, and EOS with meson condensates. The dependences of the neutron star coalescence dynamics and the resulting gravitational radiation on these EOS's will be investigated using massively parallel computation. With this project we aim at building a research team based in The Chinese University of Hong Kong, doing computational astrophysics research work at the forefront of the world stage, with direct links to strong research groups worldwide. (PS96011)

Properties of Undercooled Molten Eutectic Alloys

✉ KUI Hin Wing

□ 1 October 1996

❖ Research Grants Council

Metallic glass is formed by rapid quenching from the melt, but rapid heat removal requires that the

specimen be extremely thin, about 50 μ m. Bulk samples can only be prepared by slow cooling, but below the thermodynamic melting temperature T_m , crystallization occurs easily by nucleation around impurities. Novel techniques to remove impurities have allowed many metallic alloys to be cooled to hundreds of degrees below T_m , while staying in the liquid state. We have shown that for three alloys, at sufficiently low temperatures, the undercooled melt remarkably splits into two or more liquids (liquid state phase separation) co-existing and intertwined with each other, before transforming to the crystalline state or continuously hardening to the glassy state. The reason is the diminished importance of the entropy S (which favours mixing) at lower temperatures T , since S enters the Gibbs energy via TS . These metastable liquid states (before and after separation) may be viewed as novel forms of matter, interesting in their own right, and more importantly as intermediaries in the formation of metallic glass in the bulk. In the light of these novel phenomena, research is proposed to

- (1) examine if liquid state phase separation is found in a broad class of glass forming alloys;
 - (2) study the crystallization of the phase separated liquids; and
 - (3) study the effect of liquid state phase separation on the glass forming ability of molten alloys.
- (CU96719)

Synthesis of Glassy Spinodals in Eutectic Alloys

- ✉ KUI Hin Wing
- ☐ 1 January 1997
- ❖ CUHK Research Committee Funding

Recently, the researchers have demonstrated that molten Pd-Ni-P and Pd-Si undergo liquid state phase separation LPS in the undercooling regime. This is a novel result which has been searched over the years by many prominent research groups. There are two reactions in the LPS including liquid state nucleation and growth, and liquid spinodal decomposition LSD. Since LSD is a spontaneous reactions, it has a very important impact on the glass forming ability of eutectic alloys: As a melt is undercooled below its melting temperature or liquidus, when entering into the LSD regime, it will phase separate spontaneously into multiple liquid spinodals of compositions different from that of the original melt. Therefore, in contrast to earlier belief, they are NOT dealing with a homogeneous liquid, but rather a few liquids of different compositions.

In this proposal, the researchers have two objectives in mind:

- (1) To generalize LPS to other eutectic alloys, in other words, LPS is a general behavior of eutectic systems;

- (2) There are many applications of LPS. In this proposal, they will only focus on the synthesis of a metallic system with glassy spinodals.
- (PS96012)

Negative Conductivity in Weakly Ionized Gases

- ✉ LAW Yam Kuen Dennis
- ☐ 1 September 1996
- ❖ Research Grants Council

In the proposed research, the interesting phenomenon of negative electronic conductivity - reduced electronic mobility at increasing electric field strength (the case of negative differential conductivity), or negative electronic mobility at positive field strength (the case of absolute negative conductivity) - in low temperature, weakly ionized atomic and molecular gases will be investigated. Pure or mixed gases of interest to plasma applications (viz. CO₂/He, Ar/F₂, Xe/Cs, Xe/He, Cs/F₂ ... etc.) will be studied in detail for the possibility of negative conductivity in pulsed or stationary mode. By means of numerical model calculations, physical parameters such as gas pressure, gas composition, electric field strength, ionization fraction, source strength of external ionization ... etc. that can lead to the occurrence of negative differential conductivity (NDC) and absolute negative conductivity (ANC) will be determined. Calculation results are then to be verified and tested by swarm experiments. Potential applications such as amplification of electromagnetic waves, and plasma instabilities will be assessed and explored.

(CU96701)

Vacuum Ultra-Violet Spectroscopic Study of F₂, X₂, Kr₂ Generated by Fast Discharge Excitation

- ✉ LAW Yam Kuen Dennis ● WONG R.*
- ☐ 1 December 1996
- ❖ CUHK Research Committee Funding

The aim of the proposed research is to supplement the on-going research at Shanghai Institute of Optics and Fine Mechanics (SIOFM) on discharge-pumped high power F₂ lasers at 157 nm. While the Principal Investigator had been supported previously by Mainline Research grant to bring about a very fruitful collaborative effort with Russian scientists (two journal papers produced), this project represents a *new scientific collaboration* between the Science Faculty of The Chinese University of Hong Kong and a State Key Research Institute in Mainland China.

(PS96014)

Many-Body Physics of Novel Electronic Materials in Reduced Dimensions

✉ LIN Hai Qing

□ 1 September 1996

❖ Research Grants Council

The researchers propose to carry out theoretical investigations of novel electronic materials in reduced dimensions. Included in this class of materials are conducting polymers, organic conductors, and superconductors (high T_c superconductors and fullerenes). In particular, the researchers propose to apply analytical methods - including perturbation theory, Hartree-Fock, and Bethe Ansatz solutions - as well as numerical methods - including exact diagonalization (Lanczos) and quantum Monte Carlo simulations, to study the subtle many-body problems that arise from the complex interplay of electron-electron and electron-phonon interactions in systems exhibiting strong anisotropies in electronic properties and having a wide range of effective band-fillings. The researchers plan to focus on the quasi-one-dimensional and quasi-two-dimensional variants of Hubbard-like models in order to develop a general framework for understanding properties of strongly correlated materials. The researchers will study the ground state and excited states, the dynamical properties, and microscopic mechanisms for broken symmetry states, including ferromagnetism and superconductivity. As a side benefit of this research, they expect improvements in general many-body approaches such as BCS mean-field approximation and perturbation expansion. (CU96714)

Theoretical Studies of CMR Materials

✉ LIN Hai Qing

□ 1 March 1997

❖ CUHK Research Committee Funding

The researchers propose to study the perovskite-type transition-metal oxides $(La,Ca)MnO_3$ theoretically, by using models describing electron-electron interaction and electron-lattice interaction. Analytical and numerical approaches will be carried out to deal with many-body correlations. Their goal is to gain physical understanding of these novel materials. They will collaborate with local experimentists and make comparisons of their results with experimental measurements. Specifically, they will investigate the following two issues:

(1) Ground state properties of the double exchange model.

(2) Jahn-Teller effects in colossal magnetoresistance (CMR) materials.

(PS96024)

Bosons in Confining Potentials

✉ LIU Kwok Leung ● LO Chi Fai

□ 1 October 1996

❖ CUHK Research Committee Funding

The researchers propose a theoretical investigation of Bose-Einstein condensation in anharmonic traps. Specifically, they shall examine how the nature and properties of Bose-Einstein condensation in harmonic traps are affected by the anharmonicities. By manipulating the anharmonic confining potential they shall also investigate how the properties of Bose-Einstein condensation depend on the dimension of the system. (PS96013)

Aluminium Metal Matrix Composite Materials Reinforced by Intermetallic Compounds and Alumina Whiskers

✉ NG Hang Leung Dickon

□ 17 February 1997

❖ CUHK Research Committee Funding

Aluminium metal matrix composites are synthesized via the powder metallurgy route by using appropriate internal and external oxidation techniques. The fired compound contains the metal matrix with intermetallics and ceramic particulates as reinforcement. The microstructures and properties of the composites will be studied. The researchers' aim is to produce light but strong composite materials that would be easily fabricated into practical devices and components to replace those made from steels. (PS96031)

The Study of Rare-Earth Transition-Metal Based Permanent Magnets

✉ NG Hang Leung Dickon

□ 1 April 1997

❖ CUHK Research Committee Funding

The researcher's aim is to produce better permanent magnets, and at the same time, to study the effects of additional dopants on some rare-earth transition-metal systems, such as the commonly used $Nd_2Fe_{14}B$ and the newly developed $Sm_2Fe_{14}Si_5$ magnets. He also intends to find suitable dopants, composition and preparation methods to raise the coercivity, magnetization, curie temperature and the energy product of these magnets. (PS96023)

High Pressure Effects in Single-Crystal (La, Ca) MnO₃ Thin Films

- ✉ WONG Hong Kuen
- ☐ 2 January 1997
- ❖ CUHK Research Committee Funding

The researchers will perform a pilot experiment to study the pressure effects on the magneto-transport properties of (La,Ca)MnO₃ (LCMO), a ferromagnetic perovskite oxide possessing colossal magnetoresistance (CMR) effects. High pressure is a powerful tool for investigation of the electronic and magnetic properties of perovskite oxides. Application of pressure enhances the charge transfer and increases the electron (or hole) interactions, especially near the Curie temperature. Existing published results of high pressure studies on LCMO and related compounds are few but all (on bulk samples) show that the transport mechanism in these oxides is influenced in a qualitatively similar way by both pressure P and magnetic field B: the Curie temperature increases and resistivity decreases for increasing P or B. However these results are in contradiction with another findings which indicate that substitution of La³⁺ in LCMO by *smaller* Y³⁺ ions results in a smaller lattice constant, lower Curie temperature and higher resistivity. More detailed experiments will be done in order to elucidate the paradox. (PS96015)

Measurements of Boundary Layer Properties in Turbulent Convection

- ✉ XIA Keqing
- ☐ 1 September 1996
- ❖ Research Grants Council

In this proposal, the researchers present a program of experimental investigations that involve measurements of velocity profiles in different positions along the conducting surfaces and the insulating sidewalls in two convection cells, one with smooth upper and lower surfaces and the other with rough upper and lower surfaces. Temperature profile measurements will also be carried out in the two convection cells. From these measurements, thermal and viscous boundary layer properties of turbulent flow in the two cells will be obtained. The aims of the research are to find a detailed picture of both the velocity and the temperature fields in the boundary layer region and the interplay between the viscous and the thermal boundary layers. Given that the project will be the first such systematic investigation, the results obtained will undoubtedly enrich our understanding of turbulent convection. (CU96724)

Please refer to previous issues of *Research Projects Summary* for more details of the following ongoing research at the department:

Edition	Title/Investigators
1993-94	Crystallisation of Amorphous Germanium Films on Amorphous and Crystalline Substrates (PS93004) ✉ CHIK Kin Pong ● LUK Ka Man* ● XU Jianbin (Electronic Engineering)
1995-96	Dye-doped Sol-gel Derived Optically Active Materials (PS95025) ✉ CHIK Kin Pong
1995-96	Statistics of Fluctuations in Turbulent Fluid Flows (CU95715) ✉ CHING Shuk Chi Emily
1995-96	Coalescences of Neutron Star Binaries: Effects of Nuclear Physics (PS95046) ✉ CHU Ming Chung ● LEUNG Pui Tang ● SUEN Wai Mo ● CHENG Kwong-sang* ● CHAU Hoi Fung* ● SWESTY Doug* ● SEIDEL Edward*
1993-94	Novel Optical Materials for Photonics Technologies (BP94012) ✉ HARK Sui Kong ● HUI Pak Ming ● LEE Wing Kee ● LAW Yam Kuen Dennis ● NG Hang Leung Dickon ● WONG King Young ● CHAN Kam Tai (Electronic Engineering) ● HSU Chung Chi (Electronic Engineering)
1994-95	Physics of Macroscopically Inhomogeneous Media (PS95013) ✉ HUI Pak Ming
1995-96	Physics of Quantum Dots (PS95005) ✉ HUI Pak Ming ● JOHNSON Neil F.*
1989-90	Microstructure of Undercooled Ge and Si (BP87003) ✉ KUI Hin Wing
1989-90	The Viscosity of Easy Glass Formers (BP87004) ✉ KUI Hin Wing
1994-95	Correlations For Thermal Expansion Coefficient of Glass Forming Alloys (PS95004) ✉ KUI Hin Wing

- 1995-96 Structural Modification of Highly Undercooled Semiconductors and Metals (CU93705)
✍ KUI Hin Wing
- 1995-96 Specific Volumes and Glass Formation of Metallic Systems (CU94720)
✍ KUI Hin Wing
- 1995-96 Femtosecond Laser Pulses and Microwave Pulses Generation Using Argon Ion Laser Pumped Passive Mode-locked Ti:Sapphire Laser (CU92707)
✍ LEE Wing Kee ● WONG Sai Peng Joseph (Electronic Engineering)
- 1995-96 Studies of Variations of Phase Conjugation Beam Induced by Another Laser Beam in Photorefractive Crystals (PS95038)
✍ LEE Wing Kee ● SHE Wei-long*
- 1993-94 Quasinormal Modes and Dissipative Systems (BP93034)
✍ LEUNG Pui Tang ● LAI Hon Ming ● YOUNG Kenneth
- 1995-96 Laser Interaction with Micrometer-sized Droplets and Fibres (CU95716)
✍ LEUNG Pui Tang ● LAI Hon Ming
- 1995-96 Mechanism of Photo-emission in Rapidly-oscillating Micrometer-size (PS95039)
✍ LEUNG Pui Tang ● CHU Ming Chung
- 1995-96 Numerical Studies of Strongly Correlated Systems (PS95021)
✍ LIN Hai Qing
- 1995-96 Quantum Monte Carlo Simulation of a Three-band Hubbard Model for High- T_c Materials (PS95017)
✍ LIN Hai Qing ● GUBERNATIS J.E.*
- 1995-96 Correlated Squeezed-state Approach for A Dissipative Two-state System (CU93706)
✍ LO Chi Fai
- 1995-96 Correlated Squeezed-State Approach for the Ground State of Strongly Correlated Electrons Coupled to Local Holstein Phonons (PS95022)
✍ LO Chi Fai
- 1995-96 Development of Magnetic Methods for the Non-destructive Inspection of Steel Structures (CU94721)
✍ NG Hang Leung Dickon ● KUI Hin Wing
- 1995-96 The Corrosion Protection of NdFeB Magnets by Al, Al-based Alloys and Ni Coatings (PS95040)
✍ NG Hang Leung Dickon
- 1995-96 Facing-target Sputtering Guns: Characteristics and Applications (CU95720)
✍ WONG Hong Kuen
- 1995-96 Interplay of Magnetic and Superconducting Properties of Oxide Multilayers (PS95016)
✍ WONG Hong Kuen
- 1995-96 Investigation of Relaxation Mechanisms of the Second Order Nonlinear Optical Activity in Polymeric Materials (CU95702)
✍ WONG King Young
- 1993-94 Study of Statistical Nature of Particle Motion in Fluids (BP00101)
✍ XIA Keqing
- 1994-95 Experimental Studies of Turbulent Convection (PS94012)
✍ XIA Keqing
- 1995-96 Incoherent Light Scattering Studies of Spontaneously Formed Vesicle (PS95006)
✍ XIA Keqing
- 1995-96 Testing of Scaling Laws for Polymer Solutions Near Criticality (PS95041)
✍ XIA Keqing
- 1995-96 Numerical Modelling of Winter Monsoon Surges with Forecasting Applications in Southern China (BP93008)
✍ YOUNG Kenneth
- 1995-96 Wave Phenomena in Open Systems (CU95706)
✍ YOUNG Kenneth ● LEUNG Pui Tang ● CHING Shuk Chi Emily ● SUEN Wai Mo*
- 1995-96 Transport and Optical Properties of Nonlinear Inhomogeneous Media (CU95718)
✍ YU Kin Wah ● HUI Pak Ming

1995-96 Study of Long-Range Correlations in PC
Binary Files (PS95023)
✉ YU Kin Wah

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RESEARCH PROJECTS

Experimental Design for Regression Models with Varying Dispersion

- ✉ CHAN Nai Ng ● LI Kim Hung ● SHARPE Ken* ● LAI Wing Kai
- 15 September 1996
- ❖ CUHK Research Committee Funding

In recent years much attention has been paid to the so-called Taguchi methods whose applications have successfully improved the quality of industrial processes in Japan. Taguchi makes use of statistically planned experiments to identify the settings of product (and process) parameters that reduce the performance variation of the product characteristic about its target value.

The performance characteristic of a manufactured product is affected by many factors. Some of the factors affect the mean value of the performance characteristic and these are identified as having location effects. Others might cause variations in the characteristic which are termed as dispersion effects. A very powerful class of model for analysing these effects, first proposed by Pregibon (1984), is that of the generalized linear models with varying dispersion (Smyth, 1989). In chapter 10 of McCullagh & Nelder (1989) the consequences of constructing and fitting formal models for both location and dispersion effects are explored. Aitkin (1987) pointed out that such a model can be fitted by maximum likelihood in GLIM using a simple macro. A GLIM macro for fitting the model has been devised by Chan, Li and Sharpe (1992). However, in the fitting by maximum likelihood, it sometimes happens that the chosen design matrices in the location and the dispersion effects contribute to a degenerating situation in that the likelihood function diverges to infinity for all values of the observations. In this project, the researchers would try to identify conditions on the design matrices under which a degenerating situation occurs, and suggest ways to overcome these difficulties. They would also devise GLIM macros to achieve their goals. (PS96019)

Interval Estimation of Parameters of Life Based on Record Values

- ✉ CHAN Ping Shing Ben
- 1 November 1996
- ❖ CUHK Research Committee Funding

A conditional method of inference is used to derive exact confidence intervals for the location, scale, quantiles and reliability of location-scale family based on the upper record values. The researchers

will also discuss the prediction of the future record based on the current record values. For illustrative purpose, the extreme-value distribution which is used to demonstrate the inference procedures. Finally they present a numerical example to explain the inference procedures developed in this paper. (PS96020)

Simultaneous Pairwise Multiple Comparisons in a Two-Way Design with Fixed Covariates

- ✉ CHEUNG Siu Hung
- 1 January 1997
- ❖ CUHK Research Committee Funding

The researcher proposes the statistical methodology of pairwise multiple comparisons in a two-way layout with the existence of fixed covariates. In many experimental designs, the presence of fixed covariates enables him to estimate the difference between treatment effects more accurately. The statistical procedures which will be developed in this project are very useful in data analysis of many medical and industrial experiments. (PS96027)

Bayesian Analysis of Structural Equation Models

- ✉ LEE Sik Yum
- 1 January 1997
- ❖ CUHK Research Committee Funding

The basic statistical theory and package programs in structural equation models (see, e.g., Jöreskog, 1978; Jöreskog and Sörbom, 1988; Bentler 1983, 1992) are developed under certain basic assumptions on the model and the data set via the Maximum Likelihood (ML) or the Generalized Least Squares (GLS) approach. To enlarge the scope of its applications and to achieve more meaningful and precise results, a lot of attention has been paid to investigate complex situations in which some of the basic assumptions are violated. Dominant directions of recent research in the field are those related to multilevel models and models with polytomous variables and/or incomplete data, see, e.g., Goldstein & McDonald (1988); Jöreskog (1994); Lee (1986, 1990); Lee & Poon (1992); Lee, Poon & Bentler (1990, 1992, 1995); Lee & Tang (1992) and Longford & Muthen (1992). However, due to the limitation of the ML and the GLS approaches, there are still many theoretical and computational aspects that should be improved. All the above contributions are developed under the non-Bayesian approach. The main objective of this project is to investigate structural equation models via a Bayesian approach. In general, it is well known that one advantage of the Bayesian approach is that the useful prior information of the parameters can be incorporated into the analysis. For structural

equation models, there is an additional advantage because the properties of the latent variables can also be utilized in the analysis by some appropriate Monte-Carlo simulation techniques, such as the data augmentation method (Tanner & Wong, 1987). As a result, the posterior densities in some complex situations can be computed and many of the existing theoretical and computational problems can be solved. Therefore, the Bayesian approach, when coupled with various Monte-Carlo simulation techniques, will provide a new direction of research in structural equation models and the results developed in this project will have a tremendous impact. (PS96028)

Conformal Normal Curvature and Assessment of Local Influence

- ✉ POON Wai Yin
- ☐ 1 November 1996
- ❖ CUHK Research Committee Funding

In 1986, Prof. R.D. Cook proposed to use the normal curvature of a graph in differential geometry to assess the influence of minor perturbation of statistical models. Although the method has been widely applied by statisticians, there are causes for concerns. The normal curvature is not invariant of a uniform change of scale, hence the method lacks objective criterion to judge the largeness of the curvature. The objective of this project is to utilize relevant concepts in differential geometry to address these concerns. A conformally invariant curvature, the conformal normal curvature, is constructed. Various approaches to use the conformal normal curvature and the relations among these approaches are studied. The practical applicability of the proposed method will be investigated by applying to well known statistical models such as linear regression model. (PS96029)

On Minimax Variance L-Estimation of Location in Kolmogorov Neighbourhoods of the Normal Distribution

- ✉ WU Ka Ho Eden
- ☐ 1 January 1997
- ❖ CUHK Research Committee Funding

The researchers consider minimax variance L-estimation of a location parameter, in a Kolmogorov normal neighbourhood

$K_\epsilon(\Phi) = \{F/|F(x) - \Phi(x)| \leq \epsilon, -\infty < x < \infty; F \text{ symmetric}\}$. Let F_0 minimize Fisher information $I(F)$ in $K_\epsilon(\Phi)$, and let m_0 be the corresponding weights-generating function of the L -estimator which is efficient for F_0 . In this project, the researchers try to show that the efficient estimator m_0 is not minimax for a range of ϵ value by exhibiting a weights-generating function m_1 and distributions $F_1, F_2 \in K_\epsilon(\Phi)$ with $\sup_{F \in K_\epsilon(\Phi)} V(m_1, F) = V(m_1, F_1) < V(m_0, F_2) \leq \sup_{F \in K_\epsilon(\Phi)} V(m_0, F)$. (PS96030)

Please refer to previous issues of *Research Projects Summary* for more details of the following ongoing research at the department:

Edition	Title/Investigators
1995-96	Exact Simultaneous Prediction Intervals for Multiple Forecasts from Integrated Autoregressive Moving Average Model (PS95024) ✉ CHEUNG Siu Hung ● WU Ka Ho Eden
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
1995-96	Analysis of Multilevel Structural Equation Models (PS95042) ✉ LEE Sik Yum
1995-96	Bayesian Computation (CU95713) ✉ LI Kim Hung ● WONG Wing Hung
1989-90	Analysis of Fuzzy Data (CS89005) ✉ POON Wai Yin ● LEE Sik Yum ● LEUNG Y. P.*
1995-96	Decision Analysis with Fuzzy Variables (PS95043) ✉ POON Wai Yin

RESEARCH OUTPUTS AND PUBLICATIONS

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- <P970517> **Lam, Yeh.** "The Rate of Occurrence of Failures". *Journal of Applied Probability* vol.34, pp.234-247. UK, 1997.03.
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see also <P963860>, <P970181>

