HONG KONG
INSTITUTION OF SCIENCE
12th Annual Conference 2004

香港科學的躍升
SCIENCE ADVANCEMENT IN HONG KONG

Organisers :

Hong Kong Institution of Science

Hong Kong Baptist University

programme book

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Prologue

Many people say that Hong Kong is an economic city. To-day, we all gather here to witness the other side of Hong Kong – Science and Technology – which have been developing steadfastly in the laboratories of universities and industries, and often choose to stay away from the spotlights. For the past eleven years, the HKIS Annual Conference has been one of the most important events for the community of scientists in Hong Kong. This year, it is the turn of the Hong Kong Baptist University to host this meaningful event.

Besides the very successful **Young Scientist Awards** which is now in the third year of running, we have tried very hard this year to encourage Science postgraduate students from all local Universities to attend the Conference. We believe that the talents of our distinguished speakers will inspire the young scientists who in turn will lead the future advancement of science in Hong Kong. Senior high school students are also invited to attend the afternoon sessions.

We are honoured to have 12 speakers lecturing on topics covering Physical & Engineering sciences as well as Life & Medical Sciences. A small number of excellent submissions are presented in the form of posters. A more pragmatic note to end the Conference will be a talk by Dr Collins on "Research Funds Administered by the Health, Welfare and Food Bureau, Government of the HKSAR".

We must extend our heartfelt thanks to the financial supports from the Croucher Foundation, Epson Foundation, Hong Kong Baptist University and the commercial sponsors. The technician team of the Chinese Medicine Programme and members of Organizing Committee shouldered most of the preparatory work. The success of this Conference will bear their names. Finally, I wish all participants will enjoy this 12th Annual Conference of HKIS and let us work together to realize our dream of advancing science in Hong Kong to a new height.

Albert W.N. Leung
Chairman
Organizing Committee
HKIS 12th Annual Conference

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Opening Remarks

Prof. Ng Ching Fai

President of the Hong Kong Institution of Science,
President and Vice-Chancellor of Hong Kong Baptist University

The Honourable Professor Arthur Li, Distinguished guests, Members of HKIS, Ladies and Gentlemen,

On behalf of the Hong Kong Institution of Science, I would like to welcome you all to the 12th Annual Conference jointly organized with the Hong Kong Baptist University. And if you allow me, I have to wear my other hat to welcome you on behalf of the Hong Kong Baptist University, to our campus today. Moreover, I would also have to welcome you on behalf of the organizing committee to join our conference. Today, we are honoured and privileged to have the Hon Prof Arthur Li, Secretary for Education and Manpower, to address the conference and present the Young Scientist Award to the winners of the competition this year. The Annual Conference cum Annual General Meeting has always been the most important event of the year for the Hong Kong Institution of Science where not only members of the institutions gather together to exchange views on recent scientific progress, but also between the scientific community and the society at large on topics of scientific and economic relevance to the development of Hong Kong.

The theme of the conference of this year is "The Advancement of Science in Hong Kong". We hope that the conference would allow us to show the public what is the status of Hong Kong science today. To this end, I think it is proper and fit to briefly revisit Hong Kong science yesterday.

Even in the seventies of last century, there was very little scientific research to speak of in Hong Kong. Actually, there was a vibrant industrial sector at that time — unfortunately mostly with little scientific and technology content. Even for those industrial concerns supposedly associated with high technology, hardly any original research and development would be carried out in Hong Kong. Therefore, almost all scientific research was performed at the two universities and the then Hong Kong Polytechnic, albeit with very limited scope. I still remember when I returned to Hong Kong to teach at HKU in 1970, I managed to acquire, through research grant application, a 6" electromagnet for my magnetochemistry experiment. This magnet costed about US$15,000 and I was told that it was the largest grant in that year because the total research grant (by projects) was just about HK$1 million. The level of research expenditure of the two universities and the polytechnic remained very low up to 1982-83 – there was no specific research funding, both HKU and CUHK spent approximately 2% of block grant on research expenditure (including direct, indirect cost, and infrastructure), i.e. approximately $8.6 million and $6.8 million for HKU and CUHK respectively.

What happened in 1983? That was the year the Government was persuaded that research was important in tertiary institutions and appointed a Working Party on Research under the chairmanship of Lord Flowers. The story had it that when Lord Flowers came to Hong Kong and discovered only approximately 2% or less of block grant of the institution was spent on research, he was somewhat shocked and severely criticized the institutions. To cut the story short, Lord Flowers' recommendation was to increase research funding. So in September 1984, the UPGC allocated HK$45 million earmarked research fund to the whole UPGC sector for the three years 1985-86, 1986-87, 1987-88. Moreover, a Research Sub-Committee was established in 1987 and the research funding for 1988-91 triennium was increased to $120 million. Subsequently, a Research Grants Council was formed in 1991 in place of Research Sub-Committee. The research funding was further increased to $510 million in the 4 years 1991-92, 1992-93, 1993-94, 1994-95.

The Flowers Report and the establishment of RGC were definitely two milestones in the development of Hong Kong research.

Along with this development, there came the birth of HKUST in the late eighties. This university, even in the days of her making, aspired to be a research university. Under the able leadership of Prof Chia-wei Woo, the university has recruited a sizeable number of well qualified staff in a short time. The aggressiveness of this new university certainly aroused the excitement of the existing institutions. They, too, taking advantage of the increased funding from the Government, upgraded their own research facilities and provided greater research resources to some of their very able existing staff, while at the same time actively recruited talents overseas. Thus, up to mid-nineties, Hong Kong has assembled a very respectable pool of research talents in all fields — an estimated figure of R&D personnel for the year 1998 is about 6,300.

Apart from UGC channel, the Government also provided funding to applied researches through the Department of Industry (now known as Innovation and Technology Commission) in the form of Industrial Support Fund which was subsumed under Innovation and Technology Fund after 1999 upon the launching of the $5 billion Innovation and Technology Fund. Many of the projects funded involve colleagues of tertiary institutions in one way or another and their nature varies from applied research to downstream. Thus, the private sector has begun to be contributing, albeit in a small way, towards scientific research. More recently, the establishment of Applied Science and Technology Research Institute and Science Park also help boost up R&D activities in Hong Kong, enhancing the overall strength of scientific research.

Let's take a look at the trend of scientific research in Hong Kong over the last 2 decades. I will choose a few indicators to illustrate:

(1) Table 1

Research Outputs (refereed journal articles)

	1993-94	1998-99	2001-02
Biology & Medicine	1,647	3,233	4,199
Physical Science	616	1,216	1,618
Engineering Sciences	1,478	2,879	3,768

(2) Table 2

R&D Personnel (full-time equivalent)

1970	1998	2002	
~ 300 – 800 (rough estimate)	9,000	12,890	(43% ↑)

This is a very significant increase; indeed when compared with the year 1970, we could say the increase amounts to a quantum jump.

(3) Table 3

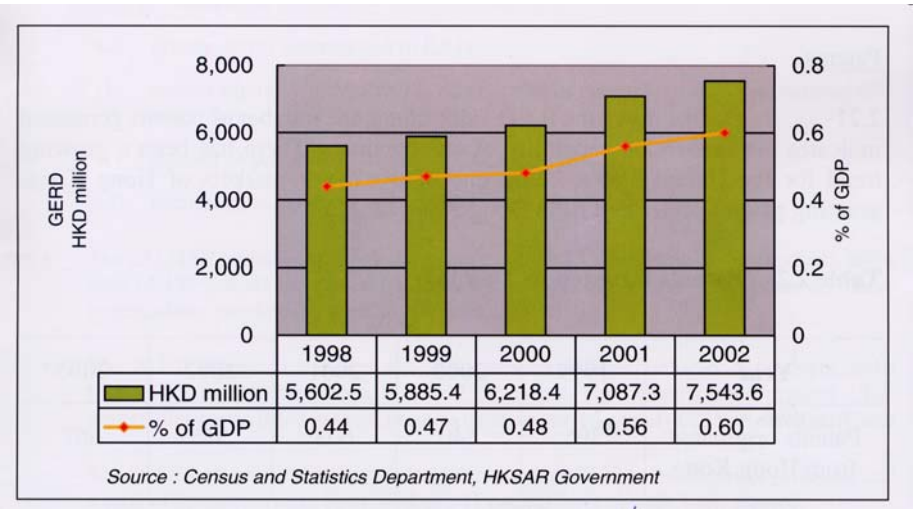
Research postgraduate students allocated by UGC

1995-96	2,995
1996-97	3,273
1997-98	3,595
1998-99	3,582
1999-00	3,595
2000-01	3,595
2001-02	4,035
2002-03	4,175
2003-04	4,375

Here, while we witness a steady increase, it is not spectacular especially if one looks at the RPG/UG ratio — the highest is 7% (HKUST).

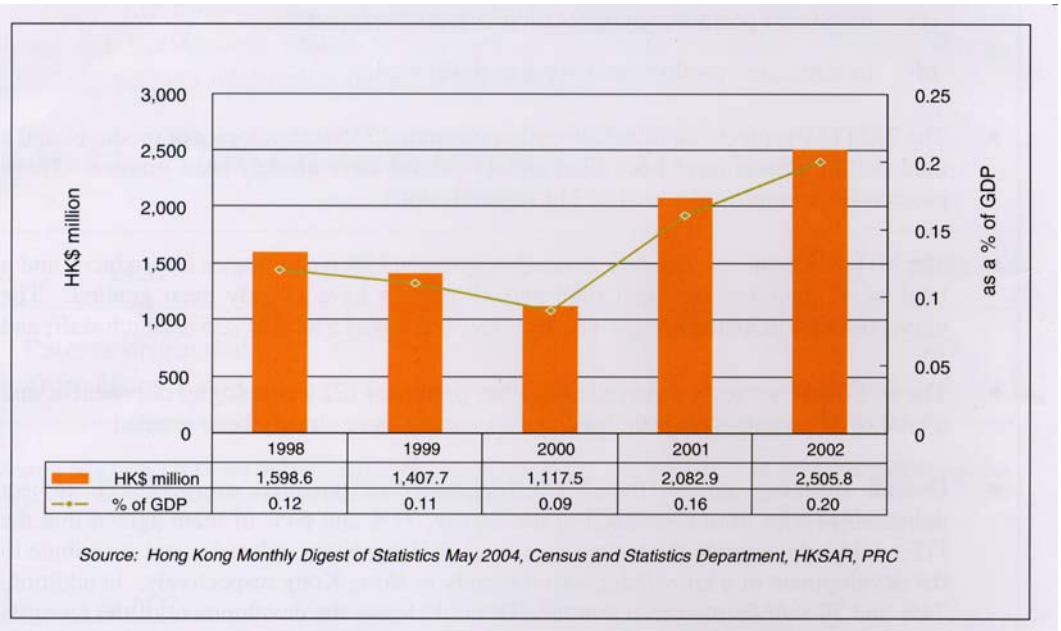
(4) Figure 1

R&D expenditure as a percentage of GDP in Hong Kong



(5) Figure 2

Business Expenditure on R&D in Hong Kong, 1998-2002



(6) Table 4

Research Expenditure of UGC-funded Institutions 1998-2001 and 2002-2003

Source of Funding	1998-1999 ($m)	1999-2000 ($m)	2000-2001 ($m)	2002-2003 ($m)
UGC	3,105	3,437	3,922	3,615.5
RGC	377	404	404	485.4
Other Government Funds	223	299	337	305.6
HK Private Funds	299	282	301	342.9
Non-Hong Kong	22	29	26	51.3
Total	4,026	4,451	4,989	4,800.7
Ratio of Research Expenditure to GDP	0.32%	0.36%	0.39%	0.39%

These are two sets of disheartening figures. Particularly, if one realizes that public sector portion already includes 78% of all universities academic staff (lecturer and above). It is nevertheless somewhat soothing that the business contribution of R&D now reaches 0.20 of GDP, thanks to ITF and latest development technology oriented industry.

From what has been presented above, one may draw the conclusion that in spite of relatively small research funding, the scientific research in Hong Kong has made very remarkable progress in a short span.

Even more importantly, while the quantity of output is impressive, the quality of our research also rises admirably — indeed enviably by many countries.

In the science areas, refereed journal publications are taken for granted; it is rather a matter of whether the results can be published in very top journals in the field concerned. Take for example, Physics Review Letters, a journal considered to be very top in Physics; in early nineties, there were probably only handful papers from HK researchers appearing in it annually. But today, the number of papers from HK appearing in this journal must be 5 to 6 fold of that in mid or late eighties. Publication by HK scientists in journals like Nature & Science has been in steady increase. Many of our colleagues are carrying out

world class cutting edge research, playing leaders in their own fields. From 1995 to 2003, sixteen and three HK scientists have been elected members of the Chinese Academy of Science and the Chinese Academy of Engineering respectively. It is worthwhile to note the bulk of the research results of these nineteen are derived from their laboratories in Hong Kong. On top of CAS and CAE, some colleagues are also elected fellows of very prestigious organizations (e.g. IEEE), and fellows of foreign academies or awarded prestigious prizes and awards.

I could continue for quite a while to describe the achievement of our colleagues. But I think I should conclude so that the more interesting part of today's programme can move on.

Suffice it to say, the HK science has gone a long way in the past two decades. We have now assembled a formidable pool of research talents covering many areas of science. Such talents are well equipped to support the development of focused areas of our new industry, such as biotechnology, nanotechnology, optoelectronics, display technologies, communication technologies, IC design, medical diagnostics and devices and the like. The advancement is something not only to be proud of by the scientific community itself or the universities, but also the HK public. I earnestly hope the exhibits, the paper presentation and the discussion of today's programme can provide a glimpse of the advancement of science of Hong Kong today.

Opening Address

Prof. Arthur K C Li, GBS, JP

Secretary for Education and Manpower, Government of the HKSAR

Science and technology have been playing a critical role in the transformation of the Hong Kong economy. To retain our competitiveness and to maintain our continued prosperity, we need to be innovative. We need an abundant supply of well-trained and talented people to invent, innovate and discover new technologies.

Hong Kong's strong fundamental and applied research capability is one of our assets for developing new and innovative technologies. Our universities and research institutions have contributed significantly in building up our research and development capability. Local academics and scientists have been playing an important and active role in supporting schools to nurture our next generation. Their support and collaboration will continue to contribute towards an innovative and inquisitive culture that promotes scientific discovery and thinking.

I wish to thank the Hong Kong Institution of Science for its continuing efforts in fostering the advancement of science in Hong Kong and promoting the importance of science to our community. The conference today is an excellent occasion to showcase our innovative capabilities and facilitate the sharing of experience and insights among industrialists, the academia and the community. The award winners we are honoring today are young scientists and engineers who have excelled in their field of study. They are dedicated to the pursuit, creation and exploration of knowledge and are role models for our students.

I would like to take this opportunity to pay tribute to you all for what you have done in all these years for our economy by bringing our scientific and technological development to new frontiers and the dedication in educating our next generation of distinguished scientists.

Programme

8:30 am – 9:15 am	**Registration**
9:15 am – 9:35 am	**Opening address by Prof. C.F. Ng, President of the Hong Kong Institution of Science, President and Vice-Chancellor of Hong Kong Baptist University**
9:35 am – 9:50 am	**Address by Prof. Arthur K.C. Li, Secretary for Education and Manpower**
9:50 am – 10:15 am	**Presentation of Young Scientist Awards**
10:15 am – 10:30 am	**Coffee break**

10:30 am – 12:20 pm

First Symposium Session (Physical Science & Engineering)

Moderators: Prof. A. T. Y. Chwang (HKU), Prof. Rick Wong (HKBU)

Prof. Liew Soung Chang (CUHK)	Area of Excellence in Information Technology of Hong Kong (AoE-IT)
Prof. Lo Sai Huen (HKU)	Finite Element Mesh Generation and its Application
Prof. Huang Jing Song (HKUST)	From Fourier Series to Harmonic Analysis
Prof. Cheah Kok Wai (HKBU)	CALM Research Activities

12:20 pm – 12:45 pm	**AGM/Poster exhibition**
12:45 pm – 2:00 pm	**Lunch/Poster exhibition**

2:00 pm – 3:45 pm

Second Symposium Session (Chemical & Life Science)

Moderators: Dr. Federick Leung (HKU), Prof. Fung Ming Chiu (CUHK)

Prof. Che Chi Ming (HKU)	Areas of Excellence: Institute of Molecular Technology for Drug Discovery and Synthesis
Prof. Wu Shiu Sun Rudolf (CityU)	Marine Environmental Research and Innovative Technology: An Area of Excellence in Hong Kong
Dr. Andrew L. Miller (HKUST)	The Use of Zebrafish as a Model to Study Calcium-related Diseases of Humans
Prof. Sun Sai Ming Samuel (CUHK)	AoE in Plant and Fungal Biotechnology: Current progress and future prospects

3:45 pm – 4:00 pm **Coffee break**

4:00 pm – 5:40 pm

<u>Third Symposium Session (Life Science)</u>

Moderators: Prof. P. L. Lim (CUHK), Prof. Kelvin Chan (HKBU)

Prof. Leung Ping Chung (CUHK)	A Practical Comprehensive Approaches to Chinese Medicine Research
Prof. Kathryn S.E. Cheah (HKU)	Areas of Excellence: Developmental Genomics and Skeletal Research
Prof. Lau Wan Yee (CUHK)	Research in Medicine
Dr. Richard A. Collins (Health, Welfare and Food Bureau, Government of the HKSAR)	Research Funds Administered by the Health Welfare and Food Bureau

5:40 pm – 5:50 pm **Concluding remarks**

5:50 pm **Exhibition ends**

2004 Young Scientist Awards

A total of 57 applications were received: 18 in Physical/Mathematical Science, 16 in Life Science and 23 in Engineering Science.

Three Selection Panels, one in each field, had been set up to review the applications and performed initial screening. Short-listed applicants were asked to give oral presentation of their work for the final selection.

Selection Panels

Physical/Mathematical Science Panel

Chairman	Prof. Qiang ZHANG	(Department of Mathematics, CityU)
Members	Prof. T.K. NG	(Department of Physics, HKUST)
	Prof. Jiming LIU	(Department of Computer Science, HKBU)
	Dr. Pauline LI	(Department of Appl. Biol. & Chem. Tech., PolyU)

Life Science Panel

Chairman	Prof. Benjamin PENG	(Department of Biology, HKUST)
Members	Prof. M.C. FUNG	(Department of Biology, CUHK)
	Prof. Nora TAM	(Department of Biology and Chemistry, CityU)
	Dr. Stephen CHUNG	(Institute for Molecular Biology, HKU)

Engineering Science Panel

Chairman	Prof. Allen CHWANG	(Department of Mechanical Engineering, HKU)
Members	Prof. J.M. KO	(Dean of Construction and Land Use, PolyU)
	Prof. S.P. WONG	(Department of Electronic Engineering, CUHK)

Short-listed Applicants

Physical/Mathematical Science

GU Hongwei 顧宏偉

Department of Chemistry, Hong Kong University of Science and Technology

Title of the Work: Biofunctional nanomaterials for pathogen detection

The work integrates biology, nanotechnology, and magnetism in developing a system for the detection of pathogens as well as a protocol utilizing biofunctional magnetic nanoparticles for capturing and separating proteins for applications in clinical diagnostics, biotechnology and biomedicine.

HUANG Ji Ping

Department of Physics, Chinese University of Hong Kong

Title of the Work: New man-made nonlinear materials with a giant nonlinearity enhancement

New man-made nonlinear materials basing on graded materials and electrorheological fluids are developed. Potential industrial applications of the materials include nonlinear optical switching devices for photonics and real-time coherent optical signal processors, nonlinear dielectric materials for electronic and microwave components and sensor windows.

KO Chi Chiu 高志釗

Department of Chemistry, University of Hong Kong

Title of the Work: Photosensitized photochromic materials

This work relates to the design and synthesis of photochromic ligands and their corresponding transition metal complexes. It provides a new strategy in the design of photochromic materials and photoswitching molecular devices which is one of the important aspects in the design, architecture and construction of optical functioning devices.

MEI Yongfeng 梅永丰

Department of Physics and Material Science, City University of Hong Kong

Title of the Work: Fabrication, characterization and application of porous anodic alumina template for nanoelectronics and nano-optoelectronics

This work relates to fabrication and characterization of nanostructures and nanomaterials for potential applications in nanoelectronics or nano-optoelectronic. Porous anodic alumina template is produced and explored for further synthesis of nanomaterials. The microstructures and color centers are investigated in details.

WANG Ligang 王立剛

Department of Physics, Hong Kong Baptist University

Title of the Work: The propagation of light pulses in dispersive media and photonic crystals

The propagation of light pulses in dispersive media and photonic crystal is an important aspect in laser physics and quantum optics. This work investigates the mechanics of superluminal pulse propagations in dispersive media and demonstrates that the coherence of light pulses plays an important effect on

superluminal propagation.

WEN Ting Bin 溫庭斌

Department of Chemistry, Hong Kong University of Science and Technology

Title of the Work: Synthesis and Chemistry of Metallabenzynes

This work relates to the synthesis and characterization of metallabenzynes which represent a new class of organometallic compounds and open up a new area in organometallic chemistry.

Life Science

CHAN Chun Fai 陳俊輝

Department of Biology, Hong Kong University of Science and Technology

Title of the Work: Study of cancer vaccine candidates for human hepatocellular carcinoma

This work relates to cancer immunotherapy and provides approaches for developing vaccine candidates for human hepatocellular cancer. Further exploration of the novel cancer/testis antigen HCA661 may provide a good target for immunotherapy for this lethal cancer.

CHAN Pui Yee 陳佩兒

Department of Chemistry, Hong Kong University of Science and Technology

Title of the Work: A superior rapid test for early diagnosis of myocardial infarction

This work relates to the field of clinical biochemistry. Fatty acid-binding protein (FABP) is demonstrated to be an early cardiac marker for heart infarction. It opens a new opportunity for early diagnosis and therapeutic intervention of myocardial infarction. The development of the rapid FABP assay has the potential to become a point-of-card diagnostic product with a huge market.

CHAN Siu Lung 陳少龍

Department of Biochemistry, Hong Kong University of Science and Technology

Title of the Work: G protein signal transduction and integration

This work aims at delineating the signal integration mechanism of G protein-coupled receptors. It can be applied to the study of the pharmacological responses of Chinese medicines and can be further extended to explore novel potential therapeutic formulation for medical use, as well as the integration of Western and Chinese medicine pharmacology.

ZHOU Chen Xi 周晨曦

Department of Physiology, Chinese University of Hong Kong

Title of the Work: Influence of sperm maturation and fertilizing capacity by secretions of male and female reproductive tract epithelia

This work is a study on the molecular mechanisms underlying sperm maturation, fertilization and the pathology of CF female infertility. The findings can be used for diagnosis of male infertility and enable better management of assisted reproductive technologies for infertile CF women. The findings may also provide grounds for development of new contraceptive strategies and treatment of infertility.

Engineering Science

CHEN Shengyong 陳勝勇

Department of Manufacturing Engineering and Engineering Management, City University of Hong Kong

Title of the Work: Automatic sensor placement for model-based robot vision perception

An automatic sensor placement strategy is developed for a robot vision system to fully automate its perception tasks in model-based applications.

CHOW Kin Kee 周健基

Department of Electronic Engineering, Chinese University of Hong Kong

Title of the Work: All-optical processing devices for high-speed fiber communications

A series of novel all-optical processing devices is proposed and demonstrated. A new kind of optical fiber is investigated and its new applications in all-optical signal processing developed, including broadband wavelength converter and signal regenerator.

SUN Zhi 孫智

Department of Civil Engineering, Hong Kong University of Science and Technology

Title of the Work: Wavelet packet based structural health monitoring and damage assessment

A novel index is proposed for structural health monitoring and damage assessment of civil infrastructures. This index is found sensitive to structural damage and insensitive to environmental noise, and can be used for various levels of damage assessment including identifying damage occurrence, location and severity.

ZHU Ledong 朱樂東

Department of Civil and Structural Engineering, Hong Kong Polytechnic University

Title of the Work: Buffeting response of long span cable-supported bridges under skew winds: field measurement and analysis

This work has both theoretical and practical significance to the wind-resistant design of long-span bridges. A new method for analyzing the buffeting response of long span bridges under skew winds is developed, and verified to some extent using the field measurement results of the Tsing Ma Bridge.

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Abstracts of Presentation

Symposium Session:	1
Title:	**Area of Excellence in Information Technology of Hong Kong (AoE-IT)**
Speaker:	**Prof. Liew Soung Chang**
Organization:	Department of Information Engineering, The Chinese University of Hong Kong.

The AoE-IT is a major research project funded by the University Grant Council, with active participations and inter-university collaborations among three major universities: the Chinese University of Hong Kong (CUHK), the Hong Kong University of Science and Technology (HKUST), and the University of Hong Kong (HKU). This talk introduces to the audience some of the exciting research efforts and collaborations undertaken by the AoE-IT participants, and their potential impact. Selected subprojects from two umbrella projects will be highlighted: 1) Large-scale Internet Intrusion Detection System; 2) Pervasive Multimedia Content Delivery over the Internet

Note: The co-PIs of the AoE-IT are Prof. Roland Chin (HKUST), Prof. Victor Li (HKU) and Prof. Soung Liew (CUHK)

Symposium Session:	1
Title:	**Finite Element Mesh Generation and its Application**
Speaker:	**Prof. Lo Sai Huen**
Organization:	Department of Civil Engineering, The University of Hong Kong.

Over a few decades of research and development, the finite element method (FEM) has well established its place in providing useful numerical solutions to practical engineering problems, ranging from solid mechanics, fluid mechanics, structural mechanics to the more challenging bio-engineering mechanics systems. The rapid increase in computer speed along with a significant price cut in powerful computing machines enable realistic engineering structures to be analyzed by the FEM employing thousands of node points.

As the concept of the FEM is based on the decomposition of a continuum into a finite number of subregions (elements), the pre-requisite for an effective use of the method is an automatic procedure for a sound discretization of the structure into valid elements. After more than three decades of development, the mesh generation algorithms for FEM have now reached a quite mature stage on many fronts, in particular, the problem of mesh generation on 2D planes and over curved surfaces can now be considered as completely resolved. Over the volumes, the discretization of complex solid objects into tetrahedral

elements can be achieved almost in an automatic manner even for the most complex industrial and bio-medical systems.

Even though some of the mesh generation techniques are applicable in more than one geometry, the paper basically follows the order of mesh generation on 2D domains, over curved surfaces and within volumes. Within this framework of classification based on geometrical dimensions, the techniques are further divided into the generation of simplex elements (triangles in 2D and tetrahetra in 3D) and non-simplex elements, such as quadrilaterals, hexahedra, etc. The two most popular methods for FEM mesh generation, namely the Delaunay triangulation and the Advancing Front Approach, are described in full details.

Symposium Session:	1
Title:	**From Fourier Series to Harmonic Analysis**
Speaker:	**Prof. Huang Jing Song**
Organization:	Department of Mathematics, Hong Kong University of Science and Technology.

The name of Fourier (1768-1830) is most familiar to mathematicians, physicists, engineers, and other scientists. Fourier series, Fourier coefficients, Fourier integrals, Fourier transform, the Fourier equation, and the Fourier analysis are everyday terms. Fourier Series were the source, and the test case, for all fundamental notions of mathematical analysis. They provide the first, and still the most important, example of an orthonomal expansion, leading to the main development in functional analysis. The Fourier transform is now used in all fields of science, from astrophysics to biology, from satellite communication to medical imaging. Wavelets as a new avatar of Fourier series has a spectacular impact on the recent technological breakthrough in imaging processing.

The Fourier point of view on the relation between nature, science, and applications, is now again fashionable among mathematicians. The continuation of Fourier analysis into contemporary mathematics is harmonic analysis, whose principal content is Lie group representations. As Fourier only wrote, “the thorough study of nature is the most fertile ground for mathematical discoveries”, representation theory was born in early 20th century under the combined influence of relativity and quantum mechanics. It develops into a major mathematical field that interacts all branches of mathematics and theoretical physics.

20th century began with a flurry of industrial inventions, such as automobile, airplane and telephone, that changed human life style. The discovery of relativity by Einstein (1879-1955) and quantum mechanics by Heisenberg (1901-1976) revolutionizes our understanding of the universe. This brought forth the discovery of Dirac (1902-1984) a matrix-valued differential equation as a square root of wave equation. Dirac derived many amazing results from this equation such as half spin of electrons and

anti-matter. These results provided the foundation of molecular physics, molecular chemistry as well as the application of nuclear magnetic resonance to medicine.

The extension of Dirac operator to a differentiable manifold and a proof of the associated index theorem by Atiyah and Singer is one of the most influential mathematical achievements of 20th century. The corresponding version of Dirac operator in Lie algebra plays an important role in the recent development of representation theory. The introduction of Dirac cohomology is the result of combination of ideas in both index theory and cohomological algebra. This new tool in representation theory opens up a new field of current research.

Symposium Session:	1
Title:	**CALM Research Activities**
Speaker:	**Prof. Cheah Kok Wai**
Organization:	Department of Physics, Centre for Advanced Luminescence Materials, Hong Kong Baptist University.

Centre for Advanced Luminescence Materials (CALM) was formed in May 2004. The aim is to bring together colleagues in Departments of Chemistry and Physics of Hong Kong Baptist University so that interdiscipline research in advanced luminescence materials can be performed in more focus fashion. In this talk, I shall highlight some of the works that have been done within this centre. Some the works, particular on Organic LED (OLED) and Si-based device and materials, has been on going well before the centre is formed. While newer work like photonic crystal and triplet emission are more recent. Our recent effort also attracted support by Innovation and Technology Commission support with two projects from them. They are on stacked OLED and PDP phosphors. They will be introduced here too.

Symposium Session:	2
Title:	**Areas of Excellence: Institute of Molecular Technology for Drug Discovery and Synthesis**
Speaker:	**Prof. Che Chi Ming**
Organization:	Department of Chemistry, The University of Hong Kong.

In the AoE second Round exercise, the UGC has allocated HK$ 48 M to the “Institute of Molecular Technology for Drug Discovery and Synthesis” with an indicative project time-frame from 2001 to 2006. The Institute of Molecular Technology for Drug Discovery and Synthesis combines the expertise of leading academics with high international repute in chemistry and life sciences from The University of Hong Kong, The Hong Kong Polytechnic University, The Chinese University of Hong Kong, The Hong Kong University of Science and Technology, City University of Hong Kong and Hong Kong Baptist University in collaboration with scientific and industrial leaders from around the world. The mission of

this AoE aims to implement world-class science and technology for the research and development in the area of drug discovery and synthesis, as well as to lay a technical foundation for a high-technology pharmaceutical and agrochemical industry in Hong Kong and nearby regions. The major research activities of the Institute include Chemical Biology of Inorganic Medicines and Traditional Chinese Medicines, discovery of new biosensors for disease monitoring, and use of chiral synthetic technologies for drug synthesis. Successful commercialization of these novel findings will foster Hong Kong's biomedical industry and enhance Hong Kong's status as a high technology centre in the Asia-Pacific Region.

Symposium Session:	2
Title:	**Marine Environmental Research and Innovative Technology: An Area of Excellence in Hong Kong**
Speaker:	**Prof. Wu Shiu Sun Rudolf**
Organization:	Centre for Coastal Pollution and Conservation, City University of Hong Kong.

Globally, the problems caused by eutrophication, waterborne pathogens and xenobiotics are likely to be exacerbated and to pose significant ecological and public health risks. This is particularly true in China which has very high population density and rapid industrialization.

Led by the City University, researchers from six local universities have teamed up and established the "Centre for Marine Environmental Research and Innovative Technology" (**MERIT**) as an Area of Excellence (AoE) in Hong Kong. The focus of this AoE is the development of innovative technologies for early detection, assessment, prediction and control of impacts arising from anthropogenic activities in the marine environment. An exceptionally high level of synergy is achievable through close collaboration between biologists, chemists, physicists, engineers and statisticians in the team. We will also work closely with our stakeholders on various projects, including technology transfer and commercialization of our novel technologies.

Research activities of **MERIT** are organized under four Task Teams, which are inter-related:

Task Team 1: Novel Technologies for Environmental Diagnosis: to develop various novel chemical, genomic and biomarker technologies for detection and monitoring of toxic chemicals, red tide toxins and waterborne disease causing agents.

Task Team 2: Field Studies and Validation: to validate the various novel technologies developed, and to study ecosystem recovery after pollution abatement.

Task Team 3: Impact and Risk Assessments: to develop models to estimate carrying capacity of

water bodies in relation to pollutants; bioaccumulation of toxic chemicals, and assess the risk of toxic chemicals.

Task Team 4: Control and Bioremediation: to develop novel, cost-effective technologies for removal of nutrients and toxic chemicals in wastewater, bioremediation technologies and controlling red tides.

Through this AoE, a range of innovative and marketable technologies will be developed for monitoring, control and management of our marine environment, which will enable Hong Kong to capitalize on the rapidly growing commercial opportunities presented by the enormous world environmental market.

Symposium Session:	2
Title:	**The Use of Zebrafish as a Model to Study Calcium-related Diseases of Humans**
Speaker:	**Dr. Andrew L. Miller**
Organization:	Department of Biology, The Hong Kong University of Science & Technology.

Over the last 10 years, the zebrafish (Danio rerio) has become one of the most popular animal models to study vertebrate development. This small freshwater fish offers many advantages to the study of organ and tissue development that are not provided by other animal model systems. In recent years, the value of the zebrafish as a model for human disease has also been recognized. Several zebrafish mutants that exhibit distinct "human" disease phenotypes have been found. These span a variety of human pathologies, including heart disease, diabetes, muscular dystrophy, neurodegenerative disease and kidney disease.

In our lab we use zebrafish to study the role played by calcium ions in a wide range of developmental and biomedical processes. Calcium signaling is studied through the use of the calcium-sensitive bioluminescent protein, aequorin, which can either be microinjected into cells or transgenically expressed without disturbing function or development. The patterns of light that are emitted by an aequorin-loaded cell, tissue or organ, reveals the changing patterns and levels of free calcium. We are currently using zebrafish to study the role of calcium signaling during normal muscle and kidney development, as well as during Duchenne muscular dystrophy and Polycystic kidney disease, two conditions where a loss of calcium homeostasis, in the muscle and kidney, respectively, has been implicated. Supported by the following grants: HKUST6016/01M HKUST6214/02M, HKUST6279/03M & N_HKUST607/01.

Symposium Session:	2
Title:	**AoE in Plant and Fungal Biotechnology: Current progress and future prospects**
Speaker:	**Prof. Sun Sai Ming Samuel**
Organization:	Department of Biology, The Chinese University of Hong Kong.

The Area of Excellence (AoE) in Plant and Fungal Biotechnology was selected in 1999 by the University Grants Committee (UGC) for a 5-year support of HK $38.8M during the first round AoE exercise. The project was initiated in March 2000. In the past four years, we have successfully built a strong and coherent research team consisting of members from different institutes in Hong Kong, including 13 labs from CUHK as core members and 3 labs from HKU, 2 labs from HKUST and 2 labs from HKBU as associate members, an effective management system, and extensive collaboration networks. Based on our complementary expertise, together we address focused and important questions related to plant and fungal biotechnology with emphasis on the niches and needs in food supply and healthcare products in China, the region and beyond. We now are close to the completion of the first phase of this AoE. In essence, we have accomplished the planned targets and delivered the promised outputs stipulated in the "Indicative Time Table" of the proposal. In this talk, I shall summarize what we have achieved, including the strength added, impact made and recognition gained, and the opportunities we see and pursue in the future.

Symposium Session:	3
Title:	**A Practical Comprehensive Approaches to Chinese Medicine Research**
Speaker:	**Prof. Leung Ping Chung**
Organization:	Institute of Chinese Medicine, The Chinese University of Hong Kong

While modern medicine has developed a very well established system of clinical research which insists on evidence based methodology relying heavily on biostatics, traditional medicine has not, in spite of the long years of existence and unreceding popularity, developed its own system of research. Since there are yet many problem areas in modern medicine, which are yet devoid of solution, and traditional medicine possessed good records of efficacy in those areas; it is natural that experts in both areas should join hands in a proper exploration to put traditional medicine into popular utilization. One way of achieving this joint effort is to stick to requirements of modern clinical trials as much as possible. Obvious obstacles include the common lack of uniformity: among the supply of herbs, consistency of their quality. Manufacturing of convenient products (which is improving nowadays) and methodology for clinical trials.

One practical way of pursuing this joint venture is to apply the Efficacy driven approach which implies

the following: -

i) Getting a simple herbal formula to try solving one difficult clinical problem and start an evidence-based clinical trial using methodology acceptable to standard clinical trials i.e. randomized, placebo-controlled;

ii) Organizing parallel laboratory experiments to understand the mode of action;

iii) Making sure that the quality of herbs or their extracts are of the best standard and

iv) Once proven efficacious in the clinical trial, optimization of the formula will give an up-graded product.

Symposium Session:	3
Title:	**Areas of Excellence: Developmental Genomics and Skeletal Research**
Speaker:	**Prof. Kathryn S.E. Cheah**
Organization:	Department of Biochemistry, The University of Hong Kong

The ability to walk and run is usually taken for granted but skeletal disorders such as crippling deformities, back pain and osteoarthritis are becoming increasingly common as people live longer. Degenerative disorders of the joints or back are the most common causes of severe long-term pain and physical disability, causing suffering and pain for hundreds of millions of people. Low back pain affects 60–80% of the ageing population world-wide and is the most frequent cause of limitation of activity in the young and middle aged and the leading reason why people seek medical treatment. Degenerative low back disorders are the third most common reason for surgical procedures and the second leading cause of sick leave. This has significant economic and human impact. In Hong Kong in 2000 over 300,000 workdays were lost through these disorders and $200 million paid in workers compensation.

So far skeletal diseases have received less attention from research than their economic importance warrants. But this deficiency is set to change with the establishment of the United Nations and WHO endorsed Bone and Joint Decade 2000-2010. Many of these disorders are due to the combined effects of mutations in many genes and interactions of those genes and their products, usually proteins, with environmental factors. This has made it difficult to study the underlying pathology. Key issues in skeletal biology are how longitudinal growth of cartilage and bone is regulated; how stress such as the presence of improperly folded proteins within cells affect skeletal growth and maintenance and contribute to disorders; what genetic factors impact on predisposition for degenerative skeletal disorders?

Building on multidisciplinary and synergistic interactions, track record and a history of collaboration, a team of scientists and clinicians from HKU, HKUST and PolyU, with collaborative contributions from international leaders in the field have gathered together to establish an Area of Excellence (AoE) programme “Developmental Genomics and Skeletal Research” to address these key issues. Empowered

by genetic information and cutting-edge technologies spawned by the genome projects and transgenic mouse technology, the AoE team will focus on identifying genes and understanding their roles in development, growth, maintenance and degeneration of our skeletal structure through life. Particular attention is made to the mechanisms that lead to abnormalities and degeneration of cartilage and bone, to skeletal malformation caused by unfolded proteins and to the identification of genetic factors predisposing to degenerative intervertebral disc disease (DDD). The AoE will become a premier centre of research excellence in the genomic biology of skeletal growth and maintenance producing high quality publications and patentable discoveries with the long term aim to to develop strategies and therapies for skeletal tissue reconstitution. The characterization of mutations predisposing to DDD will lead to better diagnosis and treatment, ultimately benefiting society through a healthier workforce. The impact of the discoveries made in the AoE extends beyond DDD and is applicable to other common skeletal disorders such as osteoarthritis. It will contribute to pharmaceutical R&D and biotechnology in Hong Kong by providing trained staff, drug targets, animal models, genetic tests and valuable genomic data and technologies.

Symposium Session:	3
Title:	**Research in Medicine**
Speaker:	**Prof. Lau Wan Yee**
Organization:	Department of Surgery, The Chinese University of Hong Kong

The accumulation of experience at a personal level does not automatically translate into knowledge because personal experience can be biased. Even if knowledge is generated in this way, with only a few exceptions, the progress in knowledge is limited. The acquisition of medical knowledge is facilitated by the recent developments in information technology which encourage exchange of experience and skills between individuals and medical centers. The storage and filing of medical information are facilitated by the improved computerized search systems.

Research in Medicine can be divided into basic and clinical research. The main aim of conducting clinical research is to generate a solution to a clinical problem. Thus the elements in a good clinical research are to identify an important clinical problem, to propose a solution, to formulate a testable hypothesis, set up an experiment to refute (or to support) the hypothesis, analyze the data and to come up with a solution to solve the original problem.

We need basic research in medicine because clinical research may not be able to solve many of the clinical problems. Basic research can be used to simplify and to clarify a clinical problem under a controlled condition. Also basic research can be used to test and to develop new approaches and new knowledge which cannot be done on human for ethical reasons. Thus we need a “bridge tender” to channel knowledge from basic research to patient’s bedside and back again. This bridge tender can be a clinician or a basic scientist.

There are many good examples of conducting research in Medicine by bringing the results of laboratory research into clinical use, and the solution of a clinical problem by using basic research. This lecture uses an example for the development of laparoscopic sutureless repair of perforated peptic ulcer to illustrate these points.

Symposium Session:	3
Title:	**Research Funds Administered by the Health Welfare and Food Bureau**
Speaker:	**Dr. Richard A. Collins**
Organization:	Health, Welfare and Food Bureau, Government of the HKSAR

The Health, Welfare and Food Bureau (HWFB) administers three funds relevant to basic and applied health-related research.

- Research Fund for the Control of Infectious Diseases (RFCID)
- Health and Health Services Research Fund (HHSRF)
- Health Care and Promotion Fund (HCPF)

The RFCID supports studies initiated by individual investigators, in addition to those commissioned by the HWFB, to address health problems, fill scientific gaps and respond to public threats or needs. The RFCID was established with a capital commitment of $500 million to encourage, facilitate and support research on the prevention, treatment and control of infectious diseases in Hong Kong, in particular emerging diseases such as SARS. The third open call for applications closed in September 2004.

The HHSRF was established with the aim of maximising population health, improving the quality of life, and enhancing the standard and cost-effectiveness of the health system through the generation of new knowledge in areas of human health and health services. The third open call for applications closed in September 2004.

The HCPF was established in May 1995 with an injection of $80 million for the purpose of increasing health promotion and disease prevention and providing assistance to certain patients in need. Eighteen rounds of applications have been processed to date.

Applications are generally received in response to open calls issued 1-2 times per year. Research proposals are peer reviewed by both local and overseas experts. The time between the closing date of the open call and a funding decision is about 20-22 weeks. The approval rate of applications to the RFCID and HHSRF is about 25%.

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Abstracts of Exhibition

Exhibition#:	1
Title:	**Areas of Excellence: Institute of Molecular Technology for Drug Discovery and Synthesis**
Authors:	**Prof. Che Chi Ming**
Organization:	Department of Chemistry, The University of Hong Kong.

In the AoE second Round exercise, the UGC has allocated HK$ 48 M to the “Institute of Molecular Technology for Drug Discovery and Synthesis” with an indicative project time-frame from 2001 to 2006. The Institute of Molecular Technology for Drug Discovery and Synthesis combines the expertise of leading academics with high international repute in chemistry and life sciences from The University of Hong Kong, The Hong Kong Polytechnic University, The Chinese University of Hong Kong, The Hong Kong University of Science and Technology, City University of Hong Kong and Hong Kong Baptist University in collaboration with scientific and industrial leaders from around the world. The mission of this AoE aims to implement world-class science and technology for the research and development in the area of drug discovery and synthesis, as well as to lay a technical foundation for a high-technology pharmaceutical and agrochemical industry in Hong Kong and nearby regions. The major research activities of the Institute include Chemical Biology of Inorganic Medicines and Traditional Chinese Medicines, discovery of new biosensors for disease monitoring, and use of chiral synthetic technologies for drug synthesis. Successful commercialization of these novel findings will foster Hong Kong’s biomedical industry and enhance Hong Kong’s status as a high technology centre in the Asia-Pacific Region.

Exhibition#:	2
Title:	**Areas of Excellence: Developmental Genomics and Skeletal Research**
Authors:	**Prof. Kathryn S.E. Cheah**
Organization:	Department of Biochemistry, The University of Hong Kong.

The ability to walk and run is usually taken for granted but skeletal disorders such as crippling deformities, back pain and osteoarthritis are becoming increasingly common as people live longer. Degenerative disorders of the joints or back are the most common causes of severe long-term pain and physical disability, causing suffering and pain for hundreds of millions of people. Low back pain affects 60–80% of the ageing population world-wide and is the most frequent cause of limitation of activity in the young and middle aged and the leading reason why people seek medical treatment. Degenerative low back disorders are the third most common reason for surgical procedures and the second leading cause of

sick leave. This has significant economic and human impact. In Hong Kong in 2000 over 300,000 workdays were lost through these disorders and $200 million paid in workers compensation.

So far skeletal diseases have received less attention from research than their economic importance warrants. But this deficiency is set to change with the establishment of the United Nations and WHO endorsed Bone and Joint Decade 2000-2010. Many of these disorders are due to the combined effects of mutations in many genes and interactions of those genes and their products, usually proteins, with environmental factors. This has made it difficult to study the underlying pathology. Key issues in skeletal biology are how longitudinal growth of cartilage and bone is regulated; how stress such as the presence of improperly folded proteins within cells affect skeletal growth and maintenance and contribute to disorders; what genetic factors impact on predisposition for degenerative skeletal disorders?

Building on multidisciplinary and synergistic interactions, track record and a history of collaboration, a team of scientists and clinicians from HKU, HKUST and PolyU, with collaborative contributions from international leaders in the field have gathered together to establish an Area of Excellence (AoE) programme *"Developmental Genomics and Skeletal Research"* to address these key issues. Empowered by genetic information and cutting-edge technologies spawned by the genome projects and transgenic mouse technology, the AoE team will focus on identifying genes and understanding their roles in development, growth, maintenance and degeneration of our skeletal structure through life. Particular attention is made to the mechanisms that lead to abnormalities and degeneration of cartilage and bone, to skeletal malformation caused by unfolded proteins and to the identification of genetic factors predisposing to degenerative intervertebral disc disease (DDD). The AoE will become a premier centre of research excellence in the genomic biology of skeletal growth and maintenance producing high quality publications and patentable discoveries with the long term aim to to develop strategies and therapies for skeletal tissue reconstitution. The characterization of mutations predisposing to DDD will lead to better diagnosis and treatment, ultimately benefiting society through a healthier workforce. The impact of the discoveries made in the AoE extends beyond DDD and is applicable to other common skeletal disorders such as osteoarthritis. It will contribute to pharmaceutical R&D and biotechnology in Hong Kong by providing trained staff, drug targets, animal models, genetic tests and valuable genomic data and technologies.

Exhibition#:	3
Title:	**UGC Area of Excellence Project "Chinese Medicine Research and Further Development"**
Authors:	***Principle Investigator:*** **Prof. Leung Ping Chung,** ***Co-Principal Investigators:*** **Prof. F.T. Chau (PolyU), Prof. W.F. Fong (CityU), Prof. K.P. Fung (CUHK), Prof. S.D. Kung (HKUST)** ***Co-Investigators:*** **Prof. C.T. Che (CUHK), Prof. Moses Chow (CUHK), Prof. C.J. Haines (CUHK), Prof. Joseph Sung (CUHK), Prof. Rita Sung (CUHK), Prof. Karl Tsim (HKUST), Prof. K.S. Woo (CUHK)**
Organization:	Institute of Chinese Medicine, The Chinese University of Hong Kong.

The Area of Excellence (AoE) scheme was launched by the University Grants Committee (UGC) in 1998, with the objective of enabling development in research areas where Hong Kong has particular potentials and where Hong Kong can develop a competitive edge internationally.

In 2001, the project "Chinese Medicine Research and Further Development", led by the Institute of Chinese Medicine of CUHK, was selected as an AoE out of 56 proposals submitted and received an award of HK$25 million to develop 5 priority projects in 5 years in collaboration with Hong Kong University of Science and Technology, Hong Kong Polytechnic University and City University of Hong Kong.

Five Priority Projects

While western medicine has advanced very rapidly, it has failed to treat all illnesses with equal effectiveness. In areas such as viral infection, chronic disorder, degenerative disease, allergy and preventive therapy, its efficacy is surpassed by that of Chinese medicine. The five priority projects, as follows, were therefore chosen in these areas where western medicine has no optimal solution:

Treatment of Chronic Hepatitis B Viral Infection with Phyllanthus
Treatment of Women's Ailments with Danggui Buxue Tang
Treatment of Diabetic Foot Ulcer with Huangqi Preparation
Treatment of Childhood Asthma with Dong Chong Xia Cao Preparation
Danshen and Gegen Preparation as Cardiovascular Tonic

Uniqueness

The uniqueness of this AoE is the adoption of an efficacy-driven approach for conducting Chinese

medicine research. The research findings will not only provide more scientific evidence for the efficacy of Chinese medicine, but can also affirm its role as an alternative or complementary therapy in the international arena. The project will also provide important references and set models for Chinese medicine research, its integration with western medicines and the development of nutraceuticals as well as herbal drugs.

Exhibition#:	4
Title:	**The Use of Zebrafish as a Model to Study Calcium Signaling during Embryogenesis**
Authors:	**Sarah E. Webb, Karen W. Lee, Christina F. Leung, Jackie C. Cheng, Omi Ma, Chris Cheung and Andrew L. Miller**
Organization:	Department of Biology, The Hong Kong University of Science and Technology

Through the injection of *f*-aequorin (a calcium-sensitive luminescent reporter) into zebrafish embryos at their earliest stage of their development, and the use of a specialized imaging system, distinct patterns of calcium signaling are observed during the first 24 hours of their development. These calcium signals begin at fertilization, and then continue to be generated throughout the subsequent zygote, cleavage, blastula, gastrula and segmentation periods. They are thus associated with the major phases of pattern formation: cell proliferation, differentiation, axis determination, the generation of primary germ layers, the emergence of rudimentary organ systems, and therefore the establishment of the basic vertebrate body plan. When signals need to be transmitted across significant distances they take the form of waves, either intracellular waves when the cell size is large, or later in development when the cell size is reduced, intercellular waves. Both types of calcium signals will be described, and their integration into signaling networks and possible functions and developmental significance with regards to pattern formation will be discussed. Supported by the following grants: HKUST6016/01M HKUST6214/02M, HKUST6279/03M & N_HKUST607/01.

Exhibition#:	5
Title:	**UGC-AoE Plant and Fungal Biotechnology, Department of Biology, The Chinese University of Hong Kong**
Authors:	**Prof. Sun Sai Ming Samuel**
Organization:	Department of Biology, The Chinese University of Hong Kong.

The UGC Area of Excellence “Plant and Fungal Biotechnology” Project, led by the Department of Biology of the Chinese University of Hong Kong, is the only science project awarded in the First Round University Grant Committee’s Area of Excellence Exercise. Its mission is to help develop Hong Kong’s

high technology industry and meet the world's increasing demands for food and healthcare products in the 21st century. These tasks will be accomplished through innovative approaches and utilization of biotechnology to generate high-valued agricultural and health products, to invent and transfer new technologies, and to train skilled technologists.

In this exhibition, the research priorities, governing structure, major research progress and developments will be described:

1) Research priorities – the research project is built on existing strength and focuses on four major important areas: i) crop improvement, ii) functional genomics study, iii) plant as bioreactor and iv) fungal biotechnology.

2) System of governance – comprises of multi-level boards and committees to oversee the direction and operation of the Research Center to achieve its stated mission.

3) Scientific achievements: Highlights recent major achievements such as technology breakthrough in high efficient *indica* rice transformation; the successful development of high-lysine, high-yield, and improved amylase content rice; the establishment of technology platform using plant seeds as bioreactor to produce high-value functional protein products; and the optimized pilot scale production of high-value or immuno-modulating natural fungal products. Besides, through the state-of-the-art functional genomics study, important genes such as salt tolerant and disease resistant genes were identified and adopted for genetic engineering applications.

4) Other high impact deliverables and accomplishments: Highlights also major deliverables accomplished such manpower training of over 150 skilled biotechnologists, 8 patent applications, 96 high impact refereed journal publications, national and international collaborations, and international conferences and seminar organization, etc.

Exhibition#:	6
Title:	**Research Funds Administered by the Health Welfare and Food Bureau**
Authors:	**Dr. Richard A. Collins**
Organization:	Health, Welfare and Food Bureau, Government of the HKSAR.

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Exhibition#:	7
Title:	**From Fourier Series to Harmonic Analysis**
Authors:	**Prof. Huang Jing Song**
Organization:	Department of Mathematics, Hong Kong University of Science and Technology.

200 years ago, in 1804 Fourier (1768-1830) took up the subject of the propagation of heat. In a remarkable three years he found the fundamental equations for heat conduction, developed new methods to solve them, applied these methods in a wide variety of cases and produced experimental evidence to support his solution. However, at the time Fourier's method of using trigonometric expansion was not accepted and criticized as lacking in rigor.

Joseph Fourier

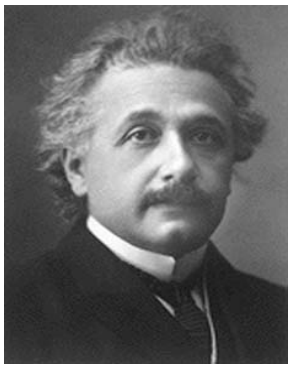
Victor Hugo

Victor Hugo wrote a few words about Fourier in his novel *Les Miserables* when he evoked the year 1817: “There was at the Academy of Sciences a celebrated Fourier whose name is forgotten now, and in some unknown attic an obscure Fourier who will be remembered in times to come.”

It was Riemann (1826-1866) who in his dissertation recognized Fourier as the first to understand trigonometric series in a completely correct way. Fourier Series provides the first, and still the most important, example of an orthonomal expansion. Fourier series, Fourier coefficients, Fourier integrals,

Bernhard Riemann

Fourier transform, the Fourier equation, and the Fourier analysis are everyday terms for mathematicians, physicists and other scientists.



Albert Einstein

20^{th} century began with a flurry of industrial inventions, such as automobile, airplane and telephone, that changed human life style in a dramatic way. The discovery of special relativity by Einstein (1879-1955) and quantum mechanics, an even more conceptual revolution, changed our understanding of the world.

The continuation of Fourier analysis into modern mathematics is harmonic analysis, whose principal content is representation theory. It was born in early 20th century under the combined influence of relativity and quantum mechanics. It develops into a major mathematical field that interacts with all branches of mathematics and theoretical physics.

In 1928 Dirac (1902-1984) discovered a matrix-valued differential equation as a square root of wave equation. Dirac derived many amazing results from this equation such as half spin of electrons and anti-matter. The corresponding version of Dirac operator in Lie algebra introduces a new tool in representation theory. This new tool is now called Dirac cohomology and it opens up a new field of current research.

Paul Dirac

Exhibition#:	8A
Title:	**CALM Research Activities**
Authors:	**Dr. Cheah Kok Wai**
Organization:	Department of Physics, Centre for Advanced Luminescence Materials, Hong Kong Baptist University.

Centre for Advanced Luminescence Materials (CALM) was formed in May 2004. The aim is to bring together colleagues in Departments of Chemistry and Physics of Hong Kong Baptist University so that interdiscipline research in advanced luminescence materials can be performed in more focus fashion. In this talk, I shall highlight some of the works that have been done within this centre. Some the works, particular on Organic LED (OLED) and Si-based device and materials, has been on going well before the centre is formed. While newer work like photonic crystal and triplet emission are more recent. Our recent effort also attracted support by Innovation and Technology Commission support with two projects from them. They are on stacked OLED and PDP phosphors. They will be introduced here too.

Exhibition#:	8B
Title:	**Research Activities in the Department of Physics**
Authors:	**Department of Physics**
Organization:	Department of Physics, Hong Kong Baptist University.

Department of Physics is one of the longest established departments of Hong Kong Baptist University. In past years the department has moved steadily from only doing teaching to fully embracing teaching and research. Our research areas cover condensed matter, spectroscopy, quantum optics, non-linear and

complex system. Within which we have emerging several inter-discipline topics such as organic LED, bio-inormatics and single molecule spectroscopy. A selection of our research works are highlighted in the poster.

Exhibition#:	10A
Title:	**Centre for e-Transformation Research**
Authors:	**Prof. Liu Ji Ming**
Organization:	Department of Computer Science, Hong Kong Baptist University.

The **Centre for e-Transformation Research (CTR)**, an affiliated Centre of Web Intelligence Consortium (WIC), was established by Prof. Jiming Liu of the Department of Computer Science in 2003. Its mission is to promote world-wide scientific research and industrial development in **Web Intelligence (WI)** which is to explore the fundamental roles as well as practical impacts of Artificial Intelligence (AI) and advanced Information Technology (IT) on the next generation of Web-empowered products, systems, services, and activities.

The Centre has recently been awarded a central allocation research grant of 3.8 million HK Dollars from the Research Grant Council. The research team, led by Prof. Liu, consists of three local research groups from 1) Hong Kong Baptist University, 2) The Hong Kong University of Science and Technology, and 3) E-Business Technology Institute, The University of Hong Kong, as well as overseas collaborators from the United States, Australia, etc., forming a critical mass for high-impact research and development.

The Centre currently focuses on a number of WI related technologies that are essential to the success of e-transformation in Hong Kong, including

- Wisdom Web, Knowledge Grid and Agent Technologies,
- Data/Web Mining and Semantic Web, and
- Service-Oriented and Ubiquitous Computing,

with applications to *e-Business* and *e-Learning*. The Centre's industrial strategic partners include Pearson Education Asia Limited, Interactive Communication Online Networks Ltd., Computer and Technology Limited (C&T), IBM Hong Kong, Peking University Founder, and Greenpea.com. In addition, the Centre also organizes regular research seminars, international conferences/workshops, and short-term visits for IP exchange.

Exhibition#:	10B
Title:	**Research Activities in the Department of Mathematics**
Authors:	**Department of Mathematics**
Organization:	Department of Mathematics, Hong Kong Baptist University.

In this poster, we shall outline the main focus of research within the Department of Mathematics as led by our full/chair professors. The Department Head and Chair Professor Fang Kai Tai is an internationally renowned pioneer in uniform design which is now widely used in the design of experiments in industry. He is also the inspirational leader in a vigorous group of colleagues in the Department covering an extensive area of statistics.

The Director of the Graduate School and Chair Professor Tang Tao is a world expert on numerical analysis and was the 2003 winner of the prestigious Feng Kang prize for Scientific Computing. He leads an exceptionally strong research group concentrating on key areas in numerical analysis and scientific computing.

The Director of JRIAM and Full Professor Frederick Hickernell is pivotal in bringing about the synergy of the two aforementioned research groups. His research combines techniques of scientific computing with ideas from Quasi-Monte Carlo methods to yield important new discoveries in complexity theory.

These three energetic leaders together serve on no less than 15 editorial boards for international journals. Moreover, under their dedicated guidance and spiritual support, the research performance of the Department has gone from strength to strength. There are currently 10 colleagues in the Department at the rank of associate professor or higher, and between them they have published over 450 refereed papers and have been awarded 19 RGC grants in the last 5 years.

Exhibition#:	11A
Title:	**Dioxin Analysis Laboratory at Hong Kong Baptist University**
Authors:	**Dr. Zongwei Cai**
Organization:	Dioxin Analysis Laboratory, Hong Kong Baptist University

The dioxin analysis laboratory in HKBU was built in April of 2003. As the sole academic dioxin analysis laboratory in Hong Kong, this facility will utilize our experience in environmental analysis, especially the expertise in dioxin analysis to support research related to dioxins and to provide analytical service to society. Although the dioxin laboratory in HKBU is new, we do have significant experience with the trace analysis of dioxins and other persistent organic pollutants (POPs) in various environmental matrices. The extensive independent and collaborative record, in addition to the facilities and equipments, and well-trained personnel at the laboratory, will allow us to serve our community.

Goals

- To establish analytical protocols for dioxin analysis based on our experience and certified standard procedures, to participate in local and international inter-laboratory quality control studies, and to achieve accreditation and recognition locally and internationally.
- To conduct research on the development and validation of new analytical techniques for higher-throughput dioxin screening, with the assistance of the developed standard analytical program.
- To provide analytical services to academic and governmental projects of environmental studies on dioxins and other POPs.

To build up a comprehensive database for research and development in environmental management, as well as the provision of technical advice and services to industrial sectors, government departments and the general public.

Exhibition#:	11B
Title:	**Risk Assessment of Organochlorine Hydrocarbons Contamination in Human Milk.**
Authors:	**M.H Wong[ab], C.K.C Wong[a], C.K.M. Leung[c], Milton Leong[d], K.C Cheung[ab], K.K.L. Yung[a], M.S. Yang[a], R.N.S. Wong[a], N.K. Mak[a], Y.F. Shen[e], Y.Xu[e], C.Y. Lan[f], and H.Y. Zhou[f].**
Organization:	[a]Department of Biology and [b]Croucher Institute for Environmental Science, Hong Kong Baptist University; [c]*In Vitro* Fertilization Clinic, Hong Kong; [d]Women's Clinic, Hong Kong; [e]Institute of Hydrobiology, CAS, Wuhan; [f]School of Life Sciences, Zhongshan University, Guangzhou.

Persistent organic pollutants (POPs), such as polycyclic aromatic hydrocarbons and their nitro-substituted compounds (PAHs, nitro-PAHs), PCBs, polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and other CHCs are extremely toxic, causing major worldwide environmental issues. They are produced during agricultural/aquatic (persistent organic pesticides/persistent organometallic compounds) and industrial (persistent manufactured chemicals) activities. They are highly persistent, being concentrated in the food chain, accumulated in body lipids, and imposed human health hazard. These chemicals not only influence mono species, but also populations. They may not only lead to losses but also lead to the appearance of new genes and ecotypes, resulting in the changes of structural and functional biodiversity. The biological half-lives of most POPs are rather long, the body burden will be increased during life if the dietary intake is constant over time. A survey was conducted to examine p,p′-DDT, p,p′-DDE, β-HCH and PCBs concentrations in human milk.

The results demonstrated that the mean levels of p,p′-DDT (Hong Kong: 0.39; Guangzhou: 0.70 μg/g of fat), p,p′-DDE (2.48; 2.85) and β-HCH (0.95; 1.11) were 2 – 15 folds higher when compared with studies conducted elsewhere (i.e., United Kingdom, Germany, Sweden, Spain and Canada), and in contrast the concentration of PCBs (0.035; 0.031) was about 10 times lower. Risk assessment using H4IIE rat hepatoma cell line was conducted to screen TCDD-toxic equivalents (TEQs) of human milk samples collected from Hong Kong and Guangzhou. The results indicated that 65 samples from Hong Kong showed TEQ values ranging of 17.7 – 347.5 pg/g of milk fat while 32 samples from Guangzhou showed the values of 41.9 – 790 pg/g of milk fat.

Exhibition#:	12A
Title:	**Studies on synergistic effects of small molecules from Chinese medicinal plants as enhancer of T cell tolerance induction**
Authors:	**Liu Liang[1], Joey C. Y. Leung[1], Y. Y. Zeng[2], Ricky N. S. Wong[3]**
Organization:	[1]School of Chinese Medicine, Hong Kong Baptist University, [2]Institute for Tissue Transplantation & Immunology, Jinan University, [3]Department of Biology, Hong Kong Baptist University

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As compared with immunosuppression which increases frequencies of malignancies and infections due to the pan-immunosuppression, induction of antigen-specific T cell tolerance is an ideal immunointervention in the clinical settings of organ or tissue transplantation, autoimmune diseases, and allergy. It is supposed that insufficient tolerogenic signaling or/and too much immunogenic signaling may be the mechanism underlying tolerance could not be maintained or established in certain situation. It has proven that the Ca2+-NFAT pathway involves tolerogenic signaling while PKCθ- NFκB pathway involves immunogenic signaling. In this project, our hypothesis is that T cell tolerance could be enhanced through the synergistic effects of augmenting the signal flow in Ca2+-NFAT pathway in association with abating the signal flow in PKCθ- NFκB pathway. For those pathways, the small molecules from Chinese medicinal plants would be a proper source as effective modulators.

On the basis of advance in the hypothesis testing, an enhancer cocktail composed of various small molecules (sinomenine, shikonin, andrographolide, baicalin, aconitine, saikasaponin d, gensinosides Rb_1 and Rg_1, panaxatriol, matrine, astragaloside (IV) and icariin) extracted from Chinese medicinal plants targeting to Ca_2^+-NFAT and PKCθ- NFκB pathway is developed as the fundamental elements for the current tolerance-inducing regiments. Our preliminary data shows that three small molecules including andrographolide, shikonin and saikasaponin d have significant inhibitory effect on the expression of CD69, a marker of early T cell activation, in response to the stimulation of PMA which is a PKC activator, indicating their candidate inhibitors of PKCθ and also the possibility for using such molecules as blockers for reducing signal flow in PKCθ- NFκB pathway during T cell activation. The screening and identification of other small molecules from Chinese medicinal plants with enhancement effect on the signaling pathway of Ca_2^+-NFAT in T cell activation will then be conducted in future.

Exhibition#:	12B
Title:	**A Clinical study of Vitalliver Suppository for Anti-viral Effect on Chronic Carriers of Hepatitis B with and without Pre-core Mutation**
Authors:	**Kelvin Chan[1], Shiu-Hon Chui[2] and Ricky Wong[3]**
Organization:	[1] Research and Development Division, School of Chinese Medicine, Hong Kong Baptist University [2] Diagnostic Medical Centre, Modern TCM Limited [3] Department of Biology, Hong Kong Baptist University

As there still exists a void for ideal and effective treatment for chronic hepatitis B carriers, especially those patients whose hepatitis B virus has gone through mutation, it is believed that Chinese medicine with its holistic approach in addressing diseases may be effective in tackling this disease. A ready-made Chinese medicinal (CM) natural product, Vitalliver suppository, has shown actions for enhancing liver functions and relieving symptoms in patients suffering from chronic hepatitis.

Priminary study in 25 patients with chronic hepatitis B have shown that Vitalliver suppository, a Vigconic CM suppository product (VCM) can effectively suppress viral multiplication in chronic carriers of hepatitis B. The exact detailed mechanism is still unknown. It is generally believed that the CM may enhance the body resistance to the virus, through modulation of the immune system. Among others, an increase in the CD4 and CD8 cell counts has been demonstrated. Hence, a study of such kind is very worthwhile. If found to be effective for those there is no available treatment, or if found to have additional benefit when prescribed together with conventional/orthodox medical treatment, the impact for the large number of HBV carries will be very significant.

This project aims to study the anti-viral effect of Vitalliver on chronic carriers of hepatitis B with and without mutation. The project targets first to assess the safety issue with respect to heavy metals, pesticide residues and microbial content etc and quality assurance of Vitalliver prior to commencement of study. Clinical study using both western and Chinese approaches will be adopted on selected patients with chronic hepatitis B infection. Then, laboratory investigations will be performed to assess the efficacy of Vitalliver.

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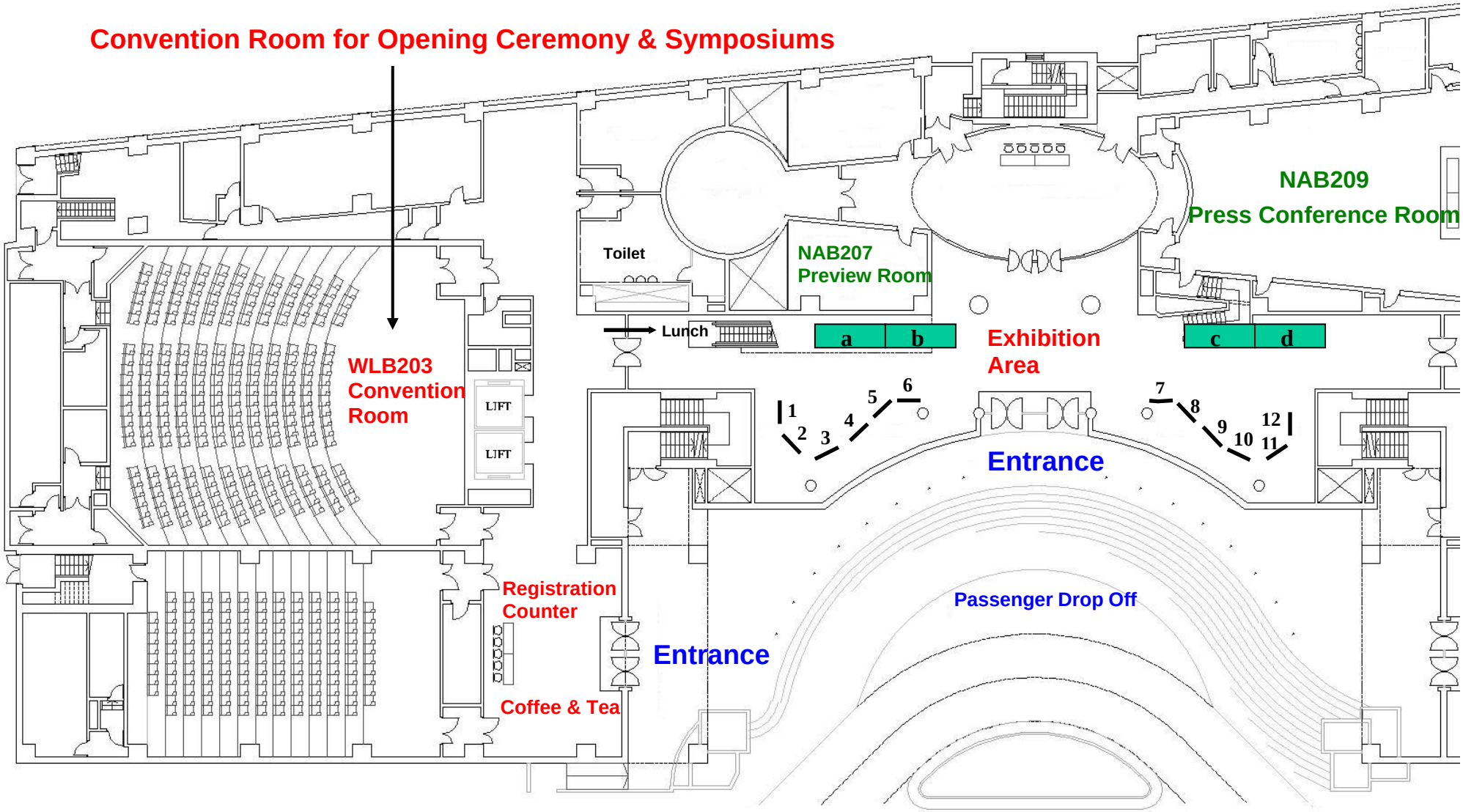

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