# Table of Contents

**Foreword**  
4

**Administration and Organisation**  
8

**Undergraduate Studies**  
9  
- Educational Philosophy  
- Degree Programmes and Enrolment  
- Undergraduate Programme Course Credit Requirements

**Postgraduate Studies**  
11  
- Degree Programme and Enrolment  
- Departmental Programmes  
- Course Credit Requirements for Degree Programmes  
- Interdisciplinary Programmes

**Faculty**  
15  
- Faculty Number and Distribution  
- Faculty Distinction

**Facilities**  
17  
- University Library  
- Centre of Computing Services and Telecommunications  
- Materials Characterisation and Preparation Centre  
- Microelectronics Fabrication Centre

**Research**  
21  
- Funding Sources  
- Research Institutes

**International Scientific Exchange**  
29  
- Distinguished Lecture Series  
- International Scientific Conferences

**Department of Biochemistry**  
32  
- Mission  
- Faculty and Their Research Interests  
- Research Areas
Department of Biology  36
- Mission
- Faculty and Their Research Interests
- Research Areas

Department of Chemistry  40
- Mission
- Faculty and Their Research Interests
- Research Areas

Department of Mathematics  45
- Mission
- Faculty and Their Research Interests
- Research Areas

Department of Physics  52
- Mission
- Faculty and Their Research Interests
- Research Areas

Appendix A — Funded Research Projects  57
The School of Science has been in existence for about three years, born the same day as the University itself, on 2 October 1991. This is a short time by any standard. Yet today we look back, both with surprise at the pace at which we have grown, and with satisfaction at what we have accomplished.

As a part of a research university, the objective of the School of Science is to provide young people, from Hong Kong and around the world, with a research-oriented science education. Increasingly, the world depends on science to advance technology and to contribute benefits to society. An education in science is not a luxury, if it ever was, but a necessary part of the educational process.

At the same time, we at the University must keep in mind that the importance of research goes far beyond its applications alone. Through such an education, we impart to students the ability to observe and to think; we place in their hands the powerful tools of scientific analysis and reasoning. These tools will prove invaluable to graduates in their future, whether they pursue careers as professional scientists and engineers, or go off into non-scientific areas altogether.

While the School of Science is organized along the conventional lines, with five “vertical” departments - biochemistry, biology, chemistry, physics and mathematics - the departmental boundaries are blurred by the existence of “horizontal” research institutes, as well as joint courses and laboratories. There are currently three such institutes based in our School: the Institute of Biotechnology spans the biological sciences and chemistry, the Institute of Scientific Computation combines the physical sciences and mathematics, and the Institute of Advanced Materials covers both the physical and biological sciences. Obviously, science was not created in neat, compartmentalized sections, as evidenced by the growing emphasis on interdisciplinary studies in academia today. An integrated approach to scientific education and research is a key characteristic of the School of Science.

To date, our School has grown to about three quarters of its full size. We have 122-member faculty, with 1,046 undergraduate and 183 graduate students enrolled. This year, for the first time, we produced a crop of 188 Bachelor of Science graduates. In terms of research, more than 250 specific projects are currently being conducted, covering nearly all scientific areas in biological, physical and mathematical sciences. The projects are sponsored by a combination of government allocations, private donations, and most importantly, competitively earned research funds. But the most significant achievement of all, in my view, is that we have gone beyond merely building the university, and have created an academic atmosphere in which devoted faculty and hard-working students together pursue what is known as college life.
Although the School is three years old, this is the first time we have put together a volume of this kind, with an integrated introduction to the various aspects of the School of Science. While the School's basic philosophy is expected to remain the same, its development is a dynamic process, subject to an ever-changing scientific world. At HKUST, we are determined to prepare students who will shape the future. I welcome your participation in this exciting endeavour.

Leroy L. Chang
Dean
December, 1994
The administrative structure of HKUST defines clear lines of responsibility and authority. The Vice-Chancellor and President is the University's chief executive and academic officer. Reporting to him are three Pro-Vice-Chancellors. They bear responsibilities for Academic Affairs, Administration and Business, and Research and Development.

There are four Schools in the University. The Deans of these four Schools report to the Pro-Vice-Chancellor for Academic Affairs.

In a manner similar to that of the University, the Dean of a School is the School's chief executive and academic officer. Reporting to him are the Department Heads. The Associate Dean shares the responsibilities of the Dean in the management and operations of the School.

Vice-Chancellor/President
Professor Chia-Wei Woo

Pro-Vice-Chancellor for Academic Affairs
Professor Shain-Dow Kung

Dean of School of Science
Professor Leroy L. Chang

Associate Dean of School of Science
Professor Grafton W.H. Hui

Head of Department of Biochemistry
Professor Jeffrey T.F. Wong

Head of Department of Biology
Professor Madeline C.S. Wu

Head of Department of Chemistry
Professor Nai-Teng Yu

Head of Department of Mathematics
Professor Din-Yu Hsieh

Head of Department of Physics
Professor Nelson Cue

Director of Biotechnology Research Institute
Professor Tian Yow Tsong

Interim Director of Advanced Materials Research Institute
Professor Nelson Cue

Interim Director of Institute of Scientific Computation
Professor Grafton W.H. Hui
EDUCATIONAL PHILOSOPHY

Science is about creativity and originality, which are extremely difficult, if at all, to teach. The School of Science nurtures an environment that is conducive to independent, critical and original thinking. Whilst all three stages of learning — learning WHAT, learning HOW and learning WHY — will have to be gone through, it is learning WHY that is most important, and hence emphasized, to students of science.

The School offers a whole spectrum of programmes in biological science, physical science and mathematical science, leading to the degree of Bachelor of Science. In response to the needs of Hong Kong and consistent with the special mission of HKUST, the departments in the School emphasize scientific studies in areas of technological importance.

The University curriculum is founded on a credit-based system, and all undergraduate degrees are honours degrees. The undergraduate curricula in the School of Science are broad-based, and all students are required to take courses in the other three Schools: School of Engineering, School of Humanities and Social Science, and School of Business and Management, in addition to a concentration of specialist courses in their own disciplines.

Degree Programmes and Enrolment

<table>
<thead>
<tr>
<th>Degree</th>
<th>Department</th>
<th>Programme</th>
<th>Enrolment 1994</th>
<th>Enrolment (planned) 1997</th>
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<tbody>
<tr>
<td>BSc</td>
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<td>Biochemistry</td>
<td>161</td>
<td>210</td>
</tr>
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<td>BSc</td>
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</tr>
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<tr>
<td></td>
<td>Pure Mathematics</td>
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</tr>
<tr>
<td></td>
<td>Scientific Computation</td>
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<td>60</td>
</tr>
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<td></td>
<td>Statistics</td>
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<td>60</td>
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<td></td>
<td>Mathematical Sciences</td>
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<td>BSc</td>
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<tr>
<td></td>
<td>Applied Physics</td>
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<td>81</td>
<td>180</td>
</tr>
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<td>School Total</td>
<td></td>
<td></td>
<td>1046</td>
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### Undergraduate Programme Course Credit Requirements

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<tr>
<th>Programme</th>
<th>Science</th>
<th>Engineering</th>
<th>Business &amp; Management</th>
<th>Humanities &amp; Social Science</th>
<th>Free Elective</th>
<th>Total</th>
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<td></td>
<td>Within</td>
<td>Outside</td>
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<td></td>
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<td>28</td>
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<tr>
<td>Biology</td>
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</tr>
<tr>
<td>Chemistry</td>
<td>48</td>
<td>12</td>
<td>6</td>
<td>6</td>
<td>12</td>
<td>16*</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure Mathematics</td>
<td>50</td>
<td>8</td>
<td>7</td>
<td>12</td>
<td>6</td>
<td>18</td>
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<tr>
<td>Scientific Computation</td>
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<td>8</td>
<td>15</td>
<td>12</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
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<td>12</td>
<td>14</td>
<td>12</td>
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<tr>
<td>Mathematical Science</td>
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<td>0-8</td>
<td>7-11</td>
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<tr>
<td>Physics</td>
<td>49</td>
<td>16</td>
<td>8</td>
<td>6</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Applied Physics</td>
<td>45-50</td>
<td>12-16</td>
<td>8-14</td>
<td>6</td>
<td>12</td>
<td>9</td>
</tr>
</tbody>
</table>

* Including 3 credits in Technical Communication
Postgraduate Studies

All departments within the School of Science offer the Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) degrees. In addition, Departments of Mathematics and Physics offer the Master of Science (MSc) degree, whilst MSc degrees are also offered by the Departments of Biochemistry, Biology, Chemistry and Physics through interdisciplinary programmes: MSc in Biotechnology, MSc in Material Science and Engineering, and MSc in Environmental Science and Engineering. All these degrees are available on a full-time basis and some of them, especially the MSc degrees, are also available on a part-time basis. The MPhil and PhD are research degrees, and students in some disciplines are required to participate in research on a full-time basis.

**Degree Programmes and Enrolment**

<table>
<thead>
<tr>
<th>Department</th>
<th>MSc</th>
<th>MPhil</th>
<th>PhD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>5 (8)**</td>
<td>12 (21)</td>
<td>9 (14)</td>
<td>26 (43)</td>
</tr>
<tr>
<td>Biology</td>
<td>0 (8)**</td>
<td>12 (18)</td>
<td>21 (26)</td>
<td>33 (52)</td>
</tr>
<tr>
<td>Chemistry</td>
<td>3 (8)**</td>
<td>30 (30)</td>
<td>13 (15)</td>
<td>46 (53)</td>
</tr>
<tr>
<td>Mathematics</td>
<td>1 (14)*</td>
<td>18 (37)</td>
<td>14 (22)</td>
<td>33 (73)</td>
</tr>
<tr>
<td>Physics</td>
<td>4 (12)**</td>
<td>25 (30)</td>
<td>16 (20)</td>
<td>45 (62)</td>
</tr>
<tr>
<td>School Total</td>
<td>13 (50)</td>
<td>97 (136)</td>
<td>73 (97)</td>
<td>183 (283)</td>
</tr>
</tbody>
</table>

* The first figure is 1994 enrolment, the figure in parenthesis is the planned 1997 enrolment  
** Interdisciplinary programmes  
* Departmental programmes

**DEPARTMENTAL PROGRAMMES**

**Master of Science (MSc) Programmes**

These are coursework degrees for which students must fulfil a minimum credit requirement of 30. Students will also undertake a project which requires the submission of a written essay and carries credits, as specified by the department, to a maximum of nine. The essays will be read by two faculty members, one of whom is the supervisor, and are graded “Pass” or “Fail”. A “Pass” grade may be denoted as “Pass with Distinction” when appropriate. For full-time students, the normal length of time for completion of the MSc degree is one and a half year.
Master of Philosophy (MPhil) Programmes

In addition to coursework requirements specified by the department concerned, MPhil students will undertake a programme of thesis research under the direction of a supervisor appointed by the department. When the thesis is ready for examination, the department head will appoint an examination committee, consisting of two faculty members and the supervisor, to examine the thesis and conduct an oral thesis defence by the student. Theses will be graded “Pass” or “Fail”. A “Pass” grade may be denoted “Pass with Distinction” when appropriate. For full-time students, the normal length of time for completion of the MPhil degree is two years.

Doctor of Philosophy (PhD) Programmes

PhD programmes focus on original research by the student, but most also require coursework. Doctoral students proceed from admission to the programme, to candidacy for the degree, and then to oral defence of the thesis; and each student has a thesis supervisor who guides and oversees the student's research. Candidacy is obtained by the successful completion of qualifying examinations. The thesis examination is conducted by a committee of five members: the thesis supervisor, two academic staff members from the department, one academic staff member from outside the department or discipline, and one additional member from outside the department. Theses will be graded “Pass” or “Fail”. A “Pass” grade may be denoted “Pass with Distinction” when appropriate.

Course Credit Requirements for Degree Programmes

<table>
<thead>
<tr>
<th>Department</th>
<th>Degree</th>
<th>MSc</th>
<th>MPhil</th>
<th>PhD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td></td>
<td>30-32*</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Biology</td>
<td></td>
<td>30-32*</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Chemistry</td>
<td></td>
<td>30-32*</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
<td>30 *</td>
<td>24</td>
<td>36</td>
</tr>
<tr>
<td>Physics</td>
<td></td>
<td>30-32*</td>
<td>12</td>
<td>12</td>
</tr>
</tbody>
</table>

* Interdisciplinary programmes
* Including 6 credits for project
INTERDISCIPLINARY PROGRAMMES

Master of Science (MSc) in Biotechnology

Biotechnology is the application of techniques and processes that utilise biological systems for efficient and useful production of materials to serve human needs in agriculture, medicine, industry and daily life. Although biotechnology had its beginnings in man’s earliest cultivation of crop plants, the production of wines and cheeses and the domestication of animals, modern developments in the field have been greatly stimulated by recent advances in biochemistry and molecular biology. Biotechnology is endowed with enormous potential for the future, and Hong Kong is well suited for its deployment.

This MSc programme, designed for the training of research and technical personnel for the biotechnology industry in Hong Kong and its surrounding regions, admits both full-time and part-time students. It is administered by a committee which is jointly appointed by the Departments of Biochemistry, Biology, Chemistry, Chemical Engineering, and Civil and Structural Engineering. Normally, the programme will take 18 months to two years of full-time study to complete and about twice as long for part-time students.

For this interdisciplinary programme, undergraduate training is required in one of the following disciplines: biochemistry, biology, chemistry, chemical engineering or civil and structural engineering.

The curriculum comprises four groups of courses, with students being required to complete a total of 32 credits.

Master of Science (MSc) in Materials Science and Engineering

This interdisciplinary programme commenced in Fall 1994 with enrolment of its first batch of students. Its aim is to train students in this expanding and increasingly important field of science and technology. It involves the participation of Chemistry, Physics, Chemical Engineering, Mechanical Engineering, and Electrical and Electronic Engineering.

It is a taught programme in which the students must take 32 credits, including core-courses in Materials Science and approved postgraduate electives from participating departments. The programme is available for full-time or part-time study and thus...
can provide valuable specialised training to personnel in the plastic (polymer), ceramic, metal-working, and electronic industries.

A minimum of 6 credits of Masters level research projects must also be completed. Materials' research facilities in the Chemistry and Physics departments and the Materials Characterisation and Preparation Centre (MCPC) are now being augmented by the setting up and equipping of the Advanced Materials Research Institute (AMRI).

**Master of Science (MSc) in Environmental Science and Engineering**

Hong Kong society has made the improvement of its environment a high priority issue to ensure sound future development. From the early days of its planning, the Hong Kong University of Science and Technology has declared its commitment to contribute to the task of improving Hong Kong’s environment. Many academic departments at HKUST are already actively engaged in a variety of research programmes aimed at finding solutions to a wide range of urgent environmental challenges facing Hong Kong and its surrounding region.

The MSc degree programme will provide an in-depth education in Environmental Science and Engineering and serve as the first step to more fully utilise HKUST’s expertise in the area of environmental education and as the catalyst to promote further educational programmes to assist in the task of improving Hong Kong’s environment. It is also planned to have significant involvement of external experts on environmental matters in certain appropriate lecture courses or projects.

The programme is designed as a MSc taught course to complement current MPhil and PhD research-based programmes in environmental studies. The course will mostly but not exclusively be admitting Part-time students, many of which may already have their career in environmental protection. Contributions from the Schools of Engineering, Business and Management, and Humanities and Social Science towards two core courses will be part of the programme.

For this interdisciplinary programme, undergraduate training is required in one of the following disciplines; biochemistry, biology, chemistry, chemical engineering or civil and structural engineering.

The curriculum comprises 9 credits of general core courses, 8 credits of science core courses, electives and a research project. Students are required to complete a total of 30 credits.
The faculty to student ratio at HKUST is one to eleven. In the School of Science, the faculty distribution is as follows:

**Faculty Number and Distribution**

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>16</td>
<td>21</td>
</tr>
<tr>
<td>Biology</td>
<td>19</td>
<td>28</td>
</tr>
<tr>
<td>Chemistry</td>
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<td>Mathematics</td>
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<td>42</td>
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<tr>
<td>Physics</td>
<td>30</td>
<td>36</td>
</tr>
<tr>
<td><strong>School Total</strong></td>
<td><strong>122</strong></td>
<td><strong>155</strong></td>
</tr>
</tbody>
</table>

The success of undergraduate and postgraduate education depends crucially on the quality of the faculty. All faculty in the School of Science have a PhD degree, and some have DSc degrees as well. Of the faculty in the School of Science, more than half of them earned their doctorates from the following institutions, each of which supplying at least three faculty.

- Bristol
- Columbia
- MIT
- UC Berkeley
- Brown
- Cornell
- Oxford
- UCLA
- Caltech
- Kyoto
- Princeton
- UC Berkeley
- Cambridge
- Maryland
- Toronto
- Washington

**FACULTY DISTINCTION**

Many senior faculty in the School of Science are world leaders in their research fields and members of prestigious learned Societies. For instance, Professor Leroy L. Chang, Dean of Science, has won numerous awards from professional societies of both physics and engineering, including the most recent Ballantine Medal of the Franklin Institute “for his pioneering contribution to the realization, understanding and development of quantum well and superlattice heterostructures”. His contribution has opened up an interdisciplinary field of Artificially Structured Materials involving physics, materials science and electronic engineering. He is a member of the US National Academy of Sciences and the US National Academy of Engineering. In addition, he is also a foreign member of the Chinese Academy of Sciences and a member of the Academia Sinica.

Professor Leroy L. Chang
Recipient of the Ballantine Medal
As another example, Professor Shang-fa Yang, Professor of biology and a member of the US National Academy of Sciences and a member of the Academia Sinica, won the Wolf Award in 1991 “for his research resulting in prolonging the life span of plants and the modification of flower and fruit development”. The Wolf prize, established in 1975 to promote science and art for the benefit of mankind, is considered one of the foremost international awards in agriculture, and is frequently compared to the Nobel Prize given to outstanding scientists in other fields.

The structure of the faculty in HKUST is a hybrid of the British and the American system. This provides flexibilities in the choice of the title of academic ranks. Thus, in addition to the four titles in the British system — Professors, Readers, Senior Lecturers and Lecturers — Lecturers and Senior Lecturers have the freedom of choosing the title of Assistant Professors and Associate Professors, respectively, which are better understood in North America.
UNIVERSITY LIBRARY

The University Library occupies a central location close to the University’s entrance Piazza, covering five floors with 10,000 square metres of space and 1,500 seats, and commanding a spectacular sea view. As an integral component of the academic programme, the Library supports the University’s teaching and research in science, engineering, business and management, the humanities and social science. There are seminar rooms for meetings and instruction, areas for group discussion, and study carrels for individual use. Audio-visual materials, both educational and recreational, are available for use in specially equipped facilities. The Library is much more than a repository for the accumulated knowledge of civilisation; it serves as the heart of the intellectual enterprise.

The rapid development of the University requires a correspondingly rapid rate of growth in its library collection. In 1994 the Library has a collection of over 250,000 volumes of books and bound periodicals, as well as a sizable collection of non-print materials. The Library plans to add about 50,000 items per year to support the growing demand of the University’s expanding programme. Reaching beyond local holdings, the Library has made extensive provisions for automation. The Library Online System forms a part of the campus-wide network, and is therefore accessible from every part of the campus. Through the Online System users are able to consult a broad range of bibliographic and full-text information as well as to search CD-ROM databases. The University Library is linked via telecommunications to libraries and databases in institutions locally and overseas.

An experienced staff assists users in a variety of ways, from the selection, acquisition, and cataloguing of materials to using the collection, online searches, and interlibrary loans. There are also a fully-equipped classroom and computer laboratory for group instruction. The University Library has a strong service orientation in order to effectively meet the information needs of its academic community.

CENTRE OF COMPUTING SERVICES AND TELECOMMUNICATIONS

The Centre of Computing Services and Telecommunications (CCST) develops and manages the computing and networking infrastructure of the University. It provides computing support to undergraduate and postgraduate teaching, and research applications in science, engineering, business and management, and humanities and social science.
The HKUST computing environment is modelled after the distributed client-server architecture. The network backbone is a collection of advanced, high-speed FDDI (Fibre Distributed Data Interface) rings, each running at 100 megabits per second. The campus network is connected to Harnet (Hong Kong Academic & Research Network) and to internet in the United States. Network services are available not only in offices and laboratories, but also in staff quarters and student dormitories.

The Centre operates powerful server computers to provide campus-wide network services such as network printing, e-mail and electronic notice board. One important characteristic of the University's computing environment is its Chinese-English bilingual capability. Increasingly, more applications will have this dual support.

All microcomputers and powerful scientific workstations are connected to the campus network, providing desktop computing power as well as serving as windows to a vast array of information and computing resources, such as the library system and various scientific and business packages, on the University's own network or that of other institutions in Hong Kong, and through the Internet, on networks of educational and research institutions worldwide.

To support scientific computing and visualisation, CCST is developing a high performance, distributed and parallel computing environment composing of high-end computation and graphics workstations with FDDI interface and interconnected by a super high-speed gigaswitch. The supercomputing facilities installed include a 10.5 GFLOPS, 140 nodes Intel Paragon Massively Parallel Multi-Processor Supercomputer, a four-HP735 workstation cluster and an 8-processor SGI Onyx Reality Engine Symmetric Multi-Processor (SMP) machine.

With its scalable high-performance architecture (configurations from 2 to 307 gigaflops) and standard OSF/1 operating system, the Paragon supercomputer sets new standards for supercomputer performance.
MATERIALS CHARACTERISATION AND PREPARATION CENTRE

Materials are the building blocks of our physical world. A better understanding of the structure and properties of materials, together with the advent of new processing methods, have underpinned many recent technological advances. State-of-the-art equipment for materials science is fundamental to meeting the research goals of HKUST’s Schools of Science and Engineering. The University has therefore established a central facility, the Materials Characterisation and Preparation Centre (MCPC), specially devoted to the synthesis and study of new materials. The facility serves academics from all the Science and Engineering Departments, and promotes both interdisciplinary research and collaboration with other research organisations. Any spare equipment capacity in the Centre is available to clients from other local tertiary institutions, government bodies, and private industry.

In the MCPC, instrumentation in operation includes scanning electron microscopes (SEM), transmission electron microscopes (TEM), X-ray diffraction systems (XRD), multi-technique surface analysis systems, a nuclear magnetic resonance spectrometer (NMR), a scanning tunnelling/atomic force microscope (STM/AFM), atomic absorption and ultraviolet/visible spectrometers, thin film preparation and measurement equipment, and other instruments for supporting sample preparation and analysis. These techniques and equipment are particularly suited to the study and development of new materials. Applicability exists for materials in the areas of electronic and optoelectronic materials, catalysts, nano-clusters, sensors, biomaterials, and materials with various engineering applications.

MICROELECTRONICS FABRICATION CENTRE

The Microelectronic Fabrication Centre (MFC) is a University central facility. It provides functional microelectronics fabrication laboratories for the faculty and students of HKUST to conduct teaching and research, particularly in new discrete semiconductor devices, novel microsensors and microactuators, advanced microelectronics process technology and application specific integrated circuits (ASIC). While closely associated with the Electrical and Electronic Engineering Department, this facility is used by scientists from many disciplines — including Mechanical Engineering, Chemical Engineering, Physics and Chemistry.

The MFC phase I laboratory provides appropriate clean room environment of about 247 square metres in area. These are Class 1,000 clean rooms (containing fewer than
A test die composed of various test patterns which are used for developing the Centre's baseline IC fabrication processes.

1,000 particles per cubic foot of air larger than a half micrometer) with five basic fabrication modules provided: photolithography, thermal diffusion / thin-film disposition, dry / wet etching and metallization. The phase I laboratory has also developed 3 micron MOS and bipolar base line processes to provide microelectronics fabrication at the discrete device and small scale integrated circuits (SSI) level, with the possibility to upgrade to LSI and VLSI level in its phase II development.

In 1995, the technical capabilities of MFC will be further upgraded with the completion of its phase II laboratory. The laboratory occupies an area of 10,000 square feet with Class 100 clean rooms constructed. State-of-the-art microelectronics processing equipment will be installed there such as the E-beam Direct Write System which facilitates the sub-half-micron photolithography and enables more advanced research work. In addition to the existing five modules in the phase I laboratory, phase II will provide the sixth module of mask-making. While the phase I laboratory mainly serves the academic departments of the University, phase II will extend its service further to the private sector through various technical collaborations.

In addition to the above central facilities in the University, there are other supporting facilities: Glass Blowing Shops, Machine Workshop, Electronic Workshop, Plant Growth Facilities and the Animal Care Centre.
Research plays a central and fundamental role in a modern university of science and technology. At HKUST, both basic and applied research are conducted. They not only provide for the intellectual development of faculty and students, but also stimulate the transfer of the latest and best knowledge in science and technology to meet the economic, industrial, commercial and environmental needs of Hong Kong. The faculty provide the leadership to position HKUST's research at the forefront of intellectual development and to insure the movement of new knowledge into teaching programmes, thus assuring high quality of postgraduate and undergraduate education. As participants in research activities, students acquire the ability of independent, critical and creative thinking and build a foundation for fruitful professional careers in industry, commerce, education, or public services.

No university, especially a technological university like HKUST, can be self contained in research. Elsewhere in the world are recognised experts, fine laboratories, and good organisations that can contribute greatly to the programmes at HKUST. One of the goals of research programme development is to cooperate worldwide with other universities, research institutions, and industrial laboratories to the benefits of all. These partnerships in research extend the capability of HKUST far beyond local resources. The benefits of these partnerships are especially significant during a period when faculty and the student body are expanding rapidly and new laboratory facilities are being constructed.

To contribute more effectively to the economic vitality of Hong Kong and the surrounding region, the University works with industrial and commercial organisations to set up new and expanded enterprises. Furthermore, the University’s personnel and facilities are available to support the community’s on-going technical needs in testing, computation, evaluation, personnel training, as well as industrial research and development.

Research in the School of Science emphasizes originality and creativity. It is funded from a variety of sources, both government and private. At present, there are already more than two hundred research projects in the School funded externally and internally; Appendix A gives the titles and the names of the investigators of these projects which offers a glimpse of current research activities in the School.

**FUNDING SOURCES**

A major source of funding for research is the recurrent budget of the University. In HKUST, departmental budgets contain a research component (between 30% and 40% of the budget) that is intended, by the University Grants Committee (UGC)
which funds tertiary institutions in Hong Kong, to support such aspects of research as conference travel, consumables, and general expenses.

The Research Grants Council (RGC) of the UGC is a major source of research funding, especially for research personnel support.

**RGC Competitive Earmarked Research Grants**

The Research Grants Council (RGC) awards research grants on a competitive basis that are primarily directed toward academic excellence as viewed by global standards. HKUST is one of the seven institutions funded by the University Grants Committee. Applications are submitted by individuals or groups of academic staff. The research can be of a basic or applied nature.

**RGC Direct Allocation Grants**

The Research Grants Council (RGC) provides funding to each of the seven UGC-funded tertiary institutions for allocation to research projects. Direct Allocation Grants are primarily intended to fund disciplinary basic and applied research to help new recruited staff and junior faculty develop new and initial research and support research projects that do not exceed the minimum threshold of RGC Competitive Grants. In 1994/95 the total funds available to the School of Science are $2.55 million. Awards are made on a competitive basis, are normally for one year, and cannot exceed $100,000 per award.

**RGC Central Allocation**

The Research Grants Council (RGC) provides, as its yearly budget permits, grants in support of inter-institutional research projects. Grant funds provide mainly support for major facilities or equipment costs that normally cannot be supported from the recurrent budgets of individual institutions. The involvement of several institutions in the proposal is strongly encouraged.

**UGC-funded Research Infrastructure Grants**

As a UGC-funded institution, HKUST uses about 2% of the overall recurrent budget to provide grants to assist in building research infrastructure at the University. Research infrastructure is mainly interpreted as the building of research programme activities, procedures and mechanisms needed for the development of HKUST into a research university. Interdisciplinary proposals are preferred to augment the normally funding pattern of disciplinary research. In 1994/95 the estimated funding in the University is $8.9 million. Awards are made on a competitive basis and are normally for a period of one to three years. Research Infrastructure Grants
programmes are required over their life-time to attract external non-UGC funding of an amount at least equal to that of the Research Infrastructure Grant awarded and other UGC-sponsored funds.

**UGC Matching Funds Grants**

UGC Matching Funds Grants are intended to provide necessary additional funding to non-UGC research grants or donations where the amount of the grant or donation is not sufficient or the sponsor requires additional funding to carry out the intended research programme or to establish a research facility. The matching funds are intended to support only costs associated with the purchase of research equipment required to establish a research programme and/or the hiring of short-term technical support personnel to install and/or make operational research equipment. Funding requests cannot exceed 20% of the committed research grant or donation and must be for more than $100,000.

**UGC Research Travel Grants**

The Research Travel Grants (RTG) programme is intended to help support the cost of travel for research postgraduate students and lecturers or assistant professors to present papers at professional meetings.

**Total Research Awards**

![Graph showing total research awards from 1991-92 to 1993-94]
The total award of the projects for the University from RGC/UGC in 1994/95 is $51.05 million, of which $18.33 million is for the School of Science. In addition, research funding supports are also available from non-RGC/UGC sources.

**RESEARCH INSTITUTES**

Some research activities fit well into the traditional disciplinary organisation, and are administered by academic departments. This is especially true of smaller, basic research programmes that primarily involve faculty and research students. For research programmes that are large and require the participation of a combination of faculty and students from different disciplines, the activities are separately administered in research institutes. Special laboratory facilities are, in some instances, also separately and centrally maintained. Faculty and students are encouraged to pursue disciplinary as well as interdisciplinary research.

There are already ten research institutes in the University, and the following three institutes are based in the School of Science. Each of these institutes involves faculty and students from at least three departments in the School.

**Department Involvement of Research Institutes**

<table>
<thead>
<tr>
<th>Institutes</th>
<th>Biochemistry</th>
<th>Biology</th>
<th>Chemistry</th>
<th>Physics</th>
<th>Mathematics</th>
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<tr>
<td>Biotechnology</td>
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<td>Advanced Materials</td>
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<tr>
<td>Scientific Computation</td>
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Biotechnology Research Institute

Biotechnology is a technology most relevant to the well being of people because products of biotechnology are revolutionizing the health care, the food and agricultural industries, and the environmental management, pest and pollution controls. Biotechnology is high-tech: while it requires highly trained work force, it does not need big capital and large manufacturing space. It is generally considered a technology of the future. Thus, biotechnology was identified as one of several key areas which are most suitable for upgrading Hong Kong’s industry thus diversifying Hong Kong’s economic basis. From its inception, HKUST has made biotechnology one of the main research and development efforts of its faculty. With the donation of $130 million from the Hong Kong Jockey Club, HKUST established the Biotechnology Research Institute (BRI) in 1991.

The mission of the BRI is to assist Hong Kong develop biotechnology through recruitment of highly qualified faculty, establishment of state-of-the-art research facilities, support of up- and mid-stream research in targeted areas and the down-stream development of products, and training of specialists in biotechnology. BRI has been supporting research in the following areas:

- Biomedical Instrumentation
- Genetic Engineering and Protein Design
- Drug Development and Delivery
- Plant and Herbal Medicine

Besides providing common equipment for biochemical and biological laboratories, BRI also sponsors several research facilities essential for biotechnology research:

- Animal Care Facilities
- Plant Growth Facilities
- Cell Culture Facilities
- Fermentation Facilities
- Molecular Structure Laboratory

Including a 600 MHz nuclear magnetic resonance apparatus, BRI is also initiating a new area of research—the neuron-specific proteins which have potential therapeutic and medical values.
The fact that historical periods are named after materials—the Bronze Age, the Iron Age, the Silicon Age, etc.—is a reflection of the crucial role of man-made materials in determining the quality of life throughout the recorded human history. In the increasingly competitive world of today that role has become essential to enhancing the economic competitiveness of any community. The Advanced Materials Research Institute (AMRI) has been formed to marshal the resources at HKUST to address both the educational and research needs of Hong Kong and its region.

Hong Kong’s current needs are much more rudimentary—more trained manpower and better infrastructure such as databases for materials selection and more diagnostic and testing facilities. But a university should not be just a service and training centre. It should be a place where discoveries and innovations reign supreme and where initiatives that could lead to new products and spawn new industries nurtured. These intellectual challenges form the natural links between the AMRI and the academic departments, and it is on the basis of these links three centres within the AMRI, each with three affiliated laboratories, have been created. These are:

**Electronic & Nanostructured Materials Centre**
- Thin-Film Science Laboratory
- Solid-State Clusters Laboratory
- Materials Modeling Laboratory

**Optical & Magnetic Materials Centre**
- Lasers & Photonics Laboratory
- Magnetic Materials Laboratory
- Liquid Crystals Laboratory

**Composite & Synthetic Materials Centre**
- Polymer Synthesis Laboratory
- Composites Laboratory
- Biomaterials Laboratory

Three laboratories of the AMRI are now equipped and functioning, thanks to the donations of $10 million each from the Zheng Ge Ru Foundation for the Thin Film Science Laboratory, the Joyce M. Kuok Foundation for the Lasers & Photonics Laboratory, and the Shun Hing Education and Charity Fund Limited for the Solid State Clusters Laboratory. Also, activities for the Liquid Crystals Laboratory have been launched by the establishment of the Centre for Display Research funded by a $13 million grant from the Department of Industry. More than 42 of the current faculty, mainly from the Departments of Physics, Chemistry, and Electrical and Electronic Engineering, are either doing or planning to do research connected with the AMRI.
The involvement of faculty and postgraduate students are expected to increase in number, breadth, and depth as the other laboratories become operational. With judicious investment of resources each centre or, for that matter, each laboratory could become a “centre of excellence” in materials research.

**Institute of Scientific Computation**

Scientific Computation has grown over the past two decades to become an important new approach to studying science and technology, adding to the traditional experimental and theoretical approaches. This has come about because of great progress in computer hardware and of spectacular advances in computational algorithms. It already has enormous importance in the economy and the environment. For instance, it is now a standard practice in the aircraft industry to use Computational Fluid Dynamics for the design of an aircraft whilst the wind-tunnel is only used for verification, and short-term weather forecasts are now routinely done using computation. It is also very clear that with the advent of parallel computers and development of new algorithms, scientific computation will play an increasingly more important role for science and technology compared to the two traditional approaches.

For the mission of the Hong Kong University of Science and Technology and for helping to transform Hong Kong to a high technology society, it is imperative that HKUST should strengthen herself to become a centre of excellence in scientific computation. For this purpose, an interdisciplinary Institute of Scientific Computation is being established at HKUST.

The aim of the Institute is to promote research and applications in large scale computation and manpower training in scientific computation. It will emphasize on large scale and parallel scientific computation of solutions to problems in science, engineering and business and management. This is to be done by developing computing algorithms that are reliable, accurate and efficient. Research and applications programmes are in:

- Computational Fluid Dynamics
- Computational Geophysics
- Computational Management Science and Economics
- Computational Physics and Chemistry
- Computational Solid Mechanics
- Neural and Parallel Computation
There are already 102 research projects undertaken by faculty from 16 departments in the University which involve large scale computation or aim at developing better computational algorithms. In addition, an undergraduate programme on scientific computation has recently been introduced in the Department of Mathematics.

**Other Institutes**

In addition, the School also participates in the following Institutes which are based in the University:

- Advanced Manufacturing Institute
- Hainan Institute
- Hongkong Telecom Institute of Information Technology
- Institute for Environmental Studies
- Institute for Infrastructure Development Technology
- Institute of Micro Systems
- Sino Software Research Centre
International exchanges of scientific ideas and discoveries form an important part of research. The School of Science actively promotes these activities by organising distinguished lectures, seminars and international scientific conferences, and by conducting joint research with scientists of other countries.

**Distinguished Lecture Series**

"The Best Way to Learn is to Learn from the Best" — under this banner the School has organised a series of distinguished lectures given by outstanding scientists throughout the world. Many of these speakers are Nobel laureates.

The School and the University also have many formal and informal research links with institutions in Canada, China, Japan, UK and the US. For instance, HKUST has a formal agreement with the Chinese Academy of Sciences, whereby the latter sends 10 students per year to study in HKUST for PhD degrees. There is also a similar agreement with the State Education Commission of China which sends 15 students per year to study in HKUST for PhD degrees.
### Distinguished Lectures in Science 1991-1994

<table>
<thead>
<tr>
<th>Date</th>
<th>Title of Lecture</th>
<th>Speaker</th>
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<tbody>
<tr>
<td>7 Oct 1991</td>
<td>Molecular Dance in Chemical Reaction</td>
<td>Prof. John Polanyi</td>
</tr>
<tr>
<td>12 Nov 1991</td>
<td>Biosynthesis of the Gaseous Plant Hormone Ethylene and its Regulation</td>
<td>Prof. Shang-fa Yang</td>
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<tr>
<td>17 Jan 1992</td>
<td>Physics in the 20th Century</td>
<td>Prof. Chen-Ning Yang</td>
</tr>
<tr>
<td>29 Jan 1992</td>
<td>Newer Insights in the Control of Globin Gene Expression</td>
<td>Prof. Yuet-Wai Kan</td>
</tr>
<tr>
<td>10 Mar 1992</td>
<td>What is Geometry</td>
<td>Prof. Wu-Chung Hsiang</td>
</tr>
<tr>
<td>9 Apr 1992</td>
<td>The Universe is our Playpen: Fun with Physics</td>
<td>Prof. Chih-Yung Chien</td>
</tr>
<tr>
<td>14 Apr 1992</td>
<td>The Frontier of Life: Viroids &amp; Satellites</td>
<td>Prof. Theodor Diener</td>
</tr>
<tr>
<td>28 May 1992</td>
<td>The Scope and Development of Applied Mathematics: My Experience in MIT &amp; U.S.</td>
<td>Prof. Chia-Chao Lin</td>
</tr>
<tr>
<td>8 Aug 1994</td>
<td>Today's Science, Tomorrow's Technology</td>
<td>Prof. J. Robert Schriefer</td>
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<tr>
<td>7 Nov 1994</td>
<td>Theory and Experiment in Science</td>
<td>Prof. Rudolph A. Marcus</td>
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### International Scientific Conferences held in HKUST

<table>
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<tr>
<th>Date</th>
<th>Conference Name</th>
<th>HKUST Faculty</th>
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<tr>
<td>21-22 Aug 1992</td>
<td>Condensed Matter Theory</td>
<td>Dr. K.Y. Szeto Organising Committee Memb</td>
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<tr>
<td>15-17 Jan 1993</td>
<td>International Conference on Complex Analysis and Its Applications</td>
<td>Prof. C.C. Yang Conference Chairman</td>
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<tr>
<td>12-13 Aug 1993</td>
<td>Hong Kong Workshop on Frontiers of Surface Diffraction and Imaging</td>
<td>Dr. M. Altman, Prof. N. Cue, Dr. T. Chen, Dr. X. Yan Organising Committee Members</td>
</tr>
<tr>
<td>8-9 Apr 1994</td>
<td>15th Meeting of the Hong Kong Society of Neurosciences</td>
<td>Dr. Karl W. Tsim Local Host</td>
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<tr>
<td>24 Jul - 21 Aug 1994</td>
<td>1994 HKUST Physics Summer School on Strong Correlated Electron Systems</td>
<td>Dr. T.K. Ng, Dr. P.W. Leung Organising Committee Members</td>
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<tr>
<td>22-26 Aug 1994</td>
<td>XIVth International Conference on Raman Spectroscopy</td>
<td>Prof. Nai-Teng Yu Conference Chairman</td>
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<tr>
<td>16-19 Jan 1995</td>
<td>First Asian Computational Fluid Dynamics</td>
<td>Prof. Grafton W.H. Hui Conference Chairman</td>
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<td>Awards/Honours</td>
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<tr>
<td>Nobel Laureate in Chemistry, Wolf Prize in Chemistry, FRS, NAS</td>
<td>University of Toronto</td>
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<tr>
<td>Wolf Prize in Agriculture, Academia Sinica, NAS</td>
<td>University of California, Davis</td>
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<tr>
<td>Nobel Laureate in Physics</td>
<td>State University of New York, Stony Brook; and the Chinese University of Hong Kong</td>
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<tr>
<td>Lasker Award in Clinical Medical Research, FRS</td>
<td>University of California, San Francisco; and University of Hong Kong</td>
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<tr>
<td>Academia Sinica</td>
<td>Princeton University</td>
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<td>Johns Hopkins University</td>
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<tr>
<td>Wolf Prize in Agriculture</td>
<td>Maryland Biotechnology Institute, University of Maryland</td>
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<tr>
<td>Academia Sinica, NAS</td>
<td>Massachusetts Institute of Technology</td>
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<tr>
<td>Nobel Laureate in Physics</td>
<td>Florida State University</td>
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<td>Nobel Laureate in Physics</td>
<td>Harvard University</td>
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<tr>
<td>Nobel Laureate in Chemistry</td>
<td>California Institute of Technology</td>
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<th>Number of Attendents</th>
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<td>197</td>
<td>22</td>
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Department of Biochemistry

MISSION

Biochemistry, as the science of biological molecules and their reactions, is in the midst of unprecedented advances. On the fundamental front, in elucidating the molecular basis of cell growth, tissue differentiation, brain function, aging and diseases, it unravels the profound mysteries of life. On the applied front, it spearheads the biotechnological revolution that is changing the face of medicine, agriculture, biomaterials and environmental science. These two fronts are equally important to us. Without the generation of new knowledge, the flow of new applications cannot endure. Without targeting on applications, it will not be possible to meet the needs of economic development so crucial for Hong Kong, in the heart of Asia where six of the ten largest economies of the world will be located by the year 2020.

The objective of the Department of Biochemistry at HKUST is to establish a centre of research excellence that attends to the challenge of both the fundamental and technological aspects of biochemistry. To do so, it focuses on four areas where basic advances and key applications are expected to arise: Genetic and Protein Engineering, Neurochemistry, Immunochemistry and Plant and Medicinal Biochemistry. Alongside basic research projects supported by the Research Grants Council, much effort is devoted to a range of biotech projects supported by the Biotechnology Research Institute and the Industry Department of the Hong Kong Government. Research activities also include contracts with Hong Kong manufacturers and patent development.

In our teaching programme as well, students are instructed during the undergraduate years on both basic principles of biochemistry and insight into the working of biotechnology. In postgraduate studies, they are offered degrees of MPhil and PhD in Biochemistry, as well as MSc in Biotechnology.

FACULTY AND THEIR RESEARCH INTERESTS

Professor and Head of Department

J. Tze Fei WONG, BA, PhD Toronto 1963
Structure and function of transfer RNA for tryptophan, drug delivery systems

Professors

Tian Yow TSONG, BSc Chung Hsin; PhD Yale 1969
(Director of Biotechnology Research Institute)
Biophysical chemistry, protein folding, membrane electrochemistry

Jerry H.C. WANG, BSc Taiwan; PhD Iowa State 1965
Enzymology of signal transduction, novel signal transduction processes in neurons, protein kinases and protein phosphatases
Senior Lecturers / Associate Professors

James A. HACKETT,  BSc, PhD U. Coll Dublin 1979; PhD Australian National 1980
Molecular pathogenesis and vaccine development

Raymond S.C. WONG,  PhD South Dakota State 1975
Lipid biosynthesis, plant biotechnology

Lecturers / Assistant Professors

Hueih-Min CHEN,  BSc Normal U. Taiwan; DSc Texas 1989
Protein chemistry, molecular biology and peptide design

King-Chuen CHOW,  BSc Chinese U. HK; PhD Toronto 1989
Biochemistry and molecular biology of the stress response of plants

Yi-Fan HAN,  BSc Shanghai First Medical Coll; PhD Medical Coll of Ohio 1991
Biochemistry of associative learning, and research and development of new memory enhancers

Robert K.M. KO,  BSc Chinese U. HK; PhD British Columbia 1990
Free radical induced tissue damage, antioxidants from Chinese medicinals

Peter Hing-Yat LAM,  BSc Chinese U. HK; PhD Wisconsin 1974
Protein expression in baculovirus, peptide library, antibody engineering

Fwu-Shan SHEU,  BSc Taiwan; PhD Northwestern 1991
Biochemistry, molecular biology and electrophysiology of synaptic plasticity

Wan-Keung WONG,  PhD British Columbia 1986
Genetic engineering, microbial genetics and production and utilization of recombinant cellulas

Hong XUE,  PhD Toronto 1993
Structure and function of receptors and transfer RNA

Mingjie ZHANG,  BSc Fudan; PhD Calgary 1993
Proteins physical biochemistry

Huan-Xiang ZHOU,  BSc Wuhan; PhD Drexel 1988
Theoretical and computer simulation of protein-protein associations, ligand binding to proteins, and molecular pattern formation.

Guang ZHU,  BSc Northwestern, China; PhD Maryland 1992
Multidimensional NMR signal processing, protein NMR
RESEARCH AREAS

Genetic Engineering and Protein Design

Current technologies in structural and molecular biology and chemical synthesis are used to study basic chemistry of biological molecules and to produce therapeutically useful protein and peptide products. The former includes studies of mechanisms of protein folding, protein structure/functional relationship, RNA/protein interactions, etc. In the department, state-of-the-art instrumentation in differential scanning microcalorimetry, circular dichroism, fluorescence spectroscopy, nuclear magnetic resonance, and computation and graphics are available for such studies. For the latter, we have developed excretion and other DNA cloning techniques to engineer growth hormone releasing factors, cellulases, anti cancer peptides and peptides which show specific activities in neurons.

Neurochemistry

The current research is focused on functions of several brain-specific proteins including a novel protein kinase, called neuronal cdc2-like kinase and neuronal PKC substrates, neuromodulin and neurogranin. The transcriptional regulation for cell type-specific and developmental stage expression will be studied. The involvement of these proteins in memory formation and neurodegenerative diseases will be assessed by gene targeting, electrophysiology of hippocampus and spatial learning tasks. In addition, we search and develop new memory enhancer from Chinese medicinal herbs for the treatment of Alzheimer’s disease and senile dementia.

Immunocchemistry

In the Department, epitope libraries are being screened for peptides which can bind to a variety of hormone receptors: the peptides may act as antagonists of the hormones, and may therefore be useful in the treatment of endocrine disorders in people. Another line of research is microbial pathogenesis. Genes of the bacterial pathogen Salmonella, the products of which are important in causing disease, are cloned, sequenced, and analysed. This work yields an understanding of the molecular basis of the illness, and suggests vaccination strategies for Salmonella-caused diseases such as typhoid fever.
Plant and Medicinal Biochemistry

The current plant bioengineering research is focused on the genetic manipulation of microspore culture technology or double haploid system of Brassica species in the development of transgenic plant with the desirable traits. Vector construction, regulatory sequence analysis as well as the establishment of efficient transformation system are in progress. In addition, biochemical studies of stress tolerance, germination physiology, seed priming and development of gene overexpression system are also underway.

For medicinal biochemistry, the possibility of delaying the aging process by promoting the ability of the body to combat free radicals has prompted us to search for effective antioxidants from the “anti-aging” Chinese medicinal herbs. Results obtained to date have revealed the existence of a new potent class of antioxidants in some of the herbs. This suggests an approach to the development of a new class of “anti-aging” agents for retarding the onset and/or progression of age-related diseases.
Department of Biology

MISSION

Biology includes the scientific study of structure, mechanism, and regulation of living process in a wide range of organisms as well as the intriguing interactions of the living organisms among themselves and with the environment. The comprehensive knowledge achieved in recent years makes modern life science playing crucial roles in biomedical science, genetic engineering, biotechnology and environmental sciences. Profound impact of life science in every aspect of human life and a large scale expansion of research efforts worldwide in the foreseeable future are predicted. The Department of Biology in HKUST are ready to meet the challenge. The Department has excellent research equipment and facilities. Existing faculty members, graduate students and research supporting staff fostered a conducive research atmosphere to attract world class scientists who are dedicated to teaching and research to join us as regular or visiting faculty members.

The research interests of our faculty members include the study of molecules, genes, viruses, cellular structure and function, developmental pattern for normal and abnormal growth, construction and utilization of transgenic plants and animals, aquaculture and the marine environment, and the ecosystem. Critical research foci are molecular neurobiology, tumour biology, cell biology and signal transduction, plant physiology and biotechnology, study of marine invertebrates, vertebrates and algae. Interaction and collaboration between research clusters within the Department as well as international collaboration in research and teaching programmes are fostered.

We are offering a comprehensive and up-to-date undergraduate curriculum to prepare our undergraduates for a wide spectrum of biology-related careers and postgraduate studies. All BSc students graduated from this Department have secured good employment in various schools, government department and companies in Hong Kong. In the research oriented postgraduate programme, we offer MPhil and PhD in Biology, MSc in Biotechnology, MSc in Environmental Science and Engineering.

FACULTY AND THEIR RESEARCH INTERESTS

Professor and Head of Department

Madeline C.S. WU,  BSc Taiwan; PhD Texas 1966
Chloroplast DNA replication, mechanisms for sequestering heavy metal, transformation studies of marine macroalga
Professors

Donald C. CHANG,  BSc Taiwan; PhD Rice 1970
Calcium signalling in cell function, biological applications of digital and laser microscopy, cell differentiation, biotechnology

Fu-Shiang CHIA,  BSc Normal U. Taiwan; PhD Washington 1964
Marine invertebrates, marine ecology, larval settlement, biofouling species

Shain-Dow KUNG,  BSc Chung-Hsing; PhD Toronto 1968
(Pro-Vice-Chancellor for Academic Affairs)
Rubisco, chloroplast genome, genetic tumor, regulatory sequences

Shang-fa YANG,  BSc Taiwan; PhD Utah 1962
Plant hormones, ethylene biosynthesis and action, plant senescence

Senior Lecturers / Associate Professors

Maria Li LUNG,  BSc Cornell; PhD Stanford 1978
Tumor biology, molecular virology, medical microbiology

I-Hsun NI,  BSc Taiwan; PhD British Columbia 1978
Fisheries biology and management, population and community ecology, environmental impact assessment with remote sensing

Lecturers / Assistant Professors

King Lau CHOW,  BSc Chinese U. HK; PhD Baylor Coll of Medicine 1990
Anteroposterior pattern formation, peripheral neural differentiation, genetic basis of morphogenesis

Robert N. HOLDEFTER,  BA Drake; PhD Southern Illinois 1985
Visual neuroscience, neurotransmitter systems

W.L. Wendy HSIAO,  BSc Taiwan; PhD Columbia 1985
Cancer biology, oncogenes, tumor suppresser genes

Nancy Y.Y. IP,  BS Simmons Coll; PhD Harvard 1983
Neurotrophic factors and their receptors, neuronal differentiation

Mun-Fai LEUNG,  BSc Northeastern; PhD Boston 1989
Cell biology, preclinical pharmacology/experimental therapeutics

Ning LI,  BSc Beijing Forestry Coll; PhD Washington 1989
Plant senescence, ethylene action, molecular biology, genetic engineering
Peiyuan QIAN,  BSc Qingdao U. of Oceanology; PhD Alberta 1991
Marine biology and ecology, reproductive ecology, larval ecology of marine invertebrates, environmental pollution

Karl Wah-Keung TSIM,  BSc Chinese U. HK; PhD Cambridge 1987
Molecular neurobiology, synaptogenesis, neural regeneration

Joseph T.Y. WONG,  BSc U. Coll of North Wales; PhD Stirling 1988
Molecular mechanism of eukaryotic cell cycle control, molecular biology of dinoflagellates, biomarkers of marine pollution, sex reversal in marine organisms

Yung-Hou WONG,  BSc London; PhD Cambridge 1988
Receptor pharmacology, signal transduction, structure and function of G proteins

Yong XIE,  PhD Cornell 1988
Anti-inflammatory therapy, immunology, platelet endothelial cell adhesion molecule-1 (PECAM-1), hepatocellular carcinoma immunology

Albert C.H. YU,  BSc, PhD Saskatchewan 1984
Central nervous system injury and regeneration, gene therapy, neuro-transplantation.

RESEARCH AREAS

Cellular Signal Reception and Transduction

Studies in this area involve the determination of functional specificity of different G proteins, the study of receptor and effector binding domains on G proteins, and the delineation of the mechanisms of cell signalling. Functional roles of growth factors, cytoskeletal proteins and membrane receptors in the signal transduction process will be studied. The latest recombinant DNA technologies and biophysical techniques are used in these studies. Knowledge of the specificity of receptor-G protein interaction may provide leads to the discovery of novel therapeutic agents.

Neurobiology

The focus is to use molecular approaches to study many important aspects of neurobiology, including development, injury, regeneration, aging, learning and memory. These studies will provide insights in understanding neuronal plasticity and pathogenesis of many neurodegenerative diseases. The ultimate goal is to develop methods and therapeutics in treating neurobiological disorders and enhancing regeneration of the nervous systems after various insults.
**Tumor Biology**

The primary interest is the cause and prevention of cancer. Projects for the development of screening assays for early detection of nasopharyngeal carcinoma are carried out. Molecular and cellular aspects of cancer will be investigated in several laboratories. Oncogenes, tumor-suppressor genes and the role of cytoskeleton in multi-drug resistance of lymphocytic leukemia will be studied.

**Plant Molecular Biology and Plant Genetic Engineering**

Molecular techniques and gene transfer methods will be used for the development of agents with agricultural and environmental application. Efforts will be concentrated on the study of a few land crop plants, marine crop plants and plants with bioremediation potential of heavy metal pollution.

**Marine Biology and Environmental Biology**

This area covers molecular studies of red tide dinoflagellates and other marine algae, genetic manipulations of economically important marine invertebrates, reproductive biology of marine fouling organisms, ecotoxicology of marine plants and satellite remote sensing of marine environment. Special attention is directed towards improving the environment of Hong Kong and the optimization of its marine resources.
MISSION

Building a new university is an exciting opportunity and, for the Department of Chemistry, it has allowed the assembly of an excellent team of young and highly active international faculty. Although from diverse backgrounds, they have the common goal to provide innovative and well-directed training at both the undergraduate and postgraduate levels in the area of molecular science to prepare men and women for careers in chemically-related industry and commerce.

Our undergraduate programme is flexible enough to allow both generalisation and specialisation, and provides gifted students with a solid foundation for future creative research. Our approach to chemistry is from the wider viewpoint of molecular science, which places both teaching and research in a modern interdisciplinary context. We feel this is especially important for chemistry because of its role as the 'central' science. The spectrum of our research thus extends from drug design and discovery, in which we interface with the biological and medical fields, to advanced materials in which our researchers seek to provide the initial driving force for engineering applications of the future.

With this outlook we aim to train a new breed of chemists who can seed and catalyse chemical technology transfer. In the long term this will help foster the creation and growth of high technology and emerging industries in Hong Kong.

FACULTY AND THEIR RESEARCH INTERESTS

Professor and Head of Department

Nai-Teng YU, BSc Taiwan; PhD MIT 1969
Laser Raman spectroscopy, biomedical applications

Professor

Hiroyuki HIRAOKA, BA, PhD Kyoto 1959
Laser photochemistry, advanced materials, diamond films, semi-conductors

Reader

Richard K. HAYNES, BSc, PhD Western Australia 1970
Organic synthesis, natural products (Qinghaosu), design of anti-malarial drugs

Lecturers / Assistant Professors

Paul R. CARLIER, BA Hamilton Coll; PhD MIT 1988
Stereoselective synthesis, catalysis, organolithium chemistry
Chun-Tao CHE,  BSc Chinese U. HK; PhD Illinois (Chicago) 1982
Natural products and drug isolation, Chinese medicinal herbs

Wei-Min DAI,  BSc Hangzhou; PhD Kyoto 1990
Organic synthesis, natural products and drug design, Taxol and enediyne compounds

Guochen JIA,  BSc Wuhan; PhD Ohio State 1989
Organometallic chemistry, catalysis, new materials, phosphine complexes, metal hydrides

Wa-Hung LEUNG,  BSc, PhD Hong Kong 1989
Organometallic synthesis and catalysis, porphyrin chemistry, metal-imido complexes

Xiao-Yuan LI,  BSc Beijing; PhD Princeton 1988
Bioinorganic and biophysical chemistry, laser spectroscopy

Zhenyang LIN,  BSc Wuhan; PhD Oxford 1989
Theoretical and computational inorganic chemistry, clusters, metal hydrides

Ben Z. TANG,  BSc South China; PhD Kyoto 1988
Polymer chemistry, organometallic and chiral polymers, polymer synthesis, materials science

Terence S.M. WAN,  BSc Wisconsin; PhD MIT 1981
Analytical chemistry, capillary electrophoresis, mass spectrometry, drug analysis

Ian D. WILLIAMS,  BSc, PhD Bristol 1985
Materials chemistry and X-ray crystallography, nonlinear optical compounds

Yun-Dong WU,  BSc Lanzhou; PhD Pittsburgh 1986
Computational chemistry, drug design, catalysis

Yijing YAN,  BSc Fudan; PhD Rochester 1988
Theoretical physical chemistry, molecular dynamics, intermolecular interactions

Shihe YANG,  BSc Zhongshan; PhD Rice 1988
Laser photochemistry, new materials, cluster synthesis, fullerenes

Lam-Lung YEUNG,  BSc Chinese U. HK; PhD London 1992
Organic synthesis, drug design, carbohydrate chemistry
RESEARCH AREAS

Traditionally Chemistry breaks down into discrete areas, Organic, Inorganic, Analytical and Physical. Here at HKUST the aim has been to develop research programmes that span these classical areas and indeed interact with other disciplines. There are several thrust areas of research which will be introduced below. Generally our faculty are able to participate in at least one of these and thus bring their complementary skills to bear on the research problems.

Drug Discovery, Design and Synthesis

The first area brings together chemists of different background to work on the general topic of drug development. Attempts to isolate, identify and synthesise compounds which are active in Chinese herbal remedies is a case in point. A database of chemical and biological information relating to Chinese medicines is being compiled and researches being actively carried out for the isolation of biologically active agents from plants. A patent has been issued for a method of producing synthetic versions of an anti-malarial agent found in the Chinese herb Qinghao. Our groups’ systematic study of the active agents in Chinese herbal medicines may hopefully yield new effective drugs and provide scientific understanding of an ancient healing art.

In the field of drug synthesis, drugs are being designed which both mimic naturally occurring compounds and attempt to improve on them. One aspect of the research is aimed at perfecting molecules with an enediyne functionality, which show considerable promise as chemotherapy anti-cancer agents. Discovered as a highly toxic compound produced by soil bacteria, the enediyne has a unique ability to destroy cells by severing their DNA with its latent reactivity, a kind of molecular “warhead”.

A chemistry post-graduate student carrying out chromatographic separations
Since the natural enediyne cannot distinguish between normal cells and cancer cells, destroying both, our researchers in collaboration with Scripps Institute, have set about creating synthetic versions which would target tumour cells selectively. The initial results announced in May 1992 were very encouraging and the work continues here at HKUST.

The theme of synthesis is also focused on new ways to introduce asymmetric centres into molecules as occur in natural products. Asymmetric synthesis is increasingly important in industry for the production of enantiomerically pure pharmaceuticals. New routes to the synthesis of beta-lactam antibiotics, by cycloaddition of olefins and isocyanates are also being studied. To complete the assault on drug design and synthesis molecular modelling and computational studies of macrocyclic antibiotics and anti-cancer drugs such as bleomycin are also being carried out.

**Advanced Materials**

Another major area of research which covers a wide range of is in Materials Chemistry which relates polymer research to modern chemical synthesis and the control of molecular properties for material design. A technique developed at HKUST for the deposition of diamond films from laser photolysis of organic polymers was recently patented. In another related area lasers have been used to induce sub-micron periodic structures which can be transferred to silicon chips. In the next century many believe there will be a revolution in information processing brought about by a switch from electronic to optical technologies. Optical computing systems would be tremendously fast and powerful. In order to achieve this revolution new materials are being sought which can allow manipulation of light. Work on nonlinear optical polymers is being conducted as a means of developing optoelectronics, a combined technique or midway point between today's electronic systems and the still visionary all-optical systems of the future. In related research new nonlinear optical materials are sought by engineering of the crystal tensor properties. This approach strives for the optimal alignment of molecular chromophores within crystals, for example by using the hydrogen bond arrangement of attached sugars to achieve this. Another class of materials with interesting optical and electronic properties, the polymeric skin pigments called melanins are also being studied. In this way nature's design of these materials is being investigated with the hope that improved transducer or sensor materials may be ultimately developed.

New polymeric materials which incorporate metal atoms, chirality or have liquid crystallinity are also being made and attempts to design molecules with interesting property combinations or chemical functionality.
Molecular Characterisation

A third major area is concerned with molecular characterisation especially through laser-based spectroscopy which is a technique of fingerprinting molecules proving to have important applications in the field of biomedical instrumentation. This technique analyses the wavelengths or spectra produced after interaction of laser light with a target molecule. The scattering of light yields precise information about the structure and properties of the molecule. Raman spectroscopy named after the Indian physicist who discovered the technique is the specialty of one group. It is of particular interest with respect to its medical applications. A laser-based instrument for early cataract detection has been developed and presently a Raman fibre-optic sensor that can be used to guide laser-driven cardiovascular surgery is being designed. In related research Raman spectroscopy is being used to investigate the electronic and vibrational properties of biologically important compounds such as metal porphyrins and polypeptides. Other analytical applications include the use of capillary zone electrophoresis for drug separation and identification.
The Department of Mathematics in HKUST is equivalent to, in many other universities, a Division of Mathematical Sciences. In terms of the composition of faculty, the research areas of the current faculty include analysis, algebra/number theory, geometry/topology, probability and statistics, scientific computation, mechanics and mathematical physics. In terms of undergraduate curricula, the Department of Mathematics offers the following options wholly within the department: pure mathematics, scientific computation and statistics; and in cooperation with other departments the mathematical sciences option in business and management, in computer science, and in physical and engineering science.

From one perspective, mathematics is facing a crisis. Bright students with excellent achievements in mathematics are turning to business or other schools which offer rosier prospects of getting rich. But from another perspective, more and more mathematics are in use by more and more people in every profession. Not only more mathematics but also more sophisticated mathematics. In that sense the influence of mathematics is growing and there is an ever brighter future for mathematics. The essential message for us then is reaching out. To reach out from traditional narrow confines of mathematics to science and technology in intellectual pursuits and also to reach out to all the students with instructions of proper and good mathematics. That is exactly what we are doing in HKUST.

This young department has already both a strong pure mathematics component and a strong component in mathematical application. We are beginning to see the realisation of fruitful mutual stimulation and inspiration out of the interactions of scholars in diverse disciplines under the same roof. It is indeed heart-warming.

FACULTY AND THEIR RESEARCH INTERESTS

Professor and Head of Department

Din-Yu HSIEH,  BSc Taiwan; PhD Caltech 1960
Waves and stability, asymptotic methods, two-phase flows

Professors

John D. BUCKMASTER,  BSc London; PhD Cornell 1969
Combustion theory, fluid dynamics, asymptotics

Grafton Wai How HUI,  BSc Beijing; PhD Southampton 1969; DSc Southampton 1983
(Associate Dean of Science)
Theoretical and computational fluid dynamics, nonlinear water wave theory, applied partial differential equations
Ronnie LEE, BSc Chinese U. HK; PhD Michigan 1968
Low-dimensional topology, gauge theory, and cohomology of discrete groups

Chung-Chun YANG, BSc Taiwan; PhD Wisconsin 1969
Complex analysis, value-distribution theory

**Adjunct Professors**

Wu-Chung HSIANG, BSc Taiwan; PhD Princeton 1962
Algebraic topology, differential topology, algebraic K-theory

James Sai-Wing WONG, BSc Baylor; PhD Caltech 1964
Ordinary differential equations

**Readers**

Ngai-Hang CHAN, BSc Chinese U. HK; PhD Maryland 1985
Time series, spatial statistics, econometrics, asymptotic inference

Vladimir A. VLADIMIROV, BSc, PhD Novosibirsk 1979; DSc Novosibirsk 1990
Fluid dynamics, rotating flow, hydrodynamic stability

Kun-Rui YU, BSc UST of China; Dr. rer. nat. Bonn 1987
Transcendental number theory, diophantine approximations

**Senior Lecturers/Associate Professors**

Kwing-Lam CHAN, BA UC Berkeley; PhD Princeton 1974
Computational Physics, Fluid Dynamics, atmospheric dynamics, astrophysics, cosmology

Yue-Kuen KWOK, BSc Hong Kong; PhD Brown 1985
Computational fluid dynamics, numerical analysis, geophysics

**Lecturers/Assistant Professors**

Gopal K. BASAK, BStat Indian Statistical Inst; PhD Indiana 1989
Probability, Markov processes, stochastic differential equation, stochastic analysis

Jeffrey R. CHASNOV, BA UC Berkeley; PhD Columbia 1990
Numerical simulation of turbulent flow, stably-stratified flows, rotating fluids, parallel computation

Bei-Fang CHEN, BSc Huazhong Normal; PhD SUNY Buffalo 1991
Discrete mathematics, combinatorics, probability
Ka-Ni CHEN, BSc Beijing; PhD Columbia 1994
Survival analysis, sequential analysis, stochastic modeling, coverage problem

Yik-Man CHIANG, BS, PhD London 1991
Ordinary differential equation in the complex plane, geometric function theory

Kwai-Man FAN, BSc Taiwan; PhD Purdue 1992
Algebraic geometry

Jimmy Chi-Hung FUNG, BSc Durham; PhD Cambridge 1990
Computational fluid dynamics, turbulence, environmental studies

Walter G. GALL, PhD SUNY Buffalo 1993
Bifurcation, scientific computation, symmetry and nonlinear stability

Guo-Qiang GE, BSc Zhejiang; PhD UC Berkeley 1993
Algorithms, number theory

Bi-Zhong HU, BSc UST of China; PhD SUNY Stony Brook 1989
Compact polyhedra with nonpositive curvature

Ji-Shan HU, BA Jiao Tong (Shanghai); PhD Princeton 1990
Applied analysis

Jing-Song HUANG, BSc Beijing; PhD MIT 1989
Representation theory, Lie theory

Bing-Yi JING, BSc Lanzhou; PhD Sydney 1989
Resampling methods, edgeworth and saddlepoint approximations.

Bao-Qin LI, BSc Yangzhou Normal; PhD Maryland 1993
Complex analysis, harmonic analysis

Kin-Yin LI, BSc Washington; PhD UC Berkeley 1989
Complex function theory, Hilbert space operator theory, functional analysis

Wei-Ping LI, BSc Nankai; PhD Columbia 1991
Algebraic geometry

Shiu-Hong LUI, BSc Toronto; PhD Caltech 1992
Bifurcation theory, numerical analysis

Jian-Min MAO, BSc East China Normal; PhD Houston 1985
Nonlinear dynamics, chaos, Hamiltonian bifurcation theory, mathematical physics, scientific computation
Guo-Wu MENG,  BSc UST of China; PhD Brown 1993
Algebraic topology, differential topology, knot theory

Mo MU,  BSc Southeast; PhD Chinese Academy of Sciences 1987
Numerical analysis, parallel computing, numerical solution to PDEs, numerical linear algebra, mathematical software

Yuan-Wei Qi,  BA Beijing; PhD Oxford 1990
Differential equations, scientific computation

Tai-Man TANG,  BSc Chinese U. HK; PhD UC Berkeley 1990
Partial differential equations, functional analysis

Charles H. TONG,  BSc UC Berkeley; PhD UC Los Angeles 1990
Numerical linear algebra, numerical PDE, parallel numerical algorithms, scientific computing

Allanus Hak-Man TSOI,  BSc Washington; PhD Alberta 1990
Probability, stochastic analysis, stochastic differential geometry

Xia-Ping WANG,  BSc Beijing; PhD New York 1990
Nonlinear partial differential equations, computational and applied mathematics

Man-Yu WONG,  BA Hong Kong; PhD London 1990
Statistical inference, generalised linear model, biological statistics, medical statistics

Li-Xin WU,  BSc Fudan; PhD UC Los Angeles 1991
Numerical analysis, computational fluid dynamics

Xiao-Ping XU,  BSc Zhejiang Normal; PhD Rutgers 1992
Self-dual codes and lattices, Lie algebras and vertex operator algebras

Min YAN,  BSc Fudan; PhD Chicago 1990
Algebraic topology, geometric topology, combinatorics

Yongchang ZHU,  BSc Beijing; PhD Yale 1990
Algebra, Lie theory, mathematical physics
The Department of Mathematics at HKUST maintains strong research in both pure and applied mathematics, the traditional core of almost every mathematics department. However, what makes this department different from typical mathematics department is the equally strong research in fluid mechanics, scientific computation and statistics. These areas usually belong to other departments or become departments themselves in many other universities. We believe that such comprehensive approach would result in fruitful and wide ranging interactions among the faculties and would meet the fast changing needs and challenges of the local community.

The department holds colloquia and seminars in pure math, scientific computation, and statistics every week. On their way to visit the Pacific area, many international scholars stop by Hong Kong and speak in these colloquia and seminars.

Analysis

Analysis of real or complex functions is always the traditional core of pure mathematics. The theoretical study reveals the beautiful and rich properties of functions, especially the complex ones. Differential equations appear in many practical as well as theoretical problems. The study of differential equations is often the crucial step for solving such problems.

The analysis research in this department include complex functions, functional analysis, differential equations and their applications to physical, social, and engineering problems. The emphasis is on complex variables and related fields.

Algebra and Geometry

Algebra and Geometry is the core of modern mathematical research. It seeks the most universal truth in every aspects of the natural and social world. It draws its primary inspirations from everyday life to modern science and provides the necessary language for describing the increasingly sophisticated world.
The research in algebra and geometry often involves interaction between specialists in different areas. The department maintains a good mixture of researchers in number theory, Lie algebras and vertex operator algebras, representation of Lie groups and Hopf algebras, algebraic geometry, low dimensional topology, K-theory, algebraic and geometric topology. The algebraists and topologists are interested in the low dimensional topology and its relation to the quantum physics, a topic that involves virtually every aspects of pure mathematics and modern physics.

**Scientific Computation**

With the spectacular advances of computer technology and computing algorithms, scientific computation has become an independent approach to studying science and technology, complementing the theoretical and experimental approaches. It focuses on developing algorithms that are reliable, accurate and economical in large scale computation of solutions to problems in science, engineering, and business and management.

Current research are concentrated on parallel algorithms, shock-capturing schemes, numerical linear algebra, numerical solutions to elliptic and hyperbolic differential equations, a generalised Lagrangian formulation of computational fluid dynamics, large eddy simulation of turbulence, and quantum chaos. There are also joint research projects with other departments (an Institute of Scientific Computation is forthcoming) and other institutions in and outside Hong Kong.

**Fluid Mechanics**

Fluid mechanics studies the motion of liquids and gases with direct application to industry and environments. It is particularly rich in nonlinear problems and is a major source of ideas and techniques in applied mathematics.

Current research areas include the study of such flows as two phase flow, rotating flow, high speed flow, and their stability, the fluid dynamics of combustion, typhoon (which comes to Hong Kong several times a year), and bubbles. Research is also carried out on such dynamical phenomena as bifurcation, chaos, and turbulence. The research in fluid dynamics are often heavily computational and there is strong interaction with the researchers in scientific computation.
Statistics and Probability

Applications of statistics have been receiving increasing attention among local business and industrial communities. The balance between theory and applications is reflected through the faculty research activities which can be classified into four main categories.

In the study of time series and dependent data, inference procedures are sought to model and explain temporal and spatial dependent structures. Specific areas include inference for nonstationarity, nonlinearity, long-memory behavior, and continuous time models. This area of research has a close connection with economics and engineering. Resampling methodology forms the second category. It deals with the estimation of parameters and construction of confidence regions with resampling techniques. Particular topics include block bootstrap, bootstrap for censored data, and Edgeworth and saddle point approximations. The third component, survival analysis, comprises estimation of survival function under random censoring and truncation, Kaplan-Meier estimator, and errors in variables for general linear models. Applications to biomedical sciences constitute an integral part of categories two and three. The fourth area is stochastic processes and stochastic analysis. Topics currently under investigation include filtering, diffusion and Markov processes, and stochastic approximation and control. Research in this area is related to the study of financial modelling.
MISSION

Physics is the science that deals at the most fundamental level with matter and energy, their interactions, and their transformation. It provides the foundation for many other sciences and for engineering. That is why many if not a majority of the first degree holders in physics have gone on to successful careers outside of the mainstream physics profession. It stands to reason that a first degree in physics would be an excellent training for a broad range of career paths. Also being such a fundamental subject, physics should be a part of the general education of an informed citizenry called upon to make democratic choices and decisions that impact the livelihood of all. Thus, our undergraduate programmes have been designed to allow students with diverse backgrounds and interests to enter and complete a degree with a high degree of flexibility in course mixes and selections.

Society also needs specialists. The new technologies that physics has spawned are so ingrained in our civilisation that their origins are often overlooked. The discoveries of the principles of solid-state transistor which led to the miniaturisation of electronic devices, of atomic hyperfine structure and superconductivity which made possible nuclear magnetic resonance (NMR) imaging, and of laser which underpinned present-day information technology are but a few examples. In addition to directly generating technological innovation, physics also indirectly supports progress throughout society by providing tools with which people in other fields create innovations. Thus, our postgraduate programmes aim to provide students with a solid grounding in broad physics principles and techniques, an ambiance for creative and innovative activities, and opportunities for cross- and inter-disciplinary research.

Research in the department is supported by modern instrumentation. It is heavily slanted towards condensed matter physics and optical physics, in both theory and experiment, because among the physics subfields they have the greatest impact on our daily lives. The programmes include those on complex systems, linear and non-linear optics, low-dimensional systems, mesoscopic systems, new materials, microstructured and nanostructured materials and devices, and surfaces and interfaces.

FACULTY AND THEIR RESEARCH INTERESTS

Professor and Head of Department

Nelson CUE, BSc Feati; PhD Washington 1967
Atomic collisions in solids, x-ray optics, nanoclusters, radiation effects
Professors

David John BARBER,  
BSc, PhD Bristol 1960
(Director, Materials Characterisation and Preparation Centre)
Structure-property relationships, non-metals, thin-films, electron microscopy

Leroy L. CHANG,  
BSc Taiwan; PhD Stanford 1963
(Dean of Science)
Condensed matter physics, semiconductor materials, solid state electronics

Peter N. DOBSON, Jr,  
BSc MIT; PhD Maryland 1965
(Associate Pro-Vice-Chancellor for Academic Affairs (Programmes))
Axiomatic quantum field theory, theory of elementary particles and their interactions at high energy

Michael M. LOY,  
BSc, PhD UC Berkeley 1971
Nonlinear optics, femtosecond studies of surfaces, interfaces microstructures and small particles

Ping SHENG,  
BSc Caltech; PhD Princeton 1971
Condensed matter theory, wave scattering and localization, liquid crystals

George K.L. WONG,  
BSc, PhD UC Berkeley 1974
Nonlinear Optics, semiconductors, thin-film and nanostructured materials

Chia-Wei WOO,  
BSc Georgetown Coll; PhD Washington 1966
(Vice-Chancellor and President)
Quantum many-body theory, statistical mechanics, low temperature physics, surface physics, liquid crystal, technology transfer

Senior Lecturers/Associate Professors

Kwok Kwong FUNG,  
BSc Cornell; PhD Bristol 1979
Transmission electron microscopy study of micro- or nano-structure and crystal defects

Weikun GE,  
BSc Beijing; PhD UMIST 1983
Physics of semiconducting heterostructures and clusters

Zhao Qing ZHANG,  
BSc Tunghai; PhD Pennsylvania 1974
Condensed matter theory, disordered systems, mesoscopic physics

Lecturers/Assistant Professors

Michael S. ALTMAN,  
BA Pennsylvania; PhD Brown 1988
Surface physics, structure and phase transitions, low energy electron microscopy
Ting CHEN,  BSc Zhejiang; PhD UC Los Angeles 1988
Surface, adsorbate, growth, nanoscale structures studied by STM/S

Sidney C.P. KAN,  BSc Chinese U. HK; PhD Caltech 1991
Physics and technology of optical micromechanical devices

Pak Wo LEUNG,  BSc Hong Kong; PhD Cornell 1990
Numerical studies of strongly correlated electron systems

Tai Kai NG,  BSc Hong Kong; PhD Northwestern 1987
Condensed matter theory, strongly correlated systems and non-equilibrium systems

Philip I.K. SOU,  BSc Jinan; PhD Illinois, Chicago 1990
Molecular beam epitaxial growth, physical properties of wide-gap II-VI semiconductors

Kwok Yip SZETO,  BEng Toronto; PhD MIT 1985
Magnetotransport, foam, quasicrystal, soliton, forecasting, genetic algorithm, coding, queueing theory

Wing Yim TAM,  BSc Chinese U. HK; PhD UC Santa Barbara 1985
Nonlinear dynamics, chaos, complex systems, electrorheological fluid

Zi Kang TANG,  BSc Hangzhou; PhD Tohoku 1992
Solid state physics, photoelectronics, nanostructure materials, quantum size effects

Jiannong WANG,  BSc Jiao Tong (Xian); PhD Bristol 1990
Semiconductor, heterostructures, transport, optical properties

Xiang Rong WANG,  BSc Wuhan; PhD Rochester 1990
Critical phenomena of equilibrium, non-equilibrium systems

Yuqi WANG,  BSc Beijing Polytech U.; PhD Columbia 1993
Semiconductor quantum structures and devices

Kam Sing WONG,  BSc London; DPhil Oxford 1987
Ultrafast lasers, time-resolved spectroscopy, semiconductor, polymer physics

Michael K.Y. WONG,  BSc Hong Kong; PhD UC Los Angeles 1986
Disordered systems, neural networks, optimization, spin glasses

Rong Fu XIAO,  BSc Chongqing; PhD Utah 1988
Phonemic thin films, crystal growth, semiconductor nanoclusters

Xudong XIAO,  BSc UST of China; PhD UC Berkeley 1992
Surface science, nonlinear optics, STM & AFM, molecular identification on surface
Xiao YAN,  BSc Beijing; PhD Pennsylvania 1989
Magnetism, magnetic granular, multilayered materials

Zhi Yu YANG,  BSc Fudan; PhD Purdue 1988
Optical properties of surface/interface, semiconductors, polymers

Kwong Mow YOO,  BSc Malaya; PhD CUNY 1990
Light scattering in random media, ultrafast laser and phenomenon

RESEARCH AREAS

Condensed Matter Theory
The current focus of the group include equilibrium and non-equilibrium physics in mesoscopic systems, complex systems, high temperature superconductors, quantum and classical many body effects, and neural network dynamics and learning, wave scattering and localization, liquid crystals and physics of disordered systems.

Computational Physics
The interests include first principle calculations of many body problems, classical and quantum Monte-Carlo approaches, molecular dynamics simulations and telecommunication network modeling.

Laser Optics and Photonics
A $10M donation from the Joyce M. Kuok Foundation is being used to set up a state-of-the-art Laser and Photonics Laboratory for the studies of nonlinear optical processes and materials, including the use of femtosecond pulses for time domain measurements, and for the exploration of applications, sensors, and medical diagnosis.

Thin Film Physics
The centerpiece is a Molecular Beam Epitaxy (MBE) unit which now is routinely producing II-VI semiconductor epitaxial layers. A second MBE system which will be used to grow III-V thin films is being set up. A $10M donation from the Zheng Ge Ru Foundation is being used to establish the Thin Film Physics Laboratory. This will
enable us to grow other thin films, implement a variety of growth techniques (such as Sputter Deposition and Pulse Laser Deposition) and study the structural, electrical, optical, magnetic transport properties of these thin films.

**Surface and Interface**

The group is equipped with a low energy electron microscope (LEEM), ultra high vacuum - scanning tunneling microscope (UHV-STM), and laser surface probe equipment. This combination places us among a select few in the world to be able to study the structure of surfaces from the atomic to the tens-of-micron scale in addition to the dynamics of surfaces from the nano- to millisecond and slower scale. Our LEEM is only the third installed at academic institutions worldwide. Research areas include atomic scale structural and electronic properties of surface and interfaces, surface growth processes, clusters and small particles systems.

**Materials Physics**

The emphasis here is on materials studies not normally included under Thin Film Physics. Examples are the areas of equilibrium-driven crystal growth, sol-gel technique for fabricating ceramic layers, polymers, liquid crystals and magnetic materials. The underlying theme is to connect crystal defects and microstructures in general to physico-chemical properties of the materials, using techniques which range from atomic resolution levels to the macroscopic.

**Clusters and Mesoscopic Systems**

A $10M donation from the Shun Hing Education and Charity Fund is being used to establish the Semiconductor Clusters Laboratory. Clusters of 10-100nm in size have very interesting properties because they are neither "molecule-like" nor "bulk-like". Our goal is understanding the properties of an individual nanosize cluster in isolation, when these cluster are compacted together, and when they are embedded in a host matrix of different structure or materials. In the aggregated nanophase structure cases, the properties are size specific. Thus, initial efforts will be directed toward finding techniques that could produce clusters in abundance and with a narrow mass distribution. Both physical and aqueous chemical techniques will be explored.

**Non-Linear Dynamics**

With the arrival of a faculty expert on the experimental aspects of nonlinear dynamical systems, we will begin a research effort in this topical area. Another specialized area is x-ray optics using glass capillaries for collimating, focusing, and steering x-ray, and their applications to in-vivo microscopy and medical imaging. Femtosecond spectroscopy using x-rays also is being investigated.
Appendix A

Funded Research Projects

Department of Biochemistry

Conformational study of protein and the dynamics of protein folding
Chen, H.M.

Reconstruction of antibacterial peptides to anti-cancer peptides and bioprocess engineering of both peptides
Chen, H.M.

Studying local stable segments to reconstruct the 3-dimensional structure of proteins
Chen, H.M.; Tsang, T.Y.

Molecular basis of bacterial pathogenesis: species-specificity in pathogenic Salmonella Serovars
Hackett, J.

The development of a new plasmid partition system to effect high-efficiency stabilization of recombinant plasmids in various bacterial strains used as host in biotechnological fermentations
Hackett, J.

The development of an expression system, based upon hybrid Salmonella Flagellins, for the synthesis of protective epitopes of Staphylococcus Aureus
Hackett, J.

Comparative studies of a new memory enhancer Huperzine A with Tacrine
Han, Y.F.

Development of a rapid and low-cost drug screening procedure utilizing yeast genetics and recombinant DNA technology
Ko, R.K.M.

Development of Chinese medicinal products with antioxidant properties
Ko, R.K.M.

Antibody-catalyzed epoxidation reactions for the synthesis of anti-inflammatory and antihypertensive agents
Lam, P.H.Y.

Regulation of inositol containing phospholipids on protein kinase C substrates (MARCKS, neuromodulin, and neurogranin) phosphorylation
Sheu, F.S.

An innovative technology for manufacturing monoclonal antibodies
Tsang, T.Y.
Conformational stability and folding mechanisms of engineered protein analogs
Tsong, T.Y.

Construction and analysis of random peptide libraries for therapeutically active peptides
Tsong, T.Y.; Hackett, J.; Lam, P.H.Y.

Development of drug delivery systems
Wong, J.T.F.

Development of hemoglobin-based technologies and instrumentation
Wong, J.T.F.

Drug delivery technology centre
Wong, J.T.F.

Structure and function of transfer RNA for tryptophan
Wong, J.T.F.

Biosynthesis of storage lipids in Brassica Napus: properties of diacylglycerol acyltransferase
Wong, R.S.C.

Improvement and modification of Brassica species: oilseed rape and vegetable Brassica
Wong, R.S.C.; Chow, K.C.

Assessment of the biodegradability and toxicity of a packing material developed by Caterly Technology Limited
Wong, W.K.

Construction of an efficient Bacillus Subtilis system for extracellular production of heterologous proteins
Wong, W.K.; Chow, K.C.

Development of efficient systems for the production of recombinant proteins
Wong, W.K.; Lam, P.Y.H.; Tsong, T.Y.

Action of the neurohormone manduca diuresin in controlling insect water balance
Wong, W.K.; Tsong, T.Y.

Yeast systems for large-scale production of recombinant human hemoglobin
Wong, W.K.; Wong, J.T.F.
Department of Biology

Development of improved electroporation and electrofusion technologies for gene transfer and cell hybridization
   Chang, D.C.

Studies of cell division and cell fusion by confocal laser microscopy
   Chang, D.C.

GABA (gamma-aminobutyric acid) receptor cells in abalone larvae
   Chia, F.S.

Successional paradigm investigation - Hong Kong Benthic ecology
   Chia, F.S.

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   Wong, Y.H.

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   Wong, Y.H.; Ko, R. (BICHI); Che, C.T. (CHEM)

Algae and pearl oyster co-culture project
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   Yu, A.C.H.
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   Barber, D.J. (PHYS); Altman, M.S. (PHYS); Williams, I.D.

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   Carlier, P.R.; Lam, P.H.Y. (BICH)

Physical and chemical characterization of atmospheric aerosols by laser-based spectroscopies: Development of an air pollution research programme
   Chan, C.K. (CENG); Li, X.Y.; Yu, N.T.; Yue, P.L. (CENG); Kot, S.C. (MECH); Wong, K.S. (PHYS)

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   Che, C.T.

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   Che, C.T.

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Integrated gas sensor technology research programme
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   Fang, M. (RC); Kot, S.C. (MECH); Wan, T.S.M.; Kwan, J.K.C. (SEPO)

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The development of novel asymmetric homogeneous catalysts based on new enantiomerically pure phosphine ligands
   Haynes, R.K.
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  Hiraoka, H.

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  Hiraoka, H.

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  Hiraoka, H.

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  Hiraoka, H.

Laser assisted chemical vapour deposition of advanced opto-electronic materials
  Hiraoka, H.; Xiao, R. (PHYS); Yang, S.H.; Wong, M. (ELEC)

Conjugated polymers with heteroatoms in the polymer backbone
  Jia, G.C.

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  Jia, G.C.

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  Jia, G.C.; Leung, W.H.

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  Ko, T.M. (CENG); Hiraoka, H.

Fabrication and mechanical behaviour of in-situ polymer composites
  Leng, Y. (MECH); Hiraoka, H.; Carlier, P.R.; Fung, K.K. (PHYS); Tong, P. (MECH)

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Lin, Z.Y.

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Lo, T.C. (MFC); Hiraoka, H.; Sin, J.K.O. (ELEC); Huang, H.C. (ELEC); Poon, V.M.C. (ELEC)

Surface dynamics from the millisecond to femtosecond time scale
Loy, M.M. (PHYS); Chan, C.M. (CENG); Kwok, H.S. (ELEC); Wong, G.K.L. (PHYS); Yang, S. H.

Synthesis of optically active polyacetylenes
Tang, B.Z.

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Wan, T.S.M.

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Williams, I.D.

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Williams, I.D.; Wan, T.S.M.

Lightwave technology research programme
Wong, G.K.L. (PHYS); Hiraoka, H.; Kwok, H.S. (ELEC); Cartier, P.R.; Leung, W.H.; Wong, K.S. (PHYS); Yoo, K.M. (PHYS); Sou, I.K. (PHYS)
Development of hemoglobin-based technologies and instrumentation
Wong, J.T.F. (BICH); Cheung, P.W. (ELEC); Leung, W.H.

Development of a rapid and low-cost drug screening procedure utilizing yeast genetics and recombinant DNA technology
Wong, Y.H. (BIOL); Che, C.T.; Ko, R.K.M. (BICH)

Theoretical studies of transition metal bonding energies and mechanisms and stereocntrol of organometallic catalysis. Design of catalysts for stereoselective reactions
Wu, Y.D.

Theoretical and experimental studies of metal binding to macrocyclic compounds: Development of calculational methods. Design and synthesis of specific metal binding and pharmaceutical agents.
Wu, Y.D.; Jia, G.C.; Qi, Y.W. (MATH); Dia, W.M.; Mu, M. (MATH)

Novel materials for magnetic storage science and technology
Yan, X. (PHYS); Altman, M.S. (PHYS); Hiraoka, H.; Lo, T.C. (MFC); Ko, T. M. (CENG); Sou, I.K. (PHYS); Szeto, K.Y. (PHYS)

Rule shaping, controlled optical spectroscopies and molecular dynamics in condensed phases
Yan, Y.J.

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Dynamics of photoinduced reactions in complexed metal clusters
Yang, S.H.

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Yang, S.H.

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Yu, N.T.; Li, X.Y.

Synthesis of graphite intercalation compounds by an electrochemical method
Zhang, T.Y. (MECH); Leng, Y. (MECH); Li, X.Y.; Mai, Y.W. (MECH); Xiao, R. (PHYS)
Department of Mathematics

Qualitative theory of degenerate diffusions and how to stabilise a class of dynamical systems
Basak, G.K.

Mathematical modeling of combustion experiments
Buckmaster, J.

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Chan, K.L.

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Chan, N.H.

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Chasnov, J.R.

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Chasnov, J.R.

Combinatorics and geometric probability on posets, graphs and singular spaces
Chen, B.F.

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Chen, B.F.

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Chiang, Y.M.

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Fan, K.M.; Lui, S.H.

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Fung, J.C.H.

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Ge, G.

Standing waves in elastic confinement
Hsieh, D.Y.

New direction to attack the adiabatic invariant problem
Hu, J.S.
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   Huang, J.S.

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   Hui, W.H.

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   Jing, B.Y.

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   Kwok, Y.K.

Stable bundles over algebraic surfaces and Donaldson polynomials
   Li, W.P.

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   Mao, J.M.

Search for scaling behaviour in bifurcations in quantum systems
   Mao, J.S.

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   Meng, G.

Develop partial differential equation solvers for parallel computer
   Mu, M.

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   Wong, M.Y.

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Theoretical and experimental studies of metal binding to macrocyclic compounds: development of calculational methods. Design and synthesis of specific metal binding and pharmaceutical agents
   Wu, Y.D. (CHEM); Qi, Y.W.; Jia, G. (CHEM); Dai, W.M. (CHEM); Mu, M.

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   Xu, X.P.

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   Yan, M.

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   Yang, C.C.

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**Department of Physics**

Growth kinetics and structure at metal surfaces
Altman, M.S.; Cue, N.

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Altman, M.S.; Xiao, R.F.

Crystallography by the electron back-scattering method in a scanning electron microscope
Barber, D.J.

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Barber, D.J.

The influence of microstructure on phase transitions in non-metals
Barber, D.J.

Physical and chemical characterisation of atmospheric aerosols by laser-based spectroscopies: Development of an air pollution research programme
Chan, C.K. (CENG); Li, X.Y. (CHEM); Yu, N.T. (CHEM); Yue, P.L. (CENG); Kot, S.C. (MECH); Wong, K.S.

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Cheung, K.F. (ELEC); Murch, R.D. (ELEC); Tsang, D.H.K. (ELEC); Yau, M.S.F. (ELEC); Altman, M.S.; Au, O.C.L. (ELEC); Fong Lochovsky, A.C.W. (COMP)

Integrated gas sensor technology research programme
Cheung, P.W. (ELEC); Sin, J.K.O. (ELEC); Chan, P.C.H. (ELEC); Yau, M.S.F. (ELEC); Yu, N.T. (CHEM); Fung, K.K.; Nieveen, W.R. (MCPC)

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Chin, R. (COMP); Pong, T.C. (COMP); Naiman, A. (COMP); Tam, W.Y.; Yoo, K.M.

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Cue, N.

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Leung, P.W.

Surface dynamics from the millisecond to femtosecond time scale

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Breaking foams
   Tam, W.Y.

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Tunnelling structures
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   Wang, X.R.

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Lightwave technology research programme
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   Wong, K.S.

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Xiao, R.F.; Yang, Z.Y.

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Xiao, X.D.

Novel materials for magnetic storage science and technology
Yan, X.; Altman, M.S.; Hiraoka, H. (CHEM); Ko, T.M. (CENG); Lo, T.C. (ELEC); Sou, I.K.; Szeto, K.Y.

Far infrared magnetooptical spectroscopy of magnetic materials and semiconductors
Yang, Z.Y.

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Yang, Z.Y.; Wong, G.K.L.; Sou, I.K.

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Yoo, K.M.

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Yoo, K.M.

Photon migration and imaging in heterogeneous random and biological media
Yoo, K.M.; Wong, K.S.

Synthesis of graphite intercalation compounds by an electrochemical method
Zhang, T.Y. (MECH); Leng, Y. (MECH); Li, X.Y. (CHEM); Mai, W.Y. (MECH); Xiao, R.F.

Fracture toughness and fatigue behaviour of piezoelectric materials
Zhang, T.Y. (MECH); Tong, P. (MECH); Mai, Y.W. (MECH); Xiao, R.F.

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Zhang, Z.Q.