SCHOOL OF SCIENCE
STATUS REPORT 1996-97
THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY
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<td>- Materials Characterization and Preparation Center</td>
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The School of Science has been in existence for about five 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.

We live in a society with a technology oriented economy. Those who have a good training in science will find better opportunities in the workplace.

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 nearly its full size. We have 125 regular and 15 visiting faculty members, with 1299 undergraduate and 275 graduate students enrolled. We have already produced a crop of 861 BSc graduates and 151 graduates with advanced degrees in MSc, MPhil and PhD. In terms of research, more than 290 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 established an academic institution in which devoted faculty and hard-working students together pursue what is known as college life.
We provide in this book an integrated introduction to the various aspects of the School of Science at its present stage of development. While the School’s basic philosophy is expected to remain the same, it evolves continuously with an ever-changing external world. At HKUST, we are determined to prepare students who will shape the future. I welcome your participation in this exciting endeavor.

Leroy L. Chang
Dean
December, 1996
The administrative structure of HKUST defines clear lines of responsibility and authority. The President is the University’s chief executive and academic officer. Reporting to him are three Vice-Presidents. 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 Vice-President 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 Deans share the responsibilities of the Dean in the management and operations of the School.

**President**
Professor Chia-Wei Woo

**Vice-President for Academic Affairs**
Professor Shain-Dow Kung

**Dean of School of Science**
Professor Leroy L. Chang

**Associate Dean of School of Science**
Professor Graffon W.H. Hui
Professor Michael M.T. Loy

**Head of Department of Biochemistry**
Professor Jerry H.C. Wang

**Head of Department of Biology (Acting)**
Professor Madeline C.S. Wu

**Head of Department of Chemistry (Acting)**
Professor Hiroyuki Hiraoka

**Head of Department of Mathematics**
Professor Shiu-Yuen Cheng

**Head of Department of Physics**
Professor Nelson Cue

**Director of Biotechnology Research Institute**
Dr. Nancy Y.Y. Ip

**Director of Advanced Material Research Institute**
Professor Nelson Cue

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

University education means to learn to think for oneself under the guidance of a teacher; it is not just the accumulation of knowledge. Independent thinking is the soul of a University.

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 programs 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.

Degree Programs

<table>
<thead>
<tr>
<th>Degree</th>
<th>Department</th>
<th>Program</th>
<th>Enrollment 1996</th>
<th>Graduates (1994-96)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSc</td>
<td>Biochemistry</td>
<td>Biochemistry</td>
<td>232</td>
<td>183</td>
</tr>
<tr>
<td>BSc</td>
<td>Biology</td>
<td>Biology</td>
<td>282</td>
<td>172</td>
</tr>
<tr>
<td>BSc</td>
<td>Chemistry</td>
<td>Chemistry</td>
<td>241</td>
<td>161</td>
</tr>
<tr>
<td>BSc</td>
<td>Mathematics</td>
<td>Pure Mathematics</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>BSc</td>
<td>Mathematics</td>
<td>Scientific Computation</td>
<td>56</td>
<td>32</td>
</tr>
<tr>
<td>BSc</td>
<td>Mathematics</td>
<td>Statistics</td>
<td>107</td>
<td>13</td>
</tr>
<tr>
<td>BSc</td>
<td>Mathematics</td>
<td>Mathematical Sciences</td>
<td>119</td>
<td>94</td>
</tr>
<tr>
<td>BSc</td>
<td>Mathematics</td>
<td>No option</td>
<td>–</td>
<td>16</td>
</tr>
<tr>
<td>BSc</td>
<td>Physics</td>
<td>Physics</td>
<td>113</td>
<td>44</td>
</tr>
<tr>
<td>BSc</td>
<td>Physics</td>
<td>Applied Physics</td>
<td>108</td>
<td>105</td>
</tr>
<tr>
<td>School Total</td>
<td></td>
<td></td>
<td>1299</td>
<td>861</td>
</tr>
</tbody>
</table>
The University curriculum is founded on a credit-based system, and all undergraduate degrees are honors 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 courses in their own disciplines.

### Course Credit Requirements for Undergraduate Degrees

<table>
<thead>
<tr>
<th>Program</th>
<th>Science</th>
<th>Business &amp; Management</th>
<th>Humanities &amp; Social Science</th>
<th>Free Elective</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Within Department</td>
<td>Outside Department</td>
<td>Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biochemistry</td>
<td>38</td>
<td>31</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Biology</td>
<td>46</td>
<td>18</td>
<td>6</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Chemistry</td>
<td>48</td>
<td>12</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure Mathematics</td>
<td>52</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Scientific Computation</td>
<td>61</td>
<td>0</td>
<td>11</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Statistics</td>
<td>56</td>
<td>0</td>
<td>6</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Mathematical Science</td>
<td>40</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Physics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics</td>
<td>40-41</td>
<td>8-16</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Applied Physics</td>
<td>50-53</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

*1 – Include 3 credits Technical Communication (LANGUAGE)
*2 – 8 credits are non-mathematics electives
*3 – 6 credits are non-mathematics electives
*4 – 12 credits are non-mathematics electives
SCHOOL OF SCIENCE TEACHING AWARD

The School of Science has recently established the annual "School of Science Teaching Award". Three outstanding teachers, selected with student and faculty input, have received this award for the first time.

The winners are Dr. King-Lau Chow, Assistant Professor of Biology, Dr. Wei-Ping Li, Assistant Professor of Mathematics, and Dr. Xiao-Yuan Li, Associate Professor of Chemistry.

Professor Leroy Chang, Dean of the School of Science, said "It is a myth that good researchers don’t make good teachers, and good teachers don’t make good researchers. Our winners are all excellent teachers and researchers.”

The awards demonstrate the School’s commitment to high quality teaching. “Everybody can be a good teacher: it’s just a case of willingness and effort.”, said Professor Chang.

ACTIVE PHYSICS LEARNING ENVIRONMENT

An "Active Physics Learning Environment (APLE)" was put into operation recently to enable us to focus on student learning instead of mere teaching in the conduct of our classes. It is an adaptation of the “Studio Physics” approach pioneered by the Rensselaer Polytechnic Institute (RPI) for the Year-One courses. It is an approach that uses powerful computer based materials as an ever-present tool for student use in class and integrates the lecture, recitation, and laboratory into one single setting. This classroom is equipped to allow student access to network multimedia, and microcomputer based laboratory systems for data acquisition, analysis, and visualization. Three additional features have been added over the RPI version:

1) a complete set of Physics Explorer which is a package of mathematical simulation software that let students explore the various “what if” scenarios of the physical laws in more realistic settings;
2) equipment for projecting materials stored in videotapes and laser disks; and

3) an electronic network that facilitates interactivity between the instructor and students in which the students responses to a question can be collected, tabulated, and displayed to the class for instantaneous feedback.

All departments within the School of Science offer the research degrees of Master of Philosophy (MPhil) and Doctor of Philosophy (PhD). 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 programs: 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.

**Degree Programs**

<table>
<thead>
<tr>
<th>Program</th>
<th>MSc</th>
<th>MPhil</th>
<th>PhD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>–</td>
<td>17 (8)</td>
<td>14</td>
<td>31 (8)</td>
</tr>
<tr>
<td>Biology</td>
<td>–</td>
<td>36 (15)</td>
<td>17</td>
<td>53 (16)</td>
</tr>
<tr>
<td>Chemistry</td>
<td>–</td>
<td>28 (31)</td>
<td>23</td>
<td>51 (35)</td>
</tr>
<tr>
<td>Mathematics</td>
<td>5 (11)</td>
<td>25 (23)</td>
<td>14</td>
<td>44 (38)</td>
</tr>
<tr>
<td>Physics</td>
<td>1 (22)</td>
<td>33 (25)</td>
<td>15</td>
<td>49 (48)</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>17 (5) **</td>
<td>–</td>
<td>–</td>
<td>17 (5)</td>
</tr>
<tr>
<td>Materials Science and Engineering</td>
<td>10 (1) **</td>
<td>–</td>
<td>–</td>
<td>10 (1)</td>
</tr>
<tr>
<td>Environmental Science</td>
<td>20 (0) **</td>
<td>–</td>
<td>–</td>
<td>20 (0)</td>
</tr>
<tr>
<td>School Total</td>
<td>53 (39)</td>
<td>139 (102)</td>
<td>83</td>
<td>275 (151)</td>
</tr>
</tbody>
</table>

* The first figure is 1996 enrollment (full-time equivalent), the figure in parenthesis is the cumulative number of graduates in 1993-96.

** Interdisciplinary programs

**DEPARTMENTAL PROGRAMS**

**Master of Science (MSc) Programs**

The MSc Program emphasizes course work to strengthen students’ general background in a science discipline.

**Master of Philosophy (MPhil) Programs**

In addition to coursework requirements specified by the department concerned, MPhil students will undertake a program 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 defense by the student. For full-time students, the normal length of time for completion of the MPhil degree is two years.

**Doctor of Philosophy (PhD) Programs**

PhD programs focus on original research by the student, but most also require coursework. Doctoral students proceed from admission to the program, to candidacy for the degree, and then to oral defense 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 member external to the University.

**Course Credit Requirements for Graduate Degrees**

<table>
<thead>
<tr>
<th>Program</th>
<th>Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MSc MPhil PhD</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>–      8  14</td>
</tr>
<tr>
<td>Biology</td>
<td>–      12 12</td>
</tr>
<tr>
<td>Chemistry</td>
<td>–      12 12</td>
</tr>
<tr>
<td>Mathematics</td>
<td>30*    24 36</td>
</tr>
<tr>
<td>Physics</td>
<td>30     12 12</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>30-32** – –</td>
</tr>
<tr>
<td>Material Science and Engineering</td>
<td>30-32** – –</td>
</tr>
<tr>
<td>Environmental Science</td>
<td>30-32** – –</td>
</tr>
</tbody>
</table>

* Including 6 credits for project
** Interdisciplinary programmes

**INTERDISCIPLINARY PROGRAMS**

**Master of Science (MSc) in Biotechnology**

Biotechnology is the application of techniques and processes that utilize 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 program, 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 the Committee on MSc Program in Biotechnology which is jointly appointed by the Departments of Biochemistry, Biology, Chemistry, Chemical Engineering, and Civil and Structural Engineering. Normally, the program will take 18-24 months of full-time study to complete and about twice as long for part-time students.

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

The curriculum which comprises four groups of courses, requires students to complete a total of 30 credits.

Master of Science (MSc) in Material Science and Engineering

This interdisciplinary program commenced in Fall 1994 with enrollment 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 program in which the students must take 32 credits, including core-courses in Materials Science and approved graduate electives from participating departments. The program is available for full-time or part-time study and thus can provide valuable specialized 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 Characterization and Preparation Center (MCPC) are now being augmented by the setting up and equipping of the Advanced Materials Research Institute (AMRI). The program has its own teaching laboratory for students’ use.

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 programs aimed at finding solutions to a wide range of urgent environmental challenges facing Hong Kong and its surrounding region.

The MSc degree program will provide an in-depth education in Environmental Science and Engineering and serve as the first step to more fully utilize HKUST’s expertise in the area of environmental education and as the catalyst to promote further educational programs 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 program is designed as a MSc taught degree program to complement current MPhil and PhD research-based ones in environmental studies. The program will mostly but not exclusively be admitting part-time students, many of which may already have their career in environmental related professions. Contributions from the Schools of Engineering, Business and Management, and Humanities and Social Science towards two core courses are part of the program.

For this interdisciplinary program, 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 success of undergraduate and graduate 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**  | **UBC**
---|---|---|---
**Brown**  | **Cornell**  | **Oxford**  | **UC Berkeley**
**Caltech**  | **Kyoto**  | **Princeton**  | **Washington**
**Cambridge**  | **Maryland**  | **Toronto**  | **Yale**

The faculty to student ratio at HKUST is one to twelve point five. In the School of Science, the faculty distribution is as follows:

### Faculty Number and Distribution at 1996

<table>
<thead>
<tr>
<th>Department</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>17</td>
</tr>
<tr>
<td>Biology</td>
<td>24</td>
</tr>
<tr>
<td>Chemistry</td>
<td>17</td>
</tr>
<tr>
<td>Mathematics</td>
<td>36</td>
</tr>
<tr>
<td>Physics</td>
<td>31</td>
</tr>
<tr>
<td><strong>School Total</strong></td>
<td><strong>125</strong></td>
</tr>
</tbody>
</table>

**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, material science and electronic engineering. He is one of only three people in the world elected to the US National Academy of Sciences, the US National Academy of Engineering, the Chinese Academy of Sciences, and the Academic Sinica. He is also a Fellow of the newly established Hong Kong Academy of Engineering Sciences. In 1995, he was awarded DSc honoris causa by the Hong Kong University of Science and Technology.
Professor Jerry H.C. Wang, Professor and Head of Biochemistry and fellow of Royal Society of Canada has won many research awards including the Gairdner International Award in 1981 for the elucidation of the mechanism of action of Calmodulin, a calcium-binding protein that plays pivotal role in cellular signal transduction. Gairdner International Award is among the most prestigious awards in medical research.

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 Prize in 1991 “for his remarkable contributions to the understanding of the mechanism of biosynthesis and mode of action of the plant hormone ethylene, which have resulted 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.
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 programs, thus assuring high quality of graduate 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 recognized experts, fine laboratories, and good organizations that can contribute greatly to the programs at HKUST. One of the goals of research program 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.

To contribute more effectively to the economic vitality of Hong Kong and the surrounding region, the University works with industrial and commercial organizations 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 more than 290 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 significant research component that is intended by the University Grants Committee (UGC) 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 1995/96 the total funds available to the School of Science were $1.56 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 program activities, procedures and mechanisms needed for the development of HKUST into a research university. Interdisciplinary and/or multidisciplinary proposals are preferred to augment the normal funding pattern of disciplinary research. In 1995/96 the infrastructure funding in the University was $21.6 million. Awards are
made on a competitive basis and are normally for a period of one to three years. Research Infrastructure Grants programs 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 Research Travel Grants**

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

The total award for projects in the University from RGC/UGC in 1995/96 was $86.3 million, of which $35.96 million went to the School of Science. In addition, substantial research funding support was obtained from non-RGC/UGC sources.

**RESEARCH INSTITUTES**

Some research activities fit well into the traditional disciplinary organization, and are administered by academic departments. This is especially true of smaller, basic research programs that primarily involve faculty and research students. For research programs 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 twelve 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>Institute</th>
<th>Department</th>
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<tr>
<td></td>
<td>Biochemistry</td>
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<td>Biotechnology Research</td>
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<tr>
<td>Advanced Materials</td>
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<tr>
<td>Scientific Computation</td>
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**Biotechnology Research Institute**

The biotechnology industry is one of the fastest growing industries in the last decade. Biotechnology products have revolutionized the health care, food, agricultural and environmental management industries. While it requires highly trained work force, biotechnology does not need huge capitals or large manufacturing plants. For these reasons, biotechnology is considered as one of several high-tech industries which can provide Hong Kong with a competitive edge in economic growth. 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 1990.

The mission of the BRI is to assist Hong Kong in developing 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. The strategic areas of research focus for BRI in coming years include:

- Neuro-Proteins
- Protein Structure and Design
- Plant Biotechnology
- Chinese 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

**Advanced Materials Research Institute**

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 center. 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 that three centers within the AMRI, each with three affiliated laboratories, have been created. These are:

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

- Optical & Magnetic Materials Center
  - Lasers & Photonics Laboratory
  - Magnetic Materials Laboratory
  - Liquid Crystals Laboratory

Blue light emission from a ZnSTe-based Schottky-barrier thin film structure
• Composite & Synthetic Materials Center
  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 Center 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, Chemical Engineering, and Electrical and Electronic Engineering, are either doing or planning to do research connected with the AMRI. The involvement of faculty, visitors, and postgraduate students is expected to increase in number, breadth, and depth as the other laboratories become fully operational. With judicious investment of resources each center or for that matter, each laboratory, could become a “center 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 approach. 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 while 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 center of excellence in scientific computation. For this purpose, an interdisciplinary Institute of Scientific Computation will be 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 programs are in:

- Computational Fluid Dynamics
- Computational Atmospheric Science
- Computational Finance
- Computational Physics and Chemistry
- Computational Material Science
- Neural and Parallel Computation

There are already many major 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 program on scientific computation has been well-established in the Department of Mathematics.

**Other Institutes and Centers**

The School also participates in the following Institutes which are based in the University:

- Advanced Manufacturing Institute
- Center for Asian Financial Markets
- Center for Economic Development
- Hainan Institute
- Hongkong Telecom Institute of Information Technology
- Institute for Environmental Studies
- Institute for Infrastructure Development
- Institute of Microsystems
- Sino Software Research Center
International exchange of scientific ideas and discoveries form an important part of research. The School of Science actively promotes these activities by organizing distinguished lectures, seminars and international scientific conferences, and by conducting joint research with scientists of other countries.

**Research Links**

The School and the University have many formal and informal research links with institutions in Canada, China, Japan, UK and the US.

As an example, a Life Science and Biotechnology Joint Laboratory was established at HKUST with the Chinese Academy of Sciences, involving the Shanghai Research Center of Life Sciences and the Shanghai Research Center of Biotechnology of the Academy. First of its kind, the Joint Laboratory will help foster collaboration and academic exchange between the two institutions.

Established recently also to promote higher education and scholarship was the Association of East Asian Research Universities, of which HKUST is a founding member. The other twelve members include four from China (Peking University, Tsinghua University, Fudan University, University of Science and Technology of China), four from Japan (University of Tokyo, University of Tsukuba, Osaka University, Tokyo Institute of Technology), three from South Korea (Seoul National University, Pohang University of Science and Technology, Korea Advanced Institute of Science and Technology) and one from Taiwan (Tsing Hua University).

**Distinguished Lecture Series**

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

Professor Yuan-Tseh Lee, Nobel Laureate in Chemistry, lecturing on “Investigation of Elementary Chemical Reactions by Lasers and Molecular Beams”
## Distinguished Lectures in Science 1991-1996

<table>
<thead>
<tr>
<th>Date</th>
<th>Title of Lecture</th>
<th>Speaker</th>
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<tr>
<td>7 Oct 1991</td>
<td>Molecular Dance in Chemical Reaction</td>
<td>Prof. John Polanyi</td>
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<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>
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<td>29 Jan 1992</td>
<td>Newer Insights in the Control of Globin Gene Expression</td>
<td>Prof. Yuet-Wai Kan</td>
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<tr>
<td>10 Mar 1992</td>
<td>What is Geometry</td>
<td>Prof. Wu-Chung Hsiang</td>
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<tr>
<td>9 Apr 1992</td>
<td>The Universe is our Playpen: Fun with Physics</td>
<td>Prof. Chih-Yung Chien</td>
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<tr>
<td>14 Apr 1992</td>
<td>The Frontier of Life: Viroids &amp; Satellites</td>
<td>Prof. Theodor Diener</td>
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<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>
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<tr>
<td>8 Aug 1994</td>
<td>Today’s Science, Tomorrow’s Technology</td>
<td>Prof. J. Robert Schrieffer</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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<tr>
<td>23 Jun 1995</td>
<td>Challenge, Response and Serendipity in the Design of Materials</td>
<td>Prof. Robert W. Cahn</td>
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<tr>
<td>20 Oct 1995</td>
<td>Symplectic Topology</td>
<td>Prof. Vladimir I. Arnold</td>
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<tr>
<td>18 Apr 1996</td>
<td>The Development of Science in China: Past, Present and Future</td>
<td>Prof. Xide Xie</td>
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<tr>
<td>25 Jun 1996</td>
<td>Investigation of Elementary Chemical Reactions by Lasers and Molecular Beans</td>
<td>Prof. Yuan T. Lee</td>
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<tr>
<td>11 Jul 1996</td>
<td>HIV Infection and Disease: Some Select Aspects of Pathogenesis and Some Novel Biological Approaches to Therapy</td>
<td>Prof. Robert C. Gallo</td>
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<tr>
<td>Awards/Honors</td>
<td>Institution</td>
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<tr>
<td>Nobel Laureate in Chemistry</td>
<td>University of Toronto</td>
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<td>Wolf Prize in Agriculture</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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<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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<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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<td>Academia Sinica, NAS</td>
<td>Massachusetts Institute of Technology</td>
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<td>Nobel Laureate in Physics</td>
<td>Florida State University</td>
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<td>Nobel Laureate in Physics</td>
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<td>Nobel Laureate in Chemistry</td>
<td>California Institute of Technology</td>
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<td>FRS</td>
<td>University of Cambridge</td>
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<td>Russian Academy of Sciences</td>
<td>Steklov Mathematical Institute, Moscow and CEREMADE, Universite Paris-Dauphine</td>
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<td>Chinese Academy of Sciences</td>
<td>Fudan University</td>
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<tr>
<td>Nobel Laureate in Chemistry</td>
<td>Academia Sinica</td>
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<tr>
<td>American Cancer Society’s Medal of Honor</td>
<td>University of Maryland</td>
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### International Scientific Conferences held in HKUST

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<th>Date</th>
<th>Conference Name</th>
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<tr>
<td>21-22 Aug 1992</td>
<td>Condensed Matter Theory</td>
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<tr>
<td>15-17 Jan 1993</td>
<td>International Conference on Complex Analysis and Its Applications</td>
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<tr>
<td>12-13 Aug 1993</td>
<td>Hong Kong Workshop on Frontiers of Surface Diffraction and Imaging</td>
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<tr>
<td>8-9 Apr 1994</td>
<td>15th Meeting of the Hong Kong Society of Neurosciences</td>
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<tr>
<td>22-26 Aug 1994</td>
<td>XIVth International Conference on Raman Spectroscopy</td>
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<tr>
<td>16-19 Jan 1995</td>
<td>First Asian Computational Fluid Dynamics Conference</td>
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<tr>
<td>3-14 Jul 1996</td>
<td>1995 HKUST Physics Summer School on Nanostructured and Granular Materials</td>
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<tr>
<td>23-26 Jun 1996</td>
<td>First Asian Photochemistry Conference</td>
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<tr>
<td>7-11 Jul 1996</td>
<td>Second International Symposium and Workshop of the Asia Pacific Society of Bioscientists</td>
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<tr>
<td>23-26 Jul 1996</td>
<td>International Workshop on Value Distribution Theory and Its Applications</td>
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<tr>
<td>30 Oct 1996</td>
<td>Workshop on Promotion of International Collaboration on New Crystal Technology</td>
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<tr>
<td>HKUST Faculty</td>
<td>Number of Participants</td>
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<tr>
<td>Dr. K.Y. Szeto</td>
<td>50</td>
</tr>
<tr>
<td>Prof. C.C. Yang</td>
<td>80</td>
</tr>
<tr>
<td>Prof. N.T. Yu</td>
<td>550</td>
</tr>
<tr>
<td>Prof. G.W.H. Hui</td>
<td>197</td>
</tr>
<tr>
<td>Prof. N. Cue</td>
<td>60</td>
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<tr>
<td>Prof. H. Hiraoka</td>
<td>150</td>
</tr>
<tr>
<td>Dr. Y.S. Wong, Dr. P.Y. Qian, Dr. I.H. Ni, Dr. A.P.S. Lau</td>
<td>300</td>
</tr>
<tr>
<td>Prof. S.D. Kung, Prof. J. Wang, Prof. J.T.F. Wong, Dr. R.S.C. Wong</td>
<td>400</td>
</tr>
<tr>
<td>Prof. C.C. Yang</td>
<td>48</td>
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<tr>
<td>Prof. G.K.L. Wong, Dr. Z.K. Tang</td>
<td>35</td>
</tr>
</tbody>
</table>
UNIVERSITY LIBRARY

The Library is an integral component of the academic programs, supporting the University’s teaching and research in science, engineering, business and management, the humanities and social sciences. As of 1996, five years after the University’s opening, the Library’s book, periodical, and microform collections total approximately 400,000 volumes, and many audio-visual materials, both educational and recreational, are available for use in specially equipped facilities.

In addition, the Library offers a learning environment rich in electronic information and services. Its focus on electronic resources may be seen in its web site (http://library.ust.hk) as well as in the prominence of computer terminals and the extensive collection of databases, many networked and many full text/full image. In a sense the Library is always open in that numerous library resources may be used by accessing the databases on the local area network, the online library catalog, and especially, information of various types via the web server. There users can search the Library’s catalog of holdings in both English and Chinese and the catalogs of other tertiary institutions in Hong Kong and overseas. Many of the library’s instructional materials and policy statements, along with numerous links to local and external resources, are available on the web site, which may be used at any time from every part of the campus.

An experienced staff assists users in a variety of ways, from the selection, acquisition, and cataloging of materials to making use of 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.
CENTER OF COMPUTING SERVICES AND TELECOMMUNICATIONS

The Center 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 modeled after the distributed client-server architecture. The network backbone is a collection of advanced, high-speed FDDI (Fiber 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 Center 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 computation and visualization, 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 CHARACTERIZATION AND PREPARATION CENTER

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 Characterization and Preparation Center (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 organization. Any spare equipment capacity in the Center 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), a time-of-flight secondary ion mass-spectrometer (TOF-SIMS) and a multi-techniques surface analysis system, a nuclear magnetic resonance spectrometer (NMR), a scanning tunneling/atomic force microscope (STM/AFM), thin film preparation and measurement equipment, dedicated laboratories for optical, thermal and electrical characterization, 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 micro-electronics and opto-electronics, catalysts, nano-clusters, sensors, biomaterials, and materials with various engineering applications.
MICROELECTRONICS FABRICATION CENTER

The Microelectronics Fabrication Center (MFC) provides functional laboratories for teaching and research, particularly in new semiconductor devices, novel microsensors and microactuators, advanced microelectronics process technology and high performance integrated circuits.

The MFC phase I laboratory provides about 247 square meters of Class 1,000 clean room environment (containing fewer than 1,000 particles per cubic foot of air larger than a half micrometer) and basic fabrication modules which provide photolithography, thermal diffusion, thin-film disposition, dry/wet etching and metallisation. The laboratory has also developed 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 1996, the technical capabilities of MFC are further upgraded with the completion of its phase II laboratory, which occupies an area of about 750 square meters with some section providing Class 100 environment. State-of-the-art microelectronics processing equipment will be installed. These include an E-beam Direct Write System which facilitates the sub-quarter-micron patterning and enables nano-structure research. The new laboratory will also provide support to the newly established Display Research Center. With the additional capabilities and capacity, MFC will extend its service to other tertiary institutions and 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 Center.
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 center of research excellence that attends to the challenge of both the fundamental and technological aspects of biochemistry. To do so, it focuses on three areas where basic advances and key applications are expected to arise: "Genetic Engineering and Protein Design", "Molecular and Cellular Biochemistry" 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 Hong Kong Government. Research activities also include contracts with Hong Kong manufacturers and patent development.

In our teaching program as well, students are instructed during the undergraduate years on both basic principles of biochemistry and insight into the working of biotechnology. In graduate 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

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

Professors

Tian Yow TSONG,  BSc Chung Hsin; PhD Yale 1969
Biophysical chemistry, protein folding, membrane electrochemistry
J. Tze Fei WONG, BA, PhD Toronto 1963
Structure and function of transfer RNA for tryptophan, drug delivery systems

Associate Professors / Senior Lecturers

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

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

Randy Y.C. POON, BA, PhD Cambridge 1994
Cell Cycle Control, Tumorigenesis

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

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

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

Mingjie ZHANG, BSc Fudan; PhD Calgary 1993
Structure and function of proteins by NMR and protein engineering
Huan-Xiang ZHOU,  BSc Wuhan; PhD Drexel 1988
Computer modeling of the structure and function of proteins, theory and simulation of diffusion-influenced processes (protein-ligand binding and generation of motility), calculation of hydrodynamic properties of macromolecules

Guang ZHU,  BSc Xibei; PhD Maryland 1992
Multidimensional NMR signal processing, biological NMR, NMR methodology

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.
**Molecular and Cellular Biochemistry**

This research area is concerned with the elucidation of biochemical principles underlying selected biological and cellular processes. One of the current focused topics is neurochemistry. A number of brain-specific proteins including a novel protein kinase called neuronal cdc2-like kinase and neuron-specific protein kinase C substrates, neuromodulin and neurogranin are studied in terms of structure, function, regulation and embryonic developmental pattern. The involvement of these proteins in memory formation and neurodegenerative diseases will be assessed by gene targeting and electrophysiology of hippocampus and spatial learning tasks. Another focused area is concerned with the molecular basis of cell division cycle control in normal and cancer cells. In addition, the relationship between cell cycle control and processes like tumorigenesis, aging and differentiation is also studied.

**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 systems are in progress. In addition, biochemical studies of stress tolerance, germination physiology, seed priming and development of gene overexpression systems 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.
MISSION

Modern Biology is very diverse and involves studies at several different levels, from laboratory experiments on simple bio-molecules through to field studies of interactive organisms. The research and teaching programs within the Department of Biology reflect this diversity. In addition to its internal program, the Department also contributes to the more specialized research programs of the Biotechnology Research Institute and the Institute for Environmental Studies. Our broad aims are to stimulate and train young students via the undergraduate curriculum and to develop a research program that achieves an effective blend of basic and applied science.

Development of recombinant DNA technology over the past two decades has transformed biological science and created tremendous research potential via integration of genetic and biochemical approaches. Modern experimentation often requires very sophisticated equipment, however, and the Biology Department has invested heavily in this area and can be compared favorably with any University internationally. The Department is currently near full strength having recently expanded to include several new faculty from around the world. The best available equipment, excellent computing systems and technical support staff come together to provide an ideal environment for tackling the challenges of modern biology.

Much of the research in the Department is aimed at understanding molecular mechanisms for fundamental biological processes such as growth, cell division and differentiation in plants and animals. In contrast there is also an emphasis on marine and environmental biology. Overall therefore the Department’s research has long term objectives involving basic science while many projects are directly relevant to medicine, the environment and biotechnology.

Students are our future scientists and the Department attempts to offer a balanced training in theoretical concepts and practical research. Graduate training leading to MPhil or PhD degrees are on offer and graduate students play a central role in the Department research activities. A high percentage of graduating BSc students pursue further studies, which augurs well for the future of Biology in Hong Kong. Other graduates are very successful in securing employment in various sectors of the Hong Kong economy, reflecting the well-rounded training that they receive during their BSc studies.
FACULTY AND THEIR RESEARCH INTERESTS

Professor and Head of Department (Acting)

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 signaling 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
(Vice-President 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

Reader

Yuk-Shan WONG,  BA Concordia; PhD McGill 1979
(Associate Director of Research Center)
Environmental biochemistry, plant physiology/biochemistry, environmental biology

Associate Professors / Senior Lecturers

Nancy Y.Y. IP,  BS Simmons Coll; PhD Harvard 1983
(Director of Biotechnology Research Institute)
Neurotrophic factors and their receptors, neuronal differentiation

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

Assistant Professors

David BANFIELD,  BSc Simon Fraser; PhD British Columbia 1991
Intracellular protein trafficking and secretory organelle maintenance
King Lau CHOW,  BSc Chinese U. HK; PhD Baylor Coll of Medicine 1990
Anteroposterior pattern formation, peripheral neural differentiation, genetic basis of morphogenesis

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

Kevin LEE,  BSc London; PhD McGill 1985
Mammalian transcription factors, DNA-binding proteins, nucleic acid-protein interactions, Ewings sarcoma oncogene

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

Andrew L. MILLER,  BSc, PhD Dundee 1986
Calcium signaling during early development, calcium imaging techniques, transgenic model systems for tracing calcium ions

Peiyuan QIAN,  BSc Qingdao U. of Oceanology; PhD Alberta 1991
Marine biology and ecology, reproductive ecology, larval ecology of marine invertebrates, environmental pollution

Christopher ROCK,  AB UC Berkeley; PhD Michigan State 1991
Molecular genetics of plant growth and development, plant hormone signal transduction, role of abscisic acid in plant stress adaptation

Nikolaus J. SUCHER,  MD, Dr Berlin med Free U. 1988
Structure, function and developmental regulation of glutamate receptors

Karl Wah-Keung TSIIM,  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,  MSc Fudan; PhD Cornell 1988
Anti-inflammatory therapy, immunology, platelet endothelial cell adhesion molecule-1 (PECAM-1), hepatocellular carcinoma immunology
RESEARCH AREAS

Cell, Developmental and Tumor Biology

These areas have considerable overlap and several groups are involved in studies of signal transduction from the cell surface to the nucleus and gene regulation by transcription factors. Much efforts are aimed at understanding aspects of cellular differentiation and tumorigenesis. Molecular analysis of mutations that occur in tumors of high incidence in Hong Kong are highlighted. At the cellular level, the structure and dynamics of subcellular organelles and the signals that determine cell function during development are studied. A critical aspect of the above studies involves the development of sophisticated microscopic techniques for imaging events in intact cells.

Neurobiology

The fast expanding field of Neurobiology is well represented with several interactive groups studying the following topics: the molecular mechanism of neural injury and regeneration; therapeutic agents for neurodegenerative diseases: synapse formation at the neuromuscular junction; growth factors and neuronal differentiation; signal transduction by neurotransmitters. Researchers within the neurobiology group are pursuing basic studies that in many cases relate to specific diseases of the nervous system and potential clinical applications.
Plant Biology

Plant studies focus on (1) plant physiology and enzymology, (2) important signaling molecules (ethylene and abscisic acid) and their role in plant growth, development and response to environmental stress and (3) methods for producing improved plant varieties by genetic engineering. The role of ethylene in growth, senescence and post-harvest performance of crops is a key area of study. Development of techniques for introduction of foreign genes into a variety of plants is also emphasized.

Marine and Environmental Biology

Marine and Environmental Biology Research is centered on basic and applied studies at ecological, organismal, genetic and biochemical levels. Particular emphasis is placed upon research issues relevant to Hong Kong that are also applicable to the South China Coast and countries of the Pacific Rim. In addition to the core Marine and Environmental research group, a variety of molecular biology, toxicology and physiology research programs employ marine and fresh water organisms as experimental models.
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 graduate levels in the area of molecular science to prepare men and women for careers in chemically-related industry and commerce.

Our undergraduate program is flexible enough to allow both generalization and specialization, 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 optics, biosensors and bioelectronics 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 catalyze 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 (Acting)

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

Professor

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

Readers

Richard K. HAYNES, BSc, PhD Western Australia 1970
Organic synthesis, mechanism, action, drug design, organophosphorus chemistry, asymmetric catalysis

Reinhard RENNEBERG, PhD Berlin Central Inst. Molecular Biol 1979
Biosensors and bioelectronics, bioanalytical and environmental chemistry, immobilization of biomolecules and cells
**Associate Professors / Senior Lecturers**

Chun-Tao CHE,  BSc Chinese U. HK; PhD Illinois (Chicago) 1982  
Natural products and drug isolation, Chinese medicinal herbs

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

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

**Assistant Professors**

Paul R. CARLIER,  BA Hamilton Coll; PhD MIT 1988  
Asymmetric synthesis, catalysis, organolithium chemistry, neurochemistry

Wei-Min DAI,  BSc Hangzhou; PhD Kyoto 1990  
Design and synthesis of DNA-cleaving enediyne compounds, enantioselective reaction, porphyrin analogs

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

Zhenyang LIN,  BSc Wuhan; PhD Oxford 1989  
Computational chemistry, clusters, metal silane complexes, aluminophosphates

Ben Zhong TANG,  BSc South China; PhD Kyoto 1988  
Polymer synthesis, organometallic catalysts, chiral polymers, liquid crystals, optical materials, fullerene science

Terence S.M. WAN,  BSc Wisconsin; PhD MIT 1981  
Analytical chemistry, capillary electrophoresis, mass spectrometry, drugs and fullerenes

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

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
RESEARCH AREAS

Traditionally Chemistry breaks down into discrete areas, Organic, Inorganic, Analytical and Physical. Here at HKUST the aim has been to develop research programs 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 synthesize 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”.

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 tumor 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 centers into molecules as occur in natural products. Asymmetric synthesis is
increasingly important in industry for the production of enantiomerically pure pharmaceuticals. Development of a stereoselective aldol reaction has resulted in the production of a new class of gamma-amino alcohol SSRI antidepressant candidates. To complete the assault on drug design and synthesis molecular modeling and computational studies of macrocyclic anti-biotics 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. For example, recently, a new class of polymers incorporating C60 “bucky-ball” molecules have been synthesized and their optical limiting properties studied.

**Molecular Characterization**

A third major area is concerned with molecular characterization especially through laser-based spectroscopy 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 fiber-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 studies include the development of capillary electrophoresis for the drug separation and identification of drugs and other materials.

**Biosensors and Bioelectronics**

Biosensors belong to the Molecular Sensor family, combining the fields of Advanced Materials and Molecular Characterization with Bioanalytical Chemistry. They comprise an analyte selective interface in close proximity to, or integrated with, a transducer (detector), whose function is to relay the interaction between the surface and analyte. In biosensors the analyte specific surface employs biomolecules, bio-recognition sites and analogues thereof. Biosensors have a great practical impact already: they can monitor the level of blood glucose in diabetics, check the fitness of athletes and race horses, indicate myocardial infarction and water pollution. Future prospects vary from 100 million to 1 billion US Dollar by the turn of the century for diagnostic and environmental applications of these Biomolecular Sensors. The reagentless biosensor devices need no special sample retreatment, they are most likely to be concerned with immobilized biomolecules and their interrogation. Truly interdisciplinary tasks have to be reached: The sensor surfaces have to be modified using sophisticated chemistry to keep biomolecules active, the signal has to be processed with the help of engineers and finally a device has to be constructed.

In combination with micro and nanosensors fabricated in the Department of Chemistry and the Department of Electrical and Electronic Engineering, biomolecules and even living cells are more and more used as an integral part of semiconductor chips, creating a new field of bioelectronics which may revolutionize not only medical diagnostics and environmental monitoring, but also the application of artificial organs.
MISSION

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 for future employment. But from another perspective, more and more mathematics are in use by an increasing number of 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 to reach out; to reach out from the traditional narrow confines of mathematics to science and technology; and also to reach out to all the students with instructions of proper and good mathematics. That is exactly what we are doing at HKUST.

This young department has already both a strong pure mathematics component and a strong component in mathematical applications. We are beginning to see the realization 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

Shiu-Yuen CHENG,  BSc Chinese U. HK; PhD UC Berkeley 1974
Differential geometry, geometric partial differential equations, game theory

Professors

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

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

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

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

Associate Professors / Senior Lecturers

Kwing-Lam CHAN,  BA UC Berkeley; PhD Princeton 1974
Computational physics, fluid dynamics, atmospheric dynamics, astrophysics, cosmology

Qiang DU,  BSc UST of China; PhD Carnegie Mellon 1988
Computational and applied mathematics, numerical and applied analysis, scientific computing

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

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

Assistant Professors

Gopal K. BASAK,  BStat Indian Stat Inst; PhD Indiana 1989
Asymptotics of Markov processes, stochastic differential equation, stochastic
modeling, classification, estimation, probability

Jeffrey R. CHASNOV,  BA UC Berkeley; PhD Columbia 1990
Turbulence simulation and theory, nonlinear dynamics, scientific computation
Bei-Fang CHEN, BSc Huazhong Normal; PhD SUNY Buffalo 1991
Discrete mathematics, combinatorics, geometric probability, computational geometry

Ka-Ni CHEN, BSc Beijing; PhD Columbia 1994
Survival analysis, bootstrap, sequential analysis, empirical process, stochastic modeling, missing data and EM algorithm

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

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

Ji-Shan HU, BA Shanghai Jiaotong; PhD Princeton 1990
Applied analysis

Bing-Yi JING, BSc Lanzhou; PhD Sydney 1993
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
Numerical analysis, differential equations

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
Superconductor simulation, parallel computing, numerical analysis, numerical solution to PDEs, numerical linear algebra, mathematical software

Yuan-Wei QI, BA Beijing; PhD Oxford 1990
Differential equations, scientific computation
Allanus Hak-Man TSOI,  BSc Washington; PhD Alberta 1990
Stochastic analysis, point processes, stochastic filtering and control, probability in finance

Rong-Guang WANG,  BSc UST of China; PhD Harvard 1993
Differential geometry, partial differential equations, topology

Xiao-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, generalized linear model, biological statistics, medical statistics

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

Kun XU,  BSc Beijing; PhD Columbia 1993
Computational fluid dynamics, gas kinetic schemes, rarefied gas

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

Yongchang ZHU,  BSc Beijing; PhD Yale 1990
Infinite dimensional Lie algebras, Hopf algebras and Quantum groups, vertex operator algebras, conformal field theory

Dr. Kin-Yin Li receiving the University’s Michael G. Gale Teaching Award at the Congregation of 3 November 1995
RESEARCH AREAS

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 departments 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 a 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 colloquium and seminars in pure mathematics, scientific computation, and statistics every week. Many well-known international scholars have spoken in these colloquium and seminars.

Algebra and Number Theory

The theory of Lie groups, Lie algebras and their representations play a very important role in many of the recent development of mathematics and in the interaction of mathematics with physics. Our current research includes representation theory of reductive groups, Kac-Moody algebras, quantum groups, conformal field theory and combinatorics.

Number theory has a long and distinguished history, and the concepts and problems relating to the theory have been instrumental in the foundation of a large part of mathematics. Number theory is flourishing in the past decades, as evidence by the recent proof of the Fermat’s Last Theorem. Our current research specializes in transcendental number theory and Diophantine approximation.

Analysis and Differential Equations

Analysis of real and complex functions studies properties of various classes of functions. Many beautiful results in this area serve to provide a solid foundation for mathematics as a whole.

Differential equations appear in many scientific as well as engineering problems when mathematical models are proposed to quantify the underlying phenomenon. The study of such equations, either theoretically or numerically, is crucial in understanding related problems.

Current research areas comprise complex analysis, exponential asymptotics, functional analysis, nonlinear dynamical systems, nonlinear parabolic equations and nonlinear schrodinger equations.
Geometry and Topology

Geometry and topology study shapes and forms and their transformations. The visual recognition of physical objects in the universe stimulates their initial development. Through interacting with various fields of science (e.g. astronomy, mechanics, physics and computer science) and other areas of mathematics such as algebra and analysis, geometry and topology have become subjects with their own independent interests as well as applications in almost every area of science and technology. The current trend is in global analysis on manifolds and the study of low-dimensional topology using ideas and methods inspired by high energy physics.

The active research areas in the department include algebraic geometry, differential geometry, gauge theory, K-theory and low-dimensional topology.

Fluid Mechanics

Fluid mechanics studies the motion of liquids and gases with direct application to industry and the environment. 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.

Scientific Computation

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

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

**Probability and Statistics**

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 modeling.
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 programs 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 civilization that their origins are often overlooked. The discoveries of the principles of solid-state transistor which led to the miniaturization of electronic devices, of atomic hyperfine structure and superconductivity which made possible nuclear magnetic resonance (NMR) imaging, and of laser which underpins 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 programs 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 programs 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

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 Vice-President for Academic Affairs (Undergraduate Studies))
Axiomatic quantum field theory, theory of elementary particles and their interactions at high energy

Michael M.T. LOY,  BSc, PhD UC Berkeley 1971
(Associate Dean of Science)
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, composites

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

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

Ming Lun YU,  BSc Hong Kong; PhD Caltech 1974
(Director, Materials Characterization and Preparation Center)
Surface analysis, nanodevices, superconductivity

Associate Professors / Senior Lecturers

Che Ting CHAN,  BSc Hong Kong; PhD UC Berkeley 1985
First principles calculations of material properties, surface physics, photonic band gap

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

Wei Kun GE,  BSc Beijing; PhD Manchester 1983
Physics of semiconducting heterostructures and nanostructures
Tai Kai NG,  BSc Hong Kong; PhD Northwestern 1987
Condensed matter theory, strongly correlated systems and non-equilibrium systems

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

**Assistant Professors**

Michael S. ALTMAN,  BA Pennsylvania; PhD Brown 1988
Surface physics, growth, structure, magnetism and phase transitions, low energy electron microscopy

Bradley A. FOREMAN,  BSc Missouri-Rolla; PhD Cornell 1995
Theory of semiconductor heterostructures and devices

Sidney C.P. KAN,  BSc Chinese U. HK; PhD Caltech 1991
Microelectronics, micromachining, communication physics, wave scattering

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

Jian Nong WANG,  BSc Xian Jiaotong; PhD Bristol 1990
Semiconductor, heterostructures, transport, optical properties

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

Yu Qi 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 and polymer physics

Michael K.Y. WONG,  BSc Hong Kong; PhD UC Los Angeles 1986
Neural networks, optimization, growth kinetics, telecommunications control

Rong Fu XIAO,  BSc Chongqing; PhD Utah 1988
Laser processing of materials, nonlinear and optoelectronic thin films, adamantine materials

Xu Dong XIAO,  BSc UST of China; PhD UC Berkeley 1992
Surface diffusion, STM & AFM, nanotribology, cluster, molecular identification

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 phenomena
RESEARCH AREAS

Condensed Matter Theory

The current focus of the group include equilibrium and non-equilibrium physics in mesoscopic systems, electrorheological fluids, 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 materials.

Computational Physics

The interests include first principles calculations of many body problems, classical and quantum Monte-Carlo approaches, molecular dynamics simulations, telecommunication network modeling, first principles calculations of electronic and structural properties of materials, and wave propagation in inhomogeneous media.

Laser Optics and Photonics

A state-of-the-art Lasers and Photonics Laboratory is set up with a $10M donation from the Joyce M. Kuok Foundation. The laser systems in this laboratory provide a wide range of capabilities, including tunability from UV to mid-infrared and time-resolution to femtoseconds for studies of optical physics, new nonlinear optical crystals, as well as nonlinear optical processes in solids, liquids and gases. They are also available for exploration of applications and device testing in such areas as optical sensors, ultrafast optical detectors, and medical diagnosis.

Thin Film Physics

The centerpiece consists of two Molecular Beam Epitaxy (MBE) units. One is routinely producing II-VI semiconductor epitaxial layers, the second MBE system is growing III-V thin films. A $10M donation from the Zheng Ge Ru Foundation is being used to establish the Thin Film Science Laboratory. This has enabled 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 Solid State 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 clusters 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**

We have initiated new research projects in complex fluids (e.g. electrorheological fluids) and cellular dynamics. A high resolution digital imaging system and a rheometer are available for these studies. 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.
Funded Research Projects

**Department of Biochemistry**

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

Studying local stable segments to reconstruct the three-dimensional structure of proteins
- Chen, H.M.

Construct of a plant gene overexpression system
- Chow, K.C.

Direct transformation of imbibing seeds
- Chow, K.C.

The development of a new plasmid partition system to effect high-efficiency stabilization of recombinant plasmids in various bacterial strains used as hosts 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.

The molecular basis of bacterial pathogenesis: species-specificity in pathogenic salmonella serovars
- Hackett, J.

Controls on the expression and function of the rfc gene, which encodes the polymerase assembling the O-antigen coat of salmonella bacteria
- Hackett, J.; Morris, C.

Comparative studies of a new memory enhancer huperzine A with tacrine
- Han, Y.F.

Comparison of the memory-enhancing effects of huperzine A and tacrine in rats with and without central cholinergic deficiencies
- Han, Y.F.

Development of Antioxidant and Immunomodulator Based Proprietary Chinese Herbal Tonics
- Ko, R.K.M.

Development of a new class of antioxidants for therapeutic applications
- Ko, R.K.M.; Che, C.T. (CHEM)

Development of Chinese medicinal products with antioxidant properties
- Ko, R.K.M.; Che, C.T. (CHEM)

Expression of epstein-barr virus latent membrane protein by a baculovirus system
- Lam, P.H.Y.

The construction and assessment of insecticidal activity of recombinant baculoviruses expressing insect oostatic hormone and diuretic hormone genes: potential biological insect pest control agents
- Lam, P.H.Y.

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

Structure study of neuron specific protein kinase C substrate, neurogranin, by multidimensional nuclear magnetic resonance
- Sheu, F.S.

An innovative technology for manufacturing monoclonal antibodies
- Tsong, T.Y.

Conformational stability and folding mechanisms of engineered protein analogs
- Tsong, T.Y.

Molecular mechanisms of cell interactions with electromagnetic fields
- Tsong, T.Y.

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

Design of specific substrates of cdc-2 like protein kinases
- Wang, J.H.C.

Development of a specific and sensitive Src protein kinase assay
- Wang, J.H.C.
High level production of biologically active recombinant proteins in bacteria
Wang, J.H.C.

Structure and function of brain-specific cyclin-dependent protein kinase 5 activator
Wang, J.H.C.; Lam, P.H.Y.

Neuro-proteins - a focused area of biomedical research
Wang, J.H.C.; Tsong, T.Y.; Ip, N.Y.Y. (BIOL)

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

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

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

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

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

Random amplified polymorphic DNA analysis of Brassica parachinensis and B. alboglabra
Wong, R.S.C.

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

Bioinsecticide: transformation of Brassica vegetables with a recombinant construct comprising the Bacillus thuringiensis (B.t.) toxin gene
Wong, R.S.C.; Wong, W.K.

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

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

Brain receptors and disease: a gene-targeting analysis
Wong, W.K.

Development of an effective process for large-scale production of recombinant human epidermal growth factor
Wong, W.K.

Factors controlling extra-cellular production of re-combinant proteins in ESCHERICHIA COLI
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.H.Y.; Tsong, T.Y.

Yeast system for large scale production of recombinant human hemoglobin
Wong, W.K.; Wong, J.T.F.

Expression of the extracellular domain of GABA receptor for structural study
Xue, H.

Receptor-based technology for drug discovery and design
Xue, H.

Multidimensional NMR studies of neuronal cdc2-like protein kinase
Zhang, M.

Role of electrostatic interactions in the structure and function of proteins
Zhou, H.X.

Apply the PCA method to multidimensional NMR signal processing
Zhu, G.

Development and application of multidimensional NMR signal processing procedures and experimental methods for structure determination of macro-molecules
Zhu, G.

Department of Biology

Genetic analysis of homotypic fusion in the budding yeast Saccharomyces cerevisiae
Banfield, D.K.
The characterization of Sft1p and Sft2p, two Golgi localized integral membrane proteins that show genetic interactions with Sed5p, the t-SNARE for ER-Golgi traffic
Banfield, D.K.

Calcium signaling in cell cycle regulation
Chang, D.C.

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

Marine fouling control in a flowing through environment - seawater pipes
Chia, F.S.; Qian, P.Y.

Genetic study of interactions between mab-21 gene product and other proteins in Caenorhabditis elegans, a free living nematode
Chow, K.L.

Molecular characterization of mab-21, a Hom-C gene modifier essential for neural patterning along the anteroposterior axis in a free-living nematode, Caenorhabditis elegans
Chow, K.L.

Identification of cellular trans-acting factor(s) related to the early onset of carcinogenesis
Hsiao, W.L.W.

Rational evolution of trioxane antimalarials agents as generalized chemotherapeutic agents
Hsiao, W.L.W.

Study p53-mediated spontaneous transformation and abrogation of p53 protein in transformants derived from cells over-expressing p53 tumor suppressor gene
Hsiao, W.L.W.

Combined effects of retinoic acid and neurotrophic factors in differentiation therapy
Ip, N.

Discovery and development of recombinant proteins for the treatment of neurodegenerative diseases
Ip, N.

Discovery of novel neurotrophic factors and their receptors, and their potential application in the treatment of diseases
Ip, N.

Identification and characterization of novel neurotrophic factors and receptors
Ip, N.

Innovative technology to develop human cell lines for biomedical applications and biopharmaceutical production
Ip, N.

Probing the functional roles of the neurotrophic factors in the formation of "innervation zones" in developing and regenerating neuromuscular junctions
Ip, N.

Studies of the mammalian oncogenic transcription factor EWS/ATF1
Lee, K.

Effects of microtubule disrupting drugs on human leukemia differentiation induced by retinoic acid
Leung, M.F.

Immunosuppressive peptides resemble microtubule binding domains
Leung, M.F.

Production of taxol by micropropagation and cell culture fermentation of Taxus
Leung, M.F.

Repression of ethylene production in citrus fruit via antisense RNA technique
Li, N.

A molecular and clinical investigation of colorectal carcinomas in Hong Kong patients
Lung, M.L.

Development of new laboratory tests based on the use of novel and conventional markers and assay methods for the diagnosis and prognostic evaluation of nasopharyngeal carcinoma
Lung, M.L.

Epstein-Barr virus as a cause of NPC and genetic predisposition to NPC
Lung, M.L.

Functional analysis of the role of tumor suppressor genes in nasopharyngeal carcinomas
Lung, M.L.

Genetic etiology of lung adenocarcinomas among women in Hong Kong
Lung, M.L.
Molecular and cytogenetic analysis of the role of tumor suppresser genes and oncogenes in the development of esophageal carcinoma
Lung, M.L.

The role of oncogenes in lung carcinomas in Hong Kong
Lung, M.L.

Total viable counts and Legionella testing at MTR cooling towers
Lung, M.L.

A study of the role of slow waves in pattern formation and cytokinesis
Miller, A.L.

Development of zebrafish expressing the jellyfish apoequorin gene
Miller, A.L.

Trawl survey program, data analysis and reporting for the environmental monitoring and audit for contaminated mud pit II at east of Sha Chau
Ni, I.H.

Remote sensing of ocean color and groundtruth screening of phytoplanktons and nutrients for the assessment of the marine environment in Hong Kong
Ni, I.H.; Chan, D.K.O.

Disease diagnosis and control in cultured abalone
Pui, J.P.; Qian, P.Y.

Pathogenesis and disinfectants of bacterial infection of cultured abalones, Haliotis diversicolor
Pui, J.P.; Qian, P.Y.

Redtides in Chinese coastal aquaculture: mechanism and prevention
Qi, Y.Z.; Ni, I.H.

Improving antibiofouling treatments in the seawater cooling
Qian, P.Y.

Improving antibiofouling treatments in the seawater cooling systems, a biological approach
Qian, P.Y.

Seabed Ecology Studies
Qian, P.Y.

Enhancement of the quality and growth rate of abalones by genetic and ecological manipulation
Qian, P.Y.; Chia, F.S.

The improvement of progeny quality and growth rate of abalone Haliotis discus hannai Ino
Qian, P.Y.; Chia, F.S.

The influence of early post-settlement mortality and other factors on population dynamics of marine biofouling species
Qian, P.Y.; Chia, F.S.

Isolation and identification of natural nontoxic antifouling compounds from marine bacteria, seaweeds, and invertebrates from Hong Kong waters
Qian, P.Y.; Rittschof, D.; Chia, F.S.

A pioneering study of integrated mariculture in Hong Kong: simultaneous cultivation of commercial species of seaweed, shellfish and fish to improve seawater quality and maximize the yield of fish farms
Qian, P.Y.; Wu, M.C.S.

Genetic analysis of abscisic acid and water stress responses in Arabidopsis Thaliana
Rock, C.D.

Biochemical identification and cloning of agrin receptor from cultured chick myotubes
Tsim, K.W.

The role of agrin in synaptogenesis and nerve regeneration in the brain
Tsim, K.W.

The influence of receptor subtype distribution on the classification of receptors
Wise, H.; Wong, Y.H.

A G-protein-coupled receptor from an sea anemone
Wong, J.T.Y.

Characterization of mixed function oxygenase system in the mussel Perna viridis
Wong, J.T.Y.

Cyclin-dependent kinases in dinoflagellates
Wong, J.T.Y.

Development of molecular markers for dinoflagellates
Wong, J.T.Y.
Molecular mechanisms of indoleamine-induced encystment in dinoflagellate
Wong, J.T.Y.

Regulation of cell cycle in dinoflagellates
Wong, J.T.Y.

Molecular basis of opiate addiction: desensitization of opioid receptor subtypes
Wong, Y.H.

The cloning of opioid receptor subtypes and the characterization of their molecular mechanisms in signal transduction and in drug dependence
Wong, Y.H.

Understanding the molecular mechanisms of G protein oncogenes
Wong, Y.H.

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

Synergistic effects of tyrosine kinases and neuropeptides on neuronal mitogenesis and differentiation
Wong, Y.H.; Tsim, K.W.K.; Demoliou-Mason, C.D.

Molecular basis of melatonin-induced encystment in dinoflagellates
Wong, Y.H.; Wong, J.T.Y.

Expression of heterologous genes in the marine macroalgae
Wu, M.C.S.

Improving Gracilaria stocks by molecular genetic approaches
Wu, M.C.S.

Regulation of chloroplast DNA replication
Wu, M.C.S.

Study of human DNA sequence characteristics
Wu, M.C.S.; Kung, S.D.

Algae and pearl oyster co-culture project
Wu, M.C.S.; Qian, P.Y.; Ni, I.H.

Development of an expression-secretion system for cecropin in C. reinhardtii
Wu, M.C.S.; Shen, D.

Apoptosis related genes in human hepatoma cells
Xie, Y.

Effect of triptolide on apoptotic cell death in human leukemia and lymphoma cells
Xie, Y.

Molecular cloning, expression and mutagenesis of an anti-human liver cancer cell single chain FV
Xie, Y.

Study of the function of platelet/endothelial cell adhesion molecule-1 (PECAM-1) in vitro
Xie, Y.

Taxol induces programmed cell death in human hepatocellular carcinoma
Xie, Y.

Genetic engineering of ethylene biosynthesis in banana
Yang, S.F.; Li, Ning

Mechanism and regulation of ethylene biosynthesis
Yang, S.F.; Li, Ning

Modulation of scar formation in the central nervous system after surgery by antisense gene therapy
Yu, A.C.H.

Department of Chemistry

Asymmetric synthesis of substituted allicin derivatives and allylic thiols
Carlier, P. R.

Solution structure, asymmetric aldol, and asymmetric alkylation reactions of lithiated nitriles
Carlier, P. R.

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

Antithromonal substances and inhibitors of 5 - reductase and aromatase from natural products
Che, C.T.
Cancer drugs active against signal transduction targets
Che, C.T.

Chemical standardization of Chinese medicine
Che, C.T.

Collaborative program for tasks in Chinese medicine and other natural products
Che, C.T.

Potential antitumour drugs from the celastraceae and euphorbiaceae
Che, C.T.

A safety center to enhance the credibility and competitiveness of the traditional Chinese medicine (TCM) industry
Che, C.T.; Chung, W.M. (TTC); Lee, O.C.W. (RC)

A multi-department project on mechanism-based drug discovery from Chinese herbs
Che, C.T.; Wang, J.H.C. (BICH); Wong, Y.H. (BIOL); Wong, J.T.Y. (BIOL)

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

Design and synthesis of analogs of enediyne anticancer antibiotics. An investigation on the mechanism of action of kedarcidin and C-1027 chromophores
Dai, W.M.

Source apportionment of aerosols in Hong Kong and surrounding regions
Fang, M. (RC); Wan, T.S.M.; Chan, C.K. (CENG)

Research and development of novel memory enhancers for Alzheimer therapy
Han, Y.F. (BICH); Carlier, P.R.; Tang, X.C.; Ji, R.Y.

Preparation and evaluation of known and new derivatives of artemisinin and totally synthetic trioxanes as antimalarials
Haynes, R.K.

Rational evolution of trioxane antimalarials as generalized chemotherapeutic agents: investigation of basic chemistry of 1,2,4-trioxane systems, methods of preparation and chemical basis for therapeutic mode of action

Artemisinin analysis
Haynes, R.K.; Wan, T.S.M.

Generalized approaches to enantioselectively pure P-chiral phosphate oxides and phosphines for asymmetric catalysis
Haynes, R.K.; Yeung, L.L.

Novel oxygen transfer reactions—generalized preparation and chemistry of 1,2,4-trioxanes with reference to the Chinese peroxidic antimalarial qinghaosu
Haynes, R.K.; Yeung, L.L.

Analysis and modeling of air quality measurements obtained from ground stations and by aircraft
Heinke, G.W. (RC); Kot, S.C. (MECH); Fang, M. (RC); Chan, K.L. (MATH); Fung, J.C.H. (MATH); Wan, T.S.M.

Pulsed laser chemistry for deposition, etching and surface modifications
Hiraoka, H.

Study on deep UV light processes
Hiraoka, H.

Study on drug particle-size distribution: diskhaler versus turbuhaler
Hiraoka, H.

Surface characterization and modifications of organic surfaces by pulsed lasers, pulsed electron, and ion beams
Hiraoka, H.

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

Asymmetric catalysis using phosphine ligands with molecular recognition ability
Jia, G.C.

Synthesis and characterization of conjugated organometallic dimeric and polymeric complexes
Jia, G.C.
The design and synthesis of novel chiral chelating phosphine ligands and the application of them in asymmetric catalysis  
Jia, G.C.

Acidic molecular dihydrogen complexes and catalysis  
Jia, G.C.; Lau, C.P.

Double-layer photoresist for microelectronic processing  
Ko, T.M. (CENG); Hiraoka, H.

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

Alkylidene complexes of late transition metals  
Leung, W.H.

High-valent metal alkylidene complexes containing multianionic chelating ligands  
Leung, W.H.

Tailored organometallic compounds as low-temperature chemical vapor deposition precursors for metal thin films  
Leung, W.H.

Novel metallotetraazaporphyrins: structure, catalysis, and applications  
Li, X.Y.

Resonance hyper-raman study of heme-protein communication: toward the understanding of the second secret of life  
Li, X.Y.

Theoretical studies of small endohedral metallofullerenes  
Lin, Z.Y.

Research and development of silicon microwave monolithic integrated circuit (MMIC) process technology  
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.

Influence of weathering and ground water on soil slope stability in Hong Kong  
Ng, C.W.W. (CIVL); Shen, C.K. (CIVL); Tang, W.H. (CIVL); Williams, I.D.

Checking Hong Kong’s water quality with novel biosensors  
Renneberg, R.

Porphyrine based sensors  
Renneberg, R.

Microbiosensors for investigation of the antioxidant effect of traditional Chinese medicine  
Renneberg, R.; Ko, K.M (BICH)

Novel biosensors for checking the water quality  
Renneberg, R.; Li, X.Y.; Wang, E.; Dong, S.; Deng; Zhang, X.E.

Development of a portable microbial sensor for fast detection of biodegradable substances in water  
Renneberg, R.; Lung, M. (BIOL); Cheung, P.W.P. (ELEC); Wan, T.S.M.; Hiraoka, H.

Development of intelligent materials: synthesis of fullerene-containing polymers and glasses and exploration of their applications as optical limiters  
Tang, B.Z.

Optically active polyacetylenes containing heteroatom chiral centers: synthesis, characterization, properties, and applications  
Tang, B.Z.

Synthesis and characterization of some important metabolites  
Wan, T.S.M.; Carlier, P.R.; Che, C.T.; Williams, I.D.

Chiral recognition in mass spectrometry  
Wan, T.S.M.; Chan, D.T.W.

Capillary electrophoresis in non-aqueous media: new opportunities for hydropobic substances  
Wan, T.S.M.; Lee, A.W.M.

Organic nonlinear optical crystals  
Williams, I.D.

Regioselective oxidation of hydrocarbons catalyzed by superoxo cobalt complexes  
Williams, I.D.

Design of new inorganic solids using organic templates  
Williams, I.D.; Lin, Z.Y.
Melanin structure and properties
Williams, I.D.; Wan, T.S.M.

Lightwave technology research program
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. (BICH); Che, C.T.; Ko, R.K.M. (BICH)

Theoretical studies of bleomycin action.
Design of new anti-cancer drugs
Wu, Y.D.

Design and synthesis of novel porphyrin analogs
Wu, Y.D.; Dai, W.M.

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.

Scanning tunneling microscopy theory for adsorbates
Yan, Y.J.

Designing receptive protein interfaces on 2-dimensional supported bilayers and 3-dimensional polymer matrix
Yang, S.H.; Renneberg, R.

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

Novel endohedral fullerenes: synthesis and characterization
Yang, S.H.

Studies of hydrocarbon activation by transition metal clusters
Yang, S.H.

The binding and interaction of exogenous ligands with guanylate cyclase by resonance raman spectroscopy
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 non-irreducible markov processes and its applications
Basak, G.K.

Qualitative theory of singular diffusions and its applications
Basak, G.K.

Numerical study of fundamental problems in solar physics-convection and differential rotation
Chan, K.L.

Asymptotic inference for nonstationary and continuous time series
Chan, N.H.; Basak, G.K.

Turbulence collapse of forced rotating flow
Chasnov, J.R.

Turbulence in a stably-stratified or rotating fluid
Chasnov, J.R.

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

The combinatorics of polyhedral spaces
Chen, B.F.

Bootstrap and survival analysis
Chen, K.

The bootstrap accuracy and the efficient estimation of treatment effects in clinical trials
Chen, K.

Explicit construction of quasiconformal extensions and univalence criteria
Chiang, Y.M.

Oscillation of linear differential equations in the complex plane
Chiang, Y.M.
Numerical simulations of vortex motions in layer superconductors
   Du, Q.

New techniques for modeling the dispersion of pollutants
   Fung, J.C.H.

Physics of fractals and spirals: falling fractal flakes, scalar-vortex interactions and flame-vortex interactions
   Fung, J.C.H.

The theory of quasiparticle scattering at helium surfaces
   Fung, J.C.H.

Analysis and modeling of air quality measurements obtained from ground stations and by aircraft
   Heinke, G.W. (IES); Chan, K.L.; Fung, J.C.H.; Kot, S.C. (MECH); Fang, M. (RC); Wan, T. (CHEM)

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

Symmetry of solutions and asymptotics beyond all orders for some nonlinear oscillators
   Hu, J.S.; Mao, J.M.

Harmonic analysis on reductive groups
   Huang, J.S.

Unitary representations of semisimple Lie groups
   Huang, J.S.

A generalized Lagrangian method for computing inviscid compressible flow
   Hui, W.H.

A generalized Lagrangian method for solving the steady three-dimensional Euler equations
   Hui, W.H.

Saddlepoint approximations and their application to resampling
   Jing, B.Y.

Smart holographic optics for industrial applications
   Kwok, H.S. (ELEC); Mao, J.M.; Wong, K.S. (PHYS); Huang, H.C. (ELEC); Murch, R.D. (ELEC)

Pricing models of commodity-linked bonds and convertible bonds
   Kwok, Y.K.

Interpolating and zero varieties in several complex variables
   Li, B.Q.

Entire and meromorphic functions of one and several complex variables
   Li, B.Q.; Yang, C.C.

Moduli space of stable bundles and Donaldson polynomials
   Li, W.P.

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

Study of seiberg-witten classes
   Li, W.P.; Meng, G.W.

Domain decomposition method for eigenvalue problems and computations and applications of pseudospectra
   Lui, S.H.

Search for scaling behavior in bifurcations in quantum systems
   Mao, J.M.

Effects of bifurcation on absorption spectrum
   Mao, J.M.; Hu, J.S.

Develop partial differential equation solvers for parallel computer
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