

Practical makes perfect

研以致用

PolyU takes pride in creating the world's first database which assembles 3D head and face measurements of ethnic Chinese. According to Mr Roger Ball, Director of this project entitled "SizeChina" and Associate Professor of the School of Design, the database will allow industry and researchers to create perfect-fitting consumer products for Chinese. The project has won the Gold Medal in the Research category and the Best in Show Award of 2008 International Design Excellence Awards (IDEA) competition co-sponsored by BusinessWeek and Industrial Designers Society of America.

理大研究人員透過搜集詳盡的華人頭型和臉型三維資料，建成全球首個同類型的網上資料庫。該項目名為「中國尺碼」，由理大設計學院副教授Roger Ball開發。他表示數據有助業界及研究人員設計適合華人頭型與臉型的產品。該項目更在由《商業週刊》與美國工業設計師協會合辦的二零零八年國際傑出設計大賽中榮獲研究組別金獎及最佳表現獎。



In 2007/08, of a total of 1,127 students enrolled in our MPhil or PhD programmes, 96 graduated with a PhD and 70 with an MPhil award. About 54 per cent of these research postgraduate students studied full-time, while 546 academic staff members were involved in supervising research degree students.

More funds for our research

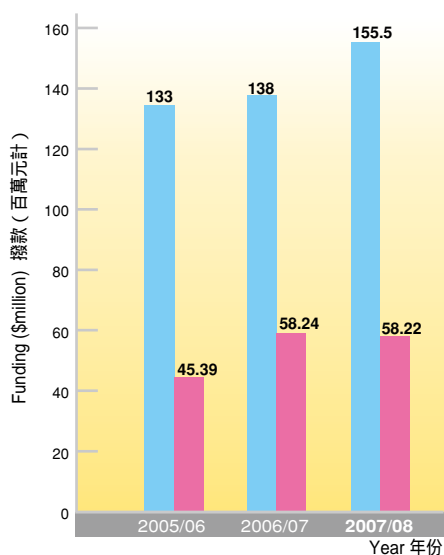
The University continued to receive encouraging public and private funding support for our research development.

During the year, a total of \$155.5 million was allocated as the Research Budget managed by the University's Research Committee. The bulk of this budget was funded by the University Grants Committee (UGC), while \$10.86 million of it was direct allocation for research from the Research Grants Council (RGC). Another \$55 million allocation from the University was earmarked for Niche Areas Development.

The University received external funds worth \$86 million for project-based research. These included an encouraging \$58.22 million from the RGC's General Research Fund (GRF), formerly known as Competitive Earmarked Research Grant, in support of 112 of our projects. Boasting GRF grants totalling \$12.4 million in 2007/08, PolyU ranked first among all local universities in terms of funding for the disciplines of civil engineering, surveying, building and construction for the seventh year in a row since 2001/02.

Funding from PolyU's Central Research Grant* and RGC's GRF allocation

理大中央研究撥款與研資局優配研究金撥款



Central Research Grant 中央研究撥款
GRF 優配研究金撥款

* Includes grants from RGC Direct Allocation; data as of 30 June each year
包括研資局的直接撥款；數據截至每年六月三十日

二零零七至零八年度，共有一千一百二十七名學生修讀哲學碩士或哲學博士課程，畢業生中有九十六人獲頒授博士學位，七十人獲頒碩士學位。研究生之中，約有百分之五十四為全日制學生，負責指導研究生的教員共五百四十六名。

經費續有進賬

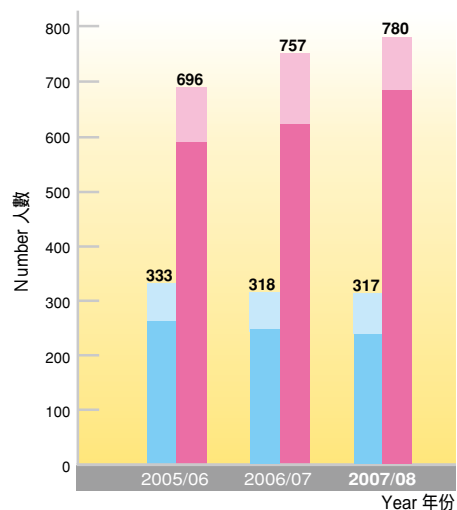
理大於本年度續獲政府和社會各界鼎力資助，藉以推進研究工作。

年內，校內研究委員會撥出一億五千五百五十萬元作為研究經費，這筆經費大部分由大學教育資助委員會（教資會）資助，一千零八十六萬元則為研究資助局（研資局）的直接撥款。此外，大學撥共五千五百萬元用於發展專長領域。

大學從校外取得的科研項目資助達八千六百萬美元，其中五千八百二十二萬元為研資局的「優配研究金」（前稱角逐研究用途補助金）撥款，用以資助一百一十二項研究計劃；特別在土木工程、測量及建造工程領域方面，本校獲得優配研究金一千二百四十萬元撥款，自二零零一/零二年度以來連續第七年成為眾院校之冠。

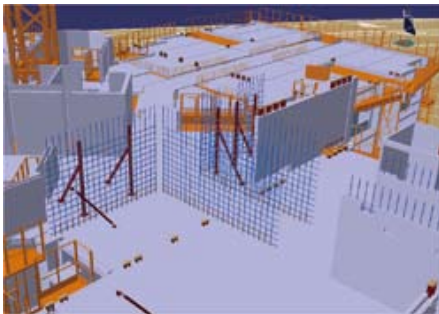
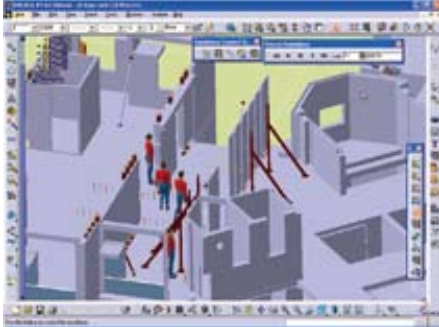
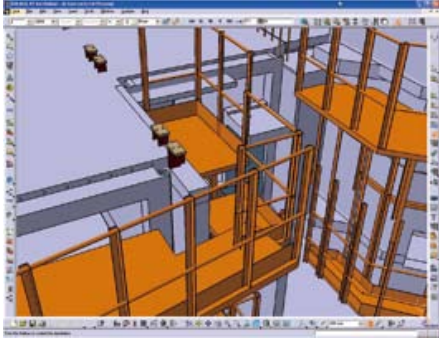
Number of research students/candidates and research degree awardees*

哲學碩士及博士研究生人數



MPhil students 哲學碩士學生
MPhil graduates 哲學碩士畢業生
PhD students 哲學博士學生
PhD graduates 哲學博士畢業生

* As of 30 June each year 數據截至每年六月三十日



▲ Virtual construction technology optimizes construction planning and use of resources.
建築策劃管理系統能優化施工程序，使資源有效運用。

► Developing integrated in-construction and in-service Structural Health Monitoring (SHM) system for the Guangzhou New TV Tower (GNTVT).
為廣州新電視塔提供一體化的施工及營運的結構健康監測系統。

The funding commitment for ongoing research projects, from both external and internal sources, came to a total of \$853.3 million. Of the 2,134 ongoing projects, 718 were initiated during the year by a 887-strong academic staff and about 1,420 researchers, including research assistants and research fellows.

Our research efforts culminated in the production of 1,905 refereed journal papers, 1,494 conference papers and 1,182 other publications. The annual rate of increase in the number of refereed journal papers published has averaged 2.02 per cent over the last five years.

Funding the PolyU R & D momentum

Supported by the Industry-Guided Applied Research and Development (IGARD) funding scheme, a total of 10 ongoing applied R&D projects were conducted by PolyU researchers on application areas ranging from stroke rehabilitation, multimedia user interface platform, virtual construction management, nanotechnology and electrical vehicle technology.

正在進行的研究獲校內校外資助的經費總額達八億五千三百三十萬元，資助研究計劃共二千一百三十四項，其中七百一十八項屬本年度新開展的項目。參與研究工作的教員人數共八百八十七名，而其他研究人員，包括研究助理、研究員等，合共約一千四百二十名。

此外，理大研究人員共發表一千九百零五篇學術期刊論文，一千四百九十四篇會議論文，並出版一千一百八十二份其他學術刊物。過去五年，大學發表期刊文章的數目，每年平均增長率達百分之二點零二。

注資推動理大科研

在「工業主導的應用科技研究及發展基金」計劃支持下，本年度理大科研人員共展開十項應用研發項目，涉及的應用範圍包括中風康復、多媒體用者介面平台、虛擬建築管理、納米科技及電動汽車科技等。

年內，「理大科技及顧問有限公司」及其轄下的創新產品快速開發所合共締造



During the year, PolyU Technology & Consultancy Co. Ltd. (PTeC) and its product development division Rapid Product Development Syndicate (RAPRODS) achieved a combined record turnover of over \$101 million with more than 700 consultancy projects and technologies licensed to industry, serving over 400 clients from across government departments, private sectors and NGOs both locally and internationally.

In 2007/08, the Partnership Development Office (PDO) processed 105 new applications for patents, trademarks and designs, and filed 89 of these applications for the academic staff members. A total of 48 patents, trademarks and designs were granted.

In terms of marketing the R&D expertise and capability, PolyU's inventors and technologies had won several awards in the international invention expos. (Please see p.20 and p.52 for details)

Showcasing PolyU's expertise and technology

With the support of PDO, a total of 41 projects at some \$79.93 million were won from various bodies such as the Innovation and Technology Fund, Small & Medium Enterprises Development Fund, Professional Services Development Assistance Scheme, various R&D centres, as well as the business and industrial sector. The well-acclaimed Teaching Company Scheme also obtained a total funding of \$7.05 million for over 10 projects from both the Government and the business sector.

The House of Innovation (HoI) continues to serve as a showcase of PolyU's expertise and applied R&D outputs. A mini thematic exhibition on space was held at the HoI to showcase PolyU's remarkable research achievements in aerospace over the years. A seminar on Space Exploration was also conducted to enhance the audience's knowledge on space research.

Further tapping our potential for excellence

Apart from focusing efforts on the designated Areas of Excellence (AoEs) funded by the UGC, the University lends strong support to our Areas of Strategic Development (ASDs) with potential to become AoEs. Upon satisfactory completion of their work, 11 former ASDs have also been designated as Areas of Strength (AoSs) for continued development.

了超過一億元總業務收入，為四百多家機構提供超過七百項顧問項目。服務對象包括本地及海外的政府部門、私營企業及非政府組織。

二零零七/零八年度，企業合作處收到共一百零五份專利權、商標及設計申請書，正式獲發申請共八十九份，獲批的新專利發明、商標及設計共有四十八份。

此外，理大的創新研究在多個國際發明展覽中獲獎，備受稱譽。(詳情請見第二十及五十二頁)

展示理大科研成果

年內，理大共有四十一個科研項目獲得政府及工商界資助，經費約為七千九百九十三萬元，資助機構包括香港特區政府的創新及科技基金、中小企業發展支援基金、專業服務發展資助計劃、各項香港研發中心計劃以及工商界。此外，廠校合作研究計劃則有十多個科研項目獲得政府及工商界資助共七百零五萬元。

理大創新館繼續發揮對外宣傳理大科研成果的功能，於年內舉行了一項以太空為題的小型主題展覽，以展示理大多年來在太空研究方面的傑出成就；此外，又舉辦太空探索研討會，藉以增進市民對太空研究的知識。



Our research under the Hong Kong UGC AoE Scheme on “Molecular Technology for Drug Discovery and Synthesis” continues to make significant progress in the following two areas:

- 1) new chiral catalysts with superior performance in new C-C, C-O, and C-N bond formations
- 2) proprietary anti-cancer drug leads with potential to be developed into new drugs

In the pursuit of new chiral catalysts, we have developed a highly efficient and economical method to make the versatile Ugi amine using our proprietary P-Phos (PolyU-invented Phosphine) technology. Further development of this valuable material (which we can now produce at low cost) led to a series of new, P/S type ferrocenophosphine ligands, which have been demonstrated to be highly effective in catalytic asymmetric C-C, C-N, and C-O bond formations.

In the development of new anti-cancer drugs, we have previously found our lead compound to have more favourable efficacy/safety indices than the popular commercial products. To achieve better patent protection of this work, we have successfully developed the lead compound further using our proprietary chirotechnology. A series of new compounds with patentable new composition of matter have been obtained and their efficacy/safety indices again compare favourably with the commercial products. Further development in preparation of human clinical studies is making good progress.

To the “Chinese Medicine Research and Further Development” (CMRFD) project led by The Chinese University of Hong Kong, PolyU has also made tremendous contributions. This AoE adopts the efficacy-driven approach focusing on clinical trials to prove the efficacy of herbs and herbal formulations with the aim of speeding up the modernization of Chinese medicine (CM). The PolyU scientists are renowned for developing chemometric techniques to mine valuable information from data about CM and biofluids acquired via advanced analytical instrument. The chemical fingerprints thus established for authentication and quality control of CM are more reliable and accurate. Since 2001, they have worked together with scholars on the Chinese mainland to help over 40 local manufacturers to set up fingerprints of CM injection products to meet the requirements of State Foods and Drugs Administration (SFDA). Furthermore, the chemometric techniques developed by them have proved to be very powerful for metabonomic research on biofluids for disease diagnosis and pharmacokinetics study. The significant contributions of the PolyU team, especially in the quality control of herbal preparation, have been widely recognized, particularly by the AoE partners.

發掘卓越潛能

本校除了銳意發展由教資會撥款的「卓越學科領域」以外，亦大力支持可更進一步發展成卓越領域的「策略性學術發展領域」項目。另有十一項原屬策略性學術發展領域的項目在完成有關工作後，則定為「學術強項領域」，以繼續有關教研工作。

「分子技術及藥物發現與合成」是教資會轄下「卓越學科領域」重點資助專案，有關方面的研究工作繼續在下列兩方面取得重要進展：

- 1) 在設計、製備的新型手性催化劑在碳-碳、碳-氧、碳-氮鍵生成等多種新反應的研究中，展現特別優異的結果。
- 2) 在擁有獨立知識產權的新型抗癌藥物先導化合物的製備及其生物活性研究中，發現的先導化合物表現出較高的抗癌活性，具有進一步新藥開發的潛力。

在新型手性催化劑的研發過程中，我們採用理大擁有獨立知識產權的新型手性配體 P-Phos (理大發明的膦配體 Phosphine)，通過進一步深入研究，發展了一條製備手性化合物 Ugi 胺的新途徑。該途徑可以有效、經濟地大量製備 Ugi 胺類化合物。從 Ugi 胺出發，我們製備了一系列新型含有二茂鐵骨架的 P/S 類手性膦配體，這些手性配體在不對稱碳-碳、碳-氮、碳-氧鍵生成等多種新反應中都有優良的表現。

在新型抗癌藥物的開發過程中，我們首先發現，我們的先導化合物的抗癌效果優於目前廣泛使用的抗癌藥物，同時表現出較高的安全性。為了對相應的工作進一步加以知識產權保護，我們採用理大擁有獨立知識產權的手性催化劑，對該先導化合物進行進一步結構改造。通過結構改造，我們得到了一系列新化合物，這些化合物均可申請專利保護。初步實驗結果表明，這些新化合物的抗癌活性及安全指數優於目前市場上銷售的抗癌藥物。進一步臨床前研究的準備工作正在進行，並取得理想的進展。

對於由香港中文大學統籌名為「中醫中藥研究與發展」的卓越學科領域，理大亦卓有貢獻。此卓越學科領域通過提供中藥和方劑的臨床療效，以推動中藥現代化為目標。理大

This AoE project has produced fruitful outcomes over the last seven years. The application filed by PolyU, together with three other universities, for an extension of the project was approved and granted by UGC for three years starting from April 2008.

Niche Areas Development

Building on the solid foundation of the ASDs Scheme, the University has developed niche areas which fall into the broad subject categories identified in the UGC's Role Differentiation exercise conducted in October 2003, and are identified in the University's Academic Development Plan submitted for the 2005–08 triennium. An allocation of \$265 million has been approved for PolyU to enhance its academic reputation and attain regional and international prominence in the identified niche areas. The funding scheme demonstrates the University's strong commitment to applied research and its determination to fulfil the role and mission defined by the UGC.

Following are three projects supported by the above funding scheme:

Smart structures and systems based on electro- and magneto-active materials

This is a multi-disciplinary project in which the Department of Applied Physics collaborates with the Department of Civil and Structural Engineering in developing new materials and devices to be incorporated into smart structures and systems. A system is smart if it can sense changes in the environment and produce corresponding responses to minimize the changes. The WEEE (The recycling and

科研人員素以開發創新化學計量學資料處理技術見稱，能從先進分析儀器提取更多有用隱藏在複雜化學體系(如中藥)內的資訊，由此建立的化學指紋圖譜和質檢更為可靠和準確。自二零零一年以來，理大科研人員與內地學者合作，為全國超過四十家中藥製造企業建立了注射液產品的色譜指紋圖譜，從而達到國家食品藥品監督管理局對中藥注射劑進行品質控制的新要求。此外，理大人員所發展的一系列化學計量學技術，已獲證實能有效地應用於生物科學有關的代謝組學和藥代動力學上，為診斷疾病和藥物在生物體內產生的變化提供更多重要資訊。理大科研隊伍在中草藥製劑品質控制方面的重大貢獻，已廣為研究夥伴和其他學者認同。

此卓越學科領域項目開展七年以來進展順利。理大及其他三所大學就延長這項目提出的申請，已獲教資會批准和資助，因此從二零零八年四月開始進行為期三年的深入研究。

專長領域發展

理大在穩固的策略性學術發展領域基礎上，按照教資會二零零三年十月就各院校角色訂立說明時所闡述的本校擅長學科範圍，以及本校二零零五/零六年度至二零零八/零九年度學務發展計劃選定學科範疇，制訂出各

Areas for focused development

Areas of Excellence (AoE)

- Institute of Molecular Technology for Drug Discovery and Synthesis
- Chinese Medicine Research and Further Development

Areas of Strategic Development (ASD)

- China Business Services

Areas of Strength (AoS)

- Building Environmental Performance
- Fire Safety Engineering
- Mitigation of Urban Hazards
- Multimedia Signal Processing
- Training for Creativity and Innovation by Product and Process Design — A New Learning Factory
- Design and Technology Innovation of Textiles and Clothing
- East meets West in Rehabilitation Sciences
- Atmospheric and Urban Air Pollution Research
- Myopia Research
- Smart Materials
- Telehealth and Telecare

重點發展專長領域

卓越學科領域

- 分子科技研究所
- 中醫中藥研究與發展

策略性學術發展領域

- 中國商業服務

學術強項領域

- 建築環保成效
- 消防工程
- 城市減災
- 多媒體訊號處理
- 透過產品和流程設計，啟發創意，推動發明 嶄新的研習工廠
- 紡織、時裝設計與科技創新
- 中西薈萃之康復科學
- 大氣及市區空氣污染
- 近視研究
- 智能材料
- 遙距醫護

Major awards for R&D projects

獲獎新發明和研究項目精選

Award 獎項	Project 得獎項目	PolyU Department 學系
56th Brussels Eureka Fair (Brussels, Belgium, 22-25 November 2007)		
第五十六屆世界創新科技博覽會 (比利時布魯塞爾，二零零七年十一月二十二至二十五日)		
Special Prize and Bronze Medal 特別獎及銅獎	Nano-structured Photonic Fibres and Fabrics 納米結構的光子纖維及其織物	Institute of Textiles and Clothing 紡織及製衣學系
Gold Medal with Mention & Special Prize 特別嘉許金獎及特別獎	Nano-structured Materials Generation System – Surface Mechanical Attrition Treatment (SMAT) 納米金屬材料的裝備 – 表面機械研磨處理方法	Department of Mechanical Engineering 機械工程學系
Gold Medal with Mention 特別嘉許金獎	Polymer-bonded Magnetic Devices 聚合物粘合的磁性裝置	Department of Electrical Engineering; Department of Applied Physics 電機工程學系、應用物理學系
Gold Medal and Special Prize 金獎及特別獎	PolyJbot Rehabilitation Robotic System 「理大關師傅」智能療復治療系統	Department of Health Technology and Informatics; Research Institute of Innovative Products and Technologies 醫療科技及資訊學系、創新產品與科技研究所
Gold Medal 金獎	PicPacker™ Intelligent Warehouse Optimizing System PickPacker™智能倉庫容積管理系統	Department of Industrial and Systems Engineering 工業及系統工程學系
Silver Medal 銀獎	A Novel Integrative Acupressure Pen for Pain Relief 嶄新結合減痛穴位按壓筆	School of Nursing 護理學院
36th International Exhibition of Inventions, New Techniques and Products (Geneva, Switzerland, 2-6 April 2008)		
第三十六屆國際發明及創新技術與產品展覽 (瑞士日內瓦，二零零八年四月二至六日)		
International Press Prize, Gold Medal and Special Prize 國際傳媒大獎、金獎及特別獎	A High-power LED Street Lighting System with a Modular Lamp Holder 組合式大功率LED路燈的燈頭	Department of Industrial and Systems Engineering 工業及系統工程學系
Grand Award and Gold Medal 特別大獎及金獎	Chinese Chess for the Visually Impaired 對奕•共融：視障人士中國象棋	School of Design 設計學院
Gold Medal with Jury's Congratulations and Special Prize 評審團特別嘉許金獎及特別獎	Rapid Demountable Platform 快速安裝平台	Department of Building and Real Estate 建築及房地產學系
Silver Medal 銀獎	Harmful Algae Indexing (HaiDex) System 「海指」(HaiDex)：海洋紅潮預測指數系統	Department of Logistics; Department of Applied Biology and Chemical Technology 物流學系、應用生物及化學科技學系
	Modern Chinese Medicine Product Development: A De-bulking Approach 現代中藥產品開發：「去蕪」處理法科技	Department of Applied Biology and Chemical Technology; Mr Alexander Tzang, Deputy President 應用生物及化學科技學系、常務副校長曾慶忠先生

recovery directive or the Waste Electronic Electrical Equipment) and RoHS (Restriction of Hazardous Substances) directives have expelled lead from many commercial applications and materials (e.g. from solder, glass and pottery glaze). Intensive worldwide search has been conducted to find suitable lead-free piezoelectric ceramics to replace the commonly used lead-zirconate-titanate (PZT) piezoelectric ceramics. In this project, environmental-friendly lead-free piezoelectric ceramics for sensor and transducer applications have been developed, and two Chinese patents on lead-free piezoceramics have been filed. We have used these lead-free ceramics in fabricating transformers, accelerometers and ultrasonic wire-bonding transducers, which are potentially useful in various industrial applications.

Another important aim of the project is to develop a smart magnetorheological (MR) damping system, consisting of smart dampers (with embedded piezoelectric force sensor) interfaced with an intelligent controller, which can serve as a simple, cost-effective and reliable device for full implementation of real-time, closed-loop vibration control of civil and mechanical structures. This device has potential to be installed on the cable-stayed Western Corridor Bridge (Shenzhen side) and used in controlling cable vibrations.

In addition to filing two Chinese patents, the project team has published 12 papers in international journals in the period from 1 July 2007 to 30 June 2008.

Integration of advanced and nano-materials in product design

Our research objective is to create and develop a product engineering approach through the integration of advanced and nano-materials in design. It explores the way to introduce the surface modification and prestress processing, nano-material in the design of the advanced product. We have built an experimental platform and a numerical simulation platform relating to this new research area at PolyU. We have also carried out studies and work on the integration of advanced composite materials, SMART materials and nano-materials in different key sectors such as aerospace, nuclear energy, automotive and biomedical implants. Collaborative research has been conducted with scientists from leading higher education/research institutions such as MIT (USA),

項專長領域的發展重點。本校撥出二億六千五百萬元作為研究經費，重點發展專長領域項目，顯示對應用為本的研究承諾堅定，銳意達致教資會為本校訂立的角色及使命。

三項由專長領域撥款資助的項目如下： 基於電致動及磁致動材料之智能結構與系統

此項目為應用物理學系與土木及結構工程學系的合作項目，旨在研發用於智能結構與系統的新材料與器件。智能化系統能感應環境的變化並作出相應的改變，以減低變化對系統的影響。國際條例如WEEE (電器及電子



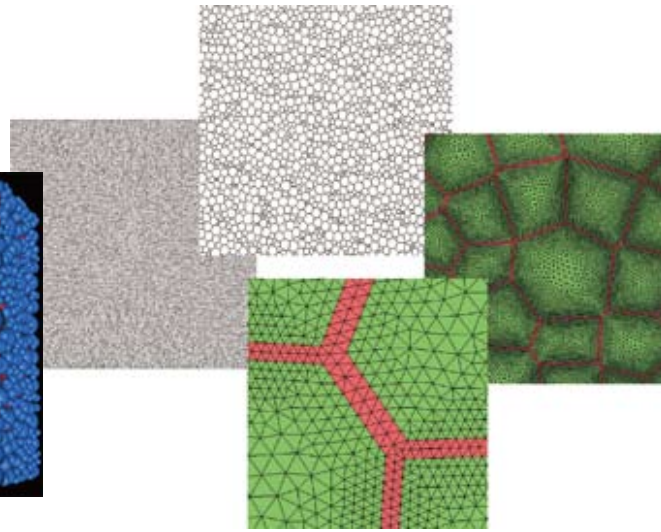
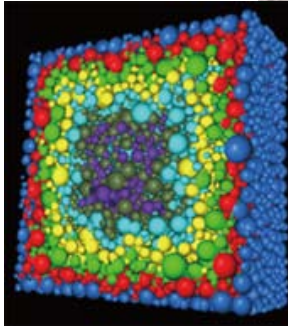
◀ The smart vibration damping system is successfully deployed on Dongting Lake Bridge of the Chinese mainland. 成功將智能震動阻尼系統設置於中國洞庭湖斜拉大橋。

設備廢料循環再用及回收條例)及RoHS (限制有害物質使用的條例)已規定在很多應用上(例如焊接、玻璃、陶瓷表面修飾)不能用鉛。近年對無鉛壓電陶瓷的研究非常活躍，以期能找到可以替代現在常用的銦鈦酸鉛(PZT)壓電陶瓷。在這項目中，我們積極研究無鉛壓電陶瓷的新配方和應用，並就無鉛壓電陶瓷提出兩項中國專利申請。用無鉛陶瓷製成了變壓器、加速器及用於微電子封裝的超聲焊接換能器，將可作各種工業用途。

此項目另一主要目標為研發一項新型的智能磁流變阻尼系統。該系統包括含壓電傳感器的磁流變阻尼器，可以感應加於阻尼器上的應力，加上連接控制介面的電路，提供了一個簡單可靠並具高經濟效益的系統；預期可用於實時控制土木工程(例如深圳西部通道吊橋)及工業用系統的震動。

除了已經申請兩項中國專利外，在二零零七年七月一日至二零零八年六月三十日期間，此項目的科研隊伍在國際期刊內發表了十二篇學術論文。

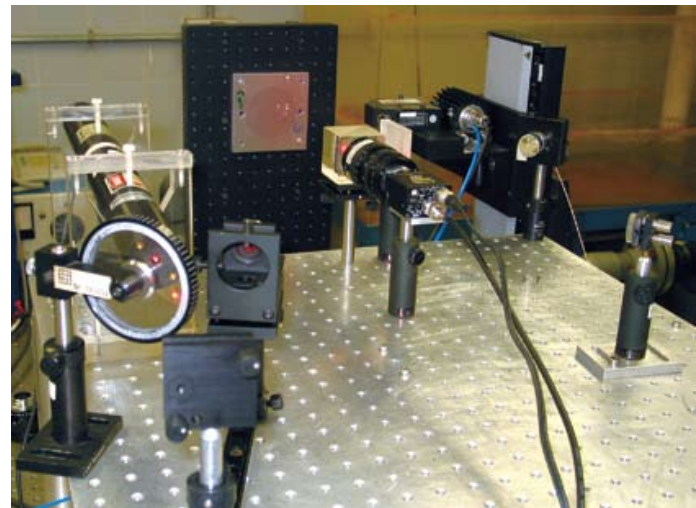
- ▶ Mesh of Nanocrystalline material (Joint Research with INRIA)
納米晶材料網格(與法國國立計算機及自動化研究院合作研究)



- ▶ Study of the residual stress distribution of the CFRP of Airbus structure (Research Contract with Airbus)
碳纖維增強複合材料殘餘應力分佈測量(與空客公司合作研究專案)

Forschungszentrum Karlsruhe (Helmholtz-Gemeinschaft, Germany), CAS (China), CNRS and INRIA (France). The promising research results have led PolyU to sign major collaborative research contracts with leading companies worldwide such as AIRBUS, AREVA, EADS, BAOSTEEL, etc.

The machine developed under this project based on the technology for the generation of the nanostructure on the surface won the “Gold Medal with Mention” at the Brussels Eureka Expo (56th World Exhibition of Innovation, Research and New Technology, 2007).



Developing a tourism demand forecasting system for Hong Kong

Although the tourism industry has played an ever-increasing role in the generation of wealth and employment in Hong Kong, there has only been minimal effort to establish a reliable and effective forecasting system catering for the needs of policymakers and business strategists in managing and planning tourism activities in Hong Kong. Conducted by the School of Hotel and Tourism Management, this project aims to develop an appropriate Web-based forecasting system to forecast the demand for tourism in Hong Kong over the next decade by monitoring tourist arrivals, total tourist expenditure, tourist expenditure by product categories, and hotel room nights. The demand forecast for hotel room nights is available by types of tariff. The number of outgoing Hong Kong residents and their preference in tourist destinations are also forecast.

先進及納米材料在產品設計中的集成

此項研究的目標是利用在設計中集成先進及納米材料，以創造並發展一個產品工程方法。它探索如何在先進產品設計中引入材料表面改性、預應力工藝和納米材料。理大建立了與這個研究新領域相關的實驗與數值計算模擬平台，並研究集成先進複合材料、智能材料和納米材料在航空、核能、汽車、生物醫學移植等不同重要領域。此項目開展了和來自頂尖高等院校/研究院的

科學家的合作，包括美國麻省理工學院，德國亥姆霍茲聯合會(大科學中心聯合會)卡爾斯魯爾中心、中國科學院、法國國家研究中心、法國國立計算機及自動化研究院等高教和研究單位，而取得的可觀研究成果促成了理大與空客(AIRBUS)公司、阿海珐(AREVA)公司、歐洲宇航防務集團(EADS)、寶鋼集團(BAOSTEEL)等國際知名的企業簽訂合作研究協議。

此項目發展的表面納米化機器在二零零七年布魯塞爾舉行的第五十六屆世界創新科技博覽會獲頒特別嘉許金獎。

香港旅遊業需求預測系統的研發

雖然香港旅遊業在創造政府財政收入和就業



The system is developed and implemented as a new and innovative way to generate tourism demand forecasts. For each type of tourism demand, modern econometric methods are used to generate statistical forecasts. After that, an expert panel is invited to adjust the forecast figures with the use of statistical tools which are already built in within the system. Like other Web-based systems, the system has four significant features—wide accessibility, flexibility, reusability and user-friendliness. Experts at various locations can visit the system's website and make real-time judgmental adjustments to the statistical forecasts of tourism demand through Web browsers. The transfer of knowledge from experts in tourism forecasting to tourism-related decision makers is therefore improved considerably. Forecasting accuracy and reliability are also enhanced. Moreover, the system makes it easier for policy-makers and industry leaders to perform different scenario analyses based on their own estimation of economic growth rate and fluctuation in tourism-related costs, which can be very useful for policy evaluation and decision-making. After the historic data were collected, the major construction work of the system was completed by the end of 2007.

On 4 March 2008, the system was officially launched and introduced to the industry partners and interested parties. The forecasts can be accessed online through the system's website, and the subscribers can also obtain the forecasts and the experts' adjustments to the statistical forecasts through the quarterly *Hong Kong Tourism Forecasting Report*. More information about the forecasting system is available at <http://www.tourismforecasting.net>.

Synergy through interdisciplinary collaboration

Since 2001/02, the University has earmarked an annual \$10 million from its Research Budget for supporting collaborative projects across disciplines. As a result, various academic units have achieved substantial outputs from such interdisciplinary research in a number of target areas. Below are some notable examples.

機會方面發揮着日益重要的作用，旅遊業的決策制定者和商業策劃人卻缺乏一個可靠、有效而又能夠幫助他們管理和規劃旅遊業活動的旅遊業需求預測系統。此項目由酒店及旅遊業管理學院進行，目的在於研發預測未來十年本地旅遊業需求的網上預測系統。該系統的主要目標是對旅遊業相關的需求作出預測，包括訪港旅客人數、旅客總消費、旅客分類消費、酒店房間數目的需求等。酒店房間數量的需求可根據不同價格分類而作預測統計。該系統也可預測港人出境外遊數目及他們的旅遊熱點。

此項目致力於設計和推行一套嶄新又創新的旅遊業需求預測系統。對於各類旅遊業相關需求，系統均採用先進的現代經濟計量學方法做出預測數字。這些預測數據經由專業的專家小組透過系統的內置統計工具，為預測的數據進行適當的調整。與其他網上系統一樣，這個系統具備四個顯著特徵，即易訪問性、靈活性、可重用性和用戶友好性。專家小組成員可在不同地方通過網絡瀏覽器登入系統的網站，對預測數據進行實時的調整。因此，系統在很大程度上增強了旅遊業專家與業界決策者之間的資訊共用度；預測的準確度和可靠性也因而提高。此外，制定決策者和業界領袖可在系統中輸入其對個別國家與地區經濟增長率和旅遊產品價格變動的估計，而作出各種情境分析。系統的這個情境分析模塊可為政策評估和決策制定提供相當有效的支援。在完成歷史資料的收集工作之後，網上預測系統的主要建設工作於二零零七年年底完成。

網上預測系統於二零零八年三月四日正式啟用，推介給旅遊業界及其他有關機構使用。訂戶更可通過《香港旅遊業預測報告》季刊獲取系統預測數字以及專家對預測數字的調整。有關本項目的進一步資料，可瀏覽香港旅遊業需求預測系統網頁 <http://www.tourismforecasting.net>。

跨科協作的協同效應

本校為鼓勵不同學系之間通力合作，自二零零一/零二年度起，每年在研究經費中撥出一千萬元支援跨學科的協作研究項目。憑着近年來各學系的努力，理大在多個目標領域都取得驕人成績，以下是其中一些表現突出的例子。

Investigation of enabling technologies for plastic injectable biochips

This project involves researchers from the University's Department of Industrial and Systems Engineering and Department of Health Technology and Informatics. Micro biochips have been hailed as the laboratory on a chip that enables new analysis for wide applications such as environmental monitoring, contagious disease detection on a use-once disposable chip that reduces turn-around time from days, by conventional analytical equipment, to minutes instead. Factors that inhibit the application of these techniques are high cost of the glass biochips and large size of equipment. This project attempts to use the unique technologies built up previously in micro injection moulding and micro mould techniques to develop key technologies for low-cost production of plastic micro biochips using micro injection moulding, which also has the potential of reducing the equipment size to hand-held dimension.

The key challenges to be tackled are the low cost, low deformation and contamination-free, reproducible bonding of plastic substrates with microchannels and the incorporation of micro electrodes in micro/nano features. The success of this project will enable the production at low cost of a series of new plastic micro biochips for fast on-site bioanalysis that cannot be produced with existing techniques.



Lake sediments help scientists trace 7,000 years of metal mining and use in China

A new geochemical study illuminates 7,000 years of metal mining and use in central China and links these trends to fluctuations in airborne pollution during the Bronze Age and other military and industrial periods in Chinese history. The study, which could help scientists

better assess the accumulative environmental effects of human activity in the region since prehistoric times, was published in the July issue of *Environmental Science & Technology*.

Using carbon-dated core sediments taken from Liangzhi Lake in Hubei province, Prof. Li Xiangdong of the Department of Civil and Structural Engineering and collaborators on the Chinese mainland were able to track metal deposit trends at the lake dating back to 5,000 B.C. Beginning in about 3,000 B.C., the concentration of metals in the sediments began to rise, indicating the onset of the Bronze

微注塑技術製造塑料生物晶片可行性技術的研發

此項目由本校工業及系統工程學系和醫療科技及資訊學系研究人員共同研發。被譽為「晶片裏的實驗室」的微型生物晶片，為很多應用領域，如環境控制、傳染病測試等提供了一次性用完即棄的全新分析方法，將傳統分析儀器所需的週期由原來數天大幅減至數分鐘。應用這些技術的障礙在於玻璃生物晶片成本昂貴，而且分析設備體積龐大。此項目將利用在微型注塑及微型模具研發出來的獨特技術，作為開發用微注塑技術低價生產塑料生物晶片的關鍵技術，同時兼具將設備縮減至便攜體積的潛能。

至於尚待化解的挑戰，則包括研製低成本，不變形兼無污染且具備微通路及微電極的塑性片複合技術，以及將微電極納入微/納米型態之中。此項目一旦成功，將有助於以低成本製成一系列無法以現有技術生產的新式生物分析晶片以用於即場分式。

湖底沉積物助科學家追溯中國七千年金屬開採和使用情況

一項全新的地球化學研究揭示了中國七千年來金屬開採和使用的情況，並對應中國歷史上青銅器時代、其他軍事和工業發展大氣污染的變化。這項研究已於《環境科學與技術》七月號發表，協助科學家有效評估自遠古時期，人類在某範圍內長期活動對環境所造成的影響。

理大土木及結構工程學系李向東教授與中國內地的研究人員，從湖北省梁子湖鑽取沉積物樣品，測定碳-14年份，由此可以推斷出西元前五千年以來的金屬沉積情況。從西元前三千年開始，沉積物中金屬的含量逐漸增加，可以推斷中國青銅器時代大約始於這時。在後青銅器時代（西元前四七五至西元二二零年），金屬的含量激增，對應中國歷史上的主要戰爭時期。這些沉積物顯示該範圍內開採和使用金屬的盛衰情況，一直持續到現代，反映古時及近代人類活動對環境變化的影響。

由二零零六至零八年，這項研究獲得香港研究資助局和中國國家自然科學基金委員會聯合資助。

Age in ancient China. In the late Bronze Age (475 B.C. to A.D. 220), an era corresponding with numerous wars, sediment concentration of metals increased significantly. The sediments suggest that mining and metal usage in the region continued to wax and wane into the modern era, reflecting the environmental changes influenced by past human activity.

The research was funded by the joint funding scheme of the Hong Kong Research Grants Council and the National Natural Science Foundation of China from 2006 to 2008.

Stroke-induced changes in bone mineral density and bone macrostructure: implications for stroke rehabilitation

This project involves researchers from the Department of Rehabilitation Sciences of PolyU and the Department of Physical Therapy of University of British Columbia. Individuals with stroke often sustain substantial bone loss on the affected side, which contributes to an increased fracture risk. The objectives of this study were fourfold:

- 1) to investigate how stroke affects the bone mineral levels and macrostructure of the long bones in the upper and lower extremities
- 2) to identify the factors related to post-stroke bone health
- 3) to identify which exercises have the highest potential for inducing bone gain
- 4) to assess the effects of treadmill gait training on bone health in stroke patients.

The study used dual-energy X-ray absorptiometry and peripheral quantitative computed tomography to evaluate the bone mineral levels and bone geometry in the upper and lower extremities.

The results suggest that stroke patients have severely compromised bone mineral density and bone macrostructure on the affected side. The extent of bone loss is highly related to various stroke-related impairments such as muscle weakness, cardiovascular fitness and spasticity. Stepping and brisk walking are found to have superior potential for inducing bone formation. The treadmill training programme also significantly enhances cortical bone thickness in the tibial bone on the affected side.

Bone health post-stroke is a much neglected area in both clinical practice and research. This project provides important insight into the key factors underlying stroke-induced bone changes. Such information may assist clinicians in developing effective strategies to enhance bone health and prevent fractures in the stroke population. The project has resulted in a number of publications in highly-rated scientific journals.



中風引發骨質密度與骨骼宏觀組織結構的改變：對中風後康復治療的影響

此項目由理大康復治療科學系及加拿大卑詩省大學物理治療系研究人員共同研發。中風病人身體的弱側經常承受一定程度的骨質流失，會使骨折風險增加。這項研究的目的有四個層面：

- 1) 研究中風如何影響上下肢的骨質疏鬆水平和骨骼的宏觀結構
- 2) 識別與中風後骨骼健康有關的因素
- 3) 找出哪些運動最能促進骨骼健康
- 4) 評估利用跑步機進行健步訓練對中風病人骨骼健康的影響

這項研究使用雙能量X光骨質密度定量儀和肢體定量計算機斷層掃描骨質密度儀，用以評估中風病人上下肢的骨骼密度和強度。

研究結果發現，相對於身體強側的一邊，中風病人的弱側的骨質密度和宏觀組織具備明顯分別。骨質流失的程度與幾個中風後常見的症狀有密切關連，包括肌肉乏力、心肺功能減退和肌肉痙攣。研究亦發現，與其他運動對比，原地踏步和快速步行運動可能較有利於促進骨骼健康。此外，我們所設計的跑步機健步訓練也能有效提高弱側脛骨的皮質骨厚度。

臨床實踐和研究兩個範疇大多忽略了中風後的骨骼健康。這項研究對中風引發骨骼變化的原因提供了重要的線索。這些資料或有助醫護人員制定有效的策略，以提高中風病人的骨骼健康以及防止骨折。研究結果已於多份知名的科學期刊上發表。