

# 03

Research and Development

研究與發展

## ADVANCING KNOWLEDGE AND INNOVATION

## 推動知識創新



*PolyU researchers are driving forward significant discoveries that can help improve people's lives and boost economic development.*

理大科研人員積極促進創新發明的應用，致力改善人類的生活，並推動經濟發展。

## FUNDING THE SEARCH FOR FRESH HORIZONS

Research at PolyU moved ahead in 2011/12 in numerous areas, with a total of \$140.99 million allocated to the research budget managed by the University's Research Committee. The University Grants Committee (UGC) provided most of the funding along with a Research Grants Council (RGC) direct allocation of \$11.33 million.

The University received \$149.95 million for project-based research through external funding. This included \$76 million from the RGC's General Research Fund, which supported 110 projects. PolyU led the way among local universities in funding for civil engineering, surveying, building and construction for the eleventh consecutive year, with General Research Fund grants of \$14.1 million in 2011/12.

A total funding commitment of \$1,138 million from both external and internal sources was received for continuing research projects. Of the University's 2,457 ongoing projects, 592 were started during the year, involving 978 academic staff and over 925 researchers, including research assistants and research fellows.

During the year, the University's academics produced 2,314 refereed journal papers, 1,570 conference papers and 1,579 other publications. Refereed journal papers published have registered an average increase of 3.67 per cent over the past five years.

Funding from PolyU's Central Research Grant\* and RGC's General Research Fund allocation  
理大中央研究撥款與研資局優配研究金撥款



## 科研經費

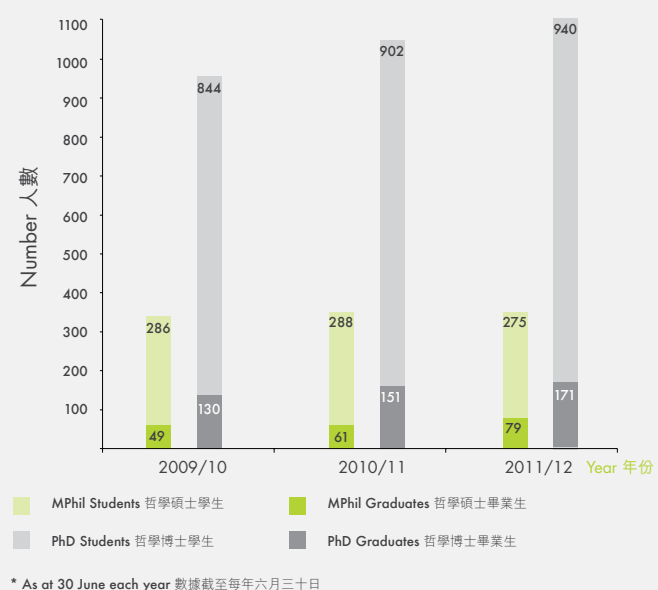
二零一一至一二年度，理大多個範疇的研究項目繼續發展，校內研究委員會撥出一億四千零九十九萬元作為研究經費。這筆經費大部分由大學教育資助委員會（教資會）資助，其中一千一百三十三萬元為研究資助局（研資局）的直接撥款。

校外資助方面，理大取得一億四千九百九十五萬元，當中包括七千六百萬元為研資局的「優配研究金」撥款，用以資助一百一十項科研項目。二零一一至一二年度，理大在土木工程、測量及建造工程領域，獲得優配研究金一千四百一十萬元撥款，連續十一年成為眾院校之冠。

理大正在進行的二千四百五十七項研究項目，一共獲校內外資助的經費總額達十一億三千八百萬元，其中五百九十二項屬本年度新開展的項目，參與研究工作的教員人數共九百七十八名，而其他研究人員，包括研究助理及研究員等，合共超過九百二十五名。

年內，理大研究人員共發表二千三百一十四篇學術期刊論文、一千五百七十篇會議論文，並出版一千五百七十九份其他學術刊物。過去五年，理大發表期刊文章的數目，每年平均增長率達百分之三點六七。

Number of research students/candidates and research degree awardees\*  
哲學碩士及博士研究生人數



## POWERING FORWARD IN AREAS OF EXCELLENCE (AoE)

The scheme, originally launched by the UGC and administered by the RGC since 1 February 2012, boosts inter-institutional research in areas where Hong Kong has strong potential to make an impact internationally.

### Institute of Molecular Technology for Drug Discovery and Synthesis (PolyU as a co-lead institution)

The programme, which first started in 2001, was completed in 2011 and a final report submitted. Objectives achieved included: establishing Hong Kong as a world-leading centre for molecular technology for drug synthesis, and developing world-class research programmes in chemical biology; advancing promising drug leads and taking them into pre-clinical and clinical trials; and developing biosensing and molecular imaging technologies based on novel luminescent organic and inorganic compounds.

At PolyU, a platform with state-of-the-art equipment and facilities for drug discovery was developed. Several drug leads for anti-cancer and anti-bacterial were found and an agreement signed between Eli Lilly and PolyU on the development of anti-cancer agents. In addition, a fluorescent biosensor for detection of antibiotics was developed, which was highlighted by the US magazine *Chemical and Engineering News*.

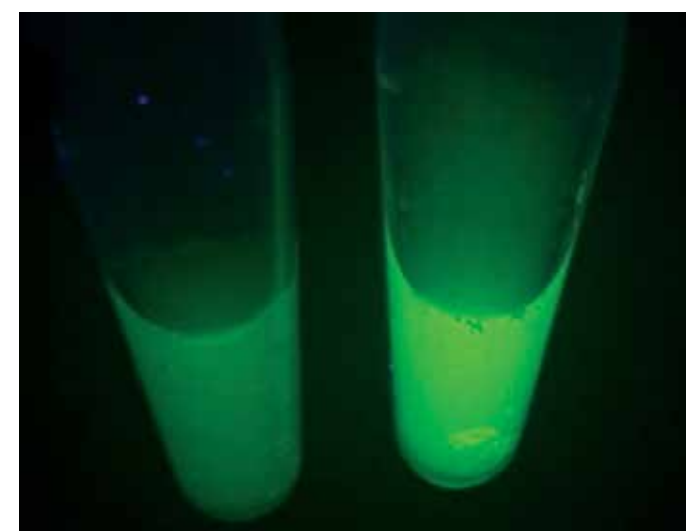
## 卓越學科領域長足發展

計劃最初由教資會推行，並從二零一二年二月一日起由研資局執行，目的是協助發展在香港有特別潛質及能提升國際競爭力的研究領域。

### 分子科技研究所 (理大為聯合負責院校)

此計劃於二零零一年開始，並於二零一一年完成，而結題報告書已提交教資會。計劃取得的成果包括：建立香港成為具國際級水平的藥物篩選及分子合成技術研究平台，並在化學生物方面的研究達到世界水平；成功開發了一些有潛力的藥物導引，部分正在進行臨床前及臨床試驗；研發了一些新的有機及無機發光化合物，並將其用於生物傳感器以及分子成像技術。

對理大而言，我們成功建立了一個具國際級水平的藥物開發科研平台。本校也發現了好幾種抗癌及抗菌的藥物導引，並與Eli Lilly簽署了一份關於抗癌製劑的研究計劃。此外，本校成功研發出一種用來檢測抗生素的螢光生物傳感器，被美國雜誌《化學與工程新聞》報導。



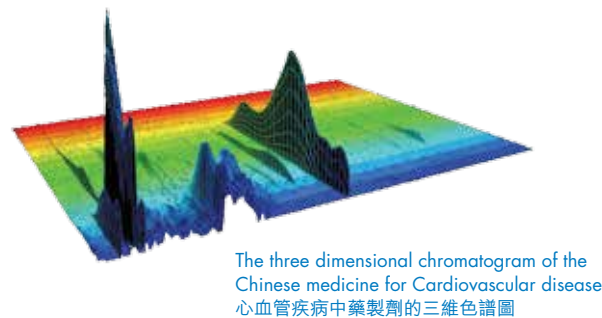
A biosensor (left), which fluoresces in the presence of antibiotics (right), can be used to detect antibiotic residues in the environment  
螢光生物傳感器（左），當有抗生素時螢光增強（右），可用於檢測環境中的殘餘抗生素

### Chinese medicine research and further development (PolyU as a co-institution)

From 2001, scholars from PolyU have worked with other Hong Kong universities to develop Chinese medicine formulations for treating six different kinds of diseases where western medicines were not very effective. In addition, efforts have been made to develop new and powerful techniques in order to establish an advanced Chinese medicine technology platform, from clinical trial and pharmacokinetics to authentication and quality control.

One of PolyU's major contributions has been the development of new chemical fingerprint analysis techniques for quality control of Chinese medicine products at a higher level. Another focus has been the discovery of active ingredients in Chinese medicines with known efficacy for plant drug development.

A further PolyU breakthrough is the invention of the Quantitative Pattern-Activity Relationship (QPAR) technique, which links chemical and activity properties of complicated systems in a quantitative manner. Part of this work was reported in leading US journal *Analytical Chemistry* in 2009, and in January 2012 BioMedLib reported that the QPAR paper was one of "the top 20 articles published on the same topic (Domain 19634860) since its publication in 2009". In April 2012, the team won the gold medal at the 40th International Exhibition of Inventions of Geneva in Switzerland for its project "A Novel QPAR Technique for Extracting Valuable Information from Herbal Medicines".



### Developmental genomics and skeletal research (PolyU as a co-institution)

A major focus of work in this area has been the search for genes that affect the risks of disc degeneration. Such degeneration is often the cause of the low back pain affecting about one-third of the world's population. The research group has identified several important genes that either protect people from or make them more susceptible to disc degeneration.

### Centre for Marine Environmental Research and Innovative Technology (PolyU as a co-institution)

A competitive assay for detecting endocrine disrupting chemicals at trace level is being developed. Such disruptions can cause cancerous tumours, birth defects and other developmental disorders. The biosensor will help the monitoring of pollutants in the marine environment which are difficult to detect by other means.

### 中醫中藥研究與發展 (理大為參與合作院校)

自二零零一年起，理大與本港其他大學的學者合作，為六類西醫療效未如理想的疾病開發有效的中藥方劑。此外，他們致力開發新技術以建立先進的科技平台，用於中藥進行臨床試驗，藥代動力學研發和品質鑒定。

理大的主要任務是開發指紋圖譜分析技術，以提升中藥產品的品質監控水平，並致力找出已知具有療效的中藥內的活性成份，以作藥物研發。

理大在此項目取得的另一突破，是發明了量化模式與活性關係 (QPAR) 的技術，它將複雜的體系內的多個化學品與生物活性的量化關係建立起來。部分成果已於二零零九年美國權威期刊《分析化學》上發表，而在二零一二年一月，一調查機構BioMedLib報道上述學術論文自二零零九年發表以來，至今仍位列二十大被引用次數最多的草藥學文章。二零一二年四月，科研團隊憑著「QPAR：一個提取中草藥內隱藏珍貴訊息的創新技術」這個項目，在瑞士日內瓦舉行的第四十屆國際發明展覽會上榮獲金獎。

### 發育基因組學和骨骼研究 (理大為參與合作院校)

此項目的一個重點研究領域是找出影響椎間盤退化的基因。有關退化常引起腰痛，影響全球約三分之一的人口。研究小組已確立了若干重要的保護基因或易感基因。

### 海洋環境研究及創新科技中心 (理大為參與合作院校)

在此研究中，科研人員提出了一系列探測痕量內分泌干擾物的方法。那些內分泌干擾物可以導致惡性腫瘤、先天畸形和免疫系統疾病。有關生物傳感器有助檢測海洋環境中的痕量內分泌干擾物，是其他方法很難準確檢測的。

## NICHE AREAS THAT FOSTER NEW PERSPECTIVES

PolyU has provided \$265 million to support research in several niche areas that can raise its profile regionally and internationally. The following are some examples:

### Strengthening Hong Kong's role as an international shipping hub: multi-user perspectives and policy implications

The project aims to study the development of the shipping and logistics industry in Hong Kong and to provide a reference for policymakers to strengthen Hong Kong's role as an international shipping hub. Utilizing multi-user perspectives, the team has developed a theoretical framework of "4C" forces (i.e. containerization, concentration, collaboration, and competition) to characterize the market environment in which the container transport business operates, and formulated the "intermodal" framework that sheds light on the key elements of an international shipping hub. The team established the Shipping Research Centre in December 2011 to provide publications, consultancy and organize international conferences, among other activities.

### Sound and vibration research

The Consortium for Sound and Vibration Research has produced a large number of publications in the *Journal of the Acoustic Society of America*, the most prestigious journal in acoustics, outperforming all other Asia institutions in the past 10 years. The Consortium also works with industry, both locally and internationally. Examples include structural health monitoring of high-speed trains; vibration isolation of drilling systems with China Oilfield Services Ltd; aircraft noise isolation with LORD Ltd. USA; airflow noise measurement facilities and testing with Phillips Ltd; control and monitoring of vibrations for hospital buildings with Hong Kong's Hospital Authority; and involvement in the acoustic design of C919 with Commercial Aircraft Corporation of China, Ltd.

### Myopia control

The Centre for Myopia Research is one of the leading research centres in the world, working for over 20 years to understand the causes of short-sightedness. The prevalence of myopia has dramatically increased recently, affecting more than 80% of the young adult population in many Asian cities. It is also a growing public health issue

## 專長領域創意創新

理大撥出二億六千五百萬元，支持一些能夠提升大學在區內及國際上影響力的專長領域。下列為其中一些例子：

### 強化香港的國際航運樞紐角色：多用戶角度及政策含義

此項目旨在探討香港的航運及物流業發展，並為政策制訂者提供參考，就強化香港的國際航運樞紐角色進行規劃。研究團隊從多用戶的角度提供一個4C理論框架，包含貨櫃運輸營運環境的四個特點—containerization (集裝化)、concentration (集中)、collaboration (協作)、competition (競爭)，又開發了一個「聯運」框架，對國際航運樞紐的要素發揮啟示的作用。團隊於二零一一年十二月成立航運研究中心，活動包括出版期刊、提供顧問服務及主辦國際會議等。

### 聲音與振動研究

聲音與振動研究中心過去十年在最負盛名的聲學雜誌《美國聲學學會期刊》發表了大量文獻，超越了其他亞洲院校。中心並與本地及國際業界合作，例子包括高速列車的結構健康監測、與中國油田服務有限公司合作的鑽井系統的振動隔離技術、與美國LORD有限公司合作的飛機噪音隔離研究、與飛利浦有限公司合作的氣流噪聲測量設備和測試、與香港醫管局合作的醫院建築物的振動控制和監測，以及參與中國商用飛機有限公司飛機型號C919的聲學設計。

01 Vibration isolation of drilling systems with China Oilfield Services Ltd  
與中國油田服務有限公司合作的鑽井系統的振動隔離技術

02 Seminar for acoustic design of C919 in Commercial Aircraft Corporation of China, Ltd.  
參與中國商用飛機有限公司飛機型號C919的聲學設計座談會





since myopia is associated with a number of sight-threatening diseases such as glaucoma and retinal degeneration.

Myopia causes blurry vision because the eye has grown too big and become out of focus. PolyU basic research has identified new candidate myopia genes and novel proteins that may be responsible for excessive eye growth. The University's clinical research work has shown for the first time that moulding the corneal shape with orthokeratology lenses can retard myopia progression.

PolyU researchers have discovered that the eye uses different optical images to guide its growth. In particular, images that are focused in front of the retina can act as a "stop" signal for eye growth. A randomized control trial using a tailor-made contact lens that sends out stop signals to the eye has brought exciting results, with the lens successfully retarding myopia progression by 50% in Hong Kong children. The invention won a Grand Prize and Gold Medal at the 39th International Exhibition of Inventions of Geneva and the data has been published in top eye research journals.

### PolyU Tourist Satisfaction Index

Launched by the School of Hotel and Tourism Management in 2009, the Index is based on a sophisticated model and vigorous research framework which captures the multiple dimensions of tourist satisfaction. The framework can produce tourist satisfaction indices for individual tourism sectors and an overall destination satisfaction index. Individual indices can be estimated for various source markets of individual tourism-related sectors on a regular basis in order to monitor the dynamics of the destination's competitiveness over time. The Index can provide much-needed information for decision-making and planning and is updated annually. It has been adopted by Macau, Shenzhen and Singapore to measure visitor satisfaction.



PolyU Tourist Satisfaction Index reports  
「理大旅客滿意指數」報告

### 控制近視

理大近視研究中心是世界知名的研究中心，早於二十多年前已致力研究近視成因。近年的近視人口比率急劇上升，在不少亞洲城市中，有超過八成年青人受影響。同時，近視與不少嚴重眼疾有密切關係，如青光眼及視網膜病變等，因而漸漸成為備受社會關注的公共衛生問題。

近視是由於眼球生長過大令影像不能聚焦在視網膜上，引致視力模糊。本校從基本科學研究中，已找出可能導致眼球長得過大的基因及蛋白質；而從臨床研究中，首次證實角膜矯形鏡可控制近視加深。

理大科研人員發現不同光學影像可影響眼球生長，尤其當焦點落在視網膜前面時，會發出遏止眼球生長的訊息。科研人員運用這個原理進行隨機控制實驗，利用特製的隱形眼鏡送出遏止眼球生長的訊息，結果發現該鏡片能有效地放緩香港學童的近視加深速度達百分之五十。此項發明於瑞士日內瓦舉行的第三十九屆國際發明展覽會上榮獲特別大獎及金獎，而有關研究數據更刊登於多份權威眼科研究期刊。

### 理大旅客滿意指數

該指數由本校酒店及旅遊業管理學院於二零零九年推出，根據精密的系統和嚴謹的研究框架構建，藉此反映旅客滿意度的多樣性。該框架可以為個別旅遊行業統計旅客滿意指數，亦可提供旅遊目的地的整體滿意指數。它可定期估算個別旅遊行業的各個客源市場的指數，以持續監測旅遊目的地競爭力之變化。指數可為有關當局和業內人士提供決策及籌劃時所需之資訊，並每年更新。該指數系統已獲澳門、深圳及新加坡採用來評估旅客對其服務的滿意度。

- 03 Defocus Incorporated Soft Contact (DISC) lens – a tailor-made contact lens that sends out stop signals to the eye  
光學離焦軟性隱形眼鏡 – 特製的隱形眼鏡送出遏止眼球生長的訊息
- 04 A student trying out the DISC lens in the clinical trial  
學童參與臨床研究中，試戴光學離焦軟性隱形眼鏡

## CONTRIBUTING TO NATIONAL DEVELOPMENT

The University provided support for research of strategic importance to contribute to the nation's ongoing development.

### Safety monitoring of high-speed rail

The University has established a strong interdisciplinary research team to study the use of optical fibre and ultrasonic wave sensing technologies for monitoring the structural health and safety of the nation's fast-expanding high-speed rail.

The team's key members include Prof. Ho Siu-lau, Prof. Tam Hwa-yaw and Dr Michael Liu of the Department of Electrical Engineering; Prof. Ni Yiqing, Prof. Yin Jianhua and Dr Ye Xiaowei of the Department of Civil and Environmental Engineering; Prof. Cheng Li, Prof. Zhou Limin and Dr Su Zhongqing of the Department of Mechanical Engineering; and Dr Wang Dan of the Department of Computing.

The technologies have been applied in several high-speed rail projects, including the Beijing-Shanghai High-Speed Rail. During the first few months of operation, a joint team from PolyU and Southwest Jiaotong University was commissioned to deploy our proprietary optical fibre level and deflection sensors on a segment of the Beijing-Shanghai High-Speed Rail Line to understand the safety of rail foundation and related changes (photo 01& 02).

In collaboration with Dalian Jiaotong University, the PolyU team installed optical fibre sensors (strain sensors, temperature sensors, acceleration sensors, wind pressure sensors) on a high-speed inspection train running on the Beijing-Shanghai High-speed Rail Line. The team successfully monitored the dynamic response of bogies, air cylinder suspenders, brackets and the aerodynamic force acting on the rail vehicle surfaces when the train ran at the maximum speed of 400 km/h (photo 03-07).

## 推動國家發展

理大亦對具策略重要性的研究項目提供支援，為國家的持續發展出一分力。

### 高速鐵路的安全監測

理大成立了跨學科研究團隊，致力於研究光纖和超聲導波傳感技術在國家高速鐵路結構健康與安全監測中的應用。

團隊骨幹成員包括電機工程學系何兆鏞教授、譚華耀教授和廖信義博士；土木及環境工程學系倪一清教授、殷建華教授和葉肖偉博士；機械工程學系成利教授、周利民教授和蘇眾慶博士；以及電子計算學系王丹博士。

這些創新技術已應用於若干高速鐵路項目，包括京滬高鐵。在正式通車初期，理大和西南交通大學聯合組成的團隊，受委託在京滬高鐵的一段綫路安裝理大自主研發的光纖水準儀和撓度計，用以掌握京滬高鐵路基安全及變化（圖01、02）。

通過與大連交通大學合作，理大研究團隊在京滬高鐵的高速綜合檢測列車上，安裝了不同類型的光纖傳感器（包括光纖應變傳感器、光纖溫度傳感器、光纖加速度傳感器和光纖風壓傳感器），並成功監測在最高每小時四百公里的速度下，列車轉向架、風缸吊帶和支架的動態響應，以及作用於車體表面的氣動力（圖03-07）。

- 01 A railway section monitored by PolyU's sensors  
採用理大傳感器監測的高速鐵路路段
- 02 Installation of optical fibre level and deflection sensors  
安裝光纖水準儀和撓度計
- 03 High-speed inspection train  
高速綜合檢測列車
- 04 Installation of various optical fibre sensors on the high-speed inspection train  
安裝各類光纖傳感器於高速綜合檢測列車



PolyU researchers have also been invited to undertake a joint project with Dalian Jiaotong University deploying PolyU proprietary sensors on a new generation of alpine high-speed trains during operational trials for the Harbin-Dalian High-speed Rail Line.

Together with CNR Changchun Railway Vehicle Company and Southwest Jiaotong University, the PolyU team conducted a full-scale experimental study on the use of smart vibration control technology for enhancing the stability of high-speed trains. Based on this investigation, the team also secured Innovation and Technology Fund support for a study on semi-active control of high-speed trains using magnetorheological dampers (photo 08-10).

In a further collaboration with Southwest Jiaotong University, the PolyU team installed a series of optical fibre sensors along a section of the Beijing-Shanghai High-speed Rail Line near Nanjing for continuous and long-term monitoring of sedimentation. The instrumented automatic monitoring system can provide real-time information about the stability of the high-speed rail foundation and enhance operational safety (photo 11).

The PolyU team and Southwest Jiaotong University also conducted full-scale laboratory and in-situ experimental studies comparing the performance of optical fibre sensors and EMI-immune piezoelectric sensors for cracking and damage monitoring at point blades of railroad switches (photo 12).

The University successfully hosted the 1st International Workshop on High-speed and Intercity Railways in July 2011. The workshop was co-organized with Southwest Jiaotong University, Beijing Jiaotong University, Dalian Jiaotong University, China Engineering Consultants, Inc. (Taiwan), Zhejiang University and Tsinghua University.

### Optical fibre sensors for tracking condition of rail systems

Another boost for railway system monitoring has been provided by the large-scale optical fibre sensing networks developed by the Department

of Electrical Engineering. The networks employ hundreds of fibre sensors for measuring a wide range of parameters, such as temperature, strain, acceleration, pressure, and magnetic field, over many years.

All the sensors are based on fibre Bragg gratings which are created inside the 9-micron diameter core of standard telecommunication fibres. A large number of sensors can be monitored over very long distances using a single optical fibre. Over the past six years, several thousand optical fibre sensors have been designed and installed by PolyU for railway systems in Hong Kong, Taiwan, and the Beijing-Shanghai High-speed Rail Line (photo 14 & 15).

PolyU's Photonics Research Centre is equipped with state-of-the-art facilities to design and fabricate novel sensing fibres for the development of next-generation optical fibre sensors (photo 16).

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### 光纖傳感監測鐵路狀況

PolyU's Photonics Research Centre is equipped with state-of-the-art facilities to design and fabricate novel sensing fibres for the development of next-generation optical fibre sensors (photo 16).

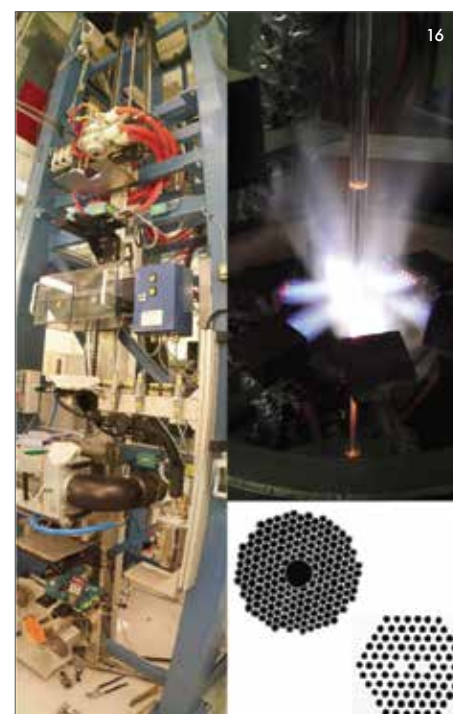
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所用的光纖光柵傳感器都刻寫在通訊用光纖中，直徑九微米的光纖中。在數百公里的單一光纖上便可分佈數百個光纖光柵傳感器。過去六年，理大已在香港、台灣及京滬高鐵設計並安裝了數以千計的傳感器（圖14、15）。

理大光電子研究中心備有最先進的儀器及設計工具，可用作設計及製造新一代傳感用的特殊光纖（圖16）。



05 FBG-based wind pressure sensors for aerodynamic monitoring of high-speed rail vehicles  
用於高鐵車體空氣動力學監測的FBG風壓傳感器

06 FBG-based wind pressure sensor deployed beneath a high-speed rail vehicle  
安裝於高鐵車廂底部的FBG風壓傳感器

07 Monitoring of a high-speed train at a running speed of 400 km/h  
在時速四百里運行速度下高速列車監測

08 Semi-active damper installed between bogie and rail car  
安裝於轉向架與車廂之間的半主動阻尼器

09 Smart vibration control experiments on a full-scale high-speed rail vehicle  
高速列車智能振動控制足尺試驗

10 The PolyU research team participating in smart vibration control experiments  
參與智能振動控制試驗的理大研究小組

11 A section of the Beijing-Shanghai High-speed Rail Line instrumented for long-term continuous monitoring  
京滬高鐵裝有長期連續監測系統的路段

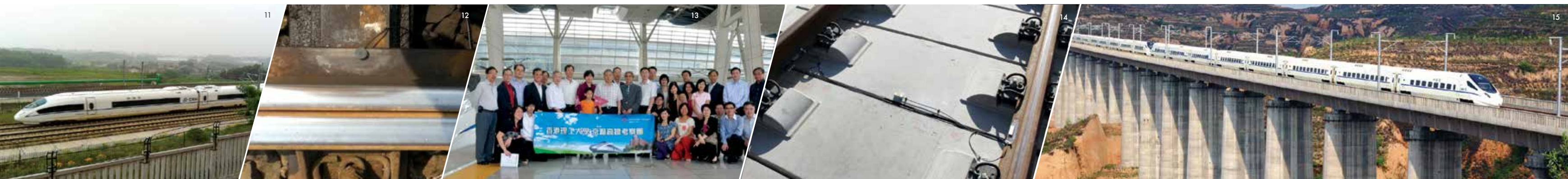
12 Piezoelectric sensors for monitoring cracking damage at point blades  
應用壓電傳感器進行鐵道岔尖軌的裂縫損傷監測

13 PolyU President Prof. Timothy W. Tong and Vice President (Research Development) Prof. Alex Wai led a delegation to join a test ride along the Beijing-Shanghai High-speed Rail before its official opening  
理大校長唐偉章教授與副校長（科研發展）衛炳江教授獲邀率領考察團在正式通車前搭乘京滬高鐵

14 PolyU's optical sensors were installed on rail and trackbed to monitor temperature, strain, vibration, and acceleration on a section of the Beijing-Shanghai High-speed Rail Line  
理大安裝於京滬高鐵鋼軌及地基上的光纖傳感器可測量溫度、應變、振蕩及加速率等多種數據

15 Train travelling at 300 km/hr on the 1,318-km Beijing-Shanghai High-speed Rail Line  
高鐵列車於全長1318公里的京滬高鐵線上以時速三百公里行駛

16 PolyU's state-of-the-art research facility for fabrication of advanced sensing fibres. The lower right diagram shows the core section of two novel sensing fibres consisting of hundreds of 1-2 μm diameter holes  
理大擁有最頂尖的光纖製造設備。右下圖顯示兩種新穎的光纖纖芯，當中包含了數百個1-2微米的小孔





### Fruitful year for Food Safety and Technology Research Centre

The Food Safety and Technology Research Centre opened in August 2011 (photo 17) and has been actively working with local and mainland government agencies (particularly those in the Pearl River Delta region), local and international companies to address issues of public concern. The Centre also reports the latest scientific discoveries made by PolyU food scientists and technologists in testing and certification; risk analysis and toxicology; functional food development; novel technology development; and education and professional development (More on p.12).

In 2011/12, the Centre received funding support from the Innovation and Technology Fund to develop a food hygiene standard certification system, in collaboration with Hong Kong's Commission on Testing and Certification. The objective is to develop a food safety culture in local catering industries. The Centre also submitted a joint research grant proposal together with Guangdong Entry-Exit Inspection and Quarantine Bureau to develop a test kit for food toxicants. Research facilities are available at PolyU's campus, Hong Kong Science Park and PolyU Shenzhen Base.

### Flying high with space tools

PolyU researchers furthered their collaboration with the China Academy of Space Technology with the development of a camera pointing system which will be carried on board the Chang'e-3 lunar lander scheduled for launch in mid-2013. The sophisticated tool serves the dual function of capturing images of the lunar landscape and monitoring the descent/progress of the lunar rover.

The two organizations also successfully bid to develop the surface sampling and packaging system prototype (photo 18). The system needs to collect lunar regolith, pack it in-situ, seal the sample and place the container into the returning spaceship, taking the lunar regolith back to Earth conserved in the lunar atmosphere. The system will be used in the third phase of China's lunar exploration programme in 2017 (More on p.68).

### 食物安全及科技研究中心

食物安全及科技研究中心於二零一一年八月成立(圖17)，積極與香港及內地(特別是珠三角地區)政府機構、本地及國際企業合作，致力研究公眾關注的議題。中心亦會公佈理大食物安全專家最新的研究成果，範疇包括檢測及認證、風險分析及毒理、功能性食品研發、創新技術研發，以及教育和專業發展(詳見第12頁)。

二零一一至一二年度，中心與香港檢測和認證局合作，取得創新及科技基金的資助，開發食物衛生標準認證體系。目的是幫助本地飲食業建立食物安全文化。中心亦與廣東出入境檢驗檢疫局共同申請研究撥款，開發快速測試工具，用以測試食物中的有毒物質。中心於理大校園、香港科學園及理大位於深圳的產學研大樓設有科研設施。

### 研製太空儀器

理大科研人員與中國空間技術研究院進一步合作，開發「相機指向機構系統」，將裝載在預期於二零一三年中發射的嫦娥三號發射器上。該精密儀器兩個主要用途是使相機可以拍攝月球上的地貌和監察月球車落地和前進。

兩所機構亦成功取得一個有關開發表層取樣和封裝系統的研究項目(圖18)。該系統需採集月球土壤樣本、進行即場樣本封裝、密封樣本在容器內，然後經返回飛行器，把月球大氣下的月球土壤送返地球。該系統將用於中國探月工程第三期的有關計劃，預期於二零一七年進行(詳見第68頁)。

17 The official opening of the Food Safety and Technology Research Centre in August 2011  
食物安全及科技研究中心二零一一年八月正式開幕

18 Signing the agreement for the lunar soil return mission with the China Academy of Space Technology in April 2012  
二零一二年四月理大與中國空間技術研究院簽訂月球土壤返回任務合作協議

## UTILIZING EXPERTISE IN PARTNER STATE KEY LABORATORIES

### Partner State Key Laboratory of Chirosciences

The laboratory started with a project funded under the University Grants Committee's Area of Excellence scheme and has been working on drug discovery and synthesis for many years. The first drug developed by the Partner State Key Laboratory was a liver cancer drug, which has undergone the phase two clinical trials. A number of catalysts developed for chiral synthesis in this laboratory have been successfully licensed to industries in Hong Kong, the Chinese mainland and overseas. The structure of an important protein related to autophagy and tumour development, Beclin 1, has been determined and the result published in *Nature Communications* in 2012. Articles have also been published in high-impact journals such as *Cancer Research*, *Journal of the American Chemical Society* and *Angewandte Chemie*.

### Partner State Key Laboratory of Ultra-precision Machining Technology

Ultra-precision machining technology is one of the most critical research areas in manufacturing technology of advanced optical components and precision mechanical parts for many high-end industries. These include aerospace, biomedical, semiconductor, and precision machinery industries with stringent requirements on the accuracy and tolerance of products down to the nanometer range.

The Laboratory is a regional leader in the frontier research it undertakes and in nurturing human resources. It is also the first of its kind in South East Asia and the Chinese mainland to support the industry in pioneering the design and manufacture of freeform elements and optical microstructures for photonics and telecommunication products.

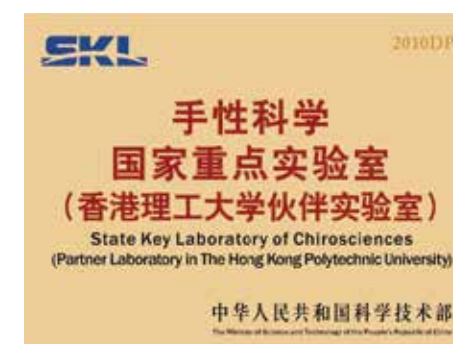
According to ISI Web of Knowledge (Thomson Reuters), the project team has authored the highest number of publications in the field of ultra-precision machining, precision optics, precision machining, and freeform measurement.

The Laboratory has enhanced Hong Kong's industrial capability to compete in the global market of high value-added products. Its achievements in research and consultancy have also seen the team receive Higher Education Outstanding Scientific Research Output Awards from the Ministry of Education for three consecutive years.

## 善用專長夥拍國家重點實驗室

### 手性科學國家重點實驗室 夥伴實驗室

此實驗室最初是大學教育資助委員會卓越學科領域計劃的資助項目，多年來一直從事藥物研發與合成工作。其研製的第一種藥物是治療肝癌的藥物，已進入第二階段的臨床試驗；另外研製的多種手性合成催化劑，已成功批出特許予香港、中國內地及海外的產業使用。此實驗室解開了一種和細胞自噬及腫瘤成長有密切關係的蛋白Beclin 1的晶體結構，並在二零一二年於《自然通信》期刊內發表。此實驗室的研究成果亦獲具影響力的期刊發表，如《癌症研究》、《美國化學學會期刊》及 *Angewandte Chemie* 等。



### 超精密加工技術國家重點實驗室 夥伴實驗室

在許多高端產業的先進光學元件和精密機械零部件的製造過程中，超精密加工技術的研究擔當著一個相當關鍵的角色。有關產業包括航空航天、生物醫學、半導體等，成品的精度都要達到納米級範圍。

該實驗室在其研究領域及培育相關人才方面，都在區內處於領先地位。它是東南亞和中國內地首個支持光電子和電信行業開發自由曲面光學元件和微結構零部件的單位。

根據 ISI Web of Knowledge (湯森路透)，研究團隊在超精密加工、自由曲面加工、自由曲面測量及自由曲面光學等領域所發表的學術論文，數量稱冠。

該實驗室增強了香港工業的能力，使其在全球高端產品市場中具競爭力。實驗室在研究和顧問服務方面的卓越成就備受肯定，過去三年連續獲得國家教育部高等學校科學優秀成果獎。



## Major Awards For R&D Projects 獲獎科研項目

40th International Exhibition of Inventions (Geneva, Switzerland, 18-22 April 2012)  
第四十屆國際發明展覽 (瑞士日內瓦, 二零一二年四月十八至二十二日)

Award 獎項	Project 項目	Principal Investigator 首席研究員/ Department 學系/Company 公司
Grand Prix Du Salon International Des Invention De Genève 日內瓦國際發明展至高榮譽大獎	The Robotic Hand of Hope (More on p.69) 希望之手 (詳見第69頁) <sup>01</sup>	Rehab-Robotics Company Limited (jointly developed with PolyU) 復康機器人技術有限公司 (與理大共同研發)
Gold Medal (congratulations from the jury) 評審團嘉許金獎	- the first Hong Kong invention to receive the Grand Prize in the 40-year history of the event 此發明展舉辦四十年來, 首個榮獲至高榮譽大獎的香港發明	
Romanian Association for Nonconventional Technologies, Bucharest, Romania, Special Award for the Invention 羅馬尼亞創新科技協會特別大獎		
Prix of the Federation of Cosmonautics of Russia 俄羅斯航天協會特別大獎		
Mawhiba Award by the Secretary General of King Abdulaziz and his Companions, Foundation for Giftedness and Creativity "Mawhiba", Saudi Arabia 沙地阿拉伯創意基金特別大獎		
Gold Medal (congratulations from the jury) 評審團嘉許金獎		Solar Powered Air-conditioning System for Vehicles (SAV) (More on p.69 & 81) 太陽能汽車冷氣系統 (詳見第69及81頁) <sup>02</sup>
Gold Medal 金獎	Preparation of Selenium Nanoparticles with Strong Anti-Tumour Activity Using Tiger Milk Mushroom 利用虎奶菇製備抗腫瘤納米硒 <sup>03</sup>	Dr Wong Ka-hing 黃家興博士 Department of Applied Biology and Chemical Technology 應用生物及化學科技學系
Gold Medal 金獎	3D Ultrasound Imaging for Spine Scoliosis 基於三維超聲的脊柱側彎的評估 <sup>04</sup>	Prof. Zheng Yongping 鄭永平教授 Interdisciplinary Division of Biomedical Engineering 生物醫學工程跨領域學部

Award 獎項	Project 項目	Principal Investigator 首席研究員/ Department 學系/Company 公司
Gold Medal 金獎	Hygienic Socks with Antifungal Microcapsules for Patients with Tinea Pedis (Athlete's Foot) 採用微膠囊技術研發治療足癬 (香港腳) 的衛生襪 <sup>05</sup>	Prof. Marcus Yuen Chun-wah 袁進華教授 Dr Joanne Yip Yiu-wan 葉曉雲博士 Institute of Textiles and Clothing 紡織及製衣學系
Special Prize – Gold Medal from Association "Russian House for International Scientific and Technological Cooperation" 俄羅斯內務國際科學技術合作協會特別獎 - 金獎		
Gold Medal 金獎	A Novel QPAR Technique for Extracting Valuable Information from Herbal Medicine (More on p.52) QPAR: 一個提取中藥內隱藏珍貴訊息的創新技術 (詳見第52頁) <sup>06</sup>	Prof. Chau Foo-tim 周福添教授 Department of Applied Biology and Chemical Technology 應用生物及化學科技學系
Gold Medal 金獎	Lead-free Ferroelectrics Based Microrefrigerator 基於無鉛鐵電材料的微型製冷器 <sup>07</sup>	Dr Daniel Sze Man-yuen 施文遠博士 Department of Health Technology and Informatics 醫療科技資訊學系
Silver Medal 銀獎	Functional and Decorative Textile Products through Sputtering Technology 功能性與裝飾性的濺射鍍紡織產品 <sup>08</sup>	Dr Kinor Jiang 姜綬祥博士 Institute of Textiles and Clothing 紡織及製衣學系
Special Award from Romanian Association for Nonconventional Technologies, Bucharest Romania 羅馬尼亞創新科技協會特別大獎		
Silver Medal 銀獎	A Novel Inline Hydropower System for Power Generation from Water Pipelines 內聯閉式輸水管水力發電系統 <sup>09</sup>	Prof. Yang Hong-xing 楊洪興教授 Mr Chen Jian 陳建先生 Dr Lu Lin 呂琳博士 Department of Building and Services Engineering 屋宇設備工程學系