

Unveiling traditional Chinese medicine

Chief Executive Tung Chee-hwa stated clearly in the 1998 Policy Address to position Hong Kong as a world centre for the development of health food and pharmaceuticals based on Chinese medicine. In order to modernize the traditional Chinese medicine industry in Hong Kong, one of the key factors is to develop new technologies for chemical analysis and quality control of products.

Since 1996 Prof. Chau Foo-tim and members of the Chemical Physics and Chemometrics research group of the Department of Applied Biology and Chemical Technology at the PolyU have been developing new mathematical-based chemical processing and information systems for analyzing Chinese medicine products. The low cost and effective systems the group developed have been applied successfully to enhance data processing and image analysis for the Government Laboratory and a local hospital for clinical studies. Outlined below are some of the systems developed by the group.

• *Low Cost Thin Layer Chromatography Image Capture and Analysis System*

Thin layer chromatography (TLC) is a low cost technique for separation and identification of substances of traditional Chinese medicine products. It is one of the two most popular techniques used for chemical analysis of these products. In the past this method could only provide qualitative information for identification of the constituting components of a sample, and very expensive instruments were required to obtain quantitative information about the amounts or concentrations of components. In 1997, Professor Chau's group set up a low cost PC-based image capture and analysis system for both qualitative and quantitative analysis of TLC patterns. This system, a breakthrough in TLC study, can provide different chemical information such as the types of substances as well as their accurate amounts. Various ginsengs and their proprietary drug samples available in the market have been analyzed using this system.

• *New Data Processing System for Hyphenated High Performance Liquid Chromatography*

Hyphenated high performance liquid chromatography (HPLC) is the most commonly used technique for identification of constituting substances as well as their amounts in traditional Chinese medicine products. HPLC can provide both qualitative and



Prof. Chau Foo-tim at work



中草藥成份新探

中醫藥在中國已經發展了超過五千年，並為世界各地華人廣泛使用。由於中醫藥之療效漸受非華人之關注，越來越多人接受中醫藥是西藥以外另一類有效又珍貴的保健、治療選擇，並展開了不少研究工作。從一九九八年開始，本地三家大學先後開辦有關中醫藥文憑和學位課程，藉以培育更多人才以配合未來的發展。因此，行政長官董建華於一九九八年度施政報告中提及要推動香港成為國際中醫藥中心，並成立中醫藥科研中心。同時，基於近年香港發生不少有關誤服中草藥之事故，香港特區政府計劃於公元二千年立法管制中醫藥的用途。由此可見，香港中醫藥工業的發展潛力極大。為確保香港中醫藥工業能現代化及達到世界認可水平，我們必須開發新技術，從而對中醫藥產品進行詳細之化學分析及品質管理。

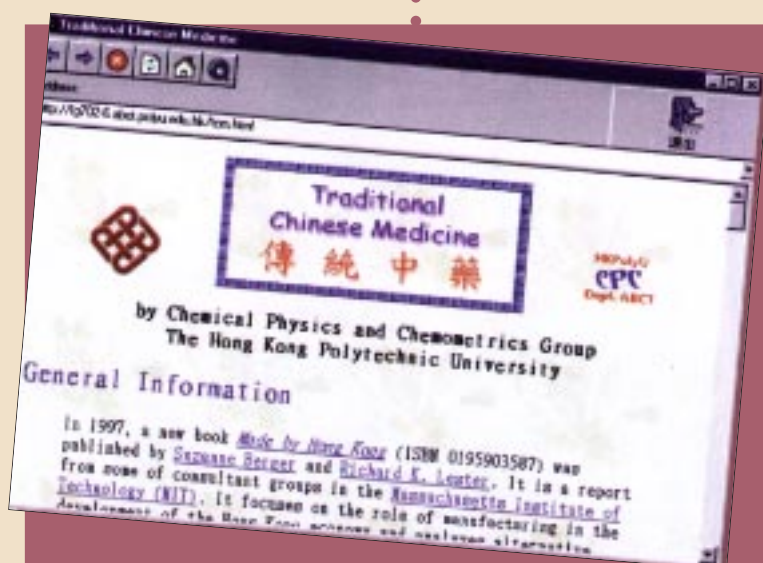
香港理工大學應用生物及化學科技學系教授周福添博士及其化學物理及計量化學研究小組，主要集中開發低成本、高效能及精確度高的中草藥化學分析方法和處理系統，自一九九六年開始，發展一套名為「中草藥化學資料分析及資訊系統」。此系統採用嶄新的數學和資訊方法組合，目的是進行中草藥化學成份分析及透過數據庫進行鑑証工作。周教授具備多年從事化學數據圖像分析及計量化學研究之經驗，並在多份權威性的國際學術期刊發表文章。這套系統已獲政府化驗所及醫院用於訊息處理及圖像分析，非常適合本地及海外中草藥或中成藥生產者使用。以下介紹這個系統其中三部分。

● 低成本薄層色譜圖像攝取及分析系統

薄層色譜分析法簡稱TLC，是一種能把不同物質分離及鑑定化學成份的方法。由於這種方法的運作成本較其他方法低，已在中醫藥工業廣為採用，就品質管理進行成份分析。傳統的TLC只可以對樣品作定性分析(鑑定化學成份之種類)，而定量分析(鑑定各化學成份之重量或濃度)則不容易得到準確結果。近年個別化學儀器生產商發展了一些攝取及分析薄層色譜圖像的系統，通過計算及分析圖像，便可得到準確的定性和定量分析結果。但由於這些儀器十分昂貴，很多規模較小或家庭式的本地中草藥生產商都不能負擔。因此，周教授及其研究小組於一九九七年開發了一套低成本「薄層色譜圖像攝取及分析系統」，包括一部個人電腦、一部平台式掃描器及研究小組編寫之軟件TLCQA，可對TLC圖像同時進行定性及定量分析。研究小組曾把此系統應用在TLC上，對市面上不同種類的人參樣品及其中成藥產品加以分析及比較，結果顯示這系統在定量分析上可準確至百萬分之一的水平，準確程度幾乎與HPLC〔見下文〕結果相同！這在中藥品質管理上無疑是一大突破。另外，研究小組正收集和整理有關中草藥TLC的實驗和圖像資料，將用CD-ROM儲存，並用TLCQA軟件來提取這些資料，使用者就可利用在TLC中藥實驗得到的圖像跟這資料庫的資料比較，以作定性和定量分析。資料庫內已儲存了超過一百種中藥和中成藥的資料。

● 高效液相色譜數據分析系統

高效液相色譜分析法簡稱HPLC，是另一種能把不同物質分離及鑑定化學成份的方法。這種分析法能對樣品同時作定性及定量分析，但儀器就比TLC昂貴得多，且需要非常熟練的技術人員來操作。由於從新開發的高效液相色譜分析儀得到的數據很多和非常複



雜，必須引入新的數據處理方法以提取有用的化學資料。近年周教授及其研究小組創出新的計量化學方法，簡化了數據分析的過程，縮短了分析的時間，且能提取更多有用資料。這個系統包括一部個人電腦及軟件WT-HELP；與市面上售賣的系統相比，能更準確地提取有用的化學成份資料。研究小組曾用這個系統來檢定冬蟲夏草〔有說這中藥在醫治肺癌上有一定功效〕，取得滿意的成果。

● 中藥化學成份資料庫

由於中醫學歷史悠久，已有很多古籍和文獻記載不同中藥的主治、功效和使用方法。隨著電腦日益普及，出現了一些電子數據庫儲存中藥資料，方便查閱。但是，絕大部分數據庫只記載中藥的基本知識，缺少了有關化學分析和成份的資料。由於後者對中藥質量的監管非常重要，實有必要建立一個更全面、涵蓋化學知識的中藥化學成份資料庫。周教授及其研究小組創造了一套名為QualBase的中英雙語中藥化學成份資料庫。這資料庫現存四十五種常用或有毒中藥的資料，其中三十一種是香港中醫藥發展籌備委員會開列出的有毒性或烈性中藥。至於資料方面包括基本中藥資訊，如名稱、類別、主治功能、用法、份量及圖片等，而化學資訊方面則包括理化鑑定方法、化學成份和毒性等。與其他中醫藥資料庫比較，這個資料庫另一特別之處是提供一個容易使用的介面，除用法簡單外，更可以讓用戶隨意增減資料，並於短時間內找到所需資料。這個快捷又廉宜的資料庫系統，對中小型中藥廠商特別適用。

近年，周教授與國內一些單位如湖南大學、湖南省中醫藥研究院中藥研究所和廣東市藥品檢驗所合作，用上述新資料分析及資料系統進行中草藥及中成藥的化學分析和鑑証工作。周福添教授正尋求商業合作夥伴，將部分中藥化學資料分析及資訊系統推出市場；與此同時，研究小組繼續尋找新方法，對中草藥中有效成份進行深入的研究，期望新的方法能帶動香港中醫藥工業走向現代化，並且提高中醫藥產品之質素。

有關更多周教授及其研究小組的工作詳情，可於網址 <http://fg702-6.abct.polyu.edu.hk> 查閱。

Minimizing the damage



Dr. H. Baki Iz (5th from left) with colleagues visited Huang Cheng (3rd from left) and Liao Ximau (1st from right) at the Shanghai Observatory.

Natural disasters are of great concern in our daily lives. Earthquakes, volcano eruptions, bush fires, red tides, landslides, tsunamis, to name a few. Early last year, red tides hit Hong Kong and caused \$250 million damage. In July of the same year, a tsunami, caused by a 7.0 magnitude earthquake wreaked havoc across the northwest region of Papua New Guinea, resulted in a loss of 3,000 lives. Two years ago monsoon season has brought the worst flooding to China's industrial and agricultural heartland since the 1930s. Along the Yangtze River, China's longest river, the floods are the worst since 1954, when 30,000 people died, about 90 per cent of them from contagious diseases after floodwaters receded. During the 1997 event, more than 3,000 people were killed, and as many as 240 million others were forced to evacuate their homes. The flood damage was estimated to run at \$24 billion, and 5.5 million homes were destroyed. Such damages could be minimized if people were warned before the disaster happened.

In May 1996, the "Asia Pacific Space

enrich our understanding of geosciences and environmental sciences in this area. Furthermore, the APSG project aims at studying serious nature hazards, especially the prediction of earthquakes, volcanic eruptions, sea immersion and floods, and the reduction of their hazards. The first workshop formally initiated the APSG Project, with different participating countries including China, USA, Japan, Indonesia, South Korea, Russia and Australia. The PolyU also took part in the APSG project activities. Prof. Ye Shuhua, a member from the Chinese National Academy of Sciences and the Shanghai Observatory, was elected to lead the project.

In 1997, The Faculty of Construction and Land Use of the PolyU recognized the importance of the project and allocated funds from the "Areas of Excellence project" for the establishment of a Processing Centre in the Department of Land Surveying and Geo-informatics. With subsequent financial support by Areas of Excellence and the additional financing from various other overlapping projects of H. Baki Iz, Project

Geodynamics (APSG) Project" was initiated in Shanghai to address the major problems involving natural disasters in this region. The main function of the project is to unite forces in the Asia-Pacific area to carry out cooperative research on crustal plate motion, crustal deformation and sea-level change, and to

Principal investigator, the project budget exceeded over \$1.5 million. Further information about the project is available at <http://apsg.polyu.edu.hk>.

By now, the project has produced several scientific research outputs. There are ongoing collaborative projects with the Shanghai Observatory and The Ohio State University, USA.

One of the research projects involves Synthetic Radar Interferometry (by H. Baki Iz and Y. Chen). Within the framework of APSG, Department of Land Surveying and Geo-Informatics is developing capabilities to process and evaluate the Hong Kong SAR data that can be used by land-use planners to monitor urban development and its effect on the tropical environment. The picture below is a space-borne radar image showing part of the Hong Kong territory. The South China Sea is in dark blue and red area. Land surfaces are seen in shades of lighter blue and gold. The brightest yellow areas are the densely developed areas of Hong Kong's business and



of natural disasters

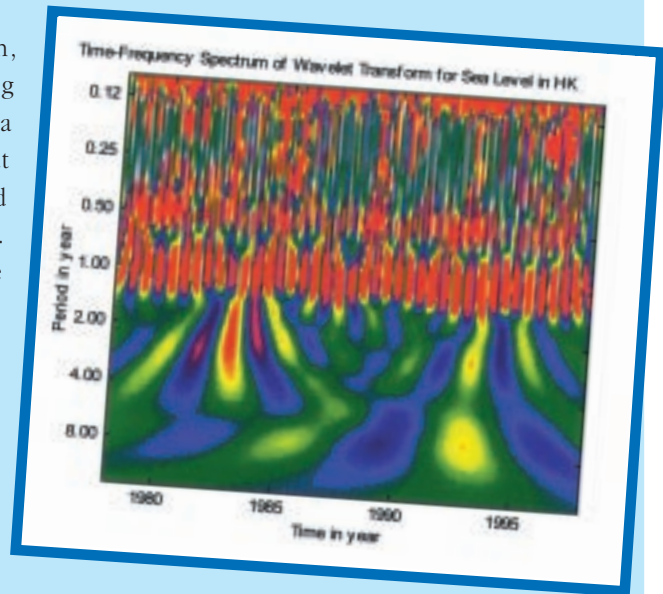
residential districts. The small yellow dots in the water are the many ships. The image was acquired by the Space-borne Imaging Radar-C/X-band Synthetic Aperture Radar (SIR-C/X-SAR) onboard the space shuttle Endeavour on October 10, 1994. The colours are assigned to different radar frequencies and polarizations of the radar.

Another study carried out under the umbrella of APSG is on the Regional GPS Network Solution for Monitoring Deformations of the Southeastern Eurasian Plate (by H. Baki Iz, J. Wang and Y. Chen). Investigations of crustal deformation styles in Asia are important for earthquake prediction in the region. In this study, GPS data over four months from six stations in Asia, including a new one in Hong Kong, were analyzed for generating crustal deformations. The data analysis below

shows motions for Wuhan, Shanghai, Xian, Hong Kong stations. The Lhasa station has a northeasterly velocity of about 3cm/year with respect to the fixed GPS station operating in Taiwan. The picture underneath shows the Kau Yi Chau GPS station. The data collected at this station and the others were used to determine the baseline lengths over several thousand kilometres with a few millimetres accuracy.

Another ongoing project involves the spectral analysis of North-Point Tide Gauge Data for monitoring mean sea level Variations (by H. Baki Iz and D. Zheng).

Recent studies have indicated that the average rise of the global sea level was 1-3 mm/year during the last century. Changes in climate with the associated sea level rise, and subsidence of populous coastal cities, including Hong Kong, will have major impacts on the economy, environment, societal and human utilization. Tide gauges have the advantage of having long records, about decades long for monitoring sea level changes. This investigation uses the existing long-term tide gauge records taken at



the North Point station in Hong Kong.

The top figure above shows important periodic variations in the mean sea level monitored by the North Point tide gauge station and calculated at the PolyU. The bottom one is a picture of the tide gauge deployed currently at the Quarry Bay station.

Although the funding by the PolyU for the APSG project will cease by the end of this year, the project activities are expected to continue. ❖

