Spring/Summer 2020 | Issue 22

澳大新語 UMagazine

澳大腫瘤精準醫療取得突破性進展——專訪17位癌症研究專家

UM Achieves Breakthroughs in Tumour Precision Medicine ——Stories of 17 Cancer Experts

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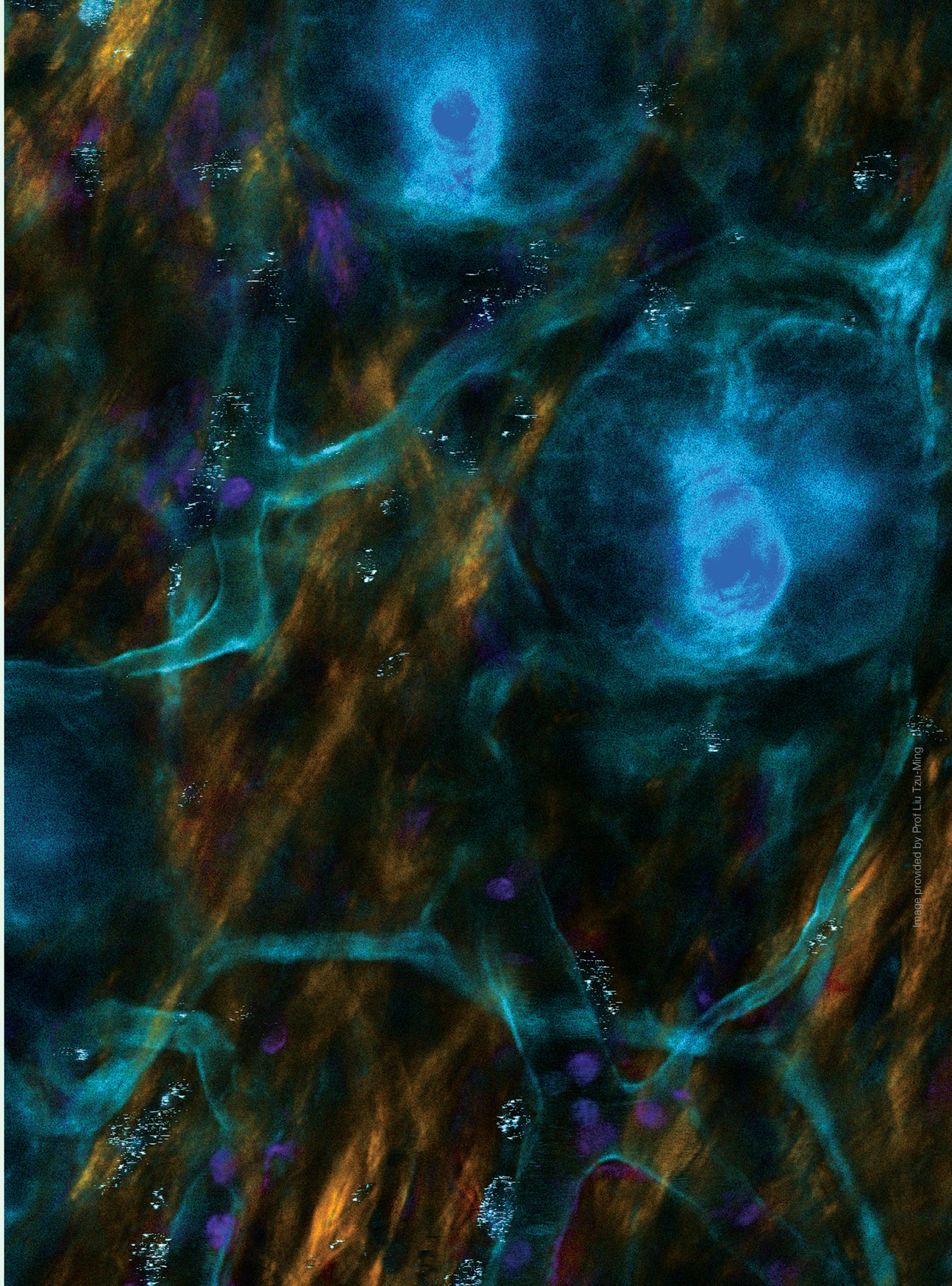

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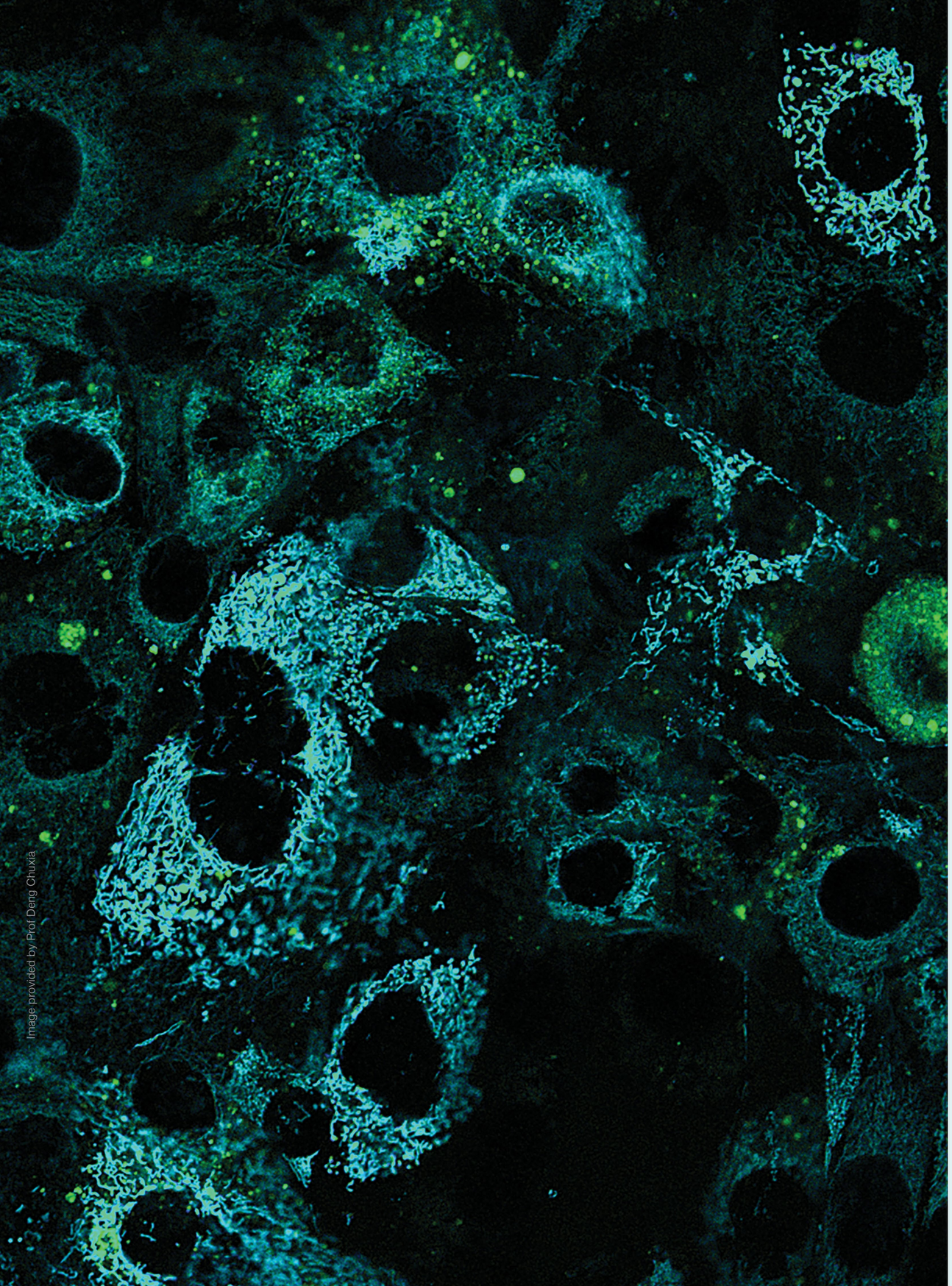

Image provided by Prof Deng Chuxia

編者的話

EDITOR'S WORDS

澳門大學近年在學術研究上騰飛精進，更形成了包括科技創新和人文社科領域的「3+3+3+3」研究戰略佈局。在眾多卓越研究領域中，2013年才從零起步的腫瘤精準醫療至今已匯聚一群頂尖的專家學者。他們結合跨學科創新技術，進行深入的癌症基礎研究，更取得了多項矚目的創新成果，備受學術界關注和認同。

今期的封面專題聚焦在癌症研究，我們訪問了17位來自健康科學學院、中華醫藥研究院、微電子研究院的專家，剖析他們各自範疇的研究項目如何通過創新技術提升癌症精準診療的成效。

在人文社科方面，新成立的人文社科高等研究院致力打造跨越學院疆界的校級研究平台，並計劃引進高端人文社科人才開展專題研究。我們訪問了兼任該研究院代院長的蘇基朗副校長，介紹研究院的發展和戰略佈局。

新型冠狀病毒肺炎肆虐全球，心理學系副教授賀佰恩與澳大專家組成一支九人的心理輔導專業團隊，為隔離人士及工作人員提供心理輔導。長期關注心理健康問題的賀教授，在專訪裡娓娓道出他的教研故事。「寶劍鋒從磨礪出，梅花香自苦寒來。」應用物理及材料工程研究院的孫國星教授是首位提出用水泥製造最便宜的納米顆粒、研發出破世界紀錄先進材料的專家，他以其刻苦求學的勵志經歷，道出了堅持是研究成功的關鍵。

在「學術研究」專欄中，微電子研究院助理教授李家明、法學院高級導師翁文挺分別撰文分享最新研究成果。

張惠琴 Katrina Cheong

In recent years, the academic research of the University of Macau (UM) has progressed in leaps and bounds, with a '3+3+3+3' strategic research structure gradually taking shape. A particularly noteworthy research field at UM is precision medicine for cancer research. The university initiated research in precision medicine in 2013, and today it has developed a team of leading experts in the field. Working together and adopting a multidisciplinary approach, these experts have achieved many impressive results that are widely recognised in academia.

This issue's cover story focuses on cancer research. We interview 17 experts in the Faculty of Health Sciences, Institute of Chinese Medical Sciences, and Institute of Microelectronics. They discuss how their ongoing research projects hold the promise for improving cancer treatment by using the latest technologies in precision medicine.

On the front of humanities and social sciences, the newly established Institute of Advanced Studies in Humanities and Social Sciences is committed to creating a university-level research platform that breaks down the boundaries of different disciplines. In this issue, we talk to Vice Rector Billy So, who is also the interim director of the institute, about how the institute plans to recruit high-calibre talent to carry out special research projects, as well as the strategic plan for the institute's future development.

With the novel coronavirus raging across the globe earlier this year, many people, especially frontline workers and those in quarantine, found themselves grappling with a silent problem—mental health issues. Prof Brian Hall in the Department of Psychology rose to the challenge and, along with eight other UM experts, he formed a psychological counselling team to provide counselling to people in need. In this issue, Prof Hall shares his research findings on mental health, a subject of his perennial interest. Prof Sun Guoxing in the Institute of Applied Physics and Materials Engineering was the first in the world to propose using cement to make the world's cheapest, mass-producible nanoparticles. Interestingly, as a brilliant researcher who has developed a world-record-breaking material, Sun was quite unimpressive in his college years and monopolised the bottom spot in his class. If you want a real-life example that proves persistence is the key to success, you need to look no further than Prof Sun's story.

Other articles not to be missed in this issue include those featured in the 'Academic Research' column, which discuss the latest research findings by Lei Ka Meng, an assistant professor in the Institute of Microelectronics, and long Man Teng, a senior instructor in the Faculty of Law.

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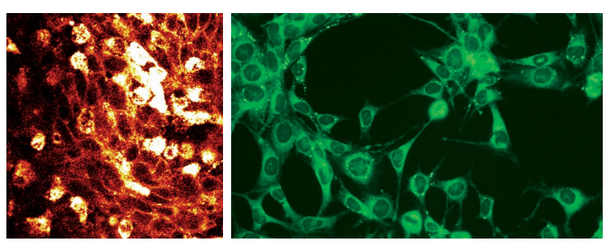
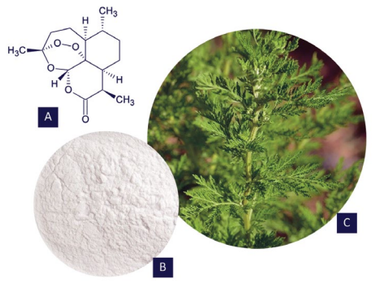
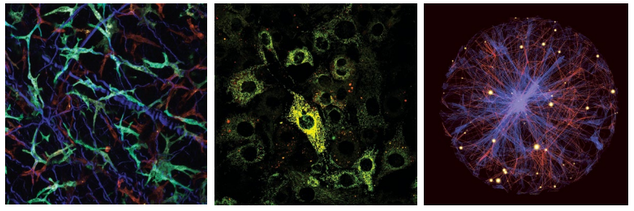






專題探討 TOPIC INSIGHT

人物專訪 EXCLUSIVE INTERVIEW

學術研究 ACADEMIC RESEARCH

澳大腫瘤精準醫療取得突破性進展

UM Achieves Breakthroughs in Tumour Precision Medicine

文/張愛華 · 圖/編輯部

English Translation / Ruby Chen · Photo / Editorial Board

澳門大學在科研發展上突飛猛進，近年更透過突出特色、發揮優勢、構建高峰和加強合作的策略，大力推動跨學科研究，形成了含括科技創新和人文社科領域的「3+3+3+3」研究戰略佈局。目前有八大學科領域：工程學、化學、計算機科學、藥理學與毒理學、材料科學、臨床醫學、精神病學/心理學、社會科學總論進入基本科學指標資料庫（ESI）前1%之列。在眾多突出的研究領域中，腫瘤精準醫療是其中一個重要板塊。本期封面專題專訪了17位專家，分享他們在癌症研究上的突破性進展。

The University of Macau (UM) is making rapid progress in scientific research. A few years ago, UM began to vigorously promote interdisciplinary research through a strategy that can be summarised as ‘highlighting characteristics’, ‘capitalising on advantages’, ‘building peaks’, and ‘strengthening cooperation’. The result is a ‘3+3+3+3’ strategic research structure. In the Essential Sciences Indicators (ESI), UM is now ranked among the top 1 per cent in eight subjects, namely Engineering, Chemistry, Computer Science, Pharmacology & Toxicology, Materials Science, Clinical Medicine, Psychiatry/Psychology, and Social Sciences, General. Among the many research fields where UM excels, precision medicine for cancer treatment is an important one. In the cover story of this issue, we interview 17 experts to learn about their breakthroughs in cancer research.

跨學科攻關癌症研究

癌症是全球人口死亡主因之一。為攻克癌症這頑疾，澳大在2013年成立健康科學學院，重點開展癌症研究和醫療保健產業研發，以填補澳門在這些領域的空白。澳大在腫瘤精準醫療領域由零開始研究工作，結合健康科學學院、科技學院、中華醫藥研究院、應用物理及材料工程研究院以及微電子研究院之間的跨學科研究優勢，融合尖端技術，針對常見癌症，進行深入的癌症基礎研究，包括利用先進的微流控技術和納米技術，提升癌症診療成效。

為提升癌症研究水平，澳大分別從生物醫學機理和生物醫學材料兩大方向攻關。健康科學學院訂立八大研究板塊，其中之一是致力癌症精準醫療研究。其轄下的癌症中心由鄧初夏院長兼任主任，帶領團隊致力建立澳門主要腫瘤冷凍組織庫及活細胞庫，研究腫瘤生長、轉移、復發及耐藥機制，開發早期診斷癌症方法，鑒定癌症驅動基因，以及篩選可殺死癌細胞的高效藥物等；並繼續針對乳腺癌、鼻咽癌、大腸癌、肝癌和肺癌等的突變基因，進行更多致癌機理及預防治療的研究。與此同時，中華醫藥研究院開拓中藥如何誘導癌細胞程序性壞死，以及中藥天然化合物助力免疫系統抵抗腫瘤等創新研究。

在生物醫學材料領域則發揮跨學科研究的優勢，例如微電子研究院研發了一款嶄新的數位微流控系統，協助醫療人員培養單細胞和選擇腫瘤藥物；應用物理

癌症中心研究重點
Main Research Areas of the Cancer Centre

信號轉導和癌形成 Signal transduction and carcinogenesis
癌症遺傳學、表觀遺傳學和流行病學 Cancer genetics, epigenetics, and epidemiology
癌症的發生、發展和轉移 Cancer initiation, progression, metastasis
發育、代謝與衰老 Development, metabolism, and ageing
癌症藥物的篩選和研發 Cancer drug screening and development
癌症預防與治療 Cancer prevention and therapy

Interdisciplinary Approach to Cancer Research

Cancer is one of the leading causes of death worldwide. In a quest to develop cures for cancer, UM founded the Faculty of Health Sciences (FHS) in 2013. FHS focuses on cancer research and the development of health products, in order to support the local community. FHS cooperates with other UM faculties and institutes, including the Faculty of Science and Technology (FST), the Institute of Chinese Medical Sciences (ICMS), the Institute of Applied Physics and Materials Engineering (IAPME), and the Institute of Microelectronics (IME), in order to carry out interdisciplinary research on cancers commonly found in Macao. Scholars use state-of-the-art technologies, such as microfluidic technology and nanotechnology, to enhance the effectiveness of cancer diagnosis and treatment.

To improve the quality of cancer research, UM focuses on tackling key issues in two areas: biomedical mechanisms and biomedical materials. FHS has identified eight research areas, one of them being precision cancer medicine. FHS Dean Prof Deng Chuxia, who is also the director of the Cancer Centre, leads his team to establish a frozen tissue bank and a live cell bank for the most common cancers found in Macao. FHS researchers also study tumour growth, metastasis, recurrence, and drug resistance mechanisms, in order to develop early cancer diagnosis methods, identify cancer driver genes, and screen for high-efficiency drugs that can kill cancer cells. They also conduct research on carcinogenic mechanisms and preventive treatment for mutant genes of breast cancer, nasopharyngeal cancer, colorectal cancer, liver cancer, and lung cancer. For its part, ICMS carries out innovative research on how traditional Chinese medicine induces necroptosis of cancer cells, and how the natural compounds of traditional Chinese medicine help the immune system fight tumours.

In terms of biomedical materials, IME has developed a new digital microfluidic system to assist medical personnel to cultivate single cells and select cancer drugs. IAPME has established a world-class nano-bio-optics research platform, through which it promotes collaboration with the university’s oncology research team, and accelerates the progress of research projects on carbon-point cancer diagnosis and treatment.

及材料工程研究院搭建國際先進的納米生物光學研究平台，促進與大學腫瘤研究團隊的深入合作，加速碳點癌症診療項目的研究進程等。

頂尖癌症研究團隊

癌症是目前澳門的10大死因之首，隨著人口逐漸老化，這一趨勢還將繼續，因此在澳門加強癌症研究是當務之急。目前，澳大匯聚研究不同癌症範疇的頂尖專家，包括鄧初夏教授、沈漢明教授、王山鳴教授、鄭文華教授、張仲榮教授、狄利俊教授、沈仲燮教授、郭珩輝教授、袁振教授、劉子銘教授、陳新教授、陳修平教授、李子安教授、代雲路教授等。

澳大的癌症研究團隊以腫瘤精準醫療為主攻方向，在抑制乳腺癌轉移和復發的新機制、用細胞自噬抑制劑治療乳癌、通過大規模人群基因突變檢測預防癌症、以青蒿素及其衍生物治療眼科腫瘤、治療前列腺癌的新機制、以激素替代療法與化療法相結合治療卵巢癌、遺傳學理論在結腸直腸癌治療中的應用、新型抗體降低肺癌抗藥性、新型多功能藥物助力腫瘤光動力療法、以多光子活體顯微術探究黑色素瘤血管新生動態、納米技術抑制卵巢癌轉移、納米粒子運載藥物高溫摧毀癌細胞、結合中藥天然化合物提升癌症免疫治療效果、中藥誘導癌細胞程序性壞死，以及數位微流控技術助篩選腫瘤藥物等範疇深入研究，取得多項突破性發展。

建設跨學科研究平台

澳大正在向國家教育部申請建立一個腫瘤精準醫學領域的前沿研究中心，通過健康科學學院、科技學院、中華醫藥研究院及應用物理及材料工程研究院之間的合作，專注精準腫瘤學跨學科研究。中心旨在成為澳門以至粵港澳大灣區癌症免疫學和精準腫瘤學研究的國際領先中心，以滿足未來十年因人均壽命延長而衍生對癌症研究和相關人員不斷增長的需求。

A Top-notch Cancer Research Team

Cancer is currently one of the ten leading causes of death in Macao, and this trend is expected to continue with the ageing of the population in the city. For this reason, it is imperative to strengthen cancer research in Macao. UM boasts leading experts specialising in different aspects of cancer research. They include Prof Deng Chuxia, Prof Shen Hanming, Prof Wang San Ming, Prof Zheng Wenhua, Prof Edwin Cheung Chong Wing, Prof Di Lijun, Prof Shim Joong Sup, Prof Henry Kwok Hang Fai, Prof Yuan Zhen, Prof Liu Tzu-Ming, Prof Chen Xin, Prof Chen Xiuping, Prof Leo Lee Tsz On, and Prof Dai Yunlu.

UM's cancer research team has already achieved multiple breakthroughs in the following areas: inhibiting breast cancer metastasis and recurrence, treating breast cancer with autophagy inhibitors, preventing cancer through large-scale populational genetic testing, treating ophthalmic tumours with artemisinin and its derivatives, discovering a new mechanism for prostate cancer treatment, combining hormone replacement therapy with chemotherapy for ovarian cancer treatment, applying genetic theory in colorectal cancer treatment, reducing drug resistance in lung cancer by developing new inhibitory antibodies, developing a novel multifunctional drug for tumour photodynamic therapy, improving precision medicine for cancer treatment by using the multiphoton microscopy system to observe the microenvironment of tumours, inhibiting ovarian cancer metastasis with nanotechnology, destroying cancer cells at high temperatures by using nanoparticles as drug carriers, enhancing the effectiveness of cancer immunotherapy with natural compounds of traditional Chinese medicine, inducing necroptosis of cancer cells with Chinese medicine, and creating a digital microfluidics system for cancer drug screening.

Establishing an Interdisciplinary Research Platform

UM is currently applying to the Ministry of Education to establish a cutting-edge research centre in the field of precision medicine for cancer treatment. FHS, FST, ICMS, and IAPME collaborate with one another to carry out interdisciplinary research in this field. The aim is to create an internationally leading centre for cancer immunology and precision medicine for cancer treatment in Macao and the Guangdong-Hong Kong-Macao Greater Bay Area, to meet the growing demand for cancer research and researchers in the next decade that will accompany the increase in life expectancy.

Earlier this year, UM established a joint cancer research centre with the Institute of Cancer and Basic Medicine, Chinese Academy of Sciences, in order to make full use of the strengths of both institutions in personnel, medical resources, and innovative research, and to support the pursuit of healthy living in Macao, the Greater Bay Area, and the rest of China. The centre tackles key scientific and technological issues in the prevention and treatment of cancers as well as in the development of cancer drugs. Scholars conduct innovative clinical research and aspire to create a world-renowned oncology research and training centre.

為充分發揮澳大和中國科學院在科技人才、醫療資源以及創新研究方面的合作優勢，提高澳門、大灣區乃至全國人民追求健康生活的願景，澳大今年已與中國科學院腫瘤與基礎醫學研究所成立聯合癌症研究中心，發揮澳大先進水準的研究力量，強強聯合，共同打造澳門和大灣區癌症免疫學和精準腫瘤學研究的國際領先中心，針對腫瘤防治和診療及抗癌藥物研發的關鍵科學和技術問題，開展創新型的基礎和臨床研究，致力將中心建設成為國際知名的腫瘤科學研究與人才培養基地。

掃二維碼
觀看癌症研究系列視頻

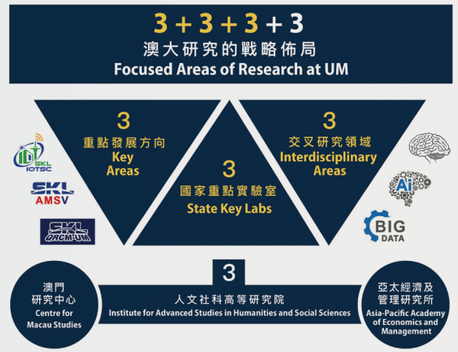
Scan the QR code for a video on UM's cancer reserach

「3+3+3+3」研究戰略佈局

「3+3+3+3」包括三間國家重點實驗室（中藥質量研究、模擬與混合信號超大規模集成電路、智慧城市物聯網）、三個重點發展方向（精準醫療、先進材料、區域海洋）、三個跨學科交叉領域（認知與腦科學、人工智能與機器人、數據科學）、三個人文社科研究平台（人文社科高等研究院、澳門研究中心、亞太經濟與管理研究所）。重點研究世界尖端學術問題、鼓勵跨學科合作，打破學科壁壘，尤其是人文社會科學和現代科技的結合。

The '3+3+3+3' Research Structure

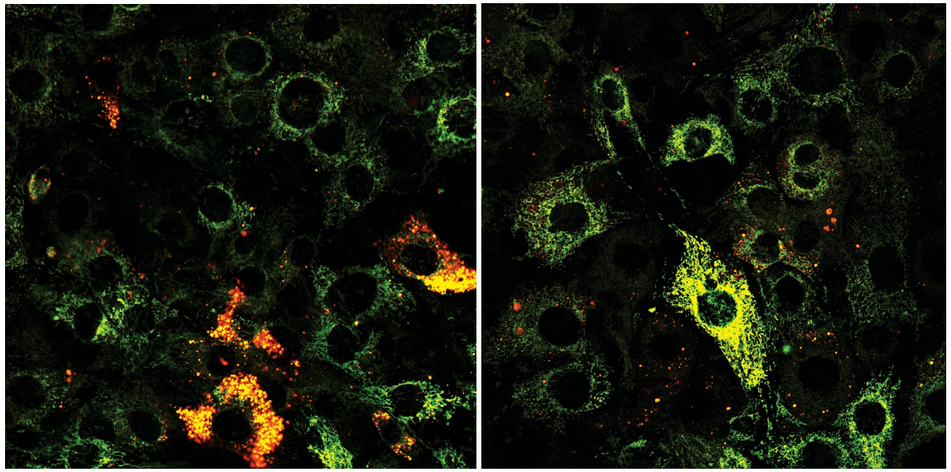
The four '3's in the '3+3+3+3' research structure refer to the university's three state key laboratories (for Chinese medical sciences, analogue and mixed signal very large scale integrated circuits, and internet of things for smart cities, respectively), three key research directions (precision medicine for cancer treatment, advanced materials, and regional oceanography), three interdisciplinary research fields (cognitive and brain science, artificial intelligence and robotics, and data science), and three research platforms for the humanities and social science (Institute of Advanced Studies in Humanities and Social Sciences, Centre for Macau Studies, and Asia Pacific Academy of Economics and Management). UM focuses on the world 's cutting edge academic issues and encourages interdisciplinary collaboration, and promotes the integration of modern technology in research in the humanities and social sciences.



抑制乳腺癌轉移和復發的新機制

A New Mechanism for Inhibiting Breast Cancer Metastasis and Recurrence

文/余偉業 · 圖/編輯部，部分由受訪者提供
English Translation / Ruby Chen · Photo / Editorial Board, with some provided by the interviewees



左圖是BRCA1野生型組，右圖是BRCA1缺失組。
Left: The wild-type copy of the BRCA1 gene
Right: The defective-type copy of the BRCA1 gene

全球癌症資料庫（GLOBOCAN）顯示，全球在2018年約有1,810萬癌症新發病例和960萬癌症死亡病例，當中女性乳腺癌佔210萬例，63萬人死亡，是威脅女性健康的「頭號殺手」。健康科學學院院長、癌症中心主任鄧初夏教授和高級導師陳強博士發現了抑制乳腺癌轉移和復發的新機制，為患者帶來新曙光。

According to GLOBOCAN, in 2018, there were about 18.1 million new cancer cases and 9.6 million cancer deaths worldwide, of which 2.1 million were female breast cancer cases causing 630,000 deaths. Indeed, breast cancer has become the leading cause of cancer death in women. Prof Deng Chuxia, dean of the Faculty of Health Sciences (FHS) and director of its Cancer Centre, and Dr Chen Qiang, a senior instructor in FHS, have uncovered a new mechanism for inhibiting breast cancer metastasis and recurrence, bringing new hope for patients.

研究癌症機理

鄧教授的研究團隊深入研究乳腺癌的發生發展、耐藥和轉移的分子機制，他們最新的發現，乳腺癌易感基因1（BRCA1）可以通過促進線粒體自噬和降低炎症小體的活性，抑制手術後乳腺癌的復發及轉移，成果獲著名SCI期刊《Advanced Science》作為封面文章刊登，為治療三陰性乳腺癌（Triple negative breast cancer，簡稱TNBC）開拓新方向。研究由鄧初夏教授、徐曉玲副教授、陳強博士（第一作者）等共同完成。

作為生命科學領域頂級美籍華人科學家，鄧教授過去20多年來研究乳腺癌的發病機制和治療方法，發表論文380多篇。他表示，乳腺癌在總體癌症的發病率非常高，威脅全球女性健康。「澳大癌症研究領域較廣，涉及多種癌症，而我們實驗室盯住在女性當中發病最高的來做研究，聚焦突變時提高患乳腺癌風險的抑癌基因BRCA1，並在研究『三陰性乳腺癌』致癌機理上取得成果。」

治療三陰性乳腺癌

按臨床病理分型，在所有乳腺癌個案中，約有10%至20%屬於三陰性乳腺癌。「三陰性」指癌細胞對雌激素受體（ER）、孕酮受體（PR）、上皮生長素因子（HER2）都呈陰性。我們可以採用荷爾蒙治療ER和PR陽性的乳腺癌，以及使用抗HER2的標靶治療來應對HER2誘發的乳腺癌，但是三陰性乳腺癌目前尚無有效的靶向藥物。

鄧教授表示，三陰性乳腺癌一直被視為最棘手、最難根治的乳癌，不僅比一般乳腺癌早發病、惡性程度較高，癌細胞也較容易轉移淋巴結，同時很快擴散，因此死亡率較高。「即使經過化療和乳房切除手術，三陰性乳腺癌首五年內復發風險仍較高，因為手術往往會刺激整個機體的免疫，釋放一些促進生長的因素令癌細胞復發和轉移，當務之急是為三陰性乳腺癌治療找到新的有效標靶。」

Studying the Mechanisms of Cancer

Prof Deng's research team studies the molecular mechanisms of breast cancer development, drug resistance, and metastasis. The team's latest study found that the susceptibility gene BRCA1 can inhibit post-surgery breast cancer metastasis and recurrence by promoting mitochondrial autophagy and reducing the activity of inflammatory bodies. The study was published as a cover article in the internationally renowned SCI-indexed journal *Advanced Science*, and opens up new directions for the treatment of triple-negative breast cancer (TNBC). The study was jointly conducted by Prof Deng Chuxia, Prof Xu Xiaoling, and Dr Chen Qiang.

As one of the foremost Chinese-American scientists in the field of life sciences, Prof Deng has studied the pathogenesis and treatment of breast cancer for more than two decades and has published over 380 papers on the subject. According to him, the incidence rate of breast cancer is very high worldwide, posing a serious threat to women's health. 'Cancer research at UM covers a variety of cancers, and our laboratory focuses on the most common types of cancer in women,' he explains. 'We focus on the BRCA1 gene, whose mutations increase the risk for breast cancer. We have made some good progress in studying the carcinogenic mechanism of TNBC.'

Treatment of TNBC

According to clinicopathological classification, about 10 to 20 per cent of breast cancer cases are TNBCs. TNBC is cancer that tests negative for estrogen receptor (ER), progesterone receptor (PR), and epithelial growth factor (HER2). If it is ER- and PR-positive breast cancer, hormone therapy is possible; if it is HER2-induced breast cancer, anti-HER2 target therapy can be used. However, there are currently no effective targeted drugs for TNBC.

According to Prof Deng, TNBC is the most difficult-to-cure type of breast cancer. It not only has an earlier onset than other types of breast cancer, but also has a high degree of malignancy. Cancer cells can easily metastasise to lymph nodes and spread quickly, so the mortality rate is high. He says, 'Even after chemotherapy and mastectomy, the risk of TNBC recurrence within the first five years is still higher than other types of breast cancer, because surgery often

導致遺傳型乳腺癌的元兇

BRCA1基因具有重要的抑癌作用，能抑制惡性腫瘤，突變時卻容易提高患乳腺癌的風險。鄧教授表示，BRCA1也是導致遺傳型乳腺癌的元兇，並且多數為三陰性乳腺癌。他們在小鼠模型中證實，BRCA1在線粒體自噬、線粒體動力學方面具重要調控作用，可以通過促進線粒體自噬清除有損傷的線粒體，以及降低炎症小體活性，抑制手術後乳腺癌的復發及轉移。

今次研究發現，BRCA1在細胞核和細胞質中發揮不同作用，能令線粒體維持正常自我修復的功能（如分裂、融合及自噬），對細胞健康至關重要。不過，當BRCA1發生突變或變異時，就會影響乳腺細胞中線粒體的正常運作。

陳強博士解釋指，這時候乳腺細胞出問題，是因為裏面線粒體的自噬功能會漸漸緩慢，令原本需要清除的受損線粒體大量積累，同時增加了活性氧，激發炎症小體的活性。他說：「這個過程會誘發腫瘤相關巨噬細胞的募集，抑制CD8+T細胞的活性，從而令腫瘤的免疫微環境發生改變，促進腫瘤發生和轉移。因此，採用炎症小體抑制劑如Glibenclamide（格列本脲）等，可以有效緩解因為BRCA1突變而誘發的乳腺癌的復發和轉移，這為治療三陰性乳腺癌開拓了新方向。」

研究成果獲國際著名SCI期刊《Advanced Science》作為封面文章刊登（本期*UMagazine*的封面也採用了此圖）

The study was published as a cover article in the internationally renowned SCI-indexed journal *Advanced Science* (Image also on the cover of this *UMagazine*)

stimulates the body's own immune system, causing it to release growth-promoting factors that lead to cancer recurrence and metastasis. Therefore, it is imperative to find new effective targets for the treatment of TNBC.'

The Main Cause of Hereditary Breast Cancer

The BRCA1 gene plays an important role in suppressing cancer. It can suppress malignant tumours, but when mutated, it can easily increase the risk of breast cancer. Prof Deng explains that BRCA1 is also the main cause of hereditary breast cancer, most of which are TNBC. Prof Deng's team has also found through experiments on mice that BRCA1 plays an important role in regulating mitochondrial autophagy and mitochondrial dynamics, which can eliminate mitochondrial damage by promoting mitochondrial autophagy and reducing the activity of inflammatory bodies, thereby inhibiting post-surgery recurrence and metastasis of breast cancer.

Prof Deng's latest study has found that BRCA1 plays different roles in the nucleus and cytoplasm, which can help mitochondria maintain normal self-repair functions (such as division, fusion, and autophagy), which are essential for cell health. But when BRCA1 mutates, it will affect the normal function of mitochondria in breast cells.

Dr Chen explains that it is when the BRCA1 gene mutates that the problem occurs. The autophagy function of the mitochondria gradually slows down, which causes damaged mitochondria to accumulate instead of being removed. It also increases reactive oxygen species, which stimulates the activity of inflammatory bodies. 'This process will induce the recruitment of tumour-associated macrophages and inhibit the activity of CD8+ T Cells, thereby changing the immune microenvironment of the tumour and promoting tumorigenesis and metastasis,' Dr Chen explains. 'Therefore, the use of inflammatory body inhibitors such as Glibenclamide can effectively relieve the recurrence and metastasis of breast cancer induced by BRCA1 mutation, which opens up a new direction for the treatment of TNBC.'

精準對症治病

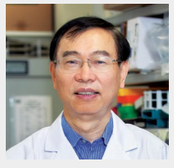
所有癌症都有機會轉移和復發，情況因人而異。鄧教授補充指出，有些人在手術前或癌症初期腫瘤就發生轉移，有些人則是在手術後促進了細胞激素、生長因子和炎症因子的表達，刺激腫瘤的生長，令癌症復發。鄧教授強調，只有以癌症病患為軸心，透過檢測和分析癌症基因的特徵，發掘其致癌機理，才能精確對症下藥，這就是愈趨普及的精準醫療，也是澳大生物醫學一直努力的研究方向。

未來五年，鄧教授將帶領研究癌症的團隊，構建澳門及周邊地區幾種高發腫瘤的生物庫，並繼續針對乳腺癌、鼻咽癌、大腸癌、肝癌和肺癌等的突變基因，進行更多致癌機理及預防治療的研究。與此同時，他們以精準醫療方法，研究癌症驅動基因的作用機理，以及開展癌症個性化治療。他說：「澳大的研究經驗不僅可以服務澳門，也可推廣到整個粵港澳大灣區，貢獻人類健康。」

Precision Medicine for Cancer Treatment

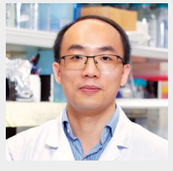
All cancers can metastasise and recur, and the situation often varies from person to person. Prof Deng says that some people have metastasised tumours before surgery or during the early stage of cancer, while others experience cancer recurrence after surgery because the surgery promoted the expression of cytokines, growth factors, and inflammatory factors, which stimulated the growth of tumours and caused cancer to recur. For this reason, Prof Deng stresses that only by identifying the characteristics of cancer genes and the carcinogenic mechanism can researchers develop tailor-made treatment for the individual patient. This is known as 'precision medicine', one of the key research areas at UM.

In the next five years, Prof Deng plans to lead his research team to build a biobank of several high-risk cancers in Macao and neighbouring regions. The team will focus on cancer-causing mutant genes for breast cancer, nasopharyngeal cancer, colorectal cancer, liver cancer, and lung cancer, in order to identify the carcinogenic mechanism and develop preventive therapies. At the same time, they will apply precision medicine to identify the mechanism of action of cancer driver genes, and to develop personalised cancer treatment. He says, 'UM's research experience not only can serve Macao, but can also be extended to the Greater Bay Area to make a contribution to the health of more people.'



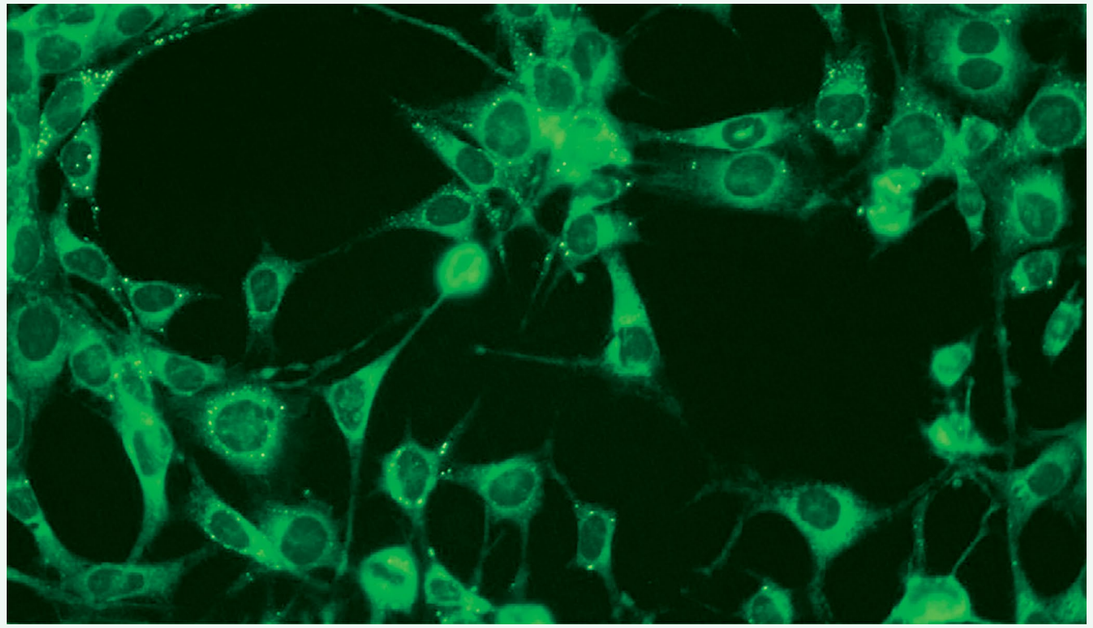
鄧初夏教授2014年起出任健康科學學院院長。在1995至2014年於美國國立衛生研究院任終身研究員和遺傳研究室主任。長期深入研究乳腺癌的發生發展、耐藥和轉移的分子機制，已發表SCI期刊論文380餘篇。

Prof Deng Chuxia assumed office as the dean of FHS in 2014. Between 1995 and 2014, he served as a tenured researcher at the United States National Institutes of Health (NIH) and the director of its genetics research laboratory. Prof Deng has been long involved in the studies of the molecular mechanisms for breast cancer occurrence and development, drug resistance, and metastasis. He has published over 380 research papers in SCI-indexed journals.



陳強博士是健康科學學院高級導師，主要研究癌症發展及代謝疾病等。他從廈門大學細胞生物學專業哲學博士學位畢業，曾在美國國立衛生研究院進行博士後培訓。

Dr Chen Qiang is a senior instructor in FHS. His main research interests are cancer development and metabolic disorders. He obtained his PhD degree in cell biology from Xiamen University and received post-doctoral training at the NIH.



癌細胞在飢餓情況下激活自噬
Cancer cells undergoing autophagy induced by starvation

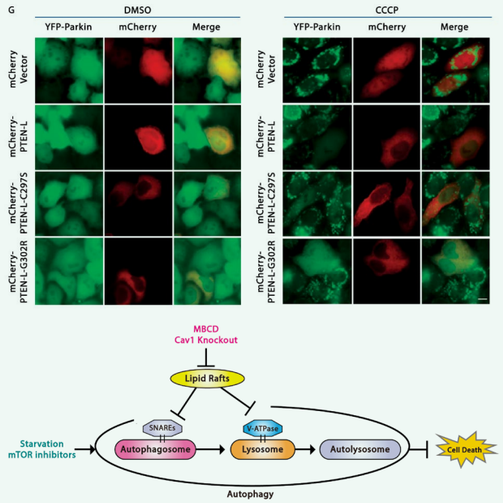
用細胞自噬抑制劑治療乳腺癌

Treating Breast Cancer with Autophagy Inhibitors

文/盛惠怡 · 圖/編輯部，部分由受訪者提供
Chinese & English Text / Debby Seng · Photo / Editorial Board with some provided by the interviewee

Caveolin-1（CAV1）是一種乳腺癌抑制基因，人體缺少了它或它發生突變時，就會影響癌細胞的自噬作用和溶酶體功能，增加患上乳腺癌的風險。健康科學學院教授沈漢明發現，可以用CAV1的缺失或突變作為生物指標，指導在臨床上是否適合用自噬抑制劑作為治療乳腺癌的手段。

Caveolin-1 (CAV1) is an important tumour suppressor in breast cancer. Its deficiency and mutation can affect the autophagy and lysosome, thus making breast cancer cells more susceptible to autophagy/lysosome inhibitors. Faculty of Health Sciences Professor Shen Hanming suggests that CAV1's deficiency and mutation can be used as a biomarker in the selection of breast cancer patients for using autophagy/lysosome inhibitors in cancer therapy.



癌細胞進行線粒體自噬
Cancer cells undergoing mitophagy

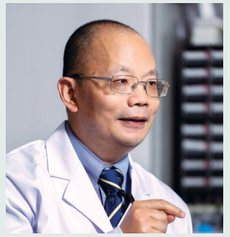
沈漢明教授發現可以用CAV1的缺失或突變作為生物指標，指導在臨床上是否適合用自噬抑制劑作為治療乳腺癌的手段。
Prof Shen Hanming suggests that CAV1's deficiency and mutation can be used as a biomarker in the selection of breast cancer patients for using autophagy/lysosome inhibitors in cancer therapy

細胞自噬（Autophagy）是生物進化過程中完整保留的一個重要機制，即細胞通過溶酶體來清除細胞內的損害物質從而讓細胞恢復正常的一個過程。目前已知細胞自噬具有十分重要的生理功能，而且和癌症、神經退行性疾病等許多疾病密切相關。在細胞自噬研究的早期，人們認為細胞自噬會導致細胞自噬性死亡，而沈教授的研究證明，細胞自噬原則上是抵抗飢餓及應急狀態的一個重要的促進細胞生存的機制。

沈教授表示，細胞自噬對癌症是一把雙刃劍：在癌症發生前，增加機體的自噬水平可以起到預防作用；但在已有的腫瘤細胞內，自噬可以促進癌細胞的生存和腫瘤的發生發展。他說：「細胞在飢餓及應急情況下會激活自噬，通過重新利用細胞內的營養元素，例如氨基酸，維持細胞的功能，促進細胞生存。」

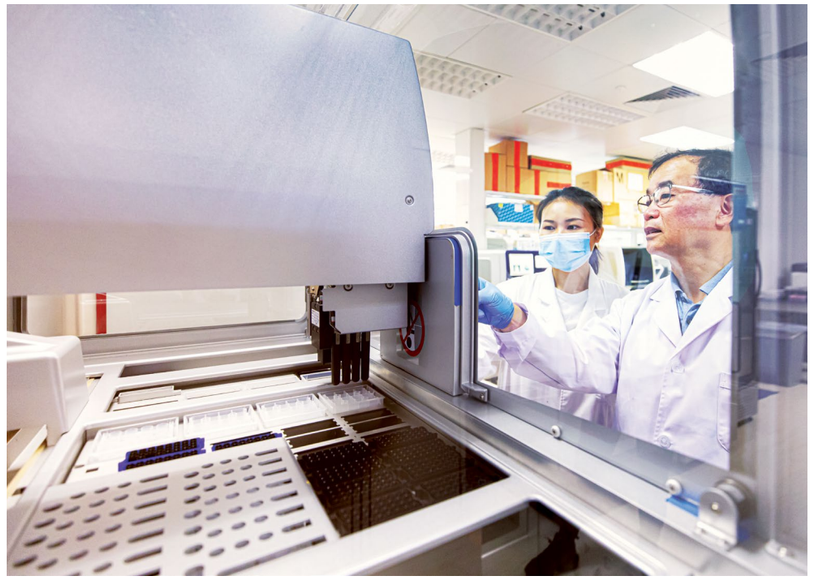
Autophagy is an essential mechanism that keeps our cells in proper balance. It does so by transporting dysfunctional components to the lysosome for digestion. Researchers have learned that autophagy plays an important role in physiological processes and has close links to illnesses such as cancer and neurodegenerative diseases. In the early years of autophagy research, some researchers suggested that autophagy could lead to autophagic cell death, but Prof Shen has proved that autophagy can, in principle, resist starvation and other stress conditions and promote cell survival.

When it comes to cancer, autophagy is widely believed to be a double-edged sword. According to Prof Shen, efficient autophagy can help prevent cancer, but it can also promote the survival of already-existing cancer cells and the development of tumours. 'By recycling nutrients such as amino acids in cells, autophagy can help cancer cells function properly and survive under various stress conditions,' Prof Shen says.



沈漢明教授曾在新加坡國立大學楊潞齡醫學院從事細胞自噬、氧化損傷、細胞信號傳導等方面的研究20多年，至今在《Autophagy》、《Cell Res》、《Cancer Res》、《Mol Cell》、《Nature Protocol》等SCI期刊發表論文200餘篇，被引用次數超過25,000次。目前在澳大展開關於細胞自噬及溶酶體、線粒體自噬、腫瘤靶向治療等方向的研究。

Before joining UM, Prof Shen Hanming studied autophagy, oxidative damage, and cell signalling for over two decades in the Yong Loo Lin School of Medicine at the National University of Singapore. He has published more than 200 research papers in SCI-indexed journals, such as *Autophagy*, *Cell Res*, *Cancer Res*, *Mol Cell* and *Nature Protocol*, with a citation frequency of over 25,000. At UM, he continues to study autophagy and lysosome in cancer cell biology, mitophagy, as well as metabolism and cancer targeted therapy.



王山鳴教授與研究生把血液樣本放進DNA自動提取儀

Prof Wang San Ming and his student put blood samples into the automatic DNA extraction instrument

通過大規模人群基因突變檢測預防癌症

Preventing Cancer Through Large-scale Populational Genetic Testing

文/張愛華 · 圖/編輯部，部分由受訪者提供

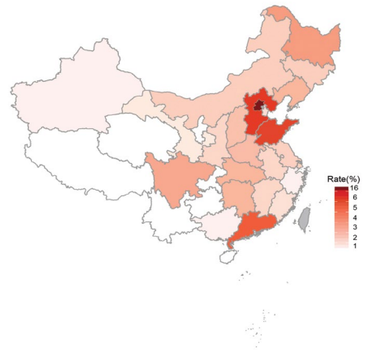
English Translation / Ruby Chen · Photo / Editorial Board with some provided by the interviewee

健康科學學院王山鳴教授的研究團隊，最近完成了一項歷時三年的中國人群癌症預防研究。該研究確定了中國人群中BRCA1/BRCA2基因突變的攜帶頻率和攜帶者數量，為在中國人群中運用大規模人群基因突變檢測進行癌症預防打下堅實基礎。有關這項研究的論文題為《中國漢族人群BRCA1/BRCA2致病性突變的攜帶率》在《英國醫學雜誌》子刊《醫學遺傳學雜誌》發表。

Prof Wang San Ming's research team in the Faculty of Health Sciences recently completed a three-year study on cancer prevention in Chinese population. This study determined the frequency of mutation-carrying and the number of carriers of BRCA1/BRCA2 gene mutations in the Chinese population, and laid a solid foundation for cancer prevention through large-scale populational genetic testing. The related paper, titled 'Prevalence of BRCA1/BRCA2 Pathogenic Mutation in Chinese Han Population', has been published in the *Journal of Medical* Genetics, a sub-journal of the *British Medical Journal.*

研究中使用的樣本來自中國內地不同省份，不同顏色漸變代表每個省的參與者比率。

Samples used in the study originated from different provinces of mainland China. The colour gradients represent the rates of participants from each province.



乳腺癌跟遺傳基因突變有著密切關係，其中攜帶BRCA1和BRCA2基因突變的人群發病風險極高。王教授和上海交通大學、中國科學院以及內地健康企業等組成的團隊合作，對中國人群進行BRCA1/BRCA2基因檢測，他說：「我們運用第二代基因測序，在澳門大學高性能計算集群超級電腦展開生物信息學大數據分析，並通過實驗方法驗證，篩查了來自全國各省份11,386個體。研究發現，中國人群中平均每256人中就有一位帶有遺傳性BRCA1/BRCA2致病性突變，共有510萬突變攜帶者。」

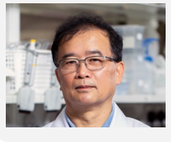
基於是次發現，王教授建議所有18歲以上人士一生做一次BRCA1/BRCA2基因檢測，「突變攜帶者有以下四種癌症預防手段，一是定期身體檢查；二是藥物預防；三是預防性手術；四是採用試管嬰兒的辦法阻斷下一代攜帶家族性的遺傳突變。」

王教授表示，BRCA1和BRCA2基因突變檢測成本低而防癌效果確切。他計劃通過澳大在粵港澳大灣區的首個產學研示範基地——珠海澳大科技研究院，與業界合作推廣大規模人群基因檢測，「BRCA1和BRCA2基因突變檢測具有極大應用價值，希望通過市場化的推廣，為廣大市民提供相關檢測服務。」

Breast cancer is closely related to inherited genetic mutations, and people with mutations in BRCA1 and BRCA2 genes are at high risk for cancer. By working with a team formed by cancer experts at Shanghai Jiaotong University, Chinese Academy of Sciences, and health examination companies in mainland China, Prof Wang tested the BRCA1/BRCA2 genes of people in various Chinese provinces. He says, 'In our study, we used second-generation gene sequencing to collect BRCA sequences, and bioinformatics tools to analyse big sequence data with the help of the high-performance computing cluster at the University of Macau (UM), and obtained experimental validation of the results. We screened 11,386 individuals from nearly all provinces in China. The study has found that an average of one in every 256 people in China carries a hereditary BRCA1/BRCA2 pathogenic mutation, and there are a total of 5.1 million mutation carriers in China.'

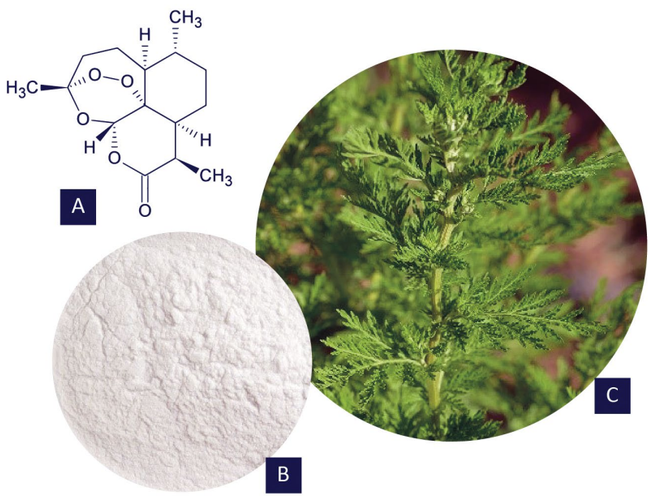
Based on the findings of the study, Prof Wang recommends that those over the age of 18 should have a BRCA1/BRCA2 gene testing during their lifetime. He explains that for mutation carriers, there are four ways to prevent cancer: regular physical examination, preventive drugs, preventive surgery, and *in vitro* fertilisation to prevent the transmission of hereditary genetic mutation to the next generation.

According to Prof Wang, the detection of BRCA1 and BRCA2 gene mutations is a low-cost yet highly effective way to prevent cancer. Next, he plans to promote large-scale populational genetic testing by working with the Zhuhai UM Science and Technology Research Institute, which is UM's first institute in the Guangdong-Hong Kong-Macao Greater Bay Area for industry-university-research collaboration. He says, 'BRCA1 and BRCA2 gene mutation detection has great practical value, and I hope to promote the testing services to the general public.'



王山鳴教授的研究重點為運用醫學遺傳學、基因組學和生物信息學的方法理解遺傳因素在癌症發生上的作用，以及發展在群體水平預防遺傳突變所致癌症的策略。

Prof Wang San Ming focuses on medical genetics, genomics, and bioinformatics approaches to understand the roles of genetic mutations in the development of cancer, so that his team can develop strategies to prevent cancer caused by genetic mutations.



圖A是青蒿素的化學結構；圖B是青蒿素粉末；圖C是黃花蒿，青蒿素來自於此。

The chemical structure of artemisinin (A), artemisinin powder (B) and Artemisia annua (C), from which artemisinin is isolated.

以青蒿素及其衍生物治療眼科腫瘤

Artemisinin and Its Derivatives in the Treatment of Eye Cancer

文/張愛華 · 圖/編輯部，部分由受訪者提供

English Translation / Ruby Chen · Photo / Editorial Board with some provided by the interviewee

健康科學學院教授鄭文華研究青蒿素多年，發現青蒿素及其衍生物在預防和治療癌症生長和轉移中起到重要作用。

華人科學家屠呦呦稱「青蒿素是中國傳統醫藥獻給世界的一份禮物」。鄭教授在探索青蒿素治病機制上積累了多年經驗，原創性發現青蒿素能對抗氧化應激導致的細胞損傷，有保護神經作用，可能成為中樞神經疾病治療用藥。

在發現青蒿素保護神經作用的研究基礎上，鄭教授的團隊最近聚焦青蒿素及其衍生物用於癌症的防治，尤其是治療罕見眼科腫瘤的作用和機制。他說：「我們已組建了包括惡性眼科腫瘤在內的多種腫瘤的細胞和動物模型，發現青蒿素及其衍生物可以抑制腫瘤細胞的生長和轉移，並延長動物的生存時間。青蒿素衍生物還可殺死一些耐藥腫瘤或延緩腫瘤耐藥性的形成，也能增強動物的抗腫瘤免疫功能。

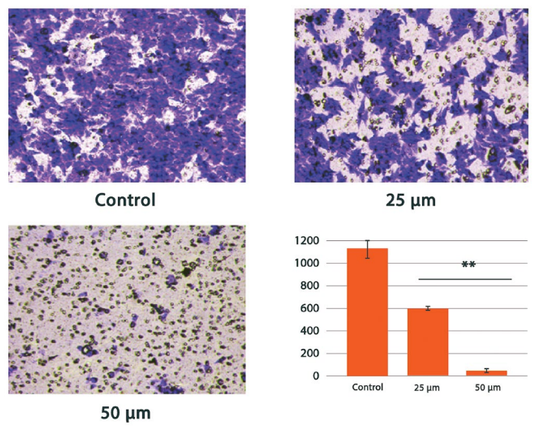
鄭教授表示，以往治療葡萄膜惡性眼科腫瘤的方法是患眼摘除術，但最近已有研究發現患眼摘除術效果存疑或幾乎無效，「病人得了腫瘤，在一兩年以後會發生肝臟轉移而死亡，死亡率特高。因此我們最近在中藥中找到一種有效的成份，並發現它可以抑制腫瘤的生長。」這項新發現目前正處於申請專利的程序中。

Prof Zheng Wenhua in the Faculty of Health Sciences has studied artemisinin for many years. He has found that artemisinin and its derivatives play an important role in preventing and treating cancer growth and metastasis.

The Chinese scientist Tu Youyou said, 'Artemisinin is a gift of traditional Chinese medicine to the world.' Prof Zheng has many years of experience studying the mechanism for using artemisinin to treat disease. He was the first to discover that artemisinin has a neuroprotective effect against cell damage caused by oxidative stress, and may become a therapeutic agent for central nervous system diseases.

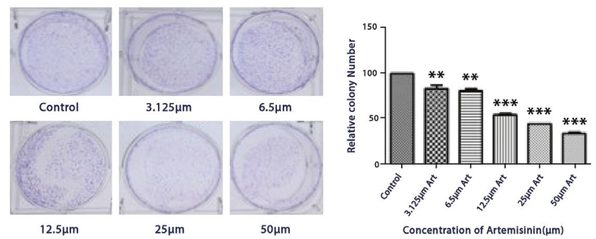
Following the discovery of the neuroprotective effect of artemisinin, Prof Zheng's team is now studying the role and the action mechanisms of artemisinin, and its derivatives, in the prevention and treatment of cancer, especially the relatively rare eye cancer. 'We have established cell and animal models for various tumours, including malignant ophthalmic tumours, and we have found that artemisinin and its derivatives can inhibit the growth and metastasis of tumour cells, and extend the survival time of animals,' says Prof Zheng. He explains that artemisinin derivatives can also kill some drug-resistant tumours, or delay the development of drug resistance. Moreover, artemisinin derivatives have been shown to enhance tumour immunology in animals.

Prof Zheng says that in the past, the main treatment for malignant ophthalmic tumours in the uvea was eye removal surgery, but recent studies have found that the effect of eye removal is doubtful at best, and ineffective at worst. 'The mortality rate of patients with tumours in the uvea is extremely high because the tumours tend to metastasise to the liver after one or two years. We recently found an effective ingredient in Chinese herbal medicine, which can inhibit the growth of tumours,' says Prof Zheng. The team has already applied for a patent for the discovery.



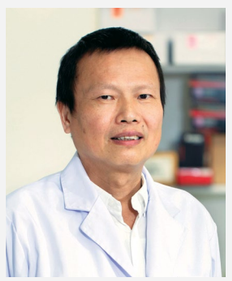
青蒿素濃縮液有效抑制癌細胞的侵襲

Artemisinin concentration effectively inhibits the invasion of cancer cells



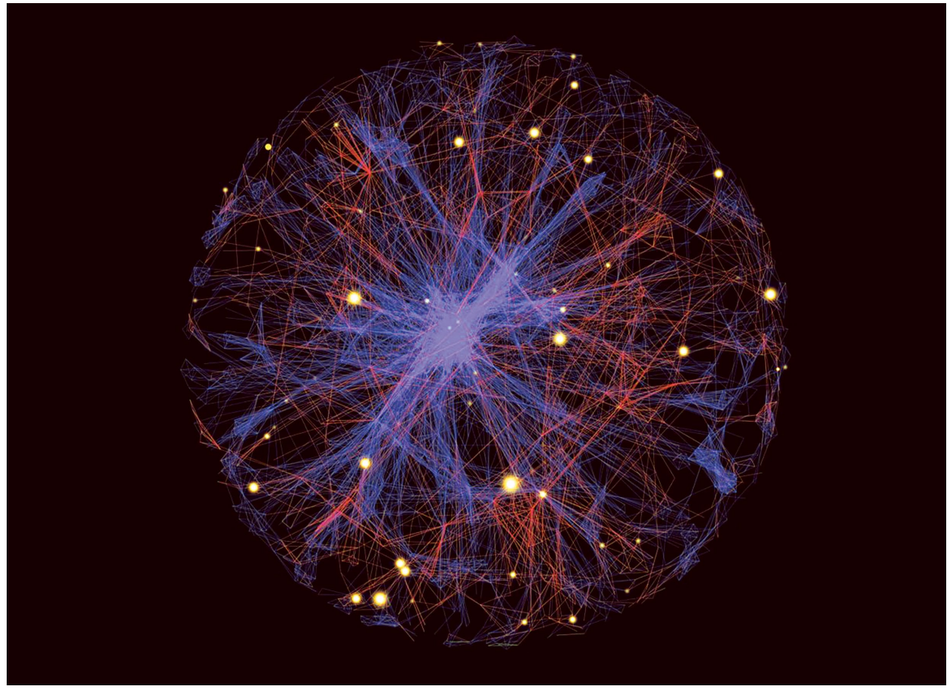
青蒿素濃縮液有效抑制癌細胞的生長

Artemisinin concentration effectively inhibits the growth of cancer cells



鄭文華教授獲中山醫科大學醫學學士學位、加拿大麥基爾大學藥理學博士學位，2006年中山大學「百人計劃」引進回國。2015年加入澳大，研究青蒿素系列化合物神經保護及抑制腫瘤生長、轉移，調節腫瘤免疫等作用及其機制，並對其進行結構改造並篩選更有效的抗腫瘤／神經保護藥物。已發表SCI期刊論文100餘篇，其中一篇獲選為2012年中國最具影響力的國際學術論文。

Prof Zheng Wenhua received a bachelor's degree in medical sciences from Sun Yat-sen University of Medical Sciences and a doctoral degree in pharmacology from McGill University, in Canada. In 2006, he returned to China through Sun Yat-sen University's 100 Talent Programme. He joined UM in 2015, studying the role and action mechanisms of artemisinin compounds in inhibiting tumour growth and metastasis and in enhancing tumour immunology. He restructured and screened the compounds to find more effective anti-tumour/neuroprotective agents. He has published over 100 papers in SCI-indexed journals, one of which was selected as one of China's most influential international academic papers in 2012.



雄激素受體介導的前列腺癌細胞基因表達的遠距離調控

Long-range regulation of gene expression mediated by AR in prostate cancer cells

治療前列腺癌的新機制

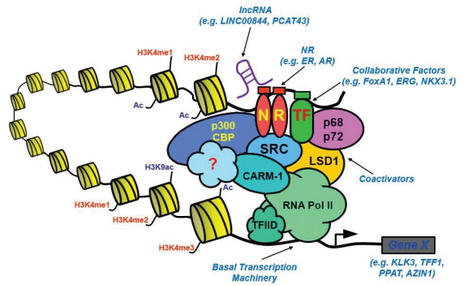
A New Mechanism for Prostate Cancer Treatment

文/盛惠怡 · 圖/編輯部，部分由受訪者提供

Chinese & English Text / Debby Seng · Photo / Editorial Board with some provided by the interviewee

雄激素在前列腺癌細胞的生長中發揮重要作用，但其運作機制仍然充滿未知。健康科學學院張仲榮教授的團隊研究首創性發現雄激素受體如何在基因組的三維結構下調控基因表達，以介導前列腺癌的發展，其發現可望有助治療前列腺癌。

Androgens play an essential role in the growth of prostate cancer cells, but the exact mechanism remains unclear. Prof Edwin Cheung Chong Wing's team, in the Faculty of Health Sciences, was among the first to show how the androgen receptor (AR) regulates gene expression in the 3D structure of genome to mediate the development of prostate cancer. This important finding could potentially help prostate cancer treatment.



核受體調節癌細胞中的轉錄過程

This picture shows how nuclear receptors regulate transcription in cancer cells

在癌細胞中，雄激素與其受體結合，這些受體作為可調節基因表達的DNA結合轉錄因子，能夠「啟動」基因而令前列腺癌細胞生長及分裂。「與正常細胞不同，前列腺癌細胞生長不受控制，因此要瞭解前列腺癌的基因表達如何運作。」

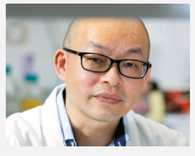
研究人員過去不清楚雄激素受體如何與基因結合，以控制前列腺癌細胞中基因表達。張教授與來自美國、新加坡和內地的研究人員首創性發現，在基因組三維結構下，許多雄激素受體和基因的結合點其實距離前列腺癌的基因很遠，意味著雄激素受體能與遠處的基因發揮相互作用，這發現改變了科學界在這研究領域的認知。「研究人員過去不太清楚lncRNA在前列腺癌細胞的作用。我們這項研究提出，雄激素受體可能會在轉錄過程中將lncRNA募集到靶向基因，因此在基因表達中起著不可或缺的作用。」

張教授表示，目前有很多針對雄激素受體的前列腺癌靶向藥物，但這些藥物未必適合所有患者，尤其是復發患者。他建議只有更加瞭解前列腺癌細胞的基因表達，才有可能為每個患者找到合適治療方法。「因此，我們下一個目標是找出其它與前列腺癌細胞的基因表達有關的因素，從而改善前列腺癌的治療。」

In cancer cells, androgens bind to AR, which acts as DNA-binding transcription factors that regulate gene expression and 'turn on genes' to make prostate cancer cells grow and divide. 'However, unlike in normal cells, cell growth in prostate cancer cells is not properly controlled. So, it is important to understand how gene expression works,' Prof Cheung says.

Prof Cheung has been working with researchers from the United States, Singapore, and mainland China, in order to find out how AR and genes come together to start gene expression in prostate cancer cells. In a recent research paper, they point out that in the 3D structure of genome, many AR binding sites are far from the genes, which means that AR could interact with distant genes. In fact, Prof Cheung's team was among the first to provide strong evidence for this discovery, which has changed the scientific community's understanding of this field of research. 'Besides, the role of long non-coding RNA (lncRNA) in prostate cancer cells was unclear to researchers in the past. Following this research, we suggested that the lncRNA can potentially be recruited by AR to target genes during transcription, thus playing an indispensable role in gene expression,' he says.

While there are existing drugs that treat prostate cancer by targeting AR, they may not be suitable for all patients, especially those with relapsed prostate cancer. Prof Cheung believes that only by better understanding the gene expression of prostate cancer cells will it be possible to find a suitable treatment for every patient. 'Therefore, our next goal is to find out what other factors are involved in the gene expression of prostate cancer cells in order to improve the treatment of prostate cancer,' says Prof Cheung.



張仲榮教授主要研究核內荷爾蒙訊號傳導及其與癌症等疾病的關係。曾在美國康奈爾大學擔任博士後研究員、在新加坡基因組研究所擔任高級研究員。目前是《分子癌症研究》的編輯委員會成員。

Prof Edwin Cheung Chong Wing's study focuses on intracellular hormone signalling and its relationship with cancer and other diseases. He was a postdoctoral research fellow at Cornell University and a senior investigator at the Genome Institute of Singapore. He is a member of the editorial board of *Molecular Cancer Research*.

狄利俊教授團隊的研究一定程度上顛覆了以往醫學界對卵巢癌治療的觀點

To some extent, the finding of Prof Di Lijun's research is distinct from conventional assumptions of ovarian cancer therapy

以激素替代療法與化療法相結合治療卵巢癌

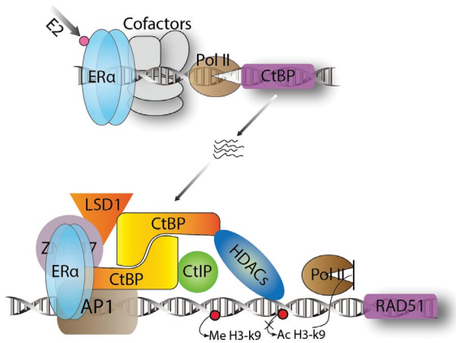
Combining Hormone Replacement Therapy with Chemotherapy for Ovarian Cancer Treatment

文/盛惠怡 · 圖/編輯部，部分由受訪者提供

Chinese & English Text / Debby Seng · Photo / Editorial Board with some provided by the interviewee

健康科學學院副教授狄利俊團隊透過元分析發現，為做過卵巢切除手術的卵巢癌患者補充雌激素（激素替代療法）有助於提升化療效果及減低復發風險，該研究結果一定程度上顛覆了以往醫學界對卵巢癌治療的觀點。

Faculty of Health Sciences Associate Professor Di Lijun and his team have discovered, through meta-analysis, that supplementing estrogen (hormone replacement therapy, or HRT) to ovarian cancer patients with ovariectomy (surgical removal of one or both ovaries) may help improve the effectiveness of chemotherapy and make recurrence less likely. To some extent, this finding is distinct from conventional assumptions of ovarian cancer therapy.



狄利俊教授團隊的研究顯示，激素替代療法有助提升卵巢癌化療的成效。

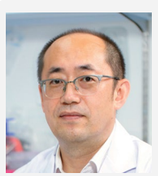
Prof Di Lijun's research shows that hormone replacement therapy may help improve the effectiveness of chemotherapy

女性體內雌激素水平越高，患卵巢癌和乳腺癌的風險就越大。針對雌激素受體（ER）陽性的乳腺癌，雌激素競爭性抑制劑展現了顯著療效，但同類方法用於卵巢癌時療效卻普遍不佳。狄教授的團隊發現，原來卵巢癌細胞內ER的行為模式與其在乳腺癌細胞中的不同，通過和C端結合蛋白（CtBP）組成複合物，ER可以減低卵巢癌細胞DNA損傷後的修復能力。

治療卵巢癌的方法主要是手術切除卵巢及化療。不過，患者失去製造雌激素的卵巢後，可能會出現因雌激素缺失而導致的併發症。醫學界普遍擔心，如果為緩解併發症而給予卵巢癌病人雌激素，會降低治療效果和增加復發風險。「但我們的實驗結果顯示，雌激素能通過ER及CtBP，降低卵巢癌細胞DNA損傷修復的能力，而且化療藥物聯用雌激素對卵巢癌細胞的殺傷力優於化療藥物單獨處理對癌細胞的殺傷力，說明雌激素的補充對於卵巢癌患者的化療可能是有益的。」他補充說，這個結論和臨床上觀察到的部分接受雌激素替代療法的卵巢癌患者其預後較好也是一致的。

Scholars know that the level of estrogen and the risk for ovarian and breast cancer are positively correlated. In clinical practice, the application of estrogen agonist in treating the estrogen receptor-positive breast cancer has achieved remarkable success. (editor's note: the estrogen receptor, or ER, is the factor that mediates the estrogen effect inside the cell.) However, the same method has shown an unsatisfactory effect in treating ovarian cancer which, in most cases, is also ER-positive. Prof Di's team has found that the difference is caused by the distinct behaviour of ER, which forms a complex with the C-terminal binding protein (CtBP) in ovarian cancer cells and inhibits the expression of DNA damage repair (DDR) genes.

Prof Di points out that treating ovarian cancer often involves ovariectomy followed by chemotherapy. However, if the patient's ovaries, which produce estrogen, are removed during surgery, complications may occur due to the lack of estrogen. In clinical practice, supplementing estrogen, or HRT, is not recommended to reduce the symptoms associated with ovariectomy because estrogen might influence the effect of cancer therapy and increase the risk of cancer relapse. Prof Di says: 'Our data show that estrogen is able to reduce the DDR capacity of cancer cells. More importantly, combining estrogen with chemotherapy is a more effective way to kill cancer cells than using chemotherapy alone, suggesting that supplementing estrogen will benefit the chemotherapy of ovarian cancer patients.' He further comments that: 'In fact, the ovarian cancer patients who happened to receive the HRT showed better survival rates according to some of the previous studies, which is consistent with our conclusion.'



狄利俊教授加入澳大前曾於美國國家癌症研究所擔任訪問學者。主要研究基因表達的轉錄調控機制和基因表達調控網絡，通過探索癌症等疾病的異常基因表達，瞭解癌症的機制、發生發展、惡化和轉移等。

Before joining the University of Macau, Prof Di Lijun was a visiting fellow at the National Institutes of Health in the United States. He focuses on the mechanisms of transcriptional regulation of gene expression and gene expression regulatory network. He is also interested in understanding the mechanisms of human diseases such as cancer, by exploring the aberrant gene expression associated with these diseases.

遺傳學理論
在結腸直腸癌治療中的應用

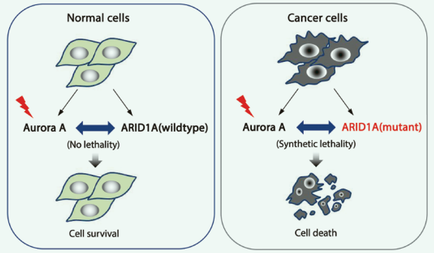
Applying Genetic Theory in Colorectal Cancer Treatment

文/盛惠怡 · 圖/編輯部，部分由受訪者提供

Chinese & English Text / Debby Seng · Photo / Editorial Board with some provided by the interviewee

健康科學學院副教授沈仲燮首創性運用遺傳學理論——「合成致死」，發現結腸直腸癌細胞中的「ARID1A基因」的合成致死搭檔為「Aurora Kinase A蛋白」，並提出後者能作為ARID1A基因突變引起之結腸直腸癌的靶標。這項研究開啟癌症治療的新篇章，更獲權威期刊《自然通訊》刊登。

Faculty of Health Sciences Associate Professor Shim Joong Sup has identified Aurora Kinase A as the synthetic lethal partner of ARID1A in colorectal cancer cells. His team was among the first to apply the genetic theory of 'synthetic lethality' in the treatment of colorectal cancer. The study suggests that Aurora Kinase A is a precision cancer target for the ARID1A mutant colorectal cancer. This research, which has unveiled a new chapter in cancer treatment, has been published in *Nature Communications*.



Exploiting synthetic lethality for cancer-selective theraphy

運用遺傳學理論——「合成致死」治療結腸直腸癌

Applying the genetic theory of 'synthetic lethality' in the treatment of colorectal cancer

ARID1A是一種抑癌基因。沈教授表示，基因突變是結腸直腸癌的成因之一，包括致癌基因突變和抑癌基因突變。對付致癌基因突變的方法，主要是靶向抑制致癌基因生長，但醫護人員遇上抑癌基因突變時，卻難以採取靶向治療，是臨床上一大挑戰。

合成致死是指兩個或以上的搭檔基因同時被抑制導致細胞死亡的現象。由於癌細胞至少有一種基因（抑癌基因）存在缺陷，因此用合成致死的方法對付抑癌基因突變，可以精準命中癌細胞。沈教授說：「我們通過高通量篩選，發現ARID1A基因的合成致死搭檔為Aurora Kinase A蛋白。當ARID1A基因突變，只要抑制Aurora Kinase A蛋白的活動，就能精準殺死癌細胞。」

沈教授團隊的研究在動物測試上取得良好效果，下一步將會研究合成致死的概念如何應用於結腸直腸癌的其它抑癌基因，以及其他癌症的抑癌基因。他們還將致力研發新型Aurora Kinase A抑制劑，治療ARID1A突變引起的結腸直腸癌。

ARID1A is a tumour suppressor gene. According to Prof Shim, one of the causes of colorectal cancer is genetic mutations, including oncogene mutations and tumour suppressor mutations. Current targeted cancer therapies focus primarily on inhibiting tumour oncogene. However, it has been a major clinical challenge to deal with tumour suppressor mutations, as they cannot be targeted by drugs.

Synthetic lethality is a genetic interaction between two (or more) genes where a single gene deficiency is tolerable for cell viability, whereas deficiencies in both genes lead to cell death. As cancer cells have existing deficiencies in at least one gene (tumour suppressor), the synthetic lethality approach for the mutant tumour suppressor enables medical personnel to target cancer cells precisely. Prof Shim says: 'By using high throughput screening approach, we identified Aurora Kinase A as the synthetic lethal partner of ARID1A. When the ARID1A gene mutates, as long as the activity of the Aurora Kinase A is inhibited, the cancer cells can be killed precisely.'

Prof Shim's team has achieved good research results in animal testing. The team's next step is to expand the application of the synthetic lethality concept to other tumour suppressor genes in colorectal and other types of cancer. Prof Shim's team is also committed to developing new Aurora Kinase A inhibitors to treat colorectal cancer cells carrying ARID1A mutations.

沈仲燮教授研究多種抑癌基因，包括p53、PTEN、RB1、BRCA1、ARID1A及SMAD4，致力找出它們的合成致死搭檔。加入澳大前，曾於美國約翰·霍普金斯大學醫學院擔任副研究員。目前是期刊《Molecular Medicine Reports》的編輯委員會成員。

Prof Shim Joong Sup is currently studying a variety of tumour suppressor genes, including p53, PTEN, RB1, BRCA1, ARID1A, and SMAD4. He is committed to identifying their synthetic lethal partners. Before joining UM, he was a research associate at John Hopkins University School of Medicine in the United States. He is currently a member of the editorial board of the journal *Molecular Medicine Reports*.

新型抗體降低肺癌抗藥性

A New Antibody for Reducing Drug Resistance in Lung Cancer

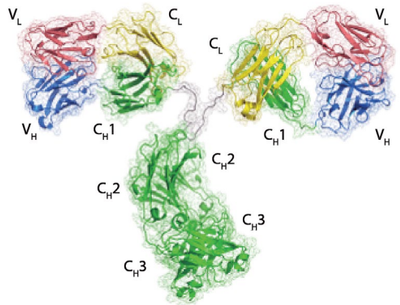
文/葉浩男 · 圖/編輯部，部分由受訪者提供
Chinese & English Text / Davis Ip · Photo / Editorial Board with some provided by the interviewee

健康科學學院副教授郭珩輝的團隊研製出一種抑制性抗體，有助降低非小細胞肺癌的抗藥性，正在為這款新型抗體及其開發申請美國專利。

In the Faculty of Health Sciences (FHS), Associate Professor Henry Kwok Hang Fai's team has developed an antibody to minimise drug resistance in non-small cell lung cancer (NSCLC). They have filed a United States patent application for this novel antibody and its development.

超過80%肺癌是非小細胞肺癌，其成因包括表皮生長因子受體（Epidermal growth factor receptor，簡稱EGFR）突變。這些受體有助傳導關於增生和協調細胞的訊號，突變時會變得過度活躍，發出促進和調控癌細胞生存的訊號。因此，醫生會讓非小細胞肺癌病人服用酪氨酸激酶抑制劑，阻截令癌細胞急速生長的異常訊號，從而治療癌症。

NSCLC accounts for over 80 per cent of all lung cancer cases. One of its causes is mutations of the epidermal growth factor receptor (EGFR), which is important in the cell signalling process for multiplying and regulating cell survival. Certain EGFR tyrosine kinase inhibitors are commonly used to treat NSCLC. These inhibitors aim to block signals from unnaturally active receptors that allow cancer cells to grow rapidly.



抑制性抗體的結構
The structure of the inhibitory antibody

近年不少醫學報告指出，很多非小細胞肺癌使用酪氨酸激酶抑制劑後，不久就會產生抗藥性。雖然轉用新一代藥物有可能消除這個問題，但病人經過幾次療程後，有可能又對新藥產生抗藥性。郭教授說：「這個過程有機會不斷重複，一直轉換藥物往往不利治療。」

為了打破困局，郭教授的團隊開發了抑制性抗體「A9(B8)IgG」，以腫瘤壞死因子——α轉化酶（TACE/ADAM17）作為標靶。郭教授說：「我們的研究顯示，這種抗體與酪氨酸激酶抑制劑結合使用，能夠增強抑制劑的效力，克服EGFR突變引致的抗藥性。」憑著這項發現，郭教授與健康科學學院助理教授謝瑞瑜正在為這款新型抗體及其開發申請一項美國專利，有助他們爭取藥廠和澳門科學技術發展基金支持。

在澳門科學技術發展基金資助下，郭教授的團隊與健康科學學院副教授譚建業正在透過進一步的動物實驗，展開前期臨床研究。他們也準備與澳門鏡湖醫院病理科顧問醫生陳建勇合作，取得本地病人的癌組織和細胞，用來深入研究抗體的效用，並找出最佳的聯合用藥策略。

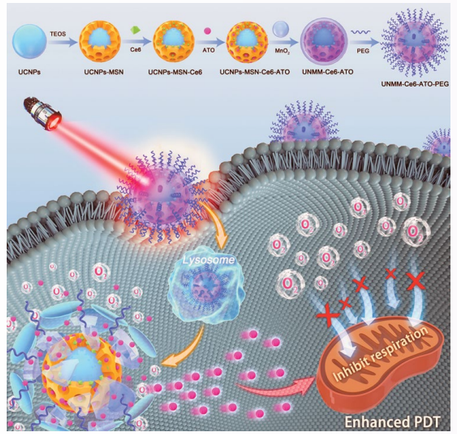
In recent years, many medical reports have shown that many NSCLC patients can develop resistance to EGFR tyrosine kinase inhibitors in a relatively short period of treatment. Although this problem might be mitigated by changing to the next generation of new drug treatment, patients can still develop resistance to the new drug after several rounds of treatment. 'This process can go on and on, and shifting from drug to drug often hampers the treatment,' says Prof Kwok.

To break this cycle, Prof Kwok's team developed a new inhibitory antibody named A9(B8) IgG, which targets Tumour Necrosis Factor-α Converting Enzyme (TACE/ADAM17) . 'Our research suggests that this antibody, when used in combination with EGFR-TKI, can potentiate the anticancer effects of EGFR-TKI and overcome drug resistance due to EGFR mutations.' Prof Kwok and FHS Assistant Professor Xie Ruiyu have filed a US patent application for this antibody and its development, which helped them obtain support from some pharmaceutical companies and the Macao Science and Technology Development Fund (FDCT, in its Portuguese acronym).

With funding support from FDCT, Prof Kwok's team and FHS Associate Professor Tam Kin Yip have been carrying out animal experimentation to conduct pre-clinical trial studies. They are also preparing to cooperate with Consultant Pathologist Dr Chan Kin long at the Kiang Wu Hospital in Macao to obtain cancer tissues and cells from local patients, in order to study the antibody's effectiveness, and to find out the best drug combination strategies.

郭珩輝教授主要研究癌症蛋白生物標記物和天然藥物開發，包括用來治療癌症的抗體和以基於毒液的肽作為藥物的靶向治療。在設於劍橋大學的英國癌症研究院劍橋中心兼任訪問科學家。學術期刊《Biomolecules》和《Toxins》的編輯委員會成員及客座主編，《Frontiers in Molecular Bioscience》副主編。

Prof Henry Kwok Hang Fai's research interests cover cancer biomarkers discovery and natural drug development, including antibody and venom-based peptide targeted therapy for cancer treatment. He also serves as a visiting scientist at the Cancer Research UK Cambridge Institute, University of Cambridge. He is an editorial board member and guest editor of both *Biomolecules* and *Toxins*, and associate editor of *Frontiers in Molecular Biosciences*.



袁振教授團隊研發的光敏劑UNMM-Ce6-ATO-PEG的合成路線和光動力抗癌機制

The synthesis process of the UNMM-Ce6-ATO-PEG photosensitiser, developed by Prof Yuan Zhen's team, and the photodynamic mechanism by which it kills cancer cells.

新型多功能藥物助力腫瘤光動力療法

A Novel Multifunctional Drug for Tumour Photodynamic Therapy

文/葉浩男 · 圖/編輯部，部分由受訪者提供

Chinese & English Text / Davis Ip · Photo / Editorial Board with some provided by the interviewee

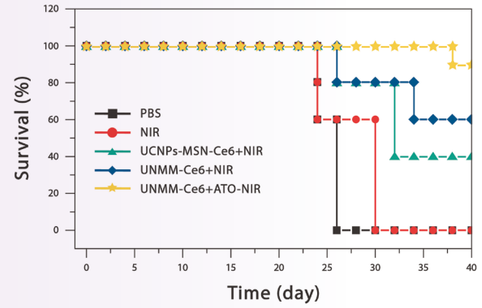
健康科學學院副教授、認知與腦科學研究中心代主任袁振的研究團隊與深圳大學屈軍樂教授的課題組合作，開發了一種新型的多功能光敏劑，有望提升腫瘤診斷和光動力治療的成效。

Two groups of researchers at the University of Macau (UM) and Shenzhen University (SZU) have developed a new multifunctional photosensitiser to make tumour diagnosis and photodynamic therapy (PDT) more effective. The UM group is led by Associate Professor Yuan Zhen in the Faculty of Health Sciences, and the other group is led by Prof Qu Junle at SZU.

光動力療法的三個主要元素是光、氧氣和藥物（光敏劑）。袁教授說，醫療人員通常首先將光敏劑注入癌症患者體內，等待光敏劑在癌細胞中積聚，然後向癌細胞發射特定波長的光線。這些光線可以激活光敏劑，並將本來在腫瘤組織的氧氣轉化為可以殺死癌細胞的活性氧。

袁教授表示，光動力療法的副作用通常比較輕微，但主要限於治療皮膚癌，較難對付其他癌症。他解釋，用來激活光敏劑的紫外光通常穿透力較弱，無法到達深層組織內的腫瘤，而且要精確判斷這些腫瘤的位置和性質也不容易。更大的問題是，腫瘤微環境本身氧氣量很低（醫學界稱為「腫瘤乏氧」）。換言之，即使光敏劑被激活，周圍也沒有足夠的氧氣轉化為活性氧。

PDT involves three components, namely light, oxygen, and light-sensitive drugs called photosensitisers, says Prof Yuan, who is also the interim head of the Centre for Cognitive and Brain Sciences. To perform PDT, medical professionals inject photosensitisers into the patient's body, wait for the drugs to accumulate in the cancer cells, and then shine the light of a particular wavelength onto the treatment areas to activate the photosensitisers to convert oxygen in the tumour tissue. This process generates an active form of oxygen that destroys nearby cancer cells.



多組患癌的實驗鼠分別接受一項不同的治療，當中包括注射UNMM-Ce6-ATO-PEG。圖為這些實驗鼠的生存曲線圖。

Several groups of tumour-bearing mice received different types of treatment, including the injection of UNMM-Ce6-ATO-PEG. This graph shows the mice's survival rates after treatment.

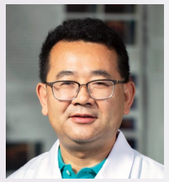
為了克服這些問題，袁教授與其他研究人員開發了一種新藥物，同時用於腫瘤診斷和治療。它能作為多種醫學影像技術的示蹤劑，協助掃描深層組織，找出腫瘤的位置和性質。在腫瘤所在的深層組織，這種藥物同時可以作為光敏劑，在波長為808納米的近紅外光照射下被激活，從而製造氧氣殺滅癌細胞。此外，這種藥物還能在腫瘤微環境釋放一種抑制劑，減低癌細胞呼吸作用的頻率和耗氧量，提高光動力療法的成效。

相關論文已獲知名期刊《生物材料》刊登。袁教授表示，這項研究的潛在臨床應用價值相當高，因此計劃申請專利，同時將與其他大學合作開展臨床測試，進一步瞭解這種藥物的特性。

The side effects of PDT are usually mild. It is mainly used to treat skin cancer. But in order to use it to treat other types of cancer, there are a few technical challenges that need to be overcome. First, the ultraviolet (UV) light commonly used in PDT cannot penetrate the superficial layers of skin to reach deeper tissues and tumours. Second, it is difficult to determine the exact location and characteristics of tumours in deeper tissues. Third, the tumour microenvironment has low oxygen levels, a condition known as 'hypoxia'. Therefore, even when photosensitisers are activated by light in deeper tissues, there might not be enough oxygen for the drugs to work with.

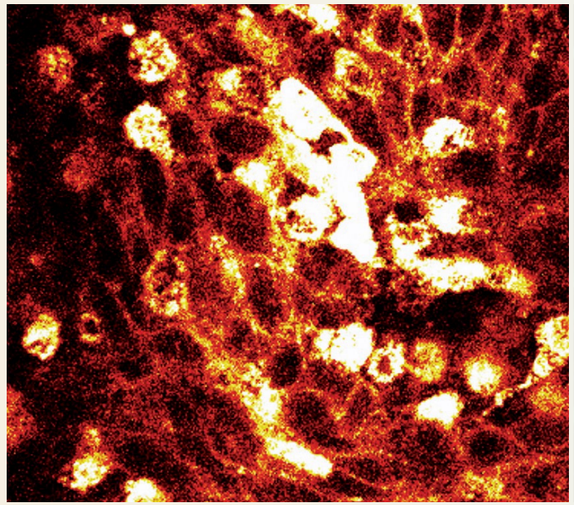
To tackle these problems, Prof Yuan's team developed a drug for the diagnosis of and treatment for tumours. Radiographers can use this drug as a tracer in several types of medical imaging scans to generate a clear picture of tumours in deeper tissues. Furthermore, this drug can be activated under the irradiation of 808 nm near-infrared light to produce more reactive oxygen species, which can kill cancer cells. More innovatively, this drug can also release an inhibitor to reduce the frequency of respiration of cancerous cells and their oxygen consumption. By making more oxygen available in the tumour microenvironment, this drug can increase the effectiveness of PDT.

A research paper on this drug has been published by *Biomaterials*, a leading academic journal in the field. Given the photosensitiser's enormous clinical potential, Prof Yuan's team plans to apply for a patent and to work with experts at other universities for further clinical tests.

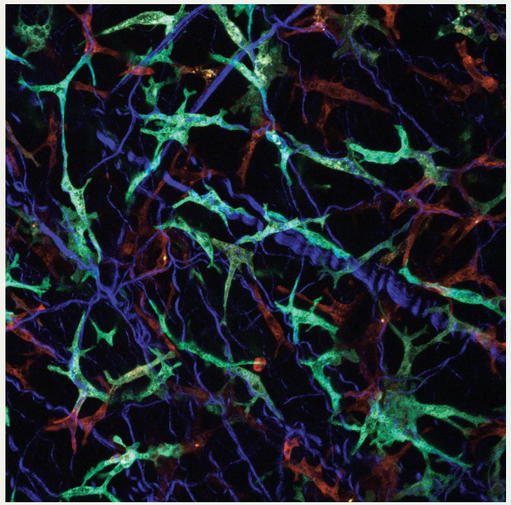


袁振教授主要從事生物醫學光子學、神經科學和腦功能成像、光學分子影像和癌症方面的研究，至今發表超過200篇SCI期刊論文。目前是《Quantitative Imaging in Medicine and Surgery》的編輯委員會成員，以及《BMC Medical Imaging》和《Frontiers in Human Neuroscience》的副主編。

Prof Yuan Zhen's research interests include biomedical photonics, neurosciences, neuroimaging, and cancer research. He has published over 200 articles in SCI-indexed journals. He is an associate editor of both *BMC Medical Imaging* and *Frontiers in Human Neuroscience*, as well as a member of the editorial board of *Quantitative Imaging in Medicine and Surgery*.



黑色素瘤的螢光影像
A fluorescence image of melanoma



巨噬細胞的螢光影像
A fluorescent image of macrophages

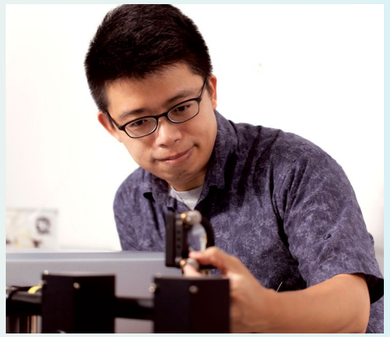
以多光子活體顯微術探究黑色素瘤血管新生動態

Investigating the Dynamics of Melanoma Angiogenesis with Multiphoton *in vivo* Microscopy

文/張愛華 · 圖/編輯部，部分由受訪者提供
English Translation / Ruby Chen · Photo / Editorial Board with some provided by the interviewee

健康科學學院副教授劉子銘與團隊正以多光子活體顯微術研究黑色素瘤血管新生的動態，目標是瞭解腫瘤幹細胞的新生血管通透性，並作為納米藥物尺寸設計的指引。

A research team in the Faculty of Health Sciences, led by Associate Professor Liu Tzu-Ming, is currently using multiphoton *in vivo* microscopy to study the dynamics of melanoma angiogenesis. The study aims to understand the neovascular permeability of tumour stem cells and provide guidance for producing nanomedicine of suitable sizes.



劉子銘教授通過多光子顯微系統平台觀察腫瘤的微環境
Prof Liu Tzu-Ming observes the microenvironment of tumours through a multiphoton microscopy system platform

黑色素瘤是抗藥性非常強的癌症，一般化療對它基本無效，因此黑色素瘤往往要做標靶治療。劉教授說：「納米藥物尺寸設計可以把癌症藥物用膠囊包裹起來，像是裝有雷達的車子，可自動找到腫瘤的位置，然後把藥打進去。」他們的研究已經確認腫瘤幹細胞的膠原纖維與血管微環境，納米藥物尺寸的設計範圍是10至20納米。

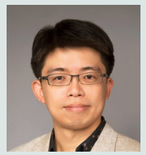
劉教授指癌症就像種子，人的身體就是土壤，不同種子在不同土壤會長出不同特性的癌症，也會改造組織環境，建構出不一樣的腫瘤微環境（居住棲地），「腫瘤為了生存，有時會把環境的某些結構改變，以適合它擴張。藉由研究癌症如何改造環境的洞察，對於藥物設計與研發可以有啟示作用。」

劉教授的實驗室目前有兩大研究方向，一是通過多光子顯微系統平台來觀察腫瘤的微環境，尤其關注癌細胞和巨噬細胞之間的關係，從而發現腫瘤的病理，協助設計標靶藥物，提升癌症的精準治療。其次是研發一項新的血液螢光技術，有如天氣預報般對嚴重疾病作早期診斷。

Melanoma is a type of cancer with high drug resistance and cannot be treated with general chemotherapy. Therefore, targeted therapy is usually mandatory in treating melanoma patients. 'Nanomedicine allows cancer drugs to be contained inside a capsule. Like a car equipped with radar, the capsule is able to locate the tumour automatically and inject the drugs,' says Prof Liu. The study has identified the collagen fibre and the vascular microenvironment of tumour stem cells, and has specified the measurement of nanomedicine at between 10 to 20 nm.

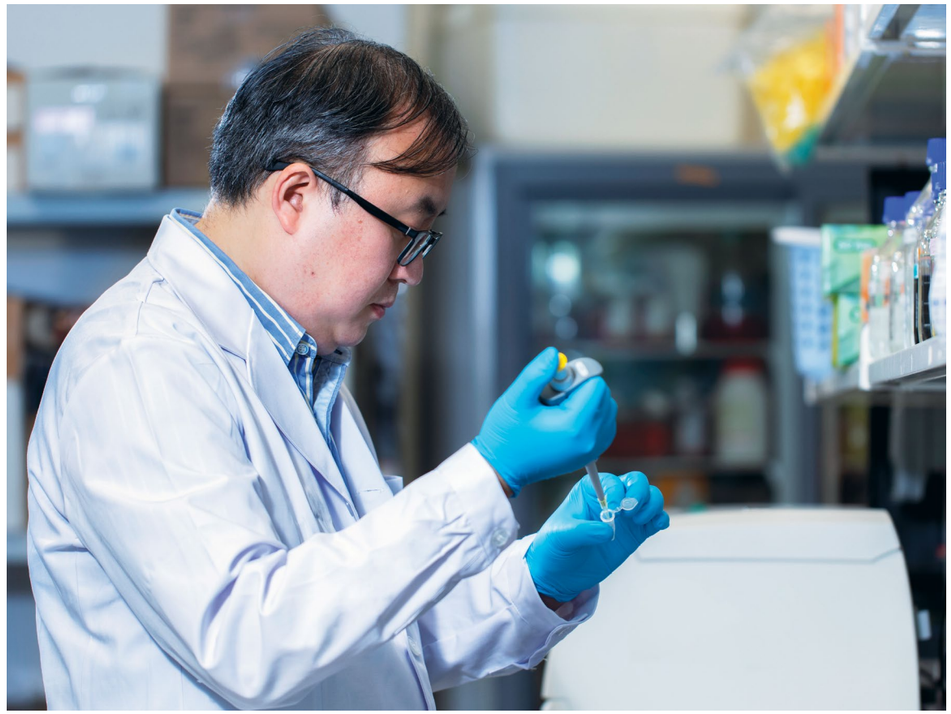
According to Prof Liu, cancer growth is in a sense analogous to germination. Seeds placed in different soil conditions will grow into plants of different shapes and change their surroundings. Cancer cells in different human bodies can also develop distinctive characteristics and shape the tissue environment around them into their own tumour microenvironment (or habitat). 'In order to survive, cancer sometimes changes the structure of its environment to suit its expansion,' says Prof Liu. 'Investigations into how cancer transforms its environment can have implications for drug design and development.'

Prof Liu's laboratory currently has two main research directions. One is to observe the microenvironment of tumours through the multiphoton microscopy system platform while paying special attention to the relationship between cancer cells and macrophages, in order to discover the pathology of tumours and assist drug design personnel in designing targeted drugs that can improve precision cancer medicine. The other direction is to develop a new blood fluorescence technology that can make early diagnosis of severe diseases, much like the weather forecast provides early warnings of bad weather.



劉子銘教授於台灣大學光電工程學研究所博士學位畢業，研究光電醫學多年。目前研究聚焦生命科學，使用超快鐳射技術，探索納米光子學研究癌症生物學，以及創造光的新診斷和治療用途。

A PhD graduate of Taiwan University's Graduate Institute of Photonics and Optoelectronics, Prof Liu Tzu-Ming has studied biomedical optics for many years. His current research interests include life sciences, ultrafast laser technology, using nanophotonics to study cancer biology, and creating new diagnostic and therapeutic uses of light.



納米技術抑制卵巢癌轉移

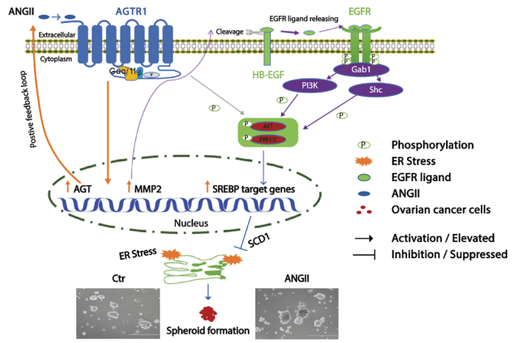
Nanotechnology for Regulating Ovarian Cancer Metastasis

文/盛惠怡 · 圖/編輯部，部分由受訪者提供

Chinese & English Text / Debby Seng · Photo / Editorial Board with some provided by the interviewee

健康科學學院助理教授李子安研究發現，卵巢癌細胞的生長及轉移原來與一種荷爾蒙（血管緊張素II）密切相關。基於這項發現，他的團隊正研究利用納米技術抑制卵巢癌細胞擴散，帶來新的治療方向。

Leo Lee Tsz On, an assistant professor in the Faculty of Health Sciences, has discovered close links between the growth and metastasis of ovarian cancer cells and a hormone known as angiotensin II. His team is now exploring the use of nanotechnology to suppress ovarian cancer metastasis, suggesting a new direction for therapy.



血管緊張素II及其受體對增強卵巢癌多細胞球囊形成、生長和轉移的分子機制

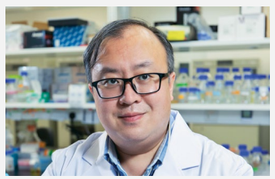
The molecular mechanism by which angiotensin II and its receptors enhances the formation, growth, and metastasis of multicellular spheroids of ovarian cancer

卵巢癌的擴散方式之一，是癌細胞從卵巢脫落，形成具抗藥性的球狀體並擴散到其它器官。李教授指出，這些球狀體的形成與血管緊張素II大有關係。在正常情況下，血管緊張素II會在血管內調控血壓，較少在卵巢出現，但李教授發現卵巢癌細胞會自行產生這種激素。他說：「通過固醇調節元件結合蛋白途徑，血管緊張素II的受體會促進不飽和脂肪酸的含量來減少細胞壞死，令癌細胞更容易轉移。」

有見及此，李教授的團隊合成了一種小分子干擾核糖核酸（siRNA），用來抑制血管緊張素II的受體運作，減少卵巢癌擴散。但這種siRNA容易在體內被分解，而且無法穿透細胞膜進入癌細胞。他的團隊於是研究運用納米材料「樹枝狀聚合物」將siRNA包住，協助進入卵巢癌細胞，阻止血管緊張素II受體的運作。他指這項研究已經進入動物測試階段，有望使卵巢癌治療效果更為顯著。

Some ovarian cancer cells detach from the ovary. After that, they reproduce and form drug-resistant multicellular spheroids, which then spread and implant to other organs. According to Prof Lee, the formation of these spheroids is closely related to angiotensin II. This hormone normally regulates blood pressure in the blood vessels and is not commonly observed in the ovary. However, he found that ovarian cancer cells are able to produce angiotensin II. 'Through the sterol regulatory element-binding protein pathway, receptors of angiotensin II increase the production of unsaturated fatty acids, which help reduce cellular necrosis and promote cancer cells' metastasis,' says Prof Lee.

In light of this discovery, his team created a type of small interfering RNA (siRNA) to block the operation of the receptors of angiotensin II, in order to reduce ovarian cancer cells. However, this siRNA, likely to be broken down in blood, cannot penetrate the membranes of cancer cells. Prof Lee's team is working to develop a technique to wrap siRNA with a type of nanomaterial known as 'dendrimer'. This material could help to deliver the siRNA to the tumour and enables the siRNA to enter the ovarian cancer cell and to suppress the receptors of angiotensin II. Meanwhile, his team has started animal testing, which is an important step towards more effective ovarian cancer treatment.



李子安教授主要研究G蛋白偶聯受體（GPCR）信號對女性生殖系統功能及GPCR對卵巢癌的發展及擴散中的作用，已發表SCI期刊論文45篇。

Prof Leo Lee Tsz On focuses on the role of GPCR signalling in the female reproductive system, as well as its impact on the development and spread of ovarian cancer. He has published 45 papers in SCI-indexed journals.

可助提升癌症診療成效的納米粒子
The nanoparticles show great potential for more effective cancer diagnosis and treatment

納米粒子運載藥物高溫摧毀癌細胞

Nanoparticles Carry Drugs and Turn the Heat on Cancer Cells

文/葉浩男 · 圖/編輯部，部分由受訪者提供
Chinese & English Text / Davis Ip · Photo / Editorial Board with some provided by the interviewee

健康科學學院助理教授代雲路的團隊開發出一種嶄新的納米粒子，能夠運載癌症藥物、產生高溫破壞癌細胞，以及協助檢測腫瘤，可望提升癌症診斷和治療的成效。

Faculty of Health Science Assistant Professor Dai Yunlu's team has developed nanoparticles that can carry drugs, turn the heat on cancer cells, and even help detect tumours. This shows great promise for more effective cancer diagnosis and treatment.

這些粒子直徑約50納米，大概是頭髮闊度的1,600至2,000分之一。代教授說：「癌症藥物經注射進入血液循環後，部分會到達癌細胞，有些卻會損害健康細胞。研究團隊開發的納米粒子可以將藥物包裹，被注射到體內後到達腫瘤位置，受到近紅外線照射時才釋放藥物。」他解釋，由於腫瘤的酸鹼值低於正常細胞，因此研究團隊將粒子設計成只在特定的酸鹼值下才改變結構，從而控制藥物釋放的位置。

The diameter of each nanoparticle is 50 nm, around 1,600 to 2,000 times smaller than the width of a human hair. Prof Dai says that after entering systemic circulation, cancer drugs can cause damage not only to cancerous cells, but also to healthy ones. To mitigate this problem, he developed nanoparticles that can encapsulate drugs and carry them to the tumours, where the drugs are released under near-infrared (NIR) light. 'We control the location of drug release partly by exploiting the fact that the pH value of tumours is lower than that of normal cells. So we designed the nanoparticles in such a way as to change their structure only at a certain pH value,' he says.

代教授表示，這些粒子可以同步用於光熱治療。它們受近紅外線照射後會產生熱能，以高溫摧毀癌細胞。此外，當利用多種成像技術生成腫瘤影像（多模態成像）時，這些粒子可以作為高效的示蹤劑，有助病情診斷。

According to Prof Dai, the nanoparticles may be used concurrently for photothermal therapy. Under NIR irradiation, the tiny particles generate heat and destroy cancer cells with a high temperature. In addition, the particles may improve cancer diagnosis as an ideal contrast agent for multimodal imaging, the simultaneous use of more than one medical imaging technique.

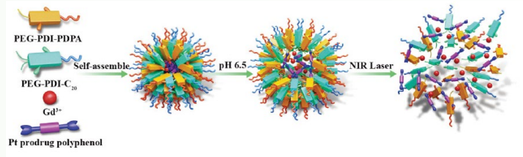
在實驗室內，代教授的團隊運用這種納米粒子，結合光熱療法和化療藥物Cisplatin治療患癌的小鼠，同時進行多模態成像。結果顯示，小鼠被特定波長範圍的近紅外線照射後，牠們的腫瘤大大縮小，個別情況下更完全消失，存活率也高於同時接受治療、但沒有使用納米粒子的同類。

In his experiments, Prof Dai treated tumour-bearing mice with a combination of photothermal therapy and chemotherapy using the cancer drug Cisplatin, apart from multimodal imaging. Following irradiations of NIR light within a particular wavelength range, the mice's tumours were significantly eradicated and, in some cases, completely disappeared. The mice's overall survival rate is higher than the survival rate of their peers treated without nanoparticles.

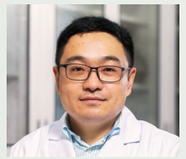
有關論文已在學術期刊《Nanoscale Horizons》登載，獲選為該刊2019年最受歡迎的文章之一。目前，代教授的團隊正繼續研究這種納米粒子如何有助醫生同時使用多種療法（聯合治療）。他說：「在癌症治療上，一加一可以大於二，這正是我們努力的方向。」

The study was published in the academic journal *Nanoscale Horizons,* and was selected as one of the journal's most popular articles in 2019. Meanwhile, Prof Dai's team continues to study the application of the nanoparticles to combination therapy, the coordinated use of two or more therapeutic agents. 'In cancer treatment, one plus one can be greater than two, and we're striving to do just that,' Prof Dai says.

代雲路教授團隊
Prof Dai Yunlu's research team



納米粒子在特定的酸鹼值下和受近紅外線照射時改變結構
The nanoparticles change their structure at a certain pH value and under near-infrared light



代雲路教授從事功能性納米材料設計及開發，應用於基因遞送、抗癌藥物靶向遞送、免疫治療，以及結合生物成像技術進行的腫瘤診斷與治療。

Prof Dai Yunlu develops and designs functional nanomaterials for gene delivery, anticancer drug deliver, immunotherapy, and biological imaging-guided tumour diagnosis and treatment.

野黃芩苷是常見中藥材半枝蓮、燈盞花和黃芩的活性成分，可能有助免疫系統對抗癌症。圖為半枝蓮。

Scutellarin is an active ingredient in some plants used in traditional Chinese medicine, including Scutellaria barbata (as shown in the picture), Erigeron breviscapus, and Scutellaria baicalensis. This natural product could help our immune system to attack cancer cells.

結合中藥天然化合物提升癌症免疫治療效果

Chinese Herbal Products Could Help Immune System Fights Tumours

文/葉浩男 · 圖/編輯部
Chinese & English Text / Davis Ip · Photo / Editorial Board

中華醫藥研究院教授陳新的研究團隊發現，一些來源於中藥的天然化合物可能有助促進身體抗腫瘤的免疫反應。

A team led by Chen Xin, professor in the Institute of Chinese Medical Sciences, has identified some naturally occurring compounds from traditional Chinese medicine that may boost anticancer immune responses.

「免疫療法」是一類通過激活免疫系統來治療癌症的方法。因其療效顯著，毒副作用少，癌症復發機會低，腫瘤免疫療法的研究獲國際學術界的普遍關注。但運用免疫療法並不簡單，因為部分免疫細胞會與腫瘤狼狽為奸，阻止其它免疫細胞攻擊癌細胞，調節性T淋巴細胞（Treg細胞）正是這些「叛徒」之一。

Immunotherapy refers to the treatment of diseases, including cancer, by activating the immune system. This approach is often effective, with mild toxic or adverse effects, and makes relapses unlikely, thus attracting attention from researchers around the world. However, immunotherapy is not as simple as it sounds because some immune cells come to the aid of tumours rather than fight them. Among such 'traitors' are Regulatory T lymphocytes (Treg cells), which suppress other immune cells from attacking cancer cells.

陳教授發現腫瘤壞死因子及其二型受體（TNFR2）結合時會令Treg細胞激活和增殖，間接促進腫瘤生長。他還提出，如果阻斷TNFR2的信號傳遞，就能大大降低Treg細胞的數量和功能，從而有助提高免疫系統對抗癌症的能力。陳教授這一原創性發現近年已獲世界各地研究人員的驗證和支持。

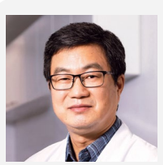
Prof Chen was the first to report that the interaction between the tumour necrosis factor (TNF) and its type-2 receptor (TNFR2) could activate and expand Treg cells to support the growth of tumours. According to Prof Chen, the blockade of the signalling of TNFR2 has emerged as a new strategy to eliminate Treg cells and consequently enhance immune responses against cancer. In recent years, researchers around the world have substantiated his pioneering findings.

歐美一些研究者和製藥公司已經在研製多種抗體藥物，期待通過靶向TNFR2而達到治療腫瘤的目的。陳教授團隊另闢蹊徑，研究中藥和其它天然產物中所含有的TNFR2抑制劑，希望以更便宜、副作用更少的天然小分子化合物取代TNFR2抗體藥物的作用。陳教授團隊也篩選了一批中藥複方，從中發現一種名為野黃芩苷的化合物在體外均有抑制TNFR2的活性，並在小鼠腫瘤模型中，觀察到該化合物通過提高抗腫瘤免疫反應而抑制腫瘤生長。有關野黃芩苷在這方面的應用已經申請了中國和美國專利。

Researchers and pharmaceutical companies in Europe and the United States have tried to develop a variety of TNFR2 antibodies to treat tumours by targeting TNFR2. But Prof Chen's team is taking a different approach, hoping to replace TNFR2 antibodies with natural small-molecule compounds that are more affordable and have fewer bothersome side effects. They are studying TNFR2 inhibitors from traditional Chinese medicinal herbs and other natural products. After screening a large number of Chinese herbs, his team has identified a promising compound known as 'scutellarin'. This compound possesses *in vitro* and *in vivo* activity in inhibition of TNFR2 biological function and boosts the anti-tumour immune responses to suppress tumour growth, as shown in mouse tumour model studies. Following this discovery, Prof Chen and his fellow researchers have filed patent applications in China and the US for the related uses of scutellarin.

2020年初，陳教授開始與中國科學院昆明植物研究所的研究人員合作，繼續有關研究。陳教授說：「我們將合作研究結構多樣性天然化合物庫，期望發現更有效的TNFR2調節劑，從而提高癌症免疫治療的效果。」

To advance this study, Prof Chen started collaborating with researchers at the Kunming Institute of Botany, under the Chinese Academy of Sciences, in early 2020. 'Together, we will study a library of structurally diversified natural compounds, in an attempt to identify more effective TNFR2 regulators for better cancer immunotherapy,' he says.



陳新教授是中醫藥和免疫學專家，其家族九代從事中醫，研究遍及免疫藥理學、免疫生物學和轉化醫學。加入澳大前於美國國家腫瘤研究所任職十多年。

Prof Chen Xin is an immunologist and Chinese medical doctor whose family has practised Chinese medicine for nine generations. His research focuses on immunopharmacology, immunobiology, and translational medicine. Before joining UM, he worked for over a decade at the National Cancer Institute in the United States.

中藥誘導癌細胞程序性壞死

Inducing Necroptosis of Cancer Cells with Chinese Medicine

文/余偉業 · 圖/編輯部，部分由受訪者提供
English Translation / Ruby Chen · Photo / Editorial Board with some provided by the interviewee

中華醫藥研究院副教授陳修平及其團隊研究基於非凋亡的程序性壞死（Necroptosis）的中藥抗癌新策略。

Chen Xiuping, associate professor in the Institute of Chinese Medical Sciences, along with his research team, is working to develop new strategies for treating cancer with Chinese medicine based on non-apoptotic 'programmed necrosis' of cancer cells (otherwise known as 'necroptosis', which means genetically controlled cell death).

陳教授用「人生自古誰無死」形容細胞如人。他解釋，細胞死亡有程序性和非程序性兩種，程序性是指細胞受特定基因、蛋白控制的死亡方式，如「凋亡」（Apoptosis），類似人之自然死亡；非程序性則是細胞處於極端環境的突然死亡，如人之意外死亡。程序性壞死是一種非凋亡的程序性死亡方式。細胞發生這種死亡時會啟動RIP1、RIP3和MLKL蛋白，MLKL蛋白在細胞膜上形成小孔，導致細胞內外滲透壓改變，導致細胞死亡。他進一步比喻道：「這時細胞發生腫脹，嚴重時就像氣球般脹起來，最終脹破死亡。同凋亡一樣，程序性壞死也可直接殺傷癌細胞。」

Prof Chen says there are two forms of cell death: programmed and non-programmed. 'Programmed cell death' refers to cell death controlled by specific genes and proteins, such as apoptosis, which is analogous to the natural death of a person. 'Unprogrammed cell death' refers to the sudden death of cells in an extreme environment, which is similar to the accidental death of a person. Necroptosis is a non-apoptotic method of programmed death. When this form of cell death occurs, it activates RIP1, RIP3, and MLKL proteins. MLKL proteins form small pores in the cell membrane, resulting in changes in osmotic pressure inside and outside the cell, which in turn causes cell death. He explains: 'The cells "swell" like balloons, and when the swelling reaches a certain point, the cells burst and die. Like apoptosis, necroptosis can also directly kill cancer cells.'

陳修平教授發現中藥虎杖具有誘導程序性壞死的成分

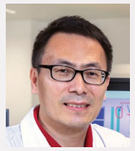
Prof Chen Xiuping has identified several ingredients in Reynoutria japonica that can induce necroptosis

陳教授表示，多年來中藥抗癌基礎研究集中於誘導凋亡。但與臨床應用的西藥相比，中藥誘導凋亡的藥效比較低。尤其是，癌細胞很「狡猾」，多次用藥後就耐藥了，亦即凋亡對它無可奈何了。這時候誘導程序性壞死，就可以殺傷這些凋亡耐受的癌細胞。因此，為了凸顯中藥的特色和優勢，課題組集中尋找和鑒定能誘導程序性壞死的中藥成分。「經數年研究，發現來自虎杖、丹參等中藥具有數個這樣的成分。」

陳教授指出，雖然尚處於基礎研究階段，藉程序性壞死抗癌的策略已於動物模型上證實。鑒於臨床抗腫瘤藥物凋亡耐受現象日益常見以及中藥誘導凋亡的低藥效，「這或將是未來中藥抗癌的一個頗具潛力和前瞻性的研究方向。」

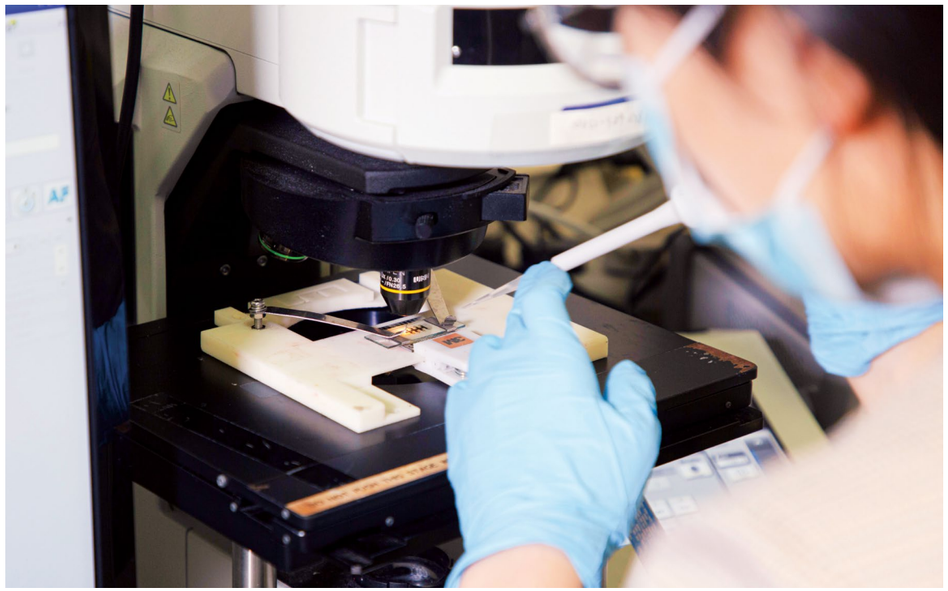
When asked why he decided to study necroptosis induced by Chinese medicine, Prof Chen says that for years, basic research on traditional Chinese medicine in cancer treatment has focused on the induction of apoptosis. However, compared with clinically applied Western medicine, the efficacy of Chinese medicine in inducing apoptosis is relatively low. One of the reasons for this outcome is that cancer cells are 'cunning' - they become resistant to drugs over time, and when that happens, apoptosis is not effective any more. This is where necroptosis comes in. Necroptosis can kill cancer cells that are resistant to apoptosis. Therefore, Prof Chen and his team are studying the characteristics and advantages of Chinese medicines, in an effort to find Chinese medicine ingredients that can induce necroptosis. 'After several years of hard work, we have identified several ingredients in traditional Chinese medicine such as Reynoutria japonica and Salvia miltiorrhiza that can induce necroptosis,' says Prof Chen.

Although the team is still at the basic research stage, Prof Chen says that the efficacy of this strategy of inducing necroptosis of cancer cells has already been confirmed in animal testing. He says, 'In view of the increasingly common resistance to cancer drugs and the low efficacy of Chinese medicine-induced apoptosis, this may be a promising research direction for treating cancer with traditional Chinese medicine.'



陳修平教授從事藥理學研究近20年，發表SCI期刊論文150餘篇，申請專利6項。曾主持多個國家和澳門的科研項目，亦曾獲兩屆澳門科學技術獎自然科學獎。

Prof Chen Xiuping has studied pharmacology for nearly two decades. He has published more than 150 papers in SCI-indexed journals, and has applied for six patents. He has headed scientific research projects in mainland China and Macao. He is a two-time recipient of the Macao Science and Technology Award in the 'Natural Science Award' category.



數位微流控系統助篩選藥物
The DMF system facilitates drug screening

數位微流控技術助篩選腫瘤藥物

Digital Microfluidics for Cancer Drug Screening

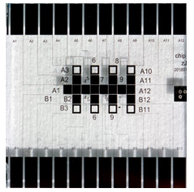
文/葉浩男 · 圖/編輯部，部分由受訪者提供
Chinese & English Text / Davis Ip · Photo / Editorial Board with some provided by the interviewees

微電子研究院、模擬與混合信號超大規模集成電路國家重點實驗室助理教授賈豔偉和博士後研究員翟蛟等組成的團隊研發了一款嶄新的數位微流控系統，協助醫療人員培養單細胞和選擇腫瘤藥物。

At the Institute of Microelectronics and the State Key Laboratory of Analog and Mixed-Signal VLSI, Assistant Professor Jia Yanwei and Postdoctoral Researcher Zhai Jiao have created a digital microfluidic (DMF) system to help doctors choose cancer drugs.

很多科研和臨床治療都牽涉細胞培養。例如，醫療人員會從癌症病人身上抽取癌細胞和正常細胞，混合不同種類和濃度的藥物，放到培養皿或多孔盤觀察。

Cell culture is a technique widely used for research and medical purposes. A typical example involves testing the impact of different types and concentrations of drugs on cancers cells and normal cells, usually in Petri dishes and well plates. However, these culture plates do not allow researchers to observe the differences among individual single cells as they tend to aggregate. To tackle this problem, UM researchers engineered 3D microstructures on a DMF chip for single-cell cultures. The microstructure forms nearly 1,000 semi-closed square micro-wells, each of which has a length of 20 μm - just the right size for a single cell.



澳大研究員開發的數位微流控芯片
The DMF chip developed by UM researchers

不過，單細胞在這些器皿內會聚合起來，令人難以觀察它們各自的變化。針對這一難題，澳大研究人員在數位微流控芯片內設計許多三維微結構，分別形成近千個半封閉式微孔，每個微孔邊長20微米，剛好足以容納一個細胞。

相關論文已在《自然》旗下權威期刊《Microsystems & Nanoengineering》刊登。賈教授表示：「這些半封閉式的微孔能讓在同一個液滴內的單細胞保持通訊，有助準確反映藥物對於群體細胞的作用。同時，這些半開放的微孔可以使液滴界面形成一個個凹面，在整個培養過程中維持單細胞狀態。」

比起一般的培養器皿，澳大開發的系統體積較小，所需的藥物和細胞量可以減少上百倍，大大減低成本。翟博士說：「要測試一個藥物濃度的反應，用96孔盤大概需要100微升試劑量，而我們的數位微流控系統只需要一微升甚至更少。」

目前，研究人員仍在改良系統，期望讓醫生和研究人員將腫瘤細胞和藥物分別加入到芯片，用電腦在芯片內混合細胞與藥物，進一步把整個過程自動化。

In many ways, the DMF system is a marked advancement from conventional culture plates: It is much smaller and requires 100 times lower volume of drugs and cells, thus sharply decreasing the cost of drug screening. ‘Using a 96-well plate takes 100 μl reagent to test one drug concentration, but our DMF needs only one μl or less,’ Dr Zhai says.

The researchers are still working toward further automation of single-cell culture. With consistent improvement, the DMF system will hopefully allow doctors and researchers to add tumour cells and drugs to the chip separately, and remotely control their on-chip combination.

賈艷偉教授從新加坡國立大學獲博士學位，後曾於美國布蘭迪斯大學從事博士後研究。目前主力研究用於疾病診斷和精準醫療的數位微流控技術。賈教授在第九屆光流體交叉學科國際研討會上獲頒創新獎。

Prof Jia Yanwei obtained her PhD degree from the National University of Singapore and received her postdoctoral training at Brandeis University in the United States. She leads a group to work on digital microfluidics for disease diagnostics and precision medicine. She won an Innovation Award at the Ninth International Multidisciplinary Conference on Optofluidics.

翟蛟博士從中國科學院大學獲生物無機化學博士學位，研究生物學分析和腫瘤治療。在澳大進行博士後研究期間聚焦數位微流控藥物篩查技術。

Dr Zhai Jiao obtained her PhD degree in bioinorganic chemistry from the University of Chinese Academy of Science. Her PhD research mainly focused on biological analysis and tumour therapy. She later worked as a postdoctoral fellow at UM to study drug screening on digital microfluidics.

高研院打造人文社科研究平台

IAS Creates a Research Platform for Humanities and Social Sciences

文/張愛華・圖/編輯部
English Translation / Ruby Chen & Davis Ip・Photo / Editorial Board

為促進人文社科研究、推廣人文社科和科技的結合，澳門大學成立人文社科高等研究院（簡稱高研院），致力打造跨越學院疆界的校級研究平台，建設澳大跨學科國際水平研究團隊，實現學術資源協同效應的戰略佈局。

The University of Macau (UM) has established the Institute of Advanced Studies in Humanities and Social Sciences (IAS) to promote research in the humanities and social sciences, and their collaboration with technology. Essentially, IAS aims to create a university-level, cross-faculty research platform, build world-class interdisciplinary research teams, and form a strategic synergistic structure to drive the sharing of academic resources.

打造跨越學院疆界的校級研究平台

高研院是澳大學術單位之一，2019年底成立，由澳大副校長蘇基朗教授兼任代院長。蘇教授是歷史學家，專長中國法制史、海洋史和社會經濟史等跨學科領域。他表示，高研院將會統籌人文學院、社會科學學院、工商管理學院、教育學院和法學院的精英研究力量，引進高端人文社科人才，開展專題研究。

因應粵港澳大灣區發展，澳門特別行政區正在打造以中華文化為主流、多元文化共存的交流合作基地，需要人文社會科學為之提供綜合性的、跨學科的理論支持和制度基礎。蘇教授認為，高研院的設立，正是牢牢把握灣區深度融合、協同發展這一歷史機遇，充分利用特區的地理區位優勢，努力發揚澳門中西結合、兼容並包的社會傳統。

「3+3+3+3」為骨幹的研究戰略佈局

澳大制定了「3+3+3+3」研究戰略佈局，包括三間國家重點實驗室（中藥質量研究、模擬與混合信號超大規模集成電路、智慧城市物聯網）、三個重點發展方向（精準醫療、先進材料、區域海洋）、三個跨學科交叉領域（認知與腦科學、人工智能與機器人、數據科學）、三個人文社科研究平台（人文社科高等研究院、澳門研究中心、亞太經濟與管理研究所）。在這些領域，澳大重點研究世界尖端學術問題、鼓勵跨學科合作，打破學科壁壘，結合人文社會科學和現代科技。

開展三大專項研究領域的團隊建設

作為人文社科研究平台，高研院將一步推動人文社科的跨領域和跨學科研究，構建高水準、跨學科、國際化、富有競爭力的綜合學術研究平台。

高研院將展開三個重大專項研究領域的團隊建設，包括中華文明與文化交流、文理滙流創新機、環球視野下的澳門。蘇教授說：「這三項重大專項研究領域，以頂層設計的方式，邀請個別研究有成的校內學者為主持人，

A University-level, Cross-faculty Research Platform

Founded in 2019, IAS is headed by UM Vice Rector Prof Billy So, who serves as the institute's interim director. He is a historian who specialises in the legal, maritime, and socio-economic history of China. According to Prof So, IAS will coordinate the efforts of various faculties, including the Faculty of Arts and Humanities, Faculty of Social Sciences, Faculty of Business Administration, Faculty of Education, and Faculty of Law, to share vital resources and optimise research capabilities. He adds that the institute will recruit top-tier scholars to work on special research projects.

In response to the development of the Guangdong-Hong Kong-Macao Greater Bay Area, the government of the Macao Special Administrative Region (SAR) hopes to develop the city into a centre for exchange and cooperation with Chinese culture as the mainstream and the coexistence of different cultures. This initiative certainly requires comprehensive and cross-disciplinary support. According to Prof So, the establishment of IAS is part of UM's effort to seize the historic opportunities presented by the integration of the cities in the Greater Bay Area, and IAS will leverage the city's geographical advantage, its inclusiveness, and its cultural diversity.

A '3+3+3+3' Strategic Research Structure

UM has formulated a '3+3+3+3' strategic research structure. The four '3's in the strategy refer to the university's three state key laboratories (for integrated circuits, Chinese medical sciences, and internet of things for smart cities, respectively), three new key research areas (precision medicine for cancer treatment, advanced materials, and regional oceanography), three interdisciplinary research fields (artificial intelligence, cognitive and brain science, and data science), and three research platforms for the humanities and social science (IAS, Centre for Macau Studies, and Asia-Pacific Academy of Economics and Management). In all these areas, UM supports cutting-edge research, interdisciplinary collaboration, and the integration of new technologies.

Developing Research Clusters in Three Key Areas

As a research platform in the humanities and social sciences, IAS hopes to enhance UM's interdisciplinary research and develop an integrated, internationalised, and competitive academic platform.

IAS has identified three keys areas where research clusters will be developed, namely Chinese civilisation

圍繞重大專項研究領域展開子項目研究計劃，以期通過文理交叉、跨科越界、協同合作的團隊方式，創造影響深遠的學術突破點。」

回饋澳門社會為己任

在澳門多元文化的背景下，澳大的人文社科教研彰顯了獨特的優勢和視角。澳大目前有五個學院歸屬於廣義的人文社會科學範疇，涵蓋語言、歷史、文學、宗哲、法律、經濟、管理、商科、教育、傳播、社會、心理、政治等。澳大在中國歷史文化、澳門地方史、葡語教育、憲法與基本法、旅遊與博彩管理、澳門教育發展、經濟模型、犯罪學、心理學、傳媒研究等領域成績斐然，在社會科學總論領域更進入基本科學指標資料庫（ESI）前1%。

澳大近年還積極推動中國歷史文化在葡語系國家的傳播與影響，同時著力提高

在人文社科領域，澳大產生了一批有影響力的學術成果。

UM has attained some important achievements in humanities and social sciences

澳大副校長蘇基朗教授

UM Vice Rector Prof Billy So

in multicultural mélange; the convergence of arts, humanities and sciences; and Macao from a global perspective. ‘In these three areas, we will develop research teams with a top-down approach, with accomplished UM scholars serving as the team leaders. These teams will carry out interdisciplinary and collaborative research in order to achieve breakthroughs,’ says Prof So.

Committed to Contributing to Macao

Firmly rooted in Macao’s multiculturalism, UM’s teaching and research in the humanities and social sciences have unique advantages. The university has five faculties in the humanities and social sciences, offering programmes in a wide array of disciplines, including linguistics, history, literature, philosophy, religious studies, law, economics, management, business, education, communications, sociology, psychology, and political science. Noteworthy achievements have been made in areas such as Chinese history and culture, local history of Macao, Portuguese language education, the constitution and the Basic Law, tourism and gaming management, development of education in Macao, economic models, criminology, psychology, and media studies. In the Essential Sciences Indicators (ESI) rankings, UM is among the top 1 per cent in Social Sciences, General.

UM is committed to disseminating Chinese history and culture in Portuguese-speaking countries, as well as enhancing Macao residents’ understanding of Chinese history and culture. At UM, the Cultural Building houses IAS, the Centre for Macau Studies, the Centre for Chinese History and Culture, Confucius Institute, Chinese-Portuguese Bilingual Teaching and Training Centre, the Centre for Arts and Design, and

澳門居民對中國歷史文化的認識。澳大崇文樓滙聚高研院、澳門研究中心、中國歷史文化中心、孔子學院、中葡雙語教學暨培訓中心、藝術設計中心及澳門中小學生人文社科教育基地等富實力的人文社科教研單位，全力促進澳門成為大灣區以至世界的中外文化交流中心。此外，澳大也是國家教育部人文社科重點研究夥伴基地，大力加強在人文社科領域的發展。

蘇教授強調說：「高研院不僅促進大學範圍內的人文和社科研究，培養學有所成的青年才俊，推廣人文和科技領域的跨界合作，還以回饋澳門社會為己任，透過建構跨領域的綜合性本地智庫，通過不同政策範疇的理論開發和實證調研，以期為澳門特區行穩致遠、融入灣區並參與灣區建設，儘力作出貢獻。」

「駐院學人計劃」吸引海內外人文社科學者

高研院設立了「駐院學人計劃」，吸引海內外人文社科頂尖學者訪駐澳大，與澳大學者一同探究高端人文學術課題，促進澳門人文社科學術的研究與交流。「駐院學人計劃」分為校內學人及訪問學人兩類，接受校內外學者申請。校內學人計劃為研究成果即將結項的優秀澳大學者提供代課經費等條件，協助其順利完成卓越學術著作。訪問學人計劃為校外資深或領軍學者而設，同時亦培養優秀年輕學者，讓後者有機會與資深學人及澳大學者，在高研院日夕問學，切磋砥礪，互相啟發。來訪學者或致力研究團隊建設，或在澳大高研院專心著述，均不難巧遇同道中人。根據訪問計劃及資歷，來訪學者將獲得澳大不同程度的資助。

掃二維碼或瀏覽
https://ias.um.edu.mo
瞭解「駐院學人計劃」詳情

Scan the QR code or visit https://ias.um.edu.mo to learn more about the Fellowship Scheme

崇文樓內匯聚富實力的人文社科教研單位

The Cultural Building houses several important academic units in humanities and social sciences

Macao Base for Primary & Secondary Education in Humanities and Social Sciences. Together, they support Macao’s effort to become a regional, or even global, cultural exchange centre. Furthermore, two research centres at UM are now official partners of two Ministry of Education Key Research Institutes in Humanities and Social Sciences.

Prof So says, ‘IAS is dedicated to promoting university-wide research in the humanities and social sciences, nurturing young talent, and stimulating collaboration between humanities and sciences. It also aspires to be a comprehensive and cross-disciplinary local think tank that generates theoretical and empirical studies in different policy fields. These efforts intend to support the sustainable development of Macao, and to enhance the SAR’s participation in the development of the Greater Bay Area.’

Fellowship Scheme Targeted at Scholars at Home and Abroad

IAS has launched a Fellowship Scheme to encourage top scholars at home and abroad to conduct cutting-edge research at UM as IAS fellows, and to promote research and exchange in humanities and social sciences in Macao. The scheme is divided into two categories, for regular UM staff and applicants who are not regular staff. The scheme provides outstanding UM scholars who are nearing the completion of their research projects with funding to help them complete their academic works. The other category is for senior or leading scholars from outside the university. It also aims to nurture excellent young scholars by enabling them to work with senior visiting scholars and UM scholars at IAS. Visiting scholars will receive different levels of funding from UM based on the specific dimensions of their visiting programmes and personal backgrounds.

賀佰恩：關注疫情下全球心理健康

Brian Hall Addresses Global Mental Health Challenges amid the Pandemic

文/余偉業 · 圖/編輯部，部分由受訪者提供
Chinese & English Text / Kelvin U · Photo / Editorial Board with some provided by the interviewee

新型冠狀病毒肺炎肆虐全球，澳門大學全球與社區心理健康研究組主任、心理學系副教授賀佰恩與澳大專家，今年初組成一支九人的心理輔導專業團隊，為相關人士提供適切的心理支援服務。賀教授長期研究身心健康問題，經常帶領學生走進社區，展開針對大眾身心健康的研究。

The COVID-19 pandemic is raging across the world. Prof Brian Hall, director of the Global and Community Mental Health Research Group of the University of Macau (UM) and associate professor in the Department of Psychology, worked with a nine-member professional psychological counselling team to provide mental health support for those affected. Prof Hall, who addresses physical and mental health challenges through research, strives to broaden the global horizons of his students by connecting them to their community through his studies.

數碼心理健康干預

疫情期間，賀教授與澳大其他專家組成的心理輔導專業團隊，包括三名澳大精神科和臨床心理學教授、六名心理輔導中心專業心理治療師和輔導人員，與澳門特區政府社會工作局合作，為隔離人士及工作人員提供心理輔導，包括電話輔導、網上訊息、語音及視頻輔導，舒緩他們的情緒壓力，同時為相關工作人員提供心理支援和解說會等。

賀教授一直研究全球與社區心理健康，帶領澳大團隊與世界衛生組織合作，開展公共健康的相關研究，改善大眾的身心健康。他還研究存在於少數族裔和移民群體間的健康不平等現象。疫情期間，他觀察到全世界的外勞人口健康保障更容易受到影響，因為他們在逗留工作的國家尋求治療時，會遇到更多障礙（如健康保險不足）。賀教授亦就此與專家探討，並合著了兩篇研究論文，獲權威醫學期刊《柳葉刀》刊登[1]。

賀教授把世衛的數碼心理健康干預項目「Step-by-Step」引進澳門，並進行文化適應調整。「Step-by-Step」是一項心理健康手機應用程式，以數碼化的心理干預手段，為難以獲得適切情緒疏導的人士提供服務。賀教授認為，澳門和大灣區其它地方的社區心理健康服務嚴重供不應求，臨床心理學家的數目始終不足應付需求，是嚴峻的社會問題。

「再宏觀一點地說，中國有14億人口，需求龐大，因此數碼化心理健康介入是解決辦法之一。」目前，研究團隊正以身處澳門的內地學生和勞工，以及菲律賓勞工為對象，為「Step-by-Step」進行嚴謹的隨機對照試驗，評估數碼心理健康干預的有效性，以滿足多元社會對心理健康服務的需求。

帶領學生走進社區

賀教授的研究方向多元廣泛，當中涉及危機時的心理健康情況。例如2017年颱風「天鴿」吹襲澳門，造成史無前例的破壞和影響。研究團隊在風災後一個

E-mental Health Intervention

During the pandemic, Prof Hall worked with a team comprised of three professors of psychiatry and clinical psychology, as well as six professional psychotherapists and counsellors from the university's Psychological Counselling Centre. Collaborating with the Social Welfare Bureau of the Macao SAR government, the team provided psychological counselling to those being quarantined, via telephone, online messages, as well as other audio and video technology, to help them cope with emotional stress. In addition, the team provided mental health support and held information sessions for those working on the frontlines.

Prof Hall conducts research in global and community mental health and leads his research group to work with the World Health Organization (WHO) on projects that aim to improve people's physical and mental health. Prof Hall also examines health inequalities among ethnic minority and migrant groups. He observes that migrant workers worldwide are more vulnerable to health and safety risks during the coronavirus disease outbreak, as they encounter more barriers to accessing health services in host countries (eg, inadequate health insurance). Prof Hall co-authored two research papers on this topic, which were published in February by the *Lancet*, a leading global medical journal[1].

賀佰恩教授指導的學生參與2018美國心理學會年度國際研討會，並獲頒最佳學生海報獎。

Prof Brian Hall's students win best student poster awards for their senior honours thesis poster presentations at the 2018 Convention of the American Psychological Association

澳大全球與社區心理健康研究組與澳門扶康會就澳門照顧智力和精神殘疾人士的華人所承受的負擔和心理健康狀況進行調查

The Global and Community Mental Health Research Group of UM collaborates with the Fuhong Society of Macau on a study on the caregiving burden and mental health condition of Chinese caregivers of people with intellectual and mental disabilities in Macao

月內進行問卷調查，研究學生災後的心理健康及求助行為。「近2,000名澳大學生填了問卷，這是個龐大的樣本，佔全校學生五分一。」賀教授連同澳大學生事務部、本地的澳大學生一起研究，以面對颱風後普遍的心理健康問題，以及學生尋求心理健康治療的偏好和當中遇到的障礙為主要研究問題。相關論文後來獲權威期刊《European Journal of Psychotraumatology》刊登[2]。

透過收集不同數據進行科學分析、為社會癥結問題帶來轉機、改善公眾健康，正正是研究團隊的核心使命。賀教授相信，每個數據點代表一個人，因此瞭解數據背後的人亦很重要。他早前也與澳門疾病預防控制中心和澳門明愛合作，帶領學生走進社區，向2,000名菲律賓及印尼婦女提供愛滋病病毒和梅毒測試，繼而瞭解她們在數據背後的故事[3]。這是同類研究中規模最大的項目，研究團隊從中獲得了很多這些婦女在性和身心健康方面的資料。另外，賀教授也帶領學生跟澳門扶康會合作，就澳門照顧智力和精神殘疾人士的華人所承受的負擔和心理健康狀況進行調查。

Prof Hall has culturally adapted the World Health Organization's digital mental health intervention programme called 'Step-by-Step', which can be delivered using a smartphone. The programme seeks to improve mental health outcomes in areas where face-to-face mental health services may be difficult to access. In his opinion, community mental health services in Macao and other cities in the Greater Bay Area are in short supply, and the number of clinical psychologists and other mental health specialists has always been insufficient to meet the demand, which poses a serious risk to public health.

'If you look at China as a whole, there are 1.4 billion people in the country and there is a great demand for mental health services. So digital mental health interventions is a solution to that challenge,' says Prof Hall. Currently, the team is conducting rigorous randomised controlled trials of the WHO digital mental health programme Step-by-Step among Chinese students, Chinese adults and Filipino migrant workers in Macao, evaluating the effectiveness of the programme to meet the mental health needs of a diverse society.

Connecting Students to Their Community

Prof Hall covers a wide spectrum of topics in his research, including mental health needs in times of crises. For instance, within one month of the end of Typhoon Hato (2017), his research group developed a questionnaire and launched a study that examined the mental health consequences and help-seeking behaviours of Chinese students. Prof Hall conducted the study in Macao, in collaboration with his students from Macao, and the Student Affairs Office (SAO) of UM. 'We enrolled almost 2,000 students at UM, which is a large sample, representing 20 per cent of the entire student population,' he says. The project linked students to needed counselling services provided by the SAO. Key research questions were related to the prevalence of common mental health issues following the typhoon exposure, and preferences and barriers to mental health treatment among students. Related papers were published by the *European Journal of Psychotraumatology*, one of the most influential journals in the field of traumatic stress studies[2].

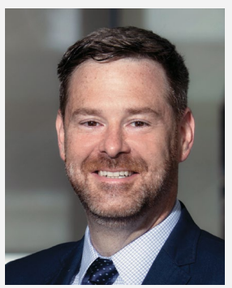
The core mission of the research group is to conduct research to inform interventions and policies that can address key problems in public health. Prof Hall believes that each significant piece of information signifies an actual person and it is important to understand the people behind the data. The research group has partnered with the Centre for Disease Control and Prevention in Macao and Caritas Macau to study the potential risks for HIV and syphilis. Prof Hall and his students have provided quick diagnostic tests on HIV and syphilis in the community and conducted a study using a representative sample of nearly 2,000 migrant Filipino and Indonesian women in Macao[3]. This was the largest study of its kind, and yielded information about the sexual, physical, and mental health of the population. Prof Hall and his students have also collaborated with the Fuhong Society of Macau on a study on the caregiving burden and mental health condition of Chinese caregivers of people with intellectual and mental disabilities in Macao.

It was the first time that Prof Hall and his students provided such diagnostic tests in research in Macao, so they were trained by public health nurses prior to launching the outreach intervention services. On the day of the interview, there were many test suites piled up at the entrance of his office. 'For me, there is no ivory tower,' says Prof Hall. 'UM is a place where people should work together on projects that are consequential for Macao and the Greater Bay Area.'

掃二維碼
觀看訪談片段

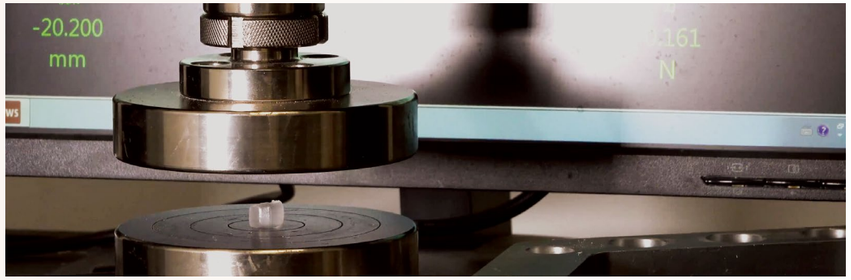
Scan the QR code to watch the interview

1. Liem, A., Wang, C., Wariyanti, Y., Laktin, C., & Hall, B. J. (2020). The neglected health of international migrant workers in the COVID-19 epidemic. *Lancet Psychiatry*, 7, 4:e20.
Bodomo, A., Liem, A., Lin, L., Hall, B. J. (2020). How African migrants in China cope with barriers to health care. *Lancet Public Health*, 5, 4:PE192.
2. Shi, W. & Hall, B. J. (in press). Help-Seeking Preferences among Chinese College Students Exposed to a Natural Disaster: A Person-Centered Approach. *European Journal of Psychotraumatology*
Hall, B. J., Xiong, Y., Yip, P. S. Y., Lao, C., Shi, W., Sou, E. K. L., Chang, K., Wang, L., & Lam, A.I.F (2019). The association between disaster exposure and media use on posttraumatic stress disorder following Typhoon Hato in Macao, China. *European Journal of Psychotraumatology*, 10:1, 1558709.
3. Hall, B. J., Yang, X., Huang, L., Yi, Grace, Chan, E. W. W., Tucker, J. D., & Latkin, C. (2020). Barriers and facilitators of rapid HIV and syphilis testing uptake among Filipino transnational migrants in China. *AIDS and Behavior,* 24, 418-427.



賀佰恩教授發表了200餘篇SSCI期刊論文和書籍章節，是世界衛生組織全球心理健康領域的首位研究員，曾為中國科學院和北京心理健康重點實驗室的國際研究員。2019年當選為美國心理學會會士，是該會唯一來自澳門的會士。曾獲約翰．霍普金斯大學布隆博格公共衛生學院頒授傑出導師獎。2020年初加入世衛西太平洋區非正式專家組，開展與新型冠狀病毒肺炎疫情相關的社區研究。

Prof Brian Hall has published over 200 articles and book chapters in SSCI-indexed journals. He is an inaugural fellow in global mental health of the World Health Organization, and a former international fellow at the Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences in Beijing. He was elected a fellow of the American Psychological Association in 2019, and is the only fellow from Macao. Prof Hall has received the Excellence in Advising Award from the Centre for Global Health of the Johns Hopkins Bloomberg School of Public Health. Most recently, Prof Hall joined the WHO Western Pacific Region informal expert group on community engagement in COVID-19.



「新型超級水凝膠」是破世界紀錄的先進材料
The new super hydrogel is an advanced material that breaks the world record

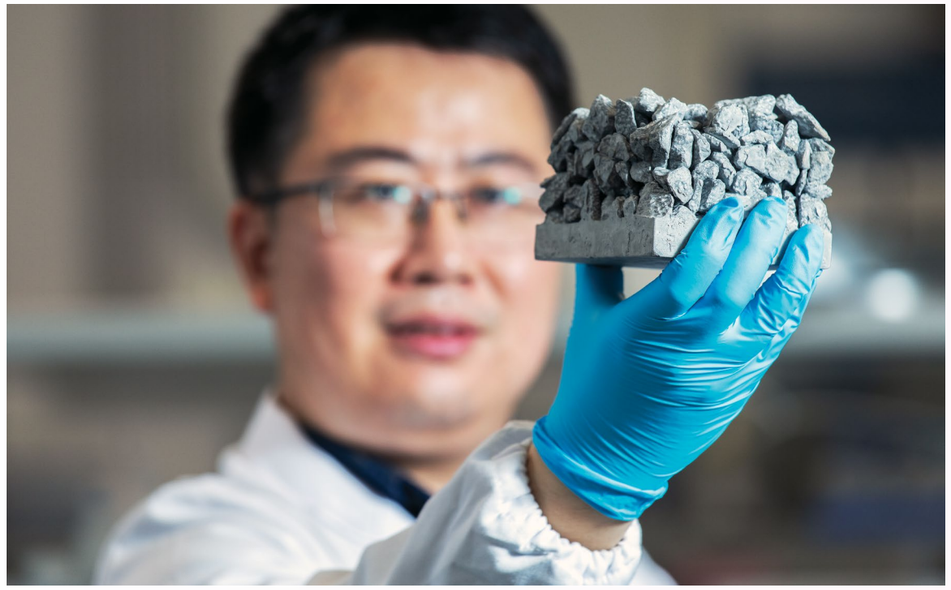
首位提出用水泥製造納米材料——孫國星

Sun Guoxing: The First to Propose the Use of Cement for Nanomaterials

文/張愛華 · 圖/編輯部，部分由受訪者提供
English Translation / Ruby Chen · Photo / Editorial Board with some provided by the interviewee

澳門大學應用物理及材料工程研究院助理教授孫國星是首位提出用水泥製造最便宜納米夥粒的專家。回憶求學之路，原來他大學時成績幾乎倒數第一，博士讀化學工程三年後又被導師勸退，轉讀土木工程建築材料後彷如發現新大陸。這些年來，他堅持以研究為使命的初心，由於擁有跨學科背景，在研究上屢獲突破性發展。

Sun Guoxing, an assistant professor in the Institute of Applied Physics and Materials Engineering (IAPME) at the University of Macau (UM), is the first person to propose using cement to make nanoparticles. Interestingly, as a brilliant researcher who has developed a world-record-breaking material, Sun was quite unimpressive in his college years. In fact, he was anything but the typical straight-A student who breezes through college, reaping awards and accolades along the way. Rather, he was consistently at the bottom of his class. After three years of doctoral studies in chemical engineering, he was advised by his supervisor to withdraw from the programme. Desperate to find a new path, he switched to construction materials, a sub-field of civil engineering, and finally began to blossom. Over the years, he has experienced ups and downs in his academic career. But he has never forgotten why he wanted to become a researcher in the first place—to give back to society by doing work that makes a difference. So he plodded on, applying his multidisciplinary background to his research in advanced materials. Breakthroughs came. Records were broken. Eventually he began to shine.



孫國星教授是首位提出用水泥製造最便宜、能夠量產的納米顆粒
Prof Sun Guoxing was the first to propose the use of cement to produce the cheapest and mass-producible nanoparticles

科研著重成果轉化

孫國星教授的實驗室位於應用物理及材料工程研究院地面層，這裏也是他與同院的李宗津教授的聯合實驗室，約240平方米的空間，佈置得像車間一樣。他在2017年加入澳大時，當時實驗室還是毛坯房，是與李教授一手一腳設計建立起來。

孫國星率先發現，把水泥放進冰水，就可以在液體中得到只有五納米大小的顆粒，用於製造各種性能優異的納米材料。在澳大，孫教授和團隊發明了一系列用水泥緩釋出納米顆粒複合而成的特種水凝膠。他們最初發現的是該凝膠優異的機械性能，例如它可以被壓縮到自身的99%的形變，一秒鐘內恢復原狀，依托這種特殊的性能還開發了三種產品：第一種產品可以吸收自身四倍重量的有機色素；第二種產品具有極強的導電性能和優異的彈性，可以做一種具有柔性的高電導率的傳感器材料；第三種產品是一種超級吸水樹

Scientific Research with a Social Impact

Sun's laboratory is located on the ground floor of the IAPME building; it is a joint laboratory operated with Prof Li Zongjin of the same institute. About 240 square meters in size, this laboratory is arranged like a production department. When Sun joined UM in 2017, it was just a roughcast space, which he designed and built into the current laboratory with Prof Li.

Prof Sun was the first to discover that by putting cement into ice water, he can obtain small five-nm particles that can be used to make high-performance nanomaterials. At UM, Prof Sun and his team invented a series of new hydrogels made of nanoparticles derived from cement. What initially caught their eyes was the excellent mechanical properties of the gel. For example, it can be compressed to 1 per cent of its original size and return to its original size within one second. The team took advantage of this special property and developed three products. The first product can absorb four times its weight of organic pigments. The second product has extremely high electrical conductivity and excellent plasticity, and can be used as a flexible sensor material with high

孫國星教授在澳大開放日展示其發明的納米泡沫水泥

Prof Sun Guoxing demonstrates the nano-foam cement he invented on the UM Open Day

脂，可以吸收自身倍數高達13,600倍的吸水量，是之前世界紀錄的二至三倍。「這塊吸水後的凝膠含水率高達99.993%，是世界上含水量最高的物質。」

求學路上波折重重

孫國星生於江蘇省淮安市，高中時屢獲全市統考第一名。當年高考第一志願是報讀清華大學最高分專業——自動化工程，惜高考時臨場發揮失準比清華分數線低了五分，後來入讀不在報考志願內的北京師範大學化學專業。入大學時，孫國星才17歲，他說當年心態未調整好，大學前三年一直荒廢學業，成績幾乎是全班倒數第一，「我當時一直否定自己，覺得上學已經沒有希望。幸好大三時碰到了我人生的第一位導師劉正平教授，他把我拉進研究小組，讓我首次接觸科研，畢業時我的論文還差點獲提名為優秀本科論文。」

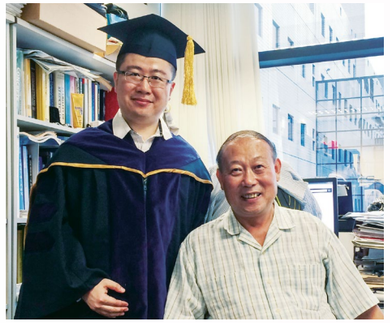
2004年大學畢業後，劉教授希望孫國星留校讀研，惟他的英語和政治課不及格令考研失敗。他於是返回家鄉，一邊在一所職業學校教化學，一邊瘋狂複習英文，考了三年才考上碩士班。回望這段經歷，他說：「當時我只不過21歲，如果拼一拼考上碩士，至少可能會改變命

conductivity. The third product is a super-absorbent resin, which can absorb up to 13,600 times its own weight of water; this is two to three times the previous world record. ‘The water content of this gel that has absorbed water reaches 99.993 per cent; you can’t find another substance with higher water content,’ says Prof Sun.

Ups and Downs in His Student Years

Born in Huai’an city, Jiangsu province, Sun almost monopolised the top spot in the city’s standardised examinations for high school students. When preparing for college, he selected Tsinghua University’s automation engineering programme as his first choice, which was the programme with the highest admission standard at Tsinghua University. Unfortunately, he fell short of the necessary admission marks by five points. He ended up studying chemistry at Beijing Normal University, which was not among his original choices for a college major. A 17-year-old young man who had just been denied admission to his favourite university to study a major of his choice, Sun felt completely disoriented and demoralised. As a result, he idled away his first three years in college, and sat firmly at the bottom of his class. ‘I was constantly doubting myself and everything I did, and I lost hope for my future,’ he says. ‘Fortunately, I met Prof Liu Zhengping, the first mentor in my life. He asked me to join one of his research groups, and gave me my first exposure to scientific research. By the time I graduated, my thesis was almost nominated for an excellent undergraduate thesis.’

When Sun graduated in 2004, Prof Liu encouraged him to pursue a master’s degree at the university. Sun took his advice, but failed the necessary tests in English and politics. So he returned to his hometown, teaching chemistry in a local vocational school while fervently studying English in his spare time. He took and failed the master’s entrance examination three times before he was finally admitted. Looking back, he says: ‘I was only 21 years old, but I knew I had to go all out and give it a try, because if I made it, at least I would have a chance to change my life.’ Soon after starting his master’s studies, and based on his outstanding research performance, Sun was recommended by his supervisor Prof Liu for a joint training programme conducted by the university and



孫國星教授與博士導師李宗津教授合照

A group photo of Prof Sun Guoxing and his doctoral advisor Prof Li Zongjin

運。」考上碩士不久，孫國星因出色的研究被導師劉正平教授推薦到中國科學院的化學研究所聯合培養，「我的研究和訓練都是在中科院完成，中科院的陳光明教授對我的科研指導非常重要。」結果孫國星不負寄望，兩年內完成了三篇SCI期刊論文和一篇核心期刊論文。

孫國星的求學路一波三折。2009年碩士畢業時他因錯過了公派留學博士的申請，於是去到一間教育集團任化學老師，半年就被擢升為星級老師，這段經歷磨練了他的教學技巧。矢志走研究路的孫國星，在教書的一年間寫了200多封博士學位申請信，「很幸運，我最後拿到四個offers，包括歐洲四大理工大學之一的代爾夫特理工大學和香港科技大學。」孫國星最後選了香港科技大學。

在交叉點上找到創新點

孫國星的首位博士導師是香港科技大學化學及生物工程學系的陳志明教授，「我當時的博士研究是傳統高分子結晶理論的深入推導，導師覺得我不太適合在這個方向繼續，難有突破，便勸我退學，否則也可能畢不了業。」

被勸退幾天後，大受打擊的孫國星發了一封電郵給土木及環境工程學系的李宗津教授，「李教授不忍心我白白浪費三年時光，便給我機會在他的課題組繼續

the Institute of Chemistry of the Chinese Academy of Sciences (ICCAS). ‘My research and training were both completed at ICCAS. Prof Chen Guangming of ICCAS played a very important guiding role in my research,’ says Prof Sun. He did not let down his mentors who had great expectations for him. In just two years, he published three papers in journals indexed in Science Citation Index and one paper in a core journal.

Sun’s education journey was anything but smooth sailing. In 2009, when he graduated from his master’s programme, he missed the deadline for applying for a government-sponsored PhD programme overseas, so he found a job in an education group as a chemistry teacher and became a ‘star teacher’ in only six months. This experience honed his teaching skills, but his eyes were set on bigger goals. During the one year when he worked as a teacher, Sun wrote more than 200 application letters for PhD programmes. Eventually, he received offers from four universities, including Delft University of Technology, one of the four major technology universities in Europe, and the Hong Kong University of Science and Technology (HKUST). He finally chose HKUST.

Finding Space for Innovation in an Interdisciplinary Field

Sun’s first doctoral supervisor was Prof Chan Chi Ming in the Department of Chemical and Biological Engineering at HKUST. ‘The focus of my doctoral research at that time was the study of traditional polymer crystallisation theory. ‘My supervisor didn’t think I was right for this direction, much less likely to achieve any breakthroughs, so he advised me to withdraw from the programme, saying that otherwise I may not be able to graduate,’ recalls Sun.

Feeling utterly demoralised, Sun quit the programme. A few days later, he sent an email to Prof Li Zongjin in the Department of Civil and Environmental Engineering, in which he explained his situation and sought Prof Li’s advice and help. Prof Li did not want to see Sun’s three years of studies end in vain, so he asked Sun to join his research group so he could finish his PhD degree. ‘Civil engineering opened up a new world for me. It was like “discovering a new continent”,’ says Sun. ‘Prof Li’s guidance shaped my philosophy of scientific research and management.’

孫國星教授（第三排左一）大四時參與一場學術會議，到澳大後始發現同場合照中有澳大應用物理及材料工程研究院院長湯子康教授（第一排左三），當時二人互不認識。

Prof Sun Guoxing (3rd row, 1st from left) participates in an academic conference during his senior year in college. It was not until after he joined UM that he realised that one professor in a group photo taken at that conference was IAPME Director Prof Tang Zikang (1st row, 3rd from left).

完成博士學位，他給我的指導直接形成了我現在的科研和管理理念。」土木工程領域為孫教授開拓一片新的天空，他形容就像「發現新大陸」。

由於擁有紮實的化工理論，孫國星在2013年6月加入李宗津教授組的第一個月，就發現了一些能夠應用在建築材料領域的化學手段，三個月後發表第一篇材料研究的SCI論文。他還記得當時第一次在電子顯微鏡房間，發現能從水泥這種建築材料中找出只有五納米大小的顆粒時那種振奮感，他更因此成為世界上首位提出用水泥製造世界上最便宜、能夠量產的納米顆粒的人，「我當時開始洞悉到，自己最擅長是做一些產品創新和理論創新的研究。」

孫國星用了一年半時間取得土木工程博士學位。博士畢業後，他先到香港納米及先進材料研發院有限公司任研發工程師，同時在香港科技大學做兼職博士後研究，兩年間就有兩個創新發明，包括能在空氣中穩定存在兩年的納米泡沫，以及以之製備的輕質高強度泡沫水泥。

Thanks to his solid knowledge of chemical technology, in June 2013, less than a month after he joined Prof Li's group, Sun discovered some chemical technologies that can be applied to the field of building materials. Three months later, he published his first research article on materials in a SCI-indexed journal. To this day, he still remembers the excitement he felt when he first discovered five-nanometre particles in cement suspension under an electronic microscope. Following that discovery, he became the first in the world to propose the use of cement to make the world's cheapest, mass-producible nanoparticles. 'That was when I began to realise that product innovation and theoretical innovation were what I was best at,' he says.

Sun completed his PhD programme in civil engineering within a year and a half. After graduation, he first worked as a research and development engineer at Nano and Advanced Materials Institute Limited (NAMI) in Hong Kong while simultaneously holding a part-time position as a postdoctoral researcher at HKUST. Within two years, he created two inventions, an innovative nano-foam that can remain stable in the air for up to two years and a lightweight and high-strength foamed cement made from the nano-foam.

研究的動力

2017年孫國星因一次機遇到訪澳大，即愛上這裡的學術環境，後來就有了在澳大的故事，還和他的恩師李宗津教授相遇，再度攜手探索未知的研究項目。目前他和李教授聯合培養20餘位博士生及博士後，「研究一直是我最想做的事，把研究回饋社會更是我最大的心願。」

把研究轉化為對社會有用的東西，一直是孫教授的研究動力。依托珠海澳大科技研究院在橫琴建立的產學研示範基地，他已計劃在珠研院的先進材料研發中心設立小型生產線，定位是把研發的產品作為中間原料，例如吸水膨脹劑，希望將來應用到農田保水、沙漠治理等方面。「我們計劃先以粉劑的形式在珠研院生產，然後再找一些做吸水樹脂的企業，直接生產民用產品，例如尿不濕或農田保水劑等，我們已計劃跟粵西最大的工業基地——珠海高欄港工業園合作把產品推出市場。」

孫教授在交叉學科領域找到了創新點，正如他經常對學生所言：「只要不放棄，就會成功！」在研究路上，他很有信心地說：「前面還有一大片未知的課題等著我去開發。」

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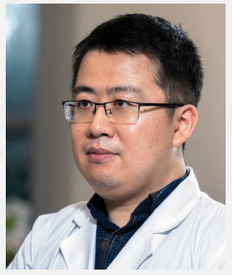
A Strong Motivation for Research

In 2017, Sun visited UM for the first time and fell in love with its academic ambience. Later, he decided to join UM. He has worked with his mentor Prof Li Zongjin on research projects and postgraduate training. So far, they have jointly supervised more than 20 doctoral and postdoctoral students. 'Research has always been my greatest passion, and being able to give back to society with research makes it even better,' says Prof Sun.

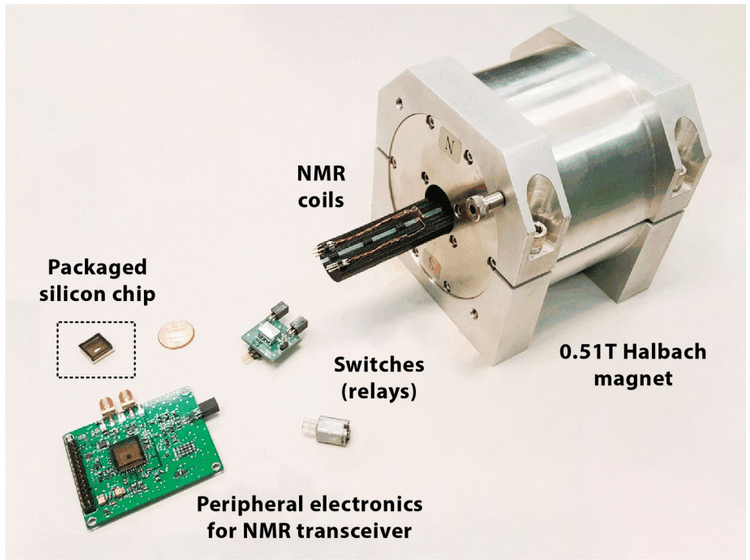
Transforming research results into products that are useful to society has always been the driving force behind Prof Sun's research. Earlier, Zhuhai UM Science & Technology Research Institute established a demonstration base for industry-academia collaboration in Hengqin, Zhuhai, in Guangdong province. Prof Sun quickly saw the opportunity. He plans to set up a small production line in the research institute so he can use the products developed as intermediate raw materials such as a water-absorbing swelling agent, which he hopes can be applied in the future to farmland water retention and desert management. 'We plan to first produce the swelling agent in the form of powder and then find some companies that make water-absorbent resins to produce products for everyday use, such as diapers or farmland water-retaining agents,' he says. 'We plan to launch the products onto the market with Zhuhai Gaolan Port Industrial Park, which is the biggest industrial park in western Guangdong.'

Prof Sun has found the space for innovation in an interdisciplinary field. As he often says to his students: 'As long as you don't give up, you will succeed eventually.' He looks at the road ahead with confidence and excitement, saying: 'There is still a vast uncharted territory for me to explore.'



孫國星教授研究方向為高分子、水泥基納米複合材料，高分子結晶、混凝土外加劑、水泥水化製造納米粒子增強高分子水凝膠、納米粒子穩固泡沫等。首位提出用水泥製造最便宜、能夠量產的納米顆粒。已發表學術論文50餘篇，作為第一或主要發明人申請中國發明專利六項（已獲授權一項），獲授權美國發明專利一項。2019年獲國際先進材料協會頒授國際先進材料科學家獎章。

Prof Sun Guoxing's main research interests include polymer cement-based nanocomposites, polymer crystallisation, concrete admixtures, preparing nanoparticle-reinforced polymer hydrogels via cement hydration, and nanoparticle-stabilised foams. He was the first to propose the use of cement to make the cheapest, mass-producible nanoparticles. He has published more than 50 academic papers and has applied for six Chinese invention patents (one already granted) as the first or main inventor, and he holds one US invention patent. In 2019, he received the Scientist Medal from the International Advanced Materials Association.



圖一：使用平行化方式的可攜式核磁共振平台，其核心是包裝在晶片載體內之CMOS核磁共振收發器。[2]

Picture 1: The hardware for the portable NMR platform with parallelism. The core of the platform is the CMOS NMR transceiver, which was packaged onto a chip carrier for testing[2].

跨越電子學與核磁共振的矽芯片

Silicon Chips Bridging Electronics and NMR

文/李家明 · 圖/由作者提供 · 中文翻譯/葉浩男

English Text / Lei Ka Meng · Photo / Provided by the author · Chinese Translation / Davis Ip

互補式金屬氧化物半導體（Complementary-metal-oxide-semiconductor，簡稱CMOS）可將電子電路縮小，製造出只有數平方毫米的單片集成電路（芯片）。自1960年代面世以來，這項科技已經帶來不少革命性影響，大為減低電子設備的成本、電力消耗和體積。無論大家是否留意，CMOS芯片其實早已滲入我們日常生活的不同層面，包括手機、車輛、藍牙耳機和遙控器等電器。

Complementary metal oxide semiconductor (CMOS) technology miniaturises electronic circuits onto a monolithic integrated circuit (IC) with a size of a matter of square millimeters. Since the invention of the CMOS technology in the 1960s, its performance has improved, radically bringing down the cost, footprint, and power consumption of electronic devices. Today, we are surrounded by CMOS ICs in our daily lives — whether or not we notice it. Common devices that contain CMOS ICs include cell phones, vehicles, Bluetooth headsets, and remote control devices.

CMOS科技所帶來的變革

CMOS科技所帶來的變革不只影響計算和通訊範疇，它也能在跨學科研究上派上用場。憑著其小巧之體積及用途多樣之優勢，經過客製化之CMOS芯片可成為貢獻科研的利器。

核磁共振是一種在實驗室觀察樣本的分子資訊和動態的重要方法，在化學、物理、生物學和醫學等領域均發揮關鍵作用。與核磁共振的相關研究及發展至今五度獲頒諾貝爾獎（分別在物理學、化學、以及生理學或醫學），在科學界的重要性不言而喻。核磁共振實驗儀器主要包括一個用來產生靜態磁場的磁鐵，藉此磁化特定的原子核（例如在我們平台上分析的1H原子核）。此外還有一個射頻線圈，用於實現原子核磁場與電子電訊號的耦合，以及一個電子收發器，用來激發原子核並記錄相關反應作後續分析。

一般的核磁共振儀器的體積通常十分龐大，因為它需要一個超導磁鐵，以產生超過一特斯拉的磁場，其獨立之電子零件也會佔用大量空間和消耗不少能量。為了減低儀器體積，有研究人員最近嘗試改用少於0.5特斯拉的永久磁鐵取代超導磁鐵，並改用客製化的CMOS芯片取代各電子零件。雖然常規核磁共振儀器在分析大分子時，可以提供無可比擬的解析度，但體積細小的微型化核磁共振儀器也有其獨特之潛力，能夠開拓核磁共振在其他層面的應用，包括井測及實地化學篩檢。

我們的CMOS核磁共振平台

過去八年，澳大模擬與混合信號超大規模集成電路國家重點實驗室的團隊致力開發小型化核磁共振系統，每一代成果都有其創新之處。我們所研發第一代之系統整合了數位微流控平台及核磁共振系統，實現自動化樣本管理（圖一及二）[1]。最新一代可攜式系統則是我們與哈佛大學Donhee Ham教授團隊的合作成果，通過平行化的核磁共振實驗加快化學篩檢（圖三），以下會介紹這項最新研究[2]。

CMOS as a Transformative Technology

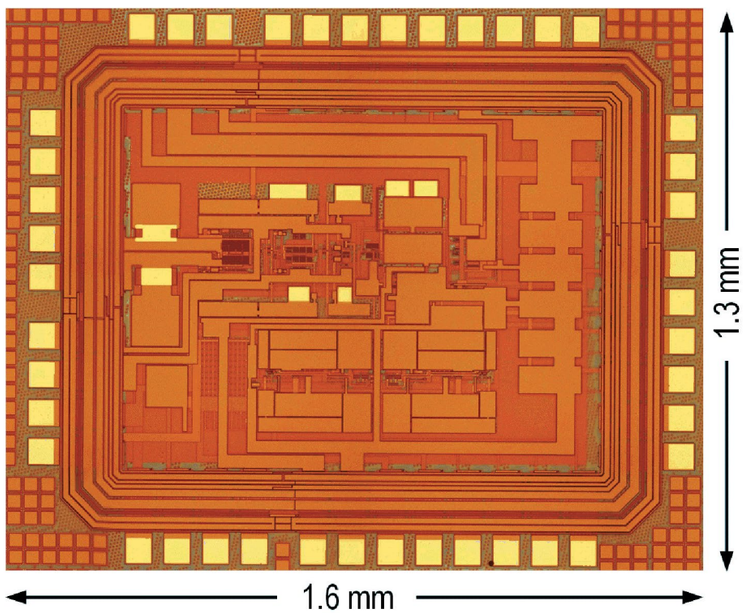
Aside from the applications for computing and communications, CMOS technology is also useful in multidisciplinary research, which leverages the advantages of CMOS ICs to further exploration of science. The compact and versatile ICs can be customised to befit a wealth of applications, rendering it a powerful solution for scientific research.

Nuclear Magnetic Resonance (NMR) is an essential method to observe the molecular information and dynamics of the samples in the laboratory. It plays a crucial role in chemistry, physics, and biology. Five Nobel Prizes (in Chemistry, Physics, and Physiology or Medicine) have been awarded to NMR-related development, manifesting the significance of NMR in scientific research. The equipment for the NMR experiment mainly includes a magnet that generates a static magnetic field to magnetise the nuclei for interest (1H in our platform), a radio-frequency coil to couple between the magnetic field for the nuclei and electrical signal for the electronics, and transceiver (transmitter + receiver) electronics to excite the nuclei and record their responses for subsequent analysis.

Conventional NMR equipment is bulky and heavy because it employs a superconducting magnet to generate an intense magnetic field (> 1 Tesla) for magnetisation. Also, the discrete electronics occupy a significant area and consume a large amount of power. Recently, there is a thrust to miniaturise the hardware of NMR equipment by using a permanent magnet (< 0.5 Tesla) and a customised CMOS IC to replace the superconducting magnet and the discrete electronics. While the conventional NMR equipment provides unparalleled resolution for delicate analysis such as fingerprinting the macromolecules, the slim footprints of the miniaturised NMR systems open up a lot of potential NMR applications such as well-logging and on-site chemical screening.

Our CMOS NMR Platform

Our research team at the State Key Laboratory of Analog and Mixed-Signal VLSI at UM has been working on the miniaturisation of the NMR system over the past eight years and has developed different generations of portable NMR systems. Each generation has its respective innovation. For example, the first generation of the miniaturised NMR system focuses on automated



圖二：
第一代可攜式核磁共振系統使用的CMOS芯片[1]

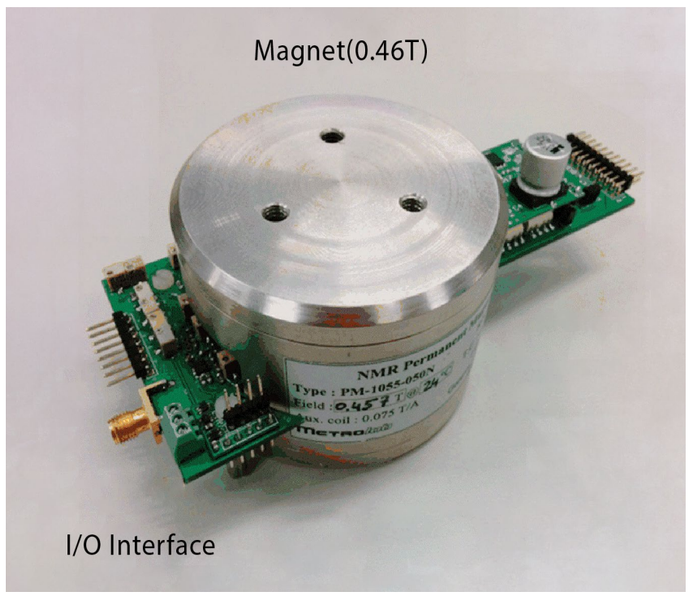
Picture 2:
The photo of the CMOS IC for our first portable NMR system[1]

該可攜式核磁共振系統之核心為一粒客製化CMOS芯片，內含脈衝序列合成器、發射器和接收器各一個。脈衝序列合成器會產生不同種類的脈衝序列，這些序列會控制原子核的自轉方式和反應。通過製造不同種類的脈衝序列，我們就能獲取研究樣本的各種資訊。發射器則會放大由脈衝序列合成器產生的激勵訊號，並引導訊號到射頻線圈，讓線圈產生磁場並激發原子核。與射頻線圈連接的接收器會擷取並放大來自線圈的微弱訊號，用作過濾或頻率轉換等後續處理。整個CMOS芯片的裸片只有四平方毫米。

無論一般還是小型化版本的核磁共振系統，都存在著吞吐量較低之先天缺點。由於樣本的核磁共振訊號通常以微伏特計，非常微弱，研究人員要重複多輪實驗才能改善擷取結果的訊號雜訊比（訊噪比）。另一方面，原子核受發射器激發後要花數秒才能回復至熱平衡以繼續下次實驗，直接限制了其重複擷取之速率，並降低了實驗的通量。因此，要獲取解析度理想的共振訊號，往往要花上

sample management by integrating a digital microfluidic platform with the NMR system (Pictures 1 and 2)[1], while the latest generation, on which we collaborated with the research group of Prof Donhee Ham at Harvard University, focuses on portable NMR with parallelism to expedite the NMR experiment for faster screening (Picture 3). Herein, we briefly discuss the key features of this latest research[2].

At the heart of the portable NMR system is the customised CMOS IC. It mainly includes a pulse sequence synthesiser, a transmitter, and a receiver. The pulse sequence synthesiser generates different kinds of pulse sequences for the NMR experiments. The pattern of the pulse sequence manipulates the spinning of the nuclei and determines the responses from them. Hence, different information from the samples can be obtained by varying the pulse sequences. The transmitter amplifies the excitation signals generated by the pulse sequence synthesiser and drives the signals into the radio-frequency coil, which excites the nuclei. The receiver, which is connected to the same radio-frequency coil, picks up the diminutive signals from the coil and amplifies the signals for subsequent processing, such as filtering and frequency-conversion. The size of the CMOS IC die is only 4 mm^2.



圖三：
第一代可攜式核磁共振系統，其CMOS芯片安裝在磁鐵內的印刷電路板上。[1]

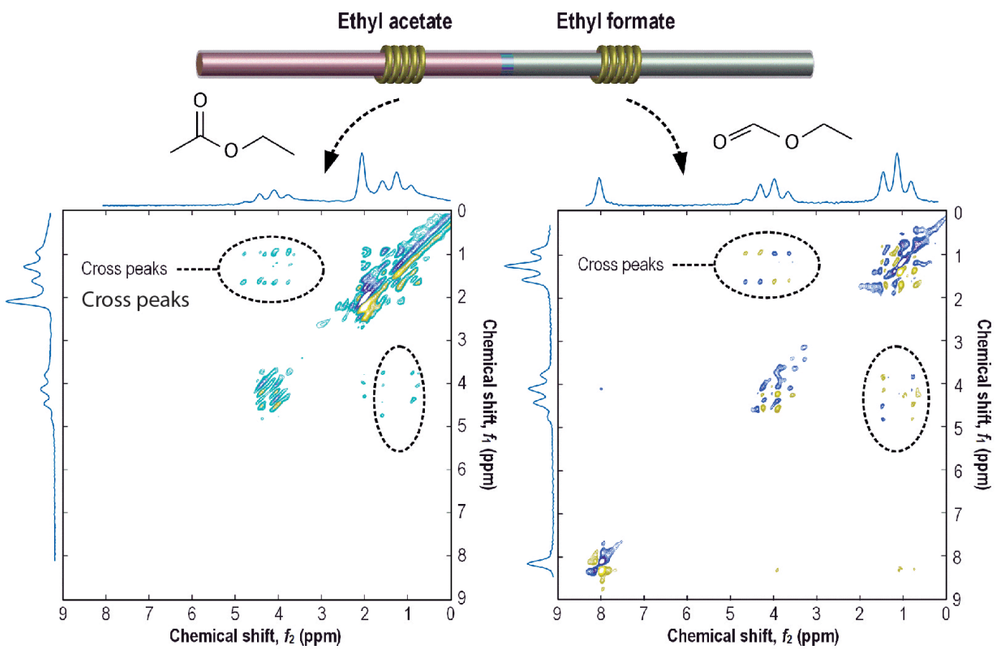
Picture 3:
The system hardware of our first portable NMR system. The CMOS IC is mounted on the printed circuit boards and put inside the magnet[1].

數小時甚至數天以進行實驗，時間視乎實驗種類而定。

為了克服這種限制、加大測量的通量，我們提出了不同的並行化方案。首先是以時間交錯方式加快實驗。具體方法是將N個同質或異質樣本分別放在一個永久磁鐵內，並各配置N組射頻線圈。這些線圈分開擺放，避免交叉干擾，但都透過繼電器連接至同一CMOS芯片。當第一組線圈中的樣本完成一次核磁共振掃描後，樣本內之原子核會逐漸回復至熱平衡，這時儀器馬上會掃描另一組線圈內之樣本，如此類推，直至完成所有N組線圈的掃描。當第一組線圈的樣本內的原子核回復至熱平衡，另一輪掃描就會開始。換言之，我們利用原子核每次掃描後回復至熱平衡的時間去進行不同樣本之掃描。在理想情況下，這種掃描方式能將實驗時間縮短N倍。我們在小型化核磁共振平台上用這種時間交錯的方式，同時間進行二維的1H關聯性磁振頻譜實驗，以檢測甲酸乙酯和乙酸乙酯的結構（圖四），結果需時48分鐘，比沒有使用時間交錯方式之裝置節省一

A critical drawback of the NMR, whether for the conventional type or the miniaturised type, is its inherently low throughput. Since the NMR signals from the samples are very weak – usually at the order of microvolts, a lot of experiments are required and accumulated to improve the signal-to-noise ratio (SNR) of the acquisition. Yet, after the excitation from the transmitter, the nuclei takes several seconds to return to their thermal equilibrium. This long recovery time limits the repetition rate of the acquisition and throttles down the throughput of the experiment. Depending on the type of NMR experiment, it may take a matter of hours or even days to acquire the NMR signals with the desired resolution.

To tackle this limitation, we proposed different parallelisation schemes to accelerate the throughput of the measurement. The first one is the acceleration of the experiment via time-interleaving. We placed multiple (N) samples (can be homogenous or heterogeneous) with their respective radio-frequency coils within the permanent magnet. The coils are separated from each other to prevent cross interference. These N coils are connected to a CMOS IC by an array of switches. After the first coil finished the NMR scan on its sample and the nuclei are resting to return to



圖四：利用時間交錯方案生成的1H原子核的二維核磁共振成像（關聯性磁振頻譜），闡明了甲酸乙酯和乙酸乙酯的結構。[2]

Picture 4:Measured 2D 1H NMR spectra (correlation spectroscopy) with time-interleaving from ethyl acetate and ethyl formate[2]

半時間。

除此之外，我們還提出使用一個有多個梯度線圈的體系，為樣本的空間訊息編碼。這個構思來自核磁共振成像技術，因為該技術正正是運用不同方向之磁場梯度，作為取得空間訊息的基礎，再基於核磁共振技術以產生成像。在我們的方案中，不同的梯度線圈會產生不同方向的磁場梯度，而樣本內原子核的旋進頻率則與它們感應到的磁場對應。有了這些磁場梯度，分佈在感測區不同位置的原子核會感應到不同的磁場，並且因此會以不同的速率旋進。我們可以對擷取到的訊號進行傅立葉變換，分析它們的頻率成分，從而取得某個樣本的核磁共振訊號的波幅。運用這個以成像為基礎的方案時，我們會在磁鐵內放置N個樣本。這些樣本共用一個連接到CMOS芯片的射頻線圈。在此設置中，我們讓18個樣本同時接受掃描，藉此取得有用的資料，期間產生的訊號包含了所有樣本的全部資訊，統統會在電腦記錄和處理以進行後續分析。這個以成像為基礎的方法比一般方法快了4.5倍。為了強化圖像的訊噪比，我們在實驗時必須增加三次額外的掃描。因此，如果對訊噪比沒有限制，理論上這個方案的測量時間可以較正常方法快18倍。

equilibrium, the second coil will initiate another NMR scan on its sample. This process goes on sequentially until the N^{th} coil finishes its scan on the sample. Then the experiment starts over from the first coil, where the nuclei within the sample have already recovered to thermal equilibrium and are ready for another NMR scan. By exploiting the long recovery time of each NMR scan with the proposed time-interleaving scheme, we can shorten the total NMR experiment time by a factor of N in the ideal case. In fact, from one of our experiments, we have used this miniaturised NMR platform with the time-interleaving scheme (N = 2) to perform 2D 1H NMR experiment and elucidate the structure of ethyl formate and ethyl acetate (Picture 4), where the total experiment time is 48 minutes (reduced by ~50%).

Inspired by the magnetic resonance imaging technique, which is based on NMR with additional magnetic field gradients to obtain spatial information, we proposed an NMR setup with gradient-coils to spatially encode the samples. The gradient-coils create magnetic field gradients in different directions. The spinning frequency of the nuclei is commensurate with the magnetic field they sensed. At the presence of the magnetic field gradient, nuclei at different regions of the sensing area experience dissimilar magnetic fields and thus spin at their individual rates. Hence, by performing Fourier Transform on the acquired signals to analyse their frequency contents, the amplitude of the NMR signals from a specific sample can be gathered. In this imaging-based scheme, we put N samples inside the magnet. They share one radio-frequency coil, which is connected to the CMOS IC. These N samples (N = 18 in our demonstration) are then scanned simultaneously for probing the information of interest. These signals, which contain all information from the N samples, are then recorded and processed in the computer to extract the information for analysis. By using this imaging-based scheme, the measurement speed is accelerated by 4.5 times, as three extra scans are necessary to enhance the SNR of the image, and it could be a full 18-time acceleration if the SNR were not limited.

展望未來

相比用於計算和通訊用途的CMOS芯片，設計用作跨學科研究的芯片仍然處於起步階段。要將微電子與納米電子學的進展恰當地應用到跨學科研究上，還需進一步的探索。設計這類芯片不單需要電路設計的知識，還要求物理、生物學等多方面的專長，以及精細和具全局性的規劃，實在充滿挑戰。展望將來，我們的團隊也會在這方面繼續前進，開發有助跨學科研究的CMOS芯片。

Outlook

Compared with the development of CMOS ICs for computing and communication purposes, the IC designed for multidisciplinary research is still in the early stage and research efforts are required to bridge the gap between the scientific research and the advances in micro- and nano-electronics. Designing an IC for multidisciplinary research involves knowledge not only in circuit design but also in other areas such as physics and biology, along with delicate system-level planning. Hence, it will be a challenging research area. Our team will continue to advance in this area, developing CMOS ICs for multidisciplinary research.

1. K.-M. Lei, P.-I. Mak, M.-K. Law, and R. P. Martins, “A μNMR CMOS transceiver using a Butterfly-coil input for integration with a digital microfluidic device inside a portable magnet,” *IEEE J. Solid-State Circuits*, vol. 51, no. 10, pp. 2274-2286, Nov. 2016.
2. K.-M. Lei, D. Ha, Y.-Q. Song, R. M. Westervelt, R. P. Martins, P.-I. Mak, and D. Ham, “Portable NMR with parallelism,” *Analytical Chemistry*, vol. 92, no. 2, pp. 2112-2120, Jan. 2020.

李家明，澳大微電子研究院助理教授。2016年於澳大獲得博士學位，2017至2019年在哈佛大學Donhee Ham教授的實驗室擔任博士後研究員，至今著有九篇同儕評審期刊論文和九篇會議文章。曾在美國、葡萄牙和意大利主持講座介紹他的研究。曾合著一本書籍和一篇書籍章節（Springer出版），以及持有一項美國專利。

Lei Ka Meng is an assistant professor in the Institute of Microelectronics at UM. He obtained his PhD degree from UM in 2016. He was a postdoctoral fellow (visiting) in Prof Donhee Ham’s laboratory at Harvard University from 2017 to 2019. He has published nine peer-reviewed journal articles and nine conference papers. He has given technical talks on his research in the United States, Portugal, and Italy. He has also co-authored one book and one book chapter published by Springer. He holds one US patent.

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Criminal Liability for Violation of Informed Consent in Macao

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在醫療手術和治療中，知情同意是一項基本的道德要求和法律要求，確保了對病人作為人的尊重[1]。這是確保醫療活動合法性的前提，因為當病人的自決權受到侵犯，醫療活動就是非法的[2]。因此，醫生或依法獲許可人士必須知道何時或如何取得病人的知情同意，以便避免違反病人的知情同意並因此而承擔刑事責任[3]。

Informed consent is an essential ethical and legal requirement for medical interventions or treatments, which guarantees respect for patients as human beings[1]. It is a requirement of the lawfulness of medical activities, which are unlawful when a patient's right to self-decision is violated[2]. Hence, it is very important that doctors or other legally authorised persons know when and how to obtain informed consent from their patient, in order to avoid its violation and, as a result, criminal liability[3].

《澳門刑法典》規定，醫生或依法獲許可之其他人若在未經病人同意的情況下進行意圖預防、診斷、消除或減輕疾病、痛苦、損傷、身體疲勞或精神紊亂的手術或治療，將被處以最高三年徒刑或科罰金（第144條和第150條第1款4）。上述「病人同意」僅在病人獲適當澄清手術或治療的性質、所及範圍、大小與可能產生的後果方面才有效；但如果病人知悉該等情況後會有生命危險，或可能造成身體或精神之健康受嚴重傷害者，不在此限[5]（第151條）。所以「知情同意」由兩部分組成：理解和自願同意。其中「理解」包括提供訊息和理解訊息[6]。

如第150條所述，即使沒有對病人造成傷害，醫生或依法獲許可之其他人仍須承擔刑事責任。此處必須澄清，這裡受保護的法益是人的尊嚴，而不是身體完整性，這與第144條的規定相反。

上述提到的「醫生或依法獲許可之其他人」，是指具有技術資格和獲法律許可的人員，其中「技術資格」確保醫生或其他依法獲許可的人士在進行醫療行為前有充分準備（例如完成相關課程和實踐）。至於「法律許可」的獲得，則需要對從事醫療行為的資格進行認定（例如在專業組織註冊）[7]。在澳門，澳門衛生局是對個人從事醫療行為進行法律許可的實體。鑑於不同國家和地區的醫學課程有所差異，澳門衛生局的委員會負責分析這些課程是否具備獲得法律許可的資格，即該課程是否符合預先制定的資格認定標準[8]。

另一方面，需要明確指出的是，第150條的規定不適用於以下情況：在沒有獲得病人的有效同意下，既非醫生亦非依法獲許可人士從事醫療活動的情況；雖然從事醫療活動的是醫生或依法獲許可人士，但醫療活動並非出於治療目的的情況。對於第一種情況，行為人可能觸犯第322條中規定的有關職務之僭越的罪行[9]，而第二種情況則被視為第144條規定的傷害身體完整性罪。

According to the Macao Penal Code, doctors or legally authorised persons who perform interventions or treatments intended to prevent, diagnose, remedy or alleviate disease, suffering, injury, fatigue, or mental disorder, without patient consent, may be punished with imprisonment up to three years or a fine (article 144 and article 150/14). The mentioned 'patient consent' is only effective when the patient has been adequately clarified about the diagnosis, and the nature, scope, extent, and possible consequences of intervention or treatment, unless it implies a communication of circumstances which, if known by the patient, would endanger his/her life or would be likely to cause serious harm to his/her physical or mental health[5] (article 151). This is the reason why informed consent has been known as a concept which requires two components, comprehension and free consent, where the first one includes provisions of information and understanding[6].

As stated in article 150, doctors or legally authorised persons should be held criminally responsible even though there is no harm caused to their patients. For this reason, it must be clarified that the protected legal interest is not physical integrity, but human dignity, contrary to what occurs in article 144.

The term 'doctors or legally authorised persons' mentioned above alludes to the persons who have technical qualifications and legal authorisation, where the first one requires an adequate preparation to perform medical acts (such as courses, practices, etc.) while the second one requires accreditation for the exercise of medical acts (such as registration in a professional organisation)[7]. In Macao, the entity that issues legal authorisation for the exercise of medical acts is the Macao Health Bureau. Given the existing difference between medicine programmes in many countries and regions, a committee of the Macao Health Bureau is responsible for analysing whether the courses can be considered adequate for legal authorisation, namely whether the courses comply with the pre-defined criteria of accreditation[8].

On the other hand, it should be clear that article 150 should not be applied in a situation where a person, who is not a doctor or legally authorised person, practices medical activities without the patient's effective consent, or in a situation where the medical acts, although practiced by a doctor

不過，在某些情況下，行使醫療行為不要求知情同意。第一種情況涉及緊急醫療手術或治療，其押後將導致生命有危險，或導致身體或健康有嚴重危險（第150條第2款a項）。在這種情況下，醫生或依法獲許可人士應該根據職業規則，分析情況是否確實危急到不能等待病人的知情同意。第二種情況，是指病人和醫生或依法獲許可人士之前曾就某種醫療行為達成一致，而當前考慮採取的另一不同醫療行為是之前達成一致的醫療行為的延伸，旨在避免對病人的生命、身體或健康造成危害（第150條第2款b項）。在這兩種情況下，醫生或依法獲許可人士應安全地得出結論，倘若病人有條件表達其意見，就不會拒絕醫生或依法獲許可人士考慮採取的醫療手術或治療。因此，這些情況被稱為「推定同意」。最後，第三種情況（第150條未作規範）涉及病人的無行為能力（例如《澳門民法典》第111條及其後條文規定的未成年人、禁治產人或準禁治產人）。在這種情況下，醫生或依法獲許可人士即使毋須獲得病人的知情同意，但仍須獲得病人法定代表人的知情同意[10]。

此外，我們還需要知道第150條所規定的犯罪是公罪、半公罪還是私罪。界定這一點很重要，因為它決定了誰可以採取行動對被告提起刑事訴訟。如果規範某種罪狀的法律沒有說明任何內容，就屬於公罪；如果法律規範表明刑事訴訟程序取決於告訴，則屬於半公罪；如果法律規範表明刑事訴訟程序取決於自訴，則屬於私罪。第150條第4款規定，非經告訴不得進行刑事程序，所以這屬於半公罪。在這種情況下，只有當作為被害利益持有人的被害人提出告訴，或者如果被害人已去世，則由法律規定的其他人提出告訴，檢察院才能提起刑事訴訟（第105條第1款和第2款）。因此，如果沒有告訴，檢察院就無法對被告提起刑事訴訟。

總而言之，如果醫生或依法獲許可人士瞭解應該如何獲得病人的有效知情同意，則意味著他們亦瞭解應該將哪些相關醫學訊息告知病人，以及如何使病人充分理解告知的訊息。為幫助病人理解，醫生或依法獲許可人士應避免使用技術術語，並以易於理解的方式或語言與病人溝通[11]。

or legally authorised person, are not destined to therapeutic purposes. For the first situation, the person may commit a crime regarding an illegal practice of profession in line with article 322[9], while the second situation should be considered a crime of offence to physical integrity in accordance with article 144.

However, there are some situations in which informed consent is not required for the exercise of medical acts. The first situation involves urgent medical interventions or treatments whose delay implies danger to life or serious danger to body or health (article 150/2/a). In this situation, the doctor or legally authorised person should analyse, in accordance with leges artis, whether a medical act is so urgent that it cannot wait for the patient's informed consent. The second situation pertains to an extension of a medical act before agreed between the doctor or legally authorised person and the patient, extension that implies another different medical act which before has not been agreed upon and is considered as a way to avoid danger to the patient's life, body, or health (article 150/2/b). In both situations, the doctor or legally authorised person should safely conclude that the consent for the medical interventions or treatments would not be rejected if the patient had the condition to express it. Therefore, these situations are called 'Presumed Consent'. Finally, the third situation, which is not regulated in article 150, refers to a patient's incapability (such as minors, interdicts, disabled persons, regulated in article 111 and following of the Macao Civil Code); in this situation, the doctor or legally authorised person still needs to obtain informed consent from the patient's legal representative, even though the patient's informed consent may be dispensed with[10].

Further, we also need to know if the crime regulated in article 150 is a public crime, semi-public crime, or particular crime. This is very important because it determines who can take action to initiate a criminal procedure against the defendant. If a legal norm that regulates a type of crime does not indicate anything, it is a public crime; in a case in which the legal norm indicates that the criminal procedure depends on a complaint, it is a semi-public crime; and, if a legal norm shows that the criminal procedure depends on a particular accusation, it means the crime has a particular nature. As article 150/4 indicates that the criminal procedure depends on a complaint, it is a semi-public crime. In this case, the Public Prosecutions Office can only initiate a criminal procedure if the offended person, regarded as the holder of offended interest, presents a complaint, and which is presented by other person legally indicated if the offended person dies (article 105/1 and 2). Consequently, without a complaint, the Public Prosecutions Office cannot begin a criminal procedure against the defendant.

In conclusion, if doctors or legally authorised persons know how to obtain effective informed consent from their patients, it implies they also know what relevant medical information should be transmitted and how to ensure that their patients clearly understand the transmitted information. For a better understanding, doctors or legally authorised persons should avoid using technical terms and communicate with their patients in an understandable manner[11].

1. Entidade Reguladora da Saúde, *Consentimento Informado – Relatório Final,* May 2009, p.2.
2. Vera Lúcia Raposo, *Do ato médico ao problema jurídico – Breves Notas sobre o Acolhimento da Responsabilidade Médica Civil e Criminal na Jurisprudência Nacional,* Almedina, 2014, p. 213.
3. 這不是指違反知情同意只會產生刑事責任。這種違反可能同時導致刑事、民事和行政責任。
   It does not imply that its violation only generates criminal liability. Its violation may cause criminal, civil and administrative liabilities simultaneously.
4. 如果沒有具體說明，則是指《澳門刑法典》的相關條文。
   If there is no specific indication, the norms refer to those of the Macao Penal Code.
5. 這裡例外情況是指「治療特權」，意味著限制或減少對患者澄清訊息，以免產生不良後果。
   Cfr. Manuel Leal-Henriques, *Anotação e Comentário ao Código Penal de Macau, Vol. III,* Centro de Formação Jurídica e Judiciária, 2014, p. 269.
   This exception refers to 'therapeutic privilege' which implies a limitation or reduction of clarification of information to a patient in order to prevent undesirable consequences. Cfr. Manuel Leal-Henriques, *Anotação e Comentário ao Código Penal de Macau, Vol. III,* Centro de Formação Jurídica e Judiciária, 2014, p. 269.
6. Entidade Reguladora da Saúde, *op cit.,* p. 3.
7. Manuel Leal-Henriques, *op. cit.* p. 203.
8. 有關資格認定標準的葡萄牙語版本，請見：
   About the criteria of accreditation in the Portuguese language, see:
   https://www.ssm.gov.mo/docs/8884/8884_16263ce150ac407b990cd16932490f89_000.pdf
9. 但也有意見指出，其應視為第144條所指的傷害身體完整性罪。
   Cfr. M. Miguel Garcia, O Direito Penal Passo a Passo, vol. 1, Almedina, 2011, p. 195. Vera Lúcia Raposo, op. cit., p. 172. However, someone considers it as a crime of offence to physical integrity according to article 144. Cfr. M. Miguel Garcia, *O Direito Penal Passo a Passo,* vol. 1, Almedina, 2011, p. 195.
10. Vera Lúcia Raposo, *op. cit.,* p. 172.
11. Entidade Reguladora da Saúde, *op cit.,* p. 3.

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