



生物科技學系

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研究興趣

• 腫瘤微環境與發炎反應-腫瘤治療與機制研究

YKL-40經常高度表現於肺癌病患的組織以及血清當中，此外其亦被證實和多數癌症的治療、預後和存活率有高度的相關性，雖其完整之生理功能尚未被清楚剖析，然而於腫瘤的發展儼然已成為具潛力之重要生物標誌物。發炎蛋白YKL-40純化自M2型巨噬細胞所釋出的蛋白中。M2型巨噬細胞目前已知於腫瘤微環境中扮演決定性角色，並會促進癌細胞的茁壯和轉移。先前諸多研究證明，透過調控M2型巨噬細胞，可有效控制腫瘤的發展。基於生物力學與材料粗糙度之理論，人工腫瘤微環境可以建立在不同奈米尺度的鋁-氧化鋁奈米點陣列上。經實驗證明，不同尺度的奈米點陣列能有效調控細胞轉移之階段性相關的基因和蛋白質表現，成功模擬人體中細胞外基質和細胞之間的密切關係。透過細胞形態變化和相關基因蛋白質之變化，本平台可作為體外人工微環境。

• 免疫檢測晶片開發-臨床生物標誌物即時檢測

基於抗原和抗體間的高度專一性和強鍵結能力，臨床生物標誌物的即時檢測平台和晶片開發即利用該項特點，將抗體呈現於研發出的生物材料上，並以

電化學法量測抗原和抗體結合前後之電阻變化來顯示受測物中的抗原濃度。本檢測平台相較於市面上其他檢測方法的優勢在於其具備高準確度，偵測極限廣，且可精確定量出臨床標記物的濃度。此外，本檢測方法亦不受血液中紅血球和偽過氧化酶的影響，為本檢測平台未來研發上的一大優勢。本檢測平台旨在讓使用者以全血形式，直接進行測試，且即時得到高準確度的數值。本檢測平台期望為臨床以及居家看護帶來一大福音。

• 無毒科技智慧農業-生物抑制劑和物聯網研究

本實驗室在科技農業上的研究以跨領域合作的方式結合了生物科技以及資訊工程的專業，開發出符合農地應用的監控平台、農業AI預測系統、防治病蟲害的無毒生物抑制劑。其中，農業AI預測系統的開發主要著重於農地土壤菌相與肥力的預測及農業病蟲害報告預測系統。而防治病蟲害的無毒生物抑制劑則源自於大自然存在的蛋白，擁有對哺乳類和授粉者無害、對環境污染低、抗藥性低、對病害蟲專一性高的特性。在本科技農業系統中，農地的詳細環境狀況將經本系統上傳至雲端進行農業AI分析，並提供農地管理者決策的建議，做到農業自動化或智慧化的管理，達到精準農業。



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Research Interests

- **Electrochemical biosensor platform for point-of-care testing (POCT) diagnosis**

We developed a new platform a label-free choosing electrochemical detection method to achieve point-of-care testing (POCT) for rapid and convenient diagnosis. Our platform demonstrates high sensitivity and no matrix effects for detection of protein, circulating tumor cells, DNA/RNA, and small molecules. The platform has been well-optimized through modification of SOP definition, reaction condition optimization, simplification of measurement technology, and detection machine customization. In summary, our platform shows high potential in development of POCT diagnosis kit and can be applied in more POCT products for purposes such as food safety monitoring, environmental monitoring, disease diagnostics, and clinical guidance.

- **Tumor microenvironment and inflammation in cancer progression**

Tumor microenvironment is considered one of the critical factors in determining cancer progression and aggressiveness. Our research focuses on the role of tumor associated macrophages (TAMs) and their secreted protein YKL-40 in non-small cell lung cancer (NSCLC). The results showed that YKL-40 is correlated to cancer metastasis and the resistance to EGFR targeted therapies and can potentially serve as a target for combined therapy to avoid residual diseases during

treatment. In addition to studying YKL-40, we also developed a biomaterial comprised of uniform nanodots as an artificial microenvironment to mimic the regulation of extracellular matrix (ECM) to cancer cells that can further serve as a drug screening platform.

- **Green and smart agriculture system**

To solve the recent problem in food shortage and soil erosion, we integrated technologies from both biotech and computer science to develop a total solution including monitoring platform · AI prediction system and bio-reagents. In the AI prediction system, we focus on the forecast the soil microbiome distribution as well as pest and disease eruption timing to assist the decision making in farm management. Our specially designed bio-reagents originate from the nature and are non-toxic to mammals and pollinators, environmentally safe, and highly specific to pests and diseases. With this agricultural system, farming data will be analyzed through AI to provide suggestion for farm management to achieve precision agriculture in the field.