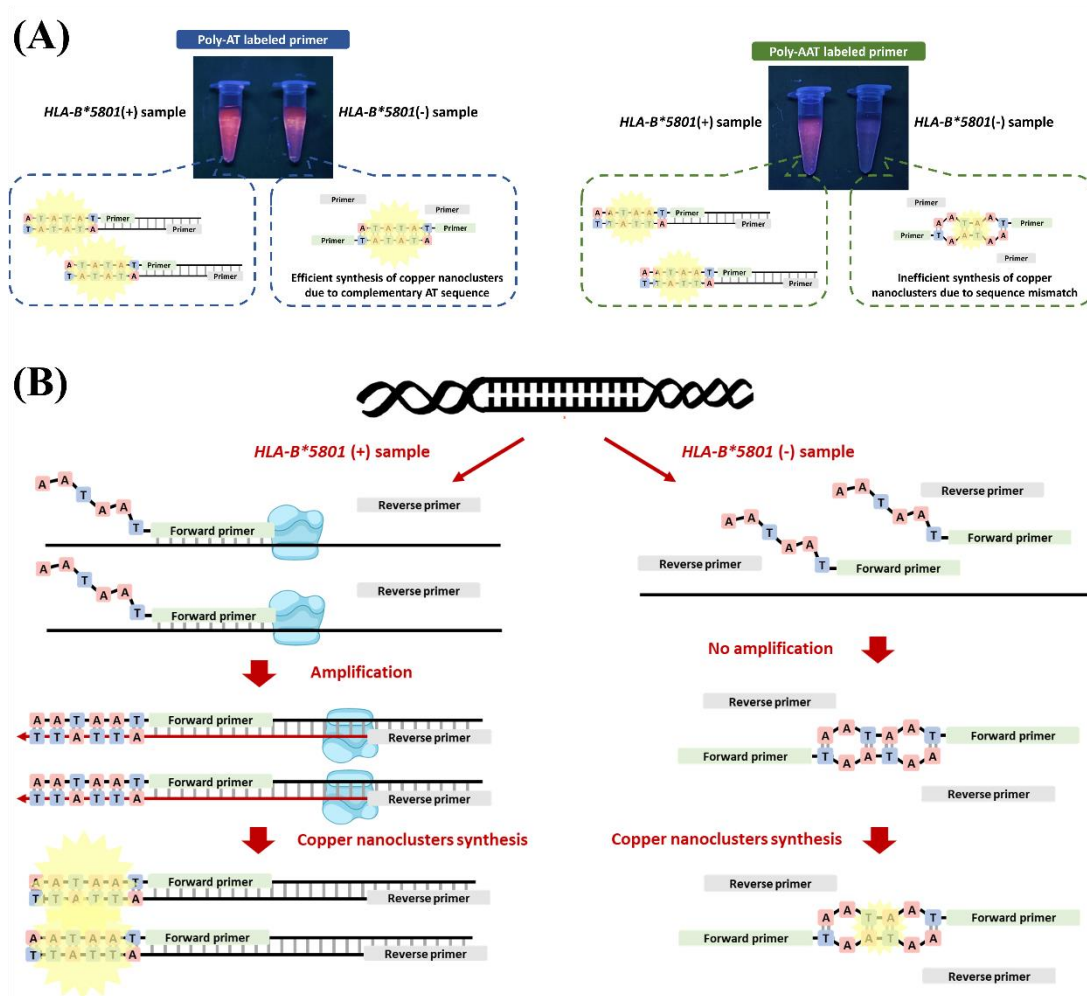




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近幾年來，由於大眾開始對健康與預防醫學的重視，使得【基因檢測】成為相當被重視的國家發展主題與學術研究項目。然而傳統基因檢測方法往往仰賴昂貴儀器或試劑，限制了其臨床應用與普及性，為此本研究建立了結合基因擴增檢測與銅奈米團簇的分析方法，實現了可視化、不須貴重儀器且具成本效益的基因檢測。本研究針對特定基因序列所形成之雙股 DNA 銅奈米團簇與基因擴增技術的最佳組合進行研究探討。其中，若以隨機雙股 DNA 序列所合成之銅奈米團簇僅能產生微弱螢光，而改用 poly-AT 序列雖能產生肉眼可見螢光，但卻因殘餘單股引子會自我黏合而在陰性樣品中產生螢光干擾。為此，本研究設計出 poly-AAT 序列接在引子 5'端，使其在自我黏合時產生錯配，大幅降低陰性樣品中銅奈米團簇的合成率，增強陰、陽性檢測結果的螢光差異。此方法成功應用於 HLA-B*5801 基因分析，並應用於實際人體基因檢體檢測。本研究所使用的低螢光干擾 AAT 重複序列合成銅奈米團簇具有多種潛在應用：可作為螢光檢測方法，應用於其他的基因檢測與生物感測平台；合成後的銅奈米團簇亦可作為奈米材料，應用於微電子學、催化反應及生物醫學等領域，兩個方向互相搭配後可以有非常廣的應用價值。



【具體成果】

- 學術成就

5 年內有多篇優質期刊發表，並擁有多國多項專利，且 2 項中華民國與美國專利正在申請中。

(詳見實驗室網頁: <https://sites.google.com/view/kmu-pharmacy-biosensors-lab>)



【研究團隊】

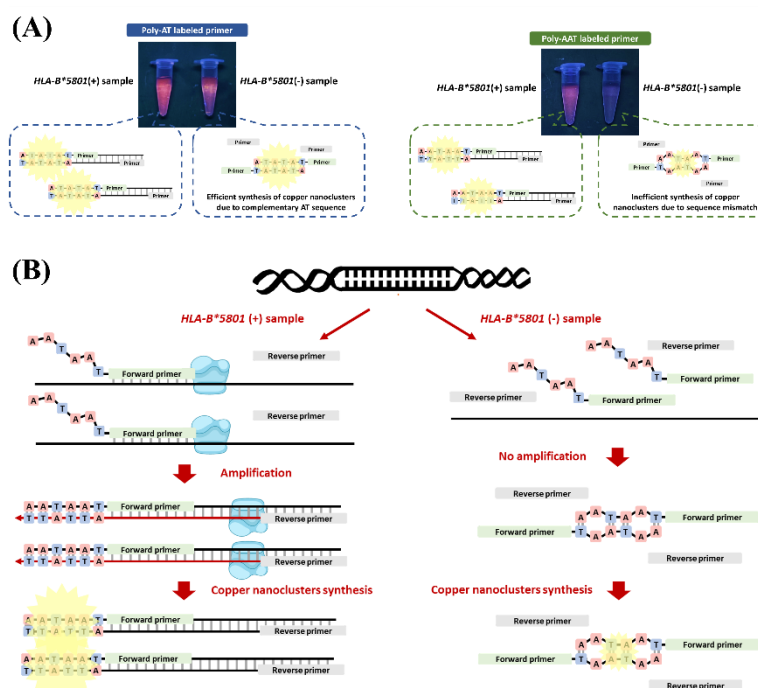
團隊成員：王俊棋、柯黃盛、賴可朋、蘇郁晴、馮光煜等

團隊簡介：本團隊以開發新穎分析技術為主，其研究內容包括線上濃縮毛細管電泳法開發、基因檢測方法開發、特殊引子及探針設計及應用、奈米粒子合成及應用等

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In recent years, with the public's increasing emphasis on health and preventive medicine, genetic testing has become a highly valued national development theme and academic research project. However, traditional genetic testing methods often rely on expensive instruments or reagents, limiting their clinical application and widespread use. To address this, this study established a method combining gene amplification detection and copper nanoclusters analysis, achieving visualized, cost-effective genetic testing that does not require expensive instruments. Copper nanoclusters synthesized using random double-stranded DNA sequences only produce weak fluorescence. While poly-AT sequences can produce visible fluorescence, residual single-stranded primers self-adhere, causing fluorescence interference in negative samples. Therefore, this study designed a poly-AAT sequence attached to the 5' end of the primer, causing mismatches during self-adhesion, significantly reducing the synthesis rate of copper nanoclusters in negative samples and enhancing the fluorescence difference between positive and negative detection results. This method was successfully applied to HLA-B*5801 gene analysis and to actual human gene sample testing. The low-fluorescence-interference AAT repeat sequence used in this study has multiple potential applications: it can be used as a fluorescence detection method for other gene detection and biosensing platforms; the synthesized copper nanoclusters can also be used as nanomaterials for applications in microelectronics, catalysis, and biomedicine. The combination of these two approaches has a very wide range of applications.





【Concrete Results】

● Academic Achievements

In the past 5 years, we have published many articles in high-quality journals, and has multiple patents in many countries, and 2 patents in the Taiwan R.O.C. and the United States are pending.

(See the lab website for details: <https://sites.google.com/view/kmu-pharmacy-biosensors-lab>)



【Research Team】

Team Member: Chun-Chi Wang, Hwang-Shang Kou, Ke-Peng Lai, Yu-Chin Su, Guang-Yu Feng

Overview: This team focuses on developing novel analytical technologies. Its research content includes the development of online concentration capillary electrophoresis methods, the development of genetic detection methods, the design and application of special primers and probes, the synthesis and application of nanoparticles, etc. systems.

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