



張值維 副教授

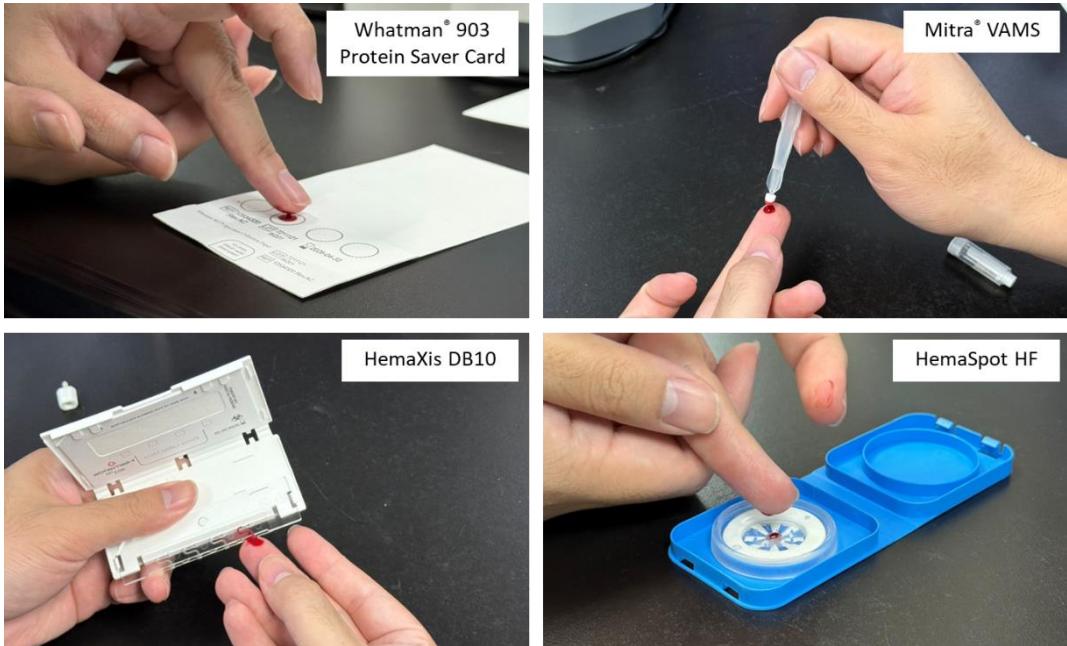
藥學院/藥學系

在運動禁藥檢測領域，「乾血點」(Dried Blood Spot, DBS) 技術因具備微量採血、樣本穩定與保存便利等優點，正逐步成為世界運動禁藥管制機構(WADA)推動的新興檢測方式。張值維老師研究團隊於 2025 年發表於國際期刊 *Analytica Chimica Acta* 的研究成果，後續更獲得 WADA 科研資助，針對六種常見類固醇(Glucocorticoids)在不同微量採血裝置中的分析表現進行完整比較，為運動禁藥檢測提供新的技術依據。

研究團隊利用超高效液相層析串聯質譜(UHPLC-MS/MS)技術，評估四款商用 DBS 裝置(Whatman 903 卡片型、HemaSpot 扇形、Mitra VAMS 筆尖型、HemaXis DB10 晶片型)的檢測精密度與操作便利性。結果顯示，Mitra VAMS 與 HemaXis DB10 在分析準確度、回收率及與全血比對的一致性方面表現最佳，其中 VAMS 在受測者的操作體驗與滿意度中也獲最高評價。相較之下，傳統卡片型與扇形裝置因血量分布不均及基質效應而出現較大變異。

本研究成果說明，微量採血技術已具備應用於運動禁藥檢測的可行性，並能協助建立更可靠的檢測流程。張老師團隊的工作不僅強化我國在微量採血與精準分析領域的研究基礎，也有助於未來推動此技術在國際賽事檢測與臨床藥物監測中的實際應用。

(主要論文：Chen C.C. et al., *Analytica Chimica Acta*, 2025; 1380: 344765)



【具體成果】

● 獲獎

- 114 年度國家科學及技術委員會補助大專校院研究獎勵 (研究彈薪第二級)
- 114 年度教育部延攬及留住特殊優秀教研人才獎勵 (教學彈薪第一級)
- 112 學年度校級教學傑出教師 (全校 5 名)
- 2024 年研究績優教師-優秀論文獎

wada

Annex A

Full application				HMRC meeting			
UniqueID	Admin Code	Name (FI)	Project title	Duration	Requested budget (US\$)	Recommendation	Recommended budget (US\$)
u2612-app4233 2420059V	Sven Voss		Effect of exercise induced proteinuria and hypoxia on the analysis of rRNA	1 year	27,700.00 Fund	27,700.00	The research exercise protocol should be modified to demonstrate that it needs to continue.
u3120-app1514 2420C09WCWT	William Chih-Wai Chang		Investigation of the applicability of dried blood spots for the analysis of glucocorticoids	2 years	124,000.00 Fund	124,000.00	Suggestion to use the mid dose of prednisolone to (no maximum therapeutic dose (no mid dose).
u5615-app2277 2420126D	Edward Isomann		Performance Enhancement and Energy Metabolism Modulation by 1 year	1 year	54,000.00 Fund	54,000.00	Recommendation to increase the washout period.
u3126-app1586 2420508P	Philip Bollinger		The effect of exercise on blood, arta and muscle metabolism, prolonged endurance performance and sprinting ability in trained endurance athletes	2 years	212,350.40 Fund conditional	93,000.00	Suggestion on the performance enhancement experiments only (stop the mechanistic mechanism and reduce budget. Enroll subjects of one gender only (gender preference).
u831-app4256 2420Z02R	Christian Reichel		Analysis and evaluation of black market nasal sprays containing peptides and proteins	1 year	55,000.00 Fund conditional	45,000.00	Reduce budget.
u3112-app1811 2420A091	Tobias Langer		Evaluation of analyte stability and uniformity of dried blood spots collected with automatic Tatio-MD devices for anti-doping applications	1 year	60,000.00 Fund	60,000.00	Suggestion to contact the manufacturer to obtain additional data on stability and homogeneity of the spots.
u2305-app4232 2420C06ED	Dimitris Klettas		Investigation of the Metabolic Fate of Nandrolone's Prohormone to the Steroid	1 year	78,941.00 Fund	78,941.00	Suggestion to increase the sampling phase to a minimum of one month.
u2271-app1293 2420A12PN	Jean-François Raud		Carbon stable isotope analysis of 7-keto-DHEA doping targeting both glucocorinated and sulfoncoglucorinated metabolites	1 year	50,250.00 Fund	50,250.00	Suggestion to contact the manufacturer to obtain additional data on stability and homogeneity of the spots.
u2067-app2577 242010ND	Nevard Dikic		Anti-doping analysis of blood samples from DOPING COMPETITIONS	1 year	39,000.00 Fund	39,000.00	Suggestion to increase the sampling phase to a minimum of one month.
u2112-app4194 2420B04CM	Christos Malin		Autologous blood doping biomarker: single-cell fluid properties, Al morphology and Extracellular vesicles.	2 years	232,962.00 Do not fund		Suggestion to provide better preliminary data and include in vivo experiments in your proposal, if possible. Suggestion to provide more power analysis and adjust sample size accordingly; provide more information on
u2596-app4172 2420D01CW	Chao Wei		Investigating the Metabolic Profiling of Endogenous Anabolic Androgenic Steroids in the Chinese population	2 years	101,266.00 Do not fund		



【研究團隊】

團隊成員：陳政嘉、林侑恩、許美智、林育全、張值維

團隊簡介：本研究團隊由藥學系博士生陳政嘉、碩士生林侑恩、運動醫學系教授許美智、附設醫院骨科主治醫師林育全及張值維老師共同組成。張老師領導之藥學院運動禁藥分析實驗室，專注於微量採血技術與質譜分析於運動禁藥與臨床藥物監測之應用。

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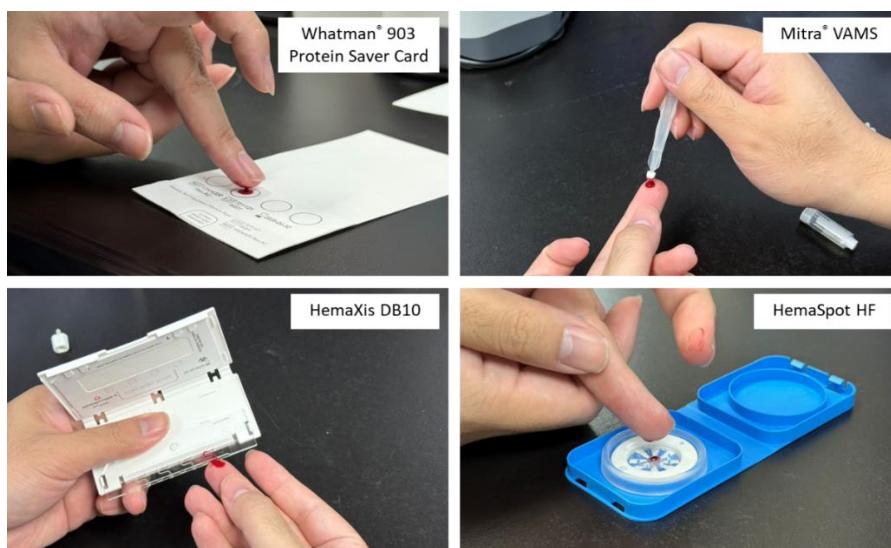


In the field of sports anti-doping testing, Dried Blood Spot (DBS) technology has emerged as a promising alternative due to its minimal invasiveness, sample stability, and convenient storage and transport. Professor William Chih-Wei Chang and his research team published their findings in *Analytica Chimica Acta* (2025), later receiving additional support from the World Anti-Doping Agency (WADA). The study provided a comprehensive comparison of the analytical performance of six commonly used glucocorticoids across different microsampling devices, offering new technical evidence for advancing doping detection strategies.

Using ultra-high-performance liquid chromatography–tandem mass spectrometry (UHPLC–MS/MS), the team evaluated four commercial DBS devices—Whatman 903 Protein Saver Card, HemaSpot HF, Mitra® Volumetric Absorptive Microsampling (VAMS), and HemaXis DB10—in terms of analytical precision and user usability. The results indicated that Mitra VAMS and HemaXis DB10 achieved the highest analytical accuracy, recovery, and consistency with whole blood, while VAMS also received the best user feedback for ease of operation. In contrast, the traditional card- and fan-type devices exhibited greater variability due to uneven blood distribution and matrix effects.

This research demonstrated the feasibility of applying microsampling technologies to sports anti-doping testing and supported the development of more reliable procedures. The work led by Professor Chang strengthens Taiwan's research foundation in microsampling and precision mass spectrometry and paves the way for future applications of DBS in international doping control and clinical drug monitoring.

(Main publication: Chen C.C. et al., *Analytica Chimica Acta*, 2025; 1380: 344765)





【Concrete Results】

● Awards

1. 2025 NSTC Incentive Award for Outstanding University Research (Tier 2)
2. 2025 MOE Award for Distinguished Teaching and Research Talent Retention (Tier 1)
3. 2023 KMU Outstanding Teaching Award (Top 5 University-Wide)
4. 2024 KMU Research Excellence Award – Outstanding Paper

【Research Team】

Team Member: Cheng-Chia Chen, Yu-En Lin, Mei-Chich Hsu, Yu-Chuan Lin, and William Chih-Wei Chang.

Overview: The research team comprises Cheng-Chia Chen (PhD student, School of Pharmacy), Yu-En Lin (Master's student, School of Pharmacy), Professor Mei-Chich Hsu (Department of Sports Medicine), Dr. Yu-Chuan Lin (Attending Physician, Department of Orthopaedics, KMUH), and Professor William Chih-Wei Chang.

Professor Chang leads the Anti-Doping and Bioanalytical Chemistry Laboratory at the School of Pharmacy, Kaohsiung Medical University, focusing on the application of microsampling technologies and mass spectrometry in sports anti-doping science and clinical drug monitoring.

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