國立陽明交通大學
National Yang Ming Chiao Tung University

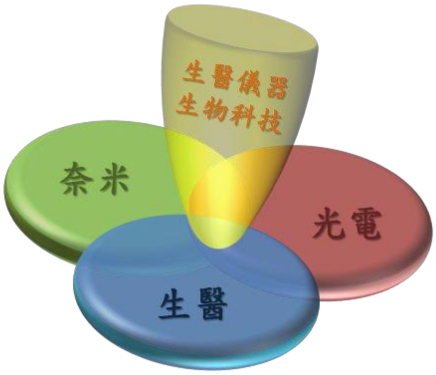
生醫光電研究所
Institute of Biophotonics

BIOPHOTONICS

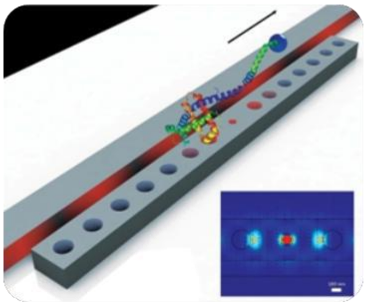
目錄

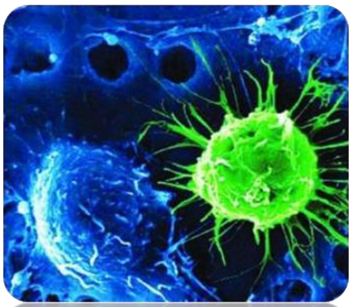
學術卓越！就業前景佳!跨領域！國際化！

本所為國內第一個結合生醫與光電領域的研究所。聘有多位外籍學者及博士後研究人員，並與多所國內外光電研究單位交流合作，協同醫院、產業界研究開發先端實用之生醫光電科技！



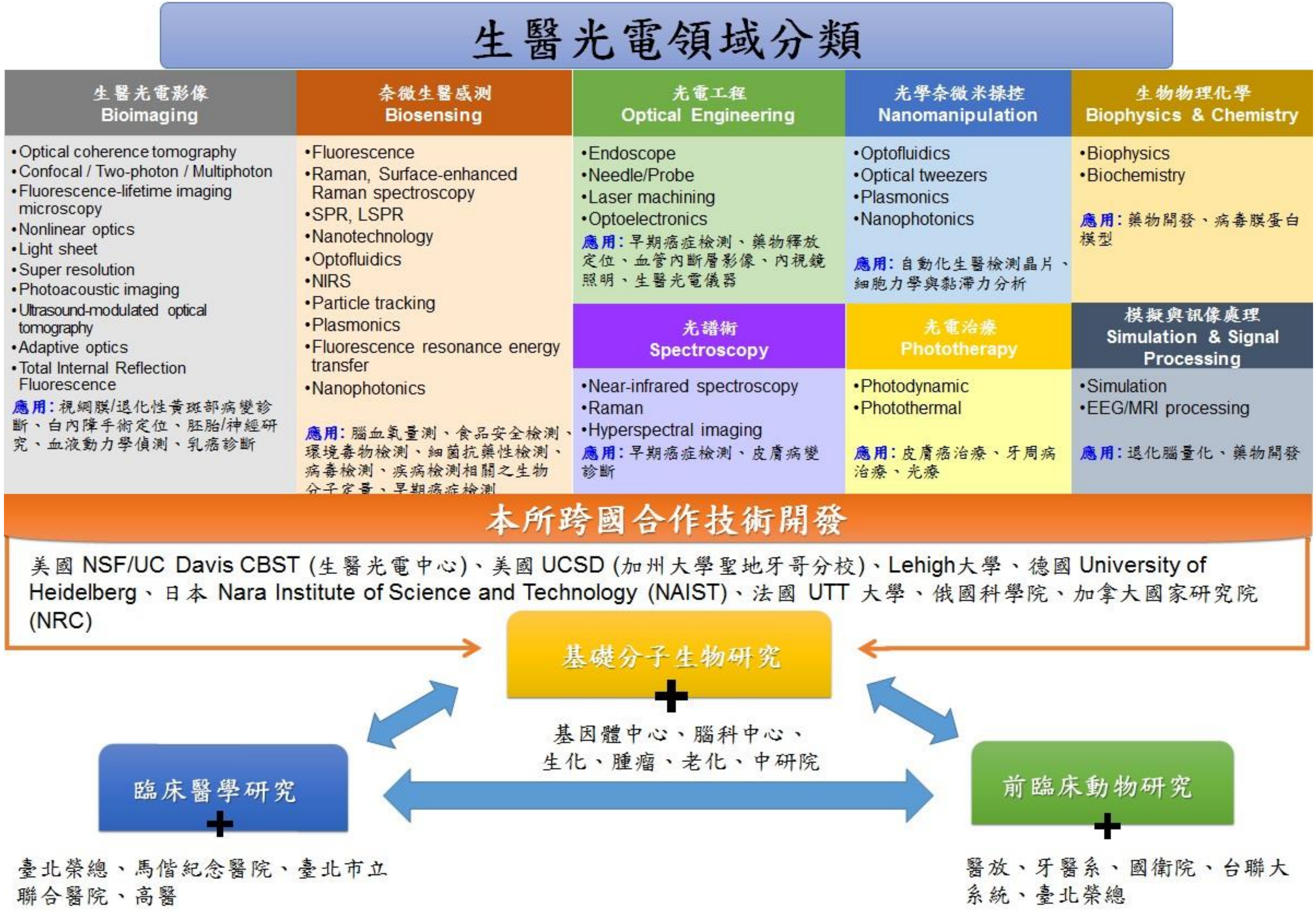
「生醫光電」技術的獨特性為感測、造影、診療提供了一種非接觸，快速且安全的方式，應用於生命科學、微生物學、藥物分析以及醫療等方面具有多個突出的優勢。目前全球人口迅速老齡化，慢性疾病患者人數顯著增加，以及深度學習的最新興起正驅動著生醫光電的發展與創新，本所研究方向聚焦於智慧影像與精準感測，未來預估此領域將持續快速增長並成為一股嶄新潮流。





醫療儀器中有一大部分與生醫光電及奈米科技相關，而本所的研究就是整合光學、電學、生醫及奈米等領域的知識，發展適合用於醫療檢測、臨床治療與生醫相關研究的儀器或技術。在教學上，本所兼顧理工及生醫背景學生的需求，以循序漸進的方式讓不同領域的學生在原本的專業基礎上學習跨領域知識，為目前已經蓬勃發展的醫療器材、光電及生技產業培養人才。本所教師的研究領域廣泛，而且研究內容兼顧學術卓越及產業應用性，使具有不同研究興趣、不同專業背景的學生都很容易在本所找到適合的實驗室進行研究，並且可以為未來的升學或就業打好基礎。

綜言之，本所培育的學生因為在其原本的專業知識外增加了生醫、光電、人工智慧及奈米的跨領域知識，畢業後的發展將更為多元、寬廣。本所過去畢業的學生在光電、醫療器材、健康照護及生技等產業就業情況十分良好，而隨著這些產業的快速發展， 本所學生必定能有更美好的前景。


生醫光電領域分類
生醫光電影像
Bioimaging
•Optical coherence tomography
•Confocal / Two-photon / Multiphoton
•Fluorescence-lifetime imaging microscopy
•Nonlinear optics
•Light sheet
•Super resolution
•Photoacoustic imaging
•Ultrasound-modulated optical tomography
•Adaptive optics
•Total Internal Reflection Fluorescence
應用：視網膜/退化性黃斑部病變診斷、白內障手術定位、胚胎/神經研究、血液動力學偵測、乳癌診斷
奈微生醫感測
Biosensing
•Fluorescence
•Raman, Surface-enhanced Raman spectroscopy
•SPR, LSPR
•Nanotechnology
•Optofluidics
•NIRS
•Particle tracking
•Plasmonics
•Fluorescence resonance energy transfer
•Nanophotonics
應用：腦血氧量測、食品安全檢測、環境毒物檢測、細菌抗藥性檢測、病毒檢測、疾病檢測相關之生物分子定量、早期癌症檢測
光電工程
Optical Engineering
•Endoscope
•Needle/Probe
•Laser machining
•Optoelectronics
應用：早期癌症檢測、藥物釋放定位、血管內斷層影像、內視鏡照明、生醫光電儀器
光學奈微米操控
Nanomanipulation
•Optofluidics
•Optical tweezers
•Plasmonics
•Nanophotonics
應用：自動化生醫檢測晶片、細胞力學與黏滯力分析
生物物理化學
Biophysics & Chemistry
•Biophysics
•Biochemistry
應用：藥物開發、病毒膜蛋白模型
光譜術
Spectroscopy
•Near-infrared spectroscopy
•Raman
•Hyperspectral imaging
應用：早期癌症檢測、皮膚病變診斷
光電治療
Phototherapy
•Photodynamic
•Photothermal
應用：皮膚癌治療、牙周病治療、光療
模擬與訊像處理
Simulation & Signal Processing
•Simulation
•EEG/MRI processing
應用：退化腦量化、藥物開發
本所跨國合作技術開發
美國 NSF/UC Davis CBST (生醫光電中心)、美國 UCSD (加州大學聖地牙哥分校)、Lehigh大學、德國 University of Heidelberg、日本 Nara Institute of Science and Technology (NAIST)、法國 UTT 大學、俄國科學院、加拿大國家研究院 (NRC)
基礎分子生物研究
基因體中心、腦科中心、生化、腫瘤、老化、中研院
臨床醫學研究
臺北榮總、馬偕紀念醫院、臺北市立聯合醫院、高醫
前臨床動物研究
醫放、牙醫系、國衛院、台聯大系統、臺北榮總

生醫光電所專任教師及學生相關資訊

本所教師計畫統計

	2015	2016	2017	2018	2019	2020~
計畫經費(元)	14,059,333	14,272,000	16,774,000	17,088,000	29,753,747	25,937,000
計畫總數	13	11	13	13	12	13
計畫數/專任教師人數	1.625	1.375	1.625	1.625	1.333	1.444
計畫總金額/專任教師人數	1,757,416	1,784,000	1,863,778	1,898,667	3,305,971	2,881,888
發表論文數(第一、通訊作者)/專任教師人數	2.625	2.875	2.3	3	2.3	2.1

YMU與法國UTT之雙學位

From YMU	莊〇〇、黃〇〇、李〇〇、沈〇〇、尤〇〇、楊〇〇
From UTT	Yann(楊〇〇)

本所目前學生人數

博班(外籍生)	30人(8人)
碩班(外籍生)	64人(1人)

本所專任教師卓越獎勵之情形

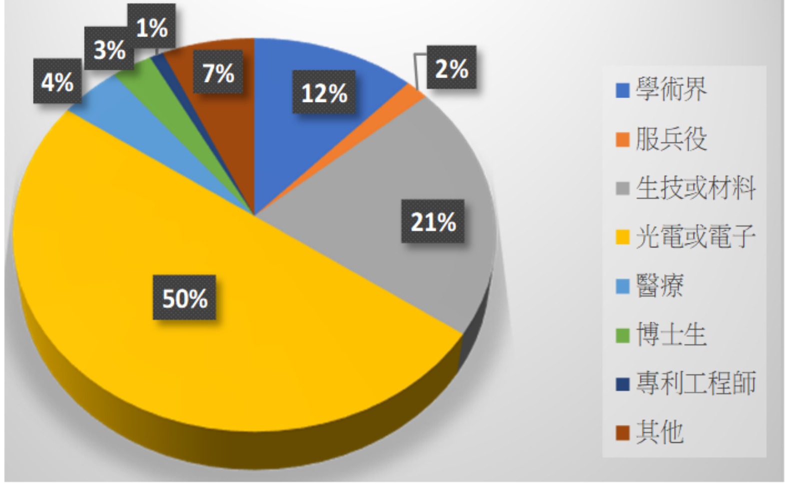
等級	教師人數(人)
A	1
B	2
C	1

生醫光電研究所主導業務

生醫光電奈米學士學位學程

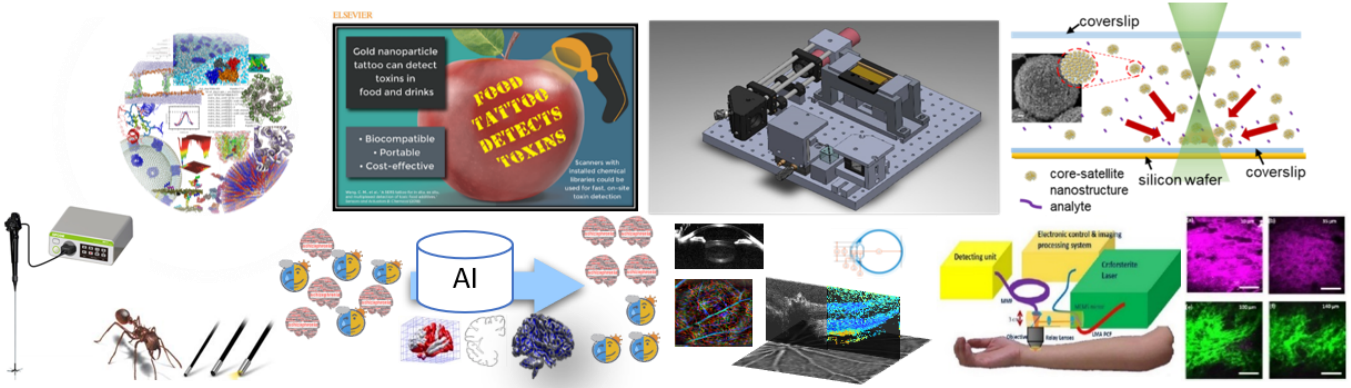
台聯大光電博士學位學程

陽明大學生醫光電所畢業生就業情形



平均薪資：NTD 48,000

就業相關程度：91.5%



生醫光電研究所 一0九學年度第一學期課程時間表

		一	二		三		四		五	
一	8：00 / 8：50									
教師										
教室										
二	9：00 / 9：50		分子生物學之計算模擬與分析				分子細胞生物學概論			LabVIEW 程式設計與應用
教師			曾伍岡				楊德明、吳岳忻 曾伍岡			陳奕帆
教室			傳甲 602A1				圖資 403			圖資 403
三	10:10 / 11：00	光學斷層影像原理與應用	生物物理化學（一）				分子細胞生物學概論	幹細胞生物學特論	院級專題討論	LabVIEW 程式設計與應用
教師		郭文娟	曾伍岡				楊德明 吳岳忻 曾伍岡	李光申 楊智宇	吳俊忠/郭文娟	陳奕帆
教室		傳甲 436	傳甲 602A1				圖資 403	圖資 405	生醫工程館 102	圖資 403
四	11：10 / 12：00	光學斷層影像原理與應用	生物物理化學（一）				分子細胞生物學概論	幹細胞生物學特論	院級專題討論	LabVIEW 程式設計與應用
教師		郭文娟	曾伍岡				楊德明 吳岳忻 曾伍岡	李光申 楊智宇	吳俊忠/郭文娟	陳奕帆
教室		傳甲 436	傳甲 602A1				圖資 403	圖資 405	生醫工程館 102	圖資 403
N	12：20 / 13：10								生物科技產業概論	
教師									吳俊忠(等 5 人)	
教室									生醫工程館 1F 階梯教室	
五	13：20 / 14：10	專題討論	線性代數	科學論文寫作	奈米化學	醫用電子學應用導論	光學斷層影像原理與應用		光學細胞顯微科技	
教師		饒啟文	曾世璿	薛特	曾伍岡、薛特、陳傳霖	饒啟文	郭文娟		李超煌	
教室		傳甲 208	傳甲 436	傳甲 602A1	傳甲 436	圖資 641	傳甲 436		傳甲 533	
六	14：20 / 15：10	專題討論	線性代數	科學論文寫作	奈米化學	醫用電子學應用導論			光學細胞顯微科技	
教師		饒啟文	曾世璿	薛特	曾伍岡、薛特、陳傳霖	饒啟文			李超煌	
教室		傳甲 208	傳甲 436	傳甲 602A1	傳甲 436	圖資 641			傳甲 533	
七	15：30 / 16：20	機器學習基礎數學:機率與最佳化方法	線性代數	科學論文寫作	奈米化學	醫用電子學應用導論	程式語言		光學細胞顯微科技	
教師		吳育德	曾世璿	薛特	曾伍岡、薛特、陳傳霖	饒啟文	盧家鋒		李超煌	
教室		圖資 403	傳甲 436	傳甲 602A1	傳甲 436	圖資 641	圖資 401		傳甲 533	
八	16:30 / 17:20	機器學習基礎數學:機率與最佳化方法					程式語言			
教師		吳育德					盧家鋒			
教室		圖資 403					圖資 401			
九	17:30 / 18:20	機器學習基礎數學:機率與最佳化方法							工程數學	
教師		吳育德							陳浩夫	
教室		圖資 403							傳甲 533	
A	18:30 / 19:20		光電工程導論				光電工程導論		工程數學	
教師			邱爾德、曾世璿				邱爾德、曾世璿		陳浩夫	
教室			傳甲 533				傳甲 533		傳甲 533	
B	19:30 / 20:20		光電工程導論						工程數學	
教師			邱爾德、曾世璿						陳浩夫	
教室			傳甲 533						傳甲 533	

一0九學年度第二學期生醫光電研究所課程時間表

		一	二		三		四		五	
一	8：00 8：50									
教師										
教室										
二	9：00 / 9：50								電路分析、儀表與量測	
教師									陳奕帆	
教室									傳甲 436	
三	10:10 / 11：00		生物物理化學Ⅱ	微奈米製造技術	醫用生物物理		再生生物醫學特論		電路分析、儀表與量測	院級專討
教師			費伍岡	董奕鍾	費伍岡		李光申		陳奕帆	吳俊忠
教室			圖資 641	傳甲 533	圖資 641		圖資 405		傳甲 436	醫工館 102
四	11：10 / 12：00		生物物理化學Ⅱ	微奈米製造技術	醫用生物物理		再生生物醫學特論		電路分析、儀表與量測	院級專討
教師			費伍岡	董奕鍾	費伍岡		李光申		陳奕帆	吳俊忠
教室			圖資 641	傳甲 533	圖資 641		圖資 405		傳甲 436	醫工館 102
N					生物醫學訊號與影像處理特論					
教師					饒啟文					
教室					傳甲 436					
五	13：20 / 14：10	專題討論	生理學	半導體光電元件與顯示科技	當代生醫影像與感應發展與應用	生物醫學訊號與影像處理特論	基礎光電材料與技術		應用雷射與非線性光學	生醫感測與微奈米操控科技
教師		饒啟文	王柏山、劉子洋	薛特	楊德明	饒啟文	高甫仁		郭文娟、賈世璿	陳奕帆
教室		傳甲 208	傳甲 533	傳甲 436	圖資 403	傳甲 436	傳甲 436		傳甲 B121	傳甲 436
六	14：20 / 15：10	專題討論	生理學	半導體光電元件與顯示科技	當代生醫影像與感應發展與應用	生物醫學訊號與影像處理特論	基礎光電材料與技術		應用雷射與非線性光學	生醫感測與微奈米操控科技
教師		饒啟文	王柏山、劉子洋	薛特	楊德明	饒啟文	高甫仁		郭文娟、賈世璿	陳奕帆
教室		傳甲 208	傳甲 533	傳甲 436	圖資 403	傳甲 436	傳甲 436		傳甲 B121	傳甲 436
七	15：30 / 16：20		生理學	半導體光電元件與顯示科技	訊號與系統		Matlab 進階程式設計與專題實作	細胞生物學 A	應用雷射與非線性光學	生醫感測與微奈米操控科技
教師			王柏山、劉子洋	薛特	賈世璿		盧家鋒	吳岳忻	郭文娟、賈世璿	陳奕帆
教室			傳甲 533	傳甲 436	傳甲 436		圖資 404	守仁樓 101	傳甲 B121	傳甲 436
八	16:30 / 17:20				訊號與系統		Matlab 進階程式設計與專題實作	細胞生物學 A	雷射與顯微技術於生醫科技之應用	
教師					賈世璿		盧家鋒	吳岳忻	細川陽一郎	
教室					傳甲 436		圖資 404	守仁樓 101	傳甲 B121/授課時間另行安排	
九	17:30 / 18:20				訊號與系統					
教師					賈世璿					
教室					傳甲 436					
A	18：30 / 19：20		傅立葉光學		生醫光電概論		傅立葉光學			
教師			邱爾德		郭文娟		邱爾德			
教室			傳甲 602-A1		傳甲 533		傳甲 602-A1			
B	19：30 / 20：20		傅立葉光學		生醫光電概論					
教師			邱爾德		郭文娟					
教室			傳甲 602-A1		傳甲 533					

研究主題

研究領域	研究主題	研究主題
生醫訊號 與影像分析	生醫訊號與影像分析 大腦人機介面 人工智慧	吳育德 教授 賈世璿 助理教授 饒啟文 專案助理教授
生醫光電感測	基因晶片光電系統 光學感測系統與生物感測器 雙頻率表面電漿波生物感測技術 發展人體血氧濃度及二維影像即時測量技術 光纖生物螢光感測技術 利用光纖生物感測技術於體液中偵測生物活性分子 侷域表面電漿共振生物感測技術 基於熱泳效應之生物感測與分析技術	高甫仁 教授 陳浩夫 副教授 陳奕帆 副教授 賈世璿 助理教授 江惠華 教授 邱爾德 教授
微奈米光學操控	雷射光鉗之分子生醫應用 光學延伸器 光子力顯微鏡 光流體微奈米操控技術	陳奕帆 副教授 李超煌 教授 林奇宏 教授 兵岳忻 副教授 邱爾德 教授
光譜學之生醫應用	凝態雷射光譜學之生醫研究 近紅外光譜學在醫學上之應用 生醫奈米拉曼光譜量測系統 表面增強拉曼光譜應用於細胞特性監測與分析 拉曼散射光譜與螢光光譜組織診斷分析技術開發 非侵入式光學量測活體生理參數光譜系統之建構 以自組裝奈米微結構進行表面增強拉曼光譜檢測	郭文娟 教授 薛特 教授 陳奕帆 副教授 賈世璿 助理教授 江惠華 教授 邱爾德 教授
生醫光電影像技術	活細胞多維功能影像 活體組織螢光影像 奈米生物影像量測 光學同調斷層影像 共焦顯微術, 差動共焦顯微術 超高解析度遠場光學顯微術 時間解析活體生物影像 時間解析多模態先進光學顯微平台 醫用超音波信號處理 外差干涉雷射掃描顯微鏡	郭文娟 教授 高甫仁 教授 陳浩夫 副教授 賈世璿 助理教授 李超煌 教授 江惠華 教授 林奇宏 教授 兵岳忻 副教授 邱爾德 教授 楊德明 副教授
非線性光學	非線性光學影像 強場短脈衝雷射光源 雷射非線性動力學	高甫仁 教授 陳浩夫 副教授 賈世璿 助理教授
生醫物理	生醫物理計算及實驗 病毒膜蛋白	費伍岡 教授

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簡介

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最高學歷 Education

國立台灣大學電機工程博士。Ph.D. in Electrical Engineering, National Taiwan University, 2005.

■ 現職 Current position

國立陽明交通大學 生醫光電研究所 教授 Professor, Institute of Biophotonics, National Yang-
Ming University (2015-).
生物醫學影像暨放射科學系合聘教授 Professor (joint appointment), Department of Biomedical Imaging and Radiological Sciences, National Yang-Ming University (2015-).
實驗動物照護及使用委員會主任 Commissioner, Institutional Animal Care and Use Committee, NYMU (2016-2018).
衛生福利部食品藥物管理署醫療器材諮議會委員 Medical Equipment Consultants, Food and Drug Administration (FAD) (2016-2018).

■ 主要經歷 Professional experiences

國立陽明大學生醫光電研究所 副教授(2011-2015)。Associate professor (2011-2015), Institute
of Biophotonics, National Yang-Ming University
國立台灣師範大學光電科技研究所 助理教授(2005-2009)、副教授(2009-2011)。Assistant professor (2005-2009), associate professor (2009-2011), Institute of Electro-Optical Science and Technology, National Taiwan Normal University

■ 代表著作 Selected publications

1. **W. C. Kuo***, M. C. Kao, C. K. Ting and W. N. Teng. Optical coherence tomography needle probe in neuraxial block application. Accept to be published in IEEE Journal of Selected Topics in Quantum Electronics, doi: 10.1109/JSTQE.2020.3042076, **2020**. (Impact factor: 4.917)
2. W. N. Teng, M. C. Kao, C. K. Ting, and **W. C. Kuo***. Fibre-needle Swept-source Optical Coherence Tomography for the Real-time Visualization of the Fascia Plane Block Procedure in a Swine Model. Anesth Analg. **2020** PMID: 33264115. (Impact factor: 4.305)
3. P. Y. Lai, C. H. Chang, H. R. Su, and **W. C. Kuo***. Lymphatic vessel segmentation in optical coherence tomography by added U-Net-based CNN for artifacts minimization, Biomedical Optics Express, **2020**, 11, No. 5, 2679-2693. (Impact factor: 3.921)
4. P. H. Chen, H. Y. Lee, Y. F. Chen, Y. C. Yeh, K. W. Chang, M. C. Hou and **W. C. Kuo***. Detection of Oral Dysplastic and Early Cancerous Lesions by Polarization-Sensitive Optical Coherence Tomography. Cancers 12, 2376, 1-18, **2020**. (Impact factor: 6.102)
5. P. H. Chen, Y. J. Chen, Y. J. Chen, Y. F. Chen, Y. C. Yeh, K. W. Chang, M. C. Hou, and **W. C. Kuo***. Quantification of microvascular change for diagnosing early digestive squamous cell carcinoma by optical coherence tomography. Biomedical Optics Express, **2020**. 11(3): p. 1244-1256. (Impact factor: 3.921)
6. T. Anna, S. Chakraborty, C. Y. Cheng, V. Srivastava, A. Chiou, and **W.C. Kuo***. Elucidation of microstructural changes in leaves during senescence using spectral domain optical coherence tomography. Scientific Reports, **2019**; 9(1167):1-10 (Impact factor: 4.122)

■ 研究領域 Research Interests

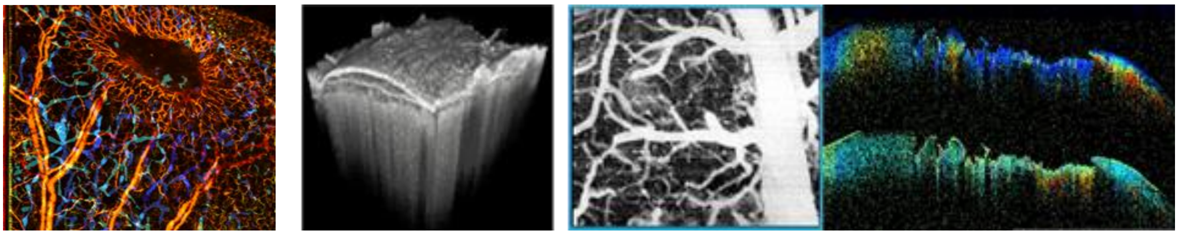
1. 功能性光學同調斷層攝影術 Functional optical coherence tomography
2. 影導式光學內視鏡斷層造影術 Surgical-guiding optical coherence tomography endoscopy
3. 高解析小動物用眼底鏡與血管斷層顯維術 High resolution fundus camera and

vascular tomographic microscopy for small animal

4. 早期癌與腫瘤轉移偵測 Detection of early cancer and cancer metastasis

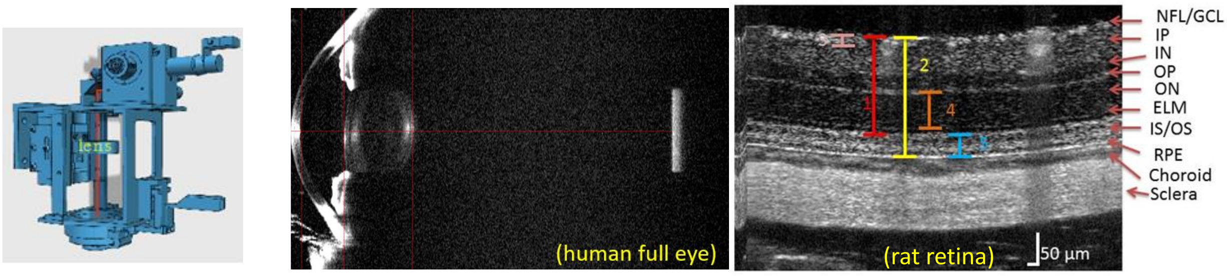
■ 研究簡介 Research Highlights

1. 開發功能性光學同調斷層掃描術於生物醫學的應用 Functional optical coherence tomography (OCT) and its biomedical applications

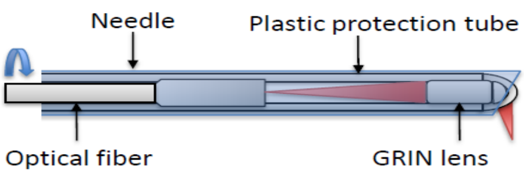


功能性光學同調斷層掃描術，可用以同時提供活體微結構、微血管、以及膠原纖維等多對比斷層影像，使用於早期癌偵測與腫瘤轉移前預測。Functional OCT provides *in vivo* multi- contrast images, which can be used in the early diagnosis of cancerous tissue and tumor metastasis.

2. 長行程全眼斷層掃描儀與高解析眼底視網膜斷層顯微儀產品設計與開發 Long-range human full eye biometry and high resolution fundus tomography for small animal-prototyping



3.光纖針頭內視鏡影像系統輔助硬脊膜外腔麻醉術 Fiber-needle endoscopy system for the identification of the epidural space



我們利用掃頻式光學同調斷層造影術結合針尖光學微探頭的設計可提供圍繞於麻醉針頭周圍的組織二維斷層影像。我們以活體小豬模式驗證，此方法於脊髓下腔麻醉針頭定位可同時達到高靈敏度與高準確性。

Epidural needle placement using conventional techniques has significant limitations. Alternative techniques lack the ability to image tissues surrounding the needle tip with rapid time resolution. We developed an optical probe placed in the epidural needle coupled with SSOCT can provide 2-D images of tissue surrounding the needle tip. Using a porcine model, high sensitivity and specificity for the identification of the epidural space were achieved.

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最高學歷 Education

PhD in Chemistry, Heidelberg University 1991

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■ 主要經歷 Professional Experience

Guest Professor, Heidelberg University, D, (2014 – 2017)
Visiting Professor, Harvard Medical School, Boston USA
(2014) Professor (2010), NYMU
Distinguished Associate Professor, Institute of Biophotonics, NYMU (2006-2010),
Lecturership in Molecular Biophysics, Depts. Biochemistry and Physics
(Bionanotechnology IRC), Oxford University, UK (2000-2006), EC-TMR Research
Fellow, Dept. of Biochemistry, Oxford University, UK (1998-2000),
Institute of Analytical Chemistry, TU Dresden, Germany (1993-
1998), Post-Doc, Boston University, USA (1992-1993).

■ 代表著作 Selected publications

1. Y.-H. Lien, D. R. Mahato, F. Hoppe-Seyler, W. B. Fischer; Membrane partitioning of peptide aggregates - coarse grained molecular dynamics simulations. *J. Biomol. Struc. Dyn.* (2020) **38**, 524-532
2. S. Dahl, M. M. Kalita, W. B. Fischer; Interaction of antivirals with a heptameric bundle model of the p7 protein of hepatitis C virus. *Chem. Biol. Drug Des.* (2018) **91**, 942-950
3. C.-P. Chen, M.-H. Lin, Y.-T. Chan, L.-C. Chen, C. Ma, W. B. Fischer; Membrane protein assembly: two cytoplasmic phosphorylated serine-sites of Vpu from HIV-1 affect oligomerization. *Sci. Rep.* (2016) **6**, 28866
4. D. R. Mahato, W. B. Fischer; Weak selectivity predicted for modeled bundles of the viral channel forming protein E5 of human papillomavirus-16. *J. Phys. Chem. B* (2016) **120**, 13076-13085
5. M.-H. Lin, H.-J. Hsu, R. Bartenschlager, W. B. Fischer; Membrane undulation induced by NS4A of Dengue virus – a molecular dynamics simulation study. *J. Biomol. Struc. Dyn.* (2014) **32**, 1552-1562
6. C.-C. Chen, et al.; ORF 8a of the human severe acute respiratory syndrom coronavirus forms an ion channel: experiments and molecular dynamics simulations. *Biochim. Biophys. Acta* (2011) **1808**, 572-579
7. J. Krüger, W. B. Fischer; Assembly of viral membrane proteins. *J. Chem. Theory Comput.* (2009) **5**, 2503-2513
8. Mehnert, A. et al.; Biophysical characterisation of Vpu from HIV-1 suggests a channel-pore dualism. *Proteins* (2008), **70**, 1488-1497
9. G. Patargias, N. Zitzmann, R. Dwek, W. B. Fischer; Protein-protein interactions: modelling the Hepatitis C virus ion channel p7. *J. Med. Chem.* (2006) **49**, 648-655

■ 研究領域 Research Interests

1. Computational modeling and bilayer recordings
2. Channel forming membrane proteins and pumps
3. Protein – ligand and protein – protein interactions, protein mechanics

■ 研究簡介 Research highlights

1. Building a structural model

One of the key assumptions is that the viral channel forming proteins have to self- assemble to form functional channels and exist as monomeric units prior to assembly. Therefore, important issues to be addressed are, (i) what is the structure of the monomeric unit, (ii) when assembling, how many proteins are involved, (iii) how is ion-flux established, and (iv) how can the mechanism of function be modulated. Experimental data are still lacking for answering the second questions of how many peptides or proteins are involved in the assembly. Therefore, we apply computational methods such as extended fine grained docking combined with short molecular dynamics (MD) simulations. With this technique the conformational space of the assembly will be explored. The transmembrane domain (TMD) of a protein is used and an axial symmetry around the center of the bundle is adopted. Some of the outcomes are shown in figure 1.

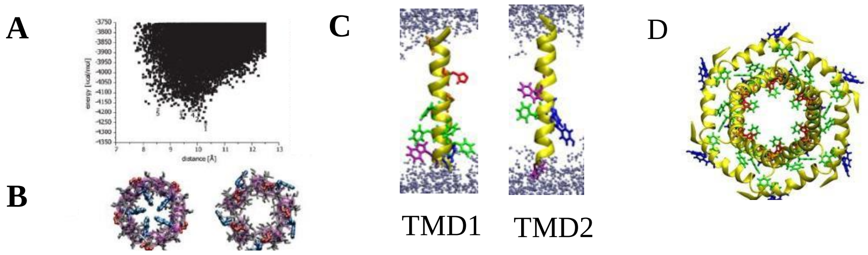

Fig. 1: (A) 2D potential energy landscape, energy versus distance, of a pentameric assembly of the TMD of Vpu from HIV-1. (B) Selected low energy structures as indicated in A. (C) Individual TMDs of the bitopic protein p7 from HCV. Water molecules are shown on top and bottom of the figure, lipid molecules are omitted for clarity. (D) A putative pore model of p7 in top view using the individual

2. Aggregation von Membranproteinen in der Lipidmembran

With coarse grained MD simulations, we are using structurally simplified models of the proteins. Even though information on an atomic level is lost, we are able to simulate over long time scales and also larger systems. This technique will be explored for its use as a quantitative analytical tool for large scale structure screening. Applications of the technique and the use of the analytical protocols will serve the drug development and also biomaterial sciences.

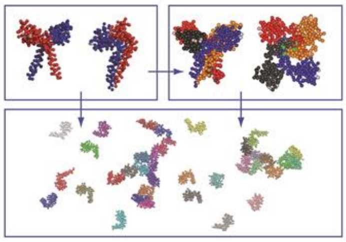

Fig. 2: Coarse grained models of Vpu (red and blue) after a 10 μs simulation in a lipid membrane (not shown). Simulations of two, four and 36 Vpu proteins. Upper right, the structure of a tetrameric assembly of Vpu proteins with an ion-channel like architecture.

3. Tailor-made liposomes for drug delivery

Liposomes play an important role in drug delivery. We have developed a software which enables the tailor-made design of liposomes using structural data of lipids and proteins.

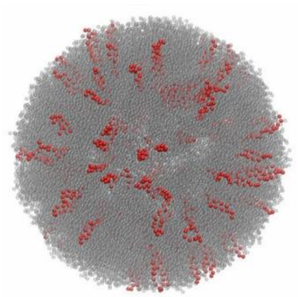

Fig. 3: Tailor-made liposome using the in-house developed software ArcVes. Two different types of lipids are used, colored in red and grey. The lipid molecules are represented by a limited number of spheres representing the atoms of the molecules. These models are called ‘coarse-grained.

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最高學歷 Education

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■ 現職 Current position

Professor, Institute of Biophotonics, National Yang-Ming University (2015-Present)

■ 主要經歷 Professional experiences

Associate Professor, Institute of Biophotonics, National Yang Ming University, Taipei, 02/2008-02/2015。

Associate Professor, Department of Electrical Engineering, National Chung Hsing University, Taichung, 08/2006-01/2008

■ 代表著作 Selected publications

1. Detection of mercury in spiked cosmetics by surface enhanced Raman spectroscopy using silver shelled iron oxide nanoparticles; Zih-Ying Chen, Akash Gupta, Surojit Chattopadhyay*. **Sens. Actuators B: Chemical** 337, 129788 (2021).
2. Metallo-graphene enhanced upconversion luminescence for broadband photodetection under polychromatic illumination; Akash Gupta, Mukesh Kumar Thakur, Tirta Amerta Effendi, Ruei-San Chen, Hao-Yu Cheng, Kung-Hsuan Lin, Mohammed Bouras, Digvijay Singh Tomar, Hsin Yu Kuo, Surojit Chattopadhyay.* **Chem. Engg. J.** 127608 (2021).
3. Graphene oxide as broadband hyperthermic agent and chemo-photothermal dissolution of kidney-stone mimicking calcium oxalate crystals; Hung-You Chen, Sandip Ghosh, Vinoth Kumar Ponnusamy, and Surojit Chattopadhyay*, **Journal of Photochemistry & Photobiology A:** Chemistry 405, 112917 (2021).
4. Upconversion nanoparticle-mOrange protein FRET nanoprobes for self-ratiometric/ratiometric determination of intracellular pH, and single cell pH imaging; Sandip Ghosh, Yu-Fen Chang, De Ming Yang, and Surojit Chattopadhyay*, **Bios. Bioeletron.** 155, 112115 (2020).
5. Ultrasensitive broadband photodetector using electrostatically conjugated MoS_2-upconversion nanoparticle nanocomposite; Sandip Ghosh, Wen Cheng Chiang, Muhammad Yusuf Fakhri, Chien Ting Wu, Ruei San Chen, and Surojit Chattopadhyay*, **Nano Energy** 67, 104258 (2020).
6. Microplasma-Enabled Graphene Quantum Dots Wrapped Gold Nanoparticles with Synergistic Enhancement for Broadband Photodetection; Mukesh Kumar Thakur, Chih-Yi Fang, Yung-Ta Yang, Tirta Amerta Effendi, Pradip Kumar Roy, Ruei-San Chen, Kostya (Ken) Ostrikov, Wei-Hung Chiang*, and Surojit Chattopadhyay*, **ACS Appl. Mater. Int.** 12, 28550-28560 (2020).
7. Optically coupled engineered upconversion nanoparticles and graphene for high responsivity broadband photodetector; Mukesh Kumar Thakur, Akash Gupta, Muhammad Yusuf Fakhri, Ruei San Chen, Chien Ting Wu, Kung Hsuan Lin, and Surojit Chattopadhyay*, **Nanoscale** 11, 9716-9725 (2019).
8. A SERS tattoo for in situ and ex situ detection of toxic food additives, Chia Min Wang, Pradip K.Roy, B. K. Juluri, and Surojit Chattopadhyay; **Sensors and Actuators B** 261, 218-225 (2018).
9. In Vivo and In Vitro Demonstration of Gold Nanorod Aided Photothermal Pre-Softening of B16F10 Melanoma for Efficient Chemotherapy Using Doxorubicin Loaded Graphene Oxide; Fan-Hsuan Kao, Najim Akhtar, Chao-Cheng Chen, Hung You Chen, Mukesh Kumar Thakur, Ya-Yun Chen, Chuan-Lin Chen, and Surojit Chattopadhyay*, **ACS Applied Biomaterials** 2, 533-543 (2019).

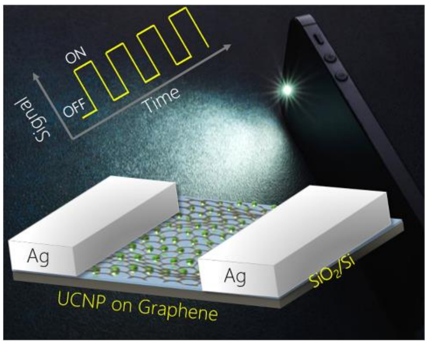
10. Photothermal Disintegration of 3T3 Derived Fat Droplets by Irradiated Silica Coated Upconversion Nanoparticles; Akash Gupta, Cheang Weng Lam, Chien Ting Wu, De-Ming Yang, and Surojit Chattopadhyay*, **Part. Part. Syst. Charact.**, 1800294 (2018).
11. Design for Approaching Cicada-Wing Reflectance in Low- and High-Index Biomimetic Nanostructures: Yi-Fan Huang, Yi-Jun Jen, Li-Chyong Chen, Kuei-Hsien Chen, and Surojit Chattopadhyay, **ACS Nano** 9, 301-311 (2015).

■ 研究領域 Research Interests

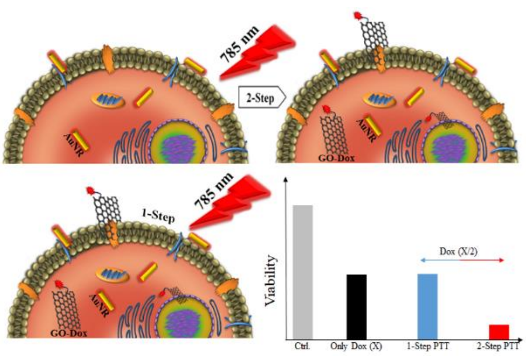
1. Nanomaterials (奈米材料).
2. Photonics (光子學).
3. Raman spectroscopy, Surface enhanced Raman spectroscopy (拉曼光譜, 表面增強拉曼光譜); Fluorescence and absorption spectroscopy (螢光和吸收光譜).
4. Biosensors (生物感測器); Photothermal therapy (光熱療法); Photodynamic therapy (光動力療法); Nanoparticle based drug delivery, and therapy (以奈米粒子為基礎的藥物遞送和治療)
5. Plasmonics (電漿子光學)
6. Microplasma (微電漿)
7. Photodetectors. (光偵測器)

■ 研究簡介 Research Highlights

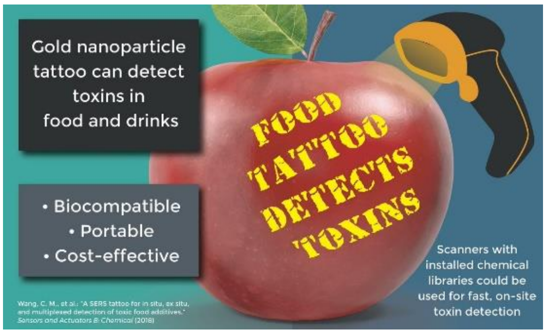
1. Nanomaterial based photodetectors: A hybrid upconversion nanoparticle (UCNP)-graphene composite is demonstrated as high sensitivity, and high gain photodetector. UCNPs is used as the photoabsorber, and an optimized graphene is used as an efficient charge transporter. This initial report of UCNP-graphene optical coupling is expressed as fluorescence enhancement/quenching of the former in presence of the latter. While the published literature mostly relies on fluorescence quenching in the UCNPs, our devices use both fluorescence quenching (using core UCNPs), and enhancement (using UCNP@SiO_2) to significantly enhance the detector parameters. For example, the photoresponsivity of the core-UCNP device was ~1.52 x 10^4 AW^{-1} could be improved to ~2.7 x 10^4 AW^{-1} (at 980 nm, power of 4.0μW, and under 1.0 V bias) with the UCNP@SiO_2 device. The responsivity, gain, and detectivity thus obtained are the highest reported so far for this class of composite photodetectors. The device could detect signals from domestic hand-held appliances such as laser pointers, cellphone flash lights, and air-condition remotes.



2. Nanomaterial based therapy: A combined photothermal therapy (PTT), and chemotherapy (CT) was performed *in vitro* on B16F10 melanoma cells, and *in vivo* using melanoma bearing C57BL/6 mice. 785 nm (100 mW) irradiated gold nanorods (AuNRs) was used as the PT agent, and electrostatically conjugated Doxorubicin (Dox) to a nanocarrier graphene oxide (GO) worked as the chemotherapeutic. Melanoma bearing mice (*in vivo*) treated sequentially with 785 nm irradiated gold nanorods for PTT, and subsequently with Dox loaded GO, for chemotherapy (CT), yielded enhanced tumor growth inhibition index compared to tumors that underwent one shot PTT+CT. Even one shot PTT +CT, using GO-Dox, had the same cytotoxicity to that of free Dox at only half the free Dox concentration.



3. **Bio-sensing via nanostructure based Surface Enhanced Raman Spectroscopy:** Different types of nanostructured gold/silver substrates were developed that could be used



for molecular detection using SERS. First, we have used a dual metal (gold and silver) nano- architecture for a label-free, high-sensitivity detection of sub-picomole level oligonucleotides by using SERS. An array of gold nanotips on which ss-DNA were immobilized were sputtered with silver nanoparticles and SERS was performed. The measurement achieved a high-sensitivity detection level (120 fM). [**Biosens. Bioelectron.** 26, 2413 (2011).]

Next, printed gold nanoparticles (AuNP) have been used for the detection of fatal food contaminants and pesticides (**RSC Adv**. 4, 40487 (2014)) and can then be used as flexible substrates for the detection of pesticides used in fruits/crops via SERS. **US and Taiwan patents obtained**. A SERS tattoo (see figure) was then developed for in situ and ex situ detection of pesticides and toxic chemicals from the surfaces of fruits and soft drinks.

4. **Lanthanide doped nanoparticles for bio-imaging.**
Up-conversion nanoparticles (UCNPs) are important for bio-imaging since they can fluoresce in the visible (green, blue) when irradiated with infra-red light which has the smallest absorption in tissues of living animals. We grow the lanthanide nanoparticles using the common Schlenk lines with liquid phase chemistry, study them by TEM, SEM, XRD, fluorescence and its lifetime, and plan to use them for photothermal therapy, and FRET. We have demonstrated both graphene and metal enhanced fluorescence in these UCNPs recently with a large enhancement of 19x (**RSC Advances** 6, 87088 (2016)) and 50x (**Mater. Sci. Engg.** C 102, 569-577 (2019)). We have used these UCNPs to eliminate fat droplets in mouse 3T3 cells by a photothermal effect (**Part. Part. Syst. Charact.**, 1800294 (2018)). These UCNPS can also be used in conjugation with m-Orange proteins as FRET pairs.

5. **Growth of chemical vapour deposited graphene, and MoS_2 and its application in glucose, uric acid, dopamine and ascorbic acid sensing:** Graphene is deposited on copper foils by thermal chemical vapour deposition using methane, hydrogen and argon gas. The quality of graphene is studied by Raman spectroscopy. Graphene with the strongest 2D band is found to be good for bio-sensing. Using graphene as a surface enhanced Raman substrate, bio-molecules such as glucose in blood (Analyst 140, 3935 (2015)), uric acid, dopamine, and ascorbic acid could be detected spectroscopically with high sensitivities (Biosensors & Bioelectronics 70, 137-144 (2015)). A monolayer of graphene could quench the 540 nm (green) fluorescence from the core-UCNPs by 3X, and a bi-layer graphene could enhance the green fluorescence from the Silica (SiO_2) coated core-shell (cs) UCNPs by 30X. This graphene-aided fluorescence tuning in the engineered UCNPs can be translated to photothermal conversion using a 980 nm excitation. From the dynamic response of local temperature, we could estimate the photothermal conversion efficiency of the core, and cs UCNP-graphene to be 65, and 46 %, respectively. The photothermally generated heat on these nanoheater surfaces can be used for desalination of salt water (**ACS Applied Nanomaterials** 2, 2250-2259 (2019)).

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最高學歷 Education

美國康乃爾大學物理博士。
Physics Ph.D., Cornell University, 1993.

■ 現職 Current position

國立陽明大學生醫光電研究所 教授。
Professor, Institute of Biophotonics, National Yang-Ming University (2004-)
亞太物理學會副理事長
Association of Asia Pacific Physical Societies (2016-)

■ 主要經歷 Professional experiences

中華民國物理學會理事長(2014-2016) President, Physics Society of ROC (2012-2014)
中華民國物理學會副理事長(2012-2014) Vice President, Physics Society of ROC (2012-2014) 國立陽明大學研發處副研發長 (2006-20011) Associated Dean, Office of Research & Development, NYMU (2006-2011)
國立陽明大學生醫光電研究所所長(2004-2011) Director, Institute of Biophotonics, NYMU(2004-2011)

■ 代表著作 Selected publications

1. **Fu-Jen Kao**, Gerd Keiser, Ankur Gogoi (Eds.), **Advanced Optical Methods for Brain Imaging**,, Springer, Berlin, 2018.
2. Zhan-Yu Chen, Ankur Gogoi, Shao-Yu Lee, Yuan Tsai-Lin, Po-Wei Yi, Ming-Kuan Lu, Chih-Cheng Hsieh, JinChang Ren, Stephen Marshall and Fu-Jen Kao*, Coherent Narrow-Band Light Source for Miniature Endoscopes, IEEE Journal of Selected Topics on Quantum Electronics, Vol 25, Issue 1 (2019) (**DOI:** 10.1109/JSTQE.2018.2836959)
3. Guan-Yu Zhuo (卓冠宇), Mei-Yu Chen (陳美瑜), Chao-Yuan Yeh (葉肇元), Chin-Lin Guo (郭青齡) and **Fu-Jen Kao*** (高甫仁), Fast determination of three-dimensional fibril orientation of type-I collagen via macroscopic chirality, Appl. Phys. Lett. **110**, 023702 (2017) (http://dx.doi.org/10.1063/1.4973885)
4. Nirmal Mazumder, Lu Xiang, Jianjun Qiu, and **Fu-Jen Kao***, Investigating starch gelatinization through Stokes vector resolved second harmonic generation microscopy, Scientific Reports 7, Article Number: 45816 (2017). (doi:10.1038/srep45816)
5. Nirmal Mazumder, Gitanjal Deka, Wei-Wen Wu, Ankur Gogoi, Guan-Yu Zhuo, **Fu-Jen Kao***, Polarization Resolved Second Harmonic Microscopy, Methods (2017) (https://doi.org/10.1016/j.ymeth.2017.06.012)
6. M. K. Lu, H. Y. Lin, C. C. Hsieh, and **Fu-Jen Kao***, Supercontinuum as a light source for miniaturized endoscopes, ***Biomedical Optics Express***, Vol. 7, Issue 9, pp. 3335-3344 (2016) (doi: **10.1364/BOE.7.003335**)
7. Gitanjal Deka, Kazunori Okano, and **Fu-Jen Kao *,** Dynamic photo-patterning of cells in situ by Q-switched Nd:YVO4 laser, J. Biomed. Opt., 19 (1), 011012, 2014.
8. Ming-Kuan Lu[1], Feng-Chen Chang[1], Wen-Zhe Wang[1], Chih-Cheng Hsieh[2*], and **Fu-Jen Kao***, Compact LED lighting Ring for Video-Assisted Thoracic Surgery, *J. Biomed. Opt*. 19(10), 105004 (Oct 07, 2014).
9. Gitanjal Deka, Kazunori Okano,* Hiroshi Masuhara, Yaw-Kuen Li and **Fu-Jen Kao***, Metabolic variation of HeLa cells migrating on microfabricated cytophilic channels studied by the fluorescence lifetime of NADH, ***RSC Adv.***, 2014,**4**, 44100-44104 (http://dx.doi.org/10.1039/C4RA06492E)
10. Jianhong Ge, Cuifang Kuang, Shin-Shian Lee, and **Fu-Jen Kao***, Fluorescence lifetime imaging with pulsed diode laser enabled stimulated emission, Optics Express, Vol. 20, Iss. 27, pp. 28216–28221 (2012). Also selected for the Virtual Journal for Biomedical Optics (VJBO), Editor Andrew Dunn and Anthony Durkin, Vol. 8, Iss. 1, February 4, 2013.
11. Gitanjal Deka, Wei-Wen Wu, **Fu-Jen Kao***, *In vivo* Wound Healing Diagnosis with Second Harmonic and Fluorescence Lifetime Imaging, J. Biomed. Opt. 18(6), 061222, 2013

12. N. Mazumder, J. Qiu, M. R. Foreman, C. M. Romero, P. Török, and **Fu-Jen Kao***, "Stokes vector based polarization resolved second harmonic microscopy of starch granules," Biomed. Opt. Express 4 (4), 538-547, 2013.

13. Nirmal Mazumder, Rodney K. Lyn, Ragunath Singaravelu, Andrew Ridsdale, Douglas J. Moffatt, Chih-Wei Hu, Han-Ruei Tsai, John McLauchlan, Albert Stolow, **Fu-Jen Kao***, John Paul Pezacki, Fluorescence Lifetime Imaging of Alterations to Cellular Metabolism by Domain 2 of the Hepatitis C Virus Core Protein, PLoS One 8(6), e66738, 2013.

14. Po-Yen Lin, Yi-Cheng Lin, Chia-Seng Chang, **Fu-Jen Kao***, Fluorescence Lifetime Imaging Microscopy with Subdiffraction-Limited Resolution, Japanese Journal of Applied Physics 52(2), 028004-3, 2013.

15. Nirmal Mazumder, Chih-Wei Hu, Jianjun Qiu, Matthew R. Foreman, Carlos Macías Romero, Peter Török, and **Fu-Jen Kao***, Revealing molecular structure and orientation with Stokes vector resolved second harmonic generation microscopy, Methods, 2013 (http://dx.doi.org/10.1016/j.ymeth.2013.07.019).

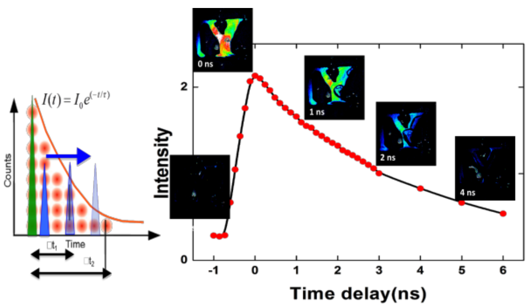
16. Kazunori Okano, Ai Matsui, Yasuyo Maezawa, Ping-Yu Hee, Mie Matsubara, Hideaki Yamamoto, Yoichiroh Hosokawa, Hiroshi Tsubokawa, Yaw-Kuen Li, **Fu-Jen Kao**,* and Hiroshi Masuhara, In situ laser micropatterning of proteins for dynamically arranging living cells, Lab on a Chip **13 (20)**, 4078-4086, 2013.

■ 研究領域 Research Interests

1. Stimulated emission based pump-probe microscopy
2. 4-channel Stokes vector resolved SH polarization microscopy
3. Biomedical optical instrument for endoscopy

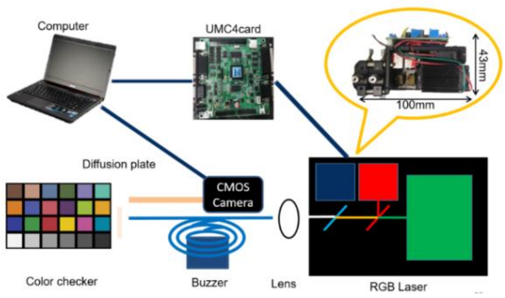
■ 研究簡介 Research Highlights

1. 受激放射之長工作距離螢光及其生命期偵測
Long working distance fluorescence and lifetime measurement via stimulated emission



利用激發放射的機制可以在長工作距離量測**螢光及其生命期**。如此，可突破螢光收集需以高數值孔徑光學元件為之的限制。In this work, we are focusing on the unique aspect of spatial coherence as a result of stimulated emission, which is utilized for long distance fluorescence detection and lifetime imaging. In contrast with the case of spontaneous emission, high numerical aperture optics is not required to collect the stimulated emission signal efficiently.

2. 雷射照明之內視鏡平台
Laser illumination for endoscopy



We have successfully established a novel ultra-compact endoscopic imaging system, which uses a miniature CMOS sensor (O.D. <1.0 mm) and a few multimode fiber for light delivery. Critically, the illumination is realized by coupling the output of a supercontinuum or RGB laser into the fiber. In this way, very high brightness is possible with extremely small footprint on the illumination part. As a result, the overall diameter (< 1.2 mm) of the endoscope can be much smaller than the currently used models.

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最高學歷 Education

美國匹茲堡電機工程博士。Ph.D. in Electrical Engineering & Computer Engineering, University of Pittsburgh, 1997.

■ **現職Current position**

國立陽明大學生醫光電研究所 **特聘教授**。Distinguished Professor and Dean of Research and Development, National Yang-Ming University.

■ **主要經歷 Professional experiences**

國立陽明大學生醫光電研究所教授(2014) 。Professor (2014), Institute of Biophotonics, National Yang-Ming University

國立陽明大學醫學影像暨放射科學系助教授(2000)、副教授(2003)、教授(2007-2014)

Assistant professor (2000), Associate professor (2004), Professor (2007-2014), Dept. of Biomedical Imaging and Radiological Sciences

陽明大學副教務長兼實習組組長(09/2012-01/2014)、生醫科學暨工程跨領域學位學程主任

(10/2012-07/2013)、生醫光電暨奈米科學學士學位學程主任(08/2013-2019/01)、生醫光電所所長(02/2014-2019/01)、研發長兼產運中心主任(2019/02-2021/01)

國立暨南國際大學資訊工程學系助教授 (02/1999-07/2000)、美國匹茲堡大學醫學院助教授與合聘卡內基美儂大學機器人研究所研究員(08/1997-01/1999)

■ **代表著作 Selected publications**

1. Wei-Kai Lee, Chih-Chun Wu, et al., Wan-Yuo Guo*, Yu-Te Wu*. Combining analysis of multi-parametric MR images into a convolutional neural network: Precise target delineation for vestibular schwannoma treatment planning. **ARTIFICIAL INTELLIGENCE IN MEDICINE** 2020; 107(101911):1-8 (SCI).
2. Cheng chia Lee, Wei Kai Lee, et al., Yu-Te Wu*, Wan Yuo Guo*. Applying artificial intelligence to longitudinal imaging analysis of vestibular schwannoma following radiosurgery. **Scientific reports** 2021; 11(3106):doi.org/10.1038/s41598-021-82665-8.
3. Hong, J. S., Lin, C. J., Lin, Y. H., Lee, C. C., Yang, H. C., Meng, L. H., Yu-Te Wu*. Machine Learning Application With Quantitative Digital Subtraction Angiography for Detection of Hemorrhagic Brain Arteriovenous Malformations. **IEEE Access** 2020, 8, 204573-204584.
4. Ko-Kung Chen, Chung-Jung Lin, Wan-Yuo Guo, Wei-Fa Chu and Yu-Te Wu*. Estimating blood flow velocity using time-resolved 3D angiography and derived physical law of contrast media. PHYSIOLOGICAL MEASUREMENT 2021:doi.org/10.1088/1361-6579/abe022
5. Yen-Ling Chen, Pei-Chi Tu, Tzu-Hsuan Huang, Ya-Mei Bai, Tung-Ping Su, Mu-Hong Chen and Yu-Te Wu*. Using Minimal-Redundant and Maximal-Relevant Whole-Brain Functional Connectivity to Classify Bipolar Disorder. **Frontiers in Neuroscience** 2020; 14:563368
6. Chun-Yi Lin, et al, Yu-Te Wu*, Using Fuzzy Classifier in Ensemble Method for Motor-Imagery Electroencephalography Classification, International Journal of Fuzzy Systems, 2021.
7. Szu-Yu Lin, Chii-Wen Jao, Po-Shan Wang*, Yu-Te Wu*. Analysis of Electroencephalography Alteration During Sustained Cycling Exercise Using Power Spectrum and Fuzzy Entropy. International Journal of Fuzzy Systems 2017, Vol 19, Issue 2, pp 580–590
8. Po-Lei Lee, et al., Yu-Te Wu*. Brain computer interface using flash onset and offset visual evoked potentials. **Clinical Neurophysiology** 2008;119(3):605-616
9. Yen-Chun Chou, Yu-Te Wu*. Classification of Hemodynamics from Dynamic-Susceptibility-Contrast Magnetic Resonance (DSC-MR) Brain Images Using Noiseless

Independent Factor Analysis. **Medical Image Analysis** 2007;11(3):242-25.
10. Chih-I Hung, et al.,Yu-Te Wu*. Recognition of Motor Imagery Electroencephalography Using Independent Component Analysis and Machine Classifiers. Annals of Biomedical Engineering 2005;33(8):1053-107

■ **研究領域 Research Interests**

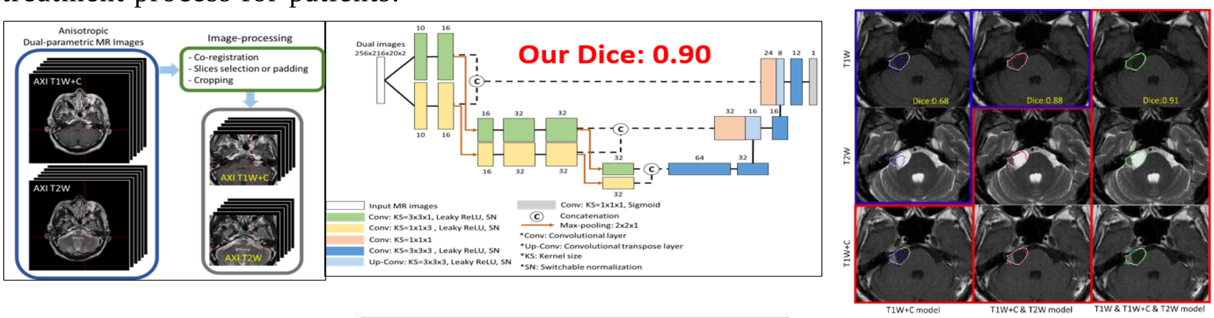
1. 人工智慧輔助診斷與預測系統 AI assisted diagnosis and prediction platform
2. 腦波人機介面 EEG-based Brain computer interface

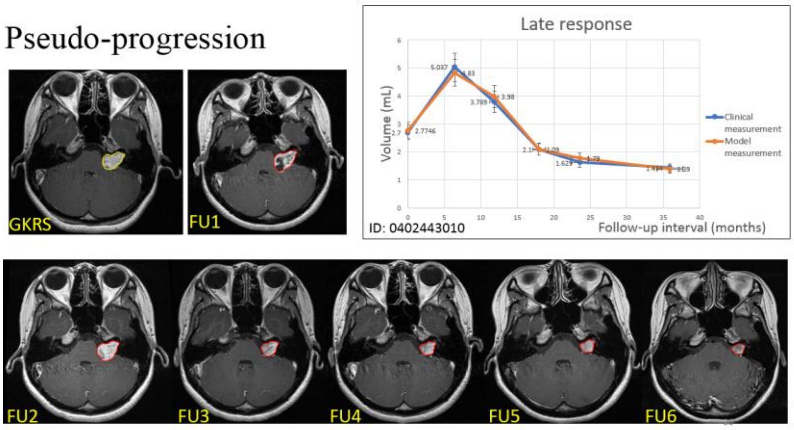
本實驗室特色之一是建置人工智慧輔助診斷與預測系統，協助臨床醫師診斷或術後預測評估之用，另外是發展即時腦波辨識軟體，應用於腦波即時操控裝置。本實驗室至今已發表百篇以上國際期刊論文，目前正執行國衛院、科技部與華碩、台達電產學合作計劃，實驗室近五年研究總經費為2358萬元。

1. 腦瘤AI自動圈選與分類系統

我們發展深度學習神經網路，針對腦瘤建立AI自動圈選與分類系統，減輕醫師負擔，加速患者診斷及治療流程。

We have developed a deep-learning neural network for segmenting and classifying brain tumors to reduce the burden on physicians and speed up the diagnosis and treatment process for patients.



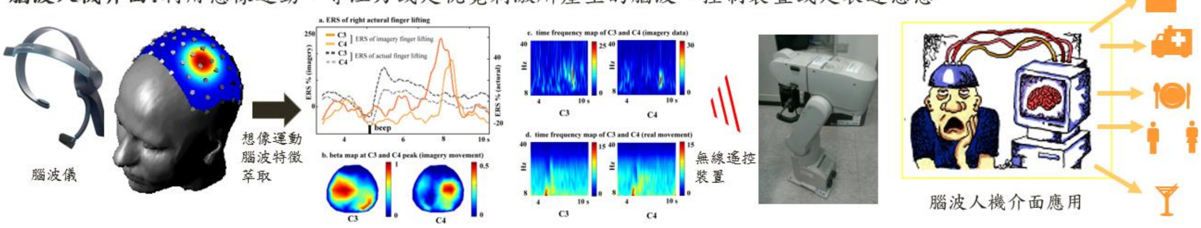


2. 想像運動、視覺刺激或專注力之腦波訊號辨認與腦機介面

利用想像運動、視覺刺激或是專注力等腦波訊號，我們可以將辨識出的腦波訊號用以控制周邊裝置，例如利用腦波訊號打字或是用以控制行動載具。

Brain computer interface is a novel technique which uses the recognized imagery motor EEG, visual evoke potential or attention induced potential to control the environmental devices.

腦波人機介面:利用想像運動、專注力或是視覺刺激所產生的腦波，控制裝置或是表達意念



陳浩夫 老師 Prof. How-Foo Chen

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最高學歷 Education
美國加州大學洛杉磯分校電機工程博士。Ph.D. in Electrical Engineering, University of California at Los Angles, 2004.

■ **現職Current position:**
國立陽明交通大學生醫光電研究所 副教授。Associate Professor, Institute of Biophotonics, National Yang Ming Chiao Tung University (2010-)

■ **主要經歷 Professional experiences**
國立陽明交通大學生醫光電研究所 助理教授(2004-2010)。Assistant professor，Institute of Biophotonics, National Yang Ming Chiao Tung University
國立陽明交通大學生醫光電研究所　副教授(2010-)。 Associate professor，Institute of Biophotonics, National Yang Ming Chiao Tung University

■ **代表著作 Selected publications (no more than 10 representative articles)**

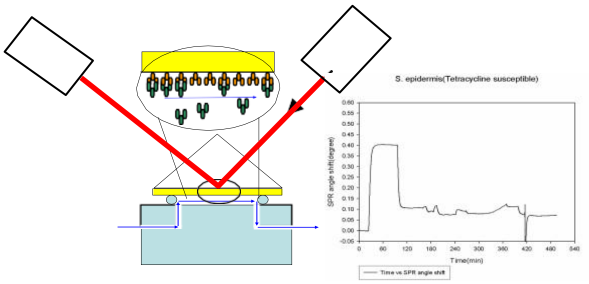
1. Wei-Kee Ong[1#], How-Foo Chen[2#], Cheng-Ting Tsai[2], Yun-Ju Fu[1], Yi-Shan Wong[1], Da-Jen Yen[3], Tzu-Hao Chang[4,5], Hsien-Da Huang[4], Oscar Kuang-Sheng Lee[6], Shu Chien[7], Jennifer Hui-Chun Ho[1,8,9]*, "Green light-emitting diode irradiation activates directional stem cell motility," Biomaterials, vol.34, Issue 8, Mar 2013, pp. 1911-1920. (IF: 7.604)(**ENGINEERING, BIOMEDICAL: 2/79; MATERIALS SCIENCE, BIOMATERIALS: 1/27**)
2. Chung-Tien Li, How-foo Chen*, Ieng-Wai Un, Hsin-Cheng Lee, and Ta-Jen Yen*, "Study of optical phase transduction on localized surface plasmon resonance for ultrasensitive detection," Optics Express, Vol. 20, No. 3, 30 Jan. 2012. (IF:3.546)(**OPTICS: 5/80**)
3. Yi-Chun Kuo, Jennifer H. Ho, Ta-Jen Yen, How-Foo Chen*, Oscar Kuang-Sheng Lee*, "Development of a Surface Plasmon Resonance Biosensor for Real-Time Detection of Osteogenic Differentiation in Live Mesenchymal Stem Cells," PlosOne, Vol. 6, Issue 7. pp. e22382, July 27, 2011. (IF:3.730)(**MULTIDISPLINARY SCIENCE: 7/56)**
4. Oi-Hong Tung, Shyh-Yuan Lee, Yu-Lin Lai, and How-Foo Chen*,"Characteristics of subgingival calculus detection by multi-photon fluorescence microscopy," *J. of Biomed. Opt.*, Vol. 16, No. 6, June, 2011. (IF:2.881) (**BIOMEDICAL RESEARCH METHODS: 30/75; OPTICS: 9/80; RADIOLOGY, NUCLEAR MEDICINE & MEDICAL IMAGING: 29/120**).
5. Chung-Tien Li, Ta-Jen Yen*, and How-foo Chen*,"A generalized model of maximizing the sensitivity in intensity-interrogation surface plasmon resonance biosensors," *Opt. Exp.* Vol. 17, No. 23, P. 20771, 9 November 2009. (IF:3.578) (**OPTICS: 5/77**)
6. Ya-Ling Chiang, Chi-Hung Lin, Muh-Yong Yen, Yuan-Deng Su, Shean-Jen Chen, How-foo Chen*,"Innovative Antimicrobial susceptibility testing method using surface plasmon resonance," *Biosensors & Bioelectronics*, Vol. 24, pp. 1905-1910, March 2009. (IF:5.602)(**BIOPHYSICS: 9/74; BIOTECHNOLOGY & APPLIED MICROBIOLOGY: 14/157; ELECTROCHEMISTRY: 1/27; NANOSCIENCE & NANOTECHNOLOGY: 14/66**)

■ 研究領域 Research Interests

1. Surface plasmon resonance biosensor
2. Nonlinear optical microscopy
3. Nonlinear dynamics of semiconductor lasers

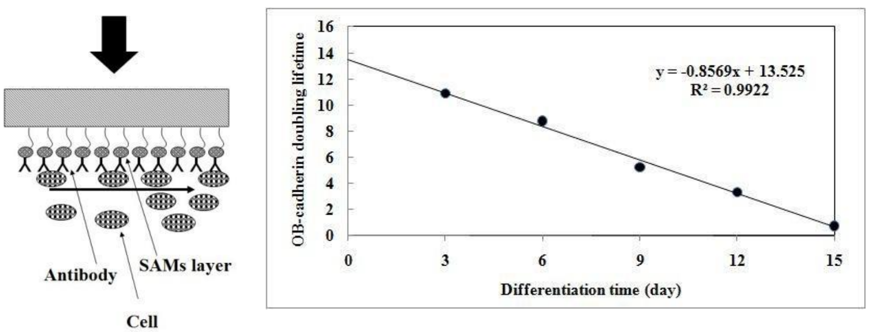
■ 研究簡介 Research Highlights

1. 表面電漿波生物檢測器檢驗細菌抗藥性 Antibiotic susceptibility test of bacteria using surface plasmon resonance biosensor



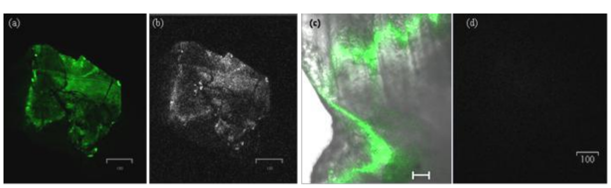
運用表面電漿波生物檢測器對待測物折射率變化的高靈敏度，可在二小時內檢驗出細菌對抗生素是否有抗藥性。Utilizing the high sensitivity of a surface plasmon resonance biosensor, the change of refractive index of bacteria subject to antibiotics can be detected within two hours after the treatment of antibiotics.

2. 表面電漿波生物檢測器即時觀測活體幹細胞分化階段



傳統上使用分子生物學方法來觀察幹細胞分化階段需要打碎細胞或固定細胞，這使觀察活體幹細胞的分化情形相當困難。為了解決這項限制，我們研發了特製的表面電漿共振儀來做即時數據的測量，以用在觀察活細胞表面特定抗體-抗原連結所造成表面光學性質的改變，藉以量測細胞分化情形。

3. 運用雙光子螢光造影技術檢測下齒齦牙結石 Characteristics of subgingival calculus detection by multi-photon fluorescence microscopy



下齒齦牙結石已被公認是牙周病的主要成因，是一種常見的口腔慢性病， 會造成牙齒的脫落。目前對於牙科醫生來說，下牙齦包覆之牙結石的是複雜且不易被診斷的。我們的研究是比較健康牙齦與有牙結石的牙齦在下牙齦包覆下所產生的螢光訊號來發現是否有牙結石產生，最後我們將雙光子螢光顯微鏡所產生出的影像與單光子共軛焦螢光微鏡做比較，發現雙光子螢光顯微鏡的螢光影像擁有較多的螢光資訊。

陳奕帆 老師 Prof. Yih-Fan Chen

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E-mail: chenyf@nycu.edu.tw

最高學歷 Education

美國密西根大學安納堡分校 生物醫學工程博士。
Ph.D. in Biomedical Engineering, University of Michigan, Ann Arbor, 2010.

■ 現職 Current Position

國立陽明交通大學生醫光電研究所 副教授。
Associate Professor, Institute of Biophotonics, National Yang-Ming Chiao Tung University (2013-)

■ 主要經歷 Professional Experiences

國立陽明大學生醫光電研究所 助理教授。Assistant Professor, Institute of Biophotonics, National Yang-Ming University (2013-2018)
國立成功大學生物醫學工程學系 助理教授。Assistant Professor, Department of Biomedical Engineering, National Cheng Kung University (2011-2013)
康乃爾大學 Kavli 奈米科學研究中心 博士後研究員。Postdoctoral Fellow, Kavli Institute at Cornell for Nanoscale Science, USA (2010-2011)
Optofluidics, Inc. 技術顧問。Technical Consultant, Optofluidics, Inc., USA (2010-2011)

■ 代表著作 Selected Publications

1. Chen, Y.C, Chen, J.J., Hsiao, Y.J., Xie, C.Z., Peng, C.C., Tung, Y.C. & **Chen, Y.F.** Plasmonic gel films for time-lapse LSPR detection of hydrogen peroxide secreted from living cells. *Sens. Actuators B-Chem.* 336, 129725 (2021).
2. Kang, C.Y., Li, J.J., Wu, L.A., Wu, C.C. & **Chen, Y.F.*** Dynamic and reversible accumulation of plasmonic core-satellite nanostructures in a light-Induced temperature gradient for in situ SERS detection. *Part. Part. Syst. Charact.* 35,1700405 (2018).
3. Wu, L.A., Li, W.E., Lin, D.Z. & **Chen, Y.F.***, Three-dimensional SERS substrates formed with plasmonic core-satellite nanostructures. *Sci. Rep.* 7, 13066 (2017).
4. Lin, D.Z., Chuang, P.C., Liao, P.C., Chen, J.P. & **Chen, Y.F.***, Increasing the spectral shifts in LSPR biosensing using DNA-functionalized gold nanorods in a competitive assay format for the detection of interferon-γ. *Biosens. Bioelectron.* 81, 221-228 (2016).
5. Yu, L.H. & **Chen, Y.F.***, Concentration-dependent thermophoretic accumulation for the detection of DNA using DNA-functionalized nanoparticles. *Anal. Chem.* 87, 2845-2851 (2015).
6. Kang, P., Serey, X., **Chen, Y.F.,** & Erickson, D.***** Angular orientation of nanorods using nanophotonic tweezers. *Nano Lett.* 12, 6400–6407 (2012).
7. **Chen, Y.F.*,** Jain, A., Jiang, L., Mancuso, M., Oncescu, V. & Erickson, D. Optofluidic opportunities in global health, food, water and energy. *Nanoscale* 4, 4839 – 4857 (2012). (*Feature Article)*
8. **Chen, Y.F.,** Serey, X., Sarkar, R., Chen, P. & Erickson, D.***** Controlled photonic manipulation of proteins and other nanomaterials. *Nano Lett.* 12, 1633 – 1637 (2012).

■ 研究領域 Research Interests

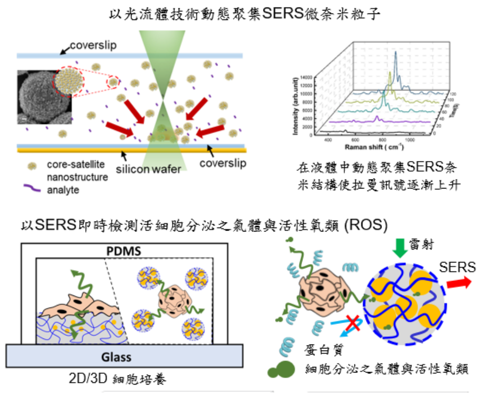
1. 光流體生醫檢測與奈米操控技術 Optofluidic biosensing and nanomanipulation
2. 表面增強拉曼光譜生醫感測 Surface-enhanced Raman spectroscopy (SERS) biosensing
3. 局部表面電漿共振生醫感測 Localized surface plasmon resonance (LSPR) biosensing
4. 可攜式生醫檢測平台 Portable biosensing platforms

■ 研究簡介 Research Highlights

以疾病檢測、健康監測、毒品檢測、食安檢測、環境監測等應用為目標，整合光學、奈米科技、光流體學、微奈米製程等技術，開發快速、靈敏、操作簡便且具有成本效益的生物感測器技術。

Our research focuses on the development of biosensors that enable rapid, sensitive, simple and low-cost disease diagnosis, health monitoring, food safety testing, environmental monitoring, and drug test through the integration of optics, nanotechnology, optofluidics and nanofabrication technology.

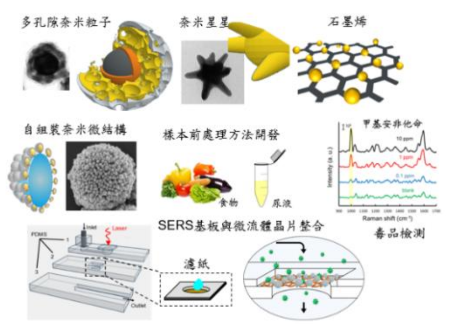
1.　光流體奈米操控及生醫檢測技術
Optofluidic nanomanipulation and biosensing



- ■ 整合光學、奈米及微流體技術，開發系統架構簡單、操作容易且可用於操控及偵測生物分子的光流體技術。Integrating optics, nanotechnology, and microfluidics to develop optofluidic devices that are easy to operate and construct for biosensing and nanomanipulation applications.

<u>研發成果與進行中的題目</u>：(1) 以光流體技術動態聚集微奈米粒子來增加拉曼訊號；(2) 利用光引起的物理或化學現象操控微奈米粒子與生物分子：(3)光流體生醫感測技術。

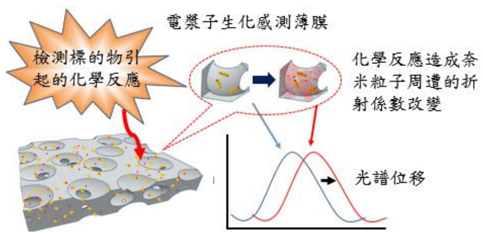
2.　表面增強拉曼光譜生醫檢測
Surface-enhanced Raman spectroscopy (SERS)



- ■ 針對毒品檢驗、食品安全及環境檢測的應用，開發具有 SERS 效果的自組裝奈米微結構與樣本前處理方法。Developing self-assembled SERS-active nanostructures and sample per-treatment methods for drug screening, food safety and environmental monitoring.
- ■ 結合光流體技術與 SERS，開發創新 SERS 檢測方法。Integrating optofluidic techniques and SERS to develop innovative SERS detection methods.

<u>研發成果與進行中的題目</u>：(1) SERS 檢測尿液中毒品之技術；(2) 開發具有 SERS 效果的自組裝奈米結構與多孔隙材料；(3) SERS 檢測病毒與細菌；(4) 開發光流體 SERS 技術。

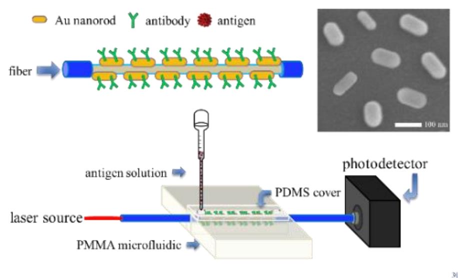
3.　局部表面電漿共振生醫檢測
Localized surface plasmon resonance (LSPR) biosensing



- ■ 開發便宜、可攜性且可快速偵測病毒、細菌、或與疾病相關之生物標記 LSPR 生物感測器。Developing low-cost, portable LSPR biosensors for rapid detection of viruses, bacteria, food contaminants, and disease-related biomarkers.
- ■ 開發可提升 LSPR 檢測靈敏度的表面修飾方法與訊號增強技術。Developing surface functionalization and signal enhancement methods to increase the sensitivity of LSPR biosensing.

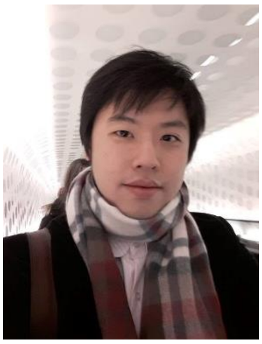
<u>研發成果與進行中的題目</u>：(1) 可快速偵測活性氧類 (Reactive oxygen species, ROS) 的電漿子薄膜；(2) 利用奈米粒子大幅升 LSPR 感測器檢測靈敏度的技術；(2) 開發以奈米光波導 (waveguide) 為基礎的微型化 LSPR 感測器。

4.　利用光流體技術操控或檢測微奈米粒子與生物分子
Using optofluidic techniques to manipulate or detect nanoparticles and biomolecules



- ■ 利用光流體技術使流體中的微球緊密排列成 2 維單層陣列，藉此產生可增強 SERS 效果及提供超解析影像的光電奈米噴流 (photonic nanojet)。Using optofluidic techniques to assemble microspheres into a 2D array for the generation of photonic nanojets for enhancing SERS and for achieving super resolution imaging.
- ■ 開發以光波導為基礎的生醫感測器。Developing optical waveguide-based biosensors.

<u>研發成果與進行中的題目</u>：(1) 以光學奈米噴流及熱對流增加 SERS 檢測效果；(2) 開發基於光纖或奈米光波導的螢光檢測技術或 LSPR 感測器; (3) 利用光電奈米噴流達到超解析顯微影像 (super resolution imaging)。



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最高學歷 Education

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德國馬克斯普朗克超快影像及結構動力學研究所
Doctorate in Physics *(SUMMA CUM LAUDE)*
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■ 現職 Current Position

國立陽明大學生醫光電研究所 助理教授。
Assistant Professor, Institute of Biophotonics, National Yang-Ming University (2017-)

■ 主要經歷 Professional Experiences

美國麻省理工訪問學者
Visiting Scientist, MIT (2017-)
德國漢堡大學超快影像中心 博士後研究 (2016-)
Postdoctoral Fellow, the Hamburg Centre for Ultrafast Imaging (CUI), Universität Hamburg

■ 代表著作 Selected Publications

1. L.-T. Chou, *et al.*, "Low noise, self-phase-modulation-enabled femtosecond fiber sources tunable in 740- 1236 nm for wide two-photon fluorescence microscopy applications," Accept to be published in *Biomed. Opt. Express* (2021).
2. G. M. Rossi *et al.*, "Sub-cycle millijoule-level parametric waveform synthesizer for attosecond science," *Nature Photonics* 14, 629–635, 2020
3. W. Liu***, *S.-H. Chia****, H.-Y. Chung, F. X. Kärtner, and G. Chang, "Energy scalable ultrafast fiber laser sources tunable in 1.03-1.2 μm for multi-photon microscopy," *Opt. Express* 25, 6822-6831 (2017). ***co-first author**.
4. ***S.-H. Chia***, G. Cirmi, S. Fang, G. M. Rossi, O. D. Mücke, and F. X. Kärtner, "Two-octave-spanning dispersion-controlled precision optics for sub-optical-cycle waveform synthesizers," *Optica* 1, 315-322 (2014).
5. ***S.-H. Chia***, L.-J. Chen, Q. Zhang, O. D. Mücke, G. Chang, and F. X. Kärtner, "Broadband continuum generation in mode-locked lasers with phase-matched output couplers," *Opt. Lett.* 39, 1445-1448 (2014).
6. ***S.-H. Chia***, C.-H. Yu, C.-H. Lin, N.-C. Cheng, T.-M. Liu, M.-C. Chan, I-H. Chen, and C.-K. Sun, "Miniaturized Video-Rate Epi-Third-Harmonic-Generation Fiber-Microscope," *Opt. Express* 18, 17382-17391 (2010).

■ 研究領域 Research Interests

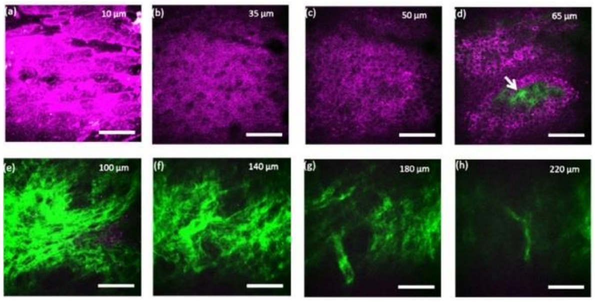
1. 光學虛擬切片術 Optical virtual biopsy
2. 非線性光學顯微影像 Nonlinear optical imaging
3. 臨床用顯微影像系統開發 Development of miniaturized microscope system
4. 寬頻同調光源產生及應用 Generation and control of broadband coherent light sources
5. 光學模擬與影像訊號分析 Modeling and optimization of optical systems and imaging analysis

■ 研究簡介 Research Highlights

本組的研究方向希望以臨床及基礎研究的需求出發開發合適的光學工具及影像系統。從合適光源的選擇與產生，討論不同生醫影像方式在不同需求時的優缺點，同時建立資料庫透過人工智慧優化影像判斷，尋求合適不同臨床及基礎研究的光學系統建造與資料分析。

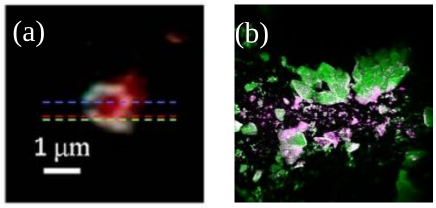
Our research focuses on the developments of suitable optical tools and systems aiming for clinical and fundamental research uses. The research projects aim to answer several questions in the direction of (1) selection and generation of different optical light sources, (2) development of new imaging modalities based on further investigation of light-tissue interaction, (3) demonstration of novel imaging system based on clinical and fundamental applications.

1. **光學虛擬切片術 Optical virtual biopsy**



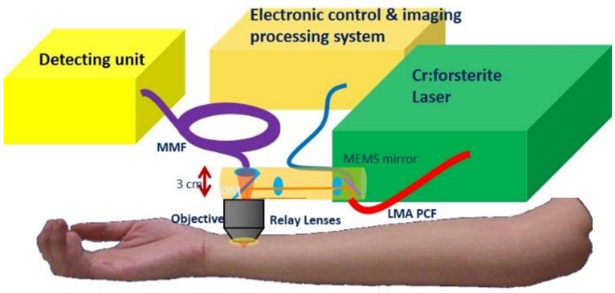
利用光學非線性取得高解析度及穿透深度三維影像，以期在未來協助或取代現有早期病變診斷/手術邊緣鑑定之病理切片技術。(Figure: skin virtual biopsy via SHG (green) and THG (magenta))
Using optical nonlinearity to obtain deep tissue imaging with pathological resolution, which can be applied for future assisting/replacing the gold standard physical biopsy for early diagnosis /positive surgery margin.

2. **非線性光學顯微影像 Nonlinear optical imaging**



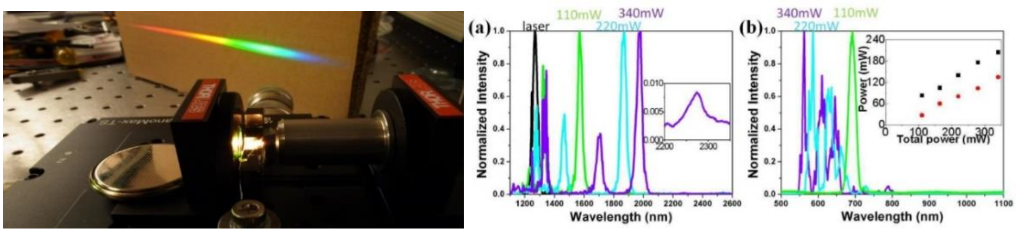
不同非線性訊號(例: 雙光子、二倍頻、三倍頻)會呈現出不同的顯微圖像表徵特定分子電子能階躍遷或組織結構。利用這些顯微特徵在不同應用上可用於區分不同螢光分子或組織光學結構。(Figure (a) 2PF (red) and THG (white) imaging of a fluorescence bead; (b) SHG (green) and THG (magenta) imaging of protein crystals)
Different nonlinear signals (e.g., two-photon fluorescence (2PF), second harmonic generation (SHG), and third harmonic generation (THG)) reveal different optical structures and electron transition states. Such nonlinear signatures can be applied to study fluorescence imaging and tissue structure/morphology.

3. **微小化高速顯微影像系統開發 Development of miniaturized microscope system**



高速手持式顯微影像系統(或進一步內視鏡系統)的使用會大大拓展臨床或活體動物實驗的彈性及增加其適用範圍，同時高速系統可同時觀察活體細胞動態，如血球流動，神經電位傳遞等等。
For clinical *in vivo* observation, extending this nonlinear optical imaging technique for hand-held or endoscopic applications is necessary. The imaging system should be miniaturized as a flexible, compact, and easily used one instead of using complicated bulk optics. In addition, high frame rate acquisition is important to observe the fast physiological processes.

4. **寬頻同調光源產生及應用 Generation and control of broadband coherent light sources**



光源的產生與控制是非線性生醫影像技術的核心。除了穩定低成本的考量外，如何選擇合適的光源取決於光與樣本的交互作用。舉例而言，減少光的吸收與散射可以增加影像的穿透深度，然而螢光影像的訊號強度也取決於分子的吸收截面。 (Figure: (left) coherent rainbow generation via optical fiber; (b) broadband source with a tuning wavelength range from 550nm to 2200nm) The capabilities of nonlinear microscopy and advanced spectroscopy strongly depend on the availability of suitable pulsed laser sources to efficiently excite nonlinear signals and signal detection. Via the precise control of the light propagation in an optical fiber, we can control the coherent light generation at different wavelengths while maintaining system robustness.

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最高學歷 Education

國立中央大學電機工程博士。Ph.D. in Electrical Engineering , National Central University, 2012.

■ 現職Current position

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■ 主要經歷 Professional experiences

國立陽明大學生醫光電研究所 博士後研究員。Postdoctoral Fellow, Institute of Biophotonics, National Yang-Ming University (2016 -2019)

親民技術學院機電系 副教授(2012-2016)

Associate professor (2012-2016), Dept. of Electro-Mechanical Engineering, Chin-Min Institute of Technology

■ 代表著作 Selected publications

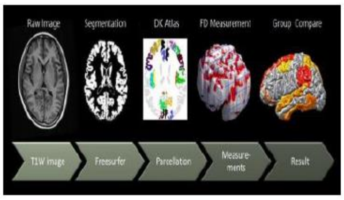
1. **Jao, C.-W**.; Lau, C.I.; Lien, L.-M.; Tsai, Y.-F.; Chu, K.-E.; Hsiao, C.-Y.; Yeh, J.-H.; Wu, Y.-T. Using Fractal Dimension Analysis with the Desikan–Killiany Atlas to Assess the Effects of Normal Aging on Subregional Cortex Alterations in Adulthood. *Brain Sci.* **2021**, *11*, 107. https://doi.org/10.3390/brainsci11010107
2. **Jao, Chi-Wen;** Yeh, Jiann-Horng; Wu, Yu-Te; Lien, Li-Ming; Tsai, Yuh-Feng; Chu, Kuang-En; Hsiao, Chen-Yu; Wang, Po-Shan; Lau, Chi I. 2020. "Alteration of the Intra- and Inter-Lobe Connectivity of the Brain Structural Network in Normal Aging" *Entropy* 22, no. 8: 826. https://doi.org/10.3390/e22080826
3. Wang P-S, Wu Y-T, Wang T-Y, Wu H-M, Soong B-W and **Jao C-W*** (2020) Supratentorial and Infratentorial Lesions in Spinocerebellar Ataxia Type 3. Front. Neurol. 11:124. doi: 10.3389/fneur.2020.00124
4. **Jao CW**, Soong BW, Huang CW, Duan CA, Wu CC, Wu YT, Wang PS. Diffusion Tensor Magnetic Resonance Imaging for Differentiating Multiple System Atrophy Cerebellar Type and Spinocerebellar Ataxia Type 3. Brain Sci. 2019 Dec 3;9(12):354. doi: 10.3390/brainsci9120354. PMID: 31817016; PMCID: PMC6956111.
5. **Chi-Wen Jao**, Bing-Wen Soong , Tzu-Yun Wang, Hsiu-Mei Wu , Chia-Feng Lu, Po-Shan Wang *, Yu-Te Wu *. Intra- and Inter-Modular Connectivity Alterations in the Brain Structural Network of Spinocerebellar Ataxia Type 3. ***Entropy*** 2019, 21, 317; doi:10.3390/e21030317.
6. Tzu-Yun Wang, **Chi-Wen Jao** (co-first authors), Bing-Wen Soong, Hsiu-Mei Wu, Kuo-Kai Shyu, Po-Shan Wang*, Yu-Te Wu* Change in the Cortical Complexity of Spinocerebellar Ataxia Type 3 Appears Earlier than Clinical Symptoms. PLoS One. 2015 Apr 21; 10(4):e0118828. doi: 10.1371/journal.pone.0118828
7. Yu-Te Wu, Shang-Ran Huang, **Chi-Wen Jao**, Bing-Wen Soong, Jiing-Feng Lirng, Hsiu-Mei Wu, and Po-Shan Wang. Impaired Efficiency and Resilience of Structural Network in Spinocerebellar Ataxia Type 3. **Frontiers in Neuroscience** 2018.
8. Shang-Ran Huang, Yu-Te Wu, **Chi-Wen Jao**, Bing-Wen Soong, Jiing-Feng Lirng, Hsiu-Mei Wu, Po-Shan Wang . CAG Repeat Length Does Not Associate With the Rate of Cerebellar Degeneration in Spinocerebellar Ataxia Type 3. **NeuroImage-Clinical** 2017; 13: 97–105.
9. Szu-Yu Lin, **Chi-Wen Jao**, Po-Shan Wang, Yu-Te Wu. Analysis of Electroencephalography Alteration During Sustained Cycling Exercise Using Power Spectrum and Fuzzy Entropy. Int.J. Fuzzy Syst. (2017) 19:580.

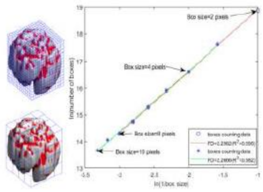
■ 研究領域 Research Interests

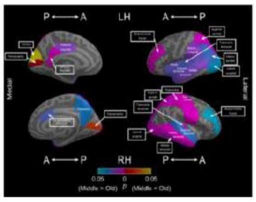
1. 磁振腦影像分析與研究 MRI brain image analysis
2. 生醫訊號處理與分析 Biomedical signal analysis

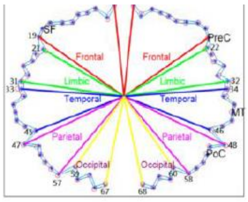
■ 研究簡介 Research Highlight

1. 碎形維度(Fractal Dimension FD)運用於大腦皮質型態複雜度評估及預診斷系統



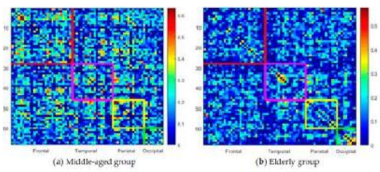


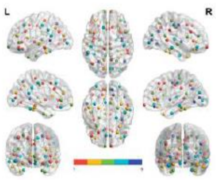


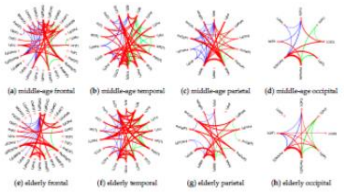


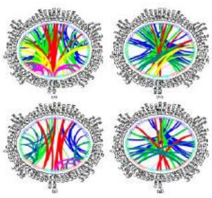
In our lab, we used 3D-FD analysis with the Desikan–Killiany (DK) atlas to assess sub-regional morphological changes in adulthood, we further to build a pre-diagnosis system that can provide a suitable tool for assessing normal aging and neurodegeneration between groups or in individual patients.

2. 運用腦部皮質結構性網絡圖(Brain Structural Network)評估腦部功能退化分析









We applied a novel fractal dimension-based structural network to measure 68 parcellated cortical regions and calculated the correlation map to build the brain structural network. With these networks, we assessed the intra- and inter-lobe connectivity alterations between young and elderly groups. We found the elderly group revealed separations, sparser long association fibers, commissural fibers, and lateral inter-lobe connectivity lost effect, mainly in the right hemisphere. New wiring and reconfiguring modules may have occurred within the brain structural network to compensate for connectivity, decreasing and preventing functional loss in cerebral intra- and inter-lobe connectivity.

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簡介

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■ 現職 Current position

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國立陽明交通大學生醫光電研究所 合聘教授。Joint-appointment professor, Institute of Biophotonics, National Yang Ming Chiao Tung University (2014-)

■ 主要經歷 Professional experiences

中央研究院應用科學研究中心 助研究員(2000-2004)、副研究員(2004-2010)、研究員(2010-)。Assistant research fellow (2000-2004), associate research fellow (2004-2010), research fellow (2010-), Research Center for Applied Sciences, Academia Sinica
國立陽明交通大學生醫光電研究所 合聘助理教授(2003-2006)、副教授(2006-2010)、教授兼所長(2011-2014)。Joint-appointment assistant professor (2003-2006), Joint-appointment associate professor (2006-2010), professor and chairman (2011-2014), Institute of Biophotonics, National Yang Ming Chiao Tung University

■ 代表著作 Selected publications

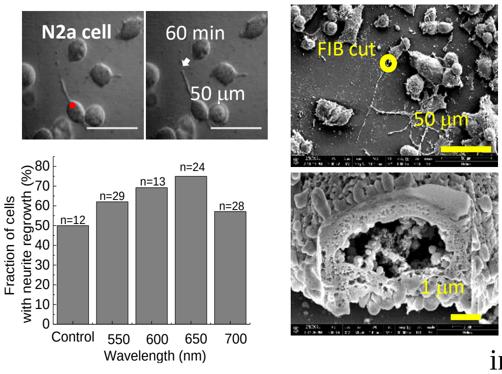
1. H.-H. Hou et al., "Autophagy in fibroblasts induced by cigarette smoke extract promotes invasion in lung cancer cells," *Int. J. Cancer* **147,** 2587 (2020).
2. Y.-C. Kao, Y.-C. Liao, P.-L. Cheng, and C.-H. Lee, "Neurite regrowth stimulation by a red-light spot focused on the neuronal cell soma following blue light-induced retraction," *Sci. Rep*. **9,** 18210 (2019).
3. C.-W. Lee, Y.-L. Chiang, J.-T. Liu, Y.-X. Chen, C.-H. Lee, Y.-L. Chen, and I.-S. Hwang, "Emerging roles of air gases in lipid bilayers," *Small* **14,** 1802133 (2018).
4. C.-H. Chang, H.-H. Lee, and C.-H. Lee, "Substrate properties modulate cell membrane roughness by way of actin filaments," *Sci. Rep.* **7,** 9068 (2017).
5. Y.-C. Kao et al., "Elevated hydrostatic pressure enhances the motility and enlarges the size of the lung cancer cells through aquaporin upregulation mediated by caveolin-1 and ERK1/2 signaling," *Oncogene* **36,** 863 (2017).
6. C.-W. Lee, C.-C. Wang, and C.-H. Lee, "Mechanoprofiling on membranes of living cells with atomic force microscopy and optical nano-profilometry," *Adv. Phys. X* **2,** 608 (2017).
7. L. K. Chin, C.-H. Lee, and B.-C. Chen, "Imaging live cells at high spatiotemporal resolution for lab-on-a-chip applications," *Lab Chip* **16,** 2014 (2016).
8. B. Patra et al., "Drug testing and flow cytometry analysis on a large number of uniform sized tumor spheroids using a microfluidic device," *Sci. Rep.* **6,** 21061 (2016).
9. C.-W. Lee et al., "Membrane roughness as a sensitive parameter reflecting the status of neuronal cells in response to chemical and nanoparticle treatments," *J. Nanobiotechnol*. **14,** 9 (2016).

■ 研究領域Research Interests

1. Optical microscopy and related techniques
2. Cell–cell and cell–microenvironment interactions in 3D
3. Biomedical applications of microfluidic devices and nanoparticles

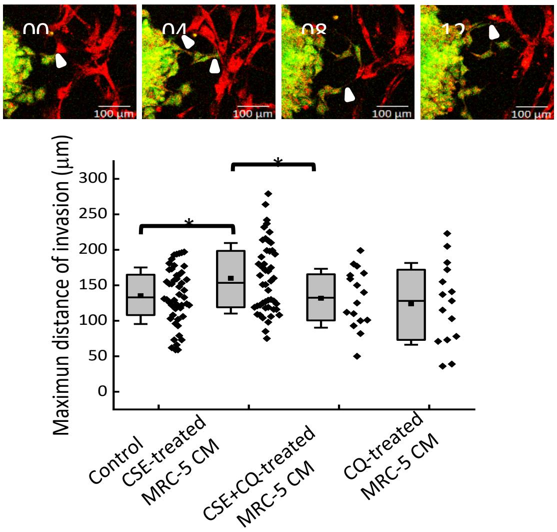
■ 研究簡介 Research Highlights

1. 以光電方法刺激神經再生 Neurite regrowth stimulated by optical or electrical methods



我們利用各種光學與電子刺激，引發受損的神經突觸再生。實驗結果顯示以波長650 nm的紅光刺激細胞本體，可以引起神經突觸再生。交流電場可以幫助神經突觸排列到同一方向。為了更進一步了解再生的神經突觸的內部結構，我們也利用聚焦離子束－掃描電子顯微術觀察神經突觸的骨架分布情形。We used various optical and electrical techniques to induce the regrowth of impaired neurites. Focusing a light spot of a 650 nm wavelength on the soma of an N2a cell, we observed neurite regrowth. Alternative current (AC) electric fields helped the alignment of growing neurites. In order to understand the internal structures of a re-growing neurite, we also used focused-ion beam scanning electron microscopy (FIB-SEM) to observe the cytoskeletons inside a neurite.

2. 三維共培養細胞球在抗癌藥物測試上的應用 3D co-culture cellular spheroids on the applications of anti-cancer drug testing



我們開發了三維共培養細胞球作為藥物或汙染物質測試平台。三維共培養細胞球提供類似動物組織的空間特性與細胞交互作用微環境，但是成本比動物實驗低很多。我們使用肺癌細胞和肺部纖維母細胞的共培養細胞球，發現香菸萃取物會引起纖維母細胞的自噬作用而分泌interleukin-8 (IL-8)。IL-8則會提高纖維母細胞帶領肺癌細胞侵襲的能力。我們目前進一步用這個系統測試治療肺癌的不同藥物組合效力。We developed 3D co-culture cellular spheroids as drug or pollutant testing platforms. The 3D co-culture cellular spheroid provides spatial configurations similar to those in real tissues and microenvironments for cell–cell interactions with costs much lower than those of animal tests. Using the co-culture of lung cancer cell spheroids and lung fibroblasts, we found that cigarette smoke extract induces autophagy in fibroblasts, which causes the secretion of interleukin-8 (IL-8). IL-8 enhances the fibroblast-led cancer cell invasion in the 3D co-culture system. We are currently using this system to test the effects of various drug combinations on lung cancer.

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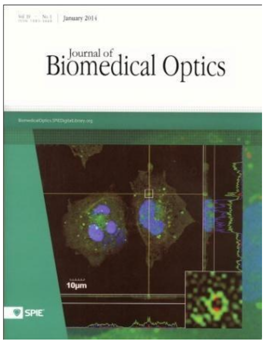
■ 代表著作 **Selected publications**

1. Chi-Fen Chiu, Li-Wen Chu, I-Chen Liao, Yogy Simanjuntak, Yi-Ling Lin, Chi-Chang Juan, and Yueh-Hsin Ping*, The Mechanism of the Zika Virus Crossing the Placental Barrier and the Blood-Brain Barrier, Frontiers in Microbiology, 2020, 11: 214 (*: corresponding author)
2. Wei-Chia Chen, Yogy Simanjuntak, Li-Wei Chu, Yueh-Hsin Ping, Yi-Ling Lee, Yi-Ling Lin, Wen-Shan Li, Benzenesulfonamide Derivatives as Calcium/Calmodulin-Dependent Protein Kinase Inhibitors and Antiviral Agents against Dengue and Zika Virus Infections, Journal of Medicinal Chemistry, 2020, 63: 1313-1327
3. Li-Wei Chu, Chia-Jui Yang, Kuan-Jen Peng, Pei-Ling Chen, Shuu-Jiun Wang and Yueh-Hsin Ping*, TIM-1 As a Signal Receptor Triggers Dengue Virus-Induced Autophagy, International Journal of Molecular Sciences, 2019, 20: 4893
4. Kate Hua, Yu-Ting Chen, Chian-Feng Chen, Ya-Syuan Tang, Tzu-Ting Huang, Yu- Cheng Lin, Tien-Shun Yeh, Kuo-Hung Huang, Hsin-Chen Lee, Ming-Ta Hsu, Chin- Wen Chi, Chew-Wun Wu, Chi-Hung Lin, and Yueh-Hsin Ping*, MiR-23a/27a/24-2 Cluster Promotes Gastric Cancer Cell Proliferation in a Synergetic Manner, Oncology Letter, 2018, 16: 2319-2325
5. Ji-Lin Chen, **Yueh-Hsin Ping**, Min-Jen Tseng, Yuan-I Chang, Hsin-Chen Lee, Rong-Hong Hsieh,Tien-Shun Yeh, Notch1-promoted TRPA1 expression in erythroleukemic cells suppresses erythroid but enhances megakaryocyte differentiation, Scientific Reports, 2017, 7: 42883
6. Chih-Yeu Fang, Siang-Jyun Chen, Huey-Nan Wu, **Yueh-Hsin Ping**, Ching-Yen Lin, David Shiuan, Chi-Long Chen, Ying-Ray Lee, and Kao-Jean Huang, Honokiol, a Lignan Biphenol Derived from the Magnolia Tree, Inhibits Dengue Virus Type 2 Infection, Viruses, 2015, 7: 4894-4910
7. Jye-Chian Hsiao, Li-Wei Chu, Yung-Tsun Lo, Sue-Ping Lee, Tzu-Jung Chen, Cheng-Yen Huang, **Yueh-Hsin Ping*** and Wen Chang*, Intracellular Transport of Vaccinia Virus in

HeLa Cells Requires WASH-VPEF/FAM21-Retromer Complexes and Recycling Molecules Rab11 and Rab22, Journal of Virology, 2015, 89: 8365-8382

8. Tzu-Ting Huang, **Yueh-Hsin Ping#**, An-Ming Wang#, Chia-Chi Ke, Wen-Liang Fang, Kuo- Hung Huang, Hsin-Chen Lee, Chin-Wen Chi, Tien-Shun Yeh, The reciprocal regulation loop of Notch2 pathway and miR-23b in controlling gastric carcinogenesis, Oncotarget, 2015,6: 18012-18026(#:contributed equally to this work.)
9. Li-Wei Chu, Yi-Lung Huang, Jin-Hui Lee, Long-Ying Huang, Wei-Jun Chena, Ya-Hsuan Lin, Jyun-Yu Chen, Rui Xiang, Chau-Hwang Lee, Yueh-Hsin Ping*. A single- virus tracking approach to reveal the interaction of Dengue virus with autophagy during the early stage of infection. Journal of Biomedical Optics 2014, 19, 011018 (*: corresponding author) (cover photo)



■ 研究領域 Research Interests

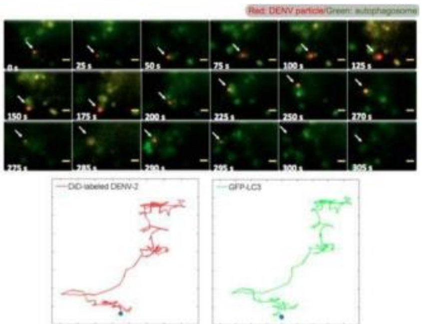
1. Single virus particle tracking *in vivo*

2. Fluorescence imaging; nano-imaging

3. Optical tweezers

■ 研究簡介 Research Highlights

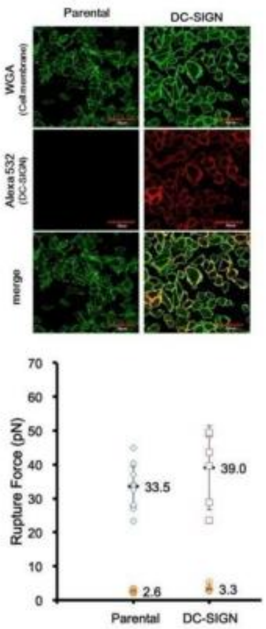
1. 利用單分子影像解析登革熱病毒感染之分子機制及細胞途徑 **Illustration of molecular mechanisms and cellular pathways of DENV infection by merging advanced photonic approaches and single-virus particle tracking**



我們建立一套及時多螢光顯微鏡影像系統，可以進行在活細胞中對單一病毒及時 影像追蹤。病毒顆粒的時序影像分析發現，在細胞內病毒運動軌跡具有多元性。如左圖雙螢光時序影像結果顯示，登革熱病毒顆粒存在於含有 LC3 蛋白的自噬體內。這個研究除了揭露更多新的登革熱病毒相關的細胞 分子機轉之外，這些光電研究方法的建立 提供更好的機會來研究病毒與宿主細胞的交互作用。

We have established time-lapsed multi-fluorescence microscopy to investigate the cellular pathways of DENV by a single viral tracking approach. Time-lapsed images of DENV particles and trajectory analysis showed that multi-motion patterns of DENV particles during viral infection. Dual-fluorescence images indicated that DENV particles exist in LC-3-cantaining autophagosome. This study not only promise unprecedented new insights into the molecular mechanisms of the DENV infection, but also suggests that photonics approaches offer better opportunities to study virus by visualizing the trafficking pathways of single virus particles and of single viral genomes in living cells.

2. 利用光鉗在單一病毒層次以視覺化和力學量化分析登革病毒與細胞受體的作用力
Using optical tweezers to visualize and mechanically quantify the physical interactions between virus and its cellular receptors at a single-virus level.



病毒與細胞受體的結合是感染的第一個關鍵步驟。我們結合光鉗和單一病毒追蹤技術來定量登革病毒與其細胞受體的結合做用力，初步結果顯示當細胞表現DC-SIGN 受體時，登革病毒與CHO 細胞的結合強度會從背景值34.2 pN 上升到 62.5 pN。這個研究證明利用光鉗可以提供新的數據來了解登革熱病毒相關的細胞分子機轉 。

The virus-host cell binding marks the first critical step of infection. We try to quantitatively determine the binding forces of DENV with its cellular receptors at a single-virus particle level by combining optical tweezers and single-virus tracking approaches. The preliminary results have provided strong evidence that the binding forces of DENV with CHO cells increased from 33.5 pN to 39.0 pN when the cells expressed DC-SIGN, indicating that the binding forces between DENV particle and DC-SIGN could be around 39 pN. Taken together, our results promise unprecedented new insights into the molecular nteractions of DENV with cellular receptors by optical tweezers.

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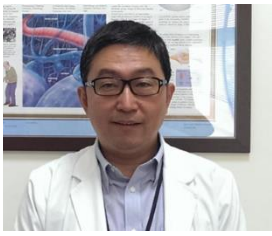

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1. **Yang DM**,* Fu TF, Lin CS, Chiu TY, Huang CC, Huang HY, Chung MW, Lin YS, Manurung RV, Nguyen PNN, Chang YF.* **High-performance FRET biosensors for single-cell and *in vivo* lead detection. Biosens Bioelectron.** 2020 Aug 31;168:112571. doi: 10.1016/j.bios.2020.112571. Epub ahead of print. PMID: 32892119. **(IF=10.257; 1/86, Analytical Chemistry)**
2. **Yang DM**,* Manurung RV, Lin YS, Chiu TY, Lai WQ, Chang YF, Fu TF. **Monitoring the heavy metal lead inside living *Drosophila* with a FRET-based biosensor. Sensors** (Basel). 2020 Mar 19;20(6):1712. doi: 10.3390/s20061712. PMID: 32204388; PMCID: PMC7146181. **(IF=3.275; 15/64, Instruments and Instrumentation)**
3. **Yang DM**,* Huang CC, Chang YF. Combinatorial roles of mitochondria and cGMP/PKG pathway in the generation of neuronal free Zn^{2+} under the presence of nitric oxide. **J Chin Med Assoc.** 2020 Apr;83(4):357-366. doi: 10.1097/JCMA.0000000000000280. PMID: 32101891. **(IF=2.17; 80/556, General Medicine)**
4. **Yang DM**,* Chang TJ, Wang ML, Tsai PH, Lin TH, Wang CT, Liang KH. Hunting severe acute respiratory syndrome coronavirus 2 (2019 novel coronavirus): From laboratory testing back to basic research. **J Chin Med Assoc.** 2020 Jun;83(6):524-526. doi: 10.1097/JCMA.0000000000000332. PMID: 32502116; PMCID: PMC7199774. **(IF=2.17; 80/556, General Medicine)**
5. Liang KH, Chang TJ, Wang ML, Tsai PH, Lin TH, Wang CT, **Yang DM**.* Novel biosensor platforms for the detection of coronavirus infection and severe acute respiratory syndrome coronavirus 2. **J Chin Med Assoc.** 2020 Aug;83(8):701-703. doi: 10.1097/JCMA.0000000000000337. PMID: 32349033. **(IF=2.17; 80/556, General Medicine)**
6. Chiu TY, Chen PH, Chang CL, **Yang DM**.* **Live-cell dynamic sensing of Cd^{2+} with a FRET-based indicator. PLoS One.** 2013 Jun 11;8(6):e65853. doi: 10.1371/journal.pone.0065853. PMID: 23776557; PMCID: PMC3679114. **(IF=2.740)**
7. Chiu TY, **Yang DM**.* **Intracellular Pb^{2+} content monitoring using a protein-based Pb^{2+} indicator. Toxicol Sci.** 2012 Apr;126(2):436-45. doi: 10.1093/toxsci/kfs007. Epub 2012 Jan 12. PMID: 22240981. **(IF=3.703)**

■ **研究領域 Research Interests (reurl.cc/mqpO3A)**

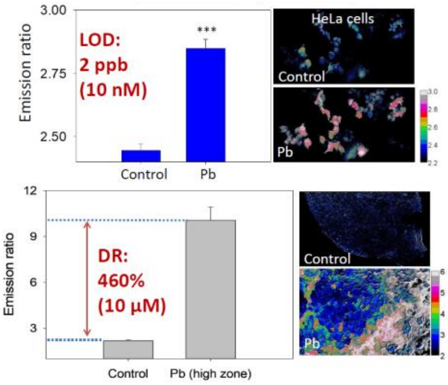
1. 鉛離子生物感應器與活體腦鉛迴路建構 Pb biosensor and *in vivo* mapping Pb-sensitive neuronal circuit
2. 環境鉛感應之可攜式生物感應器 Portable FRET-based device biosensor for environmental Pb detection
3. 新冠肺炎病毒蛋白突變研究 Genomic mutation analysis on SARS-CoV-2 viral proteins

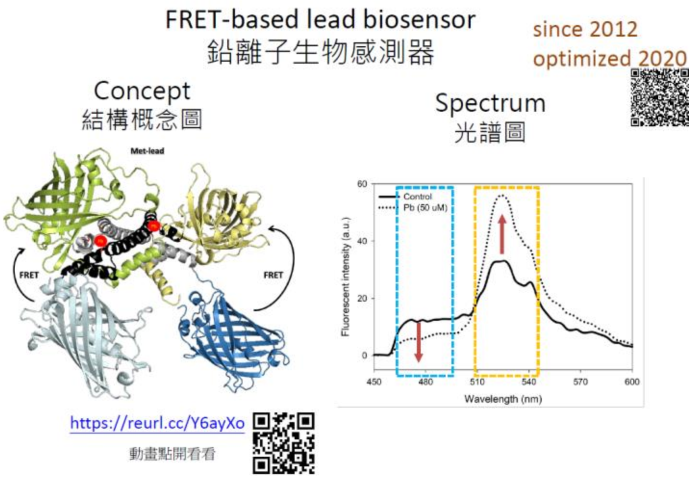
■ **研究簡介 Research Highlights**

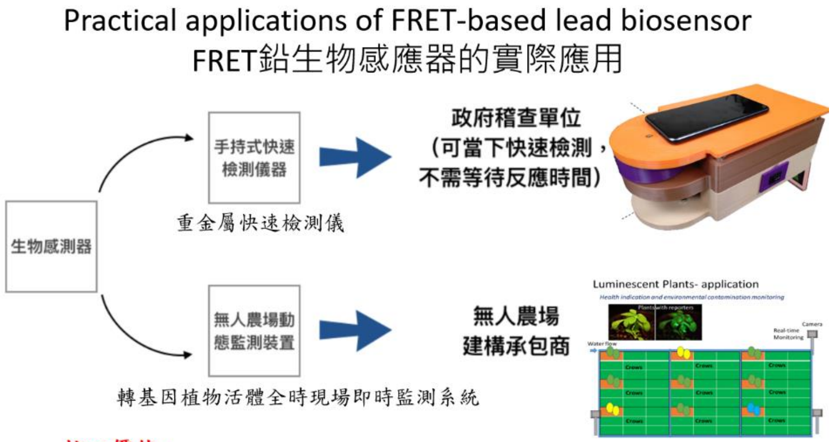
鉛（Pb）無聲無息侵入人類生活長達千年以上，鉛最大的危險在於其傷害人類的過程中並沒有明顯的徵兆或跡象可作為警訊，迄今全世界超過8億個兒童仍生活在含鉛的有毒環境中。雖然血鉛（blood lead level，BLL）的量測是目前關於鉛暴露程度的常規診斷方法，然而科學研究卻漸漸地發現：可能並沒有一個真正所謂安全的BLL數值存在！因此為避免鉛更進一步不可逆的長期低劑量傷害，能在活體內準確偵測低含量鉛的快速準確方法，是極重要且被期待著的。為此我們運用**2008年諾貝爾化學獎得主錢永健教授**的「**綠色螢光蛋白技術**」，搭載比率螢光即時影像感應系統，開發並優化以偵測螢光共振能量轉移（fluorescence resonance energy transfer，FRET）為策略的「**遺傳編碼重金屬鉛生物感應器」。整體而言，最佳版本Met-lead 1.44 M1具有10 nM（0.2 μg/dL; 2 ppb）的感應極限（limit of detection，LOD；敏感度sensitivity），是2017年WHO自來水溶出鉛含量最低標準（10 ppb）的5分之一、兒童BLL安全數值（3 μg/dL）的15分之一**。由於此**優化版動態感應範圍（dynamic range，DR）接近5倍（遠高過舊版的不到2倍）**，因此有辦法成功的進一步被應用在多元模式生命活體內鉛的監測。本論文（doi: 10.1016/j.bios.2020.112571）與相關論文（doi: 10.3390/s20061712）不但做了完整的鉛生物感應器基本特性分析、還運用不同類型的FRET比率螢光顯微影像平台（從進階倒立活細胞、正立或解剖活組織、光譜式共軛焦、到高解析雙光子顯微鏡等）、展示多元廣泛層面，從人類誘導型幹細胞衍生的心肌細胞（induced pluripotent stem cells，iPSCs）、不同年齡期（幼蟲與成蟲）轉基因動物模式的活體果蠅（*Drosophila*）神經系統、到轉基因植物模式阿拉伯芥（*Arabidopsis*）不同部位等等的應用，這部分研究為重金屬毒理學領域設下獨特創新的里程，期能用以協助後續更多廣泛深入的鉛毒研究，包括更高解析三維腦區鉛含量監測的追蹤，增加對鉛毒更深的基礎知識。本研究的成果與影響，**將有助環境鉛與血/尿鉛之快速即時檢驗、增加人們對鉛毒的警覺與預防、協助共同打造無毒的健康生活環境**。相關領域研究上，與陽明大學生醫光電所薛特教授共同合作成功建構以FRET策略的活細胞內酸鹼生物感應器（doi: 10.1016/j.bios.2020.112115）。**未來目標**：將此優化版建構成攜帶式測鉛儀，以應用在環境鉛、以及血/尿鉛的檢測。建立高解析大範圍果蠅腦的鉛敏感感應影像圖譜、探索鉛毒與腦神經迴路毒理功能關聯。「**鉛離子的偵測方法及生物感應器**」之中華民國、泰國、印尼等**專利**申請中。

reurl.cc/R68Vd6

Standard / unit conversion	*ppb (μg/L)*	*μg/dL*	*nM*
Blood lead level (BLL) for adult	100	10	500
BLL for children	50/25	5/2	250/100
WHO 2017 Pb in tap water	10	1	50
CNS 8088：Pb from faucet Taiwan	7	0.7	35
Food containing Pb	300	30	1,500
Mushroom containing Pb	3000	300	15,000





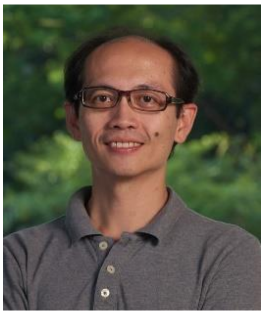


核心價值:

a. 安全無操作風險的便利可攜帶環境水質監控(不須繁雜樣品前處理)。

b. 快速動態的水質檢測(即時通報與汙染警戒)

c. 與未來農業4.0整合搭配建構健康生活家園



董奕鍾 老師　Prof. Yi-Chung Tung(兼任教授)

Phone: 886-2-2787-3138 (Office) 886-2-2787-3162 (Lab)

E-mail: tungy@gate.sinica.edu.tw

最高學歷 Education

美國密西根大學安納堡分校 機械工程博士

Ph. D. in Mechanical Engineering, University of Michigan, Ann Arbor (2005)

■ 現職 Current position

Research Fellow/Professor, Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan (August 2018 - now)

■ 主要經歷 Professional experiences

Associate Research Fellow/Professor, Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan (November 2013 - August 2018)

Assistant Research Fellow/Professor, Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan (June 2009 - November 2013)

Postdoctoral Research Fellow, Biomedical Engineering, University of Michigan, Ann Arbor (January 2006 - April 2009)

■ 代表著作 Selected Publications

7. H.-H. Hsu, P.-L. Ko, H.-M. Wu, H.-C. Lin, C.-K. Wang, and Y.-C. Tung*, "Study Formation of Three-Dimensional Endothelial Cell Network under Various Oxygen Microenvironment and Hydrogel Composition Combinations Using Upside-Down Microfluidic Devices," accepted to *Small*

8. H.-C. Shih, T.-A. Lee, H.-M. Wu, P.-L. Ko, W.-H. Liao, and Y.-C. Tung*, "Microfluidic Collective Cell Migration Assay for Study of Endothelial Cell Proliferation and Migration under Combinations of Oxygen Gradients, Tensions, and Drug Treatments," *Scientific Reports*, Vol. 9, 8234, June 2019

9. H.-M. Wu, T.-A. Lee, P.-L. Ko, W.-H. Liao, T.-H. Hsieh, and Y.-C. Tung*, "Widefield Frequency Domain Fluorescence Lifetime Imaging Microscopy (FD-FLIM) for Accurate Measurement of Oxygen Gradients within Microfluidic Devices," *Analyst*, Vol. 144, pp. 3494-3504, June 2019

10. S. Sarkar, C.-C. Peng, C. W. Kuo, D.-Y. Chueh, H.-M. Wu, P. Chen, and Y.-C. Tung*, "Study of Oxygen Tension Variation within Live Tumor Spheroids Using Microfluidic Devices and Multi-Photon Laser Scanning Microscopy," *RSC Advances*, Vol. 8, pp. 30320-30329, August 2018

11. H.-M. Wu, T.-A. Lee, P.-L. Ko, H.-J. Chiang, C.-C. Peng, and Y.-C. Tung*, "Review of Microfluidic Cell Culture Devices for Gaseous Microenvironments Control in vitro," *Journal of Micromechanics and Microengineering* , Vol. 28, 043001, February 2018

12. T.-A. Lee, W.-H. Liao, Y.-F. Wu, Y.-L. Chen, and Y.-C. Tung*, "A Fully Disposable and Optically Transparent Electrofluidic Circuit Pressure Sensor Integrated Microfluidic Viscometer for Analysis of Newtonian and Non-Newtonian Liquids," *Analytical Chemistry*, Vol. 90, No. 3, pp. 2317-2325, February 2018

13. C.-H. Lin, C.-K. Wang, Y.-A. Chen, C.-C. Peng, W.-H. Liao, and Y.-C. Tung*, "Measurement of In-Plane Elasticity of Live Cell Layers Using a Pressure Sensor Embedded Microfluidic Device," *Scientific Reports*, Vol. 6, 36425 (14 pages), November 2016

14. B. Patra, C.-C. Peng, W.-H. Liao, C.-H. Lee, and Y.-C. Tung*, "Drug Testing and Flow Cytometry Analysis on a Large Number of Uniform Sized Tumor Spheroids Using a

Microfluidic Device," *Scientific Reports*, Vol. 6, 21061 (12 pages), February 2016

15. C.-C. Peng, W.-H. Liao, Y.-H. Chen, C.-Y. Wu, and Y.-C. Tung*, "A Microfluidic Cell Culture Array with Various Oxygen Tensions," *Lab Chip*, Vol. 13, Issue 16, pp. 3239-3245, August 2013

16. S.-C. Lin, J.-C. Lu, Y.-L. Sung, C.-T. Lin*, and Y.-C. Tung*, "A Low Sample Volume Particle Separation Device with Electrokinetic Pumping Based on Circular Traveling-Wave Electroosmosis," *Lab Chip*, Vol. 13, Issue 15, pp. 3082-3089, August 2013

17. M.-C. Liu, S.-C. Shih, J.-G. Wu, T.-W. Weng, C.-Y. Wu, J.-C. Lu, and Y.-C. Tung*, "Electrofluidic pressure sensor embedded microfluidic device: a study of endothelial cells under hydrostatic pressure and shear stress combinations," *Lab Chip*, Vol. 13, Issue 9, pp. 1743-1753, May 2013

18. Y.-C. Tung, N.-T. Huang, B.-R. Oh, B. Patra, C.-C. Pan, T. Qiu, P. K. Chu, W. Zhang*, and K. Kurabayashi*, "Optofluidic Detection for Cellular Phenotyping," *Lab Chip*, Vol. 12, Issue 19, pp. 3552-3565, October 2012

19. S.-C. Lin, P.-W. Yen, C.-C. Peng, and Y.-C. Tung*, "Single Channel Layer, Single Sheath-Flow Inlet Microfluidic Flow Cytometer with Three-Dimensional Hydrodynamic Focusing," *Lab Chip*, Vol. 12, Issue 17, pp. 3135-3141, September 2012

20. Y.-A. Chen, A. D. King, H.-C. Shih, C.-C. Peng, C.-Y. Wu, W.-H. Liao, and Y.-C. Tung*, "Generation of Oxygen Gradients in Microfluidic Devices for Cell Culture Using Spatially Confined Chemical Reactions," *Lab Chip*, Vol. 11, pp. 3626-3633, October 2011

21. C.-Y. Wu, W.-H. Liao, and Y.-C. Tung*, "Integrated Ionic Liquid-Based Electrofluidic Circuits for Pressure Sensing within Polydimethylsiloxane Microfluidic Systems," *Lab Chip*, Vol. 11, pp. 1740-1746, May 2011

22. Y.-C. Tung, A. Y. Hsiao, S. G.. Allen. Y. Torisawa, M. Ho, and S. Takayama*, "High-Throughput 3D Spheroid Culture and Drug Testing Using a 384 Hanging Drop Array," *Analyst*, Vol. 136, pp. 473-478, February 2011

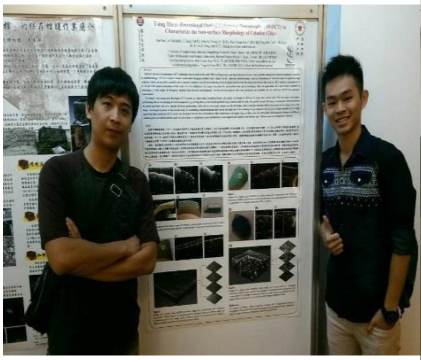
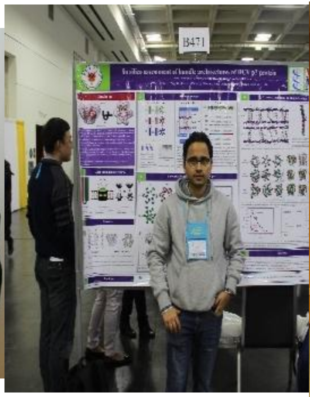
23. Y.-C. Tung, Y. Torisawa, N. Futai, and S. Takayama*, "Small Volume, Low Mechanical Stress Cytometry Using Computer-Controlled Braille Display Microfluidics," *Lab on a Chip*, Vol. 7, Issue 11, pp. 1497-1503, November 2007

■ 研究領域 Research Interests

Integrated Biomedical Microdevices
Cell Culture in Various Micro-Environments
Micro/Nanofluidics
Polymer/Silicon Hybrid Microsystems
Advanced Micro/Nano Fabrication Techniques

本所學生國際交流活動

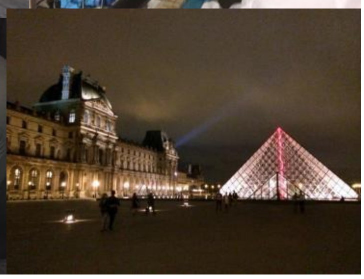
- 不定期邀請國內外專家來演講及授課
- 教師與學生經常參加國際學術研討會


- 本所與法國 Université de Technologie de Troyes (UTT) 簽署雙邊雙學位合約







國立陽明交通大學生醫光電研究所碩士班研究生修業辦法

（民國九十一年十月初定）
（民國九十四年九月二十六日所務會議修正通過）
（民國九十五年三月十五日所務會議通過報教務長核定）
（民國九十五年三月三十一日核可，自九十五學年度入學新生開始適用）
（民國九十八年九月二十八日所務會議修正通過）
（民國一00年二月十八日所務會議修正通過）
（民國一0三年九月十一日所務會議修正通過）
（民國一0五年十一月二十五日所務會議修正通過）
（民國一0六年六月二十三日所務會議修正通過）
（民國一0六年十二月十四日所務會議修正通過）
（民國一0七年一月二十三日所務會議修正通過）
（民國一0七年十月十二日所務會議修正通過）
（民國一0八年一月十一日所務會議修正通過）
（民國一一〇年四月八日所務會議修正通過）

第一條 入學資格：

一、入學考試及有關規定：詳見當學年度招生簡章。

二、新生報到及註冊：

(一)新生入學報到及註冊，悉依當學年度招生簡章及本校入學、註冊通知及其他有關規定辦理。

(二)新生錄取後應於規定期限內親自到校辦理入學手續，逾期未辦理，亦未事先請假核准者，即取消入學資格。

(三)新生所繳證件，如有不實，一經查覺，即予開除學籍。

第二條 修業年限：

碩士班修業期限以一至四年為限，在職進修研究生未在規定修業期限修滿應修課程或未完成學位論文者，碩士班得延長修業年限一年。

第三條 畢業學分：

一、碩士班研究生，至少應修畢與本所專業相關二十四學分，但不包含科目如：專題討論、專題研究、外國語文等及論文學分。

二、本所研究生修本所所開授之課程，至少為**十二**學分，方得畢業。

三、本所研究生於原大學部修習研究所課程，學生需於開學後第一週提出原學校所修課程之綱要、參考書目、授課教師以及成績單，提出抵免學分申請並經由所務會議審核。

四、課程：

（一）專題討論：在學期間，每學期必修，每學期課程給予一學分，但不列入畢業學分。

必修課程：所有研究生皆必修「光電工程導論」課程(除醫學 B 組學生可四選一，詳見第 5 點規定)、「學術研究倫理」0 學分課程。

（二）生物醫學必選課程：必修課程除外，理工組研究生需選修至少六學分生物醫學相關學分，入學前已修讀之相關學分，得向所上提出申請認定為生物醫學學分，經核可者得免修，唯學分不得抵免畢業學分。

（三）理工必選課程：必修課程除外，生物醫學組研究生需選修至少六學分理工相關學分，但不包含必修課程，入學前已修讀之相關學分，得向所上提出申請認定為理工學分，經核可者得免修，唯學分不得抵免畢業學分。

（四）五年一貫修讀學、碩士學位者，除大學部所需之畢業學分外，需於碩士畢業前修讀完畢十二學分本所開授課程(含必修課程)，以及光電專題研究與奈米專題研究各六學分，合計二十四學分。另在學期間，每學期必修專題討論，每學期課程給予一學分，但不列入畢業學分。

（五）醫學B組生應修習醫學院核心課程六學分，醫師科學家碩士專題研究(一)三學分及醫師科學家碩士專題研究(二)三學分共計十二學分，以上學分本所均予採計。本所必修課程為光電工程導論、機器學習領域、生物物理領域或奈米科學領域三學分課程四選一，以及選修課程(可選修光電或奈米專題研究六學分)共計十二學分，總計二十四學分。

（六）碩士班研究生學業成績採等第制，以A+為滿分，B-為及格，操行成績採等第計分法，以乙等為及格。

（七）碩士班研究生學業成績不及格之必修科目應重修。操行成績不及格者，應令退學。

第四條 指導教授：

一、 本所研究生原則上應於入學後第一學期結束前選定論文指導教授，並繳交選定指導教授同意書，其餘規定請詳見「國立陽明交通大學論文指導教授與研究生互動準則」。

二、 每一碩士班研究生均有一位主要指導教授，指導教授直接負責指導該研究生有關學業與論文研究、撰寫事宜。

三、 主要指導教授需為本所專任或經所務會議通過同意之教師。

第五條 學位考試：

一、應考資格：1. 完成本辦法中第三條有關學分與課程之要求。
2. 論文初稿經指導教授初審通過。

二、碩士學位候選人，應於規定期限內填妥申請表格，並檢附相關證明及歷年成績單，向本所提出申請，由指導教授及所長審核其應考資格後，一併交教務處辦理。

（一） 學位考試委員：

1. 學位考試委員人數三至五人，由指導教授推薦，送所長核備，並由委員其中一位擔任召集人，指導教授不得擔任召集人。
2. 學位考試委員之資格依本校「研究生學位授予作業規章」第六條相關規定辦理。
3. 碩士學位考試委員核備後，不得任意變更。

（二） 論文考試：

1. 論文考試成績以全體出席委員所評定分數平均計算之。如有半數(含)以上委員評定，不及格者，即以不及格論。
2. 論文考試成績以A+為滿分，B-為及格。

3. 論文考試成績不及格者，得於次學期起再行提出申請重考；惟應於其修業年限屆滿前完成。重考以一次為限，重考成績仍不及格者，應令退學。需依規定期間填寫申請書，經指導教授、所長、教務長及校長核可後，始得重考。

第六條 畢業及離校：

博士、碩士學位論文(含摘要)以中文或英文撰寫為原則，並須符合本校學位論文格式規範。學位考試通過後應將論文摘要及全文電子檔上網建檔(依照本校圖書館學位論文摘要及全文電子檔建檔規範辦理)，並繳交論文三冊(一冊本校圖書館陳列，一冊由國家圖書館收藏，一冊於本所陳列)。

第七條 跨國雙學位：

一、 依據『國立陽明交通大學與境外大學辦理雙聯學制辦法』，符合資格學生在二校修業之時間，合計至少須滿十二個月。

二、 修習雙聯學制之學生，在二校修習之學分數，得予併計；但在二校當地修習之學分數，累計須各達獲頒學位所需總學分數之三分之一以上。

三、 課程修讀須符合規定如下：

（一）專題討論：在校期間，至少須修滿兩學分方得畢業，但不列入畢業學分。

（二）必修課程：所有研究生皆必修「光電工程導論」課程、「學術研究倫理」0學分課程。

（三）修過相關領域課程，欲申請本所相近之必修課程免修者，得於每學期選課前提出，經由所上課程委員會審議，通過得免修。

四、 其餘規定依據雙方合作辦理碩士雙學位制協議書辦理之。

第八條

一、其他未盡事宜，悉依本校其他有關規定辦理。

二、本辦法於所務會議通過後，經各級課程委員會審查通過，教務會議核備後實施，修正時亦同。

國立陽明交通大學生醫光電研究所博士班研究生修業辦法

（九十四年十二月修訂，九十五學年開始實施）
（九十七年四月二十二日所務議修訂通過）
（九十八年九月二十八日所務會議修訂通過）
（一00年二月十八日所務會議修正通過）
（一0一年一月六日所務會議修正通過）
（一0一年六月十四日所務會議修正通過）
（一0二年五月二十二日所務會議修正通過）
（一0三年九月十一日所務會議修正通過）
（一0四年六月四日所務會議修正通過）
（一0四年七月三日所務會議修正通過）
（一0五年一月十四日所務會議修正通過）
（一0六年十二月十四日所務會議修正通過）
（一0七年一月二十三日所務會議修正通過）
（一0七年十月十二日所務會議修正通過）
（民國一一〇年四月八日所務會議修正通過）

第一條 入學資格：

一、入學考試及有關規定：詳見當學年度招生簡章。

二、新生報到及註冊：

（一）新生入學報到及註冊，悉依當學年度招生簡章及本校入學、註冊通知及其他有關規定辦理。

（二）新生錄取後應於規定期限內親自到校辦理入學手續，逾期未辦理，亦未事先請假核准者，即取消入學資格。

（三）新生所繳證件，如有不實，一經查覺，即予開除學籍。

第二條 修業年限：

博士班修業期限以二至七年為限。在職進修研究生未在規定修業期限修滿應修課程或未完成學位論文者，博士班得延長修業年限二年。

第三條 畢業學分：

一、博士班研究生，至少應修畢二十二學分，但不包含科目如：專題討論、專題研究、外國語文等及論文學分。其中至少六學分需修習本所開設之課程，若有特殊問題可個案上提所務會議審議。

二、碩士班已修課程之學分不列入二十二學分內計算。

三、課程：

（一）專題討論：在學期間，至少需修滿四學分方得畢業，唯此四學分不列入畢業學分。

（二）生物醫學相關課程：至少需選修六學分之生物醫學相關學分。入學前已修讀之相關學分，得申請認定為生物醫學學分，經核可者得免修，唯學分不得抵免畢業學分。

（三）理工相關課程：至少需選修四學分之理工相關學分，但不包含必修課程。修過

大學相關理工課程者，得向所上提出申請，經核可者得免修，唯學分不得抵免畢業學分。

（四）必修課程：所有研究生皆必修「學術研究倫理」0學分課程以及「光電工程導論」課程，未修過本所之必修課程者，必須選修該課程，不及格者重修。

(五)生物醫學及理工相關課程，由所上課程委員會認定之。

(六)修過相關領域課程，欲申請本所相近之必修課程免修者，得於每學期選課前提出，經由所上課程委員會審議，通過得免修。

(七)逕行修讀博士學位者須修滿三十學分。

第四條 指導教授：

一、博士班研究生入學入學後第一學期結束前必須選定主要指導教授並繳交指導教授選定同意書，其餘規定請詳見「國立陽明交通大學論文指導教授與研究生互動準則」。

二、每一博士班研究生均有一位主要指導教授，直接負責指導該研究生有關學業與論文研究、撰寫事宜。

三、主要指導教授需為本所專任或經所務會議通過同意之教師。

第五條 資格考核：

一、資格考核最遲應於博士班修業第三學年第一學期結束前完成第一次考試。第一次未通過者應在第三學年第二學期結束前得重考一次，重考不及格者應予退學。

二、資格考核：

（一）、 應考條件：

1．需完成本辦法第三條中有關學分與課程之要求。

2．檢附相關證明於考試前兩個月，經指導教授同意後，提出考試申請。

（二）、 考核方式以該研究生之博士論文研究計畫為範圍，於應考前繳交博士研究計畫書，計畫書中需明列該研究計畫預計達成之目標，由所長聘請召集人，成立博士生論文委員會，由該委員會委員進行口試，口試成績以B-(百分制七十分)為及格，A+(百分制一百分)為滿分，且需經由博士論文委員會同意預計達成目標。

（三）、 口試委員由指導教授推薦，所長召集三至七位校內外委員，送所務會議核備後組成。

三、通過資格考核者為博士學位候選人，本所核發資格考核合格證明書並得以參加學位考試。

四、博士班研究生通過資格考後之次一學年度起，每學年度均應舉行「研究進度報告」一次，相關規定遵循本所「博士班研究進度報告」施行辦法。

第六條 學位考試：

一、博士學位候選人，應於規定期限內，填妥申請表格，附歷年成績單、資格考核合格證明書及完成本辦法第三條中所有學分與修課要求證明，向本所提出學位考試申請，由指導教授及學術委員會審核後，一併交教務處辦理。

二、其他應考條件：

（一）、博士班研究生提出學位考試申請時，至少需具備以下其中一項資格：

1. 有兩篇論文屬於國際科學索引(SCI)列名之期刊被接受，該生必須為第一作者或通訊作者，並且其發表之單位必須為本所。

2. 如未發表國際期刊，學生需完成在博士資格考時博士研究計畫所提出之預計達成目標，或等同程度之研究成果，並由指導教授同意後方可提出申請。

如有其他特殊表現，雖無法達成上述(1)或(2)項要求，但其指導教授仍同意提出學位考試申請者，得提所務會議裁定之。

（二）、論文初稿經指導教授初審通過。

（三）、論文考試之前半部為公開發表，應於一週前在院內張貼公告，歡迎任何人員出席並提出問題或表示意見，後半部為秘密考試，僅由口試委員出席。

三、學位考試委員：

（一）、學位考試委員人數五至九人，並由其中一位委員擔任召集人，指導教授不得擔任召集人，校內外委員均各須佔三分之一(含)以上。

（二）、學位考試委員之資格依本校「研究生學位授予作業規章」第八條相關規定辦理。核備後之委員會，不得任意變更。

四、論文初稿撰寫：

初稿之撰寫必需依照格式，經指導教授審查認可後，於學位考試舉行一週前，印妥需要份數(同學位考試委員人數)，交各考試委員。

五、論文口試：

一、考試成績以全體出席考試委員所評定分數平均計算之。如有三分之一(含)以上委員評定不及格者，即以不及格論。

二、論文口試成績以 B-(百分制七十分)為及格，A+(百分制一百分)為滿分。

三、論文口試成績不及格者，如修業期限尚未屆滿，得申請重考一次，申請重考學生，仍需於修業期限內，且規定期間填寫申請書，經指導教授、所長、教務長、校長核可後，始得重考，重考以一次為限，仍不及格者，應令退學。

第六條 畢業及離校：

博士學位論文(含摘要)以中文或英文撰寫為原則，並須符合本校學位論文格式規範。學位考試通過後應將論文摘要及全文電子檔上網建檔(依照本校圖書

館學位論文摘要及全文電子檔建檔規範辦理)，並繳交論文三冊(一冊本校圖書館陳列，一冊由國家圖書館收藏，一冊於本所陳列)。

第七條 跨國雙學位：

一、 依據『國立陽明交通大學與境外大學辦理雙聯學制辦法』，符合資格學生在二校修業之時間，合計至少須滿二十四個月。

二、 修習雙聯學制之學生，在二校修習之學分數，得予併計；但在二校當地修習之學分數，累計須各達獲頒學位所需總學分數之三分之一以上。

三、 課程修讀須符合規定如下：

（一）、專題討論：在校期間，至少須修滿四學分方得畢業，但不列入畢業學分。

（二）、必修課程：所有研究生皆必修「光電工程導論」課程以及「學術研究倫理」0學分課程。

（三）、修過相關領域課程，欲申請本所相近之必修課程免修者，得於每學期選課前提出，經由所上課程委員會審議，通過得免修。

四、 其餘規定依據雙方合作辦理博士雙學位制協議書辦理之。

第八條

一、其他未盡事宜，悉依本校其他有關規定辦理。

二、本辦法於所務會議通過後，經各級課程委員會審查通過，教務會議核備後實施，修正時亦同。

Activity Agreement on

Double Master Degree and *Double PhD Degree*

between

UNIVERSITE DE TECHNOLOGIE DE TROYES

and

NATIONAL YANG MING UNIVERSITY

This activity agreement on Double Master Degree and Double PhD Degree is entered into by and between the

National Yang Ming University (hereinafter referred as NYMU)
Located No 155, Sec. 2, Linong Street, Taipei 112, Taiwan, ROC
represented by Wan-Jr Syu, Vice President

and

Université de Technologie de Troyes (hereinafter referred to as UTT),
located 12 rue Marie Curie – CS42060 – 10004 Troyes cedex, France,
represented by M. Christian LERMINIAUX, Vice-Chancellor.

Students leaving UTT in September:

Master 2	NYMU (Sept-June)	Master thesis (30 credits) + UTT modules by distance learning validated by UTT (8 credits) + 4 NYMU courses (≈ 30 credits) validated by NYMU	68
Master 1	UTT (Sept-June)	UTT Courses	60
Year	**Place**	**Contents**	**Credits**

Students leaving UTT in February:

Master 2	NYMU (Feb-Jan. n+1)	Master thesis (30 credits) + 2 NYMU courses (≈15 credits)	69
	UTT (Sept-Jan)	UTT Courses (24 credits)	
Master 1	UTT (or other place) (Sept-June)	UTT (or other place) Courses	60
Year	**Place**	**Contents**	**Credits**

The list of preferable courses for UTT students at NYMU is in Appendix II.

1.3.2. Curriculum for the NYMU students

Master 2	UTT (Sept-June)	Master thesis (30 credits) + UTT courses equivalent to ≈ 3 NYMU courses (24 credits) + 14 credits in equivalence *	68
Master 1	NYMU (Sept-June)	NYMU courses	60 (24 Tw credits)
Year	**Place**	**Contents**	**Credits**

*NYMU Students are entering the DMD program after 5 years of studies at university: they will receive 8 science and technology credits in equivalence plus 2 credits for SD10 and 4 credits for the language course.

The list of preferable courses for NYMU students at UTT is in Appendix III.

Both institutions shall appoint a supervisor for the students admitted in the programme. Prior to a student departure the supervisors shall agree with each other about which courses the student needs to take at the host university and the topic of the thesis in order to ensure that the curriculum at the host university will allow to validate both home and host universities degrees. The master thesis will be co-supervised.

交通資訊

國立陽明交通大學生醫光電研究所相關連絡與重要資訊：

地址：11221 台北市北投區立農街二段 155 號傳統醫學大樓甲棟 6 樓608 室

聯絡電話：(02) 28267000 轉5707 或(02) 28204624

聯絡信箱：biophotonics@ym.edu.tw

如何至國立陽明交通大學 - 陽明校區

另可依個人狀況，參考與使用「台北市大眾運輸公車路線查詢系統」查詢，或連結「北市大眾運輸資訊網」及「北縣乘車資訊服務網」查詢。

一、搭乘公車

石牌站	紅12、紅19、216、223、601、645 (步行至本校約 12 鐘)
陽明大學站	216(副)、223、288、550 (步行至校門約 5 分鐘)

二、自行開車

由台北車站「承德路」往「北投方向」前進，至與「石牌路」右轉直行至「東華街」左轉直行約500 公尺後，再右轉便是「立農街二段」，左手邊即為"陽明大學門口"。

三、捷運淡水線「石牌站」轉搭「陽明大學校車」(石牌站斜對面眼鏡門口)

搭乘校車需支付 2 元交通費(需以悠遊卡刷卡支付)

四、由捷運淡水線「石牌站」步行至「陽明大學」

石牌站出口，沿著捷運線下方之公園往「唭哩站」方向步行，約 5～8 分鐘後見右手邊有「立農街二段」及「陽明大學告示牌」，右轉進入即可見校門。

國立陽明交通大學生醫光電研究所

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