國立臺灣大學生醫電子與資訊學研究所

Graduate Institute of
Biomedical Electronics and Bioinformatics,
National Taiwan University

E-mail： ntubebi@ntu.edu.tw
Website： http://www.bebi.ntu.edu.tw/
Address： 10617台北市大安區羅斯福路4段1號　博理館410室
Room 410, Barry Lam Hall,No. 1, Sec. 4, Roosevelt Road,
Taipei, Taiwan (ROC) 10617
Phone： +886-3366-4961
Fax： +886-3366-3754

國立臺灣大學生醫電子與資訊學研究所 BEBI Annual Report, No. 10 / 2016

國立臺灣大學
生醫電子與資訊學研究所

Graduate Institute of
Biomedical Electronics and Bioinformatics,
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BEBI Annual Report, No. 10 / 2016

國立臺灣大學生醫電子與資訊學研究所

Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University

BEBI Annual Report, No. 10 / Sep. 2016

序言 Preface

轉眼間，臺灣大學生醫電子與資訊學研究所創立10年了。

十年間，我們從草創初期的八位教師、幾位研究生，壯大為擁有將近四十位教師、百餘名學生的研究所，無論在教學、研究各方面都有傑出表現。我們不因現有成就過度驕傲，但過去十年篳路藍縷所打下的基礎及成果，卻不容忽視。

為了加強不同領域的教學資源以及研究方向，並持續推動師生跨領域學習研究及交流，今年，我們新聘二位教師，分別為約翰霍普金斯大學醫工博士魏安祺教授、臺大電機所博士現任之初創投合夥人的詹益鑑博士。二位傑出人才在各自的專業領域皆為佼佼者，魏博士擁有橫跨藥學、生物醫學、生醫電子等領域的背景，專長為粒線體功能及型態與心臟疾病的關係，並開發生物物理模型；詹博士投身創業、創新、創投領域多年，其所共同創辦的AppWorks Ventures（之初創投），是目前是亞洲最大的創業加速器，預計開設課程「技術創新與科技創業」可帶領學生瞭解創新本質與創業實務，教導學生結合科學與工程態度，去思考創新與創業本質，讓修課者以「理解創業、參與創新」的態度思考及學習創業。二位教師的專業皆有異於本所現有教師，有助於提升本所教學及研究的廣度，我們非常期待他們的加入能夠為所內激盪出更燦爛火花。

去年底，我們主辦了「中華民國生物醫學工程學會生物醫學工程科技研討會」，此研討會於每年底舉辦，為臺灣生醫工程科技領域的重大盛事，一系列活動除了是醫工學會的年度聚會外，更是國內生醫工程科技學術界及產業界互動、交流的平台，對於本國生物醫學與工程領域產業的技術水準提升、促進國內產學雙方合作、落實人才培育等發展皆有極重大的貢獻。本所自創所以來無不致力於生物醫學與科技的研究及教學，此次爭取到主辦此活動，不僅極具意義，更是睽違十年後再次回到臺大來舉辦。這場與醫工所合辦的研討會，吸引上百名學者及將近一千名與會者共襄盛舉，透過此研討會，本所與合辦的醫工所能夠為臺灣的生醫工程領域盡一份心力，促進臺灣生醫工程領域間的合作與交流，對本所著實深具意義。

此外，籌備二年的生醫核心實驗室已在年初落成啟用，此BSL2等級的實驗室由本所籌資提供精密生物實驗儀器，無償開放予本所教師、學生共同使用，此空間做為一個研究交流、分享的平台，有益於整合本所資源，進行前瞻性跨領域整合研究。

招生方面，本所招生率始終位居全院排名前段，這點應該歸功於全所教師的努力。除了遠赴中、南部舉辦跨校招生說明會，更舉辦錄取新生說明會；加之教師們熱心回答報考學生的疑問，亦十分關心在學生狀況，導生相處融洽，使本所招生狀況能夠在大環境中突圍，維持優異水準。

在學生事務方面，為鼓勵學生參與所學會運作，我們積極安排所學會至新生說明會、所長時間等場合宣傳，並鼓勵所學會主導籌劃所上活動事務，如：醫工盃、生醫電資營等活動，充分給予發揮空間。除了今年的生醫電資營隊，由所學會全權規劃安排之外，課外活動、全所交流活動等亦由所學會幹部籌備規劃，並辦得有聲有色，熱鬧非凡。期許此發展方向能夠增加學生對於系所的認同感及向心力，並培育我們的學生在出社會前，便能夠體認團隊合作及責任感的重要性。

同時我們並沒有忘記，獲得教育對於下一代是多麼重要的事。因為希望能夠幫助更多學生安心就學，故今年度起本所設置了特殊教育學生助學金、清寒獎學金、重大變故助學金等，希望透過所上的關懷及助學金的濟助，幫助身心障礙、經濟弱勢及家中發生重大變故的學生，提供予他們安心就學的保障，讓學生們無後顧之憂的繼續求學。這不僅是身為教師及主管所應盡的義務，更是落實、體現社會責任的一大步。

年輕的我們雖然還沒有聲名顯赫的校友來提升知名度，但隨著未來產業發展趨勢的走向，我們正站在產業發展的浪尖上，由國家主導推動的生醫電資產業，廣浩未來即將來臨。

臺大生醫電資所十歲了，衷心期許我們能夠在現有的基礎下，繼續努力茁壯，成為跨領域研究教學單位的典範。也相信在全所教學、行政同仁的齊心努力下，本所一定能保持生醫 / 工程 / 電資學界的領頭羊地位，妥善運用相關資源提升教學與研究能量，積極培育學用合一的人才，肩負起學術引領產業的使命，為全球相關領域尋求更多開拓及前進的契機。

臺大生醫電資所，十歲生日快樂！

莊曜宇

2016年8月

序言 Preface

Time flies; it has been ten years since the founding of the Graduate institute of Biomedical Electronics and Bioinformatics of the National Taiwan University.

During the past decade, our institute has grown from eight faculty members and postgraduates to nearly forty faculty members and hundreds of students, making outstanding progress in both teaching and research. In terms of our accomplishments, we are not excessively proud of what we have achieved, yet we have built a strong foundation since our beginnings ten years ago.

Our institute promotes interdisciplinary learning, research and exchange, in order to strengthen our research resources in different fields. This year, we have appointed two new faculty members: Dr. An-Chi Wei and Dr. I-Chien Chan.

Dr. Wei received her PhD from the Department of Biomedical Engineering at Johns Hopkins University. Dr. Chan received his PhD from the Department of Electrical Engineering of National Taiwan University, and is a founding partner of AppWorks Ventures. They are the tops in their respective fields. Dr. Wei has a cross-disciplinary background that includes medicine, biomedicine, and biomedical electronics; her fields of expertise lie in the connection of dysfunction and typology of mitochondria to cardiac vascular diseases, and in the development of physio-biological models. Dr. Chan, has been involved in the fields of startups, innovations, and venture capital for many years. He is a co-founder of the company AppWorks Ventures, which is the largest startup accelerator in Asia. The course that he is planning to run, “Technological Innovation and Technological Entrepreneurship (Startups)”, will lead students towards invention and in the practical aspects of entrepreneurship. It will also teach students to incorporate scientific and engineering to reflect on “understanding entrepreneurship, participating in innovation” and about entrepreneurship.

The ways in which these two faculty members’ fields of expertise differ from those of the Institute’s current staff members will help enhance our instruction and research. We greatly look forward to their participation bringing new innovations, creativity, leading technologies, and vision to the Institute.

At the end of last year, we hosted the Annual Symposium on Biomedical Engineering and Technology. This Symposium, held at the end of every year, is a major event in the biomedical field in Taiwan, and is important to the whole biomedical engineering technology industry here. It provides academia and industry with an opportunity to collaborate, share knowledge, improve techniques, and develop talent. Since its founding, the Institute has been dedicated to research and education in biomedical engineering and technology, so having the honor of being the organizer of this event was particularly meaningful to us, especially since the event was being hosted by NTU again after a decade. The Symposium, which was co-organized with the Institute of Biomedical Engineering, has promoted collaboration and exchange within the field of biomedical engineering in Taiwan.

After two years of preparation, the Graduate Institute of Biomedical Electronics and Bioinformatics funded the Biomedical Core Laboratory at the beginning of this year. The Laboratory is Biosafety Level 2 (BSL2), with sensitive and precise equipment and instruments. The Laboratory is free to be used by all the Institute’s staff members and students. This space is designed for staff members and students to carry out research, communicate, and share the knowledge that will help concentrate our Institute’s strengths in pioneering cross-disciplinary research.

When it comes to student recruitment, our recruitment rate has always been ranked highly in the College. This achievement is due to the efforts of all our staff. In addition to attending inter-university recruitment events all around Taiwan, they organize new student orientation events. Moreover, our staff members enthusiastically help and care for the students. The good relationships between mentors and students have also contributed to our outstanding standard of recruitment.

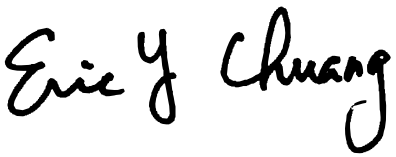
When it comes to student affairs, in order to encourage student participation in the Graduate Student Association (GSA), we have begun promoting the Association at events such as the new graduate students' orientation and discussions with the director. We also encourage the Graduate Student Association to take the reins in the organization of institutional functions, such as the Biomedical Engineering Cup and the Biomedical Electronics and Bioinformatics Camp. The GSA has done a great job with extracurricular and social events for our institute. We hope these activities will help students gain a deeper understanding of the importance of teamwork and responsibility before they leave the school.

Education is of prime importance for the next generation. We want our students to be able to focus on their studies without financial or health concerns. As a result, this year, the Institute has set up education assistance funds, scholarships for low income families, and financial aid for major accidents that occur in students' families. We hope that, with the care provided by the Institute and the assistance made available through financial aid, we will be able to help disabled and financially needy students, as well as students who have suffered major upheavals at home. This is not only the duty and obligation of teachers and supervisors; this is our commitment to showing how we fulfill our social responsibility.

Despite a lack of famous alumni to boost our reputation, our institute is still progressing along with the development trends in the industry. Biomedical engineering, now a national focus, is getting ready for a prosperous future.

The Graduate Institute of Biomedical Electronics and Bioinformatics of NTU is now ten years old. We have faith that we will continue to grow and flourish, and become a model center for interdisciplinary academic research. We believe that with the united efforts of our teaching and administrative staff, our Institute will continue to maintain a leading position in biomedical engineering and bioinformatics. We will use our resources and give great efforts to enhance both teaching and research, and to cultivate biomedical and bioinformatics talent. We look forward to taking up academia's role in leading the industry, and seeking out opportunities to develop and advance the field of biomedical engineering technologies around the globe.

Happy Tenth Anniversary to all of us!



August 2016

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壹 生醫電子與資訊學研究所簡介
Introduction of BEBI

國立臺灣大學生醫電子與資訊學研究所（簡稱生醫電資所）於2006年8月1日正式成立，本所的獨特性在於生物醫學、電機與資訊三大領域的結合，進行生物醫學之前膽研究及跨領域教學。換言之，生醫電資所的主要使命在於提升跨領域的研究及教學，以因應生物醫學科技的快速發展，這些領域有：生醫電子、分子/細胞/組織影像、生醫訊號處理、生醫光電、感測器、微陣列分析、電腦輔助診斷、生物資訊學、系統生物學以及醫學資訊學等，為了在此專業領域中追求卓越，並謀求進一步的研究合作，整合來自不同領域的專業是相當必要的。

2006年8月，生醫電資所開始招收博士班，目前每年招收18名博士生加入生醫電資所的行列，碩士班也於2007年8月開始招生，每年有41名碩士新生加入。本所有38位教師，來自不同領域的背景，包含了電機工程、資訊科學、生物、藥學、生醫工程、醫學以及生命科學。本所的課程設計也提供學生有足夠的跨領域訓練，以迎合生物醫學科技此一領域的挑戰，目前，我們針對重要的生醫問題進行整合性的研究，同時也和生醫電子及生物資訊相關產業合作，及進行跨領域的訓練和教育，我們期待本所持續的成長茁壯，並對生物科技與健康照護領域做出貢獻。

The Graduate Institute of Biomedical Electronics and Bioinformatics (BEBI) at National Taiwan University was formally founded on August 1, 2006. In a way, it is a very unique institute among those in College of Electrical Engineering and Computer Science, National Taiwan University, in that the fields of expertise are diversified but our efforts remain extremely focused. The main mission of the institute is to promote multi disciplinary research and education in respond to the rapid advancement of biotechnology. In this regard, the following areas have been identified as our focus areas which we have been putting our major efforts in: biomedical electronics, molecular/cellular/tissue imaging, biomedical signal processing, biophotonics, sensors, microarrays, computer aided diagnosis, bioinformatics, systems biology and medical informatics. To excel in these areas and to bring up research synergy, integrative efforts from different disciplines are necessary.

The BEBI institute started the doctoral program in August, 2006 and now we admit 18 new Ph.D. students every year. Our master program started in August, 2007 with 41 new students entering the institute annually. There are 38 faculty members, among those 8 are with primary appointments. As our main mission mandates, our faculty members come from different trainings, including electrical engineering, computer science, biology, pharmacy, biomedical engineering, medicine and life sciences. Our curriculum is also designed to provide students with sufficient cross-disciplinary training to meet the challenges in biotechnology. Currently resources are used to promote integrated research projects aiming at important biomedical problems, collaboration with local industry in biomedical electronics and bioinformatics, as well as multidisciplinary training and education. As a result, research teams have been formed and several integrated program projects are underway. New courses have also been developed and a core lab is also being established to provide students with hands-on training. We look forward to continuing growth and contributions to this exciting field of biotechnology.

貳 新進教授介紹
New Faculty

一、魏安祺助理教授 An-Chi Wei, Assistant Professor

魏安祺助理教授於2004年取得臺灣大學藥學系學士後，前往美國喬治城大學取得生物化學和分子生物學碩士學位，於2013年取得約翰·霍普金斯大學生物醫學工程博士學位，並於約翰·霍普金大學擔任博士後研究員，研究項目包含粒腺體與鈣離子對於心肌功能之影響，藉由探討粒腺體中鈣離子在能量和心肌功能中的作用，了解心臟疾病發展過程中的生物能量變化。其間多次參與知名國際心臟血管和生物醫學會議，並發多篇生物醫學期刊論文，包括Journal of Biological Chemistry 、Journal of Proteome Research，上述成果獲得美國國衛院(National Institutes of Health)、美國心臟協會 (American Heart Association)等數項研究計畫補助。

魏教授的主要研究方向為： (1) 粒線體鈣離子的調控，並建立他們對生物能量和細胞生命和凋亡之影響(2)闡明代謝相關疾病中粒線體功能的改變及疾病機制 (3) 整合電腦模擬與定量實驗，研發粒腺體與細胞模型 (4)代謝網路分析

An-Chi Wei received her Ph.D. degrees in Biomedical Engineering from Johns Hopkins University in 2013. She continue her postdoctoral training in Cardiology in the Johns Hopkins University. She joins Institute of Bioelectronics and Bioinformatics at National Taiwan University in fall 2016.

Her main areas of research interest are using integrative computational and experimental methods to study mitochondrial biology, bioenergetics and metabolism. She is studying the role of mitochondrial calcium regulation in energy production, cell death and buffering by quantitative experiments and developing biophysical based computational model.

二、詹益鑑兼任講師（專業技術人員）I-Chien Jan, Adjunct instructor of Specialist

詹益鑑博士投身創業、創新、創投等領域多年，於2010年共創AppWorks（之初創投）並任合夥人，專注於穿戴裝置、運動科技、健康照護等領域。AppWorks迄今輔導250個新創團隊、500個創業者，是亞洲最大的創業加速器，並管理新臺幣18.2億創投基金，是臺灣少數專注於網路、移動、人工智慧等領域的早期創投。

詹博士具跨領域背景及創投經歷，曾服務於誠信開發、台灣工業銀行及聯訊創投等創投機構；於2007年投身精密儀器領域，多次帶領技術創業團隊，主導產品研發、事業發展與團隊招募。

詹博士於1998年及2004年取得臺灣大學物理系學士及電機工程研究所博士，並於2009年取得政治大學智慧財產研究所商學碩士。詹博士的產業經歷與教學主軸為技術移轉與商品化、技術價值與產業趨勢分析、新創企業之事業發展與投資評估等。

Dr. I-Chien Jan is a Co-founder and Partner at AppWorks Ventures, the largest accelerator in Asia with 250 startups and 500 founders in its alumni network since 2010. AppWorks also manages a total of US$ 61M in VC funds. It typically leads seed and Series-A rounds for its startups, invests US$ 100K to 5M and aligning coinvestors based on each startup's needs.

Before co-founding AppWorks, he was VP & Acting CEO at ARDIC Instruments Co., an technology transformation and commercialization platfom to offer pipelines of analytical instruments for educational, research, and industrial applications in nanotechnology. Before joining ARDIC, Dr. Jan was a Director of Development Dept. at Chang-Yu Technology (CYT) and Vice President at OTO Science, as key member leading teams focus on miniature optical spectrometer based on MEMS technology.

Prior to OTO, Dr. Jan has worked for three kinds of VCs include independent VC, Banking VC and corporate VC in Taiwan from 2004 to 2007.

Dr. Jan received his B.S. in Physics and doctoral degree in Engineering from National Taiwan University in 1998 and 2004, and his MBA in Intellectual Property from National Chengchi University in 2009.

參 研究領域 Research Fields

一、生醫電子組 Biomedical Electronics Group

本組研究主題涵蓋醫學影像、醫療儀器與生醫信號處理、生物晶片與生醫微感測器、生醫光電等數個領域。在醫學影像方面，研究重點係針對核磁共振與超音波造影技術，提升影像的品質、速度與功能性，並發展分子影像技術，應用於臨床醫學診斷、治療以及神經認知科學等方面。在醫療儀器與生醫信號處理方面，重點為開發或利用現有的醫療儀器，擷取各種生理訊號，並透過數位信號處理技術，提供醫療人員有效之疾病診斷及生理監測資訊。生物晶片的研究重點包括DNA微陣列晶片之製程、感測技術與資料分析方法，以及以光電蝕刻技術控制生物分子、細胞及微組織之排列，並將其應用於生物醫學之研究。在生醫微感測器方面，主要為發展表面電漿共振光學檢測技術與利用標準半導體製程方式，進行生物分子的感測，並進一步將檢測元件微小化。在生醫光電領域，發展高解析度光學顯微影像以及各種光譜技術，提供生物分子、細胞與組織的分析、成像與操控工具，進而輔助疾病的診斷與生醫相關的研究。

Faculty members in this group have diverse research interests including "medical imaging", "medical instrumentation and biomedical signal processing", "biochips and biomedical sensors", and "biomedical optics". In the area of "medical imaging", research efforts are focused on magnetic resonance imaging (MRI) and ultrasound imaging techniques. The goals are to improve the quality, acquisition speed and functionality of imaging, as well as to apply these techniques for diagnosis and treatment of disease. In the area of "medical instrumentation and biomedical signal processing", digital signal processing techniques are used to extract information that is useful for diagnosis or monitoring of physiological status. Research efforts in the area of "biochips and biomedical sensors" are focused on improving the manufacture and detection of DNA and protein microarrays, arranging biomolecules and culture tissue using micro-patterning techniques, development of new data analysis methods for DNA microarrays, and development of miniature biosensors based on surface plasmon resonance (SPR) and nanowire biomolecular sensing devices based on standard CMOS fabrication. The emphasis of research in "biomedical optics" is to use optical microscopy and spectroscopy techniques to detect, image, analyze, and manipulate biological molecules, cells, and tissues. The ultimate goal is to provide information relevant to diagnosis and useful tools for the general biomedical research community.

二、生醫資訊組 Bioinformatics Group

本組研究主題為「生醫資料分析與探勘」、「計算系統生物學」、「計算藥物學及化學」以及「醫學資訊系統」。在生醫資料分析與探勘方面，研究重點包括生物晶片(微陣列)和次世代定序資料分析、DNA與蛋白質序列分析、基因及蛋白質結構與功能分析、生醫資料探勘等。在計算系統生物學方面，研究重點則是針對複雜的生物系統，建構數學分析及模擬計算的模型，以作為分析及模擬尖端生物醫學及生命科學現象的基礎。在計算藥物學及計算化學部分，則針對藥物及疫苗開發所涉及的量子化學計算及化學動力學計算建構新的計算模型以及設計更有效率的演算法。在醫學資訊系統方面，研究主題涵蓋層面極廣，包括醫學資訊應用所涉及的網路、多媒體與資料庫系統，以及平行運算、分散式和即時計算等。

We dedicate our resources to cutting-edge topics such as "biomedical data analysis and mining", "computational systems biology", "computational pharmacology and chemistry", and "medical information systems". Our major research interests in biomedical data analysis and mining include biochip (microarray) and next generation sequencing data analysis, DNA and protein sequence analysis, gene and protein structure and function analysis, as well as biomedical data mining. In the area of computational systems biology, we focus on developing advanced mathematical models and simulation methods to describe the operations and behaviors of complex biological systems. Our research on computational pharmacology and chemistry aims to design novel computational models and efficient simulation algorithms for quantum chemistry and molecular dynamics to facilitate drugs and vaccine development. In medical information systems, we cover a wide range of topics on developing information technologies for medical applications, including networking, multimedia, database, parallel processing, distributed and real-time computing.

肆 學術活動 Academic Activities

一、第五屆獎勵研究創新獎 The 5th Biomedical Electrical Engineering reward research and innovation

本所為鼓勵學生研究創新並提昇本所及本校之國際學術地位，於民國100年通過〈獎勵研究創新辦法〉並施行之。104年度為第五次舉辦，於八月開放所上同學申請，在本所招生及學術委員會上審議通過得獎名單後，並於104年12月14日(一)舉行第五屆頒獎典禮。本獎項特別邀請本所傑出校友-泰博科技副總詹東權先生擔任頒獎人，同時邀請副院長、本所老師、校友、學生共襄盛舉，參與老師有莊耀宇、黃念祖、阮雪芬、宋孔彬等諸位老師，及所上100多位同學熱烈參與。

在頒發獎項前，首先邀請泰博科技副總詹東權先生跟所上師生分享他的人生經驗，接著在演講結束後，便開始進行頒獎典禮。本獎項共分成兩大項，分別是學生傑出研究獎、年度最佳碩士、博士學位論文獎，此次特地有請詹東權副總及李副院長來頒發獎項。

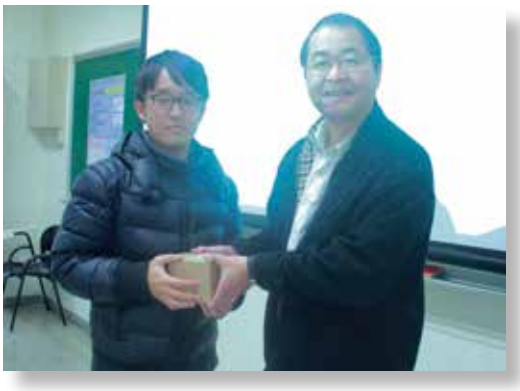
本次學生傑出論文獎獲獎學生為：得獎人有張耀尹同學、杜羿樞同學、黃振綜同學、張郁欣同學；年度最佳碩士論文獎的獲獎學生為謝弘柏同學、王文昱同學；年度最佳博士論文獎則由張耀尹同學、朱美孍同學獲得。此三個獎項除了鼓勵所上學生勇於在國際的舞台上創新研究外，今年也頒發年度榮譽榜，獲獎學生有何德威同學、郭峻延同學、蔡宗翰同學為肯定學生們在研究上的成就。

The Graduate Institute of Biomedical Electronics and Bioinformatics (BEBI) at National Taiwan University encourages students to conduct innovative research to promote our university' s international academic status. The Biomedical Electrical Engineering research and innovation award was established in 2011. In August of 2015, the 5th Biomedical Electrical Engineering research and innovation award was opened to student applications. The BEBI Admissions and Academic Committee evaluated the final award list and the 5th Biomedical Electrical Engineering research and innovation awards ceremony was held on December 14th, 2015. Distinguished alumni, TaiDoc Technology's Vice President of the board Mr. Jim Jan Chan, was invited to present students with their awards. Other distinguished faculties invited to participate in this event included the Associate Dean of Electrical engineering and Computer Science, professors, alumni, and students from BEBI. Professors who participated in the event were Chuang Eric Y, Huang Nien-Tsu, Juan Hsueh-Fen and Sung Kang-Bin. In addition, approximately 100 students attended the ceremony.

The opening ceremony began by inviting Mr. Jim Jan Chan, VP of TaiDoc Technology' s board, to share some of his life experiences. The awards ceremony started after the inspiring speech. Two types of awards were given: The Graduate Student Outstanding Research and Best Master Thesis Award and The Best Ph.D. Dissertation Award of the Year. The awards were handed out by Mr. Jim Jan Chan and Dr. Li, the Associate Dean of Electrical Engineering and Computer Science.

The students awarded for the Graduate Student Outstanding Paper Award included: Chang Yao-Yin, Tu Yi-Shu, Huang Chen-Tsung and Chang Yu-Shin. The students awarded for the Best Master Thesis Award included: Hsieh Hong-Po and Wang Wen-Yu. The student awarded for the Best Ph.D. Dissertation Award included: Chang Yao-Yin and Chu Mei-Lan. Students who received these awards were given an international level of recognition for their innovative research. Furthermore, Ho Te-Wei, Kuo Chun-Yen and Tsai Tsung-Han received the BEBI Honorary Award. These students received well-earned recognition for their academic achievements.

二、博士班招生說明會
BEBI Introduction to prospective students: College of medicine (2016/03/30)

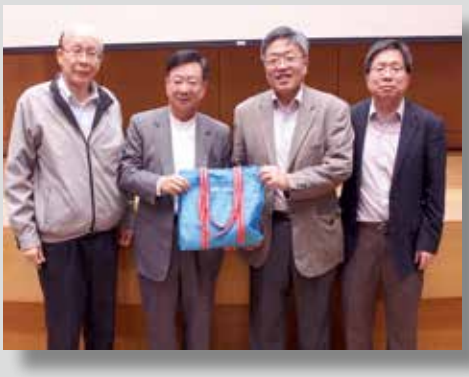


三、碩士班新生說明會BEBI Introduction to new students: (2016/4/11)

2015.09.21	台北市消防局金華分隊 彭茂凱隊員	正確的火災應變觀念
2015.10.05	財團法人生物技術開發中心	DCB 財團法人生物技術開發中心　參訪
2015.10.12	臺北市立大學視覺藝術系 蘇振明教授	藝術與人生─臺灣美術賞析與審美對話
2015.10.19	中研院基因體研究中心 陳仲瑄院士	Novel Mass Spectrometry and It's Application
2015.10.26	University of Texas Health Science Center at San Antonio 陳一東博士	Characterizing gene regulation network via competitive endogenous RNAs mechanism of different tumors
2015.11.02	臺灣大學生醫電資所 李嗣涔特聘教授	信息醫學對經絡的啟示─X 信息的發現
2015.11.09	臺灣大學法律學院 謝銘洋教授	從台積電案看營業秘密的重要
2015.11.16	力晶半導體 黃崇仁董事長	精準醫學─新一代高科技與生物醫學的整合醫療工程
2015.11.30	聯華電子股份有限公司 宣明智董事長	我的生技視界──探索臺灣新生計
2015.12.07	所友時間─國家衛生研究院 郭立威助研究員	Mapping Brain Connectomics with MRI: Technical Development, Methods and Applications
2015.12.21	中研院生物醫學科學研究所 沈志陽研究員	Taiwan Biobank for the Health of Next Generations
2015.12.28	財團法人資訊工業策進會 吳瑞北執行長	掌握機會之窗，再造臺灣榮光──談物聯網經濟
2016.03.07	臺灣大學國家發展研究所 周桂田主任	全球化跨界風險與治理挑戰─ 科技、健康、環境之治理典範轉移
2016.03.21	財團法人生物技術開發中心生物製藥研究所紀威光特聘專家	Trends in Biopharmaceutical Development
2016.03.28	UT Southwestern Medical Center Benjamin Chen	DNA Dependent Protein Kinase in Genome Maintenance and Cancer Development
2016.04.11	臺灣大學臨床醫學研究所 楊偉勛所長	Human Diseases, Medical Practice and Research
2016.04.18	陽明大學生物醫學影像暨放射科學系 黃正仲教授	Enhancement of Adoptive T-Cell Therapeutics in Tumor-Bearing Animal Model with Molecular Imaging.
2016.04.25	和沛科技創辦人兼總經理 翟本喬博士	雲端運算、大數據的理念與應用
2016.05.02	國泰綜合醫院品質管理中心 王拔群主任	生醫資訊在醫療品質與病人安全上的應用
2016.05.09	臺灣大學管理學院 郭瑞祥院長	從創意思考到商業創新
2016.05.16	臺灣大學外文系 劉亮雅特聘教授	臺灣國家歷史書寫：以施叔青《臺灣三部曲》為例
2016.05.23	國家衛生研究院	國家衛生研究院　校外參訪
2016.05.30	所友時間─之初創投 創辦人兼合夥人　詹益鑑	伊甸園還是醫電員─ 在新經濟時代，你該如何投資自己的未來？
2016.06.06	陽明大學生物醫學工程學系 江惠華教授	創新醫材的研發與產業現況
2016.06.13	臺大醫院　何弘能院長	再生醫學

1. 2015.11.02
臺灣大學生醫電資所 李嗣涔特聘教授
「信息醫學對經絡的啟示──X信息的發現」

2. 2015.11.16
力晶半導體 黃崇仁董事長
「精準醫學─新一代高科技與生物醫學的整合醫療工程」



3. 2015.11.30
聯華電子股份有限公司 宣明智董事長
「我的生技視界──探索臺灣新生計」

4. 2015.12.14
第五屆獎勵研究創新頒獎典禮

5. 左 2015.12.21
中央研究院生物醫學科學研究所 沈志陽研究員
「Taiwan Biobank for the Health of Next Generations」
右 2015.12.28
財團法人資訊工業策進會 吳瑞北執行長
「掌握機會之窗，再造台灣榮光 - 談物聯網經濟」

6. 2016.03.28
UT Southwestern Medical Center Benjamin Chen教授
「DNA Dependent Protein Kinase in Genome Maintenance and Cancer Development」

7. 2016.04.25
和沛科技創辦人兼總經理 翟本喬博士
「雲端運算、大數據的理念與應用」

8. 2016.05.02
國泰綜合醫院品質管理中心 王拔群主任
「生醫資訊在醫療品質與病人安全上的應用」

9. 2016.05.16
臺灣大學管理學院 郭瑞祥院長
「從創意思考到商業創新」

10. 2016.05.23
校外參訪 國家衛生研究院

11. 2016.06.06
陽明大學生物醫學工程學系 江惠華教授
「創新醫材的研發與產業現況」

12. 2016.06.13
臺大醫院 何弘能院長
「再生醫學」

五、國立臺灣大學電機資訊學院104年度畢業典禮
2016 Commencement of College of Electrical Engineering and Computer Science, NTU

六、 2016/07/07~07/09 生醫電子資訊營
Biomedical Electronics and Bioinformatics Camp on July, 7-9, 2016

2016台大生醫電資營於7月7日至7月9日假台大博理館演講廳舉辦。有別於去年結合黑客松的形式，今年改以學術演講與專題競賽，期許帶給學員對生醫電資所有更深入而廣泛的認識。本次主題為「展望未來十年：新世代生醫技術——個人化醫療的機會與挑戰」，邀請了九位來自公司企業、學校與醫院的講者，從生物、軟體、硬體等不同角度切入，就個人化醫療發展的現況、面臨的挑戰、未來的趨勢，做深入淺出的探討。

『個人化醫療』的核心價值在於，透過收集與分析個人化的基因資訊，以準確了解疾病於不同個體發生的根源，並結合跨領域的專業知識，為病患找出最適合的治療方法，從而精準化各種疾病的預防、診斷及治療。緣此，如何有效的結合生醫、電子及資訊等不同領域的專業知識，以研發出具有最佳適應性及最佳個人化的療程與藥物，便成為各領域研究人員當前最關心的課題。同時，在追求結合跨領域專業知識的過程中，如何適時的把握眼前的機會，將現有的資源做最有效的溝通，並為即將面臨的生醫應用做好準備，亦為各領域研究人員必須面臨挑戰與深究的課題。

本次活動總計有52位學員報名參加，成員為高中生、大學生、研究生及社會人士。除生醫與資訊背景學生外，亦有財務、管理背景的參加者。在學員的問卷調查中，幾乎都滿意本次的營隊規劃、願意再參加，也願意推薦給其他人，並對講者的演講都有很高的評價。

美中不足的是，這次營期期間，遭逢強颱尼伯特襲台，第二天的議程被迫取消，連帶影響到學員的討論時間，因此最後沒有機會舉辦專題競賽。明年本所亦將視培養國家未來生醫電子與資訊人才為己任，繼續舉辦生醫電資營。

The 2016 National Taiwan University Biomedical Electronics and Bioinformatics Camp was held from July 7th to July 9th at NTU Barry Lam Hall. It was different from last year' s event, and included a Hackathon. We hoped to give our participants a broad introduction to emerging and innovative technologies with the theme, "Next decade: the new generation of biomedical technology - opportunities in and challenges of personalized medicine". We invited nine speakers from academic backgrounds and the industry to discuss this topic from different aspects such as biology, software, hardware, and so on.

The core value of "Personalized Medicine" is giving patients precise precaution, diagnosis, and treatments according to the correlation between genes and diseases. The research is done by collecting and analyzing genes from individuals. Therefore, combining biology, medicine, electronics and computer science to develop personalized treatments and drugs is a major topic for those researchers. Meanwhile, combining interdisciplinary expertise, grasping opportunities

for effective cross communication, and preparing for upcoming biomedical applications are all challenging tasks that need further exploration by researchers.

A total of 52 participants joined the event, including high school students, college students, graduated students and members of the community. Apart from biomedical and engineering professionals, there were also people with financial and management backgrounds. According to our questionnaires, all participants were quite satisfied with the program and were willing to participate again. At the same time, they gave high ratings to speaker presentations.

Everything went well, other than the appearance of typhoon Nepartak, which forced us to cancel the second day's agenda, as well as the last day' s competition. Next year, we will foster new talent from academics and the industry and continue to hold the Biomedical Electronics and Bioinformatics Camp.

伍 學術交流 Academic Exchanges

一、2015中華民國生物醫學工程科技研討會暨科技醫學工程學門成果發表會 Annual Symposium on Biomedical Engineering and Technology

本次研討會由國立臺灣大學生醫電子與資訊學研究所及醫學工程學研究所共同承辦，於2015年11月13~14日為期兩天的「2015中華民國生物醫學工程科技研討會暨科技部醫學工程學門成果發表會」。此次研討會目的，除了推廣臺灣生物醫學工程科技技術，培養跨領域的優秀人才，同時引進國際最新之生醫工程研究，並與國際發展現況接軌，以達到全方位之整合。

本次研討會中特邀生醫領域深具影響力的學者蒞臨演講：(1)英國倫敦帝國學院(Imperial College London) Prof. Anthony Bull；(2)美國哥倫比亞大學(Columbia University) Prof. Clark T. Hung；(3)國立臺灣大學電機工程學系李嗣涔特聘教授；(4)美國伊利諾州立大學(University of Illinois) Prof. James C. Lin。此外，本會針對生醫材料 (Biomaterials)、細胞/組織工程(Cell/Tissue Engineering)、奈米醫學(Nanomedicine)、醫學影像(Medical Imaging)、生醫訊號(Biomedical Signal)、生醫資訊(Bioinformatics)、生醫光電(Biomedical informatics)、醫用電子(Bioelectronics)、生醫感測(Biosensing)、臨床工程(Clinical Engineering) 、生物力學(Biomechanics)、復健工程和輔助科技(Rehabilitation Engineering and Assistive Technology)等13大領域進行徵稿，經審查共安排96場次口頭演講及超過600份海報論文展示，也包括國內生醫相關企業參與，儼然已成臺灣生醫學門相關之盛大學術研討會。

我們期盼透過每年中華民國生物醫學工程學會生物醫學工程科技研討會的舉行，為臺灣的生醫工程領域盡一份心力，促進臺灣生醫工程不同領域間的合作與交流，並注入新銳研究，協助國內生醫界在學用並進，開啟臺灣生醫工程領域的新里程碑。

The "Annual Symposium on Biomedical Engineering and Technology" was held on November 13-14, 2015. The Graduate Institute of Biomedical Electronics and Bioinformatics and Institute of Biomedical Engineering at National Taiwan University co-hosted this symposium. This symposium aimed to promote biomedical engineering technologies in Taiwan and develop interdisciplinary researchers. The latest biomedical engineering studies around the globe were also introduced during the seminar to synchronize with the worldwide trend in academia.

We invited several outstanding researchers to share their research and experience with all the participants, including:

(1) Prof. Anthony Bull of Imperial College London,

(2) Prof. Clark T. Hung of Columbia University,

(3) Distinguished Prof. Si-Chen Lee of Department of Electrical Engineering of National Taiwan University, and

(4) Prof. James C. Lin of University of Illinois.

In addition, papers from thirteen areas were called for our review as following: Biomaterials, Cell/ Tissue Engineering, Nanomedicine, Medical Imaging, Biomedical Signal, Bioinformatics, Biomedical informatics, Bioelectronics, Biosensing, Clinical Engineering, Biomechanics, Rehabilitation Engineering and Assistive Technology. After the review, 96 researchers were invited to share their findings through oral presentations, and more than 600 studies and results were shared through poster presentations. Numerous corporations in related fields also participated in this conference, making this conference a major biomedical event in Taiwan.

Through hosting this conference, we hope to devote our efforts to the biomedical engineering field in Taiwan. At the same time, we hope to establish long-term milestones through proposing the cooperation of different sub-areas in biomed and instilling forefront research energy.

陸 生醫核心實驗室
Biomedical Core Laboratories

永齡生醫工程館-生醫核心實驗室 YongLin Biomedical Engineering Hall

永齡生醫工程館自民國97年受鴻海集團郭台銘先生及其所屬之永齡健康基金會之捐贈而開始籌建，目的在於建構一處生醫研究基地，而橫跨生醫、電子、資訊等三領域為一體的本所在積極爭取之下，受有七樓一層。民國102年，本所雖已有規劃之雛形，所內也有著建置實驗室的共識，但為妥善運用空間，並務求資源能公平、透明的分配予本所全體師生，我們先於103年6月成立任務型空間規劃委員會，爭取時間討論規劃，同年8月便交由新學年之正式空間規劃委員接力運作，擘畫空間、設立規範，全所共用之「生醫核心實驗室」與「高速運算中心」便在此時集結眾人之心力逐步成形。

歷經數百個日子的醞釀，生醫核心實驗室率先於104年暑假動工，終於趕在104年11月正式落成，得以在新的學年為師生們提供服務。生醫核心實驗室的規劃是以長期提升本所研究能量為指標而建置，所以在儀器規格、實驗室內裝配置以及操作規範上，都是以極為嚴謹的態度進行全盤考量。為顧及所內眾多師生不同的實驗需求，一般生物實驗室所需的儀器設備在此皆甚為齊備，例如：整齊安全的工作檯、排氣櫃、細胞離心機等儀器，我們更在實驗室內部規劃了生物安全等級第二級（BSL2）的區塊，設有細胞培養室、生物安全操作櫃等設備，同時更透過實驗室使用規範控管使用者的安全，藉由嚴格遵守相關規範來保障本所最寶貴的人才資產。

本所自2006年成立，一路走來受到諸多資源挹注，因此，生醫核心實驗室不僅提供本所師生申請使用，同時也將秉持最開放的態度接受全校師生的借用，讓有限的資源在共享之下得以發揮最大的價值。我們相信生醫核心實驗室在全所的努力與運作下，將能持續茁壯成為國內生醫研發人才與技術的搖籃之一。

YongLin Biomedical Engineering Hall was constructed in 2008 through the generosity of Mr. Tai-ming Guo from Honghai Corporation and its YongLin Health Foundation, with the goal of building a base for biomedical research. After continuous effort, our department, encompassing backgrounds ranging from biomedical to electronics and IT, has secured the entire seventh floor.

In 2013, although we already had done initial planning and had mutual agreement on setting up laboratories, we formed the "space allocation temporary committee" for detailed discussion of proper utilization of space and equal sharing of the resources among all members in the department. In August of 2014, the "committee of space allocation" took over the work of outlining the partition of space and set up usage clauses. During this period, the Biomedical Core Laboratory and High Performance Computing Center started to take shape.

Hundreds of days in the making, the Biomedical Core Lab was the first to be constructed in the summer of 2015. It was completed in November of the same year, just in time to provide service in the new academic year. The Biomedical Core Lab was designed for long-term use. Thus, the specifications of the equipment and configuration of the lab interior have been handled with the greatest care. To fulfill the different requirements of all types of experiments, all the equipment commonly found in an average biology lab, such as workbenches, exhaust cabinets, and centrifuges, are provided. We also set apart a specific region in the lab for with BSL2-grade safety which contains the cell culture room and biological safe operation cabinet. Strict usage clauses are enforced to ensure the safety of all users.

Ever since the birth of our department in 2006, we have had the luxury of receiving resources from all directions. Therefore, the Biomedical Core Lab will not only serve teachers and students of this department, but also do its best to share such resources with members of the whole school, exercising them to their greatest value. We are confident that this lab will never cease to grow and become one of the greatest sources of biomedical talent.

生醫核心實驗室

柒 實驗室及教師
Laboratories and Faculty

生醫電子組實驗室 Laboratory of Biomedical Electronic Group

實驗室名稱 Name	主持教授 Advising professor	地點 Room
超大型積體電路系統晶片電腦輔助設計實驗室 SOC VLSI-EDA Lab.	陳中平 Chung-Ping Chen	博理館 405 Room 405, Barry Lam Hall
醫學影像實驗室/磁共振影像頻譜實驗室/生醫分子影像核心實驗室 Medical Imaging Lab./Magnetic Resonance Imaging Lab./Biomedical Molecular Imaging Core Lab.	陳志宏 Jyh-Horng Chen	明達館706 Room 706, MingDa Building
智慧型與精密運動控制實驗室 IPMC Lab.	陳永耀 Yung-Yaw Chen	明達館604 Room 604, MingDa Building
放射物理生物實驗室 Radiation Physics and Biology Lab.	成佳憲 Chia-Hsien Cheng	臺大醫院 NTUH
生物晶片研究室 Bioinformatics and Biostatistics Core Lab.	莊曜宇 Eric Y. Chuang	明達館701 Room 701, MingDa Building
光流體生醫系統實驗室 Bio-Optofluidic Systems Lab	黃念祖 Nien-Tsu Huang	明達館702 Room 702, MingDa Building
醫用磁振造影研究室 Magnetic Resonance in Medicine Lab.	鍾孝文 Hsiao-Wen Chung	明達館704 Room 704, MingDa Building
電子束暨奈米元件實驗室 E-beam and NanoDevice Lab.	管傑雄 Chieh-Hsiung Kuan	電機二館426/129 Room 426/129, EE 2
細胞行為實驗室 Cell Behavior Lab.	郭柏齡 Po-Ling Kuo	明達館707 Room 707, MingDa Building
統計信號處理實驗室 Statistical Signal Processing Lab.	李枝宏 Ju-Hong Lee	電機二館553 Room 553, EE 2
紅外線元件實驗室 IR Device Lab.	李嗣涔 Si-Chen Lee	電機二館451 Room 451, EE 2

超音波影像實驗室 Ultrasonic Imaging Lab.	李百祺 Pai-Chi Li	明達館731 Room 731, MingDa Building
內皮細胞分子生物學實驗室 Laboratory of Endothelial Cell Molecular Biology	李心予 Hsinyu Lee	生命科學館 504 室 Room 504, Life Science Building
生醫晶片系統實驗室 Bio-Electronics-System Technology Lab.	林致廷 Chih-Ting Lin	電機二館450 Room 450, EE 2
醫用微感測器暨系統實驗室 Medical Micro Sensor and System Lab.	林啟萬 Chii-Wann Lin	永齡生醫工程館 526 Room 526,YongLin Biomedical Engineering Hall
人腦實驗室 Brain Imaging and Modeling Lab.	林發暄 Fa-Hsuan Lin	展書樓703 Room 703, Jan Su Hall
奈米生醫光電實驗室 Nano-Biophotonics Lab.	孫啟光 Chi-Kuang Sun	電機二館R406A Room R406A, EE 2
生醫光譜與影像實驗室 Biomedical Optical Spectroscopy and Imaging Lab.	宋孔彬 Kung- Bin Sung	明達館703 Room 703, MingDa Building
微奈米分析技術及系統實驗室 Micro/Nano Analytical Technologies & Systems Lab	田維誠 Wei-Cheng Tian	明達館509 Room 509, MingDa Building
數位信號處理實驗室 Digital Signal Processing Lab.	曹建和 Jen-Ho Tsao	電機二館552 Room 552, EE 2
臨床磁振影像實驗室 Clinical Magnetic Resonance Imaging Lab.	吳文超 Wen-Chau Wu	明達館704 Room 704, MingDa Building
中研院生醫所 IBMS RM511	楊泮池 Pan-Chyr Yang	臺大醫院 NTUH
台大醫院第七共同研究室 Laboratory	周迺寬 Nai-Kuan Chou	臺大醫院 NTUH
生醫系統工程實驗室 Biomedical System Engineering Lab.	魏安祺 An-Chi Wei	明達館705 Room 705, MingDa Building

柒 實驗室及教師
Laboratories and Faculty

生醫資訊組實驗室 Laboratory of Bioinformatics Group

實驗室名稱 Name	主持教授 Advising professor	地點 Room
醫學影像處理實驗室 Medical Image Processing Lab.	張瑞峰 Ruey-Feng Chang	德田館402 Room 402, CSIE Building
演算法與計算生物學實驗室 Algorithms and Computational Biology Lab.	趙坤茂 Kun-Mao Chao	德田館432 Room 432, CSIE Building
數位相機與電腦視覺實驗室 Digital camera and Computer Vision Lab.	傅楸善 Chiou-Shann Fuh	德田館328 Room 328, CSIE Building
	黃俊升 Chiun-Sheng Huang	臺大醫院 NTUH
系統生物學研究室 Systems Biology Lab.	阮雪芬 Hsueh-Fen Juan	生命科學館1105 Room 1105 Life Science Building
醫學資訊實驗室 Medical Informatics Lab.	賴飛羆 Fei-pei Lai	德田館346 Room 346, CSIE Building
演算法實驗室 Algorithmic Research Lab.	呂學一 Hsueh-I Lu	德田館406 Room 406, CSIE Building
分子生醫資訊實驗室 Molecular Biomedical Informatics Lab.	歐陽彥正 Yen-Jen Oyang	德田館410 Room 410, CSIE Building
臨床-生物醫學工程-產業融合實驗室 Merger Laboratory for Clinical Sciences, Biomedical Engineering and Industry	孫維仁 Wei-Zen Sun	臺大醫院 NTUH
計算分子設計與代謝體學實驗室 Computataional Molecular Design and Metabolomics Lab.	曾宇鳳 Y. Jane Tseng	德田館404 Room 404, CSIE Building

趙坤茂 教授

Kun-Mao Chao, Professor

國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學資訊工程學系暨研究所教授
國立臺灣大學資訊網路與多媒體研究所合聘教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/ Department of Computer Science and Information Engineering, National Taiwan University
Adjunct Professor, Graduate Institute of Networking and Multimedia, National Taiwan University

演算法與計算生物學實驗室

Algorithms and Computational Biology Lab.

演算法與計算生物學實驗室創立於2002年8月。我們的研究主軸為「序列」與「樹狀結構」主題相關的演算法設計，以及利用這些演算法為基礎的生物資訊軟體工具開發，可說是「計算理論為體，生物資訊為用」。在過去幾年裡，我們的研究主軸是關於序列及樹狀結構上的有效演算法設計與分析。在序列方面，包括生物序列分析，如：單套體預測問題、標記SNP、複製數目變異問題、各種不同評分準則等，以及數列分析，如：最大總和區段問題、最大平均區段問題、不同條件的最佳化問題等。在樹狀結構方面，包括樹的建構問題，如：演化樹建構、最小繞線代價伸張樹問題等，以及樹的探索問題，如：樹邊分割問題、樹的查詢問題、樹邊置換問題等。這是非常有樂趣及成果的研究歷程，我們最終的目標是開發更多關於序列及樹狀結構的基本性質，並充分運用它們來設計解決這方面計算難題的實用演算法。

The Algorithms and Computational Biology Laboratory was established in August, 2002. We are interested in all aspects of the design and analysis of combinatorial algorithms. In particular, we solve algorithmic problems arising in computational molecular biology and networking. For the past few years, we have been mostly focused on the design and analysis of efficient algorithms for analyzing sequences and trees. For sequences, we mainly work on problems related to biological sequence analysis (haplotype vs. genotype; tag SNPs; copy number variations; variant scoring schemes), and numerical sequence analysis (maximum-sum segments; maximum-average segments; other maximization criteria). For trees, we mainly work on some tree construction problems (evolutionary trees; minimum routing cost spanning trees), and tree exploring problems (tree edge partition; tree querying; swap edges). This has been a joyful and fruitful journey to us. Our ultimate goal is to reveal more properties related to sequences and trees, and fully utilize them to design practical algorithms for solving hard problems in that line of investigation.

主要研究領域 Major Research Areas

計算生物學及生物資訊學、演算法、套裝軟體
Computational Biology and Bioinformatics, Algorithms, Software Tools

研究計畫 Research Projects

1. 大眾化配對問題的延伸研究及其演算法設計(104-2221-E-002-046-MY3)
2. 用於辨識布林網路特徵的新演算法(103-2221-E-002-157-MY3

E-mail: kmchao@csie.ntu.edu.tw
Phone: +886-2-23625336*423
Office: 德田館423 (CSIE-423)
Website: http://www.csie.ntu.edu.tw/~kmchao
Lab. Phone : +886-2-33664888*432
Fax: +886-2-23628167
Lab. : 德田館432 (CSIE-432)

莊曜宇 教授

Eric Y. Chuang, Professor

國立臺灣大學生醫電子與資訊學研究所教授兼所長
國立臺灣大學電機工程學系教授
國立臺灣大學生命科學系教授
國立臺灣大學流行病學與預防醫學研究所教授
國立臺灣大學生命科學院與中央研究院合辦-基因體與系統生物學學位學程教授
國立臺灣大學腫瘤醫學研究所教授
國立臺灣大學永齡生醫工程中心主任
國立臺灣大學醫療器材研發中心副主任
國立臺灣大學基因體醫學研究中心-生物資訊暨生物統計核心實驗室主持人

Director and Professor, Graduate Institute of Biomedical Electronics and Bioinformatics
Professor, Department of Electrical Engineering/ Department of Life Science/ Graduate Institute of Epidemiology and Preventive Medicine/ Genome and Systems Biology Degree Program, College of Life Science/ Graduate Institute of Oncology, National Taiwan University
Director, Yong Lin Biomedical Engineering Center, National Taiwan University
Deputy Director, Research and Development Center for Medical Devices, National Taiwan University
Principal Investigator, Bioinformatics and Biostatistics Core Lab, NTU Center of Genomic Medicine

生物晶片實驗室
Microarray Lab.

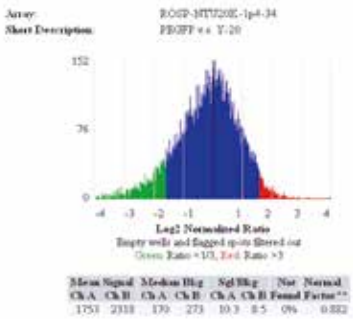
本研究室研究是以基因體學探討癌症形成機制為主軸。近年來基因晶片(DNA microarray)與次世代定序(Next-Generation Sequencing)已經被廣泛應用在同時觀察大量的基因表現，為研究特定基因調控極為方便、快速與可靠的方法。因此研究室的研究方向乃致力於增進基因晶片與次世代定序技術在生物醫學領域上的研究，研究範疇涵蓋晶片製備技術、影像擷取與分析、基因序列資料分析、生物資訊學、資料管理，以及利用基因晶片分析與次世代定序技術來解析致癌基因複雜的調控關係，探討基因表現或基因突變與細胞反應的關連。長遠的目標為藉由基因體研究找尋特定的癌症分子指標，將來作為癌症治療與診斷的標的。

The focus of our laboratory is using genomic approaches to investigate the mechanisms of carcinogenesis. DNA microarray has been applied widely in simultaneously monitoring a large quantity of gene expression patterns and served as a convenient, quick, and reliable method to investigate specific gene regulation. Therefore, our lab devotes to the application of microarray technology in the biomedical field. Interests in our laboratory include microarray fabrication, image capture and analysis, bioinformatics, database management, and analytic technique to understand the complicated regulatory mechanisms of cancer related genes as well as the correlation between gene expression or gene mutation and cellular response. Our long-term goals are via genomic study to identify specific cancer molecules as biomarkers for the targets of cancer therapy and diagnosis.

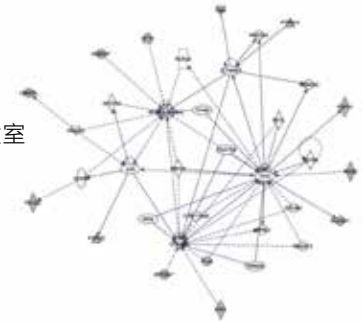
主要研究領域 Major Research Areas

生物晶片、次世代定序、生物資訊、癌症生物、輻射生物
Biochip, Next-Generation Sequencing, Bioinformatics, Cancer Biology, Radiation Biology

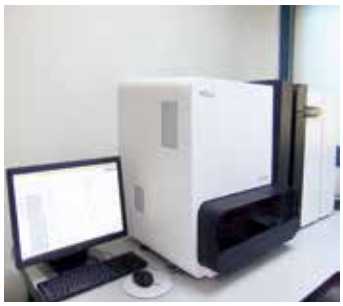
研究計畫 Research Projects



1. 華人乳癌基因資料庫及個人化雲端諮詢平台(財團法人永齡健康基金會)
   Chinese breast cancer genome database and personalized online consulting system
2. 癌症藥物基因體研究(財團法人資訊工業策進會)
3. Pharmacogenomics Research in Cancer臺灣特有雉科-藍腹鷴基因體定序計畫
   (臺北市立動物園)
   Taiwan endemic species-Lophura swinhoii sequencing project
4. 利用整合性基因群分析與舊藥新用策略尋找各乳癌亞型之最佳治療藥物
   (財團法人國家衛生研究院)
   Utilize Gene Set Analysis to Reposition Putative Drugs for Breast Cancer with ModulatedResponses



5. 優勢重點領域拔尖計畫 - 基因體醫學研究中心 - 生物資訊暨生物統計核心實驗室
   (邁向頂尖大學計畫)
   Bioinformatics and Biostatistics Core Facility
6. 研究 SEMA6A 在肺癌所扮演的角色及探討其基因多型性在台灣地區
   非吸菸女性肺癌的重要性(科技部)
   To investigate the roles of SEMA6A in lung tumorigenesis andsusceptibility-associated SNPs of SEMA6A in non-smoking female lung cancer



7. 覆氧時NDRG1受非編碼核糖核酸調控之機轉研究(科技部)
   Investigation of regulatory mechanism of NDRG1 by non-coding RNA upon reoxygenation
8. 合併化學及放射性治療療效預測_食道癌生物標記臨床應用驗證
   （宣捷生物科技股份有限公司）
9. 冠心症基因檢測平台開發與臨床應用驗證（宣捷生物科技股份有限公司）

E-mail: chuangey@ntu.edu.tw
Phone: +886-2-33663660
Office: 明達館622 (MD-622)
Website: http://www.ee.ntu.edu.tw/profile?id=99
Lab. Phone : +886-2-33669601
Lab. : 明達館701 (MD-701)

鍾孝文 教授

Hsiao-Wen Chung, Professor

國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學電機工程學系教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Department of Electrical Engineering, National Taiwan University

醫用磁振造影研究室

Magnetic Resonance in Medicine Lab.

成立於2000年7月，指導教授為鍾孝文教授，目前計有博士班研究生9名，碩士班研究生3名。博士班畢業生26名，碩士班畢業生19名。

Founded in July 2000. Supervisor: Prof. Hsiao-Wen Chung. This lab currentlyhas 9 Ph.D. students and 3 M.S. student, plus 26 Ph.D. graduates and 19 M.S. graduates.

主要研究領域 Major Research Areas

醫用磁振造影

Biomedical magnetic resonance imaging

研究計畫 Research Projects

1. 螺旋槳式面迴訊磁振造影進階技術發展

   Advanced technical developments for Propeller echo-planar MR imaging

   補助單位：行政院科技部工程司

   計畫期間：2013/8/1 ~ 2016/7/31

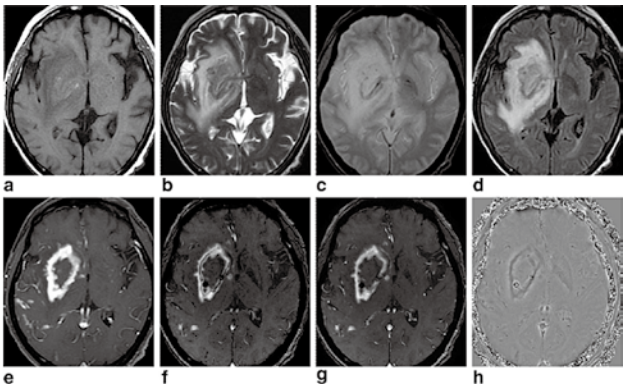
2. 數據分享式螺旋槳多b值擴 散磁振造影

   Data sharing Propeller diffusion MR imaging with multiple b-values

   補助單位：行政院科技部工程司

   計畫期間：2015/8/1 ~ 2018/7/31

■ 代表圖及中英文說明：



54歲女性右側基底核腦膿瘍病患。a：T1權重影像。b：T2權重影像。c：梯度迴訊T2*權重影像。d：FLAIR影像。e：顯影劑T1權重影像。f：顯影劑磁化率權重影像。g與h：原始絕對值與相位影像，用以產生f中之磁化率權重影像。腦膿瘍莢膜在顯影劑磁化率權重影像中顯現出亮暗相間之多層結構。

A 54-year-old female patient with pyogenic abscess in the right basal ganglion. a: T1-weighted image. b: T2-weighted image. c: Gradient-echo T2*-weighted image. d: T2-weighted fluid-attenuated inversion recovery image. e: Contrast-enhancedT1-weighted image. f: Contrast-enhanced susceptibility-weighted image. g,h: The original magnitude and correctedphase images used to generate the susceptibility-weighted image shown in f. The abscess capsule exhibiting hyperintensityon contrast-enhanced T1-weighted image shows a darkened ring within the central layer on contrast-enhanced susceptibility-weighted image.

E-mail: chunghw@ntu.edu.tw
Phone: +886-2-33663628
Office: 明達館624 (MD-624)
Website: http://www.mrilab.org/
Lab. Phone: +886-2-33663675
Lab. : 明達館704 (MD-704)

賴飛羆 教授

Fei-Pei Lai, Professor

國立臺灣大學生醫電子與資訊學研究所 教授
國立臺灣大學醫療器材與醫學影像研究所
國立臺灣大學資訊工程學系
國立臺灣大學電機工程學系

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics
Graduate Institute of Medical device and Imaging
Professor, Department of Electrical Engineering/
Department of Computer Science & Information Engineering,
National Taiwan University

醫學資訊實驗室

Medical Informatics Lab.

本實驗室成立於1987年，由賴飛羆教授所領導的研究群所組成。賴教授指導畢業的學生已有30餘名博士生及120餘名碩士生。目前實驗室成員包括博士班10餘人及碩士班10餘人。實驗室創立初期以研究計算機結構及低功率系統晶片設計為主，近年來改以醫療資訊系統、遠距照護、醫學資料探勘及資訊安全等領域為主要研究方向。

主要研究領域 Major Research Areas

醫學資訊

Medical Informatics

研究計畫 Research Projects

1. 銀髮族智慧健康感測及遠距照護應用─以外科為例

為提供銀髮族安全與高品質之醫療照護，應用資通訊科技來照護健康。本計畫旨在開發一套「銀髮族術後智慧健康感測及遠距照護服務之外科臨床應用平台」，並提供人工智慧判讀，以支持銀髮族外科術後之全人照顧。包含生命徵象及日常生活資訊的蒐集、傳輸及健康資料加值應用。期望結合資通訊遠距照護技術，導入臨床決策支援服務，將外科臨床實務經驗及知識(know-how)轉化於銀髮族資通訊加值應用服務之中。計畫目標主要包含：(1)、建置銀髮族術後智慧健康感測及遠距照護服務應用平台，供醫護人員進行病患預後管理及生命徵象監控；(2)、研發銀髮族專用之智慧健康感測手機應用程式，結合穿戴式手環(錶)及手機周邊設備，提供智慧健康感測及更多元化的服務情境應用，使銀髮族患者易於疾病自主管理；(3)、發展臨床決策人工智慧判讀，提供健康資料加值應用服務，警示病患及照顧者異常事件，並同時轉知醫療人員及早介入，減少非預期事件的發生；(4)、智慧科技應用之臨床效益分析，探討智慧健康感測和預後改善情形的相關性，及遠距照護之認知行為調查，瞭解新興科技應用於銀髮族術後遠距照護的可行性與接受性。透過醫療專業與資訊專業人員的跨領域創新性整合研究，預期建立智慧健康感測及遠距照護服務於銀髮族外科術後照護之前瞻創新應用。

2. 應用智慧型手機於改善氣喘學童健康生活型態及健康狀態之成效: 隨機對照試驗研究

氣喘是一個複雜多重因素疾病，許多證據指出環境及生活型態是影響氣喘表觀遺傳的因素。過去20年來，兒童同時發生氣喘及肥胖的健康問題，已為全球性的關注議題，需要有效措施來降低醫療及社會成本。近年來，行動醫療科技已廣為運用來預防及處置健康問題，智慧型手機的便捷及個別性的措施，將有效地改變健康行為。鑑此，本研究目的在於：(1)發展符合年紀及個別化的KidsHealth智慧型手機APPS 措施計畫，以調整氣喘學童的健康生活型態；(2)評值智慧型手機措施計畫之可行性及可近性；(3)評值智慧型手機於改善氣喘學童的健康行為及健康狀況。本研究之隨機對照試驗，將運用智慧型手機平台提供氣喘兒童的互動回饋，而產生健康行為的改變。研究方案的發展及執行，期望能夠提供發展其他慢性疾病兒童e-健康照護計畫之參考。

3. 睡眠障礙管理資訊系統及巨量資料分析

本子計畫目標在於開發一套睡眠障礙管理資訊系統平台的臨床決策支援系統(clinical decision support system)，以支持臺大醫院睡眠中心將睡眠障礙診斷治療服務推廣到病友家中，病友可以在家自行裝置腦電波等相關量測儀器並且透過網際網路將睡眠相關生理訊號不間斷即時傳到臺大睡眠中心，讓個管師可在遠方即時有效率的監控病人睡眠情形。本計畫尚包括分析所收集之大量病友生理資訊，例如腦電波、心電圖、肌電圖、眼動圖、體溫及血壓等，結合問卷評估資料及電子病歷，希望藉此找出與睡眠障礙之間的關聯性，並且利用機器學習方式提供睡眠障礙的自動分類判讀。

4. 遠距照護服務

本計畫目的在於提供第四代無縫遠距照護服務。目前已建立一套完整的疾病個案管理照護系統，其主要功能包含：(1) 與生理數值偵測儀器連結其數據(包含心電圖、血壓、血糖及血氧)；(2) 上傳的生理數值會在頁面中自動更新並且有即時的判讀與異常提醒；(3) 水平整合醫院電子病歷；(4) 病人上傳的心電圖訊號，醫師可直接給予診斷，系統亦會預先判讀；(5) 病人生理數值之報表產生；(6) 醫師在醫院系統中亦可查詢病人的上傳資料；(7) 交班系統可以讓個案管理師有更方便的界面來說護理交班；(8) 透過系統上傳傷口照片給醫師及個案管理師參考。未來預計擴展遠距照護的服務族群，並將重點著重於自動判讀機制的建立。

E-mail: flai@ntu.edu.tw
Phone: +886-2-33664924
Office: 德田館 419 (CSIE-419)
Website: http://archi.csie.ntu.edu.tw/
Lab. Phone: +886-2-33664888*346
Lab. : 德田館346 (CSIE-346)

李百祺 特聘教授

Pai-Chi Li, Distinguished Professor

國立臺灣大學電機資訊學院副院長
國立臺灣大學生醫電子與資訊學研究所特聘教授
國立臺灣大學電機工程學系特聘教授
國家衛生研究院醫工組兼任研究員

Associate Dean, College of Electrical Engineering and Computer Science
Distinguished Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Adjunct PI, National Health Research Institutes

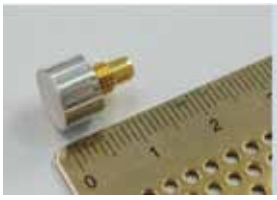
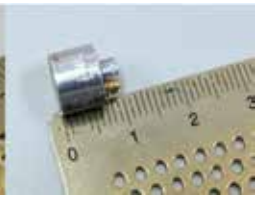
超音波影像實驗室

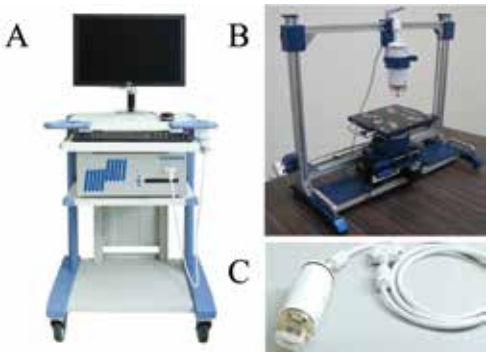
Ultrasonic Imaging Lab.

本實驗室由李百祺教授成立於1997年，主要從事醫學電子與影像物理相關研究，目前以生醫超音波技術與光聲影像等領域為研究重點。本實驗室在上述領域已產出許多具體貢獻並在全世界有很高之能見度。此外，本實驗室之成員來自電子、資訊、工程、生命科學及醫學等各領域，多年來亦積極與國內外單位進行合作，合作夥伴包括產、研、學各界，領域更涵蓋基礎科學、工程技術與臨床研究。跨界整合研究資源，致力前瞻生醫科技研究，提升健康與醫療品質，是本實驗室之成立宗旨與具體目標。

Ultrasonic Imaging Laboratory was founded by Professor Pai-Chi Li in 1997, with the main research focus in biomedicalelectronics and imaging physics. In the past few years, we have conducted a number of research projects in biomedical ultrasound and photoacoustic imaging. We have also made several critical contributions and are now one of the most visible research laboratories in this field in the world. Members of the lab come from various backgrounds, including electronics, informatics, engineering, life sciences and medicine. We have also been actively collaborating with research labs throughout the world, covering industry, research institutes and universities, from basic sciences, engineering to clinical research. Integrating multi-disciplinary research efforts, exploring advanced biomedical technologies, and improving healthcare quality is the mission of this lab.





主要研究領域 Major Research Areas

生物醫學工程、超音波影像、生醫光聲影像

Biomedical Engineering, Ultrasound Imaging, Biomedical Photoacoustics

研究計畫 Research Projects

1. 自動化三維超音波乳房影像檢查

   Automatic 3D ultrasound breast screening
2. 剪力波斷層掃描影像儀技術創新與治療應用(重點主題C3)總計畫兼子計畫-斷層掃描式剪力波影像技術開發與系統實現

   Technology development and system implementation of shear wave computed tomography
3. 用於三維細胞培養系統之多波影像技術

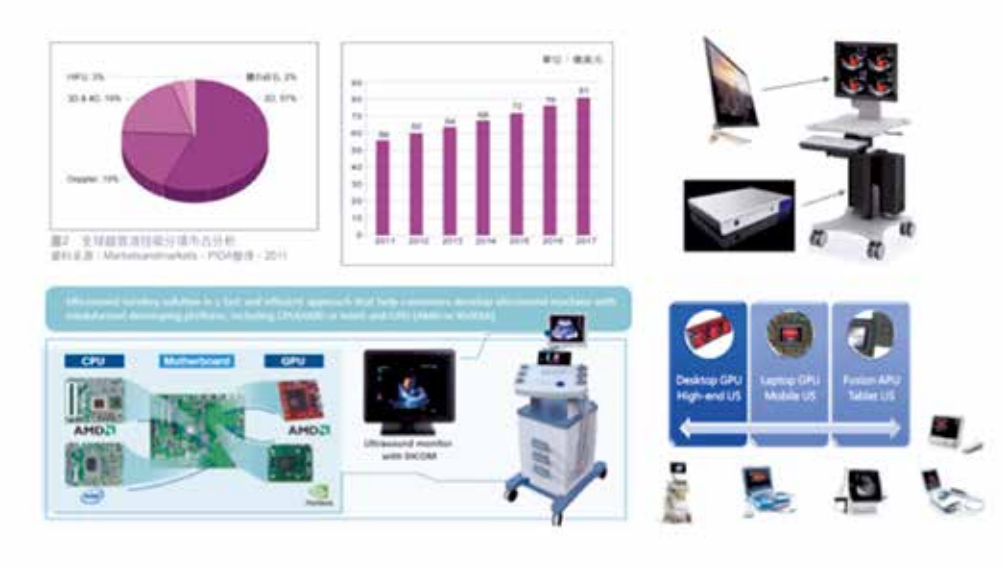
   Multiwave imaging technologies for 3D cell culture systems
4. 萌芽個案計畫-三維細胞培養系統與影像觀測技術(12)

   Validation, prototyping and application promotion of shear wave elasticity imaging for 3D cell culture systems
5. 高階診斷超音波系統商品化與事業化計畫

   Development and integration of high-end diagnostic ultrasound systems

■ **研究計畫** - 研究計畫-高階診斷超音波系統商品化與事業化計畫

Development and integration of high-end diagnostic ultrasound systems之代表圖及說明：



E-mail: paichi@ ntu.edu.tw
Phone: +886-2-33663551
Office: 博理館425 (BL-425)
Website: http://ultrasound.ee.ntu.edu.tw
Lab Phone: +886-2-33669752
Lab. : 明達館731(MD-731)

歐陽彥正 教授

Yen-Jen Oyang, Professor

國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學資訊工程學系教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/ Department of Computer Science and Information Engineering, National Taiwan University

分子生醫資訊實驗室

Molecular Biomedical Informatics Lab.

分子生醫資訊實驗室專注於設計先進的機器學習演算法以應用於生物醫學的研究上。近幾年，本實驗室與臨床醫師合作，將創新的機器學習演算法運用於臨床資料庫的分析上。主要的成果包括:

(1) 發現手術中麻醉藥的使用與罹患失智症的相關性；
(2) 發現長期服用安眠藥與罹患失智症的相關性；
(3) 發現婦女罹患子宮內膜異位與偏頭痛的相關性；
(4) 發現4個與精神分裂症相關的基因。

The Molecular Biomedical Informatics (MBI) laboratory focuses on design of advanced machine learning algorithms for biomedical applications. During the past few years, the MBI team has been collaborating with clinical physicians to conduct analyses on large medical databases. The main results include:

1. identified the risk of suffering dementia for patients who received anesthesia in surgery;
2. identified the risk of suffering dementia for insomnia patients who were long-term users of hypnotics;
3. identified the risk of suffering migraines for women with Endometriosis;
4. identified 4 genes that are associated with schizophrenia.

主要研究領域 Major Research Areas

生醫資訊學、機器學習

Biomedical informatics, Machine Learning

研究計畫 Research Projects

1. 應用巨量資料探勘與地理空間資訊分析技術針對緊急救護服務之醫療資源管理、配置與未來規劃進行整體研究計畫--應用巨量資料探勘方法分析緊急救護時間、空間、與醫療資訊之研究。
   An integrated study on applying massive data mining and geographic information technologies to analyze the resource management, allocation, and future planning of Emergency Medical Service

E-mail: yioyang@csie.ntu.edu.tw
Phone: +886-2-33664888*431
Office: 德田館431 (CSIE-431)
Website: http://mbi.csie.ntu.edu.tw/member/yjoyang.html
Lab. Phone: +886-2-33664888*410
Lab. : 德田館410 (CSIE-410)

宋孔彬 副教授

Kung-Bin Sung, Associate Professor

國立臺灣大學生醫電子與資訊學研究所副教授
國立臺灣大學電機工程學系副教授

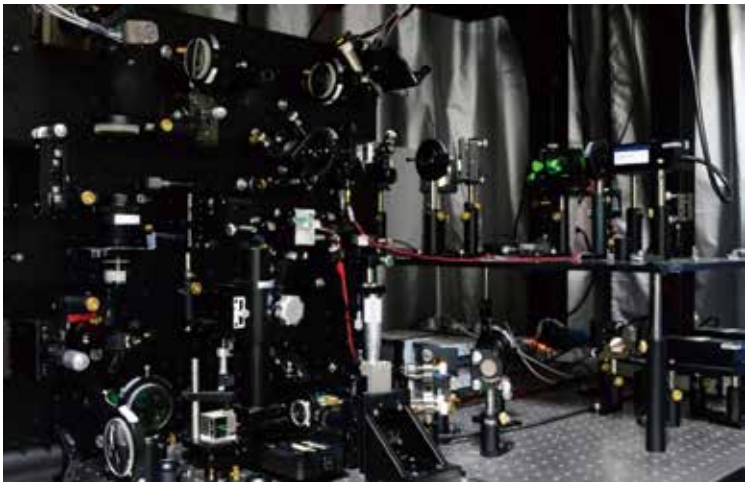
Associate Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Associate Professor, Department of Electrical Engineering, National Taiwan University

生醫光譜與影像實驗室

Biomedical Optical Spectroscopy and Imaging Lab.

我們實驗室目前的研究重點是以光學方法來觀察生物組織、細胞與分子，主要分為各種光譜的偵測分析以及光學影像系統的開發，以期對生物醫學領域的研究有所助益，並開發新的輔助醫學診斷的工具。長期的目標是發展可應用於活體的工具，協助疾病如上皮癌前病變之診斷，以及生理狀況的長期監測。

Current research in our laboratory is focused on pushing forward optical spectroscopy and microscopy technologies and utilizing these methods to aid biomedical research and develop new diagnostic tools. The long-term objectives are to develop in-vivo tools for diagnosing disease such as epithelial precancers and monitoring physiological status.



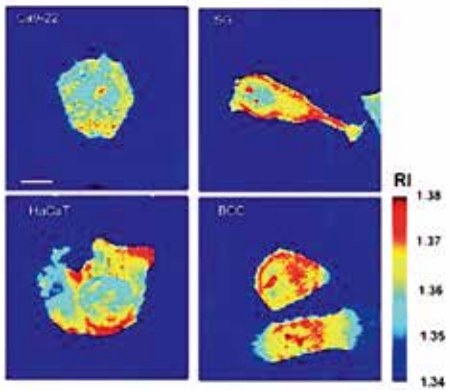
主要研究領域 Major Research Areas

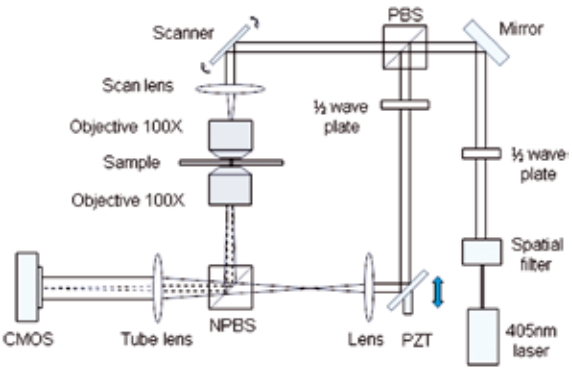
生醫光電、生醫工程
Biomedical Optics, Biomedical engineering

研究計畫 Research Projects

1. 以光學虛擬切片分子影像從事早期疾病診斷(共同主持人)
   Advanced Optical Virtual Biopsy for Early Disease Diagnosis (co-PI)
2. 三維折射率活細胞顯微術(主持人)
   Three-dimensional refractive-index microscopy for live cell imaging (PI)
3. 非侵入性高光譜顯微影像系統進行食道癌域理論之光學定量分析(共同主持人)
   Optical quantification of field carcinogenesis in the esophagus with a non-invasivehyperspectral imaging system (co-PI)
4. 針對大腸腫瘤及淋巴結轉移的早期發現和清除的光電醫學診斷與治療關鍵問題研究(共同主持人)
   Integrated optoelectronic approaches for early diagnosis and precision treatment of metastasis colorectal cancer and lymph node (co-PI)

■ **研究計畫** - 三維折射率活細胞顯微術 Three-dimensional refractive-index microscopy for live cell imaging, Supported by: Ministry of Science and Technology之代表圖及中英文說明：





上圖為本計畫所建構的光學相位斷層掃描系統，利用此系統可以得到細胞的三維折射率的分布，下圖為四種不同細胞株(CA9-22, BCC, HaCaT及SG)於聚焦平面之折射率分布。圖中白色線代表10 μm。

The figure at the top shows a schematic diagram of an optical tomographic phase microscope developed in this project. We have used this novel technique to acquire three-dimensional distributions of refractive index of living cells. The four figures at the bottom show refractive index images of four cell lines at the focal plane.

E-mail: kbsung@ntu.edu.tw
Phone: +886-2-33669675
Office: 明達館715 (MD-715)
Website: http://www.ee.ntu.edu.tw/profile?id=739
Lab. Phone: +886-2-33669600
Lab. : 明達館703(MD-703)

曾宇鳳 教授
Y. Jane Tseng, Professor

國立臺灣大學藥物研究中心主任
國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學資訊科學與工程學系教授
國立臺灣大學藥學系教授
國立臺灣大學生命科學院與中央研究院合辦-基因體與系統生物學學位學程教授
國立臺灣大學藥物研發暨跨領域轉譯醫學與生醫工程國際研究生博士學位學程教授
國立臺灣大學化學生物學暨分子生物物理學國際研究生博士學位學程教授
國立臺灣大學基因體醫學研究中心-代謝體核心實驗室主持人

Director, Drug Research Center, National Taiwan University
Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/Department of Computer Science and Information Engineering/School of pharmacy/ Genome and Systems Biology Degree Program, College of Life Science,/International Graduate Program of Drug Discovery, Interdisciplinary Translational Medicine and Biomedical Engineering/ Chemical Biology and Molecular Biophysics Program, National Taiwan University
Principal Investigator, Metabolomics Core Lab, NTU Center of Genomic Medicine

計算分子設計與代謝體學實驗室

Computataional Molecular Design and Metabolomics Lab.

本實驗室是一個跨領域的實驗室，研究的方向有兩個主軸，一是以分子結構為中心探討分子結構與活體、活性、毒性之關係，包括計算化學用在藥物設計、計算毒理學、化學資訊、生物資訊及代謝體學等，本實驗室應用物理化學、數值分析及資訊統計的技術來解決各種生物、化學及醫學方面的問題。目前主要的研究包括: 1. 發展新的計算化學方法做為藥物篩選，化學結構資訊比對，臨床前藥物吸收、分佈、代謝及毒性之分析及新藥設計。 2. 應用代謝體之化學結構光譜找尋臨床上用來做為診斷、病程及癒後生物指標之結構及新藥設計。

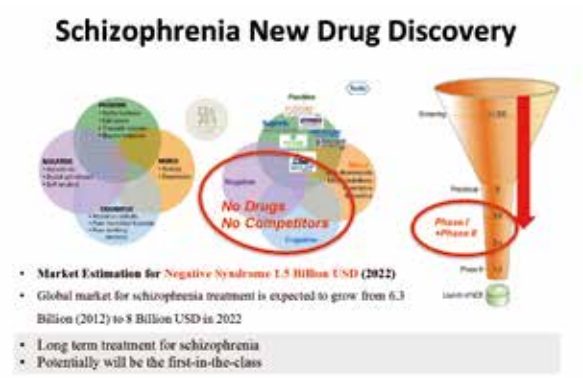
Bioinformatics and Cheminformatics Laboratory is a multidisciplinary lab. There are two main researchthemes in this lab. First and the major one is to analyze molecular structures such as drugs, endogenousmolecules, proteins, and relate the structure for their pattern with biological activities, toxicities, andbiological systems in the field of computational chemistry, computational toxicology, bioinformatics,cheminformatics, and metabonomics.

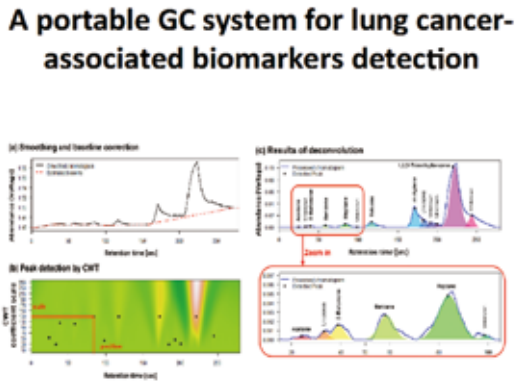
主要研究領域 Major Research Areas

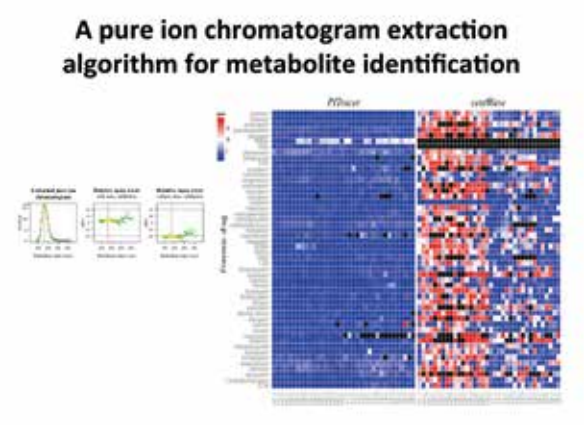
計算化學及計算毒理學,、生物資訊學、新藥開發、代謝體學
Computational Chemistry and Toxicology, Drug Discovery, Bioinformatics, and Metabolomics

研究計畫 Research Projects

1. 從現有市場藥品之代謝物設計新型 NMDA 受體調節劑及安全性評估
2. 優勢重點領域拔尖計畫-基因體醫學研究中心-代謝體核心實驗室
3. 前瞻研究領航計畫【可攜式氣體分析儀應用於人體呼吸測試】
4. 肺癌幹(源)細胞之轉譯醫學研究與臨床應用-代謝體、外吐小體與細胞脂質在肺癌幹細胞的癌症微環境研究
5. 雙胺類D-胺基酸氧化酶抑制劑的開發
   組蛋白甲基轉移酶G9a抑制劑之發展-(子計畫一)電腦輔助設計組蛋白甲基轉移酶G9a之抑制劑暨臨床前結構安全性篩選







E-mail: yjtseng@csie.ntu.edu.tw
Phone: +886-2-33664888*529
Office: 德田館529(CSIE-529R)
Webpage: http://www.csie.ntu.edu.tw/~yjtseng/
Lab. Phone: +886-2-33664888*404
Lab. : 德田館404(CSIE-404)

張瑞峰 教授

Ruey-Feng Chang, Professor

國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學資訊工程學系教授
國立臺灣大學資訊網路與多媒體研究所教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Professor,Department of Computer Science and Information Engineering, National Taiwan University
Professor,Graduate Institute of Networking and Multimedia,National Taiwan University

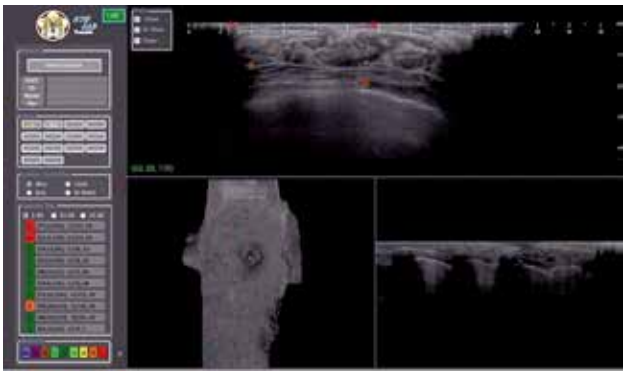
醫學影像處理實驗室

Medical Image Processing Lab.

乳癌是近年來已全球化的婦女死亡的主要原因，如果可以及早查出腫瘤的存在，乳癌治癒的機會將大增不少。在臨床上，電腦輔助診斷系統(CAD)可以幫助醫師分辨惡性和良性的乳房腫瘤，如果電腦輔助診斷系統可以提供更高的準確率，便可以大幅減少乳房切片檢查的需求。從1998年開始，我們致力於發展超音波電腦輔助診斷系統，也有了不錯的研究經驗與成果，成果計有2D/3D超音波、彩色超音波、PC-based超音波、彈性超音波及自動超音波的電腦診斷系統。合作研究單位有美國芝加哥大學，美國U-Systems超音波公司，並與韓國漢城大學醫院、日本獨協大學醫院、台大醫院、台北榮總醫師均有密切合作研究。

In recent years, the breast cancer is globally the main causes of death for women. If a cancer can be found out earlier, the curability of the breast cancer will increase greatly. Clinically, the computer-aided diagnosis (CAD) systems can help physicians to differentiate the benign and malignant tumors. If the computer-aided diagnosis systems have higher accuracy, the demand of the breast biopsy can be reduced. Since 1998, we are devoted to develop the ultrasound (US) CAD systems including 2D/3D US, color Doppler US, color elastography, PC-based US, and automated US. The laboratory also collaborates with The University of Chicago and U-systems Inc., USA. We closely collaborate

with physicians from Seoul National University Hospital, Dokkyo Medical University Hospital, National Taiwan University Hospital, and Taipei Veterans General Hospital.



代表圖及中英文說明：
Automated Breast Ultrasound / 全自動乳房超音波

主要研究領域 Major Research Areas

醫學影像電腦輔助診斷、影像視訊處理、多媒體系統及通訊

Medical Image Computer Aided Diagnosis, Image Processing, Multimedia Systems and Communication

研究計畫 Research Projects

1. 新式乳房彈性超音波之電腦輔助診斷 / Computer-aided Diagnosis System for Advanced Breast Elastography
2. 自動乳房超音波之電腦輔助腫瘤偵測 / Computer-aided Tumor Detection System for Automated Breast Ultrasound

■ **研究計畫** - 自動乳房超音波之電腦輔助腫瘤偵測
補助單位：行政院科技部
計畫期間：2014/08/01 ~ 2017/07/31

自動乳房超音波是繼彩色Doppler 超音波及彈性超音波之後最重要的超音波新技術，自動超音波是利用自動掃瞄機構來移動探頭以取得全乳房超音波影像並儲存成電腦檔案，可如其他醫學影像將掃瞄及診斷工作分開，醫師並可隨時查詢任何部位的影像，其主要可避免徒手式超音波易有人為失誤及可進行大量快速篩檢。但自動超音波一個病例會掃出大量的影像，醫師仍需花費許多時間來診斷，因此利用電腦輔助腫瘤偵測是有其必用性。目前技術已可以找出腫瘤但主要問題在於降低偽陽數，如果偽陽數過多對於醫師的診斷助益並不高。而乳房腺體回音紋理類型分類是目前相當熱門的新主題，回音紋理類型主要可分成同質性或異質性，異質性回音紋理類型較同質性的女性有更高的罹患乳癌風險。本計畫將以西門子的ABVS影像及新式的iVu俯臥式旋轉ABTS影像為研究對象，發展電腦輔助偵測、診斷、密度分析、紋理類型分類系統，第一年將利用分水嶺偵測將腫瘤從大量的自動乳房超音波影像中找出，以提供診斷參考。第二年針對iVu旋轉式ABTS自動超音波腫瘤偵測及密度分析。第三年將發展偵測效能自動評估工具並利用乳房組織結構及整合多次掃瞄結果降低腫瘤偽陽率，同時研究自動超音波回音紋理類型，紋理類型在乳癌風險預測具有極大意義。

■ Project title: Computer-aided Tumor Detection System for Automated Breast Ultrasound
Supported by: Ministry of Science and Technology
Project period: 2014/08/01 ~ 2017/07/31

The automated breast ultrasound (ABUS) is the most important development in ultrasound technology since the advent of Doppler imaging and elastography. In the ABUS, there is a mechanism to automatically move a longer probe to obtain the whole breast ultrasound images. The images will be saved into a computer file and the physician could review the images at any locations of scanned breast. For the ABUS, the scanning and diagnosis could be separated as other modalities such as Mammography and MRI. It could avoid the disadvantages of conventional freehand ultrasound and be used in the fast breast mass screening. However, there are a lot images in an ABUS case and the physician still needs a lot of time to review the images. Hence, a computer-aided detection system is needed to reduce the diagnosis time and avoid the misdiagnosis. Although the current technology could detect the tumors easily, the main issue is how to reduce the number of false positives. A computer-aided detection system with high number of false positives still cannot help the doctors to reduce the diagnosis time. This project will focus on the Siemens ABVS images and the newest prone rotational iVu ABTS images to develop the computer-aided detection, diagnosis, density analysis, and echo texture type classification systems. In the first year, the watershed technique will be applied for finding the breast tumor in the ABUS images. In the second year, the computer-aided diagnosis and density analysis systems for the iVu rotational ABTS images will be developed. In the third year, an automatic detection evaluation tool will be developed to reduce the evaluation time and the breast structure and multi-pass detection results will be used to further to reduce the number of false positives. Also, the echo texture classification will be developed for the breast cancer risk factor.

E-mail: rfchang@csie.ntu.edu.tw
Phone: +886-2-33664888*331
Office: 德田館331 (CSIE-331)
Website: http://www.csie.ntu.edu.tw/~rfchang/
Lab. Phone: +886-2-33664888*402
Lab. : 德田館402 (CSIE-402)

陳中平 教授

Chung-Ping Chen, Professor

國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學電子工程學研究所教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics,
Professor, Department of Electrical Engineering, National Taiwan University

超大型積體電路系統晶片電腦輔助設計實驗室

SOC VLSI-EDA Lab.

自2003年成立至今,本實驗室一向是一個不斷追求創新及擴展知識的一個的國際化研究團隊,其研究領域包括了生醫電子,電腦輔助設計及數位IC設計實驗室，其研究重點在於針對電路實體設計及時序之最佳化以及線路模擬，及在針對製造時所產生之製程移之影響及解決方案。最近，我們又極力發展生醫MRI及PEI影像及血管模擬以及半導體光學製程之模擬之最佳化。在IC設計方面，我們主力在發展在高速低功率之微處理機所須之電路。本實驗室目前的研究方向主要可分為九大領域

- 生醫MRI, PET影像處理
- 生醫行動生理檢測系統
- 蛋白質摺疊分析
- 可製造性設計
- 數位電路之最佳化
- 統計型時序分析
- 高效能電路設計
- 半導體光學製程影像之模擬與處理
- 電力線通訊系統

Established in 2003, BIO-EDA-VLSI Lab has been relentlessly pursuing new challenges and enrich knowledge in the field of EDA, VLSI circuit design, and BIO/Optical Microlithography Image Simulation and Processing. The focus of our research field include the following 9 major projects:

- Biomedical MRI,PET Imaging processing
- The transmission and analysis of Bio-signal
- Protein folding
- Digital Circuit Optimization
- Design for Manufacturabiliy
- Statistical Static Timing Analysis
- High Performance Circuit Design
- BIO and Optical Microlithography Imaging Simulation and Processing
- Power Line Communication system

主要研究領域 Major Research Areas

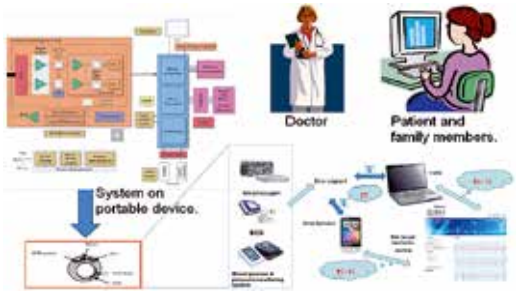
生醫及半導體光學製程影像處理、微處理機設計、VLSI電腦輔助設計、微波通訊線路設計、電力線通訊系統、生醫行動生理檢測系統

BIO/Optical Microlithography Image Processing, VLSI CAD, Microprocessor Design, RF Mix/Signal Circuit Design, Power Line Communication system, The transmission and analysis of Bio-signal

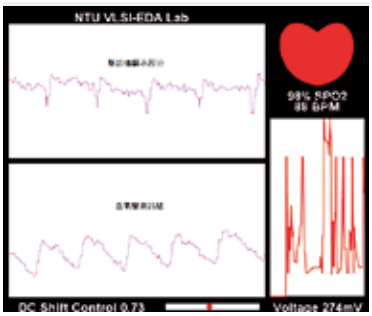
研究計畫 Research Projects

1. 次微米下之高速電路及低耗電最佳化
   Deep-Sub-Micron High-speed Low Power Optimization
2. 動態邏輯加法器設計及自動化
   Domino Adder Design and Automa
3. 次微米級干涉週期量測之診斷演算法
   Efficient and Accurate Optical Scatterometry Diagnosis of Grating Variation Based on Segmented Moment Matching and Singular Value Decomposition Method
4. 行動式無線癲癇症預測雲端系統
5. 連續性個人化健康照護整合平台子計畫三
6. Telecare platform with portable biomedical system applied in Smartphone

■ **研究計畫** -
連續性個人化健康照護整合平台子計畫三之代表圖：



■ **研究計畫** - Telecare platform with portable biomedical system applied in Smartphone：
結合藍芽晶片傳送至智慧型手機，做圖形化的顯示。



E-mail: cpchen@ntu.edu.tw
Phone: +886-2-33663611
Office: 博理館625(BL-625)
Website:http://vlsi.ede.wisc.edu/
Lab. Phone: +886-2-33663700*6405
lab.: 博理館405(BL-405)

陳志宏 教授

Jyh-Horng Chen, Professor

國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學電機工程學系教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics
Department of Electrical Engineering, National Taiwan University

醫學影像實驗室

Medical Imaging Lab.

醫學影像實驗室目前位於臺灣大學明達館七樓 (room706)。負責人為陳志宏(Jyh-Horng Chen)教授，助理一人，研究生六人，博士班學生一人。主要研究方向為核磁共振造影(MRI)、殘障者人機介面與噪音抑制(Noisecancelation)等研究主題。在電機一館一樓設有MRI/MRS實驗室，設有一台Bruker 3.0 Tesla MR，平時提供校園內學術單位做研究，以及本實驗室研究造影技術之用。

核磁共振影像頻譜實驗室
Magnetic Resonance Imaging Lab.

本實驗室於1999年成立，以提供有效、可靠的成像技術及訓練課程予各研究領域之研究學者，心理學家、生理學家、動物學家，可藉由磁振光譜影像之重建方式，為未來之基因蛋白體研究、動物病變模型之評估，提供微細且精確的訊息，以成為臺灣的MRI研究及人才培訓資源中心。另一方面，本實驗室亦從事新技術之研發，期能突破現有磁振造影 (MRI) 之成像速度限制，提升磁共振影幅系統成像能力及臺灣在磁共振領域之國際知名度，並藉由國內現有MR研究資源合作，以跨學科之研究，使人文、科學、醫學、工程等不同學科得以匯整激盪，並創造21世紀之新學門科學，建立一個世界級之核磁共振卓越中心。主要研究方向包括：大腦功能性磁振造影、擴散磁振造影、MR線圈設計、MRI成像最佳化技術、超快速平行擷取MRI系統、小動物生理病理研究、分子影像。

The laboratory will apply the existing MRI / MRS techniques to interdisplinary research, including school of humanity, psychology, medicine, engineering, agriculture and food science. Its object is to combine experts in different areas to generate, hopefully, some new academic areas in 21 century. This laboratory is supported by National Taiwan University (NTU) as well as Instrumentation Center of National Science Council (NSC) in Taiwan.

生醫分子影像核心實驗室

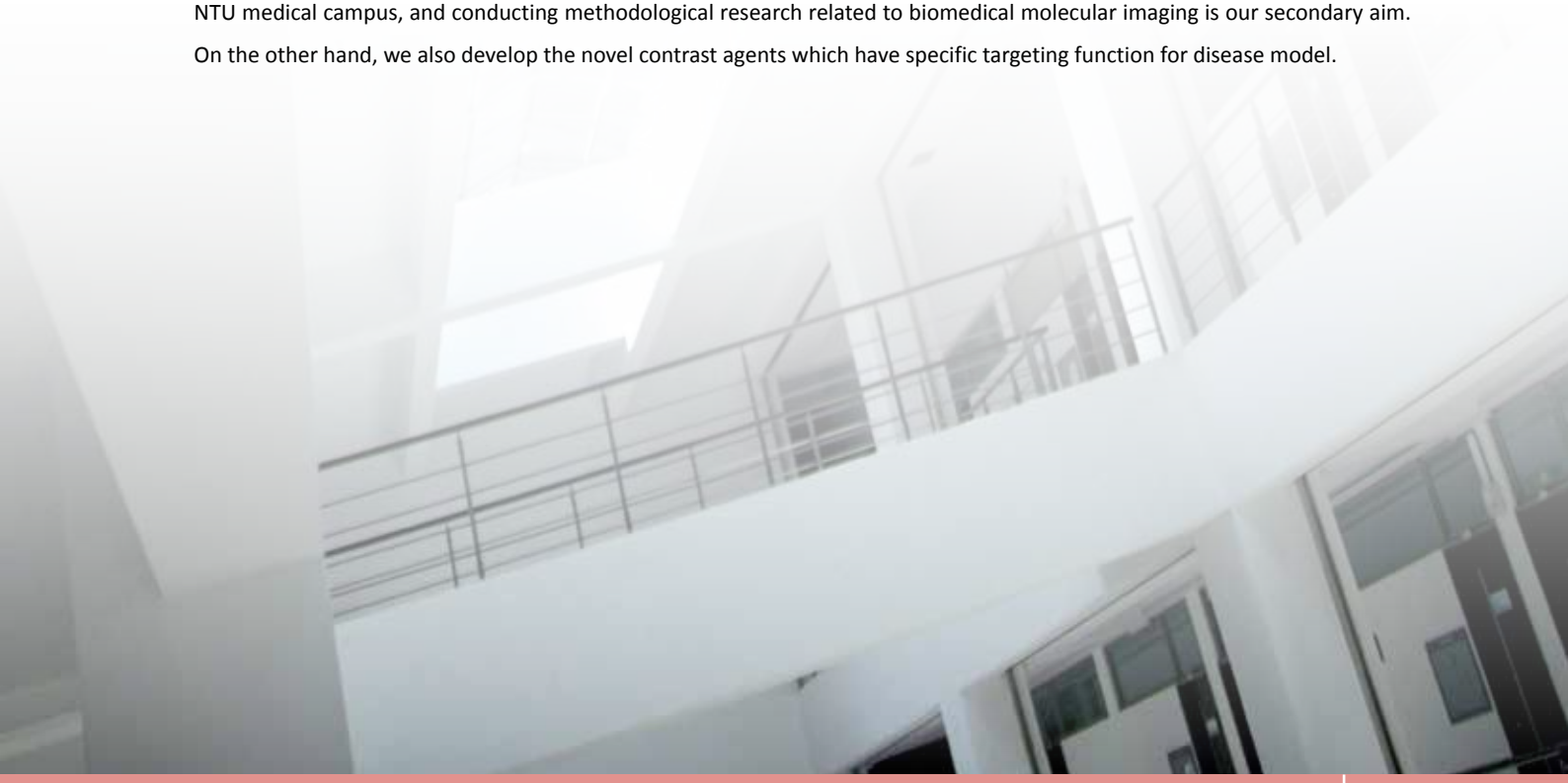
Biomedical Molecular Imaging Core Lab.

此核心實驗室結合磁共振(MR)分子影像、光學分子影像 (Optical molecular imaging) 及超音波分子影像 (Ultarsonic molecular imaging)，此外，為使活體中特定的分子成像，除了要有上述高分辨率、敏感、快速的成像技術，還具備合成具有高親和力的分子探針及具有特異標定之顯影劑。

本核心實驗室主要目標之一為提供分子醫學影像之量測與生物體之醫學成像技術研究服務予臺灣大學醫學院區內從事生物醫學、基礎醫學與臨床醫學研究人員，此外，本實驗室致力發展新型醫學影像之顯影劑開發，並結合分子生物之技術，開發新式具特異標定功能之奈米粒子。

This core combined MR molecular imaging, optical molecular imaging and ultrasonic molecular imaging, thence, besides above mentioned properties, high spatial resolution, sensitivity and fast imaging technology, it has the ability to synthesize high affinity molecular probe and specific-targeting contrast agent, and then in vivo specific molecular imaging will be obtained.

Our primary aim for this Biomedical molecular imaging Core is to provide research services to all the investigators within NTU medical campus, and conducting methodological research related to biomedical molecular imaging is our secondary aim. On the other hand, we also develop the novel contrast agents which have specific targeting function for disease model.



主要研究領域 Major Research Areas

核磁共振影像、醫學工程

Magnetic Resonance Image, Functional MRI, Molecular imaging, Man Machine interface, Medical Engineering

研究計畫 Research Projects

1. 磁化率定量影像於磁振造影之生醫應用：動態定量之磁共振影像
   Novel Biomedical Applications of Quantitative Susceptibility Mapping: Dynamic and Quantitative MRI
2. 心智科學大型研究設備共同使用服務計畫—身體、心靈與文化整合影像研究中心
   Installation and Operation of Core Facility in Mind Science: An Initiative for Integrated Research on Brain, Mind and Culture
3. 構建中樞與週邊神經系統聯結之磁共振影像技術: 定量化中風偵測與評估研究
   Quantitative Brain-Peripheral MR Imaging and Classification Techniques for Stroke Detection and Assessment
4. 以多模式超高解析度神經磁振造影建立老年失智症生物標誌之研究
   Establishing Dementia Biomarkers with Multimodal High Spatiotemporal MR Neuroimaging
5. 神經退化性疾病之定量磁化率影像研究
   Development of Quantitative Susceptibility Mapping Technology in Neurodegenerative Diseases

E-mail: jhchen@ ntu.edu.tw
Phone: +886-2-33663610
Office: 博理館619 (BL 619)
Website: http://fmri1.ee.ntu.edu.tw/wiki/doku.php
Lab. Phone: +886-2-33663517
Lab. : 明達館706(MD-706)

陳永耀 教授

Yung-Yaw Chen, Professor

國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學電機工程學系教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Department of Electrical Engineering, National Taiwan University

智慧型及精密運動控制實驗室

IPMC Lab.

本實驗室「智慧型精密運動控制實驗室」由陳永耀教授領導，位於明達館604室，其研究的主要方向為智慧型控制與超音波熱療。實驗室的近期研究領域分成反向光學微影技術、電子束微影系統、姿態辨識聲音的分析與處理、仿生機械人、及超音波熱療等五大主題。

反向光學微影技術的研究是針對在IC製程上小尺度的光罩所產生的繞射現象，在光罩設計時將繞射現象考慮進去，設計出最佳的光罩形狀。電子束微影系統的研究是在IC製程中的電子束蝕刻時，對電子束做位置的訊號回授控制以修正電子移動時所產生的漂移現象。姿態辨識的研究是利用人工智慧的方式來處理影像中的資訊，本實驗室建立影像的監視系統應用在老人看護上。另外在聲音處理的方面是利用訊號處理的方式將聲音中的雜訊濾除，進而研究聲音本質與語者分析。仿生機械人的研究是模仿生物的運動模式，將生物的優點轉換成電機領域的應用，近期的研究是將蛇的運動設計成新型的載具。超音波熱療的研究是發展新的預測方式，來追蹤人體中因呼吸而上下運動的腫瘤細胞，使得聚焦的超音波能夠正確的加熱在腫瘤細胞上，殺死腫瘤細胞。

本實驗室致力於將智慧型控制嘗試應用在各方領域，將機械自動化，改良儀器控制法，改善人類生活。

Intelligent Precision Motion Control Laboratory is led by Prof. Yung-Yaw Chan and located in room 604, Minda building. Researches included inverse optical micro-lithography, electron beam lithography, motion identification, sound Analysis, biomimetics, and high intensity focus ultrasound.

Inverse optical micro-lithography is to design the optimal from of the mask, due to the diffraction of light changes. Electron Beam Lithography is to write on wafers by electron beam directly. We use sensors to feedback control the system to reduce beam broadening and proximity effect. In motion identify, we analyze the human activities for the home care systems. Biomimetics is to study the biological structure and the locomotion of real snakes,and to develop and design advanced platform actuation systems.Our laboratory applies Intelligent Control to automate machine and to improve the system performance.

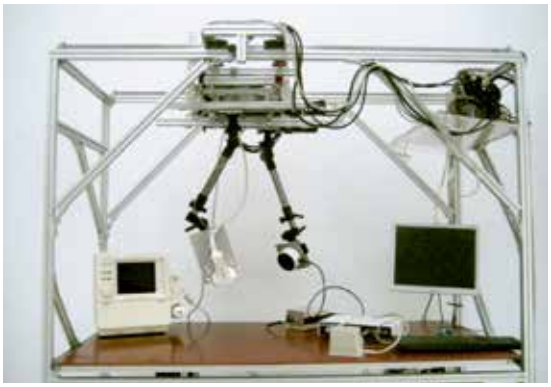
主要研究領域 Major Research Areas

智慧型控制、微創手術自動化、超音波加熱治療、居家看護

Intelligent control, Automation of minimally invasive surgery, Hyperthermia treatment planning, Home care system

研究計畫 Research Projects

1. 科技部三年期整合型計劃：
   智慧型微創手術內視鏡機器人系統研發 - 總計畫兼子計畫三：
   微創手術血管與腫瘤安全距離警示系統研發



E-mail: yychen@cc.ee.ntu.edu.tw
Phone: +886-2-33663700
Office: 明達館719 (MD-719)
Website: http://usl.ee.ntu.edu.tw/drupal/
Lab. Phone: +886-2-33669724
Lab. : 明達館604 (MD-604)

成佳憲 教授

Chia-Hsien Cheng, Professor

國立臺灣大學生醫電子與資訊學研究所合聘教授
國立臺灣大學醫學院腫瘤醫學研究所教授
國立臺灣大學醫學院臨床醫學研究所合聘教授
國立臺灣大學醫學院附設醫院腫瘤醫學部放射腫瘤科主治醫師

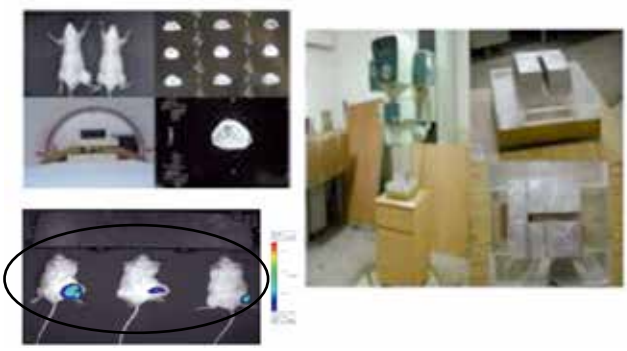
Adjunct Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Professor , Graduate Institute of Oncology, National Taiwan University College of Medicine
Adjunct Professor, Graduate Institute of Clinical Medicine, National Taiwan University College of Medicine
Attending Physician, Division of Radiation Oncology, Department of Oncology, National Taiwan University Hospital

放射物理生物實驗室

Radiation Physics and Biology Lab.

本實驗室由成佳憲教授於2002年起隨同整建臺大醫院腫瘤醫學部放射腫瘤科時設立，主要從事放射治療物理學與放射生物學相關研究，目前以設備技術物理與腫瘤放射治療轉譯醫學等領域為研究重點。本實驗室在影像導引放射治療領域與肝癌放射治療領域已產出許多具體貢獻。本實驗室之成員來自臺大醫院腫瘤醫學部放射腫瘤科醫學物理師、放射師及放射生物醫學領域研究人員，多年來亦積極與國內外單位進行合作。

The laboratory for radiation physics and biology was established by Jason Chia-Hsien Cheng, M.D., M.S., Ph.D., with the reconstruction of Division of Radiation Oncology, Department of Oncology, National Taiwan University Hospital. The main research directions are radiation physics related to equipment and technique, as well as translational medicine of radiation oncology. Our research team has been contributing significantly the progress in image-guided radiation therapy and radiotherapy to hepatocellular carcinoma. The team members of our laboratory include the radiation physicists, radiation technologists, and radiation biologists from Division of Radiation Oncology. The laboratory also has the collaboration with the other research teams in Taiwan and in the other countries.



主要研究領域 Major Research Areas

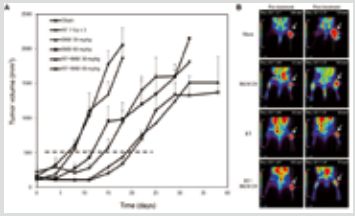
放射腫瘤學、放射物理學、放射生物學、癌症轉譯醫學
Radiation Oncology, Radiation Physics, Radiation Biology, Cancer Translational Medicine

研究計畫 Research Projects

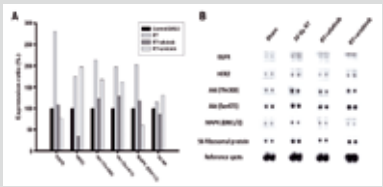
1. 探討磷脂醯肌醇3-激酶/蛋白質激酶B/哺乳動物雷帕黴素靶蛋白傳遞路徑及相關拮抗劑對於肝癌細胞放射抵抗性之作用機轉
   Investigation on the mechanisms of PI-3K/Akt/mTOR dependent radioresistance of epatocellularcarcinoma and the related inhibitors.
2. 表皮生長因子受體訊息傳遞路徑對表現基質金屬蛋白酶9之小鼠肺癌放射治療模式於腫瘤生長及轉移之機轉研究
   Mechanism investigation of EGFR/HER2 signaling pathway on tumor growth and metastasis by radiotherapy for MMP-9 expressed Lewis lung carcinoma.
3. 新一代EGFR酪氨酸激酶抑制劑可協同阻斷EGFR和HER2，克服膀胱癌細胞對放射治療的抗性：第二、三年機轉研究
   Synergistic blockade of EGFR and HER2 by new generation EGFRtyrosine kinase inhibitor overcomes radioresistance of bladdercancer cells: mechanistic studies

■ **研究計畫** - 1,3之代表圖及英文說明：

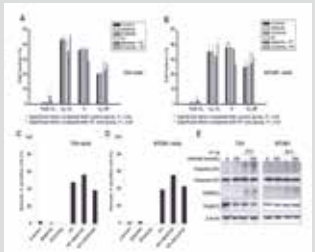
Combined BKM120 and radiotherapy (RT) enhances tumor suppressive activity in two BNL xenograft models.



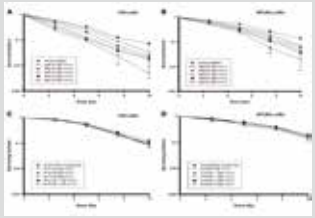
Concomitant EGFR and HER2tyrosine kinase inhibitionsignificantly suppressesradiation-activated signaling pathways in bladder cancer cells.



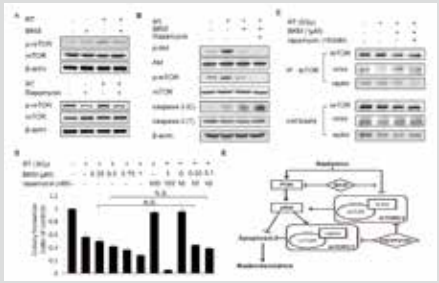
Tyrosine kinase blockade of both EGFR and HER2 by afatinib, not blockade of EGFR alone, promotes radiation-induced apoptosisin bladder cancer cells.



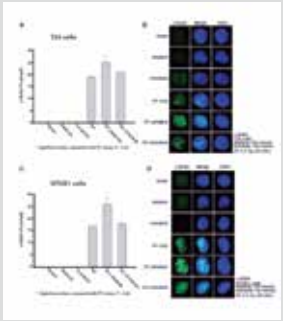
Dual blockade of EGFR and HER2 tyrosine kinases significantly radiosensitizes bladder cancer cells.



The addition of rapamycin to BKM120 enhances the inhibition of mTOR and Akt phosphorylation and increases caspase-3 activation in irradiated BNL cells.



The EGFR/HER2 dual inhibitor afatinib, not the EGFR inhibitor erlotinib, promotes radiation-induced DNA damage in bladder cancer cells.



E-mail: jasoncheng@ntu.edu.tw
Phone: +886-2-2356-2842
Website: http://www.ntuh.gov.tw/onc/
Lab Phone: +886-2-2312-3456*67141
Office: 台大醫院西址檢驗大樓地下1樓放射腫瘤科
NTUH (West site) laboratory Building B1 / Department of Radiation Oncology

周迺寬 臨床副教授

Nai-Kuan Chou, Clinical Associate Professor

國立臺灣大學生醫電子與資訊學研究所合聘臨床副教授
國立臺灣大學醫學系外科臨床副教授
國立臺灣大學醫院附設醫院外科加護病房主任
國立臺灣大學醫院附設醫院器官勸募小組召集人

Clinical Associate professor of Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Clinical Associate professor of surgery, National Taiwan University, College of Medicine
Director of Intensive Care Unit of Department of Surgery, National Taiwan University Hospital
Convener m of Organ Procurement Organization, National Taiwan University Hospital

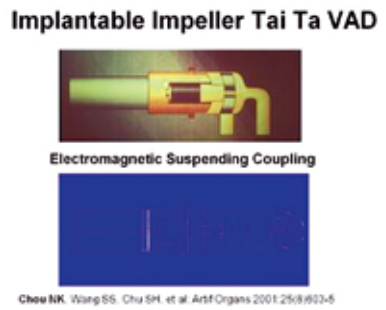
臺大醫院第七共同研究室

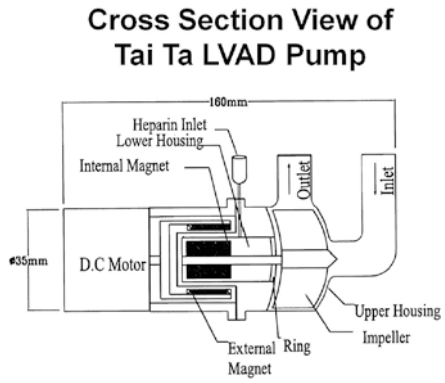
Laboratory.

實驗室結合研究團隊的各實驗室，成員如下：應力所邵耀華教授、電機系汪重光教授、獸醫系徐久忠教授、高分子所謝國煌教授、包舜華博士、戴浩志醫師、王碩盟醫師、劉亮廷醫師

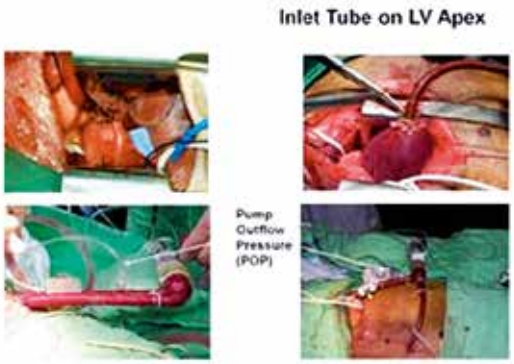
1. 小動物實驗模型
2. 醫療儀器、訊號分析處理
3. 超音波影像處理
4. 實驗室儀器：雙向心臟血管用X光射影系統、多頻道生理記錄分析系統(Polygraphy)、Injector、Autoinjector、多頻道心理生理電腦化記錄分析儀(EP recording)、CARTO、電氣生理刺激器、血管內導線壓力儀器(PressureWire)、OCT、電燒機、血管內超音波(i-LAB)、血液凝固測試儀(ACT)、波士頓科技羅塔培特控制台系統、IABP、電擊器、血中含氧測定儀、非侵入式自動血壓計、微量點滴控制器(Syringe pump)、人工心律調整器、血氧飽合濃度監視器、血壓血氧ECG監視器、電刀機、點滴幫浦、耳溫槍、血糖機、JJ電燒機等等。

Laboratory animals, animal models of heart failure and artherosclerosis, establishes computerized database for laboratory animal science and assists in various experiments, disease diagnosis, and health monitoring.

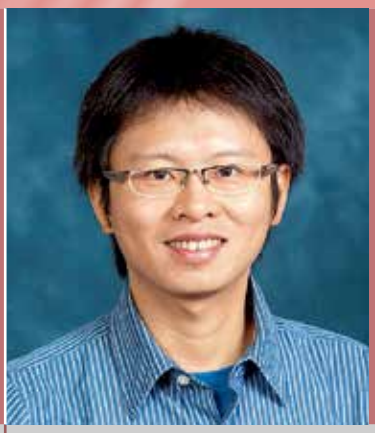




Chou NK, Wang SS, Chu SH, et al: Artif Organs 2001;25(8)603-5



E-mail: nickchou@ntu.edu.tw
Phone: +886-2-23123456#65066
Fox: +886-2-23956934
Office: 台大醫院新大樓臨床研究大樓8樓
外科研究室08-11室



黃念祖 助理教授

Nien-Tsu Huang, Assistant Professor

國立臺灣大學生醫電子與資訊學研究所助理教授
國立臺灣大學電機工程學系助理教授

Assistant Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Assistant Professor, Department of Electrical Engineering, National Taiwan University

光流體生醫系統實驗室

Bio-Optofluidic Systems Lab.

光流體生醫系統實驗室為黃念祖博士成立於2013年，隸屬於國立台灣大學電機工程學系和生醫電子與資訊學研究所。本實驗室主要研究為發展整合型微流體生物晶片(Lab-on-Chip)，其晶片將微型化電子、光學、機械及流體等元件進行生醫領域相關應用，如細胞生物學、藥物篩選、快速疾病檢測，並期許將來能使用醫療資源較為匱乏環境之定點照護功能(Point-of-care)。

Bio-Optofluidic System Lab is in the department of Electrical Engineering and the graduate institute of Biomedical Electronic and Bioinformatics at National Taiwan University, Taipei, Taiwan. Our lab is focusing on developing integrated electrical, optical and mechanical miniaturized fluidics and sensors for biological applications, such as cellular biology, drug screening, and disease diagnosis.

主要研究領域 Major Research Areas

光微流道系統, 微系統細胞操控, 集中型表面電漿共振, 奈微米製造技術

Bio-MEMS, Optical-MEMS, Microfluidics, Bio-sensing, Cell Manipulation in Microenvironment, Micro/Nano Fabrication Techniques.

研究計畫 Research Projects

1. 細胞表型分析之整合式光流體平台研發
   Developing integrated optofluidic platform for cellular phenotyping
2. 免標定侷限表面電漿共振感測系統應用於肺結核病患免疫系統檢測
   A Microfluidic Platform Integrating Localized Surface Plasma Resonance (LSPR) Sensing for Immunodiagnostics of Patients with Tuberculosis

■ **研究計畫** -
細胞表型分析之整合式光流體平台研發
Developing integrated optofluidic platform for cellular phenotyping
之代表圖說明：

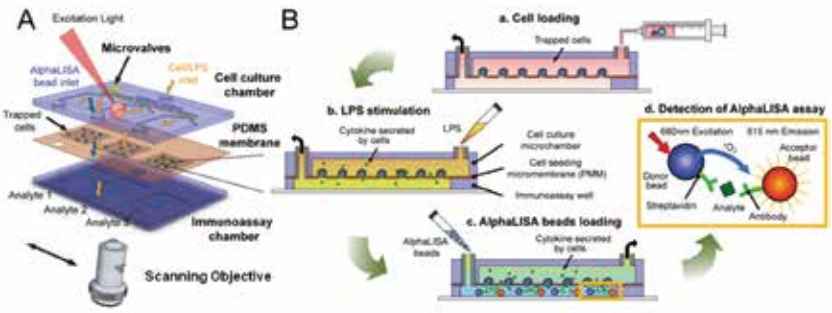


Figure 1 (A) Schematic of integrated optofluidic platform for cellular immunophenotyping
(B) Schematic showing the immunophenotyping assay protocol used in this study.

■ **研究計畫** - 免標定侷限表面電漿共振感測系統應用於肺結核病患免疫系統檢測
A Microfluidic Platform Integrating Localized Surface Plasma Resonance (LSPR) Sensing for Immunodiagnostics of Patients with Tuberculosis之代表圖說明：

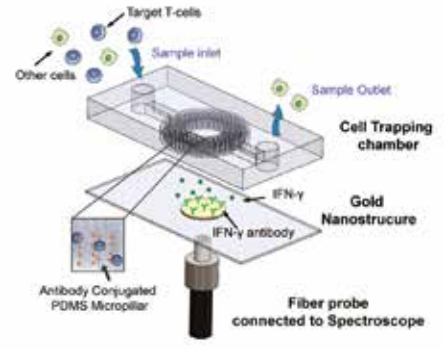


Figure 2 Schematic of microfluidic platform integrating LSPR sensing

E-mail: nthuang@ntu.edu.tw
Phone: +886-2-33661775
Office: 明達館522 (MD-522)
Website: http://homepage.ntu.edu.tw/~nthuang/index.html
Lab. : 明達館702 (MD-702)

傅楸善 教授

Chiou-Shann Fuh, Professor

國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學資訊工程學系教授
國立臺灣大學資訊網路與多媒體研究所教授

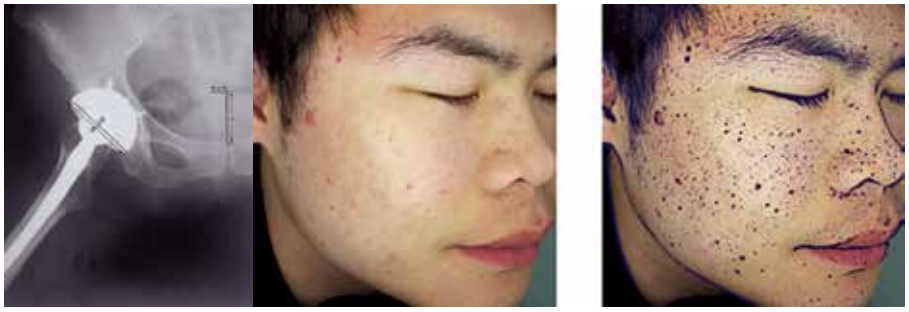
Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/ Department of Computer Science and Information Engineering/ Graduate Institute of Networking and Multimedia, National Taiwan University

數位相機與電腦視覺實驗室

Digital Camera and Computer Vision Lab.

本實驗室由傅楸善教授成立於2003年，主要從事數位相機與電腦視覺相關研究。歷年來已執行多項研究計畫，目前以生醫數位相機、影像處理與自動光學檢測等領域為研究重點。本實驗室在上述領域已產出許多具體貢獻並在全世界有很高之能見度。此外，本實驗室之成員來自電子、資訊及醫學等各領域，多年來亦積極與國內外單位進行合作，合作夥伴包括產、研、學各界，例如：光寶科技、源浩科技、德律科技等。提升數位相機與自動光學檢測技術及其生醫應用，是本實驗室之成立宗旨與具體目標。

Digital Camera and Computer Vision Laboratory was founded by Professor Chiou-Shann Fuh in 2003, with the main research focus in digital camera and computer vision. In the past few years, we have conducted a number of research projects in digital image processing and automatic optical inspection. We have also made several critical contributions and are now one of the most visible research laboratories in this field in the world. Members of the laboratory come from various backgrounds, including electronics, informatics, and medicine. We have also been actively collaborating with research laboratories throughout the world, covering industry, research institutes, and universities, from basic sciences, engineering to clinical research, such as Liteon, Winstar Technology, Lumens Digital Optics, and TRI. Integrating multi-disciplinary research efforts, exploring advanced digital camera with biomedical applications, and automatic optical inspection are the mission of this laboratory.



主要研究領域 Major Research Areas

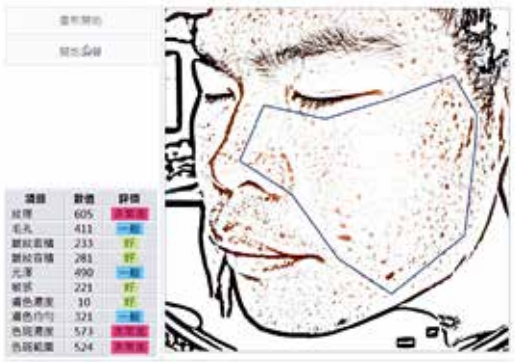
數位相機、電腦視覺、自動光學檢測、數位影像處理
Digital Camera, Computer Vision, Automatic Optical Inspection, Digital Image Processing

研究計畫 Research Projects

1. 用X光重建錫球三維空間形狀與瑕疵檢測: 二維重建, 三維重建, 加速計算
   3D Solder Shape Reconstruction and Defect Inspection with X-Ray Images:
   2D Reconstruction, 3D Reconstruction, Computation Acceleration
2. 數位相機之影像處理: 高動態範圍影像, 行人偵測, 性別與年齡估計
   Image Processing for Digital Cameras: High Dynamic Range Image, Pedestrian Detection, Gender and Age Estimation
3. 數位相機之影像處理: 降低雜訊, 光線補償, 臉色改善
   Image Processing for Digital Cameras: Noise Reduction, Light Compensation, Facial Color Enhancement

■ Project title: 3D Solder Shape Reconstruction and Defect Inspection with X-Ray Images: 2D Reconstruction, 3D Reconstruction, Computation Acceleration
Supported by: Ministry of Science and Techology
Project period: 2015/08/01 ~ 2018/07/31

This is a three-year project to use computer vision and digital image processing methods and X-ray images for 2D reconstruction, 3D reconstruction, defect inspection, and computation acceleration research. We will study the best X-ray camera, light source, environment, distance, angle, and solder ball reconstruction and defect inspection algorithms and computation acceleration. In the first year, we will research algorithms and programs for 2D reconstruction and defect inspection such as open circuit, short circuit, too small solder ball, insufficient solder, or too much solder. After 2D reconstruction, in the second year, we will research 3D reconstruction and defect inspection with different X-ray camera and light source distances and angles. We aim to inspect defects of multiple-layer ball grid array and circuit boards with package on package and land grid array. After 3D reconstruction and defect inspection, due to enormous computation, we will research to accelerate computation with graphical processing units or streaming SIMD extension 4 instruction set. We aim to break Japanese and German patent and technology barriers in these three aspects and enhance Taiwan's international competitiveness and market shares on semiconductor inspection equipment such as AOI, AXI, and SPI.
代表圖及中英文說明：



Human Face Feature Detection and Analysis
人臉特徵偵測與分析

E-mail: fuh@csie.ntu.edu.tw
Phone: +886-2-33664888*327
Office: 德田館327 (CSIE-327)
Website: http://www.csie.ntu.edu.tw/~fuh/
Lab. Phone: +886-2-33664888*328
Fax: +886-2-23628167
Lab. : 德田館328 (CSIE-328)

黃俊升 教授

Chiun-Sheng Huang, Professor

國立臺灣大學生醫電子與資訊學研究所合聘教授
國立臺灣大學醫學系外科教授
國立臺灣大學醫學院附設醫院外科主治醫師

Adjunct Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University Professor, Department of Surgery, National Taiwan University
Attending Physician, Department of Surgery, National Taiwan University Hospital

主要研究領域 Major Research Areas

乳房外科、乳房超音波檢查、腫瘤外科、分子流行病學

Breast Surgery, Breast Ultrasound, Surgical Oncology, Molecular Epidemiology

研究計畫 Research Projects

一、轉譯醫學研究 Translational Medicine Research

1. 針對亞洲年輕婦女急速增加luminal type乳癌發展新穎治療標的與生物標記 - (總計畫與子計畫一)以多平臺全基因微陣列方法去分析及發現不同臨床生物表現之同Luminal A型態乳癌的特別基因特徵。
2. 微流體平台進行藥物篩選與化療療效監測。

二、乳房超音波及其他影像檢查研究 Breast Ultrasound and Other Imaging Screening Research

1. 自動乳房超音波之電腦輔助診斷
2. 以乳房超音波及乳房攝影術進行台灣40-49歲婦女乳癌篩檢隨機試驗。
3. 乳房彩色彈性超音波之電腦輔助診斷。
4. 雙波段紅外線乳房影像系統之三維模型建立與血管增生定量分析。
5. 萌芽個案計畫-雙波段紅外線乳房影像系統：化療反應監控

三、其他研究計畫Other Research

1. 轉譯醫學資源中心之臨床試驗合作聯盟：乳癌

四、臨床試驗 Clinical Trial (2014~至今)

1. Kristine：一個隨機分配、多中心、開放性、雙組的第三期試驗，比較trastuzumab emtansine 併用pertuzumab與化學療法併用 trastuzumab 及 pertuzumab做為HER2陽性乳癌患者之前置輔助療法。
2. Kaitlin：一個隨機分配、多中心、開放性的第三期試驗，比較使用anthracyclines後併用trastuzumab、pertuzumab及taxane與使用anthracyclines後併用trastuzumab emtansine及pertuzumab作為可手術切除的HER2陽性原發性乳癌患者之術後輔助治療。

3. BMN 673：一項第3期、開放性、隨機分配、平行、雙組、多中心試驗，比較BMN 673與醫師選用之藥物用於罹患局部晚期及/或轉移性乳癌，且過去接受過不超過2種轉移性疾病化學治療之生殖細胞BRCA突變患者的效果。
4. PPD_GO29227：一項以AKT抑制劑 Ipatasertib (GDC-0068) 與 Paclitaxel併用，作為轉移性三重陰性乳癌病患第一線治療的隨機分配、第二期、多中心、安慰劑對照試驗。
5. AZ_OlympiAD：一個第三期、開放性、隨機、對照的多中心試驗，針對先天性BRCA1/2突變的轉移性乳癌患者，評估Olaparib之單一療法相較於醫師選用之化療的療效與安全性。
6. AZ_OlympiA：一個隨機、雙盲、平行組別、安慰劑對照的多中心第三期試驗，針對具有先天性BRCA1/2突變與高風險HER2陰性，且已完成明確的局部治療與前置輔助性（neoadjuvant）或輔助性化療的原發性乳癌患者，評估olaparib相較於安慰劑作為輔助療法之療效與安全性。
7. Abbvie：一項針對患有初期三重陰性乳癌 (TNBC) 受試者，以評估增添 Veliparib 加 Carboplatin 於標準前導性化療相較於增添 Carboplatin 至標準前導性化療相較於標準前導性化療的安全性與療效之隨機分配、安慰劑對照、雙盲、第 3 期試驗。
8. PPD Her2+：一項第 3 期、雙盲、隨機分配、平行分組、活性藥物對照試驗，比較 CT-P6 與 Herceptin作為 HER2 陽性早期乳癌患者的新輔助性與輔助性療法，其療效與安全性。
9. Kailee：一項隨機、多中心、開放標示第三期臨床試驗，針對疾病進展或復發之HER-2陽性局部晚期或轉移性乳癌患者，評估Trastuzumab emtansine (T-DM1)對照Trastuzumab併用 Docetaxel，作為第一線治療之療效與安全性。
10. JPBL：一項隨機分配、雙盲、安慰劑對照的第3期試驗，使用fulvestrant搭配LY2835219 (一種CDK4/6抑制劑)或單獨使用fulvestrant治療荷爾蒙受體陽性、HER2陰性的局部晚期或轉移性乳癌女性患者。
11. JPBM：一項隨機分配、雙盲、安慰劑對照的第3期試驗，使用非類固醇類芳香環轉胺酶抑制劑(Anastrozole或Letrozole)合併LY2835219 (一種CDK4/6抑制劑)或合併安慰劑，治療荷爾蒙受體陽性、HER2陰性的局部復發或轉移性乳癌停經女性患者且此疾病未曾接受過全身性治療。
12. Pfizer：一項多中心、隨機分配、雙盲之第三期臨床試驗，以 Palbociclib (口服 CDK 4/6 抑制劑) 併用 letrozole，比對安慰劑併用 letrozole，治療具ER (+)、HER2 (-) 晚期乳癌且不曾接受過治療之亞洲停經女性患者。
13. JPBY：第二期前導性試驗，評估於荷爾蒙受體呈陽性(HR+)、人類上皮細胞生長因子受體2呈陰性(HER2-)乳癌停經後女性施予2週Abemaciclib (LY2835219)與Anastrozole合併療法，相較於使用Abemaciclib單一療法和Anastrozole單一療法的生物效應，以及評估後續14週Abemaciclib (LY2835219)與Anastrozole合併療法的臨床療效和安全性。
14. 1280.4：一項比較BI 836845聯合Exemestane和Everolimus與僅使用Exemestane和Everolimus用於治療患有局部晚期或轉移型乳癌的女性患者的Ib / II期隨機臨床試驗。
15. 評估 Afatinib 合併太平洋紫杉醇用於三重陰性乳癌之術前治療第II 期臨床試驗的療效並尋求預測 Afatinib 有效性之生物標記。
16. 一項多國多中心，針對三陰性乳癌治療的長期結果與影響的長期追蹤研究。
17. 與賀爾蒙受體陽性、Her2陰性的早期乳癌預後相關的單核.酸多型性變異的功能性分析暨探討次世代基因定序發現的單核.酸多型性變異在預後的重要性。

E-mail: huangcs@ntu.edu.tw
Phone: +886-2-23123456*65080
Office: 臺大醫院東址臨床研究大樓825

阮雪芬 教授

Hsueh-FenJuan, Professor

國立臺灣大學生醫電子與資訊學研究所教授兼資訊組召集人
國立臺灣大學生命科學系教授
國立臺灣大學分子與細胞生物學研究所教授
國立臺灣大學基因體與系統生物學學位學程

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/ Department of Life Science/ Institute of Molecular and Cellular Biology/ Genome and Systems Biology Degree Program, National Taiwan University

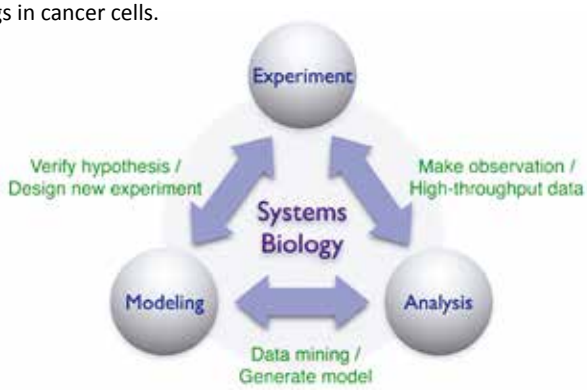
系統生物學研究室

Systems Biology Lab.

本研究室主要以系統生物學探討藥物在癌細胞的作用機制，內容包括運用各種體學資料進行各蛋白質間交互作用的預測和建構、基因網絡的模擬和建構，及非編碼核酸於其調控的蛋白質間交互作用及網路關係，期望進一步達到開發新藥的目地。主要的目標是利用系統生物學研究法來研究藥物誘導下胃癌、乳癌、肺癌及神經母細胞瘤細胞的分子作用機制；同時，利用系統生物學和合成生物學研究法開發新的治療方法。

The main research in our lab is to apply systems and synthetic biology for drug discovery. We discover novel drugs for cancer therapy and investigate the molecular mechanism of drugs in cancer cells.

MicroRNAs and long non-coding RNAs (lncRNAs) are non-coding RNA molecules which play a key role in post-transcriptional regulation of mRNAs. A non-coding RNA can affect many downstream targets which in turn form a complicated network. Our lab has characterized the roles of non-coding RNAs in the regulation of cellular networks and revealed that non-coding RNA-regulated network could be used as a novel therapeutic target for cancer as well as other diseases such as neurological and cardiovascular diseases.



主要研究領域 Major Research Areas

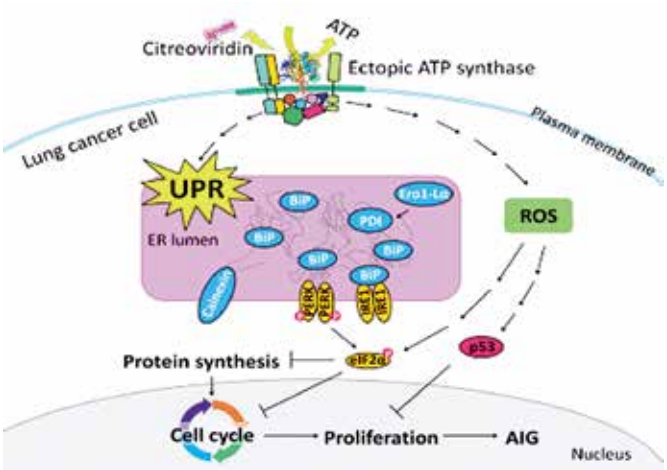
系統生物學、蛋白質體學、生物資訊、合成生物學

Systems Biology, Proteomics, Bioinformatics, Synthetic Biology

研究計畫 Research Projects

1. 結合蛋白質體學和網路生物學研究細胞膜異位表達ATP合成酶的反應路徑
   Elucidating the response pathways of ectopic ATP synthase by combining proteomics and network biology
2. 新穎致癌蛋白ZNF322A之蛋白質交互作用網路與訊息路徑研究
   Studying protein interaction networks and signal pathways of novel oncoprotein ZNF322A
3. 重定位藥物探索於神經母細胞瘤治療: 反應機制研究
   Drug repositioning for neuroblastoma therapy: investigation of the mechanism of action
4. 以系統生物學探索神經母細胞瘤中重要的長鏈非編碼核糖核酸
   Systems biology approach for key lncRNAs in neuroblastoma

■ **研究計畫** - 結合蛋白質體學和網路生物學研究細胞膜異位表達ATP合成酶的反應路徑 Elucidating the response pathways of ectopic ATP synthase by combining proteomics and network biology之代表圖及中英文說明：



Summary of the plausible mechanisms in breast cancer cell death induced by combination therapy targeting ectopic ATP synthase and 26S proteasome.
本圖顯示藉由以ATP合成酶和26S蛋白酶體為標靶的合併治療而誘導乳癌細胞死亡的可能機制。

E-mail: yukijuan@ntu.edu.tw
Phone: +886-2-3366-4536
Office: 生命科學館1105 (Life Science Building-1105)
Website: http://juan.lifescience.ntu.edu.tw

管傑雄 教授

Chieh-Hsiung Kuan, Professor

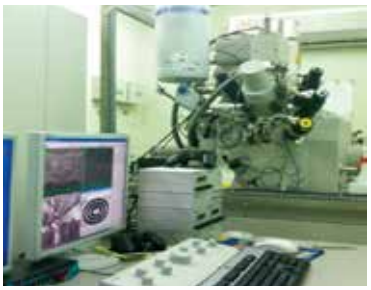
國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學電子工程學研究所教授
國立臺灣大學電機工程學系教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/Graduate Institute of Electronics Engineering/ Department of Electrical Engineering, National Taiwan University

電子束暨奈米元件實驗室

E-beam and Nano Device Lab.

- 電子束微影製程與電子束顯微鏡實驗室
  (Direct-Writing Electron Beam Lithography System Lab., Scanning Electron Microscope Lab.)
- 聚焦離子束實驗室 (Focus Ion Beam Lab.)
- 微拉曼/光激發光光譜實驗室 (Micro-Raman/PL Spectral Lab.)
- 紅外線光譜實驗室 (Infrared Spectral Lab.)

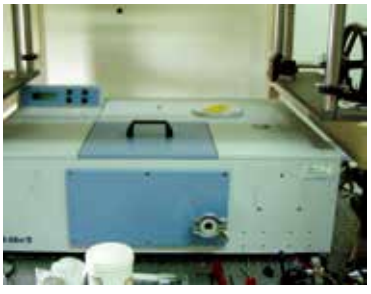


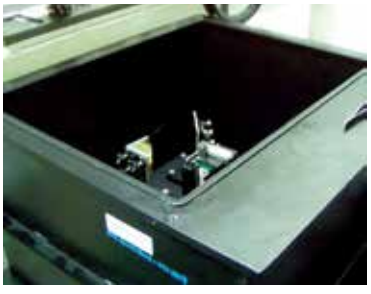
Focus Ion Beam -FIB,聚焦離子束設備

電子束微影系統(100KeV高加速電壓)

電子束微影系統(50KeV中加速電壓)

電子束顯微鏡與微影系統
(5KeV低加速電壓)

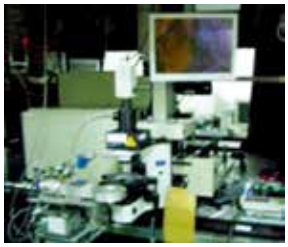




Bruker FTIR 紅外線光譜儀及變角度反射模組

電晶體特性曲線實驗器

FTIR 紅外線光譜儀



T 64000微光譜量測系統
(含XY平面定位掃描功能)

電子束顯微鏡系統
(5KeV低加速電壓)

主要研究領域 Major Research Areas

紅外線光偵測器、發光二極體、太陽能電池、電子束微影技術、生醫元件、量子點元件、電子元件雜訊分析、光學模擬、聚焦離子束系統

Optoelectronic Device, E-beam Lithography, Noise Measurement, Bio-medical Chip, Quantum-dot Device, Optics simulation, Focused-ion-beam System

研究計畫 Research Projects

1. 發展電子束微影技術與聚焦離子束技術於製作三維微結構
   Development of eBeam Lithography technology and Focused-ion Beam technology for Three-dimensional Nano-fabrication
2. 共振式太陽能電池Resonant Solar Cell
3. 發展奈米結構增強光偵測與光發射
   Development of nano-tructures to enhance light detection and emission
4. 矽鍺量子點奈米級記憶元件及陣列之製作與研究
   Nano-scale SiGe quantum-dot memory and array
5. 可低偏高溫操作且正向頂面入射的超晶格紅外線偵測器及陣列的研發
   Development of the Superlattice Infrared Photodetector and Array for Low-Bias High-Temperature Operation and Top Normal Incidence of Light
6. 光譜與電性量測於基因篩選之應用
   Application of spectrum and electrical signal measurements on gene screening
7. 窄頻紅外線光源與偵測器及其在植物與神經細胞上的應用
8. 離子的高敏感度交流電性量測並以紅外線頻譜作輔助分析(2/3)
   High-sensitivity AC electrical signal measurement and infrared spectrum assistant analysis originated from ions
9. 整合雙能障超晶格及量子井紅外線偵測器以達到高偵測率高響應及高溫操作
   Integration of double-barrier superlattice and quantum well infrared photodetectors for advantages of high detectivity, high responsivity,and high-temperature operation

E-mail: chkuan@ ntu.edu.tw
Phone: +886-2-33663569
Office: 博理館513 (BL-513)
Website: http://cc.ee.ntu.edu.tw/~kuanlab
Lab. Phone: +886-2-33663700*426/129
Lab. : 電機二館426/129(EE-426/129)

郭柏齡 副教授

Po-Ling Kuo, Associate Professor

國立臺灣大學生醫電子與資訊學研究所副教授
國立臺灣大學電機工程學系副教授
國立臺灣大學附設醫院復健部主治醫師

Associate Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/ Department of Electrical Engineering, National Taiwan University
Attending Physician in the rehabilitation department at the National Taiwan University Hospital

細胞行為實驗室

Cell Behavior Lab.

本實驗室主要研究細胞物理學、力學生物學的基礎原理以及相關臨床運用。力學生物學為一新興的跨領域學科，主要探討與力學訊息相關的生物反應。力學訊息目前被認為與多種生理及病理過程有強烈相關，包括組織生成、傷口癒合、血管新生、動脈硬化、心肌肥大、以及腫瘤進展等。因為相對僅能靠擴散方式作用的化學物質而言，力學訊號的作用範圍更遠，傳遞速度也較快。因此在大範圍組織整合過程，包括組織發育、修補、以及退化，惡化，光學訊號可能扮演了具有相當決定性的角色。我們特別對壓力對生物體的影響、生物體如何利用力學訊息通訊、並互相調節功能、以及改造周遭力學環境有興趣。我們研究重點是同質細胞間的自我聚合及功能整合，以及異質細胞間的空間協調。我們的短期目標是發展出能精確測量、並調控細胞與細胞間、以及與介質間力學通訊的實驗平台。遠程目標則是促進吾人對異質細胞間在各種生理、病理狀態下的交互作用，並對組織老化及再生的治療方針上有所啟益。目前本實驗室的研究主題為

- 壓力在細胞生理學以及生物物理學的角色
- 利用生物微機電技術製作可供研究細胞間通訊、以及多重物理因子對細胞生理影響肢體外實驗平台
- 建立可監控細胞與環境力學互動之三維體外實驗平台，並探討該平台在臨床上如藥物篩檢等應用
- 建立臨床上可用於監測及治療緻密結締組織，如肌腱及韌帶，力學功能失常時之非侵入性工具及技術

Mechanobiology is a new field focusing on understanding how living organisms generate, sense, and respond to various mechanical stimuli, which are believed to play a key role in numerous physiological and pathological processes, such as tissue development, tissue repairing, atherosclerosis, cardiac hypertrophy, and cancer progression. My researches primarily focus on the fundamental mechanisms and clinical applications of mechanobiology. Specifically, we investigate the effects of hydrostatic pressure and environmental elasticity on cell physiology, how cells remodel the mechanical properties of their environment, and develop tools quantitatively evaluate the mechanics of cell-matrix interactions. Our previous achievements and ongoing projects include

1. Elucidate the role of hydrostatic pressure on cell physiology

Hydrostatic pressure is an important physical factor in tissue physiology and pathology. We investigated how hydrostatic pressure affects muscle differentiation, immunological activities, cell motility, and cancer invasiveness. Currently we are working on the possible biological signaling pathways involving these processes.

2. Evaluate the effects of multiple biophysical and biochemical stimuli on cell physiology

The cells in vivo are generally exposed to the coexistence of multiple biophysical and biochemical cues. Knowledge of how cells response to these complex stimuli is important for many disciplines such as regenerative engineering and cancer biology. Using BioMEMS techniques, we have developed several platforms allowing the coexistence of mechanical, electrical, and chemical stimuli for cultured cells. Currently we are delineating the antagonistic and agonistic roles between these stimuli.

3. Develop a 3D cell culture system that allows quantitatively accessing the mechanics of cell-matrix interactions

The changes of mechanical properties such as stiffness of a tissue usually are hallmarks of various physiological and pathological processes, such as arthrosclerosis and tumor malignant transformation. In vitro assays quantitatively measuring the mechanics of cell-matrix interactions are of great importance to understand the mechanisms and facilitate the development of corresponding therapeutic strategies of these processes. Cells cultured in a 3D environment behave far different from that cultured in 2D and recapitulate more physiological characteristics in vivo. An important ongoing project in our lab is to develop a 3D cell culture system using state-of-the-art imaging and scaffold fabrication techniques to quantitatively access the mechanics of live cell-matrix interactions.

4. Develop clinical tools for treatment and monitoring of the mechanical dysfunction of dense connective tissues

Mechanical malfunction of dense fibrous tissues usually leads to protracted and debilitating conditions, such as joint capsule contracture, tissue fibrosis, and tendinosis. Our goal is to develop clinical tools that allow treating these disorders non-invasively, while the change of mechanical function of the diseased tissues can be non-invasively and quantitatively monitored. We have combined the state-of-the-art ultrasonic techniques and developed a prototypical system for this purpose. Our ongoing project is to evaluate its effectiveness in various clinical conditions.

主要研究領域 Major Research Areas

生物物理、力學生物學、生物力學、組織工程、醫用超音波

Biophysics, Mechanobiology, Biomechanics, Tissue engineering, Medical ultrasound

研究計畫 Research Projects

1. 靜水壓力對肌母細胞型態及分化影響
2. 智慧型非侵入陣列式血流監控系統晶片--子計畫六：以非侵入陣列式系統晶片監控頸動脈血流動力—力學模型及臨床評估
3. 經濟部政策型科專計畫：診斷超音波系統關鍵技術開發3年計畫—影像核心平台基礎技術開發
4. 用於肌腱治療之超音波剪力影像
5. 萌芽個案計畫-三維細胞培養系統與影像觀測技術
6. 三維折射率活細胞顯微術
7. 適用多波影像之三維細胞培養支架開發

E-mail: poling@ ntu.edu.tw
Phone: +886-2-33669882
Office: 明達館519 (MD-519)
Website: http://www.ee.ntu.edu.tw/profile?id=762
Lab Phone: +886-2-33669883
lab. : 明達館707(MD-707)

李心予 教授
Hsinyu Lee, Professor

國立臺灣大學生醫電子與資訊學研究所 教授
國立臺灣大學電機工程學系 教授
國立臺灣大學生命科學系 教授

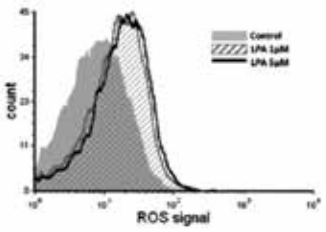
Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Professor, Department of Electrical Engineering, National Taiwan University
Professor, Department of Life Science, National Taiwan University

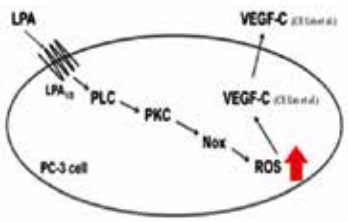
內皮細胞分子生物學實驗室
Laboratory of Endothelial Cell Molecular Biology

Research on Lysophospholipids

Lysophosphatidic acid (LPA) and sphingosine 1-phosphate (S1P) are two low molecular weight lysophospholipids (LPLs) highly enriched in serum. They are derived from enzymatic cleavage of membrane phospholipids. Through the efforts of my laboratory, we have demonstrated that LPLs enhance endothelial cell proliferation, migration and secretion of proteases. These observations strongly suggested that LPLs are regulators for vessel formation. In addition, LPLs also enhance ICAM-1 expression, CD31 phosphorylation and IL-8, MCP-1 secretion from endothelial cells through activating specific G-protein coupled receptors. These results suggested that LPLs are important regulators for inflammation processes. Our most recent findings suggested that LPA is also an important regulator for lymphatic vessel development. These results strongly suggested that LPA might be an important regulator for cancer metastasis. LPLs are also demonstrated by our laboratory to be important regulators for tumor development and cancer cell survival. Therefore, we expanded our research to LPL biology in different cancer models.

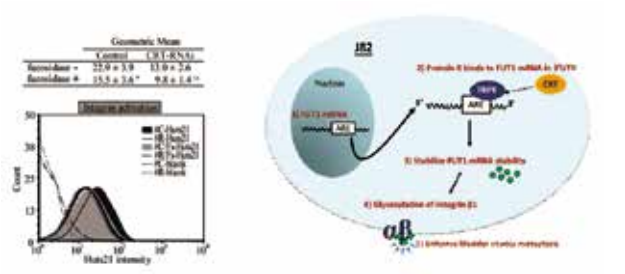
■ 右圖說明：
Lysophosphatidic acid induces reactive oxygen species generation by activating protein kinase C in PC-3 human prostate cancer cells Biochem Biophys Res Commun. 2014. 440(4):564-9





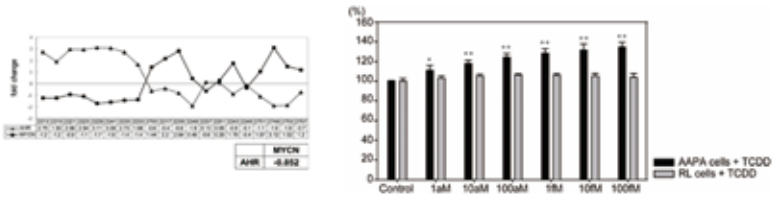
Research on Cancer cell biology

Through collaboration with colleagues at NTU hospital, we extended our research to identify neuroblastoma and hepatoma related cancer markers and exploring their potential roles in tumor formation. Calreticulin (CRT) was therefore identified as an important target. Based on these observations, we further explore the roles of CRT in bladder tumor development. Our results demonstrated that alteration of CRT levels affected cell adhesion and metastasis in bladder cancer. Furthermore, we observed that CRT regulated cell adhesion through modifying α1,2-linkaged glycan on β1-integrin, which was catalyzed by fucosyltransferase 1 (FUT1). Most importantly, we made a novel finding that higher levels of fucosylation catalyzed by FUT-1 directly activate β1-integrin. Moreover, mechanistic investigation demonstrated that CRT affected FUT1 levels through regulating mRNA stability. Our results may provide a potential clinical treatment strategy for bladder cancer patients.



■ 右圖說明：

Calreticulin activates β1 integrin via fucosylation by fucosyltransferase 1 in J82 human bladder cancer cells
Biochem J. 2014 May 15;460(1):69-78

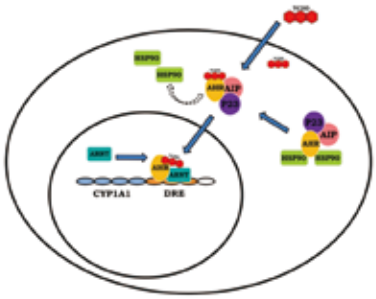


■ 右圖說明：

Aryl Hydrocarbon Receptor Down-regulates MYCN Expression and Promotes Cell Differentiation of Neuroblastoma
PLoS One. 2014 Feb 21;9(2):e88795.

Dioxin detection systems and bioassay development

In the past ten years, our laboratory has intensively exploring the possibility of developing more sensitive and low cost bioassay for dioxin like compounds. Two assays, including FRET and BRET based dioxin detection systems were developed.



■ 上圖說明：

Establishment of a cell-free bioassay for detecting dioxin-like compounds
Toxicol Mech Methods. 2013 Jul;23(6):464-70

李枝宏 特聘教授
Ju-Hong Lee, Professor

國立臺灣大學生醫電子與資訊學研究所特聘教授
國立臺灣大學電機工程學系特聘教授
國立臺灣大學電信工程學研究所特聘教授

Distinguished Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/ Department of Electrical Engineering/ Graduate Institute of Communication Engineering,
National Taiwan University

統計信號處理實驗室
Statistical Signal Processing Lab.

本實驗室由李枝宏教授負責成立於1986年，主要研究領域為數位信號處理之理論與技術研發，近年來也積極進行應用數位信號處理之理論與技術於生醫領域之相關研究，包含：

1. 由國立臺灣大學醫學院骨科部提供人體膝關節病變與運動傷害所產生之振動訊號，應用相關信號處理理論研發建立此振動訊號之數學模型的技術，以協助臨床上分析診斷人體膝關節病變與運動傷害之型態與種類，以期提供醫生進行正確且必要醫療措施所需之資訊。

2. 由國立臺灣大學獸醫學系提供馬匹膝關節病變與老化所產生之振動訊號，應用相關信號處理理論研發建立此振動訊號之數學模型的技術，以協助臨床上分析診斷馬匹膝關節病變與老化之型態與種類，以期提供獸醫生進行正確且必要醫療措施所需之資訊。

3. 由國立臺灣大學醫學院牙科部提供人體顳顎關節病變所產生之振動訊號，應用相關信號處理理論研發建立此振動訊號之數學模型的技術，以協助臨床上分析診斷人體顳顎關節病變之型態與種類，以期提供醫生進行正確且必要醫療措施所需之資訊。目前進行的研究希望利用此特性進而更精確的找出膝關節振動訊號的特徵，進而發展實用簡單方便的非侵襲性關節診斷系統。

I. Basic Digital Signal Processing:
   (1) Techniques for the Design and Implementation of 1-D and 2-D FIR and IIR Digital Filters.
   (2) Techniques for Design and Implementation of 1-D and 2-D FIR and IIR Digital Filter Banks (Multi-rate Digital Signal Processing)

II. Statistical Digital Signal Processing:
   (1) Adaptive Signal Processing for Array Signals
   (2) Adaptive Array Beamforming Under Random Mismatches
   (3) Adaptive Array Bearing Estimation Under Random Mismatches
   (4) Adaptive Beamforming Using 2-D Circular Array for Wireless CDMA Systems
   (5) Adaptive Minimum Bit Error Rate Beamforming Assisted Receiver for Wireless Communications
   (6) Adaptive Signal Processing Techniques for Smart Antennas with Applications in Wireless and Mobile Communications

III. Processing and Analysis of Biomedical Signals:

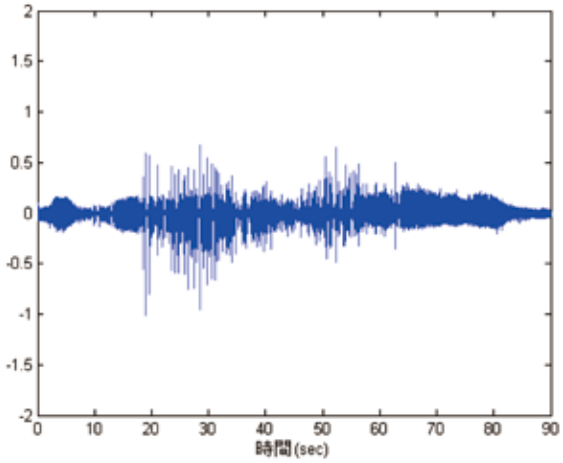
Analysis and Processing of Joint Vibration Signals for the Diagnosis of Cartilage Pathology

(1) Signal Processing Techniques for Vibration Signals of Human Knee Joints

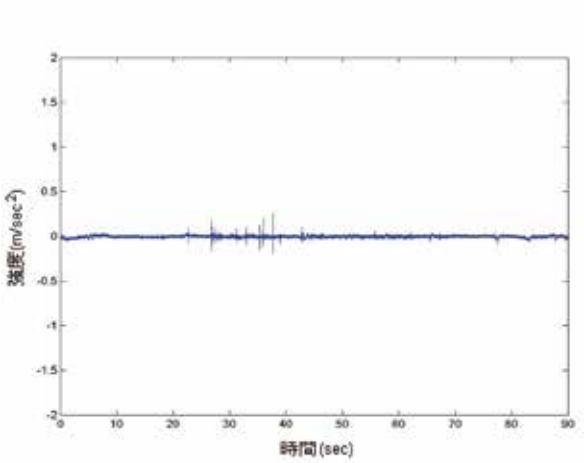
(2) Signal Processing Techniques for Vibration Signals of Equine Knee Joints

(3) Signal Processing Techniques for Vibration Signals of Human emporomandibular joints

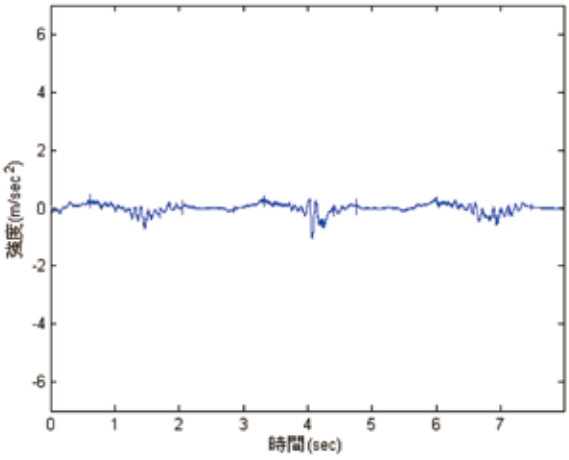
Goal of this research: To conduct research on Vibration Arthrometry (VAM) and provide the public a noninvasive, accurate tool (Expert Systems) for the diagnosis of joint disorders in clinical medicine.



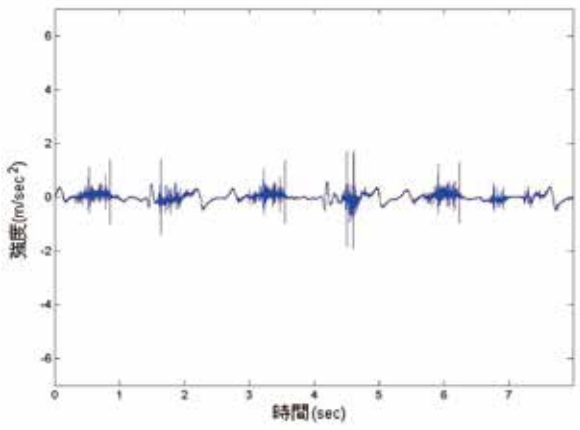
(A) 正常著膝關節在慢速擺動下所產生的振動訊號
(Physiological Patellofemoral Crepitus; PPC)



(B) 非正常著膝關節在慢速擺動下所產生的振動訊號
(Physiological Patellofemoral Crepitus; PPC)



(C) 正常著膝關節在快速擺動下所產生的振動訊號
(Vibration Arthrometry; VAM)



(D) 非正常著膝關節在快速擺動下所產生的振動訊號
(Vibration Arthrometry; VAM)

主要研究領域 Major Research Areas

數位信號處理、智慧型天線與無線通訊信號處理、生醫信號處理、數位影像處理

Digital Signal Processing, Signal Processing for Smart Antennas and Wireless Communications, Biomedical Signal Processing, Digital Image Processing

研究計畫 Research Projects

(1) 應用於視訊信號處理之二維副頻帶濾波器組之設計 (Design of Two-Dimensional Subband Filter Banks with Applications to Video Signal Processing), 行政院國家科學委員會, NSC 97-2221-E-002-116-MY3, NT$650000.00, 2008/8 ~ 2011/7.

(2) 應用於通訊環境下可適性陣列信號處理理論與技術之研究 (Theory and Techniques for Adaptive Array Signal Processing Under Communication Environments), 行政院國家科學委員會, NSC 97-2221-E-002-174-MY3, NT$890000.00, 2008/8 ~ 2011/7.

E-mail: jhlee@ntu.edu.tw
Phone: +886-2-33663657
Office: 電機二館517(EE2-517)
Website: http://www.ee.ntu.edu.tw/profile?id=15
Lab. Phone: +886-2-23635251*553
Lab. : 電機二館553(EE2-553)

李嗣涔 特聘教授

Si-Chen Lee, Distinguished Professor

國立臺灣大學生醫電子與資訊學研究所特聘教授
國立臺灣大學電機工程學系特聘教授

Distinguished Professor, Graduate Institute of Biomedical Electronics and Bioinformatics / Department of Electrical Engineering, National Taiwan University

紅外線元件實驗室

IR Device Laboratory

本實驗室開發之波導型熱輻射紅外光源(圖一)，俱有室溫操作、窄頻寬、可調變波長之特性，且成功地應用在觀察紅外光對植物生長基因表現，和影響癌細胞生長變化的研究。善用窄頻紅外光源，我們可研究動植物細胞持續受到特定波段紅外光照射時，其成長型態、基因表現，以及所有蛋白質表現的增減變化。

研究成果發現4~5μm紅外光照射大腸桿菌24小時，可刺激外膜蛋白(OmpA，OmpF)表現量，增強新陳代謝和菌落生長，結果如同圖二所示。阿拉伯芥經過3~5μm 窄頻紅外光照射72小時後，分析GASA4、CHS、RbcS、NPQ4和PSAK基因，發現不同波段窄頻紅外光可影響生長型態和基因表現。照射3~5μm寬頻紅外光48小時的肺腺癌細胞A549，生長受到明顯抑制，細胞明顯膨大和停滯於細胞週期G2與M，結果如同圖三所示。3~5μm窄頻紅外光照射子宮頸癌細胞HeLa48小時，可破壞粒線體膜電位和增加細胞凋亡，加強化療藥物 Paclitaxel的療效。

Our lab has developed the narrow bandwidth, tunable wavelength and room temperature-operated infrared radiation (IR) waveguide thermal emitteras shown in Fig. 1. It has been applied to investigate the effects of IR radiation on plant growth and cancer cell physiology. Furthermore, narrow band IR emitters can be used to compare growth morphology, gene and protein expression under specific wavelengths of IR radiation.

Recently,we found that 4~5μm IR radiation for 24 hours increased up-expression of membraneproteins (OmpA,OmpF) and growth rates of E. colicolony as shown in Fig. 2. In addition, we found that 3~5μm IR radiation for 72 hours regulated morphology and the genes expression of Arabidopsis, such as the GASA4, CHS, RbcS, NPQ4 and PSAK genes. The 3~5 □m IR radiation can induce cell dilation and G2 /M cell cycle arrest in lung cancer A549 cellsat 48 houras shown in Fig. 3. Moreover,we found that the narrow band infrared radiation with peak wavelengths of 3, 4, and 5 □m for 48 hours can damage mitochondrial membrane potential and cellular apoptosis to enhance the effectiveness of paclitaxel treatment on cervical cancer HeLa cells.

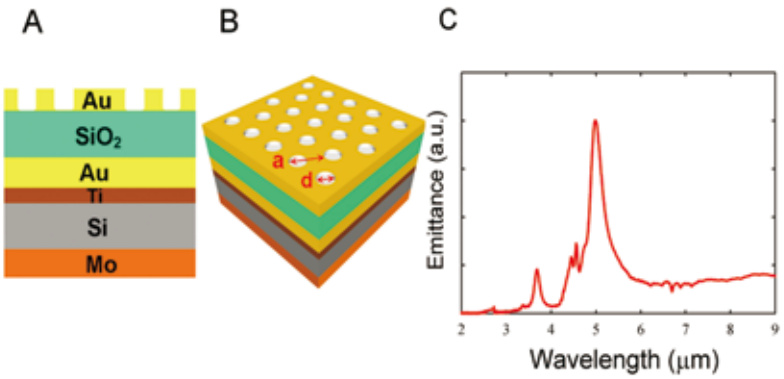


圖1 波導型熱輻射紅外光源(A) 側面圖與(B) 斜面圖，其晶格週期是a孔洞直徑是d(C)頻譜之主要峰值是位於5.0 μm

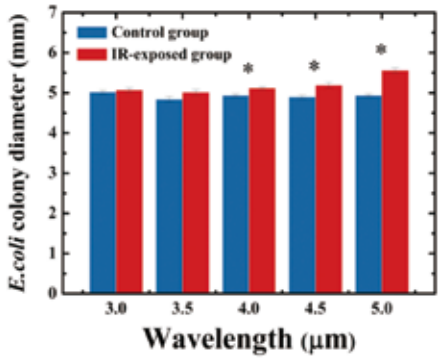


圖2 圖二、腸桿菌照射紅外光24小時之菌落分析

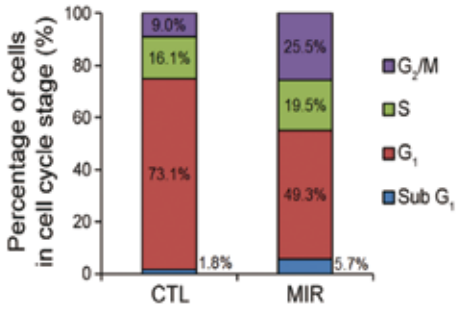


圖3 肺癌細胞A549照射紅外光48小時之細胞週期分佈結果

■ 研究成果

1. Paclitaxel(紫杉醇)可阻斷細胞週期G2與M，聚合和穩定細胞內微管，讓腫瘤細胞在有絲分裂階段被固定住，生長過程受阻斷而凋亡。窄頻波導型熱輻射發射器可發出窄頻紅外光3,4,5 □m破壞子宮頸癌細胞的粒線體膜電位，進而提升Paclitaxel對子宮頸癌細胞HeLa的治療效果。
2. 3~5 □m寬頻紅外光會造成肺癌細胞A549在細胞週期G2/M 停滯和雙股DNA的斷裂，若我們在照光前，使用抗氧化劑NAC 一小時，可消除紅外光造成的雙股DNA斷裂。
3. 窄頻表面電漿子熱輻射發射器照射阿拉伯芥72小時，不同波段的窄頻紅外光可影響GASA4、CHS、RbcS、NPQ4和PSAK基因表現。
4. 4~5μm紅外光照射大腸桿菌24小時，可增強生長代謝，和刺激外膜蛋白(OmpA , OmpF)表現量。

研究計畫 Research Projects

1. 前瞻技術產學合作計畫-7-5nm半導體技術節點研究(3/5)
   Pathfinding for 7–5nm Semiconductor Technology Nodes

E-mail: sclee@ntu.edu.tw
Phone: +886-2-33662000/33664962
Office: 電機二館440 (EE2-440)
Website: http://sclee.ee.ntu.edu.tw/
Lab. Phone: +886-2-33663700*451
Lab. : 電機二館451 (EE2-451)

林致廷 教授
Chih-Ting Lin, Professor

國立臺灣大學生醫電子與資訊學研究所 教授
國立臺灣大學電機工程學系教授
國立臺灣大學電子工程學研究所教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Professor, Department of Electrical Engineering, National Taiwan University
Professor, Graduate Institute of Electronics Engineering, National Taiwan University

生醫晶片技術實驗室
Cmos Biotechnology Laboratory

本實驗室成立於2006年，主要研究方向為電子生醫晶片技術相關研究，目前以生物分子檢測技術、微細胞監測晶片技術、軟性電子材料與無線感測器網路系統等領域為研究重點。進一步的說明，整合現今蓬勃發展的奈微米製程科技與傳統生物科學知識，可以發展出極具應用及發展潛力之關鍵性跨領域技術，因此，本實驗室致力於開發不同之生醫電子應用晶片與系統，期能在相關領域獲得良好之成果與能見度。本實驗室之成員來自電機系、機械系及醫工等工程相關領域，以此為基礎，積極與生醫相關領域學者進行合作，合作領域及研究範疇涵蓋基礎科學、工程技術與臨床研究等。

The bio-related research activity is one of the major focuses in world wide research institutes. However, the advancement of bio-research is limited by costly instruments and time consuming analysis. To overcome this obstacle, in our research group, the nano-electronics and micro-mechanism are integrated to be a powerful tool for this emerging research field.

More specific, a series of bio-chemical molecular sensors can be developed by utilizing nano-scale electrical devices. Based on the superior fabrication facilities and skills in Complementary Metal-Oxide-Semiconductor (CMOS) and Nano/Micro Electro-Mechanical System (N/MEMS), moreover, micro protein sensor arrays technologies and living cell monitoring systems are also envisioned to be an exciting research direction. In summary, our research is aiming at developing innovative and integrated systems for nano/bio research fields.

主要研究領域 Major Research Areas

奈微米生物機電系統、生物晶片、生物分子量測技術、奈米製程技術、生物微感測器、軟性噴墨電子技術
Bio-NEMS, Bio-Chip, Nano fabrication, Biomolecular Detection Technology, Inkjet Printing Organic Electronics

研究計畫 Research Projects

1. 以病人為中心的無線醫療環境-腦與心的對話 – 子計畫三: 智慧型奈米多晶矽心血管疾病生物標誌診斷系統晶片之研發(3/3) (NSC 102-2220-E-002-009)
2. 有機電子噴墨技術與標準半導體電子製程技術整合之異質三維系統晶片架構之研發 (NSC 101-2628-E-002-022-MY3)
3. 整合阻抗分析、光學檢測和光流體晶片的定點照護系統之開發與系統驗證 (NSC 102-2627-E-002-004)
4. 以細胞治療進行毛囊再生：發展大量生產可控制知可注入式誘導性微組織的方法及特化其毛囊誘導特性 (NSC 99-2320-B-002-004-MY3)

■ **研究計畫** - 智慧型奈米多晶矽心血管疾病生物標誌診斷系統晶片之研發
補助單位：行政院國家科學委員會
計畫期間：2011/08/01 - 2014/07/31

心臟冠狀動脈(Coronary Artery Disease)退化及心肌退化症，往往會使患者過勞或進行一些劇烈活動時，引起心絞痛甚至造成患者死亡，已經成為國人十大死因之第二名。雖然近幾年來醫學上對於治療心血管疾病有相當之進步，但心臟衰竭之治療仍具有相當之挑戰性及極限，因此如何提供心衰竭患者全面性的照護，是刻不容緩的議題。其中，最為重要的即為心衰竭的長期及緊急照護之用藥，然而，用藥的效果及用量，會因為心衰竭病患基因之不同而有不同的感受性，因此，如何進一步利用DNA晶片技術進行檢驗及資料篩檢即成為心臟疾病相關早期預警及輔助用藥等生醫照護科技下一步重要的發展。

本研究團隊針對此一課題發展以標準半導體製程為基礎的DNA檢測晶片系統。本研究團隊計劃將以對DNA分子及元件表面處理的了解做為為基礎，利用對奈微米電子元件的知識為工具，先以元件理論分析的方式來建構此一DNA檢測晶片的基礎模型，而後以標準半導體製程技術進行DNA檢測晶片及其相關電路之設計及製作，進一步與臨床資料進行分析比對，期能使國內生物感測元件知識與技術可以確實與臨床治療技術更進一步的整合，並可藉由國內獨步全球之半導體製程技術將此一研究成果落實於生物科學之應用層面上，以提升既有之產業價值。

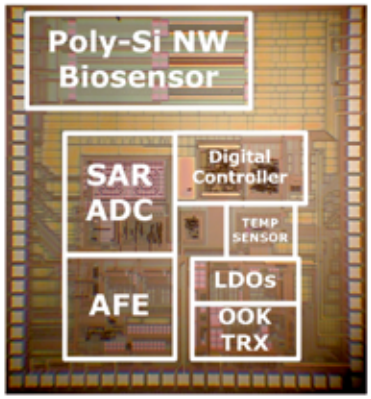
■ Project title:The development of poly-silicon nanowire sensor-system-on-chip for biomarkers in heart failure diagnosis

Supported by: National Science Fundation

Project period: 2011/08/01 - 2014/07/31

With rapid advancements of System-On-Chip and MEMS/nanotechnologies, a wide variety of new chemical analysis devices and their integrated system, such as biomolecular analysis devices and micro-total-analysis systems, have been designed, implemented, and demonstrated. However, few of them integrated with clinical analysis and achieve the practical requirement of the modern biomolecular diagnosis. As the consequence, this research project will aim at the development of DNA analysis system-on-chip for the clinical heart-failure-medicine-treatment, which is one of the most important steps toward the heart failure disease treatment in both emergency and chronic recovery. In specific, this research project will be based on the basic understanding of electronic devices, biomolecular interaction, and nano/micro fabrication to design and implement the DNA chip for heart-failure medicine treatments. Furthermore, this research project will also compare with clinical data in order to bridge the electronics, bioinformatics, and clinical applications into a fully integrated system.

代表圖及中英文說明：



利用CIC以台積電0.35μm標準製程製做出多晶矽奈米線生物分子系統晶片，晶片之特性如圖所示，此一系統晶片包含：一組多晶矽奈米線生物分子感測元件；一組介面放大電路(Interface Circuit)；一組類比數位轉換電路(Analog-to-Digital Converter)；一組微處理器單元(Microcontroller)及一組無線收發器(On-Off Key Tranceiver)。此一晶片將可以有效地將生物分子感測之信號，以無線收發的方式發送至PC，此一系統晶片為首顆落實半導體奈米線生物分子感測之系統晶片。

Technology	TSMC 0.35μm CMOS	*Digital Controller*	
Chip Area	6.26mm²	Clock Rate	1MHz
Poly-Si NW Biosensor		Power Consumption	9.8 μW
Type	N Type NW	*SAR ADC*	
Width/Height	625/170 nm	Resolution	10 bits
Analog Front-end (AFE)		Conversion Rate	100KSPS (Max)
Power Consumption	IA: 387 μW@3V LPF:130 μW@3V	ENOB	9.4 bit @0.57KHz
ICMR	0~2.75V	Power Consumption	1.8μW @1KSPS 20μW @10KSPS
CMRR	137dB	*OOK Receiver*	
Unit-Gain BW of DDIA	1.7MHz	Operation Freq.	433.92 MHz
Chopping Freq.	10kHz	Sensitivity	-62 dBm
Temperature Sensor		Power Consumption	7.2 mW @ 1.8V
Power Consumption	194.2μW @3V	*OOK Transmitter*	
R-Squared Value	0.9999	Operation Freq.	433.92 MHz
Temperature Range	-20~120 ℃	Output Power	-10 dBm
		Power Consumption	7.2 mW @ 1.8V

E-mail: timlin@ntu.edu.tw
Phone: +886-2-33669603
Office: 電機二館447 (EE2-447)
Website: http://bio-cmos.blog.ntu.edu.tw/
Lab. Phone: +886-2-33663719
Lab. : 電機二館450 (EE2-450)

林啟萬 教授
Chii-Wann Lin, Professor

國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學醫學工程研究所教授
國立臺灣大學電機工程學系教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/
Graduate Institute of Biomedical Engineering/
Department of Electrical Engineering, National Taiwan University

醫用微感測器暨系統實驗室
Medical Micro Sensor and System Lab.

本實驗室致力於配合醫療儀器認證與驗證法規之推動與精神體現，以微機電技術與光學感測方式進行生醫奈微米微感測器元件與系統整合之研究與應用-包括表面電漿共振(surface plasmon resonance)原理，表面電漿子感測器設計、微型系統整合、軟硬體介面溝通，主旨在於發展快速、便利、正確、與人性化醫用感測儀器，以促進個人化醫學(personalized medicine)與電子化醫療(e-health)之研究與產業發展。

We have devoted to apply microfabrication technologies and optical sensing mechanisms to develop nano/micro sensors and integrated system for the medical applications with compliance of medical device regulations and standards. Our research currently focus on the theoretical development for novel Surface Plasmon Resonance (SPR) devices, design of SPR nano/micro sensor, bioplamonics, and the heterogeneous integration of micro-system from hardware to software. The aim is to develop the fast diagnosis, easy to use, and user-friendly medical devices toward the success of personalized medicine and e-health.

主要研究領域 Major Research Areas

生物微感測器與系統、生醫晶片、生醫光電、類神經網路、醫材法規

Bioelectronics, Biomedical Micro sensors and System, Biochip, Biomedical Optics, Artificial Neural Networks, Regulatory Affairs

研究計畫 Research Projects (103學年度：1030801-1050731)

1. 針對大腸腫瘤及淋巴结轉移的早期發現和清除的光電醫學診斷與治療關鍵問題研究102-2218-E-002 -014 -MY3
2. 無線充電高頻脈衝電刺激貼片於腕隧道症候群之應用研發 102-2320-B-002 -040 -MY2
3. 國立臺灣大學萌芽創業推廣計畫-拋棄式表面電漿子共振晶片原型開發與前臨床驗證 103-2812-8-002-003-
4. 以軟體鎖相偵測與智慧手機實現無所不在的表面電漿子共振生物感測平台MOST 105-2221-E-002 -016 -MY3

E-mail: cwlinx@ntu.edu.tw
Phone: +886-2-33665272
Office: 永齡生醫工程館 526
Website: http://bionems.bme.ntu.edu.tw/

林發暄 教授
Fa-Hsuan Lin, Professor

國立臺灣大學醫學工程研究所教授
國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學腦與心智科學研究所教授
國立臺灣大學醫學院醫學系放射線科教授

Professor, Institute of Biomedical Engineering, National Taiwan University
Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Professor, Graduate Institute of Brain and Mind Sciences, National Taiwan University
Professor, Department of Radiology, School of Medicine, National Taiwan University

人腦實驗室
Lab of Brain Imaging and Modeling

近年來，科學界逐漸了解複雜的人類行為與認知功能是藉由腦中不同階層的神經系統交互作用所表現出來, 而非由單一的結構所掌控，有鑑於此，欲進一步了解人腦功能，則需要在結構與功能層面上研究以下三個問題: (1)什麼地方發生活動(2)這些活動是何時發生以及其發生順序為何(3)是如何藉由在大規模的神經網路中的訊息傳遞完成這些認知行為。現代非侵入性的醫學影像技術可幫助我們獲得高空間與時間解析度的神經活動資料，而定量的系統模擬將有助於解譯隱含於這些神經影像資料中協同完成感官，認知，與行為歷程的動態神經活動。

本實驗室的研究方向為整合硬體研發, 資料分析, 與數值模擬等工程技術來幫助我們了解複雜的人腦功能. 進行中的研究計畫集中於結合結構與功能性核磁共振影像, 腦磁圖與腦電圖之高時間空間解析度的神經影像技術, 以及系統階層的神經信號模擬. 以了解神經活動與行為間的關係。

Complex behavior and cognitive functions of the human brain are suggested to be "mapped at the level of multi-focal neural systems rather than specific anatomical sites, giving rise to brain-behavior relationships that are both localized and distributed''. Further understanding of these brain mechanisms requires both structural and functional knowledge to answer (i) where are the foci of activity, (ii) when are these areas activated and what is the temporal sequence of activations, and (iii) how does the information flow in the large-scale neural network during the execution of cognitive and/or behavioral tasks. Advanced noninvasive medical imaging/recording modalities are able to localize brain activities at high spatial and temporal resolution. Quantitative modeling to interpret these data is needed to understand how large-scale distributed neuronal interactions underlying perceptual / cognitive / behavioral functions emerge and change over time.

Our research interests include the integration of hardware development, data analysis, and mathematical modeling to facilitate our understanding of brain cognition. Current research projects try to explore challenges of spatiotemporal brain imaging and modeling by using a combination of hardware and analytical approaches to enhance the spatiotemporal resolution of single (MRI) or combined (MRI/fMRI and MEG/EEG) modalities. In addition, mathematical approaches for identifying large-scale neural networks and their correlation to behavioral measurements are investigated.

主要研究領域 Major Research Areas

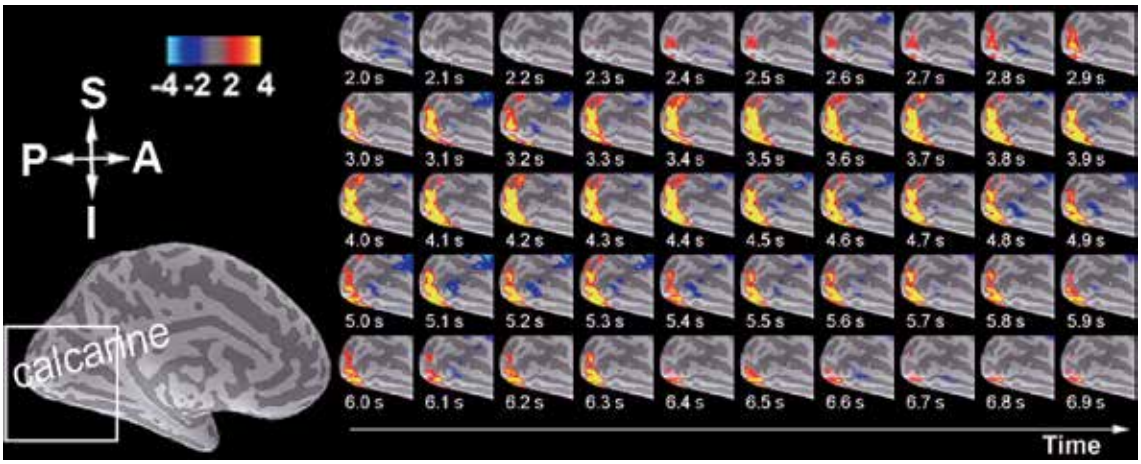
神經影像、核磁共振影像、腦磁圖、腦電圖、神經系統模擬

Neural imaging, Magnetic resonance imaging, Magnetoencephalography (MEG), Electroencephalography (EEG), Neuronal modeling

研究計畫 Research Projects

1. 科技部計畫 -【應用於人腦神經網路之快速核磁共振影像技術發展】
   Devleopment and application of fast functional magnetic resonance imaging technology
2. 科技部計畫 -【整合高解析度核磁共振影像與經顱磁刺激器系統】
   Integrated high spatiotemporal resolution magnetic resonance imaging and transcranial magnetic stimulation system
3. 教育部桂冠型研究計畫【應用於人腦神經網路之快速核磁共振影像技術發展】
   Devleopment and application of fast functional magnetic resonance imaging technology

■ **研究計畫** - 利用多種神經影像進行人腦視覺系統之時空映像與系統模擬
Multimodal spatiotemporal brain mapping and modeling of human visual system
之代表圖及中英文說明：



A single-subject 100-ms resolution INI fMRI time series of activations to visual stimulation (TR/TE=100/30 ms, flip angle 20º, FOV=200 mm), co-registered to a flattened region of the left occipital cortex. The data were obtained using a 32-channel head coil array in 128 randomized trials, each of which consisted of 6 seconds pre-stimulus baseline, followed by 8-Hz flashing checkerboard flashing for 0.5 sec and subsequently 23.5 s post-stimulus (30 sec in total for each trial). The time stamps labeled in the figure indicate time after onset of the flashing checkerboard.

單一受試者對於視覺刺激以100毫秒解析度INI重建之功能性核磁共振影像(fMRI)時間序列 (TR/TE = 100/30毫秒，Flip angle = 20度，視野 = 200微米)。本實驗使用32通道頭部線圈陣列，資料從128次隨機呈現的刺激中取得，每此測試包含了6秒的baseline，跟接下來的0.5秒8Hz閃爍棋盤格刺激，以及接下來的23.5秒後刺激期 (每次總共30秒)。圖上的時間標記指的是閃爍棋盤格刺激開始後的時間。

E-mail: fhlin@ ntu.edu.tw
Phone: +886-2-33665264
Office: 展書樓703(JanShu Hall-703)
Lab. Phone: +886-2-33669702
Office: 展書樓701/702(JanShu Hall-701/702)

呂學一 教授

Hsueh-I Lu, Professor

國立臺灣大學生醫電子與資訊學研究所教授
國立臺灣大學資訊工程學系暨研究所教授
國立臺灣大學網路多媒體研究所教授

Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/ Department of Computer Science and Information Engineering/ Graduate Institute of Networking and Multimedia, National Taiwan University

演算法實驗室

Algorithmic Research Lab.

演算法實驗室於2005年成立，本實驗室的研究專注於基礎演算法的設計、分析以及應用。

The Lab of Algorithmic Research was established in 2005. Our research focuses on fundamental algorithms and their applications.

主要研究領域 Major Research Areas

演算法、圖論

Algorithms, Graph Theory

研究計畫 Research Projects

圈與洞之圖論演算法

圖論演算法與資料結構之研究

E-mail: hil@csie.ntu.edu.tw
Phone: +886-2-3366-4888*522
Office: 德田館522 (CSIE-522)
Website: http://www.csie.ntu.edu.tw/~hil/
Lab. Phone: +886-2-3366-4888*406
Lab. : 德田館406 (CSIE-406)

孫啟光 特聘教授

Chi-Kuang Sun , Distinguished Professor

國立臺灣大學生醫分子影像研究中心 核心實驗室召集人
國立臺灣大學生醫電子與資訊學研究所特聘教授
國立臺灣大學光電工程學研究所特聘教授
國立臺灣大學電機工程學系特聘教授
國立臺灣大學光電生物醫學研究中心教授
中央研究院應用科學研究中心合聘研究員
中央研究院物理研究所合聘研究員

Head of Core Laboratory, Molecular Imaging Center, National Taiwan University
Distinguished Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University.
Distinguished Professor, Graduate Institute of Photonics and Optoelectronics, National Taiwan University.
Distinguished Professor, Department of Electrical Engineering, National Taiwan University.
Professor, Center for Optoelectronic Medicine, National Taiwan University
Adjunct Research Fellow, Research Center for Applied Sciences, Academia Sinica.
Adjunct Research Fellow, Institute of Physics, Academia Sinica.

奈米生醫光電實驗室

Bio-nanophotonics Lab.

本實驗室在致力於發展非侵入式光學顯微影像術，以於臨床受試者或活體動物體內取得三維深層次微米解析之次細胞級影像。所發展之獨特技術包含倍頻顯微術、超解析雙光子顯微術、雙光子聲光顯微術等。所發展的技術，可於臨床受試者皮膚與黏膜內，在無傷害且不須染色切片的情況下，直接取得病理切片級的光學顯微影像(稱之為光學虛擬切片影像)，並將此技術應用於早期癌症檢測、次微米活體臨床神經影像、與術前、術中、術後之臨床即時檢測、邊緣鑑定與療效追蹤。

主要研究領域 Major Research Areas

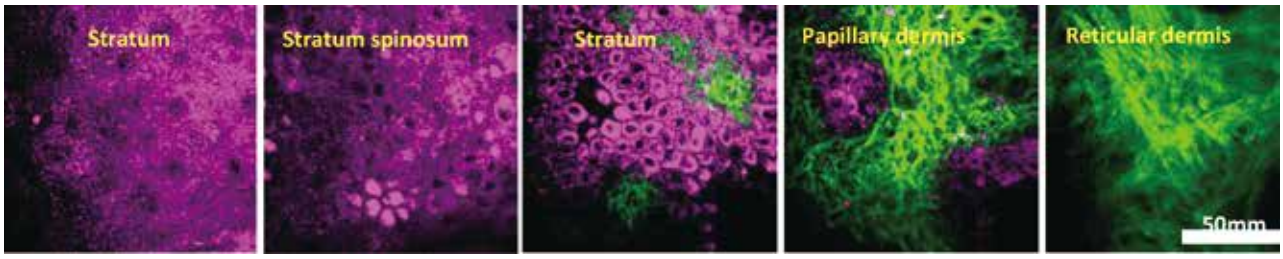
非侵入式光學奈米影像與操控、兆赫波與微波生醫應用、奈米超音波

Non-invasive optical microscopy and manipulations, THz and Microwaves for biomedicine, nano-ultrasonics.

研究計畫 Research Projects

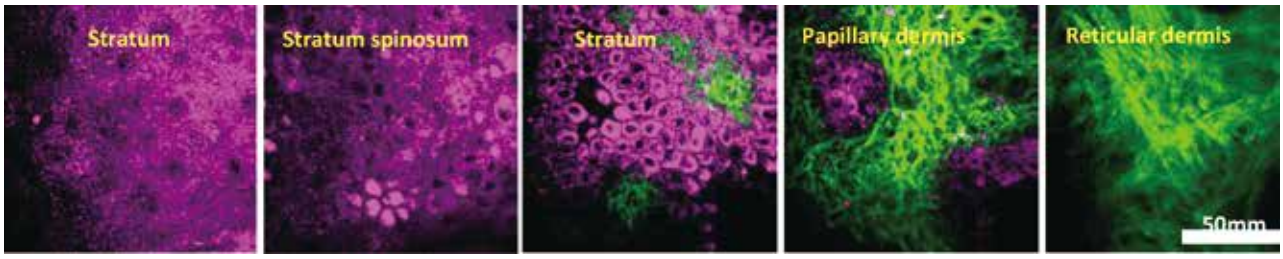
1. 頻譜解析三倍頻顯微術 (2/3)：科技部
   Spectrally-resolved Third Harmonic Generation Microscopy
2. 倍頻式光學虛擬活體切片術 (第7年)：國家衛生院
   Harmonics-Based Invio Optical Virtual Biopsy

■ **研究計畫** - 倍頻式光學虛擬活體切片術Harmonics-based in vivo optical virtual biopsy之代表圖及中英文說明-1：



In vivo harmonic generation microscopic images of human skin, taken at different depths.
於人體活體皮膚不同深度所取得之倍頻式光學虛擬切片影像。

■ 代表圖及中英文說明-2：



In vivo harmonic generation microscopic images of human oral mucosa, taken at different depths.
於人體活體口腔黏膜不同深度所取得之倍頻式光學虛擬切片影像。

E-mail: sun@ntu.edu.tw
Phone: +886-2-3366-5085
Office: +886-2-3366-1552
Website: http://ufo.ee.ntu.edu.tw
Fax: +886-2-3366-1552

孫維仁 教授
Wei-Zen Sun, Professor

國立臺灣大學醫學院麻醉科教授
國立臺灣大學醫學院緊急醫療研究中心主任
國立臺灣大學神經科學及認知中心副主任
國立臺灣大學腦與心智科學研究所合聘教授
國立臺灣大學生醫電子與資訊學研究所合聘教授

Professor, Department of Anesthesiology, National Taiwan University
Vice Chair, Neurobiology and Cognitive Science Center, National Taiwan University
Chair, Center for Emergency Medical Service, National Taiwan University

臨床-生物醫學工程-產業融合實驗室

Merger Laboratory for Clinical Sciences, Biomedical Engineering and Industry

本融合實驗室由孫維仁教授成立於1992年，主要工作是從臨床服務的病患需求觀點，來提供醫療儀器與資訊處理之相關整合研究和產品研發。九〇年代開始，是以病患自控式鎮痛儀(Patient-Controlled Analgesia, PCA)導入數位化和無線化技術為主軸的急性疼痛服務提升，開發出 i-Pain®整合平台，並已和領先全球品牌進行緊密的結合。〇三年經歷SARS氣管插管爆發群聚感染的致命性災難時，本融合實驗室針對非感染性醫材的迫切市場需求，研發出可拋式內視鏡Sunscope®，獲得經濟部學界科專和產業的贊助，朝向全球商業市場邁進。三位一體的融合實驗室成立的宗旨就是要：敞開各專業的籓籬，主動並積極的邀集跨領域人才進行多元腦力激盪，讓一切研發終極目標導向臨床應用，通過醫師嚴格的臨床驗證，確保病患實際需求獲得超值滿足，以吸引產業關注和早期資本投入。

In 1992, Professor Wei-Zen Sun founded the merger laboratory in National Taiwan University Hospital. Based on the unmet demand from patient’ s perspective, we have successfully provided innovative development of medical devices and informatics through synergistic interaction among clinician, and biomedical engineer, and entrepreneur. We started by integrating the digital and wireless technology with conventional PCA pump (patient-controlled analgesia) to transform into an update web-based platform, i-Pain®. This product is currently adopted by a global leader brand and served as the major service module in Asia. In 2003, as SARS outbreak through non-protected endotracheal intubation, we developed the most advanced intubation device with disposable visual tube. This design totally eliminates the risk of air-borne lethal infection by avoiding close contact with patient’ s airway. This innovative product, Sunscope®, has won a first prized award and is currently supported by government grant and industry investment. Collectively, we establish this merger laboratory to trigger brainstorming among multidisciplinary specialties and to make sure that the cross-reaction of respective domain knowledge is taken place under the goal: to put forth any helpful effort and technology in synergy, to assess the product under critical assessment of clinicians, to bring in industry investment and commercial distribution for patient welfare.

主要研究領域 Major Research Areas

臨床與生物醫學工程與產業整合、疼痛醫學、麻醉醫學、緊急醫療

Integration of Clinical Science, Biomedical Engineering and Industry; Pain Medicine; Anesthesiology; Emergent Medical Service

研究計畫 Research Projects

1. i-Pain®(美商赫士睿公司技術轉移，Hospira，USA)
2. 輸液幫浦研發（經濟部學界科專委託計畫）
3. 應用巨量資料探勘、地理空間資訊分析技術與實證醫學針對我國緊急救護服務之醫療資源配置、管理與未來規劃進行整體研究計畫（科技部委託計畫）
4. 基於生命之鏈週期探討智慧型穿戴式裝置之臨床應用─以急重症及術後照護為例（科技部委託計畫）

E-mail: wzsun@ ntu.edu.tw
Phone: +886-2-23123456*65522
Office: 臺大醫院研究大樓四樓(麻醉部第一實驗室)
永齡生醫工程館706室

田維誠 副教授
Wei-Cheng Tian, Associate Professor

國立臺灣大學生醫電子與資訊學研究所副教授
國立臺灣大學電子工程學研究所副教授
國立臺灣大學電機工程學系副教授

Associate Professor, Graduate Institute of Biomedical Electronics and Bioinformatics/Graduate Institute of Electronics Engineering/Department of Electrical Engineering, National Taiwan University

微奈米分析技術及系統實驗室
Micro/Nano Analytical Technologies & Systems Lab.

本實驗室由田維誠教授成立於2009年。本實驗室的研究方向為微奈米分析技術及系統在生醫檢測, 醫療技術, 及生物化學應用之研究。本實驗室的研究重心在微奈米機電,微奈米流體力學,及有關元件系統整合,封裝,及可靠性之研究,並希望與CMOS製程相結合。

未來將以微奈米分析技術及系統儀器出發,希望能大幅改進臨床前,臨床,及體外診斷之準確性,速度,成本,及使用方便性。

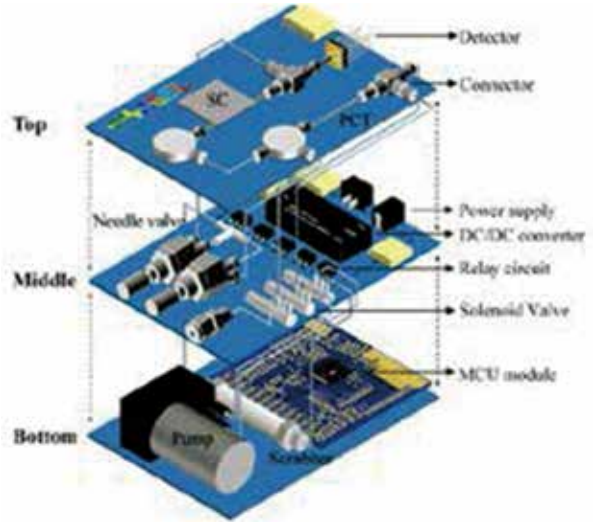
My research interests are on biological, chemical, and medical applications of micro & nano technologies with the focus on the CMOS compatible integration, packaging, and reliability of the micro/nano devices and systems. The future goal is to improve the accuracy, speed, cost, and ease-of-use of pre-clinical, clinical, and in vitro diagnostics by using micro/nano-enabled systems or instrumentations.

主要研究領域 Major Research Areas

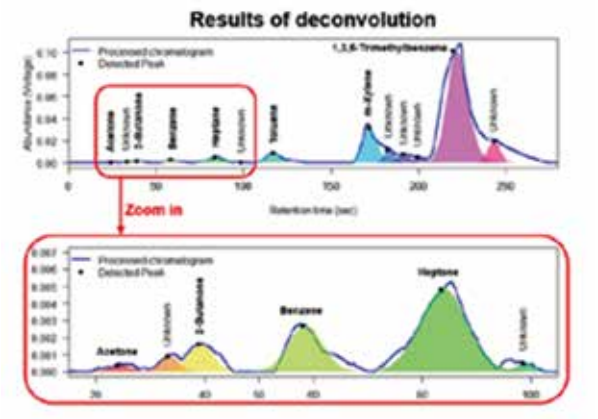
微奈米分析及流體集成技術,、微奈米機電系統儀器在生化醫療之應用
Micro and nano analytical & fluidic integrated technologies, MEMS/NEMS enabled instrumentation for biological, chemical, and medical applications.

1. 微型氣相層析儀 (Micro Gas Chromatography, µGC)
   應用於揮發性有機化合物檢測之可攜式微型氣相層析系統
   計劃補助單位：改善前瞻研究領航計畫 (三年期計劃) 計劃編號：104R7624-2

隨著科技日新月異，人類平均壽命增長造成人口老化；工業的發達，其背後也伴隨著各類型汙染物的產生，接踵而來的是慢性病和癌症之好發率提高。根據研究指出，揮發性有機化合物(Volatile organiccompounds, VOCs)於環境中或者是人體內的含量扮演著非常重要的指標，因此，若能對空氣或者人體進行長期監控檢測，是非常重要的。由於傳統的揮發性有機化合物檢測儀器，其體積較為龐大，並且操作較不便利，因此本團隊提出一可攜式微型氣相層析儀(Micro gas chromatography, µGC)，將其應用於檢測揮發性有機混合氣體。



可攜式微型氣相層析儀架構示意圖

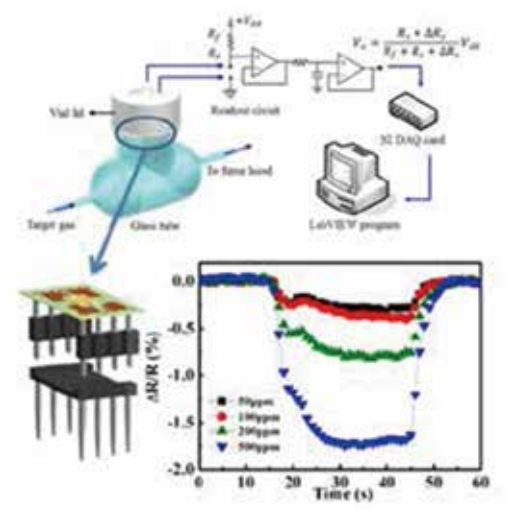


七種潛在性肺癌因子氣體層析圖

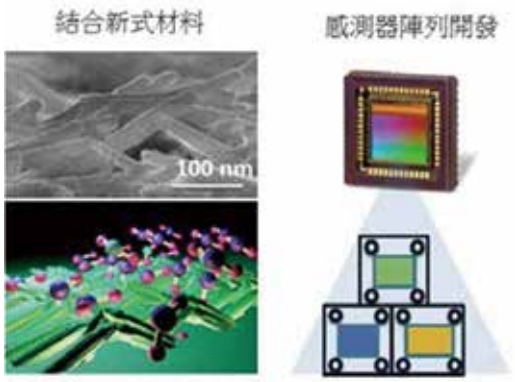
2. 氣體感測器陣列 (Sensor arrays)
開發揮發性有機氣體偵測之高靈敏與常溫氣體感測器陣列

對於未知氣體在環境檢測一直是十分重要的角色，如過量的有毒氣體(如甲苯)可能對人體造成如抑制中樞神經系統、致癌等危害；此外，對於環境中的未知氣體(如丙烯)在特定的濃度內，更可能發生氣爆等不可忽視的問題，所以開發量測快速與未知氣體的氣體感測器陣列是十分重要的課題。

本組具體之研究主題有二：1. 結合新式材料(如奈米材料)且具備高靈敏度的常溫型量測氣體感測器。我們使用微機電 (Microelectromechanical Systems, MEMs) 製程開發平面指叉狀電極，並結合奈米技術，或是其他極具潛力的氣體感測材料，提高氣體感測器的靈敏度與量測極限。2. 感測器陣列開發。結合多種不同材料之氣體感測器並組成陣列，目的為量測未知氣體濃度與組成比例，量測結果結合電路整合，將所得之感測訊號以矩陣處理，目前所開發氣體感測器陣列對於未知氣體的分析預測組成，誤差皆達 5% 以下，可靠度佳，並期望最終可應用於電子鼻(Electronic Nose) 之前端系統。



量測氣體生成系統與感測器對應甲苯的反應數據

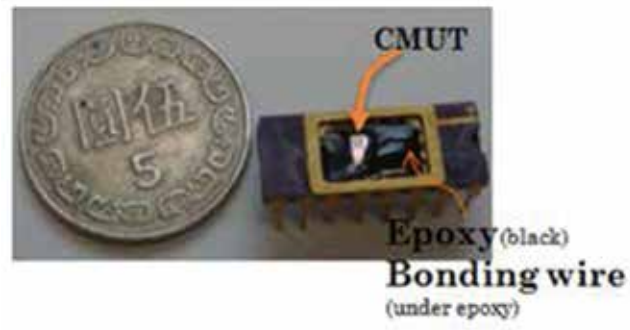


氣體感測器之研究主題

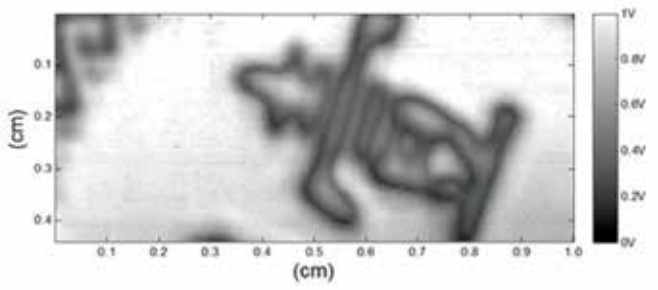
3. 電容式微機電系統傳感器 (cMUT)
應用於血管內超音波之前視型互補式金氧半導體超音波換能器開發
計劃補助單位：科技部 (三年期計劃) 計劃編號：103-2221-E-002-061-MY3

心血管疾病長年來位居我國十大死亡原因的第二名，根據統計，在民國101年有高達11.1%的人死因是由其相關疾病所造成。心導管檢查為其最主要的方式，此方式有主要三個缺點：1. 血管本身的彎度或是走向會使得影像無法精確呈現出冠狀動脈的血管硬化程度，2. 在阻塞率不到50%或是硬化堆積均勻時無法藉由心導管檢查判斷真實病況，3. 顯影劑的注射對人體的腎臟會造成負擔。超音波影像不會產生游離輻射(Ionizing radiation)對人體造成輻射傷害，且具有非侵入性(Non-invasive)、即時性(Real time)、可攜性的優點，因此在臨

床醫學上的運用十分廣泛。因此，本團隊利用台積電0.35μm製程，基於CMOS-MEMS所開發的CMUT元件，主要優點在於經由適當設計，可以讓元件與後端電路進行最緊密的整合，以達到最大微小化；並可降低寄生電阻，提昇訊號品質。



TSMC 0.35 μm CMOS-MEMS製程之cMUT封裝圖

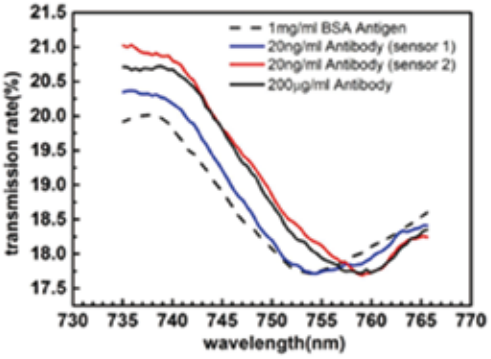


一元硬幣非破壞性檢測結果圖

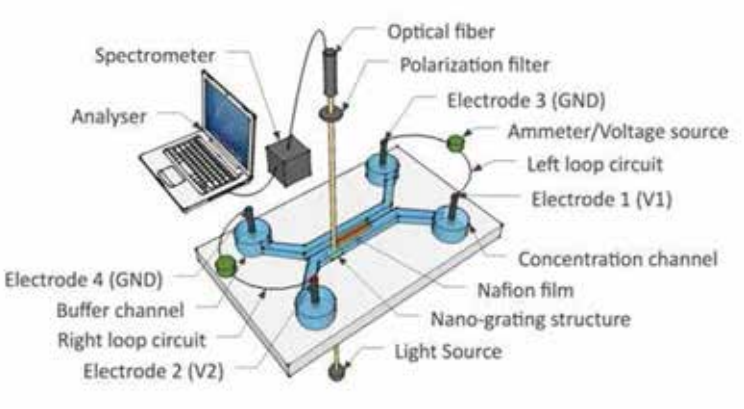
4. 微奈米流道 (Micro/nanofluidic)

開發奈米預濃縮與週期性奈米金屬閘表面電漿共振感測器結合於免標定光學免疫分析平台

在現今免疫分析方法中，要做到免標定的超低濃度檢測是目前多數生物感測平台所面臨的一大困難。表面電漿共振生物感測器，有免標定且可即時檢測等優點，在這幾年被大量的研究以及應用，但因為其檢測原理的限制，使其最低檢測濃度往往無法符合我們需求。在本研究中，我們將奈米預濃縮的功能加入表面電漿共振的感測器中，完成一可預濃縮生物分子再進行表面電漿共振感測的全程免標定免疫分析平台。



牛血清蛋白用於免疫分析平台之量測結果



奈米預濃縮結合週期性奈米金屬閘表面電漿共振感測器之免標定光學免疫分析平台

E-mail: wctian@ntu.edu.tw
Phone: +886-2-33669852
Office: 明達館517 (MD-517)
Website: http://www.ee.ntu.edu.tw/e_profile?id=100116
Lab. : 明達館509 (MD-509)

曹建和 副教授
Jen-Ho Tsao, Associate Professor

國立臺灣大學生醫電子與資訊學研究所副教授
國立臺灣大學電信工程學研究所副教授
國立臺灣大學電機工程學系副教授

Associate Professor, Graduate Institute of Biomedical Electronics and Bioinformatics / Graduate Institute of Communication Engineering / Department of Electrical Engineering, National Taiwan University

數位信號處理實驗室
Digital Signal Processing Lab.

本實驗室的研究領域包括醫用超音波成像及通訊信號處理。醫用超音波成像研究包括 3D 立體成像、血流流速估測、超音波斷層掃描、超音波信號誤差校正、二維陣列波束成形架構設計、對比劑成像與非線性成像等。

Medical Ultrasound Imaging
Bio-signal Analysis
Underwater Acoustic Communication

主要研究領域 Major Research Areas

一、超音波成像

B-mode脈衝壓縮影像系統常被用在內科的診斷上，由於成像的發射和接收系統常是固定的設定參數，以及非適應性的訊號處理技術，以致影像的品質受到限制。我們提出–最佳化發射-可適性接收脈衝壓縮對比劑諧波成像系統，此技術主要包含兩部份，分別是最佳化發射訊號，以及回波訊號之可適性脈衝壓縮。特別考慮非線性參數組織和微汽泡之時變訊號的影響。由於(1)組織發生變異時，會導致其非線性參數特性改變，影響產生二倍頻諧波強度的機制，以及(2)氣泡濃度分布隨著時間的變化，在這兩個重要條件影響之下，使用一般固定發射頻率的超音波成像系統，無法達到最佳的對比度以及解析度，因此發射和接收的系統參數的最佳化是需要被研究的。本研究提出的最佳化系統，在發射系統方面透過Optimal Iterate Search Method 找出最佳發射頻率來提高回波訊號功率，且利用即時回波訊號頻譜估測，自動產生新的envelope function 發射訊號，達到Pre-enhancement的目的，進而提高解析度。在接收系統方面，將透過估測頻譜技術，對回波之諧波訊號進行可適性的脈衝壓縮，再一次提高訊號對比度以及解析度。透過發射和接收部分的兩次最佳化，有別於一般的脈衝壓縮影像系統，以期將來使用於心臟內科以及肝臟的臨床診斷。

二、生醫訊號處理：

含麻醉生理訊號分析及胎兒心電圖的研究。

胎兒心電圖：

胎兒心電圖的觀察有實際上的困難,因為胎兒位於母體之內，皮膚上的電極所紀錄的信號中，同時存在兩個本質上相同的來源，為母親和胎兒的心臟。尤其母親心電圖的信號強度遠大於胎兒心電圖，更增加了處理上的困難。另外，因為胎兒心電圖十分微弱，其他生理現象所產生的干擾或是量測上造成的雜訊，相對於胎兒心電圖的影響也會十分顯著。本研究著力於胎兒心電圖的信號取得。

研究計畫 Research Projects

1. 一個用於二次諧波脈衝壓縮成像之多頻合成技術　2010 ~ 2013
2. 超音波對比劑諧波成像之最佳訊號參數選擇　2013~ 2014

E-mail: jhtsao@ ntu.edu.tw
Phone: +886-2-33663580
Office: 電機二館215 (EE2-215)
Lab Phone: +886-2-33663700*552
Lab.: 電機二館552 (EE2-552)

吳文超 副教授
Wen-Chau Wu, Associate Professor

國立臺灣大學腫瘤醫學研所副教授
國立臺灣大學生醫電子與資訊學研究所合聘副教授
國立臺灣大學醫學院附設醫院影像醫學部合聘副教授
國立臺灣大學臨床醫學研究所合聘副教授

Associate Professor, Graduate Institute of Oncology, National Taiwan University
Adjunct Associate Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Adjunct Associate Professor, Department of Medical Imaging, National Taiwan University Hospital
Adjunct Associate Professor, Graduate Institute of Clinical Medicine, National Taiwan University

臨床磁振影像實驗室
Clinical Magnetic Resonance Imaging Lab.

本實驗室由吳文超教授成立於2010年，主要從事磁共振影像技術開發與臨床應用之相關研究，目前以微灌流影像與功能性影像為研究重點，並與台大醫院影像醫學部、神經部、核子醫學部合作，建立多模技術平台，提高於臨床診斷及預後的準確性。

Professor Wen-Chau Wu founded the Laboratory for Clinical Magnetic Resonance Imaging in the summer of 2010. The main research focus has been placed on the technical development and clinical applications of magnetic resonance imaging (MRI). Currently, we are conducting two NSC funded projects using advanced MRI techniques, including multi-modal functional MRI, perfusion MRI (arterial spin labeling, dynamic susceptibility contrast enhanced imaging, and dynamic contrast enhanced imaging), and diffusion-weighted MRI. We closely collaborate with the Departments of Medical Imaging, Neurology, and Nuclear Medicine in National Taiwan University Hospital to build up a multi-modal framework to improve the accuracy of diagnosis and prognosis in various diseases.

主要研究領域 Major Research Areas

微灌流磁共振影像、功能性磁共振影像、醫學影像處理、生醫信號分析

Perfusion Magnetic Resonance Imaging (Arterial Spin Labeling and Contrast-Material-Based Methods), Functional Magnetic Resonance Imaging, Medical Image Processing, Biomedical Signal Analysis

研究計畫 Research Projects

1. 以進階磁振影像參數診斷腦瘤：延伸擴散影像與對比劑灌流影像之結合與比較
   Diagnosis of brain tumors using advanced magnetic resonance imaging parameters – combination and comparison of extended diffusion imaging and contrast-material-based perfusion imaging
2. 結合血氧濃度對比與動脈氫質子標記磁振影像探討咖啡因對大腦功能性連結之影響
   Investigation of caffeine' s effect on cerebral functional connectivity using combined BOLD and ASL MRI

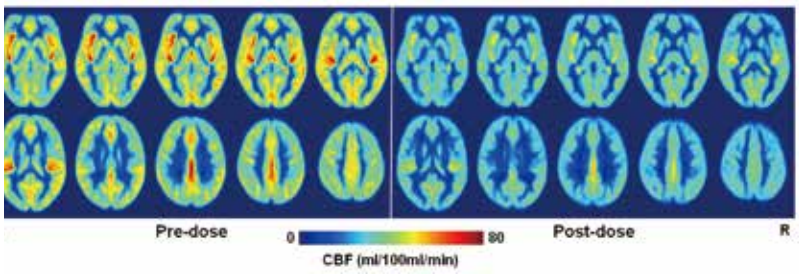


Figure 1. Quantitative perfusion maps averaged over 17 healthy participants before and after caffeine ingestion. Two hundred milligrams of caffeine decreased the gray matter perfusion by 24% ±7%. No significant perfusion change was found in placebo data.

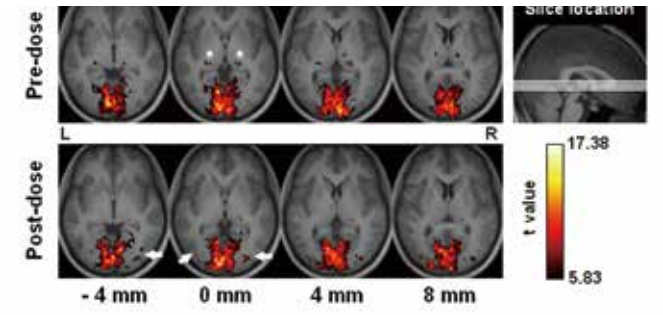


Figure 2. Group functional connectivity of the visual cortex (N = 17, eyes-open during the scan). Slice location is marked in units of millimeters. Caffeine alters the integration of relay area (the lateral geniculate nuclei as indicated by asterisks) and attention-associated area (the extrastriate visual areas as indicated by arrows) in the functional connectivity of the visual cortex.

E-mail: wenchau@ntu.edu.tw
Phone: +886-2-23123456*88653
Office: 明達館704 (MD-704) (temporary)
Website: homepage.ntu.edu.tw/~ntuoncology/faculty/wenchauwu/index.htm

楊泮池 特聘教授

Pan-Chyr Yang, Distinguished Professor

國立臺灣大學生醫電子與資訊學研究所特聘教授
國立臺灣大學醫學院內科教授
中央研究院生物醫學研究所合聘研究員
中央研究院院士
國立臺灣大學校長

Distinguished Professor, Graduate Institute of Biomedical Electronics and Bioinformatics
Department of Internal Medicine, College of Medicine, National Taiwan University
Research Fellow, Institute of Biomedical Sciences, Academia Sinica
Academician, Academia Sinica
President, National Taiwan University

中研院生醫所

IBMS RM511

我們主要研究工作有下列四方面（1）找尋國人肺癌之危險基因。（2）建立體外癌轉移模式，全基因體搜尋癌轉移相關基因。（3）發現新的癌轉移基因及機轉做為診斷及治療標的。（4）研究癌細胞與周邊微環境之交互作用，特別是發炎細胞與癌細胞的互動。我們以cDNA基因微陣列研究基因之調控，訊息傳遞及功能。在基因流行病學研究我們已找到數個國人肺癌之危險基因，我們更以自己建立之肺腺癌之細胞株，利用侵襲篩選之細胞培養方式，篩選出高侵襲能力之子細胞株，並在老鼠實驗動物模式證明高侵襲肺癌細胞株也同時具有高轉移能力，利用以一體外模式及cDNA微陣列，我們可以全基因體找尋癌轉移之相關基因，在含9600基因之微陣列中我們找到近600個基因與肺癌轉移有關，我們將利用這些基因製成癌轉移檢測晶片推廣至臨床使用。同時在這些癌轉移相關基因中，我們發現新的抑癌轉移基因及促癌轉移基因如Collapsin Response Mediator Protein-1 (CRMP-1)，LCRMP-1，HLJ1及Slug等。這些基因在癌轉移之分子調控機制為目前主要研究之重點，且此類新的癌轉移相關蛋白也成為治療主要標誌分子，我們也用基因微陣列之研究模式，剖析這些基因之下游基因。最近，我們正著重於研究這些新的癌轉移相關蛋白之訊息傳遞途徑及功能和蛋白交互作用機制。

Our research teams are interested in studying the molecular pathogenesis of lung cancer in Taiwan and mechanisms of cancer metastasis. We focus on four aspects: (1) identification of novel risk genes for lung cancer in Taiwan, (2) molecular signature for prognostic prediction and personalized therapy of lung cancer, (3) identify novel genes and mechanisms involved in cancer metastasis for potential diagnosis and treatment targets, and (4) interaction of cancer cells and microenvironments, especially the cross talks between cancer cells and microenvironment inflammatory cells. Our team has identified several candidate risk genes for lung cancer. Cancer metastasis is a complicated process that may involve numerous genetic changes. To identify invasion/metastasis associated genes, we used DNA microarray and invasion/

metastasis lung cancer cell line model and identified a panel of genes associated with lung cancer metastasis. We also developed gene expression signature and microRNA signature that can predict survival and metastasis of lung cancer patients. These molecular signatures may be helpful for personalized therapy of lung cancer patients. We have also identified novel invasion/metastasis suppressor genes such as collapsin response mediator protein-1 (CRMP-1), long form CRMP, HLJ-1 and invasion promoting gene slug. Currently, we are investigating the molecular mechanisms and signaling pathways and protein interaction maps of these novel metastasis related genes.

主要研究領域 Major Research Areas

基因體醫學、細胞生物學、轉譯醫學

Genomic medicine, Cell Biology, Translational Medicine

研究計畫 Research Projects

1. 探討HIPK2與Slug在致癌性及癌轉移的角色
   HIPK2 regulates slug-mediated tumorigenesis and metastasis
2. 研究促癌轉移基因 Slug 在細胞週期扮演的角色
   The invasion promoter Slug is a novel cell cycle regulator
3. 整合性功能基因體學核心實驗室II
   Integrated Core Facility for Functional Genomics (II)
4. 多功能轉錄因子YY1和肺癌生成關係之探討
   Multifunctional Transcription Factor YY1 and Lung Cancer Progression
5. 整合性功能基因體學核心實驗室I
   Integrated Core Facility for Functional Genomics (I)
6. 癌轉移之外基因調控
   Epigenetic Control of Cancer Metastasis

E-mail: pcyang@ntu.edu.tw
Phone: +886-2-33662000
Lab Phone: +886-2-33661778

魏安祺 助理教授
An-Chi Wei, Assistant Professor

國立臺灣大學生醫電子與資訊學研究所助理教授

Assistant Professor, Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University

生醫系統工程實驗室
Biomedical System Engineering Lab.

粒線體是細胞的能量工廠，粒線體也在細胞中扮演了其他重要的角色，例如調節細胞凋亡與維持離子平衡。也因此粒線體功能與許多重要的疾病與生理現象有密切的關係，像是心臟疾病、神經退化疾病、糖尿病、癌症以及多種代謝疾病都與粒線體的功能都有關聯。

本實驗室的研究方向為整合計算模擬與實驗，用系統生物學的角度來了解細胞能量的供應與需求。研究方法以發展線粒體計算模型為基礎，並由直接的實驗測量來驗證，透過緊密的理論與實驗的配合，提供線粒體如何影響正常和病變的能量狀態的全面了解。該模型可被用於優化治療的設計，以達到最大的保護作用。開發粒線體模型，可在未來提供更全面的細胞、器官模型及藥物設計的基礎。

Mitochondria, the powerhouse of the cell, are organelles found in most types of cells.In addition to being the main site of energy production, mitochondria also play important roles in regulating ion homeostasis, and apoptosis. Mitochondrial dysfunction is related to rare inborn errors of metabolism, and some of the most common human diseases, such as cardiac vascular disease, diabetes, neurodegeneration, and cancer. Because of their important roles in basic biology and clinical medicine, mitochondria are an excellent model for systems biology.

The objective of our lab is to apply recent advances in systemic and quantitative methods to characterize the properties of crucial ion transporters in mitochondria, examine their functional roles in the mitochondrial ion circuits, and develop computational model of mitochondrial ion dynamics and energetics. The goal is to elucidate the roles of mitochondrial ion transport in energy supply and demand matching, integrated cell function, and the progression of disease. The model may ultimately be used to optimize the design of therapeutic agents in order to maximize protective effects.

主要研究領域 Major Research Areas

線粒體、生物能量與代謝、系統生物學、生物系統模型建構模擬

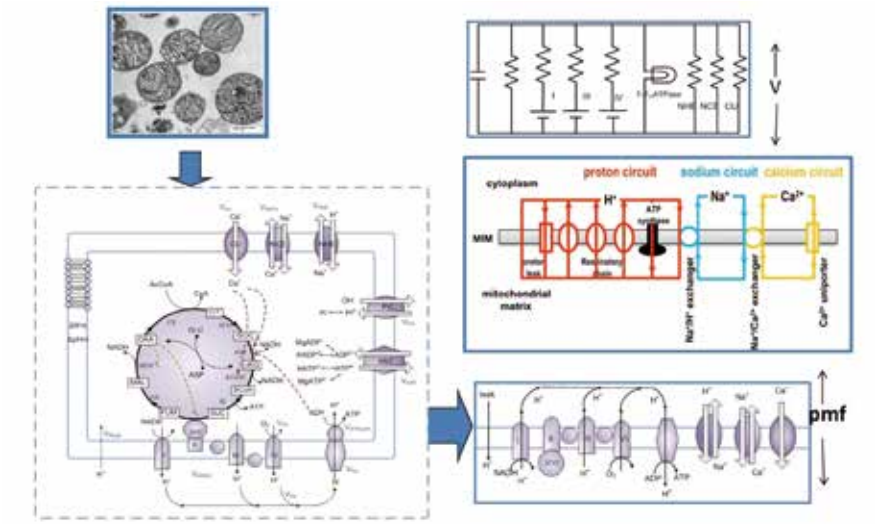
Mitochondria, bioenergetics and metabolism, systems biology, modeling and simulation of biological systems

研究計畫 Research Projects

1.【研發細胞線粒體的計算模型】

Developing mitochondrial computational model in the cell to elucidate the interplay between ion balance, mitochondrial energy state, and redox status

研發細胞線粒體的計算模型，整合能量代謝，離子調節，與氧化還原。



圖一 線粒體系統和電路模型之類比

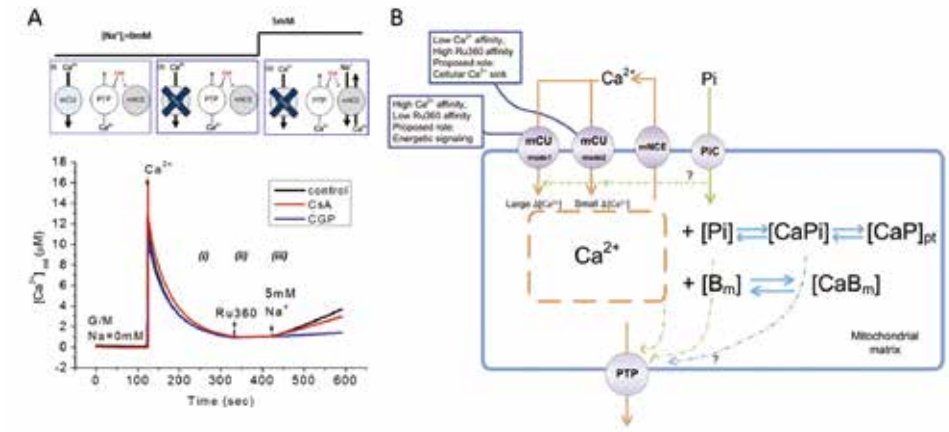
Figure 1.

Mitochondrial ion circuit as an analog of an electrical circuit:By making analogies between the complex mitochondrial system and a simple electrical circuit model, we will have a better understanding of the interactions between ion dynamics and energetics in a unique and intuitive manner.

2.【心肌細胞線粒體鈣離子調節之研究】

Study of mitochondrial calcium regulation in cardiac myocytes

研究線心肌細胞粒體鈣離子處理和緩衝。



E-mail: acwei86@ntu.edu.tw
Phone: +886-2-33668612
Office: 明達館521 (MD-521)
Lab. Phone: +886-2-33663543
Office：明達館705 (MD-705)

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鍾孝文教授 Hsiao-Wen Chung, Professor

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賴飛羆教授 Fei-Pei Lai, Professor

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2. Chien-Han Kuo, Xiao-ou Ping, Feipei Lai, Yi-Ju Tseng, Ja-Der Liang, Guan-Tarn Huang, Pei-Ming Yang, "Predictive Model with Liver Cancer Multiple Measurements Data Based on Support Vector Machines: A Case Study," The Second World Conference on Targeting Liver Diseases, St. Julian's, Malta, June 25-56, 2015.

3. Wei Chen, Chia-Ping Shen, Ming-Jang Chiu, Qibin Zhao, Andrzej Cichocki, Jeng-Wei Lin, Feipei Lai, "Epileptic EEG Visualization and Sonification Based on Linear Discriminate Analysis," IEEE Engineering in Medicine and Biology Society (EMBC'15), Milano, Italy, August 25-29, 2015.

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5. Zih-Heng Wu, Wei Chen, Feipei Lai, Jian-Jhong Wang, Kai-Ti Chang, Meng-Chun Lin, Ron-Bin Shu, Chun-Fu Lai and Tun-Jun Tsai, "Web-based Pulse Analysis System for Detection of Acute Kidney Injury," 2015 IEEE MTT-S International Microwave Workshop Series on RF and Wireless Technologies for Biomedical and Healthcare Applications, Taipei, Taiwan, September 21-23, 2015.

6. Hui-Chung Ho, Te-Wei Ho, Peter Shaojui Wang and Feipei Lai, "A Secure Authorization System in PHR based on CP-ABE," International Conference on e-Health and Bioengineering, EHB 2015, 19-21 November 2015, Iasi, Romania.

7. Chih Chang, Te-Wei Ho, Jin-Ming Wu, Feipei Lai, Hao-Chih Tai, Nai-Chen Cheng and Charlie Chung-Ping Chen, "Robust Dermatological Wound Image Segmentation in Clinical Photos," International Conference on e-Health and Bioengineering, EHB 2015, 19-21 November 2015, Iasi, Romania.

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李百祺特聘教授 Pai-Chi Li, Distinquished Professor

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2. P.-L. Kuo and P.-C. Li, "Evaluating Elasticity Dynamics of Three-Dimensional Cell-Matrix Using Ultrasonic Shear Waves", the 8th Asian-Pacific Conference on Biomechanics, Sapporo, Japan, September 16-19, 2015.
3. P.-C. Li, "Shear Wave Elasticity Imaging for Preclinical Research on Small Animals and 3D Cell Cultures", invited talk, IEEE International Ultrasonics Symposium (IUS), Taipei, Taiwan, October 21-24, 2015.
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5. Nien-Ching Ho and P.-C. Li, "Near Field Shear Wave Elasticity Imaging with High Frequency Single Element Transducers", IEEE International Ultrasonics Symposium (IUS), Taipei, Taiwan, October 21-24, 2015.
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8. C. J.-T. Lee, W.-W Liu, P.-C. Li and Y.-H. Hsu, "A microfluidic platform for developing a microtumor," the 19th International Conference on μTAS, Gyeongju, Korea, October 25-29, 2015.

9. P.-Y. Lee, W.-W. Liu, S.-C. Chen and P.-C. Li, “Dual-wavelength optical-resolution photoacoustic microscopy for cells with gold nanoparticle bioconjugates in three-dimensional cultures”, SPIE Photonics West 2016, San Francisco, California, U.S.A., February 13-18, 2016.
10. P.-Y. Lee, W.-W. Liu, S.-C. Chen, L. Tseng, L. Cao and P.-C. Li, “3D Photoacoustic Microscopy for Cell Tracking”, European Molecular Imaging Meeting, Utrecht, Netherlands, March 8-10, 2016.
11. W.-S. Wu a, W-W. Liu and P.-C. Li, “Cost-effective design of a concurrent photoacoustic-ultrasound microscope using single laser pulses”, European Molecular Imaging Meeting, Utrecht, Netherlands, March 8-10, 2016.
12. P.-C. Li, “Preclinical Research with 3D Cell Cultures Using Light and Sound”, invited talk, 3rd International Academic Conference of Chinese Society of Ultrasound Molecular Imaging (CSUMI), Ultrasound Biological Effects and Ultrasound Treatment, Chongqing, China, April 8-11, 2016.

歐陽彥正教授 Yen-Jen Oyang, Professor

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宋孔彬副教授 Kung-Bin Sung, Associate Professor

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2. Shih-Chung Wei, Pei-Tung Yang, Tzu-Heng Wu, Yin-Lin Lu, Frank Gu, Kung-Bin Sung*, and Chii-Wann Lin*, “Characteristic investigation of scanning surface plasmon microscopy for nucleotide functionalized nanoarray,” Optics Express, 23(15), 20104-20114, Jul. 2015.
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1. Y.H. Hsiao, G.H. Tien, M.J. Chuang, F.W. Hsu, H.P. Hsieh, and K.B. Sung*, "Development of a Movable Diffuse Reflectance Spectroscopy System for Clinical Study of Esophageal Precancer," Symposium on Clinical and Biomedical Spectroscopy and Imaging IV, European Conferences on Biomedical Optics (ECBO), paper 9537-63, Munich, Germany (Jun. 2015) - Runner-up of the Best Student Poster Award.
2. Fan-Hua Ko, Gen-Hao Tien, Min-Jie Chuang, Tsan-Hsueh Huang, Ming-Hua Hung, and Kung-Bin Sung, "In-vivo diffuse reflectance spectroscopy (DRS) of oral mucosa of normal volunteers," Biomedical Optics 2016: Optical Tomography and Spectroscopy, paper JTu3A.45, Fort Lauderdale, FL United States (April 2016).
3. Ting-Wen Yu, Gen-Hao Tien, Fang-Wei Hsu, and Kung-Bin Sung, "Extracting Fluorescence Efficiency with a GPU-Based Monte Carlo Model for Two-Layer Mucosal Tissue," Biomedical Optics 2016: Optical Tomography and Spectroscopy, paper JTu3A.10, Fort Lauderdale, FL United States (April 2016), – received OSA student travelling grant.
4. Andy Liao and Kung-Bin Sung, "Simulation Study on Optimal Probe Numerical Aperture for Diffuse Reflectance Spectroscopy," Biomedical Optics 2016: Optical Tomography and Spectroscopy, paper JM3A.17, Fort Lauderdale, FL United States (April 2016).

曾宇鳳教授 Y. Jane Tseng, Professor

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※ 專書 Book Chapers

1. Tseng, Y. J., Essential Algorithms in Cheminformatics. In: Molecular Conceptor. Israel. 2008: 13.1-13.10

張瑞峰教授 Ruey-Feng Chang , Professor

※ 學術期刊論文Journal articles

1. Chen JH, Lee YW, Chan SW, Yeh DC, Chang RF*, 2016.05, "Breast Density Analysis with Automated Whole-Breast Ultrasound: Comparison with 3-D Magnetic Resonance Imaging," Ultrasound in Medicine and Biology, vol. 42, no.5, pp. 1211-1220.
2. Lo CM, Chan SW, Yang YW, Chang YC, Huang CS, Jou YS, Chang RF*, 2016.05, "Feasibility Testing: Three-dimensional Tumor Mapping in Different Orientations of Automated Breast Ultrasound," Ultrasound in Medicine and Biology, vol. 42, no.5, pp. 1201-1210.
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陳志宏教授 Jyh-Horng Chen, Professor

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黃俊升教授 Chiun-Sheng Huang, Professor

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郭柏齡副教授 Po-Ling Kuo, Associate Professor

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李嗣涔特聘教授 Si-Chen Lee, Distinguished Professor

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林啓萬教授 Chii-Wann Lin, Professor

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6. CC.-K. Sun, “Higher harmonic generation microscopy for clinical virtual biopsy,” MCASTA International Symposium on Biomedical Devices and Annual Conference, Clayton, MO (2015). Invited Speaker
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孫維仁教授 Wei-Zen Sun, Professor

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吳文超副教授 Wen-Chau Wu, Associate professor

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玖 教師得獎、專利及技術轉移
Award、Patents and Technology Transfer

一、教師得獎

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2. 鍾孝文，臺大教學優良獎，2016。
3. 張家禎、陳震宇、莊琮亮、吳子珩、魏淑鈔、廖洪恩、林啟萬，臺灣化學感測器科技協會105年度傑出論文獎，2016。
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