July, 2015　第17期

醫工學會

http://www.bmes.org.tw/

中華民國生物醫學工程學會

Taiwanese Society of Biomedical Engineering

E-Newsletter

P1 即日起至104年7月20日
韓偉生物醫學工程服務獎章開放推薦囉

恭賀!!蘇芳慶教授榮獲中工會104年度傑出工程教授
賴景義教授研究團隊榮獲中工會104年度工程論文獎

Cover: 長庚大學

更多醫工動態盡在醫工學會電子報，請即刻閱讀！
學會為了嘉惠醫工大家庭，100年4月回復電子報發行，預計每三個月出刊一期，敬請期待，對於本學會電子報，有任何意見，歡迎來電指教
(06) 3028292

目錄

醫工學會秘書處：70101 台南市大學路一號
國立成功大學生物醫學工程系轉醫工學會
TEL: +886-6-3028292
FAX: +886-6-2343270
E-mail: tsbme@conf.ncku.edu.tw

【成果榮譽】

恭賀本會顧問國立成功大學生物醫學工程學系蘇芳慶特聘教授，榮獲中國工程師學會 104 年度傑出工程教授。
詳請請見中國工程師學會 104 年度各獎項得獎名單：
http://www.cie.org.tw/Home/News_class_detail?cn_id=162

【成果榮譽】

恭賀本會生物醫學工程學刊年度最佳論文「Computer Assisted Fracture Reduction and Fixation Simulation for Pelvic Fractures」，榮獲中國工程師學會 104 年度工程論文獎，獲獎者為賴景義教授研究團隊。
詳請請見中國工程師學會 104 年度各獎項得獎名單：
http://www.cie.org.tw/Home/News_class_detail?cn_id=162

【韓偉生物醫學工程服務獎章】

104 年度「韓偉生物醫學工程服務獎章」推薦開始囉，推薦表之收件期間為即日起至 2015 年 7 月 20 日截止（以郵戳為憑）。推薦表填妥後，請將紙本以郵寄方式送回本會：701 台南市東區大學路一號國立成功大學醫工系轉醫工學會。
更多訊息以及相關表單敬請參閱醫工學會網站最新消息：
http://www.bmes.org.tw/notice_show.php?id=390

【學會核予教育學分公告】

本會於 2015 下半年度確定舉辦核予教育學分之活動以及研討會如下表所示，敬邀各位醫工先進以及同仁踴躍參與。教育學分相關最新公告可至醫工學會網站-研討會專區查詢。http://www.bmes.org.tw/seminar.php

日期	活動名稱	地點	主要學分	輔助學分
7 月 30 日	2015 生物醫學工程研討會： 醫療器材維修保養基準之探討	台北國壽大樓	8	0
11 月 13-14 日	2015 生物醫學工程科技研討會	台灣大學	20	0

【2015 第四屆醫工盃】

2015 年第四屆全國大專院校醫工盃聯誼賽已在 7 月 11 日至 7 月 12 日於國立台灣大學順利展開並圓滿結束。各項比賽結果如下，恭喜以下隊伍及選手。

	冠軍	亞軍	季軍
羽球團體	弘光科大	台灣大學	中原大學
羽球雙打	弘光科大 B	台灣大學	中原大學第一雙打
桌球個人	陳詮樺	鄭文勇	徐宗平
桌球團體	台灣大學		
男子排球	中原大學	清華大學	
女子排球	台灣大學	清華大學	
男子籃球	元培科大	銘傳大學	中原大學 A

國立台灣大學生醫電子與資訊學研究所

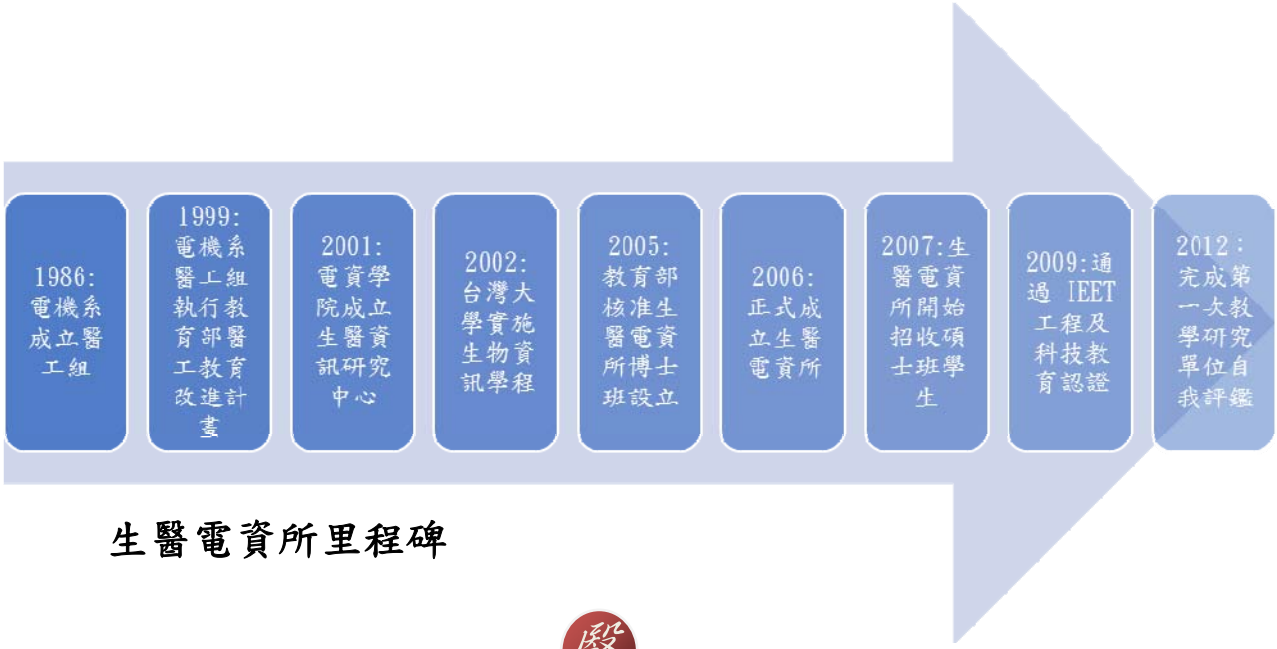
Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University

- **歷史沿革**

為發展醫學工程研究，期許成為台灣醫療器材研發和生物醫學研究之領先研究組織，本校電資學院於 1999 年執行教育部醫工教育改進計畫，並於 2001 年成立生醫資訊研究中心，隔年開設生物資訊學程。

鑒於近年來生物資訊及醫學資訊成為新世紀科技發展的趨勢，僅是開設學程已不足因應及整合來自不同領域的專業，為了促進電機與資訊兩大領域的結合，進行生物醫學之前瞻研究及跨領域教學，**2006 年 8 月 1 日正式成立生醫電子與資訊學研究所**，進行生物醫學之前瞻研究及跨領域教育，以因應生物醫學科技的快速發展。

- **設立宗旨**
  - 探索生命
  - 提升資電科技
  - 發展醫療科技

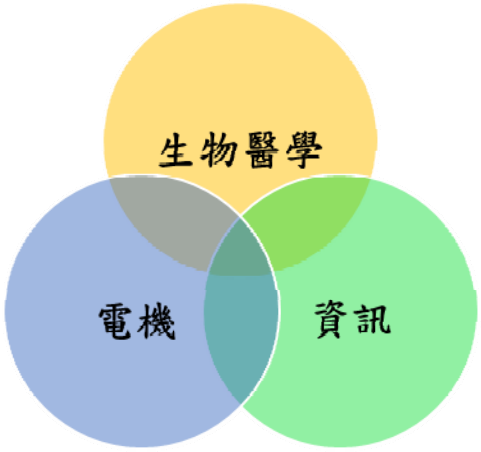


生醫電資所里程碑

- **發展方向**

聚焦資訊電子科技，探討生物醫學課題，促進跨領域整合

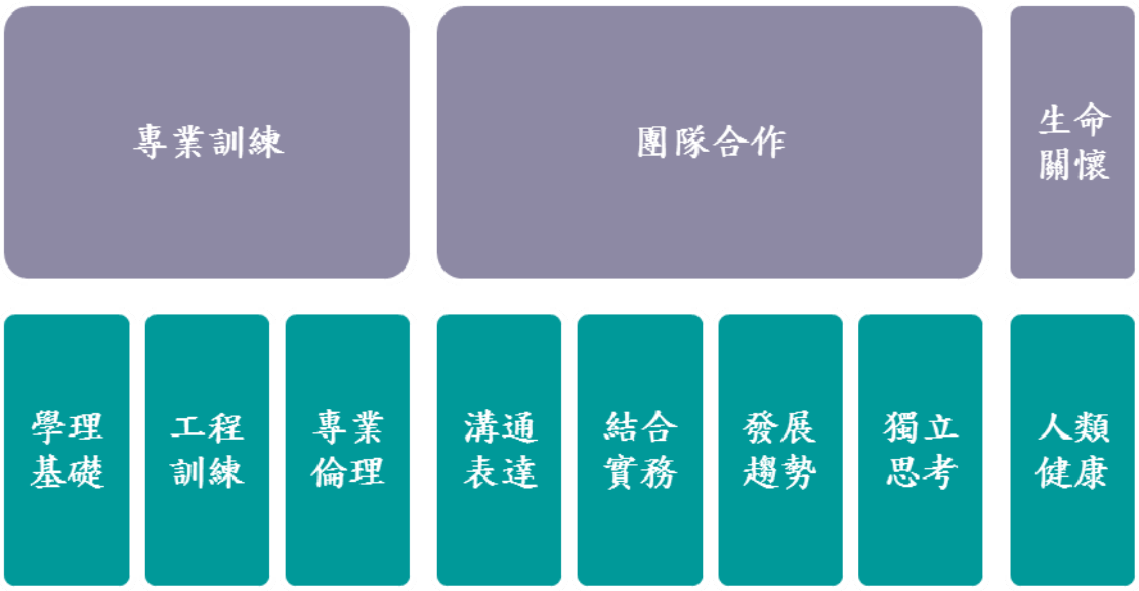
結合生物醫學、電機與資訊三大領域，進行生物醫學之前瞻研究及跨領域教學，其教育目標致力於「培養生醫工程與科學之領袖人才，透過跨領域團隊合作、生命關懷與專業訓練，開創生醫工程與科學之新領域，應用資電科技，改善人類健康與生活品質。」



- **教育目標與核心能力**

培養生醫電資領域之領袖人才，改善人類健康與生活品質

致力「培養生醫工程與科學之領袖人才，透過跨領域團隊合作、生命關懷與專業訓練，開創生醫工程與科學之新領域，應用資電科技，改善人類健康與生活品質。」。



學生核心能力

- **結合不同專業之師資，發揮研究綜效**

本所教師專兼任共計 39 名。含教授 29 名、副教授 8 名、助理教授 2 名；師資專業領域橫跨有電機、資工、醫工、醫學、生物、藥物化學等眾多科系，擁有跨電機、資工、生物三大領域之師資。各教師與國際學術間交流頻繁，創所以來廣邀眾多國際知名學者來本所進行短期的訪問，可謂十分活絡。此外，各教師亦積極參與國際學術活動，分別擔任會議主辦人、活動計畫主持人等重要職位。

➢ **本所教師**

醫學影像

核磁共振：陳志宏、鍾孝文、林發暄、吳文超

超音波：李百祺

腦磁波腦電波：林發暄、邱銘章

神經影像：邱銘章

3D 生醫影像擷取及後製：陳中平

醫療電子儀器

張璞曾、王唯工 、王水深、陳永耀、周迺寬 、陳中平 (行動生醫儀器)

生醫信號處理

曹建和、李枝宏、郭柏齡、周迺寬、邱銘章、陳中平 (腦波及心電圖)

生醫材料

周迺寬

生物晶片

莊曜宇

生醫光電

李嗣涔、林啟萬、管傑雄、宋孔彬、成佳憲、孫啟光、周迺寬、黃念祖、陳中平 (行動生醫儀器,血氧機及血壓機)

生醫微感測器

林啟萬、林致廷、田維誠、黃念祖

基因治療

楊泮池

醫學資訊

賴飛羆、張瑞峰、傅楸善、曾宇鳳、孫維仁、黃俊升

生物資訊

演算法：趙坤茂、呂學一、歐陽彥正、曾宇鳳

系統生物學：阮雪芬、曾宇鳳

針對重要的生醫問題進行整合性的研究，並和生醫電子及生物資訊相關產業合作，以期未來對生物科技與健康照護領域做出貢獻。

本所之發展重點包括奈米生醫科技、生物資訊、醫學資訊系統、醫學影像、生物晶片與生醫微電子系統及生醫光電技術，針對各領域以廣博的基礎，整合研究能量與優異師資，投入重要新科技的研發，以配合國家整體之發展並引領國際研究趨勢。

對外合作方面，本所目前研究計畫案之合作醫院以台大醫院為主，本所教師與台大醫院合聘醫師亦有密切的研究、教學合作關係。如共同執行計畫、共建實驗室、研究生共同指導、共同開設合授課程等。另外與國防醫學院、三軍總醫院、長庚醫院、中國醫藥大學附設醫院等也皆有合作關系。

➢ **跨學院合作設立「國立台灣大學醫療器材研發中心」**

本所與工學院醫工所合作設立「國立台灣大學醫療器材研發中心」，以該中心作為一整合平台，提供跨領域整合與交流的活動與服務，擴大整合校內相關研究單位之前瞻性研發基礎與應用之能量、資源。例如推動跨學院、跨領域合作、縮短研發週期、提供器材、研究成果商品化諮詢與評估服務、辦理服務性課程、國際性研討會、出版專書及出版品等。協助本所教師集合資源，加速生醫電子領域之醫療器材、生醫資訊領域之醫療保健與治療、健康照護議題研究進程。

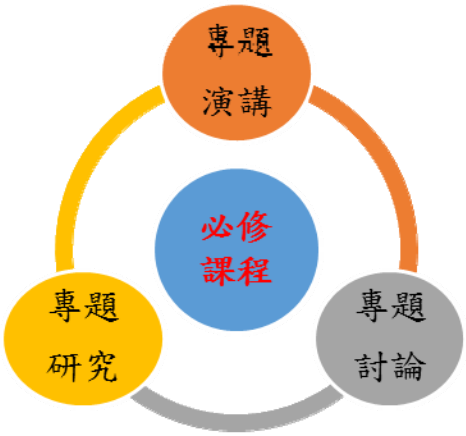
- **<u>提供跨領域的課程與研究環境</u>**

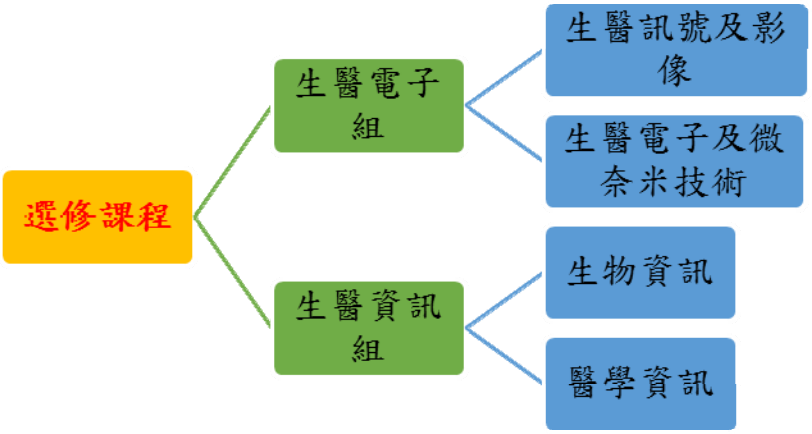
提供學生完整的跨領域訓練，以迎合生物醫學科技領域的挑戰

本所分為「生醫電子」與「生醫資訊」兩組，依據本所訂定之教育目標，本所之獨特性在於生物醫學、電機與資訊三大領域的結合，進行生物醫學之前瞻研究及跨領域教學，以因應生物科技的快速發展，研究領域包含：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，學生可自行依照領域類別選修相關課程，以落實學域規劃之實質效果。

在課程安排上，本所雖分為電子與資訊兩組，但兩組課程可互相選修，在課程規劃上也規定分別代表兩組的醫學工程導論與生醫資訊學導論為全所必修，相信在兩組互動之下必有助於生物知識的學習，亦可落實跨領域學習的目標。

此外，本所針對課程選修已建立複選必修的規定，非生醫背景之學生需從生理學、分子生物學、生物化學、生物科學通論四門課中選修一門基礎課程，以確立本所學生對於基礎生物知識的了解。本所亦已於 102 學年度第 1 學期起將分子生物學與生物化學新增為博士資格考的基本科目之一，期以鼓勵學生增進基礎生物知能。





本所對於課程的安排極為嚴謹，每科目於開課之前皆需備有完善的教學計畫，除了基礎理論課程之授課外，本所亦重視學生在實際操作上的訓練，藉由實質的產學合作交流，開設多門與產業實務密切相關之應用實作課程，更有跨領域的合作計畫模式，培養學生藉由實作及問題解決之經驗，學以致用。

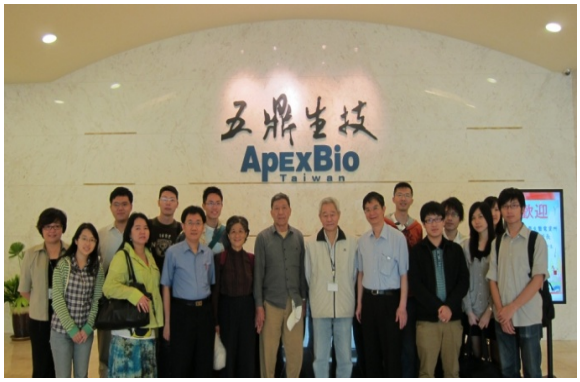
- 開設「**基因晶片方法與數據分析**」、「**核磁共振影像實驗**」這兩門課，其課程設計將理論知識與實務應用作結合，透過學生親自操作練習，將書本上的學理知識轉化應用到實際面。
- 本所每年皆會舉辦**生醫電子資訊營**，課程內容主題分別為生醫影像、生物晶片、生物資訊、醫學資訊，並延攬各專業領域中傑出人士擔任，包含學界、業界、臨床等，相當豐富。

- **安排學生實習機會**：除了定期安排企訪外，本所更積極促成學生至研究機構及企業實習的機會。首先於 102 學年度寒假開始，本所與台大醫院合作，於寒假及暑假期間薦送優秀研究生至台大醫院醫工部、資訊室、病歷資訊室實習。另外透過電資學院與美國農業部國家農業圖書館（USDA National Agricultural Library, NAL）簽訂的實習計畫，更每年推薦 2 名優異博班學生前往美國農業部國家農業圖書館進行研究實習。

- **重視學生在實務操作上的訓練**

  - **定期安排企業參訪**：為讓所上學生實地至各研究機構及企業參訪，實際體會研究機構及企業內部之運作、開發研究進程，本所定期安排企業參訪，希望藉此機會讓所上學生及畢業生增加就業機會並學以致用。

  - **舉行徵才說明會**：本所為讓所上學生於畢業後能學以致用，能在產業界中運用所學之相關知識與技能更積極爭取企業前來徵才，提供一個能讓「學生求職」、「企業求才」雙方彼此交流的合作平台。



- **聯絡我們**

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電話：02-3366-4961
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地址：10617 台北市大安區羅斯福路 4 段 1 號 博理館 410 室
E-mail：ntubebi@ntu.edu.tw
Facebook：https://zh-tw.facebook.com/NTUBeBi

長庚大學醫療機電工程研究所

成立沿革

長庚大學醫療機電工程研究所創立於民國 91 年 8 月，成立宗旨為因應國內高齡化社會到來及我國醫療器材產業之發展，秉持本校「理論與實務結合」之教學理念，以培育醫療器材產業所需之機電工程研發人才，落實政府達到「醫療器材本土化」之目標。本所之教育目標訂為「培育理論與實務結合且具有設計、分析與製作醫療器材（如手術器械、輔具或醫療設備等） 之研發人才」，期望本所畢業生能具備學理基礎、創意思考、終身學習以及解決醫療機電工程應用問題之能力。

系所特色

本所自成立以來，依據學校教育目標，強調培育具「醫學」與「工程」整合能力之醫療器材研發跨領域人才，作為發展教學、研究之特色。本所重點研究領域包括「醫療設備開發、仿生工程」、「生物力學分析與實驗」、「智慧型生醫光電、微機電工程」、「遠距醫療及醫療器材軟體工程」等。本所曾獲教育部顧問室支持成立之全國唯一「醫療機電設計與整合教學資源中心」，連續六年負責整合國內各大專院校機電相關系所及醫療產業廠商成立產學合作教育中衛體系，除了建立產學合作教育網絡，並開發醫療機電學程、教材、教案外，每年亦舉辦短期人才培訓課程、學術研討會和全國學生醫療機電專題實作競賽等活動。本所為配合政府落實醫療器材產業發展之特色，曾獲 Cheer 雜誌和 Career 雜誌分別撰文報導。


【特色系所】
長庚大學
醫療機電工程研究所

激盪工學院與醫學院
交流的火花


特色研究所

醫療器材研發領軍重鎮
長庚醫療機電工程所

教育目標

「培育理論與實務結合且具有設計、分析與製作醫療器材（如手術器械、輔具或醫療設備等）之研發人才」。

核心能力

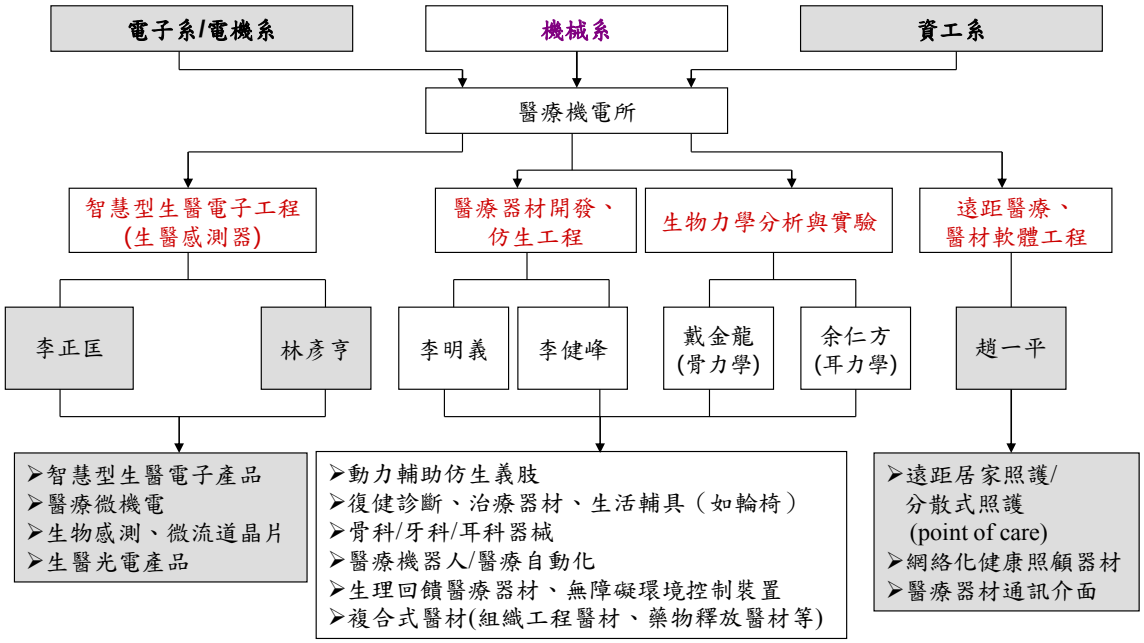
(1)理論分析能力
(2)醫療機電工程設計與分析能力
(3)醫療機電實驗規劃與執行能力
(4)口頭報告及溝通能力
(5)計畫書與論文撰寫能力
(6)應用工程相關軟硬體工具能力
(7)醫療實務應用能力
(8）使用外語及資料檢索吸收科技新知之能力

師資與研究專長

本所目前專任教師共有 7 位，包括教授 1 人，副教授 3 人，助理教授 3 人。教師多具有產業經驗且專長涵蓋醫學工程、醫療機電整合工程、醫療器材設計開發、生物力學、生醫光電及醫療微機電工程、醫療器材軟體工程等領域 (教師專長研究方向如下表)。

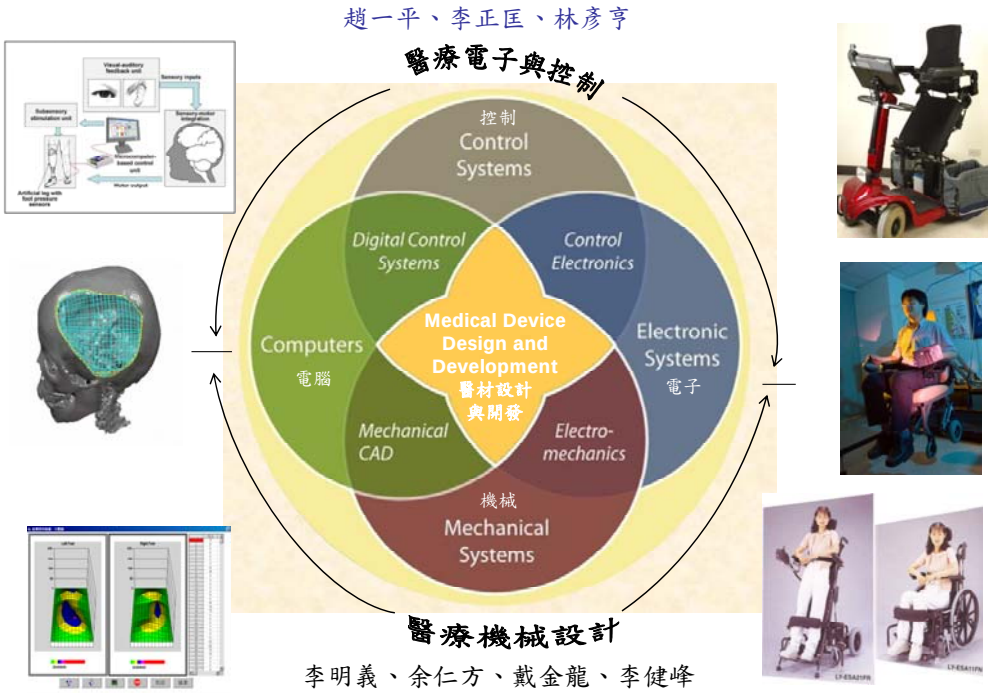
姓 名	職 稱	學 歷	專長／研究方向
李明義	所長/教授	美國明尼蘇達大學/機械工程博士	醫療自動化、科技輔具、醫療快速成型/逆向工程、醫療設備開發
戴金龍	副教授	中原大學/醫學工程博士	生物力學、有限元素分析、骨科植入物設計、生醫材料
余仁方	副教授	美國德州大學/ 機械工程博士	聽覺科學、聽力預防、耳科學、聽覺輔具、聲學
李健峰	副教授	香港中文大學/自動化與電輔助工程博士	生醫微機電系統、微流體系統、細胞動態量測平台、快速篩檢技術
林彥亨	助理教授	成功大學/工程科學博士	生醫晶片設計及製作、光介電泳操控平台、微機電製程技術、奈米感測器製作
趙一平	助理教授	台灣大學/電機工程博士	生醫影像處理、大腦磁振造影分析、電腦視覺、人機介面、醫材軟體工程
李正匡	助理教授	台灣大學/光電工程博士	生醫光電、光子傳播模擬、光學同調顯微術、醫學影像分析、光學系統設計

為達校內教學資源共享，本所與機械、電機、電子、資工系所搭配、互補，形成一所由多系支援之跨領域教學資源整合，但仍維持獨立招生之特色。



專業跨領域教學

為兼顧教學跨領域特色與學生學習興趣，本所課程規劃了「醫療機械設計」及「醫療電子與控制」兩個領域，期使本所畢業學生能依入學前科系背景及研究方向，在指導教授輔導下選修合適課程，以養成所訂醫療機械設計或醫療電子與控制之核心能力。



成立工學院生物醫學工程博士學位學程

為增加學生畢業後進修升學管道，本所於 99 年 11 月開始籌劃工學院生物醫學工程博士學位學程，設立宗旨為整合本校工程與醫學領域豐富之教學資源以及長庚醫院完善之臨床病例，以銜接本所訓練課程，期望能培育具有生醫工程跨領域專業能力之高階醫療器材研發人才。本項博士學位學程已於 101 年 9 月正式招生。

學生課業與生活輔導

本所設有雙導師制度，每位研究生之指導老師為其個別導師外，本所另有所導師提供學生在課業外生活（如住宿、社團活動等）之輔導工作。本所也成立所學生會之自治團體，借此培養同學團隊合作，舉辦全所師生聯誼活動之能力（如迎新、送舊、師生心連繫及球類競賽等）。除此，本所為加強養成學生專業及基礎核心能力，每學期均安排多項專題演講，講題涵蓋醫療器材法規與認證、醫療器材產業發展介紹、創意思考與創新設計、腦力開發與快速記憶、專利申請與佈局、研究方法、英文說聽講、創業規劃與案例、學生心靈成長、公職考試說明、學生生涯規劃、校友回娘家經驗分享等。

迎新活動

校友返校座談會

腦力開發與快速記憶

生命教育

生涯及就業規劃

創意思考與創新設計

工程倫理

專利及智財權管理

溝通技巧

醫療產業發展概況

醫療器材認證實務

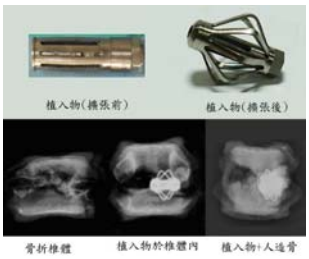
畢業茶會

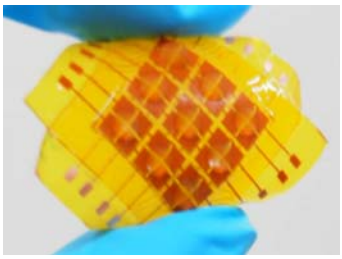
送舊活動

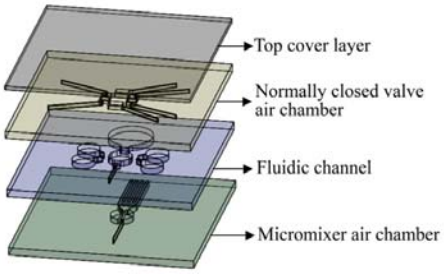
師生校園巡禮

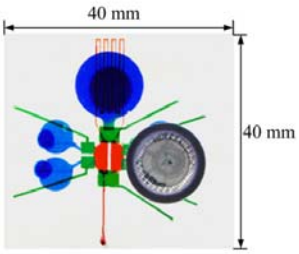
研究重點及成果

本所目前研究重點為「醫療設備開發及仿生工程」、「生物力學分析與實驗」、「智慧型生醫光電及微機電工程」、「遠距醫療及醫材軟體工程」等。成立以來，本所師生與長庚醫院密切合作，已開發之醫療器材與設備如多功能自動病床、遠端操控尿便感測器、無人搬運洗澡設備、EMG 監控復健牽引機、生理回饋站立平衡設備、動態站姿穩定度評估訓練設備、穿戴式生理量測智能衣、站立式輪椅、組織工程支架製作快速成型機、膝關節動力輔助裝置、膝關節外骨骼步行復健設備、肌動信號控制復健系統、人體患部姿勢即時監測與調整系統等，並已獲國內、外多項專利。近兩年本所老師重要之研究成果包括智慧型姿態感測背心智慧衣、可擴張且具有支撐骨骼結構強度功能之新型植入物、腳底壓力感測器、耳蝸曲率的活體量測及微流體晶片快速偵測蛋白質癌症生物標記等。









現有學制

□學士班■碩士班 □博士班 □進修學士班 □碩士在職專班

聯絡方式

網址：http://gimm.cgu.edu.tw

電話：(03)2118800 轉 5336

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地址：33302 桃園市龜山區文化一路 259 號 長庚大學工學大樓 4 樓 醫療機電所

104 年醫工證書考試相關訊息

本會將於 104 年 8 月 1 日(六)舉行本年度之臨床工程師、醫療設備技師、醫學工程師之醫工證書考試。非會員報考者，亦可參加考試。待考試通過後，必須完成入會手續，始頒予證書。入會相關規定請至學會網站左側「各式辦法與表格下載區」，點選「中華民國生物醫學工程學會會員入會申請須知」(http://www.bmes.org.tw/down_list.php) 詳閱參考。

本次醫工證書考試報名已於 104 年 7 月 1 日截止，報名統計預計今年將有名 252 考生參加證書考試。考試結果將於 8 月底以專函個別通知並公布於學會網站。最新證書考試訊息，請至醫工學會網站查詢。

- **筆試日期：2015 年 8 月 1 日(六) 上午 09:30-11:30**
- **口試日期：2015 年 8 月 1 日(六) 下午 13:30-17:00**
- **考試地點：私立中原大學工學館 (桃園市中壢區中北路 200 號)**

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Review: Anti-fouling Coatings of Poly(dimethylsiloxane) Devices for Biological and Biomedical Applications

Hongbin Zhang, Mu Chiao

Fouling initiated by nonspecific protein adsorption is a great challenge in biomedical applications, including biosensors, bioanalytical devices, and implants. Poly(dimethylsiloxane) (PDMS), a popular material with many attractive properties for device fabrication in the biomedical field, suffers serious fouling problems from protein adsorption due to its hydrophobic nature, which limits the practical use of PDMS-based devices. Effort has been made to develop biocompatible materials for anti-fouling coatings of PDMS. In this review, typical nonfouling materials for PDMS coatings are introduced and the associated basic anti-fouling mechanisms, including the steric repulsion mechanism and the hydration layer mechanism, are described. Understanding the relationships between the characteristics of coating materials and the accompanying anti-fouling mechanisms is critical for preparing PDMS coatings with desirable anti-fouling properties.

Enhanced Therapeutic Epidermal Growth Factor Receptor (EGFR) Antibody Delivery via Pulsed Ultrasound with Targeting Microbubbles for Glioma Treatment

Ai-Ho Liao, Hsin-Yi Chou, Yi-Lei Hsieh, Sheng-Chieh Hsu, Kuo-Chen Wei, Hao-Li Liu

Pulsed-mode ultrasound (pUS) in combination with intravenously (IV) administered microbubbles (MBs) can enhance local drug delivery by temporarily enhancing capillary permeability. This study evaluates the use of epidermal growth factor receptor (EGFR)-targeting MBs after pUS treatment to enhance the effects of therapeutic-EGFR antibody delivery to glioma tumor cells in mice. Three animal groups were compared: (1) IV-injected non-targeting MBs, (2) IV-injected targeting MBs, and (3) IV-injected targeting MBs combined with pUS treatment. All animals were analyzed using high-frequency small-animal US imaging. The mean halftime of circulating targeting MBs was significantly increased from 3.13 min of targeting bubble alone to 5.86 min by targeting MBs combined with pUS treatment, compared to 2.34 min for non-targeting MBs. Compared to targeting bubble administration alone, pUS exposure prior to injection of targeting MBs was also significantly better at suppressing tumor growth when monitored for up to 35 days ($p < 0.05$). The final relative tumor volumes were 2664, 700, and 188 mm3 for non-targeting MBs, targeting MBs, and targeting MBs combined with pUS treatment, respectively. pUS treatment prolonged the mean circulatory halftime of targeting MBs and enhanced the anti-tumor effect of EGFR antibodies in a human glioma model in mice. Targeting MBs combined with pUS treatment thus has potential for enhanced therapeutic antibody delivery for facilitating anti-glioma treatment.

Electromyography-Based Quantitative Representation Method for Upper-Limb Elbow Joint Angle in Sagittal Plane

Muye Pang, Shuxiang Guo, Qiang Huang, Hidenori Ishihara, Hideyuki Hirata

This paper presents a quantitative representation method for the upper-limb elbow joint angle using only electromyography (EMG) signals for continuous elbow joint voluntary flexion and extension in the sagittal plane. The dynamics relation between the musculotendon force exerted by the biceps brachii muscle and the elbow joint angle is developed for a modified musculoskeletal model. Based on the dynamics model, a quadratic-like quantitative relationship between EMG signals and the elbow joint angle is built using a Hill-type-based muscular model. Furthermore, a state switching model is designed to stabilize the transition of EMG signals between different muscle contraction motions during the whole movement. To evaluate the efficiency of the method, ten subjects performed continuous experiments during a 4-day period and five of them performed a subsequent consecutive stepping test. The results were calculated in real-time and used as control reference to drive an exoskeleton device bilaterally. The experimental results indicate that the proposed method can provide suitable prediction results with root-mean-square (RMS) errors of below 10° in continuous motion and RMS errors of below 10° in stepping motion with 20° and 30° increments. It is also easier to calibrate and implement.

Classification of Benign and Malignant Breast Tumors in Ultrasound Images with Posterior Acoustic Shadowing Using Half-Contour Features

Zhuhuang Zhou, Shuicai Wu, King-Jen Chang, Wei-Ren Chen, Yung-Sheng Chen, Wen-Hung Kuo, Chung-Chih Lin, Po-Hsiang Tsui

Posterior acoustic shadowing (PAS) can bias breast tumor segmentation and classification in ultrasound images. In this paper, half-contour features are proposed to classify benign and malignant breast tumors with PAS, considering the fact that the upper half of the tumor contour is less affected by PAS. Adaptive thresholding and disk expansion are employed to detect tumor contours. Based on the detected full contour, the upper half contour is extracted. For breast tumor classification, six quantitative feature parameters are analyzed for both full contours and half contours, including standard deviation of degree (SDD), which is proposed to describe tumor irregularity. Fifty clinical cases (40 with PAS and 10 without PAS) were used. Tumor circularity (TC) and SDD were both effective full- and half-contour parameters in classifying images without PAS. Half-contour TC [74 % accuracy, 72 % sensitivity, 76 % specificity, 0.78 area under the receiver operating characteristic curve (AUC), $p > 0.05$] significantly improved the classification of breast tumors with PAS compared to that with full-contour TC (54 % accuracy, 56 % sensitivity, 52 % specificity, 0.52 AUC, $p > 0.05$). Half-contour SDD (72 % accuracy, 76 % sensitivity, 68 % specificity, 0.81 AUC, $p < 0.05$) improved the classification of breast tumors with PAS compared to that with full-contour SDD (62 % accuracy, 80 % sensitivity, 44 % specificity, 0.61 AUC, $p > 0.05$). The proposed half-contour TC and SDD may be useful in classifying benign and malignant breast tumors in ultrasound images affected by PAS.

Detection of Abnormalities in Type II Diabetic Patients Using Particle Filters

Omid Vahidi, R. Bhushan Gopaluni, Ezra Kwok

This study proposes a strategy for detecting possible dysfunction of organs such as the liver, pancreas, muscles and adipose tissues in a group of type II diabetic patients. Several in silico clinical trials are performed on a previously developed type II diabetes model. Since the pancreatic insulin secretion rate and glucose metabolic rates of different organs represent the functional behavior of the corresponding organs, calculated values of these rates are analyzed and compared with the corresponding rates calculated from a healthy subject's model to detect possible abnormalities. These rates are calculated from estimated values of glucose and insulin concentrations inside the corresponding organs/tissues from the physiological model. Estimation of the concentrations in body organs/tissues is carried out using a sequential Monte Carlo filtering method called particle filters. The results show that the proposed strategy is capable of detecting deficiencies in hepatic and peripheral glucose disposal, hepatic glucose production and pancreatic insulin secretion. The information provided by this strategy can potentially be used to tailor patient dietary requirements and/or select appropriate medications for the patients.

Effects of Arch Support Insoles on Gait Patterns of Patients with Knee Osteoarthritis

Shu-Zon Lou, Fong-Chin Su, Yu-Chi Chen

Although arch support orthotics are prescribed for knee osteoarthritis (OA) patients in clinics, the biomechanical effects of such devices are not fully clear. This study conducts an experimental investigation to evaluate the short-term effects of shoes with arch support insoles on the gait patterns of patients with knee OA during level walking. Twelve adults with knee OA were recruited, and biomechanical data were measured under three test conditions: walking barefoot, walking in shoes, and walking in shoes and insoles. Participants' gait patterns were recorded and analyzed using a motion analysis system, Kistler force plates, and EVaRT software. Walking in shoes with insoles significantly increased the peak knee flexion angle and the peak dorsiflexion and external rotation angles of the ankle, but reduced the peak ankle internal rotation angle compared to those for walking barefoot. Both walking in shoes with insoles and walking in shoes significantly reduced the toe-out angle compared to that for walking barefoot. However, no significant difference was observed in the peak knee varus moment. The results suggest that the foot insoles and shoes tested in this study might have influenced the ankle joint in OA patients. In view of the significantly decreased toe-out angle of the foot and increasing trend in the knee varus moment, the use of shoes with insoles may be unsuitable for knee OA patients.

Identification of Heart Sounds with Arrhythmia based on Recurrence Quantification Analysis and Kolmogorov Entropy

Qing-Zhen Liang, Xing-Ming Guo, Wen-Ying Zhang, Wan-Di Dai, Xing-Hua Zhu

Heart attacks are a leading cause of mortality worldwide. This paper proposes an identification method based on recurrence quantification analysis (RQA) and Kolmogorov entropy (KE) to help diagnose heart disease. The experimental data are collected from clinical trials. A wavelet packet denoising algorithm based on the singular spectrum analysis is used to eliminate noise in the heart sounds. Then, the KE of the heart sounds, an invariant feature of a nonlinear chaotic time series, is extracted. Recurrence plots are used to analyze the mechanisms of the two kinds of heart sound and RQA is used to extract three recursive parameters, namely recursive rate (RR), Determinism (DET) and the longest diagonal (l max). KE, RR, DET and l max are merged into one feature vector, which is analyzed and transformed using principal component analysis into an orthogonal and dimension-reduced feature vector that is used to establish joint probability models with an identification threshold for the two kinds of heart sound. The joint probability density classifiers based on the models are used to identify heart sounds with arrhythmia. The results show that the average recognition rate is 94.83 ± 0.37 %.

Partial Volume Correction for Equivocal Retropharyngeal Nodal Metastases of Nasopharyngeal Carcinoma with Fluorodeoxyglucose Positron Emission Tomography–Computed Tomography

Yu-Wen Wang, Chin-Shun Wu, Chih-Han Chang, Kuo-Sheng Cheng, Yu-Kang Chang, I-Wen Huang, Chin-Li Lu, Wei-Jen Yao

The objective of this study is to determine the size range where the recovery coefficient (RC) method of fluorodeoxyglucose (FDG) positron emission tomography–computed tomography (PET–CT) is helpful in detecting lateral retropharyngeal lymph (LRPL) nodal metastases of nasopharyngeal carcinoma (NPC) patients previously treated with radiation therapy. A total of 142 LRPL nodes assessed by magnetic resonance imaging (MRI) in 71 NPC patients were chosen for investigation. LRPL nodes with central necrosis, extracapsular invasion, or asymmetric grouping or those ascertained on follow-up MRI scans were considered positive for metastases. The criterion for positive diagnosis of nodal metastasis on FDG PET–CT scans was defined as maximal standard uptake value (SUVmax) ≥ 2.5. Nodes not separated from main tumors were excluded. An established RC method, the sphere-to-background ratio, was employed. Nodes were further categorized into three groups of minimal axial diameters: below 6, 6–7 mm, and above 7 mm. A total of 88 nodes were examined by FDG PET. Thirty-five nodes were positive and 53 nodes were negative. The RC method significantly improved sensitivity (from 20 to 100 %) and accuracy (from 14 to 71 %) for nodes sized 6–7 mm. In LRPL nodes above 7 mm, the RC method also provided slight improvement, with sensitivity and accuracy both increasing from 92 to 96 %. However, the nodal sizes below 6 mm were too small for valid comparisons. In conclusion, partial volume correction in FDG PET–CT enhances the accuracy of detecting nodes in the equivocal size range of 6–7 mm for LRPL nodal metastases of NPC.

Power Amplifier Linearizer for High Frequency Medical Ultrasound Applications

Hojong Choi, Hayong Jung, K. Kirk Shung

Power amplifiers (PAs) are used to produce high-voltage excitation signals to drive ultrasonic transducers. A larger dynamic range of linear PAs allows higher contrast resolution, a highly desirable characteristic in ultrasonic imaging. The linearity of PAs can be improved by reducing the nonlinear harmonic distortion components of high-voltage output signals. In this paper, a linearizer circuit is proposed to reduce output signal harmonics when working in conjunction with a PA. The PA performance with and without the linearizer was measured by comparing the output power 1-dB compression point (OP1dB), and the second- and third-order harmonic distortions (HD2 and HD3, respectively). The results show that the PA with the linearizer circuit had higher OP1dB (31.7 dB) and lower HD2 (−61.0 dB) and HD3 (−42.7 dB) compared to those of the PA alone [OP1dB (27.1 dB), HD2 (−38.2 dB), and HD3 (−36.8 dB)] at 140 MHz. A pulse-echo measurement was also performed to further evaluate the capability of the linearizer circuit. The HD2 of the echo signal received by the transducer using a PA with the linearizer (−24.8 dB) was lower than that obtained for the PA alone (−16.6 dB). The linearizer circuit is capable of improving the linearity performance of PA by lowering harmonic distortions.

Primary Stability of Absorbable Screw Fixation for Intra-articular Calcaneal Fractures: A Finite Element Analysis

Ming Ni, Xiao-Hong Weng, Jiong Mei, Wen-Xin Niu

Absorbable implants have been widely used in bone osteosynthesis, but biomechanics of its application to calcaneal fracture fixation remains unclear. This study investigates the primary stability of absorbable screws used to fix calcaneal fractures with the finite element method. A Sanders type III calcaneal fracture was modeled according to X-ray and computed tomography images of a representative patient. Fixation with four crossing absorbable screws was simulated using a finite element software package according to clinical operation. The stance phase of gait was simulated to calculate stress and displacement distributions of the calcaneus and screws. The stress concentration of screws was located at the connections between screws and fracture surfaces. For the two transverse screws, the peak von Mises stress of the inferior screw was almost twice that of the superior one. For the two longitudinal screws, the medial screw had a 64 % larger von Mises stress than that of the lateral one. The peak displacement of the calcaneus was located on the medial fragment. No notable relative displacement was seen between different fragments. The displacements of the two transverse screws were similar, and larger than those of the longitudinal screws. The displacement of the medial longitudinal screw was slightly greater than that of the lateral one. Based on the computational stress distribution, a screw with a large diameter should be recommended to fix the anterior part of the posterior facet and the medial tuberosity of the calcaneus. Fixation with crossing absorbable screws is safe and should be recommended for Sanders type III intra-articular calcaneal fractures with good bone quality. Early ambulation and rehabilitational activities should be encouraged after operation.

Anorectal Manometry in Wistar Rats with Inexpensive Setup: A Physiological Description of the Mechanical Activity

Alejandro Barriga-Rivera, Juan Luis Vinuesa, Manuel Lopez-Alonso

Anorectal manometry is a common technique for investigating the performance of the anal canal. The absence of the rectosphincteric reflex may determine the existence of important pathologies. Animal models are essential to assess the efficacy of new therapies as well as to provide a better understanding of the physiological mechanisms underlying intestinal motility. This paper describes an inexpensive laboratory setup for experimental anorectal manometry that consists of a water-perfused customized catheter, a signal acquisition and processing system, and a personal computer with a software program to display biosignals. Twenty Wistar rats, ten males and ten females, were anesthetized using a ketamine–xylazine intraperitoneal injection. The basal tone of the anorectal sphincter and the rectosphincteric reflex were studied. In basal conditions, two frequency peaks were found, one at 0.015 ± 0.007 Hz and the other at 0.363 ± 0.057 Hz, corresponding to slow and ultraslow pressure waves, respectively. The maximum resting pressure varied between 37.8 and 109.0 mmHg. Anorectal relaxations derived from stimulation of the rectum wall dropped to 82.65 ± 14.61 % of the pressure level prior to stimulation. The overall period of the relaxation wave was 10.22 ± 2.91 s. Differences between genders were found: autonomous pressure oscillations were significantly slower in female rats whereas the period of the relaxation wave was significantly shorter in male subjects. Overall, the mechanical description of the anal canal in Wistar rats is similar to that in humans, especially to that in newborns. Therefore, it represents a good animal model for the investigation of anorectal motility.

Direct-Conversion X-Ray Detector with 50-µm High-Gain Pixel Amplifiers for Low-X-Ray-Dose Digital Mammography

Tsung-Ter Kuo, Chien-Ming Wu, Isaac Chan, Hui-Hsin Lu, Sun-Hua Pao

This study proposes an active pixel sensor (APS) design for readout signal amplification to replace the traditional passive pixel sensor (PPS) design. The APS design adds only one extra thin-film transistor (TFT) amplifier, giving it the high signal sensitivity of the APS architecture and the high spatial resolution of the PPS architecture. The mobility of the amorphous silicon (a-Si) TFT is 0.56 cm2/Vs, the signal amplification of the APS circuit is more than 10×, the on/off current ratio is more than 107, and the leakage current is on the order of 1 fA. A 200-µm-thick layer of amorphous selenium (a-Se) as the X-ray photoconductor was deposited on the APS array with 160 × 160 pixels of various sizes, down to 50 µm. The 40-kVp X-ray spectra obtained with tube currents of 40 and 50 mA, respectively, were used for measuring the gray-level contrast induced by the X-rays. The experimental results show that the gray-level contrasts for the 50-µm pixels were 5.57 ± 0.89 and 13.19 ± 1.94 and those for the 70-µm pixels were 15.94 ± 2.98 and 24.19 ± 2.76 under 40-kVp X-ray exposure at 40 and 50 mA, respectively.

Decellularization of Aorta Tissue Using Sonication Treatment as Potential Scaffold for Vascular Tissue Engineering

N. Syazwani, A. Azhim, Y. Morimoto, K. S. Furukawa, T. Ushida

Arterial scaffolds have potential for replacing native arteries for vascular surgery. These scaffolds are anti-thrombogenic, biocompatible, and capable of growth and repair, making them suitable for application in vascular tissue engineering. This study develops a sonication decellularization system for preparing a complete decellularized artery. The sonication decellularization efficiency on arterial tissues is investigated. Aorta samples are decellularized by sonication treatment with various treatment times and application of sodium dodecyl sulfate (SDS) detergent with and without saline. The relation between decellularization and dissolved oxygen concentration is investigated. The treated samples are evaluated using hematoxylin–eosin staining, scanning electron microscopy, diamidino-2-phenylindol (DAPI) staining, biomechanical testing, and DNA quantification. From the histological analysis, sonication treatment without saline shows complete decellularization at a specific region on the extracellular matrix. This is further confirmed by the DAPI staining, which demonstrates complete removal of DNA fragments for sonication treatment in 2 % SDS without saline. Sonication treatment without saline is thus capable of producing complete decellularized scaffolds for vascular tissue engineering.

Electric-field-based Transfer Functions for Volume Visualization

Yipeng Song, Jie Yang, Lei Zhou, Yuemin Zhu

Transfer functions play a crucial role in direct volume rendering. The intensity and gradient magnitude (IGM) space is one of the most commonly used transfer function spaces, in which boundaries between different materials appear as arches. However, there are often overlapping regions of adjacent arches in the space, which makes it difficult for users to design good transfer functions for exploring and visualizing tissues of interest. To deal with this problem, the present study proposes a transfer function space based on electric field theory. For each voxel, the volume charge density and electric force magnitude in its local neighborhood are calculated. Then, the two properties are used to create the transfer function space. Compared with the IGM space, the proposed space significantly reduces the number of overlapping regions of adjacent arches and produces more compact arches. Thus, users can design appropriate transfer functions for tissues of interest and obtain meaningful visualizations. Results for various datasets are used to illustrate the effectiveness of the proposed method.

Examination of Scale-Invariant Characteristics of Multi-channel ECoG Data for Epileptic Seizure Localization

Suparerk Janjarasjitt, Kenneth A. Loparo

One of the most important tasks for epilepsy surgery is to localize a region of the brain involved with the development of epileptic seizure. This study investigates the scale-invariant behavior of brain activity for evidence of epileptic seizure localization. Multi-channel electrocorticogram (ECoG) data of a subject diagnosed with right mesial temporal lobe epilepsy obtained from various regions of the brain and associated with different states of the brain are examined using the wavelet-based fractal analysis. The spectral exponent computed from such analysis is used as a measure for quantifying scale-invariant behavior. The computational results show that the ECoG data corresponding to various regions of the brain and also different states of the brain exhibit distinguishable characteristics of the spectral exponent. Furthermore, a significant increase in the spectral exponent is observed only in the ECoG channels associated with an epileptic seizure event (inside the epileptogenic zone) during the ictal state. The computational results provide preliminary evidence that an epileptic seizure can be both temporally and spatially localized using scale-invariant characteristics.

國內研討會：

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會議時間：2015-07-30
網址：http://www.bmes.org.tw/seminar_show.php?id=230

第 19 屆奈米工程暨微系統技術研討會
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會議時間：2015-08-13~2015-08-14
網址：http://www.nma.tw/new.html

2015 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
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會議時間: 2015-11-13 ~ 2015-11-14
網址：http://www.bmes.org.tw/2015

國際研討會：

- Toronto'2015 AES-ATEMA 25th International Conference
  Montreal, Canada. August 10 - 14, 2015.
  https://toronto2015aesatema.wordpress.com/

- The 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC'15)
  MiCo - Milano Conference Centor - Milan, Italy. August 25 - 29, 2015.
  http://embc.embs.org/2015/

- 13th International Conference of Numerical Analysis and Applied Mathematics (ICNAAM 2015)
  Rodos Palace Hotel, Rhodes, Greece. September 23 - 29, 2015.
  http://www.icnaam.org/

- Ottawa'2015 AES-ATEMA 26th International Conference
  Ottawa, Canada. October 12 - 16, 2015.
  https://astaa2015.wordpress.com

- The 17th IEEE International Conference on E-health Networking, Application & Services (IEEE Healthcom 2015)
  Boston, USA. October 14 - 17, 2015.
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