Oct, 2013 第 11 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**

醫學工程研究所
Graduate Institute of Biomedical Engineering
國立臺灣科技大學 TAIWAN TECH

TAIWAN TECH 醫學工程研究所

更多醫工動態盡在醫工學會電子報，請即刻閱讀！
學會爲了嘉惠醫工大家庭，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)2760665

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: +886-6-2760665
FAX: +886-6-2343270
E-mail: tsbme@conf.ncku.edu.tw

【成果榮譽】

韓偉生物醫學工程服務獎章 2013 年得獎人:楊順聰博士

【重要研討會訊息】

2013 醫工科技研討會暨國科會醫學工程學門成果發表會，早鳥優惠價到 10/31 截止！

本年度的「2013 年生物醫學工程科技研討會暨國科會醫學工程學門成果發表會」，將由清華大學生醫工程與環境科學系及生物醫學工程研究所共同承辦，會議地點在清華大學，大會特地邀請三位在醫工領域極具影響力之國際知名學者擔任大會邀請演講：

(1) Dr. Sung Wan Kim：目前為美國猶他州大學生物工程特聘教授，研究領域包括了水膠、可生物降解的藥物複合物、可自行調節藥物傳遞、刺激敏感的聚合物、醫療聚合物、設計新穎的聚合物為蛋白質藥物、細胞和基因交付。

(2)熊克平博士：美國南加州大學生物醫學工程系教授，研究領域包括超聲波成像，超聲組織相互作用、超聲造影劑與時域測量血流。

(3)裘正健博士：目前為國衛院細胞及系統醫學研究所研究員與國科會生物發展處之處長，研究領域為物學，細胞和分子生物學，實驗生物學，流體力學和組織工程。

中華民國生物醫學工程學會與承辦單位籌備委員會竭誠歡迎相關領域的各位專家學者、醫師、產業界人士及學生共襄盛舉參與此年度醫工盛會。我們大家今年十一月新竹清華見！

【重要研討會訊息】

IEEE ISBB 2014 (IEEE International Symposium on Bioelectronics and Bioinformatics) 已開始徵稿，歡迎踴躍賜稿!

會議時間：2014 年 4 月 11-14 日

會議地點：中原大學

會議網址：http://www.2014isbb.org.tw/

此會議第一屆(2009)於澳洲墨爾本舉辦，第二屆(2011)於大陸蘇州舉辦，第三屆(2014)將於中原大學舉辦，由中原大學、清華大學、成功大學、中正大學與勤益科大幾位教授協辦，會議將邀請多位國外 IEEE Fellow 進行演講，包含曾擔任 IEEE EMBC general chair (Metin Akay)與 IEEE Journal of Biomedical and Health Informatics (原 IEEE Trans. Information Technology in Biomedicine) Editor-in-Chief (Y. T. Zhang)，主題將涵蓋醫學、醫工與電機工程，為 IEEE EMBS 亞洲指標性的會議之一。

國立台灣科技大學 醫學工程研究所

(一) 本所概況

1. 發展過程

醫療之目標在於如何藉外在的輔助或治療來維持生命現象及改善生活上便利性，因此、整合「工程」與「醫學」研究領域之相關性乃為首務。基於政府極力推展生技及醫療產業政策與世界潮流，醫學工程相關產業無疑是繼光電產業之另一項明星工業。過去、本校雖不少專業教授在醫工研究領域表現優異，由於分散各系所，缺乏整合機制與互動。為強化本校在醫學工程人才培育與醫工領域研發能量，並加速與業界密切互動，以配合國內醫療產業發展，2007 年 8 月 1 日於「工程技術研究所」設立醫學工程領域，初期結合國防醫學院與校內相關師資開設課程與共同指導研究生。「醫學工程研究所」則於 2009 年 2 月 1 日設立籌備處，同年 8 月 1 日成立。

「醫學工程」乃結合醫學、機械力學、機電資訊、材料科學、生物科技等工程，為擴大在醫工領域之發展，未來將以「醫學工程研究所」為平台，整合校內外教學研究資源。並規畫結合校內如：機械、化工、材料、電子、電機與資工等專業系所，設立碩士班與大學部「醫學工程」學位學程，提供其他系所學生選讀第二專長，進而提升本校醫工領域之研發能量。

2. 現況

本所目前專任教師共 9 名與專案教師 1 名，主要研究領域分為生醫材料、生物力學與生醫電資等三大方向。為配合臨床醫學相關課程教學，特別延聘三軍總醫院等醫療院所醫師約 10 名兼任教師。現每年招收碩士班學生 18 名、博士班學生（應用科技研究所醫工領域）4 名。校內空間規劃「醫療器材研發實驗室」、「生醫影像資訊實驗室」、「生醫機電工程實驗室」、「生醫奈米材料實驗室」等四大共同實驗室。

為推動與實現本所發展願景，本校前校長 陳希舜博士與國防醫學院前院長 張德明將軍先於 2007 年 11 月 2 日簽署「教育暨學術策略聯盟」合作協議。在強化雙方實質合作之利基上，更於 2010 年 1 月 5 日共同成立「醫學工程研究中心（Biomedical Engineering Research Center）」，設於國防醫學院院內。並進而推動三軍總醫院規劃成立「植牙中心」，於同年 3 月 25 日啟用營運。

另於國防醫學院「醫學工程研究中心」供本所師生進駐外，為加強與臨床醫生共同研究，三軍總醫院也已提供「醫學影像部」、「牙醫部」、「骨科部」、「復健部」、「病理部」、「醫工室」、「藥學部」等研究空間給本所師生進行實習與實驗。為加強雙方學生學習互補之效益，未來也將實施跨校選課機制，相互承認學分。

3. 中長程發展計劃

本所的中長期發展方向分成如下三個方向：

A. 生醫材料與奈米藥物：再生醫學與組織工程、藥物傳輸載體、醫用顯影劑

B. 醫療器材與科技輔具：生物力學、動作分析、牙骨材手術器械、輔具設計應用.

C. 生醫影像、資訊與訊號：電腦輔助診斷、手術導引系統、生醫訊號處理、生醫光電感測、醫學影像、基因/蛋白質表現分析

未來本所持續茁壯之工作規劃則包括：

(1) 繼續延攬師資，以增加研究能量。

(2) 整合校內資源，成立跨領域醫工學程。

(3) 推動國際化與提升學生外語能力。

(4) 加強實務課程與醫學及產業界交流。

(5) 積極推動產學合作與提升產業技術。

(6) 結合校外資源設立「醫材測試與檢驗」等中心。

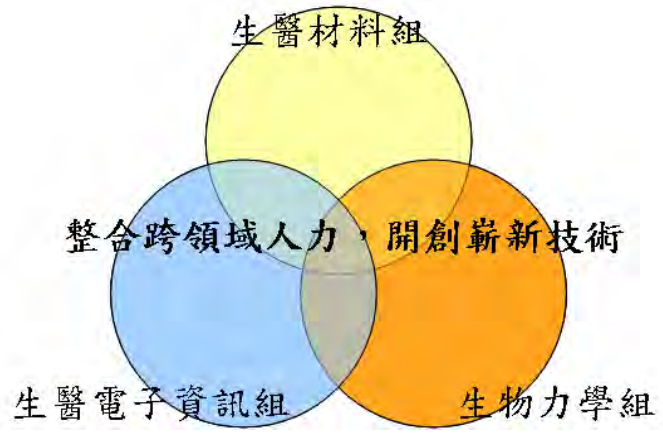
(二) 本所特色簡介

1. 教師分組與研究方向

以下為本所專任師資研究專長之列表

姓名	最高學歷	研究範疇
郭重顯 教授兼所長	國立台灣大學 機械工程所博士	1、醫療機器人 2、嵌入式醫療儀器 3、科技輔具
洪伯達 特聘教授	東京工業大學 有機材料工學博士	1、生醫材料組織設計 2、機能性高分子凝膠 3、軟物質科學
許昕 副教授	國立台灣大學 電機所博士	1、生醫電子 2、微循環血流量測分析 3、血液循環力學
林上智 副教授	國立台灣大學 機械工程所博士	1、骨牙器材與復健生物力學 2、醫療器材法規認證與測試 3、電腦輔助分析與生醫訊號應用
王靖維 助理教授	英國林肯大學 資訊工程博士	1、醫學影像 2、生物資訊探勘 3、3D 立體顯微影像分析
廖愛禾 助理教授	國立台灣大學 電機工程學所博士	1、多模式醫學影像造影 2、超音波標靶性對比劑設計 3、小動物分子影像
許維君 助理教授	國立台灣大學 醫學工程學所博士	1、人體動作力學分析 2、神經肌肉骨骼生物力學 3、動作控制學
白孟宜 助理教授	國立清華大學 化學所博士	1、奈米顯影劑合成之應用 2、奈米材料於藥物傳輸上之應用 3、電噴灑技術於生醫上之應用
高震宇 助理教授	美國喬治亞理工學院 醫學工程博士	1、生醫材料 2、藥物制放系統 3、組織工程與再生醫學

本所師資研發人力之跨領域結合如下圖所示：



2. 研究發展規劃

以目前專業師資為基礎，將可對目前本所規劃之生醫材料、生物力學、生醫電子與訊號影像等三大方向，提供有效的發展助力，且對於三大領域之主要課程內容講授，均可滿足醫學工程知識灌輸之需求。

- 生醫材料組目前主要之研究人力包括高震宇教授以及白孟宜教授，於藥物釋放、再生醫學、組織工程、奈米材料、生醫高分子應用等領域，具有深入且優良之研發能力。未來主要研究將著重於生物可降解聚合物、奈米微粒治療、中藥活性成分開發、生醫奈米醫學顯影劑、奈米藥物制放/傳輸載體等領域，可望在我國生技產業的發展上，掌握生產所需技術及相關 know how，而為台灣的生技研發建立新的利基點。
- 生物力學組主要包括林上智教授與許維君教授兩位，分別由人工骨牙植體、輔助醫療系統資訊整合設計、復健工程、運動生物力學、物理治療學等不同領域入手，並佐以許昕教授於血液流體力學之相關專長，可望於生物力學領域與其在醫療儀器之應用，如：醫療檢測、醫療資訊與輔具設計、運動治療評估訓練器材與指標研發、科技輔具復健系統開發等方面，取得豐碩的成果。
- 生醫電子與訊號影像領域則包含許昕、王靖維、廖愛禾三位教授，將著重於生醫光電量測、非侵入式生醫量測技術、生物晶片資訊、腫瘤醫學影像、分子影像等重要研究課題，涵蓋生醫資訊電子領域目前的重要發展方向，學術方面將貢獻以生物標記、分子影像或光電量測之研究成果，以進一步瞭解生理功能運作，實務方面則可望改善臨床病理醫學工程技術，或開發以超音波腫瘤影像診斷技術或遠距醫療非侵入量測技術為基礎之相關儀器商品。

於台科大之實驗室建制，則著重教師專長之整合，藉由目前規劃四大主題實驗室(生醫機電工程實驗室、腫瘤醫學影像實驗室、生醫材料實驗室、生物力學實驗室)，融合各教師之專業知識，有助於嶄新研究方向之激盪與產生，可望增進教師之研究廣度與深度。此外於國防醫學院等醫療院所之合作，可加強各教師與醫師之跨領域專長結合，以切實發揮教師之專長，解決臨床實務之問題。

(三) 課程

本所課程地圖如下圖所示。由於醫學工程屬於跨領域的學門，因此本所在課程規劃上，除了依據教師的專長外，也儘量考量含蓋醫學工程應有的基本知識以及所的發展方向，期望研究生能夠學習到基礎知識以及研究所需的專業知識。目前課程之規畫依本所的發展方向分為以下四大類，以期與本所三大重要發展領域互相契合：

A. 基礎或共同課程
B. 生醫材料課程
C. 生物力學課程
D. 醫用電子與訊號影像課程

(四) 研發成果與得獎記錄

以個人研究能力為基礎，本所教師於計畫補助爭取、跨領域合作、產學技轉、團隊競賽等層面，皆有廣泛且深入的豐碩成果。以下針對近三年來的重要成果，擇要說明：

1. 論文發表

本所教師於本所成立三年以來，共發表 SCI 論文 67 篇，平均每位教師每年發表 3.19 篇。

2. 國科會計畫

本所教師獲國科會補助計畫列於下表：

主持人	計畫名稱/編號	計畫編號
王靖維	新精準三維量化動脈硬化之醫學影像技術研發	101-2628-E-011-006-MY3
白孟宜	新型態包覆顯影劑與藥物之奈米有機高分子粒子的合成與其在藥物傳輸和醫學影像上之同步雙功能應用	99-2218-E-011-032-
白孟宜	利用多層毛細管式電紡技術開發多功能型創傷止血敷料	100-2221-E-011-069-
白孟宜	標靶性奈米藥物載體之開發與應用	101-2221-E-011-053-
林上智	高風險性之脊椎微創手術的影像數位整合教育訓練平台	99-2321-B-011-001-
高震宇	生物可降解聚縮酮共聚物高分子之合成與其應用在藥物載體及藥物制放之研究	100-2221-E-011-014-
高震宇	口腔多功能藥物制放系統對抑制口腔發炎及抑制白色念珠菌之研究	101-2221-E-011-021-
許昕	微循環血流變異度之研究與評估指標開發	99-2221-E-011-155-MY2
許昕	微循環血流變異度分析應用於中風非侵入式診斷指標之研究	101-2221-E-011-001-MY3
許維君	步行至移動表面時動作調控之生物力學分析：年齡、視覺刺激及表面速度之影響	99-2218-E-011-033-
許維君	中老年人步行啟動及行走至不同速度移動表面及不同視覺刺激回饋時預期性及反應性之動作調控分析	100-2221-E-011-056-
許維君	以生物力學觀點開發羽球鞋-子計畫二：以運動傷害防治為基礎之羽球鞋設計研究	100-2622-H-011-001-CC3
許維君	結合動作擷取系統與人體動作模型開發高爾夫球即時揮桿動作檢視器	101-2622-H-011-002-CC3
廖愛禾	使用總體經驗模態分解法改善超音波肝腫瘤對比劑影像	99-2218-E-011-031-
廖愛禾	以聚焦式超音波調控磁振微氣泡包覆腦腫瘤藥物之釋放以及療效評估	100-2628-E-011-015-MY3
Hossein	3D 多重組織結構合併多功能幹細胞之設計	99-2314-B-011-001-MY3

3. 產學合作計畫

本所教師爭取產學補助重要計畫合作廠商涵蓋醫學工程各領域，包括東聯化學、奇祈科技、佳儀國際、思銳生物科技、博信生物科技、寶元科技股份、聯合骨科器材、生寶生物科技、音感科技、京華堂實業股份有限公司、有聲電子有限公司、財團法人紡織產業所、中山科學研究院，岱妮蠶絲、三軍總醫院、耕莘醫院等。重要產學計畫詳列於下：

主持人	代號	計畫名稱	起始日期
王靖維	醫工所產字 0004	工業區廠商轉型再造升級計畫—紅外線氣體偵測技術與化工製程應用	2010-12-01
	醫工所產字 0010	X 光影像品質優化與牙骨結構影像特徵加強顯示之醫學影像軟體系統	2012-06-15
	醫工所產字 0012	三總 - 組織病理學三維影像之建立與應用	2012-01-01
	醫工所產字 0017	三總-電腦視覺與機器學習技術在測顱分析法中生長預測與治療成果模的運用	2013-01-01
	醫工所產字 0029	佳儀國際有限公司-GPU 高速平行運算于醫學影像應用	2013-07-01
白孟宜	醫工所產字 0009	適用於電化學拋光金屬螯合劑篩選及測試	2012-01-06
林上智	醫工所產字 0001	南部生技醫療器材產業聚落發展計畫-整合型計畫-解剖型骨板/骨釘及手術輔助系統開發	2010-06-01
	醫工所產字 0002	南部生技醫療器材產業聚落發展計畫-整合型計畫-解剖型骨板/骨釘及手術輔助系統開發	2010-06-01
	醫工所產字 0003	內載骨成形蛋白之牙根生物力學模型研究	2010-08-01
	醫工所產字 0005	南部生技醫療器材產業聚落發展計劃之產學合作計畫簽約及請款手續	2011-06-01
	醫工所產字 0007	南部生技醫療器材產業聚落發展計畫-解剖型骨板/骨釘及手術輔助系統開發(第二年/共三年)	2011-06-01
	醫工所產字 0008	超低溫高密度之生物試片儲存與監控槽的改良	2011-09-01
	醫工所產字 0011	北醫-椎間盤退化等級與橈度可調性後位腰椎動態穩定裝置的關聯性分析	2012-03-01
	醫工所產字 0016	三總-以影像為基礎的高解剖貼合特性之脛骨近端骨板系統開發	2012-01-01
	醫工所產字 0020	三總-後位腰椎動態穩定裝置對鄰近節單元的運動學與力學影響	2013-01-01

高震宇	醫工所產字 0014	三總 - 發展具有二階段式釋放抗真菌藥物能力之組織調理材	2012-01-01
許昕	醫工所產字 0015	三總 - 利用雷射杜卜勒微流儀循環血流訊號頻譜分析早期偵測糖尿病小血管病變	2012-01-01
	醫工所產字 0019	三總 - 以雷射杜卜勒微流儀評估新陳代謝症候群對表皮微循環的影響	2013-01-01
廖愛禾	醫工所產字 0013	三總 - 超音波微氣泡對比劑在內耳耳蝸藥物輸送的應用	2012-01-01
	醫工所產字 0018	三總 - 超音波微氣泡對比劑在內耳耳蝸藥物輸送的應用	2013-01-01

重要技轉案如下表所列：

王靖維	奇祈科技	X 光影像品質優化與牙骨結構影像特徵加強顯示之醫學影像軟體系統
王靖維	佳儀國際	GPU 於醫學應像應用
林上智、白孟宜	永磐科技公司	點滴滴空之監測與回報系統

4. 重要研發、產學與競賽成果

■ [2013-09-26] 本所林上智教授、白孟宜教授與國防醫工中心林清亮主任合作參與台北國際發明暨技術交易展，發表「點滴滴空之監測與回報系統」。本發明係藉由重量感測模組及應用該模組之點滴重量監測裝置，將醫院、診所、居家照護與長期照護機構病患之點滴即將滴完訊號，以無線傳輸方式即時發送警示訊息(聲音、震動與閃燈)，給該病患之專責護理師或照護人員知悉，得以即時監控點滴狀況並及時更換。本產品已技術移轉給永磐科技公司。

■ [2013-06-18] 本所王靖維老師，開發高速巨量醫學影像即時互動技術

20G影像壓縮不失真真 病理切片手機看

2013-06-17 中國時報 胡清暉／台北報導

台科大助理教授王靖維研發「巨量超高解析影像的雲端互動式即時顯示系統」，運用特殊編碼技術，可把20G的影像無失真壓縮成500M。（胡清暉攝）

一張病理切片影像檔通常要廿G，無法透過網路傳送。台科大助理教授王靖維運用特殊編碼技術，把廿G影像壓縮成五百M，且不失真，讓病理切片可藉由網路即時顯示在手機、個人電腦。這項發明連獲西班牙、法國競賽佳績，未來有助於跨國醫學合作。

王靖維分析，目前的組織切片、病理切片、腦部切片、癌症標靶治療的蛋白質分析、幹細胞研究，都必須透過高倍率的光學顯微鏡、電子顯微鏡觀看，放大一千倍至一萬倍。

高倍率、高解析顯微影像往往需要廿G（約一萬張、每張二M的照片），目前醫院必須透過價值上千萬新台幣的數位病理系統觀看，無法在網路

- [2013-05-21]本所葉明功教授與洪伯達教授所共同指導胡接燊、湯松陵二位同學榮獲 2013 中華民國生醫材料及藥物制放研討會口頭論文競賽 藥物制放組優等
- [2013-05-21] 本所王靖維教授指導洪楚媚、彭俊瑋、陳翔洲同學「第四屆校園創意創業─新事業發展競賽組」，榮獲第一名
- [2013-04-01] 本所林上智教授獲得 102 年脊椎外科醫學會優秀論文比賽第二名
- [2013-03-07] 三總與本所助理教授廖愛禾博士的跨領域合作研究團隊，研發出嶄新的定量給藥技術，以低能量超音波結合微氣泡的方式，可暫時改變圓窗膜的通透性，讓藥物更有效的進入內耳，對聽損治療具重大意義
- [2012-12-17] 由葉明功、洪伯達教授共同指導博士班學生胡接燊、湯松陵獲第 39 屆國軍軍醫學術研討會海報競賽藥學藥理學組第二名
- [2012-11-26] 本所林上智教授團隊，獲 2012 全國大專校院資訊應用服務創新競賽產學合作第一名

- [2012-11-13] 本所林上智教授榮獲第九屆國家新創獎
- [2012-10-11] 本所王靖維教授及指導學生彭俊瑋、陳翔洲獲得國際 4D 胸腔 MRI 右心室偵測與辨識比賽第二名。

- [2012-07-20] 本所林上智教授與學生許祥瑞、吳帝頡組成研究團隊，改良現有的儲存系統，開發「超低溫世界管理者」。
- [2012-06-25] 本所教師王靖維及學生彭俊瑋、陳翔洲、洪楚媚開發的「全自動醫學影像技術分析」，獲國際超音波醫學影像競賽第 1 名。
- [2012-05-28] 由房同經教授與本所合聘洪伯達教授指導之學生高藝慈、黎青草，參加生醫年會壁報論文競賽榮獲碩士組第三名佳績
- [2012-03-31] 本所團隊，量身打造專屬鞋墊，獲教育部頒發創業基金 100 萬元，創業團隊由醫工所林上智教授指導，成員包括范昌源、劉家忠。
- [2012-02-14] 本所許昕老師指導之學生張勳宇、許家良及與國防醫學院醫工科陳福基老師共同指導之學生林家瑋，參加「2012 智慧電子創新應用與設計競賽」，榮獲第一名
- [2012-02-02] 本所高震宇老師指導之學生劉律君榮獲 2012 高分子年會-口頭英文論文報告-銅牌獎
- [2011-12-30] 電子所林淵翔老師和本所許維君老師共同指導醫工所學生許婉汝，參加第二屆全國生醫電子與資訊專題實務競賽，榮獲第三名(Epson 特別獎)。
- 本所廖愛禾教授指導學生鄭志浩榮獲 2011 醫工年會壁報論文優等獎

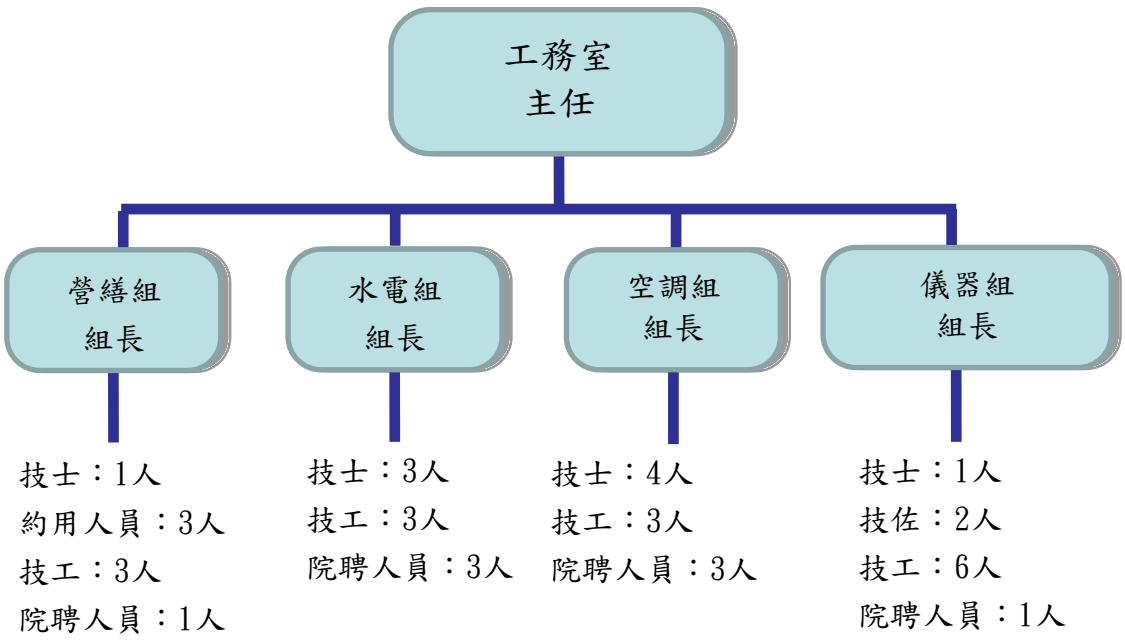
聯絡方式

網址：http://www.be.ntust.edu.tw/home.php
電話：(02) 02-2733-3141 轉 3216　　傳真：(02)22852422
地址：台北市 106 大安區基隆路 4 段 43 號 研揚大樓 9F TR-930

成大醫院工務室之組織架構及定位

國立成功大學醫學院附設醫院(以下簡稱本院)於民國 73 年 9 月起開始興建，係當時國家「十四項重要建設計畫」之一，亦是嘉南地區唯一國家醫學中心。民國 77 年 6 月完工啟用，迄今已屆滿 25 年。本院為教學、研究、訓練及醫療服務並重之機構，而工務室(本室)的職責為確保各項工務相關系統工程之正常運作，使醫學中心醫療業務及教學研究得以運作順暢。由於公立醫院體系中是以「作業基金」制度營運，因此如何有效利用資源，降低成本，進而加強內部控管，遂成為本院重要之管理指標。

本室組織編列共 42 人，下設組別有營繕組、水電組、空調組及儀器組，如圖一所示。**營繕組**主要負責醫學中心整建工程之規劃設計、訪價、招標、簽約、監工及驗收。**水電組**負責水電設備、消防安全、防火管理工程之裝設維護及巡檢工作。**空調組**負責空調設備、鍋爐設備、熱泵設備等維護兼發包小組、空氣品質、中央監控室、工程檔案管理。**儀器組**負責醫療氣體之氣送系統供應維護，弱電設備、UPS 設備保養及醫療儀器整合性評估、驗收、修護及報廢等技術管理工作。本室同仁為具有各項技能之專業技術人員，以團隊合作整體服務扮演著重要的後勤服務支援角色。



圖一、工務室組織編制

在「國立成功大學醫學院附設醫院第二大樓擴建計畫」中，建築物規模為地上十層、地下三層，總樓地板面積為 65,451.92 ㎡（約 19,799.2 坪），總經費為 22 億 5,000 萬元整(如圖二、三所示)。自 95 年 12 月 20 日開工至 99 年 6 月 12 日舉辦啟用典禮，在歡慶成大醫院邁向另一個嶄新的里程之際，前林院長炳文特別提出：「萬萬不可以忘記那些辛苦的工程人員，無論是各級監督的工程師、現場施工人員，輔助點工、清潔人員，均是完成這個工程的不可或缺的人員，因這工程是可以傳世的，應該找個地方讓他們簽名，以彰顯他們的成就。」因為工程人員一向都是沉默的工作者，常是「做好是應該的」，在醫院舞台中是永遠的配角，不搶戲卻是使醫學中心醫療業務得以運作順暢的重要人物。

圖二、成大醫院中心全區透視圖

圖三、99 年 12 月 28 日門診大樓獲行政院公共工程金質獎合影

本室同仁各組間的組務運作常以團隊合作進行後勤服務角色，如目前本院正在進行的門診大樓 9 樓 10 樓增建計畫、放射腫瘤部空間新建工程、住院大樓 7C 病房區整建工程、住院大樓 3、4 樓與機電中心連通整修工程等。而以目前住院大樓手術室第二期併第三期整建工程為例：營繕組在整建工程中，所需面對的是室內裝修申請設施變更使用執照與符合消防法規之防火區規劃關鍵瓶頸；水電及空調組在二、三期工程銜接之消防、空調管線因涉及開刀房運作與感控之要求，在設備安裝中需克服重重困難；而儀器組在這個工程中面臨新型醫療儀器引入_達文西機器人手術系統(da Vinci® Surgical System)、微創手術系統、複合式手術室之數位雙軸心血管攝影 X 光機等，在未來新醫療儀器維修、保養的管理也備受挑戰。

近年來因應用科技發展與進步，許多醫療儀器進展日新月異，如何提升醫療品質安全以確保儀器診斷治療品質，已成為各醫院努力的方向。而本室未來即將面臨人力結構年資達 25 年以上人員超過半數的窘境，故新人力的引進、組織再造、積極培訓同仁之專業能力及鼓勵同仁提升醫工相關專業技能，將是本室未來努力的重點目標。希望我們這一群「永遠的配角」醫界中的無名英雄，能夠陪伴成大醫院渡過無數璀璨的 25 年。

圖四、99 年 6 月 4 日工務室同仁合影

102 年醫工證書甄試通過名單

<<此放榜名單，僅具領證資格，領證尚須符合領證規定>>
放榜名單下載處: http://www.bmes.org.tw/notice_show.php?id=311

在此，將領證及換證相關事項，說明如下，敬請協助配合！！
本學會得於應試者成為本會正式（個人或永久）會員後，始授與證書。
以下為重要訊息更正請詳讀：
以學生會員入會並通過證書考試者，因領證需符合個人會員入會成功才可領證(學生會員不可領證)，故若是今年報考證書考試時已繳交學生會員入會費者，若符合領證資格欲領證，請繳交轉換成個人會員之 102 年常年會費差額 600 元及領證費用 2000 元，一共 2600 元整。
1. 已符合領證資格：請於 102 年 09 月 30 日前，提供
a) 個人二吋證件照片一張；
b) 繳交領證費，共計 2000 元；劃撥帳號：01850504 戶名：中華民國生物醫學工程學會蘇芳慶。
請將照片與劃撥單收據影本，以紙本方式寄至本會。證書預計於 11 月底前統一寄送。
2. 未符合領證資格：
筆試與口試之及格成績可保留三年(105 年 12 月 31 日)。報考時尚未畢業或工作年資未達規定者，考生於考試及格後三年內待學歷及累積工作年資符合後再行發證。
3. 換證：本證書三年需更換一次，請在證書有效期間內，維持會員資格，且累積繼續教育學分至少 60 學分數(其中主要學分至少 45 學分，輔助學分 15 學分)，詳細學分累計方式，請參閱本會網站(http://www.bmes.org.tw/notice_show.php?id=107)。

以上，如有任何疑問，歡迎隨時與學會秘書處聯繫。再次感謝您的支持！
敬祝 業安

中華民國生物醫學工程學會
秘書處 敬啟

2013 Vol. 33, No. 3

Review: Application of Non-linear Methods in the Study of Atrial Fibrillation Organization

Raúl Alcaraz, José J. Rieta

Nonlinear analysis has emerged as a novel methodology for the processing of physiological time series over the past few decades because biological systems and processes are inherently complex, nonlinear, and non-stationary. In this sense, cardiac cells and the time course of atrial electrophysiological properties have shown a far-from-linear behavior during atrial fibrillation (AF). This work reviews the main approaches of nonlinear analysis (chaos theory, information content quantification, irregularity measures, and geometric features) in the study of AF. The application of these indices both to surface electrocardiographic recordings and invasive atrial electrograms reveals useful clinical information in a complementary way to traditional linear techniques, such as spectral analysis. Indeed, atrial activity signal analysis through nonlinear indices provides more accurate estimates of the temporal, spatial, and spatio-temporal organization of AF. Given that AF organization has been associated with the number of simultaneous wavelets wandering throughout the atrial tissue during arrhythmia, its robust estimation can help improve treatments and allow more appropriate decisions on AF management.

Residual Analysis of Seed-Position Error for Orthogonal-Film Reconstruction Technique Used in Brachytherapy

Liyun Chang, Tsair-Fwu Lee, Hueisch-Jy Ding, Sheng-Yow Ho

It is essential to verify the reconstruction techniques as suggested in ESTRO booklet 8 that institutions should perform the verification of any reconstruction technique employed clinically. However, the seed-position error that undergoes residual analysis is usually not noticed, but is important, since the error may not be in normal distribution. An isocentric beam checker device is used in this work. The device has a two-dimensional array of steel balls embedded on its surface. The checker was placed on a simulator couch and the simulator gantry was rotated to make the checker behave like a three-dimensional array of balls. All points were located within 20□ 20 □ 20 cm3, with the isocenter in the middle, and were reconstructed using an orthogonal-film algorithm in the Abacus treatment system. To correctly calculate the standard deviation of the seed-position error, Jarque-Bera and Doornik-Hansen normality tests were used. All normality tests were passed. With 0.1° and -0.1° read errors of the gantry angle and collimator angle, respectively, the mean error was zero for each axis in Cartesian coordinates, with an uncertainty of around 0.74 mm with a 95% confidence interval, which implicated the importance of the normality test. The mean distance error was around 0.28 mm in each axis and the uncertainty of the seed-isocenter distance error did not depend on the seed-isocenter distance. The proposed method can be used for the verification of seed-position error in any facility, and can be applied to evaluate the delivered dose errors of brachytherapy.

Numerical Analysis of Protective Cage Geometries for Mechancical Cavopulmonary Assistance in a Patient-Specific Fontan Physiology

Sharjeel A. Tahir, William B. Moskowitz, William B. Moskowitz, Amy L. Throckmorton, Amy L. Throckmorton

This study investigated the performance of an intravascular, percutaneously inserted, axial-flow blood pump in a patient-specific model of a Fontan physiology. This pump is designed to augment pressure and thus blood flow in the cavopulmonary circulation. The outer cage of the device serves as a protective and functional design component. The performance of three cage geometries with unique directions of filament twist was evaluated via numerical simulations and direct comparison to a previous cage design. The cage designs performed acceptably to support Fontan patients. The cage design with filaments twisted in the opposite direction to the impeller blades and in the direction of the diffuser blades (against-with) outperformed the other designs by producing a pressure rise in the range of 1-8.5 mmHg for flow rates of 1-4 L/min at 1500-4000 RPM and pulmonary arterial pressures of 16 mmHg. Results from the blood damage index analyses indicate a low probability for damage with maximum damage index levels of less than 1%. Fluid force magnitudes in the axial and radial directions were less than 0.2 N, and the exit vorticity from the pump was minimized by the against-with cage. This study represents ongoing progress in the development of this blood pump.

Formation and Stimuli-Directed Migration of D. discoideum Slugs in Microchips

Jinho Kim, Timothy Olsen, Xuye Zhuang, Ji Luo, Jun Yao, Milan Stojanovic, Qiao Lin

This paper presents a microfluidic device that geometrically constrains the development of individual Dictyostelium discoideum cells into multicellular organisms (slugs). A microchip for the stimuli-directed migration of slugs is also presented. To demonstrate the formation of slugs in a predetermined shape, a microchip is designed to confine the slugs in the vertical direction. In the microchip, sufficient oxygen is supplied to the cells via a membrane, allowing the formation and adaptation of slugs to the shape of the channel. In addition, the manipulation of slug migration direction in a microchip via external stimuli, such as light and temperature gradients, that induce phototaxis and thermotaxis of slugs, respectively, is demonstrated. To direct slug migration with external stimuli, an optical fiber is used for phototaxis and an electrical wire heater is used for thermotaxis. Experimental results show slug formation in a predefined geometry in the microchip, suggesting that this chip is potentially useful for understanding the relationship between the shape and function of cells or tissue. The controlled migration of slugs demonstrated in the microchips can potentially be employed in biologically based microactuators or microrobots.

Finite Element Simulations of Bone Temperature Rise During Bone Drilling Based on a Bone Analog

Yuan-Kun Tu, Li-Wen Chen, Ji-Sih Ciou, Chih-Kun Hsiao, Yung-Chuan Chen

Many researchers have attempted to measure bone temperature using thermocouples; however, the limitations of thermocouples make it difficult to determine the bone temperature in the immediate vicinity of a drilled hole. This study develops a method of analysis that can be used to obtain the bone temperature rise in the immediate vicinity of a drilled hole. A three-dimensional finite element model, based on a bone analog, was used to simulate bone temperature rise during a drilling process. The effect of drilling speed on bone temperature distribution is discussed. The results indicate that, for a constant drill feed rate, the drill bit with a higher rotation speed can cause a noticeable increase in bone temperature as well as the size of the thermally affected zone. Based on the numerical results, an empirical equation is proposed to estimate the peak bone temperature using the value of the rotation drilling speed. The maximum difference between the peak bone temperatures predicted by the proposed equation and those obtained from the numerical model is less than 3.5%.

A Locally Linear Least Squares Method for Simultaneously Smoothing DWI Data and Estimating Diffusion Tensors

Xiaozheng Liu, Wei Liu, Guang Yang, Weidong Chen, Junming Zhu, Yongdi Zhou, Bradley S. Peterson, Dongrong Xu

Magnetic resonance diffusion-weighted imaging (MR-DWI) data usually contain a great deal of noise and a significant number of outlier data points that can undermine the accurate estimation of diffusion tensors (DTs). Raw MR-DWI data therefore usually must undergo substantial preprocessing prior to tensor estimation. This study proposes an approach for the reconstruction of DT fields from MR-DWI data that combines into a single step the regularization of raw MR-DWI data and the optimized estimation of DT fields. The approach uses locally weighted linear least squares (LWLLS) estimation to correlate information within the local neighborhood of each voxel. It incorporates into the linear least squares (LLS) framework a bilateral filter which assigns different weights to neighbor voxels according to their intensities and relative distance. This method efficiently smoothes the MR-DWI data and estimates optimal tensors simultaneously. The performance of the proposed method was compared to that of traditional LLS estimation of tensors using both simulated and real-world human MR-DWI data. Both the simulated and real-world datasets demonstrated that the proposed method greatly outperforms the conventional LLS method and that the simultaneous smoothing of MR-DWI data and tensor estimation performs as well as the separate and sequential execution of these procedures.

Measurements of Lifetime and Attenuation Properties of Ultrasound/Magnetic resonance Multimodality Molecular Probe

Ai-Ho Liao, Che-Chou Shen, Chih-Hao Cheng, Ho-Chiao Chuang, Chih-Hung Wang, Chin-Hsiang Lin

It has been shown that microbubble (MB)-enhanced focused ultrasound (FUS) temporally and locally disrupts the blood-brain barrier (BBB), thereby enhancing drug delivery into brain tumors. Imaging tumor angiogenesis with contrast-enhanced ultrasound (US) has been explored with targeted MBs. The BBB opening threshold and BBB opening volume were found to be bubble-size-dependent. However, the relationships between the various components of bubble shells and BBB opening are still unclear. According to a previous study, 1-2 m bubbles have the most pronounced acoustic activity at frequencies above 10 MHz. The present study developed targeted US/magnetic resonance (MR) multimodality MBs, whose acoustic properties were compared with two commercial MBs, namely SonoVue and Targestar SA. The acoustic activities of these 1.15-2.78 m MBs with different shells at 10 MHz were investigated. The lifetime and attenuation properties of lipid MBs (SonoVue and Targestar SA), albumin-(Gd-DTPA) MBs, and avidin-conjugated albumin (avidin-albumin)-(Gd-DTPA) MBs at 10 MHz were investigated with the pulse- echo substitution method. It was found that incorporating avidin into the albumin MBs and albumin-(Gd-DTPA) MBs affects the size distribution but does not affect the concentration of MBs produced. The avidin-albumin-shelled MBs had more significant nonlinear activity at 4-18 MHz ($p = 0.025$), whereas the nonlinear activity of the other MBs peaked at 6-24 MHz ($p = 0.003$-0.044). Moreover, the incorporation of paramagnetic metal ions into the MB shells increased their attenuation coefficients. With regard to the lifetime of these agents, the attenuations of the SonoVue and Targestar SA were 87.96% and 8.74%, respectively, and those of albumin, avidin-albumin, albumin-(Gd-DTPA), and avidin-albumin-(Gd-DTPA) MBs were 49.52%, 41.38%, 74.69%, and 100%, respectively. Avidin conjugation decreased the lifetime of the albumin MBs, but not that of the lipid MBs. The incorporation of paramagnetic metal ions into the shells of albumin MBs did not decrease their lifetime.

Influence of Ocular Stiffness on Intraocular Pressure Estimation Using Goldmann Applanation Tonometry

Masako Shirane, Yoshiaki Kiuchi, Keiko Otani, Yuichi Kurita, Makoto Kaneko, Joji Takenaka

Accurate intraocular pressure (IOP) measurement is important for management of glaucoma. Ocular stiffness is considered to be an important biomechanical factor influencing corneal deformation during IOP measurements by a Goldmann applanation tonometer (GAT). The purpose of this study was to investigate how ocular stiffness is related to clinical parameters. Ocular stiffness was defined as the ratio between the change in the force applied to the cornea and the resultant displacement of the corneal apex. Fifty-nine Japanese subjects had their ocular stiffness measured. A GAT was used to apply pressure to the cornea and a high-resolution camera was used to measure corneal apex displacement by photographing the cornea in profile. Multiple regression analyses were used to assess how ocular stiffness is associated with seven factors: IOP measured by the GAT (IOPGAT), radius of curvature of the cornea (R), ocular axial length, anterior chamber depth, central corneal thickness, age, and gender. Ocular stiffness was found to be proportional to the product of (IOPGAT)0.66 and (R)0.92; the other factors were not significantly associated with ocular stiffness. For an individual eye, because the value of the radius of corneal curvature was unchanged, ocular stiffness was proportional to (IOPGAT)0.66. This means that the rate at which ocular stiffness diminishes is greater in the lower, compared to the higher, IOPGAT range. Hence, the rate at which the true IOP diminishes is greater in the lower IOPGAT range because the true IOP is considered to be the primary factor influencing ocular stiffness. This suggests that, in patients with lower IOPGAT, the change of true IOP should become progressively greater than the value indicated by IOPGAT. This result allows improved evaluation of treatment effectiveness in normal-tension glaucoma patients.

Design of Experimental Hypoxia Chamber for Cell Culture with Manipulatable Microprobe

Ching-Huang Hsu, Jia-Jin Jason Chen

Hypoxia chambers are a well developed device for investigating the biochemical effect of tissue under hypoxic conditions. The enclosed design of the chamber is essential to prevent re-oxygenation by external air but also limits access to measurements during experiments, resulting in fewer sampling points or only pre- and post-hypoxia data. The present study implements a non-enclosed hypoxia chamber to provide free entry for manipulating microprobes, which makes frequent sampling during experiments feasible. A steady deoxygenated environment is created directly by supplying nitrogen to the culture medium or indirectly by supplying a pre-prepared deoxygenated medium. Three hypoxia chamber schemes were designed and validated to induce a low oxygen level. In addition, nerve growth factor (NGF)-differentiated PC12 cells were utilized to verify the efficiency of ischemic conditions. Results indicate that the design with a continuous supply of nitrogen into the water-trapped chamber provides the most stable deoxygenated environment and prevents the dehydration effect caused by nitrogen pumping. The designed hypoxia chamber can be used for continuous monitoring of optical or electrical properties of neuronal cells insulted by ischemia for drug screening or fundamental research.

An Improved Parametric Relaxation Approach to Blood Flow Signal Estimation with Single-Ensemble Samples in Color Flow Imaging

Zhiyuan Shen, Naizhang Feng, Yi Shen, Chin-Hui Lee

In color flow imaging, it is a challenging work to accurately extract blood flow information from ultrasound Doppler echoes dominated by strong clutter components. Conventional non-parametric estimators usually cause flow velocity estimation biases since clutter rejection filters often distort parts of blood flows or fail to suppress clutter adequately. In this paper, a parametric estimation framework called relaxation (RELAX) is proposed to directly extract blood flow information from raw ultrasound Doppler signals. RELAX constructs an exponential model to approximate single-ensemble ultrasound Doppler echoes and solves for its parameters in a decoupled manner. The principal Doppler frequencies of the clutter and the blood flow obtained by RELAX are independent of the corresponding phase shifts. A parameter selection algorithm based on the energy ratio is proposed to determine the number of principal components. A series of simulations shows that the proposed RELAX approach can achieve accurate velocity estimation of blood flow. The mean overall errors obtained by RELAX are 30% lower compared to those obtained using state-of-the-art non-parametric methods using eigen-decomposition based filters. RELAX also eliminates the effect caused by white noise and achieves an extremely low estimation variance of low-velocity blood flow (< 15cm/s) compared to those obtained using competing methods. Clinical experiment results show that the RELAX method leads to the highest blood flow energy and blood-to-clutter energy ratio among those obtained using the discussed methods.

Point-of-care Testing of Portable Blood Coagulation Detectors Using Optical Sensors

Chin-Lung Yang, Yan-Chao Chiou, Cheng-Wei Chou, Kung-Chia Young, Song-Jeng Huang, Chih-Yi Liu

A portable optical blood coagulation detector is proposed for point-of-care testing for determining prothrombin time (PT). The detector is applicable to sending the results to a computer via wireless transmission. The integrated apparatus comprises an optical module, a signal processing module, and a communication module for directly sensing real-time changes of transmittance during the blood coagulation process. The efficacy of the proposed device was validated with patients' whole blood specimens. Only a small amount of whole blood (approximately 60 μl) is required. The mean relative error of the PT values obtained using the proposed device is 4.8 + 3.5% (less than one second) compared with the PT values obtained using the standard manual PT method (n = 26). The two testing platforms have highly correlated results (r = 0.997, $p < 0.001$). The proposed device has advantages of portability, ease of operation, real-time results, accuracy, carrying a potential for remote monitoring in the personalized long-distance healthcare industry.

Comparison of Stainless Steel and Titanium Alloy Instruments in Posterior Correction and Fusion Surgery for Adolescent Idiopathic Scoliosis-Prospective Cohort Study with Minimum 2-year Follow-Up

Eijiro Okada, Kota Watanabe, Naobumi Hosogane, Yuta Shiono, Yohei Takahashi, Yuji Nishiwaki, Kazuhiro Chiba, Yoshiaki Toyama, Morio Matsumoto

This prospective study compares the radiographic and clinical results of posterior correction and fusion surgery for adolescent idiopathic scoliosis (AIS) using stainless steel and titanium alloy instruments. The subjects consisted of 65 AIS patients who underwent posterior correction and fusion surgeries using a 5.5-mm-diameter rod at a single institution. Of these, 27 patients were treated using stainless steel instruments (S group) and 38 were treated using titanium alloy instruments (T group). The mean age at the time of surgery was 14.4 ± 3.5 years. The radiographic findings, intra-operative time, estimated blood loss, perioperative complications, and SRS-22 (a patient questionnaire used in the clinical evaluation of idiopathic scoliosis outcomes) were examined. The mean preoperative Cobb angle of the major curve was 62.5 ± 17.2° in the S group and 57.8 ± 13.2° in the T group ($p = 0.407$). Postoperatively, the curves were corrected to 11.2 ± 10.5° and 10.3 ± 8.5° ($p = 0.384$), with mean correction rates of 83.4 ± 12.2% and 83.1 ± 11.6% ($p = 0.940$), respectively. At the final follow-up, although the mean correction loss was slightly larger in the S group (4.4 ± 5.2°) compared with that in the T group (2.3 ± 5.5°), the values were not significantly different ($p = 0.118$). The coronal balance and sagittal balance were also not significantly different between the two groups at the final follow-up. The function, pain, and mental health sub-scores and the total score for SRS-22 show a tendency for better outcomes in the T group; however, there were no significant differences between the two groups. Thus, there was no statistical difference in radiographical and clinical outcomes between AIS patients treated surgically using stainless steel instruments and those treated using titanium alloy instruments.

Surface Modification of Commercially Pure Ti Treated with Aqueous NaOH Treatment and Ethyl Alcohol Aging

Hsueh-Chuan Hsu, Shih-Ching Wu, Shih-Kuang Hsu, Shao-Hsuan Chuang, Wen-Fu Ho

This study evaluates the biomimetic calcium phosphate-forming abilities of commercially pure titanium (c.p. Ti) substrates treated with NaOH aqueous solution and subsequent ethyl alcohol aging before being soaked in simulated body fluid (SBF). Specimens of c.p. Ti were initially treated with 5 M NaOH at 60 °C for 24 h, resulting in the formation of a porous network structure composed of sodium hydrogen titanate (NaxH2－xTi3O7). The specimens were then aged in ethyl alcohol at 60 °C for 5 or 10 min, and subsequently immersed in SBF at 37 °C for 3, 7, and 14 days, respectively. The calcium phosphate-forming abilities of the c.p. Ti after a single NaOH treatment were low, but significantly increased after ethyl alcohol aging. Similarly, aging in ethyl alcohol reduced the water contact angles of the surfaces. NaOH treatment combined with ethyl alcohol aging for 5 min resulted in the greatest deposit of calcium phosphate on the c.p. Ti.

Kinematic Model of Colonoscope and Experimental Validation

Wu-Bin Cheng, Ki-Young Song, Yun-Yun Di, Edwin M. Zhang, Zhi-Qin Qian, Sivaruban Kanagaratnam, Michael A. J. Moser, Wen-Long Luo, Wen-Jun Zhang

Minimally invasive surgery represents the future of many types of medical intervention, such as endoscopic surgery. Colonoscopy involves the insertion of a flexible instrument (a colonoscope) into the human colon for the diagnosis and management of diseases of the colon. A colonoscope consists of a control hand unit with valves and a manoeuvrable bend section at the distal end controlled by two knobs at the control hand unit. During colonoscopy, loop formation present challenges. The form of a walking stick at the distal end of the scope plays a major role in loop formation in colonoscopy. Thus, an accurate kinematic model of the relationship between the motion of the distal end and the control unit could help colonoscopists effectively manipulate the motion of the distal end to avoid loop formation. This study uses D-H parameters to model the kinematics of the distal end of a colonoscope and analyzes the kinematic relationship between the motion of the tip of the colonoscope and the angular control at the control hand unit. The position and orientation of the distal end of the scope can be predicted for a given operation at the control unit. The kinematic model is validated by the experiment.

Effects of Food Viscosity on Swallowing Velocity in Pharynx for Different Groups of Age and Gender

Sompong Bangyeekhan, Vitoon Leelamanit, Perapong Tekasakul

Dysphagia can be treated using methods such as direct food swallowing. However, the viscosity of food can be an obstacle to patients. To prepare appropriate food for patients, nutritionists need to understand the influence of food viscosity on the velocity of bolus transport in the pharynx. In the present study, the effects of the viscosity of shear-thinning food on bolus velocity are investigated. Food viscosity in the range of 95 to 1368 mPa•s (nectar to honey consistency) is tested. Thai volunteers were classified into 3 groups, namely young adult, adult, and elderly. Videofluorographic recording was performed and bolus velocity was calculated. The average tail bolus velocity of young adult volunteers while swallowing food with a nectar-honey consistency was about 99-125 mm/s for males and 77-90 mm/s for females. The values were 97-117 mm/s for males and 76-80 mm/s for females in the adult group, and 87 mm/s for males and 85 mm/s for females in the elderly group. Swallowing characteristic of male is developed in natural style, where velocity decreases with increasing viscosity. However, the swallowing characteristic of female is developed to a full performance, where swallowing power is at maximum regardless of viscosity. The velocity of food swallowing depends on food viscosity. A suitable swallowing velocity for healthy persons can be used for the design of food for dysphagic patients to yield similar velocity.

2013 Vol. 33, No. 4

Review: Roles and Functions of User-oriented Gerontechnology: mStick and hStick

Satu Pekkarinen, Päivi Kuosmanen, Helinä Melkas, Antti Karisto, Raisa Valve, Kari Kempas

This study focuses on the role of user-oriented gerontechnology in elderly care services. The memory and reminiscence stick (mStick) and health stick (hStick) concepts have been developed to increase user involvement in services and to make the service chains smoother, which has been the focus of the health and social policies in many countries. The mStick is a biographical memory store where personal documents, like family photographs, texts, and audio and video clips, are stored. The hStick is used for storing health-related data, needed in the case of emergency or in self care, especially in health promotion. Eighteen pilot cases were investigated throughout their implementation to assess the roles and functions of the sticks. Qualitative data were collected in the years 2010 to 2012 via interviews, learning diaries, photographs, memos, and participatory observation diaries. Qualitative content analysis was conducted. In the analysis, ten roles and functions of the sticks were found at three levels, namely the organizational and societal level, “the meso-level” (relationships between an individual and the social environment), and the individual level. The simplicity and versatility of the sticks has facilitated acceptance of these kinds of concepts.

Stenosis Detection using Burg Method with Autoregressive Model for Hemodialysis Patients

Wei-Ling Chen, Chia-Hung Lin, Tainsong Chen, Pei-Jarn Chen, Chung-Dann Kan

This paper proposes a signal processing method for the evaluation of arteriovenous (AV) shunt stenosis in hemodialysis patients. AV shunts are surgically created pathological fistulas that serve as access routes for hemodialysis. The distinct and periodic bruit of the vascular shunts is clearly audible over the access routes. Thus, a bruit spectral analysis can be a valuable noninvasive method for quantifying the severity of vascular stenosis. This study collected phonoangiographic data from thirty AV shunts obtained from an electronic stethoscope during pre- and post-percutaneous transluminal angioplasty (PTA) periods. An autoregressive (AR) model was applied to analyze the phonoangiographic signals. The AR model and a filter order of eight were chosen to estimate the characteristic frequency of the bruit. AR model results obtained from the analysis of the phonoangiographic data under the pre- and post-PTA conditions show significant changes in frequency and magnitude. Seven patients were enrolled for periodical follow-up analysis for AV shunts. The Burg AR model is used to find the characteristic frequency of phonoangiographic signals. Therefore, the variation of frequency and amplitude in power spectra analysis showed strong correlation with the severity of AV shunt stenosis.

RFID in eHealth: How to Combat Medication Errors and Strengthen Patient Safety

Pedro Peris-Lopez, Masoumeh Safkhani, Nasour Bagheri, Majid Naderi

A medication error is an adverse event or even a miss in the treatment process that may harm a patient. As a consequence of this, patients' diseases may recrudesce and the mortality rate could rise. Therefore, medication errors have consequences in human terms and result in higher medical costs. Advanced inpatient medication safety systems can help reduce such errors in hospitals. Radio-frequency identification (RFID)-based systems are a promising solution for such applications. In this context, RFID grouping-proofs have been proposed to generate evidence that a collection of tags were read at the same time. These proofs are useful for automating the five rights method (right patient, right drug, right dose, right route, and right time). Wu et al. recently proposed an RFID grouping-proof. Unfortunately, the security level offered by this protocol is too low, as demonstrated here. This study shows how a passive attacker can conduct a full-disclosure attack. The cost of the proposed attack is only , which is inappropriate for medical applications, and thus the attack requires only a few minutes on a personal computer. In addition, a de-synchronization attack can be conducted with only two runs of the protocol. Finally, as the idea of using grouping-proofs seems useful to enhance patient safety, a protocol called EKATE is proposed and a security analysis is performed.

A Multi-level Cloud-based Virtual Health Exam System on Health Cloud

Chin-Ho Lin, Ping-Huei Tseng, Liang-Cheng Huang, Yen-Jen Oyang, Ming-Shiang Wu, Seng-Cho T. Chou

The design purpose of preventive health exams (PHEs) is to identify early asymptomatic disease and function that may affect health, making the exams a crucial measure in preventative healthcare. However, in practice, before health examinations, the majority of the public lacks practical personal health assessment for planning personal health examinations. This greatly affects the results and effectiveness of PHEs. To address this problem, this study proposes a virtual health examination (VHE) system that predicts examination results prior to health examinations, allowing people to conveniently select relevant test items before deciding to proceed with the actual examinations. The VHE model is designed to facilitate the support of all examination items and various grades or levels of health examination. The model uses cloud computing virtualization technology to rapidly integrate existing exam prediction models or newly developed models and follows a multi-level prediction framework. Therefore, different levels of VHE models can be constructed for each examination item, allowing the system to assemble various grades or levels of VHEs. Additionally, to respond rapidly to the large quantity of enquiries from the public, the system employs a cloud computing architectural design. Specifically, the VHE models deployed within the system are driven by the collaborative operations of two units in the system, vheMap and vheSum, to increase computing efficiency. This allows people to obtain their virtual exam reports quickly.

Thermal Imaging for Assisted Living at Home: Improving Kitchen Safety

Ming Y. Yuan, James R. Green, Rafik Goubran

The stove is one of the most frequent sources of fire accidents in the home, many of which are caused by human error or forgetfulness, a problem which may become more serious with advanced age. An automated stove-top monitoring system could significantly increase kitchen safety. This study develops such a system, which uses a thermal camera to detect dangerous situations and behaviours, and alerts the user before a fire occurs. It is hoped that this system will serve to promote independent living among the elderly, leading to increased quality of life and decreased health care costs. The stove-top monitoring system consists of four subsystems: burner status (active/inactive), burner temperature trend, pot presence/absence, and human activity detection. Twenty-two experiments were conducted using ceramic, electric coil, and gas stove tops. Rule-based algorithms were developed to combine the outputs of the four subsystems, and to alert the user or caregiver when a dangerous situation occurs. Excellent performance was achieved for alert generation (sensitivity = 94%, positive predictive value = 83%). Furthermore, no modifications are required to the stove top, allowing this system to be retrofitted on any stove top.

Statistics-Based Initial Contour Detection of Optic Disc on a Retinal Fundus Image Using Active Contour Model

Huang-Tsun Chen, Chuin-Mu Wang, Yung-Kuan Chan, Shys-Fan Yang-Mao, Yung-Fu Chen, Sheng-Fuu Lin

The retinal optic disc is the region from where the central retinal artery and optical nerve of the retina emanate. Hence, it often serves as an important landmark and reference for other features in a retinal fundus image. The features obtained from a fundus images are often helpful in the diagnosis of various eye diseases. Locating and segmenting the optic disc are key pre-processing steps for extracting retinal features. This paper proposes a statistics-based method for locating a rectangular region of interest (ROI) containing the optic disc in a retinal fundus image. From a set of candidate rectangular regions, the method chooses the ROI using statistical features, namely the mean, standard deviation, and skewness of the pixel gray levels in the candidate regions. Since an optic disc is approximately round or slightly oval in the vertical direction, this study treats the maximal inscribed circle of the ROI as the initial contour of the optic disc and uses an active contour model (ACM) to precisely segment the optic disc further based on the initial contour. The experimental results show that the proposed statistics-based method combined with an ACM provides impressive performance in the segmentation of optic discs.

Study on Real-time Monitoring Technique for Cardiac Arrhythmia Based on Smartphone

Jian Weng, Xing-Ming Guo, Li-Shan Chen, Zhi-Hui Yuan, Xiao-Rong Ding, Ming Lei

Electrocardiography (ECG) monitoring is an important method for cardiac disease detection and prevention. With the development of telemedicine, ECG real-time monitoring becomes more convenient. The rise and popularization of smartphone provide a new technical means for ECG monitoring. This paper focuses on the development of software for an ECG monitoring system on a smartphone platform. The system includes a client and a center. The client is developed on smartphone. Its main function is process and diagnose ECG signal. A wavelet method is used to detect the QRS-complex and diagnostic criteria are formulated to diagnose 14 kinds of arrhythmia disease. The tele-monitoring center is developed on a PC with LabVIEW, which receives ECG signal and diagnosis from smartphone by GPRS. Results show that the system can monitor ECG and diagnose arrhythmia by calculating the heart rate in real time. The proposed system is reliable and gives good real-time performance.

Analysis and Construction of Genetic Network for Mice Brain Microarray Datasets

Jui-Ming Chen, Yu-An Liu, Yu-Ling Jung, Yung-Kuan Chan, Jorng-Tzong Horng, Jen-Hui Syu, Meng-Hsiun Tsai

This paper intends to find out target genes about memory and learning via microarray analysis. Microarrays are often used to store and manage large amounts of data; however, there is no consensus as to how to best analyze microarray data. This paper uses computational algorithms to analyze gene samples from mice with various calcium channel phenotypes. Min-max normalization was used first to normalize the data. Then, analysis of variance was applied to detect genetic differences among the genes. Finally, Pearson correlation coefficients were calculated to identify the regulatory network of the genes. This analysis model can be applied to efficiently analyze complicated gene expression data. It can also be used to examine the biological functions and regulations of target genes.

Three-layer Activity Recognition Combining Domain Knowledge and Meta-classification

Simon Kozina, Hristijan Gjoreski, Matjaž Gams, Mitja Luštrek

One of the essential tasks of healthcare and smart-living systems is to recognize the current activity of a particular user. Such activity recognition (AR) is demanding when only limited sensors are used, such as accelerometers. Given a small number of accelerometers, intelligent AR systems often use simple architectures, either general or specific for their AR. In this paper, a system for AR named TriLAR is presented. TriLAR has an AR-specific architecture consisting of three layers: (i) a bottom layer, where an arbitrary number of AR methods can be used to recognize the current activity; (ii) a middle layer, where the predictions from the bottom-layer methods are inputs for a hierarchical structure that combines domain knowledge and meta-classification; and (iii) a top layer, where a hidden Markov model is used to correct spurious transitions between the recognized activities from the middle layer. The middle layer has a hierarchical, three-level structure. First, a meta-classifier is used to make the initial separation between the most distinct activities. Second, domain knowledge in the form of rules is used to differentiate between the remaining activities, recognizing those of interest (i.e., static activities). Third, another meta-classifier deals with the remaining activities. In this way, each activity is recognized by the method best suited to it, leaving unrecognized activities to the next method. This architecture was tested on a dataset recorded using ten volunteers who acted out a complex, real-life scenario while wearing accelerometers placed on the chest, thigh, and ankle. The results show that TriLAR successfully recognized elementary activities using one or two sensors and significantly outperformed three standard, single-layer methods with all sensor placements.

An Authentication Protocol for Ubiquitous Health Monitoring Systems

Chang-Kuo Yeh, Hung-Ming Chen, Jung-Wen Lo

Many emerging application domains are being developed for smart living environments. In particular, smart living environments that provide assistance for aging populations are becoming increasingly feasible. Therefore, there is an urgent requirement for a ubiquitous health monitoring (UHM) system. The proposed authentication scheme for UHM system consists of a wireless body area network, inexpensive sensors, a personal mobile device, and a medical server. To prevent fraudulent behavior, the mutual authentication between elements is necessary. However, the current security mechanism for UHM system is not clearly described. In such a way, a secure authentication for UHM system is proposed which can protect the patient-data well and is suitable for currently available wireless sensors.

Wearable ECG Recorder with Acceleration Sensors for Monitoring Daily Stress

Yoshio Okada, Tsuyoshi Yi Yoto, Taka-aki Suzuki, Satoshi Sakuragawa, Hiroyuki Sakakibara, Kayoko Shimoi, Toshifumi Sugiura

A small and light-weight wearable electrocardiograph (ECG) device with three accelerometers (x, y, and z axis) was developed for prolonged monitoring of everyday stress. It consists of an amplifier, a microcomputer with an analog/digital converter, a tri-axial accelerometer, and a memory card. Four parameters can be sampled at 1 kHz for a maximum of 27 h with the default battery and a 1 GB memory card. An algorithm for the reliable and clear detection of R wave peaks of ECG was also developed for accurate heart rate variability (HRV) analysis. The algorithm reduces ECG motion artifacts induced by body movements. Off-line data processing includes autonomic nervous system (ANS) activity bi-spectral analysis and the application of the tone-entropy method to HRV data. The availability of the system was tested through simulated office work and three-day monitoring. Both short-term and circadian rhythms of ANS activity were clearly observed. The experimental data verifies the functionality of the proposed system.

Smart Healthcare Environment: Design with RFID Technology and Performance Evaluation

Chia-Chen Chen, Ya-Fen Chang

This research proposes a radio-frequency identification (RFID)-based smart hospital environment (SHE) with distributed reading capability to enhance the quality of service by improving just-in-time healthcare, patient identification, emergency message delivery, healthcare worker assignment, and rescue response. Most research on emergency healthcare has focused on pre-hospital emergency medical services, with healthcare for general in-patients seldom mentioned. In this study, an RFID-based smart suite is applied to create a healthcare monitoring system for monitoring patients in real-time. An Android-based smartphone is used for sending patient alarm messages to healthcare workers. A pilot study is used to demonstrate and simulate how the proposed system can significantly improve daily emergency healthcare operations and its benefits in the hospital.

國內研討會：

- 雷射系統於生醫/光電材料應用技術研討會
  地點:台北市羅斯福路二段九號五樓 （第一會議室）
  會議時間: 2013-10-30 ~ 2013-10-31
  網址:
  http://www.pida.org.tw/seminar/WelcomeEnter.asp?semiPKcode=1807&ActionYes=Yes

- 2013 生物醫學工程科技研討會暨國科會醫學工程學門成果發表會
  地點: 清華大學 (醫工學會會員可取得主要學分 20 學分)
  會議時間: 2013-11-15 ~ 2013-11-16
  網址: http://bmes2010.xwing.com.tw/2013

- 2013 國際奈米科技研討會 (2013ISNST)
  地點: 南台科技大學
  會議時間: 2013-11-15 ~ 2013-11-16
  網址: http://chem.stust.edu.tw/en/node/call

國際研討會：

- ISOT 2013 International Symposium on Optomechatronic Technologies

  Seoul, Korea. Oct. 28-30, 2013.

  http://www.isot2013.org/main/

- 2013 Annual Conference on Rehabilitation Engineering and Assistive Technology，

  Seoul, South Korea. November 1-2, 2013.

  http://www.resko.or.kr/

- MEDICA-World Forum for Medicine - International Trade Fair with Congress

  Dusseldorf, Germany. Nov. 20-23, 2013.

  http://www.medica-tradefair.com/

- 13th Asian BioCeramics Symposium (ABC2013)

  Kyoto, Japan. Dec. 04 – 06, 2013.

  http://www.abc2013.jp/

- The 15th International Conference on Biomedical Engineering (ICBME 2013)

  National University of Singapore, Singapore. Dec. 04-07, 2013.

  http://www.icbme.org/

- IEEE International Symposium on Bioelectronics and Bioinformatics (IEEE ISBB)

  Chung Yuan Christian University, Taiwan. April 11-14, 2014.

  http://www.2014isbb.org.tw/

歡迎會員提供更多研討會相關訊息