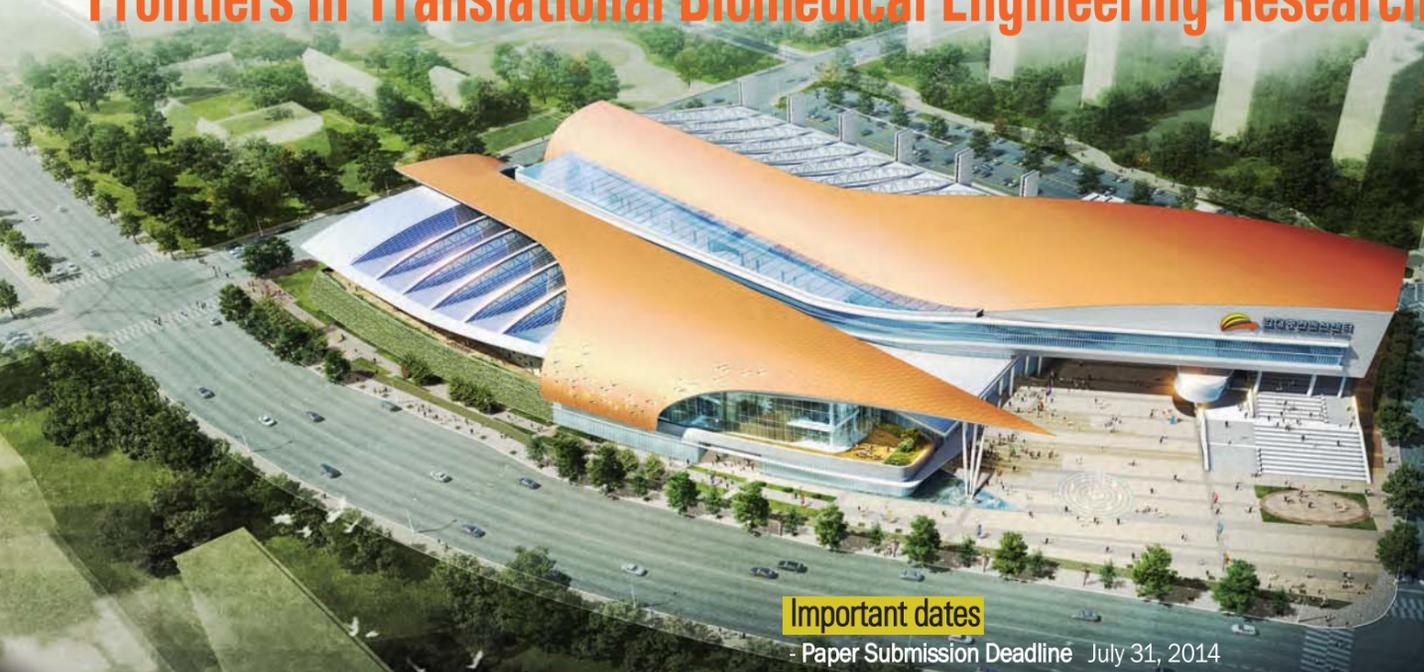


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- Paper Submission Deadline July 31, 2014
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S7 Therapeutic Devices
S8 Diagnostic Devices
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S9 Computational Biomechanics
S10 Clinical Biomechanics
S11 Sports Biomechanics
- T6. **Biomedical Robotics and Rehabilitation Engineering**
S12 Biomedical Robotics
S13 Rehabilitation Engineering
- T7. **Molecular and Cellular Biomechanics, Tissue Engineering**
S14 Molecular Cell Mechanics and Mechano-biology and Biomaterials
S15 Tissue Engineering and Biomaterials
S16 Biochip and Organ on a Chip
- T8. **Cardiovascular and Respiratory System Engineering**
S17 Cardiovascular and Respiratory System Engineering
- T9. **Sensors and Measurements for u-Healthcare**
S18 Non-Intrusive Measurements
S19 Sensors for U-Healthcare
S20 Ambient assisted Living & Smart Homes
S21 Body Sensor/Area Networks
S22 Signal And Data Processing
- T10. **Mobile and Remote Healthcare System**
S23 Wireless/Mobile Healthcare System
S24 Home Healthcare System
S25 Emergency Healthcare System
S26 Telemedicine
- T11. **Application of u-Healthcare**
S27 Sleep Monitoring & Evaluation
S28 Cardiovascular Informatics
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2014년도 제49회 대한의용생체공학회 춘계 학술대회

2014년도 제49회 대한의용생체공학회

춘계 학술대회

Evolution to Success in Biomedical Engineering: Research Clustering as Win-Win Strategy

- 일시 | 2014년 5월 9일(금)~10일(토)
- 장소 | 충청북도 오송 C&V Center (오송첨단의료기기개발지원센터)

- 주최 | 대한의용생체공학회
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대한의용생체공학회 제49회 춘계학술대회에 참가하신 회원 여러분을 진심으로 환영합니다.

이번 학술대회를 “Evolution to Success in Biomedical Engineering: Research Clustering as Win-Win Strategy”라는 주제 하에 오송 첨단의료기기개발지원센터에서 주최하게 되어 매우 의미있게 생각합니다.

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2014년 5월
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2014년도 춘계학술대회를 맞이하여



2014년도 제 49회 대한의용생체공학회 춘계학술대회를 오송첨단의료산업진흥재단에서 개최하게 된 것을 진심으로 기쁘게 생각합니다.

오송첨단의료산업진흥재단은 세계수준의 첨단의료기기 및 신약을 개발할 수 있도록 첨단 인프라를 지원해주기 위해 설립된 재단법인입니다. 재단 내 핵심 시설인 첨단의료기기개발지원센터는 BT기술을 기반으로 하는 첨단의료기기의 개발을 집중 지원하여 글로벌 경쟁력을 강화하고, 의료기기산업 발전에 기여하고 있습니다.

우리 재단은 작년 11월 핵심연구개발지원시설의 준공으로 충북단지에 입주한 기업은 물론, 국내·외 연구기관에 첨단의료제품 개발에 필요한 시설, 장비, 인력 등 인프라를 지원하여 제품화에 이르기까지의 One-Stop 지원 서비스를 목표로 하고 있습니다. 올해부터는 각 부처에서 충북단지 지정으로 공동연구지원 사업이 본격적으로 진행될 것으로 기대하고 있습니다. 이러한 시점에서 의공학의 학술적 발전과 인력 양성에 중심적인 역할을 하고 있는 대한의용생체공학회 학술대회를 개최하게 된 것에 대해서 매우 뜻깊게 생각합니다.

2014년도 춘계학술대회의 성공을 위해 조직위원회는 최선을 다하여 학술대회를 준비하였습니다. 특히 우리 재단의 김선일 센터장님을 비롯한 구성원들과 학회 박광석 회장님 이하 사무국 관계자분들, 충청북도 도청 관계자분들 그리고 인근에서 큰 힘을 보태 주신 충북대학교 의공학 교실 교수님들께도 깊은 감사의 말씀을 드립니다. 앞으로도 우리 재단은 대한의용생체공학회 발전을 위해 지속적으로 관심을 가지고 지원하도록 하겠습니다. 우리 재단을 찾아주신 모든 회원님들을 환영하며, 이번 학회를 통해 저희 재단에 대해 이해하는 자리가 되기를 바라옵고, 의공학 전문가들의 학문적 교류와 건승을 바랍니다. 감사합니다.

2014년 5월

대한의용생체공학회 제49회 춘계학술대회 조직위원장 **이귀현**

CONTENTS

The Korean Society of Medical & Biological Engineering ■■■

기조강연	01
국내 의료기기 클러스터의 상생 방안 김선일 센터장 (오송 첨단의료기기개발지원센터)	
심포지엄 I : Onset BME technologies	05
마이크로테슬라 MRI와 생체자기공명 김기웅 센터장 (한국표준과학연구원 생체신호센터)	
Stem Cell Transportation Using Magnetically Actuated Scaffold-type Microrobots 최홍수 교수 (대구경북과학기술원)	
의광학 기술의 실용화 연구 정병조 교수 (연세대학교 의공학부)	
심포지엄 II : Ready-to-use BME technologies	11
A Monolithic Portable fNIRS System with 1cm Spatial Resolution for Functional Brain Imaging 배현민 교수 (KAIST 전기및전자공학과)	
From Biochip Development to System Development: Blood Physiometers Abstract 양 성 교수 (광주과학기술원 기전공학부)	
Seeing Inside Human Body: From On-Optical-Bench System Development to Bedside Patient Imaging 오왕열 교수 (KAIST 기계공학과)	
식품의약품안전처 특별세션	17
유헬스케어 의료기기 허가심사 및 정책 방향 강영규 연구관 (식품의약품안전처)	
체외진단용 시약의 관리 현황 김세중 의료기술주사 (식품의약품안전평가원 의료기기심사부 체외진단의료기기TF팀)	
초음파영상진단장치 등 10개품목 의료기기 위험관리 가이드라인 마련 연구 박호준 수석연구원 (한국산업기술시험원 의료기기평가센터)	
인공무릎관절 수술로봇 평가 가이드라인 개발 연구 최재순 연구부교수 (서울아산병원 아산생명과학연구원)	

오송첨단의료기기개발지원센터 특별세션

23

오송 첨단의료기기개발지원센터 기업지원 방향

강태건 연구기획부장 (오송 첨단의료기기개발지원센터)

회사 소개 및 기능성 봉합사의 연구, 개발

최종화 전무이사 ((주)메타바이오메드)

자동제세동기(AED)의 현재와 미래

최성환 연구소장 ((주)씨유메디칼시스템)

정밀 뇌수술을 위한 5-ALA와 ICG 병용 다중형광 광역학진단기기 개발 발표

신민선 수석 ((주)엠지비엔도스코피)

현존하는 스텐트의 분류와 장단점

이민구 차장 (태웅메디칼 오송연구소)

공초점(Confocal) 레이저 스캐닝 현미경 기술과 응용

전병선 대표 (나노스코프시스템즈(주))

생명, 아름다움을 여는 비밀이 열리는 2014오송국제바이오산업엑스포

이차영 사무총장 (충청북도청)

산업통상자원부 의료기기 R&D 특별세션

33

산업부 의료기기 R&BD 발전전략

허 영 PD (KEIT)

국내 의료기기 R&D 현황 및 우수성과

장종찬 팀장 (KEIT)

차세대 분자영상 시스템 기술개발 ; PET-MRI 시스템 핵심기술 및 기대효과

조규성 교수 (KAIST 원자력 및 양자공학과)

노약자/장애인을 위한 근력보조시스템 개발 ; 'Smart Mobile Walker'를 중심으로

장우석 상무 (LG전자 Creative Innovation Center)

신진연구자

37

Human-Computer Interaction (HCI) Technologies for People with Autism Spectrum Disorder (ASD)

김광욱 교수 (한양대학교 컴퓨터공학과)

Size-dependent MR Property of Iron Oxide Nanoparticles

이노현 교수 (국민대학교 신소재공학과)

Plasmonic Nanosensors for Biomedical Analyses

최인희 교수 (서울시립대학교 생명과학과)

Intracoronary OCT Clinical Application

하진용 교수 (세종대학교 광전자공학과)

의료기기 측정불확도 특별세션	43
------------------------	-----------

모두가 알아야 하는 측정과 불확도	
최종오 책임연구원	(한국표준과학연구원, 글로벌 측정 아카데미)
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일반연제 1, 2, 3	47
---------------------	-----------

Biomedical Optics	성명수
Biomedical Robotics	김윤재
Medical Imaging	손성진, M. Chauhan, Nguyen Van Phuc
Neural Engineering	김진호, 신호진, 장경은
Orthopedic and Rehabilitation Engineering	김유현, 김의령
Tissue Engineering and Biomaterials	김병휘
System Biology, Physiological Modeling	조용준
U-Health, e-Health, m-Health Technology	황라영
Medical Nano and Microtechnology	하준목
Biomedical Engineering Education and Career	안준형

- POSTERS I 55
- POSTERS II 77
- POSTERS III 99

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편집이사	이경중	연세대
	이상훈	고려대
	이재성	서울대
학술이사	김인영	한양대
	최영빈	서울대

직책	성명	소속
국제협력이사	우응제	경희대
	김법민	고려대
기획이사	김희찬	서울대
	홍성화	삼성서울병원
교육이사	지영준	울산대
	김주명	광양대
산학협력이사	김성민	동국대
	송태경	서강대
	허영	한국전기연구원
	김동현	연세대
정보이사	안원식	서울대
	노정훈	부산대
회원관리이사	김한성	연세대
	이계한	명지대
협력이사	이성호	고려대
	윤인찬	KIST

정보위원회

직책	성명	소속
정보이사	노정훈	부산대

직책	성명	소속
정보이사	안원식	서울대

학술위원회

직책	성명	소속
학술위원장	김인영	한양대
학술부위원장	임창환	한양대
	최영빈	서울대
위원	강현욱	부경대

직책	성명	소속
위원	유흥기	한양대
	윤종인	대구가톨릭대
	임기무	금오공대
	임도형	세종대

직책	성명	소속
위원	김필한	KAIST
	문홍상	한양대
	민세동	순천향대
	박중열	중앙대
	박지호	KAIST
	박한수	중앙대
	변경민	경희대
	성종환	홍익대
	성준경	고려대
	송영준	오송첨복단지
	양성	광주과기원
	유형석	울산대

직책	성명	소속
위원	장동표	한양대
	전상범	이화여대
	정용	KAIST
	정의현	GIST
	주세경	울산의대
	천홍구	고려대
	최성용	경희대
	최연호	고려대
	한동욱	부산대
	허찬영	서울대
	윤인찬	KIST
	황도식	연세대

교육위원회

직책	성명	소속
교육이사	김주명	광양보건대
	지영준	울산대
위원	권기진	영남이공대
	권춘기	순천향대
	김덕현	광주대
	김동욱	전북대
	김성민	동국대
	김영곤	인제대
	김윤년	계명대
	김형훈	광주여대
	김휘영	동주대
	나승권	폴리텍대(원주)
	박준식	강릉영동대
	박태건	충북도립대
	박해암	남부대
	서종범	연세대
	송동진	중원대
	심은보	강원대
	오대호	한림성심대
	오승훈	한중대

직책	성명	소속
위원	오정환	부경대
	원철호	경일대
	윤종인	대구가톨릭대
	이기영	관동대
	이동훈	동명대
	이석재	서남대
	이우철	을지대
	이정환	건국대
	이종민	한양대
	이주원	안동과학대
	임용규	상지대
	임재근	강동대
	정광손	상지영서대
	조민형	경희대
	조성보	가천대
	최병철	춘해보건대
	최승한	대구한의대
	최연호	고려대
	최중한	해천대
	태기식	건양대

(국문)편집위원회

직책	성명	소속
편집이사	권성훈	서울대
	김동욱	전북대
	정병조	연세대
위원	남기창	동국대
	남윤기	KAIST
	송병섭	대구대
	신정욱	인제대
	엄광문	건국대
	유선국	연세대
	이계한	명지대

직책	성명	소속
위원	이수열	경희대
	김경아	충북대
	이재성	서울대
	이종민	한양대
	임도형	세종대
	임창환	한양대
	조성보	가천대
	정동근	동아대
	한동근	KIST

(영문)편집위원회

직책	성명	소속
편집위원장	이상훈	고려대
편집이사	이재성	서울대
간행이사	박현진	성균관대
위원	박지호	KAIST
	김한성	연세대
	임창환	한양대

직책	성명	소속
위원	정봉근	서강대
	임용규	상지대
	김광기	암센터
	박재석	고려대
	윤대성	연세대

역사편찬위원회

직책	성명	소속
위원장	조진호	경북대
부위원장	김희찬	서울대
위원	김경아	충북대
	김법민	고려대
	김경환	연세대

직책	성명	소속
위원	박희준	계명대
	이정환	건국대
	이성재	인제대
	양윤석	전북대
	지영준	울산대

조직위원장

직책	성명	소속
준비위원장	이귀현	오송첨단의료산업진흥재단
위원	김선일	오송첨단의료산업진흥재단
	강태건	오송첨단의료산업진흥재단
	송영준	오송첨단의료산업진흥재단

직책	성명	소속
위원	차은종	충북대
	이태수	충북대
	송동진	중원대
	최종화	메타바이오메드

2014년도 대한의용생체공학회 춘계학술대회 프로그램

The Korean Society of Medical & Biological Engineering ■■■

5월 9일 (금)

시간/장소	대회의실	중회의실(B)	중회의실(C)
10:00~12:00		National Instrument Tutorial	Agilent Tutorial
12:00~13:00	식사		
13:00~13:40	개회식		
13:40~14:40	기조강연		
14:40~15:00	Tea break		
15:00~16:00	심포지엄 1: Onset BME technologies	식품의약품안전처 특별세션	오송첨단의료기기개발 지원센터 특별세션
16:00~16:30	심포지엄 2: Ready-to-use BME		산업통상자원부 의료기기 R&D 특별세션
16:30~17:00	technologies		
17:00~18:00	포스터 1		
18:00~20:00	저녁 만찬		

5월 10일 (토)

시간/장소	대회의실	중회의실(B)	중회의실(C)
09:30~10:30	포스터 2		
10:30~11:45	일반연제 1: Biomedical Optics, Robotics and Medical Imaging	일반연제 2: Cardiovascular, Neural, Orthopedic and Rehabilitation Engineering	일반연제 3: Biomaterials, Physiological Modeling, U-Health & eHealth and Medical Nano and Microtechnolog
11:45~13:00	식사		
13:00~14:30	포스터 3	신진연구자 세션	의료기기 측정불확도 특별세션
14:30~15:00	폐회식		

2014년도 대한의용생체공학회 춘계학술대회 개최 안내

The Korean Society of Medical & Biological Engineering ■■■

- 행사명: 2014년 대한의용생체공학회 춘계학술대회
- 개최일정: 2014. 5. 9(금) ~ 5. 10(토)
- 개최장소: 충북 청원군 오송 첨단의료기기개발지원센터(C&V센터)



■ 찾아오시는 길

◦ 주소 : 본부 : C&V센터 - 충북 청원군 오송읍 오송생명1로 194-41
센터 : 4개센터 - 충북 청원군 오송읍 오송생명로 123

◦ 연락처 : TEL : 043-200-9100 / FAX : 043-200-9109

◦ 오시는 방법

1. 자가용

- > 청주 IC(경부고속도로) - 조치원, 행정도시 방면 우측 - 고가도로옆길(36번국도) - 오송생명과학단지 방면 우측 - 국책연구기관 방면 우회전(오송생명 3로) - 좌회전(오송생명2로) - 도착
- > 서청주 IC(중부고속도로) - 옥산, 청주역방면 우측 - 청주역사거리(청주역로) - 월곡사거리(36번국도) - 고가도로옆길(36번국도) - 오송생명과학단지 방면으로 우측방향 - 국책연구기관 방면으로 우회전(오송생명3로) - 우회전(오송생명2로) - 도착

2. 철도

- > KTX : 오송역 하차 (택시로 5분 거리) [코레일 홈페이지](#)
- > 열차: 조치원역 하차 (택시로 20분 거리) [코레일 홈페이지](#)

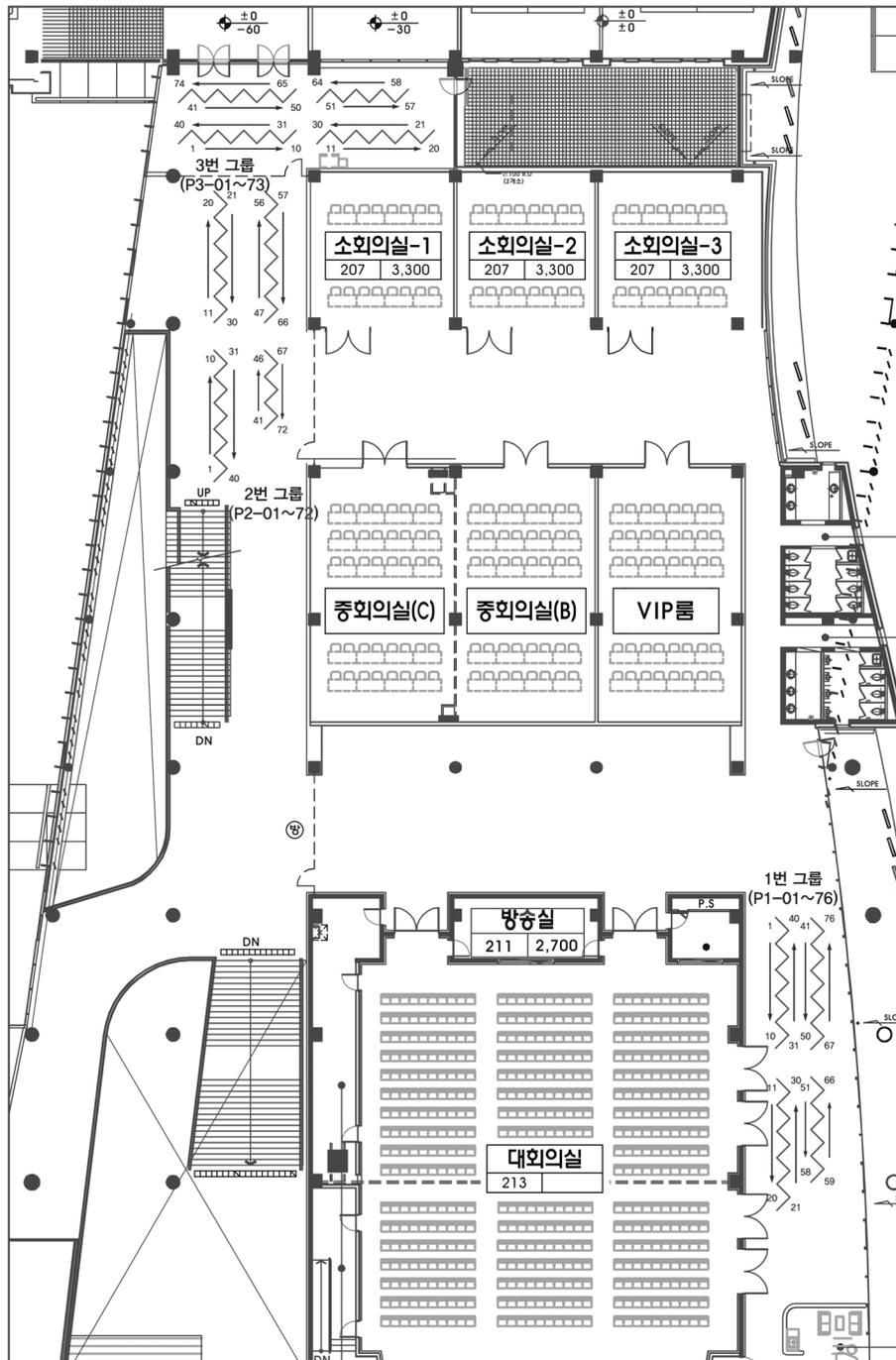
3. 시내버스

- > 오송역 : 53, 57, 500, 511, 525, 750, 751
- > 조치원역 : 53, 525

4. 시외버스

- > 서울 남부터미널 출발 ↔ 오송역 3번 출구 ↔ 오송첨단복합단지 (1일 편도 3회 운행)
 - 상행(오송타운 남문-서초동): 15:20, 18:50
 - 하행(서초동-오송타운 남문): 07:10, 19:25, (월요일 06:45 추가)

■ 평면도



■ 참가비 납부방법

2014 춘계	사 전	당 일
일 반	10 만원	12 만원
학 생	5 만원	6 만원
비회원 일반	11 만원	14 만원
비회원 학생	7 만원	8 만원
학부생(참관)	2 만원	2 만원

* 학술대회 논문발표자는 반드시 학회 회원으로서 연회비 납부와 사전 등록비를 각각 별도의 계좌번호 입금처리를 하여 주셔야만 하오니, 이점 착오 없으시길 바랍니다.

* 사전등록비 납부방법 :

국민은행, 계좌번호 031-01-0420-215(예금주: 대한의용생체공학회)

* 연회비 납부방법 :

국민은행, 계좌번호 031-25-0006-795(예금주: 대한의용생체공학회)

대한의용생체공학회 학술대회 셔틀버스 운영안내

The Korean Society of Medical & Biological Engineering ■■■

■ 배차간격 및 시간표

5월 9일 (금)	오송역 → 학회장 노선					
	배차 순서	오송역 출발	학회장 도착	KTX 상행선 도착 시간	KTX 하행선 도착시간	구분
	1	09:40	09:50	09:21, 09:28	08:47, 09:33	1호차
	2	10:55	11:05	10:28	10:34, 10:47	2호차
	3	11:45	11:55	11:36	11:01, 11:33	1호차
	4	13:10	13:20	12:34	12:57, 13:02	2호차
	학회장 → 가경동 고속버스터미널(숙소) 노선					
	배차 순서	학회장 출발	가경터미널 도착		구분	
	1	20:00	20:30		1호차	
	2	20:10	20:40		2호차	
	3	21:10	21:40		1호차	
	4	21:20	22:00		2호차	
5월 10일 (토)	가경동 고속버스터미널(숙소) → 학회장 노선					
	배차순서	가경터미널 출발	학회장 도착		구분	
	1	07:30	08:00		1호차	
	2	08:30	09:00		2호차	
	3	08:40	09:10		1호차	
	4	09:40	10:10		2호차	
	학회장 → 오송역 노선					
	배차순서	학회장 출발	오송역 도착		구분	
	1	14:10	14:20		1호차	
	2	15:20	15:30		2호차	
	3	15:30	15:40		1호차	
	4	16:00	16:10		2호차	



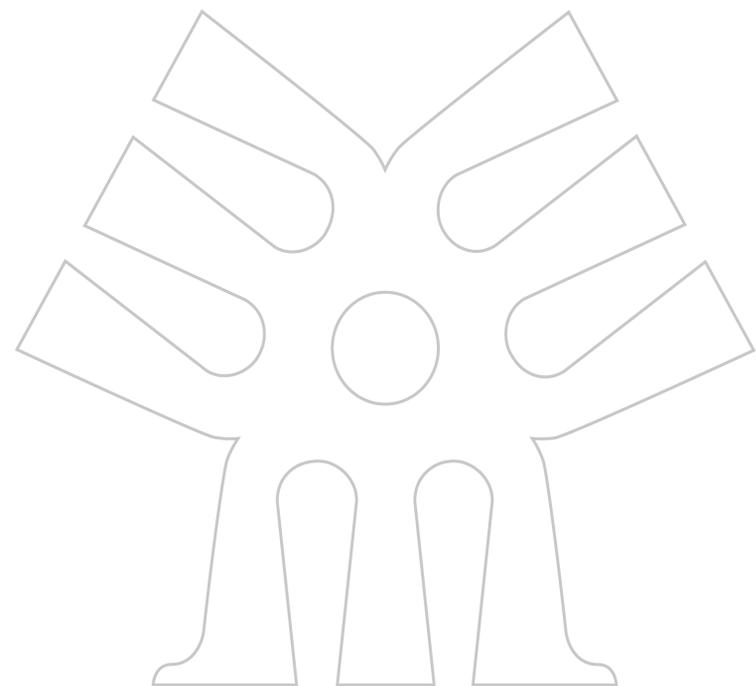
기조강연

2014년도 제49회 대한의용생체공학회 춘계학술대회

좌장 | 우응제 교수님 (경희대)

국내 의료기기 클러스터의 상생 방안

김선일 센터장 (오송 첨단의료기기개발지원센터)





국내 의료기기 클러스터의 상생 방안



이름: 김선일
 직위: 첨단의료기기개발지원센터장
 소속: 오송첨단의료산업진흥재단 첨단의료기기개발지원센터
 한양대학교 생체공학과 교수

Abstract 국내 의료기기 산업을 육성하기 위해, 2005년 의료산업선진화 위원회에서 첨단의료 복합 단지 조성 방침이 결정된 이후 10년이 지난 2014년에는 첨단의료기기 개발지원센터가 정상적인 연구개발 지원 체계를 갖추려 하고 있다. 원주의료기기 테크노밸리, 구미IT의료융합기술센터, 대구 첨단의료기기개발지원센터, 김해의생명 센터, 서울디지털산업단지 메디컬클러스터 등 전국 각 지역에서 구성되어 있는 의료기기 산업 클러스터와의 상생 방안을 찾고자 한다. 오송과 대구의 첨단 의료기기 개발지원센터는 제품화R&D 연구 지원을 하는 기관으로서, 응용연구·시제품제작·시험검사 및 동물실험이 가능하도록 되어 있다. 이러한 인프라 활용의 극대화를 통해 국내 의료기기 산업이 2020년 세계 7대 의료기기 강국이 되도록 국내 클러스터들의 현황을 알아보고 상생 협력 방안을 제시하고자 한다.

Brief Biosketch

■ 학력

1972~1976 서울대학교 공과대학 전기공학과(공학사)
 1976~1978 서울대학교 공과대학원 전기공학과(공학석사)
 1982~1987 DREXEL University 의공학과(공학박사)

■ 경력

2003~2005 한국과학재단 기초연구본부장
 2009~2010 대한의용생체공학회 회장
 1988~현재 한양대학교 생체공학과 교수
 2013~현재 한국한림원 공학부분 정회원
 2011~현재 오송첨단의료산업진흥재단 첨단의료기기개발지원센터장



심포지엄 1

Onset BME technologies

2014년도 제49회 대한의용생체공학회 춘계학술대회

좌 장 | 윤종인 교수 (대구가톨릭대)

정 용 교수 (KAIST)

마이크로테슬라 MRI와 생체자기공명

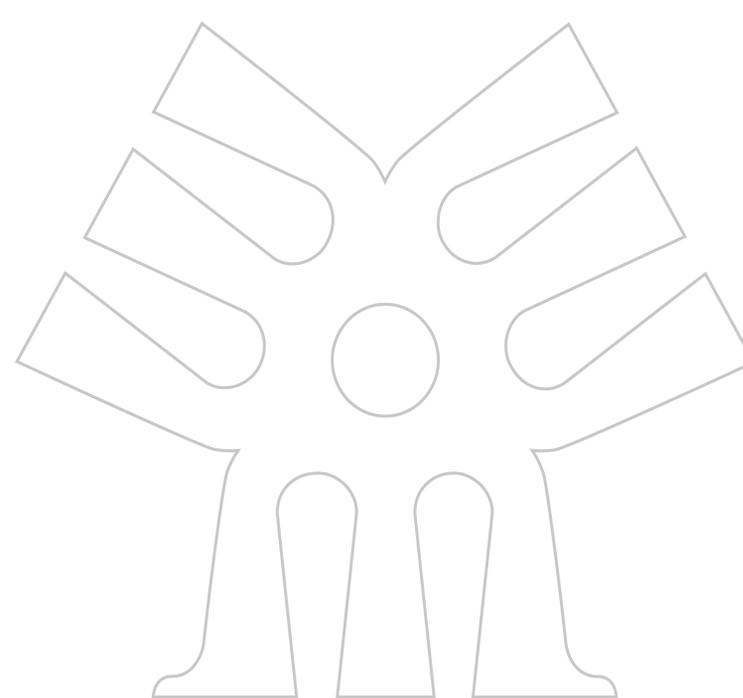
김기웅 센터장 (한국표준과학연구원 생체신호센터)

Stem Cell Transportation Using Magnetically Actuated Scaffold-type Microrobots

최홍수 교수 (대구경북과학기술원)

의광학 기술의 실용화 연구

정병조 교수 (연세대학교 의공학부)





마이크로테슬라 MRI와 생체자기공명



이름: 김기웅
 직위: 센터장
 소속: 한국표준과학연구원 생체신호센터
 UST 의학물리학과 교수

Abstract 현재 뇌기능 연구에 가장 활발히 활용되고 있는 장비는 핵자기공명 영상장치(MRI)이다. MRI 영상은 자기장 세기의 제곱에 비례해서 신호가 강해지고 해상도가 좋아진다. 그래서 MRI는 보통 병원의 1.5 T(테슬라) 장치로 비롯해서, 3 T, 요즘은 7 T, 11 T 장치가 계속해서 개발되고 있다. 소개하려는 기술은 이러한 개발 추세에 반하는 역발상으로, 일반 MRI의 백만분의 일, 지구 자기장보다도 낮은 자기장에서 초전도양자간섭(SQUID)센서를 활용하여 MRI 영상을 얻는 기술이다. 이런 낮은 자기장에서 주기적으로 진동하는 생체신호가 주변의 양성자를 직접 공명시키는 현상을 생체자기공명이라 명명했다. 한 예로, 뇌파가 발생시키는 진동 자기장이 뇌 속의 양성자를 직접 공명시키는 현상을 뇌파자기공명(brainwave magnetic resonance; BMR)이라고 부를 수 있다. 결국, 뇌의 여러 부분의 기능을 이어 통신하는 뇌파가 뇌파 발생부분의 양성자를 공명시키고, 이 공명된 양성자를 영상화함으로써 뇌과학에서의 핫이슈인 뇌기능 연결성을 직접 가시화하는 신개념 뇌기능 연구툴을 개발하는 것이 가능하다. 발표에서는 마이크로테슬라 MRI의 개발과 활용 및 뇌신경팬텀을 이용한 BMR 실험에 관해 보고한다.

Brief Biosketch

1992~2002 KAIST 물리학과 이학학사, 석사, 박사
 2002~현재 한국표준과학연구원 생체신호센터 센터장(우대/책임연구원)
 2006~현재 과학기술연합대학원대학교 의학물리학과 교수
 2012~2012 독일 PTB/Bernstein 뇌신경센터, 초청과학자
 2006~2007 미국 프린스턴 대학교 물리학과, 연구원



Stem Cell Transportation using Magnetically Actuated Scaffold-type Microrobots



이름: 최홍수
직위: 부교수, 공동센터장
소속: 대구경북과학기술원, 로봇공학전공, DGIST-ETH 마이크로로봇 센터

Abstract This study involved fabrication, manipulation, and culture of adult hippocampal neural stem cells derived from rats using microrobots. The micro-robot structures were fabricated using photopolymerized material (SU-8) and a 3D laser lithography system. The structures were surface coated with magnetic (nickel) and biocompatible material (titanium). The microrobots were controlled with a magnetic manipulator; the coated nickel enabled the micro-robots to be controlled by an external magnetic field. The position, orientation, and velocity of the microrobots were accurately controlled. Hippocampal neural stem cells were plated on microrobots coated with collagen and laminin, and cultured in the presence of basic fibroblast growth factor to maintain stemness. Adhesion and proliferation of the cultured cells were evaluated by scanning electron microscopy and fluorescence microscopy. The results suggest a new approach to stem cell therapy, targeted cell/drug delivery, and microrobotic research.

*This work was supported by the DGIST MIREBrain program.

Brief Biosketch Hongsoo Choi is an Associate Professor and Co-Director of DGIST-ETH Microrobot Research Center at Daegu Gyeongbuk Institute of Science and Technology. He received his B.S. (2002) in Mechanical Engineering from Yeungnam University, and a M.S (2003) and Ph.D. (2007) from the School of Mechanical and Materials Engineering at Washington State University. He served as a Postdoctoral Scholar at WSU and UC Davis before joining Korea Institute of Machinery & Materials as a Senior Researcher in 2009. He joined the DGIST in 2010 as one of the Founding Member at the Department of Robotics Engineering. His general research area is in BioMEMS, and his currently research topics are micro/nano robot, artificial cochlea, micro ultrasonic transducers, electrode array for BMI, and microfluidic device.

Symposium I



의광학 기술의 실용화 연구



이름: 정병조
 직위: 정교수
 소속: 연세대학교 의공학부

Abstract 본 강연에서는 빛과 생체 조직간의 상호 작용을 다루는 조직광학 기초 연구를 기반으로 연세대 의광학 연구실에서 2005년부터 지난 9년간 연구 개발된 생체분광 기술 기반의 의광학 영상 진단 기술 및 치료 기술의 실용화 연구 결과를 소개한다. 의광학 영상진단 기술로 polarization imaging, laser speckle imaging, NIR imaging, broadband fluorescent imaging, 3D imaging, multimodal imaging 기술을 소개하고, 레이저 치료 기술로 interstitial low level laser stimulation system, 조직광학 분야에서는 다양한 optical tissue clearing 방법을 소개한다.

Brief Biosketch

■ 학력

1994 공학사(의공학), 연세대학교
 1998 공학석사(의공학), Texas A&M University, College Station, TX, USA
 2001 공학박사(의공학), Texas A&M University, College Station, TX, USA

■ 경력

2013~현재 BK21+ 사업단장
 2013~현재 연세대학교 의공학부 학부장
 2013~현재 연세대학교 의공학과대학원 주임교수
 2013~현재 연세대학교 의공학부 정교수
 2008~2013 연세대학교 의공학부 부교수
 2005~2008 연세대학교 의공학부 조교수
 2012~2013 연세대학교 의료기기인적자원양성센터 센터장
 2009~2011 대한의용생체공학회 교육이사
 2002~2005 연구원, Beckman Laser Institute, University of California, Irvine, USA



심포지엄 2

Ready-to-use BME technologies

2014년도 제49회 대한의용생체공학회 춘계학술대회

좌장 | 천홍구 교수 (고려대학교)

장동표 교수 (한양대학교)

A Monolithic Portable fNIRS System with 1cm Spatial Resolution for Functional Brain Imaging

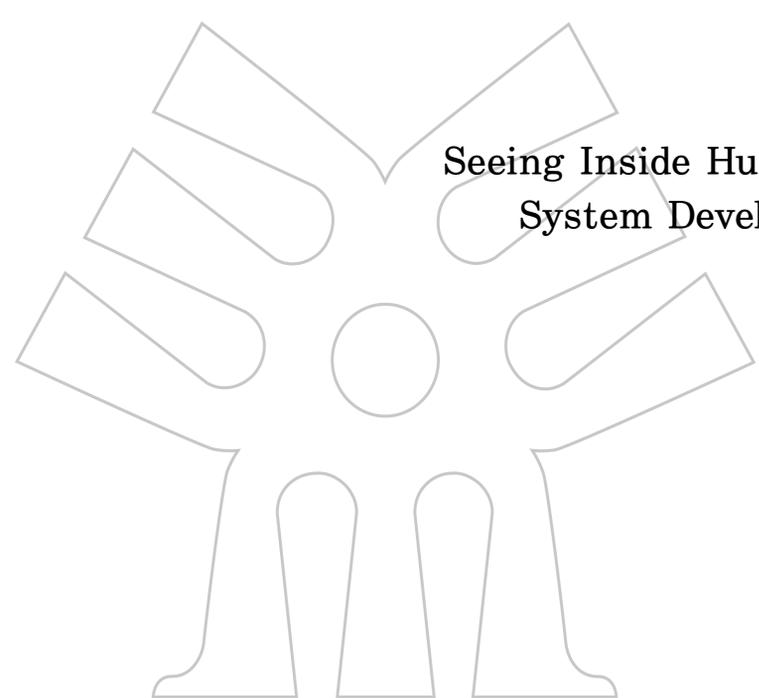
배현민 교수 (KAIST 전기및전자공학과)

From Biochip Development to System Development: Blood Physiometers Abstract

양성 교수 (광주과학기술원 기전공학부)

Seeing Inside Human Body: From On-Optical-Bench System Development to Bedside Patient Imaging

오왕열 교수 (KAIST 기계공학과)



Symposium II



A Monolithic Portable fNIRS System with 1cm Spatial Resolution for Functional Brain Imaging



이름: 배현민
 직위: 조교수
 소속: 카이스트

Abstract Functional near-infrared spectroscopy (fNIRS) is an effective and non-invasive functional brain imaging method. Neuronal activities of the brain are strongly coupled with the hemodynamics in the local cerebral cortex and the hemodynamics can be extracted by using the fact that the absorption spectra of oxy hemoglobin (HbO) and deoxy hemoglobin (HbR) differs in the near-infrared region of the spectrum. The fNIRS retrieves the hemodynamics by monitoring the variations in the optical signal power traveling through the cerebral cortex of the brain. The fNIRS has an apparent advantage over functional magnetic resonant imaging (fMRI) in terms of cost and portability. However, the inherent limitation of the spatial resolution of the fNIRS restricts its widespread use in clinical applications. In addition, the conventional fNIRS devices have yet to utilize its potential for portability to the fullest extent. In this talk, a monolithic highly portable fNIRS system with 1cm spatial resolution will be presented. The improvement in the resolution is achieved by joint optimization of hemodynamic extraction algorithm employing CDMA and MIMO schemes and circuitry for high SNR.

Brief Biosketch Hyeon-Min Bae has extensive experiences in circuit and system level design of broadband communication systems and biomedical devices. From 2001-2007, he led the analog and mixed-signal design aspects of OC-192 MLSE based EDC ICs at Intersymbol Communications, Inc, Champaign, IL. From 2007-2009, he was with Finisar Corporation (NASDAQ: FNSR) after its acquisition of Intersymbol communications Inc.. Since 2009, he has been an assistant professor of electrical engineering in Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea, where his research has been focused on high-speed clock-data recovery systems and high resolution functional brain imaging systems. In 2010, He founded Terasquare, Inc., a venture-funded fabless semiconductor start-up that provides world's lowest power 100Gb/s Ethernet solutions. Prof. Bae received the excellence award from the national academy of engineering of Korea in 2013 and the 2006 IEEE Journal of solid state circuits best paper award.



From Biochip Development to System Development: Blood Physiometers



이름: Sung Yang, PhD
직위: Associate Professor
소속: Department of Medical System Engineering and School of
Mechatronics, GIST

Abstract Recently, a lot of attention has been made on physical properties as well as chemical properties of human blood as crucial indicators in clinical practice for diagnosis and treatment purposes. Among various physical properties of blood, blood viscosity is known to be one of representative physical properties of blood along with blood hematocrit, which might be useful in diagnosing diseases such as cardiovascular diseases. Currently, almost no effective way, which possibly replaces or improves currently available ones in the fields, has been reported yet, although it would be beneficial for early diagnosis with accurate and fast assay. In this presentation, two case studies for the development from biochip to system, which are able to provide blood viscosity and hematocrit values with minimal sample consumption, will be intensively discussed.

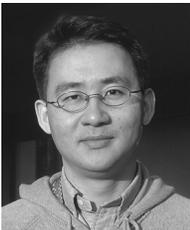
Acknowledgements The research was partially supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MEST) (No. 20110028861), and a grant from the Institute of Medical System Engineering (iMSE) in the GIST.

Brief Biosketch Sung Yang received his Ph.D. degree from the Department of Bioengineering at the Pennsylvania State University, USA, in 2006. He is currently an associate professor in the Department of Medical System Engineering and the School of Mechatronics at GIST since 2007. His research interests include biomedical applications of MEMS technology for continuous, real-time sensing, separations, and drug delivery. Currently, he is an editorial board member of international journal “Micro and Nano Systems Letters”, a founding member of “International Society for Pediatric Mechanical Cardiopulmonary Support”, a board of trustee member of “the Korean Society of Mechanical Engineering: Bio-division” and a member of the Korean Biochip Society as well as the Korean Society of Medical and Biological Engineering.

Symposium II



Seeing Inside Human Body: From On-Optical-Bench System Development to Bedside Patient Imaging



이름: 오왕열
직위: 부교수
소속: KAIST 기계공학과

Abstract Light is uniquely well suited for non-invasive visualization of microscopic structure, molecular composition, and biomechanical properties of biological tissues. Optical imaging has recently been playing critical roles in various fields from biological studies in laboratory settings to in-vivo patient imaging in clinical environments. In this talk, I will present recent researches on novel optical imaging system development. Several key applications will be demonstrated showing how the technological innovations bring new understandings in biomedical studies and help improving public health care.

Brief Biosketch

■ Education

1997 Ph.D. Physics, KAIST
1993 M.S. Physics, KAIST
1991 B.S. Physics, KAIST

■ Professional Experience

2009~Present Associate Professor
Dept. Of Mechanical Engineering, KAIST, Korea
Visiting Scientist
Harvard Medical School and Wellman Center for Photomedicine
Massachusetts General Hospital, Boston, MA, USA
2004~2009 Instructor/Research Fellow
Harvard Medical School and Wellman Center for Photomedicine
Massachusetts General Hospital, Boston, MA, USA
2002~2003 Senior Engineer
LNL Technologies, Cambridge, MA, USA
1998~2002 Senior Member of Engineering Staff
ETRI (Electronics and Telecommunications Research Institute), Korea
1997~1998 Postdoctoral Researcher
Imperial College, London, UK



식품의약품안전처 특별세션

2014년도 제49회 대한의용생체공학회 춘계학술대회

좌장 | 김혁주 과장 (식품의약품안전처)

유헬스케어 의료기기 허가심사 및 정책 방향

강영규 연구관 (식품의약품안전처)

체외진단용 시약의 관리 현황

김세중 의료기술주사 (식품의약품안전평가원 의료기기심사부 체외진단의료기기TF팀)

초음파영상진단장치 등 10개품목 의료기기 위험관리 가이드라인 마련 연구

박호준 수석연구원 (한국산업기술시험원 의료기기평가센터)

인공무릎관절 수술로봇 평가 가이드라인 개발 연구

최재순 연구부교수 (서울아산병원 아산생명과학연구원)



식품의약품안전처 특별세션



유헬스케어 의료기기 허가심사 및 정책 방향



이름: 강영규
 직위: 연구관
 소속: 식품의약품안전처
 식품의약품안전평가원 첨단의료기기과

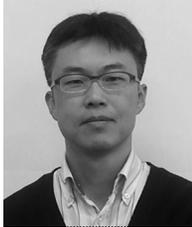
Abstract 세계적인 인구 고령화와 ‘건강한 삶’에 대한 관심의 증가는 의료서비스에 대한 수요와 더불어 의료기기 산업의 성장을 견인하고 있다. 최근에는 IT·BT·NT와 의료기기의 융복합이 가속화되고 있으며 특히, 유헬스케어 의료기기는 IT와 의료기기가 융합한 대표적인 사례에 해당된다. 또한, 유헬스케어 의료기기는 다양한 형태의 제품이 출시될 수 있으며, 기존의 독립적인 기기 형태에서 최근에는 스마트폰, 태블릿PC 등을 이용한 모바일 앱(Application) 형태의 소프트웨어 제품이 활발히 개발되고 있는 추세이다. 본 발표에서는 유헬스 환경에서는 사용되는 다양한 의료기기 중 식약처에서 유헬스케어 의료기기로 분류하고 정의하는 의료기기에 대한 사항과 허가심사 절차, 제품의 안전성·유효성을 평가하기 위한 적용규격 및 제출자료, 허가신청 시 고려사항, 향후 식약처에서 추진하고자하는 정책 방향 등을 소개하고자 한다.

Brief Biosketch

2001~현재 식품의약품안전처 의료기기심사부
 : 의료기기 안전성·유효성 심사, u-healthcare 등 신개발 의료기기 허가심사 등
 2011.2~현재 국제전기기술위원회 IEC/TC 62(의료용전기기기) 전문위원



체외진단용 시약의 관리 현황



이름: 김세중
 직위: 의료기술주사
 소속: 식품의약품안전평가원 의료기기심사부 체외진단의료기기TF팀

Abstract 체외진단용 시약은 의료기기와 동일하게 4등급으로 분류하여 1등급은 신고로, 2~4등급은 허가로 사전관리하고 있으며, 의료기기 관계법령에 따라 GMP, 유통, 광고 및 표시기재 등의 사후관리를 받는다. 등급 구분에 있어 검사의 결과가 개인과 공중보건에 미치는 잠재적 위해성의 정도에 따라 등급을 분류한 것이 의료기기와 구분된다. 『의료기기법 시행규칙』 개정을 통해 체외진단용의약품으로 관리되던 DNA 칩, 임신진단시약 등을 의료기기로 일원화 관리할 예정이며, 체외진단용 시약의 임상시험계획승인 면제도 추진 중이다.

Brief Biosketch

1999 연세대학교 임상병리학과 석사
 2001~2003 대웅바이오텍 진단시약개발부
 2003~2006 한국원자력연구원 동위원소이용연구부
 2006~2009 대전지방식품의약품안전청
 2010~ 식품의약품안전처

식품의약품안전처 특별세션



초음파영상진단장치 등 10개품목 의료기기 위험관리 가이드라인 마련 연구



이름: 박호준
 직위: 수석연구원
 소속: 한국산업기술시험원 의료기기평가센터

Abstract IEC는 의료기기 국제규격이 기술발전에 미흡하다고 판단하여 IEC 60601-1 3rd Ed.을 2005년 12월에 발행하고, IEC 60601 시리즈의 모든 규격(보조규격, 개별규격)을 전면 개정하고 있다. IEC 60601-1 3rd Ed.은 2nd Ed. 과 달리 전기·기계적 안전성에 대해 필수성능, 위험관리 등을 추가하여 안전기준을 강화하였다. 현재 산업체에서 활용 중인 위험관리 가이드라인은 필수성능에 대한 위험분석을 적용하지 않고 있다. 따라서, 필수성능이 적용된 품목별 위험관리 가이드라인을 마련하여 우리 제조업체의 수출경쟁력 제고가 필요하다. 본 연구에서는 각 품목 별 위험관리 요구사항을 분석하고 필수성능을 도출하여 IEC 60601-1 3rd Ed.에서 요구하는 필수성능이 포함된 초음파영상진단장치 등 10개 품목 의료기기의 위험관리 가이드라인(안)을 제시하였다.

Brief Biosketch

1997~2000 (주)SKC 중앙연구소 공정제어팀 주임연구원
 2000~현재 한국산업기술시험원 의료기기평가센터 수석연구원
 2008~2010 복지부 첨단의료복합단지 조성사업단 파견근무, 의료기기전문위원
 2012~현재 식약처 자체규제 심의위원회 위원
 2012~현재 고려대학교 구로병원 의료기기임상시험센터 자문위원
 2013~현재 세브란스병원 의료기기임상시험센터 자문위원



인공무릎관절 수술로봇 평가 가이드라인 개발 연구



이름: 최재순
직위: 연구부교수
소속: 서울아산병원 아산생명과학연구원
울산대학교 의과대학

Abstract This talk presents an investigation on international and Korean standards related to evaluation of safety and performance of the surgery assist robots for knee replacement surgery and development of a guideline of the method and technique. The safety of the knee replacement surgery assist robots can be evaluated in biological, mechanical, and electrical aspects. The performance can be evaluated in terms of motion control, clinical efficacy, and functional components. Specific evaluation items are different among different types of the robots, which can be largely classified by whether the robots perform autonomous task or surgeon-guided actuation. The relevant international and Korean standards, indices to evaluate the safety and the performance of the robot systems are discussed including short discussion on test methods for the evaluation.

Brief Biosketch Jaesoon Choi received the B.S. degree in control and instrumentation engineering and the M.S. and Ph.D. degree in biomedical engineering from Seoul National University, Seoul, Korea, in 1995, 1997 and 2003 respectively. He had pre-doctoral training in the Department of Biomedical Engineering, Lerner Research Institute, The Cleveland Clinic Foundation, Cleveland, OH, from 1999 to 2000. From 2003 to 2006, he was a Staff Researcher at Research Institute, National Cancer Center, Seoul, Korea. From 2007 to 2012, he worked as a Research Professor at College of Medicine, Korea University, Seoul, Korea. He is currently an Associate Research Professor at Asan Institute for Life Sciences, Asan Medical Center, Seoul, Korea. His research interest includes computer aided surgery and intervention and mechatronics system application in biomedicine.



오송첨단의료기기개발지원센터 특별세션

2014년도 제49회 대한의용생체공학회 춘계학술대회

좌장 | 송영준 박사 (오송첨단의료기기개발지원센터)

오송 첨단의료기기개발지원센터 기업지원 방향

강태건 연구기획부장 (오송 첨단의료기기개발지원센터)

회사 소개 및 기능성 봉합사의 연구, 개발

최종화 전무이사 (주)메타바이오메드

자동제세동기(AED)의 현재와 미래

최성환 연구소장 (주)씨유메디칼시스템

정밀 뇌수술을 위한 5-ALA와 ICG 병용

다중형광 광역학진단기기 개발 발표

신민선 수석 (주)엠지비엔도스코피

현존하는 스텐트의 분류와 장단점

이민구 차장 (태웅메디칼 오송연구소)

공초점(Confocal) 레이저 스캐닝 현미경 기술과 응용

전병선 대표 (나노스코프시스템즈(주))

생명, 아름다움을 여는 비밀이 열리는

2014오송국제바이오산업엑스포

이차영 사무총장 (충청북도청)





오송 첨단의료기기개발지원센터 기업지원 방향



이름: 강태건
 직위: 연구기획부장
 소속: 오송첨단의료산업진흥재단 첨단의료기기개발지원센터

Abstract 오송 첨단의료기기개발지원센터는 첨단의료복합단지의 핵심연구시설로서, 산업체의 의료기기 개발 및 의료산업의 발전을 위해 태동하였습니다. 정부의 세계 의료기기 7대 강국이라는 목표를 실행하는 기관으로서, 의료기기 제품화를 위한 응용연구, 시제품제작, 시험검사의 One-Stop 서비스를 지원할 준비를 해 왔습니다. 센터에서는 BT 기반의 인체삽입형 의료기기를 집중적으로 지원하여 우리나라의 의료기기 선진화 및 시장 창출을 하려 합니다. 이에 센터의 기업지원 방향에 대해 인프라 지원과 R&D 지원을 소개합니다.

Brief Biosketch

1991 동국대학교 산업공학 석사
 2000 동국대학교 산업공학 박사
 1999~2010 한국보건산업진흥원 책임연구원
 2010~2013 한국의료기기산업협회 수석연구원
 2013~현재 오송첨단의료산업진흥재단 첨단의료기기개발지원센터 연구기획부장



회사 소개 및 기능성 봉합사의 연구, 개발



이름: 최종화
 직위: 전무이사
 소속: (주)메타바이오메드

Abstract (주)메타바이오메드는 1999년 설립되어 치과용 기자재를 시작으로 봉합사, 골수복재, 생체재료까지 의료소재의 연구개발, 생산, 마케팅 전 부분을 자체적으로 수행하는 전문기업으로 오송첨단의료복합단지 에 입주하여 위치하고 있습니다. (주)메타바이오메드의 주생산품은 봉합사로 체내에서 분해되는 생분해성 고분자(PLA, PGA, PDO 등)를 자체 합성하여 우수한 기계적 강도를 가지는 multifilament와 monofilament의 봉합사를 개발, 생산하고 있습니다. 또한, 봉합사의 연구 및 개발을 위하여 대학교, 병원과 연계하여 연구를 지속적으로 연구를 진행하고 있으며, 오송첨단의료 산업진흥재단과는 기능성 봉합사의 개발에 대한 연구과제를 체결하여 기능성 봉합사의 연구, 개발을 진행하고 있으며, 차후 인허가까지 지속적인 협업관계를 통해 보다 빠른 기능성 봉합사의 제품화에 도달 할 수 있을 것으로 판단됩니다.

Brief Biosketch

- 1994 연세대학교 화학공학석사
- 2012 전북대학교 유기신물질공학 박사
- 2008~2012 전북대학교 헬스케어사업단 겸임부교수
- 2010~현재 한국생물공학회 산업정책위원장
- 2010~현재 코리아바이오경제포럼 정책위원
- 1991~2012 한국사내입기술평가원 수석연구원
- 2013~현재 (주)메타바이오메드 전무이사/기술연구소장



자동제세동기(AED)의 현재와 미래



이름: 최성환
 직위: 연구소장
 소속: (주)씨유메디칼시스템

Abstract 최근 국내에서도 식생활 등 생활방식의 서구화로 인해 심혈관 질환이 증가하고 있으며 이로 인한 심정지 발생 가능성이 급증하고 있다. 급심정지(SCA: Sudden Cardiac Arrest)는 돌연사의 주요 원인이며 병원 밖 환경에서의 급심정지 발생에 있어 조기 심폐소생술 및 조기 제세동 처치가 소생율을 높이는 핵심 요소으로 알려져 있다. 공공 장소 등 인구 밀집 지역에 설치되어 있는 자동제세동기(AED: Automated External Defibrillator)는 급심정지 환자의 생존율을 높이는데 중요한 역할을 한다. 본 강연에서는 자동제세동기의 최근 현황을 살펴보고 향후 미래의 변화에 대해 알아보고자 한다.

Brief Biosketch

2002 국내 최초 상용화 자동제세동기(AED) 개발
 2008 IR52 장영실상, i-PAD NF1200 개발 유공자
 현재 (주)씨유메디칼시스템 연구소장



정밀 뇌수술을 위한 5-ALA와 ICG 병용 다중형광 광역학진단기기 개발 발표



이름: 신민선
직위: 수석
소속: (주)엠지비엔도스코피 연구기획 실장

Abstract 환자의 교종과 뇌혈관을 각각 다른 형광물질로 개별 발광시킨 후 영상 융합기술을 통하여 실시간으로 통합 후 수술에 활용하는 기술 개발

Brief Biosketch

베를린 국립예술대학 졸
前 (주)후후 영상미디어 팀장
前 광운대 겸임교수
前 국립암센터 위암연구과 수석연구원
現 엠지비엔도스코피 연구기획 실장



현존하는 스텐트의 분류와 장·단점

이름: 이민구
직위: 차장
소속: 태웅메디칼 오송연구소

Abstract 스텐트는 쓰이는 위치, 적응증에 따라 심혈관 스텐트, 말초혈관 스텐트, 뇌혈관 스텐트, 비혈관 스텐트 등으로 구분되며 스텐트의 재료에 따라서 또한 분류가 가능하며 제작 방법에, 또한 기능에 따라서도 여러가지 분류가 가능합니다. 적응증에 따른 현존하는 스텐트 분류를 기준으로 하여 각 스텐트의 특성과 장단점을 파악해봅니다.

Brief Biosketch

산업융합원천기술사업 비혈관용 국소약물방출 스텐트 총괄책임자



공초점(Confocal) 레이저 스캐닝 현미경 기술과 응용



이름: 전병선
 직위: 대표
 소속: (주)나노스코프시스템즈

Abstract 전통적인 아날로그 방식의 현미경과 차별화 된 디지털 현미경에 대한 요구가 늘어나면서, 우수한 감도로 안정적인 영상 데이터 취득이 가능한 레이저 스캐닝 방식의 공초점 현미경이 새로운 형태로 조명 받고 있다. 국내에서는 최초로 상용 제품으로 출시된 나노스코프시스템즈(주)의 레이저 공초점 형광 현미경 사례로 공초점 현미경의 원리와 관련 기술을 소개하고, 향후 디지털 현미경으로의 세대 교체에 따른 현미경의 활용 형태에 대해 살펴본다.

Brief Biosketch

- 한국과학기술원 기계공학 박사 (공초점 현미경 방식 고속 3D측정 연구)
- 실험실 연구원들과 공초점 현미경 전문 기업 나노스코프시스템즈(주) 설립
- 2007 국내 최초의 공초점 현미경 제품 출시 후 현재까지 국내외 시판
- 2011 국가광과학기술로드맵 구축사업 실무위원 (공초점 현미경 분야)



생명, 아름다움을 여는 비밀이 열리는 2014오송국제바이오산업엑스포



이름: 이차영
직위: 오송국제바이오산업엑스포조직위원회 사무총장
소속: 충청북도청

Abstract 창조경제 시대를 주도할 핵심 성장 동력인 바이오산업 육성을 위한 2014오송국제바이오 산업엑스포 소개

- 기간: 2014. 9. 26(금)~ 10. 12(일), 17일간
- 장소: 오송생명과학단지내(KTX오송역인근)
- 주최: 충청북도, 산업통상자원부, 청주시, 청원군
- 목표: 참여업체 1,000여개(산업전시 223개, 바이어 700개) 관람객 70만명
- 내용: 바이오산업전시, 체험, 산업전시, 컨벤션, 비즈니스 포럼 등

<주제어>

- 생명, 아름다움을 여는 비밀(The Secret of Life, Beautiful Future)
- 인류의 영원인 건강, 무병장수, 아름다움을 실현하는 비밀을 오송에서 밝혀내고 바이오산업의 메카로 도약하는 충북을 상징함

Brief Biosketch

충청북도청 총무과, 자치행정과(비서관, 조직관리팀장, 행정팀장)
충청북도청 기반건설과장, 관광항공과장
충청북도청 비서실장
충청북도 괴산부군수
오송국제바이오산업엑스포조직위 사무총장



산업통상자원부 의료기기 R&D 특별세션

2014년도 제49회 대한의용생체공학회 춘계학술대회

좌장 | 장선호 단장 (KEIT 전자전기산업평가단)

산업부 의료기기 R&BD 발전전략

허영 PD (KEIT)

국내 의료기기 R&D 현황 및 우수성과

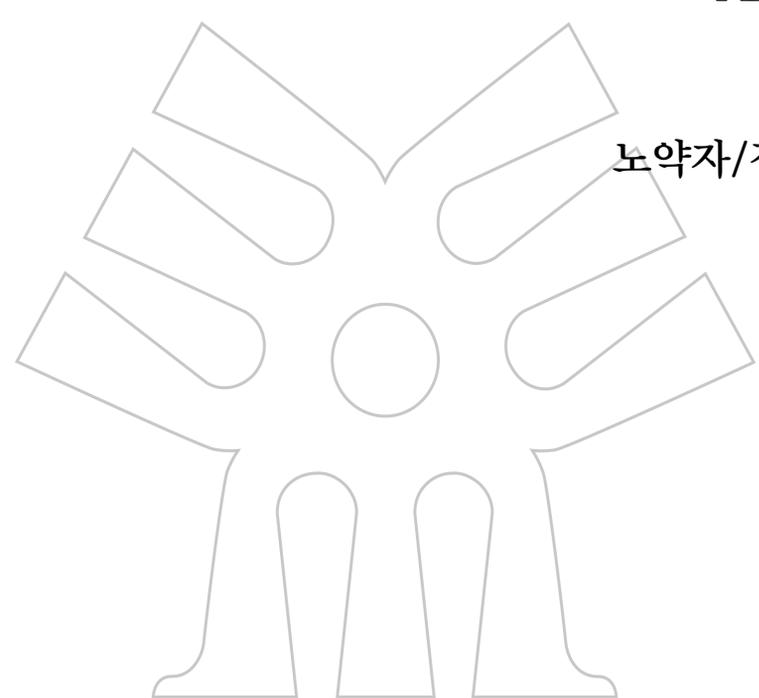
장종찬 팀장 (KEIT)

**차세대 분자영상 시스템 기술개발 ;
PET-MRI 시스템 핵심기술 및 기대효과**

조규성 교수 (KAIST 원자력 및 양자공학과)

**노약자/장애인을 위한 근력보조시스템 개발 ;
'Smart Mobile Walker' 를 중심으로**

장우석 상무 (LG전자 Creative Innovation Center)





차세대 분자영상 시스템 기술개발
- PET-MRI 시스템 핵심기술 및 기대효과 -



이름: 조규성
직위: 교수
소속: KAIST 원자력 및 양자공학과
한국방사선산업학회 수석부회장
한국과학기술원, 방사선및핵의공학연구센터 센터장
한국과학재단, 신형원자로 센터 국제협력실장

Abstract 고령화의 급격한 진행으로 국가적 차원에서 사회적 비용을 줄이고 의료기기 산업을 국가 성장동력으로 하기 위해 생리적·분자화학적 기능의 변화를 비침습적으로 영상화하여 암이나 치매와 같은 질병을 진단하는 첨단 의료진단 기술 같은 과학기술에 대한 국산화 개발에 대한 기대와 요구가 증가 하고 있다. 이에 본 연구진은 PET를 MRI와 융합할 수 있도록 자기장내에서 동작하고 APD 광센서에 비해 신호증폭도가 우수한 차세대 광센서인 실리콘 광증배관 (Silicon Photomultiplier, SiPM)을 개발하고 또한 PET-MRI 시스템의 성능 최적화를 위한 뇌전용 RF coil과 PET 갠트리 및 신호처리 장치들을 개발하고 이들 요소기술을 이용하여 최종적으로는 MRI와 동시 측정이 가능한 뇌전용 MR compatible PET의 국산화 개발하였으며, 이를 통해 그 동안 부진했던 국내 의료영상기기 산업계에 활기를 넣을 수 있는 계기가 되었으며, 또한 모든 국민이 쉽게 첨단의료기기를 활용한 의료서비스를 받을 수 있을 것으로 기대된다.

Brief Biosketch 조규성 교수는 1983년과 1985년 서울대학교에서 원자핵공학과 학사와 석사를 받았으며, 1992년 미 캘리포니아 버클리대학 원자핵공학 박사 학위를 받았다. 1994년부터 현재까지 20여년간 한국과학기술원 원자력 및 양자공학에서 근무하면서, 방사선 의료기기 개발이라는 한 분야에만 매진하고 있으며 또한 170 여편의 SCI 논문을 발표하였고, 지금은 엑스선과 감마선을 활용하는 의료 방사선 진단기기와 비파괴 검사기기의 핵심 기술 개발을 대한 연구를 하고 있다.



노약자/장애인을 위한 근력보조시스템 개발
- Smart Mobile Walker를 중심으로 -



이름: 장우석
 직위: 연구위원(상무급)
 소속: LG전자 Creative Innovation Center
 한국로봇학회 이사
 한국로봇산업협회 이사
 의료기기상생포럼 총괄위원

Abstract 노인 신체 기능 저하 및 상실은 비단 신체적 불편함을 넘어 노인의 자존감을 저해하고 심한 경우 노인을 사회로부터 격리시키는 효과를 발생 시킬 수 있으며, 고령화가 급격히 진행되고 있는 현재 상황에서 비단 노인 개인의 문제를 넘어 사회적 문제가 되고 있다. 이런 문제들을 극복하기 위해서는 일상생활에서의 자립과 존엄성 확보를 통하여 노약자의 삶의 질을 향상 시키고 사회적 비용을 저감시킬 수 있는 제품 또는 기술 개발이 필요하다. 산업통상자원부 지원으로 진행된 ‘노약자/장애인을 위한 근력보조시스템 개발’ 과제에서는 저하되거나 상실된 노인의 신체 기능을 보조하기 위하여 상지, 하지를 포함한 일상 생활 보조를 위한 시스템들을 개발하였다. 특히 Smart Mobile Walker는 근력보조시스템 중 하나로 플랫폼 형태의 일상 생활 보조 시스템으로 보행 보조 및 낙상 방지 등의 기능을 통해 노약자/장애인의 삶의 질 향상을 위하여 개발되었다.

Brief Biosketch 장우석 위원은 1988년과 1990년 서울대학교에서 전기공학 학사와 석사를 받았으며, 1999년 미 MIT공대에서 기계공학 석사, 2003년 동대학에서 전기공학 박사 학위를 받았다. 2003년에서 2005년까지 미국의 Varian Semiconductor Equipment에서 수석 연구원으로 근무하였으며, 2005년에서 2009년까지 미국의 Levitronix 사의 기술 총괄 직책을 수행하였으며, 이후 현재까지 LG 전자 연구위원으로 재직 중이다. 그의 연구 분야는 로봇 개발 및 시스템 제어, 반도체 장비 분야이다.



신진연구자

2014년도 제49회 대한의용생체공학회 춘계학술대회

좌장 | 강현욱 교수 (부경대학교)

문홍상 교수 (한양대학교)

Human-Computer Interaction (HCI) Technologies for People with Autism Spectrum Disorder (ASD)

김광욱 교수 (한양대학교 컴퓨터공학부)

Size-dependent MR Property of Iron Oxide Nanoparticles

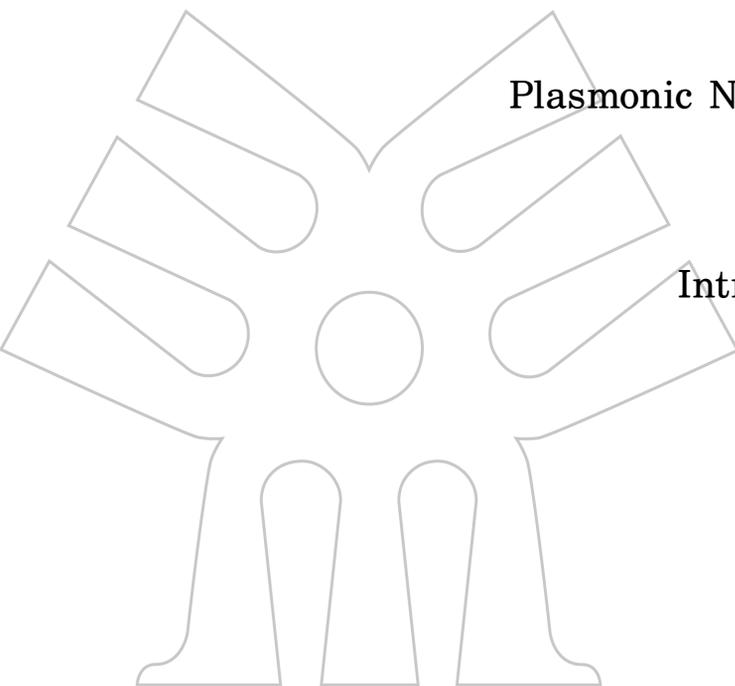
이노현 교수 (국민대학교 신소재공학부)

Plasmonic Nanosensors for Biomedical Analyses

최인희 교수 (서울시립대학교 생명과학과)

Intracoronary OCT Clinical Application

하진용 교수 (세종대학교 광전자공학과)





Human-Computer Interaction (HCI) Technologies for People with Autism Spectrum Disorder (ASD)



이름: 김광욱
 직위: 조교수
 소속: 한양대학교 공과대학 컴퓨터공학부
 한양대학교 대학원 컴퓨터·소프트웨어학과

Abstract Autism spectrum disorders (ASD) are characterized by core deficits in three domains including social interaction, communication, and repetitive or stereotypic behavior. It is crucial to develop intervention strategies helping individuals with autism, their caregivers and educators in daily life. To this purpose, Human-Computer Interaction (HCI) can be useful as it allows instructors and therapists to offer a safe, repeatable and diversifiable environment during learning. In this talk, I will review studies that I have investigated for people with ASD including joint attention, social motivation, and social cognition studies.

Brief Biosketch Professor Kwanguk (Kenny) Kim received Ph.D at the Department of Biomedical Engineering, Hanyang University in 2009. He worked as a post-doctoral associate at the Department of Psychiatry, Duke University, NC, USA, from 2009 to 2010, and he worked at the MIND Institute (Medical Investigation of Neurodevelopmental Disorders), University of California - Davis, CA, USA, from 2010 to 2013. From 2013, he has been working for the Department of Computer Science and Engineering, Hanyang University, Seoul, Korea as an Assistant Professor.

Size-dependent MR Property of Iron Oxide Nanoparticles



이름: 이노현
 직위: 조교수
 소속: 국민대학교 신소재공학부

Abstract Iron oxide nanoparticles have been extensively used as MRI contrast agents due to their unique magnetic property and biocompatibility. Extremely small iron oxide nanoparticles (ESIONs) smaller than 5 nm were developed as biocompatible T₁ contrast agents using their weak magnetic property. Superparamagnetic iron oxide nanoparticles (SPIONs) with sizes ranging from 5 nm to 20 nm exhibit very stable colloidal stability and moderate T₂ contrast effect. Multifunctional Fe₃O₄/TaO_x core/shell nanoparticles were prepared by a sol-gel reaction of tantalum (V) ethoxide in a microemulsion containing SPIONs. Tumor-associated vessels and tumor microenvironments were revealed after injection of the nanoparticles using CT and MRI, respectively. Ferrimagnetic iron oxide nanoparticles (FIONs) show very strong magnetization. The theoretically predicted maximum r₂ relaxivity (761 mM⁻¹s⁻¹) of iron oxide nanoparticles was achieved by optimizing the sizes from 20 nm to 30 nm. Although r₂ relaxivity of larger FIONs is smaller, they were efficiently taken up by various cells. Their efficient cellular uptake and strong magnetic property enabled highly sensitive MR imaging of single cells and pancreatic islets after transplantation.

Brief Biosketch

2007~2011 서울대학교 공과대학 화학생물공학부 (공학박사)
 2011~2012 서울대학교 화학생물공학부 박사후 연구원
 2012~2013 Johns Hopkins Medical School, Research Fellow
 2012~2014 기초과학 연구원, 나노입자연구단 박사후 연구원
 2014~현재 국민대학교 신소재공학부 조교수



Plasmonic Nanosensors for Biomedical Analyses



이름: 최인희
 직위: 조교수
 소속: 서울 시립대학교
 생명과학과

Abstract Recent progress in plasmon-based sensors has greatly overcome the limitations of conventional optical sensors, in terms of sensitivity, tunability, photostability, and in vivo applicability, by employing nano-structured plasmonic materials (i.e., single metallic nano-particle and well-fabricated nanostructured metal substrate). In this presentation, notable approaches for new types of plasmonic nanosensor platforms and their potential applications to biological and chemical detection would be introduced. Our recent achievements including nanoassembly-based plasmonic signal amplification and its integration into microfluidic platforms provide new opportunities toward ultrasensitive biological and chemical analyses and point-of-care biomedical devices. In this respect, the plasmonic nanosensors have a bright future and would contribute to innovative biomedical breakthrough.

Brief Biosketch

2014~현재 서울시립대학교 생명과학과 조교수
 2011~2014 University of California at Berkeley, 바이오 공학과 Post-Doc.
 2009~2011 Cornell University, 기계공학과 Post-Doc.
 2009~2009 서울대학교 BK21 박사후 연수연구원

Intracoronary OCT Clinical Application



이름: 하진용
 직위: 조교수
 소속: 세종대학교 광전자공학과

Abstract Heart attack is the leading cause of death in the United States (the second cause in Korea) and most other industrialized nations throughout the world. The most common cause of heart attack is known as coronary artery disease which narrows the arteries and reduces the blood flow to the heart. To treat the coronary artery stenosis, percutaneous coronary intervention (PCI) (non-surgical procedure to place a stent which holds the artery wall open) is performed. To determine whether PCI or stenting is appropriate and to perform stent evaluation in a catheterization laboratory, optical coherence tomography (OCT) imaging is carried out. Intracoronary OCT is a catheter-based invasive imaging system. The integration of an optical fiber endoscope (the size of a human hair) with a frequency domain OCT system enables video images (>100 frames/s) that display location and changes of coronary plaques and stent apposition in live patients. In this talk, the principle and method of catheter-based intracoronary OCT imaging are briefly presented and then the ongoing clinical research is discussed to find benefits of OCT-guided PCI.

Brief Biosketch Jinyong Ha received the B.Sc. degree in electrical electronic engineering from Yonsei University, South Korea, in 2002, and the M.Sc. degree in electrical engineering and computer science from KAIST, South Korea, in 2004, and the Ph.D. degree in electrical engineering from the University of Cambridge, U.K., in 2008. To move his career from optical telecommunications to biomedical imaging, he joined the Wellman Center for Photomedicine at Massachusetts General Hospital and Harvard Medical School in 2008. After he worked for Samsung Advanced Institute of Technology for 1 year in Korea, he then joined Sejong University as a faculty member in 2013. His research interest includes the development of novel medical instrumentation and methods that address challenges in clinical settings. He currently serves as secretary of academic affairs in Optical Society of Korea.



의료기기 측정불확도 특별세션

2014년도 제49회 대한의용생체공학회 춘계학술대회

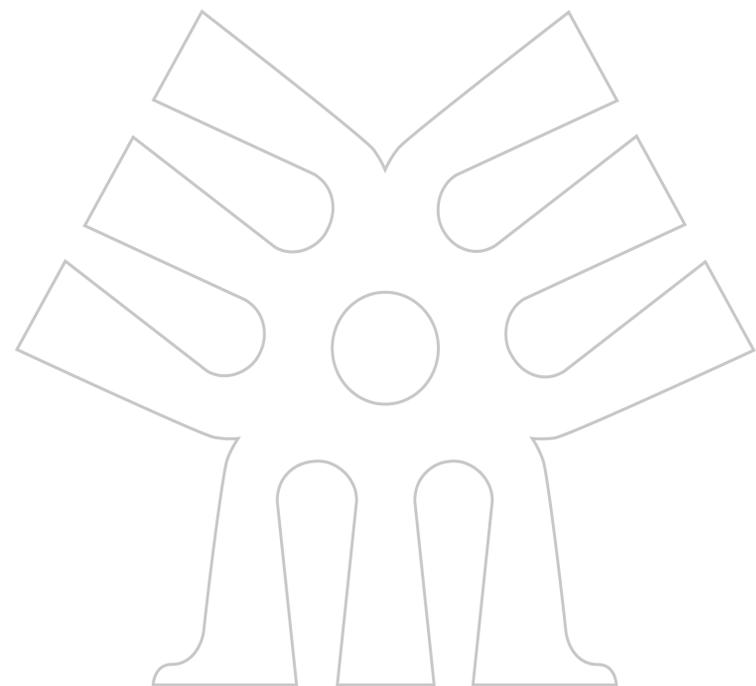
좌장 | 안원식 교수 (서울대학교)

모두가 알아야 하는 측정과 불확도

최종오 책임연구원 (한국표준과학연구원, 글로벌 측정 아카데미)

참조표준과 의료기기 개발

김창근 책임연구원 (한국표준과학연구원 국가참조표준센터)



의료기기 측정불확도 특별세션



모두가 알아야 하는 측정과 불확도



이름: 최종오
 직위: 책임연구원
 소속: 한국표준과학연구원, 글로벌 측정 아카데미

Abstract 의료 활동은 물론 의공학 관련 연구·개발은 대부분 측정을 통해서 이루어집니다. 많은 분들이 측정을 기기가 하는 것으로 생각하고, 이야기하고, 연구결과를 발표하고 있습니다. 그래서 기억해 둘 만한 말을 소개합니다.

‘측정! 소급성으로 시작하고 불확도로 마무리한다.’

측정의 소급성 확보와 불확도 평가에 대하여 알고 있어야 제대로 된 측정결과를 내고 활용할 수 있습니다. 이제 소급성과 불확도는 연구·개발을 하는 사람이 갖추어야 하는 기본 지식입니다. 이번 세미나에서 측정의 개념, 소급성과 불확도의 필요성과 중요성에 대하여 이야기를 나눕니다.

Brief Biosketch

- 측정 및 표준 교육 (개념, 용어, 국제단위, 불확도 등) 및 가이드 7권 개발
- 불확도 교육 및 자문 (국내외 교육/세미나, 350회 이상)
 - 중앙아시아 10 개국 : 측정신뢰성, 품질경영 (ISO 9001, 17025) 교육 및 자문
 - 해외 초청 세미나 15회 : 측정과 불확도, 품질경영
 - 해외 초청 세미나 및 자문 2회 : 불확도 평가 (국제원자력기구)

2011~Present Chair of TC8 on Traceability Committee of IMEKO
 2003~Present Member of Measurement Uncertainty Committee of KOLAS
 2005~2012 Chair of Measurement Uncertainty Committee of KRISS
 2011~2012 Chair of Advancing Committee for Law on Metrology of Korea
 1999~2002 Head of National Research Laboratory for Reliable Chemical Measurement



참조표준과 의료기기 개발



이름: 김창근
직위: 책임연구원
소속: 한국표준과학연구원 국가참조표준센터

Abstract 국가표준기본법에 명시되어 있는 3대 표준분야는 측정표준, 성문표준, 참조표준이다. 특히, 참조표준은 엄밀한 평가 과정을 거쳐 그 신뢰성이 보장된 수치 데이터를 의미한다. 데이터의 신뢰성을 보장하기 위해서는 데이터의 평가기준 수립, 평가기준에 의거한 데이터 평가 과정을 거쳐야 한다. 이렇게 개발된 의료분야 데이터를 활용한 의료기기 개발 방향에 대해 알아보하고자 한다.

Brief Biosketch

■ 학력

- 1990~1995 한양대학교 물리학 학사
- 1996~1998 한양대학교 플라즈마 물리학 석사
- 2000~2003 한양대학교 플라즈마 물리학 박사

■ 경력

- 2002~2004 캐나다 INRS-EMT 연구소 박사후연수원(핵융합장치의 divertor simulation)
- 2004~2005 한국 기초과학지원연구원 박사후 연수원(KSTAR Divertor simulation)
- 2005~현재 한국표준과학연구원 국가참조표준센터 책임연구원



일반연제 1, 2, 3

2014년도 제49회 대한의용생체공학회 춘계학술대회

- 일반연제1 좌장 | 전상범 교수 (이화여대), 정의헌 교수 (GIST)
일반연제2 좌장 | 성종환 교수 (홍익대학교), 주세경 교수 (울산대학교)
일반연제3 좌장 | 최성용 교수 (경희대학교), 박지호 교수 (KAIST)

일반연제1 Biomedical Optics, Robotics and Medical Imaging

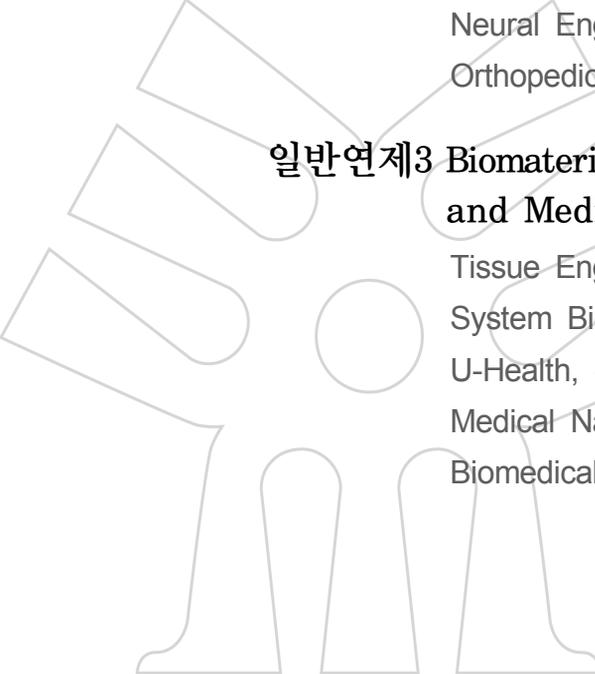
Biomedical Optics
Biomedical Robotics
Medical Imaging

일반연제2 Cardiovascular, Neural, Orthopedic and Rehabilitation Engineering

Neural Engineering
Orthopedic and Rehabilitation Engineering

일반연제3 Biomaterials, Physiological Modeling, U-Health & e-Health and Medical Nanoand Microtechnolog

Tissue Engineering and Biomaterials
System Biology, Physiological Modeling
U-Health, e-Health, m-Health Technology
Medical Nano and Microtechnology
Biomedical Engineering Education and Career



일반연제 1, 2, 3



일반연제 1

Biomedical Optics

라만 분광기를 이용한 항암치료에 따른 유방암의 생화학적 조성 변화 관찰

성명수¹, 명노성², 임상엽², 김재관^{1,3}
¹광주과학기술원 의료시스템학과
²고등광기술연구소
³광주과학기술원 정보통신공학부

Adjuvant/neoadjuvant chemotherapy is a method to decrease tumor size before surgical excision when tumor size is too big to be removed right away. Monitoring its efficacy will reduce the side effects from chemotherapy and can guide a personalized treatment. Thus, this research was conducted to see if Raman spectroscopy can observe the change of biochemical composition during chemotherapy which may serve as a prognostic tool to monitor chemotherapy efficacy. The comparison of the Raman signals post chemotherapy with one obtained before treatment showed that there are noticeable changes of Raman shift spectrum and this result provides an evidence of Raman spectroscopy being used as a monitoring tool of cancer treatment.

Biomedical Robotics

Guidance기법을 이용한 로봇 팔의 뇌 신호 추적에 관한 초기연구

김윤재¹, 박성우¹, 김원식¹, 염홍기², 서한길³, 이용우⁴
 방문석³, 정천기³, 오병모³, 김준식³, 김유단⁴, 김성완^{1,3}
¹서울대학교 공과대학 바이오엔지니어링 협동과정
²서울대학교 공과대학 뇌과학 협동과정
³서울대학교병원
⁴서울대학 공과대학 기계항공공학부

It has been tried to move robot arm with brain signal.

This study is focused on moving robot with coordinates obtained from MEG signal more efficiently. The coordinates obtained from brain signal can't be used intact because of the spatial difference between human arm and robot arm's reference. To solve this problem, we tried to apply guidance laws which is usually used when a missile trace a target. We made the algorithm for robot arm to trace MEG signal. As a result, we simulated the algorithm and applied to Denso robot arm. The algorithm worked well as we expected.

Medical Imaging

경도인지장애 환자의 FDG-PIB-PET 영상을 이용한 뇌 네트워크 분석 가능성 관찰

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 성균관대학교 전자전기컴퓨터공학과

Recent research on mild cognitive impairment (MCI) has shown that cognitive and memory decline in this disease is accompanied by disrupted changes in the brain functional network. In this study, we acquired ¹⁸F-FDG PET and ¹¹C-PIB PET images of normal controls and MCI patients from ADNI database. Brain networks were reconstructed by thresholding binary correlation matrices using graph theoretical approaches. Both normal controls and MCI group showed small-world property in ¹¹C-PIB PET images as well as ¹⁸F-FDG PET images. This result will be able to analyze brain network measurement of ¹¹C-PIB PET images.

Simultaneous Imaging of Dual-Frequency Electrical Conductivity using a Combination of MREIT and MREPT

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Biological tissues show frequency-dependent conduc-



tivity spectra and its values at different frequencies may provide valuable diagnostic information. MREIT provides conductivity images at frequencies below a few kHz, while MREPT produces conductivity images at 128 MHz at 3T. Those two techniques are supplementary to each other and can provide new information when combined together. In this study, we perform two different phantom imaging experiments for the understanding of frequency-dependency using simultaneous dual-frequency conductivity imaging from the one MR scan. We present experimental results of both MREIT and MREPT and highlighted their distinct features in probing and visualizing an object.

원형광섬유 기반 광음향 이미징 기법을 이용한 HIFU 치료 연구

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The current study demonstrated the feasibility of noninvasive photoacoustic imaging (PAI) using a fiber optic ring (FOR) to monitor targeted tissue after high intensity focused ultrasound (HIFU) treatment. By using FOR, the photoacoustic sensitivity (i.e. signal to noise ratio) was enhanced by approximately two times in comparison with that of the lens-based PA guidance system. In vitro PA imaging showed that the targeted tissue after thermal therapy was evidently visualized due to selective light absorption by the coagulated lesion. The results suggest that the systematic simplification with FOR-assisted photoacoustic imaging (FOR-PAI) be potentially utilized to identify both location and size of thermal lesions after HIFU treatment and provide an effective method for assessing treatment process in clinical applications.

일반연제 2

Neural Engineering

생체모방 완전이식형 인공와우의 시스템 프로토타입 개발

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 김두희², 이민영², 오승하², 김성준¹
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In this study, we designed and fabricated a system prototype for totally implantable cochlear implant using biomimetic acoustic sensor which mimics the behavior of a biological cochlea. Developed system prototype consists of the electronics module which contains amplifier array, digital controller, and current stimulator, and a multichannel cochlear electrode array. Efficacy of the overall system is verified by measuring electrically evoked auditory brainstem response in a guinea pig.

Fornix 전기 자극에 따른 Nucleus Accumbens의 도파민 분비 측정

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²한양대학교 의공학교실

Deep Brain Stimulation (DBS) is recently turned up as a potential therapy for improving memory functions in Alzheimer's Disease. However, neurochemical change inside brain caused by electrical stimulation is still unknown. Here, we implant twisted stimulation electrode in the fornix of the rat, a key element of the memory related circuitry, and applied electrical stimulation with various stimulation amplitude and frequency. We measured neurochemical changes in nucleus accumbens(NAcc) depends on stimulation parameters.

일반연제 1, 2, 3



공간 지각적 작업 기억 능력을 향상시키는 강도 높은 사격 훈련의 전환 효과에 관한 신경 메커니즘

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³경북대학교병원 영상의학과

Recently, researchers have shown that it could be attributable to improvements in general working memory capacity by training program. But, the plastic changes in neural networks associated with visuo-spatial working memory after sports training have been seldom studied. We investigate the dynamic neural changes in neural activation related to transfer effects of shooting training on visuo-spatial working memory, performing the judgment of line orientation (JLO) task, using fMRI. Our finding of greater activations in fronto-parietal networks and striatum after training suggest not only dynamic neural changes in relation to training but also transfer effects of training to visuo-spatial working memory.

Orthopedic and Rehabilitation Engineering

인코더를 이용한 허벅지 각도 기반 보행 불균형 평가 방법

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In this study, we propose a method for evaluating gait imbalance with measurement thigh angle for improving the limitations of gait analysis that was used a lot in the previous. To verify the reliability of evaluation of gait imbalance with measurement thigh angle, it was compared with the result of gait imbalance estimation using foot pressure. SI was used for estimation of asymmetric gait. With five healthy volunteers, we performed a test for 1 minute on a treadmill. According to experimental results, the imbalance gait that cannot

be evaluated by foot pressure sensor could be confirmed by thigh angle.

실내 승마운동이 대사증후군 요인을 가진 20대 성인들의 요추 근기능에 미치는 효과

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¹전북대학교 헬스케어공학과

²전라북도체육회 스포츠과학센터

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The purpose of this research was to examine muscular function in 20th aged people who have metabolic syndrome risk factors according to indoor horse riding exercise. Participants were twenty eight peoples who have bigger BMI than 24 index. They did horse riding exercise using SRIDER(Rider, Co., Korea) at thirty minutes a day. Exercise has proceeded three day a week for 12 weeks. We determined muscular strength and muscle reaction of lumbar joint using the BIO-DEX System3. The result of average power increased after exercise. Also the result of acceleration time decreased too. This means that indoor horse riding exercise would be activated continuous muscular contraction with maintained tonus of muscle. We considered that continuous movement of horse riding could be lead to muscle contraction. Our study found that indoor horse riding exercise could improve muscular strength and muscular endurance. Also we proposed that indoor horse riding exercise could be provide another physiology of human body.

일반연제 3

Tissue Engineering and Biomaterials

실리콘 임플란트 주변 피막구축 억제를 위한 Cysteinyl Leukotrienes 장기간, 국소 억제



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박천권², 정웅¹, 한수민¹, 허찬영⁴, 최영빈^{1,2}

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⁴분당서울대학교 병원 성형외과

Capsular contracture resulted from fibrosis formation around the silicone implant has been accepted as one of the most serious complications. CysLTs are known to play a critical role in fibrosis and thus, we hypothesize that local, sustained exposure of CysLTs receptor antagonist can reduce fibrosis formation around the silicone implant in this work. To test this hypothesis, we employed a drug, montelukast as CysLTs receptor antagonist and prepared two different kinds of silicone implants, which were coated with montelukast only and a blend of poly(lactic-co-glycolic acid)(PLGA) and montelukast, which were enabled with a short (3 days) and long term release (15 days) of the drug, respectively.

System Biology, Physiological Modeling

초음파에 의한 직장 온도 상승이 변비 환자에게 미치는 영향에 대한 임상 연구

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²의료법인 에스디엘 의료재단

Since activity of normal microflora in digestive tube is closely related to thermal environment, we hypothesized the constipation can be eased by minor temperature increase in rectum area. An ultrasound transducer was designed to focus at 4 - 10 cm depth to increase local temperature up to 1.6 °C noninvasively by 10 minute sonication. A clinical pilot study is conducted for four weeks to 8 constipation patients whose average age is 80. The stool consistency results show that the average score increases at least twice

after ultrasound sonication and the changes is statistically significant (p-value < 0.05).

U-Health, e-Health, m-Health Technology

자전거 운동량 평가를 위한 전도성 직물 기반의 사용자 무구속 심전계 및 스마트폰 어플리케이션

황라영, 신영은, 최우혁, 신태민
연세대학교 보건과학대학 의공학과

As assessment of quantitative energy expenditure for effective exercise is becoming more important, many researches about the monitoring system for exercise status or result are being actively carried out. In this case, however, bicycle riders feel restrained and uncomfortable because the riders should wear a belt-type electrocardiograph or a watch-type accelerometer or GPS system during the assessment of bicycle exercise. In this study, therefore, an electro-cardiograph based on textile electrode was developed for measuring ECG and calculating heart rate from the bicycle rider without feeling restraint, and smartphone application was also developed for monitoring the heart rate.

Medical Nano and Microtechnology

전기적 후처리 기법을 이용한 초소형 X-선 튜브용 고안정성 탄소나노튜브 전계방출원

하준목, 김현진, 김현남, Hamid Saeed Raza, 조성오
KAIST 원자력 및 양자공학과

Highly stable carbon nanotubes (CNTs) emitter that can endure more than 450 arcing has been demonstrated. The CNTs cathode was fabricated on a flat Kovar tip using metal binders (a mixture of silver, copper and indium nanoparticles) at a high temperature (750°C). A number of vacuum breakdowns were introduced intentionally by rapid increase of electric

일반연제 1, 2, 3



field. The CNTs emitter shows remarkable stability after the electrical treatment due to the strong adhesion with substrate. It is found that uniformity of I-E curves and $\pm 7\%$ of current fluctuations were observed at $450\ \mu\text{A}$ in spite of intense arcing.

Biomedical Engineering Education and Career

Hydraulic jump Phenomenon을 이용한 Micro particles의 분리기술

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In the field of microfluidics, micro particle or cell, such as bacteria in a variety of solution or blood, separation of particles is extremely important. Accordingly, Acoustic, chemical, mechanical, magnetic, electronic, and various methods have been applied to more efficiently and quickly separation a particles in solution. However, the magnetic fields and electric fields in progress externally can influence to particle death or damage. Particles which are separated releasing were also difficulties. Thus, In this research the separation technique of the particles would minimize damage to particles or cell and also release possible using PDMS and continuous condition.



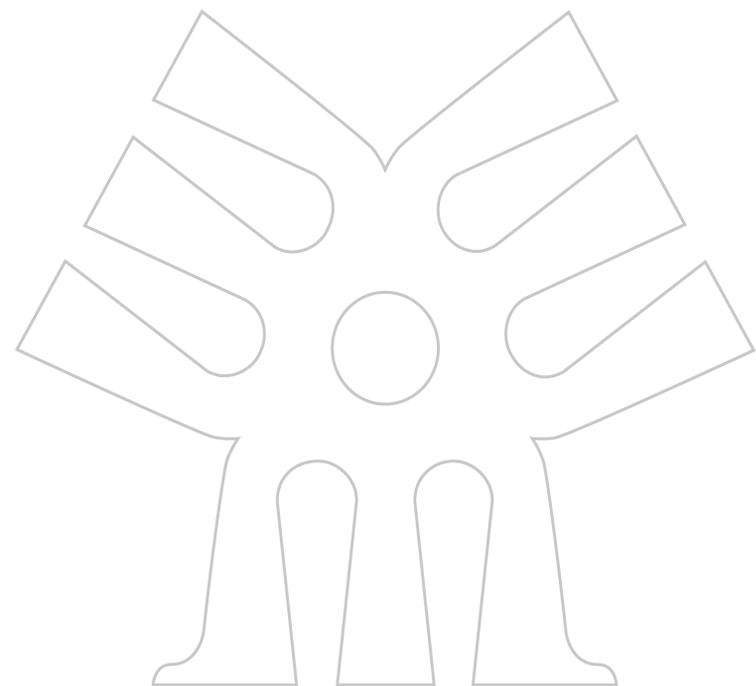
POSTERS I

Biomedical Engineering Education and Career

Medical and Bio-informatics

Tissue Engineering and Biomaterials

U-Health, e-Health, m-Health Technology





Biomedical Engineering Education and Career

P1-01 이식형 보청기를 위한 16비트 축차 비교형 A/D 설계

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성기웅², 이정현³, 김명남¹, 조진호²

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In this paper, we proposed 16-bit 32 kHz successive approximation register analog-todigital converter (SAR ADC) for implantable hearing aid. The proposed SAR ADC consists of sample & hold, R-2R ladder DAC, comparator and SAR logic. Low-power and Area- Efficient operation is achieved by DAC based on R- 2R register array and comparator using offset rejection techniques. Simulation results show that a reference voltage was approximated to sampled value of input signal. The SAR ADC is implemented in a 0.18 μ m CMOS technology. Total power consumption is 422 μ W under 3.3V supply voltage and the core area of SAR ADC occupies 167.5 μ m*45.5 μ m.

P1-02 성범죄자 치료효과의 객관화를 위한 음경 혈류량 측정 시스템 개발을 위한 기초연구

연세대학교 보건과학대학 의공학과
전세훈, 황라영, 최우혁, 신태민

Between the growing numbers of sexual offenders each year, a sexual offender treatment program is to help prevent recidivism. In case of foreign country, PPG estimation system is used, in treatment program evaluation, as not only psychophysiological tool but also risk assessment tool. However, domestic treatment program evaluation only use risk assessment tool. Thus, in this study, to enhance the objectivity of the treatment evaluation, the penile plethysmograph estimation system is developed and validated. It is expected that evaluation of treatment program will be

more objectifiable through proposed system from this study.

P1-03 허가현황을 통한 극돌기간 삽입체의 특성 비교

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Recently, a number of Interspinous Spinal Spacer(ISS) devices have been introduced as an alternative to pedicle screw fixation(PSF) for the treatment of the lumbar degenerative disease. It is designed to provide posterior fixation by locking interspinous processes of two adjacent vertebrae. Proponents of ISS insist that it is far less invasive and less likely to induce adjacent level motions and disc degeneration than PSF while effectively providing stability at the operated level. This review article summarized existing domestic approvals of ISS and each characteristic - the clinical indications, designs, materials and surgical technique characteristics was compared.

P1-04 손가락 모세혈관 혈류 속도 측정을 위한 이차원 고속 푸리에 변환 기반 혈관 자동 선택 시스템

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³서울대학교 분자의학 및 바이오제약학과

⁴서울대학교 의학연구원 의용생체공학연구소

⁵서울대학교 의과대학 의공학교실

A measurement of red blood cell (RBC) velocity in nailfold capillaries may be clinically important in pathological condition such as Raynaud's phenomenon. Although various image processing approaches including cross-correlation (CC) method, optical flow method (OFM), and Hough transform method to estimate RBC velocity have been carried out, most stu-



dies were limited to evaluate algorithm efficiency based on healthy or clear image data. Here, we have developed a robust, simple, and user-friendly nailfold capillaries RBC velocity measurement system based on Fast Fourier Transform on space-time diagram for application in clinical practice.

P1-05 초음파 수술기의 수술 효율성 향상을 위한 초음파 수술기 위상 측정에 따른 인체유래물에서의 조직 분류 연구

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²국립암센터 이형성 임상 제2연구부 특수암연구과
³국립암센터 이형성 임상 제1연구부 위암연구과

Ultrasonic shears is currently in wide use as an energy device for minimal invasive surgery. The vibrational energy transfer system has a pitfall in energy consumption. When the movement of the forceps is interrupted by the tissue, the horn which transfers the vibrational energy of the transducer will be affected. A study was performed to recognize different tissues by measuring the impedance of the transducer of the ultrasonic shears in order to find the factor of energy consumption according to the tissue. It was found that stomach and greater omentum have different phase values of 1075°, 1000°, respectively. This relationship will be used to improve the energy efficiency of ultrasonic shears.

P1-06 저속 후방 충돌 시 인체 반응 특성 평가를 위한 저속 후방 충돌 모사 시스템 개발 및 검증

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¹세종대학교 기계공학과
²연세대학교 의공학부

BioRid-II has not still clearly estimated a risk of whiplash injury in low speed rear-end collision due to the inadequate understanding of human responses. The aim of this study is to design a low speed rear-end collision simulation system for evaluation of

human response characteristics. To accomplish this, the sled simulation system was designed to embodied actual low speed rear-end collision simulation. It was validated the system by using the wireless acceleration sensor. The result showed that Acceleration pulse curve was appeared longitudinal wave pattern.

P1-07 오실로메트릭 방법에 의한 평균혈압추정

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A theoretical and experimental analysis is performed to evaluate a method to estimate the mean blood pressure using commonly used oscillometric method. The normalized average of pulsatile cuff pressure at maximum cuff oscillation pressure is used to estimate the mean blood pressure within 3% accuracy in most cases and could be corrected readily based on the vessel compliance model.

P1-08 압통계와 EDA미터를 이용한 피부전기반응 측정

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 박근철¹, 손정만¹, 김영재², 전계록¹
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In the study, the system for detecting pain trigger points on MPS (Myofascial Pain Syndrome) patients was implemented by using EDA(Electrodermal Activity) meter and algometer. A variety of electrodermal activities were investigated on sweat glands, while the sympathetic nerve was stimulated. The pain trigger points could be found using the implemented system, and the result of algometer and electrodermal activities was monitored on PC monitor comfortably. As a result, it was verified that the electrodermal activity response was related to sympathetic nerve.

P1-09 인체 분절 임피던스 측정을 위한 다 주파수 임피던스 측정기 구현

POSTERS I



장우영, 김수성, 김수홍, 박근철,
윤성욱, 손정만, 전계록
부산대학교 의학전문대학원 의공학교실

In this study, the multi frequency impedance meter was developed to measure the bio-segment impedance. The frequency band were 10 KHz, 50 KHz, 100 KHz, 150 KHz, 200 KHz, 300 KHz, 400 KHz, and 500 KHz. The whole system was composed of frequency generator part, constant-current source part, and AGC (automatic gain control) part. The impedance of forearms and shins was measured. As a result, the high impedance was measured in low frequency domain, while the low impedance was measured in high frequency domain. The accuracy of the multi frequency impedance meter was verified.

P1-10 멀티 어레이 전극을 이용한 집중형 전기자극 시스템 개발

김수홍, 윤성욱, 박근철, 장우영, 김수성, 전계록,
부산대학교 의학전문대학원 의공학교실

Myofascial pain syndrome is a disease with characteristic symptoms such as trigger point and that has been reported as the most common cause of muscle pain. For the treatment of myofascial pain syndrome, after looking for the location of pain and attaching electrodes, using the electronic stimulation should be treated to relieve the pain. However, these treatments did not effectively treat the trigger point of myofascial pain syndrome. In this study, in order to effectively treat the trigger point, have made a multi-array electrode. And we have developed an centralized electrical stimulation system can be removed pain efficiently using a intensive stimulation by the multi-array electrodes.

P1-11 객관적인 후각기능평가를 위한 후각 전위 측정

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There are several ways to evaluate the function of the sense of smell. Although psychophysical tests have been widely used, there is difficulty to evaluate objectively the olfactory function. The olfactory ERP(Event-Related Potential) of the electro physiologic inspections is considered as one of the alternative methods to test the function of the olfactory. In this study, we conducted the olfactory ERP test using the olfactometer developed previously, and T&T olfactometer test.

P1-12 자체 부품제작 및 수리를 통한 수리 비용절감

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In the case of Bio Medical Engineering team of ASAN MEDICAL CENTER, we have been managing medical devices by its location. Especially, there are many times to be charged high cost of maintenance when we manage the medical devices that are used in operating room (OR) and intensive care unit (ICU). In this paper, we propose a protocol how Bio Medical Engineering team in hospital manages actively medical equipment.

P1-13 내시경 의료기기의 운영 및 관리 개선 활동

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The endoscopic equipments compose of endoscope, endoscope system and endoscope washer. When all of them can operate organically well with each other, we can offer more efficient and safe endoscopic examination and treatment. Each equipments are operated and maintained by each different occupational group that are doctor, nurse, the staff for endoscope cleaning and biomedical engineer. We totally analyzed the process of endoscopic equipment's operation and types of



the failure reasons. So we implemented the various activities for shock prevention of endoscope and improved various solutions about the replacement components of endoscope equipments. Additionally we arranged the standards of endoscope's specific failure. Finally we expanded the opportunity of operator's educations and support them to make the user guideline and checklist about endoscopic equipments by themselves. As a result, we could not only reduce the number of repair and repairing cost but also establish the environment for more efficient and safe endoscopic examination and treatment.

P1-14 파킨슨병 동물모델을 이용한 PPTg 저주파 자극이 basal ganglia의 oscillatory activity에 미치는 영향

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Deep brain stimulation (DBS) is an effective surgical treatment for Parkinson's disease and other neuropsychiatric disorders. The subthalamic nucleus (STN) or the globus pallidus internus (GPi) has been used as surgical target for DBS. The pedunculopontine nucleus (PPTg) has been suggested an alternative target for DBS in recently studies. In this study, we recorded local field potential (LFP) from STN and SNr and compared relative power of beta oscillation with and without 25Hz low frequency stimulation. We found that beta oscillation was enhanced in 6-OHDA lesioned rat and relative power of beta oscillation in STN and SNr was decreased by low frequency stimulation on PPTg.

P1-15 착좌 자세 평가용 인체 더미 개발

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Development and test results of a human dummy to evaluate the comfort level of the sitting postures in an automotive are briefly introduced. While the conventional methods by the human feeling test evaluate the comfort level qualitatively, the dummy-based methods quantitatively through its embedded sensors. Comparison of the body pressure distribution between a human subject and the dummy proved the biofidelity of the dummy. And, the magnitudes of joint loading at the back joint at three different postures showed a good correlation with the comfort levels by human feeling test.

P1-16 확산 텐서 영상을 이용한 경도 인지 장애 환자의 신경 섬유 추적 기법 계산

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Magnetic resonance image (MRI) methods have been effectively applied to Alzheimer's disease (AD). One of MRI methods, diffusion tensor image (DTI) can be used to provided fiber track information based on anisotropic of water diffusion. We assumed that DTI based tractography might be different for sub groups of MCI. We tested ten patients from early mild cognitive impairment (MCI, n=5) and late MCI groups (n=5). The result of our test, using fiber track counting, showed significant value ($p < 0.05$) between two groups.

P1-17 미세 기공의 3차원적 상호 연결이 이상인산칼슘 스키펴드에서의 세포거동에 미치는 영향

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The objective of this study was to evaluate the effect of interconnective micropore on osteoblast response. The microstructures were observed by field emission



scanning electron microscope. Contact angle goniometer was used to evaluate differences in contact angle between surfaces. MTT assay was used to measure the optical density (OD). The contact angles of microporous specimens were lower than that of non-microporous specimen. Cell spread was greater on microporous scaffolds than non-microporous scaffolds. In addition, proliferation was increased when cells were cultured on microporous scaffold. The result demonstrated that interconnective micropores of biphasic calcium phosphate scaffold improved the response of osteoblast.

P1-18 클로르헥시딘-알부민 나노입자를 함유하는 스키펀드 의향균효과

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치과생체재료학교실

A simple and highly efficient method was developed for drug delivery from HAp scaffold surfaces using biodegradable albumin nanoparticles was developed in this study. Porous HAp scaffold was fabricated using a polymeric template coating technique was used as a bioceramics with a localized drug delivery structure. Human serum albumin (HSA) nanoparticles loaded with chlorhexidine (CHX) as a model drug were fabricated by a desolvation technique. The results suggested that the PEI-coated HSA nanoparticles loaded with CHX (PEI-CHX-HSA) were incorporated successfully and well-dispersed on the HAp scaffold surfaces. The agar diffusion test showed this innovative delivery platform potentially imparts antibacterial activity to the HAp scaffold surface.

P1-19 반지형 맥박 측정기를 위한 기초 연구

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(주)메디스윙

Cardiovascular disease is a class of diseases that involve the heart, the blood vessels or both. It is the leading cause of deaths worldwide. For monitoring the cardiovascular status, a basic method is pulse observation that represents the tactile arterial palpation of the heartbeat by trained fingertips. In this paper, for convenient and cosmetic reasons, a basic study for developing a finger ring shaped pulse detector was proposed. The pulse signal was measured from the first joint of finger by photoplethysmogram (PPG) method. Also, a designed circuit includes amplifier and filter was used to acquire the signal more precisely. The experimental results shows the proposed basic study for the finger ring shaped pulse detector development has a good performance in human pulse monitoring.

P1-20 3D 프린팅을 이용한 골절 쇄골 모델의 침착가공

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Clavicle bone is located between the sternum and the scapula. Whose main causes are traffic accidents, sports, etc. When the bone is fractured, nerve and blood vessel is rare damaged. In this study, clavicle fracture models were manufactured using patients' CT images with 3D printer so that they have the same size as the actual extent of the fracture and could be used to identify the location, size, and orientation before surgery. Before surgical treatment for anatomical restoration, the size and fixed position and orientation of the mounting screws and metal plate could be determined through simulation. Unstable



clavicle fractures may cause the complications or mortality due to the anatomical specificity of the patients'. Therefore, the 3D printed models can be used to select the appropriate surgical method and improve the clinical outcome through the more precise operation and reduced operating time.

P1-21 모바일 의료용 앱 규정의 한국과 미국의 비교연구

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Development of mobile technology and mobile device with the mobile applications improves the patient care and their use in a clinical environment becomes more widely accepted. The market is developing and the growth is accompanied by a rapid increase in the number of mobile medical apps. On September 25 2013, final report about their regulation by FDA was published and the app developers are required to comply with the regulations. It is rooted in patient safety, but the patient-centered approach would make the limitations on the innovation and discovery as well as the emergence of both mHealth and new healthcare delivery system. It will be necessary to achieve a balance for ensuring patient safety while supporting innovation in the development and use of mobile medical apps. The KFDA therefore should adopt the balanced policies that include identifying low-risk apps subject to enforcement discretion and providing clear guidance to the remaining higher risk apps subject to regulation.

P1-22 RGB-HSV 칼라 매핑을 통한 동공대광반사 특성 측정

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The pupillary light reflex (PLR) test is the method of examining the immediate reaction of the pupil by light stimuli, and dysfunctions in autonomic nervous system can be evaluated quickly and easily through this method. The proposed system in this study utilizes the flash LED of the smartphone to provide light stimuli to the patient's pupil, and the resulting reactions are recorded as images and videos to be analyzed. In case of video recording, the user can turn the flash on or off at the desired moment and data acquisition time was set to be 6 seconds. For the image mode, the system was designed to acquire one image prior to light stimulation and 4 images after light stimulation, so that temporal changes in pupil sizes with passing of time can be compared. The system developed in this study utilizes smartphones so that anyone can easily utilize the tool conveniently without restrictions of time and location. Further, other strengths include the fact that light stimulation can be provided using the flash function built within the smartphones, as well as the fact that patient data could be saved and managed easily, and shared using the email transmission function.

P1-23 좌심실보조장치의 출구 캐놀라의 삼관 위치에 따른 혈액관류에 대한 시뮬레이션 연구

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Outflow cannulation site of left ventricular assist device (LVAD) chosen by considering anatomical structure of thoracic cavity and vascular system. In this study, we computed the amount of blood perfusion at each arterial branch numerically according to outflow cannulation sites. We generated computational meshes to the three-dimensionally reconstructed arterial system. Clinically measured arterial pressure were used for inlet boundary condition, porous media were applied to mimic flow resistance. Blood perfusion through left common carotid artery was 2.5 times higher than



other cases. This study will be useful reference data for the clinical study of LVAD which considers blood perfusion efficiency.

P1-24 삼차원 가상심장을 이용한 KCNQ1 돌연변이가 심방부정맥에 미치는 영향에 대한 예측

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Functional analysis has shown that the missense gain-in-function *KCNQ1V241F* mutation associated with familial form of atrial fibrillation produces an increase of the slow delayed rectifier K⁺current (IKs). A causal link between the mutation and genesis of atrial fibrillation has not yet been directly demonstrated. Therefore, utilizing a computer modeling approach, this study investigates the pro-arrhythmogenic effect of *KCNQ1V241F* mutation on human atrial-fibrillation. It was shown that *KCNQ1V241F* mutation abbreviated atrial APD and flattened APD restitution curve, facilitate initiation and maintenance of reentrant excitation waves, increasing atrial susceptibility to arrhythmia.

P1-25 삼차원 가상심장을 이용한 심부전 정도에 따른 좌심실보조장치의 박동효율예측

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In order to maximize the effect of left ventricular assist device (LVAD) on ventricular unloading, the therapy should be begun at appropriate level of heart failure severity. We predicted pumping efficacy of LVAD according to the severity of heart failure theoretically. Using three dimensional virtual heart, we predicted cardiac responses under the treatment of continuous LVAD. Contractile ATP consumption, which indicates the ventricular energetic loading condition decreased maximally at the 5th level heart-fail-

ure under LVAD therapy. We conclude that optimal timing for LVAD treatment is 5th level heart-failure when considering LVAD treatment as “bridge to recovery”.

Medical and Bio-informatics

P1-26 단일 채널 도플러 레이더를 이용한 비접촉 방식의 호흡률 및 심박률 검출

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We designed a single channel Doppler radar system for noncontact detection of respiration rate and heart rate. The designed system consists of a Doppler radar sensor (10GHz), a baseband module, and a micro-processor. To evaluate a performance of the system, we measured simultaneously the respiratory signals acquired from a chest-belt and electrocardiogram in order to use as reference data. The respiratory rate and heart rate were assessed with the three young healthy men in supine position. As a result, correlation analysis revealed a significant correlation between Doppler radar and reference results (0.99 for respiration rate and 0.81 for heart rate).

P1-27 병원용 스마트폰 기반 현장진단 검사 시스템

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The use of POCT in medical fields emerges rapidly since they offer a rapid and convenient way in diagnosing diseases. However, they require adequate reaction time to get the result. This is not a problem for personal use but medical staffs in a hospital cannot wait for the time to see the result. Therefore, in this paper, we present a smartphone-based system for automatic management of POCT results in a hospital. The



developed system identifies barcodes of prescription number, waits for the specific time, takes a picture of the test result, and finally transfer the image to an EMR server. The system received a positive feedback from medical staffs after test periods.

P1-28 신뢰할 수 있는 전기적 뇌 자극 시뮬레이션을 위한 팬텀 기반 검증방법

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김소희, 정의현, 이종현
GIST 의료시스템학과
GIST 정보통신공학부
GIST 기전공학부

The purpose of the study is to establish the validation system for simulation of neuromodulation. We used magnetic resonance imaging (MRI) to generate the phantom mold. The computational model is identical to the geometry and material property of phantom. Based on the phantom, we have validated the simulation of electric brain stimulation and confirmed that the design error was as small as 6% between models. The proposed phantom-based validation approach has a potential to validate a various type of simulation of neuromodulation changing material property.

P1-29 빅데이터 보건의료 연구를 위한 실시간 중환자실 환자 생체신호 수집 시스템

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In this paper, a system of collecting real-time vital sings from patients in intensive care unit (ICU) was developed. The system collects vital signs such as electrocardiogram, photoplethysmogram, respiration rate, and blood pressure measured on 15 patient monitors attached to patients in the ICU. The system transmit the real-time vital signs to a database server via WiFi network. On the server, a software developed with LabView receives the real-time vital

signs from 15 patient monitors and stores the signals. During 7 months of collecting period, vital signs from 670 patients were collected. This database will offer good opportunities in healthcare researches based on big-data analysis.

P1-30 SVM 모델을 이용한 전당뇨병 감별

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In this study, we developed and validated a model to predict pre-diabetes using support vector machine (SVM) method. Data from the Korean National Health and Nutrition Examination Survey (KNHANES) 2010 and 2011 were used to develop and validate, respectively, the SVM model for pre-diabetes. The SVM model was trained with 7 predictors including age, gender, waist circumference, body mass index (BMI), family history of diabetes, hypertension, and alcohol intake, which were selected using backward logistic regression. The areas under the curves (AUCs) for the SVM model in the internal and external datasets were 0.768 and 0.729, respectively.

P1-31 SVM을 이용한 마이크로 어레이 데이터 기반의 11개의 신경 근육병증 다중분류

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To develop multicategory classification models with optimal parameters and features, we performed a systematic evaluation of three machine learning algorithms and a feature selection method using three-fold cross validation and a grid search. This study included



114 subjects of 11 neuromuscular diseases and 31 subjects of a control group using microarray data with 22,283 probes. We obtained an accuracy of 100% by applying the models of three multiclass support vector machines using the ratio of genes between categories to within-category sums of squares (BW) feature selection method. Each of these three models selected only four features to categorize the 12 groups.

P1-32 편광된 전자 전송을 위한 수직 성장된 탄소나노튜브의 선택적 기능화

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Carbon nanotubes (CNTs) are allotropes of carbon, which have excellent physical and electrical characteristics including high thermal conductivity, mechanical strength and thermal stability. CNTs attract interest as various biomedical applications such as X-ray, drug delivery system (DDS), electrochemical biosensor. For Polarized electron beam transport, end-localized cluster of COOH groups on vertically growth CNTs. We have shown CNTs can be end-functionalized carbon modified. We will study that high level control by using functionalization of covalently bonding DNA strands on CNTs. The CNTs was etched and oxidation with terminal COOH groups. The COOH groups can be react with amine group of DNA strand. Our study will be applied for various modified nucleotide, nanomaterials and molecular-scale electronic systems.

P1-33 용적맥파를 이용한 개인인식 시스템

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This study is about the method of individual identifi-

cation use PPG. Unlike the other biometric methods, such as face, iris, fingerprint, or veins on the back of hand, which use the structural difference of human body parts, the PPG method has the advantage of using life phenomenon. The main characteristic of proposed method can be classified the method of analysis PPG features. The Proposed method extracts 5 times PPG signal from each 11 person, and use 11 PPG for training and 44 PPG for testing. The proposed method shows amounting to 93% recognition rate.

P1-34 수술에 사용하기 위한 모바일 디지털 X-선 투시 시스템에 관한 연구

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In this paper, we describe mobile digital X-ray fluoroscopy System. It can support for intraoperative use. Also, it provides imaging services that allow us to deal with the radiography and fluoroscopy. In order to implement this system, we describe about system configurations and we show the results of imaging services.

P1-35 기립경사 검사를 이용한 실신 예측 Heart Rate Variability 분석

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Syncope is defined as a sudden temporary loss of consciousness associated with a loss of postural tone with spontaneous recovery. Patients with syncope show different responses to head-up tilt(HUT) test, which



may be due to different pathophysiological mechanisms. Heart rate variability(HRV) was analyzed at 5min periods during HUT. R-R intervals were analyzed by time-and frequency domain methods. The STD HR, RMSSD(STD), NN50(STD), pNN50(STD), LF/HF, VLF power, LF power and HF power of the RR interval series of the subjects were significantly different from those of the control group ($p < 0.05$). These findings suggest that there are different pathophysiological mechanisms underlying syncope.

P1-36 공간섭 단층영상기(OCT)를 이용한 망막 병변 자동 분류 시스템

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Automated segmentation and pathology classification of retinal layers in Optical Coherence Tomography (OCT) can help ophthalmologists' diagnosis by providing valuable pathological information. In this paper, we propose and demonstrate automated classification of macula diseases with automated segmentation. The classification method is based on Support Vector Machine(SVM) and Rule-based method. Successful classification of 5 class of control/pathology group is shown. Sensitivity and specificity from finding abnormal volume were 100% and 98.61%, respectively. Automated classification of each pathology following pathogenic feature was also successful. Our method has been developed for 3D volume data, allowing to help users to diagnose pathologies without any complex operation.

Tissue Engineering and Biomaterials

P1-38 나노섬유의 표면구조에 따른 지방유래줄기세포의 증식 및 생존 능력 분석

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Nanofibrous scaffolds have been widely investigated for tissue engineering applications. Recently, patterns on nanofibers have been interested for controlling the response of cells seeded on those fibers. In this study, we have prepared poly(epsilon-caprolactone) (PCL) and poly(Lactic-co-Glycolic acid) (PLGA) based pattern nanofibrous scaffolds and examined the effect of nanofibrous patterns on viability and proliferation of adipose stromal stem cells (ASCs).

P1-39 연골 분화 향상을 위한 지방줄기세포와 수핵세포의 반복적인 공배양 방법

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Recently, a co-culture has been suggested as an effective method for stem cell differentiation in tissue engineering applications. In this work, we investigated whether repeated co-cultures of adipose stem cells (ASCs) and nucleus pulposus(NP) cells using porous membranes would enhance their chondrogenic differentiation. The results showed NP cells co-cultured with ASCs upregulated COLII and AGG gene expressions and the NP cells from 1st co-culture promoted same gene expression of co-cultured ASCs. These data demonstrate the repeated co-culture system can enhance chondrogenic differentiation of co-cultured ASCs and NP cells and provide a promising approach for cell therapy of IVD diseases.

P1-40 Nanoceria doped Electrospun Antibacterial Composite Mats for Potential Biomedical Applications

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This study presents the fabrication and characterization of novel bactericidal Nanoceria doped composite nanofibers. Nanoceria doped composite nanofibers fabricated by physically blending Polyurethane (PU) with two biopolymers such as Cellulose acetate (CA) and Zein. The Nanoceria were prepared by electrospinning of a sol-gel composed of cerium nitrate hexahydrate, and polyvinylpyrrolidone and followed by calcination and sonication. The physico-chemical characterizations of the synthesized Nanoceria doped composite nanofibers were carried out by X-ray diffraction pattern, field emission scanning electron microscopy, and transmission electron microscopy. The antibacterial activity was tested against most common pathogenic bacteria such as Escherichia coli, Klebsiella pneumoniae, Salmonella enterica (Gram-negative), Staphylococcus aureus and Enterococcus faecalis (Gram-positive). The Nanoceria doped composite nanofibers have demonstrated effective toxicity against both the Gram positive and Gram negative bacterial strains. The obtained results indicate that the inhibition is dependent on the concentration of Nanoceria doped composite nanofibers. TEM analysis reveals that Nanoceria caused disruption of cell membranes which led to the irreversible damage to the cell envelope eventually leading to cell death. Generally, these Nanoceria doped composite nanofibers were depicted as a promising nano material for exceptional antibacterial treatment and can be used as another smart material for biomedical and industrial applications.

P1-41 병원성 미생물을 이용한 플라즈마 멸균 시스템 시험

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To prove the sterile performance of the plasma sterilization systems, we tested them using the process challenge devices(PCDs) and surface of surgical tools with reference strains of bacteria (Staphylococcus aureus, ATCC-29213). We utilize the clamps and forceps which are frequently used in surgery. To see the control of the experiment, one group was contaminated with the reference strains of the bacteria, and the other group was not touched. After sterilized in the plasma sterilization systems, all tools are swiped with the sterilized cotton swab and CO₂ cultured in BAP badge for 24 hours. We concluded that the plasma sterilization systems perform well to sterile those reference strains of bacteria. Further research will be pursued to find out sterilization performance of plasma sterilizers.

P1-42 뇌동맥류 완화를 위한 뇌혈관 니티놀 스텐트의 표면 안정화

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김경수, 백승민, 유창민, 최혁
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Nikel titanium shape memory alloys (NiTi) are promising materials due to their shape memory effect. The disadvantage of the nickel is the toxicity, there are too many restrictions on the use of the human body. Hence, if the proper surface modification is chosen, the surface of NiTi can be tranquilized and smooth. Also, toxic chemicals can be protected by oxide film. The polishing method we have used is electro-polishing which is simple enough, economical and can handle wide range at once. In this study, we are surface modification NiTi by surface electro-polishing. The polishing method we have used is electro-polishing which is simple enough, economical and can handle wide range at once. We have used AFM(atomic force microscopy), SEM(scanning electron microscopy), OM (optical microscope) to analyze the roughness, and formation of surface of NiTi stent. To measure corro-



sion resistance, steady potentiostat was used to corrosion test. Our study group have concluded that condition of 40V 10seconds of electro-polishing showed the optimal stabilization of the surface.

P1-43 The effect of combination of electrical stimulation and bone graft material on bone formation of rabbit tibia defect

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Dental implant is a treatment method to implant in loss part of teeth or used in bone transplant of jaw-bone under biocompatibility. We have used *in vivo* model, white rabbit with damaged tibia and observed the new bone formation in the loss part of tibia after adaptation of dental implant and fine electric stimulation. New bone formation and histomorphometrical evaluation was observed and compared through micro-CT within groups of no treatment (implant), grafting with bone graft material alone, stimulating the electricity alone or grafting with bone graft material combined with electrical stimulation. We suggested that combined with micro-BEC (biphasic electrical current) stimulation and bone graft material to adapt in effective new bone formation.

P1-44 MEMS 기술 기반의 체외 3차원 종양 모델

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As a tool for generating 3D cancer model in vitro, we fabricated concave microwell arrays using simple lithography based-replica technique with PDMS. Using

this mold, we generated MCF-7 spheroids of uniform size and then assessed cytotoxicity of anti-cancer drug conjugated nanoparticles. We treated spheroids with PNIPAM only or PNIPAM-DOX nanoparticles. When treated with doxorubicin containing particles, the original character of cancer spheroid was destroyed. We observed the effect by performing live/dead assay and electro microscopy. Proposed cancer spheroid generated by MEMS technology well efficient tool on cancer study as an in vitro tumor model.

P1-45 세포의 3차원 배양 시 D₂O와 TSP가 세포 생존에 미치는 영향

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Nuclear Magnetic Resonance (NMR) has been being used to identify cell metabolite with reference material (TSP). And deuterated solvents are used to control magnetic field in the sample so that the resonance frequencies do not drift. The purpose of this study is to evaluate the effects of D₂O and TSP on viability of cells in 3D culture. MG-63 were selected and cultured at media containing 10% D₂O and low concentrations of TSP(0.5 and 1mM). Our results indicate that there was no significant difference in mixed media with 10% D₂O and low concentrations of TSP. We concluded that D₂O and TSP with appropriately low concentrations can be used for MRS in 3D cell culture.

P1-46 지르코니아 분말이 포함된 전처리제를 통한 복합레진과 지르코니아 간의 접착강도의 향상

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치과생체재료학교실

The aim of this study was to improvement of shear bond strength between composite resin and zirconia

POSTERS I

with the zirconia powder. The zirconia specimens were airborne-particle, abraded using an intraoral sandblaster. Characteristics of the zirconia powder measured using differential scanning calorimetry and Attenuated total reflectance-Fourier transform infrared spectrophotometry. All bonded specimens were thermocycled 5000 times prior to the shear bond strength test. Bond strength of the group to which the zirconia powder was added 25% higher than the other groups. The use of zirconia powder-incorporated primer is effective for increasing the repair bond strength of resin composite zirconia.

P1-47 멜라토닌을 이용한 지방세포사 유도

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Obesity is a major disease that causes various complications. However, the mechanism for cell therapy in obesity has not been fully understood. Melatonin is a hormone secreted by the pineal gland that is involved in the regulation of body fat and body weight. In this study, we investigated the effects of melatonin in cell death using pre-adipocytes. 24 hours of melatonin treatment decreased expression of p-ERK and increased activation of cleaved caspase-3. These results indicate that melatonin has a significant role in inducing cell death in pre-adipocytes.

U-Health, e-Health, m-Health Technology

P1-48 PVDF 센서를 이용한 침대에서의 수면자세 추정 사전 연구

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Sleep position is regarded as an important parameter for evaluating sleep health. It has been reported that some of sleep apnea is closely related to sleep position. Also, it is known that patients who live most of day in bed are easy to get pressure ulcer. To prevent sleep position related diseases, we developed novel method to estimate sleep position using PVDF sensor. As PVDF sensor is flexible and possible to collect the signal non-intrusively, comparing with conventional sensors like accelerometer or pressure sensor pad, PVDF is much more simple to set-up and comfortable. We conducted sleep position estimation using BCG beat collected from PVDF sensor. As a result, it has shown 93.3% of sensitivity.

P1-49 Verilog를 이용한 3채널 심전계 전극 오부착 검출 알고리즘의 모의 검증

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One of the most common mistakes in getting an electrocardiogram(ECG) is to misarrange electrodes. It causes ECG signals Lead I, Lead II, Lead III to be inverted toward negative direction or can change each lead signal to other signals among themselves. It makes patients waste time needed to recheck their heart health. When attaching each electrodes for ECG, detecting algorithm for misarranged electrodes will help them to save rechecking time. In this paper, we designed its algorithm which has six case categories in a simple condition and made a simulation module using VerilogHDL. For testing its operation we used ModelSim simulator.

P1-50 파킨슨 환자의 손가락 탭핑 점수 예측 모델의 비교

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Parkinson's disease is characterized by movement disorders such as bradykinesia, tremor, rigidity, postural instability. Finger tapping, which is one of the signs of motor impairment is usually quantified by physicians with Unified Parkinson's disease rating scale (UPDRS). Many measurement systems using inertial sensors were proposed to quantify finger tapping objectively in the literature. In this study, we compared two quantitative score prediction models in previous studies - linear regression and ordinal logistic regression model. The estimated scores of logistic regression model showed smaller deviations from clinical scores than those of linear regression.

P1-51 모바일기기를 이용한 만성 폐쇄성 폐질환 환자의 호흡훈련 프로그램 개발

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In this paper, we developed mobile based breathing exercises for patients with chronic obstructive pulmonary disease. Respiration signal was sensed from changing chest angle which was detected by a mobile device located on the chest. The signal was transferred to the tablet-PC through bluetooth connection so that breathing exercises program could be worked. The breathing exercises program encourage a user make a regular and continuous respiration by keep pace with music and visual effects provided on the screen. With the program, individual who need respiration training could be helped by providing simple paradigm which can be used in their home.

P1-52 운동중 심박수 측정을 위한 벨트형 용량성 전극 시스템

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To measure heart rate during exercise, this study describes a capacitive coupled electrode system which integrated into a chest belt. Capacitive coupled electrode measures electrocardiogram without direct conductive skin contact. However, motion artifact effect should be overcome for ambulatory monitoring. We designed motion artifact robust electrode. We validated the performance of the system during subjects walking on a treadmill.

P1-53 PPG 신호로부터 Linear Predictor를 이용한 심박수 추적 방법

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The interest to health state monitoring during daily life has grown as ubiquitous healthcare develops. Specifically, smart phone applications were developed to measure user's heart rate using light absorbance of finger of face, same as PPG. To satisfy user's convenience, the health monitoring approach using smart watch has been recently interested, and hence the need to real-time tracking of health state has grown. In this study, we focus on the heart rate tracking method from PPG using the frequency estimator which is based on linear predictor. We performed experiment to assess our approach, and, from experiment result, this method was verified through comparison with zero-crossing method, which is frequently used for HR calculation.

P1-54 체내 이식형 약물주입기의 블루투스 통신 성능 향상 연구

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To enhance the communication performance of the full longterm implantable infusion pump which is utilizing the Bluetooth (2.4GHz) protocol in ISM band. Bluetooth will enable the implanted medical devices to communicate with many mobile devices such as mobile smartphones and laptop computers so we can implement ubiquitous medicine. By relocating Bluetooth chip antenna and employing a short waveguide the communication performance can be enhanced. Our device could communicate with a tablet computer at 5cm distance from the skin while it was buried under 1.5cm fat and skin at our Ex-vivo experiment with a chunk swine tissue including skin, fat and muscle.

P1-55 자전거 운동 시 표면근전도 근피로도 분석을 통한 최적 기어비 검출에 관한 기초 연구

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The purpose of this study is to find the optimal gear ratio and pedal rate using sEMG analysis of muscle fatigue during cycling exercise. It is previous study for real-time optimal gear ratio detection of outdoor cycling exercise. We analyzed changing trend of muscle fatigue using sEMG. 3 subjects completed four trials with same velocity, power consumption and different gear ratios, pedal rates. As a result, when the subjects exercised equal velocity and power, muscle fatigue variation is different due to gear ratio. So, the gear ratio, has least accumulation velocity of muscle fatigue, determined to optimal gear ratio.

P1-56 심전도를 이용한 RR-interval 추정 및 부정맥 감지 시스템 개발

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The signals from the body give us the useful in-

formation that is kinds of diseases and unexpected physiological reactions. Especially, ECG (Electrocardiogram) signal which is measured on the chest represents the electrical activation of the heart. By analyzing this, the cardiac activity can be closely monitored and detected the diseases that are related to the heart. In paper, RR-interval that is distance of the R points in the ECG is estimated. And then detection system of arrhythmia that is heart disease of irregular cardiac rhythm is developed through RR-interval.

P1-57 ECG 신호 전송을 위한 저전력 블루투스 송수신 시스템 설계

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Heart disease patient is being increased for several years. Electrocardiography(ECG) and 24-hour Holter monitor tapes are used to diagnose the symptom and sort of heart disease. But when patient suffers from acute heart disease like ventricular fibrillation, measuring ECG with 24-hour Holter monitor tapes has limit to respond. In this study, ECG monitoring system with smartphone and wireless radio Bluetooth technology has been designed to simplify real-time measurement. Bluetooth Low Energy(BLE) makes it possible for designed system to maintain high data transfer rate and consume extremely low current.

P1-58 표면 근전도 신호를 이용한 펀치 투 줌 동작 인식

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Electromyogram (EMG) is the representative electrophysiological signal for estimating the level of muscle



contraction. Many researchers have used EMG for constructing the human-machine interaction device. However, almost studies have only focused on detecting the movement of arms or legs, not estimating the position of them. In this study, we estimated the distance between index and thumb finger to recognize the pinch-to zoom gesture using electromyogram. For accomplishing this purpose, multiclass support vector machine with radial basis function was used. Finally, we successfully estimated the distance between two fingers in $93.51 \pm 4.67\%$.

P1-59 착용형 기능성 근적외선 분광기 구현을 위한 예비 연구: 숨 참기 실험

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In the paper, the preliminary study to create the wearable functional near infrared spectroscopy was described. The in-house fNIRS included the time division multiplexing for 760nm red light and 880nm infrared light due to measure cerebral hemodynamics. The in-house fNIRS was able to measure the hemodynamics in previous studies. Therefore, two experiments were conducted to verify its ability for measurements of the states of hemoglobin distinctively. The first experiment was the monitoring of blood in the forearm during arm-occlusion. The second task was the breath-holding during 40 seconds which affected the hemodynamics in the prefrontal region.

P1-60 뇌졸중 후 상지 편마비 환자를 대상으로 한 모바일 게임 기반 상지 재활훈련 프로그램의 임상적 유용성 평가

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In the paper, we developed the mobile based rehabilitation system for patients with upper extremity hemiplegia after stroke and evaluated clinical usefulness and effectiveness of the system. The sensors built in the mobile device were used to track patients' upper limb motion and the movements was transferred to the mobile device through bluetooth connection so that the game contents could be interact with the movements. For the clinical evaluation of the effectiveness, 12 patients were recruited and make them perform an exercise of their wrist, shoulder, and forearm using the system for two weeks. The results showed significant improvement in upper limb function, quality of life and depression. Given the fact that our experiment, we verified mobile based rehabilitation program could be useful and effective for the clinical use.

P1-61 자궁근전도 분석을 통한 조산 예측 기술

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Preterm delivery means giving birth of a baby less than 37 weeks of gestational age. As preterm delivery can cause fatal health problems in mother or fetus, many researchers try to develop the preterm delivery prediction technology. In this study, we implemented a preliminary study to develop the preterm delivery prediction technology which can distinguish preterm delivery and onterm delivery before the 32nd week of gestation. In future study, we would evaluate the classification performance based on the feature vectors used in this study.

P1-62 심폐소생술 관련 스마트폰 앱 조사

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Cardiac arrest often occurs outside of hospitals, where experienced rescuers or chest compression depth (CCD) feedback devices are unavailable. The smartphone is widely spread, and the cardiopulmonary resuscitation (CPR) related applications for layperson are being developed. In this study, we survey these applications. From a number of apps, we selected the app that provide various functions and investigated detail functions. Most of apps provide procedure of CPR. All of Korean version apps did not provide the CCD feedback function, whereas the apps that from the other country have feedback function with various other functions. It could increase the survival rate if we developed the app of Korean version that has the feedback function.

P1-63 무선 전자청진기 개발

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This study have implemented a portable wireless electronic stethoscope, this system includes sound acquisition module and wireless transmission module. In medical practice fields, It is restricted that students for educational purposes try to a female patient with stethoscope, and this could invade her privacy. In order to facilitate students' auscultation skill training, wireless stethoscope is required. We have developed new stethoscope system for the co-auscultation. In comparison with conventional analog electronic stethoscope, electronic stethoscope is more bulky and higher level of background noise, and different sensation of grip. These could be improved according to the user feedback information and could be useful in medical education for the clinical skill.

P1-64 전두엽 뇌파 신호만을 이용한 수면/깨움 검출

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Polysomnography (PSG) is a gold standard method for sleep stage scoring. However, in PSG recording, a large number of electrodes are attached to the subject's face and specially trained sleep experts are needed. For accurate and daily sleep/wake monitoring, we used only frontal lobe EEG data for analysis. For every 30 seconds, peak frequencies of 1 second EEG data were calculated and sleep/wake epoch were determined based on the suggested conditions. For epoch-by-epoch detection, the method classified sleep/wake with an average sensitivity of 83.3%, specificity of 94.5%, accuracy of 93.1%, and kappa statistic of 0.73.

P1-65 FPGA 보드를 이용한 난청보상 알고리즘의 임상적 평가

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In this study, we utilized a FPGA board to evaluate the performance of two testing hearing aid algorithms - wide dynamic range compression and Wiener filter - clinically using speech intelligibility test with hearing-impaired subjects. Experimental results demonstrated that the output signal patterns of the Matlab-based algorithms and those of the FPGA design were almost identical, and that the FPGA-processed signals showed clinical benefit in speech intelligibility at relatively low input signal-to-noise ratio conditions. Considering these results, we expect that the use of FPGA in evaluation of the on-developing hearing aid algorithms is a good strategy to reduce time and computational complexity problem.


P1-66 스마트폰의 비디오카메라를 이용한 혈압 측정

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In this study, to measure blood pressure(BP) more easily, photoplethysmography(PPG) from a fingertip using the built-in camera of a smartphone was measured. The reflection mode of PPG measurement was realized by the camera and LED flash. The fingertip PPG from a male in twenties for 30 second and non-invasive BP were measured 100 times. A significant correlation equation was derived by the multi-regression analysis using 70 data of them as training set and the performance of this equation was evaluated by 30 data as test set. The average measuring efficiency is 2.92% in systolic BP and 3.81% in diastolic BP.

P1-67 Quaternion을 사용한 sedentary의 신체활동 분석에 관한 기초연구

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Previous physical activity recognition system are not consider device direction and orientation. These system measure acceleration with fixed orientation and recognize activity only using signal pattern or simple parameter. So it have low accuracy. In contrast, physical activity assessment method based on rotated acceleration by quaternion can classify sedentary behavior with more accuracy with unfixed device. This paper demonstrates preliminary research of physical activity assessment method based on quaternion.

P1-68 LED 조명 자극에 따른 인체 생리학적 평가

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In this study, the objective was to verify the physiological effect of LED lights on the body. Ten males in their twenties were involved without the medical history of eyes and heart disorders. The subjects were exposed to LED lighting during five minutes and the experiment was conducted eight times changing with red, orange, yellow, green, blue, indigo, purple and achromatic (white) color. Heart rate variability (HRV) was measured before and after the stimulation. In the result of HRV, sympathetic nerve was more activated than parasympathetic nerve in the groups of achromatic color, red, orange and yellow color lights. Parasympathetic nerve was more activated than sympathetic nerve in the groups of green, blue, indigo and purple color lights.

P1-69 심박변이율에 근거한 수면 모니터링 기술 개발

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In this research, we developed sleep monitoring system based on heart rate variability. Heart rate variability (HRV) was extracted from electrocardiogram (ECG) simultaneously recorded during night time polysomnography. The feature which reflects NREM/REM cycle was obtained through linear summation of extracted HRV. Overall, our system provided 83% agreement compared to the results of the gold standard polysomnography. Also, there was no performance-difference according to the severity of sleep apnea syndrome.

P1-70 2차 메모리 버퍼를 이용한 음성구간 검출 결정 알고리즘

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Voice activity detection (VAD) plays an important role in the performance of the overall system. In this paper, we propose a decision algorithm to effectively distinguish speech from non-speech in noisy environments. We present a new decision rule for VAD which is used entropy and 2nd order memory buffer. Performances of the proposed decision algorithm of VAD are evaluated by objective test under white noise environments.

P1-71 안드로이드 기반의 기본소생술 어플리케이션 개발

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Many of the cardiac arrest happens out-of-hospitals where the experienced rescuers or chest compression depth (CCD) feedback devices do not exist. In case of using smartphone with built-in accelerometer, it is possible to estimate CCD and chest compression rate (CCR). In this study, we developed an app which provides feedback of CCD and CCR. Also, the app supplies the basic knowledge of CPR, direct emergency call and the map of automated external defibrillator (AED). To verify accuracy of feedback data, we used displacement sensor and MATLAB software. As a result, the app has a suitable level of accuracy in CCD and CCR feedback. Through this app, we expect to increase survival rate by leading accurate CPR.

P1-72 치아의 구조적 특성을 이용한 치아 영역 분할 전처리 방법

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In this paper, we proposed method of preprocessing for tooth region segmentation. In order to improve the tooth segmentation ratio, tooth district be divided by structure characteristic of tooth. In case of conventional tooth detection method has not considered to reduce intensity at molar region, and disadvantage of low detection ratio is occurred by these problems. To supplement the disadvantage of conventional method, intensity of molar regions is improved and components of MCWA are extracted using proposed method. According to simulation result, the proposed method is better than conventional method at color tooth image.

P1-73 ECG 신호 분석을 통한 운전자 졸음 및 각성 상태 특성 분석

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The increase in traffic accident from carelessness driving is a serious problem in society with falling asleep. Distinct features in heart rate signals during the driver's wake and sleep states could provide an initiative for the development of a safe driving systems such as drowsiness detecting sensor in a smart wheel. We measured ECG signals from 30 adult subjects during the wake and sleep states. After detecting R-peaks in ECG signal, heart rate signal was obtained. Heart rate variability (HRV) was investigated for the time domain and frequency domains; mean RR, STD RR, mean HR, STD HR, RMSSD, NN50, pNN50, RR Trian, TNN(STD), VLF peak(Hz), LF peak(Hz), HF peak(Hz), VLF(ms²), LF(ms²), HF(ms²), LF/HF, VLF power(%), LF power(%) and HF power(%). The STD HR(0.029), NN50(0.044) and VLF power(0.0018) of the RR interval series of the subjects were significantly different from those of the control group ($p < 0.05$). In conclusion, there are



changes in heart rate from wake to sleep that are potentially to be detected. The results in our study could be useful for the development of drowsiness detection sensors for effective real-time monitoring.

P1-74 그래픽 시스템 디자인 기반의 임베디드 기술을 이용한 모바일 헬스케어 시스템 개발

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This research tried to reach out developing “m-Health-care” system that is measuring various Bio-signals by using LabVIEW based-on Graphic System design language and embedded system based-on FPGA. It could combine one total System to 7 sensors like as EKG Sensor, Hand Dynamometer, Heart Rate Monitor, Blood Pressure Sensor, Spirometer, Surface Temperature Sensor, O2 Gas Sensor etc. “m-Health-care system” is possible to measure and gather, analyze data, transfer to mobile. Through these features, our system has improved convenience for users and helping medical engineering field students and biomedical system development companies.

P1-75 T-REX: 일상생활 중 심전도 모니터링을 위한 패치형 시스템

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T-REX was developed previously to measure ECG at any time and any places. The present study aims to assess validity of T-REX in comparison to a standard measurement system. Ten participants(mean age, 27.2±3.3 year) performed a test protocol involving activities of daily life such as lying on a bed, sitting on a chair and 1,3,5 km/h walking on a tread mill. ECG signal from each system was processed to cal-

culate HRV parameters. There were no significant differences in heart activity monitoring performances between T-REX and commercial system. Therefore, we suggest that T-REX could be useful for a various ECG monitoring applications.

P1-76 입면기 호흡주기를 이용한 수면무호흡증 심각도의 예측

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Prediction of sleep apnea severity can serve as a preventive measure against sleepdisordered breathing. We proposed a novel method based on the respiratory cycle obtained at sleep onset for prediction of apnea-hypopnea index (AHI). The significantly strong negative correlation between natural log-transformed coefficient of variation in respiratory cycle and AHI was observed. Based on the correlation, linear regression analysis was applied and the best-fit linear regression model explained 75% of the AHI variation. The prediction performance was evaluated with leave-one-out cross-validation and it resulted in the correlation coefficient of 0.90 between the predicted and actual AHI.



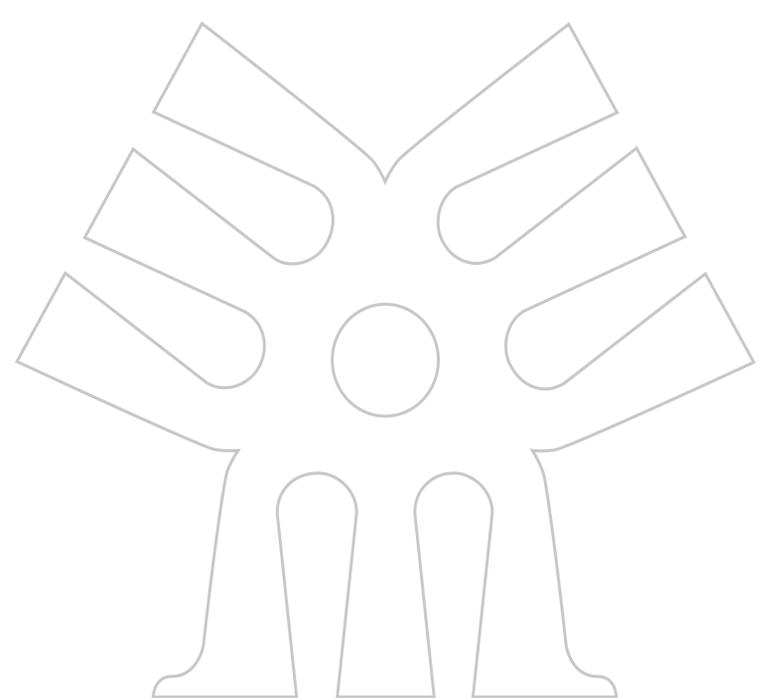
POSTERS II

Biomedical Optics

Medical Imaging

Orthopedic and Rehabilitation Engineering

Respiratory Engineering



POSTERS II



Biomedical Optics

P2-01 시료 챔버의 형상이 영상 기반 입자 계수 결과에 미치는 영향

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Microscopy and flow cytometry are widely used in biomedical and scientific research as well as clinical diagnosis for counting and characterization of various cell types. Numerous procedures in biology and medicine require counting of cells, on most occasions the concentration of the cells. Here we studied the distribution of local particle densities in a narrow channel and a square-shaped chamber containing the same volume. We found that the spreading of sample solution affected the distribution of particles inside the chambers. Sample chamber with non-uniform distribution of particles resulted in high coefficient of variation when we counted particles with small sample volume.

P2-02 Mammary imaging window를 통한 유방암세포 전이의 생체 내 영상화

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최기백, 황윤하, 김필한

KAIST 나노과학기술대학원

Breast cancer is the most frequently diagnosed form of cancer and the second leading cause of death in Western women. Breast cancer metastasizes from breast to lymph nodes and bone, lung, liver and brain. To analyze metastasis behavior, we visualized the same breast tumor microenvironment over multiple and long terms through mammary imaging window (MIW). In this study, we implanted mammary imaging window on the breast tumor and visualized by custom-designed real-time confocal microscopy *in vivo*. Herein, we achieved visualization of metastasis behavior of breast cancer cells.

P2-03 Dorsal skinfold chamber 기반의 피하 조직 내 암세포의 반복적 영상화

송은주, 최기백, 황윤하, 서호원, 안진효, 김필한

KAIST 나노과학기술대학원

Dorsal skinfold chamber and confocal microscopy have been applied for visualization of cancer cell growth and pharmacokinetic analysis. Commercial dorsal skinfold chamber (12 mm window) can provide wide range imaging, but it can cause breathing problems of mouse due to its large size. In this work, we implanted smaller (8 mm window) dorsal skinfold chamber into BALB/c nude mouse to reduce burden on mouse. We injected 0.1-0.5 million of B16F10-GFP melanoma or H460-GFP NSCLC into chamber window and visualized changes in characteristics of cancer cells and surrounding environments. We observed cancer cell morphology, motility, and early angiogenesis within subcutaneous tissues.

P2-04 광섬유 간섭계 기반의 비접촉 광음향 단층영상 시스템

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**정보통신공학부

We propose a noncontact photoacoustic tomography system that measures the acoustic signal using a fiber-optic heterodyne interferometer. The surface vibration of a specimen, resulting from the acoustic wave generated by the photoacoustic effect, is optically measured by using the fiber-optic interferometer without any physical contact. Phantom and *in vivo* image of blood vessels of chicken chorioallantoic membrane was conducted to evaluate the proposed system, and the initial pressure distribution associated with the light absorption was reconstructed by a Fourier transform-based reconstruction algorithm. The proposed system can be applied for the medical image diagnostic tool where the noncontact scheme is required.


P2-05 광활성 염색약을 이용한 전립선 비대증 치료 연구

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³해양과학 MIBT 융복합 센터

Laser light has been widely used as a tool to treat benign prostate hyperplasia (BPH) over 20 years. Recently, excessive laser power up to 200W was applied to surgically remove prostatic tissue. The purpose of this study was to validate the feasibility of photoactive dye injection to enhance light absorption and eventually to facilitate laser-induced tissue ablation under lower power applications. Four biocompatible photoactive dyes (Amaranth, Black dye, Endoscopic marker, Hemoglobin powder) were tested in vitro with a customized 532-nm laser system with radiant exposure ranging from 170 to 787 mJ/cm² on highly reflective chicken breast tissue. Ablation performance was evaluated in light of laser power, dye, concentration and injection volume. Among the tested dyes, amaranth generated the highest laser ablation efficiency, and 70% dye concentration was measured to be the optimal concentration to achieve efficient laser ablation. Ablation craters created with the increasing injection number (i.e. five shots) showed more efficient the laser performance possibly due to more uniform distribution of the injected dye in tissue. In-depth comprehension of adjuvant-assisted laser performance can help accomplish predictable and efficient laser treatment for BPH.

P2-06 펄스형 자기장을 응용한 광열 치료

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The purpose of this study was to demonstrate the use of magneto-motive technique to detect superpara-

magnetic iron oxide (SPIO) nanoparticles as a marker of cancer cells in tissue as well as to offer photothermal therapy to destruct the detected cells. 30 mg/ml concentration of Fe₃O₄ magnetic nanoparticles was administered through an artificial vessel tube, and the external magnetic field was applied to the sample at the distance of ~ 3 mm. After the application of the magnetic field (~5 KG), 980 nm laser light (~130 mW and ~300 s) was irradiated on the area of the aggregated particles. The results demonstrated that after 30 s of magnetic field application, the magnetic particles were evidently localized inside the tubes due to strong ferromagnetic susceptibility. Strong light absorption at 980 nm led to temperature increase (i.e. 0.75 K/s) at the targeted area inside the tube. Application of the pulsed magnetic field associated with laser irradiation can be a feasible method to detect circulating tumor cells and to selectively target them.

P2-07 흉터 재생 과정의 모니터링을 위한 교차편광시스템

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대구가톨릭대학교 의료과학대학 의공학과

A scar is an area of fibrous tissue on the skin or within the body that replaces the normal area after injury. For the evaluation of various scar treatments, a continuous observation of scar morphology is important to monitor healing process during the treatments. In this study, a cross-polarization imaging system was developed to examine the scar morphology. Tissue-mimicking phantoms were prepared as a scar model and the obtained images were analyzed in frequency domain. Area of scar was calculated by an image processing based on an edge detection algorithm. From the results, the proposed imaging system clearly extracted only the scar region even in the sample with high scattering coefficients corresponding to the well-restored scar.

POSTERS II


P2-08 동맥경화반 검출을 위한 광단층영상-근적외선 형광분자영상 통합 카테터 개발

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Intravascular optical coherence tomography (OCT) is an emerging diagnostic tool for coronary artery disease. Near-infrared fluorescence (NIRF) enables getting molecular information of inflamed coronary plaques with fluorescence agent. We have developed an integrated intravascular OCT-NIRF imaging catheter, which provides microstructural and molecular information from the artery wall simultaneously. We used, a clinically approved NIRF agent, Indocyanine green(ICG), which binds to albumin with high affinity and accumulates in atherosclerotic plaque. We acquired images from fluorescent phantom, then rabbit model of atherosclerosis in vivo. This dual-modal imaging approach could enhance our capabilities to detect and study high-risk coronary plaques.

P2-09 혈관 내 레이저 정맥폐쇄술을 이용한 하지정맥류 치료연구

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³해양과학 MIBT 융복합 센터

Endovenous laser ablation (EVLA) is a promising minimally invasive treatment for patients suffering from varicose vein. The purpose of this study was to verify the effective laser parameters for varicose vein treatment with respect to irradiation time, energy and duty cycle. A 1470nm diode laser system was employed on bovine liver tissue with power ranging from 6 to 12W, along with irradiation times of 30

to 60 s in continuous wave (CW) and 10 to 75 s in modulation modes. For modulation mode, the total energy was fixed at 90 and 180 J. Top and cross-sectional images of the tested tissue were evaluated in terms of the total irradiated area, carbonized lesion, and coagulation thickness. In CW mode, the total irradiated area and carbonized area increased while coagulation thickness decreased along with output power. However, in modulation mode, the total irradiated area and coagulation thickness increased while carbonization area decreased along with output power. The current study demonstrated that the temporal modulation in output power could control the degree of thermal features in tissue and eventually provide the optimal modulation conditions for blood coagulation during non-uniform varicose vein treatments.

P2-10 자가 배열 핫 스팟을 통한 동시 포획 및 탐지

심은, 홍순우, 최연호
고려대학교 생체의공학과

Fabricating substrate has regarded as one of the important aspects for molecular detection. Conventional approaches to fabricate have been focused on increasing the intensity of detection, but in these ways, it is necessary to find the hot-spot, which requires expensive and time-consuming work. Here, we fabricated advanced nano-bowtie with self-aligned hot-spot being able to detect biomaterials into the aimed spot which we called trap-and-detect process in convergence with plasmonic trapping. In addition to, we demonstrate these results *via* experiment and numerical calculation. Hereupon, we envision self-aligned hotspot technique as an economical, and shortcut techniques for molecular detection field.

P2-11 자궁경부 세포핵 면적 획득을 통한 암세포 자동 추적 알고리즘 구현에 관한 연구

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In this paper, it is a study on the implementation of the automatic tracking algorithm of cancer cells according to the area of the cell nucleus acquisition of the cervix. It is necessary to early diagnosis because high as seventh in the cancer that women cervical cancer. So, we have implemented an algorithm that can obtain the area of the cell nucleus as a reference for diagnosis thereby tracking the cancer cells. As a result, it was possible to obtain results that conforms to the diagnostic criteria of individual cells.

P2-12 광시야 형광 이미징에서 곡면 샘플 챔버를 이용한 상면만곡 보정

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We propose a wide field-of-view fluorescence imaging system with corrected field curvature in a simple and low cost preparation. The design of optical systems for fluorescence is complicated by the requirement that the image surface be planar, which results in complex and expensive optics. We analyzed a compact optical system with a curved sample surface and compared its performance to systems with planar object surfaces via optics analysis and image system simulation. To prove this concept, we fabricated a curved sample chamber and evaluated its quality by taking image on a planar detector.

P2-13 고출력 808 nm 근적외선 레이저를 이용한 돼지 위 조직의 천공 특성 연구

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Tissue ablation apparatus with high-power laser to exercise in endoscope have been developed to facilitate the surgical procedure. We have performed a fundamental study on the interaction between 808-nm infrared laser and porcine tissue with purpose of finding the characteristics of perforation depth. We have measured perforation depth at porcine fillet and stomach tissues with different output power and irradiation time and compared the results. The perforation depth was slightly greater at higher laser output power at the same energy level. No significant difference of perforation depth between fillet and stomach was found.

P2-14 OTDR 기반의 삽입형 광섬유 글루코스 센서의 개발을 위한 기초연구

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 건국대학교 의료생명대학 의공학부
 BK플러스 의공학실용기술연구소

In this study, a glucose sensor was fabricated using a single-mode optical fiber and an optical time-domain reflectometer (OTDR) for monitoring concentration of glucose solution. Using the infrared light reflected at the distal end of optical fiber, we measured the glucose solutions with a concentration range from 50 to 500 mg/dl.

Medical Imaging

P2-15 Egg-white 팬텀에 집속 초음파가 조사될 때 발생하는 캐비테이션 및 변성에 관한 고찰

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Cavitation effect has disadvantages that interrupt the efficient treatment and increases the risk of treatment by limiting the treatment conditions. Therefore, in

POSTERS II



this study, three-channel sensor was fabricated using PVDF piezoelectric film for in order to measure the cavitation. We considered cavitation generation rate and denaturation extent in egg-white phantom according to ultrasound sonicated using a manufactured sensor. Therefore, we conclude that the results of this study will utilize the parameters of basic research for the evaluation of cavitation in the therapeutic field using a focused ultrasound through further study.

P2-16 젤라틴을 이용한 근육 유사 초음파 팬텀 개발에 관한 연구

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As the ultrasound diagnosis and treatment techniques are improved, the evaluation methods for the safety and usefulness are emerging. The tissue mimic material phantom is generally used to estimate the ultrasonic bio-effect. These phantoms have the similar acoustic characteristic to overall human tissue. However, phantom with the characteristics of the target tissue is needed in order to evaluate more precise and clear human effects in the application region. In this study, muscle mimicking phantom in tissue was produced using glycerol and gelatin, we was evaluated acoustic property.

P2-17 대뇌 네트워크의 노드 개수에 따른 그룹 특성 변화

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The human brain contains many connected regions and the interconnected network of the human brain has been called 'small-world networks'. While many factors such as nodes, definition of network nodes is especially important because it is basic structural

fundamentals of the human brain and the network measurements can be changed depending on the definition of nodes. However, it is not easy to define the network nodes because the most appropriate method that determines the optimal scale to analyze the brain as network is unknown. The purpose of this paper is to provide the results comparing network parameters over a variety of nodal scales. The CV was used for measuring group variation. These results show that nodal scale affects group property in cerebral network analysis.

P2-18 다양한 생리적 노이즈 제거 방법으로 인한 기능적 연결성의 차이

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There are several methods to remove physiology noise in resting-state functional magnetic resonance imaging (fMRI). We examined seed-based functional connectivity in resting-state fMRI using three different noise removal methods: with PESTICA, regression method with and without global signal. In regression method without global signal, there was significantly over-estimated positive functional connectivity compared with PESTICA and with global signal. The results of global signal regression were more negative correlations and under-estimated positive correlations.

P2-19 대뇌구조 영상과 CSF tissue map을 이용한 소뇌 영역 자동 분할 연구

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In this study, we proposed a hybrid procedure for segmentation of cerebellum disposing tissue classification, template-based approach and morphological operations sequentially. Cerebellum region was roughly defined that removing cortical tissue mask from



brain mask. Then, non-cerebellum region was trimmed off using morphological operator and partial volume estimation map. And, brain stem atlas was registered on individual brain image to remove brainstem and cerebellar peduncles.

P2-20 Reference function based evaluation of uterine cervix by application of quantitative ultrasonic elastography image analysis

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Recently, many researches have been studied about ultrasonic image technique (UIT). Application of mathematical reference function to UIT makes it enables to evaluate characteristics of tissue and young's modulus without biopsy has being studied in our group. The aim is to materialize a tool to make it possible to aid gynecologist examine more quantitatively and diagnose more precisely. Data of ultrasonic image has been composed of 34 patients (mean age 34.2, age range 29~39). Our purpose is to provide the fiducial value of the patients' stiffness degree by calculating mean value, maximum, minimum, and standard deviation of each patient's stiffness of uterine cervix to evaluate patients relatively. If further supplement of data fulfills, it will aid more mathematical analysis and support more quantitative and accurate diagnosis to give clear information.

P2-21 구조적 네트워크 기반 알츠하이머 질환 추적 분석

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Alzheimer's disease (AD) has been shown to reorganize brain structure. In this paper, we compared

brain pattern between AD group and Normal Control (NC) group with 3-year longitudinal study. All subjects were estimated with neuropsychological tests and with magnetic resonance imaging (MRI) at baseline, follow 1yr and follow 3yr. Through longitudinal analysis of the group difference using statistical methods, we found significant regions and edges which play important roles in advancement of AD.

P2-22 대뇌 피질 두께 분석을 위한 종적 맵핑 방법

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Longitudinal studies are important in longitudinal studies for Alzheimer's disease (AD) and other progressive neurological and psychiatric disease. The thickness of the cortex provides anatomical information on disease-related for detection of pathology and treatment planning. But, applying the existing cross-sectional methods independently to the estimation of the thickness at each time point in a longitudinal study may generate longitudinally-inaccurate measuring the thickness. In this work, we proposed a longitudinally-accurate mapping of cortical thickness method combined with local coordinate system and surface inflation vector, which is robust for effect of between-subject variability.

P2-23 대마초 중독 환자의 resting-state functional MRI를 이용한브로드만 28번 영역에서의 변화 관찰

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The hippocampal region (Brodmann's area 28) is an area that is important for normal memory function. Specifically, hippocampal region manifests neurofibrillary tangles in cannabis addiction. In this study, we acquired resting-state fMRI images of normal control and cannabis addiction patient from HCP



database. For connectivity analysis, we preprocessed images using FreeSurfer. We then applied the connectivity analysis with seeds in the hippocampal region. As a result, we confirmed disconnection between the hippocampal region and other brain regions. This potentially represents cognitive impairment of cannabis addiction patients by disconnection of functional links.

P2-24 알츠하이머 환자의 대뇌 회백질 영역에서의 평균 확산도와 부분용적효과에 관한 연구

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In recent years, some researchers have been interested in investigating a property of cortical GM with cortical surface model that reconstructed from T1-weighted volume. However, diffusion weighted image suffers from substantial geometric distortion. The geometric distortion makes it difficult to align non-diffusion weighted volume (b0 volume) to an undistorted, high resolution anatomical volume. The purpose of this study was to suggest a method for correcting coregistration error between T1-weighted volume and B0 volume using the information of cortical thickness (Thickness Guided Mapping, TGM). The main concept of TGM is that the boundary between GM and CSF is redefined by profiling MD value toward inward and outward direction.

P2-25 알츠하이머질환과 혈관성치매질환에서의 대뇌 피질의 두께 감소와 백질 미세구조 변화의 패턴 분석

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Indices of gray matter and white matter play a role in the disease process of Alzheimer's disease (AD) and

Subcortical Vascular Dementia (SVaD). There has been a relative lack of investigation of the interactions of the two tissue types together. In this study, we aimed to investigate differences in correlated pattern of reduced cortical thickness and white matter integrity in patients with Pittsburghcompound B (PiB)-negative SVaD and those with PiB-positive AD. We used sparse canonical correlation analysis (sCCA) to elucidate cortical thickness and fractional anisotropy relationships in both AD and SVaD.

P2-26 Kinect를 이용한 졸음운전을 방지하는 감시 시스템의 개발

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This paper proposed a prototype monitoring system for preventing drowsiness driving using Kinect. The parameters used for detecting the state of the eye were pupil and eye closure duration. Initially, the images from Kinect were used to track the frontal face, left and right eye region. Then, the image processing techniques such as binary, labeling to find the more accurate eye region was applied on the captured images. Finally, we extracted the image of the pupil through a data analysis and determined the state of the eye according to a difference of extracted the pupil areas. The system that we proposed can help the drowsy driving prevention with sensing eyelid movement.

P2-27 폐 CT 영상에서 재구성 방법에 따른 폐기종 지수의 영향을 보상하는 커널 변환 기법

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This study presents an image-based kernel conversion technique which converts CT image of sharp kernel to that of standard kernel and evaluates its impact on the emphysema index (EI) normalization. An image-based kernel conversion technique was performed to the CT data set of B50f kernel to produce a converted B30f data set. The EI compared between two data sets of B30f kernel and those converted B30f kernel. The mean of pair-wise differences of the two data sets in EI was $0.85\% \pm 0.76\%$. Our study demonstrates the feasibility of image-based kernel conversion technique for normalization of kernel effect.

P2-28 방사광을 이용한 치아구조분석

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A variety of medical research using synchrotron radiation is underway. Micro-structure of the tissue using synchrotron radiations and many studies have been actively conducted by researchers. In this study, obtaining a three-dimensional image of the various tooth microstructure and crack using synchrotron radiations analyzed. These results suggest that in the future, the fine teeth and a tooth nerve replication studies is expected to be applied to the treatment.

P2-29 수술영상에서 수술도구 추출 기법의 비교 연구

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Robot-assisted surgery, specially, minimal invasive procedure has been growing over the past years rapidly. However, there are still several problems in the robotic surgery. By providing preventive caution to

surgeons using segmentation techniques for surgical instrument in imagery of surgery resolving this issue. The methods that color and morphological information are used to segment the features, and compare algorithms and estimates performance through RMSE and Image sizes. Therefore, this study could minimize medical injuries during the robot-assisted surgery.

P2-30 흉부 X선 영상에서 늑골 자동 분할 연구

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In this study, we propose a novel ribbed bottom edge detection method to be implemented on a computer-aided diagnosis (CAD) system for the diagnosis of rib fractures. The noises on the original image were removed using the wiener filtering and two images were created using a diagonal kernel and a parallel kernel. Thinning was performed on the two created images for a ribbed bottom edge detection. Each ribbed bottom boundary was detected using the least square method and line tracking method, and detected boundaries were merged together. The rib detection rate of the proposed method for the bottom of the image is low, but unlike traditional methods, the proposed method can detect the anterior rib. We expect that the proposed method can be very useful for a CAD-based diagnosis.

P2-31 뇌 PET/MR에서의 감쇠보정 방법에 따른 감쇠 보정맵 비교

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Simultaneous PET and MR data acquisition has several advantages. Despite the advantage of simultaneous PET/MR imaging, one of the most challenging issues is attenuation correction. Various approaches have

POSTERS II



been developed to obtain attenuation map in PET/MR system. However, attenuation map results from conventional methods showed quantitative bias in clinical data. Therefore, we suggest advanced attenuation correction method that is based on multi-phase level set method to improve conventional methods. In this study, we compared several approach of attenuation correction for brain PET/MR including our proposed method.

P2-32 양전자방출단층촬영-초음파 융합영상을 위한 나노 버블 제작

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The aim of this study was to develop and evaluate the phospholipid nano-bubbles encapsulated ⁶⁴Cu-ATSM for hybrid PET-ultrasound (PET-US) imaging agent for theragnosis. The ROI activity of 100 nm Perfluoropentane core nano-bubble (PP-NB) were increased 581 % in the lower area than upper area. The ROI activity of 100 nm PP-NB was increased 264 % than ⁶⁴Cu-ATSM-DW with contrast-enhanced ultrasound images. The 100 nm PP-NB encapsulated ⁶⁴Cu-ATSM is expected to be very useful as advanced agent for a PET-US dual modality imaging and targeted drug delivery system.

P2-33 PET/MR 동시 영상 획득용 삽입형 PET 개발

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Recently, there has been great interest on the development of combined PET/MR, which is a useful tool for

both functional and anatomic imaging. The purpose of this study was to develop a MR compatible PET insert for simultaneous PET and MR imaging of human brain and to evaluate the performance of the hybrid PET-MRI. Experimental results indicate that the high performance compact and lightweight PET insert for hybrid PET/MRI, which could be utilized with the MRI of different vendors, can be developed using GAPD arrays and charge signal transmission method proposed in this study.

P2-34 유연한 특성을 가진 x-ray 변환 물질층 연구와 적용 가능성 평가

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In this study, we fabricated the x-ray conversion material layer with flexible properties and compared with existing x-ray conversion material layer of flat structure. The x-ray equipment has flat panel structure from the past to the present and it makes a problem for image distortion phenomenon by curved structure of human body. As a result, image distortion affects x-ray image resolution. To solve these problem, we fabricated the bendable x-ray conversion material layer freely and evaluated the x-ray luminance efficiency.

P2-35 치료용 초음파 음파변환기 제작 및 성능 측정

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A therapeutic transducer can generate various bio-effects. Producing the therapeutic transducer is based on an element of piezo(PZT, Steminc, USA), and output of transducer could be maximized through matching system. The transducer build own acoustic



filed, focus and sound pressure. In this study, we made transducers of various frequencies (0.5MHz, 4 MHz, and 7 MHz), and then proposed a method for performance measurement

P2-36 선형 배열 변환자 설계를 위한 KLM과 FEM 시뮬레이션 성능 비교 연구

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동국대학교 의생명공학과

In this paper, we designed a 128 element 6.5 MHz linear array transducer with PiezoCAD based on KLM and PZFlex based on finite element analysis. Based on simulation results, we fabricated a linear array transducer and compared the performance of simulation and experimental results. The results show that simulation and experimental results had similar center frequency and fractional bandwidth at -6 dB. Below -6 dB, the results had slightly different frequency spectrum in accordance with analytical method.

P2-37 50 MHz 혈관 내 초음파 변환자의 제작 및 성능 검증에 관한 연구

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Recently, IVUS (Intravascular ultrasound) has been frequently used for diagnosing cardiovascular lesion. In this paper, we designed and fabricated 50 MHz side-looking IVUS transducer. Through pulse-echo and impedance measurement, we evaluated the performance of IVUS transducer and implemented B-mode (brightness mode) IVUS image. The electrical impedance was 50 Ω , the center frequency was 51 MHz, and the -6 dB bandwidth was 25 % without a matching layer.

P2-38 검출기 시간 분해능 변화에 따른 비행시간 3차원 영상 재구성 적합성 연구

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The time-of-flight (TOF) information with high resolution of detection can provide an improvement of the image quality for reconstruction of the Positron Emission Tomography (PET). In this work we developed the TOF iterative reconstruction based on the geometrical LOR information of the 3D PET system. We analyzed the compatibility of reconstruction by using generated list mode data which contains the TOF information with various timing resolution. Both quality and quantity parameters of result images showed that our TOF reconstruction algorithm has a good compatibility with various timing resolution.

P2-39 유전자 전달을 위한 미소기포의 제작 및 평가

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송길수, 차오름, 서종범
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Gene transfer using ultrasound is important to reach the cancer tissue safely. But gene become extinct by Dnase and RNase in the blood. In this study, we have created a microbubble that contains siRNA to solve the problem. In order to assess existence of siRNA inside microbubbles, confocal microscope and electrophoresis were used. According to the results, we can know that siRNA is protected by microbubble.

P2-40 복합 스플라인 정칙자를 사용한 투과 단층영상 재구성

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We investigate a model-based iterative reconstruction (MBIR) method for transmission tomography. The MBIR method considered in this work utilizes non-quadratic convex spline models as regularizers. Specifically, we use a hybrid regularizer obtained by applying a linear combination of two-dimensional



smoothing splines with low (first) and high (second) spatial derivatives to non-quadratic convex penalty functions. To compare quantitative performance of the hybrid regularizer, we use the quantitation of bias/variance, regional percentage errors (PEs), and contrast recovery coefficients (CRCs). Our numerical results show that a linear combination of the first- and second-order splines applied to non-quadratic penalty functions improves reconstructions in terms of both regional PEs and CRCs.

P2-41 CT 영상의 잡음수준 자동측정기법의 개발과 평가

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융합과학부 방사선융합의생명전공

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Measurement of the noise level in CT images is an important task in assessing the image quality. In clinical routine, image quality is usually carried out by manual measurement of standard deviation within a region of interest, which causes rater dependent variability. We have developed a technique for automatically localizing the homogeneous regions and quantifying the noise level in CT images, and applied proposed algorithm to 50 images for performance evaluation. Our developed technique has successfully in all the test images by showing an agreement of 0.89 with the reference measurement.

P2-42 3차원 DBT 단면영상에서 선명도 기반 central slice 추정

김대회, 김성태, 노용만

한국과학기술원 전기 및 전자공학과

Digital breast tomosynthesis (DBT) is a new 3-D imaging modality that alleviates the tissue overlap

problem of mammography. However, DBT increases workload of radiologists by providing 35~80 reconstructed slices compared to a single mammogram. Moreover, due to its limited view reconstruction, anatomical structures are blurred at out-of-focused slices. To solve aforementioned problems, we propose a novel conspicuity based central slice estimation of given objects. In addition, a mass texture feature extraction framework that utilizes the proposed method alleviates blur problem for mass classification. Comparative experiments have been conducted using clinical dataset to investigate the performance of the proposed methods.

P2-43 동적 자기공명 위상영상을 위한 새로운 직교좌표의 표본화 전략

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In this study, we present a novel sampling strategy of cartesian trajectory which is hybrid acquisition using a few center area sampling and variable density random sampling for dynamic magnetic resonance imaging. The key idea is based on the fact that the signal has not only temporally redundancy but phase is not drastically changed in a certain successive imaging frame. In practice, however, the error occur when the signal changes were significant due to motion and respiration. Therefore, to alleviate these problem, we propose the selective irregular sampling using MRI navigator when signal changes are significant, thereby reducing errors and increasing temporal resolution.

P2-44 간암 환자의 시계열 동적CT영상에서 비자립적인 종양을 가진 환자를 이용한 Parametric Response Map기법의 적용

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성균관대학교 전자전기컴퓨터공학과

Hepatocellular carcinoma (HCC) has high incidence



rate in Korea. and dynamic CT imaging is used for the diagnosis. It is important for prognosis of patient to predict between two types of HCCs, viable and non-viable, as the treatment options are considerably different. In this paper we applied novel image analysis approach to observe changes in longitudinal data of non-viable HCCs after transcatheter arterial chemoembolization (TACE) treatment. We collected five subjects with non-viable tumors. Our results reported stable parametric response map results were obtained for non-viable patients.

P2-45 비정시간 측정 가능 양전자단층촬영장치를 위한 고양자효율 다량극 광전자증배관 검출기의 시간 성능 최적화

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Positron emission tomography (PET) scanner non-invasively generates images of physiological, chemical and functional process of living body by injecting radiopharmaceuticals into the body. Time-of-flight (TOF) PET provides improved quality of images with reduced statistical noise, and the noise can be further decreased by developing detectors with finer timing resolution. We developed PET detector with high quantum efficiency multi-anode PMT for TOF PET scanner. The relationship between timing resolution and threshold voltage was observed in order to find the optimal setup. The optimized coincidence timing resolution in center region was 498 ps. The developed detector shows promising timing performances for TOF PET scanner, and the whole body size system is under developing.

P2-46 생체 내 미세 단층 촬영 시스템을 이용한 연령별 마우스 성장판 추적 관찰

엄시내, 박지형, 서동현, 김한성
연세대학교 의공학과

As an index for the growth, we are suggesting to use the in-vivo micro computed tomography to investigate calcification pace of growth plate, which has a strong connection with the longitudinal growth of long bone. To investigate the thickness of growth plate in tibia, 6-, 10-, and 14-week-old male C57BL/6J mice were used. However, as growth plate got closed, the thicknesses of growth plate were hardly possible to be measured with the 18 μ m resolution, which is usually used to assess morphological properties of trabecular bones. So, we'd better to improve the resolution or use bigger experimental animal like rats.

P2-47 위치감응형 PET 블록 검출기의 고비율 아날로그 멀티플렉싱 평가

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This paper describes a block detector multiplexing technique that reduces required number of readout channel without modifying data acquisition system. An analog multiplexing method for MA-PMT based block detector was evaluated by assessing up to 16 block detectors with 4 data acquisition channels and one trigger input. By incorporating proposed method, the flood images of multiple block detectors were obtained with 4 data acquisition channels and one trigger input. Although there are some degradations in flood histogram quality and timing resolution of the block detector compared to the one without multiplexing, individual crystals were clearly separated using proposed multiplexing method.

P2-48 뇌 부위 한정용 Volumetric CT의 촬영 프로토콜 최적화

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Parameters of image quality of the volumetric CT are conditions of X-ray, detector, system configurations, acquisition projection number, and etc. In this study, we find best condition of x-ray and projection number using Quantitative analysis.

P2-49 투영 횟수와 필터의 변화에 따른 CBCT 재구성 영상의 변화

김진욱, 이민희, 이상현, 김동윤
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In this study, we used Shepp-logan phantom to investigate the reconstructed images according to the changes of the number of projections and filters at cone beam computed tomography (CBCT). Contrast and Noise was used to evaluate the result images. In our experiment, contrast was increased as the number of projections increases and as filter contains more high-frequency components. Noise was increased as the number of projections decreases and as filter contains more high-frequency components. This trend was notable as object becomes small.

P2-50 EIT를 이용한 간조직 고주파 절제술 영상화

위헌, 장극영, 오동인, 우응제
경희대학교 생체의공학과

Image-guided thermal therapy has been used for treating of focal metastatic hepatic tumors instead of the standard surgical resection because it is minimally invasive. We measured the electrical conductivity and its spectrum of a biological tissue before and after RF ablation to understand conductivity changes due to ions mobility in intra- and extra-cellular fluids corresponding to the temperature and changes in cellular

morphology induced by the heat. We shows series of reconstructed conductivity images during heating and cooling period. Pixels in ablation area were compared between time difference image and weighted frequency difference image with temperature.

P2-51 초소형 X-ray tube의 각도에 따른 초점 크기

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Miniature x-ray tube can make easy to get images because of its small size and mobility. Because miniature x-ray tube can emit x-ray to all direction, measurement angle-dependent focal spot can make it easy to know that tendency of angle-dependent images. And the angle becomes larger, the focal spot is also on the increase.

P2-52 실리콘 카바이드를 이용한 인체 적합한 탄소-점 제조

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Because carbon dots show their unique luminescence-properties and have diameter less than 10nm, it is expected carbon dots can be used as contrast media. However, using current synthesizing methods, using chemicals and laser, it is difficult to make carbon dots without residues. Also, some chemicals to synthesize carbon dots are harmful and methods are complex. In here, a new method to synthesize carbon dots easily without any residues and without using harmful chemicals so called bio-compatible carbon dots will be suggested.

P2-53 군집계수를 이용한 측두엽영역의 뇌 네트워크에 대한 비교 연구

이상현, 김동윤, 이민희, 김진욱,
*M.K.Chung, *Nagesh Adluru, *Richard J. Davison



연세대학교 의공학과
*위스콘신 대학교 메디슨캠퍼스
웨이즈먼 뇌영상-행동 연구소

Recently, MRI studies have reported that patients with autism had shown deficits on regions of the temporal lobe. In this study, we constructed the brain networks from DT-MRI tractography data in both left and right temporal lobe using non-linear normalized AAL template. Ezys program is used for non-linear normalized template matching between FA template and AAL template. We analyzed the number of average clustering coefficient of the brain networks in 14 control subjects and 16 autistic subjects. From the statistical analysis, the observed difference in topological property is statistically significant at the 0.03 significance level in this region of interest.

P2-54 뇌 네트워크에서 연결 수에 대한 parcellation과 ϵ -neighbor 구성 방법의 비교

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Brain network analysis is neurobiologically meaningful and easily computable measures. We constructed the brain networks from fiber tracks using both parcellation method and ϵ -neighbor construction method. To analyze the connectivity of the brain network, we used the average degree for the 16 autistic subjects and 14 control subjects. From the statistical analysis, the observed difference in average number of degree is statistically significant at the 0.05 significance level for ϵ -neighbor construction method (p-value = 0.0140) while we could not observed difference for parcellation method.

P2-55 유정란 체외혈관계에서 동맥분지관 형태의 박동 변화 관찰

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**의공학협동과정

Bifurcation geometry of arteries has been widely studied because it is closely related to the occurrence and development of various arterial diseases. However, the characteristics of their geometrical variation caused by pulsation of blood flow are not well understood yet partially due to difficulties in establishing an experimental model. In the present study, we observed extraembryonic arteries, such as vitelline artery and chorioallantoic artery, in an embryonic chicken model to investigate the pulsatile variation of arterial bifurcation geometry. Microscopic artery images were captured and recorded at a high frame rate. By analyzing the images, it was possible to investigate the distribution of regional variation of arterial wall movement during a cardiac cycle. The extraembryonic circulation system of chick embryos is suggested to be a useful model to study pulsatile variation of arterial bifurcation geometry.

Orthopedic and Rehabilitation Engineering

P2-56 체간 중심안정화 방법에 따른 하지 근활성도 비교

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This study was investigated the muscle activity difference of lower extremity by trunk core stabilization. 30 healthy women without pain in the back and lower extremity were participated. Muscle activities of lower extremity were measured during the feet in 20 cm from the floor to the raised position without bending the knee at ADIM and Bracing, respectively. HAdL, RF, and BF muscle activities in the Bracing were higher significantly. Also, Gmed and TA muscle in the ADIM were activated.

POSTERS II

**P2-57** 전신 기울임 각도에 따른 체간 근 활성화도 분석권대규^{**}, 신선혜^{***}^{*}전북대학교 바이오메디컬공학부^{**}(주)웰니스텍^{***}전북대학교 헬스케어공학과

The objective of this study was to investigate the trunk muscle activities during whole body tilt of a 3D dynamic exercise device. Ten healthy volunteers participated in this study. A 3D dynamic exercise device provided tilt into four different directions: anterior (A), posterior (P), right (R), and left (L). Tilt angles of the directions were applied to 10, 20, 30, 40 degrees. We measured EMG signal of trunk muscles. As a result, the more increase of whole body tilts angle, the more trunk muscles activity. This study indicates that various exercise patterns such as tilt direction and angle could be applied to an effective training for various users.

P2-58 공압 하중분산 모션플랫폼을 이용한 실감형 루지 시뮬레이터 개발강승록¹, 김의령¹, 봉혁², 권대규³¹전북대학교 헬스케어공학과²(주)트윈테크³전북대학교 바이오메디컬공학부

This research is goal as development of tangible luge simulator using motion platform based load dispersion of air pressure. This project developed simulator using three degree of freedom based dispersed load from air pressure which could suggest various basic training pattern for performance improvement and virtual reality for being used leisure and sports facilities and attract voluntary, and built database of physical factor in sports athletes and normal peoples. For this, we performed product design of motion, exercise training program and measured basic physical fitness to be adapted for virtual contents. Also, we tried to investigate and analysis of technique trend about simulator related sports for research goal. We

progress manufacturing design of motion system and boarding equipment for access ability to sports athletes and people. In addition, we built database of physical fitness factor in them for developing training program and virtual reality contents of luge simulator. There measured body composition, muscle strength, muscular endurance, agility, flexibility and aerobic capacity as basic physical fitness, and all measured parameters is built to database. Beside, we tried to investigate a literature search, market search of internal and external simulator and questionnaire survey related sports expert as athletes and supervisor.

P2-59 4점점 체중부하 기술을 이용한 부하 감소율에 따른 하지의 실시간 근전도 특성평가강승록¹, 김의령¹, 문동안², 권대규³¹전북대학교 헬스케어공학과²전라북도체육회 스포츠과학센터³전북대학교 바이오메디컬공학부

The purpose of this study was to investigate unweight effect according to weight bearing ratio in electromyography of lower limbs using four point system. We recruited ten subjects and they performed gait exercise according to weight bearing ratio at 60%, 70%, 80% and 90%. We measured real-time EMG using bignoli 8-ch system(Delsys bignoli, USA) to rectus femoris, tibialis anterior and gastrocnemius in both side. The results showed that it reduced at 48.33% in RF, 36.48% in TA and 52.91% in GN when 60%. Also, it reduced muscular activity in 30% that it more reduced 13.61% than 40%. The results of 80% and 90% showed similarly as result of muscular activity of 30%. This is, enough anterior tibial transition could provide regular reduction of muscular activity at reduction ratio although irregular activities in rectus femoris with tibiofemoral transition enough from gait velocity at 3km/h. Our conclusion was that reduction ratio using weight bearing methods of four point of could reduce reduction effect of body weight enough without femoral pressure and pain.



P2-60 보행 재활 훈련을 위한 무동력 착용형 외골격 시스템이 결합된 새로운 개념의 전동 휠체어 시스템 개발: 개념 설계 및 검증

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세종대학교 기계공학과

The aims of the current study was to design a new moving system with both moving and gait rehabilitation function together and evaluated the system. The moving and gait rehabilitative training functions were then embodied based on a non-motorized lower-limb exoskeleton and a general wheelchair platform. We measured joint range of motion during gait in normal gait of participants and virtual simulation of the 3-D modeling. These findings indicate that newly designed system may have a potential to be applicable as a gait rehabilitative training assistance incorporated with wheelchair platform for movement, although it doesn't realize a normal gait completely.

P2-61 다양한 방향의 동적 움직임에 따른 균형 및 근육 활성화 특성 분석

정호현, 김충연, 전경진, 임도형
세종대학교 기계공학과
한국생산기술연구원

Previous study investigated various rehabilitation programs for elderly to prevent falling. The aim of study is to evaluate balance and muscle activation characteristics using dynamic balance system that generate multiple directions. Center of mass (COM) was measured by 3D motion analysis system in 4 directions. In order to evaluate muscle activation and Center of Pressure(COP), wireless surface EMG system and Pedar flexible insoles system were used in 4 directions. Characteristics of muscle activity and sway were different in each 4 direction. These findings may valuable to establish rehabilitation program for elderly.

P2-62 하지의 효과적인 재활 치료를 하기 위한 관성 센서 기반 모션 캡처 시스템 개발

강신일, 조재성, 홍성준, 이종실, 김인영
한양대학교 의공학교실

In this paper, an inertial sensor-based motion capturing system to measure and analyze whole body movements is presented implementing wireless AHRS (attitude heading reference system) we developed using a combination of rate gyroscope, accelerometer and magnetometer sensors. AHRS is an easy-to-use, cost efficient system to measure joint angle between each body segments during rehabilitation. To evaluate the performance of our AHRS module, the Vicon motion capture system is used as a reference. We have built a jig to evaluate the algorithm used to measure joint angle between each body segments during flexion/extension. To verify the optimization of the joint angle between the tibia and femur calculated whilst performing flexion/extension movements standing straight, two AHRS and 16 optical markers can be attached to anatomical landmarks on the body to evaluate the movement of the lower limb.

P2-63 시각 장애 보행자를 위한 초음파 센서 기반 진동 피드백 방식 장애물 감지 시스템의 개발

김진우, 전세훈, 송문, 신태민
연세대학교 의공학과

In this paper, the vibration-feedback-type wearable travel aid system using ultrasonic sensors which detects obstacles around of walker when the system and the white cane is used together. Ultrasonic sensor is used to measure distance between the walker and an obstacle, and vibration motor feedback which is inversely proportional to the measured distance is used to warn walker if the obstacle is close. Measuring accuracy of the system was 99.45% and average halt distance before colliding was 92.62cm. Average number of collision during path-finding session was 1.4



times. It was reported that the walker was able to guess his current position between side walls by comparing vibration feedback magnitude of two module attached to walker's shoulders. From the results, it is expected that, if used with white cane, the system will be a good method of detection and avoidance of obstacles to the blinds.

P2-64 MSP430을 이용한 EMG 획득 시스템 개발

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Electromyogram is widely used as control signal in not only clinical and medical but also industrial and military purposes. The system is connected to 4 channel electrode so we can acquire distinguishable each signals with windows based program in real time. There are many advanced studies but our purpose is making small, portable and low power system.

P2-65 공압 고무 액추에이터를 이용한 족하수 방지 보조기의 동작특성에 관한 평가

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⁵고령친화복지기기연구센터

The purpose of this study is to evaluate the performance of a orthosis to prevent foot-drop using pneumatic rubber actuator that we developed. It assists dorsiflexion of ankle joint during walking. Ten elderly subjects performed three sessions(no orthosis, without assist, with assist). Subjects walked on a treadmill and walking speed was set 3km/h during each session. As a result, the muscular activation decreased when pneumatic rubber actuator was assist. It is considered to be effective in assistance of the muscular strength

when walking with a orthosis to prevent foot-drop using pneumatic rubber actuator.

P2-66 근전도기기를 이용한 간섭전류치료기의 효율시간 측정

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Interferential current (IFC) therapy is a common electrotherapeutic modality for the various musculoskeletal pain treatments. Despite its widespread use, there is no feedback information to provide the progress of IFC in real-time. In this study, we developed an electromyography-based monitoring system for IFC in real time, which can measure the effective value and median frequency of a treated region in muscle during IFC. Preliminary experiments were conducted on the contracted back muscles for 6 healthy subjects. The results showed that, as the contracted muscles became recovered by IFC therapy, the effective value was stabilized and the median frequency was shifted to higher frequency. We believe that the proposed method should help to guide the appropriate time of IFC therapy to individuals.

P2-67 전방 낙상시 발생하는 신체 움직임을 이용한 낙상 검출 알고리즘에 관한 연구

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In recent years, the social activities of the elderly have been increasing as our society progresses toward an aging society. As their activities are increased, the occurrences of falls that could lead to fractures are increased. Falls are serious health hazards to the elderly and we need more thorough understanding of falls including the progress of falls. In this study, we induced simulated falls and observed the body mo-



vement during the forward fall. The movement of the body was sensed using 3-axes acceleration sensor. Andfall detection algorithm was developed to detect a fall using the acceleration data detected by the sensors.

P2-68 애주의 기하학적 변화가 뜸의 연소 특성에 미치는 영향

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³제주한라대학교 방사선과

This study was to investigate the influence of moxa cone shapes on combustion characteristics. For a standard moxa cone which has a bottom diameter of 12mm, a height of 16mm, a volume of 603 mm³, and a weight of 100mg, various cone shapes were tested, altering the bottom diameter in the range of 12±4mm increased by every 2mm (5 shapes), while the volume and weight remained unchanged. Temperatures at (the centre of) the bottom of each moxa on contact to skin phantom were measured with time from ignition till cooling to surrounding temperatures. The results showed that the maximum temperatures increased when increasing the moxa bottom diameters (decreasing the heights). In contrast, the maximum temperature rising rates decreased for the same conditions. This finding is expected to be practically useful in optimizing the construction of moxa.

P2-69 전정감각 이상으로 인한 이상 보행 중 체성 감각 자극 인가 시 가속도 변화의 연구

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Vestibular disorders cause difficulties in posture balance responses, resulting in the degradation of positional control of our body that is essential for stability

and maintaining direction while walking. This in turn leads to disability in maintaining our posture in a stabilized manner, resulting in abnormal or deflected walking. In this study, we examined how the somatosensory, which control balance in our posture, can control such disorders. For this purpose, we analyzed 3 axis acceleration signal while one walks. Results showed that change in the acceleration value.

Respiratory Engineering

P2-70 블루투스 통신을 이용한 호흡 측정 시스템 개발

이기혁, 김도현, 윤정민, 이종실, 남경원, 김인영
 한양대학교 의공학교실

In this paper, we present the development of blue-tooth communication system for cardiopulmonary exercise test (CPET). We measure ventilation and concentration of oxygen and carbon dioxide in breath by breath through this system. From measured value, we can calculate flow rate (VE, L/min), Oxygen uptake (VO₂, L/min), CO₂ production (VCO₂, L/min). Also We focused on improving of accuracy comparing with golden standard for making the high performance portable gas analyzing device.

P2-71 후두 기능 진단을 위한 호흡 감지 소자

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 김경욱³, 차은중, 김경아
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Flow dynamics, neurophysiology, and voice signal should be measured as a whole for laryngeal diagnosis. The present study developed a respiratory flow sensing element capable of continuous measurement during voice generation followed by analyzing



the flow to pressure conversion properties. A parabolic equation well fitted the pressure-flow data with a correlation coefficient less than 3%, resulting in very accurate flow measurements.

P2-72 수중 호흡기류 측정 센서 개발

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Swimming is a representative aerobic exercise for strengthening muscles as well as enhancing cardiopulmonary function. However, difficulties in measurement under water greatly limit respiratory air flow signal analysis. The present study implemented a respiratory air flow transducer followed by analyzing the measurement characteristics. Almost ideal symmetry was demonstrated with a parabolic calibration curve showing a correlation coefficient higher than 0.999. The calibration formula between pressure and flow predicted relative errors less than 3%, guaranteeing very accurate flow measurement.



POSTERS III

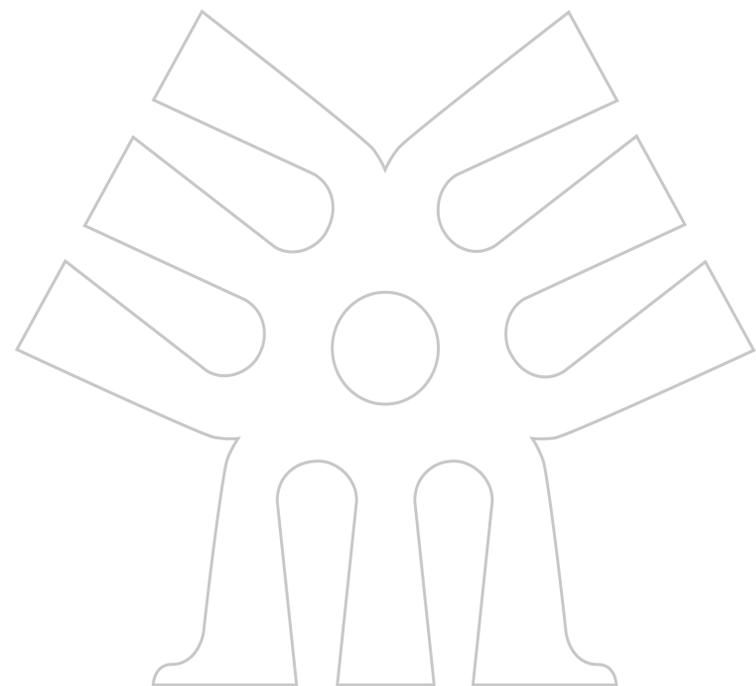
Biomedical Robotics

Cardiovascular Engineering

Medical Nano and Microtechnology

Neural Engineering

System Biology, Physiological Modeling





Biomedical Robotics

P3-01 손목 동작의 추정을 위한 역전파 신경망에 대한 연구최항적¹, 고민수², 홍기환², 이상민^{1,2}¹인하대학교전자공학과²인하대학교정보전자공동연구소

In this paper, we used the Back-Propagation(BP) neural network with the feature extraction algorithm (MAV, DASDV) to estimate wrist movements and compare the results with the former study which used the k-Nearest Neighbor(k-NN). As a result of our study, the recognition rate of the BP classification method is 93.084% and 1.456% higher than the former study.

P3-02 정전용량 센서로 로봇 수술용 수술도구 말단의 접촉을 감지하는 방법

김수분, 이두용

KAIST 기계공학전공

This paper reports a method to detect a contact between the patient's tissues and the tip of the surgical robot instrument. This is required for friction compensation in the recently developed method of estimating the interaction forces between the tissues and the instrument without deployment of any force sensors to the tip of the instruments. The contact information takes it possible to discern and utilize free-motion force data for parameter estimation of the compensator. It is necessary because contact-motion force data are not valid for the parameter estimation because the interaction force acts as a disturbance.

P3-03 Signal to Noise Ratio(SNR) 측정을 통한 Titanium 바늘 및 초음파 모터의 MR 적합성 파악에 관한 연구

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국립암센터 의공학과, 영상의학과

In general, it is much easier for a breast investigator to discriminate some tumors from the flesh using MRI than other devices including naked eye. Therefore, for the purpose of a biopsy and/or an breast cancer operation, some devices that are compatible with MR environments have been proposed and developed. One of the MR compatibility requirements is that a device located in MR scanning region has negligible effects on the MR image quality. In this paper, as the items for a biopsy and/or operation in MR environments, the effects of titanium needle and ultrasonic motor on the scanned MR images is to be tested and analysed in terms of Signal to Noise Ratio(SNR).

P3-04 헤드밴드형 이마 안전도 측정 시스템을 위한 안구 움직임 구별 알고리즘허정¹, 장민혜², 윤희남³, 박광석⁴^{1,2,3}서울대학교 공과대학 협동과정

바이오엔지니어링 전공

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Headband-based forehead EOG measurement system is comfortable to setup the system and relatively good looking. But it has baseline drift problem. So drift robust algorithm is need to use this system. In this study, we developed baseline drift robust eye movement classification algorithm for headband-based EOG measurement system. Feature set was extracted from derivative of EOG signals. Stepwise regression was performed to minimize the feature set. LDA classifier was used to classify six different eye movements. 60 trials were used to train the classifier and 57 trials were tested. Classification accuracy was 97.9%.

P3-05 공압식 박동형 심실보조장치의 안전성을 향상시킬 수 있는 슈퍼바이저 시스템의 평가

강성민, 최성욱

강원대학교 융합시스템공학과

With the increase in the frequency of clinical applica-



tions of a ventricular assist device, many cases of its use are being reported. In particular, it is reported that next to sepsis, the second most frequent cause of death from using the device is its failure. In this study, a supervisor system has been developed to make a pneumatic pulsatile ventricular assist device safer. The system was applied to a pneumatic pulsatile ventricular assist device (LibraHeart-I, Korea) for assessment. The in-vitro and in-vivo tests revealed that the flow rate was more stable when it was applied than when it wasn't and that it was kept safe while power was interrupted. While the supervisor system is expected to make a pneumatic pulsatile ventricular assist device safer, it is necessary to conduct many different clinical tests in terms of its safety and reliability.

P3-06 치료용 초음파 발진 회로 테스트를 위한 시뮬레이터 개발

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강원대학교 기계의용공학과

A new high power ultrasonic transmission circuit was designed by applying push-pull class E amplifier that operated with high Q value in resonant state. Ultrasonic transmitters can have varying capacitance or inductance according to the power of ultrasound and environmental pressure and this makes the resonant circuit unstable. Conventional circuit simulator cannot be applied to the optimal design of push-pull class E amplifier that contains many parameter-changing elements such as transmitter and switches. To develop stable high power ultrasonic transmitter, the mathematical model of push-pull class E amp was designed and verified its accuracy by comparing data obtained from the simulator and experiments with the developed circuit.

P3-07 기어와 링크를 이용한 소형 복강경 엔드이펙터 설계 및 제작 연구

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³서울대학교 의과대학 비뇨기과학교실
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The prototype of laparoscopic surgical robot's end-effector, which has an external diameter of 14mm, was developed without mechanical string. The pitching motion and the gripping motion of the prototype are actuated by two separate motors. The prototype is installed at the robot arm's end-effector, which can be controlled by Hands-On-Throttle-And-Stick (HOTAS) device developed in Aerospace Engineering for aircraft pilot to operate many functions. Further studies are to be conducted for reducing size of prototype and adding the yawing motion.

P3-08 미세중력 모사장치 개발에 관한 연구

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³국군함평병원

Based on the findings from highly advanced space science, it has been continuously reported that new, unexpected biological phenomena occur under micro gravity condition. We propose to develop the Random Positioning Machine (RPM) that can simulate the extreme physical conditions, such as micro gravity. Experiments were conducted in order to validate a micro gravity environment with RPM. It has been shown that it is possible to make space environment and to provide a solid foundation for Human Space Biology (HSB).

P3-09 Gimbaling Ducted Fan을 이용한 능동형 캡슐 내시경 개발의 기초연구

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⁴서울대학교병원

The prototype of maneuverable capsule endoscope with gimbaling ducted fan was developed. Compared to the pre-prototype, which had the structural insecurity and low performance due to the underactuation of the control system, improvements have been achieved in reducing the size, increasing the maximum steering angle of gimbaling ducted fan, changing the linear actuator control system with the face gear control system. Further studies are to be conducted for the motion simulation and testing the prototype within the simulated intestine.

P3-10 연수막 암종증에서 뇌실로 약물을 주입하기 위한 브레인 케모포트의 설계

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²한양대학교 메카트로닉스공학과

³국립암센터 신경외과

In order to inject a drug into a ventricle, ommaya reservoir is often used in leptomeningeal carcinomatosis. However, using an ommaya reservoir, continuous drug injection is not possible as it is made of a soft material. On the other hand, a chemoport, which is often used in lung cancer, can hold a needle for continuous drug injection due to its solid structure. Therefore, we designed a brain chemoport which suits to a human skull. The dimensions of the developed chemoport are chosen to meet the demands of medical professionals. Values which is required to procedure being conducted is applied to each dimension.

P3-11 의료영상기반 다기능 침로봇 시스템개발

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김영재¹, 박창민², 김광기¹

¹국립암센터 의공학연구과

²서울대학교병원 영상의학과

In this research, we aim to design a needle intervention robot system compatible with CT imaging, to improve the positioning accuracy of needle intervention and to guarantee the safety of practitioners from harmful environment. First we evaluated and improved the existing biopsy robot prototype to set the exact scope of the research. On the other hand, we developed 3D image ROI and segmentation technology and registration technology considering CT environment. Because we decided that the responsiveness of the system is important with this type of robot, we developed DSP based controller for the system as well. After a few revisions, we finalized the system in the form of a robot with passive arm, and tested its performance with CT system.

P3-12 상용 내시경 수술 도구의 교체가 가능한 능동 위치 결정 장치의 개발

황민호¹, 정현수², 권동수¹

KAIST 기계공학과 연세대학교 의과대학 내과학교실 소화기내과 KAIST 기계공학과

Flexible Endoscopy has widely been used to investigate interior of hollow organ or cavity of human body. Although techniques and procedures using flexible endoscope have become more complex, the function of conventional endoscope is still limited. One of the main difficulties comes from limited dexterity of endoscopic tool, which can only move back and forth. This paper presents a design and verification of portable endoscopic tool handler (PETH), which makes conventional endoscopic tool to be dexterous. After preliminary test, 7 case of ex-vivo ESD (Endoscopic Submucosal Dissection) were successfully performed using the developed active guider (PETH).

P3-13 뇌-기계 인터페이스 잠재 사용자의 선호 기능 및 개발 방향 연구

이정원, 안광욱, 이자호, 김정환, 최현, 이성재



보건복지부 국립재활원 재활연구소
재활로봇증개연구사업단

In this paper, we surveyed 60 potential users of BMI technology(30 spinal cord injury, 30 neuromuscular disorder)about user's preferring function and direction of developing BMI. Survey questions are consist of personal characteristics, usage of assistive technology in everyday life, perception and preferences of BMI technology. From the results of the present study, we know that potential users wanted to use the BMI technology most for environmental controls(91.6%) and preferred a non-invasive method(55%) compared to an invasive one(35%). We expect to set the appropriate direction of developing BMI technology. Also it is essential to set the future process of developing the BMI technology based on the accurate demand survey (disabled person and patient).

P3-14 로봇 최소침습수술을 위한 ER 햅틱 마스터의 반력 제어

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인하대학교 기계공학과

This paper discusses a novel haptic master featuring electrorheological (ER) fluid for robot-assisted minimally invasive surgery (RMIS) for a surgeon. During RMIS, because surgeons cannot sense haptic sensations, it is highly necessary to develop a haptic interface for them to sense the surgical site. To achieve this goal, we developed a new type of ER haptic master for obtaining sense of touch during operation. After manufacturing the ER haptic master. A proportional controller is used to generate the desired repulsive force, and its force tracking performance is plotted in time domain.

Cardiovascular Engineering

P3-15 Ensemble Empirical Mode Decomposition를 이용한 반사형 PPG의 주변광 잡음 제거

고현철, 이승환, 장기영, 윤영로
연세대학교 보건과학대학 의공학과

The photoplethysmography (PPG) has been widely used for diagnosis purposes of vascular diseases. Clear state PPG signal are utilized by the physiological and pathological phenomena. However, in real situations, PPG recordings are often corrupted by artifacts. One prominent artifact is the ambient light noise caused by light sources. Several methods have been developed for PPG denoising method. In this paper, we assess denoising method based on the developed Ensemble Empirical Mope Decomposition (EEMD).

P3-16 심근경색 검출을 위한 새로운 파라미터의 유용성 분석

김중혁, 이승환, 윤영로
연세대학교 의공학부

This paper presents detection of myocardial infarction (MI) using new features. The new features of each beat in the ECG signal such as Q wave and R wave amplitude are extracted from V1-V4 in 12 leads ECG. Total 5,193 ECG beats from PTB database available on Physio-bank is used to investigate the performance of extracted features with support vector machine (SVM) classifier. 90% of ECG beats were used for training SVM classifier, 10% of ECG beats were used for test. For detection, it is found that the Accuracy of SVM for beat classification is 87.5 % - 100% respectively. The proposed new features due to its simplicity and high accuracy over the PTB database can be very helpful in correct diagnosis of MI.

P3-17 녹색광을 이용한 반사형 광용적맥파측정기의 주변광 간섭시신호측정에 대한 효용성 검증

POSTERS III



장기영, 고현철, 이정직, 박주용, 윤영로
연세대학교 의공학과

To verify the utility of reflected photoplethysmography using green light, this study measures the PPG signal distortion by ambient light and propose a solution. Measurement sensor is made flexible and PPG signal is measured by measurement board. Ambient light source are light bulb and white LED that has three step brightness. PPG signal is measured at the finger and wrist at the same time for 1 minute, 1250Hz sampling rate. The PPG measurement sensor using two green LEDs is shown better utility than using one green LED and similar level of red LED.

P3-18 12채널 ECG의 3차원 변환 기법을 통한 심장 질환 진단에 관한 기초연구

허정현, 김현우, 박주용, 이정직, 윤영로
연세대학교 의공학과

This study is about improved method for diagnosis of cardiovascular disease by converting 12-channel electrocardiogram data into 3-dimensional data. After we divided ECG data into chest lead data and limb lead data, we organized each data into group which is comprised of six ECG data. And then we plotted on a 3-dimensional graph respectively. This method can identify and analyze cardiovascular disease at a glance unlike existing analyzing ECG method. For estimation of its performance, in this study, we handled simulated disease data and verified its usefulness. As a result using 3-dimensional analyzing method we could diagnose some cardiovascular disease more easily and quickly.

P3-19 단일 채널 심전도를 이용한 개인 식별

임서현, 민경란, 이종실, 김인영
한양대학교 의공학과

This paper presents a new method for individual identification using a single-lead ECG signal. We

extract various features from an ECG waveform and QRS complex of its differential waveform and the Relief-f algorithm ranks the features by weighting. Features extracted from QRS complex were given high weightings. Support Vector Machine (SVM) binary classifier with a one to many approach is used for classification. The proposed method for identification of individuals with various states of ECG resulted in an accuracy of 98.55%.

P3-20 혈관 내 광 간섭성 단층영상에서 스텐트 스트럿 자동 측정 방법

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We present an automated method to detect and measure stent struts in intravascular optical coherence tomography (OCT) images. Commonly, most of automated detection methods use gradient-based filters to find the candidate positions of stent struts, and re-examine the candidates to locate the centroids or the positions proximal to the vessel wall. In contrast, we use second derivative operators, which produce the centroid positions of stent struts directly, and a radial deformable active contour method to segment vessel walls.

Medical Nano and Microtechnology

P3-21 신장사구체 구현을 위한 Kidney-on-a-chip내 인체유래족 세포 분화촉진 유도기술

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The renal glomerular tissue is essential for controlling the toxicity in human body that it performs the first filtering of blood in the kidney and the urine generation. Therefore, reconstruction of renal glomerular tissue is important for the better understanding of renal physiology and pathology. However, difficulty in differentiating human primary podocyte, a major cell in glomerulus for filtration, has been the limitation in reconstructing the function of renal glomerulus. In this study, we describe a novel method to differentiate human primary podocyte cells that perform the blood filtration and the urine generation. The method consists of multilayer microfluidic cell co-culture system, Kidney-on-a-chip, in which endothelial cells and human primary podocytes were co-cultured under shear stress. When 300ul/hr of shear stress is applied to the endothelial cells, we observed the differentiation of human primary podocytes through expression of synaptopodin and the formation of foot process and slit diaphragm through Zo-1 expression. These results provide the first proof-of-principle that a multilayer microfluidic system, Kidney-on-a-chip, can be used to differentiate human primary podocyte cells and may contribute to the deeper understandings of the human renal system.

P3-22 분자 동역학 기반 아미로이드의 기계적 특성 규명

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Amyloid fibrils playing a critical role on disease expression have recently been found to exhibit excellent mechanical properties such as elastic modulus in the order of 10 GPa being much higher than that of other protein materials. In this work, we study the nanomechanical properties of amyloid fibrils using

atomistic simulations such as steered molecular dynamics simulation. It is found that the remarkable mechanical strength of amyloid fibril is attributed to the network of chemical bonds between cross- β structures; in particular, the rupture of chemical bonds formed between β -strands is responsible for the mechanical strength of amyloid fibril. Our study implies that the mechanical properties of amyloids are encoded in their chemical structures.

P3-23 임상용 체외충격파치료기의 충격파 펄스에 의하여 생성된 캐비테이션의 시계열 거동

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This study considers the cavitation bubbles produced by a shock pulse from a clinical extracorporeal shock wave therapy (ESWT) system (Shinewave, HnT Medical, Korea). The temporal variations of the cavitation bubbles, from inception to inertial collapses were visualized in a series of photographic snapshots. The snapshot images were captured with a highly light sensitive camera (EOS 5D Mark II, Canon Inc., Japan) under a nano second lasting laser lighting produced by nano-pulse light (NP-1A, Sugawara Lab, Japan). It was observed that the bubble clouds were always generated by the shock pulse, distributed over a largely elongated ellipsoidal region along the beam axis. The bubbles, immediately after inception by shock wave, were expanded for a long time over 100us before they rapidly collapsed. During the violent collapses, the bubbles were shown to produce jets which are understood to play an important role in the destructive effects of the shock pulse on tissues.

P3-24 Design of a Mobile phone case with EBG structure to reduce SAR



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This paper investigates the performance of phone case with an electromagnetic band gap (EBG) structure to realize a low specific absorption rate (SAR). In order to design the phone case, loop antenna which has PCS 1900 band was used. The phone case consists of a hairpin-like EBG structure that is more compact than other EBG structure. The SEMCAD X fdtd simulation results of the calculation showed that, this proposed case can reduce SAR by 5.9% at similar power that is radiated by the antenna. This case can be used in future to reduce the SAR from mobile phone.

P3-25 Real time monitoring of nitric oxide using sol-gel modified electrochemical sensor for the demonstration of remote ischemic preconditioning effects.

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Ischemic stroke is one of the leading causes of death and long-lasting disability, resulting from a transient or permanent decrease in cerebral blood flow (CBF) caused by cardiac arrest, cerebral arterial occlusion or severe vasospasm after subarachnoid ischemia. Nitric oxide (NO) plays an important role in cerebrovascular physiology and pathophysiology, as well as neuro-transmission, vasodilation, platelet adhesion and activation, angiogenesis and wound healing. Remote

ischemic preconditioning (RIPC) is the phenomenon that occurs when an organ is submitted to sublethal periods of ischemia and reperfusion to confer protection to another organ. RIPC is considered as an attractive strategy for brain protection. It is generally known that endogenous NO is associated with protection against ischemic cell death. To evaluate the neuro-protective effects of RIPC, we investigate changes in NO dynamics during cerebral global ischemia-reperfusion utilizing a sol-gel modified electrochemical NO sensors. Real-time in vivo monitoring of NO would be very helpful for investigating the physiological response of endogenously produced NO during cerebral ischemia, as well as inspection the effect of drug.

P3-26 돌출된 망막 전극의 문턱 전류, 해상도, 삽입 트라우마

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Shorter distance from stimulating electrode to target tissue is desired in neural prosthetics. It contributes to lower threshold current and higher resolution. In this paper, we calculated the effect of bringing the electrode closer to the retinal ganglion cell in retinal prosthesis. Also, we propose the shape of the electrode maximizing the effect and minimizing adversary effect such as insertion trauma and mechanical instability

P3-27 세포-pairing을 위한 L 형상 마이크로웰 내의 확산 해석

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Cell-cell interaction studies require trapping/pairing cells. Conventional microwell systems adopt a fall-and-trap principle with inherently limited functions. To increase functionality of microwell regarding cell manipulation, we have taken note about the elasticity



of PDMS (polydimethylsiloxane) to create stretchable substrate for trapping/pairing two cells per microwell. Here we propose L-shaped microwell to achieve the goal. Computational simulation performed three-dimensional time-dependent diffusion simulations to visualize molecular diffusion in the L-microwell for communication with the partner cell. The computational results showed that the molecules that diffused quickly to the partner cell, but much slower to the outside of the L-microwell due to dilution by the bulk solution. We have shown that the cell communication in the L-microwell is reasonably isolated, and thus, the proposed microplatform can be useful for cell-cell interaction studies such as cancer metastasis and immune system.

P3-28 다공성 스캐폴드 제작을 위한 소금 결정 방법

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고려대학교 바이오 의공학과

In this study, we present new fabrication technology for nano- or micro structure. Salt leaching is popular method for porous structure. But, its salt crystal size is so large that it can't be applied to fabricated small size pores. To overcome this problem, we make sub micron-sized salt by using salt crystallization. Sprayed salt solution droplet goes by heating coil. It is crystallized in air, and then we can be obtained various sized salt. Controlling salt size can be used to fabricate porous scaffold. It expected to apply various cell researches.

P3-29 초음파 에너지에 의한 단백질 섬유 분해

이원석, 정휘현, 곽태준, 손명구,
이규도, 이상우, 윤대성
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Protein fibril is closely related to many kinds of degenerative diseases such as Alzheimer's and Huntington's diseases. Here we investigate that well-

defined ultrasonic energy can decompose the fibrils into the uniform fragments. Our results indicate that ultrasonic energy will be useful in the future therapeutic strategy for amyloid.

P3-30 유전영동 집계를 활용한 생체분자간 Weak Forces 측정

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Direct measurement of intermolecular interaction between biological molecules is of important in understanding all things in life. We measure the weak forces between nucleic acids, which compared with that from other biological molecules. It is found that the weak force between nucleic acids amounts to hydrogen bond despite the electrostatic repulsion between poly-cytosine nucleotides.

P3-31 켈빈프루브현미경을 이용한 DNA 코로나 복합체 기반의 점 돌연변이 유전자 고속 검지 기술

이형빈, 이상원, 이규도, 이원석,
남기환, 이상우, 윤대성
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Rapid and quantitative detection of gene mutations is essential for accurate early diagnosis of many kinds of diseases including cancer. Here we report a novel detection method for *BRCA1* gene mutation related to breast and ovarian cancer on the surface of nanoparticles which are probed by Kelvin probe force microscopy (KPFM). It is found that one point mutation can be detected by high resolution KPFM imaging technique.

P3-32 생체분자간 결합력을 측정을 위한 측면 유전영동 힘 분광기의 연구

곽태준, 최범준, 최승엽, 윤대성, 이상우
연세대학교 의공학과



A massively parallel dielectrophoretic tweezers system has been constructed that utilizes the electrostatic repulsion of polystyrene microparticles from a silicon dioxide surface via a lateral axis of dielectrophoresis force. We show proof-of-concept for lateral dielectrophoresis force spectroscopy (LDFS) that seizes up microparticles moving toward center of electrode in the microfluidic chip under a dielectrophoretic field, resulting in defining electrostatic intermolecular binding between chemically modified microparticles and substrate.

P3-33 전기적 시료농축기를 이용한 와류 현상 기반 입자표지

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In most of bioanalysis techniques, the procedure of cell/particle labeling has adopted for essential common protocol to visualizing and detecting, such as labeling of cells with antibodies conjugated to fluorescent labels. But the conventional method of sample preparation is required longer than a half of hour for incubation, and more than several mL of sample volumes. So the conventional method is not suitable for point-of-care application because of time consuming, wasting of samples and labor intensive procedure. Due to overcome these limitations, we present a methodology for enhanced cell/particle labeling on chip using nanofluidic electro preconcentrator without contamination.

P3-34 미세유체 칩 내에서 유전영동 집게(Dielectrophoretic Tweezers)를 이용한 단백질A와 면역글로불린 G의 결합에 관한 연구

곽태준, 최승엽, 최범준, 손명구, 이상우

연세대학교 의공학과

The 'Dielectrophoretic Tweezers(DEP Tweezers)' can

be used as a facile, economical toolkit for quantitative measurement of chemical and biological binding forces related to many biological interactions within a microfluidic device. Our experimental setup can probe the interaction between a single receptor molecule and its specific ligand. Immunoglobulin G(IgG) functionalized on polystyrene microspheres has been used to detect individual surface linked Staphylococcus protein A(SpA) molecules and to characterize the strength of the noncovalent IgG-SpA bond. It was measured and compared with the existing measurements. This work can be used to investigate several different ligand-receptor interactions and antigen-antibody interactions.

P3-35 미세유체칩 내 구형 미세입자의 랜덤워크 궤적 분석

손명구, 이규도, 손종상, 이세영, 윤대성, 이상우

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We observe the random walk of spherical microparticles functionalized with carboxyl or amino functional groups on a glassy substrate (SiO_2) in a microfluidic chip, resulting in different regimes of trajectories, mean square displacement (MSD), and the distribution of relative angles of Brownian motion. This is attributed to electrostatic interactions between the microparticles and the substrate, implying that the surface charge of particles is critical in the random walks on a negatively charged substrate in a microfluidic system.

P3-36 인공 미세혈관 네트워크 형성을 위한 미세튜브 형성 미세유체소자 설계 및 수치모사

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To make artificial micro-blood vessel network vascularization, we intend to develop micro-tube generating microfluidic device and culture Human Umbilical Vein Endothelial Cells(HUVECs) in the generated tube. In order to determine design parameter, we analyzed tube inner diameter change according to injecting material parameter. Model is designed with one outlet and three inlets for tube generating materials (sodium alginate, CaCl₂, PBS). The simulation results showed that the inner diameter of the generated tube is proportional to the sodium alginate concentration.

P3-37 니켈 부착형 수직 성장된 탄소나노튜브 하이브리드 기판을 이용한 비효소 혈당 바이오센서

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A nonenzymatic biosensor was developed for glucose detection based on Ni decorated vertical growth of carbon nanotubes nanohybrids on graphite electrode. The electrochemical performance of the nanohybrids electrode for detection of glucose was investigated by cyclic voltammetry and amperometry. It was found that the nanohybrids modified electrode showed remarkably enhanced electrocatalytic activity towards the oxidation of glucose in alkaline solution attributing to the synergistic effect of CNTs and Ni²⁺/Ni³⁺ redox couple. The nanohybrids electrodes exhibits an enhanced electrocatalytic property, low working potential, high sensitivity and excellent selectivity, thus is the great potential for the development of nonenzymatic glucose sensor.

P3-38 만성질환 치료를 위한 정자기력 기반 체내 이식형 약물전달 펌프

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To attain on-demand pulsed drug delivery, we developed an implantable drugpump actuated by static magnetic field (MDP). The device made of poly (methyl methacrylate) mainly consisted of 3 parts; a drug reservoir, cylindrical chamber and plunger. The drug was released when an external magnetic field was applied and removed: the plunger was pulled upward and downward, respectively, to push the drug outward via the aperture formed at the bottom of the pump. When there is no external magnetic field, the heads of a cylindrical chamber and a plunger, made of magnets, were attached to close the aperture, thereby no drug release. Therefore, in this work, the drug could be controlled by adjusting the number of apertures and actuations. To evaluate its in vivo feasibility, the MDP was implanted in Sprague Dawley(SD) rats for 30 days. Thus, we could demonstrate the drug was detected in the blood plasma only when the pump was actuated. Therefore, we conclude that the MDP has a high potential for on-demand, pulsatile drug release as a future drug device.

P3-39 세포 분리를 위한 나선형 채널 유동의 수치 해석

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This paper deals an advanced approach for particle separation using a helical microchannel in three dimensions. In the present work the helical structure is cylindrical in shape and it is oriented horizontally for the fluid to be passed through it. The simulations were performed using Computational Fluid Dynamics (CFD) technique with the aid of the software package FLUENT. Here theoretical studies for fluid flow were



carried out for a rectangular and a trapezoidal cross-sectional channel with a constant radius of curvature and pitch under different flow rates. The result shows that due to the inertial and dean forces a high particle separation rate can be achieved for a helical structure with a higher separation rate for the trapezoidal cross section over the rectangular under a constant curvature ratio.

Neural Engineering

P3-40 ALS 환자의 네 가지 운동 과제 수행 시 뇌파 특성 분석에 관한 기초 연구

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Motor task BCI system translates different brain activity patterns, which are due to topographical mapping between motor/somatosensory cortex region and the corresponding parts of body. The aim of this study was to classify four different movement tasks using electroencephalogram of ALS patients. The self-paced experiment was performed in virtual environment and feedback was given based on automatic EMG detection. Common spatial patterns (CSP) and linear discriminant analysis (LDA) was applied to extract features and to classify motor execution tasks.

P3-41 미세전극을 이용한 자극전극에서 측정된 신경 응답 분석을 통한 전기자극효과 분석

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 KAIST 바이오 및 뇌공학과

Neural network or single neuron stimulation and recording present valuable measurement to analysis. Particularly recording of response at stimulating electrode give lots of information. Although previous

systems allow this in 4~5 ms after stimulating, recording of responses before this range was very difficult and these responses have not been analyzed yet. In this article using the system which allow recording of neural signal in 2ms after stimulus to collect, we analyzed responses in terms of responsiveness. These responses were classified into synaptic and non-synaptic response and we correlated responsiveness of electrode to network status.

P3-42 데이터베이스 기반의 사용자 피드백: 뇌파 특성의 개인 편차를 고려한 향상된 뉴로피드백 전략

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 한양대학교 생체의공학과

The aim of this study was to develop a data-driven user feedback strategy considering individual variability of electroencephalography features in order to develop “universal” neurofeedback systems. Twenty healthy subjects participated in our experiments, and performed a hidden catch paradigm used for inducing attention. The proposed feedback strategy was based on the EEG feature database, and the process was as follows: (1) Calculation of attention feature in each subject, (2) Acquisition of grand feature distribution, (3) Determination of objective function in order to rescale the feedback scale, (4) Optimization of objective function, and (5) Evaluation of algorithm performance. From the experimental results, 53% increment in the number of valid bins could be obtained when the proposed strategy was applied.

P3-43 네트워크 동기화 억제 연구를 위한 MEA기반 다 채널 전기자극 스위치 개발

김대정, 정현준, 남윤기
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There have been several efforts to suppress the abnormal synchronized bursting pattern of dissociated neurons cultured on multi-electrode array (MEA).



However, few studies have applied a novel coordinated-reset stimulation pattern in MEA. Here, we developed the PC controlled switch system to deliver high-frequency stimulus trains to the selected channels in random sequence. The system showed sub-millisecond switching performance and low background and crosstalk noise level. We are expecting to study the optimal number of stimulus channels and stimulus intensity to effectively desynchronize the seizure-like activity.

P3-44 다중채널 유연 전극을 통한 마우스 EEG신호 측정 및 감각자극에 대한 신호특성 분석

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We designed the six-channel array of the electrode analyzing sensory evoked potential recording spatiotemporally, and each dry-type flexible pin for long-term experiments requires minimally invasive surgery procedures for safe, stable, and practical usage. Moreover, it provides reusability so that multiple mice can attach and detach the electrode from skull conveniently. We verified its performance by two kinds of experiments. An EEG theta band was activated during the mechanical tail stimulation, and the brain activity processing order appeared symmetrically through the spatiotemporal analysis between left hind limb stimulation and right hind limb stimulation.

P3-45 마우스의 감각 전위신호 측정을 위한 다중채널 EEG 유연 전극의 개발 및 성능 평가

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Although stainless steel screw is widely used in various mouse electroencephalogram (EEG) researches, it is dangerous to be implanted in young mice or

disease models. In this paper, we introduce a flexible electrode for EEG recording to alleviate the risk of screw implantation in mice. The electrode is designed to sit on the skull stably and cover the curvature of skull without the need of screws. We designed a six-channel array of the electrode and we conducted an experiment related to the left hind limb mechanical stimulation. We verified its performance by comparing the result of screws.

P3-46 뇌파 상호 동기화 특성 기반 운동 수행 신호 분석

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We present analysis applying multivariate synchronization on motor execution EEG data to examine time-transient characteristics of ERD/ERS. Conventional motor imagery induced ERD/ERS are analyzed in frequency domain in respect of analyzing power spectrum which does not contain time-transient features. Multivariate synchronization measures strength of time coupling characteristics within EEG channels. We calculated synchronization index Omega with time window size 250ms on data executing 4 types of movements, left, right, both hands and both feet of 2 healthy and 1 patient subjects by combining EEG channels respective to anatomical regions. Relative to both hands, both feet movement trials, omega increased significantly higher than baseline in left, right hand movement trials during execution period.

P3-47 통증 신경전달경로 분석을 위한 VPL과 S1에서의 동시신경신호 기록

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Neuropathic pain is caused by dysfunction in the nerve system and involved in hyperactivity in several brain areas such as thalamus, somatosensory cortex, and anterior cingulate cortex (ACC). Especially, it was reported that the lesion of ACC alleviates the representative characteristics associated with neuropathic pain. In this study, we simultaneously recorded neural activities in both ventral posterolateral nucleus (VPL) and primary somatosensory (S1) from anesthetized rats while applying mechanical stimulation on the hind paw mimicking the pain. In order to investigate the effect of modulation from ACC on the pain-related neural activity, electrical current stimulations with various frequencies were applied while the neuropathic pain.

P3-48 초음파를 이용한 다채널 전극 위에 배양된 신경 세포의 신경조율

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Ultrasound is becoming a promising non-invasive neuromodulation approach due to non-invasive stimulation with high spatial resolution. However, the underlying principles have been not clarified yet. Therefore, we have been aiming to examine the mechanisms and to develop the optimized ultrasonic neuromodulation method. In the present study, we investigated the effect of ultrasonic stimulation using neuronal cell cultured on multi-electrode arrays (MEAs). Primary hippocampal neurons were cultured on the MEAs and low-intensity, low-frequency ultrasound was applied to the neural networks. Spontaneous action potentials (APs) were recorded and calcium imaging was performed simultaneously to monitor the neural activities. In most of neurons, the frequency of APs and the calcium transient were increased during the ultrasound application.

P3-49 다차원 신경 인터페이스를 위한 지형적 구조를 가진 미세전극칩 개발

김래영, 장민지, 주성훈, 남윤기
 KAIST 바이오및뇌공학과

A planar microelectrode array (MEA) is a widely used platform for neural signal recording of in vitro neuronal culture. Surface modification of MEA has been tried both chemically and topographically to control growth and development of cultured neurons, however, construction of microscale topography on MEA has been rarely reported. In this study, we fabricated various microstructures on the surface of a MEA. 3 μm of dot and line patterns were patterned between microelectrodes and spontaneous neural signals were recorded. The developed MEA is expected to be useful for long term neural development and activity studies.

P3-50 장기적 신경신호기록을 위해 미세약물공급채널을 가진 128채널 폴리머 전극어레이

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Multi-channel electrode array is one of essential tools for neurophysiology. It is hoped that the array device could be used for long term implant applications as well. Liquid crystal polymer (LCP) is a biocompatible, implantable material that has an advantage of having low moisture absorption rate that is similar to that of glass. When combined with microfluidic channels, steroid material could be injected, reducing problematic reactive gliosis, leading to enhanced long term implant stability. We propose and report a 128 channel microelectrode arrays integrated with 8 channels of microfluidic channels, as a preliminary form of a brain implantable microsystem that is capable of stimulation of the brain tissues as well as recording from them. To verify feasibility of the fabricated elec-



trode, electrochemical measurement and liquid delivery was assessed. As preliminary experiment, a multi-channel neural recording experiment was performed as well.

P3-51 단채널 EEG 신호에서의 스파이크 자동검출

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A spike is generally defined as an isolated wave within a short time period in electroencephalogram data. The detection of the spike in electroencephalogram (EEG) data is an important issue in EEG processing, because emergence of spiking activities can be a marker of some brain disorders, and some spikes from external sources need to be removed for more reliable EEG analyses. In this paper, we introduce a new computerized method to automatically detect the spikes included in EEG data. Experiments with twenty-four subjects' EEG data to detect eye blink artifacts showed that dynamic positional warping technique (DPW), which was originally invented for handwriting data analysis, outperformed conventional methods used for template matching.

P3-52 CTVEP를 이용한 뇌 스위치 시스템 개발

차호승, 임정환, 황한정, 한창희, 임창환
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Brain switch systems based on steady-state visual evoked potential (SSVEP) or P300 are often suffering from users' tiredness due to high-speed flickering light stimulation. To circumvent this, we propose a brain switch system based on chromatic transient VEP (CTVEP) evoked by a slowly flickering (< 1Hz) visual stimulus with chromatic sinusoidal gratings. Results of a questionnaire on the relative preference between conventional SSVEP stimulus and CTVEP stimulus showed that most subjects felt comfortable when the new stimulus was presented. Online ex-

perimental results showed that the average time needed to turn on the brain switch was about 14 s. Moreover, the brain switch stayed being 'off' state for 109 s when participants watched a fixation point or a movie clip, suggesting the possibility of CTVEP-based brain switch system in practical scenarios.

P3-53 전역 뇌파 동기화를 이용한 비디오 시청 시 감정 변화 추적

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In the present study, we investigated whether global EEG synchronization can be a new index to track emotional changes during EEG recording. Global Field Synchronization (GFS) was evaluated to quantify synchronization of multichannel EEG data recorded from a group of participants ($n = 20$) while they were watching two short video clips. The two video clips were designed to respectively evoke happy and fearful emotions. Other participants ($n=21$) were asked to select two most impressive scenes in each clip. The GFS results corresponded well with the questionnaire results, demonstrating that the GFS measure could be used as a new index to track group emotional changes during video watching and could be potentially used for evaluating cultural contents including TV commercials, movies, and music videos.

P3-54 망막변성모델마우스(*rd 10 mouse*)에서 망막신경절세포의 주령별 자발적 스파이크 변화분석

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For identifying retinal degeneration pattern by aging, we measured spontaneous spikes of postnatal week (PNW) 2, 2.5, 3, 3.5, 4, 4.5, 8, 10, 15, 20 and 30 *rd10* mice by using 8*8 multi-electrode array. Mean frequency of retinal ganglion cell spike increased by PNW30. Latency of 2nd peak in interspike interval



histogram (ISIH) differed according to PNW. First peaks of power spectral density (PSD) were observed at 10 Hz by PNW4.5, but it was observed at 4~5 Hz after PNW8. In continuous wavelet transform (CWT) analysis, the hot spot of 4 Hz and 10 Hz was observed after PNW4 and the 4 Hz spot was diminished at PNW30.

P3-55 변성망막의 망막 신경절 세포 반응에 미치는 장기 전기 자극 효과

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We used charge-balanced, cathodic phase-1st biphasic current pulse and we compared the firing pattern of RGC spikes while applying electrical stimulation or without any stimulation. The mean frequency of RGC spikes significantly increased in 10, 20, 30, and 60 minutes stimulus group relative to control group with no stimulus. The 2nd peak in inter spike interval histogram (ISIH) was observed significantly later at 160ms in stimulus group for 60 minutes than other stimulus groups for 5, 10, 20, and 30 minutes ($p < 0.001$, ANOVA). Now we are applying longer stimulus than 60 minutes to find long-term safety limit for electrical stimulus.

P3-56 하지불안증후군 환자의 작업기억 과제 수행 시 교차 주파수 결합 변화

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We investigated that the alteration in brain activities in patients with restless legs syndrome (RLS) during a working memory task by observing increases of the cross-frequency coupling. At early period, significantly altered theta-beta/gamma coupling were observed in RLS patients at frontocentral regions. Our results support that RLS patients have cognitive dysfunction,

which was associated with working memory processing on the visual stimuli.

P3-57 폴리머 기반의 코클리어 전극에서 유한 요소 방법을 통한 전류 집중 자극 방식의 분석

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Current focusing stimulation method has been studied to reduce crosstalk of stimulation channels in cochlear implant. In this study, we confirm that the effect of current focusing can improve in film type polymer-based cochlear electrode array having recessed structures on its stimulation site due to encapsulating silicone elastomer, which is different in conventional cochlear electrode array having ball type or ring type sites, by using finite element method. Additionally, we propose more recessed structure around stimulation site to enhance current focusing performance.

P3-58 수면 시 하지불안증후군 환자의 대뇌 네트워크 변화

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In this study, we compared brain network between patients with restless legs syndrome (RLS) and healthy control using sleep electroencephalogram (EEG). Phase synchronization was analyzed to observe inter-regional functional connectivity, and its connection pattern was quantitatively analyzed using graph theoretical measures. Delta-band functional connectivity at stage N3 was remarkably weaker in RLS patients. Also, the network for RLS patients showed significant loss of small-world-ness. Our results may imply that the functional organization of cortical network is significantly altered in RLS patients.



P3-59 LIKE/DISLIKE 의도에 따른 알파대역 신경동기화의 차이

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We investigated the differences in alpha-band neural synchronies between LIKE and DISLIKE intentions using time-frequency and phase synchronization (PS) analyses of event-related electroencephalograms (EEGs). Significantly greater frontal alpha power was observed for LIKE compared to DISLIKE intention. Considerable anterior-posterior connections in alpha-band were observed for both intentions, but it was much stronger for Like intention, especially, at frontal regions. Our results may indicate that the LIKE/DISLIKE intentions could modulate the local and global neural synchronies in alpha-band.

P3-60 Sawhorse 파형을 사용한 이중 펄스 볼타메트리 최적화

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Fast-scan cyclic voltammetry (FSCV) technique with carbon-fiber microelectrodes (CFMs) has been widely used for detecting electroactive neurotransmitters in vitro and in vivo. However, FSCV in vivo still has problems due to complex voltammograms, influenced by pH transient, changing nonfaradaic background current and other gross environmental changes at the CFM surface. To differentiate analytes and minimize the confounding factors under rapidly changing circumstances at the surface of CFM based on analytes' adsorption characteristics, paired-pulse voltammetry was suggested as a modified FSCV technique, which consists of two identical triangle-shaped waveforms, separated by a short interval at the holding potential. In this study, we investigated the influence of reduction process on PPV by manipulating scan parameters and proposed new type of PPV waveform for enhancing the responses of PPV on DA.

P3-61 영장류에서의 뇌경막외 피질뇌파(epidural ECoG)를 이용한 눈 움직임 예측

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Recently, several studies have reported use of epidural electrocorticogram (eECoG) for brain computer interface (BCI). However, the feasibility and performance of eECoG on BCI were not fully evaluated yet. In this study, we verified the usability of implanted eECoG in non-human primate by predicting saccadic movement using eECoG signals. Two micro electrode patches (32 channels) were inserted over duramater on rhesus monkey. The monkey performed four directional eye movement tasks responding to target's color change. As results, we classify the eye movement directions using eECoG and showed significant and stable decoding performance over two months. This could support the efficacy of BCI using eECoG.

P3-62 다채널 전극을 이용한 집속 초음파 자극에 의한 해마뉴런의 활동전위의 변화 연구

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Recently some studies have shown that focused ultrasonic mechanical energy has modulatory effect on the nervous system. The motivation for the present study was to investigate the modulatory effect of low intensity, low frequency ultrasonic stimulation on hippocampal neurons. This study concludes, ultrasonic stimulation induces change to the neuronal network activity. The mechanical stimuli may not have a direct effect on neuronal activities but somehow help neuronal cells to be in a more excitable state, although further study is necessary.

POSTERS III


P3-63 유한 요소 방법을 이용한 무선 전력 전송 장치의 전자기장 생체 흡수율 분석

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Power delivery to the neural prosthetic device is a crucial factor for long term operation. Recently, inductive link is employed as effective wireless power delivery for medical applications. However, due to the electromagnetic wave (EM-wave) generated by the transmitter and the receiver, tissue absorption of EM-wave could cause tissue damage. Therefore, tissue absorption of EM-wave should be kept below the limit (0.4 W/kg). In this paper, we investigated tissue absorption of EM-wave using finite element method. We designed the wireless power delivery system and showed average specific absorption rate of 0.083 W/kg.

P3-64 말초 신경 자극을 위한 액정폴리머 기반의 다채널 커프 전극 설계 및 제작

서정민, 이성은, 안승희, 박정환, 김성준
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A cuff electrode is one of essential methods for peripheral nerve stimulation. For its cylindrical-shaped geometry, the electrode has high selectivity and low threshold voltage for nerve activation. The suggested LCP-based electrode has flexibility as well as rigidity to be used for cuff electrodes. Our group has been working on developing neural prosthetic devices using LCP (Liquid Crystal Polymer), which has biocompatibility and durability so that it is suitable for a neural prosthesis. The LCP-based cuff electrode has been implemented using MEMS, thermal press bonding and thermal-transformation processes. Moreover, the electrochemical characterization was also performed. The fabricated electrode is in the process of applying for peripheral nerve stimulation experiments.

P3-65 국부 자극이 가능한 동물용 심부뇌 자극 전극 구조 설계

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Polymer-based deep brain stimulation (DBS) electrode for localized stimulation was suggested, which has multichannel sites in a small and specific region *in vivo*. This study aimed to calculate and to verify the effectiveness of a novel polymer-based multichannel DBS electrode for localized bipolar stimulation compared to other conventional electrodes including a commercial bipolar electrode for animals. The finite element method (FEM) was performed using Comsol Multiphysics (Ver. 4.3, Comsol Inc., Stockholm, Sweden).

P3-66 3차원 배치의 채널을 갖는 액정폴리머기반의 신경 전극의 제작과 전기화학적 임피던스 특성

신수원, 정준수, 김성준
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For decades, various implantable neural probes with single or multiple neural recording or stimulation electrodes have been researched to study brain. To date, a variety of neural probes have been developed with various shapes and materials. Metal, silicon and polymers have been used as substrate material for neural electrode arrays. Using micro-fabrication technologies, multi-channel neural recording probe has been researched, therefore it can record neural signals from multiple brain tissues simultaneously. In this study, we propose neural probe with three-dimensionally located channels using liquid crystal polymer (LCP). The proposed neural probe was fabricated by thin-film process and thermal lamination. It has three-dimensional composition of sites, therefore it can record neural signals from multiple brain tissues simultaneously.



P3-67 표면 근전도를 이용한 근육피로도 평가 파라미터 간 성능 비교

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This study compared the performance between the parameters for the quantitative evaluation of muscle fatigue in repetitive work. Thirty-seven medical staffs performed chest compression for 5 min on a manikin on the bed. sEMG was measured from 4 muscles while compressing the chest according to the CPR(Cardio-pulmonary Resuscitation) guideline. Two sEMG electrodes were attached on the muscles that are selected as fatigued muscles, the other two muscles were selected as non-fatigued muscles. RMS(Root Mean Square), MDF(median frequency), FI_{nsm5} were compared to investigate the relationship with time, which correlation with muscle fatigue. In result, MDF was decreased in fatigued muscles but not in non-fatigued muscles but the amount of changes were not large. RMS, FI_{nsm5} shows similar trend, but FI_{nsm5} seems to be more sensitive to the fatigue. As a conclusion, MDF and FI_{nsm5} can be used in combination to evaluate the muscle fatigue in repetitive work.

P3-68 BioPAC 시스템을 이용한 정상마우스에서의 빛 자극유발전위 반응 측정

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For the development of feasible retinal prosthesis, Electrically Evoked Potential (EEP)recording on V1 cortex is needed to see if the patient can see or not. For the preliminary experiment for EEP recording, here, we established Visually Evoked Potential (VEP) recording on V1 cortex using BioPAC system. Amplitude and latency of N1 peak at VEP recording varies according to depth of the electrode on V1 cortex. This finding will be used to baseline data for

recording depth on V1 cortex for the upcoming EEP experiment.

P3-69 진전 증상을 잘 반영하는 안정시, 체위성, 운동성 진전 프로토콜 비교

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The purpose of this paper is to compare 6 tremor protocols from rest, postural, and kinetic tremor and find an optimal protocol for each task. 26 patients with Parkinson's disease or Essential tremor participated in the clinical test. Two clinician evaluated patients'tremor severity by clinical tremor rating scale (CTRS). In rest tremor, when patients performed calculation test during resting state, the tremor severity got worse and higher 23.5 CTRS scores in 23 of 52 data. In postural task, there was little difference between a posture with the arms elevated against gravity (9.5 scores) and a position with the arms bended to face each other (12.5 scores). In kinetic tremor, finger tapping test(25.5 scores) reflected more than the severity of finger-to-nose test (7.5 scores).

P3-70 컴퓨터 신경모델을 이용한 정현파 전기자극에 대한 신경반응 연구

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Most cochlear implants stimulate auditory nerve fibers (ANFs) using amplitude-modulated electric pulse train stimuli to encode the temporal information of sound. Understanding of Temporal representation of neural response to electric pulse train is important to improve quality of hearing and speech perception. In this study, we have investigated neural patterns to sinusoidally amplitude modulated electric pulse-trains.

POSTERS III



We systematically evaluated effects of ANF diameter and electrode-to-fiber distance on neural responses using a computational model. The results show that the response to SAM pulse was influenced by the fiber diameter, whereas less effect of electrode-to-fiber distance was observed.

P3-71 Acoustic Change Complex에 기반한 와우 소실 영역 평가

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Amplification doesnot provide any benefit for individuals with cochlear dead region (CDR) due to the loss of inner hair cells and/or spiral ganglion neurons. To identify the location of the CDR, “TEN test” has been used to evaluate whether patients’ pure tone detection is evaluated in the presence of threshold-equalizing noise (TEN). Such behavioral test provides useful information of the presence of the CDR, but it is no feasible for some patient groups, such as infants/toddlers and those who cannot cooperate with the test. The goal of this study is to develop an objective and neurophysiologic method of identifying the presence of CDR using acoustic change complex (ACC) responses.

System Biology, Physiological Modeling

P3-72 당뇨입원환자의 혈당조절을 위한 인슐린 치료 프로토콜의 In-silico 평가

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Although some basal bolus insulin therapy (BBIT) protocols are currently being used in clinical environ-

ment, more effective and safer BBIT protocol is still required for glucose management in hospitalized patients with type 2 diabetes. In this study, using the proposed *in-silico* model, two different BBIT protocols were evaluated adjusting basal-insulin dose (BBIT1) versus adjusting total-daily-insulin dose (BBIT2). *In-silico* study demonstrated that BBIT2 showed relatively better performance than BBIT1. This study could be further utilized to develop the optimal protocol prior to clinical studies without the risk of danger or high cost.

P3-73 폭발 과압에 의한 귀 손상 예측을 위한 귀의 유한 요소 모델 구현

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The primary blast injury (PBI) is a pressure-induced injury caused by the blast overpressure (BOP). The PBI mostly occurs in the ear that is a most sensitive organ to pressure difference. The object of this study is an implementation of a finite element model that could simulate BOP induced situations on the ear and estimate the PBI of the ear. In this study, a middle ear FE model was developed based on micro-CT images and mechanical properties of middle ear. Movements of the model were validated by frequency response of the model and we simulated BOP-induced situations with the model.

ALTMS : 우울증 치료기 경두개 자기자극기 (Transcranial Magnetic Stimulator)

국내최초 비수술적 뇌자극 치료(TMS) 임상시험

“우울 및 불안장애 환자에서 반복 경두개 자기자극 (Repeated Transcranial Magnetic Stimulation) 장비 ALTMS의 안전성 평가 및 유효성 평가 – 이중 맹검 전향 고안”

국내유일! 미국에 이어
세계 두번째 허가 획득

2014년 1월 7일
식약청 품목허가 획득
허가번호 제 13-820호

사용목적

성인 환자의 우울증 치료를 목적으로
전자기장을 두부에 인가하는 기구



NET 인증 (New Excellent Technology) / 2014년 1월 8일 제 81호로 NET 인증 획득

국내 기업, 연구기관, 대학 등에서 개발한 신기술을 조기에 발굴해 그 우수성을 인증함으로써 개발된 신기술의 상용화와 기술거래를 촉진하고 초기 시장 진출기반을 지원하기 위해 보건산업진흥원에서 인증. 지난10년간 약 80여개의 기술만 인증 획득.



내일의 미소를 선물합니다

방사선 장비의 대명사로 성장한 리스팀.
첨단 기술을 바탕으로 환자 중심, 생명존중 정신으로
인간을 위한 기술개발과 의료기기 문화의 변화를 위해
늘 여러분 곁에서 함께 하겠습니다.

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