CONTENTS

학회장 인사말

2013년도 추계학술대회를 맞이하여

회원 여러분 안녕하십니까?

결실의 계절 가을을 마무리 짓는 아름다운 11월에 2013년도 추계학술대회를 연세대학교 국제캠퍼스에서 개최하게 되어 기쁘게 생각합니다. 이번 학회는 'Pioneering path to clinical readiness in biomedical engineering' 라는 주제로 회원 여러분들과 다양한 의견을 교환할 예정입니다.

1979년 창립된 이후 지난 34년간 우리나라의 융합학문을 대표하는 학회로 자리매김 해 온 의용생체공학회는 지금까지 각기 다른 전공분야의 연구자들이 자유로이 의견을 교환하며 발전해 왔습니다. 그동안 본 학회는 첨단 융합 연구를 바탕으로 새로운 진단법과 치료법을 개발하는 연구에 매진해왔으며, 의공학의 산업적 중요성이 날로 증대되고 있는 최근에는 보견의료 HT산업이라는 차세대 성장동력을 제시한 바 있습니다.

이번 추계학회에서는 현재 의공학이 차지하는 위치와 앞으로 그것을 실현화하기 위한 전략을 재점검 해보는 자리를 마련하였고, 한국연구재단 세션과 신진연구자 세션을 통하여 지금까지의 성과를 알아볼 수 있도록 하였습니다. 또한 회원 여러분들이 준비한 논문을 포스터를 통해 발표하실 수 있도록 하여 보다 다양한 의견교환이 이루어지기를 기대하고 있으며, 국내의료기 회사들의 전시부스를 통하여 나날이 발전하는 국내 의료기기 산업을 둘러보는 기회도 제공할 수 있도록 하였습니다.

학술대회 준비에 도움을 주신 한국과학기술단체총연합회, 한국연구재단, LG전자, SK telecom, 연세대학교 글로벌융합기술원에 감사드리며, 이번 학술대회가 다음 세대를 위한 학문으로서 향후 의공학의 발전에 밑거름이 되는 계기를 되기를 기대합니다.

감사합니다.

2013년 11월

대한의용생체공학회 제48회 추계학술대회
회 장 선 경 올림

조직위원장 인사말

2013년도 추계학술대회를 맞이하여

2013년도 대한의용생체공학회 추계학술대회를 연세대학교 송도 국제 캠퍼스 캠퍼스에서 개최하게 된 것을 진심으로 기쁘게 생각합니다. 연세대학교의 국제 캠퍼스는 우리학교의 미래를 위한 준비의 일환으로서 국제화를 통한 학교의 비상을 꿈꾸면서 시작한 곳입니다. 추계학회를 송도의 비상에 맞추어 같이 열수 있음을 더더욱 기쁘게 생각합니다. 개인적으로 제 연구 분야는 이동통신입니다. 최근에 저처럼 동 떨어져 있다고 생각했던 공학 분야가 의료분야와 연결되면 매우 의미 있는 결과를 얻을 수 있다는 것을 깨닫게 되었습니다. 그런 연유로 이 분야 연구에 적극적으로 참여하기 위해서 대한의용생체공학회에 가입을 하고 추계학술대회 추진위원장을 맡게 되었습니다.

어느 분야나 융합 연구는 성공을 위한 핵심이며, 특히 의료기기 개발은 그 어떤 분야보다도 융합의 중요성이 강조되고 있습니다. 세브란스 병원은 의료 서비스 및 의료기기 연구에 이미 세계적인 경쟁력을 가지고 있습니다. 저희들도 의료현장과 연세대 내의 여러 캠퍼스간의 관련 교수/연구원들이 함께 어울려 가며 새로운 아이디어를 내며 융합연구를 해볼 계획입니다. 이제 막 시작한 것이라서 서툰 점이 많겠지만 열심히 노력해서 의료기기 개발과 대한의용생체공학회의 발전에 조금이라도 기여할 수 있도록 노력하겠습니다. 많은 관심과 후원 부탁드립니다.

2013년도 추계학술대회의 성공을 위해 추진위원회는 최선을 다하여 학술대회를 준비하였습니다. 특히 연세대학교의 여러 캠퍼스의 구성원(세브란스 병원 송시영 교수, 원주 캠퍼스정병조 교수, 국제 캠퍼스 김시호 교수)들이 함께 손 붙잡고 준비한 잔치입니다. 부디 많이 참석하시어 융합을 추구하는 송도의 새로운 캠퍼스도 돌아보시고, 또한 많은 학문적인 수확을 거두어 가시길 기원합니다.

감사합니다.

2013년 11월 8일

대한의용생체공학회 제48회 추계학술대회
조직위원장 홍 대 식 배상

대한의용생체공학회 제20대 임원

직 책	성 명	소 속		직 책	성 명	소 속
명예회장	조진호	경북대			김동욱	전북대
회 장	선 경	고려대		교 육	지영준	울산대
수석부회장	박광석	서울대			김주명	광양대
부회장	송시영	연세대			박희병	한국의료기기협동조합
	이재화	한국의료기기협동조합		산학협력	강태건	한국의료기기산업협회
감 사	윤영로	연세대			최보영	가톨릭대
	허 영	한국전기연구원			홍성화	삼성서울병원
총 무	이성호	고려대		국제협력	김법민	고려대
	이원진	서울대			김태성	경희대
기 획	김인영	한양대		재 무	김명남	경북대
	김희찬	서울대			김성민	동국대
학 술	문치웅	인제대			안원식	서울대
	최영빈	서울대		정 보	노정훈	부산대
	김상희	금오공대			임영진	서울대
편 집	이상훈	고려대		회원관리	김한성	연세대
	이재성	서울대			이상민	인하대
	이경중	연세대			김윤년	계명대
간 행	박현진	성균관대		협 력	최귀원	KIST
					이두용	KAIST

정보위원회

직 책	성 명	소 속		직 책	성 명	소 속
정보이사	노정훈	부산대		위원	최성욱	강원대
정보이사	임영진	서울대		위원	신범주	부산대
정보이사	안원식	서울대		위원	정동근	동아대
위원	서광석	서울대				

학술위원회

직 책	성 명	소 속		직 책	성 명	소 속
학술이사	문치웅	인제대학교		위원	유형석	울산대학교
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학술이사	김상희	금오공과대		위원	윤종인	대구카톨릭
위원	강현욱	부경대		위원	이수홍	차의과대학
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위원	박재영	고려대		위원	전상범	이화여대
위원	박중열	중앙대		위원	정 용	KAIST
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위원	변경민	경희대학교		위원	최연호	고려대
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위원	성준경	고려대		위원	허찬영	서울대
위원	양 성	광주과기원		위원	황도식	연세대

교육위원회

직 책	성 명	소 속	직 책	성 명	소 속
교육이사	김동욱	전북대	위원	오승훈	한중대
교육이사	김주명	광양보건대	위원	오정환	부경대
교육이사	지영준	울산대	위원	원철호	경일대
위원	권기진	영남이공대	위원	윤종인	대구가톨릭대
위원	권춘기	순천향대	위원	이기영	관동대
위원	김덕현	광주대	위원	이동훈	동명대
위원	김성민	동국대	위원	이석재	서남대
위원	김영곤	인제대	위원	이수열	경희대
위원	김윤년	계명대	위원	이정환	건국대
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위원	김정래	을지대	위원	임용규	상지대
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위원	박준식	강릉영동대	위원	진경수	충북도립대학
위원	박해암	남부대	위원	최병철	춘해보건대
위원	서종범	연세대	위원	최승한	대구한의대
위원	송동진	중원대	위원	최연호	고려대
위원	심은보	강원대	위원	최중한	해천대
위원	오대호	한림성심대	위원	태기식	건양대

(국문) 편집위원회

직 책	성 명	소 속	직 책	성 명	소 속
편집이사	이상훈	고려대	위원	유선국	연세대
편집이사	이재성	서울대	위원	이계한	명지대
편집이사	이경중	연세대	위원	이성재	인제대
위원	권성훈	서울대	위원	이수열	경희대
위원	김동욱	전북대	위원	이우철	을지대
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위원	남윤기	KAIST	위원	임창환	한양대
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위원	신정욱	인제대	위원	한동근	한국과학기술연구원
위원	엄광문	건국대	위원	이 전	연세대

(영문) 편집위원회

직 책	성 명	소 속	직 책	성 명	소 속
편집위원장	이상훈	고려대	위원	정봉근	서강대
편집이사	이재성	서울대	위원	임용규	상지대
간행이사	박현진	성균관대	위원	김광기	암센터
위원	박지호	KAIST	위원	박재석	고려대
위원	김한성	연세대	위원	윤대성	연세대
위원	임창환	한양대			

조직위원회

직 책	성 명	소 속
조직위원장	홍대식	연세대 신촌캠퍼스
부위원장	송시영	연세대 세브란스 병원
부위원장	정병조	연세대 원주캠퍼스
부위원장	김시호	연세대 국제캠퍼스
위원	이상윤	연세대 신촌캠퍼스
위원	김동현	연세대 신촌캠퍼스
위원	황도식	연세대 신촌캠퍼스
위원	이충용	연세대 신촌캠퍼스
위원	박종철	연세대 세브란스 병원

직 책	성 명	소 속
위원	이우정	연세대 세브란스 병원
위원	박인철	연세대 세브란스 병원
위원	한웅규	연세대 세브란스 병원
위원	임준석	연세대 세브란스 병원
위원	김한성	연세대 원주캠퍼스
위원	김지현	연세대 원주캠퍼스
위원	이세영	연세대 원주캠퍼스
위원	백종덕	연세대 국제캠퍼스

2013년 추계학술대회 프로그램 일정

● **주제:** Pioneering Path to Clinical Readiness in Biomedical Engineering

- 주 최: 대한의용생체공학회
- 일 정: 2013년 11월 8일(금)
- 주 관: 대한의용생체공학회, 연세대학교
- 장 소: 연세대학교 국제캠퍼스 (인천 송도)

11월 8일 (금)			
시 간	종합관 301	자유관 A 102	자유관 A 201
09:00 ~ 10:00	등록 및 포스터 설치		
10:00 ~ 12:00		특별세션: 의료기기 아이디어 실현화 (Medical Device Realization) 좌장: 류제청	
12:00 ~ 13:00	점심	평의원회	
13:00 ~ 14:00	포스터 발표		
14:00 ~ 14:10	개회식		
14:10 ~ 15:00	기조강연: 바이오스페이스 차기철 사장 좌장: 문치웅, 최영빈		
15:00 ~ 15:15	Tea break		
15:15 ~ 16:05	특별강연: Perspectives for clinical readiness in BME 좌장: 윤종인, 박중열	초청강연: 한국연구재단 성과발표 좌장: 이성종	학생연구자 발표 좌장: 박지호, 성준경
16:05 ~ 16:15			Tea break
16:15 ~ 17:15			신진연구자 좌장: 황도식
17:15 ~ 17:30	Tea break		
17:30 ~ 18:00	폐회식		
18:00 ~	만찬		

- 학회장소 : 연세대 국제캠퍼스 (인천 송도)

주 　 소 : 인천광역시 연수구 송도과학로 85 (인천광역시 연수구 송도동 162-1)
전화번호 : 1599-1885

- 연세대 국제캠퍼스 대중교통안내

▶ 버스

번호	기착지	주요 노선	배차 정보
1301	송도 ↔ 서울역	인천대학교 → 송도 시내 → 캠퍼스타운역 → 인천 논현동 → 부천시청 → 강서세무서 → 합정역 → 홍대입구 → 신촌오거리 현대백화점 → 이대역 → 서울역 (회차) → 신촌오거리 현대백화점 →	첫차 05:00 막차 23:00 배차간격 30분
M6405	송도 ↔ 강남역	송도 ↔ 강남역 송도 웰카운티 → 송도 시내 → 캠퍼스타운역 → 선바위역 → 서초역→ 강남역 → 양재역 (회차) → 선바위역 →	첫차 05:00 막차 23:30 배차간격 15분
M6724	송도 ↔ 신촌 (연세대학교 정문)	경제청 → 더샵에비뉴 → 컨벤시아 → 연세대학교 국제캠퍼스 → 동막역 → 동춘역 → 제2경인고속도로 → 서울외곽고속도로 → 제1경인고속도로 → 강서세무서 → 합정역 → 홍대입구역 → 연세대학교신촌캠퍼스(하행시, 연세대학교) → 신촌2호선역 → 신촌오거리 → 홍대입구역 → 합정역 → 강서세무서 → 이하역순	첫차 05:00 막차 23:10 배차간격 20분
303	간석오거리 ↔ 인천공항	간석오거리 ↔ 인천공항 간석오거리 → 인천터미널 → 문학경기장역 → 동막역 → 송도시내 → 인천국제공항 → 송도시내 →	첫차 05:00 막차 21:30 배차간격 24분

▶ 지하철 노선 이동 경로 배차 정보

노선	이동 경로	배차 정보
인천지하철 1호선 → 서울지하철 1호선 → 서울지하철 2호선	캠퍼스타운역(인천지하철 1호선 승차) → 부평역(서울지하철 1호선 환승) → 신도림(서울지하철 2호선 환승) → 신촌역(하차)	* 캠퍼스타운역(부평역방면) 첫차 05:39 / 막차 24:16 * 부평역(캠퍼스타운역방면) 첫차 05:37 / 막차 24:27
인천지하철 1호선 → 공항철도 → 서울지하철 2호선	캠퍼스타운역(인천지하철 1호선 승차) → 계양역(공항철도 환승) → 홍대입구역(서울지하철 2호선 환승) → 신촌역(하차)	*계양역(홍대입구방면) 첫차 05:35 / 막차 24:11 * 계양역(캠퍼스타운역방면) 첫차 05:32 / 막차 24:07

Subway 국제캠퍼스 지하철노선

구분	번호	목적지	이동경로	배차정보
지하철	인천지하철 1호선 + 서울지하철 1호선 + 서울지하철 2호선	송도 ↔ 신촌	캠퍼스타운역 (인천지하철 1호선 승차) → 부평역 (서울지하철 1호선 환승) → 신도림 (서울지하철 2호선 환승) → 신촌역(하차)	캠퍼스타운역 - 첫차 05:39 - 막차 24:16 ※부평역방면 / 부평역 - 첫차 05:37 - 막차 24:27 ※캠퍼스타운역 방면
	인천지하철 1호선 + 공항철도 + 서울지하철 2호선	송도 ↔ 신촌	캠퍼스타운역 (인천지하철 1호선 승차) → 계양역(공항철도 환승) → 홍대입구 (서울지하철 2호선 환승) → 신촌역(하차)	계양역 - 첫차 05:35 - 막차 24:11 ※홍대입구방면 / 계양역 - 첫차 05:32 - 막차 24:07 ※캠퍼스타운역 방면

M6724 국제캠퍼스 버스노선

구분	번호	기착지	주요노선	배차정보
버스	M6724번	송도 ↔ 신촌	경제청 → 더삼에비뉴 → 컨벤시아 → 연세대학교 국제캠퍼스 → 동막역 → 동춘역 → 제2경인고속도로 → 제1경인고속도로 → 강서세무서 → 합정역 → 홍대입구역 → 연세대학교신촌캠퍼스 (하행시, 연세대학교) → 신촌2호선역 → 홍대입구역 → 합정역 → 강서세무서 → 이하역순	첫차 05:00 막차 23:10 배차간격 20분

정류장 위치

》》 송도   》》 신촌

1301 국제캠퍼스 버스노선

구분	번호	기착지	주요노선	배차정보
버스	1301	송도 ↔ 서울역	인천대학교 → 송도 시내 → **캠퍼스타운역** → 인천 논현동 → 부천시청 → 강서세무서 → 합정역 → 홍대입구 → **신촌오거리 현대백화점** → 이대역 → 서울역 (회차) → **신촌오거리 현대백화점** →	첫차 05:00 막차 23:00 배차간격 30분

정류장 위치

》》 송도   》》 신촌

M6405 국제캠퍼스 버스노선

구분	번호	기착지	주요노선	배차정보
버스	M6405번	송도 ↔ 강남역	송도 웰카운티 → 송도 시내 → **캠퍼스타운역** → 선비위역 → 서초역 → 강남역 → 양재역 (회차) → 선비위역	첫차 05:00 막차 23:00 배차간격 15분

정류장 위치

》》 송도   》》 강남역

303 국제캠퍼스 버스노선

구분	번호	기착지	주요노선	배차정보
버스	303번	간석오거리 ↔ 인천공항	간석오거리 → 인천터미널 → 문학경기장역 → 동막역 → **송도시내** → 인천국제공항 → 송도시내 →	첫차 05:00 막차 21:00 배차간격 24분

정류장 위치

》》 송도   》》 인천공항

• 연세대 국제캠퍼스 자가용 이용 시

▶ 제1경인고속도로 이용시

인천IC(제1경인고속도로 종점)에서 좌회전 → 아암대로 진입 후 직진(송도국제도시 방면) → 송도1교(고가차도)아래에서 우회전 → 센트럴로 교차로에서 연세대학교 방면으로 좌회전 → 직진 후 좌회전하여 캠퍼스 진입

▶ 제2경인고속도로 이용시

문학IC로 진출(송도국제도시 방면) → 문학터널/청량터널/동춘터널 통과 후 직진 → 송도국제도시로 진입 → 쉐라톤인천호텔 사거리에서 좌회전 → 계속 직진 후 송도국제대로 교차로 통과 → 직진 후 좌회전하여 캠퍼스 진입
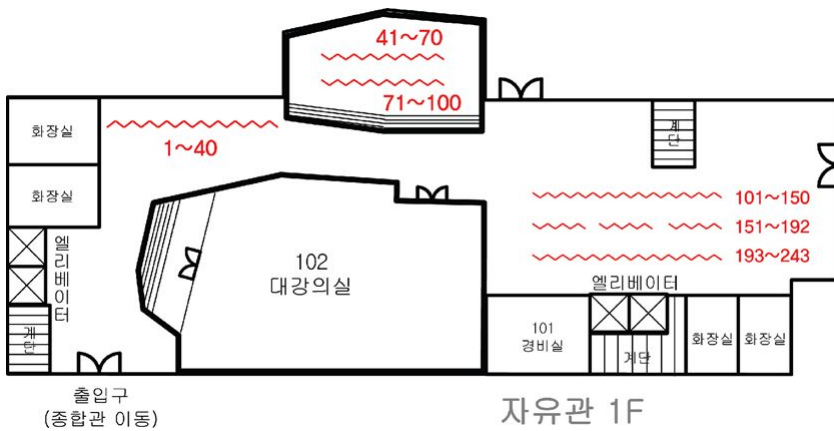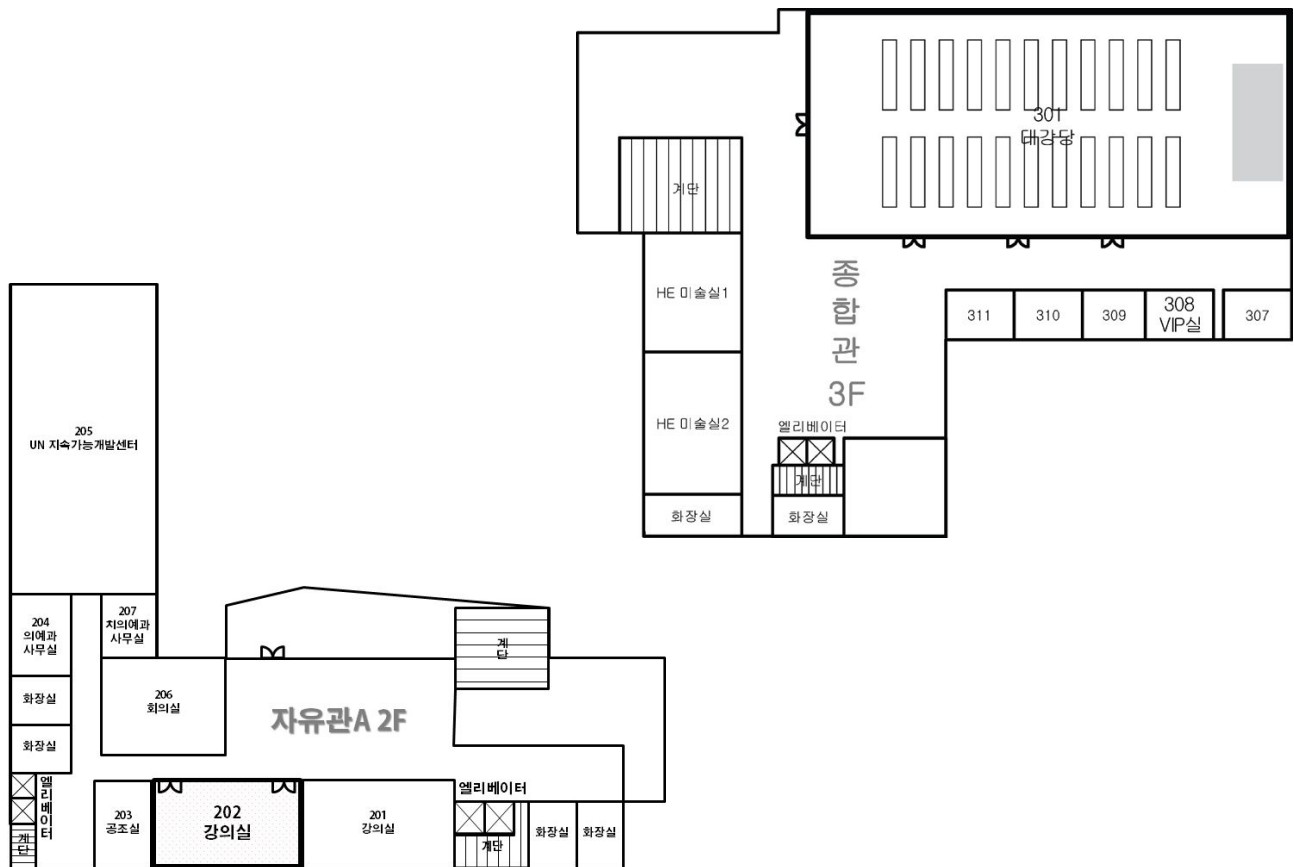
▶ 제3경인고속도로 이용시

월곶JC에서 인천공항 방면 진입 후 직진 → 고잔 톨게이트 통과 → 송도1교(고가차도)에서 좌회전 → 센트럴로 교차로에서 연세대학교 방면으로 좌회전 → 직진 후 좌회전하여 캠퍼스 진입

▶ 인천공항고속도로 이용시

공항신도시 JC에서 송도 방면으로 진출 → 인천대교 통과 → 송도IC로 진출(송도 방면) → 송도1교(고가차도)아래에서 우회전 → 센트럴로 교차로에서 연세대학교 방면으로 좌회전 → 직진 후 좌회전하여 캠퍼스 진입

• 연세대 국제캠퍼스 평면도

버스 정류장,
지하철역에서
걸어오는 입구
(인천 1호선 캠퍼스타운역
2번 출구, 도보 10분)

학회 장소 : 자유관A & 종합관
점심, 만찬 : 기숙사 식당

송도롯데캐슬
호수공원
송원초등학교
운동장
송도캐슬
&해모로
송도해모로
월드뷰아파트
자유관B
진리관A
진리관B
자유관A
종합관
대학본부
지하주차장
점심
만찬
진리관C
진리관D
연세대학교
국제캠퍼스
자매학교3
R&D캠퍼스1
기념관
자매학교2
R&D캠퍼스2
저에너지
환경실험주택
자매학교4
R&D캠퍼스3
차량 출입구
R&D캠퍼스4

화장실
화장실
엘리베이터
계단
출입구
(종합관 이동)
102
대강의실
41~70
71~100
1~40
101~150
151~192
193~243
엘리베이터
101
경비실
계단
화장실
화장실
자유관 1F

출입구
(자유관A 이동)

103

16 17
독립부스

15
14 11 6
13 10 7
12 9 8

1
2
3
4
5

일반부스

게단

244~267
268~281

등록데스크

현장 사전

101관리실

엘리베이터

종합관
1F

출입구

102
휘트니센터

종합관
3F

301
대강당

계단

HE 미술실1

HE 미술실2

엘리베이터

311 310 309 308
VIP실 307

화장실

화장실

계단

205
UN 지속가능개발센터

204
의예과
사무실

207
치의예과
사무실

화장실

206
회의실

자유관A 2F

계단

화장실

엘리베이터

203
공조실

202
강의실

201
강의실

엘리베이터

화장실 화장실

계단

계단

※ 참가비 납부방법

2013 추계	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 사전등록비를 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)

특별세션

좌장 | 류제청 박사 (재활공학연구소)

『의료기기 아이디어 실현화 (Medical Device Realization)』

● **스타트업 단계 기업의 의료기기 아이디어 실현화 (Healcerion Start-up History)**
류정원 대표
㈜ 힐세리온

● **Commercialization of High Frequency High Resolution Ultrasound Imaging Technology**
김형함 박사
USC

● **의료기기 R&D효율화**
김성민 센터장
동국대 의료기기 개발 촉진센터
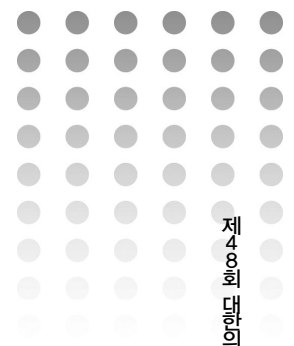
스타트업 단계 기업의 의료기기 아이디어 실현화
(Healcerion Start-up History)

이름: 류정원
직위: CEO
소속: ㈜ 힐세리온

Abstract

T최초 회사 설립부터 현재까지 초음파 진단기기 아이디어를 사업화하기까지의 과정을 통해 실패 사례, 성공사례 분석 및 해결해야 할 문제점들을 짚어보고 초기 기업이 나아가야 할 방향을 본 학회에서 발표하고자 함.

Brief Biosketch

1997. 03 - 2001. 08	서울대학교 졸업 (물리/전자공학)
2005. 02 - 2009. 02	가천의학전문대학원 졸업 (의학)
2001. 02 - 2002. 10	㈜디지젠 CEO/CTO (디지털영상압축 기술)
2003. 02 - 2009. 02	㈜아이티매직 CTO (생체신호처리/이미지 프로세싱 기술)
2010. 04 - 2012. 01	DoIT CTO (Mobile Application 기술)
2011. 01 - 2013. 01	청구성심병원 응급실 전임
2006. 11. 25.	한국최초 우주인 3차 선발과정 합격 (한국항공우주연구원 주최)
2012. 10. 19.	실전창업리그 - 슈퍼스타 V 대상 (중소기업청 주최)
2012. 11. 30.	전국 창업경진대회 왕중왕전 "2012 슈퍼스타V" 왕중왕상 (중소기업청 주최)

Commercialization of High Frequency High Resolution Ultrasound Imaging Technology

Name   : Hyung Ham Kim, Ph.D.
Job Title   : Research Assistant Professor of Biomedical Engineering
Affiliation   : University of Southern California

Abstract

High frequency ultrasound (15 – 120 MHz) is now being actively investigated for high resolution imaging not only in preclinical but also clinical imaging applications, e.g. ophthalmology, dermatology, pediatrics, and intravascular imaging. In preclinical imaging, mice, mouse embryos, rats or zebrafish are tested to model a variety of human diseases and high frequency ultrasound imaging provides an excellent visualization of the progress and effects of the designed experiments. Due to the complexity and difficulty in the fabrication of array transducers, single element transducer based imaging systems are still widely used. However, the mechanical translation of the single element required to obtain images works as a limiting factor for temporal resolution, depth of field and operating modes. Array transducer translates acoustic beams electronically and therefore it may achieve higher frame rates up to 100 frames per second. Transmit beamforming and receive dynamic focusing provide the extended depth of field. Doppler and color flow modes are offered, which were very difficult to implement with the single element. High frequency ultrasound imaging with linear, convex, and phased arrays is now expanding its applications from preclinical imaging to clinical imaging. A 20 MHz convex array, a 30 MHz phased array, and a 30 MHz linear array for preclinical and clinical imaging with their commercialization path are presented. High frequency arrays can obtain high resolution images of any small parts adjacent to the skin or accessible through the cavity.

Brief Biosketch

Dr. Hyung Ham Kim received his B.S. degree in Electrical Engineering from Korea Advanced Institute of Science and Technology, Daejeon, Korea in 1993, his M.S. degree in Electrical Engineering from Seoul National University, Seoul, Korea in 1995, and his M.S. and Ph.D. degrees in Biomedical Engineering from the University of Southern California, Los Angeles, CA in 2006 and 2010, respectively. He had served as the Manager and Principal Engineer of the Probe Department at Medison Co., Ltd. in Seoul, Korea, from 1994 to 2004. He is currently a Research Assistant Professor in the Department of Biomedical Engineering at the University of Southern California and Manager of the NIH Resource Center for Medical Ultrasonic Transducer Technology. His current research is focused on the design and fabrication of high frequency array transducers for high resolution ultrasound imaging.

특별세션

의료기기 R&D효율화

이름: 김성민
직위: 교수
소속: 동국대학교 바이오시스템대학 의생명공학과
기타: 1. 동국대학교 의료기기 개발 촉진센터 (센터장)
      2. 동국대학교 의료기기산업특성화대학원 (주임교수)

Abstract

의료기기 산업은 미국, 유럽 등 선진국 기업들이 선점하고 있으며, 우리나라의 기업들은 기술력, 자본력, 인지도 등에서 선진국 기업들에 비해 매우 열세하여 국내 수요의 약 62%를 수입 제품에 의존하고 있다.

이러한 문제점의 원인으로 국내 의료기기 R&D 투자가 첨단-기술 위주의 중장기·대형 과제 위주로 지원되고 있으며 매년 R&D 수요는 증가하고 있으나, 정부 R&D 지원을 통한 사업화 성공률이 5% 미만 수준으로 R&D투자대비 매우 낮은 효율성을 지적하고 있으며, 이로 인해 원천 기술 개발의 부족으로 인해 산업 전체의 발전을 지연시키고 있다.

현 시점에서 정부 R&D효율성 강화 및 실질적인 과제 성공률 제고를 위해 지속적으로 R&D 지원 시스템의 효율성 개선이 필요하며, 무엇보다 과제의 기획부터 시장수요에 대한 철저한 분석 및 의견이 적극 반영되는 시스템을 갖추는 일이 매우 중요할 것이다. 본 강연에서는 현재 의료 현장에서의 의료기기 아이디어의 실현화 및 R&D및 오픈이노베이션 시스템을 활용한 의료기기 개발 사례를 발표하고자 한다.

Brief Biosketch

2013. 05 - 현재	동국대학교 의료기기산업 특성화 대학원	주임교수
2013. 01 - 2014. 12	한국에프디시법제학회	부회장
2010. 05 - 현재	보건복지부 지정 "동국대학교 의료기기 개발촉진 센터"	센터장
2012. 01 - 현재	대한의용생체공학회	재무이사
2009. 03 - 현재	동국대학교(바이오시스템대학 의생명공학과)	교수
2004. 04 - 현재	한국정밀공학회	편집위원
2008. 10 - 2012. 12	기획재정부(재정사업평가 자문회의)	민간위원
2007. 10 - 2011. 12	지식경제부(차세대기술개발사업 기술위원회_의료기기분과) 위원	

기조강연

좌장 | 문치웅 교수 (인제대학교)
최영빈 교수 (서울대학교)

● **신개념 체성분 분석 기술 개발과 상용화**
차기철 대표이사
바이오스페이스
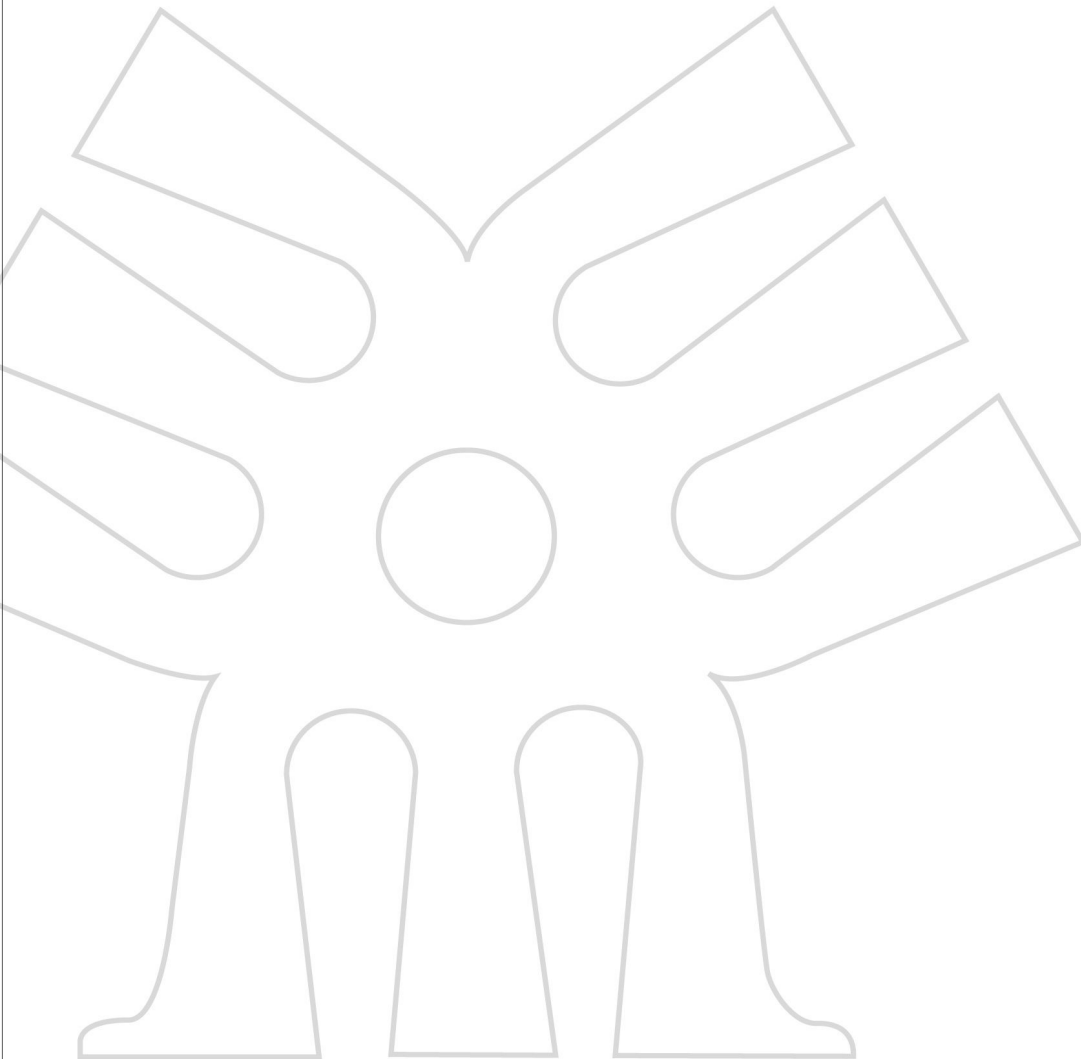
신개념 체성분 분석 기술 개발과 상용화

이름: 차기철
직위: 대표이사
소속: ㈜ 바이오스페이스

Abstract

1969년, 인체의 전기저항은 체내 수분의 양과 깊은 관련이 있다는 호퍼의 논문 발표 후 10년, 이 이론을 바탕으로 미국의 RJL사가 또 다시 10년 후 타니타와 옴론사가 체성분분석기를 상용화하였다. 이를 이용한 연구에서 환자, 비만, 노인, 아동에서 많은 문제가 있다는 결과들이 나오기 시작했다. 왜 그럴까?
몸을 원형 물기둥이라고 가정했는데 팔, 다리, 몸통의 단면적은 굉장한 차이가 있어 다섯 개의 원통으로 부위를 나누어 생각해보는 것이 좋았다. 또 세포내외액을 각각 측정하여 더욱 정확한 측정을 하였다. 쥐의 세포외액의 양을 변경시켜서 실험하였더니 몸통 임피던스는 멀티프리퀀시에 영향을 받지 않았고, 따라서 세그멘탈 측정 시 각 부위의 해석을 달리해야겠다는 결론을 내릴 수 있었다. 또한 전극의 위치에 대한 측정값 변동을 없애기 위해 일정한 지점에서 측정이 시작될 수 있도록 엄지 전극을 개발, 기계가 가지고 있는 단점인 재현도를 보완하였다.

Bio sketch

1980년 연세대학교 기계공학과를 졸업하고 KAIST, 유타대학, 하버드 의대에서 생체공학을 수학한 뒤 바이오스페이스를 창업하여 세계 최초의 획기적인 체성분분석 기술을 개발하였다. 기술력과 품질을 최우선으로 한 가치경영으로 국내에서는 모범적인 성공벤처 사례를 제시하였고 세계에는 국내 의료기술의 우수성을 알리는데 공헌하였다. 인재발굴과 양성, 투명하고 열려있는 기업문화 조성, 근로자 복지증진 등으로 회사발전에 이바지 하고 있으며 차세대 국가 성장 동력이 될 u-헬스케어산업의 발전을 위해서도 최선을 다하고 있다.

특별강연

좌장 | 윤종인 교수 (대구가톨릭대학교)
박중열 교수 (중앙대학교)

: Perspectives for clinical readiness in BME

『 Perspectives in academia 』

● **방사선 기술기반 생체재료 개발과 산업화 전략**
임윤묵 박사
한국원자력연구원

● **Optical Coherence Tomography Combined with Intra-operative Microscope**
김지현 교수
경북대학교

『 Perspectives in industrial investment and human resources 』

● **의료기기 산업 투자 현황과 전망**
김명기 전무
㈜ 인터베스트

● **기업체 연구개발에 필요한 인재성**
박은성 상무
삼성종기원

MEMS Technologies for Biomedical Applications

이름: 임윤묵
직위: 선임연구원
소속: 한국원자력연구원 첨단방사선연구소 공업환경연구부
기타: 한국생체재료학회 학술위원
IRaP 2014 Domestic Committee Member

Abstract

1895년 뢴트겐에 의해 X-선이 발견된 이래로 방사선과 방사성동위원소는 우리 생활에 밀접하게 이용되어져 왔다. 첫 번째는 의료용으로서 질병의 진단과 치료에 사용되며, 다양한 의료용구의 멸균처리에 방사선 기술이 이용되고 있다. 둘째는 농작물의 품종개량이나 해충구제, 식품의 장기간 보존에 활용되고, 셋째는 계측/비파괴 검사, 산업용 신소재의 제조에 방사선 기술이 적용되어진다. 마지막으로 방사선 기술은 연대측정, 환경보전, 유전자공학 등의 다양한 영역에서 활용된다. 특히 이들 중 산업용 신소재 그 중에서도 생체재료로서의 활용으로 하이드로겔의 개발과정과 기술이전 사례를 소개하고 방사선 기술을 활용한 조직공학용 소재의 개발에 대해 설명한다.

Brief Biosketch

1998년	충남대학교 공업화학과 공학석사
1998년	독일 Erlangen-Nuernberg 대학 유기화학연구소 연구원
2005년	한양대학교 화학공학과 공학박사
2006년	한국원자력연구소 방사선이용연구부 Post Doc.
2006년 ~ 현재	한국원자력연구원 공업환경연구부 선임연구원
2012년 ~ 현재	한국생체재료학회 학술위원

- 다수의 방사선 기반 생체재료 개발 연구업적 (기술이전 2건)
- SCI 논문 75편, 국내특허 등록 29건, 해외특허 등록 4건
- 기술가치평가사

특별강연

Optical Coherence Tomography Combined with Intra-operative Microscope

이름: 김지현 (Jeehyun Kim)

직위: 교수

소속: 경북대학교 IT대학 전자공학부

기타: EQ Med CEO

14

Abstract

In this paper, Optical Coherence Tomography (OCT) method is used which is combined with an intra-operative microscope. The cross-sectional image of a sample cannot be determined accurately by using the actual intra-operative microscope. However, by applying the proposed non-invasive method, a real-time micro-invasive surgery can be done without doing any damage to a normal tissue by cutting only the exact diseased area. The stability and the reliability of a surgery can be increased by utilizing this method. OCT system was designed to monitor the real-time images such as 2-D micro-structure OCT images and microscope images which cannot be seen by using the eyepiece of the conventional intra-operative microscope combined OCT. Therefore by applying this method, both the OCT image as well as the conventional microscope image can be viewed separately through the two lenses of the intra-operative microscope eyepiece simultaneously. When the surgery has to be done for a non-microscopic part, an OCT images of the monolayer can optionally be selected and the surgery can be done using the conventional intra-operative microscope images.

Brief Biosketch

1998 ~ 2000	University of Texas at Austin(M. S.-Biomedical Engineering)
2000 ~ 2004	University of Texas at Austin(Ph. D.-Biomedical Engineering)
2004 ~ 2007	University of California, Irvine, Beckman Laser Institute, Post doctor
2007 ~ present	Kyungpook National University, Professor
2008 ~ present	EQ Med CEO

특별강연

의료기기 산업 투자 현황과 전망

이름: 김명기
직위: 전무이사
소속: 인터베스트㈜

Abstract

의료기기 산업은 미래성장 산업으로 인식되어 투자기관에서도 높은 관심을 보이고 있습니다. 의료기기 산업은 치료용 의료기기, 진단용 의료기기를 거쳐 최근에는 mobile health 시장에 관심이 커지며 투자액도 늘어나고 있는 추세입니다. 의료기기 산업은 의약품 산업과 일반 제조업과의 중간정도에 해당하는 규제 강도를 가지고 있어 빠른 투자금 회수가 가능하다는 인식하에 국내에서도 관련된 많은 기업들이 생겨나고 투자를 받고 있는 상황입니다. 그러나 의료기기 산업에 대한 규제 강도가 상대적으로 낮더라도 생산, 판매 등에 대한 많은 제약이 있으며 사업화를 진행하는데 있어 이에 대한 다양한 검토가 선행되어야 한다고 봅니다.

Brief Biosketch

1996년	KAIST 생물공학 박사
1997년	LG화학연구원 선임연구원
2000년	TG벤처 선임심사역
2005년	인터베스트㈜ 전무이사

신약개발, 의료기기, 환경 관련 투자를 수행하는 바이오/제약 팀을 이끌고 있으며 그동안 30여 개 전문기업에 1,000억원 가량의 투자를 진행하였습니다. 현재 신약개발 관련 공공 사업단 투자심사위원을 역임하고 있으며 다양한 과제 평가 업무와 정책 수립에 관여하고 있습니다.

기업체 연구개발에 필요한 인재상

이름: 박은성
직위: 상무
소속: 삼성전자 종합기술원

Abstract

기업체의 연구개발은 대학의 연구개발과는 많은 차이가 있다. 대학 연구의 목적은 새로운 현상의 과학적 근거를 찾아내는 데 있지만, 기업체 연구개발은 제품을 만들어 이윤을 추구하는 데 있다. 즉 어떤 현상의 근거 보다는 그 현상의 실질적인 응용에 관심이 있고 다양한 응용 방식의 구현에 필요한 새로운 접근방식과 유연한 사고력, 넓은 분야의 지식 등의 역량이 기업체 연구개발에서는 선호된다. 특히 대기업에서는 제품으로 나오는 분야가 늘어나다 보니 융합학문이 또 융합하여 새로운 분야를 창출하는 경우가 많고 융합학문의 응용이 낳은 분야가 생기는 경우가 많다. 이런 분야는 대학에서 학문을 통해서는 쉽게 접할 수 없고 직접 현장을 경험해야만 알 수 있는 분야이다. 이런 상황에서 기업체가 경쟁력을 가지려면 자신의 전공 수준을 뛰어넘어 현장에서 새로운 지식을 창출 해내는 능력을 발휘할 수 있는 사람을 선호할 수 밖에 없다. 본 발표에서는 본인의 글로벌 대기업 연구개발 및 사업화 분야 경험과 신입사원 채용의 경험을 바탕으로 대기업 연구개발에 필요한 인재의 모습을 설명 해보고자 한다.

Brief Biosketch

Dr. Park is currently a vice president at Samsung Advanced Institute of Technology, leading a mobile healthcare team. Prior to Samsung, he worked at Medtronic, a world leader of medical devices, for 14 years. At Medtronic, he worked as a team leader of Brachytherapy of Cardiovascular Division and Sr. Manager at Corporate Strategy and Innovation.

초청강연

좌장 | 이성종 박사 (전자정보 융합연구단 PO)

『 한국연구재단 성과발표 』

● **기초연구사업 참여 의공학자 연구실적 분석**
차은종, 천기우
한국연구재단

● **특발성 척추측만증 환자의 동적특성 분석을 통한 보상작용 주요인자 탐색에 관한 연구**
문정환
성균관대학교

● **생체구조 기반의 차세대 이식형 음향센서기술 개발**
조진호
경북대학교

● **생체모방형 인공근육시스템의 연구**
김선정
한양대학교

기초연구사업 참여 의공학자 연구실적 분석

이름: 차은종
직위: 기초연구본부 전자정보융합연구단장
소속: 한국연구재단
기타: 충북대학교

Abstract

의공학(Biomedical Engineering)은 의학과 공학의 융합을 바탕으로 의료기술 발전과 함께 의료기기를 개발하는 학문 분야이며, 21세기의 대표적인 융합연구분야이다. 학문 특성상 의공학 분야 연구자는 다양한 연구 배경을 갖고 있으며, 의공학 분야의 연구실적은 넓은 스펙트럼의 저널에 발표되고 있다. 한국의 기초연구분야를 지원하는 대표적인 사업인 한국연구재단 이공분야 기초연구사업에 참여한 의공학자를 대상으로 최근 10여년간의 연구실적(SCI급 논문)을 연구자(소속기관), 연구자 전공 분야, 발표 저널 분야 등을 분석하여 의공학 관련 세부 분야의 발전 추세 및 연구 동향의 기초자료로 활용하고자 하며, 역동적으로 변화하고 있는 의공학 분야의 과학기술 범주 및 연구분야 분류에 도움을 주고자 한다.

Brief Biosketch

이력

1987	미국 남가주대학 의공학과 박사
1988-현재	충북대학교 의과대학 의공학교실 주임교수
2012-현재	한국연구재단 전자정보융합연구단장

주요 연구 과제

연속 호흡 모니터링을 위한 착용형 호흡 센서 및 시스템 개발, 휴대형 생체진단기기 실용화개발, 유비쿼터스 만성질환 관리시스템 개발, 정밀가공을 위한 미세변위 측정 센서 및 분석시스템 개발, 당뇨환자 자가 혈당검사를 위한 최소통증 채혈기술 개발 등.

특발성 척추측만증 환자의 동적특성 분석을 통한 보상작용 주요인자 탐색에 관한 연구

이름: 문정환
직위: 교수
소속: 성균관대학교 생명공학대학 바이오메카트로닉스학과
기타: 성균관대학교 의과대학 삼성융합의과학원

20

Abstract

특발성 척추측만증은 원인을 알 수 없는 척추변형 질환으로 중・고등학교 여학생의 약 10%에서 나타나며 그 수가 매년 증가하고 있고, 중증일 경우 심장, 폐 등의 기능저하와 요통을 유발할 수 있다. 또한 척추체의 3차원적 변형으로 환자의 요추부, 골반, 하지 등에서 보상작용이 발생하여 보행 및 균형유지 등의 동작에서 동적인 기능 손실이 발견되고 있으나, 현재 주로 활용되고 있는 검사 방법은 정적인 상태에서 2차원적으로 평가하는 방사선적 기법이기 때문에 환자의 기능적, 동적 특성을 평가하기 어렵다. 따라서 이러한 특발성 척추측만증 환자의 동적 특성을 평가할 수 있는 정형화된 방법이 필요하지만 현재 관련된 기초연구가 부족하여 척추측만증의 동적 특성을 분석할 수 있는 주요 인자에 대한 정보가 없고 이와 관련된 데이터베이스 또한 확보되어 있지 않다. 그러므로 본 연구과제에서는 특발성 척추측만증 환자의 동적 특성을 정량적으로 분석할 수 있는 주요 인자를 탐색하고, 이에 대한 데이터베이스를 확보하여 향후 환자의 동적 평가를 위한 기초자료를 구축하고자 한다.

Brief Biosketch

1998	University of IOWA 기계공학과 박사학위 취득 : 의공학
2002 ~ 현재	성균관대학교 생명공학대학 바이오메카트로닉스학과 교수
2010 ~ 현재	성균관대학교 의과대학 삼성융합의과학원 교수
2007 ~ 현재	성균관대학교 인체운동분석센터 센터장

생체구조 기반의 차세대 이식형 음향센서기술 개발

이름: 조진호 (Jin-Ho Cho)
직위: 교수
소속: 경북대학교 IT대학 전자공학부
기타: 경북대학교 의학전문대학원 의공학교실

Abstract

Many countries have been tried to develop fully implantable middle ear hearing aids which are clinically effective and safe by their expert researchers and hearing aid companies. However, so far, it was unsuccessful mainly due to the unavailability of high performance implantable microphone among various components of implantable hearing aids, such as signal processor, vibration transducer, implantable battery, and etc. Even in cochlear implant case, it has been required a good implantable microphone to realize fully implantable cochlear implant. In this paper, we have developed a high performance implantable microphone which can make use of the properties of human hearing organ including middle ear mechanics and characteristics of sound propagation from the outer ear to the inner ear. The proposed implantable microphone pick up the sound directly in the ear cannel by a small diameter guide tube (OD:1.4 mm, ID:0.8 mm) which is percutaneously installed at the middle of tympanic membrane. Then the sound in guide tube is detected without any loss by a tiny microphone element installed in the middle ear cavity wall. Therefore, the system can provide the advantages not only effectively eliminate mastication noise and head touch noise but also it can obtain the pinna effect and ear canal gain in mid band frequencies.

Brief Biosketch

1988. 2	Ph. D: Major in Biomedical Electronics, Graduate School, Kyungpook National Univ. (KNU)
1984. 4 ~ Currently	Professor, School of Electronics Eng., College of IT Eng., KNU
2010. 3 ~ 2012. 3	Dean, College of IT engineering, KNU
2010. 1 ~ Currently	Chairman, Biomedical Eng. Research Expert Group in Daegu - Kyungpook Area
2012. 1 ~ 2012. 12	Chairman, Korea Society of Medical and Biomedical Engineering.

Research interest

Development of implantable hearing aids, Biomedical sensor systems & signal processing

생체모방형 인공근육시스템의 연구

이름: 김선정
직위: 교수
소속: 한양대학교

Abstract

자연은 이미 지난 수억년 동안 나선형으로 감긴 근육을 기반으로 하는 회전구동을 이용하고 있으며, 코끼리와 문어가 그들의 코와 다리를 꼬는 행위도 이에 해당한다. 코끼리와 문어 근육에서 나선형의 근육섬유는 뼈가 없는 비압축성 중심 조직에 대항하는 방식으로 수축하게 되며 이러한 과정에서 회전운동이 일어난다. 본 연구에서는 나선형으로 꼬인 탄소나노튜브들이 전기화학적으로 충전이 일어나는 동안 길이 변화는 거의 일으키지 않으면서 전해질에 의한 다공성 인공근육 실의 부피 팽창으로 회전 구동을 발생시켜 기존의 인공근육에 비해 단위 길이당 회전력이 1,000배나 우수한 새로운 형태의 인공근육 발견 성과를 나타냈다. 이러한 간단한 구동 원리, 큰 회전각, 높은 회전 속도 및 마이크로 크기의 실 직경 특성이 조합된 탄소나노튜브 실을 이용한 인공 근육은 특히 마이크로유체 펌프, 밸브 구동기 및 믹서 등의 응용에 기여할 수 있다.

Brief Biosketch

연구수상실적

- 2009 최우수 교수상(한양대학교)
- 2007 국가연구개발 우수성과 100선(미래창조과학부)
- 2007 대표적 우수성과 50선(한국연구재단)
- 2006 대표적 우수성과 50선(한국연구재단)

신진연구자

좌장 | 황도식 교수 (연세대학교)

● **Genetic modifiers modulating neuronal toxicity in neurodegenerative diseases**
나도균 교수
중앙대학교

● **Graphically encoded microparticles for bioapplicaions**
박 욱 교수
경희대학교

● **Inverse geometry CT system : a new concept for x-ray computed tomography**
백종덕 교수
연세대학교
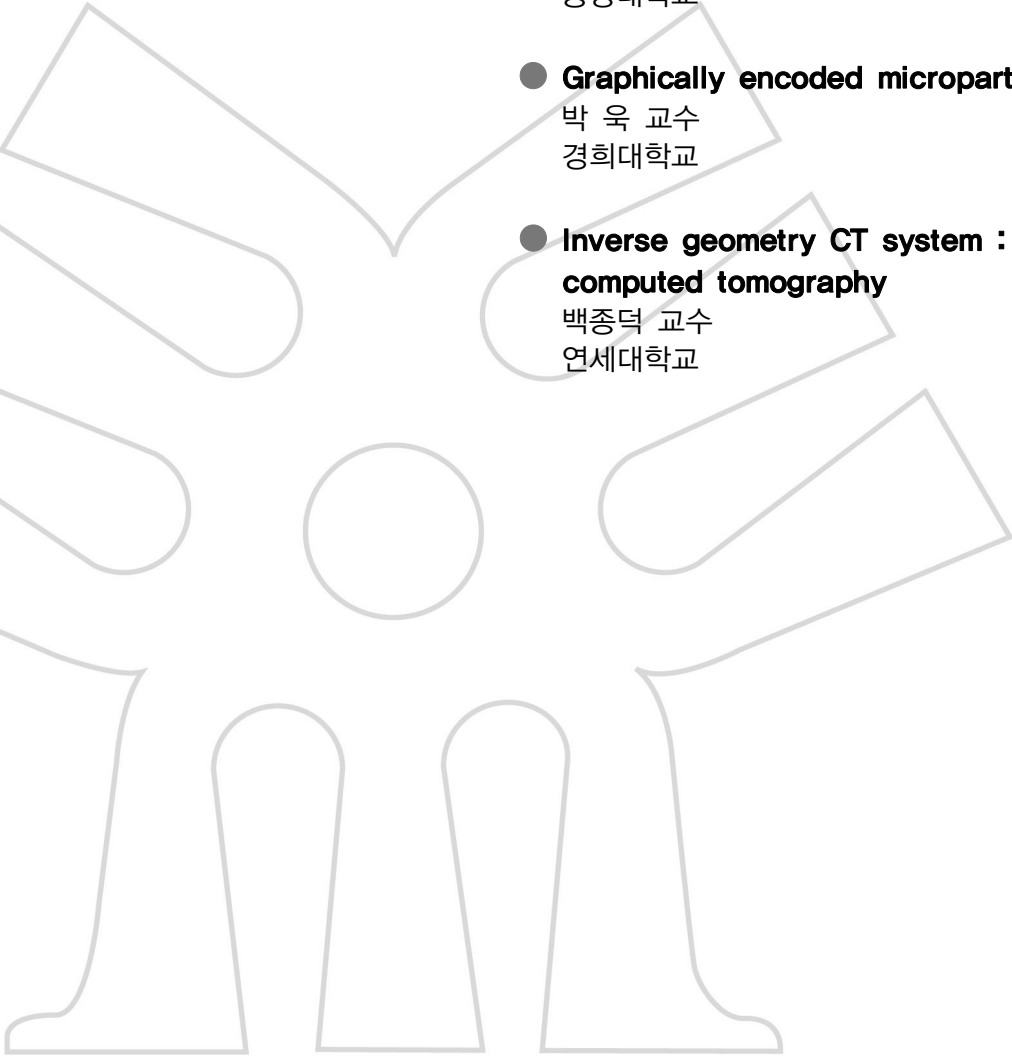
Genetic modifiers modulating neuronal toxicity in neurodegenerative diseases

이름: 나도균

직위: 조교수

소속: 중앙대학교 융합공학부

Abstract

Intracellular protein aggregation is a feature of many late-onset neurodegenerative diseases. These include Alzheimer's disease, Parkinson's disease, and nine polyglutamine expansion diseases exemplified by Huntington's disease. The pathophysiology of neurodegenerative diseases is very complex, which is one of the reasons why there are no effective strategies that slow or prevent neurodegeneration. In recent years, significant efforts have been made to identify genes that modify severity of neurodegenerative diseases. In order to understand the complex nature of the pathological processes underlying proteinopathies, we developed a database of genetic modifiers from nine disease models from three model organisms. We then developed a computational model to identify common genetic modifiers that are able to modify disease phenotypes in multiple neurodegenerative diseases. The model utilized our database as well as available genomic databases including sequences, gene expression, protein interaction networks, etc. These common genetic modifiers provide hints to understand the common features of neurodegeneration and they would be prime therapeutic targets. We also developed a computational model to identify genetic modifiers in a particular neurodegenerative disease, Huntington's disease, that are able to induce substantial change in neurodegeneration. Our efforts on identifying key genetic modifiers by systems approach would help unveil the underlying complex mechanisms of neurodegeneration and would help find novel therapeutic targets.

Brief Biosketch

Research

Synthetic Biology	Synthetic genetic networks for in vivo protein evolution. Synthetic small regulatory RNAs for high-throughput metabolic engineering. Synthetic ribosome binding sites with a desired expression level.
Systems Biology	Computational models/algorithms on immune suppression, mRNA translation, protein aggregation, protein autoinhibition
Nanotechnology	Microfluidic devices for rapid and accurate permeability assay.

Research Experiences

Sep 2013-Present	Assistant Professor. School of Integrative Engineering. Chung-Ang University
Jan 2012-Aug 2013	Research Associate. Centre for High-throughput Biology. University of British Columbia, Canada.
May 2011-Jan 2011	Assistant Research Professor. Department of Chemical and Biomolecular Engineering. KAIST
Sep 2008-May 2011	Post-doctoral Fellow. Department of Chemical and Biomolecular Engineering. KAIST
Feb 2008-Aug 2008	Post-doctoral Fellow. IBM-KAIST Computing Research Center. KAIST

Education

Sep 2002-Feb 2008	PhD. Department of Bio and Brain Engineering. KAIST
Sep 2000-Feb 2002	Master's degree. Graduate School of Biotechnology. Korea University
Mar 1996-Feb 2000	Bachelor's degree. Division of Life Science. Korea University.

Graphically encoded microparticles for bioapplicaions

이름: 박 욱 (Wook Park)
직위: 조교수
소속: 경희대학교 전자전파공학과

Abstract

다양한 방법의 비구형의 마이크로입자 기술이 개발되고 있다. 기존의 단순한 구형을 넘어서, 다양한 형태의 입자의 제작이 가능해졌으며, 이에 따라 기존에 단순한 바코드에서 복잡한 패턴까지 다양한 그래픽적인 코드화 입자의 생성이 가능하였다. 본 발표에서는 광경화 미세유체 공정을 사용하여 다양한 모양의 코드화된 폴리머 입자를 생성하고, 이를 이용하여 다양한 분야로 응용할 수 가능성을 선보인다. 대량의 데이터를 저장하기 위해서QR code 기술을 사용하여 제작된 입자는 위조약 방지 기술에 응용될 수 있음을 보이며, 자연의 무작위 패턴이 나오는 기술을 이용한 기술로 제작된 입자는 각 입자가 유일무이한 코드를 가진 입자를 가짐으로써, 물리적으로 복제할 수 없는 기능을 가지게 된다.

Brief Biosketch

1997 - 2002	서울대학교 공과대학 전기공학부 학사
2006 - 2011	서울대학교 공과대학 전기공학부 석,박사
2011 - 2012	서울대학교 반도체공동연구소 대통령포닥
2012 - 현재	경희대학교 전자전파공학과 조교수

Inverse geometry CT system : a new concept for x-ray computed tomography

이름: 백종덕
직위: 조교수
소속: 연세대학교 공과대학 글로벌 융합 공학부
소속: 연세대학교 미래융합기술연구원

27

Abstract

2009년 보건복지부 발표자료에 의하면 한국인이 평균수명까지 생존 할 경우 암에 걸릴 확률은 남자가 3명 중 1명, 여자가 5명 중 1명이라고 합니다. 많은 경우, 암은 조기 발견시 완치가 가능하고, 이를 위해 PET, MRI, CT, US와 같은 많은 의료 영상 장비들이 사용되고 있습니다.   하지만, 최근 시카고 대학의 연구 결과에 따르면, CT를 통한 cancer screening의 성공율은 76%에 불과하다고 합니다. 이는 기존의 CT system 이 가진 image quality의 한계 때문인데요, 이번 발표에서는 기존 시스템의 한계를 극복할 수 있는 새로운 개념의 CT system (Inverse geometry CT system)을 소개하고, reconstruction algorithm과 이와 관련된 artifact correction method에 관해 이야기하겠습니다.

Brief Biosketch

백종덕 교수는 2004년 연세대학교 전자공학과를 졸업하고, 스탠포드 대학 전자공학과에서 2007년과 2009년에 석사 및 박사 학위를 취득하였다.

2011년까지 동 대학에서 박사후 연구원으로 재직한 후 2012년 연세대학교 글로벌융합공학부 교수로 임용되었다.

학위 과정 동안, GE Global Research Center와 새로운 형태의 컴퓨터 단층 촬영장비인 Multi-source Inverse-Geometry CT(MS-IGCT) system개발을 8년간 수행하였으며, 현재 한국에서는 삼성 전자와 함께 차세대 CT system 개발을 진행하고 있다.

백종덕 교수의 연구분야에는, CT 시스템 개발, CT 영상 복원 알고리즘 개발, CT artifacts 보정 기술 개발, CT 영상 화질평가, x-ray detector 기술 개발이 포함된다.

학생연구자 발표

좌장 | 박지호 교수 (KAIST)
성준경 교수 (고려대학교)

● **Biomedical Optics**
신현구

● **Medical Imaging**
이우진

● **Medical Nano and Microtechnology**
Samriddhi Ghimire

● **Neural Engineering**
이슬비

● **Tissue Engineering and Biomaterials**
최성윤

31
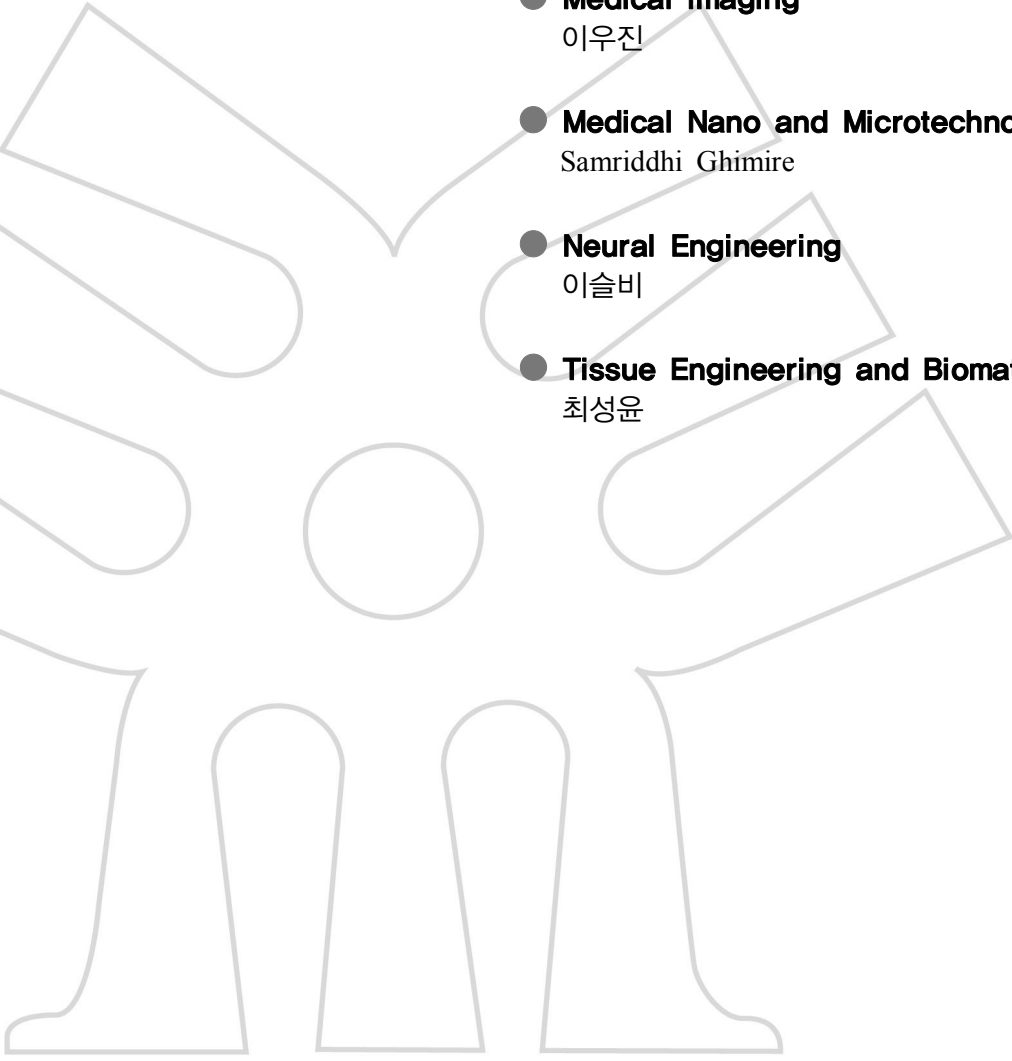
Biomedical Optics

생체 내 응용을 위한 플라즈몬 공명 에너지 전이 현상 기반 실시간 비표지 대면적 pH 나노센서

신현구, 최연호

고려대학교 생체의공학과

In spite of many researches about cell biology, pH detection in a small part of a living cell is limited in real time detection and complex preprocessing. Here, we demonstrated in-situ, label-free, a large area pH nanosensor by Plasmon Resonance Energy Transfer (PRET). We induced PRET between a single gold nanoparticle (GNP) and phenol red. In condition between pH 6 and 9, the single GNP has the special changes in the Rayleigh scattering profile at the wavelength of 560 nm. In addition, we designed the plasmon metal complex of Au and Ag for pH mapping of a living cell.

Medical Imaging

다중판별분석을 이용한 멀티에너지 CT 영상에서의 물질 분류

이우진[1], 김대승[2], 우상윤[1], 강세룡[1], 이원진[2]

[1]서울대학교 의과대학 협동과정 방사선응용생명과학
[2]서울대학교 치과대학 구강악안면방사선학교실

Energy resolving detectors provide more than one spectral measurement. The purpose of this study is to investigate, with experiment, the ability to decompose five materials using energy discriminating detectors and multiple discriminant analysis (MDA). Linear attenuation coefficient was considered as features of multiple energy CT. MDA was used to decompose five materials with six measurements of the energy dependent linear attenuation coefficients. A small field-of-view energy discriminating CT system was built. The results of the experimental study showed that a CT system based on CdTe detectors with MDA can be used to decompose five materials.

Medical Nano and Microtechnology

Colorimetric detection of Mycobacterium lipoarabinomannan on a strip test using gold nanoparticle

Samriddhi Ghimire[1], Jichul Hyun[3], Sung Yang[2,3]
[1]Department of Nanobio Material and Electronics
[2]Department of Medical System Engineering
[3]School of Mechatronics, GIST

Test strip for colorimetric detection is a platform for detection of Lipoarabinomannan (LAM) which is present in patients with tuberculosis disease. LAM is a polysaccharide in the cell wall of Mycobacterium tuberculosis, a causative organism of tuberculosis. The presence of LAM can be detected by appearance of two red lines (test and control) on nitrocellulose membrane as a result of interaction between LAM, which is allowed to flow from sample pad, and monoclonal Anti-LAM immobilized gold nanoparticle (Test) complex with polyclonal Anti-LAM as well as streptavidin immobilized on the same gold surface with Biotin-BSA (Control). Test strips are most suited for resource poor settings; they provide advantages such as low cost, easy to use and portable. Detection of LAM using a test strip is a simple, rapid and inexpensive point-of-care platform.

Neural Engineering

손목 동작에서의 sEMG를 이용한 휴먼-컴퓨터 인터페이스

이슬비[1], 지영준[2]
[1]울산대학교 의공학과
[2]울산대학교 전기공학부

This study aims to develop the human-computer interface using sEMG by wrist movements which replace the joystick. We divide the wrist movements into four directions and select the muscle that most activates when move the wrist to each direction. The measured signal is pre-processing, calculate the RMS, extract the feature and classify the gesture using LabVIEW. We experiment three test, 4 channels 2 levels (80~100%), 4 channels 3 levels (90~100%),
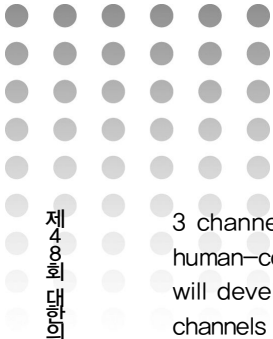
3 channels 3 levels (70~80%). We developed the human—computer interface using 4 channels, and we will develop the human—computer interface using 3 channels with high accuracy to compensate the signal processing.

Tissue Engineering and Biomaterials

32

흉터 형성 억제를 위한 약물전달기능 생체흡수성 외과용 봉합사

최성윤[1], 김병휘[4], 정웅[3], 박민[1], 박천권[1], 허찬영[2,3], 최영빈[1,4,5]

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Scar, mostly formed locally at the wound, is troublesome for the patients after surgery. Especially, with the patients at a high risk of hypertrophic scar formation, this would be considered serious, thereby need in more an active strategy in therapy. For this purpose, in this work, we suggest a surgical suture enabled with delivery of an anti—scarring drug, tranilast. To fabricate the drug—delivery suture, we separately prepared a drug—loaded sheet of poly (lactic—co—glycolic acid) (PLGA), which was physically assembled with a surgical suture already in clinical use. As controlled drug delivery would be a key factor to reduce scar during wound healing, we modified only the drug—loaded sheet and in this way, the mechanical strength of the suture itself could be retained to a large extent. The drug—delivery suture herein could release the drug for up to 10 days, and it could be effectively inhibit the scar formation in vivo.

POSTERS

● **Biomedical Engineering Education and Career**

● **Biomedical Optics**

● **Biomedical Robotics**

● **Cardiovascular Engineering**

● **Medical and Bio−informatics**

● **Medical Imaging**

● **Medical Nano and Microtechnology**

● **Neural Engineering**

● **Orthopedic and Rehabilitation Engineering**

● **Respiratory Engineering**

● **System Biology, Physiological Modeling**

● **Tissue Engineering and Biomaterials**

● **U−Health, e−Health.m−Health Technology**

Biomedical Engineering Education and Career
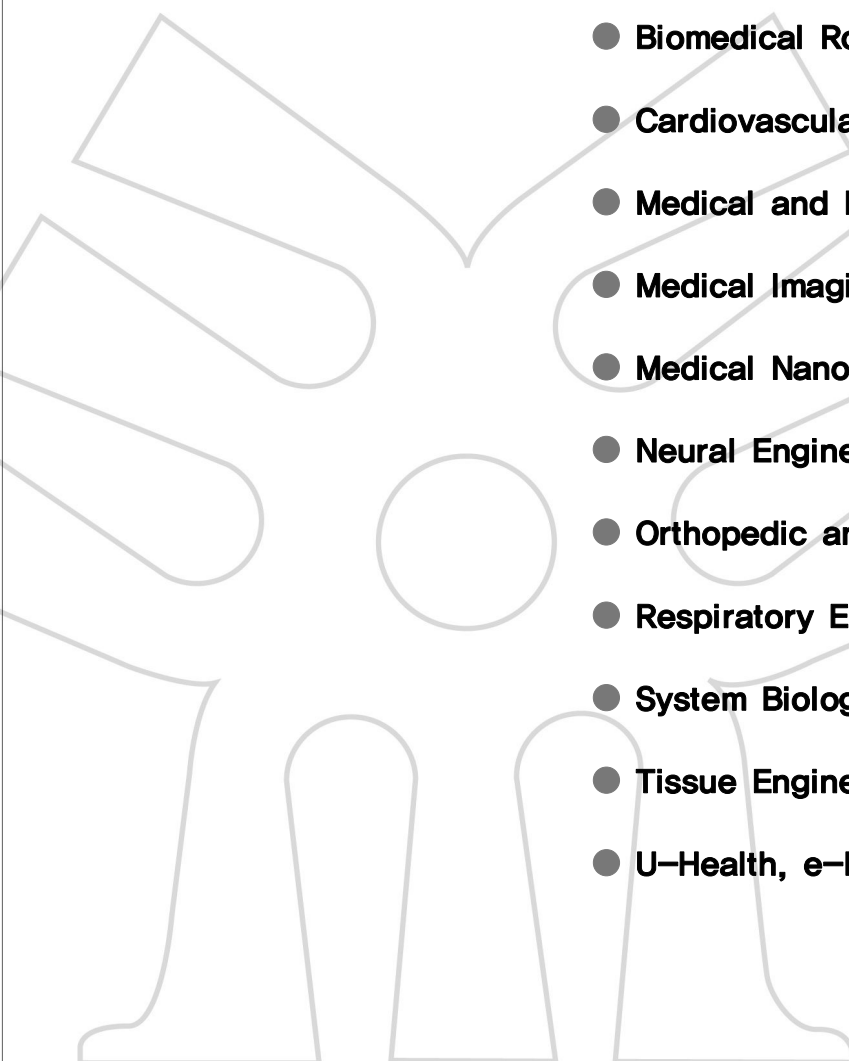
P-001 의료기기 오염 관리를 위한 표준지침 구축

민경환[1], 김승훈[1], 김만기[1], 김종순[1], 신동익[1],
허수진[1,2], 주세경[1,2]

[1]서울아산병원 의공학과
[2]울산대학교 의과대학 의공학교실

Increasing of infection that occurs in the hospital as a social issue has been raised. 300,000 people every year, due to the infection is increasing and the number of days hospitalized. The results of about 15,000 people lost their lives and the economic loss is having a medical dispute.

In this study, exposed to hospital infections and medical device to identify and determine the extent of contamination of the current level and to determine the level of contamination by improving enforcement activities aims to build a safe medical system.

P-002 의료기기 평가 Tool 개발을 통한 관리 방안 개선

사은식[1], 오주현[1], 김진만[1], 김종순[1], 신동익[1],
허수진[1,2], 주세경[1,2]

[1]서울아산병원 의공학과
[2]울산대학교 의과대학 의공학교실

In replacing medical equipment, the decision has been made based on a subjective judgment rather than an objective evaluation. In this paper, we describe the activities to build up the data required for the establishment of policy of medical equipment replacement. At first, we are digitized several parameters such as clinical performance, revenue effect and technical performance evaluation for target medical equipments. With the parameters, we could classify the state of medical equipment as pending section, review section, and replacement section and by providing the data to the equipment managing boards, replacement decision can be made in objective manner.

P-003 PET-CT 기기의 안전관리 활동을 통한 유지보수 개선활동 연구

이근호[1], 조성범[1], 진경원[1], 김종순[1], 신동익[1],
허수진[1,2], 주세경[1,2]

[1]서울아산병원 의공학과
[2]울산대학교 의과대학 의공학교실

PET-CT is called a Positron Emission Tomography Computed Tomography, can examine the functions in the tissues of our body and biochemical metabolism of department of nuclear medicine. To scan the main constituents of the body, that are injected intravenously and made by the synthesis of radiopharmaceuticals, it detects positrons through the Detector Block in PET-CT system. Through this, the body's tissues or metabolic disorders, brain-heart diseases, the diagnosis and early detection and treatment of various cancers used to determine the effect will be. By the detector characteristics of PET-CT system, it is very important to management a stable state and on the condition based maintenance activities. In order to implement environmental of the best medical equipment, by analyzing the factors of PET-CT system, will continue to realize a stable scan environment.

P-004 공기흐름을 이용한 촉감제시 장치의 개발

정율호, 이정철, 박성준, 백지혜, 홍상표, 최미현,
김현주, 정순철, 김형식

건국대학교 의학공학부 의공학실용기술연구소

In this study, we developed a tactile stimulator based on blow and suction of airflow. The developed stimulator consists of three parts; control, drive part, and actuator. From the results, two types of tactile stimulation was displayed stably in 6×6 mm2 stimulation region. It is expected to be utilized for tactile studies on pressure stimulation.

P-005 유한요소 모의실험을 이용한 피부 임피던스 모델의 비침습적 측정법

김민수[1], 조영창[2], 손창식[1], 허윤석[3], 이종하[3],
김윤년[1,3,4]

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[2]경운대학교 항공정보통신공학과
[3]계명대학교 의공학과
[4]계명대학교 동산의료원

Human impedance is a measurement technique that has been investigated in a wide variety of medical diagnosis. The skin model consisted of a 0.020mm

stratum corneum, 0.130mm living epidermis, 1.1mm dermis and 1.2mm subcutaneous fat. In this work, standard flat electrodes are characterized with a finite element method AC conductivity solver and the dependence of the non-invasive impedance on geometrical factors is explored. Non-invasive measuring with different characteristic geometries measure biophysical properties at separate penetration depths in the tissue and have therefore different sensitivities to e.g. physiological processes in the tissue. Experimental result supports the conclusions drawn from simulation output.

P-006 조이스틱을 이용한 PACS 사용자 인터페이스 개선

임기선, 오왕균, 차은종, 이태수
충북대학교 의용생체공학과

In the environment of digital hospital, doctors view medical images through computer monitors to make clinical report of patients. During this operation, if they view the monitor and use keyboard and mouse more than four hours continuously with rigid posture, they have the risk of musculoskeletal disease, such as, VDT syndrome and Carpal tunnel syndrome. In this paper, radiological doctor friendly interface was proposed using game controller device. When joystick was used to emulate function keys of keyboard and mouse, it made doctors to perform their daily task as if sitting on a sofa comfortably. Therefore, this method may be helpful to prevent the hard working doctors from musculoskeletal diseases.

P-007 점적센서를 이용한 수액주입펌프 검사기의 개발

장우영, 박근철, 전아영, 이상훈, 김수성, 노정훈
부산대학교 의학전문대학원 의공학교실

A convenient and economic volumetric flowmeter has been developed to test infusion pumps using drop sensor components easily available in the hospitals. An algorithm for measuring the volume of a fluid drop passing through an intravenous drip chamber was found through a review on the physics of liquid drop formation. The dependence on drip interval and temperature on the volume of a falling pendant drop has been taken account to the total volume estimation.

A microprocessor based system was developed to realize the algorithm. The error of the implemented system is within 2% through the flow rate range of up to 2000 mL/h. The implemented system has enough precision of flow rate measurement and easy to apply for the infusion pump preventive management.

P-008 초음파수술흡인기 핸드피스의 고장유형에 관한 고찰

김홍규, 정석범, 이호석, 전석봉, 임효순
삼성서울병원 의공기술실

The ultrasound surgical aspirator is the medical equipment which is used for fragmentation and aspiration of tissue in the human body. The equipment consists of a handpiece and a main console. The handpieces have much more frequent failure trending than that of the main consoles. In this paper, we analyzed the failure pattern and causes of handpiece failures from recorded data. Also, we would suggest how to reduce the failures of handpieces and use them more safely.

P-009 피부의 탄성변화를 이용한 정량적 림프부종 진단 시스템 개발

서종현[1], 조창노[1], 김성천[1], 정승현[2], 김광기[1]
[1]국립암센터 융합기술연구부 의공학연구과
[2]국립암센터 지원진료센터 재활의학클리닉

Lymphedema is a phenomenon in which fluid is accumulated inside tissues due to the damaged lymphatic systems. Lymphedema can cause changing skin elasticity. In this study, a lymphedema screening system based on the elasticity of the skin is proposed to easily quantify lymphedema. The developed system can be used to estimate the change in the elasticity of the skin to quantify lymphedema by measuring the indentation force on the skin and the return time of the skin. It was found that the increase in the elasticity leads to a higher indentation force and shorter return time using gelatin gels.

P-010 초음파 수술기 임피던스를 이용한 조직 분류 연구

김홍래[1], 김성천[1], 김광기[1], 김영우[2]

[1]국립암센터 융합기술연구부 의공학연구과
[2]국립암센터 이행성 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 fat and skin tissue, tendon, liver and protein all have different impedance values of 420 Ω, 490 Ω, 530 Ω, and 580 Ω, respectively. This relationship will be used to improve the energy efficiency of ultrasonic shears.

P-011 이동형 의료기기 충전지의 효율적인 관리에 관한 고찰

김태종, 김현준, 서현원, 김승엽, 김원규, 임효순
삼성서울병원 의공기술실

Using the portable medical equipment for the diagnosis and treatment of patients is becoming more common. Many of the potable medical equipment using the battery are related to life of the patients. If the battery is dead, it may be happen the fatal and terrible situations to patients. In that reason, the battery of portable medical equipment is need to be paid particular attentions for effectively managed. In this paper, I would suggest the effective management strategy of the battery which is used in portable medical equipment, especially the life support equipment in hospital.

Biomedical Optics

P-012 산광형 파이버를 이용한 자궁내벽 광치료 해석

권진희[1], 신현[1], 이창용[2,3], 오정환[1,3], 강현욱[1,3]

[1]부경대학교 의공학과
[2]부경대학교 기계공학과
[3]해양과학 MIBT 융복합 센터

A balloon-catheter optical diffuser for endometrial treatment was evaluated with computational analysis. Various catheter materials and dimensions were implemented to identify the optimal device design for photocoagulation. Temperature growth during 30-sec irradiation of 532-nm light demonstrated thermal insulation effects of the polyurethane catheter. The current model revealed the degree of thermal coagulation 13% thicker than experimental results possibly due to lack of tissue dynamics and light intensity distribution. In combination with photon distribution, the analytical simulation can be a feasible tool to optimize the new optical device.

P-013 휴대용 HIFU을 이용한 동맥지혈 치료 연구

Nguyen Van Phuc[1], 오정환[1,2,3], 강현욱[1,2,3]
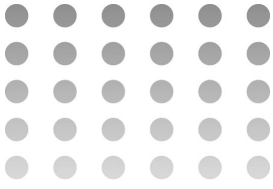
[1]부경대학교 의생명융합공학과
[2]부경대학교 의공학과
[3]해양과학 MIBT 융복합 센터

High Intensity Focused Ultrasound (HIFU) has been used to arrest bleeding from punctures in blood vessels. While previous studies have focused on potential clinical benefits of HIFU in hemostasis of incised livers, spleens and kidneys, this study was to develop an integration of photoacoustic tomography (PAT) and high power HIFU system for blood coagulation of severe vascular injury. Complete hemostasis was achieved in nine treatments, along with the treatment times of 5 to 10 seconds. The proposed HIFU system may provide an effective method for immediate blood coagulation for arteries and veins in clinical applications.

P-014 확산 분광 기술을 이용한 생체유사조직의 천공 깊이 측정 연구

김태훈, 이귀원, 윤종인
대구가톨릭대학교 의료과학대학 의공학과

Bone drilling is widely used in orthopedic surgery, neurosurgery and reconstructive surgery. However, the lack of adequate feedback system for depth measurement is a major problem of the drilling procedure. In this study, a simple spectrometer system which can measure the diffusive scattering light in tissue phantoms was developed for the crater

depth measurements. Craters were formed by a soldering iron on a hard-tissue phantom and the backscattered light from the sample was measured at each 2 mm in depth. A light source was apart from a spectrometer in a few centimeters based upon the light path length in tissue samples. The results showed that the intensity of the backscattered light decreased as the depth increased due to the restriction of light propagation in the hole region. This technique may help to measure the hole depth in real-time for bone drilling.

38

P-015 GRIN 렌즈 내시경을 이용한 내부 장기의 세포수준 영상화

안진효[1], 왕태준[2], 최기백[1], 황윤하[1], 김기현[3], 김필한[1]

[1]KAIST 나노과학기술대학원
[2]포항공대 융합생명공학부
[3]포항공대 기계공학과

Intravital fluorescence microscopy has been used as a powerful tool to visualize biological phenomena in vivo. However, due to bulky size of objective lens, conventional in vivo microscopy studies have been mostly limited to visualizing surface of skin or artificially exposed tissues. In this work, we developed 2.2mm diameter endoscopic imaging probes constituted by multiple graded-index (GRIN) lens and micro-prism. By integrating the GRIN lens endoscope to confocal microscope, minimally invasive visualization of microvasculatures and fluorescent cells in small intestine and colon was demonstrated in vivo, which can provide new way to investigate pathophysiology of human disease originated from epithelium of gastrointestinal tracts by longitudinal monitoring at cellular level.

P-016 Peak-hold 회로를 활용하여 측정 안정성을 향상시킨 Time-division Multiple Access 방식의 fNIRS 시스템 개발

홍승혁[1], 백현재[2], 박광석[3]

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[3]서울대학교 의과대학 의공학교실

In the paper, utilizing the peak-detection technique to the time division multiple access fNIRS was described. An in-house fNIRS includes the time division multiplexing due to measure cerebral hemodynamics using multiple channels. It has uncertainty of data acquisition because of the ripple voltage of source, noise and the difference of sampling timing of analog-to-digital convertor. The idea to overcome the limitation was to hold the peak of light. After applying peak-hold circuits, the variation of steady-state signal was observed for comparison of stability between a former and the peak-holding TDMA fNIRS system.

P-017 토끼 결막하의 종양 형성 모델 개발

황상석[1,2], 박은기[1,3], 옥철호[1,4], 안예찬[1,2]

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[2]부경대학교 의공학과, 의생명융합협동과정
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Conjunctival squamous cell carcinoma(SCC) is an uncommon disease. However, SCC has recently become an important clinical problem due the identification of a high incidence of SCC among a group of black African patients with AIDS. However, basic research concerning SCC is limited due to the lack of an ocular tumor animal model. In the present study, we describe the development of a reproducible model of subconjunctival squamous carcinoma in moderate-sized immunocompetent rabbits. Under optical coherence tomography(OCT) guidance, VX2 carcinoma cells were inoculated into the subconjunctival space of rabbits. Malignant tumor involvement developed on the subconjunctival space.

P-018 기관손상 후 지방 줄기세포 생착과 아급성 기도개형의 광학 이미징

채유경[1,2], 김성원[1,3], 박은기[1,4], 옥철호[1,5], 안예찬[1,2]

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[3]고신대학교 의과대학 이비인후과
[4]고신대학교 의과대학 인문사회학교실
[5]고신대학교 의과대학 내과

Acquired airway injury is frequently caused by endotracheal intubations, long-term tracheostomies, and some systemic diseases. An effective and less

invasive technique for both the early assessment and interventional treatment of airway stenosis is therefore needed. Optical coherence tomography (OCT) has been proposed to have unique potential for early monitoring. Additionally, stem cell therapy using adipose stem cells is generally used in option for early interventional treatment in airway and lung injury. The purpose of this study was to assess the engraftment of exogenous adipose stem cells in injured tracheal epithelium with fluorescent microscopy and to detect and monitor the degree of airway injury with OCT. OCT detected thickening of both the epithelium and basement membrane after tracheal scraping. The engraftment of adipose stem cells was successfully detected by fluorescent staining in the regenerative epithelium of injured tracheas.

P-019 근접방사선 치료용 베타선원 검출을 위한 체렌코프 방사선 센서의 기초 연구

김재석, 신상훈, 전다영, 심혁인, 홍승한, 김선근, 장경원, 유욱재, 이봉수

건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소

To detect beta-particles emitted from the brachytherapy source, we measured Cerenkov radiation generated in various Cerenkov radiators, such as aerogel, CaF_2, SiO_2, and Al_2O_3. Since Cerenkov threshold energies are determined by the refractive indices of Cerenkov radiators, the intensities of Cerenkov radiation varies according to the type of Cerenkov radiator. As a fundamental research, in this study, we verified various optical windows to detect the beta-particles.

P-020 중피종 의광학 연구를 위한 설치류 장막 창 형성 모델 개발

황상석[1,2], 박은기[1,3], 옥철호[1,4], 안예찬[1,2]

[1]의공학 임상혁신 융합 연구단
[2]부경대학교 의공학과, 의생명융합협동과정
[3]고신대학교 의과대학 인문사회학교실
[4]고신대학교 의과대학 내과

Mesothelioma induced by an asbestos is reported more frequently than ever. However, basic research concerning the mesothelioma is limited due to the lack of an animal model. Observation of tumor growing in mesothelium is important since it can help early diagnosis and proper treatment. The mesothelium, however, is difficult to be accessed or observed. In this study, we developed an omentum window model that enabled us to easily access and optically observe the mesothelioma in an early stage.

P-021 광산란감소물질과 공초점 현미경을 기반으로 한림 프절 구조의 세포수준 영상화

송은주, 서호원, 최기백, 황윤하, 안진효, 김필한

KAIST 나노과학기술대학원

Structural analysis of biological samples based on sectioning optical microscopy has been limited by light scattering. Recently, it have been demonstrated that optical clearing, a technique based on refractive index matching, can reduce light scattering and help to visualize cellular structures deeper inside. Lymph node is a secondary lymphoid organ crucial for adaptive immune response mediated by many subtypes of immune cells tightly packed in accordance with highly specialized structure. Cellular-level 3D visualization of whole intact lymph node in the context of functionalized structures is highly desirable. Herein, we applied optical clearing agent, glycerol and FocusClearTM, to achieve 3D visualization of fresh dissected lymph node, which clearly revealed various cellular structure such as T cell zone, B cell follicle and germinal center.

P-022 레이저 스펙클 대조비 이미징을 이용한 광혈전에 따른 혈류 변화 관찰

조아라[1], 연찬미[2], 정연수[2], 정의헌[1,2]

[1]GIST 기전공학부
[2]GIST 의료시스템학과

Recently, laser speckle contrast (LSC) imaging has become one of the most widely used optical methods for in vivo assessment of blood flow in the animal brain. This technique is useful to monitor brain hemodynamics surrounding the lesion of stroke. A laser diode-based speckle contrast imaging system is implemented with back-illumination. LSC images before and after photothrombotic event was obtained as a model of local ischemic stroke. The LSC imaging
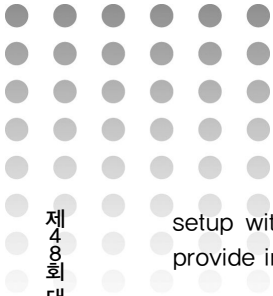
setup with photothrombosis preclinical model can provide insight into the mechanistic study of stroke.

P-023 마우스 대장암 모델에서 종양 진단을 위한 형광 내시경 시스템 개발

오경석[1], 유수웅[2], 박영롱[3], 김성지[3], 김기현[4], 명승재[5], 정의현[1,2]

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Early detection and treatment of gastrointestinal (GI) diseases require specific markers and endoscopic imaging. Molecular targets that are overexpressed in transformed mucosa relative to normal can provide imaging contrast for efficient detection. Especially, the target with fluorescence allows endoscopist to identify suspicious lesions with altered various fluorescence as potential biopsy. We develop a frontal view fluorescence endoscope to screen GI tract for monitoring of tumor growth. This system can be applied to better understanding of tumor physiology, monitoring treatment response and analysis of drug delivery in site within tumor circumstance.

P-024 플라즈모닉 파장분리기 구조를 이용한 생체 형광 이미징 기술 개발

엄세영, 최종민, 변경민
경희대학교 전자정보대학 생체의공학과

In this study, we propose a new fluorescence imaging system based on a surface plasmon resonance (SPR). The fabricated SPR substrate incorporates a dielectric grating on a thin gold film to diffract propagating surface plasmons into a transmitted light. This diffracted light can be used to excite the fluorescence dyes within a target sample. As the wavelength of transmitted light can be precisely selected by changing the incidence angle of white light source, the imaging system is simple, effective, and cost-effective, compared to a conventional fluorescence microscope which requires many wavelength filters.

P-025 심전도를 이용한 안저사진의 혈관 분석

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Retinal vessel evaluation in fundus images can be an important tool for measuring disease progression of not only the retina but also blood vessels in systemic disease. With the increasing interest to manipulate these images to clinical use, researchers are looking for faster and more precise analysis methods. To acquire credible results from the experiment, an electrocardiographic module was adopted to synchronize the retinal vessel pulsation according to the heartbeat. Illumination compensation based on a simple eye model was then carried out on the synchronized photographs for better imaging and better detection. Moreover, several evaluation methods were applied to investigate retinal vessel condition.

P-026 광음향 이미징 기반의 전립선암 진단을 위한 3차원 몬테카를로 시뮬레이션

박주원, Sherif H. El-Gohary, 변경민
경희대학교 전자정보대학 생체의공학과

In this study, we design a 3-dimensional (3D) model of human prostate with cancer tumors and optimize illumination parameters for efficient light energy absorption inside the prostate cancer. We expect that the proposed 3D prostate model is useful for navigating and guiding us to interpret what information this new modality is providing about prostate since it will save a lot of trials and errors before working in-vivo or in-vitro.

P-027 Surface film electrode를 투과한 초음파 빔의 특성 연구

원종호, 조용준, 박진감, 손정우, 송길수, 서종범
연세대학교 보건과학대학 의공학과

This study is advanced study of brainwave-measuring using the surface film electrode, and the purpose of this study to analyze effect of ultrasound on the electrode. To fix the electrode using the
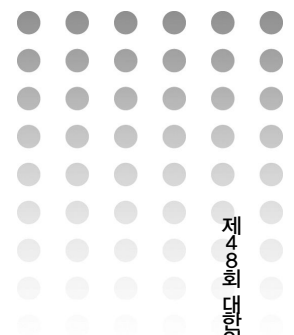
phantom produced by plastic hardener and softener, and ultrasound was generated by the 500kHz transducer. Changes in ultrasound characteristics were analyzed according to the presence of phantom and electrodes. In this study, because the changes of characteristics were observed using low ultrasonic energy, physical changes of the electrode surface were not identified. In future research, research for analyzing the changes in the electrode surface and the changes in brainwave signal is needed when ultrasonic energy was changed.

P-028 표면 플라즈몬 공명 현상을 이용한 광학적 방식의 온도 센서 연구

김영미, 여인선, 변경민

경희대학교 전자정보대학 생체의공학과

In this study, we propose an optical temperature sensor system based on a surface plasmon resonance (SPR) technique. Temperature variation of an air environment induces a change in the refractive indices of a thin metal film and subwavelength nanogratings on the substrate. The numerical results indicate that the SPR shift is highly linear over a wide range of temperature and the SPR structure based on a nanograting shows an enhanced performance, compared with a conventional SPR system.

Biomedical Robotics

P-029 마찰력 모델화를 위한 바늘과 연조직 사이의 마찰력 측정

김청준, 이두용

한국과학기술원 기계공학전공

Realistic haptic rendering is important to enhancing the effect of training simulation of needle intervention. Measurement and analysis of the real friction that occurs when the needle is inserted into the soft tissue is required to model the friction force. Hence, the experimental setup was constructed by using a 6-DOF articulated robot and 6-axis Force/Torque sensor, and porcine tissues. The measured friction data will be used to model the friction between the needle and soft tissues.

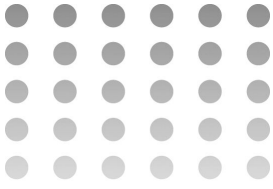### P-030 자동제어 알고리즘을 적용한 거울상 2축 상지 재활로봇 개발

김원식[3], 범재원[1,4], 남형석[1,2], 이치원[3], 박성우[3], 김윤재[5], 정선근[2], 김희찬[1,3], 김성완[1,3]

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Mirror therapy has been known to have positive effects for functional recovery of hemiplegic arm in stroke patients. Recently, not only conventional occupational therapy, but the robot-assisted therapy has been studied. In this research, a 2-axis robot specialized on mirror therapy has been developed. Designing the 2-axis robot, we considered various patients' body size, spasticity and safety of human joint. It also used automatic control algorithm. The 2-axis mirror robot would potentiate clinical effects of mirror therapy.

P-031 항공기 조종간, 6축 매니퓰레이터, 복강경 엔드이펙터를 이용한 복강경 수술 로봇 움직임의 기초 연구

이치원[1], 김원식[1], 윤치열[1], 노승우[1], 김희찬[2], 김성완[2]

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To develop and analyze a new concept of laparoscopic surgical robot system, three devices are integrated; 1) Hands-On-Throttle-And-Stick (HOTAS) device developed in Aerospace Engineering for aircraft pilot to operate many functions, 2) 6-axis manipulator developed in industrial area for precision & reliable control better than human, and 3) new laparoscopic end-effector designed for simple surgical trials. In this research, a feasibility study on the movements of laparoscopic robot system is conducted and its prototype of that is also developed. Laparoscopic robot system using a HOTAS, 6-axis manipulator, and laparoscopic end-effector will increase surgeon's efficiency and patient's safety.

P-032 삼투압 약물주입기의 주입압 분석

김동선 , 최성욱

강원대학교 기계의용공학과

The conventional commercialized drug-infuser has problems of low pressure and severe changes in drug delivering rate according to the environment such atmospheric temperature and pressure. To reduce the changes of drug delivery without heavy batteries, new pumping mechanism was suggested by applying osmosis caused by saturated NaCl solution that induces high injection pressure for the new drug-infuser. To regulate the pressure of infusion-pump, additional chamber was incorporated to control the difference of ion concentration at each side of membrane. New method can raise high injection pressure to reduce the effect of different hydrostatic pressure and maintain stable drug delivering rate.

P-033 자석을 이용한 무축 회전 수술용 칼날 개발

이운희[1], 서종모[1,2], 위원량[2]

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[2]서울대학교병원 안과

This paper introduces the concept of a surgical cutter using a shaftless rotating system. The shaftless rotating system of this equipment uses electromagnetic force to levitate and rotate the disk shaped blade in the air or in the liquid. The position of the rotor is controlled by electrical circuits, a hall-effect sensor, and an electromagnet in the upper stator. The blade is rotated by principle of the permanent magnet motor system. The rotor shaped blade is aimed to be used as a device for surgical destruction or ablation of the target tissue.

P-034 초음파 영상을 이용한 갑상선 스캔 로봇 개발

김민태, 김성천, 이상봉, 김광기

국립암센터 의공학연구과

In this study, we developed a 3-DOF robot which can hold the ultrasound probe and perform ultrasonography on the thyroid of a human body. The robot is designed to move along an arch-shaped guide, and a force sensor is attached between the probe and the robot to regulate the applied force on the human skin. The robot can scan from the jaw to the collarbone of the human, and the operator may control the robot while looking at the ultrasound image in real-time. We expect the developed robot to increase the efficiency of ultrasonography by reducing the workload of the operator.

P-035 의료영상기반 다기능 침 로봇 시스템 기구부의 설계

정현철[1], 손재범[1], 이상봉[1], 김광기[1], 박창민[2]

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[2]서울대학교병원 방사선과

The rapid evolution of robotic technology made it to penetrate into medical applications, of which safety criterion is considered one of most strict. While many state-of-art medical robots have shown satisfactory performance, their roles are still limited because of their cost, size, and environmental susceptibility. Therefore robots having ability to handle special practice are strongly demanded. In this paper, we design a medical instrument driving platform for various medical purposes. This platform provides at least three degrees of freedom, which orientates and drives an attached instrument in tasks such as real-time computed tomography biopsy.

Cardiovascular Engineering

P-036 고혈압 선별검사 지표로서의 경동맥 내중막 두께

김원식[1], 배장호[2], 최형민[3], 김용태[1], 안봉영[1]

[1]한국표준과학연구원 의료융합측정표준센터
[2]건양대학교병원 심장내과
[3]PHYSIONICS

The severity of carotid intima-media thickness (IMT) is an independent predictor of atherosclerosis which causes transient cerebral ischemia, stroke, and coronary events such as myocardial infarction. To inspect how efficiently the IMT to screen hypertension, it was measured for 1,478 cases of positive group and 735 cases of negative group. Results showed that, the sensitivity was 75.9% and the specificity was 46.6% with the cutoff value as 0.60 mm (p<0.0001). This result suggests that the IMT can enhance the

reliability screening hypertension when it will be used together with the conventional method measuring hypertension.

P-037 심실보조장치용 심전도를 이용한 심실조기수축의 검출

이진홍, 박성민, 최성욱

강원대학교 융합시스템공학과

The ventricular-Electrocardiogram (v-ECG) has been developed to measure the heart rate of left ventricular assist device (LVAD) patients. However v-ECG did not show any specific characteristics in abnormal heart beat. In this study, the R-wave peak, R-wave area and slope of R-wave were obtained from measured v-ECG and many premature ventricular contractions (PVC) were detected automatically with the newly developed algorithm. Clinicians found PVCs with a conventional ECG that are measured with v-ECG simultaneously and the confirmed PVCs were compared with the result of the new algorithm with v-ECG. According to the result of comparison, the ratio of the false detection of the algorithm was $5.1 \pm 4.1\%$ and the ratio of failed detection was $9.6 \pm 6.2\%$.

P-038 수면 심박-호흡의 위상 동기 특성과 방향성 관계 분석

윤희남[1], 김상경[1], 김고근[2], 이원규[1], 정다운[1], 이유진[3], 정도언[3], 박광석[4]

[1]서울대학교 공과대학 협동과정 바이오엔지니어링 전공
[2]기초과학연구원 인지 및 사회성 연구단
[3]서울대학교병원 수면의학센터
[4]서울대학교 의과대학 의공학교실

In this research, we study in cardiorespiratory synchronization and directional property in human sleep. We find that cardiorespiratory synchronization changes in different sleep stages. It shows that 400% increased phase synchronization between heart rhythm and respiration is presented in slow wave sleep compared to rapid eye movement sleep. We also find that interaction strength from respiration to heart rhythm is gradually decreased as sleep goes deeper. However, there is no significant difference in directionality index in different sleep stages when cardiorespiratory synchronization is observed. With

this result, we conclude that both biological systems are coupled with particular interaction strength when synchronization is observed.

P-039 혈류역학 에너지를 이용한 인공판막의 안전성 연구

이종태[1], 안치범[3], 신연수[1], 이덕희[1], 이성호[1,2], 선경[1,2]

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[2]고려대학교 의과대학 흉부외과교실
[3]강원대학교 공과대학 기계의용공학과

Blood flow is predicted with the mean pressure gradient, in which the blood flows from high to low pressure areas. However, environments such as the left atrium-aorta show flow pattern that contradicts the prediction from mean pressure gradient. Analysis with energy equivalent pressure (EEP) better explains this phenomenon, as the narrowing near the aortic valve alters the kinetic energy of the flow. While the narrowing of the aorta has been shown to affect EEP, no previous study examines the influence of the aortic valve itself; in this study, the hemodynamics of mechanical and bioprosthetic aortic valves were compared using EEP.
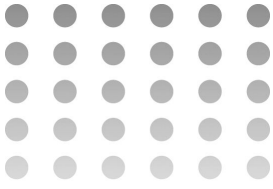
P-040 맥파전달속도 계산을 위한 맥파 전이 시간차 측정 프로그램 개발

정민영[1], 김정훈[2], 이나희[3], 권주영[1], 박지은[1], 안도현[1], 이종민[1,4]

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[2]경북대학교 전자공학과
[3]경북대학교 수학과
[4]경북대학교 의학전문대학원 영상의학교실

Among various indicators Pulse Wave Velocity (PWV) is selected to evaluate the property of the vessel, which is the most reliable indices of the aortic stiffness in the blood vessel.
The aortic PWV is generally calculated in Magnetic Resonance Imaging (MRI) as the ratio of the distance between two locations in the aorta to the transit time of the pulse wave reaching that distance. Although the estimation of the distance is relatively easy to calculate from MRI Cine Data, the determination of the transit time is somewhat difficult to evaluate. In this work, a method to measure PWV and its measurement instruments were discussed, and a

POSTERS

44

program measuring PWV using MRI was developed to improve conventional measurement method.

The purpose of this study is to estimate the time difference between each transmitted pulses to calculate PWV. A pulse wave form analysis program was developed with MATLAB to evaluate the time difference, and the function and operation of this program were also discussed; this results in an estimation of the PWV. In conclusion, the PWV can be evaluated non-invasively from morphological and hemodynamic MR data with two different estimators of transit time.

P-041 LibraHeart I의 Cannula 길이 및 작동 상태에 따른 박출량 및 압력 분석

강성민[1], 최성욱
[1]강원대학교 융합시스템공학과

The malfunction with VAD system is the 6% of the VAD patient's death causes and need the new idea that the trouble with the VAD does not affect the patient's heart movement and hemodynamic states. In previous studies, we developed a pulsatile conduit VAD that has two valves and conduit shape that remove the possibility of blood regurgitation. In this paper, measured the flow rate according to the length of cannula connecting the heart and confirmed the AAC function by in-vitro and in-vivo. The flow rate is appropriated when length of cannula 40~60mm, and it is possible to AAC function.

P-042 CT를 활용한 15-리드 심전계용 시뮬레이터의 개발

강유민, 강성민, 최성욱
국립강원대학교 융합시스템공학과

It is well known that 15-Lead ECG can measure the disorders of the ventricular posterior wall and right ventricle and those cannot be measured with a conventional 12-Lead ECG. However, the efficacy and accuracy of 15-Lead ECG`s have not been estimated for the absence of a compatible simulator for the 15-lead ECG. The purpose of this study is to find the abnormal ECG waveform that can be measured with not conventional ECG but 15-lead ECG. And, the ECG waveform was verified that it can

appear when a patient has myocardial infarction at the posterior wall of left ventricle and right ventricle by comparing the patient's model to the measured results.

P-043 진폭변화가 심한 심전도 신호에서 R peak 검출을 위한 진폭 한계치 설정

이유진, 황도식
연세대학교 전기전자공학과

In this study, an amplitude adaptive thresholding (AAT) method to detect R peak of electrocardiogram (ECG) signal is proposed. The algorithm is based on exponential weighted average (EWMA) to detect R peak in the ECG signal having abruptly changed R peak amplitude. To compare the performance, a conventional (fixed thresholding) method was used. The proposed algorithm achieved 96.52% sensitivity which was 30.72% higher than the statics of the compared method in the dynamically changed R peak environment. The results demonstrate that the AAT method can be used for ECG signals having various R peak amplitudes.

P-044 음악에 의한 심혈관계 생체신호의 변화 분석

이원규[1], 김상경[1], 윤희남[1], 정다운[1], 김고근[2], 박광석[1,3]
[1]서울대학교 공과대학 협동과정 바이오엔지니어링 전공
[2]기초과학연구원 인지 및 사회성 연구단
[3]서울대학교 의과대학 의공학교실

Mayer waves are slow oscillation in arterial blood pressure which have a frequency about 0.1Hz. They are closely related to mechanisms of baroreflex and sympathetic nervous system. We tested whether particular music affect cardiovascular response by using coherence analysis. Six subjects listened to music (Giuseppe Verdi's arias "Va pensiero") which has similar rhythmic phrases with mayer waves. And the 0.1Hz coherence value between music and PPG amplitude profile were calculated. Average of total length which exceeded confidence limit (0.2831 for 10Hz sampling rate) was 298.1 beats. However, if we analyze the value between music and other PPG signals that was not measured simultaneously with music, the coherence value was decreased to 215.8 beats. This result shows that particular music

can entrain cardiovascular response synchronized with music.

P-045 폐순환을 구현한 혈류 유동 시스템의 재현

권주영[1], 이나희[3], 정민영[1], 안도현[1], 박지은[1], 김정훈[2], 이종민[1,4]

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During the 20th century, medical technology has been progressed dramatically together with the development of science and engineering, and also the accuracy of diagnosis has been improved significantly with the invention of various medical devices. However, there are still lots of areas to be investigated, and to overcome those limitations in medical exercise such as side effect, experimental data over human body are the most meaningful.
With the emphasis on realizing human body model, this study focused on reproducing the most fundamental blood flow parameters such as blood flow velocity and pressure. In the experiment setting, pulsatile pump can be considered as ventricular in the heart, and stroke volume of the pump is controlled by the height of the cylinder. Heart beat rate can be adjusted in the Labview program, and silicon tube was installed to produce compliance in the blood vessel. The blood flow velocity and pressure data for normal adult were obtained in the experiment, and in the future studies on contrast media with temperature and viscosity will be performed.

P-046 Evaluation of the wireless power transfer systems in a pacemaker

R. Das and H. Yoo

Department of Biomedical Engineering, School of Electrical Engineering, University of Ulsan

Wireless Power Transfer (WPT) to medical implants is desirable for removal of the bulky energy storage components. In this paper, wireless power transfer in a pacemaker (PM) was studied. Two standard frequency bands MICS (Medical Implanted Communication Service) and ISM (Industrial, Scientific and Medical) were applied to calculate the efficiency of the wireless power. The Remcom XFdtd simulation results of the calculation showed that, the MICS band was much more efficient than the ISM band and by using the MICS band it was possible to transfer more than half of the power to the receiver.

P-047 동맥혈관 압력-용적 모델에 기반한 혈관 컴플라이언스 추정 방법

이상훈[1], 전아영[1], 박근철[1], 장우영[1], 김수성[1], 백승완[1], 노정훈[2], 전계록[2]

[1]마취통증의학교실
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A method to estimate the compliance of the blood vessel has been studied by applying a small sinusoidal volume variation and measuring the pressure signal of the system. Simulation on the various blood vessel models on volume-pressure relation with small sinusoidal volume waveform inputs has shown the volume- stiffness relation, which is the reverse of the compliance information. Various vessel compliance models were reviewed and it is found that the actual vessel compliance is similar to Type5 defined by Jung et. al., in which the derivative of compliance with respect to volume or pressure is continuous.
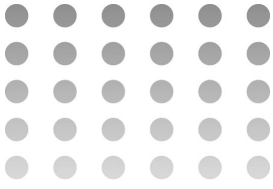
P-048 돼지 전혈을 이용한 수액/혈액 가온기의 안전성과 효용성 평가

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Warming fluids prior to transfusion helps prevent complications and expedites recovery after an extended surgery or serious trauma by maintaining natural body temperature. Fluid/Blood warming device is effective method to elevate body temperature in hypothermic condition. Swine blood test was performed to evaluate safety and effectiveness of new fluid/warming device (Thermosens, Sewoon Medical).

P-049 중대뇌동맥압의 비침습적 추정 방법 연구

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The pressure in the middle cerebral artery(MCA) is very important to understand cerebral blood flow, metabolism, mechanism, and cerebral diseases. The cerebral blood flow velocity in the MCA can measure by Transcranial Doppler. This parameter is used for the evaluation of cerebral autoregulation, however it is insufficient to fully understand the mechanisms of cerebral blood flow. If the pressure in the MCA can measure non-invasively, it is more helpful to understand the brain blood flow mechanisms. Therefore we suggest the non-invasive estimation method of the MCA pressure using the cerebral blood flow velocity and systemic blood pressure.

P-050 관상동맥협착검출을 위한 초음파 진단기의 성능평가 방법 연구

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동국대학교 의생명공학과
춘해보건대학교 의료공학과

The related blood vessel or cardiac disease that it is 2th, 3rd ranked death rate in Korea increase consistently. The increasing in the use of IVUS (Intravascular Ultrasound System) what consequential obtained three-dimensional image after insert directly into the coronary arteries intravascular ultrasound catheter by technical limits of the existing cardiovascular diseases diagnosis devises. However, there are have troubles in permission because the guideline system about this machine's performance and safety doesn't established systematically in Korea. Accordingly, in this study, we present a guideline in respect of performance evaluation for a manufacturer of medical instruments and equipment in Korea. The proposed evaluation guideline will expect to contribute the improvement in quality and secure the stability.

P-051 비침습 자동혈압계 교정방법 및 교정기기 개발

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한국표준과학연구원 의료융합측정표준센터

Blood pressure is one of important vital signs for monitoring patients' medical conditions. Automated non-invasive blood pressure devices measure systolic and diastolic blood pressures from the oscillation of cuff pressure caused by periodic motion of artery. For the first time, we propose a SI-traceable calibration method for these oscillometric blood pressure devices. The system generates pressure pulses to device-under-test at the pre-determined cuff pressure with the pre-determined amplitude. By the calibration devices, the reliability of blood pressure measurement would be enhanced.

P-052 심폐소생술 수행 시 sEMG 주파수분석을 통한 근육 피로도 평가

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This pilot study is to verify the possibility to evaluate the fatigue level of each muscle used in cardiopulmonary resuscitation (CPR) through the frequency analysis of surface electromyogram (sEMG). Five medical staffs performed chest compression for 5 min on a manikin on the bed. sEMG was measured from 6 muscles while compressing chest according to guideline of the basic life support. The median-frequency (MDF) was calculated in every 30 second for 5 minute. The slope of MDF plot in time (%/min) was calculated using linear regression. MDF's from biceps brachii, triceps brachii, deltoid, quadriceps muscles were decreased that means these muscles are fatigued a lot. But the MDF's from rectus abdominis, pectoralis muscles were not decreased. According to the decrease of MDF in EMG in general, our result shows the possibility that sEMG can be used to quantify the fatigue level in each muscles between various postures of providers.

P-053 분산 웨이블릿 변환을 이용한 심전도 특징 신호 분리

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서울대학교 전기 전기공학부
서울대학병원 안과

Wavelet transforms have proved useful in bio-medical signal processing. In this short article one application of the wavelet transform for electrocardiographic (ECG) signal processing is demonstrated. Aided with this tool the electrocardiographic derived respiration (EDR) signal is obtained. Signal baseline removal and feature extraction are successfully demonstrated. For this experiment a 4-lead ECG front end with an extra electrode for the modified central lead (MCL1) signal were used to acquire the data.

P-054 동맥 탄성도가 맥파의 최정점 위치 변화에 미치는 영향: Windkessel 모델을 이용한 시뮬레이션 연구

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The purpose of this study is to demonstrate effects of arterial compliance on variations of pulse peak locations using the Windkessel model. The three-element Windkessel model is employed since it describes well the global aspects of human pulses. In order to demonstrate the effects, we first represent the Windkessel model as a formal equivalent electrical circuit. Based on the Kirchhoff's voltage law, we derive a system function of the Windkessel model and then apply normally distributed values of arterial compliance as an input parameter of the function. As a result, we obtained a slightly right-skewed distribution of resulting pulse peak locations with respect to the normally distributed arterial compliance. The result indicates that human pulses are slowly time varying signals and they follow a normal distribution approximately.

P-055 A mouse model of Timothy syndrome for studying $Ca_V1.2$-dependent arrhythmogenesis

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Background and Introduction: Timothy Syndrome (TS)[1] is an arrhythmogenic disorder due to a mutation in $Ca_V1.2$ L-type Ca^{2+} channel that delays its voltage-dependent inactivation (VDI) leading to excess Ca^{2+} influx, prolongation of action potential duration (APD), and lethal cardiac arrhythmia. We developed a mouse model of TS to interrogate how abnormal Ca^{2+} influx leads to an increased propensity for arrhythmias. **Methods:** We generated a tamoxifen-inducible, tissue-specific Cre-Lox mouse model that expresses a TS mutant or wild-type $Ca_V1.2$ channel in the adult heart. Simultaneous optical measurement of intracellular Ca^{2+} (Ca_i) transients (CaTs) and membrane potential (V_m) changes was performed to investigate a link between TS and PVT. **Results:** At 5Hz pacing, action potential duration was significantly prolonged in TS mice compared to WT mice (p<0.01, n=6). After transition from normal heart rate (5Hz) to ventricular bradycardia (1Hz), spontaneous Ca_i elevation occurred prior to V_m re-depolarization during action potential diastole only in TS mice. During sustained ventricular bradycardia pacing, whole heart optical mapping showed EADs, DADs, and PVT in all TS hearts while no triggered activity was recorded in WT mice. At the origin of EADs or DADs, the rise of CaTs often preceded the rise of V_m. **Conclusion:** We generated a novel TS mouse model that offers new insights into mechanisms of arrhythmogenesis at both the cellular and whole-heart level.

P-056 저주파 대역의 전자기장이 인공 심장 박동기 및 이식형 제세동기에 미치는 영향

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In this study, we evaluated the effects electromagnetic fields of extremely low frequency (ELF) and very low frequency (VLF) ranges on some implantable devices. Four pacemakers and three implantable cardioverter defibrillators (ICDs) were subjected to in-vitro test with three headphones and two electromagnetic (EM) electronic article surveillance (EAS) systems. In conclusion, the electromagnetic interference (EMI) sources had no effects on the pacemakers, but ICD magnet response was observed on one ICD for the clip-on and closed-back headphone.

48

P-057 **마이크로파 전자파가 인공 심장 박동기 및 이식형 제세동기에 미치는 영향**

정재원[1,2], 김성권[1,2], 최수범[1,3], 박지수[4], 김덕원[1,2,3]

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[4]연세대학교 의학전문 대학원

In this study, we evaluated the effects electromagnetic radiations of microwave frequency range on some implantable devices. Four pacemakers and three implantable cardioverter defibrillators (ICDs) were subjected to in-vitro test with a wideband code division multiple access (WCDMA) module, an ultra high frequency (UHF) radio frequency identification (RFID) reader, and an UHF electronic article surveillance (EAS) system. In conclusion, the electromagnetic interference (EMI) sources had no effects on the pacemakers and ICDs.

Medical and Bio-informatics

P-058 **Human fibrosarcoma cells 에서 해양 미세조류, Pavlova lutheri으로부터 분리된 peptide의 Matrix metalloproteinase -2 와 -9 억제 효과**

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In this study, a pentameric peptide with matrix metalloproteinases (MMPs) inhibitory activity was isolated from Pavlova lutheri fermented by yeast Hansenula polymorpha. The peptide from fermented P. lutheri (PFPL) has molecular mass of 543.3 Da and its amino acid sequence was determined as IQPSV.

MMPs inhibitory effects of PFPL were determined in human fibrosarcoma cells (HT1080 cells) by zymography, western blot and RT-PCR assay. The results showed that PFPL could significantly inhibit MMP-2 and -9 in dose-dependent manners, and PFPL could reduce cell migrate activity. In assays for protein expression by Western blot and mRNA expression by RT-PCR, the data illustrated that PFPL-treatment induce to not only down-regulation of MMP-2 and -9 but also up-regulation of (TIMPs).

Thus, these results suggest that PFPL might play a role as potent inhibitors of MMP-2 and -9, and contribute to attenuate human fibrosarcoma cell migration.

P-059 **Human fibrosarcoma cells에서의 MMP-2, MMP-9의 발현에 대한 Fucoxanthin의 이동억제효과**

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Fucoxanthin has been known to be effective in inhibit the proliferation and anti-angiogenic activity. In this study, we examined the potential role of fucoxnathin suppresses matrix metalloproteinase (MMPs) in HT1080 cells. The MTT, zymography, RT-PCR, and Western blot analysis were used to reveal molecular events of fucoxnathin. In zymography experiments, these fucoxnathin led to the reduction of the expression levels and activities of MMPs. Protein levels and mRNA expression of MMPs were inhibited by fucoxnathin in RT-PCR and Western blot analysis. Collectively, these results indicate that fucoxnathin may be useful as anti-invasive agents in therapeutic strategies against metastasis.

P-060 **B16F10 쥐 흑색종 세포에서 발효된 미세조류 Pavlova lutheri 로부터 분리·정제된 펩타이드의 멜라닌생성 억제효과**

오건우, 천충길, 정원교

부경대학교 의공학과 및 해양과학 MIBT 융복합 BK21 Plus 사업단

An anti-melanogenic peptide was purified from fermented Pavlova lutheri. The tetrameric peptide purified from fermented P. lutheri (TPFP) has molecular mass of 526 Da (Tyr-Arg-Gly-Met). To evaluate effect of TPFP, we determined its antioxidant and anti-melanogenic effects on B16F10 cells. The results showed that TPFP could attenuate oxidation stress induced by hydroxyl radical, and inhibit melanin synthesis and tyrosinase activity. Also, TPFP has dose-dependent inhibitory effects against melanogenesis-related proteins. Furthermore, the results illustrated that p-p38 MAPK was decreased

and p—ERK was increased. Our study demonstrated that TPFP inhibit melanogenesis through the inhibition of p—p38 MAPK and activation of p—ERK.

P-061 내피세포에서 Spirulina sp. 소화가수분해물로부터 정제된 펩타이드의 MAPKinase를 통한 Angiotensin I converting enzyme과 Angiotensin II에 의해 유도되는 Nitric oxide 억제효과

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[2]퀸즈랜드대학교 약학대학

The objectives of this study were to investigate the amino acid composition isolate from spirulina sp. and to evaluate angiotensin—converting enzyme (ACE) inhibitory activities of its hydrolysate prepared with gastrointestinal enzymes. This peptide structure was identified as Pro—Lys—Gly—Pro—Glu—Met—Thr (759 Da).

In human—derived Ea.hy926 endothelial cells, this peptide significantly could attenuate the productions of NO and ROS induced by angiotensin II. This peptide inhibited expression protein levels of iNOS and ET—1. Moreover, we investigated that peptide inhibits activation of p—p38 MAPK.

These results indicate that this peptide inhibits angiotensin II induced hypertension via blocking of p—p38 MAPK signaling pathway in endothelial cell, and demonstrated its in vitro anti—hypertensive potential.

P-062 의료기기 성능시험 가이드라인 마련을 위한 연구

정승환

식품의약품안전처 의료기기심사부

In order to receive medical clearance items according to the medical device regulatory technical writing and attached documents shall be submitted accordingly. Technical Writing is one of the most distress as complementary to the part you need is to set testing standards. The results of research projects guidance for performance testing of medical devices and medical device clinical trials, information is carried forward and will provide ongoing revision and approval medical device business would like to take advantage.

P-063 작업부하에 따른 운전자의 생체신호 처리 및 특성 분석

이은지[1], 이미래[1], 김민수[2], 김윤년[1,2,3], 이재열[4], 박희준[1], 구정훈[1], 이종하[1], 허윤석[1]

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Car accidents causes by drivers are considered as the major causes along with other causes such as conditions of roads, weather and cars. In this study, we investigated the Driver's workloads under three different driving conditions (Weather, Driving time zone, and Traffic density) through analyzing biological signals obtained from a car driving simulator system. Five young adults (the twenties) were tested by the three conditions. ECG, SPO2, and Temperature using each biosensor attached to the subjects. The SDNN, which is calculated from HRV time domain analysis on ECG signals, showed the mean 134.96 ± 36 under Un—Load condition and 127.06 ± 20, 129.54 ± 28, 131.10 ± 31 under each load condition, respectively. RMSSD at each load condition is decreased from the mean 27.16 ± 9 (Un—load) to 18.26 ± 11, 24.21 ± 10, 25.23 ± 12, (Load)respectively. Therefore, we expect that this car simulator system will be a great tool for studying the Drivers Biological conditions under different driving conditions.

P-064 인공심장판막의 성능평가 가이드라인

백 홍, 송정민, 장윤영, 장동혁, 이승영, 맹은호

한국화학융합시험연구원, 의료기기본부

The goal of this study is to develop guideline for prosthetic heart valve implanted in the human heart, the physical and chemical properties, mechanical properties and biological safety assessment. It was classified into biological and nonbiological prosthetic heart valve in accordance with materials. Guideline based on the relevant international standards(ISO, FDA guidance) through a comparative review of biological safety and mechanical and physicochemical performance test were set up.

P-065 전기 임피던스 측정기술을 이용한 과산화수소의 세포 독성 관찰

최용현, 조성보

가천대학교 의공학과

H_2O_2 causes growth stimulation, temporary growth arrest, or necrotic cell death according to its concentration. The toxicity of H_2O_2 has been investigated in different cell lines with respect to the incubation time or temperature. In this study, the effect of H_2O_2 on 293/GFP cells during cell culture was studied by using electrical impedance spectroscopy. The cells were cultured on the indium tin-oxide electrodes, and the impedance of cells on the electrode was monitored. The application of 50 mM H_2O_2 resulted in a decrease in the number of cells and the measured impedance value correspondingly.

P-066 지식기반 유방 초음파 진단지원시스템

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In this study, we discuss a method for designing informatics engine, which was used to estimate not only outcomes of new cases but also the probabilistic evidence from a knowledge base, in knowledge-based ultrasound diagnosis support system of breast tumor. Of 33 features, 13 features were found to be indispensable for diagnostic knowledge discovery in breast ultrasound images. The experimental results showed that the discriminant power of a rule set with coverage level $\geq$ 8% outperformed those with other levels in terms of accuracy (91.75±0.75%), geometric mean (91.71±0.83%), and f-score (91.34±0.90%), during 10-fold cross validation.

P-067 Structured Report Template of Nuclear Medicine Images

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With the increasing nuclear medicine imaging examinations such as PET (Positron Emission Tomography), effective structured report systems are required to manage the complex and large nuclear medicine databases. Authors constructed the preliminary structured report template system for nuclear medicine images using XML and the locally mapped common terms in nuclear medicine to RadLex and SNOMED-CT. Structured nuclear medicine report data were transported effectively and retrieved based on the relation of attributes and elements. Further system development may be warranted including large amount of database and various semantic functionality.

Medical Imaging

P-068 Dose-Related Effects of Binge-Like Alcohol Drinking on Cerebral Metabolite Changes in Rats Using Ex Vivo 1H High-Resolution Magic Angle Spinning NMR Spectroscopy

D.W. Lee[1,2], J.W. Min[3], S.Y. Kim[1,2], J.H. Lee[1,2,4], J.Y. Jung[1,2], K.H. Song[1,2], B.Y. Choe[1,2]
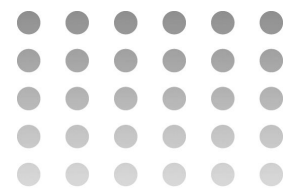
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The aim of this study was to assess the effects of acute-dose of binge alcohol-intoxication on cerebral metabolite changes among controls (CNTL), low-dose-ethanol (LDE)-exposed, and high-dose-ethanol (HDE)-exposed rats. Twenty rats in LDE and HDE received ethanol doses of 1.5-g/kg and 2.5-g/kg, respectively, through oral gavage every 8-h for 4-days. Normalized tNAA, GABA, and GSH levels were significantly lower in frontal cortex of HDE-exposed rats than that of LDE-exposed rats. Moreover, compared to CNTL group, LDE rats exhibited significantly higher normalized GABA levels. Our results suggested some novel metabolic markers for dose-dependent influence of acute-binge ethanol intoxication in frontal cortex.

P-069 Short-Term Influence of Intermittent Ethanol Exposure on Biochemical Changes in Rats: Evidence from Ex Vivo Proton NMR Spectroscopy

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The purpose of this study was to provide ex vivo evidence of changes in neurochemical profiles of rat hippocampus after acute binge ethanol intoxication, using proton nuclear magnetic resonance spectroscopy. Twenty male rats, divided into two groups, were used in this study. 10 rats received ethanol doses of 1.5-g/kg, through oral gavage every 8-h for 4-days. The Glu/tCr and Glx/tCr ratios were significantly higher in binge-ethanol group than in control. Our main findings suggest that the glutamate signals and glutamate-glutamine cycle in hippocampal region are particularly sensitive to acute binge ethanol consumption.

P-070 Development of Fused ACR-MRS Phantom and Simultaneous Acquisition Protocol for Quality Assurance

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Research Institute of Biomedical Engineering, The Catholic University of Korea

This study was to develop four layered shape ACR-MRS phantom for quality assurance (QA), to evaluate of single-voxel spectroscopy (SVS), multi-voxel spectroscopy (MVS) and to conduct quantitative analysis of metabolite concentrations of a magnetic resonance (MR) system. ACR factors and experiment of accurate SVS for simultaneous acquisition quality assurance were performed by a Philips 3.0 T MR system. Factors of measured ACR-MRS were as follows: geometric diameters (189.35±0.32 mm), low contrast object detectability (36.70±1.55), SNR of the NAA (25.95±0.35). The present study is being measured with the quantitative accuracy of the metabolite and the accuracy of the position of the VOI.

P-071 Evaluation of Optimal Time Scheme for Dose Calibrator Linearity in Quality Assurance of Gamma and PET System

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Department of Biomedical Engineering, College of Medicine, The Catholic University of Korea
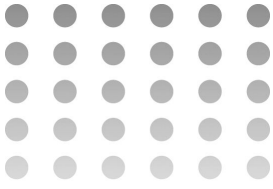Research Institute of Biomedical Engineering, The Catholic University of Korea

Linearity of dose calibrator is conducted to check the linearity from high to low activity using decay method, this study is to find more optimal time scheme than the conventional method. We performed regular time interval and equal-time sampling measurement with a high activity of Tc-99m and F-18 in Gamma and PET dose calibrator respectively until the activity was very low. The ratio of the decay-corrected measured activity over the decay-corrected average activity (cfM) as linearity index were within acceptable ranges (0.95~1.05) in both methods. We devised a new method that is optimal for linearity of full range of activity.

P-072 경로 길이를 이용한 자폐증 환자에 대한 뇌 네트워크 분석에 관한 연구

이민희[1], 김동윤[1], 이상현[1], 김진욱[1], 민아름[1], M.K. Chung[2], Nagesh Adluru[2], Richard J. Davison[2]

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Autism is neurodevelopmental disorder which is characterized by impaired communication and social interaction, comprehension. We constructed the brain network from fiber tracks which are obtained from the diffusion tensor MRI tractography, using the ε-neighbor construction method. The ε-neighbor method used two endpoints of the fiber tracts. To analyze the connectivity of the brain network, we used the average path length for the 17 autistic

subjects and 14 control subjects. From the statistical analysis, the observed difference in average number of path length is statistically significant at the 0.01 significance level.

P-073 PET/CT 검사에서 비스무스(bismuth) 차폐체의 적용에 따른 유용성 평가

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In this study, to apply to the shielding of the breast, by using the bismuth shields that contains 0.06 mm Pb ingredients, was applied to the PET/CT GEMINI TF 64 (Philips Healthcare, Cleveland, USA). Phantom experiments using the NEMA IEC Body Phantom, images were acquired according to the presence or absence of bismuth shields apply. Also, When applying, images were obtained by varying the spacing 0, 1, 2 cm each image set to the interest range in the depth of the phantom by using EBW–NM ver.1.0. When image of the PET Emission acquires, the SUV was in increased depending on the use of bismuth shields, difference in the depth to the surface from deep in the phantom increasingly SUV increased (P<0.005). Also, when using shields, as the more gab decreased, SUV is more increased (P<0.005). Through this study, PET/CT examination by using of bismuth shields which is used as purpose of reduction dose be considered. When using shields, the difference of SUV resulting from the application of bismuth shields exist and that difference is more decreased as gab of shields and surface is wider. Therefore, setting spacing of shield should be considered, if considering the reduction of the variation of SUV and image quality, disease of deep or other organs should be a priority rather than superficial disease.

P-074 k-space 샘플링과 compressed sensing 기법을 이용한 빠른 심장 자기공명영상을 얻는 방법

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Sparse acquisition MRI has been shown to be very promising in decreasing scan times while achieving clinically diagnostic image. It is assumed that more contrast lines in the center of k–space will cause better reconstructed image quality. We determine how the number of central k–space lines affects the overall reconstructed image quality in sparse sampling acquisitions using the compressed sensing scheme.

P-075 Sparse k-space 샘플링이 cardiovascular system에서의 phase-contrast MRI에 미치는 영향

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Sparse acquisition MRI has been shown to be very promising in achieving extremely fast scan times while still resulting in clinically diagnostic image quality. A particular area of interest is phase contrast flow imaging due to its potentially lengthy scan times when desiring higher spatial resolution and low heart rates. We determine the feasibility of applying sparse sampling in high resolution phase contrast imaging by comparing quantitative flow results between reconstructed under–sampled images with different sampling rate to a typical fully sampled clinical acquisition.
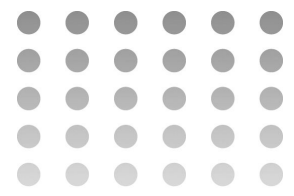
P-076 글리세롤 조직유사 팬텀의 성분비 조절을 통한 피부 유사 팬텀의 제작

김재영[1], 김주영[1], 정현두[1], 민정화[2], 김미선[1], 노시철[3], 최흥호[1]

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In this study, we produced skin phantom by adjusting the component ratio of glycerol TMM phantom. The sound velocity of fabricated the phantom was 1635±5m/s at 3 times of the ratio of glycerol, and attenuation coefficient was 0.21±0.01 dB/cm–MHz at 0.3 times of the ratio of glycerol in TMM phantom. To confirm a thermal lesion through skin phantom, we sonicated to the multi–layer phantom of skin phantom and egg white phantom. Through the results

of experiment, we consider that phantoms similar to other tissues can be produced by adjusting the component ratio of glycerol TMM phantom.

P-077 외부 진동에 의한 칼라 도플러 트윈클링 허상

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Twinkling artifact (TA) often appears as turbulent flows in color Doppler and is useful for diagnosing of renal stones. This study considers an external vibration to a target as a source for enhancing TA. The color twinkling was quantified in terms of color pixel numbers, as the frequency of the vibration varied from 30 Hz to 600 Hz, under the condition of pulse repetition frequency of 100 Hz, for a circular contrast scattering target. It was shown that TA was significantly enhanced 30Hz to 120Hz and from 170Hz to 250Hz, whereas it did not appear around 150Hz and over 250Hz that were located to the dead zone of the color scale bar. This study illustrates that an external vibration to the target can effectively enhance TA unless its frequency is located in the dead zone of the color scale bar. It is concluded that external vibration driven at a carefully chosen frequency is a useful way to enhance TA when clinically needed.

P-078 Cortical Thickness 분석을 통한 정신 분열 증 고위험군 진단

무하마드 나비드 이끼발 쿠레시[1], 민범준[1], 권준수[3], 이보름[1,2]

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[2]GIST 기전공학부
[3]서울대학교 의과대학 정신과학교실

Schizophrenia is one the most common brain diseases that effects the individual in early indolence. We have developed a technique to diagnose the disease with early symptoms, i.e. in the clinical high risk patients. We have developed an average cortical thickness model of clinical high risk group patients with FreeSurfer and QDEC. Later on we have analyzed the same group data with the different age groups and psychometric scores.

P-079 겸형적혈구를 이용한 새로운 약물전달시스템의 개발

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Sickle red blood cells (RBCs) possess tumor targeting and controlled release properties that may enhance delivery of therapeutic agents to disseminated solid tumors. We tested the ability of sickle RBCs, photosensitized and light-activated ex vivo for controlled release, to deliver calcein to flank tumors in mice. In addition, sickle RBCs showed accumulation in 4T1 tumors between 12-24 hours after systemic administration. Calcein-loaded sickle RBCs showed 3-4 fold enhanced calcein delivery to 4T1 tumors compared to controls. Sickle RBCs, loaded by hypotonic dialysis then photosensitized and light-activated for controlled release, can enhance in vivo delivery of encapsulated calcein into tumor parenchyma.

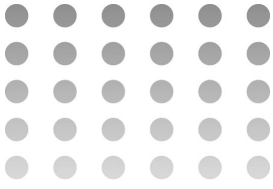## P-080 웨이블릿 변환에 기반한 속도 조정 빔포밍 알고리즘과 초음파 영상

장진성, 황도식
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Ultrasound imaging is one of the most widely used medical imaging techniques for medical diagnosis. Conventional beamforming algorithm that is essential processing in ultrasound imaging used to process receive data assuming that human tissues are homogeneous and transfer velocity of ultrasound is constant. So, robust beamforming algorithm suitable for heterogeneous tissue is needed. This paper proposes adaptive beamforming algorithm for non-uniform tissue using wavelet transform of ultrasound imaging.

P-081 광섬유 감마 영상 프로브의 개발을 위한 위치 민감형 광증배관의 출력 신호 보정

홍승한, 신상훈, 전다영, 심혁인, 김선근, 장경원, 유욱재, 박장연, 이봉수
건국대학교 의료생명대학 의학공학부, 의공학 실용기술

POSTERS

연구소

A fiber-optic gamma imaging probe was fabricated using a scintillator bundle, optical fibers, and a position sensitive photomultiplier tube (PS-PMT). To calibrate the different anode gains at each channel of PS-PMT, a gain compensation method was applied. In this study, we obtained the planar images of gamma-ray distribution for measuring the radioisotope.

P-082 Fourier Descriptor를 이용한 영상 시퀀스 기반 맥박 측정 알고리즘 연구

황석민[1], 구정훈[1], 김윤년[2], 허윤석[1], 박희준[1], 이종하[1]

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In this paper, we introduced the new method to extract the heart rate using Fourier Descriptor and video sequence images. Remote measurements of the heart rate can provide comfortable physiological assessment without external sensors. This novel approach can be applied to color video recordings of the human face and is based on automatic face segmentation along with Otsu method. This is the demonstration of a low-cost accurate video-based method for contact-free heart rate measurements that is automated.

P-083 3차원 의료 영상에서 벡터 흐름 정보를 이용한 고성능 기관지 추출 기법

박상준[1,2], 이두희[2], 구진모[1,2], 김종효[1]

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A three-dimensional (3-D) segmentation of the human airways from the lung parenchyma is notoriously difficult. This is due to the fact that the contrast of small airways which are adjacent to the some different anatomical structures (air, blood vessel, and soft tissue) could be influenced by CT quantum noises and partial volume effects. Thus, the limited intensity contrast between the participating materials increase the segmentation difficulties. In this paper, we proposed a novel segmentation technique for segmentation of the human bronchial trees using vector stream information in 3-D CT images.

P-084 fMRI를 이용한 근섬유통 환자의 Milnacipran 약물 사용에 따른 전 후 압통 자극에 대한 대응 표본 분석

강민재[1], 김성호[2], 문치웅[1]

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Milnacipran is well known as a medicine of chronic pain and fibromyalgia (FM). But that has not been studied quantitatively for therapeutic effect. In this study, we were performed neuroimaging studies comparison of before and after in drug treatment. We acquired functional MRI of before and after drug treatment with periodic pain stimulate. Our findings suggest that Milnacipran has an influence on the aspects of the whole pain network. Especially, insula and thalamus, as well known pain network, tend to deactivation. We propose that these results could be applied to quantitative research of the effects of Milnacipran as basic study.

P-085 녹내장 조기발견을 위한 안저영상의 망막신경섬유층 검출 알고리즘 개발

오지은[1], 황정민[2], 양희경[2], 김광기[1]

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[2]분당서울대병원 안과

Glaucoma is the second leading cause of blindness worldwide. Retinal nerve fiber layer (RNFL) defect is a major sign at the early stage of glaucoma. Early detection of RNFL defects on fundus photographs is crucial to prevent the progression of vision loss. In this study, we proposed an automatic detection method for the RNFL defects. First, we corrected the illumination nonuniformity of the fundus image and then blood vessels were removed. The image was converted to polar coordinate with the center of the optical disk (OD). Candidates of RNFL defects are observed as vertical dark bands and false positives of them are then reduced by using knowledge based rules. The proposed method achieves a sensitivity of 89% at 0.95 false positive per image. In the early diagnosis of glaucoma, the proposed algorithm can be useful for the detection of RNFL defects.

P-086 Visualization of the ultrasonic field in the patient body undergoing ultrasonic treatment of an eye disease

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[3]KORUST Ltd.

The present study was to predict the acoustic field inside a patient undergoing an ultrasonic treatment of an eye disease, in particular, for glaucoma. The numerical simulation based on a finite element method resulted in the ultrasonic pressure distribution colored on the top of anatomical image. It was shown that ultrasound propagated and was refracted through the lens, and was confined within the conical inner space behind the lens bounded by the back muscles. An annular type transducer was found to be effective and safe in radiating ultrasound selectively to the trabecular meshwork known to play an important role in maintaining normal ocular pressure.

P-087 자기공명영상장치의 전자파 안전성에 관한 고찰

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A global trend of the high intensity magnetic field MRI has increased interest in safety problems to patient and the public people. The analysis results of DICOM SAR information extracted from 10 domestic hospitals, showed that the electromagnetic intensity of MRI pulse sequence of TOF MRA exceeded that of mobile devices. In the future, systematic study should be done on the high intensity magnetic field and high-frequency electromagnetic waves in MRI equipment, using the proposed quantitative analysis methods. Besides, there is an urgent need to provide the safety guidelines.

P-088 시스플라틴에 의한 사멸 과정에서 나타나는 난소 암 세포의 형태와 물리적 특성의 변화

김경숙[1,2], 박헌국[1,2,3]

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[2]경희대학교 의료산업연구원
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The changes in morphology and biophysical property such as surface roughness and stiffness are associated with the apoptosis of cancer cells, and the changes depend on the variety of the anticancer drug or the cancer cell. In this work, we examined the effect of cisplatin on the morphology and biophysical property of ovarian cancer cells using atomic force microscopy (AFM). And, it was discussed the relationship between the changes and apoptotic process.

P-089 자화율 강조 정맥 영상에서 위상 에러의 효과

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연세대학교 전기전자공학과

Susceptibility weighted (SW) venography is a contrast enhanced venography obtained from MR (Magnetic Resonance) images. This image is useful for understanding vein structures, so it is applicable to various applications like fMRI (functional MRI). However, in reality, randomly distributed black points are appeared on SW venography because of unknown reason. Because of these black points, identifying vein structures in SW venography become difficult. In this study, we established the phase error causes the black points. The black points were resolved by using only the first half phase data during phase unwrapping.

P-090 액상세포 검사용 현미경 광원 자동 선택 기술 개발에 관한 연구

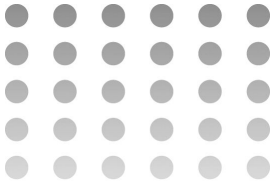오한영[1], 김성현[2], 소하주[1], 김동욱[2,3], 문민기[2], 임완택[2], 허진혁[2], 김현창[4]

[1]전북대학교 대학원 헬스케어공학과
[2]전북대학교 공과대학 바이오메디컬공학부
[3]전북대학교 고령친화복지기기연구센터
[4]㈜ 패스텍

The purpose of this study to control of the microscope light source, the background color of the cell cytoplasm by the color of fairy tales, or more easily find and check the cells of the objectives is to increase the speed. Led by a light source arranged in two rows, the first line was configured with led by one place, led to the second line were placed three rows.

POSTERS

Each led by the DAQ was controlled through Labview. As a result, the light source automatically in the cytoplasm could be investigated. The henceforth, cell automatically handles the entire process of diagnosis and faster than ever outside of cells, determining whether the cancer will be valid for the initial verification.

P-091 방출단층영상재구성에서 선적분 시스템 모델의 사용효과에 대한 비교 연구

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In iterative reconstruction methods for emission tomography, any error caused by the approximations used in the projection and backprojection operations propagates through many iterations and can eventually degrade the quality of the reconstructed image. One of the most popular ray integral methods is the ray-tracing method (RTM) using the line-integral system model. Although the RTM has been widely used over the last decades, with the introduction of more exact models, such as the strip-area based method (SAM) using the strip area system model and the distance-driven method (DDM) which is an approximation to the SAM by combining the RTM and the pixel-driven method, it is often considered to be inferior to the more exact models in that it leads to high-frequency artifacts in the backprojection process. In this work we re-examine the performance of the above three representative system models and experimentally show that, in spite of the problem of high-frequency artifacts, the RTM outperforms both the SAM and the DDM in restoring the edges.

P-092 셔터 안경을 이용한 자동화된 사시 검사의 개발

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[1]서울대학교 전기 정보 공학부
[2]서울대학교 의과대학 안의학교실

The automatic strabismus examination system was developed. By using the shutter glasses to control the cover state electrically Cover-Uncover test and Alternate-Cover test are performed according to the flowchart. By capturing the infrared video during the test, we can measure the deviation of the eye from the difference of the pupil center and the corneal reflex point.

P-093 알츠하이머 환자의 시계열 FDG-PET 영상을 사용한 Parametric Response Map 분석

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성균관대학교 전자전기컴퓨터공학과

Many imaging modalities have been successfully applied to Alzheimer's Disease (AD). One of them, PET images provides significant information to detect changes associated with progression of AD. A novel image analysis method called parametric response map (PRM) was proposed. Here, we applied PRM to longitudinal PET images to discriminate between normal control and converting patients from mild cognitive impairment (MCI) to AD. We tested five normal and five converting patients. Our approach of using PRM method yielded strong performance of distinguishing between normal and converting patients.

P-094 엠슬리 안구 모델을 이용한 망막 영상 정합 기법

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서울대학교 전기 정보공학부, 서울대학교병원 안과

Previous studies about retinal image registration usually focus on the landmark-based image analysis. If overlapping regions are big enough and sufficient matching points are found, successful outcomes can be achieved in a short time. Otherwise, image registration error increases and computation takes a considerable amount of time. Unfortunately, retina images usually don't have enough distinctive features and overlapping regions are not enough for this technique, therefore it is hard to make retina map in good quality. We propose new transformation method using the Emsley eye model, which can be generally applied to reduce registration error.

P-095 금속 물질에 따른 보정 방향성에 대한 연구

김선중, 김영욱, 황도식
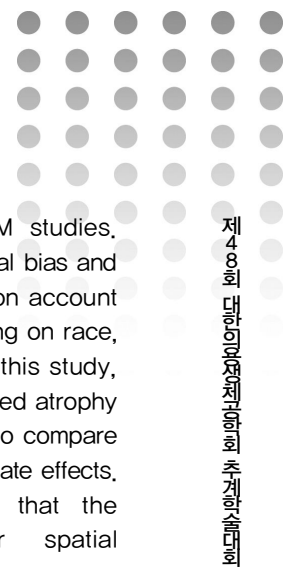
연세대학교 전기전자공학과

Reduction or elimination of image artifacts is one of the important issues in Computed Tomography (CT). Especially, the causes of metal artifacts are quite complicated. While many studies have been conducted to overcome metal-induced image artifacts, their performances are not perfect. In order to solve this problem due to metallic materials research for direction was corrected. The result shows that material of aluminum and copper tend to be corrected.

P-096 비만 및 대사 증후군 연구를 위한 MR 영상 기반 지방 조직 구분 감쇠계수 지도 개발

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[2]서울대학교 영상의학과
[3]UC Irvine Department of Nuclear Medicine

Attenuation correction is a prerequisite procedure in quantitative PET imaging. For whole-body PET/MR, 2-point Dixon MR sequence used to classify soft and fat tissue. However, the current approaches had difficulties to generate automatic accurate attenuation map. In addition, it has been observed that visceral adipose tissue (VAT) showed higher FDG uptake compare to subcutaneous adipose tissue (SAT). Considering these results, we propose the potential MR-based attenuation map with fat segmentation. It was implemented by a fully automated method that uses Dixon sequence in combination with a level set algorithm to derive attenuation maps for whole-body PET in abdominal region.

P-097 공간 정규화를 위한 뇌 표준판에 따른 Voxel 기반의 형태분석 비교

정원범[1], 김제훈[2], 이정희[1,2], 김태형[3], 문치웅[3]

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[2]삼성서울병원 영상의학과, 성균관대학교 의과대학
[3]인제대학교 의용공학과/UHRC

Brain template is important to spatially normalize the individual images to common stereotactic space in voxel-based morphometry using brain MRI. MNI 152 template derived from Caucasian population is the current standard brain in human VBM studies. However, MNI 152 may involve the potential bias and be suboptimal for spatial normalization on account of different brain characteristics depending on race, age, gender and disease conditions. In this study, we performed VBM analysis using simulated atrophy images of Korean and Caucasian brains to compare the variation of atrophy detection by template effects. As a result of this, we confirmed that the study-specific brain template for spatial normalization improves VBM accuracy.

P-098 뇌 네트워크 분석 방법을 이용한 브로드만 35번 영역에서의 변화 관찰

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성균관대학교 전자전기컴퓨터공학과

The hippocampal region (Brodmann' area 35) is an area that is important for normal memory function. Specifically, hippocampal region manifests neurofibrillary tangles in the very early stages of Alzheimer's disease. In this study, we acquired resting-state fMRI images of normal control and Alzheimer's patient from ADNI database. For connectivity analysis, we preprocessed images using SPM8. 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 represents cognitive impairment of Alzheimer's patients by disconnection of functional link.

P-099 Egg white TMM 팬텀을 이용한 조직의 열적 변성 특성 분석

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In generally, heating degree is evaluated by the medium inside the insert temperature sensor in therapeutic ultrasound. However, the complicated pre-processing for temperature measurement has disadvantage. For these reason, in this study, we proposed the evaluation method with the changing of color scale by thermal denaturalization on

Egg-white TMM phantom which has excellent thermal sensitivity. The thermal changes of Egg-white TMM phantom (changing of color scale) were observed in accordance with temperature, and the result was compared with the results of porcine tissue and bovine liver. The usefulness of proposed evaluation method was discussed for estimating the thermal denaturation.

P-100 초음파 B-mode 영상에서 Tri-apodization 기법의 성능 검증

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In the ultrasound image, various window functions have been suggested to reduce sidelobe level which degrades image resolution. However, they reduce sidelobe level at the expense of mainlobe width degrading lateral resolution. Therefore, non-linear apodization has been suggested to reduce sidelobe level maintaining narrow mainlobe width. In this paper, we computationally evaluated the performance of tri-apodization through ultrasound point target simulation. The simulation results show that tri-apodization had identical mainlobe width and 53 ~ 61 dB lower sidelobe level compared to that of the rectangular window. Thus, we demonstrated that tri-apodization can effectively reduce sidelobe level resulting in improved ultrasound image resolution.

P-101 단층촬영 영상에서 추출한 장기 표면모델과 중재 시술용 바늘 사이의 거리 측정 방법

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The needle insertion trajectory for biopsy is planned on CT images to determine the insertion point and angle. The insertion trajectory should avoid critical organs in the path. This paper develops a method to compute distances between the planned insertion trajectory and the nearby critical organs. For computation efficiency, a parameter for this method is optimized through the simulation experiment. As a result, computation time of proposed method with optimized parameter is 200 times smaller than poor

designed parameter.

P-102 고속 카메라를 이용한 눈 깜빡임 검출 및 패턴 분석

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The aim of this study is to propose the new method for analyzing eye blinking. Using a high-speed camera, we took a video clip of an eye with rectangular shaped marker attached below the lower eyelid at 240 frames per second. While shooting a video, a headrest, a chinrest and any additional illumination other than room light are excluded, because those can affect the autonomic nervous system and eye blinking by stress. In order to analyze eye blinking, we extract eye blinking sequences from video clip, align the eye blinking images and estimate the shape and position of the eyelid on blinking by the polynomial curve fitting algorithm. Eyelid shape and position were plotted as a three dimensional graph for further evaluation.

P-103 치아 크기를 고려한 개선된 치아 분할 알고리듬

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In this paper, tooth image segmentation is improved by MCWA considering tooth size at RGB color image. Step of MCWA is boundary appointment, assignment seeds and detecting image segmentation. We proposed to divide into regions using tooth size at step of boundary appointment and assignment seeds. In order to make the boundary and seed, apply to different binary threshold and morphology structural components as per regions. So this method is improving individual tooth segmentation by MCWA. According to simulation result, the proposed method is better than existing MCWA at color image.

P-104 소동물용 PET/MRI 시스템의 MR 호환성 평가

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Here, we'd like to report MR compatibility of a small animal dedicated PET insert developed for simultaneous PET/MR imaging mainly focused on the influences of PET insert on MR imaging. The PET insert was shield by carbon fiber case and magnetic components are minimized. Signal-to-noise ratio (SNR) of MR images and temporal stability of EPI were measured without PET insert, with PET power off, and with PET power on. The results indicated that PET inserts can be used within an MR system without any severe interference for practical animal studies.

P-105 간암 환자의 동적CT영상에서 자립적인 종양과 비자립적인 종양을 구분하기 위한 Parametric Response Map기법의 적용

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Hepatocelluar carcinoma (HCC) is very common worldwide and dynamic CT imaging is used for diagnosis. It is important to distinguish between two types of HCCs, viable and non-viable, as the treatment options are considerably different. In this paper we applied novel image analysis method to distinguish between viable and nonviable HCC after transcatheter arterial chemoembolization (TACE) treatment. We collected subjects with five viable and five non-viable tumors. Our results using PRM analysis reported that there were noticeable differences between viable and non-viable tumor types.

P-106 CT 영상 및 X-ray 투과 영상에서 적용 가능한 병변 추출 방법 연구

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Finding the exact position of tumor is one of the important issues in planning radiotherapy, as the needs to low dose and reduce damage to patient are increase. So many image segmentation techniques were studied, but their performances are not perfect. Level set method is one of the remarkable solutions in segmentation methods, since it can overcome the limitation of conventional method. We show the performance of level set method and compare with the thresholding method both in Computed Tomography(CT) image and X-ray projection image. The result shows that level set method can find more accurate position of the object.

P-107 비강 내 망간 주입 이후 냄새 자극에 따른 후각신경경로 자기공명영상

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The aim of this study is to investigate the central nervous system (CNS) delivery of manganese following intranasal administration form the nasal passage to the CNS, response to different olfactory stimulants. Olfactory bulb in the Signal intensity increased about Formic acid and Linalool. Acetone, Normal saline reduced the Signal intensity, but there was statistically difference about four stimuli. Change of signal intensity on cerebral cortex, amygdale, pons and cerebellum showed statistical differences according to four stimuli ($P<0.05$). In conclusion, Manganese-enhanced MRI (MEMRI) revealed different manganese uptake on olfactory pathway according to different olfactory stimuli, which suggest activity-induced manganese-dependent MRI of olfactory pathway dependant on olfactory function.

P-108 수술 로봇 시스템에서 파노라마 제작 기법을 이용한 출력 방식

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Panoramic mosaic is stitching pictures, taken from one scenery image in multiple degrees, into one. This technique can provide surgeon with wider range of view during laparoscopic surgery. To implement this, affine transformation with six degrees of freedom which needs three corresponding points is used.

Corresponding points are obtained using SIFT(Scale Invariant Feature Transform) which gets hundreds of corresponding points, and then RANSAC(RANdom SAmple Consensus) picks three corresponding points. The panoramic mosaic images are stitched through these processes, and when a laparoscopy moves, an Icon pops up in the view. There are two methods of stitching each frame image. First method compares compiled image and new image, and the second method compares prior image and new image. The application of panoramic mosaic can be located within the whole view or the exterior location with the central laparoscopic view.

P-109 운전 중 주의 분산 요인이 뇌 활성화에 미치는 영향

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This study was to analyze the effect on brain activation depending on the distraction task during driving using a MR−compatible driving simulator. Nine healthy male college students (26.0±1.4 years) participated in this fMRI study. An Experiment consisted of three blocks, each having a Rest phase (1 min.) and Driving phase (Driving only or Driving Task, 2 min.). The distraction task was double digit addition that do not exceed 100. As results of double subtraction, activation of precuneus, middle frontal gyrus, inferior parietal gyrus, cuneus, supramarginal gyrus and declive were increased during Driving only−Driving Task. During Driving Task−Driving only, activation of cingulate gyrus and lentiform nucleus were increased.

P-110 녹내장 질환을 위한 OCT 이미지의 분할선 검출 자동화 시스템

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Glaucoma is a progressive neurodegeneration of the optic nerve, which causes vision loss. Thus, early detection of ganglion cell loss is crucial to delay glaucoma progress. In early glaucoma patients, partially damaged ganglion cells are observed as split line in ganglion cells inner plexiform layer (GCIPL) thickness map acquired by OCT. We are able to detect a split line in GCIPL thickness map and evaluate degree of ganglion cell damage. A split line is analyzed using a chain of image processing techniques and parameter analysis on thickness difference. The automated split line analysis provided multiple parameters in early glaucoma patients.

P-111 아가로즈 젤 타입 MRI 조직 팬텀 특성연구

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We have fabricated agarose gel MRI phantom that shows T1 and T2 characters similar to human tissues as the reference for the standardized quantitative process. Agarose was used as T2 modifier and CuSO4 as T1 modifier. The T1 and T2 values were measured and analyzed in terms of uniformity, reproducibility and long−term stability.

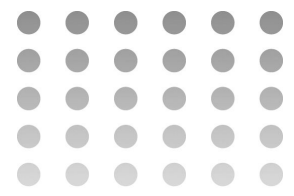### P-112 K−edge 필터링과 에너지 가중을 이용한 CBCT 영상의 대조도 향상

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Research for radiography in the medical imaging has shown that the importance of the dose of radiation for patients during CT scans. Therefore, quality of CT image enhancement, reducing the dose of radiation, is the best topic steadily. This paper presents K−edge filtering and energy weighting methods which enhance the contrast and reduce the image noise for less does radiation. We applied these methods to integral CBCT. Using K−edge filtering, we obtained different energy bin data and used these energy bin data for energy weighting methods. Energy weighting factors were calculated for projection−based weighting. The evaluation of the contrast−to−noise ratio (CNR) of reconstructed image with and without these two methods showed that enhancement of CNR with low dose radiation.

P-113 한국형 뇌자도 시스템 개발 및 임상응용

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Korean Domestic Magnetoencephalography (MEG) system has been developed and installed to department of neurosurgery in Severance Hospital. The MEG system contains helmet-shaped arrays of 152 first-order double relaxation oscillation SQUID sensor. As a clinical application we have measured and analyzed evoked responses of the patients with functional brain disease by outer stimulation (for example, sound, visual, somatosensory and motor). Clinical data by MEG analysis shows that Korean domestic MEG system can provide useful information for pre-surgical planning or human brain research.

Medical Nano and Microtechnology

P-114 Liposomal Indocyanine Green as Diagnostic and Phototherapeutic Tool in Sentinel Lymph Nodes

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Current sentinel lymph node (SLN) biopsy systems for metastatic cancer require multiple injections of chemicals, and surgical removals of lymph nodes. We developed liposomal indocyanine green (ICG) as a biocompatible nanoparticle with use as both diagnostic and therapeutic tool in SLN biopsy. Liposomal ICG has enhanced fluorescence intensity and stability in comparison to free-ICG, along with higher photothermal properties for cancer therapy. In vivo, liposomal ICG visibly accumulated into the SLN, whereas free-ICG did not. Ex vivo NIR fluorescence analyses by excision of LNs confirmed higher accumulation by liposomes than free-ICG. In addition, both free- and liposomal ICG at 128uM heated up to over 50° C in vitro, which destroyed majority of cells. Ex vivo irradiation of excised LNs showed temperature increases over 70° C with liposomal ICG. Lower accumulation by free-ICG into LNs resulted in heating below 45° C. With only FDA-approved materials, we have developed a

single nanoparticle with potential to perform as both diagnostic and photo-therapeutic tool ideal for SLN biopsy.

P-115 디클로페넥 서방 전달을 위한 체내 이식형 마이크로칩

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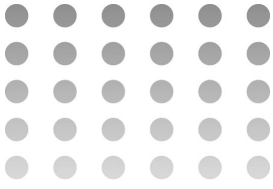[3]서울대학교 의과대학 의공학과 및 의학연구원 의용생체공학연구소

To allow controlled delivery of an anti-inflammatory drug, diclofenac sodium, we prepared a microchip embedded with precisely-designed micro-channels and -wells, serving as diffusion wall and drug reservoir, respectively. As we adjusted the length and cross-sectional area of the channel, the drug release profiles could be accurately tailored, following the Fick's 1st law of diffusion. Thus, by properly combining multiple pairs of micro-wells and channels of different geometry, a single microchip could release the drug in a zero-order pattern. The microchip herein also demonstrated continuous, long-term exposure of the drug in vivo.

P-116 액정폴리머 기반의 뇌피질용 플렉시블 64채널 미세전극

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We demonstrate a novel flexible 64-channel microelectrode array for cortical applications. The base material, liquid crystal polymer (LCP), has low moisture absorption rate which is significant factor for reliability of the electrode. LCP is also semiconductor process compatible and chemically inert. Applying the finger-shaped structure, the suggested microelectrode array was designed for conforming to the brain structure. In vivo neural recording experiment and frequency analysis were performed to validate the feasibility of this electrode.

P-117 신경 자극용 전극에서의 티타늄 사용 효과와 계면 분석

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The bonding strength between laminated metal and polymer is strongly related to the long-term reliability of polymer-based neural interface. Flexible liquid crystal polymer (LCP) is one of candidates for manufacturable long-term implant because it has low water absorption rate (<0.04%) and can form monolithic encapsulation by fusion bonding. In this study, we utilized titanium to enhance adhesion property between metal and LCP. Visual inspections after 4 weeks of stimulation in 95℃ phosphate-buffered saline (PBS) solution showed that the sample with titanium is more durable. X-ray photoelectron spectroscopy (XPS) results revealed that there is oxide binding at Ti-LCP interface.

P-118 원자힘 현미경을 이용한 고해상도 아밀로이드 섬유 이미징

이원석, 이형빈, 이규도, 이상우, 윤대성

연세대학교 보건과학대학 의공학부

Atomic force microscopy (AFM) was used to image, measure, and manipulate biomolecules in nano-biotechnology. Protein performs various functions such as enzymatic reactions and immune systems. Abnormal protein aggregation is associated with amyloidosis that is linked to degenerative disorders such as Alzheimer's, Parkinson's disease, and Huntington's diseases. The formation of amyloid fibrils depends on physiological milieu (e.g. pH and temperature). In this study, we synthesize amyloid fibrils in vitro and investigate hierarchy of amyloid fibrils. AFM enables quantitative analysis of structural conformation of amyloid fibrils.

P-119 마이크로유체칩을 이용한 연속적인 나노입자 분리 기술

김지만, 김자영, 천홍구, 홍종욱

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고려대학교 보건과학대학 생체의공학과
어번대학교 기계공학부 재료과학센터

In microfluidics, separation of micro and nanoparticles plays key role in various applications. Especially separation of nanoparticles has great importance in research field of sub-cell structures, for example nanometer size vesicles, siRNA. In this research, continuous nanoparticle separation was performed using microfluidic chip. PDMS microfluidic chip was designed and fabricated to separate nanoparticle separation. It has three inlets for partitioning fluids and silica NPs and 9 outlets for collection of separated particles. Nano-sized silica nanoparticles were synthesized as a model particle to test the chip. Developed chip facilitated separation of nanoparticles in continuous manner.

P-120 수분침투로부터 안전한 인덕티브 코일 링크 회로 설계

박정환, 김진호, 정준수, 민규식, 김성준

서울대 전기·정보 공학부

In the present study, we propose a design of an inductive coil link circuit safe from water leakage for an implantable electronic device. Detuning resonant frequency using a capacitor and interdigitated electrodes (IDEs) on water leaked state, the designed circuit makes an internal voltage induced by a receiver coil reduced drastically. Measured internal voltages of dry state and water-leaked state are 14 Vp-p and 0.6 Vp-p, respectively. Thus, the internal circuit turns 'off' on water-leaked state. This scheme can enhance the safety of implantable packaging, thus patients are free from danger in water leak state.

P-121 액정 폴리머 기반의 인공와우 전극을 위한 제작 공정과 측두골 삽입 실험 결과

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In the present study, a cochlear electrode array based on a high-performance liquid crystal polymer material is devised. The fabrication steps introduced here include thin-film processes with liquid crystal polymer (LCP) films and customized self-aligning molding processes for the electrode array. The

insertion force into a transparent plastic cochlear model with displacement of 8 mm from a round window was 8.2 mN, and the maximum extraction force was 110.4 mN. Two cases of human temporal bone insertion showed no observable trauma while three cases showed a rupture of the basilar membrane.

P-122 의료용 기기에 적용 가능한 고효율 나노선 센서 구조 연구

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연세대학교 전기전자공학부

Highly effective photo sensor and gas sensor have been realized by using vertically-aligned nanowire array. Silicon nanowires were synthesized by metal-assisted chemical etching and ZnO film was uniformly deposited on nanowire by atomic layer deposition. ZnO/Si core-shell nanowire photosensor shows enhanced photo-responsivity compared to planar structure photosensor, due to the low reflectance. Also nanowire-based ZnO gas sensor shows high sensitivity to NO_2 gas. High performance of nanowire-based sensors is expected to contribute in the medical diagnosis instrument area.

P-123 소형 비드를 이용한 반구형 3D 마이크로 웰 제작

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Concave microwell array has been useful for spheroid culture. Reported concave microwell fabrication methods are complicated in terms of fabrication and use. We suggest a new simple fabrication method using suction pressure and small metallic beads. Concave microwells were successfully patterned on polymer substrates. We observed the size and shape of the patterned microwell via SEM (Scanning Electron Microscope) and found that it is suitable for spheroid culture. We demonstrated the performance of the fabricated concave microwell by culturing spheroids from adipose stem cells.

P-124 다양한 구조의 나노패턴 위에서 인간지방유래줄기세포의 증식과 형태 비교 평가

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Stem cells are consistently stimulated by physical factors of microenvironment where they reside. They include substrate elasticity, micro or nano topography, tension, shear stress and so on. Specially, many studies have reported that micro and nano topography has an ability to enhance or stimulate the proliferation and differentiation of human mesenchymal stem cells. However, there is no study reporting that which shape and size of nanostructures has the most effective structure to regulate stem cells. In this study, we fabricated the three features of nanopatterns (line, hex dot and square dot) with various sizes. And we investigated the effect of various features of nanopatterns on cell adhesion, proliferation, viability, and morphology of human adipose-derived stem cells.

P-125 다양한 혈액 흐름 조건에서 연속적인 용적률 측정에 관련된 연구

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We investigated an accurate method for continuous hematocrit (HCT) measurement of blood flow under various plasma conditions (conductivity and osmolality) and varying shear rate. In a previous work, the HCT measurement error could be reduced using a novel HCT estimation parameter (HEP) under the various plasma conditions. However, shear rate is also a factor to increasing the HCT measurement error in the blood flow. To solve this problem, another novel parameter, the normalized difference (ND), is proposed to compensate for the variation in the HEP. The measurement error was drastically decreased using two parameters under various blood flow conditions.

P-126 전기화학 바이오센서 개발을 위한 페로신 기반의 다기능성 산화환원 고분자

성대경[1], 김태원[3], 양성[2,3]

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We developed novel ferrocene-containing multifunctional redox copolymer for application of electrochemical immunosensor. The synthesized copolymer provides four roles as follows: the surface adhesive monomer acts as an anchor to the ITO electrode, the PEG group prevents nonspecific binding of biomolecules, the epoxide group conjugates antibodies on the polymeric ITO electrode, and the ferrocene group acts as an effective electron transfer mediator. To demonstrate the usefulness of our polymer systems in biosensor, we performed a sandwich immunoassay. As a result, ferrocene-containing polymer improved the sensitivity as well as the dynamic range of the immunoassay compared to ferrocene-free polymer.

P-127 Capture agent를 기반으로 한 전기화학 탄저 균 방어항원 센서 개발

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We demonstrate electrochemical anthrax protective antigen (PA) detection method with chemically synthesized capture agent which is based on peptides. Anthrax is caused by the Bacillus anthracis and can be used a bioweapon. That needs to be early diagnosis and treatment because of high mortality. A capture agent has highly specific interactions with targets, have chemical, physical and thermal stabilities, and can make simple to produce compared to antibodies. The proposed electrochemical anthrax protective antigen sensor permits the detection of PA with a limit of detection (LoD) of 170 pg/mL (2.1 pM).

P-128 단일 세포 내 고효율적인 Nanoinjection 기술

의 정량화

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고려대학교 보건과학대학 바이오융합공학과
고려대학교 보건과학대학 의생명융합과학과

Nuclear reprogramming, which include human somatic cells into induced pluripotent stem cells (iPS), is the major topic in biological field because it can suggest the alternative to problems with stem cell-based researches such as ethical questions and immune suitability. Many researchers has been devoted to improve the efficiency of nuclear reprogramming and iPS cell production. In these flow, we suggest the essential idea to quantifying methods to produce the iPS cells. Establishing the mechanisms of nuclear reprogramming is unsolved challenge. To solve these problem, we should bring the present multi cell level experimental system to single cell level system. For this purpose, we set the nanoinjection system to deliver the nuclear reprogramming factor into a single cell. In this study, to optimize the conditions for nuclear reprogramming, we observed expression efficiency by calculated injected volume & injection pressure through nanoinjection system.

P-129 전기 임피던스 분광기술을 이용한 SU-8 절연층 의 변성 분석

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The life-time and functionality of the microelectrode-based sensors are determined by the durability of the insulation layer. SU-8, epoxy-based negative photoresist, has been used as an insulation layer of the microelectrode system due to its high resistivity and easy processing. However, one of the drawbacks of SU-8 is swelling in the liquid by water diffusion into the polymer, which results in the changes in the electrical characteristic and structure of SU-8. In this study, the durability of SU-8 coated on the gold electrode was tested by using electrical impedance spectroscopy. The impedance of the electrode soaked in 0.9% NaCl at 37 °C was measured and analyzed by equivalent circuit modeling.

P-130 회전에 의한 미세유동장치에서의 채널 디자인에 따른 미세유체흐름 분석

박지흠[1], 이정찬[2], 김희찬[2,3]

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Extensive research has demonstrated versatility of centrifugally driven microfluidics controlled by various combinations of rotational speed in realizing critical functionalities including pumping, mixing, valving, and metering. One of the major advantages of centrifugal microfluidics with rotating platform is the replacement of external pumping device with centrifugal forces to generate effective pressure-driven-like flow through the microchannel, and therefore fluid mechanics including heat transfer as well as flow characteristics in radially positioned microchannel has been extensively explored. However, those for other possible designs that could be implemented in the rotating microchannels were less likely discovered. Here, we have investigated fluid dynamics in three different microchannel designs, which may provide qualitative and quantitative basis for the design principles in centrifugal microfluidics to manipulate the flow with high controllability.

P-131 생체모사 맥동 자극을 발생하는 마이크로 유체 시스템

안기훈, 이기훈, 김성환, 박중열
중앙대학교 기계공학부

Various studies have tried to increase rate of IVF (In Vitro Fertilization) through bio-mimic methods which have better successful rates than that of the hanging droplet method. However, no methods have been reported that can mimic fallopian tubes cilia pulsation motion. In this study, we developed squeezing pumping mechanism to apply squeezing/releasing stimulation as well as to make pulsatile flow in microfluidic system. Using this pumping mechanism, we successfully made mechanical squeezing stimulation and monitored pulsatile flow.

P-132 Nd:YVO4 레이저를 이용한 실리콘 표면의 그루브 패터닝

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서울대학교 전기·컴퓨터공학부

We evaluated Nd:YVO4 laser to get the groove surface, because laser micromachining technique facilitates creating various depth of grooves from a few microns to a few hundred microns. However, debris after laser treatment decreased resolution of grooves. To remove the debris, we employed silicon wet etching method and this reduces time and cost compared to the photolithography. By using the laser micro machined silicon structure as a mold, a PDMS replica is created.

P-133 마이크로플루이딕스를 이용한 마이크로 구조체의 표면 선택

오다롱[1], 허건[1], 유형정[1,2,3], 서종모[1], 조동일[1,2,3], 김성재[1,3]

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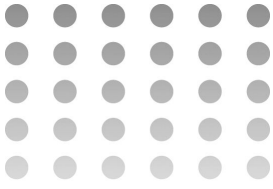[2]서울대학교 자동화연구소
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Advantage of bacteria as actuator in active, micro-scale drug delivery system (DDS) is bacterial flagellum, so they can move without external power sources. This paper, we propose a bacteria-assisted biodegradable polymer having drugs. For the selective bacterial adhesion onto the micro DDS surface, DDS trapper was designed and tested. More than 70% of the trapping sites succeeded in capturing micro DDS structure.

P-133 Nd:YVO4 레이저를 이용한 실리콘 표면의 그루브 패터닝

오다롱, 서종모
서울대학교 전기·컴퓨터공학부

We evaluated Nd:YVO4 laser to get the groove surface, because laser micromachining technique facilitates creating various depth of grooves from a few microns to a few hundred microns. However, debris after laser treatment decreased resolution of grooves. To remove the debris, we employed silicon wet etching method and this reduces time and cost

65

compared to the photolithography. By using the laser micro machined silicon structure as a mold, a PDMS replica is created.

P-134 미세척추동물의 근전도 검사를 위한 미세 바늘 전극 개발

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Myotonia is a disease that muscle relaxation of the skeletal muscle is delayed after voluntary or electrical stimulation, and has no fundamental treatment so far. As the first step towards the development of new drugs to treat myotonia, myotonic zebrafish embryos can be used as they are cheap and easy to screen. To measure the electromyography in such small vertebrates, a new type needle electrode is required. In this paper, we introduce the fabrication of the new electromyography needles that can be used for myotonic zebrafish embryo models, together with the measurement system to hold and position the needle electrodes.

P-135 접촉임피던스 감소를 위한 나노 다공성 백금 전극의 개발

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In this paper, a nanoporous electrode that features increased surface area and reduction in skin-electrode impedance is introduced. Here two types of fabrications, L2ePt and nano platinum particle coating, were used to make the sensor. Evaluations using cyclic voltammetry and contact impedance recordings were conducted to see the increased surface area and its effect on reducing contact impedance. The result showed that the proposed sensor had forty-fold increase in surface area and nearly 30% decrease in contact impedance compared to that of a gold electrode.

P-136 Real time monitoring of nitric oxide and blood flow during cerebral ischemia-reperfusion in rat model

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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 neurotransmission, vasodilation, platelet adhesion and activation, angiogenesis and wound healing. 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.

P-137 Changes in nitric oxide and oxygen in myocardium during cardiac ischemia-reperfusion of the rat

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We simultaneously measured nitric oxide (NO) and oxygen (O2) dynamics in the myocardium during myocardial ischemia-reperfusion (IR) utilizing sol-gel modified electrochemical NO and O2 microsensors. In addition, we attempted to clarify the correlation between NO release in the ischemic period and O2

restoration in the myocardium after reperfusion, comparing a control heart with a remote ischemic preconditioning (RIPC)-treated heart as an attractive strategy for myocardial protection. As a result, we showed that the cardioprotective effect of RIPC could be attributed to endogenous NO production during the ischemic period, which subsequently promoted reoxygenation in post-ischemic myocardia during early reperfusion.

P-138 증폭 라만 산란 신호를 이용한 실시간 인플루엔자 바이러스 검출법

양세은[1], 남정수[2], 신현구[1], 강태욱[3], 임광일[2], 최연호[1]

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Since the influenza virus is a fatally infecting disease, if not treated immediately, it could incur life-threatening complications. Therefore, we cannot overemphasize the importance of obtaining a quick diagnosis of the rapidly spreading virus. As a result, In-situ influenza viruses become one of the most important topics in diagnostics and it is required for prevention and control of contagious disease. Here, we demonstrate virus detection result by surface enhanced Raman scattering (SERS). It is expected that different surface proteins on viruses will generate different Raman spectra, leading to the ability to identify viruses with unique lipids profiles and comparing them to vesicular stomatitis virus G protein (VSVG). It also obtain real-time detection of spectral differences between viruses. Our experimental method and results show that the SERS virus spectrum provides a unique fingerprint of individual virus at high selectivity and efficiency, without requiring any viral manipulation.

P-139 EMT 유도된 암세포의 세포 이동성 관찰을 위한 미세유체소자 플랫폼

최종찬[1], 김병준[2], 조혜정[3], 양성[1,2]

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This study aims to understand the role of Epithelial to Mesenchymal Transition (EMT) process in cancer metastasis. MCF-7 cells are cultured with 10 ng/ml of TGF β to induce EMT process for 2 days. Morphological change and immune-fluorescent staining is investigated to confirm the EMT process. A Collagen type 1, as an extracellular matrix is introduced and polymerized in a micro channel to form 3D hydrogel. A linear concentration gradient is generated through hydrogel and EMT-induced cells are incubated on a 2D surface. Concentration gradient of 10-1 % of FBS is formed and cell migration is observed to see the effect of TGF β on cell migration. Results indicate that TGF β activates EMT process of cancer cell with enhanced cell migration.

P-140 바이오칩 응용을 위한 고효율 미소유체제어 방법

도 일[1], 이동우[2], 김윤지[2], 조영호[2]

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An advanced combinational microfluidic multiplexer capable to address multiple fluidic channels for fuel cell reactors is proposed. Using only 4 control lines and two different levels of control pressures, the proposed multiplexer addresses up to 19 fluidic channels, at least two times larger than the previous microfluidic multiplexers. The present multiplexer providing high control efficiency and simple structure for channel addressing would be used in the application areas of the integrated microfluidic systems such as fuel cell reactors and dynamic pressure generators.

P-141 곤충 날개 모방의 새로운 공정 제안

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To develop biomimetic insect wings for micro aerial vehicle (MAV), exploration of flapping wing mechanism is necessary. The actual insect wing is composed of veins covered with a very thin membrane. To mimic these wings hard metal materials are chosen to substitute veins and thin flexible materials are chosen to substitute the membrane. While producing thrust, the difference in solidity of vein substitute and membrane substitute results in

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damaging the membrane portion. In this paper, we propose a novel design and the fabrication method to develop biomimetic wings that can produce both thrust and maneuverability without self-damaging during flapping.

P-142 SU-8을 기반으로 한 다기능 DBS 전극

김정훈, 임재호, 이상훈

고려대학교 보건과학대학 생체의공학과

The therapeutic technique of deep brain stimulation (DBS) has now become widely applied for treating a variety of disorders. Here, we present the design, fabrication and packaging of SU-8 based micro needle electrode for neural applications. By the use of photolithography, evaporating, bonding and electroplating techniques, polymer needles with 2 channels of recording sites and bipolar stimulation site have been successfully fabricated. DBS insertion for stimulating subthalamic nucleus (STN) has been expected as a potential therapeutic method for Parkinson's disease (PD). To demonstrate role of DBS electrode in STN stimulation, we implanted fabricated-electrode on the target STN. Once electrode is implanted, it stimulates the neuron cells in the subthalamic nucleus and at the same time neural signal is recorded from the STN.

P-143 바이오 분자 감지를 위한 이황화 텅스텐의 합성

송정규, 박주상, 김형준

연세대학교 전기전자공학과

Recently, the two dimensional materials such as graphene oxide (GO) and molybdenum disulfide (MoS2) have been studied for the biomolecular detection. The two dimensional materials can achieve low price and high efficiency in the application of biomolecular detection. In this regard, the tungsten disulfide (WS2) is promising material as the biomolecular detection. In this study we synthesized WS2 nanosheets based on atomic layer deposition process which has several advantages in thickness control and large area uniformity.

P-144 원자힘 현미경을 이용한 금나노입자 기반의 상보적 DNA 결합 검지

이상원, 이형빈, 이규도, 이상우, 윤대성

연세대학교 보건과학대학 의공학과

BRCA1 gene mutation is closely associated with breast cancer. We use BRCA1 gene sequence to make several mismatched DNA and detect the extent of mismatch of DNA immobilized on nanoparticles by using atomic force microscopy (AFM). AFM allows us for visualizing DNA-DNA interaction (i.e., hybridization) on nanoparticles. We enable high-sensitive detection of topological change between probe DNA functionalization and DNA hybridization on nanoparticle at the nanoscale level with label-free manner by AFM. It is considered that this technique may be very useful in quantitative detection of mismatched DNA sequence-related to breast cancer.

Neural Engineering

P-145 액정 결정성 폴리머를 기반으로 하는 미세전극칩을 이용한 신경세포망의 전기적 활성 연구

김래영[1], 김대정, 홍나리, 이성은[2], 김범진[3], 김성준[2], 정택동[3], 남윤기[1]

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Microelectrode arrays (MEAs) have been widely used to study the electrical characteristics of neural networks in vitro. Conventional MEAs are usually based on glass and insulated with silicon nitride, which is easily broken that not suitable for long term experiments. Liquid crystal polymer (LCP) can be a solution for MEA development because it is biocompatible and chemically stable. In this study, we developed LCP based microelectrode arrays and electrical activities of neural networks were measured. The LCP surface was appropriate for long term neuronal cell culture. Spontaneous neural signals were measured. The electrical and chemical stimulations could evoke unique neuronal responses.

P-146 안구밀착형 망막보철을 위한 액정폴리머 기반의 공정기술

정준수, 민규식, 신수원, 김성준

서울대학교 전기정보공학부

A new retinal prosthetic system is developed based on liquid crystal polymer (LCP). This device is fabricated using monolithic encapsulation of LCP in which all the components such as planar coil, stimulation circuit and electrode array are integrated on a single body of curved LCP substrate. This enables a thin, lightweight, eye-conformable, and long-term reliable retinal prosthesis. The newly developed fabrication processes such multilayer integration, spherical deformation, IC & components assembly, LCP packaging and laser machining are described. This device has been implanted into rabbit retina for more than a year for evaluating its long-term stability.

P-147 미세전극배열을 이용한 집속 초음파 자극에 의한 해마신경세포의 신경 활동 변화에 관한 연구

최정봉[1], 임성환[1], 김도형[1], 장동표[1], 김인영[2]

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[2]한양대학교 의공학교실

Many experiments investigated the neuro modulatory effects of ultrasonic stimulation, yet there are few researches that investigate which parameters are needed to change activity of excitable cells. In this study, changes in neural network activities were recorded during ultrasonic stimulation with various parameters using a multi-electrode array (MEA). This study concludes ultrasonic stimulation induces bimodal effect to the neuronal network activity. However, the timing of neuronal activity and stimulus was not synchronized. 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.

P-148 3차원 표면 신경 신호 기록을 위한 나선형 평면 전극 제작

김준민, 서종모

서울대학교 전기컴퓨터공학부

To record signals of the three-dimensional neural tissue, organ, flexible surface electrodes, depth electrodes, and multichannel depth electrodes are introduced. In this study, Electrodes were patterned onto flexible PDMS substrates and encapsulated in PDMS to enhance skin compatibility. If the surface of the target organ for neural recording has high convexity, then these electrodes are not appropriate to minimize the distance between the recording sites and the neural tissues. To solve this problem, we developed spiral-patterned flexible microelectrode arrays (MEA) with gold and PDMS by semiconductor micro-fabrication technique.
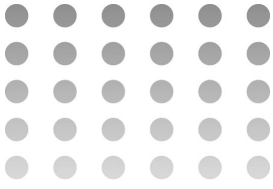
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P-149 신경 신호 기록을 위한 PDMS기반의 유연한 평면 전극 제작 기술

김준민, 서종모

서울대학교 전기컴퓨터공학부

Planar electrode for recording neural signal are fabricated using PDMS and gold. Most of planar electrodes have a typical structure which is consist of a metal layer between insulating layers, and this will make gap between target neural tissue and the electrode pads. To solve this problem, electrodes should be plated with gold. But PDMS thin films are highly vulnerable to external physical force, thus gold plating is very difficult after MEA being fabricated. In this study, we propose new fabrication process which enable the surface of electrodes to be raised until same planar level of the cover layer.

P-150 자극 주파수에 따른 이중 주파수 안정상태 시각유 발전위의 주파수 분석

장민혜[1], 김현석[1], 박광석[2]

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Dual-frequency steady-state visual evoked potentials (SSVEPs) have harmonics at main frequencies (f1 and f2) and their linear combinations such as the sum of them. This study analyzed dual-frequency SSVEPs at every harmonic component for fifteen different combinations of stimulus frequencies. Dual-frequency SSVEP peaks occurred most at f1, f2, and |f1-f2|. SSVEP

signal-to-noise (SNR) significantly differed depending on the stimulus frequency combination and the difference between the two stimulus frequencies. This finding would be helpful when designing dual-frequency SSVEP-based BCIs for high accuracy.

basic parameters of neural activity, such as spike rate and inter-spike-interval, were shown as the form of graphs on the webpage. This online database system also allows users to readily share their data set, thus possibly contributing to neuroinformatics fields.

P-151 해마 발달과정의 전기생리학적 변화 관찰을 위한 CA3-DG 공동배양 플랫폼 개발

주성훈, 이은수, 선 웅, 남윤기

KAIST 바이오및뇌공학과
고려대학교 의과대학 해부학교실

For studying characteristic of hippocampal neural network, brain slice and in vitro neuron culture have been used as a research model. Unlike brain slice, in vitro neuron culture system does not have reproducible structure, however, it is a valuable model system for long-term, non-invasive experiment and test under various conditions. Expecially, for studying electrophysiological characteristic in a process of hippocampal development, it is important to make a brain mimicked neuron culture system as a model rather than using a brain slice which has fixed structure. In this work, we report a co-culture platform that is patterned CA3 pyramidal neuron and dentate gyrus granule cell inside the agarose microwell on multielectrode array for observing the change of electrical signal of co-cultured neural network.

P-152 다채널 신경 신호의 데이터베이스 구축 및 웹 기반 분석 시스템 개발

이형섭, 장민지, 남윤기

KAIST 바이오및뇌공학과

Multichannel recording and analysis of neural signals using microelectrode arrays have been widely used in neural network studies. There are several commercial systems and softwares that support such experiments, but the management of massive data has been challenging. In this work, we developed a database that contains spike train data and its web interface for data management and online analysis. As well as the upload and search of data, this system enables the basic analysis of uploaded data set; the

### P-153 단채널 자극-기록 장치를 이용한 다채널 신경전극 어레이 스캐닝 시스템 개발

정현준, 남윤기

KAIST 바이오 및 뇌공학과

Neural network or single neuron stimulation and recording present valuable measurement to analysis. Differently with conventional neural recording system, which preclude direct neural response recording at stimulating electrode, application of 24bit high resolution Analog-to-Digital Converter (ADC) with low gain amplification allows recording of neural responses after 2ms at stimulating electrode [1]. However, this system requires manual interface with electrode which is too laborious and time consuming especially at multichannel stimulation. In this research, we developed neural recording system with some analog switches, single amplifier and ADC which can record not only spontaneous activity but also evoked activity in 2~3ms after switching. Also automated sequential stimulation is possible using MFC program and microcontroller.

P-154 미세유체채널 내의 복합적 자극에 의한 미세아교 세포의 활성도 및 운동성에 대한 연구

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[1]KAIST 기계공학과
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Microglia, a type of glial cells, are known to play critical roles in neurodegenerative diseases. Microglia undergo significant changes in their activation states upon various physicochemical stimulations from the microenvironment of the brain. Therefore, it is important to understand how physical cues influence the activation states of microglia. The activation states, that are known to determine their functional roles, correlate closely with distinct migration patterns. To investigate how physical cues
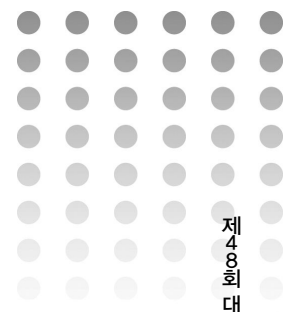
influence the activation states of microglia, we used a microfluidic platform that enables the regulation of the combinatorial stimulation of an electric field and fluid shear stress on microglia independently.

P-155 망막 영상 정합을 위한 대응점 추출 기법

이우람, 서종모

서울대학교 전기 정보공학부
서울대학교병원 안과

Useful information of retina disease can be recorded as a fundus photograph, and it is routinely used for diagnosing and monitoring retina diseases. However, a single retinal image does not show the whole area of the fundus and has limitation in clinical evaluation, because the fundus camera can usually take pictures with a field angle of 30 to 60 degree. For this reason, retinal image registration is needed, and in order to merge retinal images common points between images should be found. The most prominent feature in retinal images is blood vessels thus by using characteristics of blood vessels in the retina, we suggest a robust and fast algorithm for extracting matched features of fundus images.

P-156 자궁근전도로 평가한 조산 그룹의 자궁 근층 운동 특성 변화

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The diagnosis of preterm delivery is very important for protecting the lives of mothers and babies and reducing the costs from unnecessary medical interventions but still remains a challenge for obstetricians. Recently, many researchers have paid attention to Electrohysterogram (EHG) for predicting preterm delivery because of its noninvasiveness and inexpensiveness. In this study, we investigated the changes in characteristics of myometrium activities as delivery approaches using EHG database. We expect to develop delivery onset and preterm delivery prediction technique based on this preliminary study.

P-157 이식 가능한 근적외선 신경 자극기

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Recently, infrared neural stimulation gained increasing attentions due to its merits of high spatial selectivity, damage free, artifact free over conventional electrical stimulation. However, due to its big size of the laser source, implantation remains questionable. In this paper, we report a novel optical neural stimulation method using miniaturizable semiconductor laser diode for implantable device. Using this method, we could successfully stimulate nerve (in vivo) showing magnitude of compound action potential of 54uV.
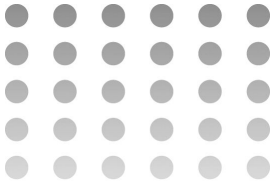
P-158 일과성완전기억상실환자의 병변위치에 따른 정량 뇌파의 차이 분석

김정연[1], 박영호[2], 김성윤[2], 임창환[1]

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It was suggested that there are two parallel pathways between hippocampus and neocortex and they differentially interacted with regions along the anterior-posterior axis of the hippocampus. We investigated whether the differential interaction could be revealed by examining EEG data of patients with transient global amnesia (TGA). Patients were divided into two groups, anterior (n = 33) and posterior (n = 41) hippocampal lesion groups. We compared the regional EEG spectral powers between the two groups. We found that differential interaction of the anterior and posterior hippocampus with neocortex by analyzing quantitative EEG data acquired from TGA patients.

P-159 수동 운동과 능동 운동(운동 심상) 동시 수행 시 혈류역학 반응 변화 비교 및 단독 시행 분류

한창희, 황한정, 임창환
한양대학교 생체의공학과

It is well-known that active motor execution or motor imagery can enhance the outcomes of passive exercises for neurorehabilitation. In the present

study, we investigated if functional near infra-red spectroscopy (fNIRS) could be used to evaluate whether the users actively performed motor execution or motor imagery during the passive exercise. We compared concentration changes of oxygenated hemoglobin in three different task conditions: passive exercise, passive exercise with motor imagery, and passive exercise with active motor execution. The results of statistical analyses showed that the concentration change of oxy-Hb significantly increased when the participants performed active tasks (P+MI or P+AME) during passive exercise, elucidating why the combinatory execution of passive and active exercises enhances the outcomes of neurorehabilitation. Results of single-trial pattern classification between the "passive exercise only" class and the "combinatory strategy" calss showed high classification accuracy more than 85%, demonstrating that fNIRS could be used as a potential tool to monitor how well the users of the rehabilitation systems performed the given exercise tasks (active exercise or motor imagery during passive exercise).

P-160 휴대폰 케이스에 따른 전자파 인체 흡수 비율 고찰

오도영, 유형석

울산대학교 전기전자컴퓨터공학과 의용생체공학전공

In this paper, we designed the phone which consist of iphone 4s material and used the planer monopole antenna. Afterward, we measure radiation of mobile phone. In order to compare SAR (Specific Absorption Rate) in a human head, we change the case that now commonly used as a phone case. Measurement of SAR is calculated by using the FDTD (Finite-Difference Time-Domain) numeric technique in 1800MHz. From the simulation results, the phone which is not covered with case has lower SAR than phone which is covered with case under the same output power.

P-161 ANSYS와 MATLAB을 이용한 코일 시뮬레이션

홍상표, 정율호, 박성준, 이정철, 최미현, 김형식, 정순철

건국대학교 의료생명대학 의학공학부 의공학실용기술연구소

Magnetic field strength and field map of magnetic stimulation coil were simulated using ANSYS and MATLAB computer simulation software. A three type of coil were analyzed; circular coil, figure-8 shape coil, and overlapped coil. We evaluated magnetic field strength at 2, 5, 7 cm form surface stimulation coil. From the results, overlapped coil shows best efficiency than other two type of coils.

P-162 Rd1 마우스에서 급성 분리된 망막과 조직 배양된 망막의 신경절세포 발화반응비교

김주연, 안근노, 이왕우, 구용숙

충북대학교 의과대학 생리학교실

We performed tissue culture on retinal explants from rd1 mice well-known animal model for RP patients and confirmed retinal explants are viable for upto 4 culture days. We conducted multichannel recordings on freshly isolated and tissue cultured retinas. In comparison with freshly isolated retina, spontaneous oscillatory rhythm tends to disappear in tissue-cultured retinas day by day. Tissue-cultured retinas show hypoactivity and more clustered pattern of spike firing than freshly isolated retinas. Now we confirmed viability of upto 4 culture days, we are using this culture system when we test safety limits for degenerated retinas while applying long-term electrical stimulation.

P-163 온도변화에 따른 신경신호 패턴 분석을 위한 PID 온도제어시스템 개발

김대정, 유상진, 남윤기

KAIST 바이오 및 뇌공학과

Temperature plays important roles in regulating biological system, including the electrical activity of neurons. However, abnormal increase in the temperature can induce febrile seizure and contribute to the limbic epilepsy. Although there have been various in vitro and in vivo febrile seizure models mimicking the fever environment, the test condition was confined to setting the maximum temperature level rather than controlling the temperature slope. In this article, finely tuned PID temperature control system is introduced to studying the temperature effect on neural activity with various conditions of

temperature in vitro. We are expecting it to be further used in febrile seizure model.

P-164 Neurogram을 이용한 CIS방식 자극설정 평가 방법 개발

양혜진, 강수진, 우지환

울산대학교 의공학과, 울산대학교 전기공학부 의공학전공

Cochlear implant (CI) system is set to various stimulus configurations. In this study, we proposed new method to estimate CI performance using the neurogram similarity. The neurograms were generated using a computational model and the similarities between the neurograms were computed based on similarity index measure (NSIM). We estimated how the stimulus configuration influence CI performance by comparing the distance of NSIMs between standard sound and each target sound. The effects of stimulus rate and noise on the CIS strategy were investigated with the set of 6 vowels. While adding noise decreased vowel discrimination, the stimulation rate per channel does not significantly influence CI performance.

P-165 3차원 신경 전극의 제작 및 기계적 특성 실험

신수원, 김성준

서울대학교 공과대학 전기공학부

In this study, we propose three-dimensional neural probe using liquid crystal polymer (LCP). The proposed neural probe was fabricated by thin-film process, thermal lamination and assembling process. It has three-dimensional composition of sites with multiple shanks. In this paper, we study mechanical characteristics of three-dimensional neural probe by in vitro and in vivo insertion experiments.

P-166 다채널 전극을 이용한 초음파 자극 시 뇌 해마 신경 세포의 활동 전위의 변화 검출

한희석[1], 전현재[1], 황서영[2], 이예나[2], 전상범[2], 김태성[1]

[1]경희대학교 생체의공학과
[2]이화여자대학교 전자공학과

It is known that ultrasound affects action potentials in neurons, but the underlying principles of ultrasonic neural stimulation are not clearly elucidated yet. In this study, we have measured the action potentials of primary cultured hippocampal neurons of the rat on multi-electrode arrays during ultrasound stimulation. The increased action potentials (i.e., spikes) were mostly observed during ultrasound stimulation with few decreased cases.

P-167 후각 사건 관련 전위 측정을 위한 Olfactometer 개발

김우섭[1], 신영석[1], 박진식[1], 조석현[2], 장동표[1], 김인영[1]

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[2]한양대학교 이비인후과학교실

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) is considered as one of the alternative methods to test the function of the olfactory. In this study, we designed the olfactometer for injecting fragrance quantitatively. By evaluating with olfactory ERP experiment, we confirmed that the developed system could be used for testing the quality of olfactory function.

P-168 시각유발전위를 이용한 뇌 스위치 시스템 구현

차호승, 임정환, 황한정, 한창희, 임창환

한양대학교 생체공학전공

Brain switch systems based on steady-state visual evoked potential (SSVEP) or P300 are uncomfortable to the users because the users have to stare at flickering or reversing light sources with a high modulation frequency. In this study, we proposed a new brain switch system based on a transient VEP (P100) elicited by relatively infrequent (> 1 Hz) flickering frequency, which can be a nice alternative of SSVEP or P300 based brain switch systems. Support vector machine (SVM) was used to classify between switch 'on' and 'off'. EEG signals were acquired while the subject was gazing at a square-shaped visual stimulus and a fixation on a monitor by turns. The true positive rate and the false

positive rate of the offline experiments were 86 % and 10%, respectively, demonstrating the possibility of a VEP–based brain–switch system.

Orthopedic and Rehabilitation Engineering

P–169 **미세골절부위의 간격변화에 따른 생체역학적 특성**

이강토[1], 윤상운[2], 김영직[2], 박상혁[1], 민병현[2], 배태수[1]

[1]중원대 의료공학과
[2]아주대학교 의과대학 정형외과학교실

Microfracture technique has been used for the repair of articular cartilage. The distance among microfractured holes by awl was still controversial, however, few studies have addressed with respect to biomechanically structural stability. The purpose of this study was to estimate biomechanical characteristics as holes' distances by using finite element method. The result showed that the von mises stress of subcondral legion at 3mm space was dramatically decreased and gradually increased again after 2.5mm space. It is considered that the stress on subcondral bone between 3mm–3.5mm space was more penetrated into trabecular bone compared to other spaces.

P–170 **전방낙상시 발의 미끄러짐에 따른 신체 움직임 측정에 관한 연구**

김성현[1], 오한영[2], 소하주[2], 김동욱[1,3]

[1]전북대학교 공과대학 바이오메디컬공학부
[2]전북대학교 대학원 헬스케어공학과
[3]전북대학교 고령친화복지기기연구센터

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 and the impact area in various fall directions. Falls are resulted from foot slips and foot slips are broken out variously. In this review article, body movement was measured during forward fall according to foot slip in order to distinguish the acceleration patterns.

P–171 **모사경골 홀의 유무에 따른 경골과 기저판 사이의 Micromotion 차이 분석**

장영웅[1], 이재영[1], 염정현[1], 유의식[2], 김정성[2], 임도형[1]

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[2]㈜코렌텍 중앙연구개발센터

The use of artificial bones in implant testing has become popular due to their low variability and ready availability. But the hole, which is created during the production process in located proximal tibia, changed stress distribution pattern and maked stress concentration. The purpose of this study was to analysis of micromotion deviation between cancellous bone and baseplate according to hole using finite element analysis (FEA). The FEA results revealed that the hole model measured 58% higher than the removal hole model. Therefore, mechanical test with artificial bone should be considered the effect of poximal tibia hole.

P–172 **가변기저면 기반의 평형 훈련에서의 하지 근육 협응 특성 분석**

정호현, 김충연, 이범기, 전경진, 임도형
세종대학교 기계공학과
한국생산기술연구원

Falling is major problem to the elderly because of a decrease of functional balance ability and muscle strength. Up to now, study of effective increase of muscle activation for prevention of falling is not well. In current study, purpose is to evaluate muscle synergy characteristics response to specific dynamic motion. A motion capture system, surface EMG system, unstable base and wii fit balance contents were used for this study. The result showed that certain muscle were activated corresponding to specified motion in terms of muscle synergy.
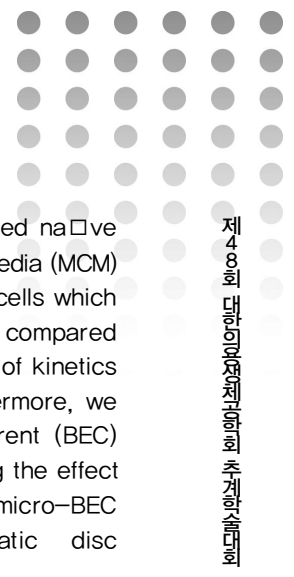
P–173 **체성감각에 진동 자극 인가 시 근전도 변화의 연구**

박민화[1], 김성현[2], 김동욱[2]

[1]전북대학교 헬스케어공학과
[2]전북대학교 바이오메디컬공학부

Gait disturbance in the elderly that has carried out the treatment on the inflow of external sensory

stimulation, rehabilitation treatment such as physical therapy experts have helped to improve the walking and sensory function in the elderly. In many cases, the treatment is not more than a certain limit. it is possible to stimulate into the sensory receptors distributed in human skin sensory stimulation of additional external, as well as improve walking function and induce smooth movements daily needs. Measuring somatometry indicated by stimulating somatosensory related to body surface are to reflect on the improvement of gait.

P-174 정상상태 시각 유발전위를 이용한 뇌-스위치 시스템 개발: 예비 연구

이준학, 임정환, 황한정, 한창희, 임창환

한양대학교 생체공학전공

A brain switch system is a representative type of asynchronous brain-computer interface (BCI) systems, which allows the users of the BCI systems to turn on/off the systems by themselves. Steady-state visual evoked potential (SSVEP)-based brain switch has been one of the most widely-used brain switches, which showed a nice performance in terms of the true-positive rate (TPR). Unfortunately, however, previous studies did not focus more on the false positive rate (FPR), which might be of great importance in practical applications of the brain switch systems. In this study, we implemented a brain-switch system based on SSVEP, and assessed the FPR performances more strictly.

P-175 Analysis of kinetic properties from the effect of micro-biphasic electrical current on annulus fibrosus (AF) cells

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Symptomatic disc degeneration is an important cause of chronic intractable lumbar pain. AF cells are most common reason to low back pain, initiated by tears in the outer annulus fibrosus. We cultured naïve AF cells under macrophage conditioned media (MCM) exposure in vitro to induced nemotic AF cells which were mimicked AF tissue disruption. We compared the naïve AF and the nemotic AF cells of kinetics in real time live imaging system. Furthermore, we analyzed micro-biphasic electrical current (BEC) treated nemotic AF cells for investigating the effect of a BEC. We suggested that the micro-BEC stimulation may diminish symptomatic disc degeneration.

P-176 악교정 수술을 위한 가상 모델 수술 시뮬레이션 시스템 개발

김대승[1], 이우진[2], 최순철[1], 이삼선[1], 허민석[1], 허경회[1], 황순정[3], 이원진[1]

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Accurate orthognathic surgery planning and planning transfer in the operation theatre are important factors for a successful surgery outcome with appropriate esthetical and functional improvements. A new system of virtual model surgery simulation for orthognathic surgery has been developed. After designation of the landmarks for bone relocation on the surface model, bone segment was relocated by a combination of rotational and translational movements for each axis. Movements of the designated landmarks were calculated for each relocation step. Relocated final position of the bone segment was recorded for the surgery guide system. Discrepancy of the landmark positions between the virtually planned position and the actual position according to the model surgery was calculated and used for the evaluation of the system accuracy. Total of 7 cases of experiment was done and 5 measurements were implemented on 8 landmarks for each case. Total average of the absolute error ranged from 0.06 to 0.87 mm and the RMS error was 0.54 ± 0.21 mm. The evaluation results showed clinically acceptable accuracy.

P-177 평면 검출에 기반한 다중 키넥트의 3차원 정합 기법

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After emerging of Microsoft Kinect, the interest in three-dimensional (3D) depth image was significantly increased. Depth image data can be converted to 3D coordinates by simple arithmetic calculation and then can be three-dimensionally reconstructed. However, because the surface coordinates can be acquired only from the front area of an object, total solid cannot be reconstructed but also volumetrically measured. In this paper, multiple Kinects registration method was suggested, in which surface information from each Kinect was simultaneously collected and registered in real time to build 3D total solid. To unify relative coordinate system used by each Kinect, 3D perspective transform and 3D randomized Hough transform was used. Once transform matrices were generated, real time 3D reconstruction of various objects was possible. To verify the usefulness of suggested method, human arms were 3D reconstructed and the volumes were measured by using four Kinects and the measurement error was lower than 5%, which was similar to that from medical CT (Computerized tomography) images.

P-178 보행 보조 수단으로써의 역하진동자극의 활용 가능성에 대한 연구

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This study was conducted to suggest the potential use of a vibratory stimulation in the ankle to correct gait abnormalities. As for the vibratory stimulation, different locations and durations are suggested based on the detection results of real-time gait patterns. Five young males participated in this study. They were asked to perform assigned gait tasks when either a threshold or sub-threshold stimulation was applied in the tibialis anterior and Achilles tendon. The analysis results of muscle activity showed the changes on gait cycle. Also, the result of sub-threshold stimulus showed similar effects as that of threshold stimulus. The result of this study can be used as basic data for the correction of individual's specific gait abnormality and rehabilitation using vibratory stimulation.

P-179 관성센서 기반 모션 캡처 시스템 개발 및 검증

조재성, 강신일, 임서현, 이종실, 김인영
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The Hanyang IMU(H-IMU) system is an easy-to-use, cost efficient system for full-body human motion capture. Hanyang IMU system is based on unique, state-of-the-art miniature inertial sensors, 3DS Max biped models and sensor fusion algorithms. Hanyang IMU does not need external cameras, emitters or markers. It does not suffer from problems of occlusion or missing markers. In addition, Hanyang IMU unique for inertial motion capture technology: the captures any type of movement, joint angle calculation including rehabilitation.

P-180 전동휠체어 주행거리시험의 신뢰성 평가방법 개발

육선우, 정진석, 황인호, 안윤호, 문무성
근로복지공단 재활공학연구소

Energy consumption of electric wheelchair is measured for two types of driving such as CDT(continuous driving test) and MT(manoeuvring test). Theoretical range values are calculated from the energy consumed, the nominal distance travelled, and the battery capacity. Therefore, we will study effective evaluation method for two types of electric wheelchair driving.

P-181 인지 재활훈련 평가 시 단기 스트레스가 주는 영향

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The cognitive rehabilitation training is important for treating a variety of cognitive impairment conditions, including Parkinson's disease, stroke, and ADHD.

In this study, we developed a new evaluation system to improve the measurement of the conventional evaluation systems. The developed system measured the activity of dopamine (DA) and an autonomic nervous system (ANS) with photoplethysmography and electromyography. The results demonstrated that the cognitive capacity was increased but the activity of DA was decreased with unbalanced ANS by short-term stress. Based on the results, the effect of short-term stress should be recognized for the cognitive rehabilitation training.

Intervertebral disc degeneration is an important cause of chronic intractable low back pain (LBP) and is associated with inflammation induced by interleukin (IL)-1β released from macrophage in the annulus fibrosus (AF). The purpose of this study is to investigate the effects of biphasic electrical current on the AF in disc degeneration. We showed that the IL-1β modulated the production of extracellular matrix (ECM)-modifying enzymes. The biphasic electrical current diminished IL-1β-induced, ECM-mediated disc degenerative expression at an optimal dose of 500mV/mm. These data provide for the potential application of chronic disc degenerative low back pain.

P-182 정원창 자극방식 중이 이식형 보청기의 이소골 진동변위를 이용한 성능평가 방법의 타당성 연구

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The stapes displacement has been used to evaluate the performance of the active middle ear implant (AMEI) using forward stimulation method. In some case, it also has been used to evaluate AMEI using reverse stimulation although the structural asymmetry of cochlear with ossicular chain. In this paper, to examine the feasibility that the performance of AMEI using the reverse stimulation method could be evaluated based on stapes displacement. As a result, the amplitudes of ABR waves by each stimulation method were too different to estimate the performance of reverse stimulation method devices at the similar stapes displacement.

P-184 The effect of biphasic electrical currents on inflammatory mediators in IL-1β-stimulated AF cells

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To identify the effect of biphasic electrical currents on the production of inflammatory mediators in IL-1β-stimulated AF cells. Symptomatic disc degeneration is associated with macrophage-mediated inflammation in the AF. Human AF cells were treated with 1ng/mL IL-1β and cultured in a microcurrent generating chamber system. IL-6, IL-8, vascular endothelial growth factor(VEGF), and nitric oxide(NO) were measured. Compared with unstimulated cells, IL-1β-stimulated AF cells produced significantly higher levels of IL-6, IL-8, VEGF, and NO. The cells exposed to 500mV/mm field produced significantly less IL-6, and VEGF than unexposed cells. NO production was markedly increased at 500mV/mm.

P-183 The biphasic electrical current modulates the expression of extracellular matrix-modifying enzymes on human annulus fibrosus cells

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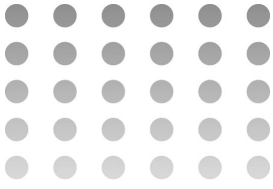[1]Department of Medical Sciences, Graduate School of Medicine, Korea University
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P-185 고령자 대상 원적외선과 쑥찜훈증 자극에 따른 인체영향평가

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POSTERS

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Our study performed estimation of human body effect about far-infrared radiation and steam stimulus. Subjects consist of ten females in seventies aged without disease. They were stimulated by far-infrared radiation and steam stimulus during 20 minutes. We measured HRV, body heat skin before and after stimule. Result showed that parasympathetic were activated than sympathetic nerve system. We found that body heat increased too. This research could be applied to develop stability and mental stress improvement in elderly body bathing system.

P-186 골절모델에서 금속판의 응력과 변형: 유한요소 해석

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The fracture fixation plate is designed to stabilize a fracture by driving the ends of the fracture together and compressing them. Plates have beneficial for primary bone healing, but they are very vulnerable to bending and torsion. In this study, we calculate how much weaker in bending and torsion force rather than compression force by finite elementary model. We could conclude that orthopedic doctors should compress the fracture surfaces with plate not only allows the bone cortex to resist bending loads but also the frictional contact helps resist torsion during fracture operations.

P-187 낮은 조도에서 평지 보행 시 보행 속도, 지지구간 비율, 발들림높이 및 신체안정성 변화

최진승[1,2], 강동원[1], 배재혁[1], 이주학[1], 신윤호[1], 탁계래[1,2]

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The purpose of this study was to evaluate the changes in gait pattern during even surface walking under low illumination. Fourteen young subjects walked the walkway five times at a self-selected walking speed

under normal walking (NW), under low illumination (LW) and normal walking with reduced speed (SW) which was the speed of LW. Walking speed, stance phase ratio, toe clearance (TC) on swing phase, and body and head stability were used. According to the results, it was confirmed subjects even young adults increased safety margin for stable walking. To evaluate the effect of low illumination by aging on gait pattern clearly, further study is necessary to perform additional experiment by elderly subjects and uneven walkway.

P-188 뇌-기계 인터페이스 잠재 사용자의 선호기능 및 기술척도 도출방법 연구

서정우, 안광옥, 김정윤, 최현, 이성재
보건복지부 국립재활원 재활연구소
재활로봇중개연구사업단

Brain-machine interface(BMI) technology is defined as a direct connection between the human brain and external devices. It can help people with severe disabilities use external devices without motor function. In order to establish the direction of technology development, we need to obtain needs and requirements of potential BMI-users. In this study, brain storming and Mind mapping techniques are used for questionnaires. The survey items are separated by personal characteristics, current assistive technologies solutions and level of satisfaction technology recognition and technology preference research.

P-189 전신진동운동 자세에 따른 하지 근 활성 변화

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The purpose of this study was to evaluate thigh muscle activities during WBV exercise with different squat position. Ten healthy women performed four squat posture on a vibration platform such as LS, HS, HU&HS and OS. Surface electromyography signals thigh muscles were taken and analyzed. A vibration stimulus is 25Hz and intensity is 4mm. Muscle activities

during WBV were compared with no-WBV. In the result, EMG signals caused by WBV were significantly increase(P<0.05) compared with no-WBV in all thigh muscles and various squat positions. In conclusion, WBV would have an effect on increasing activation of the thigh muscles.

P-190 3D 프린팅을 이용한 골절 골반 모델의 첨삭가공

오왕균, 임기선, 이태수

충북대학교 의용생체공학과

Pelvic fractures account for approximately 3% of total fractures, whose main causes are traffic accidents, falls, etc. Unstable pelvic fracture caused by high-energy trauma can have a life-threating damage on the other organs, particularly the abdominal or pelvic hemorrhage with mortality 8 to 20 percent. In this study, pelvic 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 pelvic fractures may cause the mortality or complications due to the anatomical specificity. 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.

P-191 유량-압력 변환 기법을 이용한 수액주입펌프 분석기 개발

김수홍[1,2], 윤성욱[1,2], 조명헌[1], 이승준[1], 임문혁[1], 서수영[1], 전계록[1,2], 박선언[3]

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[3]삼흥메디칼

Currently, a pump analyzer for preventive inspection of the infusion and syringe pump is used to measure the flow rate in an open circuit system. Since this measurement method is consumed a lot of time and human resource, a closed circuit system with a flow rate-pressure conversion technique is required for

a pump analyzer. In this study, we 've developed a pump analyzer that is occlusion pressure and flow rate are measured at the same time and the flow rate is displayed by a change in pressure. According to the experiments, the developed pump analyzer showed the reduction of inspection time as compared to an existing pump analyzer(IDA4 Fluke).

P-192 전기 임피던스 근운동 기록법을 이용한 손목 굽힘 관찰

박일환, 조성보

가천대학교 의공학과

Electrical impedance myography is a non-invasive and real-time measurement of the impedance of individual muscles can be used to diagnose neuromuscular disease including radiculopathy, amyotrophic lateral sclerosis, and inflammatory myopathy. In this study, we monitored the impedance change of the flexor carpi radialis according to the wrist flexion by using a virtual lock-in amplifier based impedance measurement system. The input signal was an alternating current with a frequency of 1 kHz and amplitude of 1 □A. The wrist flexion caused an increase in the impedance magnitude and a decrease in the phase measured with a pair of electrodes attached on the skin over the flexor carpi radialis but not over the flexor carpi ulnaris. The difference of the impedance magnitude and phase between the wrist flexion and drop were about 40 Ω and 1.3 °, respectively.
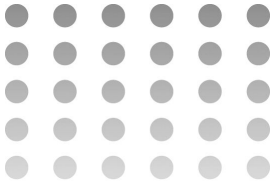
P-193 연골세포의 탈분화가 이동성에 미치는 영향

신현준[1], 송석현[2], 신현정[1,2]

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Chondrocytes near OA legion in vivo lose inherent characteristics and undergo dedifferentiation. Such conditions of dedifferentiated states can be mimicked in vitro by culturing primary chondrocytes to higher passages. The dedifferentiated cells exhibit marked differences in their motile properties in addition to the changes in morphology and gene expression. In this study, we investigate how dedifferentiation affects the motile properties of the chondrocytes.

POSTERS

Primary rat chondrocytes are sub-cultured to establish cells of different passages, and the type I versus type II collagen expression levels are accessed for each passage to quantitatively confirm the state of dedifferentiation. Our results show that the chondrocytes become more dedifferentiated with the passage. The average trajectory speeds of the dedifferentiated chondrocytes are faster than those of the unaltered primary chondrocytes.

P-194 상호파워스펙트럼을 이용한 좌우 하악과두 궤적에 대한 위상지연차이 분석

우상윤[1], 김대승[2], 이우진[1], 강세롱[1], 이원진[2]
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[2]서울대학교 치과대학 구강악안면방사선학교실

The temporomandibular joint (TMJ) is the most complex and unique joint. Correlation between the path of the TMJ and facial morphology has been studied. The purpose of this article was to analyze the time difference of dislocation occurred in bilateral condyle. Cross power spectral density allowed us to calculate the time difference between bilateral condyle movements of TMJ in frequency domain. We computed the phase delay of bilateral condyle movement and analyzed correlation between the phase delay and facial morphology. The result explained that the time difference after surgery is correlated with facial morphology after surgery ($p<.05$).

P-195 유연한 소재를 이용한 링키지 기반의 공압 손 엑소스켈레톤 개발

구인욱, 강병현, 조규진
서울대학교 기계항공공학부

A hand exoskeleton is a device for assisting or reinforcing the hand motion. In this paper, a pneumatic hand exoskeleton is introduced. Though some pneumatic hand exoskeletons are developed already, their motion is not accurate as exoskeletons based on linkage and motor system. In order to overcome this accuracy problem, we designed a new linkage which can guide the direction of the motion of pneumatic air muscle. Then we developed the prototype of exoskeleton. We also conducted an experiment to validate the usability of the exoskeleton.

P-196 가변 스텝 크기 적용 필터와 GSAP를 이용한 보청기용 피드백 제거 알고리즘

안홍섭, 김서준, 심현민, 이상민
인하대학교 전자공학과

Acoustic feedback is a phenomenon that is to reduce the maximum insertion gain of hearing-aid device and give a displeasure feeling to hearing-aid user. A continuous adaptation systems and suppression algorithm to avoid acoustic feedback have been proposed in the past. In this paper, we propose a variable step size normalized LMS(least mean squares) algorithm using VAD(voice activity detection). The VAD algorithm is GSAP(global speech absence probability) and feedback cancellation algorithm is normalized LMS. The proposed algorithm applies different step size between voice and non-voice using VAD for high stability, fast convergence and low misalignment when correlated inputs, such as speech. The result of simulation with white noise and speech signal, the proposed algorithm is shown that high performance then traditional algorithm in terms of stability, convergence and misalignment.

P-197 자세 조절 평가 및 훈련 시스템 개발을 위한 키넥트 센서의 적용: 기초연구

최진승[1,2], 강동원[1], 탁계래[1,2]
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[2]건국대학교 의공학실용기술연구소

This is a preliminary study on the application of Kinect sensor for postural control test and training system. To recognize three kinds of movements of balance improvement exercise, the Kinect sensor was used. Results showed that recognition rate was very high, such as an average of sensitivity and that of specificity were 95% and 100%, respectively. Through further research, it can also be improved the sensitivity by changing the threshold of joint range of motion. Therefore we think that it is possible to use the Kinect sensor for development of feedback-enabled postural control test and training system.
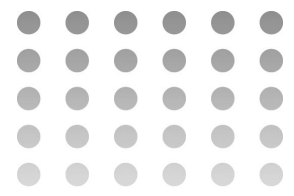
P-198 수액/혈액 가온기의 수액온도에 따른 유량대비 가온 성능 평가

유성묵[1], 신연수[1], 이종태[1], 허몽도[3], 김희중[1,2], 정재승[2], 손호성[1,2], 선경[1,2]

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Blood warmers are used in various settings, ranging from emergency medicine, hospital care, and on the battlefield. These devices are relatively large in size and expensive, which limits its mobility and therefore versatility. Warmers used in Korea are mostly imported, which further increases the price, and the Department of Ministry of Health & Welfare reports that roughly 64% of hospitals in Korea lack fluid warmers. To address both the high price and limited mobility, we have developed a Korean-made fluid warmer that is both cheap and portable. This study compares the performance of the Thermosens® fluid warmer with those of commercial fluid warmers.

Respiratory Engineering

P-199 수면무호흡 검출을 위한 압전 센서 신호 기반의 파라미터 도출에 관한 연구 (A preliminary study)

에르덴바야르, 박종욱, 이효기, 이경중
연세대학교 의공학과

In this study, the parameters which are feasible to detect sleep apnea using a single piezo-snoring-sensor attached on the neck during overnight sleep were extracted. Total 6 parameters (NN, SDNN, rMSSD, LF, LH, and LF/LH ratio) were extracted from heart rate variability induced by the piezo-sensor signal and the difference of the parameters between each apnea and non-apnea section using Student's t-test was analyzed. We concluded that there is a no statistically significant difference between each apnea and non-apnea section in all parameters. Further study is required to find additional parameters for automatic detection of sleep apnea.

P-200 수중 호흡기류 측정이 가능한 장치의 정기류 측정

이유미[1], 이인광[1], 홍준식[2], 차은종[1], 김경아[1]

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Respiratory measurements are easily made to evaluate to an individual's sports capability as well as pulmonary function for the activities performed on the ground such as walking or bicycling. However, under water environment makes it difficult to make respiratory measurements. The present study developed a device continuously measuring the respiratory air flow rate under water, and the steady flow characteristics were evaluated. The pressure-flow data well fitted to a parabolic with a high enough correlation coefficients higher than 0.999. Therefore, accurate respiratory measurements would be possible for under water activities such as swimming.

P-201 휴대용 호흡 측정 시스템 개발

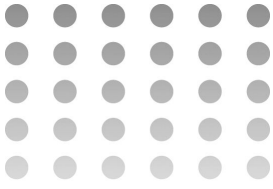전상건, 이기혁, 김지원, 김도현, 김범룡, 이종실, 김인영
한양대학교 생체공학과

In this paper, we present the development of portable 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.

P-202 수축기혈압을 이용한 수면 무호흡 검출

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This paper proposed the algorithm for sleep apnea detection based on systolic blood pressure. Sleep apnea detection is important clinical issue since it usually implies an underlying health conditions such as heart problems. The proposed algorithm consists of detection of peaks in continuous blood pressure

signal, feature extraction, and classification of sleep apnea using support vector machine. To evaluate the performance of algorithm, the MIT−BIH Polysomnographic Database provided by PhysioNet was employed. As a result, the sensitivity of 81.08% and the positive predictive value of 94.61% were obtained.

P−203 수면 무호흡/저호흡의 실시간 검출을 위한 비강 압력 신호의 사용

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This study proposes a method for real−time detection of sleep apnea/hypopnea using a nasal pressure signal. The method consisted of pro−processing part, peak and trough point detection part, amplitude computation part, and apnea/hypopnea detection part. Total twenty patients with sleep apnea syndrome were evaluated during overnight PSG study. The performance was evaluated with manually annotation labeled by sleep expert. Results showed that the method based on a nasal pressure signal would be useful for portable, cost−effective, easy−to−use and objective sleep apnea/hypopnea monitoring system for home healthcare.

System Biology, Physiological Modeling

P−204 저속 측면 충돌 시 탑승자 근육 활성이 동역학적 변화에 미치는 영향

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Computational models for automobile collisions are being developed. To consider the effect of bracing on muscles, we administered side collisions with two muscle conditions, i.e. muscle relaxing/bracing, at two different velocities, 6.7/8.1 kph. Lateral flexion in coronal plane was calculated to verify the effect of side collision through Vicon motion analysis system. At both 6.7 kph and 8.1 kph collision, muscle bracing makes further lateral flexion than muscle

relaxing. The more the impact velocity was administered, the less effect of muscle bracing was shown. In conclusion, muscle activation on side collision should be considered to refine the established computational models.

P−205 객관적 이명 진단 연구를 위한 최적 피팅 기반의 GPIAS 산출법의 제안

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[1]한국베크만광의료기기연구센터
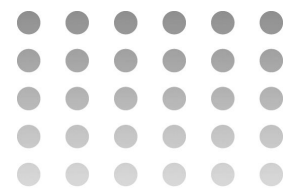[2]단국대학교 의과대학 의공학교실
[3]단국대학교 의과대학 이비인후과학교실

Since tinnitus is the perception of sound in the brain although no external sound is present, it is difficult to be diagnosed objectively by the conventional testing method. The GPIAS (gap pre−pulse inhibition of acoustic startle) method has been used for tinnitus screening in rats. However, there are several GPIAS calculation methods which can produce different results. In this study, we suggest the optimally fitted GPIAS calculation method than existing method based on a comparative analysis.

P−206 뇌파와 심전도를 이용한 진통제 효과의 정량적 측정

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[2]서울대학교 의과대학 마취통증의학교실
[3]서울대학교 의과대학 의공학교실 및 서울대학교 의학연구원 의용생체공학연구소

This study was aimed to investigate the quantitative parameters for the effect of the opioid analgesics which are administered to a patient during the operation. In order to evaluate the previously proposed electroencephalographic and electrocardiographic parameters such as ApEn and HRV, one channel EEG and ECG signals of a patient were acquired with fixed doses of the opioid analgesic. The ApEn and HRV value was analyzed before and after opioid administration. The results show that opioid analgesics could change the value of ApEn and HRV.

P-207 **왜도와 첨도를 이용한 부정맥 검출을 위한 유비쿼터스 심전도의 최적 부착위치 예측: 시뮬레이션 연구**

임기무[1], 심은보[2]
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The purpose of the study is predict optimal placement of ubiquitous electrocardiogram (U-ECG), which spaced 5cm apart bipolar electrode, in order to detect arrhythmia using skewness and kurtosis of signal. Using a three-dimensional model (3D) of cardiac electrophysiology, we have developed a simulation method for identifying the optimal placement of U-ECG electrodes on the torso surface. We simulated the heart-torso model to obtain a body surface potential map (BSPM) and ECG waveforms. Using this model, we determined the optimal placement of the two U-ECG electrodes, spaced 5 cm apart, for detecting the P, R, and T waves for normal and characteristic wave for arrhythmia. The present study provides an efficient simulation method to identify the optimal attachment position and direction of the U-ECG electrodes on the surface of the torso for arrhythmia detection.

P-208 **대동맥 및 방실판막 부전이 좌심실보조장치의 성능에 미치는 영향**

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금오공과대학교 메디컬IT융합공학과

The purpose of the study is to predict the effect of aortic and mitral regurgitation on the function of left ventricular assist device (LVAD). In order to achieve the purpose, we used LVAD-implanted cardiovascular system model which consist of 16 Windkessel compartments for the simulation study. To mimic aortic and mitral regurgitation, we modified one-way valves to be leaked, then allows reverse flow. In the case of mitral valve regurgitation, LVAD maintained normal cardiac output. However, cardiac output did not increase to normal value under the condition of 10% severity of aortic regurgitation. Although this study was conducted in silico, our results may be used as a reference data for clinical experiments when considering LVAD treatment with valve regurgitation patients.

P-209 **KCNQ1 유전자의 Gain of Function 돌연변이가 심방세동에 미치는 영향에 대한 수학적 예측**

리스키 이마니아스투티, 임기무
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Atrial fibrillation is the most common sustained cardiac arrhythmia and a major cause of morbidity and mortality. The mechanism underlying AF are not fully understood, several studies demonstrated that some cases of atrial fibrillation have genetic basis, including gain of function mutations in K+ channel. V241F is one of gain of function mutation in KCNQ1 gene, which affects the cardiac action potential repolarization. This study investigates the effect of KCNQ1 gain of function mutation on atrial fibrillation. We demonstrate by one- and two- dimensional simulation of original, mutation and wild type using model of human atrial cell and tissue.

P-210 **태아-임부간 심장박동 위상 동기화 분석**

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[2]서울대학교 의과대학 의공학교실

The objective of this study was to look for evidence of coordination between fetal and maternal cardiac systems. We examined fetal and maternal electrocardiogram from 5 healthy singleton pregnant women in labor. Fetal and maternal R-R interval time series were constructed and the phases were determined. The distributions of these phases were examined and synchrograms were constructed for real and surrogate pairs of fetal and maternal data sets. Synchronization epochs were determined for defined n:m coupling ratios. There was no significant difference for synchronization index between real and surrogate data with respect to synchronization epochs. There was however a preference for the occurrence of synchronization epochs in specific phases in real data not apparent in the surrogate for some n:m combinations. These results suggest that occasional synchronization between fetal and maternal does occur.

P-211 **저속 후방 추돌 시 음주에 따른 피험자의 거동 분**

POSTERS

석

김동현[1], 정영진[1], 임도형[2], 김한성[1]

[1]연세대학교 의공학과
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This study was aimed to determine the effects of human body behavior following blood alcohol concentration while rear-end collision. One healthy man performed a bout of sled test which is composed to three steps, non-drinking state, drunk one bottle, drunk two bottles before rear-end collision test. There was significant between non-drinking and drinking of human body behavior. It seems to be appeared that the high blood alcohol concentration evoked large movement of human body, so when the people drinking before riding that might be induced more serious injury than non-drinking people.

Tissue Engineering and Biomaterials

P-212 브로모니딘 생체이용도 향상을 위한 나노구조 친점액성 마이크로입자

박천권[1], 김영국[2,3], 김미정[2,3], 박민[1], 김명훈[1], 이승호[1], 최성윤[1], 정유정[4], 정영은[4], 박기호[2,3], 최영빈[1,4,5]

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Topical drug administration is widely used to treat various eye diseases due to ease of administration, which, however, is still limited in short residence time and low bioavailability of drug. To resolve this, we developed nanostructured microparticles (NMs) of poly (lactic-co-glycolic acid) containing a mucoadhesive polymer (polyethylene glycol) to synergistically enhance ocular retention and thus to obtain higher bioavailability of drug. NMs were prepared by freeze-milling the eletrospun nanofibers to maintain the nanostructure, providing microparticles with a 10-fold increase in the specific surface area, as compared with spherical microparticles by emulsion method. NMs contained Brimonidine as a model drug, and were formulated in a dry dosage form for administration to eyes. In vivo animal study revealed mucoadhesive NMs show

the best results of 13 h in lowering intraocular pressure (IOP), while the periods of lowered IOP were 9-10 and 6 h for the other types of microparticles and Alphagan P (marketed product of BRT), respectively.

P-213 초음파와 초음파 조영제를 이용한 약물 전달에 관한 연구

송길수, 손정우, 박진감, 김경희, 신운철, 원종호, 조용준, 서종범

연세대학교 초음파 연구실

The drug delivery system using ultrasound is non-invasive way to delivery drugs. The point of this research is to find the resonance frequency appropriated produced UCAs. Ultrasound (800kHz, 600kHz) with a 1% duty cycle at 1MPa acoustic pressure for 30min was applied in all sonication sessions. The results showed that the proposed method using 600kHz significantly improved drug penetration compared with 800kHz frequency case. Ultrasound with UCA has excellent potential with in using the different size of bubbles in UCAs and resonance frequency to maximize the cavitation effect.

P-214 복합자극에 의한 근아세포 분화의 극대화

고웅현, 김미나, 조영빈, 방현승, 박석희, 신현준, 신현정

KAIST 기계공학과

In muscle tissue engineering, development of fully-maturated myoblasts is critical for successful tissue integration. Recent reports have shown the efficacy of exogenously applied physical stimulations such as topological alignment and electrical field in muscle tissue engineering. However, the mechanism of how these physical cues influence muscle development has not been fully understood. Therefore, in this study, we apply both topological alignment and electrical field simultaneously to find the synergistic effects and the underlying mechanism. The combinatorial stimulation of aligned fibers and EF simulation in parallel orientation enhances myogenic differentiation, highlighting the importance of the relative orientation of EF and fiber alignments in maturation of the differentiated myoblasts.

P-215 대기압 플라즈마에 의한 피부 섬유아세포의 형태 변화

김미나[1], 권보미[2], 조영빈[1], 김기중[2], 심은영[1],
최원호[2], 신현정[1,3]

[1]KAIST 기계공학과
[2]KAIST 물리학과
[3]KAIST 의과학대학원

Atmospheric pressure plasma (APP) has recently gained a great deal of attention as a prospective tool for skin care. However, fundamental cellular level responses and the underlying mechanism of how APP influences different cells in the skin remain unclear. In this study, we focus our study on the biological effect of APP on the human dermal fibroblasts (HDFs) in vitro. HDFs are treated by helium jet plasma (970 V input voltage driven at 50 kHz) for 20 mins. We find that APP induces the transformation of mesenchymal fibroblasts into cells of epithelial characteristics. This observed phenotypic change is related to the reverse process of fibrosis during wound healing, suggesting that the APP has a potential to be utilized in minimizing the scar formation during abnormal wound healing.

P-216 3D의 마이크로 파이버 형태의 중간내배엽줄기세포 패턴의 세포 이동과 관련된 인자에 의한 변화 평가

홍소영, 박용두
고려대학교 의과대학 의공학교실
고려대학교 한국인공장기센터

Bioprinting is ideal tool for organ regeneration in tissue engineering. Human mesenchymal stem cells (hMSCs) are patterned as a microfiber in 3D hydrogel using bioprinting, then the fiber structure is cultured in vitro to monitor the integrity and shape change from the initial structure. Fibers shaped with hMSCs are dramatically aggregated in the hydrogel, not maintaining the fiber structure. Treatment of ROCK inhibitor (Y27632) and E-cadherin antibody attenuated the hMSCs aggregation and hMSCs with Y27632 and E-cad sprouted 2 days after patterning. Measurement of actin filament, Rho, E-cadherin, and VE-cadherin intensity ratio compared to DAPI were evaluated.

P-217 PCL/β-TCP/collagen/HA로 구성된 계층구조의 3차원 세포담체

여명구, 김용복, 진규현, 이형진, 전호준, 김근형
성균관대학교 바이오메카트로닉스학과

In general, bioceramics such as β-tricalcium phosphate (β-TCP) and hydroxyapatite (HA) are promising biomedical materials for bone tissue regeneration, because of their good osteoconductivity and, in some cases, osteoinductivity, whereas their shortcomings may include low mechanical fracture toughness and brittleness. One reinforcing technique is to use a coating process with various composite systems consisting of synthetic biopolymers and bioceramics. In this study, we suggest rapid-prototyped polycaprolactone (PCL)/β-TCP composite scaffolds, and to increase the biological properties of the composite scaffold, we used a simple coating process to reinforce the scaffolds with a mixture of collagen/HA. The fabricated scaffolds were assessed for not only physical properties including surface roughness, tensile modulus, and water uptake ability, but also biological capabilities by culturing osteoblast-like cells (MG63) for various HA compositions (1, 3, 5 wt %) in a 2 wt% collagen solution. The results of cell viability, scanning electron microscopy, alkaline phosphatase (ALP) activity, and mineralization analyses showed that, although a small portion (0.3 vol %) of coating agent (collagen/HA mixture) was used, the cellular behavior (such as attachment spreading, proliferation, and mineralization) improved remarkably.

P-218 뼈 조직 재생을 위한 core (PCL) – shell (collagen/alginate) 구조의 세포담체

김용복, 여명구, 전호준, 진규현, 안승현, 김민성, 김근형
성균관대학교 바이오메카트로닉스학과

We herein describe a novel hybrid scaffold comprising microsized struts with a core (PCL) shell (collagen/alginate) structure. The collagen-based hybrid scaffold was fabricated using plotting method supplemented with a core-shell nozzle. The core region (PCL) in the struts has mechanical support and shape integrity functions, and the shell region (collagen/alginate) enhances biological activities. Through use of various processing conditions, we

could manipulate the mechanical properties of the scaffolds without any loss of biological functions, similar to a pure collagen scaffold. The mechanical properties of the hybrid scaffold were enhanced by ~12-fold compared with those of a pure collagen scaffold due to the reinforcement of the core region (PCL). To demonstrate the feasibility as a hard tissue scaffold, osteoblast-like cells (MG63) were seeded and the cell-seeding efficiency and various cellular activities were investigated. The cell-seeding efficiency (53%) and cell viability of the hybrid scaffold were similar to those of the pure collagen scaffold (57%), while the pure PCL scaffold showed relatively low cell-seeding efficiency (19%) and viability. To determine its potential as a scaffold for bone tissue regeneration, in vitro cellular activities, including ALP activity and calcium deposition, were compared with those of the pure collagen scaffold; no statistically significant differences compared with those of the pure collagen scaffold were found. These results indicate that the in vitro cellular activities of the hybrid scaffolds were identical to those of the pure collagen scaffold; moreover, the hybrid scaffold exhibited significantly improved mechanical properties.

P-219 외피 세포의 분산에서 물리적 힘에 관한 연구

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Cell scattering is prevalent in many cellular processes including cancer metastasis and wound healing. Although biochemical mechanisms of scattering have been studied extensively, the role of mechanical forces in scattering is poorly understood. Here, we evaluated the role of a scatter factor, hepatocyte growth factor (HGF), in modulating mechanical forces within the collective migration of small cell clusters. We analyzed the cellular migration, the traction force exerted by cells on their substrate, and the intercellular stress within cell clusters. Our findings suggest that reduction of inter-cellular shear stress may precede cell scattering.

P-220 출혈을 동반한 상처의 지혈을 위한 배트록소빈을 포함한 접착제의 적용

류경은[1,2], 권병주[1,2], 서혁진[1,2], 김민성[1,2], 구민아[1,2], 이미희[1], 박종철[1,2]

[1]연세대학교 의과대학 의학공학교실
[2]연세대학교 의과학과 BK21 Project

Conversion of fibrinogen to fibrin is a critical process for blood coagulation, which is catalyzed by thrombin. A venomous component of Bothrops atrox moojeni, batroxobin plays a similar role to thrombin, and forms soluble fibrin clots during hemostasis. In this study, recombinant batroxobin was topically applied as a hemostatically active agent and a powdery medical adhesive composed of aldehyded dextran and ε-poly (L-lysine) was also adopted as a mechanical base for bleeding injuries. The hemostatic effects of the materials were evaluated by in vitro experiments and animal models. As a result, total blood loss and the hemostasis time can be effectively controlled by co-treatment of the batroxobin-containing adhesive.

P-221 광동역학적 기반으로 발생된 활성산소종에 의한 혈관내피세포의 증식효과

구민아[1,2], 권병주[1,2], 이미희[1], 김봉진[3], 왕강균[3], 김용록[3], 박종철[1,2]

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[2]연세대학교 의과학과 Bk21 project
[3]연세대학교 화학과

Attempts to overcome limitation of vascular graft implantation have been challenging over the past decade due to thrombosis and intimal hyperplasia. However, such interventions are associated with major complications such as narrowing of the prosthesis due to restenosis and thrombosis caused by injury and dysfunction of endothelial cells. Therefore, rapid re-endothelialization on graft surface is considered to be an effective strategy to improve the patency of vascular grafts. It is well known that high concentrations of reactive oxygen species (ROS) cause apoptosis and death of endothelial cell. Low levels of ROS, on the other hand, play an important role in functioning as signaling molecules to mediate endothelial cell proliferation and migration. In this study, we investigated that extracellular ROS generated from photodynamic therapy stimulate endothelial cell proliferation.

P-222 열 자극에 의한 3차원 배양된 암 세포주의 세포 생존율 변화 관찰

곽소영, 문치웅

인제대학교 의용공학과

The purpose of this study is to establish the cell viability of three-dimensional cultured cancer cell lines by heat stress according to cell lines and stress conditions. The cell viability depending on target cells(Hep3B and A549), temperature(39℃, 41℃, 43℃ and 45℃), heat exposure time(1hour, 6hours and 12hours) and recovery time after heat stress(1hour, 4hours, 6hours, 24hours and 48hours) was measured by MTT assay. The highest cell viability was shown at 41℃. The longer time of heat stress, the more cell viability decreased. Furthermore, Hep3B is more sensitive to heat stress than A549. In further study, the authors conclude that it is necessary to establish the appropriate conditions of heat stress through measurement of apoptosis and heat stress effects on normal-derived cells in same origin.

P-223 임상용 자기공명 장치를 이용한 세포 대사물질 분광의 비 침습적 측정

강복만, 천송이, 곽소영, 강민재, 한용희, 김태형, 문치웅

인제대학교 의용공학과 및 UHRC

Conventional methods for quantitative measurements of specific cellular processes and conditions do not reuse the cell again due to cytotoxicity of preparing process or reagents. Moreover, these are difficult to apply directly to clinical field. The aim of the study is to quantify cellular metabolic change non-invasively using clinical MRI. The cellular metabolic spectra were acquired successfully using 3T-MRI at culture day 1, 7 and 14. Furthermore, we can find metabolic changes according to culture period. This result does not only offer the new non-invasive quantification method for measurement of cell states but also possibility of clinical MRI applying to diagnosis or evaluation of cytotherapy.

P-224 불규칙 수면에 의한 일주기 리듬의 교란이 성장기 마우스의 말초조직에 미치는 영향

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The aim of this study was to assess the effects of circadian rhythm disturbances induced by night-shift activities on the adipose tissue and the 4th lumbar vertebrae (L4). Fourteen 6-week-old C57BL/6 male mice were assigned to 2 groups. At 4 weeks, area of abdominal adipose was significantly higher in the NOR group. However, there were no differences in other adipose tissue, structural parameters and BMD of L4 trabecular bone. These results implied that the circadian rhythm disturbances induced by night-shift activities increased the accumulation of abdominal adipose tissue, and led to an increased risk of obesity in the growing mice.

P-225 지방줄기세포의 연골 재생력 향상을 위한 수핵세포와의 반복 공배양 방법

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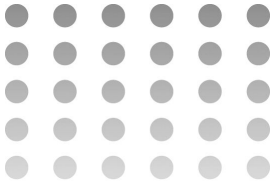[1]중앙대학교 공과대학 융합공학부
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Recently, a co-culture has been suggested as an effective method for stem cell differentiation in tissue engineering applications. In this work, we investigated whether repeated co-cultures of adipose stem cells (ASCs) and nucleus 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.

P-226 인간지방유래 줄기세포 부착 및 증식을 위한 PLGA/ Poly-L-Lysine 나노섬유 제조 및 분석

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Cell—substrate interaction was fundamentally essential for phenotypic maintenance and multipotency of stem cells. To regulate the cell—substrate interaction, many researchers have tried to mimic the native cellular environment by introducing physical and chemical factors. Electrospinning technique is a useful tool to produce fibrous structure with various diameter, porosities and compositions. Poly—l—lysine (PLL) is a common coating material for the improvement of cell adhesion. In this study, we fabricated poly—L—lactic acid—co—glycolic acid (PLGA) nanofibers incorporating PLL by emulsion electrospinning technique and investigated stem cell expansions and differentiation on them.

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Capsular contracture caused by fibrosis formation around the silicone implant has been one of the most serious complications. TGF—β is known to play a critical role in fibrosis and thus, we hypothesize that local, sustained exposure of an inhibitor of TGF—β can reduce fibrosis formation around the silicone implant in this work. To test this hypothesis, we employed a drug, tranilast as a TGF—β inhibitor and prepared two different kinds of silicone implants, which were coated with tranilast only and a blend of poly(lactic—co—glycolic acid)(PLGA) and tranilast, which were enabled with a short and long term release of the drug, respectively.

P-227 장 흡수를 모사하기 위한 3차원 하이드로젤 장 융모 칩

김시현, 최애림, 최인욱, 하상근, 최낙원, 성종환

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바이오마이크로시스템연구단

A drug screening technology by using gut—on—a—chip has evolved rapidly in recent years. Now 3—D model mimicking the intestinal environment is required, because 2—D model reproducing the intestinal environment is physiologically different from realistic environment. Villi of small intestine was reproduced via novel hydrogel microfabrication technique, and vascular channel was added to the hydrogel villi structure. Mechanisms of drugs absorbed into the bloodstream through the villi have been simulated. The kinetics of diffusion process from the villi to the bloodstream in the microfluidic device was measured and analyzed through the mathematical modeling.

P-229 간헐적 정수압 및 피브린 하이드로젤 지지체가 중간엽 줄기세포의 연골세포로 분화에 미치는 영향

오민재[1], 박소희[1], 강윤경[1], 김영미[1], 현진숙[1], Maria Victoria Garcia[2], Jubert C. Marquez[2], 신정욱[1,2,3]

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To induce chondrogenic differentiation of human mesenchymal stem cells (hMSCs), three—dimensional (3—D) culture conditions and growth factors are essentially used. Various studies have reported that proper mechanical stimuli can promote differentiation of hMSCs. In this study, therefore, fibrin hydrogel was used as 3—D substrates for hMSCs culture, and four different magnitudes of intermittent hydrostatic pressure (IHP) were applied. From the results, hMSCs seeded in hydrogel with high density of fibrinogen maintained both viability and round morphology. Furthermore, higher magnitude of IHP seemed more effective on chondrogenesis of hMSCs, but there were no significant differences among all groups.

P-228 실리콘 임플란트 주변 피막구축 억제를 위한 TGF—β 장기간, 국소 억제

박수빈[1], 박민[2], 이지은[1], 박효진[3], 이승호[2], 박천권[2], 허찬영[4], 최영빈[1,2]

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P-230 분화 방법에 따른 줄기세포와 평활근 세포의 핵형태 비교

현진숙[1], 박소희[1], 강윤경[1], 김영미[1], 오민재[1], 정성훈[2], 안혜린[1], 신정욱[1,2,3]

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Biochemical and/or mechanical stimuli are widely adopted methods for effective differentiation. However, the detailed mechanisms of each method are still unclear. Therefore, it is necessary to compare between target cells and differentiated cells. This study examined the morphological changes of mesenchymal stem cells(MSCs)' nuclei during smooth muscle cells(SMCs) differentiation. Specifically, this circularity and compactness of the nuclei were measured. The biochemical stimuli group differentiated and showed similar nuclei morphology of SMCs, but the combinational stimuli group showed lower circularities than those of SMCs. This study suggested the necessity of further study with regard to differences during differentiation depending on methods.

P-231 예측 모델링을 이용한 다중 분사체 기반 바이오프린팅 시스템의 2차원 패터닝에 관한 연구

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The field of tissue engineering and regenerative medicine has been much progress owing to recent remarkable advances in computer technology and precision engineering technique. Especially the development of bioprinting technique has interested many researchers. The purpose of the present study is to study on novel control algorithm for the bioprinting system, leading to the confirmation of the feasibility of this system through various verification experiments. This study has been performed by varying printer control parameters. The results proved that the predictive model shows significantly similar results to the experimental results.

P-232 연조직 수복용 히알루론산 수화겔의 divinyl sulfone을 이용한 가교 최적화

문승민, 김현정, 김진태, 이득용
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Hyaluronic acid (HA) microbeads were synthesized by dropping the sodium hyaluronate (Streptococcus) solutions in NaOH into a solution mixture of divinyl sulfone (DVS) in 2-methyl-1-propanol, followed by stirring, cleaning and drying process at room temperature. The initial experimental conditions are crosslinking time (CLTi) of 5 h, crosslinking temperature (CLTe) of room temperature, injection air pressure (IAPr) of 5 psi, and DVS concentration (DVSc) of 0.2 vol%, respectively. Then, parametric studies were performed by varying the parameters to investigate the morphology, the porosity, the swelling ratio and the size of the beads. The microbead size was not a function of the degree of crosslink probably due to the polydispersity of HA having the heterogeneity of sizes of the microbeads. It was observed that the swelling ratio, the degree of crosslink, and the pore size can be controlled by adjusting the CLTi, CLTe and DVSc. Among the parameters investigated, the smallest bead size can be achieved by varying the CLTi parameter. The lowest swelling ratio, as an indication of the highest degree of crosslink, can be obtained by varying CLTe.

P-233 통증완화를 위한 디클로페낙의 국소전달이 가능한 생분해성 봉합사

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To treat a post-operative pain, conventional oral delivery of non-steroidal anti-inflammatory drug (NSAID) has been widely used. However, this therapy can lead to adverse side effects such as gastrointestinal complications. In this reason, we fabricated a drug delivery nanofibrous sheet composed of a biocompatible polymer (PLGA) and a pain relief drug (diclofenac), which is physically winded to the original biodegradable suture. Then, we evaluated in vitro drug release profiles of the two different sutures assembled with the drug delivery sheets with 0.5% and 2.5% w/w diclofenac, respectively.

P-234 Core-Shell 하이드로젤 마이크로 구조체의 제작

이하영, 간석주, 이광호

강원대학교 신소재공학과

Biomaterial based microfluidic devices are one of the field which is receiving the attention, recently. Although it has limitation because of the difficulty of fusion with other materials, microfluidic device is have been widely applied in various areas. In this paper, we are presenting generation of collagen microfiber using a sacrificial method based co-axial flow induced microfluidic device. The procedure presented here enables the fabrication of a collagen microfiber with removing of alginate from alginate-collagen microfiber, in a single process without using any sophisticated process. This collagen microfiber is used as a carrier for field of drug delivery and cell-based biotechnology.

P-235 비중심순환계 인공혈관의 임상적 유효성 평가방법 현황조사

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Peripheral vascular prostheses have been widely used in Korea, but most of them are imported products. To develop the new domestic peripheral vascular prosthesis, it is required to understand the standardized safety and efficacy clinical evaluation methods for peripheral vascular prosthesis. Therefore, we analyzed the international standards, reports of clinical trials, peer reviewed journals, and FDA references for standardized criteria of efficacy in clinical evaluation. The most frequently used methods of clinical evaluation are ankle-brachial index and run-off scoring system.

P-236 조직수복용생체재료의 임상적 안전성 및 유효성 평가방법 현황 조사

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It has been over 4 years since the approval of the domestic clinical trials conducted by manufacturers to prove the safety and effectiveness of each dermal filler device involved evaluation of device injection into nasolabial folds. Most of domestic clinical trials proved new developed filler device of non-inferiority compared to the former hyaluronic acid (HA) filler which has most frequently been used because of their logevity, ease of use, and low immnogenicity. In this study date collected from FDA Executive Summary of Dermal Filler Device, the domestic and other countries approved clinical trials, and published literatures.

P-237 심부체강창상피복재(유착방지재)의 임상적 안전성 및 유효성 평가방법 현황조사

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It has been over 3 years since the approval of the domestic clinical trials conducted by manufacturers to prove the safety and effectiveness of each adhesion barrier device involved evaluation of adhesion incidences after abdominal/pelvic surgery. The domestic clinical trials proved new developed adhesion barrier of non-inferiority compared to the former one which already has been proved its safety and effectiveness. In this study date collected from FDA guideline and official documents, the domestic and other countries approved clinical trials, and published literatures.

P-238 금속기반 방사선 선원의 이식 후 체내 이동방지를 위한 표면 개질 기술 개발

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Brachytherapy is widely known as an internal radiotherapy, where a metallic seed containing a

radiation source is implanted in the tumor. However, the seed can easily migrate, often resulting in uncontrolled delivery of an exact irradiation dose to the target tissue. To resolve this, we coated the seed with polydopamine as bio-adhesive material. The in vitro experiment revealed that the seed after coating showed better adherence to the tissue than the intact metallic seed.

P-239 표면장력을 이용한 멤브레인 제조 기술과 응용

박형준, 이상훈

고려대학교 생체의공학과

Membrane fabrication techniques are increasing its interest in various fields of biomedical engineering. We can easily fabricate membrane using diverse polymeric materials by applying surface tension. Also, membrane's characteristics—size, thickness, porosity, pore-size—can be controlled over a wide range. This method can be used for different areas in the field of biomedical engineering. It can be applied in tissue engineering, bio-separation system, artificial organs, controlled drug-release system, organ on a chip.

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

P-240 스마트폰 연동형 호기 내 CO 농도 모니터링 애플리케이션

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This study aims to develop a CO concentration monitoring smart-phone application synchronized with portable measuring device. We reduce electrical and electronic components that include a CO measuring device to decrease a device and cost by replaced input-output of CO measuring device and function related a user interface with smartphone application. Measured values showed on a display screen and it saved continuously. Also, we tried to

improve a convenience by to control a device through the application. The application confirmed effectively with portable CO measuring device, in future, by using the technology that accumulated through the development of this study, we planned to develop a smartphone application that synchronized with portable instruments other than carbon monoxide.

P-241 제세동기와 연동을 위한 실시간 12채널 심전도 계측 및 판별 시스템 개발

허정현, 이정직, 고현철, 최우혁, 이승환, 윤영로

연세대학교 보건과학대학 의공학부

In case of deaths by cardiac diseases, Arrhythmia such as ventricular fibrillation takes the high ratio. The most effective way to stop arrhythmia is to defibrillate the heart. To avoid unessential repetition of defibrillation and to know an effective timing to do it, it is important to observe statues of a heart. In this research, it is studied that the 'real-time 12chanel ECG Measurement System' which is able to be co-operated with defibrillator to detect exact moment of arrhythmia occurrence and so that effective treatment of defibrillation can be possible.

P-242 Ensemble empirical mode decomposition과 cubic smoothing spline를 이용한 심전도 간섭 제거

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Surface electromyography (EMG) is used to rehabilitation and clinical treatment for muscle disease. These recordings are critically contaminated by cardiac artifact. Our objective of this study was to develop algorithm for removing electrocardiogram (ECG) noise from surface EMG using combined the ensemble empirical mode decomposition (EEMD) and cubic smoothing spline method (EEMD+CSS). The EEMD+CSS algorithm enabled the algorithm to effectively remove ECG noise without reference signal. This filter procedure proved a reliable and efficient tool to remove ECG artifact from surface EMG.
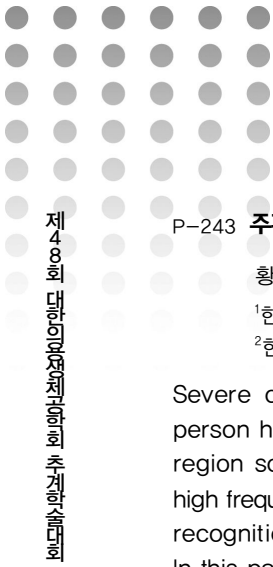
P-243 주파수 압축 알고리즘을 이용한 어음 인지도 향상

황종호[1], 김진률[1], 윤성훈[2], 강신일[1], 남경원[1], 김인영[1]

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[2]한양대학교 의공학연구소

Severe or profound high frequency hearing loss person have a difficult to listen the high frequency region sound information. So, Severe or profound high frequency hearing loss person has a low speech recognition.
In this paper, use non—linear frequency compression algorithm to person. The algorithm to help to be able to listen the high frequency region sound information. As a result, severe or profound high frequency hearing loss person has increased speech recognition.

P-244 PDMS 기반의 유연하고 이식 가능한 소동물용 심전도 모니터링 전극

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고려대학교 보건과학대학 바이오융합공학과

Monitoring small animal's physiological signals 24hours has several barriers. Especially, when the animal is in awake and freely moving condition, it is tough to acquire steady continuous signals. To solve the problems, thin film electrode which can be implanted into body is one of the method monitor physiological signal. However, it has several hindrances, for instance, signal degradation due to fibrosis, delamination of metal layer and allergy occurred by metal are main obstacles for long term usage of signal monitoring. To overcome those problems, we developed a non—contact implantable electrode. This prevents signal degradation and delamination of metal since PDMS is wholly coated. With this electrode, we were able to observed ECG signal after implantation.

P-245 저전력 센서네트워크에서의 광대역 간섭 센싱 기법

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연세대학교 전기전자공학과 정보통신연구실

Interference avoidance strategy is essential for low power sensor networks (WSN) in order to coexist with other systems in open spectrum. Especially, dominant interference is caused by wideband systems such as Wi—Fi which have long airtime than narrowband systems. However, WSN is not able to classify the wideband interference from narrowband interference with simple conventional sensing strategy. Therefore, we propose a wideband interference sensing strategy which can distinguish the wideband interference from the narrowband interference. The simulation results show that an interference avoiding system which utilize the proposed strategy achieves higher energy efficiency than the conventional system.

P-246 다양한 스마트폰 사용 패턴을 고려한 무자각적 심전도 계측 스마트폰 커버 센서 시스템

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A number of usage patterns of a smartphone give opportunities to measure electrocardiogram (ECG) signal insensibly and unobtrusively. e.g., The ECG can be measured from the both hands in message typing or one ear and one hand during a call. In this study, we propose unobtrusive smartphone cover sensor system for ECG monitoring in various usage patterns of a smartphone. We evaluated our proposed sensor system during the both hands typing on portrait mode by comparing with the reference ECG measurement system. More than 99% R peaks could be detected and the correlation of R peak interval is also over than 99%. After the correction of missing R peaks by cubic spline interpolation, the average error rate from HRV parameters is lower than 1%.

P-247 웨이브렛 패킷 분석과 웨이브렛 수축을 이용한 잡음 제거 알고리즘

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Noise reduction algorithm plays an important role in the performance of the overall system. In this paper, we propose a new noise reduction algorithm to effectively enhance speech in noisy environments.

The proposed algorithm has voice activity detection part to distinguish speech from a nonspeech and speech enhancement algorithm using wavelet shrinkage. Performances of the proposed noise reduction algorithm are evaluated by objective test under white noise environments.

P-248 Development of Cloud Web Service for Ubiquitous Healthcare Centers

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Integration of medical health data is an important issue in the healthcare field. Generally, medical health data is generated from different specialized medical equipment (hardware) and is stored in independent work places making it difficult to integrate the data into one database. The implementation of web services in a cloud computing platform has demonstrated the successful achievement to integrate information between different systems in healthcare. This paper describes how the implementation of SOAP web services supports the integration of medical health data between uHealthcare centers across South Korea.

P-249 잡음이 존재하는 환경에서의 De-reverberation algorithm 연구

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There are lots of noises around you. Reverberation is a type of that. We define the reverberation as the collection of reflected sounds from the surfaces in an enclosure space. And in speech signal processing the reverberated speech signal can be viewed as the same source signal coming from several different locations in the room and thus arriving at different times and with different intensities. The effect of reverberation is valuable and important in audio rendering, like concert and opera. But it is almost unhelpful in voice communication. When the reverberation effects are severe, intelligibility of speech is degraded. This will be a problem for speech

recognition, source localization and speaker verification, especially for hearing disorder patient. So the de-reverberation system is needed in digital hearing aid. In this latter, we want to use this de-reverberation algorithm in the noise environment.

P-250 임베디드 블루투스 통신이 가능한 자가발전 줄넘기

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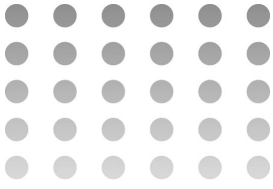[1]전북대학교 공과대학 바이오메디컬공학부
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Jump-rope is a simple and effective exercise, but its intensive exercise load and monotonous pattern make it difficult to perform consistent workout. In this study, we developed electricity-generating jump-rope by using energy Harvesting circuits and direct current (DC)-geared motor. The generated electric power enabled a low-power embedded Bluetooth system to have wireless connection with a smart phone during jumping-rope. We also developed a smart phone app which automates the counting of jumps, which is one of the hardest activities during jumping-rope. In further study, we will focus on providing various exercise feedback so that users can adjust the level of exercise intensity or energy consumption during jumping-rope.

P-251 스마트 폰을 이용한 노이즈 환경 청력 테스트 앱 개발

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울산대학교 의공학과, 울산대학교 전기공학부 의공학전공

In this study, we developed hearing test App that uses a built-in microphone to measure background noise. We calibrated the smartphone-microphone and headset by comparing sound level meter measures. Hearing threshold shifts (HTS) in the presence of noise were systematically analyzed. The HTS compensation algorithm was imported into the hearing test App. The App measures environmental noise using the built-in microphone and does tone-test using the headset in sequence. Then, the App automatically adjusts hearing threshold based upon environmental noise. We expect that the

ubiquitous hearing test App could be used as a simple hearing screening tool and alert if the user suffers from sudden sensorineural hearing loss.

P-252 Research for Healthcare 3.0 technologies and services: Experience

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This paper presents the new paradigm for disease prevention and health promotion in the area of Health 3.0, the core products and services that create true customer value elements and the creation of a new health industry. The proposed paradigm revolves around assessment, prescription, practice, monitoring and motivation strategies.

P-253 측지선 거리와 평균이동 집단화를 이용한 뎁스 및 RGB 실루엣에서의 얼굴 및 수족 검출

김소망, 한희석, 전현재, 남상범, 김태성
경희대학교 생체의공학과

In this paper, we present an approach to face, hands, and feet detection from depth and RGB silhouette images using geodesic distance and mean-shift clustering. Our proposed method utilizes geodesic distance map of a human depth silhouette to detect face, hands, and feet, which is complemented by detecting face and hands from its corresponding RGB silhouette images utilizing skin colors and mean-shift clustering. The experimental results show the mean recognition rate of 90% over 200 test images. Our proposed methodology should be useful in reconstruction of human poses in 3D to be used in better human-computer interface designs.

P-254 무선 인체 영역 네트워크(WBAN)를 위한 에너지 효율적인 CSMA/CA 구조

김용옥, 장영록, 황규호, 최수용
연세대학교 전기전자공학부

To support wireless body area network(WBAN), an energy efficient communication protocol is necessary. Thus, we propose an energy efficient slotted CSMA/CA structure. This structure improves the energy efficiency by using additional CCA to avoid packet collisions. Simulation results show that the performance of the proposed structure is better than that of the conventional structure.

P-255 Photoplethysmography (PPG) 센서를 이용한 데이터획득과 IIR filter를 이용한 실시간 신호 처리 및 Heart Rate Variability 측정

조동래, 박찬기, 이보름
광주과학기술원 기전공학부

The signals from the people show us the state of disease as well as healthy. In order to detect the signals we need, a lot of algorithms are developed. From the Bio-signals, heart rate variability (HRV) is the important parameter that shows the state and ability of cardiac. However, it is difficult to measure the HRV parameter in real time. So we suggest that the infinite impulse response (IIR) filtering can extract the signal of the HRV and we confirm the HRV parameters in real time easily.

P-256 기울인 방향으로의 흉부 압박 깊이 측정 정확도 향상

송영탁[1], 지영준[1], 오재훈[2]
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There are many CPR(Cardiopulmonary Resuscitation) related applications for smartphone. However, they do not give the correct feedback about chest compression depth. The aim of this study is to develop the algorithm for the correct feedback of chest compression depth using android based smart phone. We tested our algorithm in three kinds of situations. In the results, we compared our achievement and PocketCPR which is the most popular application for CPR. When Chest compression is performed to oblique direction, there are no significant difference between real chest compression depth and the suggested algorithm. However, PocketCPR is underestimated chest compression depth.

P-257 수면 무호흡증이 심혈관계 신호의 방향성에 미치는 영향 평가를 위한 인과성 지표의 사용 가능성에 관한 연구

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We attempted to quantify the effect of baroreflex and non-baroreflex which induce specific directionality in cardiovascular signals by assessing the causal influence between blood pressure and heartbeat interval. The validation and application of our approach using Granger causality index to sleep apnea suggest the potential to apply it for studying the pathophysiology of sleep apnea and for diagnosing sleep apnea syndrome.

P-258 무선 이식형 근전도 시스템 구현

조현성, 김동환, 조재성, 강신일, 이종실, 김인영
한양대학교 의용생체공학과

The wireless implantable EMG system was implemented in this study. The existing wire EMG system was modified to be of compact form and wireless to be used in animal testing. The system is connected with four-channel EMG electrodes, and distinguishable EMG signals were measured by amplifiers and filters. The proven wireless implantable EMG system is implanted in the animal, and the EMG signals that occurs in the hind limb muscle fibers are measured to identify the distribution of slow twitch and fast twitch by separating frequency components.

P-259 PVDF 필름 기반 센서를 이용한 코골이 추정

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Snoring is loud, noisy breathing during sleep which is caused by the vibration of tissue in the nose or throat. Polysomnography is gold-standard method for snoring diagnosis but it needed specially trained sleep experts and controlled environment. The five middle-aged subjects participated in this study.

Snoring signals were measured non-intrusively by a PVDF film-based sensor installed bed. Using peak frequency and power ratio, each event was classified as 'snore' or 'non-snore'. As a result, the sensitivity and positive predictive values were 95.1% and 98.1% for snoring detection, respectively. Especially, proposed method was robust with respect to subject's motion artifact.

P-260 Crest Factor를 사용한 음성 상황 및 잡음 환경 분류

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Generally, crest factor is a measure of an alternating current, showing the ratio of peak values to the average value. Recently, there is a need for a simple classifier that has low computational complexity and can easily set the decision level of input noise in digital hearing aid and self-fitting hearing aid. In this study, we applied crest factor to a sound classification. To determine the usefulness of crest factor, we performed experiments in various environment and noise situations to observe crest factor values obtained and compared the results. As a result, crest factor is suitable for environment classification, however, not suitable for noisy classification.

P-261 청각 자극에 따른 편두통환자의 알파파 위상 동기화

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Migraine is a neurological disorder with accompanying frequent one-sided headache. In this study, we investigate alpha wave phase synchronization in EEG from migraine patients during auditory stimulation. 9, 24, 27Hz amplitude modulated waves are used for auditory stimulation. We used synchronization index ρ, γ, λ to quantified synchronization change in auditory stimulation. AAFT surrogate data was used to validate phase synchronization. In stimulation condition, synchronization indexes were decreased in patient.

P-262 **일상생활중 심박과 운동량을 이용한 Cardiopulmonary Fitness 추정**

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서울대학교 협동과정 바이오엔지니어링
서울대학교 의과대학 의공학교실

Cardiopulmonary Fitness (CPF) is important in health management. However, measurement of CPF needed professional equipment and operator of cardiopulmonary exercise test (CPET). Due to the difficulty of CPET measurement, there have been necessities to measure CPF in daily life without any specific protocol or professional equipment. We measure activity energy expenditure (EE) and heart rate (HR) in 4 consecutive days without specific exercise protocol. Maximum EE determined by HR was compared with VO2max and the estimation model was developed.

P-263 **Neuromodulation을 위한 다수신경자극장치의 동시적 무선제어 기반기술개발**

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In the future, multiple neural prosthetic devices can be implanted simultaneous for treating various neuropathic disorders. However, most of the current implant device control methods are based on inductive coil link which have some limitations such as low data rate and lack of capacity for real time feed-back control and back telemetry. This study demonstrates a noble bluetooth-based simultaneously multiple controllable neural stimulation system including customized current stimulation chips, various kinds of electrodes, and a power cage for wireless power transmission and some results of feasibility tests using the suggested system.

P-264 **이식형 보청기 진동체의 공진 특성을 고려한 3-band 보청기 프로세서의 구현**

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In this paper, a 3-band processing chip which uses a wide dynamic range compression (WDRC) algorithm is designed and fabricated for vibration transducer of implantable hearing aids system. For the considering the vibration characteristics, the designed chip composed of a FIR filter bank, a level detector, and a compression part and fabricated 0.18 um MPW process of MagnaChip semiconductor. To verify the performance of the designed chip, the temporal bone experiment was implemented by using vibration transducer. From the experimental results, we confirmed performance of designed chip that successfully worked.

P-265 **자동차용 무구속 생체계측시스템 개발**

이종원[1], 박제호[1], 김해성[1], 송상훈[1], 김정호[1], 박호동[2]

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[2]MEZOO(주)

최근 다국적 자동차회사들이 생체신호를 이용한 운전자의 건강상태 모니터링기술을 자동차에 도입하고 있다. 운전자의 심전도, 심박수, 호흡, 체중, 온도, 운전자의 음주여부 등의 생체 신호를 측정하여 건강 상태를 점검하는 자동차용 생체신호 계측시스템을 개발하였다. 스템의 구성은 크게 심전도(ECG), 심탄도(BCG : Ballistocardiography), 호흡(Respiration), 알콜수치 그리고 온도측정 모듈로 구성된다. 스티어링 휠에 2점식 3M 센서 전극을 부착하였으며, 체중과 호흡을 측정하기 위해 에어방석을 이용하여 심탄도와 호흡신호를 검출하였다. 또한, 스티어링 휠에 체온센서를 부착하여 체온을 측정하였으며 운전석에 알콜센서를 부착하여 음주 측정이 가능하게 설계하였다. 본 연구에서 설계한 자동차용 생체계측시스템은 자동차용 헬스케어 시스템에 활용 가능하다.

P-266 **Generalized Normal-Laplace distribution 기반의 음성 검출기**

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In this paper, we propose a novel voice activity detection (VAD) algorithm based on generalized normal-Laplace (GNL) distribution to provide enhanced performance in the adverse noise

environments. Specifically, the probability density function (PDF) of the noisy speech signal is represented by the GNL distribution and the variance of the speech and noise of GNL distribution are estimated using higher order moments. After in-depth analysis

of estimated variances, a feature that is useful for discrimination between the speech and noise at low SNR is derived and then is compared to threshold to detect the speech activity. In order to consider the inter-frame correlation of speech activity, the result of previous frame is employed in the decision rule of proposed VAD algorithm. The performance of our proposed VAD algorithm are evaluated by detection accuracy, and it is found that the proposed method yields better results than conventional VAD algorithms.

P-267 동공대광반사 검사를 위한 스마트폰앱

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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 simulation, 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.

P-268 순환기 모니터링 및 진단기기의 생체신호 측정을 위한 심전도 개발

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[2]고려대학교 의과대학 흉부외과학교실
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Electrocardiogram (ECG) detects the voltage gradient to aid in diagnosis of diseases. Such monitoring devices for the circulatory system and other vital signs are being developed worldwide; however, there are not many devices that integrate multiple vital signs into a single system. Therefore, we developed a system for such device to better manage the data received, starting with the electrocardiogram as described.

P-269 세 가지 모델의 골프 드라이버에서 임팩트 음 비교

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동아대학교 의과대학 의공학교실

This study was aimed to compare the characteristics of impact sounds among three different drivers. Golf ball was dropped at the height of 100 cm. Peak frequencies of impact sounds from three driver models were seen in the range of 4 kHz and other peaks were shown in similar frequency ranges, but different in relative peak size. This finding suggests that three models of golf club head have distinguishing impact sound tones, but they have similar peak frequencies.

P-270 고빈도 흉벽진동요법에 사용되는 진동에 의한 점착액의 점도 변화

김민선[1,2], 강관석[2], 조성찬[1,2], 최민주[2,3]

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[2]제주대학교 의공학협동과정
[3]제주대학교 의학전문대학원

HFCWO among chest physiotherapy regimens has been clinically proven to be effective. Despite of clinical utilization of HFCWO, vibration mechanisms on excretion of secretion is not clear. In this study, viscosity characteristic by vibration was analyzed thorough experiment. It is expected to verify the effect
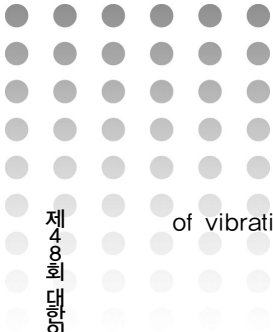
of vibration that is used for clinical trials.

P-271 국내 중고의료기기 유통현황

안원식[1,2], 김영아[2]

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We surveyed trading of used medical devices from 2008 to 2012. Homepages for doctors were reviewed for the transaction of small medical devices. Discarding medical devices from general hospitals were reviewed for transactions of large medical devices. The majority of trading consisted of the devices for skin care and obesity control in small medical device. The endoscopic device was the most commonly trading devices from general hospitals. Radiologic imaging devices including CT, MRI were the second most commonly trading devices from general hospitals.

P-272 모바일 기반 건강관리 서비스 어플리케이션 개발

김혜민, 김종혁, 허정현, 이승환, 윤영로

연세대학교 의공학과

In recent days, as chronic diseases increased, the importance of the precautionary health care system increased. To prevent the chronic diseases, the continuous management is required. The user can check their health information quickly and easily anywhere, anytime by expanding the web-based healthcare monitoring services to mobile. In this study, we designed user interface, considering the accessibility and ease of use. We also designed data-viewer that users can easily view the health information dependent on the mobile environment. Finally we implemented the mobile-based diabetes and hypertension management service application.

P-273 컴퓨터를 이용한 안운동평가 기기의 개발

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Traditional Hess-Lancaster test uses nine points for diagnosing which part of the ocular muscle is paralyzed, and it uses red/green glass lenses for the inhibition of binocular fusion mechanism. This method is simple and easy to follow, but the manual examination and recording system decreases the reproducibility. To minimize this problem, we developed computerized Hess-Lancaster test. To measure the deviation according to the gaze, circle matching method is proposed. And to evaluate the torsion, rotating bar is adopted. These two different measurements are performed step-by-step manner. The software is developed on Windows 7 operating system with Application Programming Interface.

P-274 병렬 풀-브리지 방식을 이용한 고출력 DC-DC 컨버터의 개발

김형식, 홍상표, 이정철, 박성준, 정율호, 최미현, 정순철

건국대학교 의료생명대학 의학공학부 의공학실용기술 연구소

A parallel full-bridge DC-DC converter was presented. The proposed converter was designed with the two step-up circuit of conventional full-bridge converter on the secondary side was connected in parallel and the output capacitor was connected in series. This structure is beneficial to generate a high-power in a short time. From the results, the 1.5 kilovolts output was maintained stably for 1.5 kohm load in continuous discharging experiments.

P-275 상지의 당김힘을 이용한 고효율 소형 자가발전장치

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In the several motion of human body, abundant energy that be able to supply the power for portable electric devices in real-time is inherent. Among the rest, human power generation method using pulling force of the upper limb has not only a lot of energy that can be inserted to the generator, but has also kinematically natural and intuitive movement due to rectilinear motion. In this study, we developed small-sized human power generator that convert from rectilinear motion to continuous one-way rotational

motion using pulling force of the upper limb. Developed generator was able to generate approximately 3.7W of power by taking 20.3W of power occured from human energy.

P-276 후프 형상 기반 자가 발전기의 에너지 손실 감소를 위한 자석 구조물

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portable self-generator technology has been used for a long time and has been used power source for portable electronic devices because recently the spread of portable device and increasing outdoor activities using these devices. developed utilizing tube based on hoop self-generator is implemented longitudinal electromagnetic coupling and also possible to can be easily long time driving and relatively high output using the rhythm of whole body. However, it is raising energy loss problem due to friction and noise when occurring by inner magnet is rotating induced path. In this study developing and designing structure of magnet inside generator for solving the energy loss problem due to friction and noise of inner magnet and we are testing electricity production comparing using developed structure of inner magnet for verifying this performance. it is passible producing electric energy average power production of self-generator based on hoop using developed structure of inner magnet is 1.6W and peak-to-peak voltage is 40V.

P-277 Smart Mat – Physical Activity Promotion System

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This paper presents preliminary experiences on the design and implementation of low budgetary physical activity promotion system targeted particularly for children. Capacitive sensing technology using polyurethane rubber material and EMI conducting plates were deployed to detect the weight spectrum

of 0~20 kg with the resolution of 0.6 kg. When capacitive sensor pressed, it generates different signal based on the pressed force, the generated sensor's signals are interfaced to pc/tablet via USB interface to create health activities by which engaging children in different exercises.

P-278 랜덤 포레스트 확률 분포 기반의 바디 파트 인식 및 관절 추정을 통한 향상된 3D 인체 관절 포즈 구현

남상범, 박성언, 한희석, 전현재, 김소망, 김태성
경희대학교 생체의공학과

In this work, we report an improved reconstruction of 3D human skeletal poses from depth silhouettes. The use of probability distribution from Random Forests in the body parts label voting and joint proposal estimation by the mean shift helps 3D human skeletal pose reconstruction by improving the accuracy of body parts labeling and identifying correct joint locations. The results should be useful in the application fields of human activity recognition and human computer interface.

P-279 정원창 소와 장착형 전자기 진동체 구현

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In this paper, we proposed an electromagnetic type transducer that can be mounted at round window niche. The transducer was designed for vibrational displacement enhancement by minimizing leakage flux and consists of two permanent magnets, three coils. The vibration characteristic of transducer was measured using the laser Doppler vibrometer. To verify the performance of the transducer, we compared the frequency characteristics of proposed transducer and those of the normal temporal-bone stapes vibration by the sound pressure measured in the ear canal (ASTM-F2504), respectively. From the experimental results, magnitude of proposed transducer was 6 dB higher than ASTM on average. By comparing these two frequency characteristics,
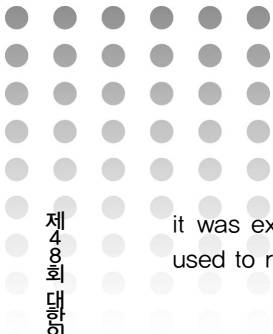
it was expected that proposed transducer can be used to round window niche mountable transducer.

P-280 모바일 기기를 이용한 실내 자전거 운동 시스템 개발

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A mobile stationary bicycle exercise game program was developed. For this, two mobile devices were used. One is for sensing movement and the other is for providing game contents. These devices are connected through Bluetooth each other. The hand-phone could be attached on the ankle to measure user's movements then it transferred to the Tab and analyzed to extract speed of bicycle. This program is expected to overcome conventional program's limitations like lack of user's interest as well as, most of all, to expand the usability of the exercise program by enabling it to be applied to any exercise equipments.

P-281 데이터글러브와 압력센서를 이용한 모바일 기반 손 재활 프로그램 개발

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In this paper, we present the mobile based system for hand rehabilitation by integrating a data glove and a pressure sensor. The data glove and pressure sensor were connected using bluetooth to a mobile device. And a rehabilitation game was designed in which a user can play the fishing game with grasping and pinching motion. In the fishing game, a user can catch fishes by flexing and pinching their fingers with proper angle and pressure. We expect that this mobile based hand rehabilitation system may help patients have training in their home.