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학회장 인사말

대한의용생체공학회 춘계학술대회를 맞이하면서

안녕하십니까?
올해 31주년을 맞이한 대한의용생체공학회가 2010년 춘계학술대회를 5월 14일부터 15일까지 강원도가 자랑하는 아름다운 호반의 도시 춘천에서 개최합니다. 강원도는 아시는 바와 같이 의료기기 산업의 기반 확립을 위한 학문의 메카로서 자리매김하고 있습니다.

이번 춘계학술대회에서는 "Future Neurotechnologies for Neuron, Network and Brain"이라는 주제로 세계적인 석학의 강의와 토론의 장도 마련하였습니다. 그 외에도 평소 관심을 가지고 계시던 다양한 주제들에 대해 새로운 지식을 습득하고 함께 토론할 수 있는 좋은 기회가 제공될 것입니다.

아름다운 도시 춘천에서 우리 국내 의공학 연구자들이 만나 교류의 장을 활발하게 펼치면서 국내 의공학 연구의 발전상을 느끼고 배울 수 있을 것으로 확신합니다. 학문적 교류와 함께 자연과 호반의 도시 춘천에서 몸과 마음의 새로운 정기를 충전해 가시기 바랍니다. 기쁜 마음으로 초청합니다.

감사합니다.

대한의용생체공학회 회장 **정도언** 올림

조직위원장 인사말

대한의용생체공학회 춘계학술대회를 맞이하면서

2010년 대한의용생체공학회 춘계학술대회가 강원대학교 춘천캠퍼스에서 개최하게 되었습니다. 강원도는 의료기기가 주력 특화산업의 하나이며, 원주 및 홍천에 많은 관련 업체들이 있습니다. 이러한 의료기기 산업의 기반 학문으로서 의공학의 중요성은 널리 알려져 있으며, 이에 대한 관심이 나날이 증대되고 있습니다. 이번 학술대회를 통해서 국내 의공학 연구자들 간 활발한 교류의 장이 펼쳐지고, 한층 발전된 국내 의공학 연구수준을 볼 수 있을 것으로 확신합니다. 또한 학문적 교류와 더불어 아름다운 자연이 펼쳐져 있는 호반의 도시 춘천의 향취를 한껏 누리시기를 바랍니다.

저희 강원의료융합인재양성센터는 대한의용생체공학회 회원 여러분은 물론 관련학계의 여러 전문가 및 연구자들의 학회참석을 진심으로 환영합니다. 공사다망 하신 가운데에서도 부디 함께 자리를 같이 하시어 학문적 토론과 함께 학회의 발전방향에 대해서도 아낌없이 조언하여 주시기를 바라며 정중히 초대합니다.

학술대회 조직위원장

강원대학교 강원의료융합인재양성센터장 **김헌영** 배상

학술이사 인사말

대한의용생체공학회 회원님들과 의공학 연구자 여러분께,

2010년도 춘계학술대회를 오는 5월 14, 15일 이틀동안 강원대학교 60주년 기념관에서 “Future Neurotechnologies for Neuron, Network, and Brain”이라는 주제로 개최합니다.

이번 학술대회에는 신경기술의 융합연구를 주도하고 계시는 국내외 선도 연구자 두 분의 초청강연을 준비했습니다. 미국 플로리다 대학교 의공학과 학과장이며, 현재 IEEE Transactions on Biomedical Engineering 편집장이신 Dr. Bruce C. Wheeler 교수을 초청하여 Brain on a Chip 기술에 대한 현황과 앞으로의 전망에 대하여 듣습니다. 또, 서울대학교 전기공학부 김성준 교수님을 모시고 신경보철기술의 현주소과 앞으로의 과제에 대하여 알아봅니다.

우리나라 의공학 분야를 이끌고 다양한 연구자들이 함께 모이는 학술 교류의 장으로 거듭날 수 있도록, 여러분들의 많은 참여를 바랍니다

대한의용생체공학회 학술이사 **신정욱, 남윤기** 배상

대한의용생체공학회 제18대 임원

직 책	성 명	소 속
회 장	정도언	서울대
수석부회장	조진호	경북대
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	손원길	메디슨
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	허 웅	명지대
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	지영준	울산대
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	김인영	한양대
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	정선근	서울대
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	정병조	연세대
학술이사	신정욱	인제대
	남윤기	KAIST

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	이재성	서울대
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	노정훈	부산대
국제협력이사	김법민	고려대
	김태성	경희대
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	유규하	식약청
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	김명남	경북대
	이봉수	건국대
	신홍범	코모키수면클리닉
특임이사	김 린	고려대
	홍성화	삼성병원
	김윤년	계명의대

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위원	서광석	서울대
위원	최성욱	강원대

직 책	성 명	소 속
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위원	신범주	부산대
위원	정동근	동아대

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학술이사	남윤기	KAIST
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위원	양 성	GIST
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위원	서종모	서울대
위원	정 용	KAIST
위원	박재영	고려대

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직 책	성 명	소 속	직 책	성 명	소 속
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위원	박현진	가천의과학대	위원	태기식	건양대
위원	서광석	서울대			

편집위원회

직 책	성 명	소 속	직 책	성 명	소 속
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위원	이종민	한양대	위원	김한성	연세대
위원	권성훈	서울대	위원	임창환	연세대
위원	임도형	한국생산기술연구원	위원	신정욱	인제대
위원	유선국	연세대	위원	김동욱	전북대
위원	정동근	동아대	위원	이성재	인제대
위원	엄광문	건국대	위원	이우철	을지대
위원	남윤기	KAIST			

프로그램위원회

- Cardiovascular Engineering / Respiratory Engineering

  박재영_고려대학교 비뇨기과　　정용_KAIST 바이오및뇌공학과/삼성병원 신경과

- Orthopedic and Rehabilitation Engineering / Biomedical Robotics

  신정욱_인제대학교 의용생체공학과　　임도형_한국생산기술연구원

- Tissue Engineering and biomaterials

  이수홍_CHA 의과대학교

- Neural Engineering

  남윤기_KAIST 바이오및뇌공학과

- Medical and Bioinformatics / Systems Biology, Physiological modeling

  최진욱_서울대학교 의공학과　　심은보_강원대학교 기계의용공학과

- Medical Imaging

  임창환_연세대학교 의공학과　　황도식_연세대학교 전기전자공학부

- Biomedical Optics / Cellular and Molecular Engineering / Medical Nano and Microtechnology

  변경민_경희대학교 동서의료공학과　　전누리_서울대학교 기계항공공학부　　최영빈_서울대학교 의공학과

- U-Health, eHealth Technology

  서종모_서울대학교 전기공학과　　양성_GIST 기전공학과

- Biomedical Engineering Education and Career

  지영준_울산대학교 의공학과

준비위원회

직 책	성 명	소 속	직 책	성 명	소 속
준비위원장	김헌영	강원대	**준비위원**	심은보	강원대
			준비위원	최성욱	서울대

행사준비위원회

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변경민	경희대	원지영	학회사무국

춘계학술대회 프로그램 일정

주 최: 대한의용생체공학회
주 관: 대한의용생체공학회, 강원의료융합인재양성센터
일 정: 2010년 5월 14일(금) ~ 15일(토)
장 소: 강원대학교 60주년기념관

5월 14일 (금)					
시간	110호	111호	301호	304호	310호
12:00 ~ 13:00	등 록 (1층 로비)				
13:00 ~ 13:30	개회식				
13:30 ~ 14:20	초청강연 #1 (110호) Brain on a Chip: Designing Neural Networks in Culture Dr. Bruce Wheeler, J. Crayton Pruitt Dept. of Biomedical Engineering, University of Florida, USA				
14:30 ~ 16:00	심포지움	일반연제 1-1 U 헬스케어	일반연제 1-2 의공학교육		
16:00 ~ 16:20	휴식				
16:30 ~ 17:50	심포지움	포스터 1 (2층 3층 로비)			
19:00 ~ 21:00	만찬				

5월 15일 (토)					
시간	110호	111호	301호	304호	310호
09:00 ~ 10:00	포스터 2 (2층, 3층 로비)				
10:00 ~ 10:50	초청강연 #2 (110호) Progress and Challenges of Neural Prostheses: Cochlear, Retina implants, DBS, and beyond 김성준 교수, 서울대 전기컴퓨터공학부				
11:00 ~ 12:30	일반연제 2-1 임상의학과 공학의 만남	일반연제 2-2 의료영상	일반연제 2-3 나노바이오공학	일반연제 2-4 조직공학/의료로봇	일반연제 2-5 신경공학
12:30 ~ 13:30	점심 / 전시부스 방문				
13:30 ~ 15:00	포스터 3 (2층, 3층 로비)	특별 강연 (111호) Writing a scientific article Dr. Bruce Wheeler, IEEE T-BME Editor-in-Chief			
15:00 ~ 15:30	폐회식				

심포지움 프로그램	
Future Neurotechnologies : From Neuron to Brain 좌장_남윤기/양윤석	
14:30 ~ 15:00	Spinal Cord Injury treatment with Stem cells and Gene therapy 하 윤 교수_연세대학교 신경외과
15:00 ~ 15:30	Development of a fully integrated single-chip wireless neural interface and its safety and reliability evaluation 김소희 교수_GIST 기전공학과
15:30 ~ 16:00	Advanced Photonic Technologies for Brain Implantable Microsystems and Its Application to (Non-Human) Primates 송윤규 교수_서울대학교 나노융합학과
16:30 ~ 17:00	Quantification of Cerebral Oxidative Metabolism without Hypercapnia using Simultaneous Near Infrared Spectroscopy and fMRI Measurements 예종철 교수_KAIST 바이오및뇌공학과
17:00 ~ 17:30	Decoding Cortical Activity for Motor Control 김성필 교수_고려대학교 뇌공학과

일반연제 1-1 U 헬스케어 좌장_서종모/양성	
논문발표 (8분)	1~100MHz에서 On-Body Communication용 Dipole Antenna 작동특성 문진희_고려대학교 보건과학대학 생체의공학과
논문발표 (8분)	PVDF필름을 이용한 BCG, ECG 동시측정 심교식_서울대학교 생체계측신기술연구센터
논문발표 (8분)	TI C6713DSK 과 Simulink 를 이용한 보청기 알고리즘 개발 및 검증 김진률_한양대학교 의용생체공학과
논문발표 (8분)	양이 보청기를 위한 멀티 프로토콜 블루투스 통신 황대근_경북대학교 일반대학원 전자전기컴퓨터공학부
논문발표 (8분)	홈 헬스케어를 위한 휴대용 유방암 진단 시스템 류지원_서울대학교 바이오 엔지니어링
논문발표 (8분)	PVDF film을 응용한 수면 중 심박수 및 연속적 수축기 혈압 추정 시스템 이정수_서울대학교 대학원협동과정바이오엔지니어링
논문발표 (8분)	독거노인을 위한 무구속 행동량 측정 시스템의 실제 적용과 문제점 신재혁_서울대학교 공과대학 의용생체협동과정
논문발표 (8분)	청각을 이용한 시각 재현장치의 분석프로그램 개발 김정훈_경북대학교 의용생체공학과/영상처리학과
논문발표 (8분)	무선 통신 기술에 기반한 시각장애인용 지팡이 조동석_서울대학교 전기컴퓨터공학부
논문발표 (8분)	안전위도를 이용한 시운동안진의 자동측정 문혁준_서울대학교 공과대학 전기공학부
논문발표 (8분)	시선 추적 시스템을 이용한 객관적 시력검사 임장혁_서울대학교 공과대학 전기공학부

일반연제 1-2 의공학 교육 좌장_지영준/김동욱	
논문발표 (10분)	수요자 중심의 의공학 교과목 개발 연구 양윤석 교수_전북대학교, 바이오메디컬공학부
논문발표 (10분)	문제 해결형 의공학 교과목 개발 사례 양윤석 교수_전북대학교, 바이오메디컬공학부
논문발표 (10분)	학부생을 위한 의공학 실험 서종범 교수_연세대학교, 의공학부
논문발표 (10분)	의공학 공학교육 인증 준비 사례 연구 임용규 교수_상지대학교, 한방의료공학과
논문발표 (10분)	전문대학 의공학 공학기술교육 인증기준 프로그램 최병철 교수_춘해보건대학, 의료공학과
논문발표 (10분)	의공학에 특화된 소프트웨어 교육과정 박현진 교수_가천의과학대학교, 의료공학부
논문발표 (10분)	의공학 설계입문 교과목 개발 사례 지영준 교수_울산대학교, 의공학과
종합 토론 (20분)	

일반연제 2-1 임상의학과 공학의 만남 좌장_박재영/서종모	
논문발표 11:00 ~ 11:07	혈압조절을 위한 경동맥 혈압수용기용 전기자극기(10_초록182) 김유석_강원대학교 기계의용공학과
논문발표 11:08 ~ 11:15	HRV분석과 인공신경회로망을 이용한 심실빈맥의 진단 (10_초록043) 주세경_서울 아산병원 의공학과
초청강연 11:15 ~ 11:40	실시간 근적외선 영상을 이용한 말초조직 혈류 측정 기술 최철희 교수_KAIST, 바이오및뇌공학과
초청강연 11:40 ~ 12:05	Optimization of Cortical stimulation for chronic stroke: Experiences from clinical and experimental studies 김형일 교수_GIST, 의료시스템공학과
초청강연 12:05 ~ 12:30	Laparoendoscopic Single Port Surgery: What is it and what obstacles does it have? 박재영 교수_고려대학교 비뇨기과

일반연제 2-2 의료영상 좌장_임창환/황도식	
초청강연 11:00 ~ 11:25	최신 뇌영상 연구 기법: 뇌 연결체학 박해정_연세대학교 의과대학 영상의학교실
초청강연 11:25 ~ 11:50	뇌의 수초 양 측정 황도식_연세대학교 전기전자공학과
논문발표 11:50 ~ 12:10	자기 펄스를 이용한 고해상도 초음파 생체현미경 개발 오정환_부경대학교 의공학과
논문발표 12:10 ~ 12:30	고해상도 PET을 위한 FPGA기반 데이터 획득 시스템 윤현석_서울대학교 의과대학 핵의학교실

일반연제 2-3 나노바이오공학	좌장_변경민/최영빈
초청강연 11:00 ~ 11:25	무선 인덕션 히팅을 이용한 세포 파괴 기술 박정환 교수_경원대학교 바이오나노대학
초청강연 11:25 ~ 11:50	질병진단에 유용한 단백질 바이오마커 검출을 위한 초고감도 바이오센서 이혜진 교수_경북대학교 화학과
논문발표 11:50 ~ 12:10	혈액점도 측정을 위한 미세유체소자 기반 점도계 강양준_GIST 기전공학과
논문발표 12:10 ~ 12:30	현장검사를 위한 초소형 유세포 분석기 최형선_서울대학교 의공학과

일반연제 2-4 조직공학/의료로봇	좌장_임도형/이수홍
초청강연 11:00 ~ 11:30	줄기세포의 신배양방법과 조직재생을 위한 응용연구 이수홍 교수_차의과대학교
논문발표 11:30 ~ 11:50	균일한 크기의 배아 형성 및 배양을 위한 원형 microfluidic chip 개발 전예슬_고려대학교 생체의공학과
논문발표 11:50 ~ 12:10	CT 기반 생검 로봇 시스템 프로토타입 개발 김민태_국립암센터 융합기술연구부
논문발표 12:10 ~ 12:30	보행훈련 시뮬레이션을 위한 로봇-보조형 보행훈련 모델링 및 동역학 해석 황성재_연세대학교 의공학과

일반연제 2-5 신경공학	좌장_김소희/김성필
초청강연 11:00 ~ 11:25	Decoding of multi-neuronal activities from retinal neural for the development of retinal prosthesis 김경환 교수_연세대학교 의공학과
초청강연 11:25 ~ 11:50	MEA 시스템을 이용한 전압자극 파라미터 변화에 따른 망막 신경절세포 반응 비교 구용숙 교수_충북대학교 생리학 교실
논문발표 11:50 ~ 12:10	Closed-loop 자기제어 배뇨장애 조절시스템 개발을 위한 기초연구 임창균_한림대학교 해부학 교실
논문발표 12:10 ~ 12:30	말초신경신호 획들을 위한 저잡음 증폭기 개발 송강일_KIST 의과학센터

• 학회장소 : 강원대학교 60년 기념관

주 소 : 200-701 강원도 춘천시 강원대학길 1(효자2동 192-1) 강원대학교 춘천캠퍼스
전화번호 : (033) 250-6114 , Fax : (033) 251-9556

• 전국에서 오시는 길

경춘고속도로 이용

서울 →강일IC → 강촌IC → 조양 IC→ 남춘천IC -춘천분기점(춘천IC)

대구 → 중앙고속도로 → 춘천IC → 춘천

부산 → 경부고속도로 → 대구IC → 중앙고속도로 → 춘천

목포 → 호남고속도로 → 중부고속도로 → 이천IC → 영동고속도로 → 원주IC → 중앙고속도로 → 춘천

인천 → 영동고속도로 → 원주IC → 중앙고속도로 → 춘천

• 서울에서 오시는 길

• 고속도로 이용

중부고속도로 : 서울 TG → 하남 IC → IC 통과후 팔당대교방향 → 팔당대교 건너서 6번국도(양평방향)진입 → 봉안대교 지난 후 조안 삼거리에서 양수리(청평) 방면 → 양수리 지나 경춘선 철길 통과 후 바로 우회전 → 청평 → 가평 → 춘천

경부고속도로 : 서울 톨게이트 → 구리방면 → 성남 톨게이트 → 구리 톨게이트 → 춘천 방면 → 구리시 → 남양주시 → 검문소에서 좌회전(춘천 방면) → 청평 → 가평 → 춘천

• 시외버스 이용

지하철 2호선(강변역에서 하차) → 동서울 터미널 → 춘천

지하철 7호선(상봉역에서 하차) → 상봉 터미널 → 춘천

• 기차 이용

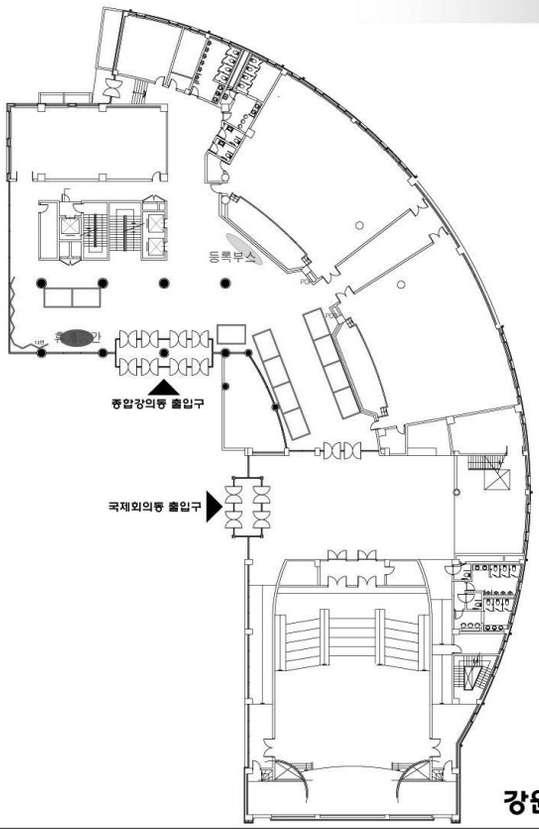
지하철 1호선(청량리역에서 하차) → 남춘천역

지하철 1호선(성북역에서 하차) → 남춘천역

• 자가용 이용

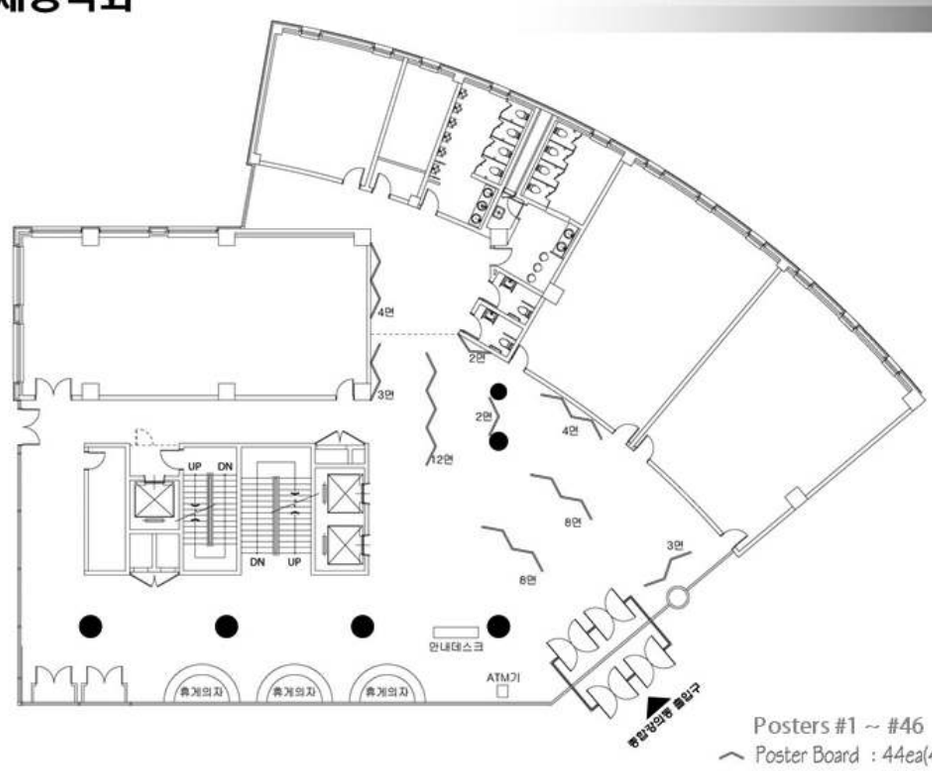
구리시 → 남양주시 → 검문소에서 좌회전(춘천 방면) → 청평 → 가평 → 춘천

대한의용생체공학회

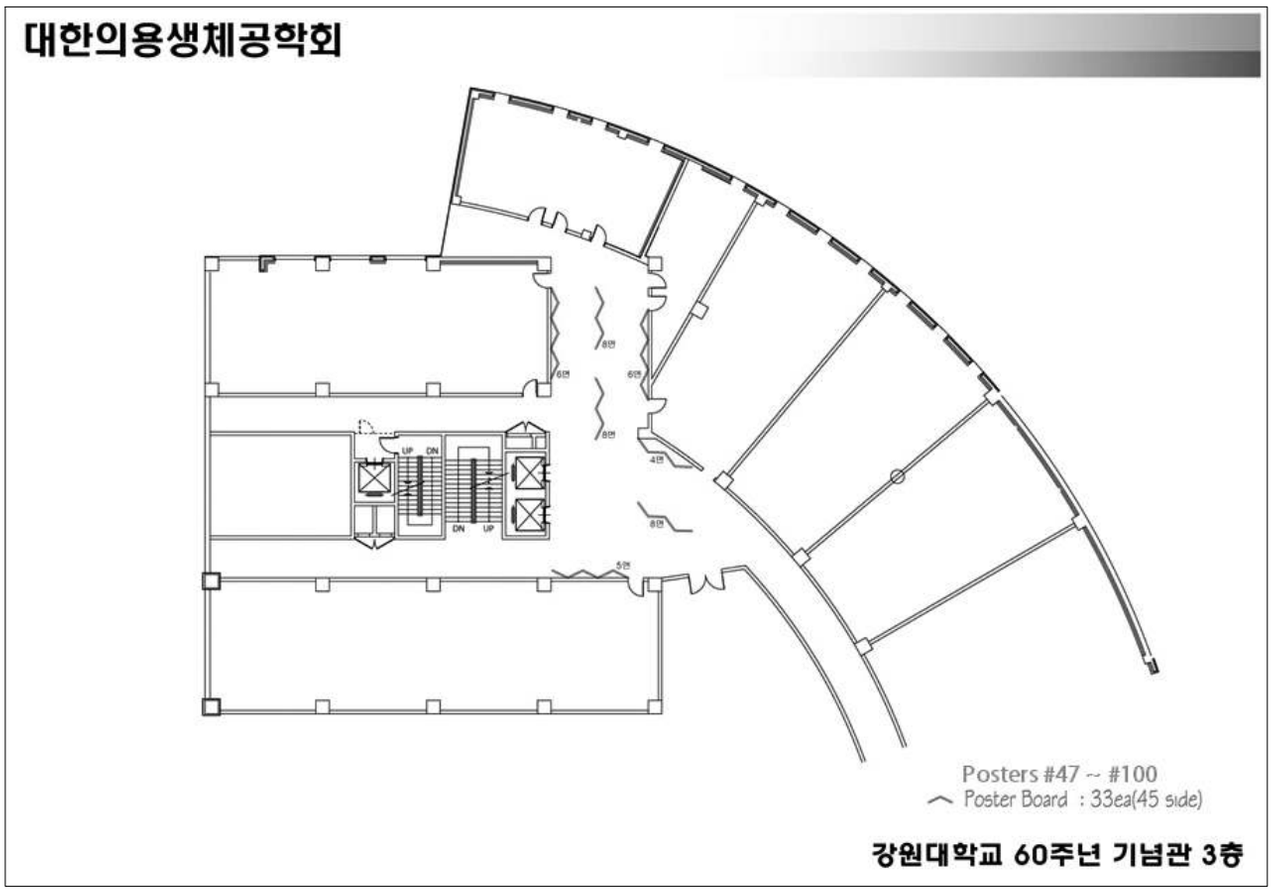


강원대학교 60주년 기념관 1층

대한의용생체공학회



강원대학교 60주년 기념관 2층



※ 참가비 납부방법

2010 춘계	사 전	당 일
일 반	7 만원	8 만원
학 생	5 만원	6 만원
비회원 일반	10 만원	11 만원
비회원 학생	7 만원	8 만원

- 학술대회 논문발표자는 반드시 학회 회원으로써 연회비 납부와 사전등록비를 각각 따로의 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)

KEYNOTE SPEAKERS

- **Brain on a Chip: Designing Neural Networks in Culture**
  Dr. Bruce Wheeler
  J. Crayton Pruitt Dept. of Biomedical Engineering, University of Florida, USA

- **신경보철 (청각, 시각보철및 DBS) 의 오늘과 내일**
  김성준
  서울대학교 전기컴퓨터공학부

Brain on a Chip: Designing Neural Networks in Culture

Dr. Bruce Wheeler

J. Crayton Pruitt Dept. of Biomedical Engineering, University of Florida, USA

The wild idea that nerve cells grown in culture could have reliable computational function, while still a wild idea, is closer to reality than is reasonable to expect, thanks to applications of both engineering and applied biology. The metaphor works both ways: applications of more traditional engineering technologies –signal processing, electronics, microlithography, materials science – make possible the controlled growth, recording, and stimulation of nerve cells. In turn the goal is to design, construct, test, and utilize – in short to engineer –a working biological construct. In this lecture examples, mainly from the speaker's laboratory, illustrate the component technologies that have been utilized in this pursuit, as well as examples illustrating how the approaching the problem as an engineer leads to the asking new questions.

Collaborator: Dr. GJ Brewer, SIU School of Medicine, Springfield IL. Support: NIH and NSF.

Bio sketch

Bruce Wheeler is Professor and Interim Chair of the Pruitt Family Department of Biomedical Engineering at the University of Florida. From 1980 to 2008 he was with the University of Illinois at Urbana-Champaign, most recently as Professor and Founding and Interim Department Head of the Bioengineering Department. He was also a Professor of Electrical and Computer Engineering and the Beckman Institute, a former Associate Head of ECE, and a former chair of the Neuroscience Program. He is the Editor in Chief of the IEEE Transactions on Biomedical Engineering and a Fellow of the IEEE and AIMBE. He received the B.S. degree from MIT and later the M.S. and Ph.D. in Electrical Engineering from Cornell. Prof. Wheeler's research interests lie in the application of electrical engineering methodologies, signal processing and microfabrication, to the study of the nervous system, including the microlithographic control of the patterns of growth of neurons in vitro soas to permit stimulation and recording with microelectrode arrays. Hopefully this work will lead to better understanding of the behavior of small populations of neurons and lead to better insights into the functioning of the brain. He also has had involvement in algorithm development for directional hearing aids.

신경보철 (청각, 시각보철및 DBS) 의 오늘과 내일

김성준
서울대학교 전기컴퓨터공학부

Neural prosthesis (NP) is a device that connects directly with the nervous system to replace or supplement sensory or motor function. It is also a device that improves the quality of life of a neurologically impaired individual so much that he or she is willing to put up with the surgery, gadgetry, etc[1] Remarkable progress has been made recently in various modalities of the NP. Technologies matured in auditory prosthesis and the Cochlear Implant (CI) devices have been implanted in more than 120 thousand of people worldwide, with average speech recognition scores as high as 80%. Yet better speech recognition through nature mimicking and reduction of the U$25,000 price, while maintaing the high effectiveness, are among the key issues that need to be solved. Visual prostheses based on Retina or Optic nerve implant have been tried. At least two teams in U.S. and in Europe are pursuing clinical trials using their pilot devices employing more than 60 electrode sites. Blind participants are able to recognize simple patterns or objects presented with high contrast. Commercial DBS (Deep Brain Stimulation) devices have been shown effective in the treatment of Parkinson's disease. The DBS shows further promises in other neurological diseases such as neuropathic pains, depression and even the obsessive compulsive disorder. In Korea, a multichannel commercial Cochlear Implant has been made available recently. A set of simplified design ideas were used to reduce cost. The device was tested on four Ineraid patients to show a speech recognition performance at least as good as the control device. In a patient, close to perfect speech recognition scores were recorded. The Retina implants based on flexible polyimide or LCP (Liquid Crystal Polymer) electrode have been in animals (rabbits). A small DBS system has been developed and tested in small animals (rats). A head mountable DBS system is being developed for clinical trials. In this talk, we will review recent progress made in each area of the NP, as noted above. We will then consider emerging technologies and new applications for the future. (2000.04.23.)

[1]Definition used by NIH Neural Prosthesis Program, 2000.

Bio sketch

Sung June Kim studied Electronics Engineering in Seoul National University(SNU) for his B.S. degree and Electrical Engineering in Cornell University, for his M.S. and Ph.D. degrees in 1981 and 1983, respectively. His ph.D. work was an early attempt of applying solid state microelectronics technology to the newly emerging field of neural prosthetics (NP). He then was employed by AT&T Bell Laboratories to perform research and development of advanced semiconductor devices. In 1989, he returned to Korea to join SNU, where he is devoting all his effort and experience he gained so far, to the establishment of an NP program in Korea. In 2000, he, together with 18 other faculty members with diverse academic backgrounds, was given an ERC(engineering research center) grant from Korean government to work on various modalities of NP. Now his NP program includes cochlear implant (hearing), retinal implant (vision) and deep brain stimulation(motion). He is particularly interested in providing low cost NP technologies for people in developing countries. He is a full professor of Electrical Engineering, has been the director of the ERC (2000-) and had been a program chair of Biomedical engineering program (1997-2003) at SNU.

2010년도 제41회 대한의용생체공학회 춘계학술대회

SYPOSIUM SPEAKERS

Future Neurotechnologies : From Neuron to Brain

좌장 | 남윤기/양윤석

KOSOMBE

줄기세포와 유전자치료 기술을 이용한 척수손상의치료

하 윤
연세대학교 의과대학 신경외과 척추신경연구소

Devastating spinal cord injury continue to occur in spite of the tremendous efforts of various prevention programs. The enormity and annual escalation of healthcare costs due to them require that therapeutic strategies be responsibly developed. The dysfunctions that occur after injury are primarily due to neurotransmission damage. The last two decades of both experimental and clinical research have demonstrated that neural and non-neural tissue and cell transplantation with gene therapy is a viable option for ameliorating dysfunctions to markedly improve quality of life. Moreover, significant progress has been made with cell transplantation in studies of pathophysiology, plasticity, sprouting, regeneration, and functional recovery. This presentation will review our research about the ability and potential, particularly for traumatic spinal cord injury, that neural and non-neural tissue and cell transplantation combined with gene therapy has to replace lost neurons and glia, to reconstruct damaged neural circuitry, and to restore neurotransmitters, hormones, neurotrophic factors, and neurotransmission.

뇌이식형 마이크로시스템을 위한 고급 광학기술과 그 기술의 영장류 응용

송윤규
서울대학교 나노융합학과

Recent advances of microelectronic SoC(System on Chip) technology in conjunction with current understanding in neuroscience are beginning to show the possibility of cracking the mechanisms of brain microcircuits with extremely high spatio-temporal resolution as well as enabling people with neural impairments to control assistive devices, such as prosthetic arms or legs, in the most efficient and natural way. In this work, I describe current progress in the area of neurotechnology that aims to develop a fully-implantable neural microsystem connecting the brain and the outside world, with special emphases on the high fidelity and ultra-wide band transcutaneous infrared (IR) optical data link, advanced photovoltaic devices for optical power delivery, and the state-of-the-art surgical techniques to implant neural microsystems in the brain of non-human primates.

통합형 무선 신경 인터페이스

김소희
GIST 기전공학과/ 의료시스템공학학제전공

Many neuroprosthetic or neural interface devices used in clinical and research applications have employed wired connections and thus, suffered from several drawbacks. Recently, a fully integrated wireless neural interface has been developed as a single-chip device, based on the conventional silicon-based Utah microelectrode array. This article highlights the technical challenges in developing such a device, e.g. high-yield and reliable fabrication technology, wireless power supply and data transmission, low-power VLSI electronics, high-density and reliable integration, and long-term biocompatible and stable encapsulation. The functionality of the developed device is demonstrated in *in vitro* as will as *in vivo* conditions.

근적외선분광시스템과 기능자기공명영상의 동시측정을 통해 과탄산혈증 단계없이 뇌산소대사량을 측정하는 기법

예종철
KAIST 바이오및뇌공학과

Estimating cerebral metabolic rate of oxygen (CMRO2) and cerebral blood flow (CBF) is important to investigate neurovascular coupling during brain activation. In this paper, a novel method to determine $CMRO_2$ without hypercapnia is described using simultaneous near infrared spectroscopy (NIRS) and fMRImeasurements. Specifically, an optimization framework is proposed that minimize differences between two forms of relative $CMRO_2$–CBF coupling ratio from NIRS and fMRI biophysical models, from which hypercapnia calibration and model parameters are readily estimated. We found that during finger tapping task, group-average CBF, $CMRO_2$, and flow-metabolism coupling ratio are within the range of values reported from other literatures.

운동 제어를 위한 뇌 신경세포 신호 디코딩

김성필
고려대학교 뇌공학과

How cortical neurons encode the movement commands in interaction with environments has been one of key questions to understand neural information processing. The understanding of neural code has played a central role in various neuroengineering areas such as neural motor and sensory prosthetics, neuromarketing, neuroimage analysis, and brain–computer interfaces, to name a few. To unravel the information embeded in neural signals, one should address basic questions including: what kind of brain signals can we measure?; how can we process the brain measurements to represent underlying neural activity?; what mathematical models properly describe the relationship between neural activity and movements?; and can we decode neural activity accurately to extract sufficient movement information? In this talk, I will present the work on decoding the firing patterns of motor cortical neurons, measured by chronic microelectrode arrays. First, I will address the issue of representing the firing patterns with the time binning method by introducing a novel algorithm for smoothing firing patterns using a Gaussian kernel. Next, I will overview some decoding models that have been most widely used and present how we can address the limitation of these models using movement priors. Finally, I will compare two decoding models, the Population Vector Algorithm and the Kalman Filter, and show in which conditions the Kalman filter is preferably used.

INVITED ORAL

KOSOMBE

실시간 근적외선 영상을 이용한 말초조직 혈류 측정 기술

최철희
KAIST 바이오및뇌공학과

Measurement of functional tissue perfusion is needed for preventive measures and adequate treatment especially in patients with peripheral vascular diseases (PVD). Near-infrared (NIR) fluorescence imaging has been focused as an modality of *in vivo* imaging because of low scattering and deep tissue penetration. We have developed a novel indocyanine green (ICG) perfusion imaging that employs the intravenous injection of a NIR dye, ICG, planar imaging with a NIR-optimal CCD camera, and analysis of spatiotemporal dynamics. We have previously demonstrated the efficacy of this novel method in animal models of hindlimb ischemia for quantitative measurement of tissue perfusion rates. Pilot clinical study using sameprinciple clearly showed that ICG perfusion imaging is sensitive enough to diagnose early functional vascular insufficiency in PVD patients.

Optimization of Cortical stimulation for chronic stroke: Experiences from clinical and experimental studies

김형일
GIST 의료시스템공학과

Cortical stimulation (CS) proved to be effective in various kinds of neurological disorders. However, it is challenging to improve the neurological deficits in chronic stroke patients. Although the basic mechanism of CS on the infracted brain is not fully understood, it is assumed that CS may influence neural function in a time-dependant manner. As stimulation continues, it is thought to change the microanatomical and functional environment associated with brain plasticity. However, to maximize effective use of CS in recovery of function, questions remain regarding the mode, and optimal parameters of stimulation.
From animal experiments, we found that prolonged stimulation that differs with the size of cortical infarct lesion was effective; continuous stimulation greatly improved recovery in animals with large infarct, whereas intermittent stimulation was more effective in animals with small infarct. Therefore, pattern and duration of stimulation requires modification depending on the extent of lesion. On the other hand, chronic stroke patients with massive infarct showed the neurological improvement if multiple peri-infarct areas are simultaneously stimulated. It is not clear these effects were the result of network stimulation or simply the results of wide area stimulations. CS is often compared with noninvasive brain stimulation methods, however, it therapeutic effect is not surpassed by any other modalities. If the invasiveness of CS is minimized, CS may be the ideal tool to augment the neurological recovery in chronic stroke.
Based on these observations, new stimulation devices need to be developed for better effect of CS.

Laparoendoscopic Single-Site Surgery: What is it and what obstacles does it have?

박재영
고려대학교 비뇨기과

Laparoscopic surgery is beginning to gain acceptance as a standard of care in many intra-abdominal operation. With increasing experience in the laparoscopic environment, efforts are now directed at further minimizing morbidity and improving cosmetic outcomes. Recently convened international multidisciplinary consortium of experts have coined the term "LESS" (LaparoEndoscopic Single Site) surgery to collectively encompass laparoscopic procedures performed through a single skin incision. With the development of the laparoscopic procedures, there are a lot of things invented such as multichannel single-access ports and novel bent/ articulating instruments that could allow the laparoscopic procedure to be performed through a single skin incision often hidden within the umbilicus. Nevertheless, LESS accounted for only 15% of overall laparoscopic cases because it is still technically challenging.
In this presentation, the history of laparoscopy, the surgical process of LESS, the problems of LESS will be dealt with. From this presentation, productive ideas to improve LESS procedure can be come out to provide benefits for physicians and patients simultaneously.

최신 뇌영상 연구 기법 : 뇌 연결체학

박해정
연세대학교 의과대학 영상의학교실

Recent brain research relies heavily on connectionism since connection exists universally in the brain, for example, between neuron and neurons, between region and regions, between brains and cultures. To examine different levels of connection within brain, various neuroimaging techniques have been suggested to show functional brain connection. Anatomic connection is provided by diffusion tensor imaging andfunctional connection is dealt by functional MRI. These techniques have been used for diagnosis and exploration of diseases and also for understanding brain and interactions. In this presentation, we will review advanced methods for brain connectivity in the respect of anatomic connection, functional connection from neuronal level to social brain level.

무선 인덕션 히팅을 이용한 세포 파괴 기술

박정환
경원대학교 바이오나노대학

Cell lysis is essential process of breaking down cell membrane to get DNA or protein from cell in an integrated bio-chip. Several cell lysis methods based on chemical reagent and electroporation have been devised for efficient cell lysis in bio-chip [1]. However, previous cell lysis methods are uneconomical to apply for bio-chip because of wire connection, out-power source and complex fabrication. In this work, wireless induction heating of microfluidic device was devised for portability and economic efficiency by wireless operation, easy fabrication, and treatment of large number of cells.

뇌의 수초 양 측정

황도식
연세대학교 전기전자공학과

Myelin is an important component in the central nervous system. It surrounds the neuronal axons to protect axons and increase the neurons' conduction speed. When it degrades, the brain cannot function properly. It is related to many kinds of neuronal diseases such as multiple sclerosis. In this study, we present a method to measure myelin integrity noninvasively using magnetic resonance imaging. Multi-gradient echo sequence was used to measure multiple images at different echo times, and analyzed to extract myelin-related signals. The myelin water fraction (MWF), which is the ratio of the amount of the myelin-related signal components to the others, was calculated. This MWF maps can represent the myelin content throughout the brain.

질병진단에 유용한 단백질 바이오마커 검출을 위한 초고감도 바이오센서

이혜진
경북대학교 화학과

Development of quantitative assays of protein biomarkers in serum or urine samples could offer an excellent opportunity to improve patient care via earlier diagnoses in a fast and convenient manner. This paper will highlight our latest efforts to develop ultra-sensitive optical detection method for protein biomarkers associated with various types of diseases using biofunctionalized gold nanomaterials in conjunction with surface enzyme reactions. For example, DNA aptamer and antibody microarrays with biofunctionalized gold nanomaterials can be utilized for the ultrasensitive SPR detection of protein biomarkers such as immunoglobulin E in a sandwich assay format.

줄기세포의 신배양방법과 조직재생을 위한 응용연구

이수홍
차의과학대학교, 의생명과학과,
줄기세포공학연구실

Stem cells have been widely studied as a powerful source for cell therapy because of their high self-renewal activity and high telomerase activity that may provide an unlimited supply of target cells. Despite the clinical prospect, it is necessary that several problems be resolved prior to clinical application. Recently we have not only developed a novel culture technique using porous membranes for human embryonic stem cell (hESC) expansion, but also shown the neovascularization and bone formation potential of hESCs. Herein, I will present my recent studies about more improved culture technique as well as therapeutic effect of stem cell using scaffold and gene delivery system for clinical applications.

Decoding of multi-neuronal activities from retinal neural for the development of retinal prosthesis

김경환
연세대학교 의공학과

For successful restoration of vision by retinal prostheses, the neural activity of retinal ganglion cells (RGCs) evoked by electrical stimulation should represent the information of spatiotemporal patterns of visual input. We propose a method to evaluate the effectiveness of stimulation pulse trains so that the crucial temporal information of a visual input is accurately represented in the RGC responses as the amplitudes of pulse trains are modulated according to the light intensity. This was enabled by spike train decoding. The effectiveness of the stimulation was evaluated by the accuracy of decoding pulse amplitude from the RGC spike train, i.e., by the similarity between the original and the decoded pulse amplitude time series. When the parameters of stimulation were suitably determined, the RGC responses were reliably modulated by varying the amplitude of electrical pulses. Accordingly, the temporal pattern of pulse amplitudes could be successfully decoded from multiunit RGC spike trains. The range of pulse amplitude and the pulse rate were critical for accurate representation of input information in RGC responses. These results suggest that pulse amplitude modulation is a feasible means to encode temporal visual information by RGC spike trains and thus to implement stimulus encoding strategies for retinal prostheses.

MEA 시스템을 이용한 전압자극 파라미터 변화에 따른 망막신경절세포 반응 비교

구용숙
충북대학교 의과대학 생리학교실

Retinal prosthesis is regarded as the most feasible method for the blind caused by retinal diseases. For prosthesis development, optimal stimulation parameter is one of the most essential issues. Therefore, we focused on RGC responses to different stimulation parameters and compared threshold charge densities in normal and *rd1* mice using MEA system. With voltage-controlled pulses, RGCs in degenerated retina also respond to voltage amplitude or voltage duration modulation as well in wild-type RGCs. But the temporal pattern of RGCs response is very different. The thresholds charge densities are overall more elevated in *rd1* mice retinas compared to wild-type mice retinas.

ORAL PRESENTERS

KOSOMBE

U-Health, eHealth Technology

O1-1-1 1~ 100MHz에서 On-Body Communication용 Dipole Antenna 작동 특성

문진희[1,2], 백동현[2,3], 박지수[2], 김성환[2], 이상훈[2]
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[2]고려대학교 보건과학대학 생체의공학과
[3]고려대학교 공과대학 전기전자공학과

Though Zimmerman suggested electrostatic coupling which explains On-Body Communication (OBC) works by capacitive induction in 1995, precise theory of operation for OBC is not known. To find out that it works also as antenna, dipole antenna was made on flexible PCB whose material was Polyimide (PI). After attaching Rx antenna on the left wrist, Tx was attached on the arm at each distance from Rx. It is ascertained that OBC is operated also as antenna from S-parameters between 1~100 MHz measured by Vector Network Analyzer (VNA). And contact impedance, transmission gain (dB) were discovered.

O1-1-2 PVDF필름을 이용한 BCG, ECG 동시측정

심교식, 백현재, 이정수, 이승민, 박광석
서울대학교 생체계측신기술연구센터

In this paper, a new approach for simultaneous measurement of ECG and BCG signal was presented. For unconstrained measurement purpose, both signals should be recorded over clothing. Therefore, piezoelectric characteristic of PVDF film and methodology of capacitive coupled electrode was applied to the proposed system. Preliminary experimental results showed that both R-peak and J-peak could be detected. It is expected that the proposed system can be applied for home sleep monitoring.

O1-1-3 TI C6713DSK과 Simulink를 이용한 보청기 알고리즘 개발 및 검증

김진률[1], 한종희[1], 이상민[2], 홍성화[3], 김동욱[4], 김인영[1], 김선일[1]
[1]한양대학교 학과간협동과정 의용생체공학부
[2]인하대학교 전자 공학과
[3]성균관대학교 의과대학 이비인후과학교실
[4]삼성종합기술원 바이오헬스 연구실

This paper focuseson the development and evaluation of hearing aid algorithm on real-time. Generally, Hearing aid algorithms are developed on PC basis, while those algorithms should be operated on a DSP. Therefore, it is necessary to evaluate the algorithms on DSP basis. We used a TI C6713DSK as target DSP. In order to reduce the developing period, we used a Simulink, which is a model-based program, instead of coding manually with the C language. We convert a statistical log-magnitude spectral method(logMMSE) and a Wide Dynamic Range Compression(WDRC) using Modified Discrete Cosine Transform(MDCT) into Simulink models. With the Embedded IDE link, these models were embedded in the target board. When we compared the output on TI C6713DSK with PC, it shows similar performance. Consequently, the period developing and evaluating hearing aid algorithms could be considerably reduced.

O1-1-4 양이 보청기를 위한 멀티 프로토콜 블루투스 통신

황대근[1], 우상효[1], 웨이췬[1], 지아모이우딘[2], 조진호[1,2]
[1]경북대학교 일반대학원 전자전기컴퓨터학부
[2]경북대학교 일반대학원 의용생체공학과

A multi protocol of Bluetooth communication for binaural hearing aid device is proposed. In order to use the binaural hearing aid effect, communications between both hearing aids are necessary to maximize its efficiency. Therefore, a Bluetooth communication method was chosen and shared the fitting data between the hearing aids by using a serial port profile (SPP). Further, the Bluetooth was programmed to receive the voice signal from Smartphoneby using an advanced audio distribution profile (A2DP). From the experiment, both profiles were simultaneously worked each other and there was no distortion from the audio single and missing fitting data.

O1-1-5 홈 헬스케어를 위한 휴대용 유방암 진단 시스템

류지원[1], 허만승[1], 김희찬[2]
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[2]서울대학교 의과대학 의공학교실, 의학연구원 의용생체공학연구소

We developed a portable breast scanner to detect breast cancers in its early stages through self-diagnosis. Regular self breasts exam is recommended for an early detection to decrease the risk of getting cancer however, the tactile sensing is difficult for women to define the abnormality. In this paper, aprototype for detecting early breast cancer using multi array tactile sensors and its visualization program are illustrated.

O1-1-6 PVDF film을 응용한 수면 중 심박수 및 연속적 수축기 혈압 추정 시스템

이정수[1], 정기성[1], 황수환[1], 정도언[2], 박광석[3]

[1]서울대학교 대학원 협동과정 바이오엔지니어링
[2]서울대학교병원 신경정신과 수면의학센터
[3]서울대학교 의과대학 의공학교실

In this study, ballistocardiogram(BCG) measurement system using Polyvinylidene fluoride(PVDF) film is developed to monitor heart rate and estimate continuous blood pressure during sleep. PVDF film is a thin piezoelectric material which has enough sensitivity to measure BCG signal. The heart rate was extracted from BCG signal by simple peak detection algorithm. Then, blood pressure was estimated with BCG and ECG while the subjects were in supine position. Three parameters in time domain were analyzed and we showed that blood pressure and time delay between ECG-R peak and BCG-J peak are correlated. The proposed system is promising to make a contribution to ubiquitous healthcare system.

O1-1-7 독거노인을 위한 무구속 행동량 측정 시스템의 실제 적용과 문제점

신재혁[1], 박광석[2]

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[2]서울대학교 의과대학

We tested the IR motion detection sensor based activity monitoring system with aubiquitous network as a home healthcare solution for the elderly living alone. Total 11 elders who living alone in the government supported house were selected as subjects and the activity monitoring systems were installed in each. The motion signals were collected for periods of approximately one month to the six month, depending on the subject, from October to December, 2008. In this paper, we describe the development of activity monitoring system for the solitary elders and discuss the practical issues of the proposed system.

O1-1-8 청각을 이용한 시각 재현장치의 분석프로그램 개발

김정훈

경북대학교 대학원 의용생체공학과/영상처리학과

The final goal of our research is developing not a simple collision alarm equipment for the blinded walkers, but the apparatus (Audio-Vision System) which can simulate vision based on auditory information so that the blinds can figure the three dimensional space in front of them. On the way to the final goal, in this study, simulation software was developed and verified. Thirty normal volunteers were included in the subject group and the average age was 25.8 years old. After being accustomed to the system by evaluating 10 blinded virtual spaces, the volunteers performed test using another set of 10 blinded virtual spaces. The results of test were scored by shape, position, and dimension of objects in virtual space. The score of each checking point ranged from 1 to 4, and the full score was converted to 100. As results of this study, the total score ranged from 84 to 97 with the average of 93.3. In this study, a simulation software was developed and verified to have acceptable success rate. By combining to visual sensors, the vision-reconstruction system based on auditory signal (Audio-vision System) may be developed.

O1-1-9 무선 통신 기술에 기반한 시각장애인용 지팡이

조동석[1], 서종모[1,2]

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[2]서울대학교 병원 안과

We newly developed the special cane for visually handicapped people. It provide voice signal through wireless communication system. By embedding a special device into a cane, it can deliver voice signal. The voice signal is transmitted to the blind only when it passes above a tag including specific information. Our group use wireless technology such as RFID, Bluetooth. One can attain some information by using RFID, transmit its signal to the Bluetooth headset. It can transfer audio signal well, and we can devise new method for recognizing direction information. So we can transfer safety or commercial related voice signal well by using cane embedded with RFID and Bluetooth device.

O1-1-10 안전위도를 이용한 시운동안진의 자동측정

문혁준[1], 서종모[1,2], 황정민[2]

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For the objective visual acuity test using optokinetic nystagmus (OKN), we developed an algorithm to detect OKN waveforms from eye gaze information and an electroculogram data acquisition system to track the eye gazes of the examinees. We verified the performance of the automated OKN detection algorithm which consists of 3 steps – peak detection, phase detection, and OKN detection, by applying the algorithm to eye gaze information acquired from 3 examinees. The result of the experiment shows 89.5% of detection rate on average. This newly developed automated OKN detection system could improve the objectivity of the test and could reduce the burden of examiners.

O1-1-11 시선 추적 시스템을 이용한 객관적 시력검사

임장혁[1], 서종모[1,2], 황정민[2]
[1]서울대학교 전기컴퓨터공학부
[2]서울대학교 의과대학 안과학교실

This paper introduces a new objective visual acuity test using eye-tracking system. This test is based on OKN (optokinetic nystagmus) response. The eye tracking system monitors the eye movements and detects whether OKN occurs.
Three types of stimuli are used: gray pattern, still stripe pattern, and moving stripe pattern. When the subject recognizes the stripe pattern, OKN occurs with moving stripe pattern while it does not occur with other two stimuli. By counting the number of OKN occurrences on each stimuli and comparing the numbers, we can distinguish if the subject can recognize the stripe pattern or not. The width of the stripe is automatically adjusted according to the previous result.

Biomedical Engineering Education and Career

O1-2-1 수요자 중심의 의공학 교과목 개발 연구

양윤석
전북대학교 공과대학 바이오메디컬 공학부

Interdisciplinary nature of the current science and technology needs more creative and high level of practical knowledge in engineering. Biomedical engineering is a typical example of fusion technology. This study aims to define essential abilities of a biomedical engineer required in the upcoming more fused scientific era to develop the undergraduate courses to meet these requirements. Among the wide range of interdisciplinary curricular subjects, we selected 4 basic topics needed for more creative thinking, problem-solving, and experimental and practical knowledge about biology and technology re-use. We finally proposed viable syllabuses for these 4 essential courses for adoption by several biomedical academic institutions in Korea. The proposed courses will contribute to competent human resources in biomedical research and development.

O1-2-2 문제 해결형 의공학 교과목 개발 사례

양윤석
전북대학교 공과대학 바이오메디컬 공학부

The biomedical engineering has a huge range of scope and continuously doubling its depth and range of study. Therefore, it is rarely possible to transfer the great amount of knowledge to students in undergraduate engineering curriculum. Only some introductory courses try to describe briefly as many subjects as possible with the lack of thorough understanding of each subjects. This might cause some ambiguous or insufficient understanding about their major in the student who want to train their specialties to manage their career. This study aims at the development of an undergraduate course for in-depth understanding about biomedical engineering by utilizing Problem-Based Learning (PBL). We proposed a viable course syllabus composed of many interdisciplinary problems as a result of the study. The proposed course is being to an existing class for viability test. The unique and thorough understanding of his/her major established through the voluntarily problem solving processes will be benefit to developing his/her own career in biomedical engineering area.

O1-2-3 학부생을 위한 BME 실험

서종범
연세대학교 의공학부

Most of biomedical engineering departments in Korea provide laboratory classes oriented to electrical engineering, while molecular/biological laboratory classes are dominant in the top universities in the U.S. A balanced laboratory class for BME undergraduate students is proposed based on the review in this presentation.

O1-2-4 의공학 공학교육 인증 준비 사례 연구

임용규
상지대학교 한방의료공학과

A practical application case of an educational program based on the criteria of ABEEK (Accredition Board for Engineering Education of Korea) is shown. The program has been applied at the department of Oriental Biomedical Engineering of Sangji University since 2007. At present, the program is applied successfully with some to be improved. The case will be a useful guide for the application of ABEEK to education of the biomedical engineering.

O1-2-5 전문대학 의공학 공학기술교육 인증기준 프로그램

최병철
춘해보건대학 의료공학과

Each program in biomedical engineering technology specialty seeking ABEEK accreditation shall provide two or more years of demand-driven and outcomes-based education and satisfy the following eight criteria. The eight criteria are Program Educational Objectives, Program Outcomes & Assessment, Curriculum, Students, Faculty, Facilities and Funding, Improvement in Educational Quality and Program Criteria.

O1-2-6 의공학에 특화된 소프트웨어 교육과정

박현진
가천의과학대학교 의공학과

Biomedical engineering is the application of engineering principles and techniques to the medical field. Biomedical engineering lies between traditional engineering and medicine and is an inter-disciplinary field in its nature. Current Korean biomedical curriculum is a simple list of traditional engineering courses combined with basic medical science. There have been efforts to improve biomedical engineering education to reflect its inter-disciplinary nature. Here, enhanced software course for biomedical engineering is given. In this newly proposed course, students will learn MATLAB and LabVIEW, which are the most widely used software tools in biomedical engineering.

O1-2-7 의공학 설계입문 교과목 개발 사례

지영준
울산대학교 공과대학 의공학과

'Introductory Biomedical Engineering Design' is the course for the freshman who started his/her university education in the department of biomedical engineering. Based on the experience in University of Ulsan, the goal, special features, detailed contents of this course was summarized as the case study. Also the difficulties and suggestions to grow creative biomedical engineers are described in this article.

Cardiovascular Engineering

O2-1-1 혈압조절을 위한 경동맥 혈압수용기용 전기자극기

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The carotid artery baroreceptor electric stimulator is designed to be controlled by the external monitor that has a Zigbee module as communication method. And the external monitor can monitor the operation of electric stimulator and change the control parameter of the stimulator. And, it can directly control the stimulator. In addition, it can directly control the stimulator to adjust the blood pressure according to the IBP result.

O2-1-2 HRV분석과 인공신경회로망을 이용한 심실빈맥의 진단

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In this paper, we developed a program for detecting ventricular tachycardia by utilizing an artificial neural network with time- and frequency-domain parameters of heart rate variability (HRV) analysis. HRV is an effective and noninvasive tool for diagnosing autonomous nerve system. Database from 78 patients with implanted cardioverter-defibrillator was used. Signals were preprocessed to remove ectopic beats and trend. Total 11 parameters from time-domain analysis, Poincare analysis, and frequency-domain analysis were used to train and test artificial neural network. Result showed that the accuracy was 78.8% (63/80) in total, 80.0% (28/35) for ventricular tachycardia, and 77.8% (35/45) for normal status.

Medical Imaging

O2-2-3 자기 펄스를 이용한 고해상도 초음파 생체현미경 개발

윤주호, 구자성, 지예진, 송영진, Yosefine Arum, 오정환
부경대학교 의공학과

We demonstrated the utility of pulsed magneto-motive ultrasound (PMM-US) to noninvasively detect nanocomposites in tissue-mimicking phantoms and phantoms containing living macrophage cells. Pulsed MM-US imaging has several advantages including less-severe thermal damage constrains and increased magnetic flux density thus allowing the imaging of deeper internal tissue structures. We used custom-built iron oxide nanoparticles (10nm mean diameter) and high frequency ultrasound transducer made by PVDF film for molecular imaging. To image motion from iron-laden tissue and cell samples applied by pulsed magnetic field strength (2 Tesla), ultrasound images were recorded using a linear transducer operating at 40MHz center frequency. The induced tissue motion was detected using various quantitative and qualitative techniques including Doppler ultrasound, color/power Doppler, and a block-matching speckle tracking method.

O2-2-4 고해상도 PET을 위한 FPGA기반 데이터 획득 시스템

윤현석, 이재성, 고근배, 권순일, 이찬미, 이또우 미끼꼬, 이동수, 홍성종
서울대학교 의과대학 핵의학교실
서울대학교 대학원 의과학과
고려대학교 물리과
을지대학교 방사선학과

In molecular imaging research, there are needs for high resolution PET scanner for small object such as small animal or human breast. We have developed small object dedicated FPGA based PET scanner. The scanner is consists of 8 detector blocks using Hamamatsu H8500 multianode PMT and $L^{90}GSO$ scintillation crystals. 170MHz sampling ADC and FPGA based data acquisition board digitizes signals and process position, energy and coincidence in real-time. Each detector module can process up-to 1Mevents/s.

Medical Nano and Microtechnology

O2-3-3 혈액점도측정을 위한 미세유체소자기반의 점도계

강양준[2], 윤상렬[3], 양성[1,2,3]
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[3]GIST 의료시스템 공학학제전공

This paper deals with a microfluidic viscometer for blood viscosity measurement in relation to PBS. Using a microfluidic channel array composed of indicating channels, the relative viscosity of blood is measured by simply counting the numbers of indicating channels filled with blood and PBS, respectively. In order to evaluate the performance of the proposed microfluidic viscometer, the viscosity values obtained by the proposed microfluidic viscometer are compared with the ones obtained by the conventional viscometer. As a result of the regression analysis via power law ($\mu_r = k(\dot{\gamma})^{n-1}$), normalized differences of two parameters (k, n) between two methods are less than 2%. Thus, it could be concluded that the proposed microfluidic viscometer is capable of providing high accurate viscosity measurement of blood sample.

O2-3-4 현장 검사를 위한 초소형 유세포 분석기

최형선[1], 김광복[1], 김희찬[2], 정택동[3]
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의용생체공학연구소
[3]서울대학교 화학부

This paper reports that the miniaturized system of flow cytometer with dual detection method in impedance and fluorescence was developed for particle and cell counting. Impedance information is provided through polyelectrolyte gel electrodes (PGEs) for particle existence. Simultaneously, fluorescence that excited by a light-emitting diode (LED) is detected by a solid-state photomultiplier (SSPM). Basically, impedance and fluorescence signal amplitude is based on a particle size. Fluorescent micro-particles are employed to characterize the miniaturized system. The purposed system is able to be utilized to categorize micro-particles simply and fast.

Tissue Engineering and biomaterials

O2-4-2 균일한 크기의 배아 형성 및 배양을 위한 원형 microfluidic chip 개발

전예슬, 강 에드워드, 이상훈
고려대학교 보건과학대학 생체의공학과

Recent studies reported that uniform size of embryoid bodies (EB) is an important factor both in improving the reproducibility of stem cell differentiation experiments and in regulating endogenously influenced cell type-specific differentiation. For this reason, we developed the novel micro-fabrication method of hemispherical wells with hemi-round channel and seeded mouse ES cells uniformly in each well. Through the perfusion culture, using osmotic pump, we could successfully trap the cells in hemispherical wells and form EBs with uniform size.

Biomedical Robotics

O2-4-3 CT 기반 생검 로봇 시스템 프로토타입 개발

김민태, 김수현, 김현호, 남경원, 김광기, 조영호
국립암센터 융합기술연구부 의공학연구과

The biopsy operation, especially in lungs, is essential to inspect whether some detected tumors are malignant or benign. But it requires a series of precise and careful actions which is time-consuming and the operator is easy to be exposed to over-radiation. We developed a distantly controlled robot for the CT-guided biopsy which is radiation-free. The robot system is easily and precisely controlled in distant from the radiation source and most actions of the biopsy operation can be automated. Also this robot has a specially designed needle insertion device which does less pain to the patient.

Orthopedic and Rehabilitation Engineering

O2-4-4 보행훈련 시뮬레이션을 위한 로봇-보조형 보행훈련 모델링 및 동역학 해석

황성재[1,2], 조영근[1,2], 이민현[1,2], 이희영[1,2], 김한성[1,2], 김영호[1,2]

[1]연세대학교 의공학과
[2]연세의료공학연구원

The diagnosis and treatment, especially training of gait disorder is very challenging. A combination of several factors, including muscle spasticity, muscle weakness, bony malalignment, and neurological impairment may contribute to a gait disorder's movement abnormality.

Neural Engineering

O2-5-3 Closed-loop 자기제어 배뇨장애 조절 시스템 개발을 위한 기초연구

임창균, 이현주, 고진수, 랑이란, 함형걸, 서인석, 신형철

한림대학교 의과대학 생리학 교실

We developed two animal models of dysuria, one by ischemic insult to spinal cord in rabbits and the other with bladder infection in rats. Changes in micturition frequency, cell death in spinal cord were observed. Simultaneous many single neuron recordings from anterior cingulate gyrus and spinal cord were done in model animals while delivering repetitive expansion and constriction of bladder. Neural activities were dramatically altered in the spinal cord of rat with bladder infection when compared to those of normal rat. The next step of our research will test the efficacy of several established commercial products for dysuria treatment.

O2-5-4 말초신경신호 획득을 위한 저잡음 증폭기 개발

송강일, 추준욱, 윤인찬, 최귀원, 서준교

한국과학기술연구원, 의과학연구센터

A low-noise amplifier was developed for recording peripheral nerve signals with cuff electrodes. The output was amplified with a gain of 10000 and bandpass filtered from 300 to 5000 Hz. The total noise of the amplifier was below 1 μV RMS for a cuff impedance of 1 kΩ, and the common-mode rejection ratio was 107 dB at 1 kHz. To enlarge the amplitude of the nerve signal in the limited implant site, the cuff electrode was fabricated with the dimension of the inner diameter of 1 mm and the length of 10 mm. The cuff electrode was then assembled together with closure, pre-amplifier circuits and headstage connector. In experiments, the performance was evaluated in vivo on the sciatic nerve in a rat animal model.

POSTERS I

KOSOMBE

Orthopedic and Rehabilitation Engineering

P1-01 힘센서를 이용한 바이오피드백 대칭하중부하 보행훈련 시스템 개발

최효준[1], 권용찬[1], 이현주[2], 태기식[1]
[1]건양대학교 의공학과
[2]건양대학교 물리치료학과

Training to achieve a functionally efficient and cosmetically smooth pattern of gait is a high priority in the rehabilitation of patients with a physical limitation involving the lower limbs. Gait rehabilitation programs often require either partial weight-bearing (PWB) or encourage full weight bearing (FWB) on the affected limb. Gait rehabilitation is more efficient when biofeedback is used to instruct patients regarding weight-bearing. In this study, we developed a biofeedback gait training system for symmetrical weight bearing in patient with gait disorder.

P1-02 특발성 파킨슨병 환자의 손목 경직의 점탄성 특성

권유리[1], 김지원[1], 엄광문[1], 고성범[2]
[1]건국대학교 의학공학부
[2]고려대학교 병원 신경과

The purpose of this study was to quantify the clinical assessment of rigidity at wrist in patients with Parkinson's disease. Forty five patients with Parkinson's disease participated in this study. Viscoelastic properties were calculated from the experimental data (wrist torque and angle) acquired during intermittent passive movement of the patients' wrist. Viscoelastic constants correlated well with the rigidity scores of UPDRS, i.e., Spearman's r=0.733 and 0.905 for spring and damping constants, respectively. The results suggest that viscoelastic properties can be used as quantitative measures of rigidity.

P1-03 디지털 보청기의 성능향상을 위한 다채널 WDRC와 FBC 설계 및 구현

강현덕[1], 전유용[1], 송영록[1,2], 이상민[1,2]
[1]인하대학교 전자공학과
[2]인하대학교 정보전자공동연구소

In digital hearing aids, WDRC is a function that compensates for the loss of a person's ability to hear. The Multi-channel WDRC technique can especially give them a higher level of compensation. FBC reduces the uncomfortable signal and can give more gain compared to hearing aids without FBC. We designed a Multi-channel WDRC and FBC using simulink. We made the 4 channel WDRC and tested it by the test signal . The results show that due to FBC, the added stable gain is 5.13dB.

P1-04 족관절 근육의 근전도 반응시간과 근전도-근력 지연시간의 측정시스템 개발

김민용, 김지원, 권유리, 엄광문
건국대학교 의학공학부

The purpose of this study was to develop a system for the measurement of EMG reaction time and electro-mechanical delay (EMD) in ankle muscle. Bidirectional load cell was used to measure the force of plantarflexion and dorsiflexion. One subject was requested to exert maximal, voluntary isometric contraction of ankle muscle in reaction to auditory stimulus to determine. We could determine EMG reaction time and EMD from the experimental data. This system is of low cost, small sized and it is expected to be conveniently applied to elderly persons and stroke patients.

P1-05 기립자세에서 footprint를 이용한 자세 변수의 신뢰도

김자영, 김지원, 권유리, 엄광문
건국대학교 의학공학부

The purpose of this study was to investigate the reliability of postural variables from footprint during standing. As analysis variables, BTD (big toe distance), IMD (inter-malleolar distance), EFL (effective foot length), BOS (base of support) area and opening angle(α) are used. All analysis variables showed excellent reliability (Cronbach's Alpha =0.929~0.985).

P1-06 태극권 발경 동작의 근육힘에 관한 연구

조효상, 이주연, 신상훈
상지대학교 한방의료공학과

The theory of Taijiquan is hard to understand with common sense, because it is explained with difficult terms like kyung(勁) and qi(氣). The purpose of this study is to analysis of Taijiquan with bio-mechanic point of view. Punching motion was measured by motion capture system with 10 year trained Tai chi expert. The measured data was analyzed with the SIMM(Software for Interactive Musculoskeletal modeling) program. In this study, Tai Chi Punching was analyzed with muscle force and muscle length.

P1-07 태극권 발경 동작에서 관절에 작용하는 힘에 관한 분석

이주연, 조효상, 신상훈
상지대학교 한방의료공학과

The purpose of this study is the analysis of Tai Chi Punching in the point of bio-mechanics. Punching motion was measured by motion capture system with 10 year trained Taichiquan expert. The measured data was analyzed with motion analysis program (SIMM: Software for Interactive Musculoskeletal Modeling). With the Inverse dynamic analysis, forces and torques of the all joints are calculated. In this study, Tai Chi Punching was analyzed with joint forces and torques.

P1-08 햄스트링 긴장도 및 유연성 측정 시스템 개발

황성재[1,2], 유제성[1,2], 이정주[1,2], 김정윤[1,2], 박시복[3], 김영호[1,2]
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[2]연세의료공학연구원
[3]한양대학교 병원 재활의학교실

The hamstring which was consist of semitendinosus, semimembranosus, biceps femoris long and short head cross both the hip and knee joint and are therefore involved in knee flexion and hip extension. The tightness and flexibility of the hamstring is very important in the rehabilitation medicine and sports medicine. In addition, the hamstring tightness causes various side effects to walking or sitting. In this study, we developed the hamstring tightness/flexibility measurement system by using a new mechanism of the pelvic tilting at maximum length of hamstring.

P1-09 고령자 남녀의 고관절 등척성 외전 동작 중 최대 모멘트 비교

신성수, 김지원, 권유리, 정홍영, 엄광문
건국대학교 의학공학부

The purpose this study was to investigate sex difference of maximal moment during isometric hip joint adduction movement. Twenty elderly subjects (4 mean and 16 women) participated in this study. Biodex system3 Pro dynamometer was used to measure hip adduction moment. Maximal moment was normalized by each subject 's body weight. No sex effect existed in both maximal moment and normalized maximal moment.

P1-10 고령자 남녀의 고관절 외전근의 근전도 반응시간과 근전도-근력 지연시간의 비교

정홍영, 김지원, 권유리, 신성수, 엄광문
건국대학교 의학공학부

The purpose of this study was to investigate the sex-effect in the elderly on EMG reaction time and electro-mechanical delay (EMD) of hip adductor muscle. Twenty elderly subjects (4 men and 16 women) participated in this study. Subjects were instructed to perform maximal, voluntary, isometric contraction of hip adductor muscle in reaction to beep signal to determine EMG reaction time and EMD. Although not statistically significant, there was a tendency that elderly women had longer EMG reaction time and EMD than elderly men.

P1-11 3축 가속도 및 자이로 센서를 이용한 낙상 인지 시스템 구현

전아영[1], 김명철[1], 전계록[2]
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[2]부산대학교 의학전문대학원 의공학교실

A System of falls detection and wireless event transmission was implemented using and algorithm based on the analysis of both acceleration and angular velocity. The acceleration signal was acquired from a 3-axis accelerometer, and the angular velocity was measured from a 2-axis gyro sensor. The accuracy of falls detection during daily activity was evaluated with application of the algorithm of decreasing errors when both acceleration and angular velocity were used together. The proposed falls detection algorithm and wireless transmission method is considered useful in detecting emergency like falls in the elderly and disabled.

P1-12 ADMA를 이용한 보청기용 엔드파이어 마이크 배열의 지향성에 대한 연구

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ADMA (Adaptive differential microphone arrays) is one of the most useful techniques for hearing aids. But it did not become known well that the practical usefulness such as characteristics which follow in distance or position of end fire microphone arrays. In this paper, the experimental results of ADMA for hearing aids are analyzed. The experiments were carried out using the B&K type 4100(Head and Torso simulator) and hearing aid model which was produced for experiment.

P1-13 기울기 센서와 가속도 센서를 이용한 보행보조 FES 자극 시점 검출 시스템 개발

박선우, 김정윤, 손종상, 류기홍, 김영호
연세대학교 의료공학 연구원

A number of researches using various types of sensor have been conducted in order to develop methods to detect gait phase which becomes a crucial basis for deciding the operational timings of walking assistive FES. The sensor system to detect stimulation timings has to ensure functional accuracy as in three-dimensional motion analysis system and convenience in carrying and operating. In this study, I have developed a sensor system by combining the motion sensors discovered in previous researches and been able to detect the stimulation timings of hemiplegic gait using the system. The heel contact and foot off have been detected using specific definite points of the superior-inferior acceleration; and, in turn, these gait events have become the bases for detecting ON / OFF timings of stimulation based on the average value of output voltages that a tilt sensor generated when each specific point occurs. The results of detecting stimulation timings in case of hemiplegic gait using the developed sensor system have shown 100% detection rate of stimulation timings for 100 steps.

P1-14 요통 환자를 위한 자세 측정 기반의 전기 자극법 타당성 연구

윤치열[1], 김기원[2], 정선근[2], 김희찬[3]
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Low Back Pain (LBP) is a chronic and painful disease in every generation. It is believed that unstable spine motion causes deforming forces to pain generating structures of the spinal column. Many different types of core stabilizing exercises have been suggested to alleviate LBP, mostly based on motor control theories. However, those theories have not been tested on strict scientific evidences. The theory of crossed pelvic syndrome: overactive hamstring would increase lumbar instability, is one the theories to be evaluated. To test the hypothesis that activation of hamstring would decrease lumbar stability, a motion triggered neuromuscular electrical stimulation system was developed. In the preliminary application of the system, larger changes of spine motion were demonstrated by the motion triggered hamstring stimulation than the gluteus maximus stimulation. Further studies with more subjects are needed.

Respiratory Engineering

P1-15 병원전단계 심폐소생술중 호흡관련신호 무선전송 및 모니터링 시스템

이인광[1], 장종찬[2], 이태수[1], 차은종[1], 김경아[1]
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Cardiopulmonary resuscitation (CPR) is performed under emergent situation such as cardiac arrest, which affects the survival rate significantly at the pre-hospital stage. CPR consists of the chest compressions to improve blood circulation and artificial ventilation to promote oxygen supply. The present study developed a wireless transmission system for respiratory signal with the audio-video monitoring. Respiratory air flow rate, tracheal pressure, and CO_2 variation were sampled at 100Hz and transmitted in text form. Real-time collaboration between the paramedical and medical staffs would be possible with the present system, enabling high quality CPR.

P1-16 호흡 방해 소자가 없는 기류센서

이인광, 이태수, 차은종, 김경아
충북대학교 의과대학 의공학교실, CBITRC, 차세대 선도 의과학전문인력양성사업단, 충북대학교

Respiration measurement is important during cardiopu-lmonary resuscitation (CPR) at the pre-hospital stage. Conventional transducers are, however, not applicable under CPR situation for various reasons. The present study developed a new respiratory air flow transducer easily connected to CPR devices and with no element on the flow stream. Instead, the energy loss resulted by turbulence occurring at abrupt changes in tube diameter was measured. Experiments demonstrated an accurate quadratic pressure-flow relationship.

P1-17 자기회귀 스펙트럼 분석을 이용한 기준 호흡과 심전도 추출 호흡간 수면 단계에 따른 비교

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As autonomic tones are varying in parallel with the progress of sleep, accompanying variation of cardiopulmonary coupling (CPC) can be expected. In this study, we derived respiration from ECG and then perform Autoregressive (AR) spectral analysis. The distance between the unit circle and the pole which was related with respiratory frequency in derived AR model during the NREM sleep showed smaller values the during the REM sleep. It is considered that it would caused by the parasympathetic dominance condition during the NREM sleep compared to the REM sleep. Consequently, ECG derived respiration can be used for the evaluation of CPC.

P1-18 심전도 2채널을 이용한 호흡빈도측정

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In this study, we have studied the method for the extraction of respiration signal from two channels ECG. We detected the respiratory rate by measuring the amplitude of QRS wave, which varies according to respiratory states of patients, such as, exhalation and inhalation. We calculated the QRS amplitude ratio between lead I and Lead II. Respiration signals measured from the QRS amplitude ratio and pnemotachometry were the same rate and similar pattern.

P1-19 기관내관의 차단상태에 따른 소리의 스펙트럼 분석: 체외 예비연구

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Partial occlusion of the endotracheal tube (ETT) is a critical problem in ventilator-dependent patients. If it is not detected early, therefore, it progresses to complete occlusion which significantly obstruct airway causes medical emergency. Since there are still lack of simple and reliable alarm systems for early detection, it is likely to underestimate the partial occlusion. In this preliminary study, we perform feasibility test for spectral analysis of sound signal from ETT as detector. Results show that the ETT sound can be used for early detector of ETT obstruction. Further studies are needed for robust and simple detection algorithm and clinical application.

P1-20 걷기와 뛰기 시 대사에너지와 운동에너지 상관관계 분석

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To estimate the energy expenditure during physical activities has been considered as a important thing and studied consistently for a long time. The purpose of this study was to estimate the energy expenditure from an accelerometer. 10 male subjects participated and were required to walk and run on the treadmill with gas analyzer and triaxial accelerometer. To find a linear relationship between energy expenditure from gas analyzer and that of accelerometer data, physical activity was calculated by forward integration of the accelerometer signals. These results would be expected to apply to health management product such as preventing fatness system.

Medical Imaging

P1-21 캡슐형내시경 평가 가이드라인(안) 개발 연구

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식품의약품안전평가원 융합기기팀

Capsule endoscopy for diseases of the small intestine was introduced into clinical practice in 2001. And an annually increasing number of publications have shown that capsule endoscopy is a reliable, noninvasive method for endoscopic examination of the entire small intestine. There have been no particular standards of capsule endoscopes. In this paper, we're developing the guidelines for capsule endoscopes based on FDA guidance and endoscopes standards. The testing lists for performance evaluation were developed such as field of view, direction of view, battery life and functional reliability.

P1-22 현미경 영상에서의 분광분석에 의한 생체조직 자동 판별

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A study was performed for tissue classification in optical imaging. Microscope images were taken through the filters of various wavelengths (414, 542, 655, 832nm) and a partial least squares discriminant analysis (PLS-DA) was applied. For the samples contained four different tissues (beef, chicken, fat, pork), PLS-DA provided a classification accuracy of 92% for beef, 100% for both chicken and fat, 95% for pork. This method can be applied for automatic detection of blood and cancer in endoscope imaging.

P1-23 PET 영상의 해상도 향상 기법

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PET images usually suffer from low spatial resolution. Although we can increase the number of samples by using wobbling motion, the sinogram resolution is not sufficiently improved because the line spread function (LSF) of the sinogram is determined by the detector width. In this paper, to increase the image resolution, we propose an efficient super-resolution scheme for the sinogram in the wobbling PET system. We demonstrate that the proposed scheme can improve the spatial image resolution in the simulation experiment.

P1-24 관전류 자동노출제어장치를 이용한 다중 검출기 전산화단층촬영의 두개부 모델 영상 질 평가

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The purpose of this study was to evaluate of head phantom image quality using automatic exposure control (AEC) technique in the 64 multi detector computed tomography (MDCT). The image quality was measured the noise using standard deviation of CT number. The range of craniofacial bone was to mentum end from calvaria apex, which devided three regions: calvaria ~ superciliary ridge (1 segment), superciliary ridge ~ acanthion (2 segment), and acanthion ~ mentum (3 segment). The standard deviation of CT number was 2.622 with the fixed tube current technique and 3.023 with the AEC technique in the 1 segment, was 3.118 with the fixed tube current technique and 3.379 with the AEC technique in the 2 segment, and was 2.670 with the fixed tube current technique and 3.186 with the AEC technique in the 3 segment.

P1-25 케타민 투여에 따른 쥐 전두엽의 Glutamate 기능장애: 4.7 Tesla에서 생체 내 자기공명분광법을 이용한 연구

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In this study, we used *in vivo* ^{1}H-NMR spectroscopy to examine the brain metabolism of rat treated with subanesthetic dose of ketamine. All proton spectra were acquired with PRESS sequence at 4.7 T. Significantly higher glutamate concentrations were observed in the prefrontal cortex of ketamine treated rats compared to control group. Our results provide first evidence that brain glutamate function is perturbed in rat prefrontal cortex after injection of ketamine with subanesthetic dose.

P1-26 X-ray CT 영상에서 금속 아티팩트 제거를 위한 GPU 기반의 실시간 Relevant Neighbor Area (RNA) 모델링

권혁준, 김영신, 이준호
성균관대학교 컴퓨터비전연구실

In order to reduce metal artifacts in X-ray CT images, an efficient method called Relevant Neighbor Area (RNA) method has lately been reported. This research proposes a GPU based real-time Relevant Neighbor Area (RNA) modeling method. Experimental results show that our GPU-based method is 100x faster than the original CPU implementation in case of parallel beam projection.

P1-27 Digital Radiography의 Noise Power Spectrum과 Radiation Therapy의 Symmetry에 대한 방법론적 비교평가 연구

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Recently Digital radiography (DR) technologies have been developed to evaluation the quality of imaging equipment operating on the comparison of various characteristics is made possible. Factor to evaluate the quality of the image as three kinds of noise power spectrum (NPS), modulation transfer function (MTF), detective quantum efficiency (DQE) is a very important factor that symmetry and treatment of medical imaging systems and technology noise proporties. Symmetry can be represented in 3D dose distribution in the amount of Radiation therapy. Reference field about 20x20 cm^2 based on international electrotechnical commission (IEC) was measured the NNPS. The value increases, the value of MU noise spatial frequency 1.0 cycles/mm at 3.89×10-4 when 1MU and 1.0 cycles/mm when the 400MU was 11.96×10-4. Spatial frequency increases the reduced noise, spatial frequency 2.0 cycles/mm when 1MU from 2.61×10-4 to 400MU was from 9.64×10-4. Result of symmetry measured the spatial frequency 1.0 cycles/mm in 400MU noise is one of the 1,4-quadrant 14.33×10-4, 12.50×10-4 was the 3 quadrants of 26.88×10-4, 2 quadrants of 54.83×10-4 noise was an increase in the step by step.

P1-28 플라스틱 기반의 초음파 탄성 팬텀 제작과 탄성계수의 측정

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A human tissue mimicking phantom is constructed to assess the performance of a medical ultrasound elasticity imaging system. Homogeneous elasticity phantoms with differing Young's moduli are constructed using a plastic hardener and softener to simulate the mechanical characteristics of a diseased human tissue. The Young's modulus of the fabricated homogeneous phantom materials was measured to be in the range between 8.2 kPa and 92.7 kPa depending on the mixing ratio of the amount of the hardener to that of the softener. The fabricated plastic-based elasticity phantom is found to faithfully represent the elastic characteristics of a human tissue.

P1-29 초음파 의료영상에서 탄성 영상을 위한 Dropout 보상

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In medical ultrasound strain imaging, displacements are estimated sequentially along the scan line direction. To reduce the amount of computation, the displacement estimated in the previous window is used as an initial guess for the displacement in the present window. However, if an error somehow occurs in the previous window, the subsequent displacement estimates along the same scan line will all be in error. This failure phenomenon is referred to as dropout. In order to prevent the dropout, a method is proposed in which displacements at the same depth for all scan lines are first estimated and erroneous displacement estimates among them are corrected using correct displacement estimates in the neighborhood. Thus, this method helps alleviate the adverse effect of error propagation along the scan line direction. Results of experiments on a plastic-based elasticity phantom confirm that the dropout can be adequately compensated when the dropout rate is less than 30% along a scan line.

P1-30 유방 초음파 영상에서 허프변환을 이용한 종괴 검출법

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Breast cancer diagnosis using ultrasound images is significantly contribute in the area of early detection but a lot of images should be examined to detect lesions. So we developed automatic lesion detection algorithm to reduce that examination time. Downsampling and filtering process reduce noise in images and sharpen the boundary of lesions. And we adopt Hough transformation to detect circle and ellipse. Finally, we can efficiently find the position of lesions using the result of Hough transform for circle and ellipse.

P1-31 Constrained, total-variation minimization 방법을 이용한 제한된 각도측정 데이터의 ART 영상재구성

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An iterative reconstruction method such as aART (additive algebraic reconstruction technique) requires sufficiently complete measurement data through 360° to reconstruct accurate cross sectional images since incomplete data usually causes undesirable artifacts in reconstructed images. A new algorithm, aART-TV (total variation minimization) significantly reduced such limited-angle problem of tomographic systems based on compressed sensing. In this article, we utilize the aART-TV to reduce artifacts produced when angular range of data measurement is limited in image reconstructions.

P1-32 SPECT 데이터의 잡음제거를 위한 적합 필터를 취합한 기댓값 최대화 재구성 알고리즘

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Expectation maximization algorithm with matched filter (EM-MF) used for an iterative SPECT reconstruction is an efficient way for Poisson noise reduction of SPECT data. EM-MF applied low-pass filter into the measured and estimated projection and backprojection for each iteration. In this study, two different low-pass filters, Hanning and Butterworth, were used to suppress Poisson noise and EM-MFs were compared with post-smoothed images qualitatively and quantitatively via reconstructed image itself and percent error.

P1-33 Oblique-view MRI를 이용한 금속 전극의 위치 결정

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Finding the accurate location of electrodes is an important issue in neuro-electrophysiology. Localization using MRI is difficult due to susceptibility induced artifacts caused by metal electrodes. Here we took advantage of the B0 pattern induced by the metal electrodes by using an oblique-view imaging method. With conventional perpendicular images, pixel shifts of a slice occur in unidirectional manner. However, with 45° oblique-view angle images, pixel shifts are bidirectional so we can detect the location of electrodes using line-plot approach.

P1-34 컴프턴 카메라의 통계학적 영상 재구성 방법을 위한 거리 기반 해상도 복원 모델

김수미[1,2], 이재성[1,2], 서희[3], 박진형[3], 김찬형[3], 이춘식[4], 이명철[1], 이동수[1], 이수진[5]
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Compton camera is an noninvasive system to image 3D source distribution based on Compton scattering interaction. Due to uncertainty of measurements such as detected position pairs and energies, the spatial resolution of the reconstructed image is degraded. In addition the degree of resolution degradation is dependent on the distance from the Compton camera. In this study, we investigated the shift-variant Gaussian model for resolution recovery during reconstruction. Monte-Carlo simulation data were generated for 7 point sources with different distance and the FWHM of the reconstructed image is calculated.

P1-35 영구 자석 MRI용 3채널 RF 머리 코일 개발

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We developed a new type of three-channel RF head coil for the permanent MRI system. The coil consisted of a pair of orthogonal elliptical coils and a two-turn Maxwell pair coil. All the 3 coil elements were mounted on a cylindrical former. Mutual isolation among the channels were better than 21dB. The calculated field distributions were compared with intensities of the phantom images. The new three-channel coil provided better signal to noise ratio with conventional head coil.

P1-36 핵의학 영상의 잡음제거를 위한 공간 적응 평활화 필터

김수미[1,2], 이재성[1,2], 이동수[1,2]
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[3]한국과학기술연구원 의과학센터

The spatially adaptive smoothing filter (SASF) is an efficient noise reduction technique for nuclear medicine images which are suffered from counting fluctuations dependent on scan time. In SASF, a series of smoothing kernels with progressively wider kernel width were applied into measured planar images in nuclear medicine. The kernel is defined by non-negative paraboloid function. After statistical tolerance test between measured image and all filtered planar images, the proper kernel width for given local region is chosen as a kernel with the largest width of all kernels accepted from the test.

P1-37 저잡음 MREIT 정전류원의 개발

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In MREIT conductivity imaging experiments, we should minimize the noise level in measured magnetic flux density data induced by injection currents with low amplitude. Since noise and artifact from an MREIT current source directly affect the quality of the data,a low-noise current source is desirable. In order to be compatible with various MREIT pulse sequences, it should be also programmable. We have developed a new MREIT current source, which is controlled by a PC program for flexibility. To minimize noise and artifact, we adopted an optical link for the connection to the PC outside the shield room. The enclosure of the new current source provides a magnetic as well as electric shielding to prevent high frequency switching noise of the current source from interfering with the scanner.

P1-38 실험견 골반의 MREIT 도전율 영상

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Recent animal MREIT studies showed a good conductivity contrast not only in the brain but also in the abdomen region. The pelvic region has a relatively large size, lower MR signal and contains various soft tissues. Especially, the prostate is an imaging area of growing concern related with aging. Hence, the conductivity imaging of the male pelvis is a challenging task. In this study, we performed in vivo MREIT imaging experiments of canine male pelvis. Reconstructed conductivity images show a contrast between the central and peripheral zones which are related with prostate diseases including cancer and benign prostatic hyperplasia.

P1-39 전산모사 유방팬텀의 모델링과 영상화 시뮬레이션에 관한 연구

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Breast cancer is positioned as first grade of incidence in women's cancer and second grade of mortality because of the change of lifestyle. Thus many groups are researching enhancement of imaging quality using numerical phantoms. In this study, we try to model numerical breast phantom by using random variables and to propose imaging simulation technique. The randomly generated breast phantom can be used for verification tool for developed imaging algorithms.

P1-40 Time-difference MREIT using b-SSFP pulse sequence

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Balanced-steady state free precession (b-SSFP) pulse sequence has been proposed recently in MREIT. It has high SNR, short scan time and high phase sensitivity to current injection. Hence, we can also utilize this pulse sequence for time-difference MREIT. In this work, we present a simulation study to perform time varying MREIT using b-SSFP pulse sequence.

Cellular and Molecular Engineering

P1-41 광역학적 암진단을 위한 광원장치의 설계 및 평가

김창수, 전민철, 이승열, 김경연, 김지원, 이병구, 이석만, 임현수

충남대학교 대학원 의공학과

Photodynamic diagnosis(PDD) diagnoses tumor using selectively accumulative mechanism to abnormal tissue. This method is non-invasive diagnosis to use fluorescence that produce excitation light if do irradiation to photosensitized tissue. In this paper, target is design of light source that cancer diagnosis is available through various phtosensitizer-induced fluorescence and auto-fluorescence. We studied design of light source for diagnosis using the Xenon lamp, optical output control using the Iris, and design of filter wheel that is consisted of various wavelength band filter. In an experiment, we estimated optical output characteristics and stability of designed light source, and detected photosensitizer-induced fluorescence using mouse model. And we confirmed performance as light source for Photodynamic diagnosis.

P1-42 멸균기 보수유지 방법개선을 통한 가동효율 향상

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

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Modern medical treatment has been evolved from curing the disease of patient to removal of infection. steam sterilizers used the high temperature and high pressure steam to remove lots of infections that could occurs serious problem. So, it is very important medical equipment because of infection control. In this thesis, we are going to find out the appropriate solution of safety repair method and recommending the management methods to enhance the efficiency of steam sterilizer. It is expected that thesis will make efficient and safety steam sterilizer management.

P1-43 음전위 전기장을 이용한 줄기세포 배양

황성업, 문기욱, 김홍배, 허현
㈜솔고바이오메디칼 의공학연구소

Recently, making accelerately differentiation stemcells is researched in various ways. Most of proliferations of stem cells are used by chemical ways in which undesirably makes it harmful to divide cells. In this paper, we propose a way of proliferation that use minus charge stimulation (MCS) on stem cells which called mesenchymal stem cell (MSC). The MSC mitosis is enhanced by the MCS in speed in period of three days. It may be likely to make the MCS open the ion channels in the cell membrane to allow ions to influx or/and efflux keeping metabolism of the cells.

Medical Nano and Microtechnology

P1-44 광학집게를 이용한 유전영동력 측정

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The term 'die1ectrophoresis (DEP)' was first introduced by Pohl in 1958 to describe the force induced by a non-uniform electric field on a small polarizable but uncharged particles. Time-periodic inhomogeneous electric fields induce polarization and subsequent movement of dielectric particles. On the other hand, optical tweezers due to its capability of measuring pico-newton order force has been applied to study mechanical force in biochemistry and biophysics. Up to date, the dielectric force has been calculated but not measured in many cases. In this paper, we will focus on experimental evaluation of dielectric force using optical tweezers.

P1-45 살아있는 신경 네트웍 설계를 위한 액상 미세 접촉 프린팅

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KAIST 바이오및뇌공학과

Micro-contact printing (μ CP) technique has been widely used for generating nano or micro-scale patterns of molecules, physically adsorbed on various substrates. Here we showed μ CP can be performed in aqueous condition with slightly modified protocol. After the layer of ink solution was loaded on the PDMS stamp, the stamp was sonicated to reduce the amount of molecular ink. This process prevented molecules of ink diffusing to background regions. Using this patterning method, we generated chemical patterns which require specific conditions for reaction. This method is applicable to chemical reactive patterning.

P1-46 피하삽입용 무선전력전송 유도코일의 비정렬 감지 기법

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CMC(Closed Magnetic Circuit) type coil was fabricated based on FPCB(flexible printed circuit board) for inductive transcutaneous power transmission. The power transmission efficiency of the coil was measured in the rat. And the power transmission efficiency of the coil at the condition of the misalignment between primary and implanted secondary coil was evaluated. It was confirmed that the feedback coil was able to sense the misalignment without confirming the position of the implanted secondary coil.

P1-47 생체모방 ZnO 나노와이어 압전 음성센서에 관한 연구

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Implantable acoustic sensor is the nucleus of the totally implantable cochlear implant system. We have been proposed new concept of the totally implantable cochlear implant using biomimetic piezoelectric acoustic sensor. In this study, we calculate the amount of current generation in single ZnO nanowire which was connected to stapes by 60 dB sound pressure level. This work would be helpful to design the amplifier stage and determine implant location.

P1-48 고효율의 단백질 혼합을 위한 3차원 마이크로 믹서

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This paper presents a three dimensional micro mixer for a high efficient molecular mixing for the Lab-on-a-chip application. This microfluidic device composed of 3 PDMS layers was fabricated by a general PDMS (Polydimethylsiloxane) casting process and a PDMS double molding process for a membrane with micro through-hole patterns that our group previously studied. The efficiency of a serpentine laminating 3D micro mixer was verified by a FEM simulation and an experiment with FITC-dextran which has the 10kDa molecular weight that is similar to that of general protein. Consequently, the FITC-dextran was mixed up successfully with PBS solution along the 4mm micro channel suggesting that the proposed device can be widely applied to the medical and biological area for the need of heterogeneous reagent mixing.

P1-49 다양한 혈장 단백질 농도에서 전기적인 적혈구용적량 측정 방법

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Hematocrit (Hct) is one of the important information to diagnose a condition, such as anemia, infection and many other disorders. Hct represents the amount of volume Red Blood Cell (RBC)takes up in the blood. Currently, many methods are adopted to measure Hct, such as electrical method, optical method and centrifugation. However, the conductivity based methods show the lower Hct value than gold standard Hct measurement method. In this study, we test the calibration method to reduce an Hct difference of electric based method comparing standard Hct in the low plasma protein concentrations by using microfluidic device and precision impedance analyzer.

P1-50 초상자성 나노입자와 외부 자기장을 이용한 새로운 표면플라즈몬공명 바이오센서에 관한 연구

이경식[1], 김낙현[2], 정우경[2], 변경민[2], 이인수[1]
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[2]경희대학교 동서의료공학과

In this study, a novel surface plasmon resonance (SPR) biosensor based on superparamagnetic iron oxide nanoparticles (SPIONs) and external magnetic fields was demonstrated. Aggregates of streptavidin (SA) molecules bound with biotinylated SPIONs were attracted adjacent to a metal film and created a layer with a refractive index contrast only when magnetic fields were externally applied. The experimental results showed that the concentrations of the reactants such as SA and the size of the SPIONs play important roles in achieving enhanced SPR sensing. This study demonstrates the potential for sensitive detection of target molecules without complex immobilization at the sensor surface.

P1-51 SNU-Nurobiosys 다채널 인공와우 시스템의 개발

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Cochlear implant, one of the most successful neural prosthetic device, has been implanted more than 120 thousands of people who had suffered from hearing loss. But about 80% of world's 120million hearing impaired people live in developing countries where cochlear implant is not or rarely affordable. In this paper, we describe the SNU-Nurobiosys cochlear implant system, and discuss the methodologies to develop low cost but highly effective next generation cochlear implant system.

P1-52 LCP 기반의 평판형 코일을 이용한 체내 이식형 무선 신경자극기 개발

정준수[1,2], 이승우[1,2], 민규식[1], 김성준[1,2]
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This report presents the development of wireless neural stimulator that can be fully implanted, receiving data and power transcutaneously via inductive link. Planar coil patterned on theliquid crystal polymer (LCP) substrate and printed circuit board (PCB) carrying custom-designed stimulator ASIC with peripheral circuits were connected both electrically and mechanically by ceramic spacer. The assembled stimulator was encapsulated in PDMS for mechanical stability and ease of handling for post-processing. The wireless stimulating system measures 16mm diameter with 2mm thickness and was capable of producing stimulus of desired parameters within the maximum distance of 16mm from external transmitter.

Neural Engineering

P1-53 근전도기반 보조 컴퓨터 인터페이스 개발을 위한 비음수 근협동행렬 구현 및 검증

최창목, 김정
KAIST 기계공학과

Although myriad efforts have been undertaken to develop an interface using surface electromyogram (sEMG) to connect a gap between a human and a machine, most of them have offered only static movement intents (ON/OFF) of the wrist. We introduced a non-negative muscle synergy matrix to extract fluid wrist movement intents by sEMG for individuals with wrist amputation to use a computer. Only four movements were predefined (wrist extension, wrist flexion, radial deviation, and ulnar deviation) to construct the muscle synergy matrix, but the experimental results showed that a variety of movements (e.g., a combination of wrist extension and ulnar deviation) could be extracted using the joint matrix.

P1-54 비등방성 전기 전도도 영향에 따른 tDCS의 공간적 자극 집중도의 변화

서현상, 조영선, 김지환, 김태성
경희대학교 동서의료공학과

For effective stimulation with tDCS, spatial focality of induced electrical field (EF) is one of the important factors to be considered. In this work, we have investigated the effect of tissue anisotropy on the spatial focality of tDCS with the 4+1 ring electrode configuration via a 3-D high-resolution finite element (FE) head model with anisotropic conductivities in the skull and white matter. We noticed that the spatial focality of the induced EF significantly drops and get diffused significantly due to tissue anisotropy. Our analysis suggests that it is critical to incorporate tissue anisotropy in the tDCS.

P1-55 미세전극칩을 이용한 신경 네트워크의 발작성 신호 패턴 분석

명준오, 남윤기
KAIST 바이오 및 뇌공학과

As one of Neuron-on-a Chip technologies, Microelectrode Array (MEA) is currently the fundamental tool for measurement and analysis of neuronal signal. This signal is called 'Spike'and the set of spikes satisfying some conditions is called 'Burst'. Because neurons send and receive signal information through synapse, signal like burst is very important for *in vivo* system. However, there are unknown many functions about burst's pattern and influence. Decoding these ones will be able to be applied to various fields including medical treatments.

P1-56 EEG 기반의 BCI 알고리즘에 대한 Motor Imagery 최적 평가 방법 결정

이영범, 김진권, 이상준, 이명호
연세대학교 전기전자공학과

In this paper, we evaluated BCI algorithm using CSP for finding out optimal performance evaluation method. BCI algorithm that was comprised of CSP and 3 kinds of classifier such as least square linear classifier, linear discriminant analysis and support vector machine was evaluated in 10 person. The effect of performance factor is important to evaluate the optimal performance for motor imagery based EEG-BCI algorithm. The kinds of performance factor is 5 kinds such as EEG mode, feature calculation, selected channel number, selected classifier and window size.

P1-57 침 자극이 뇌의알파파에 미치는 영향

김태민, 조영선, 김태성, 한승무
경희대학교 전자정보대학교 동서의료공학과

Acupuncture is a procedure of inserting and manipulating filiform needles into various points on a human body to relieve pain or cure the diseases. In this study, we have investigated the modulation of α -wave activity of the brain in a prolonged time of before, during, and after acupuncture. The effects were examined via alpha power levels and alpha power maps on four different subjects. Our results indicate that the α -wave is generally increased with acupuncture and especially strongly increased during six to nine minutes of acupuncture, confirming some relaxation effect of acupuncture.

P1-58 Anisotropic Conductive Films을 이용한 다 채널 폴리이미드 전극의 전기적 연결방법

백동현[1,2], 박지수[2], 문진희[2,3], 박정호[1], 이상훈[2]
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We propose a method for interconnecting soft polyimide (PI) electrodes using anisotropic conductive films (ACFs). Reliable and automated bonding was achieved through development of a desktop thermo-compressive bonding device that could simultaneously deliver appropriate temperatures and pressures to the interconnection area. The bonding conditions were optimized by changing the bonding temperature and bonding pressure. The electrical properties were characterized by measuring the contact resistance of the ACF bonding area, yielding a measure that was used to optimize the applied pressure and temperature. The optimal conditions consisted of applying a pressure of 4kgf/cm^2 and a temperature of 180℃ for 20 s.

P1-59 미토콘드리아 수송 추적기법 : 파티클 필터링

홍성민[1], 심학준[1], 이현준[1], 정유진[2], 이상욱[1]
[1]서울대학교 전기공학부
[2]한국외국어대학교 컴퓨터공학부

Since mitochondrial transport plays a significant role for a central nervous system to operate properly, analysis of motions of mitochondria has been suggested to help investigation of numerous neurodegenerative diseases. Recently, a micro fluidic cultural platform has been developed to image in vivo mitochondria. We propose an automatic method to track moving mitochondria from images of axons and mitochondria by means of a particle filter, which has been accepted as one of the best solutions to tracking problems. Our approach provides detailed information on movement of an individual mitochondrion and is expected to facilitate exploration of the above neurodegenerative diseases.

P1-60 뇌 피질 전기자극의 모델링을 이용한 연구

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[2]GIST 의료시스템학제전공

Epidural cortical stimulation (ECS) is an emerging therapy to treat neurological disorders. However, it is unclear how the cortical anatomy or the polarity and position of the electrode affects current flow in the brain. We presents 3D computational model simulating ECS to demonstrate the current density distribution in the brain. In this study, we implemented cortical infarction model with different geometries. Current density distributions were analyzed in human head model with different locations of electrodes. The preliminary results of this study show that we respect the infarction region for the optimal placement of electrodes. Further delineation of current density map including CSF(cerebrospinal fluid), gyrus and sulcus is required for the future study.

P1-61 심장 발작 이후의 세부뇌파와 회복도의 상관관계에 관한 연구

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숭실대학교 전자공학과

We propose a measure that using subband-based information quantity(SIQ) for diagnosis on the neurological recovery of brain after cardiac arrest. The results from correlation between the proposed measure of each subband and neural deficit score(NDS) show that proposed measure could be a criterion for early diagnosis on the neurological recovery of brain after cardiac arrest.

P1-62 손가락 굽힘 동작의 비동기식 신경 디코딩 기술

유경진, 신현출
숭실대학교 전자공학과

This paper presents a novel method for asynchronous decoding the finger motion based on statistical properties of surface electromyographic signals. The information entropy as a key feature was measured by using the Freedman-Diaconis' choice of each signal channel. For asynchronous motion decoding we have developed a motion detection method based on the short-time information entropy and a decoding method based on the maximum likelihood (ML) method. The results of the study indicates that an averaged decoding accuracy of 95.61% for five single-finger motions and three multi-finger motions with four channel electrodes. The work presented here has profound implications for future development of HRI system such as a neuronal prosthetic hand.

P1-63 전완의 자세와 근전도 신호에 기반한 손가락 동작 인식

이기원, 유경진, 신현출
숭실대학교 전자공학과

We classify finger motion 4-channel surface electromyogram (sEMG). Average recognition rate of finger motion using sEMGwith entropy and the maximum likelihood estimation (MLE) is 74.8%. However, we verify that the average recognition rate is falling when we change forearm posture. In this paper, we suggest a new method of classifying finger motion based on various posture with gyroscope sensor and sEMG. Experimental results have showed that this method could be useful recognition finger motion.

P1-64 두개강내 뇌파의 신호원 영상을 이용한 전신 간질의 간질 발생 부위 추적

조재현 정영진 임창환
연세대학교 보건과학대학 의공학과

The aim of the present study was to investigate the feasibility of using elctrocorticography (ECoG)-based source imaging to identify epileptogenic zones in generalized epilepsy. To this end, we applied four different source imaging algorithms to artificial ECoG data generated assuming various simulation conditions. The tested algorithms were minimum norm estimation (MNE), Lp norm (p=1.5), LORETA, and sLORETA. According to our simulation results, traditional MNE showed best performance among the four algorithms. The present results also demonstrated that the ECoG-based source imaging can be a promising supplementary for the pre-surgical evaluation of generalized epilepsy.

P1-65 전기자극에 대한 변성망막신경망의 응답으로부터의 자극 세기변화 추정

류상백[1], 예장희[2], 구용숙[2], 김경환[1]
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Visual prosthesis (retinal implant) is a device which is designed to restore visual function of blind patient by focal electrical stimulation to retina. Since retinal ganglion cell (RGC) responses are strongly dependent on electrical stimulation parameters, a proper stimulation strategy should be determined. In effort of developing stimulation strategy, we generated stimulation pulse trains whose amplitudes were modulated according to light intensity variation of natural scene and applied the pulse trains to photoreceptor-degenerated retinal patch attached on microelectrode array (MEA). The response strength was faithfully modulated within certain amplitude range (2-20 A) and the time-series of pulse amplitudes could be reconstructed from multiple RGC responses by using linear and nonlinear spike train decoding algorithms. The present result suggests that spike train decoding can be useful to evaluate and develop a stimulation strategy of visual prosthesis.

P1-66 청각적 Novelty 검출 시 세타대역 뇌활동의 영역간 위상동기화 특성 분석

최정우[1], 이관택[2], 고덕원[2], 정기영[2], 김경환[1]
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[2]고려대학교 의과대학 신경과

In this study, we tried to analyze the cortical activities during information processing of aurally presented sounds, focusing on the inter-regional functional connectivity based on the phase synchronizations (PSs). We observed the significant differences between cortical information processing on standard and deviant stimuli. For deviant stimuli, the PSs increased after mismatch negativity (MMN) duration primarily between the frontal and temporal regions.

P1-67 LCP 기반의 인공망막 이식용 전극 및 패키지

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[3]서울대학교병원 안과

In this presentation we report on our recent progress in development of a long-term implantable retinal stimulation device. We developed a monolithically encapsulated retinal implant device using thermo-tropic Liquid Crystal Polymers (LCPs) which have very low moisture absorption (less than 0.04%; comparable to Teflon and Pyrex glass) and fusion bondable interface. This device consists of a LCP-based retinal stimulation electrode array, a internal current stimulation board and a LCP package lid. To evaluate the long-term reliability of the LCP-based encapsulation, we performed electrical leakage current measurement with in vitro accelerated soak tests in 75℃ phosphate buffered saline (PBS). For 6 months, LCP encapsulation showed higher stability than polyimide and parylene-C in the 75℃ PBS.

P1-68 폴리도파민 박막을 이용한 전극 표면 개질

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[1]KAIST 화학과
[2]KAIST 바이오및뇌공학과

To be applied to myriad of surfaces and sophisticated purposes, surface modification methods for neuron-surface interfaces should be independent of the surfaces and versatile for the incorporation of various functionalities. Currently, the methods are yet to be advanced in order to meet the both criteria. Herein, we report a novel and powerful surface chemistry using mussel-inspired polymer for generating effective platforms for dissociated neuronal cultures. We coated polydopamine films to various surfaces which are being frequently used in neuronal applications and subsequently functionalized them with amine-based molecule for the viability of neurons on each surface. The polydopamine films exhibited uniform and reproducible surface properties and also biocompatibility for neurons independent of surface materials. In addition, spontaneous and evoked neural activities were readily recorded from the neurons culture on the polydopamine film coated on the microelectrode array.

Medical and Bioinformatics

P1-69 급성으로 알코올에 노출된 Zebrafish의 뇌대사물질 변화: 고자장 핵자기공명분광법에 의한 연구

우동철[1], 김구영[2], 김현주[3], 방은정[3], 임향숙[2], 김상영[1], 이도완[1], 최치봉[4], 성열훈[1], 최보영[1]

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The purpose of this study was to investigate the metabolic alterations associated with acute alcohol treatment in the zebrafish by 1H nuclear magnetic resonance spectroscopy. It is investigated that the brain metabolism of zebrafish after acute alcohol treatment (one hourlong exposure of adult fish to 0.00%, 0.25%, 0.50%, or 1.00% ethyl alcohol) with whole brain extraction. The results of this study showed that glutamate was significantly decreased; scyllo-inositol showed a small apparent increase only in the highest acute treatment dose group, and myo-inositol showed a significant decrease. [Glu]/[tCr] and [mIns]/[tCr] levels were significantly reduced regardless of the alcohol dose, and [sIns]/[tCr] was increased in the highest alcohol treatment dose group.

P1-70 산소포화도 측정기에 영향을 미치는 의료기기에 관한 고찰

김현준[1], 김원규[1], 김태종[1], 서현원[1], 안호문[1], 임효순[1], 김병태[1,2]

[1]삼성서울병원 의공학과
[2]성균관대학교 의과대학

SpO_2 (Oxygen Saturation) define ratio of hemoglobin to oxygen hemoglobin, measured using IR-LED, photo diode. Recently, SpO_2 is one of the important parameter in the clinical fields. However, It has often happened change of SpO_2value due to external medical devices when we measured SpO_2. In this paper, we identified the influence of Phototherapy, Linear Accelerator. Regardless of time and setting value, we observe that SpO_2 is decreased in 70cm, but we could not measure SpO_2 below 40cm from Phototherapy. Regardless of gantry degree and setting value, we could not measure SpO_2 more than 35sec from Linear Accelerator.

P1-71 근거중심의학의 원칙에 충실한 임상 문헌 검색 기법

최성빈[1], 유보림[1], 김승희[1], 유수영[2], 최진욱[1]

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Our main research question is how to retrieve articles which have both relevance to the query and high quality in terms of Evidence Based Medicine (EBM). For retrieval task, we used OHSUMED collection and implemented Okapi BM25 retrieval system. For quality classification task, we built test collection using ACP Journal Club criteria, and trained SVM classifier. We combined relevance score and EBM score to rerank documents. The result was promising.

P1-72 임상문서에서 Latent semantic indexing에 영향을 미치는 요소에 대한 분석

한충현[1], 최진욱[2]

[1]서울대학교 바이오엔지니어링 협동과정
[2]서울대학교 의과대학

Documents in a collection usually have the problem of sparseness, which deteriorates the IR performance. Vector space model, axes of which consist of terms, is influenced by the problem. Latent semantic indexing is a method improving the measurement of documents' similarity by dimension reduction.
In this research, LSI is more effective in measuring clinical documents' similarity than other documents. And, among three operational variables for co-occurrence, not only unique term count shared by documents and average term frequency of shared terms, but average term frequency of unshared terms have high influence on the similarity after LSI.

P1-73 간세포 암의 병기정보 추출을 위한 자연어처리 태그

이동훈, 한충현, 김영호, 최진욱

서울대학교 의과대학 의공학교실

The stage of a liver cancer is one of the most important factors in considering treatment options. A staging system is a standardized way for the cancer care team to summarize information about how far a cancer has spread. Doctors use staging systems to get an idea about a patient's prognosis (outlook) and to try to determine the most appropriate treatment. Despite this, stage data in cancer registries is often incomplete, inaccurate, or simply not collected. There are several staging systems for liver cancer, and not all doctors use the same system. In this article We focus on AJCC criteria which is widely used in US and South Korea. In this article We make a suggestion of tag sets which make it possible that extracts cancer staging information automatically from CT reading report.

P1-74 주요 의료기기 softwaresystem 구축

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Medical technology and the development of IT technology for the PC-based medical device is growing, accordingly there are many PC-related problems (HDD, Power supply, Monitor, Printer, etc.). And they have caused that of the most serious problem is caused by PC's HDD. The event of HDD failure is expensive and time-consuming way to respond is not clear, obsolete equipment information stored in the HDD include the patient's information disclosure is likely. HDD failure to respond quickly to your PC's HDD-based medical devices produced cloned HDD to build a backup system, to protect patient information, medical waste after collection of the HDD which patient information is stored in the HDD completely remove the HDD is in good condition and the repair time and cost of recycling to improve the protection of patient information will be realized.

P1-75 머리움직임이 편측무시환자의 주관적 모두정면에 미치는 영향

한기완[1], 구정훈[1], 이형래[1], 박진식[1], 김덕용[2], 김인영[1], 김선일[1]

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Neglect patients have biased egocentric reference and it influences to be aware of or acknowledge items on their contralesional side. It is revealed that spatial attention (or egocentric reference) is closely linked with eye movement. Moreover it is known that eye movement and head movement are mutually influenced. In conclusion, it is considered that egocentric reference would be influenced on head movement. In this study, we investigated head movement effect on egocentric reference in neglect patients.

P1-76 근거 중심 의학을 위한 Medical Text Corpus의 구축

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Evidence-based medicine (EBM) has become an emerging area of medical science. The main purpose of this research is to develop a clinical information retrieval technology for EBM. For a scientific rigorous article classification model, collection preparation is studied in this paper. Total of 600 medical literature documents from the OHSUMED collection with 6 clinical queries are used for our study. We establish several standards in order to categorize the collection papers effectively. Manual review is performed. Through this study, we can obtain the desired medical text corpus as the essential part of a clinical text classification model, which could be a useful clinical guideline based on EBM principle.

P1-77 Two-Dimensional Position Information Decoded From Hippocampal Neurons

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In this study, we investigated hippocampal neuron's responsiveness toward an object in extra-personal space when a rat is restricted in a chamber without movement. Neuron's sensitivities to places, movement pathways, directions of an external object on a two-dimensional (2D) field were investigated. Results showed that allocentric space affects firing rates and neuronal activities of hippocampal cells. These properties could be utilized for a BCI system for machine control in 2D space.

Systems Biology, Physiological modeling

P1-78 심장조직에서 class I 항부정맥제 기전의 수치해석적 연구

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In this paper, we analyzed the effect of I anti-arrhythmic drug by using computer simulation. The human ventricular tissue model was based on the cardiac cell model proposed by ten Tusscher. We observed the electric wave propagation according to the conductance change of sodium channel.

P1-79 골밀도 증강을 위한 진동 인가 시스템의 구현

박근철, 유주연, 전아영, 노정훈, 전계록
부산대학교 의학전문대학원 의공학협동과정

The researches on the diagnosis and treatment of osteoporosis have been performed using low intensity ultrasound. osteoprosis among bone diseases exing studies are usually on the base of animals, there are not study about the human being so much. It is essential to study on the patients with osteoporosis. The vibration system for animal experiment was implemented.

P1-80 정원창 구동 보청기를 위한 정원창 자극 실험

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Recently, implantable hearing aid using round window driving transducer is focused on alternative hearing aids to solve the problem of implantable middle ear hearing aids using floating mass type transducer. Proper stimulus for hearing loss compensation is needed to study about the design of round window driving transducer, which is minimized damage to surrounding tissues and able to easily implant. Also, it is necessary to the study for stimulus method and frequency response as various type transducer. In this paper, the round window stimulus was accomplished by piezoelectric ceramics and differential floating mass transducer (DFMT) and then hearing loss compensation of the guinea pig by using round window stimulus was measured by using ABR (auditory brainstem response).

P1-81 파킨슨 환자 보행 판별을 위한 확률적 접근 방법

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This paper propose a probabilistic method for recognizing Parkinsonian gait from normal gait using Spatial-Temporal Image of Plantar pressure (STIP) during walking. Participants were recruited at Parkinson Center in Seoul National Hospital and, gait data were acquired from 21 patients with Parkinson disease and 15 age-matched normal persons. Patients group consisted of UPDRS 1 group and UPDRS 2. UPDRS(Unified Parkinson's Disease Rating Scale) is for diagnosing movement disorder of patients with Parkinson's disease. The number of patients with UPDRS 1 is 10 and, the one with UPDRS 2 is 10. We averaged STIP of 3 respective groups and calculated correlation coefficients between group mean of STIP and individual STIP. Then, we extracted maximum correlation coefficient from 3 coefficients. This process was performed for all STIP of total subjects. We analyzed how many gait with maximum coefficient were allocated to corresponding group of the subjects. The results showed that 14 of 15 normal persons had normal gait. In patients group, 4 of 11 patients with UPDRS 1 and 8 of 10 patients with UPDRS 2 made up corresponding group.

P1-82 후각망울 내 3차원적 위치에서 냄새자극에 따른 동시 다 단일 신경신호 활성도 측정 및 ML 추정 분석에 의한 냄새분별

함형걸[1], 유경진[2], 이현주[1], 랑이란[1], 서인석[1], 임창균[1], 고진수[1], 김아영[2], 신현출[2], 신형철[1]
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Multi-channel extra-cellular single unit recordings were done with micro-wire array electrode implanted in main olfactory bulb (MOB) of anesthetized rats to obtain neural responses to various odors. Wide difference of neuronal activity was observed in different positions of MOB activated by various odors. For decoding the activity of simultaneously recorded many MOB neurons during presentation of various odors, we used a maximum likelihood estimation method.

U-Health, eHealth Technology

P1-83 안경타입의 무선광전용적맥파 측정장치

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This paper addressed an eyeglasses-type wireless device that can monitor subject's photoplethysmography (PPG) signal continuously during daily living. The aim of this study is to implement the device integrating two sensors(PPG sensor, accelerometer) and wireless controller, by which subject's biomedical and motion signal can be acquired unintrusively.
To evaluate its accuracy and applicability during daily life, two types of experiments during sitting and repeated sit-to-stand motion were performed in laboratory environment. Correlation coefficients of peak-to-peak intervals of PPG signal measured by the developed and reference device were 97.5% in sitting and 87% in repeated sit-to-stand motion. Wireless communication within body area was verified to be completed without any error.

P1-84 휴대형 디지털 식도청진기

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Heart sound occurs when the heart contracts and expands. It provides information on myocardial contractility and blood vessels, which is not obtainable from ECG. For this reason, stethoscopy of heart sound in anesthesiology is a very crucial means for acquiring cardiac information and preventing intraoperative medical accidents. Thus, this study purposed to develop portable digital esophageal stethoscope (PDES) that can objectify and quantify heart sound and murmur. The developed PDES is expected to be useful in the continuous stethoscopy of heart sound during operation and to contribute to research on heart sound by providing heart sound data.

P1-85 가속도 센서를 이용한 심폐소생술(CPR)에서의 흉부 압박 깊이 추정

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For the effective CPR (Cardio-Pulmonary Resuscitation), the optimal depth and period of chest compression are important. Using the accelerometer and signal processing technology, the estimation system of chest compression depth is suggested. By the comparison with potentiometer, the estimation error (mean±sd.) was 0.31±1.41mm. For the real application in emergency, the algorithm and hardware should be implemented and validated for its clinical test.

P1-86 한국 수화 동작 인식을 위한 i-KH Data Glove 개발

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경희대학교 동서의료공학과

Hand gesture recognition is an emerging technology in the field of proactive computing. In this paper, we have developed a data glove, namely i-KH Data Glove specially designed for sign language recognition. Then using i-KH Data Glove, we have developed a Korean Sign Language recognition (KSLR) system. Our i-KH Data Glove consists of tri-axial accelerometers, single-axis gyroscopes, bend sensors, and four force sensors. The KSLR system works in real-time with the Kalman filtered outputs of the sensor measurements. The KSLR system recognizes 31 Korean Alphabets based on our derived decision table. Our experimental results show 100% recognition accuracy.

P1-87 가속도 센서 기반 실시간 라이프로그 시스템

이명우[1], Adil Mehmood Khan[2], 김지환[1], 조영선[1], 김태성[1]
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[2]경희대학교 컴퓨터공학과

Recording a personal life log (PLL) of daily activities is an emerging technology for u-lifecare. In this paper, we present a single tri-axial accelerometer-based PLL system capable of human activity classification and exercise information generation. In our system, we use a real-time activity recognition scheme in which a set of augmented features of accelerometer signals, processed with Linear Discriminant Analysis (LDA), is classified by our hierarchical Artificial Neural Network (ANN) classifier. Upon the recognition of each activity, we further estimate exercise information such as energy expenditure based on Metabolic Equivalents (METS), step count, walking distance, walking speed, etc.

P1-88 Borealis Stream Processor를 이용한 Heart Variability Monitor의 개발

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This paper propose the system architecture that is suitable for continuous process of incoming sensor data in ubiquitous environment. A pilot application based on the Borealis Stream Processor that can monitor heart variability parameters with graphical user interface is developed, which is simulating real world usage with previously collected monitoring data. In addition to mere display on the variables, we facilitated an alarm function that can classify abnormal values in the mean heart rate, with display of alarm icon and log message. This kind of application will reduce human labor and will provide convenience when used in long term health monitoring.

P1-89 ZigBee 기반의 생체 신호 무선 전송 장치

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Various RF wireless telemetry system come out for many electronic technology. As a RF general-purpose telemetry, like Bluetooth, have compatibility and reliability, many electrical engineers were absorbed in it. Especially, compared with other RF general-purpose telemetry, like Bluetooth or Wi-Fi, the ZigBee telemetry protocol is superior for bio-electric signals because of low power and suitable transmission rate. We get the RF telemetry system using ZigBee protocol which is LR-WPAN(Low Rate Wireless Personal Area Network) for transmit bioelectric signals. It has ±3V(resolution 6mV) signal sensing ratio, and 50Hz receiving frequency for about 100bytes by LABVIEW.

P1-90 유비쿼터스 환경에서의 지속적 모니터링 기술의 평가

김영호[1], 유수영[2], 한충현[1], 김승희[2], 신재혁[1], 최진욱[2]
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The Smart Bed monitors subject's physiological status by analyzing ballistocardiogram (BCG) during sleep. Since attaching electrodes or connecting wires to subject's body are not required when subject is being monitored, this method can provide adequate levels of comfort to the subject. Eleven healthy subjects participated in this study, and 8 hours of experiments were performed twice per each subject. We measured the proportion of meaningful periods in which signals can be used to monitor subject's physical status, and evaluated the peak detection algorithm to confirm whether the algorithm could extract peaks which related to heart activity from recorded signal.

P1-91 PC 기반 무선 요속계 사용자 프로그램

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충북대학교 의과대학 의공학교실, CBITRC, 차세대 선도 의과학전문인력양성사업단, 충북대학교

Benign prostatic hyperplasia (BPH) significantly deteriorates the quality of life in aged men. Uroflowmetry is a convenient non-invasive clinical test to diagnose BPH. However, the test is usually performed in the presence of a technician, which may affect the way of urination for the lack of privacy. The present study developed a wireless uroflowmeter to provide the best privacy with a user program on PC evaluating the diagnostic parameters. Pilot experiment was followed to test clinical applicability.

P1-92 통합형 운동 정보 단말기 및 운동 이력관리 프로그램의 개발

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KITECH 웰니스시스템개발단

This study developed real-time energy expenditure algorithm and simple fitness index (VO2max, AT), and loaded them on hardware through various fitness tests for the simplification of the system components of the existing portable exercise terminal and for the effective and scientific exercise management of a user. Concerning an exercise history management program, the study offered exercise history data as a graph by utilizing C++, and composed the program in order to evaluate the fitness of a user and to provide a tailored exercise prescription through an analysis of the exercise history data.

P1-93 On-Body Communication을 위한 Polyimide-PDMS전극의 생체 적합성 실험

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The biocompatibility of Polyimide(PI)-PDMS electrodes for on-body communication(OBC)was investigated. Three types of biocompatibility testing were performed : hMSCs (human Mesenchymal Stem Cells)and skin fibroblast cells were cultured on the electrodes and skin compatibility was tested on the skin of five volunteers. hMSC and skin fibroblast cells were cultured on the electrodes for 3 days and the viabilities of the cells were both more than 96%. Two PI-PDMS electrodes were attached to each person's skin for 30 days and caused no skin trouble. These results suggest that PI-PDMS electrodes are completely biocompatible to be used for on-body communication.

P1-94 Fractional cross-correlation을 이용한 2채널 디지털 보청기의 방향성 잡음 제거 알고리즘

한종희[1], 지윤상[1], 김희평[1], 육순현[1], 이상민[2], 김동욱[4], 홍성화[3], 김인영[1], 김선일[1]
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In this paper, we developed a new algorithm to restore speech signal from two noisy speeches acquired in the 2-channel DHA. The algorithm used fractional cross-correlation of signals from two microphones to estimate the direction of noise. And then, fractional delay, subtraction and integration were applied sequentially. We tested the algorithm with a mathematical sound acquisition model of the microphone. Distance between two microphones was set by 1cm. It was assumed that a speech comes from the frontal side and a babble noise comes from 45(60, 90, and 120 degree). Consequently, we could observe that most of noise was reduced by the suggested algorithm.

P1-95 스마트폰을 이용한 약물정보 어플리케이션의 개발

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울산대학교 의과대학, 서울아산병원 의공학과

In this paper, we present a smart phone application that aims at supporting medication information. The smart phone application is developed based on iPhone platform and we converted 1,300 medication data to HTML format using LabVIEW.

P1-96 응급모니터링 단말기용 생체센서의 개발

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We developed a sensor module to monitor vital signs and this module is used for the monitoring of the elderly's health state. There are so many vital signs to monitor, but we simplified vital signs as activity and heart rate. We measured the activity using 3-axis accelerometer and measured the heart rate using pulse oximeter. The major problem of pulse oximeter is motion artifact. But we suggested a new method that use the combination of these two sensors. In case of active motion, we used and analyzed the accelerometer signal and withdraw the pulse oximeter signal. In case of no activity, we adopt pulse oximeter signal which has no motion artifacts. The important thing is to categorize activity patterns such as normal or abnormal activity.

P1-98 다채널 임피던스 단층촬영 시스템을 위한 전극 인터페이스의 설계

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Imaging experiments using multi-channel EIT system demands a cumbersome procedure to attach multiple electrodes on the subject. We have to ensure good contact of all electrodes and manage many lead wires during experiments. In practice, it may limit the applicability of the imaging method. In this study, we developed an electrode interface for long-term monitoring of human lung ventilation. It includes 16 embossed electrodes which make good contact with the skin. The electrode is made by conductive polymer. Soft cushion and wide contact area minimize uncomfortable sensation and reduce contact impedances. The electrodes are attached to an elastic fabric belt at equal spacing. Using the electrode belt and recently developed multi-frequency EIT system KHU Mark2, we show time-difference chest images of human subject during normal breathing cycles.

P1-99 유연한 용량성 심전도 전극을 이용한 일상생활 중 심전도 측정

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To measure heart rate variability (HRV) in daily life, flexible active electrodes are employed to measure ECG signal. As these electrodes are thin and flexible with high signal-to-ratio capability, it was perfectly hidden inside of waist belt. ECG signal was measured for 18 hours in daily life and HRV parameters are calculated. Although flexible active electrodes suffer from motion artifact overall HRV changes could be measured.

P1-100 팔부위 혈당값과 손가락 및 정맥혈당값 간의 상관분석 연구

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Blood glucose test (BGT) on the forearm has been developed to minimize pain when sampling capillary blood on the fingertip. The present study performed a large scale clinical experiment performing BGT on the fingertip and the forearm as well as with venous blood in 555 subjects including 61 patients. Three different types of correlation analysis were applied, and all three statistical methods demonstrated high enough correlation which would enable to introduce the forearm BGT in clinical practice.

POSTERS II

KOSOMBE

Tissue Engineering and biomaterials

P2-01 생체 외 양성자 Magic Angle Spinning 고체 NMR 분광법을 이용한 정상 마우스에서의 뇌부위별 신경화학 대사물질 정량분석

이 도완[1], 우동철[1], 이성호[2], 김상영[1], 김구영[3], 임향숙[3], 최치봉[4], 김휘율[2], 이창욱[5], 최보영[1]

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The purpose of this study was to quantitated neurochemical profile of normal adult mice brain and assessed metabolic differences by using ex vivo 1H high-resolution magic angle spinning nuclear magnetic resonance spectroscopy. The animals were used 40-weeks-old for this study. The brain tissues were collected four regions and quantitative 1D spectra were acquired on 40 samples with the CPMG pulse sequence. (8 kHz spectral window, TR/TE = 5500/2.2 ms, NEX = 128). Acet, Cho, NAA, NAAG and mIns were showed significantly different aspects on each region. Our finding might be helpful to investigate brain metabolism of neuro-disease in animal model.

P2-02 조직 공학을 위한 생체모사 세포-수화젤 시트 제작 기술

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Encapsulation of cells within hydrogels is desirable for applications ranging from tissue engineering to cell-based assay. In this study, we present a technique to encapsulate cells in thin hydrogel sheets with controlled micropatterns inside. HepG2 cell suspension in sodium alginate solution was dropped and evenly spread on a hydrophilic poly(dimethylsiloxane) (PDMS) mold containing micropatterns, and crosslinked by coating of nebulized calcium chloride. The fabricated hydrogel sheets had the micropatterns of PDMS mold. These cell-laden hydrogel sheets could be stably harvested and cultured. Further development of this technique may lead to applications in 3Dco-cultures for cell-based assays and tissue/organ regeneration.

P2-03 알지네이트 반구립자(Semi-spherical particle)의 제작과 간세포의 배양

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In this study, we have developed a novel and simple micro-molding method for the fabrication of semi-spherical alginate particles. The cross-linking reaction of alginate particles was formed by diffusion through porous membrane on the micro-mold. The well-formed semi-spherical alginate particle within polydimethyl siloxane(PDMS) mold, whose stable formation with cross-linking reaction must be controlled by porous membrane. It is suggested that our system can be used as a model for encapsulation and aggregation of HepG2 cell.

P2-04 잔류용매 제거와 약물탑재를 통한 신경전극의 생체적합성 향상

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To enhance biocompatibility of neural electrode, residual solvent in the neural electrode was reduced by solvent extraction and ultra-sonication processes. And to reduce the post-inflammatory reaction, an anti-inflammatory drug embedded in a polyimide. The solvent-extracted and drug eluting films are subcutaneously implanted in the mouse. The biocompatibility of the PI film was analyzed using the cytotoxicity, RT-PCR, and H & E staining. Neural electrode that is contained drug show better short term biocompatible characteristics over control neural electrode. These solvent reduction and drug containing can be used to increase the biocompatibility of neural electrode.

P2-05 하이드로젤 3차원 배양 구조물에서 배양된 성상세포의 형태에 대한 연구

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We investigated the shapes of astrocytes cultured in three-dimensional hydrogel culture constructs. Varying the concentration of hydrogel, the morphologies of astrocytes were examined by taking confocal microscope images along several time points. At the concentration higher than 8.3 mg/ml, the morphology of astrocytes in hydrogel constructs maintained stellate shape similar to thatcan be observed in the natural brain, but at the lower concentration, astrocytes in the constructs moved downwards and then extended their extracellular matrices on the surfaces of culture substrates forming endothelia-like shape, which ruined 3D characteristics of culture constructs by releasing hydrogel constructs off the substrates.

P2-06 골 재생을 위한 체내 이식형 전기 자극 장치

김정훈[1], 김리연[2], 이태형[1], 김인숙[2], 조태형[2], 황순정[2,3], 김성준[1]
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In this paper, we present an implantable electric device for bone regeneration. Concentric electrodes deliver biphasic electrical current stimulation, of which amplitude, duration and pulse rate are 20uA, 100us, and 100Hz respectively. All of the external materials composing the system are biocompatible. In vivo studies were performed in rat calvarial defect model. 8 mm critical sized calvarial defect was exposed to electrical stimulation for one week. After two weeks, cell proliferation was assessed using MTT assay and after four weeks, new bone formation was analyzed using micro CT. The results suggest that newly designed electric device accelerates in vivo bone formation.

P2-07 LCP 기반의 탐침형 신경전극의 기계적 특성 분석

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In this paper, a study is reported on a novel depth neural probe where a new material called Liquid Crystal Polymer (LCP) is used. Electrochemical measurement and biomechanical measurement were performed to investigate the characteristics of the new device. Analysis was performed on the biomechanical measurement data. The newly LCP-based depth-type neural electrode was fabricated using the established fabrication process of previous study. The tensile test and the insertion test into the brain model gel (1% agarose gel) were performed to validate the biomechanical characteristics. The newly developed LCP-based depth neural electrode has 200±0.15mN of the yield point and 7.09±0.21mN of insertion force. The results of the tensile test show that the fabricated LCP-based electrode has higher yield point (yield strength) than the required insertion force of the brain (74±33mN).

Orthopedic and Rehabilitation Engineering

P2-08 근전도 기반 근력 추정방법을 이용한 근피로도 측정

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In this study, muscle fatigue measured using EMG-based muscle force estimation technique. Muscle force estimated from raw EMG signal and high pass filtered EMG signal. Difference of raw EMG signal and high pass filtered EMG signal represented muscle fatigue. The results indicate that difference of raw EMG signal and high pass filtered EMG signal was better muscle fatigue indicator than median frequency. This method will became more correct and simple method to measure muscle fatigue.

P2-09 안정 상태 시각적 유발 전위 기반의 뇌-컴퓨터 융합기술에 의한 관절 움직임 유도

손량희, 손종상, 황한정, 임창환, 김영호
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Steady-State Visual Evoked Potential (SSVEP) was used in BCI. SSVEP are signals that are natural responses to visual stimulation at specific frequencies. When the retina is excited by a visual stimulus ranging from 3.5 Hz to 75 Hz, the brain generates electrical activity at the same frequency of the visual stimulus. The purpose of this study was to develop a SSVEP-based BCI rehabilitation training system for spinal cord injured persons. This study showed that the present BCI-based rehabilitation training system could make successfully muscle movements inducing electrical stimulation of forearm and lower-arm muscles in healthy volunteers.

P2-10 방향제어가 가능한 미세침습 전극을 이용한 디스크 병변부위 접근기술

강봉수[1], 김상운[1], 조성윤[1], 이상헌[2]
[1]유앤아이㈜
[2]고려대학교 재활의학과

Increasing aging population and leisure activities in spinal patients is increasing by 5% annually. A disc herniation which can caused readicular pain is a common disease, andit is occurred by nerve root compression. In the past, surgeons have the surgical treatment to treat it, but recently, people take a growing interest in the method of minimally invasive techniques. However, in most cases, minimally invasive treatment cannot approach to the main pain resource which is located in lateral part, and the curative effect is of slight effect, so the improvement of the minimally invasive techniques is required. Therefore, it is necessary to develop electrodes which can controlled for approaching to posterior lateral parts. In this paper, for access to lesions in the intervertebral disc, 1. Mentioned that controllable direction technology is developed by medical device, 2. Verified that developed the minimally invasive electrodes can reach to the lesion in the cadaver disc.

P2-11 근전도 기반의 손목 동작 인식을 위한 선형 판별분석, 이차 판별분석, k-최근린 분류 방법들 간의 비교

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In this study, the authors compared the k-Nearest Neighbor (k-NN), Quadratic Discriminant Analysis (QDA) and Linear Discriminant Analysis (LDA) algorithms for the classification of the directions of wrist motions, such as up, down, right, left, and rest state. Thirty normal volunteers participated in this study. The difference absolute standard deviation value (DASDV) was used to construct a feature map, and the k-NN, QDA and LDA algorithms were used to classify the directions of the signal. The recognition rates were 84.2% for k-NN, 81.4% for QDA and 80.2% for LDA. There was a statistically significant difference between the k-NN and LDA algorithms ($P<0.05$).

P2-12 완전 이식형 의료기기용 무선전력전달 장치의 효율 향상을 위한 공진 주파수 추적법의 제안

임형규[1], 이장우[1], 신동호[1], 성기웅[2], 조진호[1,2]
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Many implantable medical devices have been developed as fully implant. These devices' energy is supplied by wireless power transmission methods using the electromagnetic coupling between two coils and resonance. However, in case of the wireless power transmitter with a fixed operating frequency, inefficient power transmission can be occurred because the electromagnetic coupling state between two coils is very sensitive to the changed mutual inductance due to variation of distance between two coils. To overcome this problem, a wireless power transmitter with resonant frequency tracking method has been implemented, whose operating frequency can be in accordance with the resonance frequency.

Cardiovascular Engineering

P2-13 주성분 분석을 이용한 심실 재분극 특성 분석: 예비연구

이전
대구한의대학교 한방의공학과

Quantification of the ventricular repolarization heterog-eneity has been reported as one of the most important methods that could discriminate arrhythmia high-risk patients. So, some heterogeneity measures related to QT dispersion have been developed and widely tested for ventricular arrhythmia patients. However, in these days, there arose some adverse reports against the effectiveness of QT dispersion and the reproducibility limitation of T end detection became known. So, in this preliminary study, the other heterogeneity measuring method based on PCA was tested.

P2-14 유도된 Frank 리드에 나타난 Post-MI 환자의 신호평균화 심전도 특성

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In this study, even with derived X, Y, Z Frank leads, we tested whether the existence of late potential in the arrhythmia high-risk patients could be found or not. 12 lead ECG signals were acquired from 5 healthy subjects and 5 post-MI patients at 1,000Hz sampling rate for 5 minutes. The inverse Dower's transform was applied to derive Frank lead ECG signals and 3 parameters of signal-averaged ECG analysis were calculated from these signals. As results, post-MI patients' QRSD was found to be longer, RMS40 lesser, and LAS40 longer than those of healthy subjects and significant differences were shown in all 3 parameters between healthy subjects and post-MI patients. Consequently, in post-MI patient, the signal-averaged ECG analysis with derived Frank leads from standard 12 leads would seem valid.

P2-15 PPG 파형과 오실로메트릭 파형의 수축기 혈압을 이용한 혈압군 추정

박성민, 나재석, 유주연, 노정훈, 전계록
부산대학교 일반대학원 의공학협동과정

In this study, the estimation of the blood pressure groups was implemented through a comparison of PPG (Photoplethysmography) waveforms and Oscillometric waveforms. A time delay was calculated until the first pulsation detects in PPG waveforms. Two waveforms were differentiated for a comparison. Peak points were detected for matching and the detected points were applied to the original Oscillometric waveforms. Finally, A estimation of a pressure by time delay was obtained by PPG waveforms. The time delays were successfully recorded. These were applied to separate the pressure groups.

P2-16 Treadmill 운동 전후의 혈관탄성의 변화

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연세대학교 보건과학대학 의공학부

The purpose of this study was to examine the variation of treadmill exercise on vascular compliance by the second derivative of photoplethysmogram(PPG). Ten men volunteered to participate in this study. Vascular compliance was determined using ratio between negative and positive wave of the second derivative PPG. All participants completed sub-maximal incremental exercise test. PPG signal was recorded both before and after exercise and a paired t-test was used to examine differences between values. The vascular compliance after exercise was significantly increased compared with the value before exercise($P<0.05$). In conclusion, this study demonstrated that treadmill exercise positively affects vascular compliance.

P2-17 지첨용적맥파의 고조파 성분의 신뢰도

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Thefinger photoplethysmogram (PTG) can provide valuable information about the characteristics of the cardiovascular system. Some researchers suggested that harmonic indices from PTG signals could be used as an index of vascular aging. In order to ensure reliability of the PTG, we recruited healthy normotensive females (n=6), and repeatedly measured PTG three times. We calculated intraclass correlations coefficient (ICC) for inter-rater reliability by measuring amplitude of the harmonics normalized to that of the fundamental. The higher ICC (maximum of 1.0) means the high reproducibility. Shrout-Fleiss ICCs for intra-rater of the 4th harmonics were ranged 0.679 to 0.735.

P2-18 자전거 에르고미터 운동 중 심박수 측정을 통한 에너지소모량 추정 알고리즘 개발

최준호, 윤효정, 정경렬, 김사엽, 윤효정, 박기덕
KITECH 웰니스시스템개발단 남서울대학교 운동건강학과

The purpose of this study is to deduce oxygen consumption using the heart rate measured during exercise. Through the simple regression analysis of the heart rate and oxygen consumption measured during the cycle test, the reference formula of the heart rate and oxygen consumption of subjects, 'VO2=α ×HR − β ', was calculated. correlation analysis and multiple regression analysis of the individual characteristically elements of each individual and the slope α and y-intercept β were conducted. The method was presented through which the oxygen consumption can be deduced by measuring the heart rate during exercise by calculating oxygen consumption prediction formula.

P2-19 심장 신경 전위에서의 심전도 제거

김소정[1], 박연꽃[1], 김지현[1], 이승민[2], 최의근[3], 오세일[3], 박광석[4]
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In previous studies, the amount of cardiac autonomic nervous system activity was difficult to be measured because it combines ECG. This study effectively removes ECG using signal average. This method will be a useful to further studies.

P2-20 맥파를 이용한 안마기 모드에 따른 스트레스 완화 효과 검증

김용대[1], 장윤승[1], 최동혁[1], 이현주[2], 태기식[1]
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The aim of this study was to investigate the effects of electrical massager on stress-related parameters including heart rate variability, heart rate using the photoplethysmogram(PPG) signal. Twenty healthy subjects were randomly allocated to receive a 15-min section of three types ((1) resting mode (control group), (2) light massage mode, (3) strong massage mode). In strong massage mode, it was associated with significant increases in HF, but significant decreases in LF and LH/HF ratio compared with the light massage mode. For all outcomes, similar changes were not observed in the control group. Also, the result founded that mean HR of all groups decrease suggesting a relaxation response. We conclude that electrical massager reduces perceived stress and improves adaptive autonomic response to stress in healthy adults.

P2-21 심탄도를 이용한 심박변화율 분석 최적화 기법

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Heart rate variability (HRV) is an important feature to evaluate autonomic nervous system. To measure it continuously in our daily life, many kinds of methods have been introduced and ballistocardiogram (BCG) is one them. However, BCG is vulnerable to motion artifact because it is highly related with body fluctuation. So, to calculate exact HRV with BCG, optimal signal processing is needed. In this study, we compared the accuracy of HRV using BCG with ECG. By using optimal window, interest points, and smoothing methods, we showed that BCG would be suitable signal to obtain heart rate variability in our daily life.

P2-22 치주줄기세포를 이용한 광자극 신호전달 신경세포주의 개발

김병철[1], 전성민[1,2], 이상엽[2], 김진석[3], 이창준[4], 권일근[1], 황유식[1], 서준교[2]
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[4]KIST 신경과학센터

In this research, we have isolated dental stem cells from various periodontal tissues by MACS, and have developed an efficient culture condition for neuronal differentiation of dental stem cells. Neuronal progenitors could be generated from dental stem cell under our established specific culture condition. Using dental stem cell line, this study has developed optogenetic stem cells via lentiviral transfection carrying light-sensitive channel rhodopsin gene, which can be applied for optogenetic deep brain stimulation.

Medical Imaging

P2-23 생체시계 교란이 소동물의 복부지방에 미치는 영향

주현륭[1], 정영진[1], 서동현[1], 고창용[1], 장영수[2], 배기호[2], 김한성[1]

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The purpose of this study is to investigate alterations of abdominal adipose tissue on mice simulated night-shift work. In the present study, 14 male mice were used and randomly allocated into 2 group; NOR (normal group) and NS (night shift group). Torsos (the 2nd ~5th lumbar vertabrae) of mice were scanned at 0 week, 2 week, 4 weeks and 6 weeks by using in-vivo micro-CT. Three dimensional model of abdominal adipose tissue (ADT) was reconstructed and its volume was measured. The ADTs in NS were significantly bigger than those in NOR ($p<0.05$). This result showed that night-shift work might enhance the accumulation of abdominal adipose tissues.

P2-24 MRI 데이터를 이용한 유방 변형의 유한 요소 모델링

박하령, 윤한빈, 김호경

부산대학교 기계공학부

Recent study about diagnosis of breast cancer is revisited via. The diagnosis of breast cancer is variety for example, MRI, mammography, ultrasound and etc. This study conform each image system for effective diagnosis. For conform to each image system, breast deformation is simulated base on the patient MR image data. First, the MR image is segmented by tissue and fibroglandular. After segment, the MR image converts to mesh data. Finally, converted mesh data is applied material property and compressed. Through this process, we can verify conformity of image system. FEM (finite elemental method) software ABAQUS™ was used for this step.

P2-25 3차원 두부계측 정보를 활용한 가상 턱교정 수술 계획 시스템 개발

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

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The purpose of this study was to develop a new system of osteotomy planning systemfor orthognathic. Virtual skull model was reconstructed form the original CT scanning data. Virtual osteotomy was performed on the model using haptic device. Each segmented model was loaded on the virtual surgery planning system and freely repositioned to the desired position. Collision detection between the virtual bone segments was performed during the repositioning procedure. Three-dimensional cephalometric measurement was calculated during the repositioning procedure, which showed improvement in facial morphology quantitatively. Virtual bone segmenting was performed and repositioning plan could be verified preoperatively.

P2-26 CT영상을 이용한 하악 해면골 형태의 비교분석

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Precise in vivo measurement of the trabecular bone's properties is very important in clinical practice for dental implant treatment. The objective of this study was to quantitatively assess the trabecular bone parameter of jawbone patient model generated from cone beam computed tomography(CBCT) by comparison with same patient model obtained from multi slice spiral computed tomography(MSCT). The Statistical analysis was conducted using SPSS. Differences in means between the same parameters obtained by MSCT and CBCT were tested using Spearman correlation analysis (two-tailed). Significant correlations between MDCT and CBCT derived measures of BV/TV, Tb.Th and Tb.Sp were found ($p<0.05$).

P2-27 Chemical Shift Artifact Correction in MREIT using Iterative Least Square Estimation Method

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In vivo human and animal experiments in MREIT demands high SNR. To increase SNR, a long sampling time interval is preferred. However, it leads to chemical shift artifacts in fatty tissues. This results in signal overlap and also void in MR images and thereby an increased noise level in Bz images. Three-point Dixon technique has been proposed as an initial trial to correct chemical shift artifacts. However, this method is not suitable for fast imaging and swapping of water-fat signals may occur. This work incorporates a recently proposed chemical shift artifact correction technique based on the least square estimation.

P2-28 병렬형 다중주파수 임피던스 단층촬영 시스템

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We describe a new parallel multi-frequency EIT system, KHU Mark2. It is based on the impedance measurement module (IMM), which comprises a single-ended constant current source and a voltmeter. Each IMM has an FPGA for its independent operations including current injection at multiple frequencies, voltage amplification, ADC, digital phase-sensitive demodulation and intra-networking with a main controller of the system. The new system can accommodate any current injection and voltage sensing protocol including the optimal injection current pattern. Reduced size and new internal architecture significantly improved mechanical as well as electrical stability of the system.

P2-29 3-풀 모델링, 정규화된 비음수 최소 자승 알고리즘을 이용한 수초물분율 지도 제작 : 비교 연구

정현진, 남윤호, 김동현, 황도식
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Myelin is lipid sheath insulating axons to deliver the signal faster with less energy. Myelin Water Fraction(MWF) is quantitative measurements of the myelin content, which help to assess the condition of myelin. In this paper, MWF maps were measured using three different algorithms, regularized non-negative least squares (rNNLS) and 3-pool modeling algorithms. The MWF map with 3-pool modeling algorithm has better performance than the rNNLS methods in terms of anatomical information.

P2-30 Analysis of Backscatter Factors(BSFs) for Radiation

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The method for obtaining the patient skin dose by measuring the air kerma in the patient skin surface is being recommended. Back scatter factors (BSFs) which correspond to the radiation field in the patient skin surface and the quality of the X-ray are necessary in that time. Therefore, we have formulated analogous models for scatter imaging and used them to quantify the ultimate performance of scatter imaging. The models are semi-analytic and intentionally simple. Scatter can significantly degrade projection image quality as contrast and signal-to-noise ratio. For a given photon fluence entering the patient, the models calculate contras. Moreover, BSF is very important portion of this model. However, it is difficult that it is measured BSF included the each structure of the human internal organs and the body tissues for the patient skin dose. Then the backscattering coefficient was obtained using the Monte Carlo calculation code, and the usefulness was examined by comparing with the measured value of the TLD element. The results with Monte Carlo code were similar to the results measured by using TLDs, so that we consider that it is effective in the x-ray equipment and under the experimental condition, which were used for this method.

P2-31 소동물용 Geigermode-APD PET 프로토타입 시스템 개발

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The small animal G-APD PET was developed. This consists of 8 blocks, each of which is composed of 2x6 G-APDs and 4x13 LGSO crystals. Bias voltage for each G-APD is powered by digitally controlled voltage supply with temperature sensor. Various phantoms, rat brain and mouse tumor were successfully scanned and registered with animal CT images. The spatial resolution of a ^{22}Na point source was 1.0 mm at the center. Every result was equivalent to the PMT based animal PET data. These results demonstrate that it is possible to acquire reasonable quality animal PET images employing G-APDs.

P2-32 뇌 기능 영상의 다 변량 패턴 분석을 통한 navigation 상황에서 해마의 활성 패턴 분석

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Hippocampal neurons have place cell that fire during passing through a particular location of the environment. It is unclear what spatial pattern such place cells represent at the population level. In order to know activation pattern of place cell in hippocampus, we get fMRI images during navigating in the virtual room. We performed multivariate pattern analysis for predicting the position that the participant suppose to move in virtual room. In the results, the voxels that had higher 95 percentile accuracy located at hippocampal areas. In this study, we knew that hippocampus functionally organized with conditions and environments in spatial navigation.

P2-33 비강체 정합을 이용한 무릎 연골의 반자동화 영역화의 속도 향상

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A semi-automated segmentation process based on graph-cuts technique [1] is much faster (approximately ten times) than manual boundary delineation, but it still requires 30~40 minutes per case for the operator to place seeds. If a baseline (BL) and follow-up (FU) magnetic resonance (MR)scans of the same subject can be registered non-rigidly to each other, seeds placed on the BL scan can be converted to the FU one. Thus, we propose to utilize non-rigid registration to speed-up semi-automated segmentation of knee cartilage and provide experimental results on knee MR scans from osteoarthritis initiative (OAI) to support its feasibility.

P2-34 휴식기 상태에서 해마의 기능적 연결성 분석을 통한 공간네비게이션 수행능력 예측 가능성 연구

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The hippocampus is important region of the brain related to process of spatial, episodic memory. Resting state functional connectivity between the hippocampus and other regions are an important element to determine the cognitive and behavioral reactions. In this study, in other to identify which area functional connection strength can be predicted the spatial navigation performance. As a result, connectivity between the left middle hippocampus and the right orbitofrontal cortex can predict the spatial memory abilities.

P2-35 Design of CMOS analog circuit for radiation detector

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This paper describes a high speed integrated circuit which has been designed to interface with charge-coupled device (CCD) arrays in high speed CCD camera systems. This IC performs the analog signal processing functions required between the CCD output and analog-to-digital converter (ADC) input. Channel gain can be adjusted from 2.7 to 12 in 16 steps as specified by a 4 bit digital word. The chip operates from power supply voltages of ±5V, dissipates 380mW / channel.

P2-36 실시간 합성구경 구현을 위한 빔집속 시스템 설계

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In this paper, efficient beamformer architecture for real-time synthetic aperture focusing (SAF) technique is presented. In the developed real-time SAF beamformer, the synthetic memory, in which partially-beamformed scanline data are accumulated, is used to reduce the size and bandwidth of memory. Furthermore, the hardware complexity of the proposed SAF beamformer is reduced by utilizing time sharing and parallel beamforming. The proposed beamformer was implemented on Vertex-5 VSX95T (Xilinx Inc., San Jose, CA, USA) field programmable gate array (FPGA) with six DDR2 SDRAMs for the synthetic memory. The effect of synthetic aperture beamforming was evaluated with simulation.

P2-37 자기공명분광을 이용한 Ethylene glycol의 온도 측정

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MRI-based temperature imaging that exploits the temperature-sensitive water proton resonant frequency shift is available method for reliable quantification of temperature changes in vivo. Temperature imaging methods based on the water proton chemical shift can be classified into two categories, phase-mapping methods and spectroscopic imaging methods. The phase-mapping method has been widely used. However, the phase-mapping method is subject to susceptibility and body movement. Whereas, the spectroscopic method can reduce thermal error because of internal reference used. In this study, changes of Ethylene glycol metabolites were detected according to temperature changes using NMR, and then we also validated reliable interval.

Biomedical Optics

P2-38 자기공명영상장치 내에서의 호흡 모니터링을 목적으로 하는 시온안료를 이용한 광섬유 호흡센서의 개발

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건국대학교 의료생명대학 의학공학부, 의공학 실용기술 연구소

In this study, we have fabricated a nasal-cavity attached fiber-optic respiration sensor that can monitor the respiration of a patient during MR image acquisition. This respiration sensor can measure the temperature variation of air-flow using a thermochromic pigment. We have measured modulated light guided to photodiode-amplifier system in the MRI control room via plastic optical fiber due to the respiratory movement of the patient in the MR room, and the respiratory signal of the fiber-optic respiration sensor is compared with that of the BIOPAC® system.

P2-39 저출력 레이저를 이용한 근강직증 치료 모니터링 시스템 개발

이연의, 윤진희, 김지현, 홍정선, 윤종인
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Generally, Current therapeutic methods for suppressing myotonia are intensive functional training, surgical operation, or pharmacological interventions. However, these methods have not been fully supported by confirmed efficacy due to the aggravation of the myotonia in some patients. In this study, we build the combined system that systemically monitor the region of the treatment using an optical spectroscopy probethat measures tissue condition like oxygen saturation and deoxygenation during low power laser treatment. With our developed system, we can monitor the physiological condition of myotonia during the laser treatment. This system can be also applied to back-pain treatment/monitoring, ulcer due to paralysis, and various myotonia in joints.

P2-40 스캐너를 이용한 의한 요분석 자동분별기법

이상봉, 최성수, 김도경, 이태수, 차은종, 김경아
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Urinalysis is an important clinical test to diagnose urinary diseases, and dipstick method with visual inspection is widely applied in practice. Automated optical devices recently developed have disadvantages of long measurement time, big size, heavy weight, accuracy degradation with time, etc. The present study proposed a new computer scanning technique, in which the test strip and the standard chart were simultaneously scanned to remove any environmental artifacts, followed by automated differentiation with the minimum distance algorithm, leading to significant enhancement of accuracy. Experiments were performed on 50 subjects, which demonstrated an accuracy of 91%. The present technique uses a personal computer with scanner and shortens the test time to a great degree. The results are also stored and accumulated for later use which can be transmitted to remote locations through a network, thus could be easily integrated to any ubiquitous health care systems.

P2-41 광섬유 기반 형광 광표백 기법을 이용한 마우스의 복막 물질전달 측정

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In the microenvironment, diffusion is major transport mechanism which determines function of living system. Altered diffusion rate of macromolecules in living system often causes the malfunction of organs such as renal failure. So, it is very important to quantify diffusion rate of macromolecules in-vivo system. To measure the diffusion rate of macromolecules in-vivo, we developed fiberoptic-based fluorescence recovery after photobleaching technique. To verify our system, we measured the diffusion rates of FITC-Dextran in agar gel and applied this technique to the peritoneum of the rat.

P2-42 1064nm 근적외선 DPSS 레이저를 이용한 쑥뜸 대체 치료기 개발

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Moxibustion acting directly on the skin can treat and prevent a disease. However, it has the danger of burns and there is a shortcoming that quantitative control is difficult. We developed a laser moxibustion device using 1064-nm infrared DPSS laser. Using the device, we can raise the temperature which is similar to the one raised by moxibustion. Laser moxibustion has distinct advantages as compared with traditional one.

P2-43 안구 영상을 위한 소형화 OCT시스템 및 손잡이형 프로브의 개발

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We demonstrated compact SD-OCT system using hand-held probe for ophthalmic imaging. The hand-held probe performed OCT imaging both retina and cornea by changing tubular lens mounts. *In vivo* OCT images were acquired from eyes of rat and human, and visualized clear structural information in posterior and anterior chambers.

P2-44 음압을 이용한 피부 혈색소 측정 장비 개발

주예일, 배영우, 여창민, 정병조
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Cupping therapy is the oriental technique which used in folk remedy, however the mechanism of cupping therapy is not revealed completely. Supplying of negative pressure occur the deformation and change blood pigment of skin. Blood pigmentation is the one of major fact of diagnosis of health condition. A fiducial color of blood pigmentation is not defined, although diagnosis has serious tester-error. In this study, we develop the device consists of negative pressure pump and RGB color sensor for measuring the blood pigment of skin during cupping therapy.

P2-45 피부주름 정량평가에 대한 연구: 2D 영상처리를 통한 이미지 분석 및 u-CT를 통한 3D 데이터 비교

엄상희, 김은지, 손태윤, 강동연, 정병조
연세대학교 보건과학대학 의공학부

In this study, 2D image was acquired using silicon skin replica for quantitative measurement and evaluation skin surface wrinkle. The parameters that was extracted from image processing and u-CT were compared in order to access the data such as wrinkle length and width.

P2-46 근적외선을 이용한 경피적 에너지전달장치의 특성모델링

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Modeling of optically enhanced NIR light driven photovoltaic cell for medical implants has devised. Fresnel lens outside the skin has made photons from light source converge. We have simulated our designed model with the commercial Trace-Pro optical design tool (Lambda Research Co., US). The results show that the Fresnel lens outside the skin drives photons concentrated and raised the efficiency of power transmission. The maximum point was when the lens has an effective focal length. By simulation, many of these conclusions were verified qualitatively.

P2-47 전파정류방식의 고전압트랜스포머를 이용한 X선 기기의 특성

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X-ray system which is usefully used in diagnosis of the patient, being bombed of radioactivity is a big weak point when irradiates a X-ray to the human body so that ICRP restricted the radiation exposure tolerance of the human body. In order to reduce being bombed, the many research and development is now advanced. This research has produced the high voltage occurrence system of full-wave rectification method by using the LC resonance inverter, and evaluated the irradiation reproducibility in order to use it in diagnosis of the patient.

Medical Nano and Microtechnology

P2-48 대기압 플라즈마 표면 처리를 이용한 단백질 패터닝 기술

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This paper proposes a novel protein micro-patterning method using a conventional photolithography process and a controlled surface property by using a combination of atmospheric-pressure TEOS-He-O_2 and TEOS-He plasma deposition. Contact angle measurement for wettability analysis and XPS for chemical composition analysis were performed on the plasma-treated surface with respect to TEOS plasma conditions. In order to conduct protein micro-patterning, amphiphilic device were prepared using photolithography and selective TEOS plasma deposition. In the demonstration of the selective protein micro-patterning, rhodamine labeled anti-rabbit IgG was applied for direct protein contact and fluorescent images were acquired. The protein micro-patterning could be achieved by selective TEOS plasma deposition with photolithography.

P2-49 원자력현미경 탐침을 이용한 전기화학적 나노패터닝 기술

이규도, 정휘헌, 손종상, 남기환, 권태윤, 이상우, 윤대성

연세대학교 의공학과

We fabricated nanopatterns on Cu thin films via an electrochemical route using an atomic force microscope (AFM). In order to precisely construct the nanopatterns, an ultra-short pulse was applied onto the Cu film through the AFM cantilever tip. The line width of the nanopatterns increased with increased pulse amplitude, on-time, and frequency. The tip velocity effect on the nanopattern line width was also investigated.

P2-50 현장 진단 기기를 위한 나노다공성 백금 전극 기반의 고체 타입 기준 전극

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This research reports a novel solid-state reference electrode based on the nanoporous platinum (Pt), which is an important electrode for Point of Care Testing (POCT). The structure of solid-state reference electrode within a microchip enables stable reference potential to be performed successfully. This is expected to be a competitive alternative to conventional Ag/AgCl reference electrode currently used in the electrochemical measurements. The solid-state reference electrode on a microchip maintained a reproducible potential versus a commercial Ag/AgCl reference electrode for a long time. This solid-state reference electrode was successfuly used to monitor pH in 0.15 M PBS buffer, and showed advantages of quick hydration and short detection time. As a result, we obtained a good solid-state reference electrode for POCT device.

P2-51 비규소식 접합형 전계 효과 트렌지스터

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This paper reports that the output characteristics of nonsilicon based junction field effect transister (JFET) can be implemented by effectively controlling the ions in microchannel using a microfluidic chip with conductive charge-selective polymers of different polarity. The proposed JFET system based on microfluidic chip has poly-DADMAC which is positive charge polyelctrolytes and poly-AMPSA which is negative charge polyelectrolytes, perpendicular to the flowing direction of fluid, on the wall of microchannel. It was confirmed using fluorescent dyes with different charges that when a gate voltage is applied between these two polyelectrolytes, anions move to the polymers in the main channel through poly-DADMAC and cations through poly-AMPSA, thus forming an ion-depletion region.

P2-52 항암제 서방전달을 위한 의용고분자 나노섬유로 코팅된 식도 스탠트

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Esophageal stents have been used to open a blocked esophagus mostly found with the patients with esophagus cancer. However, due to rapid growth of malignant tumors into the stent, restenosis often occurs, leading to a multiple times of major surgeries for its replacement. Therefore, in this work, we proposed the esophageal stents enabled with sustained delivery of an anticancer agent, fluorouracil (5-FU). Poly(lactic-co-glycolic acid) (PLGA) was employed as a wall material for 5-FU delivery. The stents were coated with PLGA nanofibers loaded with 5-FU via the electrospinning method, where the amount of drug loading, rate of fiber alignment and thickness of nanofibrous sheet were varied and controlled.

Neural Engineering

P2-53 인공 망막에서 얼굴 표정 인식에 대한 영상처리 효과

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There are mechanical problems not to increase the number of phosphenes for retinal prosthesis. Thus it is required to provide more and better visual information through image processing. In this paper, we gave pixelized images of various facial expressions to subjects with or without image processing expressionless, smiling, turning one's head. They saw the image, and then they matched it with correct facial expression. As a result, it was showed that image processing can reduce the time taken to recognize facial expression.

P2-54 Water Flow Based Cooling Tube to Cure Epilepsy

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Electrical stimulation is one of the ways to cure the Epilepsy but still it can be partially control by delivering an electrical stimulus to the brain. This paper present a novel technique designed to cure epilepsy using cold water flow based cooling tube. The designed tube was composed of U shaped tube from which cold water flowed to reduce the temperature of the brain. The simulation results demonstrated that the cooling tube could cool the 7 mm^2 area of the brain when the fluid was flowing at a velocity of 0.55 m/s.

P2-55 마취단계별 HRV 분석과 BIS index 비교

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In this study, depth of anesthesia was evaluated by the analysis of HRV that relates ANS(automatic nervous system). HRV was calculated from ECG signals during operation and parameters were estimated using time and frequency-domain analysis. Detected parameter values were compared with BIS index and the correlation between them was studied. LF and HF had approximately similar phase of result like existing parameters. But the STD(standard deviation) had higher range.

P2-56 감성공학적 제품설계를 위한 소음과 인체 생리신호의 상관관계 규명에 관한 연구

조원학, 허상욱, 최현기
성균관대학교 기계공학부

This study was to investigate the responses of electrocardiogram and eye tracking data in order to evaluate direct effects of low, middle, and high frequency noise on the two main physiological stress axes: parasympathetic nervous system (PNS) activity and pupil response time (PRT). PNS activity in low or high frequency noise was smaller than that in middle frequency noise. PRT in low or high frequency noise was greater than that in middle frequency noise. The findings of this study indicate that the stress induced by low frequency noise is far more stressful than that induced by high frequency noise.

P2-57 근전도 신호와 비전 정보를 이용한 스마트 휴먼-컴퓨터 인터페이스

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We propose a new smart human-computer interface replacing conventional mouse interface. We can control cursor and command action (left, right click and drag and drop) through the interface. We materialize cursor movement control using image processing, and command control using EMG signal processing. The measure of the EMG signal what we use for inference is entropy, Gaussian modeling and maximum likelihood estimation. In image processing for cursor control, we use color recognition to get the center point of finger tip from marker, and map the point onto cursor. Accuracy of finger movement inference is over 95% and cursor control works naturally without delay. We materialize whole system to check its performance and utility

P2-58 대표적 망막변성 모델마우스인 *rd1* 마우스와 *rd10* 마우스에서 망막신경절세포 스파이크의 주기적 흥분 주파수 비교

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Despite photoreceptor degeneration, preservation of inner retinal neurons enables retinal prosthesis as a rescue strategy by stimulating the remained neurons electrically. Among many animal models, *rd1* and *rd10* mice are mostly used for studying retinal degeneration. Since the fast degeneration of photoreceptors in *rd1* mice is an obstacle to the employment of this mutant for rescue studies, *rd10* mice, another mutant carrying the mutation of same rod-PDE gene showing a later onset degeneration of photoreceptors is becoming more favorable model for testing therapeutic tools. In this study, we compared the oscillatory rhythm in retinal ganglion cell (RGC) activities between *rd1* and *rd10* mice in different postnatal ages to know the changes in RGC activities accompanying retinal degeneration.

Medical and Bioinformatics

P2-59 한국 남성에서의 전립선 조직 생검 시행 전 전립선암 위험도 예측 모델의 개발 및 타당도 검증

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BACKGROUND: We developed and validated a novel Korean prostate cancer risk calculator (KPCRC) for predicting the probability of a positive initial prostate biopsy ina Korean population.
METHODS: Data were collected from 602 Korean patients who underwent initial prostate biopsies due to an increased level of prostate-specific antigen (PSA), a palpable nodule upon digital rectal examination (DRE), or a hypoechoic lesion upon transrectal ultrasound (TRUS). The analyzed variables included age, DRE findings, total PSA level, free PSA level, percent of free PSA, TRUS findings, prostate volume, prostate transitional zone volume (PTZV), PSA density (PSAD), and PSAD of PTZV (PSADT). Multiple logistic regression analysis was performed, and the area under the receiver operating characteristic curve (AUC) was computed to compare its performance to PSA testing alone.
RESULTS: Prostate cancer was detected in 172 (28.6%) men. Independent predictors of a positive biopsy result included age, DRE findings, PSA level, and PTZV. We developed the KPCRC using these variables. The AUC for the selected model was 0.91, and that of PSA testing alone was 0.83 (P 〈 .001). The AUC for the selected model with an additional dataset was 0.79, and that of PSA testing alone was 0.73 (P 〈 .004). The calculator is available on the website: http://sryoon.web-bi.net/PCRC/kr.
CONCLUSIONS: The KPCRC improved the performance of PSA testing alone in predicting the risk of prostate cancer in a Korean population. The calculator proposed in this study is freely available on the internet, making it a practical tool for physicians and patients.

P2-60 진동이 병원 내 수술현미경에 미치는 영향

김홍규[1], 문경석[1], 김승엽[1], 채영한[1], 이호석[1], 전석봉[1], 임효순[1], 김병태[1,2]

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Vibration is undesirable, wasting energy and creating unwanted problems. Especially, in Hospital, vibration can cause harmful effects on the operation when using operating microscope. In this article, we reviewed vibration measurement and processing data with regard to evaluating vibration effects on the floor and on the objective lens of microscope in operating room. In the results of the experiment, we measured 0.011~0.110mm/s vibration speed on the objective lens of microscope, which can make blurred images with vibration.

P2-61 컴퓨터기반 의료기기의 악성프로그램 진단과 치료방법에 관한 고찰

서기홍[1], 천승민[1], 기선우[1], 임효순[1], 김병태[1,2]

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Recently, the computer-based medical devices are increasing. Also the attack of malicious programs like the virus, worm, and trojan horse is increasing rapidly. The malicious programs are threatening the computer-based medical devices. These harmful elements could cause a failure to normal operation of the medical devices and cause bad influence in diagnosis and treatment of patients. In this paper, we presented the method of protecting the computer-based medical devices from the malicious programs in Samsung Medical Center.

P2-62 대량 선별검사를 위한 자동화된 후각인지 테스트 시스템 개발

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This study proposes a RFID-based olfactory recognition test system which detects test start and identifies correct sample. The olfactory identification test system constitutes of hardware, software, and stimulator. RFID reader antenna is placed inside device body and RFID tags are inserted in the olfactory stimulus samples. Periodic scanning the tags detect test start and identify sample. Olfactory stimulus protocol considering odor type and concentration is under development.

P2-63 정원창 구동형 보청기를 위한 진동체 구현

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Recently, many people have researching into hearing aids for persons who has difficulty in hearing. Among of them, round window driving type hearing aid has many advantages in comparison with middle ear implantable hearing aids and others. The transducer for the round window driving type hearing aids must have sufficient vibration. In this paper, the transducer for round window driving type hearing aid designed and implemented. And it has been confirmed that the transducer could transfer the sufficient vibration displacement to recognize the sound to round window.

P2-64 핵의학영상 판독용어의 로컬 단어 사전의 구축

황경훈
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It is difficult to settle the well-designed local vocabulary for imaging report in the hospital information system (HIS). One of the major reasons is the local vocabulary with poor contents have been used in the hospital. Thus, we mapped the locally used terms in nuclear medicine (NM) imaging report to the SNOMED-CT, which had been widely used in the electronic medical record system, for implementation of hospital information system. Preliminary construction of vocabulary dictionary was done by mapping of local terms to SNOMED-CT and LexCare Suite. Further study may be warranted.

Systems Biology, Physiological modeling

P2-65 소형, 저전력 무선통신 시스템을 이용한 진동 측정기 설계

유주연, 박근철, 전아영, 노정훈, 전계록
부산대학교 의학전문대학원 의공학협동과정

Falls, osteoporosis, and related fractures are a major public health problem worldwide and aging of populations. Physical exercise is recommended for the prevention and treatment of osteoporosis. The recent studies evaluated the influence of WBV(whole body vibration) exercise on the bone remodeling in animals. In this paper, the WBV is designed and the ultra-low power, miniaturized wireless system is suggested for the measurement vibration and acceleration in rats or plate of WBV. The low power consumption and miniaturization make that the system will be able to apply to other biological signals.

P2-66 유한 요소법을 이용한 반고리관의 어지럼증 연구

박창용, 유승현, 미시라, 정웅락, 김슬찬, 이희성
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The benign paroxysmal positional vertigo (BPPV) which comes from moving an otolith in endolymph is called as motion sickness. It is well known how the symptom appears physiologically. The fluid inside flows when stones are dropped down by gravity and the flow makes the cupula displacement. It is not known yet on the motion of the stone and the property of the cupula. This paper presents a finite element fluid-structure interaction model for the horizontal canal system of the inner ear. These simulations reveal how the cupula displacement depends on the activity of the stone and the trajectory of the otolith in the endolymph.

P2-67 폐정맥에 의한 심방조동 모사를 위한 수치적 연구

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This study virtually reproduced atrial tachycardia induced by electric perturbation in pulmonary veins. For this purpose, we simulated electrical conduction in atrium by using electro-physiological model proposed by ten Tusscher(2006)and solving reaction-diffusion equation. Atrial reentry wave due to ectopic beat from pulmonary veins was numerically analyzed.

P2-68 생체시계 교란이 소동물의 뼈에 미치는 영향

주현륭[1], 정영진[1], 서동현[1], 고창용[1], 장영수[2], 배기호[2], 김한성[1]
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The aim of this study is to investigate effects of the disturbance in circadian rhythms induced by night-shift on bone microarchitecture. Fourteen mice were used and allocated into 2 group; NOR (normal) and NS (night-shift mimic). Morphological characteristics of bone were quantitatively evaluated at 0 and 6 weeks. Although there was no difference of trabecular bone between groups ($p>0.05$), MMI, Cs. Th and BMD of cortical bone for NS were significantly smaller at 6 weeks than those in NOR ($p<0.05$). These results showed that the disturbance in circadian rhythms might suppress a growth of the cortical bone.

P2-69 Spring-Mass 방정식을 활용한 3차원 심장 흥분-수축 기전해석

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Heart contraction is induced by electrical conduction in cardiac cells. Therefore, excitation-contraction coupling is important in the analysis of heart physiology. Existing finite element method requires too much computational time and resources. One alternative way to simulate the excitation-contraction coupling of heart is to use spring-mass equation for heart contraction. In this study we implemented the 3D heart contraction model coupled by the electrical excitation.

P2-70 혈관 형태에 따른 심근 분획 예비력(Fractional Flow Reserve, FFR)의 수치적 분석

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Fractional Flow Reserve(FFR) is known as a lesion-specific functional index which exactly shows stenosis of coronary artery. We implemented 2D model of blood vessel of coronary artery. The commercial program, ADINA, was used in the numerical simulation and FFR was computed by the ratio of lesion distal part blood pressure, about average aorta blood pressure, (). At this moment, we supposed that blood is an incompressible fluid, unsteady state, laminar flow and Newtonian fluid. Computed results showed the change of FFR according to stenosis shapeof blood vessel.

P2-71 Fibrosis 증가에 따른 2차원 심실조직의 전기전도 패턴 분석

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We present a computational study of reentry wave propagation in cardiac tissue according to the severity of fibrosis in the hypertrophic human ventricle. Fibrosis of myocardial cells caused by cardiac disease can induce ventricular fibrillation. By using electro-physiological model of ventricular cell from ten Tusscher et al. and applying reaction-diffusion partial differential equation, we simulated the reentry wave dynamics in 2D model. Fibrotic tissue in the model was implemented by decreasing diffusion coefficient. In the 40%~50% degree of fibrosis, cardiac fibrillation was induced.

P2-72 중환자의 혈당관리를 위한 혈당-인슐린 조절의 수학적 모델링 기법

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To establish the tight glycemic control for critically ill patient, it is required to achieve a shorter sampling interval for the measurement of blood glucose and a reduced workload of nursing personnel. The essential components of the closed-loop control of blood glucose are the continuous glucose monitoring and the safe control algorithm. Computer simulation study based on mathematical model of glucose-insulin regulation for critically ill patient presents the virtual experimental environment. This model can be applied to study the feasibility of closed-loop control of blood glucose and to evaluate the efficacy of the tight glucose control therapy.

P2-73 심방의 부위별 전기신호 해석을 통한 심방 세동 분석

정지훈, 심은보
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The purpose of the study is to find specific region that provides the source energy of atrial fibrillation. We used Poincare plot analysis and analyzed dominant frequency (DF) of artrial part. Based on the computed results, we showed that DF can be an important indicator to find source region of atrial fibrillation.

P2-74 dDTF 기법을 이용한 인간 해마의 기능 및 연결성 분석

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In human study the precise functional role and connectivity of the hippocampus in spatial memory and navigation remains indefinable. To investigate human hippocampus we recorded the intracranial EEG in the hippocampus of human that navigate to remember and find the location of shown object in the virtual environment. iEEG data was analyzed by direct Directed Transfer Function (dDTF) method. We found the dominantly different connections during learning between subjects. These results could propose a new potential connection mechanism of the human hippocampus, that is, the connection from the right to left hippocampus could help to process spatial memory and navigation.

U-Health, eHealth Technology

P2-75 3.5 세대 무선 네트워크를 통한 응급의료용 초음파 영상 전송 시스템의 구현

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We developed a system to transmit ultrasound images via wireless network (3.5G) for ubiquitous emergency healthcare in a reliable and effective way. Two minutes of the ultrasound images were acquired by emergency rescuers in order to confirm the presence of ascites. Then, the images were transmitted through Wibro (3.5G wireless internet) to the computer in front of the doctors. The key issue is how we can transmit a large size of image stream swiftly and safely through very limited and unstable network. We handled the limited bandwidth problem by encoding the ultrasound images in H.264 codec. We also solved the unstable wireless network problem by controlling data flow at the application layer directly based on TCP protocol.

P2-76 스마트 홈을 위한 비디오 기반 행위 인식 기술

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This paper presents a binary shape-based home human activity recognition system for smart homes. Our system uses Independent Component Analysis (ICA) on the Principal Component (PC) features followed by Linear Discriminant Analysis (LDA) to extract robust features from the video frames of some major home human activities such as walking, cooking, lying, exercise (i.e., dumb-bell), eating, and sitting-down on a sofa. Utilizing the features, recognition is achieved using each trained Hidden Markov Model (HMM) per activity. Our home activity recognition system achieves the mean recognition rate of 95.8%.

P2-77 등받이에 직각으로 배치된 능동 전극쌍을 이용한 동잡음 환경에서의 견실한 무구속 심전도 측정

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Development of high-fidelity electrocardiogram (ECG) measurement system is of great importance in U-healthcare solution. Active electrodes have been utilized to measure daily ECG but they are very susceptible to the motion artifact. In this paper, we propose a robust ECG measurement method using orthogonally-placed electrode pairs. The effectiveness of the proposed method was evaluated based on the signal availability. 20% more periods were available compared to the conventional lead using method.

P2-78 운동잡음의 영향을 최소화한 손목형 심박수 감시장치

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Real time bio-signal monitoring technologies hold a significant role towards ubiquitous healthcare. Obtaining heart rate information using PPG is one of the most common bio-signal monitoring systems. Nevertheless, PPG sensor signals are easily corrupted by the motion artifacts during exercises and movements. Thus, in this paper, we present a development of a wrist PPG module comprising an automatic stable PPG region detection algorithm using wrist PPG signals and noise references to overcome this limitation.

P2-79 독립적인 진단, 치료 프로그램들을 통합하기 위한 GUI설계 및 프로토콜 제작

최진규, 허현
㈜솔고바이오메디칼 의공학연구소

The purpose of this study is on the design of a supervisory program. The aim is to manage implementation effectively. This supervisory program will manage an independent diagnostic and treatment programs. Users easy access to individual programs by the independent diagnostic results of individual files can be obtained. Finally, using the results files are used for integrated diagnostics. Different programs to share data easily accessible information to other users file management program was developed based on integration. In addition, the diagnostic program, each protocol was designed to perform seamlessly. Diagnostics through the results of each file is obtained, the resulting file using the Constitution to perform diagnostics, the Constitutional Diagnosis was made.

P2-80 U-헬스 모니터링 시스템에서 무선통신 신뢰도 향상을 위한 NAK-based SR ARQ 기법

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We previously reported a U-Health monitoring system that used a short-range wireless Zigbee network. In this paper, a method of improving communication reliability was investigated. Among several candidates, ACK-based ARQ is simple and has a good performance. However, receiving ACK for every packet imposes too much load for the U-Health monitoring System that uses limited wireless channels. Therefore, a NAK-based ARQ technique was proposed.

P2-81 경혈 자극을 위한 경량 전자기 프로브 코어의 최적화 형상 연구

김효신, 허현, 최진규
(주)솔고바이오메디칼

This study shape the core of the electromagnetic probe for stimulation to acupoints was in order to optimize. Using the power of the coil and the basic size is fixed. Only the core of the coil geometry and finite strain analysis simulation software was FEMM3.3.
As a result, the bottom of the top 5mm 1.5mm conical core of the virtual value of the output showed 16000 Gauss.

P2-82 XML 웹서비스(Web service)를 이용한 이기종의 유헬스 데이터 통합 시스템 설계 및 구현

심훈[1], 박선아[1], 박재현[1], 황성오[2], 윤영로[1]
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In this paper, U-healthcare data integration system has been designed and implemented using XML web service and ASP.NET 2.0. The implementation shows the proposed method could integrate the information from the devices based on different platforms.

P2-83 전신 경혈 위치 정보 가이드 프로그램

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A study on acupuncture point locations of whole body is not enough. In this paper, therefore we make Guide Program to inform acupuncture point locations of whole body. This program show that picture of acupuncture point locations and descriptions of acupuncture point locations.

P2-84 수면 중 무구속적 심전도 측정 및 자세 검출 알고리듬

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It has well known that sleep posture affects the respiration during sleep. Therefore, detection of sleep posture is important to prevent sleep disorders such as snoring and apnea. We measured electrocardiogram(ECG) without direct skin-contact using capacitively coupled electrode for four sleep postures; supine, prone, right lateral and left lateral posture. We established sleep posture detection algorithm using the differences of the ratio between QR amplitude and RS amplitude.

P2-85 피팅 기술을 이용한 중심체온 추정 방법의 평가

심수영[1], 백현재[1], 박광석[2]
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[2]서울대학교 의과대학의공학교실

'Zero-heat-flow method' is the most commonly used device for measuring core temperature noninvasively. This method was developed basing on thermal equilibrium theory and requires more than 15 minutes to attain saturation level. Trend line fitting technique is useful in estimating the final result with limited amount of inputs. Therefore, in this study, possibility of applying fitting technique in core temperature measurement is evaluated.

P2-86 U-헬스를 위한 개인건강정보관리 시스템 구축

박재현[1], 심훈[1], 박선아[1], 황성오[2], 윤영로[1]
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In this paper, we developed web site for healthcare using .Net framework and ASP.NET 2.0. This website provided to members health condition from several health monitoring devices. So, members can check and ask to their consultation doctor in every time and everywhere. This website can help people enjoy their healthy life.

P2-87 허벅지-허벅지 경로를 통한 체임피던스 측정법: 싱글슬라이스 CT와의 비교

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[3]상지대학교 보건과학대학 한방의료공학과
[4]서울대학교 의과대학

In the former study, we proposed a new method measuring body impedance using thigh-to-thigh current path, which can reflect abdominal fat portion more sensitively. The effectiveness of the method was studied by comparing with the conventional foot-to-foot and hand-to-foot current paths referenced to single-sliced computed tomography (CT) image analysis. Measured body impedances were compared with visceral fat area to subcutaneous fat area ratio (VF/SF) calculated from fat of abdominal CT single images with different sites. The thigh-to-thigh current path showed higher correlations than other current paths between L2-L3 level and L4-L5 level.

P2-88 생체 인식 시스템을 위한 심전도 개인인식 알고리즘 개발

이상준[1], 김진권[1], 이영범[1], 김정국[2], 이명호[1]
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[2]명지대학교

본 논문은 심전도를 이용한 생체 인식 알고리즘에 관한 것으로, 지문인식, 홍체인식, 얼굴인식 시스템과 달리 생체 신호를 사용한 인식 알고리즘 및 시스템은 최근 소수의 연구자들에 의해 연구되어 왔다. 기존에 소개된 심전도를 이용한 개인 인식 알고리즘은 심전도의 특징을 추출하여 분석하는 방법과 심전도의 형태를 분석하여 인식하는 방법으로 나뉘는데, 본 논문에서 제시하는 ECG를 이용한 개인 인식 알고리즘은 인식률을 높이기 위해 심전도의 특징과 형태학적 분석을 동시에 수행한다. 본 알고리즘의 구성은 트레이닝 부분과 테스트 파트 두 부분으로 나뉘고 트레이닝 파트에서는 데이터들의 특징을 추출하는 부분과 형태학적 분석을 위한 주성분 분석(Principal Component Analysis) 부분으로 구성된다. 트레이닝을 위해서 우선 인식후보 심전도의 P, Q, R, S, T, U의 특징 중 R-R간격(Heartbeat: 심 박)을 분리하였고, 심전도특징을 추출하기 위해 100% 검출 가능한 심 박 간격, 심 박 데이터 중 최대값, 심 박 데이터 중 최소값 3가지의 특징을 사용하였다. 또한 형태학적 분석을 위해 심 박 간격을 분리한 데이터들의 주성분 분석을 수행하여 인식 후보 군들의 고유 심 박 파형을 만든다. 실험에서는 MIT-BIH Normal Sinus Rhythm 의 18개 데이터 군을 선정하였고 트레이닝을 위해 각 18개의 데이터 군에서 100개의 심 박을 추출하였다. 이중 10 ~ 40개 심 박은 트레이닝 데이터로 사용하였고, 90 ~ 60개까지 심 박은 테스트 데이터로 사용하였다. 실험결과 형태학적 분류에 의해 선정된 인식 후보 군이 7개이고, 트레이닝 데이터 샘플이 40개일 때 90.37%의 높은 심 박 인식률과 100%의 심전도 인식률을 보였다. 차 후 2-Leads 심전도 시스템과 연관 하여 실험한다면 개인인식을 위한 유용한 알고리즘이 되리라 판단된다.

P2-89 선형가속 암치료기의 MLC(Multi Leaf Collimator) 보수유지 방법 개선

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[2]울산대학교 의과대학 의공학교실

The linear accelerator systems are used for curing a cancer that could be treated by radiotherapy. The multi leaf collimator is necessary and important part at the linear accelerator system. But, failures in the linear accelerator system are steadily growing. In this thesis, we are going to find out the appropriate solution of troubleshooting.
It is expected that thesis will make efficient management.

P2-91 나노기술기반의 웰니스 섬유전극을 이용한 생체신호 측정시스템 개발

김태의[1], 위헌[1], 오동인[1], 윤선[2], 김갑진[2], 우응제[1]
[1]경희대학교 동서의료공학과
[2]경희대학교 고분자섬유신소재과

Textile electrodes based on nano-fiber technique are a new, potential choice for bio-signal measurements. In this research, different kinds of conductive polymer sensors were compared in order to measure bio-potential accurately. We developed PSB(physiological sensing belt) and ECG sensor using wellness textile which could be used for monitoring her/his own physiology anywhere and anytime. Bio-measurement system consisted of 4 channel PSB and 1 channel ECG measurement circuit with those sensors.

P2-92 타격목표 인디케이터를 포함한 훈련용 디지털 태권도 트레이너의 개발

송영록[1,2], 고영환[3], 이호재[1], 이상민[1,2]
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[2]인하대학교 정보전자공동연구소
[3]㈜에치티아이

In this research, we developed a digital taekwondo trainer system based on the electronic protector was authorized by the World Taekwondo Federation for the improvement of user's training effects and athletic performances. Our system consists of e-kick bag with sensors for sensing hits, taekwondo trainer program and receiver for interconnection of e-kick bag to program. Taekwondo trainer system also has an advantage to improve training effects and athletic performances such as hit-accuracy and response time by appointing a hitting target for users with 6 LED indicators.

P2-93 DAMV를 이용한 활동량 평가

박경태, 박은주, 김지혜, 정동근
동아대학교 의과대학 의공학교실

In this paper, we proposed a useful method to extract physical activity using a triaxial accelerometer. A Difference Absolute Mean Value (DAMV) was used as a evaluation method. The DAMV was calculated for each window of 0.5, 1, 5 and 10 second. We showed that DAMV was enlarged according to increase walking speed and the bandwidth of the filter. In a ubiquitous computing environment, DAMV could be a useful algorithm for the activity data management.

P2-94 디지털 태권도 트레이너 시스템에서 타격패턴 분석이 가능한 태권도 트레이너 프로그램의 개발

송영록[1,2], 황태현[1], 이호재[1], 이상민[1,2]
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In this paper, we developed a taekwondo trainer program is available to analyze hitting-patterns for the improvement of user's training effects in the digital taekwondo trainer system. The taekwondo trainer program is a user interface to provide training courses such as progress training of response time and stamina, preparation training for real sparring by training scenario. It has also characteristics which are to strengthen and supplement user's pros and cons by analyzing hitting intensity and accuracy from training.

P2-95 계단 하강시 3차원 모델링을 이용한 체성감각자극 유무에 따른 관절 부하량 분석

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The purpose of this study was to estimate the joint loading changed by somatosensory stimulation during stair descent. Motion capture data were collected by 3D optoelectric motion tracking system that utilizes active infrared LEDs and near infrared sensor and force plate. Subject performed a stair descent in four conditions. The obtained motion capture data was used to build 3D computer simulation model to estimate joint loading. The joint loading was changed with somatosensory stimulation conditions.

POSTERS III

KOSOMBE

Biomedical Engineering Education and Career

P3-01 정형용 임플란트의 미국 FDA 510(k) 등록을 위한 인허가 전략

권경제, 김종택, 조성윤
유앤아이㈜ 부설 연구소

Responding to the rapid growth of global medical device industry, the number of Korean medical device manufacturers is gradually increasing, who intends to expand their business into the largest US market. In many cases, they seem to have difficulties in clearing FDA's product registration processes, because FDA regulations are different from and in some aspects more stringent than the KFDA's. In this article, the FDA premarket notification – widely known as 510(k) – procedure of orthopedic implants is presented. Understanding the specific FDA regulatory requirements and presenting performance test results that meets the applicable FDA requirements, guidance and/or other international standards are important for successful clearance.

P3-02 전동식 운동기구를 이용한 운동패턴에 따른 근력 효율에 관한 연구

강승록[1], 김경[2], 정구영[3], 서영범[4], 정장식[4], 김정자[5], 권대규[5]
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[5]전북대학교 바이오메디컬공학부, 고령친화복지기기연구센터

This study is to compare muscle strength between isotonic exercise and isotonic & isokinetic exercise. Participants are 10-man and 10-woman whom they are healthy without medical history in shoulder and knee joint. We performed experiment total 4-weeks that exercise 3-days a week each exercise pattern. We measured shoulder and knee joint torque with BIODEX once a week. The result showed that isotonic & isokinetic exercise pattern significantly improved muscle strength than isotonic exercise pattern. Because that isotonic & isokinetic exercise pattern supplied muscle strengthen and caused muscle contraction. This exercise pattern can be used new exercise training method for major athlete and normal people. Also this pattern can be used rehabilitation treatment.

P3-03 전신진동이 인가된 인체의 하지 근력 특성분석

강승록[1], 김경[2], 정구영[3], 민진영[4], 김정자[5], 권대규[5]
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[2]전북대학교 의용생체공학과
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This study is to investigate the effect of muscle strength in whole-body vibration. We performed experiment with 30-subjects and divided two groups. One group is training group with whole-body vibration; the other is control group with non-vibration. Training group is supplied with whole-body vibration 4-days a week and proceeded total 8-weeks. The results indicated that knee joint peak torque improved significantly in training group when knee extension and flexion using BIODEX unlike control group. Because that whole-body vibration may keep muscle tension and stimulate muscular fiber. This study can be used new training mode to normal people and rehabilitation or the elderly

P3-04 컬러감성조명을 구현한 감성샤워기의 인체생리 반응변화에 관한 연구

진혜련[1], 유미[2], 김형지[2], 김미나[4], 송성미[4], 진배동[3], 권대규[4]
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[4]전북대학교 바이오메디컬공학부, 고령친화복지기기연구센터

본 연구는 컬러와 조명을 활용하여 구현한 감성조명 샤워기를 제작하고, 인간에게 실제적으로 영향을 줄 수 있는 감성 평가에 관한 연구를 정량적으로 검증하고자 한다. 인간은 감성의 영향을 심리적 영역을 넘어서 생리적 영역까지 연구되고 있고, 감성디자인, 감성마케팅, 감성공학 등 모든 분야에 감성의 키워드가 중요시 되고 있는 실정이다. 감성에 심리적, 생리적, 물리적 영향을 주는 핵심적인 요소는 컬러지각이며 이는 컬러와 빛 또는 조명을 통해서 이루어진다. 컬러감성 조명을 구현한 감성샤워기에 대한 정량적 연구를 위해서 실제적인 실험환경을 조성하여 인체생리 신호 즉, 심박변이율, 적외선 체열, 맥박 등의 변화를 분석 고찰하였다.

Biomedical Robotics

P3-05 자기 추력을 이용한 자성체의 가속도와 코일 전류의 관계

하용현, 한병희, 조민형, 이수열
경희대학교 전자정보대학 동서의료공학과

The magnetic propulsion moving a magnetic device inside a human body is very important issue in that the micro robot without a power source can be moved by magnetic propulsion to the target position as a cancerous tissue. In this paper, we have analyzed the relation ship between the coil current and, the acceleration of a magnetic body which affects the controllability of the motion of a magnetic device.

P3-06 MRI 시스템의 자기추력을 이용한 혈관 팬텀 내 자성체 이동

하용현, 김동인, 한병희, 조민형, 이수열
경희대학교 전자정보대학 동서의료공학과

The motion control of a small magnetized device using the magnetize propulsion of MRI gradient coils has an advantage of imaging which in helpful for the finding of a magnetize core inside a living body. In this paper, we have analyzed the effects of magnetic core -sizes and MR gradient strengths inside the tube phantom mimicking blood vessels in a clinical 3.0T MRI system.

P3-08 편마비 환자의 상지 재활훈련을 위한 근전도 기반 외골격 훈련시스템 개발

이민현[1,2], 손종상[1,2], 김정윤[1,2], 김영호[1,2]
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Exoskeleton system for human have been developed to assist in improving upper and lower extremity function in patient with paralysis due to cardiovascular accidents. The proposed exoskeleton system is controlled based on the EMG signals and the elbow joint torque. Motor of exoskeleton could control the joint motion according to the EMG signals which were acquired from two major muscles around the elbow joint. EMG-based control method can give active assistive exercises without therapists. In this study, EMG-based exoskeleton system was developed and tested for subjects with normal and hemiplegic patients.

P3-09 압력 센서가 내장된 맞춤형 인솔이 단하지 보조기에서의 보행에 미치는 영향

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This study is to assess the effect of customized insole included pressure sensor on active ankle-foot orthosis from signal change according to gait cycle and foot pressure distribution and electromyogram during gait. Before experiment, we manufactured customized insoles of each subject using 3d-footscanner(Pedcad Gmbh, Germany) and measured foot pressure distribution, electromyogram by pedar-x system(Novel Gmbh Inc, Germany) and MP150 EMG module(BIOPAC System Inc, USA). The results of experiment showed that customized insole included pressure sensor on pneumatic ankle-foot orthosis display distributed foot pressure of the whole sole and decreased muscle activity in gastrocnemius during gait.

Tissue Engineering and biomaterials

P3-10 천연(Fibrin, Gelatin)/합성(PEG-dA) 하이드로젤을 이용한 골세포 성장인자(BMP-2)의 방출거동 비교 및 Heparin 도입을 통한 BMP-2의 안정성 평가

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Bone Morphogentic Proteins (BMPs) have been successfully used for osteogenesis as an osteoconductive and osteoinductive factor by being treated in media exogenously, they have a disadvantage due to short half-life of biological activity. In order to prolong the activity of BMPs, many studies have reported various delivery carriers or binding molecules such as heparin that were subsequently applied to bone tissue engineering. Herein, we evaluated natural (fibrin gel and gelatin) and synthetic(PEG-dA) hydrogels for BMPs delivery. And we also observed a heparin effects on BMPs release by investigating osteogenic differentiations of adipose-derived stromal cells (ASCs).

P3-11 전압원을 이용한 광대역 생체 임피던스 스펙트로스코피 시스템

맹효열, 유필중, 이대현, 오동인, 우응제

경희대학교 동서의료공학과

Most bio-impedance spectroscopy (BIS) systems inject sinusoidal current with a variable frequency into a sample through a pair of electrodes and measure induced voltage on a separate pair of electrodes. Impedance spectra are acquired in a certain range of frequency. We found that its accuracy decreases at high frequencies primarily due to the deteriorated performance of the constant current source at high frequencies. In this study, we propose a design of a wideband BIS system using a constant voltage source. It is based on the simple voltage division between an internal resistor and an external sample or load. We describe the design, construction and performance of the new BIS system with 468Hz to 2.2MHz bandwidth.

P3-12 마이크로 파이버 및 파티클을 제작하기 위한 원형 미세 유체 칩의 설계와 제작

강 에드워드, 이상훈

고려대학교 보건과학대학 생체의공학과

In this paper, we introduce a novel cylindrical channel that generates coaxial flow without using glass microcapillary or complicated silicon processing. The fabrication of microparticles and microfibers using this channel is demonstrated.

P3-13 약물방출 스텐트용 초음파 분사법에 의한 고분자 코팅 공정 최적화

장부남[1,2], 강종희[1], 최지연[1], 이봉수[1], 박귀덕[1], 노인섭[2], 한동근[1]

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Bare metal stents (BMS) often cause a condition called restenosis due to the buildup of scar tissue around the stent. Polymer coating process of ultrasonic spray including ultrasonic atomization systems has well known with one of technologies for surface coatings of implantable devices. In order to control the roughness and thickness of PLLA and PLGA coated on stainless steel 316L stent, we have utilized ultrasonic spray method. This method has enabled vibration frequency, gas pressure and solution concentration to regulate droplet size of spray and coating time. We have optimized the polymer coating conditions for constructing upper surface smoothly for drug-eluting stents (DES).

P3-14 동물세포성장 향상을 위한 생물활성용액의 최적농도에 관한 고찰

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The purpose of this study is to investigate influence of organism activation solution (OA solution) on the animal cell. We investigated reactions on the MG-63 cell in the mixture with OA solution and DMEM-HG. The Cell was incubated for 21days and the MTT assay is used for cell viability test. The result showed that growth rate of cell was rapidly increased after 6days and the optimal range of mixture with DMEM-HG and OA solution for cell culture is 12%~15%. Besides, the maximum value of growth ratio could be observed at 15% and it was fourfold as compared with control group(0%).

P3-15 프로그램형 약물전달을 위한 조립형 튜브 디바이스

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With the increasing interest in biomedicine, the research based on the drug delivery system (DDS) attracts a great deal of attention in both industry and academia. Across DDS, polymeric devices have been widely studied, where sustained drug delivery is of great interest to improve drug bioavailability and reduce dosage schedules, hence better patient compliance. However, in most of polymeric systems, programmed drug delivery (e.g. pulsatile drug delivery) could not be easily achieved since the drug is often released simply through polymer matrix, a rate limiting barrier. Therefore, in this work, we prepared tubular devices filled with either biocompatible polymer or a drug and assembled them in a way that depending on the length of the tubes filled with polymer, the times for the drug to get released could be accurately tailored. We prepared four different types of assembled tubular devices and their drug release studies are now in progress.

P3-16 락타이드의 개환중합에 의한 생체적합성 금속 표면의 코팅 접착안정성 향상

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There is a delamination of the sub-micrometer scale between polymeric layer and metal surface after electrospray coating. This separation inhibits interfacial adhesion between them, leading to unstable state in their adhesion. We introduced nanocoupling concept by the grafting method such as surface-initiated polymerization. L-lactide was grafted by surface initiated-ring opening polymerization from the hydroxyl group generated by oxygen-plasma discharge on stainless steel. Subsequently, poly(L-lactide-co-glycolide acid) solution is coated onto the polymeric layer-grafted metal surface by electrospraying for fabricating robust and bulky film for biomedical implants including drug-eluting stents.

P3-17 투과전자현미경을 이용한 생분해성 Mg-10%Ca 합금의 in-vitro 부식 메커니즘 연구

정재영[1], 권상준[2], 양귀복[3], 이지영[1], 조성윤[1], 양석조[4], 김영율[5], 김유찬[3], 석현광[3], 안재평[2]
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Biodegradable Mg-10%Ca binary alloy was cast and corroded in Hanks' solution for the evaluation of in-vitro corrosion. The corrosion mechanism was investigated by electron energy loss spectroscopy (EELS) and energy dispersive spectroscopy (EDS) attached on transmission electron microscopy (TEM). Mg_2Ca phase in lamellar structure was first attacked in Hank's solution. In the corrosion of Mg_2Ca, Ca rather than Mg diffused out and oxygen diffused in. As the results, the Mg_2Ca phase was transformed to nanocrystalline MgO. The eutectic Mg particle consisting of Mg-Ca alloy was also corroded but the corrosion rate was very slow on the particle surface.

Orthopedic and Rehabilitation Engineering

P3-18 가상의 팔을 통한 신체 소유감 착각유도에 대한 실험적 증명

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Because we have body ownership, we perceive our body as an object distinct from the external world. In previous research, visual and tactile were used for method to manipulate the body ownership. In this study, using virtual reality technique, we try to induce body ownership through the Agency and try to measure body ownership by objective and subjective method. As a result, when human has the Agency, we proved that human has body ownership to virtual arm, which opened up the possibility that an entire virtual body could be felt as one's own in virtual reality application or online game.

P3-19 인공고관절의 걸음걸이에 따른 기계적 안전성 평가를 위한 유한요소 해석

한성민[1,2], 추준욱[1], 전흥재[2], 김정성[3], 최귀원[1], 윤인찬[1]
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THR(Total Hip Replacement) is useful therapy technique for the arthritis, rheumatism, congenital malformation and traumatic arthritis. However, excessive walking load in the hip implant causes the periprosthetic fracture, prosthetic failure and recurrent dislocation. In the present works, the stress under the wakling load are analysed using the finite element mathod and the mechanical safety evaluated for the hip implant.

P3-20 유한요소 모델을 이용한 슬관절 굴신에 따른 재건된 전방십자인대의 생체역학적 분석

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The aim of this study is to analysis the biomechanical properties of reconstructed ACL bundles during different knee flexion angles. Impingement between reconstructed ACL and surrounding structure causes a limitation of ROM resulting in failure of graft material. With a base of this concept, we intend to qualitatively and quantitatively analyze the impingement phenomenon between ligament by ligament or ligament by surrounding bone according to degree of knee flexion using finite element model (FEM) analysis.

P3-21 호핑 시 착지방법에 따른 leg stiffness 변화

이정주[1,2], 김정윤[1,2], 이희영[1,2], 손종상[1,2], 황선홍[1,2], 박선우[1,2], 김영호[1,2]
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When humans hop in place or run forward, they adjust leg stiffness to accommodate changes in stride frequency or surface stiffness. Leg stiffness can be defined as the ratio of ground reaction force (GRF) to Center of Mass(COM) displacement, joint stiffness can be expressed as the ratio of joint moment to joint angular displacement using torsional spring model. The purpose of the present study was to determine how humans adjust leg stiffness over the difference between soft landing and stiff landing. Stiffness of soft landing was compared with that of stiff landing.

P3-22 족관절 외골격 보조기를 착용한 노인의 족저굴곡 토크 보조 특성 분석

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This study was to analyze the assist characteristics for the plantarflexion torque in elderly adults wearing pneumatically powered ankle exoskeleton. To find characteristic of platarflexion motion, we compared a muscular stiffness force of a soleus muscle and isokinetic plantarflexion torque between each 15 young and elderly adults. The experimental result showed that a muscular stiffness force of a soleus muscle with control was reduced and plantarflexion torque of an ankle joint only wearing ankle-foot orthosis was reduced but a plantarflexion torque with control was increased.

P3-23 RFID 재활블록 시스템의 개발

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Stroke is the second leading cause of death, and causes the disorders of sensation, motor function, cognition, and language. This study proposes a rehabilitation system utilizing the rehabilitation blocks automated by RFID (radio frequency identification) technique. The application program in the host PC detects the movement of the blocks, tracks the game flow, and calculates their time intervals. The time intervals are decomposed to upper limb function and cognition terms. The application program was implemented and tested with four healthy subjects, with the mouse interface to simulate the RFID reader units. Each game phase was traced without any difficulty.

P3-24 공압액추에이터를 이용한 하지 운동 상관관계에 대한 연구

이호준[1], 강승록[1], 김재준[1], 김경[2], 정구영[3], 김정자[4], 권대규[4]
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This study is to investigate correlation between weight load and air pressure load for lower limbs muscular activity. The subjects are all 10-people who are healthy. Exercise performed 3-days a week and measurement is once a week. We measured rectus femoris, biceps femoris, tibias anterior, gastrocnemius for muscular activity of lower limbs. The result is that muscular activity in lower limbs is similar significantly regardless of load pattern. But 4-weeks of exercise later, muscular activity in air pressure load is higher than weight load. We indicated that exercise instrument using air pressure load is enough to create exercise effect and more safety. Finally by using air pressure load we create new type healthcare instrument for healthy man and elderly.

P3-25 전신 수직 진동이 자세 균형능력에 미치는 효과에 관한 기초연구

정구영[1], 김경[2], 김재준[2], 강승록[2], 민진영[3], 김정자[4], 권대규[4]
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This paper is to investigate the effect of postural balance ability on whole-body vertical vibration. We perform experiment with 30-subject and divided two group. One group is training group with vibration the other is control group with non-vibration. Training group is supplied with whole-body vertical vibration 4-days a week and proceeded total 8-weeks. The results indicated that whole-body vertical vibration can enhance the postural balance ability. This study can be used new training mode to normal people and rehabilitation or the elderly.

P3-26 피부에 완전 이식된 마이크로폰의 전기적 등가 모델

정의성[1], 이장우[1], 신동호[1], 우승탁[3], 성기웅[2], 이정현[4], 조진호[1,2,3]
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The frequency response of the implantable microphone placed under human skin tissue should be considered to optimize the performance of fully implantable hearing devices. But it is difficult to measure the output characteristic of the implantable microphone. Therefore, it is useful that development of estimating method for output characteristic of the microphone implanted under the skin by simulation. In this paper, we proposed the electrical model of the implemented implantable microphone to analyze the frequency response changed by skin tissue and diaphragm size. And we verified that the simulated results are similar with the experimental.

P3-27 Visual Contribution Effect on Postural Control with Aging

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The present study analyzed the postural control using stabilometry device and our aim was to check whether visual contribution on postural control changes with aging. Romberg's test comprising 30s of recording with eye-open and 30s of recording with eye-closed was performed by total 63 healthy subjects (age: 18-67). Romber's index (RI: reflects visual contribution on postural control) of center-of-pressure (COP) based parameters were analyzed and RI of total length (TL: reflects postural control efficiency) was significantly decreased in elder people group. This could indicate that more visual contribution is required due to deterioration of other functions for maintaining postural equilibrium with aging.

P3-28 골재흡수 억제제 및 항암제의 생체역학적 치료 효과 검증을 위한 복합빔 이론의 유용성

이주형[1,2], 박선욱[2], 전옥희[2], 김한성[2], 김지현[2], 전경진1, 임도형[1]

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Our aim of study is to identify whether or not Engineering Composite Beam Theory (ECBT) is useful to evaluation of biomechanical efficacy of Ibandronate and Paclitaxel used for treatment of metastatic bone tumor

Cardiovascular Engineering

P3-29 시간-위치 상수를 기반으로 제어되는 비선형 엑츄에이터에서 부하 및 환경의 변화에 의한 박출량 변동

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The pulsatile ventricular assist device should maintains the blood outflow. Due to the structural limitations of pulsatile pump, the power consumption of actuator have different values according to the periods of blood inflow and outflow. In addition, because the actuator presses against the blood sac and retract without contact with other substance repeatedly, the relation of output power and blood outflow is not linear. In this paper, It was possible that stable operation for abrupt load or physiological change based on time-position at moving time.

P3-30 심탄도 신호를 이용한 혈압 추정 시스템

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We developed a novel technique for estimating systolic blood pressure (SBP) based on electrocardiogram (ECG) and ballistocardiogram (BCG). The BCG was non-constrainedly measured using a weighing scale type sensor, and as a BP correlated parameter, R-J interval, which was defined as the time difference between the ECG R-peak and BCG J-peak, was employed for evaluating and estimating beat-to-beat BP. Under a BP varying experiment with a Valsalva maneuver, the R-J intervals were calculated at every beat and a systolic blood pressure estimation equation was established using linear regression analysis.

P3-31 판막의 개폐시 임피던스 변화에 따른 개폐시간 측정기법 개발

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강원대학교 기계의용공학과

The opening time of aortic valve can be measured by using vascular impedance from the artery to the skin above ventricular muscle. To measure the opening time of aortic valve we developed the impedance measuring system that has the 40 kHz alternative current generator, low noise sinusoidal oscillator, precision voltage-current converter, Preamplifier, analog filter-amplifier, controller, control program, external monitoring program and analyzing program. We did in-vitro experiment to evaluate its efficacy and accuracy.

P3-32 유한요소법을 이용한 재료별 스텐트의 기계적 특성 평가

이승열, 김학진, 김헌영
강원대학교 기계의용공학과

In this paper, Radial stiffness, Flexibility and Foreshortening of Performance evaluation for the stent were studided by deformed analysis. Exsiting studys have put emphasis expansion behavior and mechanical properties of stent. But, The focus on this study is the effective evaluation for respective meterial at expanding stent. FEM analysis is useful for analyzing the relationship between stent structure and stent material and will contribute to development of new stents.

P3-33 협착관내 유동에서 협착 전후단의 차압측정방법과 MRI data의 적용

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Pressure is one of the most important elements for analysis of fluid dynamics. Blood pressure has an influence on blood vessels and blood dynamics. Furthermore pressure difference gives information about blood flow like an energy loss. Unfortunately, it is difficult to measure pressure or pressure difference in vessels. The simplified Bernoulli equation is used to calculate the pressure difference in many clinical situations, but it has unrealistic limitations. For realistic pressure difference measurement, we got the data of pressure difference from experiments and drove formula.

P3-34 콘덴서 마이크를 이용한 혈압 측정법

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Blood pressure is one of important indicators in order to diagnose cardiovascular disease. In blood pressure measurement, ausculatatory method is gold standard method. In order to apply auscultatory method to automatic blood pressure measuring devices, several weaknesses are needed to resolve. For instance, a exposed sensor or microphone should is placed on the brachial artery with the cuff and is easily affected by the background noise during measurement. In this study, we suggest is to measure blood pressure using an built-in condenser microphone for compensating weakness of auscultatory method and simple measurement.

P3-35 가속도와 심전도를 이용한 자세 구별 및 에너지 소모량 추정

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The purpose of study is to separate posture and to estimate energy expenditure using acceleration and electrocardiogram. The experiment was processed in laboratory environment by the designed protocol. Acceleration and ECG were acquired, and gas analyzer was used for getting reference metabolic rate during the experiment. Data of acceleration and ECG was segmented, and then each segment was classified to static or dynamic activity in first step. The static activities were separated to postures such as lying, sitting, and standing. Finally, estimating equation of energy expenditure was derived through linear multiple regression analysis of data set for dynamic activity.

P3-36 적응필터를 이용한 60Hz 잡음 제거

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Recently, because of the importance of removing 60Hz noise, when ECG recording device is developed, DRL circuit is applied for elimination of the noise. In spite of using the noise removal circuit, components which have non-ideal characteristic make the noise remains. The remaining noise is distorted during the DRL signal and input noise signal is combining but still is correlated with the input noise. By using this redundant noise as a reference of the adaptive filter, the 60Hz noise can be removed effectively. The goal of this study is to remove the power-line interference from ECG measurement using adaptive filter and DRL signal.

P3-37 수축기 혈압과 광용적맥파 구성성분간의 상관성 증진에 관한 연구

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Photoplethysmography is invasive technology that measures indirect blood volume, and monitors cardiovascular, respiratory activity, and assessment of autonomous nervous system through vasomotive. The mechanism of PPG is similar to blood pressure, and there are various researches for estimating blood pressure. Main factors of PPG are PPG amplitude and pulse arrival time. Previous researches proposed estimation-algorithms based on multiple linear regressions, it should have high correlation coefficient between systolic blood pressure and factors in PPG. The aim of this is investigated valid period for improving correlation coefficient.

P3-38 벡터 심전도에서의 비정상 비트 검출

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In case of rarely occurred arrhythmia, it is difficult to diagnose in the short time observation. Usually, expert diagnoses arrhythmia using long term data but checking the long term ECG data directly is very inefficient. In this paper, an abnormal signal was detected using a comparison of trajectory between normal VCG(Vectorcardiogram) and abnormal VCG. And it can use a diagnosis of the arrhythmia due to recorded abnormal signal.

P3-39 시변 대리자료를 이용한 수면 구조에 따른 RR 간격의 비선형성 분석

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A method to test nonlinearity in nonstationary biomedical signals is presented and applied to RR-interval recorded during sleep. The method is based on identification of time varying autoregressive models through expansion of the time varying coefficients onto a set of basis functions. It is combined with time varying sample entropy discriminating statistic to assess nonlinearity. The recordings of the electrocardiogram were acquired from MIT/BIH polysomnography database. Nonlinear dynamics were detected in all sleep data, especially when certain sleep stage was sustained for a long time.

P3-40 Pressure Recording Analytical Method(PRAM)기반의 Cardiac Output 추정을 통한 유산소운동능력 측정

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The purpose of this study was to suggest the method of measurement for aerobic exercise capacity using cardiac output (CO) derived from PPG signal. In order to measure CO from PPG signal, we used the pressure recording analytical method (PRAM). For this experiment, 6 healthy university students who have variety exercise capacity participated in the research. By given protocol, they run on the treadmill for 5times. After each exercise, we got a PPG signal from the Finometer(Finapres Measurement Systems). We show that the slopes of person who have strong exercise capacity from evaluation of CO at each exercise gentler than that of people who have not.

P3-41 전기 임피던스 측정을 통해 아테롬성 동맥경화증 진단을 위한 *in vivo* 전극 설계

조성보
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For an early diagnosis of atherosclerosis, the use of balloon impedance catheter in which the polymer-based flexible microelectrode arrays are integrated has been investigated. According to the inflation of balloon, the electrodes located at the balloon surface are close to the intima and contact to the inner vessel walls. In this situation, the impedance measurement of vessels can be determined not only by the tissue components but also by the electrode configuration. This article reports the penetration depth of intravascular impedance measurement with the electrode array of Wenner Alpha type with respect to the separation distance between the electrodes.

P3-42 양이 보청기를 위한 양이 효과 검증용 유무선 통신 및 제어 보드 구현

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The air conduction hearing aids are generally used rehabilitation device for hearing impaired person. Recently, the usefulness and convenience of binaural hearing aids are enlarged by the wireless communication technique. In this paper, we design and implement the development board for binaural hearing aids chip. The implemented board has DSP, FPGA and communication module. We can design and verify the algorithm and HDL code for binaural hearing aids chip in the implemented board.

Medical Imaging

P3-43 초음파 영상 기반의 초음파 속도 추정

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Due to phase aberration in soft tissues, using a constant sound speed during dynamic receive beamforming in medical ultrasound imaging leads to degradation in image quality. To enhance contrast and spatial resolution, sound speed needs to be estimated and utilized for receive beamforming. In this paper, a mean sound speed estimation method is presented based on image analysis. In the proposed method, multiple ultrasound images are generated by changing sound speed and evaluated to determine optimal mean sound speed. From phantom experiments, the proposed estimation method provides less than 1% error (i.e., 1470 m/s vs. 1460 m/s).

P3-44 화소단위 합성 집속 기법을 이용한 초음파 영상

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The display pixel based focusing (DPBF) method can remove blurring artifacts from scan conversion. However, when sector scan is used with DPBF, blocking artifacts occur as field of view increases. In this paper, a new compounded direct pixel beamforming (CDPB) method, which can eliminate not only blurring artifacts but also blocking artifacts, is presented. In this method, each display pixel is obtained by linear interpolation of two beamformed values from two adjacent scanline data. From phantom experiments, the proposed method provides a better image quality than the conventional and DPBF methods.

P3-45 Current injection이 Balanced SSFP Pulse Sequence의 Steady State Signal에 미치는 영향

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Magnetic resonance electrical impedance tomography (MREIT) uses the magnetic flux density generated due to current injection to produce conductivity images of an object. This magnetic flux density can be measured using an MRI scanner with a suitable pulse sequence. Balanced SSFP (b-SSFP) pulse sequence was recently proposed in MREIT. It offers higher SNR and high phase sensitivity to current injection. In b-SSFP pulse sequence, a certain number of RF pulses are applied before data acquisition to reach steady state. This number is dependent on flip angle, T1 and T2 value. In this work, we study the effect of current injection on the number of RF pulses required to reach steady state of b-SSFP signal.

P3-46 GPU가속기반 고속 디지털 스캔 변환을 이용한 초음파 영상의 구현

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The purpose of DSC(digital scan conversion) in a ultrasound imaging devices is to translate acquired data in non-cartesian coordinate into cartesian coordinate for image devices and processing. A commonly used in interpolation method for coordinate transform is simple like bi-linear interpolation cause of trade off image quality for speed. This study presents a GPU based high speed digital scan conversion for ultrasound images. Due to GPU's speed and parallelism, it is one of useful methods which can substitute for traditional DSP.

P3-47 X-ray 탄성 영상에서 조직의 상관성과 밀도를 이용한 변위추정법

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경희대학교 동서의료공학과

To finding of small cancerous tissues is important but hard to know the exact position in human breast. The x-ray elastography is a new attempt to find cancerous tissues by using the difference of stiffness between a normal tissue and a cancerous tissue. In this paper, we have calculated the displacement which is needed to find the elasticity in the breast-mimicking phantom by using the normalized cross correlation and the density of structural tissues.

P3-48 수직 프로파일의 통계특성을 이용한 Gel Image의 정렬

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As a result of the development of biotechnology, the images analysis technique for electrophoresis gels to analyze genetic information. For this purpose the location and quantity of each band in a lane should be measured. But some case the image is tilted. In that case the work for search a lane is difficult. In most of existing study, the solution called semi-automation which modified to tilted image by user and the solution which In this paper, an image of the band when tilted, automatically, without user intervention in order to make the image vertically Lane, mean and variance of gray images is proposed to take advantage of. Vertical Gel Image projection to obtain the mean and variance of the average value of the variance is the biggest, you can find the vertical lane.

P3-49 염색체 극성에 자유로운 염색체 분류 방법

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한림대학교 컴퓨터공학과
한림대학교 유비쿼터스 컴퓨팅학과

Chromosome-polarities are often decided from the centromere positions. However their detection is not easy and the detection error even affects to the chromosome classification itself. We present a new polarity-free approach for the classification of chromosomes. Features extracted from density profile of the test data are examined twice against the training data in forward and reverse manners, resulting in an extension of k-NN method.

P3-50 Validation of Complete Data OSEM Approaches to Edge-Preserving Image Reconstruction for Emission Tomography

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We investigate performance of the complete data ordered subsets expectation maximization (COSEM) algorithm applied to edge-preserving image reconstruction for emission tomography. In this work we consider the MAP approach with convex-nonquadratic penalty functions for edge-preserving reconstruction. According to our experimental results, while the COSEM-MAP algorithm is not as fast as the conventional block-iterative MAP algorithms like the block sequential regularized EM, it provides globally converged results without requiring a hard-to-find relaxation parameter, which is important for clinical applications.

P3-51 다채널 다중주파수 병렬 임피던스 단층촬영 시스템의 보정 방법

김옥겸, 김도엽, 유필중, 오동인, 우응제
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Parallel multi-channel, multi-frequency EIT system consists of 16 independent current sources and 16 voltmeters. It requires a careful calibration to minimize systematic errors for the recently developed KHU Mark2 EIT system. Current source calibration is maximization of output impedance using multiple generalized impedance converters. Phase and gain calibrations are used for voltmeters. Phase calibration nulls out the total system phase shift. Gain calibration for each voltmeter compensates frequency dependence and channel-dependent voltage gains of all voltmeters. We made 16-channels calibrator system for it. We obtained 1MΩ minimal output impedance of the current source in the frequency range 10Hz-500kHz. The reciprocity error was as small as 0.1% after voltmeter calibration.

P3-52 다중양극 광전자증배관 이득 불균일 보정을 위한 기법의 타당성 평가

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Multi-anode position sensitive photomultiplier tube (PSPMT) is widely used for small field-of-view gamma camera and PET. However, the anode gain non-uniformity of this device is a limiting factor that degrades the intrinsic performance of detector module. The aim of this study was to develop a gain compensation method for the multi-anode PSPMT. The uniformity of input current into the charge division circuit was significantly improved by using the gain compensation method: (SD: 15.7%→2.7%, max/min: 2.0→1.2) for H8500 (n=11) and (SD: 19.6%→2.4%, max/min: 3.5→1.19) for H9500 (n=2). We demonstrated the feasibility of an efficient and inexpensive compensation method for multi-anode PSPMT.

P3-53 2차원 섬광 퍼짐을 이용한 새로운 상호작용 깊이 측정 검출기 특성 조사

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고려대학교 물리학과
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We proposed a new DOI enable detector design in which DOI dependent light dispersion is tailored by the reflector grid made of reflector trips in triangular-teeth shape. In this study, we built and investigated the detector for the experimental verification of this design. The detector module consists of a 22 x 22 array of unpolished LYSO crystals (2.0 x 2.0 x 28 mm^3) and Hamamatsu H8500 multi-anode PMT. We obtained the initial performances of our prototype DOI detector: average DOI resolution of submillimeter, energy resolutions of 16.2 ~ 20.2% and time resolutions of 1.22~1.82 ns for individual DOI positions.

P3-54 확산텐서 이미지를 이용한 뇌량의 정량적 분석

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We used a semi-automated CC segmentation scheme, parameterization of segmented CC and diffusion tensor imaging to investigate the relationship between callosal extents and structural properties in 47 right-handed healthy adult subjects. The callosal extents and structural properties were measured by the callosal thickness and diffusion indices (fractional anisotropy (FA), mean diffusivity (MD), axial and radial diffusivity), respectively. The results demonstrated significant positive correlation in callosal posterior body and isthmus. Based on this result, we suggested that not only the structural properties but also the extents of CC have to be used in estimating the inter-hemispheric connectivity in healthy adult population.

P3-55 MRI 호환용 PET을 위한 MRI RF 영역 내에서의 신호 전달 방법 연구

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The RF signals of MRI significantly affect the performance of PET requiring careful shielding of electronics and signal cables. This paper focused on comparing energy and time resolutions, and trigger rates of Multi-Pixel Photon Counter (MPPC) PET detector module between the inside and outside MRI. Single-ended signaling and differential signaling were introduced to evaluate noise reduction ability. Various signal cables such as coaxial cable, S/UTP, and S/STP used to compare shielding effect. The differential signaling technique was found to have a resistance to electromagnetic interference inside MRI. However, we found shielding of electronics and signal cables is more important issue.

P3-56 치매 환자의 대뇌 회백질 영역에서의 평균확산도 분석

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Alzheimer's disease (AD) is known as gray matter (GM) disease. In DTI analysis, the most of recent study approach a abnormalities between healthy normal and AD using Voxel-based morphometry style (VBM) to find local changes in GM. However, the above methods have some limitations related to local misalignment of structures and ambiguity to choosing the smoothing extent still remain in problems. The surface-based approach for investigating group differences can improve accuracy for measuring abnormalities of GM morphology in AD rather than volumetric analyses. The purpose of present paper was to investigate GM micro- pathological abnormalities in AD patients.

P3-57 뇌에서의 [^{11}C]Sertraline 동역학 모델링

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Purpose of this study is establishing [^{11}C]Sertralinekinetic model in human brain. Sertraline is an antidepressant of the selective serotonin reuptake inhibitor. Dynamic [^{11}C]Sertraline Brain PET scans were acquired during 90minutes (n=3) or 120minutes (n=2). Input function simultaneously measured by blood sampling from the radial artery. Time-activity curves at putamen and caudate were obtained from dynamic PET data by drawing volume of interests on co-registered MRI with PET. Three-Compartment models with irreversible and reversible, Two-Compartment models with reversible were tested. Models were compared using the Akaike information criterion (AIC) and the F-test to find the best model of [^{11}C]Sertraline.

P3-58 자기공명 뇌 영상 데이터로부터 지능 예측

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A number of studies from imaging data have confirmed neuroanatomical correlates of intelligence with various cerebral characteristics, such as the size of the brain, the volumes of subcortical and cerebellar regions, the thickness of the corpus callosum, the amount of intracranial tissue and the thickness of the cortex as well as cortical convolution as a degree of cortical folding. A study investigated the variation of the Fractal Dimension through analysis of cortical thickness, sulcal depth, and folding area, which reflected the cortical complexity. However, studies related to intelligence assessing all possible aspects of cortical structure have been little addressed. To extend previous findings, in this study, we first set out to predict the human intelligence with cortical surface area, cortical thickness, cortical convolution(degree of cortical folding) and sulcal depth that were able to represent structural characteristics. The aim of this study was to predict the human intelligence by characteristics of cortical structure.

P3-59 Group-specific template를 이용한 자동hippocampus 영역추출

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In this study, We describe hippocampus segmentation using group specific template that maked old subject data. The method use TOM software to make group specific template and SPM software to segmentation and registration. We compared a difference of template that ICBM template and group specific template. The Relative Error compared with ICBM template was less than 14%. The Similarity index compared with ICBM template was over than 7%.

Biomedical Optics

P3-60 안저사진에서의 혈관 직경 측정의 자동화

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Retina is only one site where monitoring vessel's condition is possible in real time and data can be obtained repeatedly without dissection or radiologic imaging study with the help of enhancing agents. Recently many researches show that the correlation with smaller retinal vessel diameters and variation in retinal arteriolar caliber is an important sign of systemic hypertension, and lower retinal arteriole to venule ratio (AVR) can predict the risk of hypertension. Therefore we suggested automated method for the accurate, fast and convenient measurement of retinal vessel diameter.

P3-61 진단용 X선 기기의 출력 방산선 평가

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X-ray equipment used to diagnose a patient has a big defect of a patient's exposure to radiation caused in irradiating X-ray to the human body, ICRP restricts the permissible exposure dose of the human body. So in case of the X-ray equipment for diagnosis, a operating frequency, a tube voltage, a tube current and irradiation dose have influence on the exposure. And their reproduction must be secured to secure safety in diagnosis. In this study, I fabricated a High tension generator of a full-wave rectification type using a LC resonant inverter. And in order to evaluate the capability of the fabricated equipment, I performed radiation characteristics experiments.

P3-62 근적외선 분광법을 이용한 뇨동역학 시스템 설계

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Urodynamics assesses how the bladder and urethra are performing their job of storing and releasing urine. Recently, catheter is used to check the condition of bladder and sphincter muscles. These test are painful and also very shameful. Near Infrared Spectroscopy (NIRS), can check the condition of bladder more comfortably without pain. NIRS include patient monitoring and non-invasive diagnostics, such as monitoring blood flow and tissue oxygenation status to assess physiologic and metabolic conditions. This paper presents results of some basic experiments using three types of near infrared laser-diode systems.

P3-63 피부 임상을 위한 단일 spectrometer 와 hand-held 프로브 기반 1.3㎛ 스펙트럼영역 고속 PS-OCT 시스템

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We demonstrate high speed spectral domain polarization-sensitive optical coherence tomography (SD-PS-OCT) based on a single line-scan camera with 1024 pixels at 1.3㎛ and an 2x1 optical switch. The measured axial resolution and sensitivity were 8.2㎛, 107.1dB, respectively. Furthermore, we improved a sample arm to make progress the measurement convenience and the flexibility with the hand-held typed probe using an articulated arm for clinical applications in dermatology. The intensity, phase retardation, optic axis orientation images of rat tail tendon *ex-vivo* and the averaged birefringence slop of the human hand in-vivo were acquired comprehensively via Stokes and Jones calculation methods.

P3-64 시온안료를 이용한 광섬유 온도센서의 개발을 위한 기초연구

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In this study, we describe the feasibility of developing a fiber-optic temperature sensor using a thermochromic pigments such as N102. A fiber-optic temperature sensor is capable of monitoring the temperature of a human body using the color change of the thermochromic pigment according to the temperature variation. We have measured the intensities of reflected lights due to the color change of the N102 by using of a PMT. The relationships between the temperatures and the output voltages of PMT are determined, and the measurable temperature range of the fiber-optic sensor is from 30 to 35℃.

P3-65 졸-겔을 이용한 광섬유 pH 센서의 개발

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In this study, we have fabricated a fiber-optic pH sensor using a phenol red immobilized in sol-gel film which is coated on the distal-tip of an optical fiber by dip-coating. The emitting light from a light source is guided by optical fibers to the pH buffer solutions, and the optical characteristic of reflected light is changed in the sol-gel film according to its color change. Therefore, we have measured the intensity of the modulated light, which is changed due to the color variations of sol-gel film at different pH values, by using of a spectrometer for spectral analysis.

P3-66 정방형 섬광체-광섬유 방사선량계를 이용한 피부 및 선량보강 영역에서의 상대 선량 측정

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In this study, we have fabricated a square scintillator-optical fiber dosimeter using a square organic scintillator and a plastic optical fiber for measuring relative dose in skin and build-up region with 6 MV photon beam. Also, we have measured relative doses according to thickness of scintillators in skin and build-up region.

P3-67 Rat Olfactory Bulb에서 근적외선을 이용한 후각유발 혈류역학적 반응변화 관찰

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In our previous study, we reported that differential neuronal activity changes in rat olfactory nervous system to various odor stimulations were observed and accurate discrimination of odor chemicals can be carried out by decoding simultaneously recorded many neuron activities. In the present study, we examined non-invasively odor-induced hemodynamic changes on the rat olfactory bulbs using near-infrared spectroscopy (NIRS) and found that NIRS has a potential in this application.

P3-68 표면플라즈몬공명 바이오 센서를 이용한 골형성 과정의 광학적 측정 연구

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Surface plasmon resonance is well-known as an effective optical technique for a quantitative detection of protein concentration. Since no exact quantitative analysis method for calcification of osteogenesis has been proposed, in this study, we develop an angle-scanning SPR biosensor that measures accurately an amount of calcification in MC3T3-e1 cells. The amount of calcification is sufficient to induce the SPR angle shift and calcified volume could be detected in real-time without any labeling technique. This study reveals that optimized SPR sensor is useful to analyze the calcification from the living cells and feasible in other clinical areas based on surface reactions.

Medical Nano and Microtechnology

P3-69 공기압축을 이용한 적혈구 응집성 측정방법

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This paper reports aggregation index measurement method using a pneumatic pump to agitate whole blood dropped in a test chamber which is fabricated by PDMS brick. In order to disaggregate whole blood formed as a rouleaux form, Air compression is applied using the air compressor. A laser diode and a PMT are used as a light source and receiver, respectively. Data analyses are conducted with Labview program using the light intensity received by PMT. As a result, The AI data measured by proposed method show consistent information on whole blood cell. Thus, this method proposed in this study would be applicable in blood characterization at clinical applications.

P3-70 항암제가 내재된 자기 나노입자를 이용한 자기 온열치료 시스템

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The anticancer activity of cisplatin-loaded magnetic nanoparticles was investigated. Three different magnetic nanoparticels, Fe_3O_4, Au-Fe_3O_4, and Fe_3O_4-APTS-cisplatin used to compare anticancer activities using the magnetic hyperthermia system by applying AC magnetic force on iron-laden tumor cell phantom. It has been successfully demonstrated that magnetic nanoparticles can be used to acceptable heat generation for cancer treatment. Moreover, anticancer drug nanocarrier, Fe_3O_4-APTS-cisplatin might prove to be useful in site-specific delivery, treatment by magnetic hyperthermia and chemotherapeutic activity by releasing anticancer drug.

P3-71 세포의 전기적 임피던스 측정에 대한 민감도 분석

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For a sensitive diagnosis or drug development, it is increasingly required to employ label-free cell-based assays. One of those assays is the electrode-based cell chip with electrical impedance spectroscopy, which enables to non-invasively characterize the physiological and morphological changes of cells in real time. This article reports the sensitivity analysis of cellular parameters (e.g. cell membrane, intra or extra cellular resistance) with respect to the system parameters of electrical impedance measurement.

P3-72 자기기전력 SD-OCT를 위한 금 코팅 자기나노입자의 제조

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Gold coated iron-oxide nanoparticles have been synthesized by a thermal decomposition and stirring method to identify targeted specific living cell for molecular optical imaging. The gold coated iron nanoparticles displayed a significant absorbance due to the surface plasmon resonance of Au shell and superparamagnetic which was characterized due to the presence of the iron cores. Strong magnetic susceptibility of superparamagnetic nanoparticles and high light absorbance of Au coated nanoparticles combined with an externally applied magnetic field offers attractive possibilities in biomedicine and research in targeted drug delivery, molecular imaging, magnetic bio-sensing, magnetic separation, and magnetic hyperthermia.

P3-73 Fabrication of Silane-Coated Fe_3O_4 Nanoparticles Containing Cisplatin for Anticancer Drug Nanocarrier

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In this study, water dispersible nanoparticles have been made by conjugating Fe_3O_4 nanoparticles with 3-amino-propyltrimethoxysilane (APTS). Then APTS-Fe_3O_4 was used as nanocarriers for cancer drug, cispatin. In this system, cisplatin was loaded to Fe_3O_4-APTS. The molecule structures and magnetic property have been characterized by X-ray diffraction (XRD), transmission electron micrographs (TEM) and superconducting quantum interference device (SQUID). The extent of cisplatin-APTS- Fe_3O_4 cell uptake was evaluated *in vitro* to human cervical carcinoma cell line HeLa by labeling cells with Prussian blue stain. The result showed that cisplatin-APTS- Fe_3O_4 nanoparticles are rapidly associated with the cells and saturation is typically reached within the 24 h of incubation at 37℃. In addition, the MTT assay result showed that hostile effects on cell function is the evidence of reduction in metabolic activity.

Neural Engineering

P3-74 살아있는 뉴런칩을 이용한 뉴로-로봇의 지능형 트레이닝 시스템 개발

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Artificial neural network modeling based on software has limits to model a real brain. To break these limitations, neuron-on-a-chip technology which uses microelectrode array(MEA) is studied recently. Neurons compose a neural network on MEA and generate signals. It lowers the complexity of the brain that helps researches easier. In this research, neuro-robot training system based on neuro-robot interface system is developed. Neural network is trained by various set of stimulation and the level of training is analyzed by tracking neuro-robot behavior.

P3-75 전신 마취 중 뇌파 분석 파라미터와 BIS 비교

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In this study, BIS and power annalysis parameters (SEF, SMR, ADR, ATR, BDR, BTR, DTR) were compared and analized to evaluate the depth of anesthesia. BIS and EEG signal were measured during general anesthesia, and acquired raw data were analyzed after pre-processing. As the result of analysis, the parameters could be classified into two groups, parameters(SEF, SMR, BDR, BTR) of direct correlation with BIS and parameter(ATR, ADR, DTR) of no correlation with BIS. In the further study, the availability of these parameters will be studied more.

P3-76 실내에서의 장애물 회피 실험을 위한 인공 망막 시뮬레이션

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Artificial retina is a technology to restore impaired vision using an implanted microelectrode array which stimulates retina nerve cells. We used a phosphene image that generated by simulation of artificial retina with 32×24 electrodes for obstacle avoidance performance evaluation. Three normal subjects participated in this study. We measured walking speed of experimental courses that include obstacles avoidance task. The results showed that walking speed increased and saturated as the experiment repeated eight times. It indicates that training is an effective method to restore vision by artificial retina.

P3-77 신경 재생을 위한 이식형 전기 자극 장치

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In this paper, we present an implantable electrical stimulator for regeneration of defected peripheral nerve. The implantable electrical stimulator was fabricated on a polyimide-based conduit with an integrated electrode, a stimulation chip and a battery. The stimulator was implanted in experimental animals with 7 mm defective sciatic nerve and electrical stimulation was continuously applied between the nerve stumps. The effect of electrical stimulation on nerve regeneration was evaluated. The functionality was evaluated by nerve action potential recording and immunohistochemial staining.

P3-78 뇌 지문: 뇌신경 신호의 주파수-공간 패턴에 기반한 인간 의도의 분류

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The aim of our study was to classify various mental tasks designed to elicit different brain responses with higher classification accuracy than those in the previous studies. To this end, we proposed a new method to extract features, which uses spatiospectral patterns of brain electrical activities. In order to verify the proposed method, four volunteers took part in the test experiment when they were required to carry out four different mental tasks according to our experimental paradigm and EEG data were recorded at 32 electrodes mounted on their scalp according to the extended international 10-20 system. Both the conventional and the proposed analysis methods were applied to the measured EEG data so as to compare classification accuracy between the two methods. The mean classification accuracy for the conventional method was 57.5%; while that for the new method was 69.68%, thereby suggesting that the proposed method would be a promising alterative to enhance the performance of mind-reading systems.

P3-79 청각의 선택적 집중을 이용한 뇌-컴퓨터 인터페이스 패러다임

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Brain-computer interface (BCI) is becoming a new way of communication for individuals with severe motor impairments or those who have no other options for communication but using their brain signals. To detect and classify different mental states of the individuals using electroencephalogram (EEG), various features have been suggested such as self-regulated sensorimotor rhythms, event-related potentials (ERPs), and steady-state visual evoked potentials (SSVEPs). However, the possibility of selective attention to desired stimulus is not fully studied over modalities. In the present study, we investigate a new paradigm to classify the individuals' intention using EEG responses to auditory selective attention (ASA) task.

P3-80 Extraction of Imagined Hand Movements signals from Raw EEG

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Communication only by plain thoughts in Brain Computer Interface allows human to control devices through electroen-cephalo graphic (EEG) brain signals. The proposed idea removes electro-ocular graphic (EOG) artifacts (noise parameter) from, beta (13-26 Hz) and mu (8-12) Hz of EEG, using adaptive noise cancellation (ANC) which is a very good technique for long and multifaceted data. Low pass Equi-ripple filter was used as a preprocessor for extraction of beta and mu rhythms from EEG band. These extracted features can be classified using support vector machine which is a powerful tool for classification of regression problems by using only small set of data.

U-Health, eHealth Technology

P3-81 디지털 보청기를 위한 광대역 빔포밍을 이용한 잡음제거 시뮬레이션

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Most algorithms in digital hearing aids(DHA) depend on input signal-to-noise ratio(SNR), because they use only single channel information. To improve input SNR by a microphone array, we applied broadband beamforming, providing a frequency invariant response which is desirable in signal processing. Through 2-stage optimization, we calculated the beamformer response and finite-impulse-response(FIR) filters for each microphone. We performed a simulation on Simulink to judge if the beamformer is practically useful on a real-time system. The result showed about 11 dB SNR improvement when the noise was at 120° azimuth and that this approach is capable of attenuating noise from behind.

P3-82 압신기법을 이용한 난청환자의 언어인지향상 시뮬레이션 연구

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In this paper, we simulated the companding and observed spectral analysis. Companding is based on two-tone suppression that is human auditory system phenomenon. Hearing impaired person are lower spectral resolution and temporal resolution than normal person, so spectral enhancement technique is need to them. Companding is enhanced spectral contrast and reduced spectral smearing. Consequently, after simulations of the two cases, spectral peak and valley differences were increased by using the companding strategy.

P3-83 NTC Thermistor 교정 방정식의 오차 분석

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In this study, error Analysis of NTC thermistor calibration equations that Stein-Hart, Hoge-2, and 2-parameter. A simple voltage divider circuits for temperature sensing were constructed. Divider resistance was measured by mixed signal processor built-in ADC.
5 NTC thermistor are connected in parallel with different divider resistance was measured. 5 sensor placed in water bath at the same time, resistance values were measured at 6 set temperature. The average resistance values for each temperature by using six different T-R data were recorded. Least Mean Square Error Method for recording data on each of three kinds of sensor calibration equation is estimated for the parameter. Stein-Hart and the results of Hoge-2 partial pressure of selecting appropriate resistor values, the error was within 0.2℃. However, 2-paramter to the relatively large error was found.

P3-84 RFID를 이용한 Thermal Cycler 사용자 별 프로토콜 관리

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RFID devices, that have lower costs and are miniaturized and intelligent, are being adapted in various areas such as delivery, defense, education, cultural and environment systems. We introduce the RFID techniques to the PCR thermo-cycler systems that are one of the typical bio-instruments. Each of the multiple thermo-cycler users can easily access his PCR protocols in the thermo-cycler by the proposed system. It also provides better securities on each user's experiment contents including PCR protocols.

P3-85 EMFi 센서를 이용한 비가압적 상완 혈압 측정

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Brachial blood pressure measurement without cuff is proposed using EMFi (Electromechanical film) sensor. Both electrocardiogram (ECG) and pulse were measured on the arm and EMFi sensor was used to detect pulse signal. Pulse arrival time (PAT) was computed from the time interval between the R-peak of ECG and the peak of the pulse signal. Systolic blood pressure (SBP) was estimated from the PAT. As a result, the correlation between PAT and SBP was high (r=-0.8630, p-value< 0.001).

P3-86 무구속 심박측정을 위한 새로운 구조의 레이다 모듈

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In this paper, we present Doppler radar module that can measure heart rate without contact. Critical problem of continuous Doppler radar is the null point problem. At null point, amplitude of noise spectrum is larger than that of heart rate signal. It spoils the precise measurement of heart rate signal. To eliminate the null point problem, we adjust the residual phase of radar circuit. Then, the phase of received signal can artificially adjust to optimum point for measuring vital signal. In 40 cm away, Doppler radar detected the precise heart rate signal in comparison to PPG beat signal as reference.

P3-87 자전거 기반의 하이브리드 방식 미세 에너지 수확 장치 연구

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There has been an increasing interest in a bicycle as a solution for energy, environment and health. However, the number of population using bicycle is not so much because modern people, who have already been accustomed to various digital devices and interactions, feel that riding a bicycle is a hard and boring exercise. There have been many trials to solve this problem by equipping digital attachments, such as electric power assistance, safety LED and speedometer. Most importantly, the method of getting available-electric power during bicycling should be provided for this purpose. In this study, we aim at the development of an energy harvesting device which requires no additional load for bicycle riders. We suggest a method of using ambient vibration and sun light together, based on the fact that bicycles are usually used and parked outdoor. We expect that the proposed energy harvester should lead IT innovation in bicyles and be a practical way of increasing the use of bicycle in everday life. The technologies in transformation, charging and use of ambient energy acquired through this study can be applied to mobile and implantable medical devices as well as various digital information devices.

P3-88 Quantitative Investigation of Real Time Feature Extraction in PPG Waveform

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In this paper, we propose an algorithm for real-time feature extraction in Photoplethysmogram (PPG) waveform namely their onsets and peaks. The algorithm relies on the analysis of transformation feature of PPG signal, since the original signal is less impulsive, less distinct and is also subjective towards rapid fluctuations in baseline and amplitude. Adaptive knowledge based rules are then applied to the transformed signal for the extraction of onsets and peaks. On testing with our database, the algorithm has yielded the sensitivity of 86.62% and positive predictivity of 99.65%.

P3-89 ASemantic Based approach for Communication among Human Fitness Testing Systems and Heterogeneous Client Systems

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Smart and flawless means of communication among disparate and physically distributed systems or business applications is now becoming an utmost requirement. In our world healthcare industry is now growing enormously and it is the most important area where such applications are required. Human fitness testing systems are placed at different locations. Many HIMS deployed at different location needs to communicate with the Heterogeneous Client Systems (HCS). This paper proposes a semantic based communication gateway between Human Fitness Testing Systems and HCS. This semantic based communication can assure consistent, platform independent, flexible, reliable, timely and intelligent exchange of information. The gateway is provided through central web services hosted on a semantic web application. This gateway will communicate with other semantic web services and there remains a semantic interoperability.

P3-90 Textile electrode에서 피부 수분도의 변화에 따른 ECG신호의 RMS값의 변화

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Textile electrode is the core technology in wearable system and allows acquiring bio-signal more unconve-ntionally than commercial electrode. However, the quality of signal in textile electrode depends on the moisture level of the electrode or the skin. In this study, we have observed the relationships between skin moisture level and textile electrode by experiments, which we changed the moisture level of skin in dry textile electrode. The average men's' skin moisture level was at 30~45% where the relative humidity was 40%. It was hard to gain the signal through textile electrode when the moisture level was at 30~45%. There was a light signal when we increased the moisture level up to 70%~80% and when it has reached nearly 120%, it showed the similar performance compared to commercial electrode.

P3-91 무선통신을 이용한 발기부전 진단 기기 제작

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Information on penile tumescence and rigidity is required to diagnose erectile dysfunction. Unlike conventional methods, we used an FSR sensor to measure this information.

In our device, an FSR sensor, which can convert pressure or force to resistance, is attached to an elastic band. When a penis expands, the sensor is influenced by the tension from the penis, and can thus measure resistance. The resistance value is then converted to voltage by using an I-V converter.

A microcontroller is also used for analog to digital conversion and stimulation. As communication unit, we adopted the Zigbee technology for producing a real-time erection monitoring system.

The key algorithm to diagnose erectile dysfunction accurately utilizes the relationship between the measured voltage and the actual change in penile tumescence. The proposed method can be commercialized as a device for diagnosing impotence conveniently and accurately.

P3-92 하지에 인가한 체성감각자극이 계단 하강 동작에서 관절각도와 지면반발력의 변화에 미치는 영향

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The purpose of this study is to analysis of Ground Reaction Force(GRF) and joint angles by somatosensory stimulation on the lower limb in stair-descent activity. The data was collected by 3-D motion analysis system and forceplate. GFR is decreased and ankle joint angle is increased by somatosensory stimulation. This result means the somatosensory stimulation affect stair- descent activity.

P3-93 쥐 연조직 점탄성 특성의 수학적 모델링

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A series of biomechanical tests including pre-loading, pre-conditioning (cyclic loading), holding (stress relaxation) and uniaxial tensile loading on the shoulder joint tendon of rats which had been intentionally injured and repaired were carried out to investigate the progress after operation. The quasi-linear viscoelastic (QLV) theory was adopted to quantify the nonlinear, time-dependent behavior of the rat shoulder tendon. As a result, the QLV approach showed a very good fit for the mathematical modeling of the soft tissues like the tendon as proved in a lot of previous studies.

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