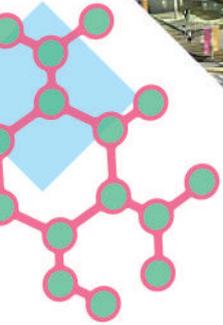


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# 2018년 대한의용생체공학회 춘계학술대회

## AI in Biomedical Engineering : Major Tide in the 4<sup>th</sup> Industrial Revolution

2018년 5월 11일(금) ~ 12일(토)  
건국대학교 글로벌캠퍼스(충주) 교양 강의동

|주최|  대한의용생체공학회  
The Korean Society of  
Medical & Biological Engineering

|주관|  KU  
건국대학교  
KONKUK UNIVERSITY

|후원|  KOFST  
한국과학기술단체총연합회

 NRF 한국연구재단

 KU  
건국대학교  
KONKUK UNIVERSITY

 전북대학교 IT융합시스템인력양성사업단  
Chonbuk National University C&IT Converged & Fusion System Human Resource Development Center



## Laser



### Laser

- Argon Laser
- CO2 Laser
- DPSS Laser
- Excimer Laser
- Femtosecond Laser
- Fiber Coupled Laser
- Fiber Laser
- He-Cd Laser
- He-Ne Laser
- LD
- LED
- Nd:YAG Laser
- SLD
- Tunable Laser

## Optical Components



### Optical Components

- Acousto-Optic Devices
- Autocorrelator
- CCD Camera
- Galvanometer scanner
- Laser Beam Diagnostic
- OCT
- OCTS Spectral Engine
- Optical Isolator
- Optical Power/Energy Meter
- Spectrometer
- Photon Counting System
- Photon Timing System
- TCSPC
- Wavelength Meter

## Fiber Optic & Others



### Fiber Optic Components

- Optical Fiber
- Tunable Filter
- Circulator
- Coupler
- Switch
- WDM
- VOA

### Others

- Opto-Mechanics
- Motion Control Products
- Optics
- Crystals
- Eye Protection

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대전광역시 유성구 지족로355. 401호(지족동.월드프라자)  
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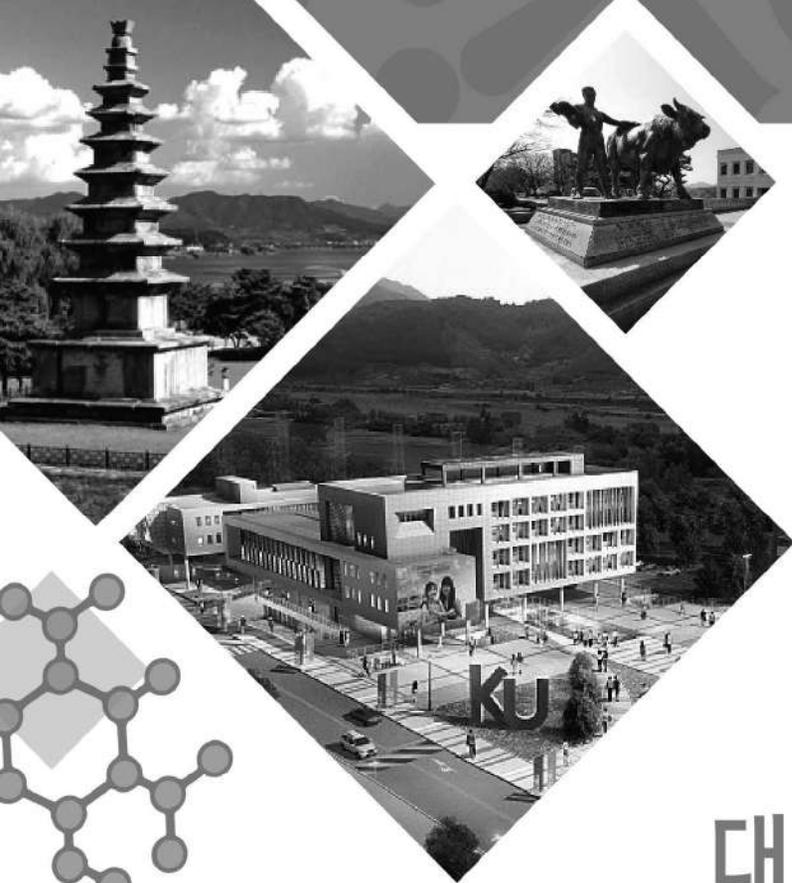
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# 2018년 대한의용생체공학회 춘계학술대회

## AI in Biomedical Engineering : Major Tide in the 4<sup>th</sup> Industrial Revolution

2018년 5월 11일(금) ~ 12일(토)

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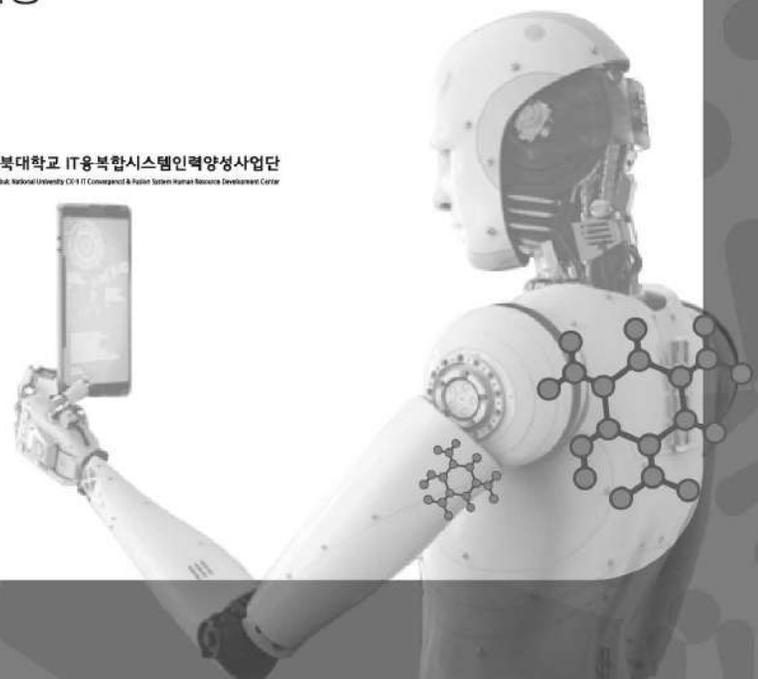
|주관|  KU 건국대학교  
KYUNGPOOK UNIVERSITY

|후원|  KCFST  
한국과학기술단체총연합회

 NRF 한국연구재단

 KU 건국대학교  
KYUNGPOOK UNIVERSITY

 전북대학교 IT융합시스템인력양성사업단  
Chonbuk National University C4-IT Convergence & Future System Human Resource Development Center







존경하는 대한의용생체공학회 회원 여러분께,

2018년 대한의용생체공학회 춘계학술대회에 참가하신 회원 여러분을 진심으로 환영합니다.

한반도의 중심지인 충주에 소재한 건국대학교 글로컬(global) 캠퍼스에서 “AI in Biomedical Engineering: Major Tide in the 4th Industrial Revolution” 라는 주제 하에 춘계 학술대회를 개최하게 되어 매우 기쁘게 생각합니다.

특히 이번 2018년도 춘계학술대회를 개최하는 건국대학교 의공학과는 1989년도에 설립된 이래 여러 학제간 융합연구를 통해 뛰어난 연구수준 및 교육환경을 보유함으로 우수한 인재를 많이 배출하는 명문 학과입니다.

이러한 곳에서 학술발표대회를 개최하게 되어 정말 기쁘게 생각하며, 이 대회를 통해 의공학 분야의 최신 연구결과들을 공유하고 열정적인 논의와 교류를 통해 학문적인 발전을 도모할 수 있는 계기가 되기를 바랍니다.

더욱이 이번 학술대회를 통해 최근 화두로 거론되고 있는 4차 산업혁명과 연관성이 깊은 인공지능, 로봇기술, 빅데이터 등의 융합으로 사람, 사물, 공간이 연결되는 새로운 산업혁명 시대를 선도할 의공학 연구 및 교육 방향을 다시 한번 생각해 보는 시간이 되었으면 합니다.

이를 위해 삼성메디슨의 조재문 부사장님과 가천대학교의 김영보 교수님을 기조강연자로 모시게 되었고, 최근 인공지능 스타트업 회사들을 초청하게 되었습니다. 저명한 두 분의 강연과 스타트업 회사들의 발표에 참여하여 보다 나은 발전을 위한 기회가 되기를 바랍니다.

마지막으로 학술대회 준비에 열과 성의를 아끼지 않으신 타계래 조직위원장을 비롯한 건국대학교 글로컬 캠퍼스 관계자 여러분, 그리고 김철홍, 변경민, 이종민 학술이사를 포함한 학회임원 및 학술위원님들께 진심으로 감사를 표합니다.

본 춘계학술대회가 더 뜻깊은 대회가 될 수 있도록 모든 회원 여러분의 적극적인 참여와 협조를 부탁드립니다. 감사합니다.

2018년 5월

대한의용생체공학회 회장 이 경 중



2018년도 춘계 학술대회를 맞이하며

2018년도 제53회 대한의용생체공학회 춘계학술대회를 건국대학교에서 개최하게 된 것을 진심으로 기쁘게 생각합니다.

건국대학교는 1989년 의학대학에 의학공학과가 설립되고, 1993년 대학원이 설립되었습니다. 1998년 ‘의학공학부’로 확대 개편되어 운영되던 중, 2017년 학교의 장기 발전 계획에 따라 과학기술대학 ‘ICT융합공학부’의 ‘의학공학’ 전공으로 운영이 되고 있습니다.

현재 12분의 전공교수님들과 400여명의 재학생과 2,000여명의 졸업생을 두고 있습니다. BK21 플러스 사업단 소속 대학원에서는 ‘병원공학 전문인력 양성’이란 과제로 첨단의료기기 개발과 의료기기 산업 발전에 기여하고 있습니다. 1993년 춘계학술대회에 이어 두 번째 개최하게 되는 이 시점에, 의공학의 학술적 발전과 인력 양성에 중심적인 역할을 하고 있는 대한의용생체공학회 학술대회를 본교에서 개최하게 되어 매우 뜻깊게 생각합니다.

2018년도 춘계학술대회의 성공적인 개최를 위해 우리 조직위원회는 최선을 다하여 준비하였습니다. 학술대회 준비기간 동안 협조를 아끼지 않으신 이경중 회장님을 비롯한 학술위원회 위원여러분, 사무국 관계자분들께 깊은 감사의 말씀을 드립니다.

또한, 물심양면으로 지원하여 주신 우리 대학의 총장님을 비롯한 학교 당국의 적극적인 도움은 물론, 우리 대학 의공학 교수진들, 석박사 과정생들 및 학부생들의 동참이 없었다면 이번 학술대회를 준비하기 어려웠을 것입니다. 이 지면을 빌어 감사의 말씀을 드립니다.

이번 학술대회는 우리 학회의 발전된 모습을 보여 주는 자리이며, 더 나은 지식의 방향을 모색할 수 있는 기회의 장입니다. 모쪼록 조직위원회에서는 이번 학술대회가 회원 여러분들의 학문적 소통과 모임의 장이 되도록 최선을 다하겠습니다.

바쁘신 가운데에도 찾아주신 회원님들을 환영하며 깊은 감사의 말씀을 드립니다. 모든 회원 여러분의 건승을 기원합니다.

감사합니다.

2018년 5월

53회 춘계학술대회 조직위원장 **탁 계 래**

◇ 기초강연 1

좌장: 김철홍 교수(포항공대)

AI in Medical Imaging as a New Enabling Technology

조재문 부사장(삼성메디슨)

◇ 기초강연 2

좌장: 이종민 교수(한양대)

4차산업혁명과 미래의학

김영보(가천대 의대)

◇ Tutorial 1. 의료기기 국제표준과 인허가

좌장: 오현주 심사부장(식약처 의료기기)

Work Plan on KS(Korean Standards) of MFDS

김국한 주무관(식품의약품안전처)

Development of electronic medical device software and quality verification

박종일 대표((주)엠트리케어)

의료기기 표준 최신동향

강범선 기술이사((주)엠디랩)

◇ Tutorial 2. 딥러닝 프로그래밍

좌장: 성준경 교수(고려대)

의료영상기반 딥러닝 기술의 기초 및 응용

성준경 교수(고려대)

◇ Tutorial 3. 공학자를 위한 전기생리학

좌장: 변효진 교수(연세의료원)

생체전기 발생과 전기 전달

김성준 교수(서울대)

생체전기를 이용한 근육 수축과 이상 반응

신터전 교수(서울대)

전기자극이 근육 및 신경세포에 미치는 영향

이형철 교수(서울대)

◇ Tutorial 4. 의학자를 위한 초음파 해설

좌장: 안원식 교수(경희의료원)

초음파 영상 진단에 사용되는 소프트웨어 알고리즘과 하드웨어 구현 해설

김찬모 수석연구원(삼성메디슨)

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## ❖ Tutorial 5. 의공학 교육의 운영방안과 사례 좌장: 태기식 교수(건양대), 윤용현 교수(대림대)

의공학 교육에서의 기초의학과목 강의방향	정동근 교수(동아대)
의료공학 기업연계 실전프로젝트 운영사례	오도창 교수(건양대)
의공학 공학교육인증과 융합교육 사례	조용석 교수(건양대)
국가직무능력표준(NCS)을 활용한 의공(산업)기사 실기시험 평가방법 개발	최병철 교수(춘해보건대)

## ❖ Special session 1. 의료기기 측정과 표준 좌장: 강훈 교수(충북대)

의료기기 개발에서 측정의 의미	안원식 교수(경희의료원 혈류데이터센터)
측정은 사람이 한다	최종오 책임연구원(한국표준과학연구원)
의료기기 측정과 표준	임현균 센터장(한국표준과학연구원 국가참조표준센터)
보건의료분야 참조표준 개발 및 활용사례	김창근 책임연구원(한국표준과학연구원 국가참조표준센터)

## ❖ Special session 2. 대구경북/오송 첨단의료기기개발 지원센터 좌장: 김명남 교수(경북대)

### ● 대구경북첨단의료산업진흥재단

How to prepare IEC 60601-1, Ed.3 in the Lab : the official approval assessment service in the MDCC	정재훈
Introduction of Human Origin Biomaterials Development Center for Tissue Engineering and Regenerative Medicine	정봉수
Establishment of ICT Clinical Trial Platform	서수원
Industry 4.0: Smart Factory in Medical Device Industry	손재범

### ● 오송첨단의료산업진흥재단

The role and Performance of Medical device development center	송영준
The supported R&BD cases for solving problems from clinical idea of Osong Medical device development center	문진희

◇ Special session 3. 인공지능 스타트업 소개

좌장: 김철홍 교수(포항공대)

VUNO  
 OBS KOREA  
 메디사피언스

◇ Special session 4. 신진연구자

좌장: 김희찬 교수(서울대)

Inertial microfluidics for cancer mechanotyping and intracellular delivery of nanomaterials	정아람 교수(고려대)
곤충 비행제어 알고리즘의 리버스엔지니어링	김안모 교수(한양대)
바이오프린팅 기술을 이용한 생체 조직 제조	장진아 교수(포항공대)
Brain organ-on-a-chip for biomedical research	정세훈 교수(인제대)
Enhancing Cancer Immunotherapy using Biomaterials	박천권 교수(성균관대)

◇ 일반연제 1 – Biomedical Instrumentation, Digital Healthcare Technology, Orthopedic and Rehabilitation

좌장: 박성민 교수(포항공대)

14:30~16:00

1. 생체 신호 딥러닝 End-to-End 모델 분석  
 광운대학교 컴퓨터정보공학부  
 박철수
2. 운전 시뮬레이션 중 외이도 뇌전도 기반 졸음 추정  
<sup>1</sup>서울대학교 공과대학 협동과정 바이오엔지니어링 전공, <sup>2</sup>서울대학교 의과대학 의공학교실  
 홍승혁<sup>1</sup>, 최상호<sup>1</sup>, 권현빈<sup>1</sup>, 박광석<sup>2</sup>
3. Co-60 방사선원의 등선량 분포 및 상대깊이선량의 동시 측정을 위한 1차원 팬텀선량계 개발  
 중앙대학교 공과대학 에너지시스템공학부  
 신현영, 신상훈, 변현기, 송시원, 박재형, 김지예, 이봉수
4. Support Vector Machine을 이용한 디지털 치아 색조 분석 시스템  
 오송첨단의료산업진흥재단 첨단의료기기개발지원센터  
 김민아, 김병연, 박병준, 이승락, 원영재

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16:00~17:30

1. 모바일 헬스케어 위한 광센서 응용 기술

순천향대학교 의용메카트로닉스공학과  
조재걸

2. 여성 웰니스 증진을 위한 웨어러블 디바이스 및 생체신호 분석 알고리즘 개발

<sup>1</sup>서울대학교 차세대융합기술연구원, <sup>2</sup>아주대학교 기계공학과, <sup>3</sup>아주대학교 전자공학과  
<sup>4</sup>성균관대학교 나노과학기술원, <sup>5</sup>쥬스마디  
한수정<sup>1</sup>, 김성민<sup>1</sup>, 최슬기<sup>1</sup>, 박석진<sup>2</sup>, 이지훈<sup>3</sup>, 임장균<sup>4</sup>, 이정민<sup>5</sup>, 오경식<sup>5</sup>, 최영호<sup>5</sup>, 이태린<sup>1</sup>

3. 거울 치료에 활용할 수 있는 가상 손의 착각 유발 가능성 연구

계명대학교 의과대학 의용공학과 스마트랩  
임승의, 구정훈

 일반연제 2 - Biomechanics

좌장: 이정찬 교수(서울대)

1. 심근의 국지적 전기적 흥분 파형의 지배적 주파수와 위상의 분산분석을 통한 심실 부정맥 심각도 예측

IT융복합공학과  
정다운, 임기무

2. Instrumented Timed up & Go test를 이용한 고령자 낙상 위험도 정량적 추적연구

<sup>1</sup>건국대학교 일반대학원 의학공학과, <sup>2</sup>건국대학교 ICT융합공학부 의학공학전공, <sup>3</sup>BK21플러스의공학실용기술연구소  
서정우<sup>1</sup>, 김태호<sup>1</sup>, 이진수<sup>1</sup>, 김정길<sup>1</sup>, 최진승<sup>2,3</sup>, 탁계래<sup>2,3</sup>

3. 세포 수준의 혈액 유동 수치해석적 시뮬레이션 연구

<sup>1</sup>서울대학교 차세대융합기술연구원, <sup>2</sup>아주대학교 기계공학부  
박석진<sup>1,2</sup>, 이태린<sup>1</sup>

4. 계단 내리기시 보행전략에 따른 무릎관절 부하분석비교

건국대학교 의학공학과  
전형민, 최의범, 허재훈, 엄광문

5. 평활근 내 피브린-4 유전자 결손 된 쥐의 상행경부대동맥에 발생하는 대동맥류의 성장에 따른

생체역학적인 특성

<sup>1</sup>연세대학교 기초과학연구원 나노의학연구단

<sup>2</sup>Department of Mechanical Engineering & Materials Science, Washington University in St. Louis, USA

<sup>3</sup>Life Science Center for Survival Dynamics, Tsukuba Advanced Research Alliance, University of Tsukuba, Japan

김정실<sup>1,2</sup>, Jessica E. Wagenseil<sup>2</sup>, Hiromi Yanagisawa<sup>3</sup>

❖ **일반연제 3 – Medical Imaging**

좌장: 유형석 교수(한양대)

1. 초음파 및 광음향 영상을 위한 실시간 지연-곱셈-합 빔 형성 알고리즘  
<sup>1</sup>POSTECH 창의IT융합공학과, <sup>2</sup>POSTECH 전자전기공학과  
 전승완<sup>1</sup>, 박은영<sup>2</sup>, 김철홍<sup>1,2</sup>
2. 딥러닝을 이용한 방사형 좌표계에서의 자기공명영상 재구성 방법: AUTOMAP과 푸리에 영역 손실함수를 이용하여  
 서울대학교 공과대학 전기·정보공학부  
 정성현, 윤재연, 정우진, 이두희, 이종호
3. CUDA 동적 라이브러리를 활용한 MATLAB 볼륨 렌더러 개발  
<sup>1</sup>포항공과대학교 시스템생명공학부, <sup>2</sup>포항공과대학교 창의 IT 융합 공학과  
 조성희<sup>1</sup>, 김철홍<sup>1,2</sup>
4. 종양 조직 분석을 위한 멀티모달 바이오 이미징 시스템  
<sup>1</sup>DGIST, 정보통신융합전공, <sup>2</sup>DGIST, 나노·에너지 연구부  
 김지훈<sup>1</sup>, 김은주<sup>2</sup>, 황재윤<sup>1</sup>

❖ **일반연제 4 – Neural Engineering**

좌장: 윤인찬 교수(KIST)

1. 공변량 변화(covariate shift)로 인한 P300 뇌파 타자기의 성능변화  
<sup>1</sup>한동대학교 전산전자공학부, <sup>2</sup>광주과학기술원 전기전자컴퓨터공학부  
 이종민<sup>1</sup>, 김지웅<sup>1</sup>, 원경호<sup>2</sup>, 권문영<sup>2</sup>, 전성찬<sup>2</sup>, 안민규<sup>1</sup>
2. 뉴로 피드백을 접목한 상지 재활 훈련 후 뇌 활성화 변화 연구  
<sup>1</sup>계명대학교 자연과학대학 생명과학전공, <sup>2</sup>계명대학교 의용공학과 스마트랩, <sup>3</sup>서울대학교병원 의생명연구원  
 손지은<sup>1,2</sup>, 임현미<sup>2,3</sup>, 구정훈<sup>2</sup>
3. 깜빡이는 운동영상을 이용한 BCI 동작관찰 게임재활 프로그램이 뇌졸중 환자의 거울신경세포시스템 활성화에 미치는 효과  
<sup>1</sup>서울대학교병원 의생명연구원, <sup>2</sup>계명대학교 의과대학 의용공학과 스마트랩, <sup>3</sup>울지대학교병원 재활의학과  
 임현미<sup>1,2</sup>, 강윤주<sup>3</sup>, 최효선<sup>3</sup>, 구정훈<sup>2</sup>
4. 영화를 함께 시청 시 감정적 공감 정도에 따른 자율신경계 신호 간 동기화  
 연세대학교 의공학과  
 김현, 여동훈, 서부경, 허성진, 최성운, 김경환

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## ◇ 일반연제 5 – Medical Nano and Microtechnology, Biomedical Optics

좌장: 최성용 교수(경희대)

1. 목시플록사신 기반 이광자 현미경의 피부암 영상화  
<sup>1</sup>POSTECH 융합생명공학부, <sup>2</sup>기계공학부, <sup>3</sup>연세대학교 의과대학  
장훈철<sup>1</sup>, 장원혁<sup>1</sup>, 이승훈<sup>2</sup>, 오병호<sup>3</sup>, 김기현<sup>1,2</sup>
2. 광활성 원자현미경을 이용한 초고해상도 광학 영상  
포항공과대학교 창의IT융합공학과  
이승현, 박별리, 김철홍
3. 암 연구 위한 나노포토닉스 기반 바이오센서에 관한 연구  
한국기계연구원 의료기계연구실  
홍유찬

## ◇ 포스터(2분스피치 1)

좌장: 천홍구 교수(고려대)

## ◇ 포스터(2분스피치 2)

좌장: 김형식 교수(건국대)

## ◇ 포스터(2분스피치 3)

좌장: 최명환 교수(성균관대)

## ◇ 포스터(일반)

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	이충근	식품의약품안전평가원
	임도형	세종대학교
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	조성보	가천대학교
	최삼진	경희대학교
	최성욱	강원대학교
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	허두창	한국전기연구원

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위원	공현중	충남대학교

직책	성명	소속
위원	유병훈	인제대학교
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	김경섭	건국대학교
	엄광문	건국대학교
	정순철	건국대학교
	이정환	건국대학교

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위원	전재훈	건국대학교
	김형식	건국대학교
	최진승	건국대학교
	유욱재	건국대학교
	김지원	건국대학교
	최미현	건국대학교

# 2018 춘계학술대회 프로그램

5월 11일 (금요일)					
	K3 교수연구동	U11 교양강의동			
	컨벤션홀	102호	103호	104호	105호
10:00~11:30		튜토리얼 1 의료기기 국제표준과 인허가 좌장: 오현주 심사부장 (식약처 의료기기)	튜토리얼 2 딥러닝 프로그래밍 좌장: 성준경 교수 (고려대)		특별세션 1 의료기기 측정과 표준 좌장: 강훈 교수 (충북대)
11:30~12:00				평의원회	
12:00~13:00	점심식사(개별) (K1 학생회관) / 포스터(일반) · 전시(302호)				
13:00~13:20	개회식 및 임시총회 사회: 이재홍 교수				
13:20~14:00	기조강연 1 조재문 부사장 (삼성메디슨) AI in Medical Imaging as a New Enabling Technology 좌장: 김철홍 교수 (포항공대)				
14:00~14:30	Tea Break				
14:30~16:00		일반연제 1 Biomedical Instrumentation, Digital Healthcare Technology, Orthopedic and Rehabilitation 좌장: 박성민 교수 (포항공대)	일반연제 2 Biomechanics 좌장: 이정찬 교수 (서울대)	특별세션 2 대구경북/오송 첨단의료기기개발 지원센터 좌장: 김명남 교수 (경북대)	특별세션 3 인공지능 스타트업 소개 (Vuno, OBS Korea, 메디사피엔스) 좌장: 김철홍 교수 (포항공대)
16:00~17:30					일반연제 3 Medical Imaging 좌장: 유형석 교수 (한양대)
18:00~	저녁만찬(K3 교수연구동 컨벤션홀)-학회제공				

5월 12일 (토요일)					
U11 교양 강의동					
	상허홀	102호	103호	104호	105호
08:30~09:10		포스터 2분스피치 ① 좌장: 천홍구 교수 (고려대)	포스터 2분스피치 ② 좌장: 김형식 교수 (건국대)		포스터 2분스피치 ③ 좌장: 최명환 교수 (성균관대)
09:10~10:00	포스터(2분스피치) 전시 · 심사(303호)				
10:00~10:40	기조강연 2 김영보 교수 (가천대 의과대학) 4차 산업혁명과 미래의학 좌장: 이종민 교수 (한양대)				
10:40~11:00	Tea Break				
11:00~12:30		일반연제 4 Neural Engineering 좌장: 윤인찬 교수 (KIST)	일반연제 5 Medical Nano and Microtechnology, Biomedical Optics 좌장: 최성용 교수 (경희대)		
12:30~13:30	점심식사(K1 학생회관)-학회제공				
13:30~15:00		튜토리얼 3 공학자를 위한 전기생리학 좌장: 변효진 교수 (연세의료원)	특별세션 4 신진연구자 좌장: 김희찬 교수 (서울대)	튜토리얼 5 의공학 교육의 운영방안과 사례 좌장: 태기식 교수 (건양대) 윤용현 교수 (대림대)	튜토리얼 4 의학자를 위한 초음파 해설 좌장: 안원식 교수 (경희의료원)
15:10~15:30	폐회식(시상 및 경품추첨, 상허홀)				

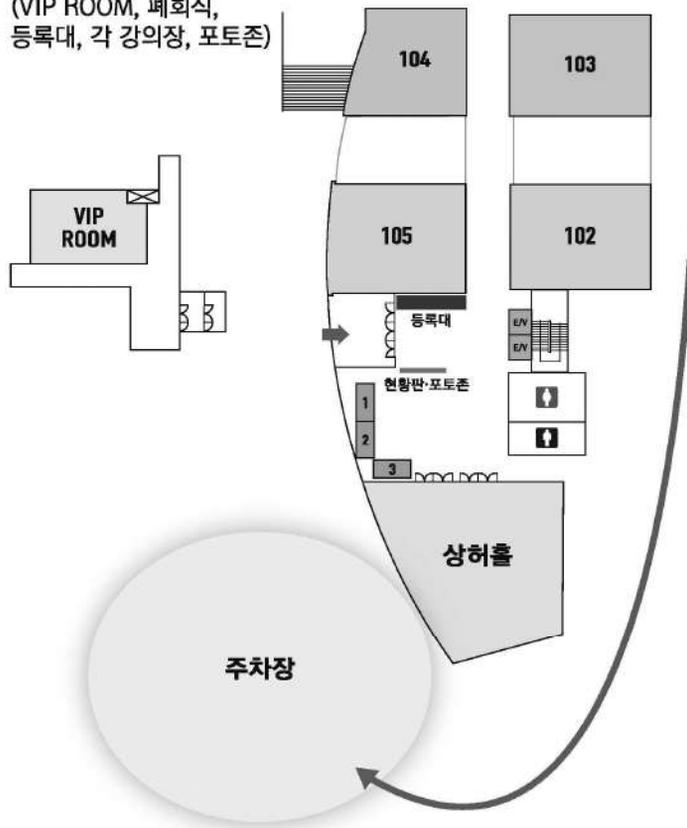
# | 오시는 길 |



# | 행사장 안내 |

## 1층

(VIP ROOM, 폐회식, 등록대, 각 강의장, 포토존)

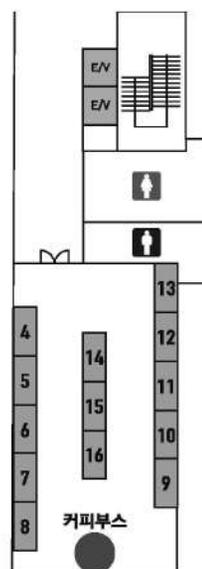


### < 부스 업체 >

1	오송첨단의료산업진흥재단
2	오송첨단의료산업진흥재단
3	대구경북첨단의료산업진흥재단
4	(재)원주의료기기테크노밸리
5	포항공과대학교
6	계명대학교산학협력단(미래산업사용성평가센터)
7	연세대학교의공학부(BK21플러스 사업단)
8	담스텍
9	주식회사 휴레브
10	(주)리메드
11	주식회사 토닥
12	한국 테루모(주)
13	(주)제이와이텍 코리아
14	(주)바디 프렌드
15	(BMEL)스프링거
16	메디아나

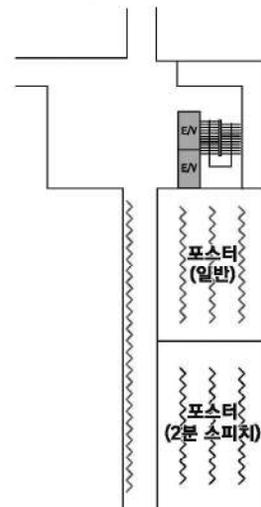
## 2층

(커피부스, 업체부스)

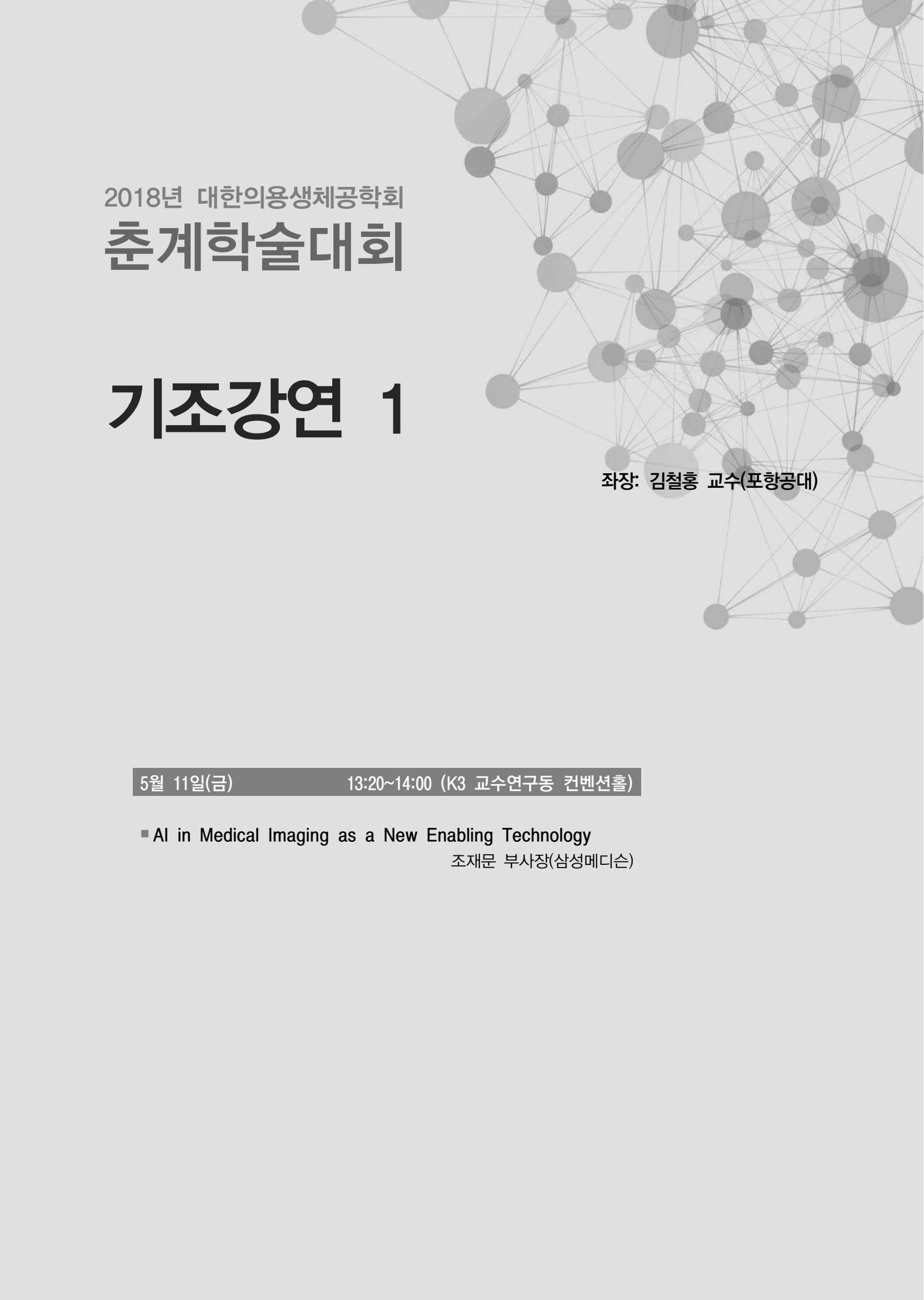


## 3층

(포스터)





A background graphic consisting of a network of interconnected nodes and lines, resembling a molecular structure or a data network. The nodes are represented by circles of varying sizes, and the lines are thin and grey.

2018년 대한의용생체공학회  
춘계학술대회

# 기조강연 1

좌장: 김철홍 교수(포항공대)

5월 11일(금)

13:20~14:00 (K3 교수연구동 컨벤션홀)

- AI in Medical Imaging as a New Enabling Technology  
조재문 부사장(삼성메디슨)



## AI in Medical Imaging as a New Enabling Technology

JaeMoon Jo, Ph.D.

*Executive Vice President of Samsung Electronics*



### Abstract

The importance of AI has been elevated and even mentioned as the core technology that will lead “The Fourth Industrial Revolution. AI-focused application in medical imaging received the most attention at RSNA (Radiological Society of North America). One plenary talk at RSNA stressed that fear of AI misguided radiologists and that radiologists should embrace AI as tools to reduce a workload and improve efficiency, precision and standardization. It needs to encourage them to accept AI as a tool for them, rather than as a threat to replacing radiologists. The deep learning technology is possibly able to go beyond the interpretation of medical images by radiologists if it can learn with enough data. However, since it is the physician's role and responsibility to confirm the disease with the medical images, the result provided by deep learning should only be used as a second opinion. The talk will introduce the novel application areas of deep learning and discuss new challenges for Samsung's medical image analysis and the initial results, as well as the opportunities for medical imaging with deep learning as a tool.

### Brief Biosketch

#### Education

1991	Korea Advanced Institute of Science and Technology (KAIST) Ph.D. in Electrical Engineering
1986	Korea Advanced Institute of Science and Technology (KAIST) M.E. in Electrical Engineering
1984	Seoul National University B.E. in Electrical Engineering

#### Work Experience

~ Present	Executive Vice President Advanced R&D Team Leader, Samsung Electronics & Samsung Medison
~ 2011.01	Senior Vice President DMC R&D Center, Samsung Electronics

# | 기조강연 1 |

~ 2010.12 Vice President  
Media SoC Team, DMC R&D Center, Samsung Electronics

~ 2010.01 Vice President  
SoC Platform Team, DMC R&D Center, Samsung Electronics

2007.01 Vice President  
DTV Team Leader, Digital Media R&D Center, Samsung Electronics

1989.06~ Samsung Electronics

1986.03 ~ 1987.02 Researcher  
University of California, Irvine

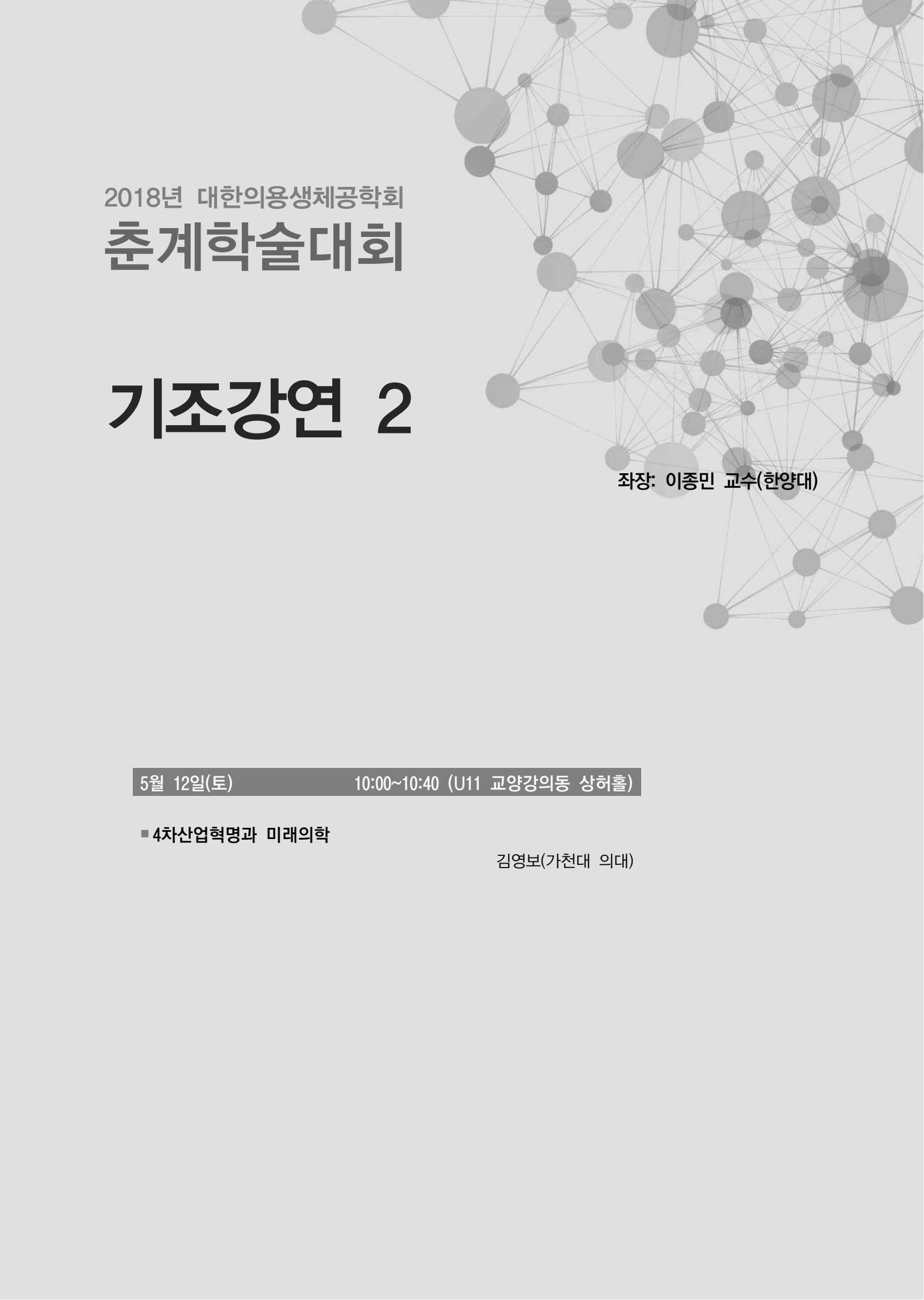
## Awards

2009 Samsung Awards of Honor

2007 Samsung Awards of Honor

2003 Samsung Awards of Honor

2003 Presidential Award at the 2003 Korea Multimedia Technology Award

A background graphic consisting of a network of interconnected nodes and lines, resembling a molecular structure or a data network. The nodes are represented by circles of varying sizes, and the lines are thin and grey, creating a complex web of connections.

2018년 대한의용생체공학회  
춘계학술대회

# 기초강연 2

좌장: 이종민 교수(한양대)

5월 12일(토)

10:00~10:40 (U11 교양강의동 상허홀)

■ 4차산업혁명과 미래의학

김영보(가천대 의대)



## 4차산업혁명과 미래의학

김영보

교수

가천대학교 의과대학 신경외과



### Abstract

Nowadays, 'Digital Transformation' is the mainstream in the world. Every company and organization is making a struggle to transform itself into a 'Network Organization'. If a machine has replaced human muscle work in the past, artificial intelligence is rapidly replacing human intelligence. AI, Cloud, IoT, Big Data, and Blockchain are encouraging each other's growth in an exponential manner, and it is time for convergent thinking to adapt

quickly to these changes and technologies in the world.

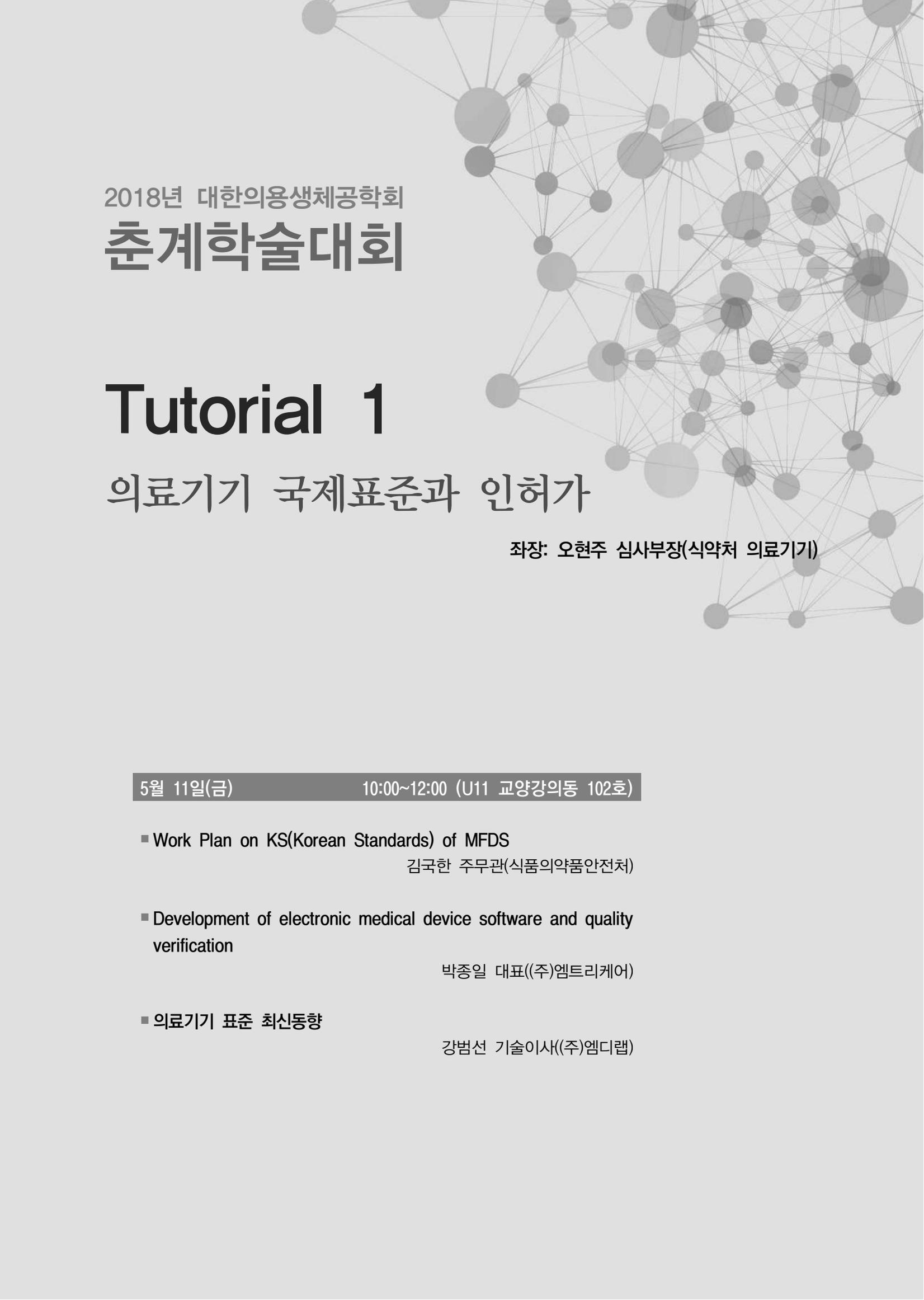
In this rapidly changing era, this talk would share the recent experiences in medicine and medical technologies, especially, IBM Watson for Oncology and Softbank Robotics' Pepper Robot.

Future medicine that the fourth industrial revolution will bring is expected to be transformed into a new concept of medical service platform such as preventive medicine, personalized medicine, and precision medicine. We try to watch the rapid transformation of these multinational corporations and think about future strategies in the medical field.

### Brief Biosketch

1986.02	M.D., College of Medicine, Hanyang University
1996.02	Ph.D. Postgraduate School, College of Medicine, Hanyang University
1999.01 ~ 2002.02	Vice CIO (Chief Information Officer) of Incheon Metropolitan City,
2000.03 ~ 2003.02	The Standing Director of Incheon Development Institute, incheon, Korea
2005.10 ~ 2007.10	Advisor, The Advanced Medical Industry Committee of President's Position
2003.07 ~ 2005.07	Visiting Research Professor, University of California, Irvine
2005.03 ~ 2014.09	Vice Director of NRI(Neuroscience research Institute), Gachon University
2008.04 ~	Professor, Department of Neurosurgery& Neuroscience research Institute, College of Medicine, Gachon University



A background graphic consisting of a network of interconnected nodes and lines, with nodes of varying sizes and shades of gray, creating a complex, web-like structure.

2018년 대한의용생체공학회  
춘계학술대회

# Tutorial 1

## 의료기기 국제표준과 인허가

좌장: 오현주 심사부장(식약처 의료기기)

5월 11일(금)

10:00~12:00 (U11 교양강의동 102호)

- Work Plan on KS(Korean Standards) of MFDS  
김국한 주무관(식품의약품안전처)
- Development of electronic medical device software and quality verification  
박종일 대표((주)엠트리케어)
- 의료기기 표준 최신동향  
강범선 기술이사((주)엠디랩)



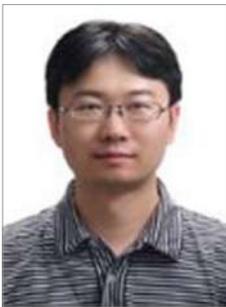
## Work Plan on KS(Korean Standards) of MFDS

김국한

주무관

식품의약품안전처

의료기기안전국 기준규격팀



### Abstract

Tasks for KS(Korean Standards) are pushed forward aligned with action plans developed every year according to the 4<sup>th</sup> Essential Plan for National Standards (2016~2020).

The presentation will overview updates on the rationale for tasks of KS to be assigned to Korea MFDS as of July 2015 and achievement in 2017. Tasks for KS are largely divided into system overhaul to maintain and apply standards, making domestically developed standards international standards, and fostering experts in standards area. To this end, Technical Committees and Cooperation Organization for Standards Development are established.

I would to share what we have achieved over time and the work plans to facilitate standards application.

### Brief Biosketch

Researcher, ETRI(Electronics and Telecommunications Research Institute)

(Security Division)

Researcher, KISTI(Korea Institute of Science and Technology Information)

(Network management Division)

Member of the Staff, SAMSUNG Electronics Co., Ltd. (Digital Media Division)

## Development of electronic medical device software and quality verification

박종일

대표이사  
(주)엠트리케어



### Abstract

Recently, convergence electronic medical device development has spread and software functions and roles are increasing.

For electronic medical devices, we are developing products based on the basic safety and essential performance standards (IEC 60601-1).

Software development specifications applicable to electronic medical devices include programmable electrical medical systems of IEC 60601-1, IEC 62304 (Medical Device Software - Software Life Cycle Process) and ISO 14971 (Medical Devices - Risk Management of Medical Devices) Based.

This presentation will discuss various software development processes and quality assurance measures as the development of electronic medical devices.

### Brief Biosketch

- |                     |  |
|---------------------|--|
| 2013.05.            | MTREECARE Inc. establishment of a company (Founder)  |
| 2014.02. ~ 2016.06. | Developed and launched THERMOCARE Smart Thermometer  |
| 2015.05. ~ 2018.04  | Development of Smart Doppler Ultrasound Blood Flowmeter(With A.I)  |
| 2017.08. ~ 2017.12. | Working with the handbook on "PEMS" of the common standards for electrical and mechanical safety of electronic medical devices |
| 2018.04. ~          | A Study on the Development of the Standards for Human Safety and Reliability Evaluation of Wearable Devices                    |

## 의료기기 표준 최신동향

강범선

기술이사  
㈜엠디랩



### Abstract

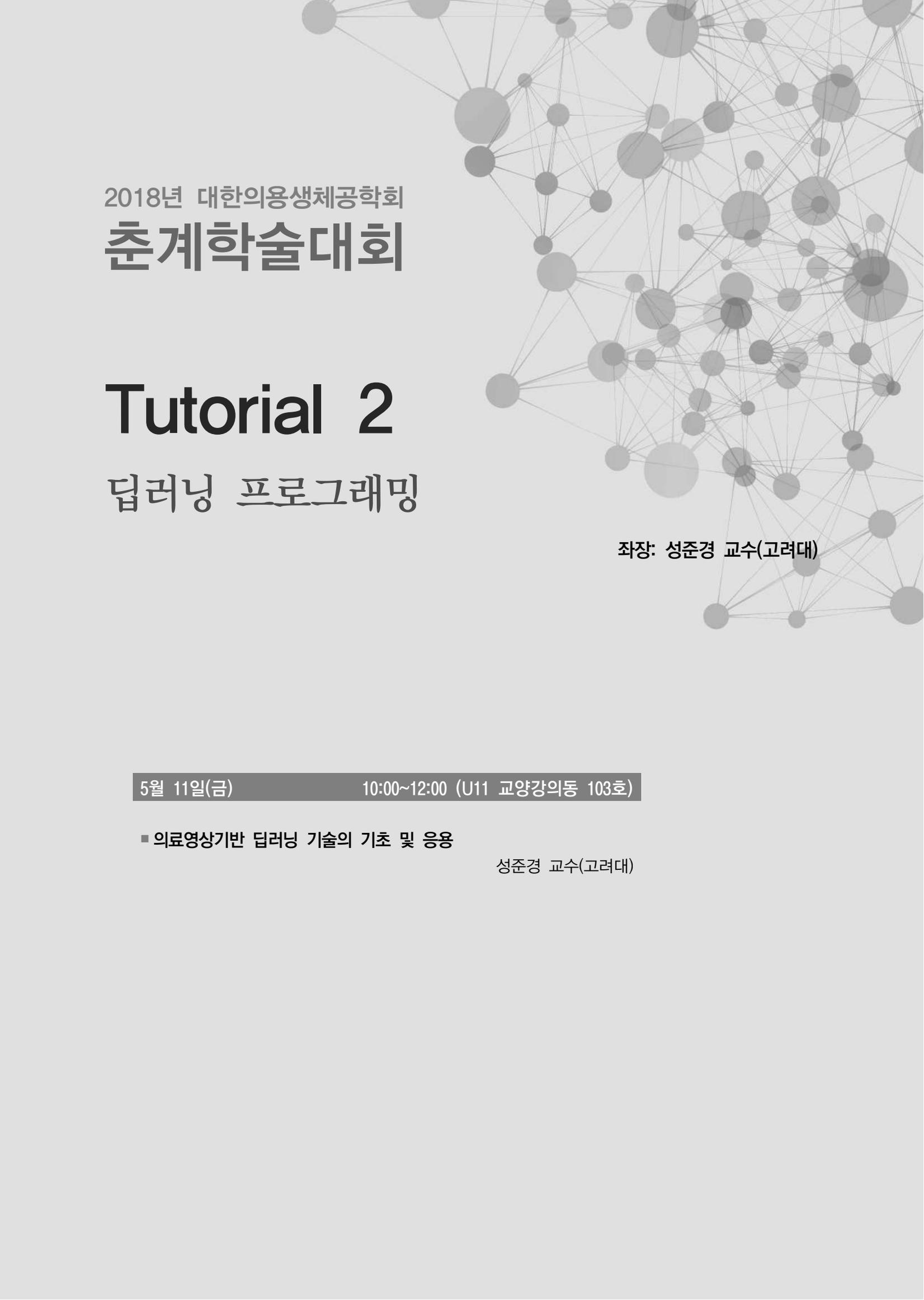
Korea and other countries have a stringent regulatory approval process for medical electrical equipment, because medical electrical equipment may cause serious risk to patients due to leakage of electricity, electromagnetic disturbances, biological safety and use errors, etc. The core of the regulatory approval process is to ensure that medical electrical equipment has been designed and manufactured in accordance with the international standards. To this end,

The International Electrotechnical Commission (IEC) has established international standards that define medical electrical equipment safety requirements (e.g. IEC 60601 series). Therefore, this lecture will examine the latest trends in medical device standards.

### Brief Biosketch

2000	Engineering Bachelor, Dep. of Electrical engineering, Kunkuk University
2014	Engineering M.D., Dep. of Electronic engineering, University of Seoul
2001 ~ 2013	KTL, Director of Test and evaluate medical devices for international certifications
2013 ~ Present	MDLab, Technical Director
2013 ~ Present	MFDS SC62A, Expert committee member
2013 ~ Present	IEC TC62/SC62A/WG14, Member



A background graphic consisting of a network of interconnected nodes and lines, with nodes of varying sizes and shades of gray, creating a complex, web-like structure.

2018년 대한의용생체공학회  
춘계학술대회

# Tutorial 2

## 딥러닝 프로그래밍

좌장: 성준경 교수(고려대)

5월 11일(금)

10:00~12:00 (U11 교양강의동 103호)

■ 의료영상기반 딥러닝 기술의 기초 및 응용

성준경 교수(고려대)



## 의료영상기반 딥러닝 기술의 기초 및 응용

성준경

부교수

고려대학교 바이오의공학부



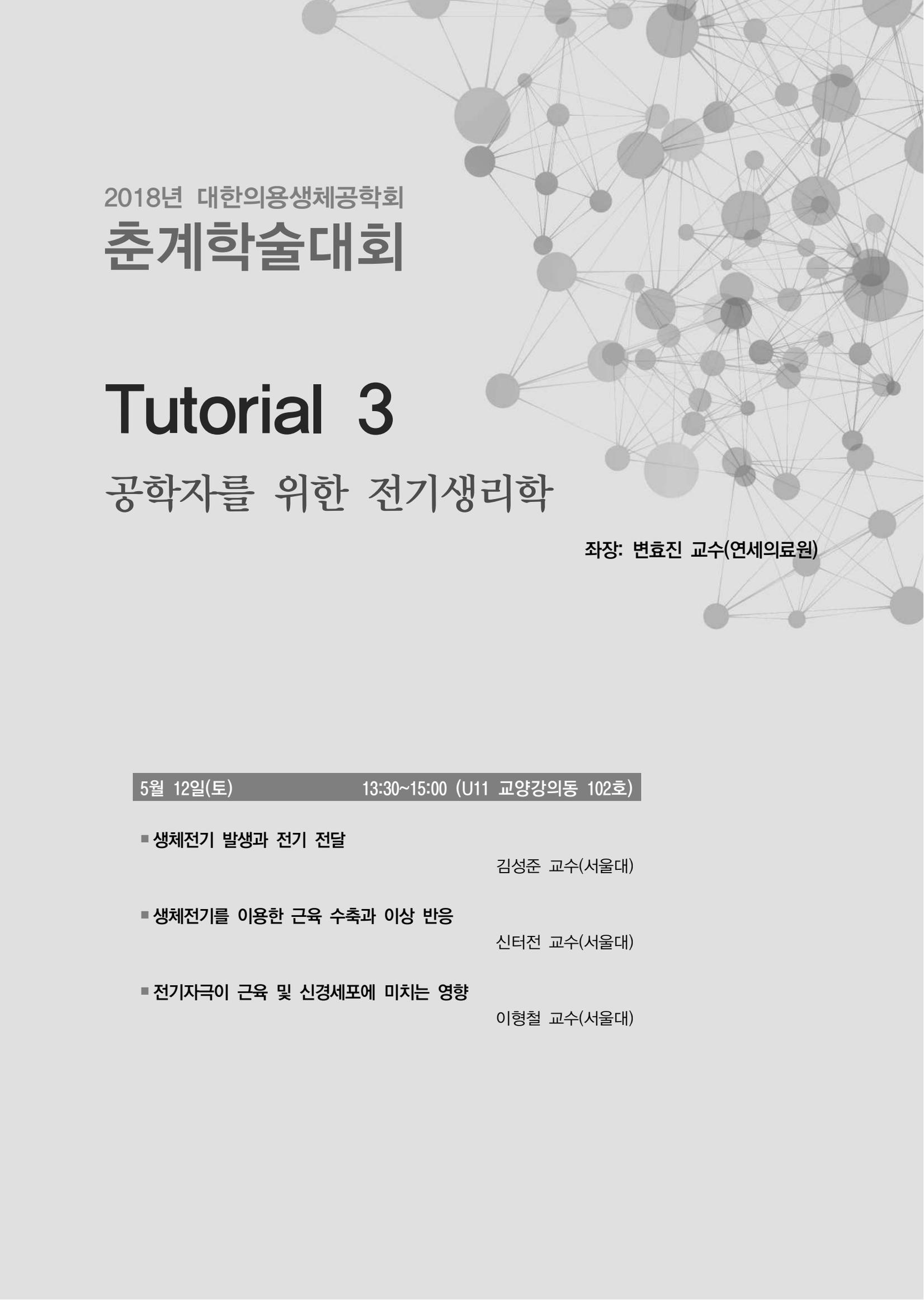
### Abstract

In this tutorial, I will introduce an emerging research area, machine learning-based medical image analysis, with emphasis on convergence technology between computer science and brain science. Computational medical image analysis deals with computational problems arising from quantification of structures and functions of human organs by exploiting non-invasive imaging modalities such as magnetic resonance imaging (MRI), computed tomography (CT), positron emission tomography (PET), and ultrasound imaging. A major challenge in this field is raised by massive high-dimensional non-Euclidean imaging data, which are difficult to analyze using available techniques. In this talk, I will show that machine learning approaches can provide both effective and efficient solutions to those challenges. As examples of those solutions, I will present some of recent deep learning techniques, convolutional neural networks.

### Brief Biosketch

2005.02	Ph.D., Computer Science, Seoul National University
2005.06 ~ 2008.09	Postdoctoral Fellow, School of Computing, University of Utah.
2008.10 ~ 2010.09	Assistant Research Professor, Department of Computer Science, KAIST.
2010.09 ~ 2012.08	Assistant Professor, School of Computer Science and Engineering, Soongsil University
2012.09 ~ 2013.08	Assistant Professor, Department of Biomedical Engineering, Korea University
2013.09 ~	Associate Professor, Department of Biomedical Engineering, Korea University.



A background graphic consisting of a network of interconnected nodes and lines, resembling a molecular or biological structure. The nodes are represented by circles of varying sizes, and the lines are thin, connecting the nodes in a complex, web-like pattern. The overall color scheme is grayscale.

2018년 대한의용생체공학회  
춘계학술대회

# Tutorial 3

공학자를 위한 전기생리학

좌장: 변효진 교수(연세의료원)

5월 12일(토)

13:30~15:00 (U11 교양강의동 102호)

■ 생체전기 발생과 전기 전달

김성준 교수(서울대)

■ 생체전기를 이용한 근육 수축과 이상 반응

신태전 교수(서울대)

■ 전기자극이 근육 및 신경세포에 미치는 영향

이형철 교수(서울대)



## 생체전기발생과 전기전달

김성준

교수

서울대학교 의과대학 생리학교실



### Abstract

Electrical phenomena in living animals (bioelectricity) have drawn attention through human history. Also, the diagnostic and therapeutic implication of bioelectricity become more important in the era of U-health. In this part of the educational session, the underlying cellular mechanisms of ‘action potential’ generation and conduction will be introduced. The contents would be, (1) early history of electrophysiology, (2) principles of action potential generation, (3) neural conduction of electrical excitation, (4) recordings on body surface (e.g. ECG).

### Brief Biosketch

1985.03 ~ 1991.02	Seoul National University College of Medicine, M.D.
1991.03 ~ 1997.02	Seoul National University, M.S. and Ph.D.(Physiology)
1998.08 ~ 2000.07	University of Freiburg, Germany, Research Fellow
2000.09 ~ 2004.08	Sungkyunkwan University School of Medicine, Assistant Professor
2004.09 ~ present	SNU College of Medicine, Assistant, Associate and Full Professor
2012.01 ~ 2013.12	SNU College of Medicine, Associate Dean for Research Affairs
2015.01 ~ present	Hypoxic/Ischemic Disease Institute, Director
~ 2017.11	SNU College of Medicine, Associate Dean for Students Affairs
2017 - present	Pfluger's Archiv-Eur J Physiol (Editorial Board)
2013 - present	Korean J Physiol Pharmacol (Editorial Board and Vice-Chief)

## 생체 전기를 이용한 근육수축과 이상반응

신터전

부교수

서울대학교 치의학대학원 소아치과

서울대학교 치과병원

### Abstract

The impairment of activities at neuromuscular junction lead to abnormal muscle function. Impaired neuromuscular function is associated with various clinical diseases. Among them, general anesthesia induces blockade of neuromuscular function to prevent mobility during surgery. Clinically, the anesthesiologist use a device to quantify the extent of neuromuscular blockade. Especially, If anesthetized patients have a neuromuscular disease, the chances of causing an anesthetic-related neuromuscular problem are greater. Therefore, care should be taken not to develop neuromuscular complications by establishing an anesthetic plan for these patients. Also, in susceptible patients, some anesthetics can interfere with the homeostasis of calcium in the muscle microstructure, leading to life-threatening symptoms such as malignant hyperthermia. In this regard, it is reasonable to seriously consider the effect of general anesthetics on neuromuscular function. This lecture covers the basic electrophysiology of normal neuromuscular function and the methods of monitoring neuromuscular function, and the basic mechanism of neuromuscular blockade and complications.

### Brief Biosketch

The main research topic

Investigating the mechanism of sedation and general anesthesia

#### Licensure

2000 licensed to practice medicine and surgery in the Korea

2005 Diplomat, Korean Board of Anesthesiology and Pain Medicine

#### Academic positions

2012 ~ Present Director, Korean Dental Society of Anesthesiology

2012 ~ Present Member, Board of Directors, Korean Society of Anesthetic Pharmacology

2013 ~ Present Director, Korean Association for Disability and Oral Health

## Effects of electrical stimulation on muscle and nerve cells

이형철

임상교수  
서울대병원 마취통증의학과



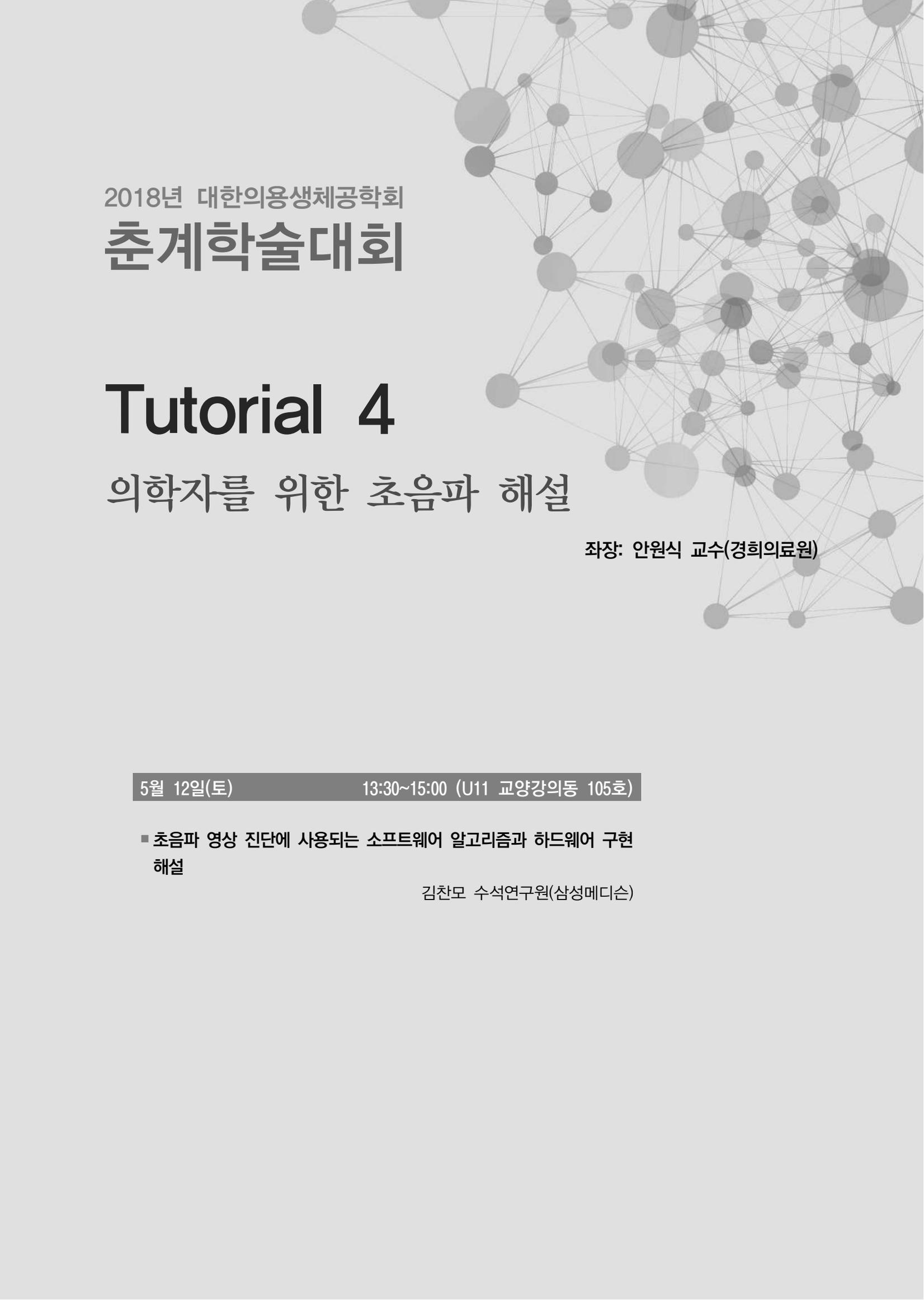
### Abstract

Electrical stimulation affects the human body, especially muscle and nerve cell. After Luigi Galvani discovered the contraction of frog legs by applying electricity in 1780, many researchers have studied muscle and neuronal effects of electrical stimulations. These results are now being applied on many medical devices such as radiofrequency treatment of chronic pain, spinal cord stimulator, deep brain stimulation, electric convulsion therapy, cardiac pacemaker / defibrillator, and electric cautery. The purpose of this lecture is to review the history and basic physiology about the effect of electricity on the human body, how this phenomenon is used in current medical practice, and then we will consider the future application of this technology.

### Brief Biosketch

1999.03 ~ 2004.02	Undergraduate, Department of electric engineering, Seoul National University
2004.03 ~ 2008.02	Undergraduate, College of Medicine, Seoul National University
2008.03 ~ 2009.02	Intern, Seoul National University Hospital
2009.03 ~ 2013.02	Resident, Department of Anesthesiology and Pain Medicine, Seoul National University Hospital
2013.04 ~ 2016.04	Public health doctor
2016.04 ~ 2017.04	Fellow, Department of Anesthesiology and Pain Medicine, Seoul National University Hospital
2017.03 ~	Clinical Professor, Department of Anesthesiology and Pain Medicine, Seoul National University Hospital



A background graphic consisting of a network of interconnected nodes and lines, with nodes of varying sizes and shades of gray, creating a complex, web-like structure.

2018년 대한의용생체공학회  
춘계학술대회

# Tutorial 4

의학자를 위한 초음파 해설

좌장: 안원식 교수(경희의료원)

5월 12일(토)

13:30~15:00 (U11 교양강의동 105호)

- 초음파 영상 진단에 사용되는 소프트웨어 알고리즘과 하드웨어 구현 해설

김찬모 수석연구원(삼성메디슨)



## Understanding Diagnostic Ultrasound

김찬모

수석연구원  
삼성메디슨



### Abstract

Diagnostic Ultrasound systems are being used for various medical applications with noninvasive, safe and real-time features. For medical diagnostic applications, a major advantage accrues from the ability of Ultrasound to penetrate biological tissue and to return signals that contain information from which the acoustic structure can be determined. Over the years, Ultrasound has adapted to new applications through new arrays suited to specific clinical purposes and to signal processing, measurement and visualization packages.

The purpose of session is to provide an introduction of the essential physics, signal processing principles, overall hardware structure & software algorithm, diagnostic features and future trends of diagnostic Ultrasound.

### Brief Biosketch

2006.02	Ph.D., Dept. of Electronics, Konkuk University
2003.12 ~ 2007.02	Senior Engineer, Medison Co., Ltd, R&D Center
2007.03 ~ 2009.12	Lecturing Professor, Konkuk University
2010.06 ~ 2012.02	Visiting Professor, Konkuk University
2009.12 ~	Principal Engineer, Samsung Medison Co., Ltd R&D Center



2018년 대한의용생체공학회  
춘계학술대회

# Tutorial 5

## 의공학 교육의 운영방안과 사례

좌장: 태기식 교수(건양대), 윤용현 교수(대림대)

5월 12일(토)

13:30~15:00 (U11 교양강의동 104호)

■ 의공학 교육에서의 기초의학과목 강의방향

정동근 교수(동아대)

■ 의료공학 기업연계 실전프로젝트 운영사례

오도창 교수(건양대)

■ 의공학 공학교육인증과 융합교육 사례

조용석 교수(건양대)

■ 국가직무능력표준(NCS)을 활용한 의공(산업)기사  
실기시험 평가방법 개발

최병철 교수(춘해보건대)



## 의공학 교육에서 기초의학과목 강의 방향

정동근

교수

동아대학교 의과대학 의공학교실



### Abstract

Education in basic medicine in biomedical curriculum is essential for the work of medical engineering specialists and for collaboration with medical professionals. However, it is time-limited to adequately teach basic medicine within a limited time. Therefore, we need to select and concentrate for effective basic medical education. Through this lecture, I would like to introduce the range of medical literacy required in modern biomedical science.

Biomedical engineering is a field that is applied to medical care and it is essential to understand basic medical terminology and human body structure and function because it is based on understanding of medical field. Clinical medicine should proceed to a level that understands the principles of diagnosis and treatment.

### Brief Biosketch

- 1989.02 M.D., Dept of Medicine, Pusan University
- 1993.08 Ph.D., Dept of Physiology, Pusan University
- 1997.05 ~ Professor, Dept of Physiology, Dept of Medical Engineering,  
College of Medicine, Dong-A University
- 2017.08 ~ Dean, College of Medicine, Dong-A University

## 의료공학 기업연계 실전프로젝트 운영사례

오도창

교수

건양대학교 의공학부



### Abstract

Project-based education in engineering is very important. It is difficult to raise competent talent by learning simple knowledge in the age of fourth industrial revolution. In particular, the field of medical engineering is a fusion education in itself, so the experience of each semester project class is very important, and students in upper grades need to link them to graduation work or graduation thesis. Therefore, we propose a biomedical education based on the corporate needs, social problem solving theme, and field study idea. This research project is important not only for research topics but also for the research team. The research team is composed of 7~8 members, including corporate mentor, clinical professor, graduate student team leader, and 3~4 undergraduate students. Finally, from the teaching of this method, students develop problem definition and problem solving abilities in the practical field of biomedical engineering.

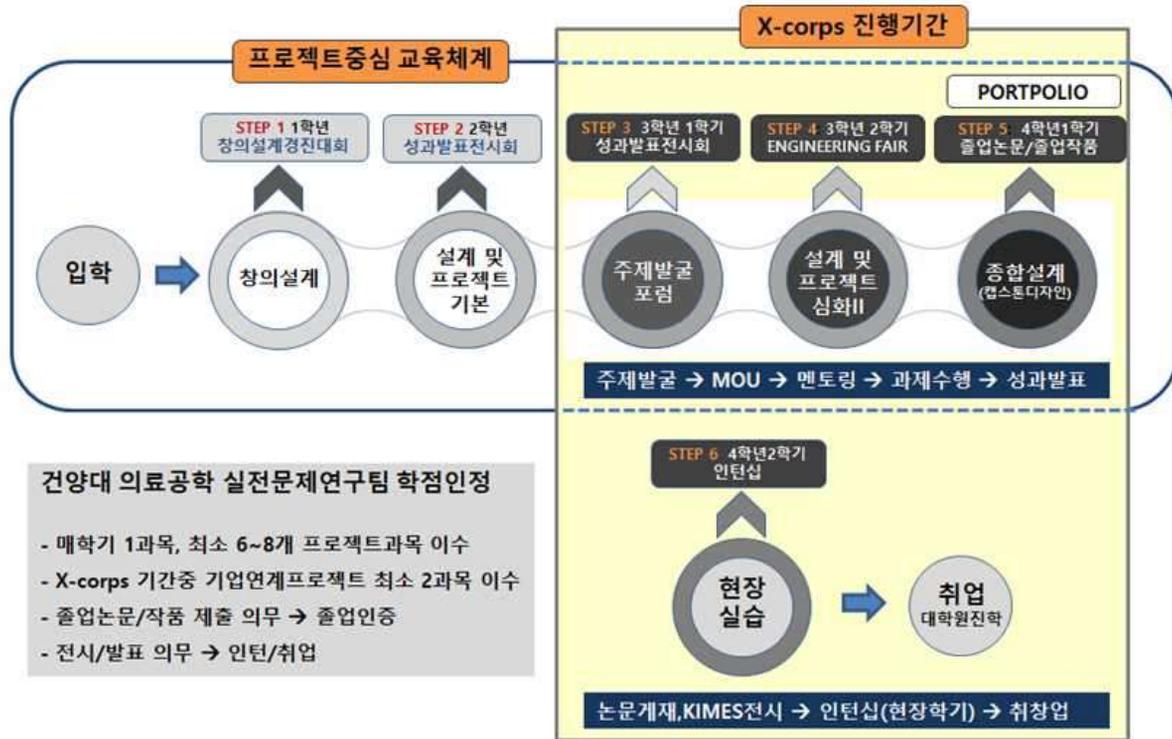
### Brief Biosketch

1997.02	Ph.D., Dept. of Electronic Engineering, Kyungpook National Univ.
2007.02 ~ 2009.12	Associator Editor, Journal of Franklin Institute
2010.01 ~ 2011.12	Director of industry-academy cooperation, Konyang Univ.
2011.01 ~ 2016.08	Manager of ACE(Advancement of College Education) Project
2013.08 ~ 2015.12	Dean of Academic Affairs, Konyang Univ.
2014.03 ~ 2016.08	Executive Director, ACE Consortium
2016.01 ~ 2017.09	Dean of Biomedical Engineering College, Konyang Univ.
2017.04 ~	Manager of Biomedical X-corps Research
1997.08 ~	Professor, Dept. of Biomedical Engineering, Konyang Univ.

의료공학분야는 그 자체가 4차산업형 융합교육이므로 매학기 프로젝트수업의 경험이 매우 중요하고 고학년의 학생은 이를 졸업작품이나 졸업논문으로 연계할 필요가 있다. 따라서 기업요구, 사회문제해결, 현장아이디어를 주제로 한 의료공학 실전문제연구를 제안한다. 이 연구과제수행 교육은 연구주제뿐만아니라 연구팀의 구성이 중요하다. 연구팀은 기업멘토와 임상교수, 대학원생팀장과 3~4명의 학부생을 포함, 총 7~8명으로 구성되어 700만원 내외의 지원금을 가지고

프로젝트교과 학점이수, 논문및특허발표, 학회/전시회 참가를 목적으로 수행하게 된다. 결국 이러한 방법의 교육으로부터 학생들은 의공학의 실전문야에 문제정의 및 문제해결능력을 기르게 된다.

설계교과이수를 통한 실전문제연구 진행



1년 프로젝트 진행 절차

단계	과제발굴	연구계획완성	사전연구 수행	프로젝트수업
실전문제 연구단 주제발굴 절차	사업 협약	멘토링 및 feedback	연구방법교육 및 사전연구 수행	프로젝트 수업 진행
	수요조사	연구계획 보완		
기간	아이디어 경진대회	연구팀 선정	Design Thinking 아카데미	중간 발표
	의료융합 주제발굴 상생포럼	기본설계 계획수립	연구관리 (연구노트) 상세설계 계획수립	멘지니 어릴패언 성과 발표회
기간	3~4월	5~6월	7~8월	9월~12월

\*이 논문은 2017년도 정부(과학기술정보통신부)의 의 재원으로 한국연구재단-현장맞춤형 이공계 인재양성 지원사업의 지원을 받아 수행된 연구임(No. 2017029990)

## 의공학과 공학교육 인증

조용석

교수  
의료IT공학과  
건양대학교



### Abstract

Abstract(영문): Accreditation for engineering education is an educational system that guarantees the quality of education of engineer. Especially, liberal arts for engineer, basic sciences, engineering design, and continuous quality improvement (CQI) of a program are essential parts of engineering education. Therefore, I would like to introduce the case of Konyang University which has built accreditation for engineering education system that is

reflected their features.

### Brief Biosketch

건양대학교 의료IT공학과 교수

건양대학교 공학교육혁신센터 센터장

## 국가직무능력표준(NCS)을 활용한 의공(산업)기사 실기시험 평가방법 개발

최병철

교수

춘해보건대학교 의료공학과



### Abstract

The practical test of the current engineer biomedical qualification test is performed in a subjective, one-response format, making it unsuitable for performing the technical verification required at the industrial site

In this study, we have improved the validation of the job performance of the current qualification to a practical test method that complies with the National Competency Standard(NCS) to provide a customized solution

### Brief Biosketch

- 2016.04 Director of Research Development for Medical Device manufacturing field NCS Learning Module in Korea Research Institute for Vocational Education & Training(KRIVET)
- 2015.04 Director of Research Development for NCS-based practical test evaluation method in Human Resources Development Service of Korea
- 2004.05 Ph.D., Dept. Biomedical Engineering, Busan National University
- 2000.03 ~ Professor, Dept. Biomedical Engineering, Choonhae College of Health Sciences



2018년 대한의용생체공학회  
춘계학술대회

# Special session 1

의료기기 측정과 표준

좌장: 강훈 교수(충북대)

5월 11일(금)

10:00~12:00 (U11 교양강의동 105호)

■ 의료기기 개발에서 측정의 의미

안원식 교수(경희의료원 혈류데이터센터)

■ 측정은 사람이 한다

최종오 책임연구원(한국표준과학연구원)

■ 의료기기 측정과 표준

임현균 센터장(한국표준과학연구원 국가참조표준센터)

■ 보건의료분야 참조표준 개발 및 활용사례

김창근 책임연구원(한국표준과학연구원 국가참조표준센터)



## 의료기기 개발에서 측정의 의미

안원식

혈류데이터 센터장  
경희의료원



### Abstract

19세기 말에서 20세기 초에 engineering 계열에서 큰 이슈 중 하나가 동력비행체 개발이었다. 당시 내로라하는 공학자들은 저마다 “최초의 동력비행” 영예를 얻기 위해 노력하였으나 아시다시피 최초 동력 비행자는 Wright 형제다. 하지만 라이트 형제도 Bernoulli 정리와 양력(揚力), 유체 역학을 배웠지만 많은 실패를 거듭하였다. 기존에 알려진 양력과 유체역학 상수를 기반으로 한 날개 구조를 설계하였으나 충분한 양력을 얻지 못하였다. 라이트 형제는 유체역학 상수가 잘못되었을 수 있다고 생각하며 풍동 실험을 직접 수행하여 제대로 측정된 유체역학 상수를 구했다. 이를 바탕으로 기본적인 날개구조와 회전, 이륙, 착륙에 필요한 양력을 계산하여 적절한 날개구조를 만들었던 것이다. 인류 최초의 동력비행기를 완성한 영광은 제대로 측정된 유체역학 상수를 구한 사람들에게 돌아갔던 것이다.

최근, 의학자와 의공학자들은 다양한 의료기기 개발에 매진하고 있다. Bernoulli 정리가 양력 발생의 기본원리이듯이 개발하고자 하는 의료기기의 기본원리는 대부분 알려져 있는 경우가 많다. 19C 말의 양력과 유체역학 상수가 부정확하듯이 최근 의료기기에 들어가는 측정 자료의 질이 낮은 경우가 많다. 제대로 된 측정을 위해서는 정확한 측정량 설정, 측정값의 추적 가능성 (소급성) 확보, 불확실 정도(불확도) 산출이 필요하다. 적절히 측정된 양질의 자료와 질 높은 참조표준이 있어야 임상적으로 활용 가능한 의료기기를 생산할 수 있을 것이다. 특히, 비행기의 양력 뿐 아니라 조정을 위한 회전, 이륙, 착륙에서의 상수값이 필요하듯이 정상인체를 대상으로 하는 것 이외에 질병의 진단과 치료를 대상으로 하는 의료기기의 개발에서는 적절한 측정에 의한 믿을 수 있는 상수값인 참조표준이 꼭 필요하다고 하겠다. 오늘 “의료기기 측정과 표준” 세션에서는 질 높은 의료기기 개발에 필수적인 “측정과 표준”에 대해 함께 알아 보고자한다.

### Brief Biosketch

학력: 의학 학사/석사/박사(서울대), 통계학 학사(방송대), 한의학사(경희대)

대한의용생체공학회 정보이사

(전) 서울의대 마취과 교수

(전) 서울대학교병원 의료기기 임상평가실장

(전) ISO TC 121 마취기 및 호흡회로 국내 위원장

연구 분야: 자율신경계/호르몬계 측정

## 측정은 사람이 한다.

최종오

책임연구원  
한국표준과학연구원



### Abstract

Metrology, the science of measurement, provides scientist including medical scientist/engineer with worldwide accepted guidance for reliable measurement results [1]. Based on the guidance, the necessary and sufficient conditions for the reliable measurement are discussed.

Metrological traceability has something to do with the scientific authority of the measurement result. Then, to what base is the authority of the result traceable? Moreover, traceability should be conceived and established before the measurement is even started. Measurement uncertainty is nothing to do with error and is not the same as repeatability and reproducibility. Uncertainty is the measure of the reliability of your measurement.

1. Guide to the expression of uncertainty in measurement. ISO (1995)

### Brief Biosketch

#### 연구

(화학) 측정학, 불확(실)도, 표준물질, 숙련도 평가, 데이터 신뢰성 연구  
품질경영시스템 (ISO17025, 34, 43, 9001) 운영  
측정능력평가, 측정품질, 측정표준 관리 및 관련 교육 및 세미나

#### 활동

측정 및 표준 교육 (개념, 용어, 국제단위, 불확도, 소급성, 신뢰성 등) 및 가이드 9권  
국가지정 '화학분석 신뢰성' 연구실 운영  
불확도 교육 및 자문 (교육/세미나 500회 이상)  
측정신뢰성 및 품질경영 (ISO 9001, 17025): 터키, 이란, 우즈베키스탄 등 중앙아시아 10 국  
해외 초청 세미나 및 자문 40회 : IAEA, APMP, APLMF, IMEKO, 필리핀, 인도네시아, 영국, 프랑스

## 의료기기 측정과 표준

임현균

센터장

한국표준과학연구원 국가참조표준센터  
교수, 과학기술연합대학원대학교, 의학물리학과



### Abstract

A big international workshop is scheduled from May 1~3, 2018 in Teddington, UK for reproducibility of scientific data: Improving Reproducibility in Research: The Role of Measurement Science. This program is prepared by the so called world leading NMI (National Metrology Institute) groups such as NIST, NPL, PTB, and KRISS. People will discuss on why it is not easy to reproduce the same results from many tests published in well-known journals including physical, chemical, and biological science with 37 scientists (i.e., speakers) from all over the world. Why are they discussing on this topic at this moment?

In this session, medical measurements (i.e., soft-metrology) will be discussed why they are difficult to make firm standards. In addition, we will discuss on why we need to give them an attention, even though reproducibility could not be easily guaranteed.

### Brief Biosketch

Baylor College of Medicine (2001) & NIDRR (2003) research fellow

Center for Medical Metrology (2011), KRISS, Head

ISO TC 173 WG 11 (2014~), Delegate

National Center for Standard Reference Data (2017~), Head

## 보건의료분야 참조표준 개발 및 활용사례

김창근

책임연구원

한국표준과학연구원 국가참조표준센터



### Abstract

우리는 제4차 산업혁명시대 정밀의료를 위한 보건의료 빅데이터 개발 및 연구가 활발하게 진행되고 이를 이용한 한국형 왓슨 개발 등 데이터기반의 의료산업의 빠른 변화가 진행되고 있는 시대를 맞이하고 있다.

보건의료 빅데이터의 개발은 여러 병원이 협력하여 구축해야 하는 일들이며 각 협력 병원에서 측정되는 임상데이터를 합치기 위해서는 고려해야 할 것들이 많이 있다. 여러 병원에서 서로의 측정결과를 신뢰하고 활용할 수 있게 해야 하며, 서로 다른 브랜드의 측정장비에 대한 교정 그리고 한국인 고유 표준참고치에 대한 기준도 만들어야 한다. 이런 측면에서 국가는 국가품질인프라 차원에서 헌법 및 국가표준기본법에 표준을 정의 하고 개발 및 보급의 역할을 임무로 하고 있다.

이러한 법적 근거를 바탕으로 국가참조표준센터가 2006년에 한국표준과학연구원 내에 설립되었으며 현재 31개 데이터 센터가 지정되어 국가적으로 필요한 신뢰성이 확보된 데이터를 생산 및 보급하고 있다. 이런 국가참조표준체계를 통하여 개발 및 활용되고 있는 참조표준에 대하여 보건의료분야 사례를 중심으로 소개하고자 한다.

### Brief Biosketch

1990.03 ~ 1995.02	한양대학교 물리학 학사(95.02)
1996.08 ~ 1998.08	한양대학교 플라즈마 물리학 석사(98.08)
2000.03 ~ 2003.02	한양대학교 플라즈마 물리학 박사(03.02)
2002.11 ~ 2004.03	캐나다 INRS-EMT 연구소 박사후연수원
2004.08 ~ 2005.10	한국 기초과학지원연구원 박사후 연수원
2017	제6대 국가참조표준센터장
5.11. ~ 현재	한국표준과학연구원 국가참조표준센터 책임연구원

“헌법 제127조 2항” 국가는 국가표준제도를 확립한다

"국가표준"이란 국가사회의 모든 분야에서 정확성, 합리성 및 국제성을 높이기 위하여 국가적으로 공인된 과학적·기술적 공공기준으로서 측정표준·참조표준·성문표준 등 이 법에서 규정하는 모든 표준을 말한다.

"**성문표준**"이란 국가사회의 모든 분야에서 총체적인 이해성, 효율성 및 경제성 등을 높이기 위하여 강제적으로 또는 자율적으로 적용하는 문서화된 과학기술적 기준, 규격, 지침 및 기술규정을 말한다.

"**측정표준**"이란 산업 및 과학기술 분야에서 물상상태(物象狀態)의 양의 측정단위 또는 특정량의 값을 정의하고, 현시(顯示)하며, 보존 및 재현하기 위한 기준으로 사용되는 물리적도, 측정기기, 표준물질, 측정방법 또는 측정체계를 말한다.

"**참조표준**"이란 측정데이터 및 정보의 정확도와 신뢰도를 과학적으로 분석·평가하여 공인된 것으로서 국가사회의 모든 분야에서 널리 지속적으로 사용되거나 반복사용할 수 있도록 마련된 물리화학적 상수, 물성값, 과학기술적 통계 등을 말한다.



2018년 대한의용생체공학회  
춘계학술대회

# Special session 2

## 대구경북/오송 첨단의료기기개발 지원센터

좌장: 김명남 교수(경북대)

5월 11일(금)

14:30~17:30 (U11 교양강의동 104호)

### ■ 대구경북첨단의료산업진흥재단

- How to prepare IEC 60601-1, Ed.3 in the Lab : the official approval assessment service in the MDDC

정재훈(대구경북첨단의료산업진흥재단)

- Introduction of Human Origin Biomaterials Development Center for Tissue Engineering and Regenerative Medicine

정봉수(대구경북첨단의료산업진흥재단)

- Establishment of ICT Clinical Trial Platform

서수원(대구경북첨단의료산업진흥재단)

- Industry 4.0: Smart Factory in Medical Device Industry

손재범(대구경북첨단의료산업진흥재단)

### ■ 오송첨단의료산업진흥재단

- The role and Performance of Medical device development center

송영준(오송첨단의료산업진흥재단)

- The supported R&BD cases for solving problems from clinical idea of Osong Medical device development center

문진희(오송첨단의료산업진흥재단)



## How to prepare IEC 60601-1, Ed.3 in the Lab : the official approval assessment service in the MDDC

Jaehoon JUNG

*Safety Assessment Team Leader  
Daegu-Gyeongbuk Medical Innovation Foundation  
Medical Device Development Center*

### Abstract

From Jan. 2015, IEC 60601-1, Ed. 3 has been applied to domestic medical device approval. Medical device companies have been well counteracted the effect of IEC 60601-1, Ed. 3. But there are limited or insufficient to take action against IEC 60601-1, Ed. 3 in laboratories. In here, we present the important things in IEC 60601-1, Ed. 3 and how to use Medical device development center for preparing the standard. Also the official approval assessment service provided in our center.

### Brief Biosketch

Dr. Jung work at DGMIF as the safety assessment team leader from 2015. He received his doctor degree from Nagoya University, Japan. Before he came to DGMIF, he worked at MFDS as an industrial research official. Based on his experiences at MFDS, he works in an assessment of medical device at DGMIF.

## Introduction of Human Origin Biomaterials Development Center for Tissue Engineering and Regenerative Medicine

Bongsu Jung

*Team leader, Principal Research Scientist  
Daegu-Gyeongbuk Medical Innovation Foundation (DGMIF)  
Biocompatibility Assessment Team, Medical Device Development Center*



### Abstract

Human origin biomaterials such as extracellular matrix (ECM), collagens, hyaluronic acid (HA), and mesenchymal stem cell (MSCs) have been widely studied in research and clinical applications for regenerative medicine during the last decades. Numerous studies have reported that adipose tissue contains important tissue regenerative sources such as ECM, collagen, HA, and Adipose-driven stem cells (ASCs). Most of the obtainable human adipose tissue is ethically uncontroversial as it is waste material resulting from a liposuction or an

abdominoplasty.

We have installed infrastructure of Human Origin Biomaterials Development Center (HOBDC) for utilizing human adipose tissue for regenerative medicine and tissue engineering. HOBDC has three major facilities such as adipose tissue-biomaterial fabrication facilities in 100~100,000 class cleanroom, biocompatibility testing facilities based on ISO10993-Good Laboratory Test (GLP), and 3D bioprinting facilities for prototype fabrication.

### Brief Biosketch

DGMIF, Medical Device Development Center, Principal Research Scientist/Team leader

University of California, Riverside, Bioengineering, Post-doctoral fellow / Assistant Research Scientist Staff

University of Texas at Austin, Biomedical Engineering, MS, Ph.D.

General Electric Healthcare Korea, R&D Center, Researcher

Yonsei University, Biomedical Engineering, undergraduate

Expert committee member for medical device in KEIT, KFDA, KHIDI, KIPO

## Establishment of ICT Clinical Trial Platform

서수원

수석연구원  
대구경북첨단의료산업진흥재단  
첨단의료기기개발지원센터



### Abstract

The project was initiated to dramatically improve the economics and effectiveness of clinical trials by applying ICT technology to the clinical trials. This project, which is supported by the Ministry of Trade, Industry and Energy, is participated by Daegu-Gyeongbuk Medical Innovation Foundation (DGMIF) and 6 medical institutions including Kyungpook National University Hospital (KNUH) and Samsung Hospital.

Currently, ICT clinical trial platform has been established at DGMIF (ICT based Clinical Trials Coordination Center). The clinical trials are in progress for 6 diseases (kidney transplantation, dementia, atrial fibrillation, cardiovascular disease, asthma, diabetes). The Comparative mid-term evaluation of the ICT clinical trials vs. conventional clinical trials was carried out and 3 factors were compared (the number of visits, medication compliance, and drop-out rate). As the results, the number of visits decreased and the medication compliance (> 90%) and drop-out rate (< 10%) were significantly improved.

After the completion of the ICT clinical trials, the economic value and usability of the ICT clinical trial system will be quantified through analysis and the guidelines for ICT clinical trial will be set.

### Brief Biosketch

2012 ~ present	DGMIF, Chief Researcher
1996 ~ 2012	Samsung Hospital, Chief Researcher
2014	Presidential Citation For contributing to the development of the medical device industry
2000	Minister's Citation (Korea Ministry Information & Communication.) For helping to solve the Y2K problems of Korea in Medical Field

## Industry 4.0: Smart Factory in Medical Device Industry

Jaebum Son

*Principal Researcher*

*Daegu-Gyeongbuk Medical Innovation Foundation(DGMIF)*



### Abstract

Smart factory is the main goal of manufacturing field based on cyber-physical systems (CPS), internet of things (IOT), and cloud computing (CC) in fourth industrial revolution which is called industry 4.0. In Korea, smart factory has been promoted since 2014, aiming introducing 10,000 systems in small- and medium-sized companies. Korean medical device industry is the fifth most important field among them, but the implementation has not yet been successful since medical device industry is very different from other industrial fields in its nature. In this presentation, the compatibility of smart factory technology in Korean medical industry is analyzed and a strategy to introduce the smart factory system into Korean medical industry is discussed.

### Brief Biosketch

Jaebum Son is a principal researcher of Medical Device Development Center of Daegu-Gyeongbuk Medical Innovation Foundation(DGMIF). He got PhD in Mechanical Engineering at the University of Michigan, Ann Arbor, in 2006, and served as an assistant professor in Biomedical Engineering at the University of Los Andes, Colombia, 2014 to 2018. He is an active member of IEEE Robotics and Automation Society and IEEE Engineering in Medicine and Biology Society. He is interested in research of medical robotics, medical device, smart systems in medical fields.

## 오송 첨단의료기기개발지원센터 역할 및 성과 현황

송영준

부장

오송첨단의료산업진흥재단  
첨단의료기기개발지원센터 기획경영부



### Abstract

I'll introduce to the role of Osong Medical device development center for BT-based high-tech medical device.

Since the 2010, I'm explain to the example of the supporting cases that the center is cooperate to company, university, research institute and hospital. It describes the future direction of the center for healthcare industry development and the future supporting direction

of the infrastructure.

### Brief Biosketch

#### 1. Education

- Chungbuk National University : Information and Communication Engineering (2004, Ph.D)

#### 2. Main Carrier

- LG Electronic, Assistant Researcher (1996~1998)
- ETRI, Senior Researcher (2000~2003)
- Chungbuk National University, Invited associate professor (2006~2011)
- Osong Medical Innovation Foundation, General Manager (2011~ )

#### 3. Record of a research

- "Face Recognition Robust to left/right shadows; Facial Symmetry", etc. (paper : 50 ea)
- "Self-balancing wheelchair" etc. (patent : 11 ea)

## The supported R&BD cases for solving problems from clinical idea of Osong Medical device development center

Jin-Hee, Moon

*Principal Researcher, Ph.D.*

*Osong Medical Innovation Foundation*

*Integrated Medical Technology Team manager in Dept. of R&D, Medical Device Development Center*



### Abstract

Osong Medical Device Development Center which is a part of Osong Hi-tech medical cluster aims to establish a coordinated infrastructure for R&BD of advanced medical devices utilizing diversified biotechnologies. And we've developed Novel medical devices that invented from MD & other's idea at clinical field and operation room. Today, I'll introduce the results of R&BD and solving problems about novel devices from clinical idea.

### Brief Biosketch

#### 1. Education

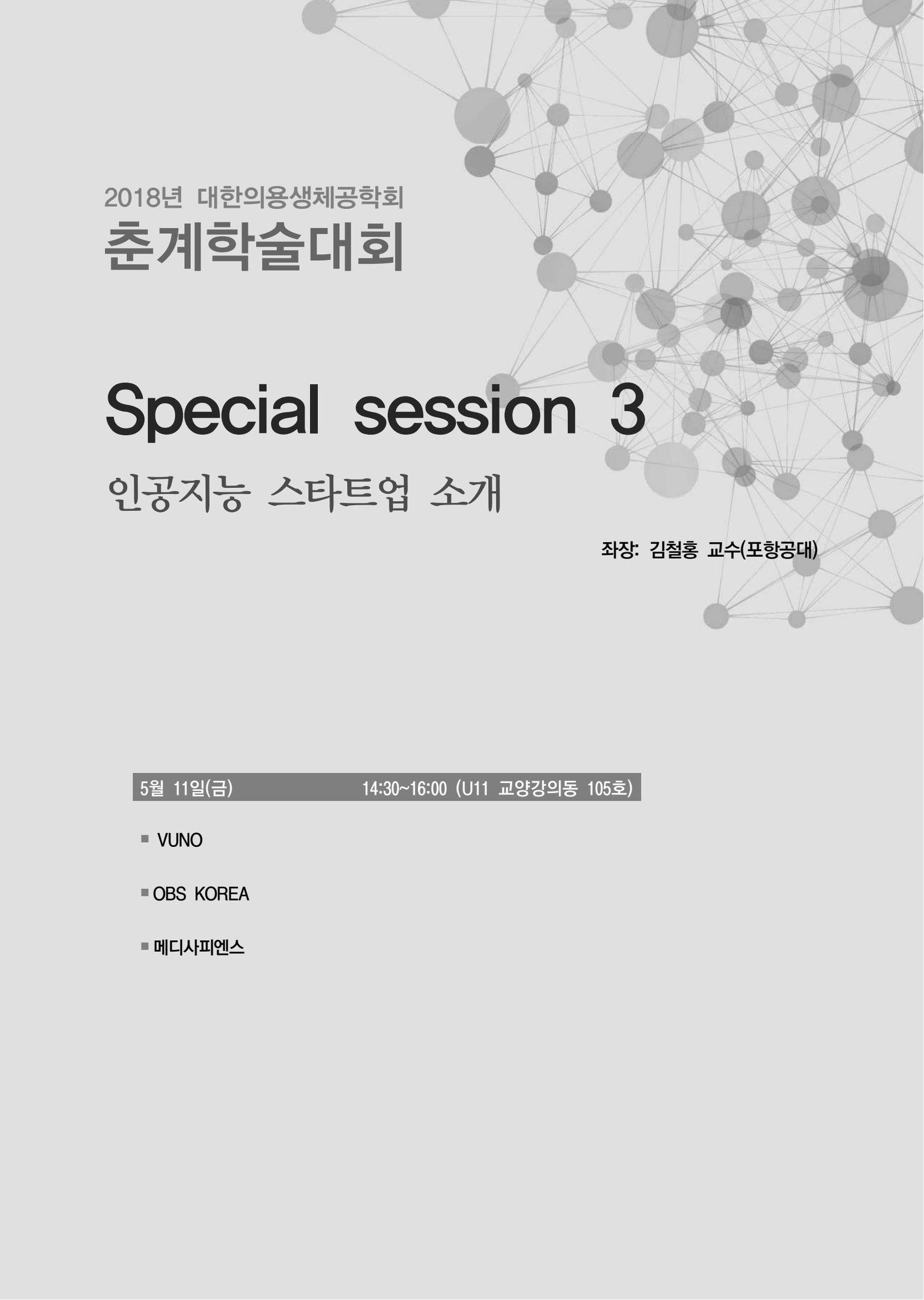
- Seoul National University : Unified Master's and Doctor's course in biomedical engineering (2010, Ph.D)

#### 2. Main Carrier

- Research-Prof. in Korea University (2010.9. ~ 2012. 10.)
- Osong Medical Innovation Foundation, Principal Researcher (2012. 10. ~ )  
Development Integrated medical technology Team Leader (2016. 7.~)
- InJe University, Outside professor (2016.9.~)

#### 3. Record of a research

- "Solderable and electroplatable flexible electronic circuit on a porous stretchable elastomer", etc. (SCI(E) paper : 10ea)
- "Flexible electrodes for human body communication and method for preparing of the same", etc. (patent : 12 ea)

A background graphic consisting of a network of interconnected nodes and lines, with nodes of varying sizes and shades of gray, creating a complex, web-like structure.

2018년 대한의용생체공학회  
춘계학술대회

# Special session 3

인공지능 스타트업 소개

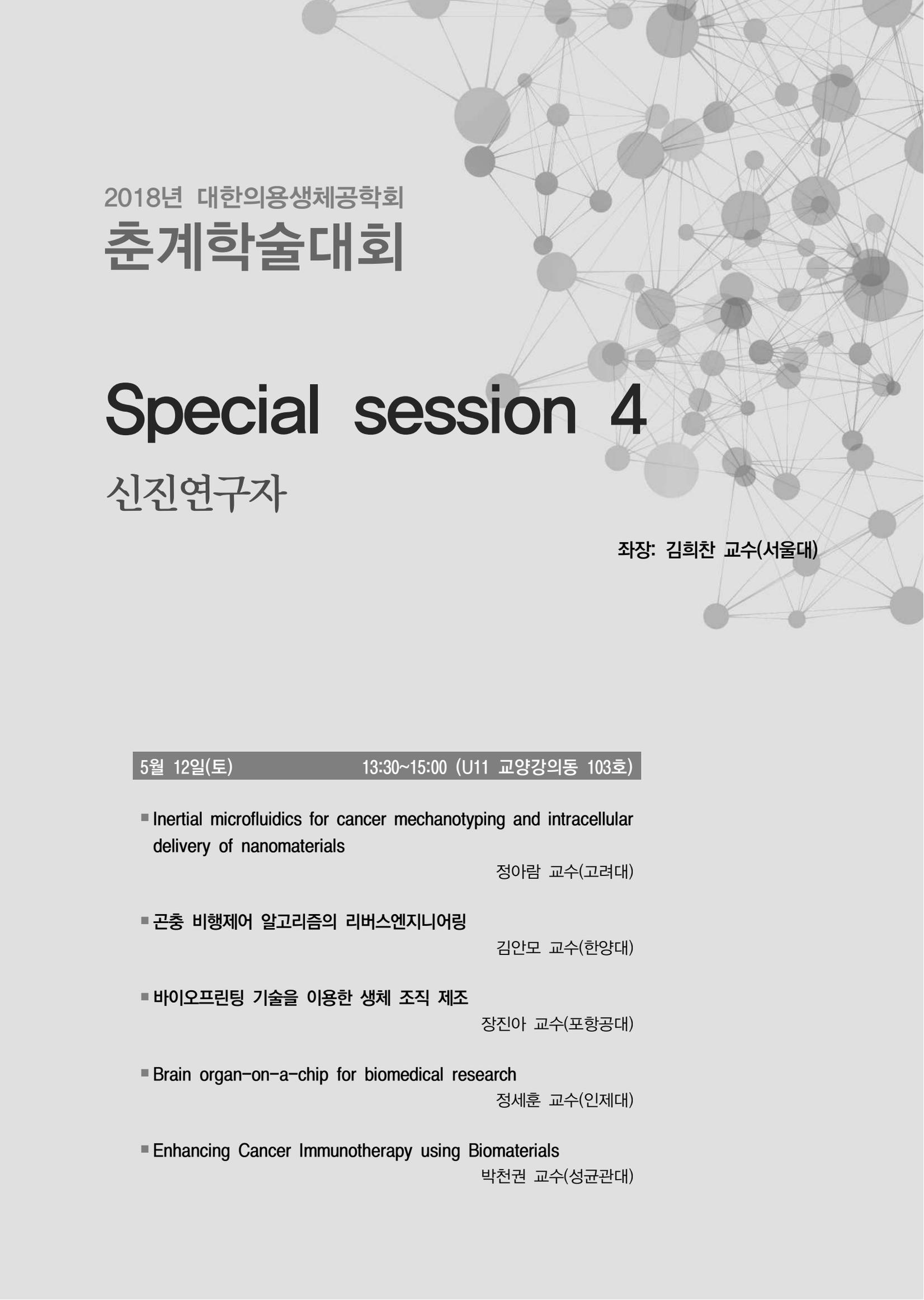
좌장: 김철홍 교수(포항공대)

5월 11일(금)

14:30~16:00 (U11 교양강의동 105호)

- VUNO
- OBS KOREA
- 메디사피언스



A background graphic consisting of a network of interconnected nodes and lines, resembling a molecular or biological structure. The nodes are represented by circles of varying sizes, and the lines are thin, light gray connections between them. The overall effect is a complex, web-like pattern that fills the right side of the page.

2018년 대한의용생체공학회  
춘계학술대회

# Special session 4

신진연구자

좌장: 김희찬 교수(서울대)

5월 12일(토)

13:30~15:00 (U11 교양강의동 103호)

■ Inertial microfluidics for cancer mechanotyping and intracellular delivery of nanomaterials

정아람 교수(고려대)

■ 곤충 비행제어 알고리즘의 리버스엔지니어링

김안모 교수(한양대)

■ 바이오프린팅 기술을 이용한 생체 조직 제조

장진아 교수(포항공대)

■ Brain organ-on-a-chip for biomedical research

정세훈 교수(인제대)

■ Enhancing Cancer Immunotherapy using Biomaterials

박천권 교수(성균관대)



## Inertial microfluidics for cancer mechanotyping and intracellular delivery of nanomaterials

정아람

조교수

고려대학교 바이오의공학부



### Abstract

Microfluidics, manipulation of fluids at the sub-millimeter scale, has been used to develop novel tools solving various biomedical problems. In my research group, we are particularly interested in creating high-throughput microfluidic systems for single-cell biology. We mainly utilize fluid inertia neglected in traditional microfluidic systems because it can be of great use to generate directional forces controlling particle/cell positions and engineer fluid streams in three dimensions, providing high flow and particle/cell controllability. In this talk, I will briefly discuss inertial microfluidics physics and present how these fundamentals can be applied to establish (1) an inertial microfluidic cell stretcher (iMCS) for fully automated, high-throughput and near real-time cancer cell mechanotyping, and (2) an inertial cell Hydroperator (iMCH) for high-throughput, single-step and vector-free intracellular delivery of various nanomaterials.

### Brief Biosketch

#### Professional experience

- |                   |   |
|-------------------|---|
| 2017.09 ~ present | Assistant Professor, School of Biomedical Engineering, Korea University   |
| 2013.08 ~ 2017.08 | Assistant Professor, Department of Mechanical, Aerospace and Nuclear Engineering, Rensselaer Polytechnic Institute (RPI), USA |
| 2011.09 ~ 2013.07 | Postdoctoral Scholar, Department of Bioengineering, University of California, Los Angeles (UCLA), USA                         |

#### Education

- Ph.D. in Mechanical Engineering (Biomedical Engineering Minor), Cornell University, 2011
- M.S. in Mechanical Engineering, Cornell University, 2009
- B.S. in Mechanical Engineering, Seoul National University (SNU), 2006

## 곤충 비행제어 알고리즘의 리버스엔지니어링

김안모

조교수

한양대학교 생체공학과



### Abstract

Living organisms have evolved important behavioral features to cope with challenges in their lives. We propose to reverse-engineer neural algorithms for flight control of *Drosophila melanogaster* (vinegar flies), thereby contributing to build a biologically inspired, autonomous robots. With premiere genetic toolkits, we can now monitor and manipulate activity of specific nerve cells in behaving fruit flies. Recently, we investigated how predictions influence visually-guided flight control. Specifically, we monitored electrical activity of single visual neurons from tethered, flying *Drosophila*, to understand how their vision is dynamically influenced by internal predictions. We showed that when an animal makes rapid self-generated flight turns, its brain forms quantitatively tuned prediction signals, which is in turn routed to the visual system to suppress visual signaling. This predictive control algorithm has general implications for autonomous robots, and we are beginning to test the possibility of using it for a micro-drone system. Our study will provide new insights about sophisticated visuomotor processing in a small brain and open new avenues for intelligent, autonomous robotic systems.

### Brief Biosketch

2018.03~present	Assistant professor, Department of Biomedical Engineering, Hanyang University
2011.6~2018.02	Postdoctoral associate, The Rockefeller University
2010.10~2011.03	Postdoctoral associate, Columbia University
2010.10	Ph.D., Department of Electrical Engineering, Columbia University

## 바이오프린팅 기술을 이용한 생체 조직 제조

장진아

조교수  
포항공과대학교



### Abstract

Recent development of bioengineering enables to create human tissues by integrating various native microenvironments, including tissue specific cells, biochemical and biophysical cues. A significant transition of 3D bioprinting technology into the biomedical field helps to improve the function of engineered tissues by recapitulating physiologically relevant geometry, complexity, and vascular network. Bioinks, used as printable biomaterials, facilitate dispensing of cells through a dispenser as well as supports cell viability and function by providing engineered extracellular matrix. Successful construction of functional human tissues requires accurate environments that are able to mimic biochemical and biophysical properties of target tissue. Formulation of printable materials with stem cells are critical process to guide cellular behavior; however, this is rarely considered in the context of bioprinting in which the tissue should be formed. This talk will cover my research interests in building 3D human tissues and organs to understand, diagnose and treat various intractable diseases, particularly for cardiovascular disease. A development of tissue-derived decellularized extracellular matrix bioink platform will be mainly discussed as a straightforward strategy to provide biological and biophysical phenomena into engineered tissues. I will also discuss about a development of 3D vascularized cardiac stem cell patch that is generated by integrating the concept of tissue engineering and the developed platform technologies. Combined with recent advances in human pluripotent stem cell technologies, printed human tissues could serve as an enabling platform for studying complex physiology in tissue and organ contexts of individuals.

### Brief Biosketch

Dr. Jinah Jang received her PhD in Division of Integrative Biosciences and Biotechnology at POSTECH (2015), and worked as postdoctoral fellow in Department of Mechanical Engineering at POSTECH (2015-2016) and Institute for Stem Cell and Regenerative Medicine/Department of Pathology and Bioengineering at University of Washington (2016-2017). She has joined the POSTECH in the spring of 2017 as an assistant professor in the Creative IT Engineering. Her research interest lies on the building the functional human tissues from stem cells via the 3D bioprinting technology and printable biomaterials. The successful achievements may lead towards clinical applications for providing advanced therapeutic methods, understanding disease mechanism and engineering micro-tissue models.

## Brain organ-on-a-chip for biomedical research

정세훈

조교수

인제대학교 헬스케어IT학과



### Abstract

Organ-on-a-chip is a promising technology that allows mimicking *in vivo* organ functions through 3D multi-cellular structures and has the potential to enable accurate drug/toxicity screening as well as help better understand disease mechanisms. The blood-brain barrier (BBB) is the major bottleneck in developing effective therapeutics against neurological diseases, and thus better understanding the mechanisms behind this barrier formation is critical. However an *in vitro* system that accurately mimics this barrier structure and functions, while amenable to easy compound screening do not exist yet. Here we report a Brain-on-a-chip system consisting of a multiplex neurovascular chamber to establish multiple BBB structures on a single chip. The effects of endothelial-astrocyte co-culture and shear stress on barrier permeability were characterized by permeability analysis. Moreover, neuroinflammation testing and drug testing were demonstrated in the BBB chip. The results showed that the chip closely mimicked the *in vivo* brain and endothelial tissue environment. In this regard, this chip is expected to be used to accurately predict the BBB permeability of drug candidates during preclinical stages.

### Brief Biosketch

2018	Texas A&M University, Biomedical Engineering, Ph.D.
2008	서울대학교 뇌과학 석사
2006	한양대학교 전자전기컴퓨터공학부 학사
2017.12 ~ 현재	인제대학교 헬스케어IT학과 조교수
2008 ~ 2013	삼성전기 중앙연구소 선임연구원
2016.11	NIH-NINDS travel fellowship award
2017 ~ 현재	IEEE member

## Enhancing Cancer Immunotherapy using Biomaterials

박천권

조교수

성균관대학교 글로벌바이오메디컬 공학과



### Abstract

Unlike traditional approaches in oncology, cancer immunotherapy harnesses a patient's coordinated and adaptive immune system in order to combat the disease. Recent clinical data have supported the utility of this therapeutic modality. The benefits of cancer immunotherapy include the potential 1) to treat all types of cancer, regardless of the underlying mutations or cell of origin; 2) to prevent metastasis and relapse by generating memory antitumor immunity; and 3) to decrease side effects relative to conventional cytotoxic treatment approaches (*e.g.*, chemotherapy and radiotherapy). Still, the therapeutic index of cancer immunotherapy must be improved, since the proportion of patients responding to this approach remains unsatisfactory and the therapy often causes systemic toxicity following parental administration. To address these issues, we used various biomaterials-based drug delivery approaches to deliver immunomodulatory compounds in a spatiotemporally controlled manner in order to improve their efficacy and safety relative to conventional systemic administration.

### Brief Biosketch

2009.08 ~ B.S. at Hanyang University  
2014.08 ~ Ph.D. at Seoul National University (SNU)  
2014.09 ~ 2015.09 Senior Researcher at Medical Research Center (SNU)  
2015.10 ~ 2018.02 Research Fellow at Harvard Medical School/Dana-Farber  
Cancer Institute  
2018.03 ~ Assistant Professor at Sungkyunkwan University



2018년 대한의용생체공학회  
춘계학술대회

# 일반연제 1

## Biomedical Instrumentation, Digital Healthcare Technology, Orthopedic and Rehabilitation

좌장: 박성민 교수(포항공대)

5월 11일(금)

14:30~17:30 (U11 교양강의동 102호)

■ 생체 신호 딥러닝 End-to-End 모델 분석

박철수(광운대학교 컴퓨터정보공학부)

■ 운전 시뮬레이션 중 외이도 뇌전도 기반 졸음 추정

홍승혁<sup>1</sup>, 최상호<sup>1</sup>, 권현빈<sup>1</sup>, 박광석<sup>2</sup>

(<sup>1</sup>서울대학교 공과대학 협동과정 바이오엔지니어링 전공, <sup>2</sup>서울대학교 의과대학 의공학교실)

■ Co-60 방사선원의 등선량 분포 및 상대깊이선량의 동시 측정을 위한 1차원 팬텀선량계 개발

신현영, 신상훈, 변현기, 송시원, 박재형, 김지예, 이봉수  
(중앙대학교 공과대학 에너지시스템공학부)

■ Support Vector Machine을 이용한 디지털 치아 색조 분석 시스템

김민아, 김병연, 박병준, 이승락, 원영재  
(오송첨단의료산업진흥재단 첨단의료기기개발지원센터)

■ 모바일 헬스케어를 위한 광센서 응용 기술

조재걸(순천향대학교 의용메카트로닉스공학과)

■ 여성 웰니스 증진을 위한 웨어러블 디바이스 및 생체신호 분석 알고리즘 개발

한수정<sup>1</sup>, 김성민<sup>1</sup>, 최슬기<sup>1</sup>, 박석진<sup>2</sup>, 이지훈<sup>3</sup>, 임장균<sup>4</sup>, 이정민<sup>5</sup>, 오경식<sup>5</sup>, 최영호<sup>5</sup>, 이태린<sup>1</sup>  
(<sup>1</sup>서울대학교 차세대융합기술연구원, <sup>2</sup>아주대학교 기계공학과, <sup>3</sup>아주대학교 전자공학과  
<sup>4</sup>성균관대학교 나노과학기술원, <sup>5</sup>㈜스마디)

■ 거울 치료에 활용할 수 있는 가상 손의 착각 유발 가능성 연구

임승의, 구정훈(계명대학교 의과대학 의용공학과 스마트랩)



**Oral 1-1**

**생체 신호 딥러닝 End-to-End 모델 분석**

박철수

광운대학교 컴퓨터정보공학부

In this talk, the applications of deep learning algorithm to physiological signals are introduced. Recently, several studies of deep learning approach to the physiological signals have been reported as a classifier using features extracted in conventional way. Due to the architecture of deep learning algorithm, its extraction of features from raw data can be expected without conventional feature engineering, that is, end-to-end model. The application of deep neural network to the raw data of ECG has been investigated to monitor stressful and normal conditions. Its results outperformed that of the conventional feature-based analysis using HRV parameters. This study also suggested the structure of deep neural network should be carefully designed with considering the properties of physiological signals. Additionally, the actigraphy data has been looked into using the deep neural network in the manner of the end-to-end learning. This also promotes the advantage of deep learning algorithm to produce the abstraction (feature) from the raw data compared to the feature-engineering method.

**Oral 1-2**

**운전 시뮬레이션 중 외이도 뇌전도 기반 졸음 추정**

홍승혁<sup>1</sup>, 최상호<sup>1</sup>, 권현빈<sup>1</sup>, 박광석<sup>2</sup>

<sup>1</sup> 서울대학교 공과대학 협동과정 바이오엔지니어링 전공

<sup>2</sup> 서울대학교 의과대학 의공학교실

We propose the ear canal Electroencephalography (EEG) system that can recognize drowsiness during daily life. The EEG was measured during the sustained-attention task of simulated driving. The classifications were

conducted with various data lengths considering the transitional traits of drowsiness. The features were sorted by their degree of importance using three types of ranking filters and the combined information. The composite ranking algorithm using multiple ranking methods improved the classification performance. The statistical measures of the performance of the classifications using machine learning indicated that the system based on the ear canal EEG is useful for detecting the drowsiness.

**Oral 1-3**

**Co-60 방사선원의 등선량 분포 및 상대깊이선량의 동시 측정을 위한 1차원 팬텀선량계 개발**

신현영, 신상훈, 변현기, 송시원,  
 박재형, 김지예, 이봉수

중앙대학교 공과대학 에너지시스템공학부

In this study, we developed one-dimensional phantom dosimeter with organic scintillators which can simultaneously measure the isodose distribution and relative depth dose of Co-60 as a radioactive source employed in radiation therapy. The one-dimensional phantom dosimeter, which is composed of square-type organic scintillator and PMMA phantom. As experimental results, we simultaneously obtained information on the isodose distribution and relative depth dose of the Co-60 source. To evaluate the performance of developed one-dimensional phantom dosimeter, isodose distribution and relative depth dose are compared to Gafchromic™ EBT3 film and Monte-Carlo simulation, respectively.

## Oral 1-4

### Support Vector Machine을 이용한 디지털 치아 색조 분석 시스템

김민아, 김병연, 박병준, 이승락, 원영재

오송첨단의료산업진흥재단 첨단의료기기개발지원센터

As the demand for esthetic dental treatment increases, the importance of dental shade selection for restoration increases and the demand for measurement accuracy has also increased. However, in the case of the spectrometer and the colorimeter, it is not possible to provide the limited measurement area and the image information about dental. Device based on image is uncomfortable to use because of their large size and poor shade-matching accuracy. In this study, Support Vector Machine(SVM) algorithm that enables optimal classification between groups was used to improve accuracy of dental shade-matching. We have proved that the accuracy of dental shade-matching by the SVM algorithm is 93.5 %.

## Oral 1-5

### 모바일 헬스케어를 위한 광센서 응용 기술

조재걸

순천향대학교 의용메카트로닉스공학과

고령화에 따른 의료비의 증가는 보다 효율적인 의료시스템을 필요로 하며, 이에 따라 모바일 헬스케어에 대한 기대가 지속적으로 증가하고 있다. 병원이 아닌 장소에서 수시로 건강을 측정해야 하는 환경에서는 빠르고 간편하면서도 비침습적인 생체신호 측정 방법이 필수적이며, 광센서는 이에 가장 적합한 센서라고 할 수 있다. 병원에서 사용되는 환자감시장치의 여러 기능 중에서 맥박, 호흡, 산소포화도, 심박변이도 측정 등이 이미 모바일 제품과 웨어러블 디바이스로 구현되었으며 특히 운동 중 맥박 측정, 일주기 리듬 분석을 위한 조도 측정 기능은 웨어러블 디바이스에 특화되어 구현되고 있다.

본 강연에서는 웨어러블 기기 또는 모바일 제품에 사용되는 광센서 응용 기술 현황과, 각 측정 기능별 광센서의

특징과 이슈 등을 살펴보고자 한다. 스마트워치에 사용되는 광센서의 구조에 따른 신호 품질, 반사형 광센서를 이용한 산소포화도 측정에서의 정확도 이슈 등에 대해 소개하고자 하며, 광센서를 이용한 피하지방 측정 기술과 그에 따른 주요 이슈들을 살펴본다.

## Oral 1-6

### 여성 웰니스 증진을 위한 웨어러블 디바이스 및 생체신호 분석 알고리즘 개발

한수정<sup>1</sup>, 김성민<sup>1</sup>, 최슬기<sup>1</sup>, 박석진<sup>2</sup>, 이지훈<sup>3</sup>, 임장균<sup>4</sup>, 이정민<sup>5</sup>, 오경식<sup>5</sup>, 최영호<sup>5</sup>, 이태린<sup>1</sup>

<sup>1</sup>서울대학교 차세대융합기술연구원

<sup>2</sup>아주대학교 기계공학과

<sup>3</sup>아주대학교 전자공학과

<sup>4</sup>성균관대학교 나노과학기술원

<sup>5</sup>(주)스마디

Various wearable devices have been suggested for improving women's wellness. However, such devices need further improvement for their healthcare with respect to their designs and functions. Here, we demonstrate a new wearable device for women's wellness. The device has six functions, *i.e.* acceleration, gyro, magnetic field, skin moisture, temperature, heart, and UV. In addition, the data, obtained from the sensors, are analyzed for figuring out a better healthcare service. Especially, we will report an artificial intelligence platform for the process. In the end of this talk, the entire process and the further work will be fully discussed.

## Oral 1-7

### 거울 치료에 활용할 수 있는 가상 손의 착각 유발 가능성 연구

임승의, 구정훈

계명대학교 의과대학 의용공학과 스마트랩

본 연구는 가상 현실이 거울 치료에 활용될 수 있는지 알아보기 위해 Virtual reality(VR)의 가상아바타의 몸을

자신의 몸으로 느끼는 착각의 정도를 측정하였다. 이를 위하여 가상의 아바타를 피험자와 일치시켜 피험자의 오른쪽 손의 움직임에 아바타의 왼쪽 손의 움직임과 동기화 되도록 하여 피험자의 왼손 위치를 판단하게 하였다. 그 결과 피험자의 왼손이 움직이지 않았음에도 불구하고 피험자는 가상의 왼손 위치 변화에 따라, 자신의 왼손 위치를 다르게 보고 하였다. 이는 가상의 왼손이 실제 왼손과 착각을 유발하였다고 볼 수 있다. 따라서 단순히 거울을 사이에 두고 치료하는 방법을 넘어 복잡한 거울 치료를 VR로 구현하면 여러 재활 연구에 효과적으로 이용할 수 있을 것이다.



# 2018년 대한의용생체공학회 춘계학술대회

## 일반연제 2 Biomechanics

좌장: 이정찬 교수(서울대)

5월 11일(금)

14:30~16:00 (U11 교양강의동 103호)

- 심근의 국지적 전기적 흥분 파형의 지배적 주파수와 위상의 분산분석을 통한 심실 부정맥 심각도 예측

정다운, 임기무  
(IT융복합공학과)

- Instrumented Timed up & Go test를 이용한 고령자 낙상 위험도 정량적 추적연구

서정우<sup>1</sup>, 김태호<sup>1</sup>, 이진수<sup>1</sup>, 김정길<sup>1</sup>, 최진승<sup>2,3</sup>, 탁계래<sup>2,3</sup>  
(<sup>1</sup>건국대학교 일반대학원 의공학학과, <sup>2</sup>건국대학교 ICT융합공학부 의공학전공, <sup>3</sup>BK21플러스의공학실용기술연구소)

- 세포 수준의 혈액 유동 수치해석적 시뮬레이션 연구

박석진<sup>1,2</sup>, 이태린<sup>1</sup>  
(<sup>1</sup>서울대학교 차세대융합기술연구원, <sup>2</sup>아주대학교 기계공학부)

- 계단 내리기시 보행전략에 따른 무릎관절 부하분석비교

전형민, 최의범, 허재훈, 엄광문  
(건국대학교 의공학학과)

- 평활근 내 피브린-4 유전자가 결손 된 쥐의 상행경부대동맥에 발생하는 대동맥류의 성장에 따른 생체역학적인 특성

김정실<sup>1,2</sup>, Jessica E. Wagenseil<sup>2</sup>, Hiromi Yanagisawa<sup>3</sup>  
(<sup>1</sup>연세대학교 기초과학연구원 나노의학연구단

<sup>2</sup>Department of Mechanical Engineering & Materials Science,  
Washington University in St. Louis, USA

<sup>3</sup>Life Science Center for Survival Dynamics, Tsukuba Advanced Research Alliance,  
University of Tsukuba, Japan)



**Oral 2-1**

**심근의 국지적 전기적 흥분 파형의 지배적 주파수와 위상의 분산분석을 통한 심실 부정맥 심각도 예측**

정다운, 임기무  
 IT융복합공학과

The number of rotors present during ventricular fibrillation (VF) is a measure of the complexity of vortex pattern. Detecting the phase singularity at the center of the reentry rotor can help to understand the mechanism of vortex pattern generation and maintenance. Therefore, we quantitatively predicted the severity of VF according to local dominant frequency (DF) and phase singularity filaments of myocardium. As a results, we found that DF increases in the region where the excited waves are more chaotic, and the higher DF, the more phase singularity filament is distributed.

**Oral 2-2**

**Instrumented Timed up & Go test를 이용한 고령자 낙상 위험도 정량적 추적연구**

서정우<sup>1</sup>, 김태호<sup>1</sup>, 이진수<sup>1</sup>, 김정길<sup>1</sup>, 최진승<sup>2,3</sup>, 탁계래<sup>2,3</sup>  
<sup>1</sup>건국대학교 일반대학원 의학공학과, <sup>2</sup>건국대학교 ICT융합공학부 의학공학전공  
<sup>3</sup>BK21 플러스의공학실용기술연구소

This study is the quantitative follow-up study of the elderly fall risk using instrumented timed up and go (iTUG) test. Total sixty-nine subjects(faller:26, non-faller: 43) were involved this follow-up test. The thirty variables were collected by IMU sensor system(APDM Inc.) during two times in two years, six times in total, and variable value trend were compared among first, second and third test of the faller & non-faller. The all variables of total two years data were used for the logistic regression model. The accuracy was 70.2%, and AUC was 69.9%.

**Oral 2-3**

**세포 수준의 혈액 유동 수치해석적 시뮬레이션 연구**

박석진<sup>1,2</sup>, 이태린<sup>1</sup>  
<sup>1</sup>서울대학교 차세대융합기술연구원  
<sup>2</sup>아주대학교 기계공학부

Red blood cells are important in delivering oxygen in the body. So various researches have been carried out to predict the flow in the microvascular system. Recently, computational models are helpful to analyze realistic blood flow. The objective of this research is to demonstrate the hemodynamics of red blood cells at the cellular level in plasma of microvessels using immersed boundary method. In the model, red blood cells are treated as a mass-spring system in the Eulerian domain of plasma. Then, several cases are selected to validate the proposed method in microvessels. The simulation results are compared with the previous theoretical models and fully discussed the capability of the model.

**Oral 2-4**

**계단 내리기시 보행전략에 따른 무릎관절 부하분석비교**

전형민, 최의범, 허재훈, 엄광문  
 건국대학교 의학공학과

Especially in the case of stair walking, when foot contact it receives a shock of 3~4 times the body weight, which causes a great burden on the joint. Therefore, this study is a basic study to suggest a gait strategy that can reduce the load on the knee joints when the stair walking by to investigate the difference of knee joint load according to various walking strategies. Seven men participated in this study. To measure kinetic data and kinematic data, Total of 4 steps with one force plate inserted in the 2nd step Highest peak force is forefoot contact in knee. Lowest peak force is rearfoot contact.

### Oral 2-5

#### 평활근 내 피블린-4 유전자가 결손 된 쥐의 상행경부대동맥에 발생하는 대동맥류의 성장에 따른 생체역학적인 특성

김정실<sup>1,2</sup>, Jessica E. Wagenseil<sup>2</sup>, Hiromi Yanagisawa<sup>3</sup>

<sup>1</sup> 연세대학교 기초과학연구원 나노의학연구단

<sup>2</sup>Department of Mechanical Engineering & Materials Science,  
Washington University in St. Louis, USA

<sup>3</sup>Life Science Center for Survival Dynamics, Tsukuba Advanced  
Research Alliance, University of Tsukuba, Japan

Fibulin-4 is a major protein required for normal assembly of elastic fibers. Mice with a smooth muscle cell specific deletion of fibulin-4 (*Fbln4*<sup>SMKO</sup>) develop ascending aortic aneurysms. We investigated the mechanical behavior of the *Fbln4*<sup>SMKO</sup> ascending aortae at postnatal day (P) 1, 7, 14 and 30. Aneurysms are not detectable by P7. Compared with the control, the outer diameters of *Fbln4*<sup>SMKO</sup> aortae are significantly larger at P14 and P30. *Fbln4*<sup>SMKO</sup> aortae exhibit more compliant behavior in the early stage of aneurysm development. However, above the physiological pressure, they are stiffer at P30 when the aneurysms become to establish.

2018년 대한의용생체공학회  
춘계학술대회

# 일반연제 3

## Medical Imaging

좌장: 유형석 교수(한양대)

5월 11일(금)

16:30~17:30 (U11 교양강의동 105호)

■ 초음파 및 광음향 영상을 위한 실시간 지연-곱셈-합 빔 형성 알고리즘

전승완<sup>1</sup>, 박은영<sup>2</sup>, 김철홍<sup>1,2</sup>

(<sup>1</sup>POSTECH 창의IT융합공학과, <sup>2</sup>POSTECH 전자전기공학과)

■ 딥러닝을 이용한 방사형 좌표계에서의 자기공명영상 재구성 방법: AUTOMAP과 푸리에 영역 손실함수를 이용하여

정성현, 윤재연, 정우진, 이두희, 이종호  
(서울대학교 공과대학 전기·정보공학부)

■ CUDA 동적 라이브러리를 활용한 MATLAB 볼륨 렌더러 개발

조성희<sup>1</sup>, 김철홍<sup>1,2</sup>

(<sup>1</sup>포항공과대학교 시스템생명공학부, <sup>2</sup>포항공과대학교 창의 IT 융합 공학과)

■ 중앙 조직 분석을 위한 멀티모달 바이오 이미징 시스템

김지훈<sup>1</sup>, 김은주<sup>2</sup>, 황재윤<sup>1</sup>

(<sup>1</sup>DGIST, 정보통신융합전공, <sup>2</sup>DGIST, 나노·에너지 연구부)



**Oral 3-1**

**초음파 및 광음향 영상을 위한 실시간  
 지연-곱셈-합 빔 형성 알고리즘**

전승완<sup>1</sup>, 박은영<sup>2</sup>, 김철홍<sup>1,2</sup>

<sup>1</sup>POSTECH 창의IT융합공학과, <sup>2</sup>POSTECH 전자전기공학과

Delay-multiply-and-sum (DMAS) beamforming algorithm has higher resolution and contrast than delay-and-sum in both ultrasound and photoacoustic images. However, it has been difficult to utilize it in practice due to its high computational complexity. This paper presents a modified DMAS beamforming algorithm for a real-time implementation. We have successfully reduced its computational complexity by eliminating the combinatorial multiplication of the received signals. Simulation results by GPU implementation on PC show that the proposed algorithm achieves real-time frame rate by accelerating the beamforming process about 53 times than the existing algorithm.

**Oral 3-2**

**딥러닝을 이용한 방사형 좌표계에서의  
 자기공명영상 재구성 방법: AUTOMAP과 푸리에  
 영역 손실함수를 이용하여**

정성현, 윤재연, 정우진, 이두희, 이종호

서울대학교 공과대학 전기·정보공학부

MRI is a non-invasive imaging modality which accompanies minimum or no harmful effects to the human subject. When the signal acquisition is done in non-Cartesian coordinates, as is the case for radial imaging, reconstruction of images is time-consuming and computationally expensive. We managed to overcome these limitations using AUTOMAP, a recently proposed deep neural network designed for robust image reconstruction. Moreover, we found that adding Fourier domain loss improved the network to output image with

more details preserved.

**Oral 3-3**

**CUDA 동적 라이브러리를 활용한 MATLAB 볼륨  
 렌더러 개발**

조성희<sup>1</sup>, 김철홍<sup>1,2</sup>

<sup>1</sup>포항공과대학교 시스템생명공학부

<sup>2</sup>포항공과대학교 창의 IT 융합 공학과

Volume rendering is important for medical imaging because it can provide an intuitive experience. Due to the high computational burden, the real-time implementing the volume rendering algorithm is difficult. Recently, advances in GPU technology make it easier to implement volume rendering algorithms in real-time applications and many software techniques were developed for volume rendering. However, most researchers have difficulty using volume rendering tools because they need to use specialized software for volume rendering. In this paper, we developed a CUDA-based volume rendering tool for MATLAB, the most popular software in the scientific and engineering world, to evaluate software performance.

**Oral 3-4**

**종양 조직 분석을 위한 멀티모달 바이오 이미징  
 시스템**

김지훈<sup>1</sup>, 김은주<sup>2</sup>, 황재윤<sup>1</sup>

<sup>1</sup>DGIST, 정보통신융합전공

<sup>2</sup>DGIST, 나노·에너지 연구부

We report a multimodal bioimaging system for tumor analysis *ex vivo*. Characterization of tumors excised from suspicious lesions is one of the important procedures during surgical operations. Particularly, residual tiny tumors at surgical sites after tumor resection can cause cancer recurrence or metastasis. For those reasons, we developed a multimodal bioimaging system including

## | 일반연제 3 |

high-frequency ultrasound B-mode, acoustic radiation force impulse, and multispectral imaging modality. This system was evaluated with tissue-mimicking phantoms and then applied to examine colorectal tumors excised from cancer patients. The results shown here showed that the developed system has the potential to undertake characterizations of excised tumors.

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# 일반연제 4

## Neural Engineering

좌장: 윤인찬 교수(KIST)

5월 12일(토)

11:00~12:30 (U11 교양강의동 102호)

■ 공변량 변화(covariate shift)로 인한 P300 뇌파 타자기의 성능변화

이종민<sup>1</sup>, 김지웅<sup>1</sup>, 원경호<sup>2</sup>, 권문영<sup>2</sup>, 전성찬<sup>2</sup>, 안민규<sup>1</sup>  
(<sup>1</sup>한동대학교 전산전자공학부, <sup>2</sup>광주과학기술원 전기전자컴퓨터공학부)

■ 뉴로 피드백을 접목한 상지 재활 훈련 후 뇌 활성화 변화 연구

손지은<sup>1,2</sup>, 임현미<sup>2,3</sup>, 구정훈<sup>2</sup>  
(<sup>1</sup>계명대학교 자연과학대학 생명과학전공, <sup>2</sup>계명대학교 의용공학과 스마트랩,  
<sup>3</sup>서울대학교병원 의생명연구원)

■ 깜빡이는 운동영상을 이용한 BCI 동작관찰 게임재활 프로그램이 뇌졸중 환자의  
거울신경세포시스템 활성화에 미치는 효과

임현미<sup>1,2</sup>, 강윤주<sup>3</sup>, 최효선<sup>3</sup>, 구정훈<sup>2</sup>  
(<sup>1</sup>서울대학교병원 의생명연구원, <sup>2</sup>계명대학교 의과대학 의용공학과 스마트랩,  
<sup>3</sup>울지대학교병원 재활의학과)

■ 영화를 함께 시청 시 감정적 공감 정도에 따른 자율신경계 신호 간 동기화

김현, 여동훈, 서부경, 허성진, 최성운, 김경환  
(연세대학교 의공학과)



**Oral 4-1**

**공변량 변화(covariate shift)로 인한 P300 뇌파 타자기의 성능변화**

이종민<sup>1</sup>, 김지웅<sup>1</sup>, 원경호<sup>2</sup>, 권문영<sup>2</sup>, 전성찬<sup>2</sup>, 안민규<sup>1</sup>

<sup>1</sup>한동대학교 전산전자공학부, <sup>2</sup>광주과학기술원 전기전자컴퓨터공학부

Although the success of P300 Brain-Computer Interface (BCI) speller, it still suffers from the issue of habituation. We investigated the effects of habituation on individual speller accuracy in P300 BCI speller. With the data from 55 subjects, we found that letter accuracy decreases as test continues due to habituation. Moreover, the subject with high accuracy at the first session showed the larger decrease as time goes, meaning the effect of habituation varies across individuals.

**Oral 4-2**

**뉴로 피드백을 접목한 상지 재활 훈련 후 뇌 활성화 변화 연구**

손지은<sup>1,2</sup>, 임현미<sup>2,3</sup>, 구정훈<sup>2</sup>

<sup>1</sup>계명대학교 자연과학대학 생명과학전공  
<sup>2</sup>계명대학교 의용공학과 스마트랩  
<sup>3</sup>서울대학교병원 의생명연구원

In this study, we investigated the brain activity changes after game based upper extremity rehabilitation training with neurofeedback of one's concentration. As a result, in the comparison of before and after the training the interactions effects were significant ( $p$  value  $<0.05$ ) in the Low Beta(14~20Hz) of T3 channel, High Beta(21~30Hz) of T4 channel, Gamma(31~50Hz) of P3 and P4 channels, and SMR(13~15Hz) of T3 and T4 channels and the mean value of brain wave was significantly increased after neurofeedback conditions compared to before the experiment. However, in the condition without neurofeedback, it was slightly changed or stational. The neural plasticity that the brain has the ability to learn

through experience would be the reason. Therefore we could conclude that patients training with could maintain exercise effect after rehabilitation treatment with neuro-feedback, which can be effectively used for rehabilitation research.

**Oral 4-3**

**깜빡이는 운동영상을 이용한 BCI 동작관찰 게임재활 프로그램이 뇌졸중 환자의 거울신경세포시스템 활성화에 미치는 효과**

임현미<sup>1,2</sup>, 강윤주<sup>3</sup>, 최효선<sup>3</sup>, 구정훈<sup>2</sup>

<sup>1</sup>서울대학교병원 의생명연구원  
<sup>2</sup>계명대학교 의과대학 의용공학과 스마트랩  
<sup>3</sup>울지대학교병원 재활의학과

Action observation (AO) training based on the theory of activation of the mirror neuron system (MNS) is helpful for brain activation in patients with brain injury. In this study, we implemented AO game using the BCI (AO-BCI) technology using flickering action video and applied it for five stroke patients. The game provide the feedback of user's watching with ERD and SSVEP evoked by the flickering action video and gave real-time feedbacks while playing the game. We compared two conditions of the conventional AO game and the AO-BCI game. As result, the AO-BCI game showed superior MNS activation compared to the conventional AO training. This could represent that the AO-BCI game paradigm could effectively facilitate motor recovery after stroke.

**Oral 4-4**

**영화를 함께 시청 시 감정적 공감 정도에 따른 자율신경계 신호 간 동기화**

김현, 여동훈, 서부경, 허성진, 최성운, 김경환

연세대학교 의공학과

People influence each other's behavioral and emotional

## | 일반연제 4 |

states in social contexts. In this study, we investigated whether the synchronization of autonomic responses is associated with the convergence of their emotional responses. Continuous autonomic system signals were collected from sixteen dyads. Each dyad watched emotional movies together, seated side by side, without direct interaction. We found that co-present individuals who reported more similar emotional valence states or arousal states showed more synchronized autonomic responses.

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# 일반연제 5

## Medical Nano and Microtechnology, Biomedical Optics

좌장: 최성용 교수(경희대)

5월 12일(토)

11:00~12:30 (U11 교양강의동 103호)

■ 목시플록사신 기반 이광자 현미경의 피부암 영상화

장훈철<sup>1</sup>, 장원혁<sup>1</sup>, 이승훈<sup>2</sup>, 오병호<sup>3</sup>, 김기현<sup>1,2</sup>  
(<sup>1</sup>POSTECH 융합생명공학부, <sup>2</sup>기계공학부, <sup>3</sup>연세대학교 의과대학)

■ 광활성 원자현미경을 이용한 초고해상도 광학 영상

이승현, 박별리, 김철홍  
(포항공과대학교 창의IT융합공학과)

■ 암 연구 위한 나노포토닉스 기반 바이오센서에 관한 연구

홍유찬  
(한국기계연구원 의료기계연구실)



Oral 5-1

목시플록사신 기반 이광자 현미경의 피부암 영상화

장훈철<sup>1</sup>, 장원혁<sup>1</sup>, 이승훈<sup>2</sup>, 오병호<sup>3</sup>, 김기현<sup>1,2</sup>

<sup>1</sup>POSTECH 융합생명공학부, <sup>2</sup>기계공학부, <sup>3</sup>연세대학교 의과대학

In skin cancer surgery, the rapid and accurate detection of surgical margin is required for precise and complete removal. Reflectance confocal microscopy (RCM) is currently used to guide the surgical margin, but has a limited detection contrast. In this study, we used a moxifloxacin based two-photon microscopy (moxi-TPM) as a high-speed and high-contrast method of human skin cancer. High-speed TPM was realized by using moxifloxacin as a cell-labeling agent. Various skin cancer tissues including squamous cell carcinoma, basal cell carcinoma, and highly pigmented melanoma were visualized in cellular level resolution by using moxi-TPM, and these moxi-TPM images were compared with dermoscopic images and histology. These results showed that moxi-TPM could be used for guiding skin cancer surgery owing to its high imaging speed and resolution.

Oral 5-2

광활성 원자현미경을 이용한 초고해상도 광학 영상

이승현, 박별리, 김철홍

포항공과대학교 창의IT융합공학과

Optical microscopy has been used to observe various microorganisms and small materials. However, it is difficult to observe a sample of less than 200 nm due to optical diffraction limit. Here recently developed photoactivated atomic force microscopy (pAFM) successfully achieved lateral resolution of less than 10 nm by

integrating an optical excitation system and an atomic force microscopy. Since the pAFM signal is primarily proportional to the optical absorption properties of the sample, pAFM can provide the unique optical properties of gold nanoparticles and melanoma cell at the nanoscale. The pAFM will be widely used in biological and material research.

Oral 5-3

암 연구 위한 나노포토닉스 기반 바이오센서에 관한 연구

홍유찬

한국기계연구원 의료기계연구실

The sensor system using nanoparticles is successfully detectable for cancer specific biomarker expression level, enzymatic activity, or micro-surrounding redox state. Thus, constant effort of integration of sensing technology using nanoparticles based nanophotonics would improve availability for nanobiosensor as cancer diagnostic and prognostic tools.





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# **포스터(2분스피치 1)**

좌장: 천홍구 교수(고려대)



2-1-1

**동결/융해 및 감마선 조사에 의해 가교 결합된 PVA/CMC 수화겔의 특성**

신지연, 윤용현, 이득용

대림대학교 의공융합과

Polyvinyl alcohol/sodium carboxymethyl cellulose (PVA/CMC) hydrogels were prepared by physical crosslinking (cyclic freezing/thawing) and gamma ( $\gamma$ )-ray irradiation to evaluate the effect of CMC concentration (2~8 wt%) on the mechanical properties and the biocompatibility of the PVA/CMC hydrogels. The swelling rate of PVA/CMC hydrogels regardless of irradiation rose with increasing CMC content from 2 wt% to 6 wt%. However, the swelling rate decreased when the CMC content was higher than 6wt%.

2-1-2

**스폰지 코팅법으로 제조한 합성골 이식재의 특성**

김도현, 신지연, 윤용현, 이득용

대림대학교 의공융합과

BCP (Biphasic calcium phosphate) bone grafts were successfully synthesized using the 45 ppi polyurethane sponge coating method. BCP scaffolds were mainly composed of hydroxyapatite and  $\beta$ -tricalcium phosphate. As the number of BCP coatings increased from 1 to 5, the pore size and the wall size decreased. The BCP scaffolds showed no evidence of causing cell lysis or toxicity. And the cell proliferation results suggested that the BCP powders are highly applicable to the synthetic bone grafts.

2-1-3

**약물전달용 TiO<sub>2</sub> 나노튜브 제조**

이혜란, 이유진, 이득용

대림대학교 의공융합과

Electrospinning was carried out using a 17G / 23G dual concentric nozzle and the core oil was chemically removed. Electrospun TiO<sub>2</sub> nanotubes were sintered at intervals of 50°C from 500°C to 650°C. The structure was confirmed by TEM, XRD and BET analysis. The porous structure of the nanotubes was believed to be used as a drug delivery system. The TiO<sub>2</sub> nanofibers calcined at 500°C showed anatase phase with a crystallite size of 16 nm, a diameter of 108±20 nm and a BET area of 16.75 m<sup>2</sup>/g. On the other hand, the TiO<sub>2</sub> nanotube showed a mixture of anatase and rutile (76/24), the crystallite size of 11/7.4 nm, the diameter of 130±40 nm, and the BET area of 34.21 m<sup>2</sup>/g, respectively.

2-1-4

**전기 방사법으로 제조한 PVDF / PU 섬유의 특성**

노정원, 허현서, 윤용현, 이득용

대림대학교 의공융합과

The 23 wt% polyvinylidene fluoride (PVDF)/15 wt% polyurethane (PU) fibers were electrospun using the conjugated nozzle at a flow rate of 0.5 mL/h and an electric field of 15 kV. The formation of  $\beta$  crystal phase in the PVDF and the PVDF/PU fibers was confirmed by FT-IR. After electrospinning, the as-spun fibers were immersed in a boiling water and then dried at 100°C in a convection oven to make a crimp phenomenon. The crimps with a diameter of 4.13 ± 0.08  $\mu$  m were observed for the PVDF/PU fibers after hydrothermal treatment without sacrificing the extent of  $\beta$  crystal phase.

2-1-5

**생분해성 PLA / PCL 필름의 특성**

노정원, 이성은, 윤용현, 이득용

대림대학교 의공융합과

Thermodynamically immiscible poly(lactic acid) (PLA)

# | 포스터(2분스피치 1) |

and poly( $\epsilon$ -caprolactone) (PCL) were blended and solution-cast by adding the 3% compatibilizer (tributyl citrate, TBC) of the PCL weight. In the PLA/PCL composition range of 99/1 to 95/5 wt%, mechanical properties of the PLA/PCL films with TBC were always superior to those of the films without TBC. The tensile strength of 43.55±1.32 MPa was observed for the 93/7 PLA/PCL films without TBC, indicating that PCL addition is effective for strength. However, the tensile strength of 63±1.4 MPa was found for the 97/3 PLA/PCL with TBC, tensile strength dramatically increased.

2-1-6

## 치과 수복물용 고분자 침투 세라믹의 특성

신지연, 김도연, 이해란, 이득용

대림대학교 의공융합과

Polymer-infiltrated ceramics (PIC) were prepared by monomer infiltration into porous leucite preforms and subsequent polymerization by varying the silane concentration in the range of 1% to 20% to investigate the effect of the silane concentration on the mechanical properties of the PILs. In this study, the polymer infiltrated ceramic composites (PIC) are prepared by modifying the ceramic matrix surface with silane solution before the monomer infiltration into the porous ceramic matrix to improve the interface strength between organic polymer and the inorganic ceramic.

2-1-7

## 박동형 ECMO의 역박동 제어 시스템이 순환계에 미치는 영향 분석

김준영, 강성민, 최성욱

강원대학교 기계융합공학과

A pulsatile ECMO that doesn't affect cardiac load while maintaining blood circulation in patients with cardio-pulmonary disease is needed and related equipment is

being developed. However, ECMO using a pulsatile blood pump may pass through oxygenator and weaken its pulsatility, and cardiac load may increase due to the pump. In this study, when PLL controlled ECMO was applied to mock circulation system simulating blood pressure environment of living body, it was confirmed that the ECMO didn't significantly increase cardiac load. In addition, ECMO and blood pump EEP were compared, and it was confirmed that the developed ECMO maintained sufficient pulsatility.

2-1-8

## 삼차원 유한요소 전기생리 시뮬레이션을 위한 CPU vs. GPU 병렬컴퓨팅 성능 비교

페브리안 세티안토, 임기무

금오공과대학교 IT융합공학과

Cardiac electrophysiology study often use simulation to predict how cardiac will behave under various conditions. A representative mesh with sophisticated and large number of nodes are used in order to have a greater detail. As the result, computation time for solving series of ordinary differential equations (ODE) and partial differential equation (PDE) are affected by the size of the problem. GPU is designed to solve parallel problems which shown excellence when working with independent process and matrix. Our study shows that with huge number of ODEs, GPU parallelization can help to increase computation performance.

2-1-9

## 원자력현미경을 활용한 암종별 탄성 차이에 대한 연구

권상우<sup>1,2</sup>, 한세직<sup>2</sup>, 김근호<sup>2</sup>, 양우철<sup>1</sup>, 김경숙<sup>2</sup>

<sup>1</sup> 동국대학교 물리학과

<sup>2</sup> 경희대학교 의과대학 생체의과학과

Cancer cell is a major challenging disease for human.

Although there are many studies to develop biomarkers for cancer cells, however there are no specific studies in biophysics fields about mechanical properties of cancer cells. Changing mechanical properties in micro-, nano-scale can be meaningful results on basic medical research. Therefore, in this study, we selected two types cancer cells (breast cancer, cervix cancer) and observed that the apparent difference in elasticity between the counterpart cell and cancerous cell by using force spectroscopy system. And also, we could suggest that the physical indices of elasticity can be used to distinguish the types of cancer cells.

**2-1-10**

**근적외선 분광기법 기반 뇌-컴퓨터 접속의 최적 특징 추출 방법 조사**

이형탁<sup>1</sup>, 신재영<sup>2</sup>, 임창환<sup>2</sup>, 황한정<sup>1</sup>

<sup>1</sup>금오공과대학교 메디컬IT융합공학과

<sup>2</sup>한양대학교 의공학과

The goal of this study was to find feature extraction methods most suitable for near-infrared spectroscopy (NIRS)-based brain-computer interface (BCI). NIRS data were recorded while twenty subjects performed mental arithmetic (MA) and baseline (BL) task 30 times each. We tested the following five feature types for classification of MA and BL: mean, slope, skewness, kurtosis, and variance. The highest accuracy was shown for mean features ( $76.35 \pm 0.07\%$ ), and slope and skewness features also showed relatively good performance ( $> 70\%$ ), compared to kurtosis and variance.

**2-1-11**

**뇌파 동시 측정을 위한 전류제한기반 경두개직류자극 시스템 제작 및 검증**

이윤성<sup>1</sup>, 최가영<sup>1</sup>, 전세현<sup>2</sup>, 정영진<sup>2</sup>, 황한정<sup>1</sup>

<sup>1</sup>금오공과대학교 메디컬IT융합공학과

<sup>2</sup>동서대학교 대학원 융합방사선학과 & 보건환경연구센터

The purpose of this study is to verify whether our in-house transcranial direct current stimulation (tDCS) device based on current limiter can be applied during electroencephalography (EEG) recording without significant inflow of artifacts. In the experiment, we measured EEG while tDCS was applied to the subjects who repetitively closed and opened the eyes. It was shown that EEG spectral results were distorted during tDCS, but which was not significant, demonstrating that our tDCS device can be used during EEG measurement.

**2-1-12**

**LED와 초음파를 이용한 암세포 증식억제 모듈의 개발**

조경래, 서정혁, 최세운

금오공과대학교 메디컬IT융합공학과

A non-invasive and low side effect cancer treatment based on ultrasonography and photodynamic therapy using reactive oxygen species was developed recently. Lasers excite high intensity are generally used in photodynamic therapy. However, the laser suffers from a few limits, such as high price and large size. Light-emitting diodes are simple and low-cost miniaturized were proposed as a substitutional excitation source for photodynamic therapy. In this work, we integrate ultrasound emitting 1Mhz which is the most applicable area for medical use with light emitting diode for developing a cancer cell proliferation control module and quantitatively analyze the suppression effect.

**2-1-13**

**MRI촬영 시 치아교정기에 의한 영상왜곡 교정**

서영섭

한국표준과학연구원 의료융합표준센터

In this study, we reduced MR images artifacts induced

# | 포스터(2분스피치 1) |

by dental braces at 1.5 T MRI system using permanent magnets.

2-1-14

## PMMA 팬텀을 이용한 연성 섬광 영상가이드의 성능평가

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<sup>1</sup> 건국대학교 과학기술대학 ICT융합공학부 의학공학전공,

BK21 플러스의공학실용기술연구소

<sup>2</sup> (주)메디애플

<sup>3</sup> 한국방사선진흥협회 의료방사선정도관리센터

<sup>4</sup> 동남권원자력의학원 연구센터

A gamma imaging probe system using a flexible scintillation image guide was fabricated. In this study, we measured the scintillation images with information regarding the gamma-ray distribution of a Co-60 radioisotope according to the depth of a PMMA (polymethyl methacrylate) phantom. As an experimental result, the intensity of scintillation image was decreased with increasing depth of the PMMA phantom because of the attenuation of gamma-ray in the phantom.

2-1-15

## 열희석법을 이용한 소변량 측정 센서의 개발

박수진, 원인식, 김지운, 박성민, 최성욱

강원대학교 기계의용공학과,

강원대학교 의학전문대학원 흉부외과

The urine output must be measured in real time to manage critical patient. However, existing devices have problems with accuracy and cost, development of new sensors is required. Using thermistors and heater, we developed a sensor measuring urine output and evaluated its accuracy. We used the principle that the influence of atmosphere and heater temperature on urine temperature is inversely proportional to flow rate. Accuracy was calculated through repetitive in vitro experiments using saline solution. The sensor of this study, it is expected

that accurate measurement in real time is possible through correction table according to temperature and flow condition.

2-1-16

## 진단방사선용 광섬유 방사선량계에 대한 온도의 영향

최수연<sup>1</sup>, 여원혁<sup>1</sup>, 장경원<sup>2</sup>, 신상훈<sup>3</sup>, 이봉수<sup>3</sup>, 윤원식<sup>4</sup>, 유육재<sup>1</sup>

<sup>1</sup> 건국대학교 과학기술대학 ICT융합공학부 의학공학전공,

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<sup>2</sup> 동남권원자력의학원 연구센터

<sup>3</sup> 중앙대학교 공과대학 에너지시스템공학부

<sup>4</sup> JPI 헬스케어(주)

We have studied the effect of temperature on the light output signal from a fiber-optic dosimeter (FOD) using a plastic scintillating fiber (PSF). During diagnostic X-ray beam irradiation, the scintillating light signal was measured using a dosimeter probe of the FOD. The probe was placed in a beaker with water on the center of a hotplate, under variation of the tube potential of a digital radiography (DR) system or the temperature of the water in the beaker. From the experimental results, the scintillator light output at the given tube potential decreased as the temperature increased in the temperature range from 25 to 50°C. We demonstrated that commonly used PSF has a significant temperature dependence in the clinical temperature range.

2-1-17

## 펄스폭 변조를 이용한 모의 광용적 맥파 신호의 구현

정선형, 강예원, 전소윤, 강문혁, 윤용현

대림대학교 의공융합과

The photoplethysmography is measured using the change in light intensity according to the volume change due to

blood flow. The signal analysis makes use of the relative variation rather than the absolute measurement value. Therefore, it is necessary to develop a calibration device for verifying the quantitative reliability of the measured signal. In this study, we collected the data to generate the pseudo photoplethysmogram necessary for calibration of the photoplethysmography and presented it using pulse width modulation. As a result, the pseudo signal is confirmed that this can be used as a signal source of photoplethysmography calibration device.

**2-1-18**

**명상음악과 전신진동운동이 결합된 복합감각자극이 집중력에 미치는 영향에 대한 연구**

정지수<sup>1</sup>, 홍철운<sup>1,2</sup>, 권대규<sup>1,2</sup>

<sup>1</sup> 전북대학교 바이오메디컬공학부, <sup>2</sup> 전북대학교  
 고령친화복지기기연구센터

This study was to investigate the effect of compound sensory stimulus combined with meditation music and whole body vibration on concentration. The study used whole body vibration chair to stimulate compound sensory stimulus and computerized neurocognitive test to compare with before and after stimulus. Concentration was decided by the accuracy and the reaction time of the inspections. This study showed that the compound sensory stimulus combined with meditation music and whole body vibration helps person's power of concentration especially in optical sense.

**2-1-19**

**측정 방법에 따른 맥파도달시간 변화와 혈압 변화 상관성 고찰**

한상진<sup>1</sup>, 신항식<sup>1,2</sup>

<sup>1</sup> 전남대학교 바이오메디컬공학협동과정, <sup>2</sup> 전남대학교 의공학과

Pulse transit time (PTT) is a time delay of pulse propagation between two body sites. The use of PTT is increasing in cardiovascular studies including in non-constrained blood pressure (BP) measurements. The purpose of this study is to observe PTT changes according to BP changes and to investigate which PTT measurement method could reflect BP changes sensitively. For this, we calculated PTT<sub>E-F</sub> from between QRS and finger PPG, PTT<sub>S-F</sub> from between seismocardiography and finger PPG, and PTT<sub>F-T</sub> from between finger PPG and toe PPG. Then, we compared PTTs change according to BP changes. As a result, we found that PTT<sub>F-T</sub> have a highest correlation with systolic BP ( $p < 0.01$ ).

**2-1-20**

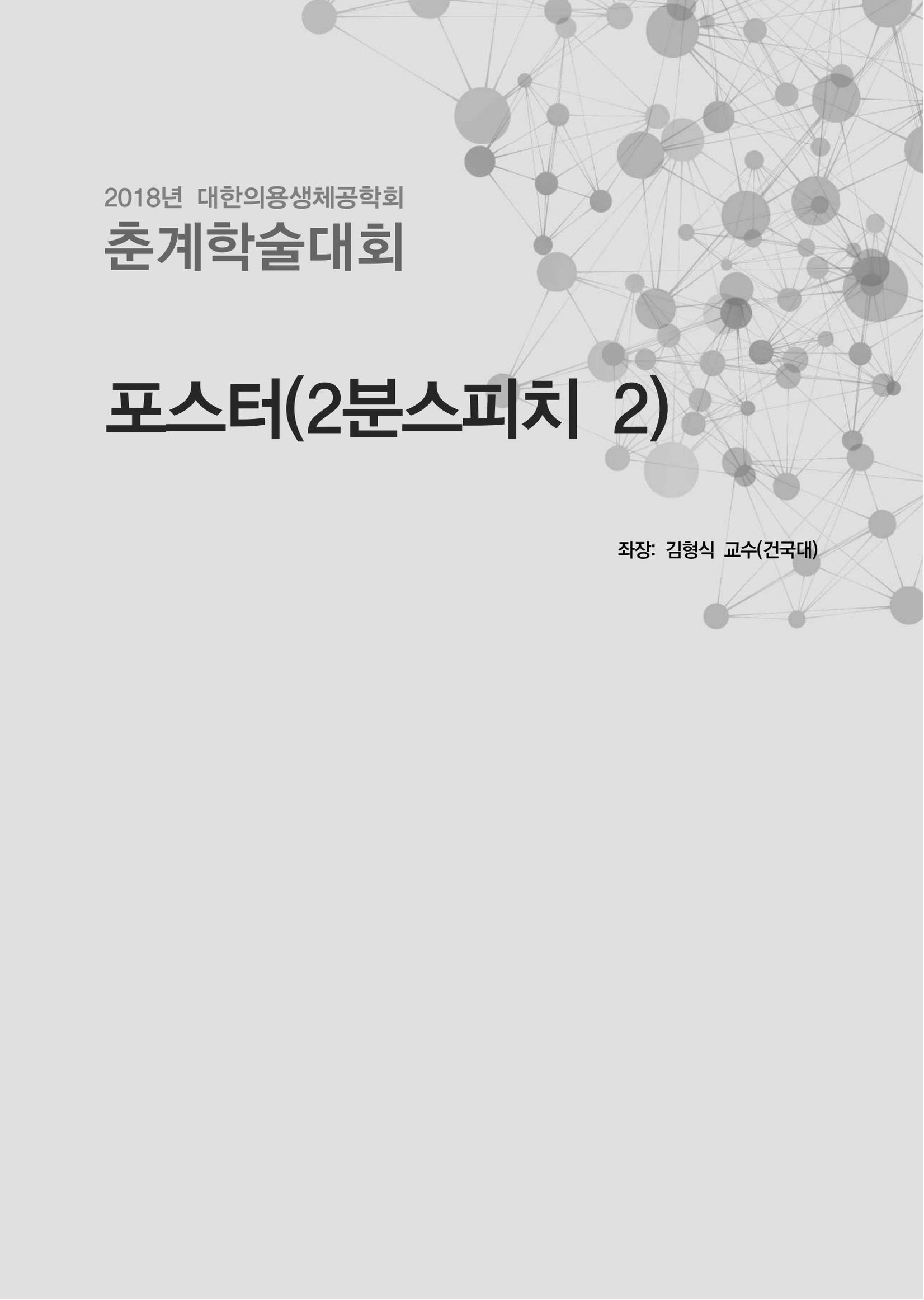
**전기장 자극에 의한 섬유아세포 탄성변화**

한세직<sup>1</sup>, 박문영<sup>1</sup>, 최병수<sup>2</sup>, 김경숙<sup>1</sup>

<sup>1</sup> 경희대학교 의과대학 생체이공학과  
<sup>2</sup> 경희대학교 물리학과

The cellular elasticity which is closely related to cell's mobility, differentiation, and diseases can be altered by electric field stimulation (EFS). In this study, we observed changes in the elasticity of Human Dermal Fibroblast (HDFs) induced by EFS. To understand the alteration, the changes in F-actin according to the EFS time was also investigated. The elasticity of HDFs increased up to 4.4 times by EFS compared to the control group.



A decorative background consisting of a network of interconnected nodes and lines, resembling a molecular structure or a data network. The nodes are represented by circles of varying sizes, and the lines are thin and light gray. The overall effect is a complex, interconnected web of points and connections.

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# 포스터(2분스피치 2)

좌장: 김형식 교수(건국대)



2-2-1

**비침습적 방법에 의한 염증성 혈관질환 이미징  
 대동물실험 사례**

이명영<sup>1</sup>, 박상훈<sup>1</sup>, 송철규<sup>1</sup>

<sup>1</sup>전북대학교 전자공학부  
<sup>1</sup>전북대학교 차세대 바이오이미징 연구센터

Photoacoustic tomography (PAT) is the hybrid imaging technique that combines the high contrast and resolution due to optical imaging and ultrasound imaging, respectively. PAT is dependent on the optical coefficient for target. It can measure the tumor, blood clot etc. using contrast agent can targets the object. In this paper, we will detect the inflammatory carotid artery disease, especially the blood clot. Since the blood clot of carotid artery can move to brain and cause stroke, it is very dangerous. In the result, PA image is overlaid on the US image and we can show the inner blood clot of artery.

2-2-2

**병원 내 감시소홀 구역 취약환자의 지속모니터링  
 시스템 개발**

임동준 서효창 최경민 주세경

울산대학교 의과대학 의공학과

It is important to continuously monitor to the patient for manage various diseases. Representatively, continuous monitoring of the ECG is helpful in the diagnosis of cardiac arrhythmia. It is necessary to develop a system that can continuously monitor the patient's emergency situation in hospital where surveillance is weak. In this study, we developed a portable patient monitoring system that measures and records various vital signal values in real time what measured patient ECG and PPG. Through this system, the survival rate of the patient can be increased by an immediate response in the emergency situation.

2-2-3

**미세먼지 정량 검출을 위한 표면 증강 라만  
 분광용 필터 개발**

박재완, 최문식, 변경민

경희대학교 생체의공학과

Raman spectroscopy has been used as optical detection technique as it provides a unique signal depending on the composition of target material. While the signal of Raman spectroscopy is relatively weak, surfaced-enhanced Raman spectroscopy (SERS) is known to amplify the signal intensity significantly. In this study, we demonstrate a quantitative measurement of fine dust concentration based on SERS techniques. We fabricate a fine dust filter combining membrane filter and Au nanoparticles. From SERS measurement, we confirm that the suggested method can improve the sensitivity and detection limit for fine dust materials of interest.

2-2-4

**표면 증강 라만 산란 분광법을 활용한 환경  
 호르몬 검출**

최문식, 변경민

경희대학교 생체의공학과

Endocrine disrupter detection becomes very important in recent years because people are easily exposed to endocrine disrupters which can affect the physiology of the hormones in human endocrinology system. Raman spectroscopy can be a potential candidate as endocrine disrupter detection due to its unique advantages of outstanding sensitivity, fingerprinting ability, label-free detection, and real-time and nondestructive detection. More interestingly, Raman spectroscopy signals can be amplified in the presence of metallic nanostructures, which is called surface-enhanced Raman spectroscopy (SERS). In this study, we intend to demonstrate that SERS-based endocrine disrupter detection could provide

## | 포스터(2분스피치 2) |

a higher sensitivity and a lower detection limit compared to a conventional detection technique.

2-2-5

### 손목 가속도 센서와 머신러닝 알고리즘을 이용한 자동 수면 패턴 분류

여민수<sup>1</sup>, 구용서<sup>2</sup>, 박철수<sup>1</sup>

<sup>1</sup>광운대학교 컴퓨터공학과

<sup>2</sup>서울아산병원 신경과

Sleep pattern analysis is important for healthy life since it arranges memory and alleviates fatigue during one third of human life. In this study, automatic sleep scoring methods were proposed to replace conventional algorithms. Subjects wore wrist bands with accelerometer for 24/7 and wrote sleep diaries including their sleep information. The recorded accelerometer data from the subjects were investigated with various bandwidths and machine learning algorithms including deep learning technique. The result of random forest, which is feature-based model, showed highest accuracy, recall and precision.

2-2-6

### 강화학습 알고리즘을 이용한 생활 패턴 분석 및 인식

석우준<sup>1</sup>, 박철수<sup>2</sup>

<sup>1</sup>광운대학교 지능정보시스템 임베디드SW공학과

<sup>2</sup>광운대학교 컴퓨터공학과

Recognizing activity of daily living is very important and most challenging in Human-Computer Interaction (HCI). This paper proposes a framework for the recognition of motion primitives, using Deep Q-network, that is, a deep reinforcement learning algorithm. In this framework, the agent decides whether to classify the class or include more features using label information as a reward. After this training procedure, it could classify

the class of the motions with high accuracy. The public data of UCI dataset for ADL recognition with wrist-worn accelerometer data set was utilized. Among the activities, the agent was trained to recognize whether the subjects climbed stairs or not as well as the other 6 movement. The classification accuracy by Deep Q-network was 93.0% and that of the traditional neural network 92.49%.

2-2-7

### LASSO 기반의 희소 정준상관분석을 이용한 뇌영상유전체 바이오 마커 관찰

김만수<sup>1,3</sup>, 박현진<sup>2,3</sup>

<sup>1</sup>성균관대학교 전자전기컴퓨터공학과

<sup>2</sup>성균관대학교 전자전기공학부

<sup>3</sup>기초과학연구원 뇌과학이미징연구단

Neuroimaging genetics is an emerging field to detect novel biomarkers associated with both genetic variants and neuroimaging features. Canonical correlation analysis (CCA) has been proposed to investigate association between two high-dimensional data and LASSO regularization method was applied to get optimal solution. Existing algorithms can only be applied to two high-dimensional data. In this study, we enhanced the CCA method to solve association among two different neuroimaging modalities and genetic information.

2-2-8

### 합성곱 신경망을 이용한 심전도 및 뇌파 기반 멀티모달 개인인증 시스템 설계

김지훈<sup>1</sup>, 성동석<sup>1</sup>, 박광석<sup>2</sup>

<sup>1</sup>서울대학교 공과대학 협동과정 바이오엔지니어링

<sup>2</sup>서울대학교 의과대학 의공학교실

In this study, we developed multi-modal based individual verification system based on ECG and EEG using convolutional neural networks. We analyzed EEG and ECG data of 100 healthy subjects from Korean EEG

database. We examined the capability of ECG and EEG as personal authentication. Alex-net based convolutional neural networks were used for data training and testing. We used Welch's power spectral density for 19 channel of EEG as network input feature data. For ECG, time domain based feature were extracted and linear discriminant analysis was conducted for identification. Score-based fusion method was used for multi-modal verification. The best result was 0.92% of EER in this research. The result shows that person identification can be performed with high accuracy using ECG and EEG multi-modal system in resting states.

**2-2-9**

**3차원 메디안 정칙자를 사용한 콘빔 단층영상 재구성**

정지은<sup>1,2</sup>, 이수진<sup>1</sup>

<sup>1</sup>배재대학교 전자공학과  
<sup>2</sup>쿠마모토대학 정보전기전자공학과

We investigate a model-based iterative reconstruction (MBIR) method for cone-beam computed tomography (CT) using a three-dimensional (3-D) median regularizer. In order to validate the improved performance of our 3-D median regularizer (3-D MR) in cone-beam CT, we also implemented a 2-D MR applied to fan-beam CT and quantitatively compared their reconstruction results. According to our simulation results using a software phantom, the 3-D MR for cone-beam CT provides more accurate reconstructions than the 2-D MR for fan-beam CT in terms of the percentage error by taking more pixels from the adjacent slices into account in its regularization.

**2-2-10**

**CT 흉부영상에서의 고립성 폐결절 검출 기법**

권준모<sup>1</sup>, 박현진<sup>2,3</sup>

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<sup>3</sup>성균관대학교 전자전기공학부

Solitary Pulmonary Nodule (SPN) is a round opaque nodule surrounded by pulmonary parenchyma. SPN is typically less than or equal to 3cm in diameter. In this study, we propose an algorithm for detecting SPN on computed tomography (CT) images. First, our algorithm performs noise reduction on each CT slice and lung region segmentation on the de-noised CT images. Second, nodule candidates are selected based on intensities of each CT slice. Histogram features are extracted from the nodule candidates. Lastly, random forest classifier is constructed to determine whether each candidate is SPN or not. Our algorithm resulted in 71% accuracy.

**2-2-11**

**T1자기공명영상을 이용한 대뇌 백질 신경섬유 지표 예측**

변경섭<sup>1,2</sup>, 박보용<sup>1,2</sup>, 박현진<sup>2,3</sup>

<sup>1</sup>성균관대학교 전자전기컴퓨터공학과  
<sup>2</sup>뇌과학이미징연구단, 기초과학연구원  
<sup>3</sup>성균관대학교 전자전기공학부

Diffusion tensor imaging (DTI) is a neuroimaging method that can measure structural information from water diffusion of neuronal fibers of the brain. T1-weighted image also contain this structural fiber information. In this study, we computed predicted tensor imaging by multivariate regression analysis using T1-weighted imaging. Then, we compared functional anisotropy (FA) and mean diffusivity (MD) of the

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predicted tensor imaging with those from real tensor imaging. Thirteen white matter regions showed significant correlations between FA of real tensor and predicted tensor imaging.

2-2-12

### Super-Resolution Reconstruction of Emission Tomography Images Using High-Resolution Backprojection

Xue Ren, Soo-Jin Lee

*Department of Electronic Engineering, Paichai University,  
Daejeon, Korea*

This paper investigates a super-resolution (SR) method for positron emission tomography (PET), where the pixel resolution is increased by high-resolution (HR) backprojection in the iterative reconstruction process. Unlike conventional imaging systems, where the high-resolution data are usually transformed back into the low-resolution data by a downsampling operation, the corresponding transformation in PET reconstruction is performed by a forward projection operation. (A projection from a radiation source to a detector bin.) We note here that there can be two different approaches to implementing the forward projector in iterative reconstruction; low-resolution (LR) projector and HR projector. In this work, we investigate and compare the performances of the two different approaches using a software phantom and show that the HR projector provides more accurate SR reconstruction than the LR projector in terms of the percentage error.

2-2-13

### 광음향 영상을 이용한 간 특정 표적 나노 입자의 in vivo 간 타게팅 과정 모니터링

이동현, 김철홍

*POSTECH 창의IT융합공학과*

The liver, a major organ of the body, performs important functions such as detoxification, protein synthesis, glycogen regulation and hemocyte degradation. However, the liver is a target for many diseases and several non-invasive imaging techniques have been used. In this study, we have developed a new hyaluronate - silica nanoparticle conjugates for liver-specific delivery and imaging for the diagnosis of liver diseases. The HA-SiNP conjugates showed high liver-specific targeting efficiency, strong optical absorbance near-infrared windows, excellent biocompatibility, and biodegradability. The liver-specific targeting efficiency was verified by *in vivo* photoacoustic imaging.

2-2-14

### 다양한 형태학적 특징을 이용한 피질 모델 기반 뇌 네트워크

최용호<sup>1</sup> 김보현<sup>1</sup> 이종민<sup>1</sup>

*한양대학교 생체공학과*

Representing the characteristics of the brain as a network can provide novel insights into brain system. It is important to represent the human brain as a network that reflects morphological properties, however, it's limited by methodological problems that construct only group-level network. Several researchers have proposed constructing individual network using intensity similarity between regions to overcome this limitation. We extended previous framework by using morphological features extracted from brain surface model. In this study, we tried to determine whether each morphological network have small-world attributes.

2-2-15

**당뇨발 진단 및 모니터링을 위한 근적외선  
 분광법과 18F FDG PET 방사선 영상 기법의  
 비교**

오르티즈메지로렌스<sup>1,2</sup>, 서정현<sup>1</sup>, 정영진<sup>1,3</sup>

<sup>1</sup>Dept. of Multidisciplinary Radiological Science,  
 Graduate School, Dongseo University

<sup>2</sup>College of Medical Radiation Technology,  
 De La Salle Health Sciences Institute

<sup>3</sup>Dept. of Radiological Science, Dongseo University

The purpose of this study is to determine the use of Near Infrared Spectroscopy (NIR) to provide a non-invasive way of detecting and monitoring foot diabetes complications in relation to radiographic imaging modality. In this study, several published materials were reviewed to determine how NIR can be used to measure the glucose concentration through the modified principle of Beer-Lambert law in comparison with <sup>18</sup>F FDG-PET as the best radiographic imaging modality for diagnosing the said hyperglycemic condition.

2-2-16

**레이저 기반 열 스트레인 영상 기술을 이용한  
 지질 구분**

최창훈, 김철홍

POSTECH Medical Device Innovation Center

We demonstrated laser-based thermal strain imaging (TSI) for lipid distinction, using an intravascular ultrasound catheter (IVUS) and a 1210-nm continuous-wave laser. The IVUS transducer obtained ultrasound rotation images from a phantom made of pig fat (lipid) and gelatin (water-bearing tissue) while the laser heated it. A result showed the pig fat was clearly distinguished by strong positive strain during the temperature increasing. On the other hand, the strain of gelatin was negative and

relatively smaller than the strain of pig fat. The result suggests that laser-based TSI could be a new method for differentiating lipid.

2-2-17

**맘모그램에서 딥러닝을 활용한 유방 종양 검출**

박성진<sup>1</sup>, 김영재<sup>1</sup>, 유은영<sup>2</sup>, 김광기<sup>1</sup>

<sup>1</sup>가천대학교 의과대학 의공학교실

<sup>2</sup>가천대학교 길병원 영상의학과

Early detection of breast cancer is important for improving breast cancer prognosis and reducing mortality. In this paper, we propose computer aided diagnosis system for early detection of breast cancer. First, set the region of interest. and split train/test set. Then we use deep learning algorithms, in particular Resnet50 based Faster-RCNN model. And detected mammo mass. Deep learning training was performed on 134 tumors and tested with 30 tumors. A comparison with the result of manual detection by an expert showed 36.67% of sensitivity and 0.4 of FP/image





2018년 대한의용생체공학회  
**춘계학술대회**

# **포스터(2분스피치 3)**

좌장: 최명환 교수(성균관대)



2-3-1

**실시간 비표지 광음향 조직병리검사 시스템 개발**

백진우, 김진영, 안효상, 변경희, 최해룡, 유선영, 김철홍

POSTECH 창의IT융합공학과

Conventional intraoperative biopsy method, the frozen section, has an obstacle of a limited examination time in clinical scenarios. To overcome this limitation, we have developed a fast ultraviolet photoacoustic microscopy (UV-PAM) system with a 2-axis waterproof microelectromechanical systems (MEMS) scanner. This scanner enables to scan 3 mm × 3 mm range and acquire a volumetric image within 2 minutes, which is 7 times faster than the frozen section. The measured spatial and axial resolutions of the developed system are 2.2 and 39 μm, respectively. Finally, we have successfully obtained *ex vivo* histology-like PA images in the fixed live tissues.

2-3-2

**적외선 체열 영상 정보를 이용한 Machine**

**Learning기반 척추질환 자동 진단시스템 개발**

주해인, 이대혁, 예현해, 조예진, 김영모

건양대학교 의료공과대학 의공학부

In this study, we developed an automatic diagnosis system of spinal diseases based on machine learning (ML) using thermal imaging device. The method of automatically diagnosing spinal diseases using thermal images can be determined by understanding that the left and right temperatures of the legs and soles are asymmetric. U-net is used to classify regions with large temperature differences according to disease temperature distribution pattern. Inception V3 models detect diagnosis rates by expressing the number of predicted outcomes as the probability of the highest disease. This study is expected to improve the accuracy of diagnosis of spinal diseases and to help diagnosis decision of medical personnel.

2-3-3

**집속 초음파를 이용한 동물의 뇌혈관장벽 개통**

**후 물 분자 확산 측정 연구**

한문, 이은희, 정병진, 황지은, 박주영

대구경북첨단의료산업진흥재단 첨단의료기기개발지원센터

In this study, the diffusion tensor MR imaging technique was used to evaluate water molecule diffusion after the blood-brain barrier disruption (BBBD) by a focused ultrasound (FUS) at normal and tumor brains. We also observed a protein (Aquaporin-4) which controls water molecule diffusion in the brain. The result demonstrate that water molecule diffusion decreased after BBBD and recovered after 24 hours. These results showed that FUS-induced BBBD could modulate water molecule diffusion in targeted brain and tumor region. We suggest that the method of measuring the water molecule diffusion after the BBBD by FUS can be applied to the brain disease treatment.

2-3-4

**Effect of the shape of polymeric nanoparticles in cellular uptake**

Susmita Aryal, E. S. Oh, J. H. Key

Department of Biomedical Engineering, Yonsei University, Wonju, Korea

The interaction between nanoparticles and cells is of significant interest. Here, we designed two different shaped PLGA nanoparticles with similar particle diameter, chemical composition and surface charge but different shape. Then the shape effect of particles in cellular uptake and behavior were studied. Discoidal particles were taken up in larger amounts and had faster internalization rate in contrast of spherical particles. It was also found that discoidal particles had greater impact on cell adhesion and cell migration.

## 2-3-5

### 세포에 대한 나노 입자의 전기적 영향을 수치화하기 위한 유전영동 장치

오은설, 박인수, 최승엽, 이세영, 이상우, 이재홍

연세대학교 의공학부

Dielectrophoretic (DEP) device have been used to measure Biophysical/Biochemical properties of living things by the electrical analysis. Nanoparticles such as silica nanoparticles are widely used as drug carriers in biomedical applications. These applications act directly or indirectly on the cells. They are present in the cell membrane and cytoplasm, or even transform the structure of cells. Then, the electrical properties of cells are changed by nanoparticles. In this study, we treated silica nanoparticles on the MCF-7 breast cancer cells and measured the dielectric properties of treated cells by DEP device. We compared it with zeta potential data. The result from this study suggest this DEP device as a tool to estimate changes in the electrical properties of the cells.

## 2-3-6

### 전기화학적 동시환원을 통한 3차원 금 나노입자/탄소나노튜브/환원된 그래핀 산화물 나노복합체의 합성과 이를 이용한 전기화학 면역센서

이재면<sup>1</sup>, 안용진<sup>1</sup>, 이영주<sup>2</sup>, 이기자<sup>1,2</sup>

<sup>1</sup>경희대학교 일반대학원 생체이과학협동과정, <sup>2</sup>경희대학교  
의과대학 의공학교실

In this study, we introduce a new sensing platform based on 3D Au nanoparticles-decorated multi-walled carbon nanotube/reduced grapheme oxide nanocomposites (GNP/MWCNT/rGO) for the detection of tryptase in nasal fluid as biomarker for allergy rhinitis. 3D GNP/MWCNT/rGO was fabricated on glassy carbon electrode

by one-step in-situ electrochemical deposition and co-reduction method. For the detection of tryptase, we prepared a sandwich-type electrochemical immunosensor. As a result, 3D GNP/MWCNT/rGO based sandwich-type electrochemical immunosensor showed a good sensitivity, selectivity, reproducibility and stability. Therefore we expect that 3D GNP/MWCNT/rGO can be utilized as the effective immunosensing platform for detection of tryptase.

## 2-3-7

### 펄스자기장에 따른 적혈구의 형태변화

안효제, 신경훈, 이현숙

상지대학교 한방의료공학과

It is known that pulsed magnetic field (PMF) has a positive effect on the red blood cells (RBCs) rouleau formation which affects blood circulation. Based on these magnetic fields, we investigated the effect of PMF on the chemical treatment and osmosis of RBCs using microvascular model and smear method. As a result, PMF showed the effect of decreasing erythrocyte aggregation in the tBHP treated group and increasing blood flow velocity in the microvascular model with PMF. However the effect of PMF did not show much in the osmotic phenomenon due to NaCl causing outflow of H<sub>2</sub>O inside RBCs.

## 2-3-8

### 폐암 치료용 Discoidal Polymeric Nanoconstructs

박상효, 이재홍

연세대학교 의공학부

Lung cancer and pulmonary metastasis are the leading cause of cancer fatality worldwide. Lung cancer is difficult to diagnose early on as symptoms do not manifest early on, and there are many difficulties in

diagnosing and treating lung cancer because there are no effective treatments available as the transfer of lung cancer progresses. Nano/Micro particles have been developed for the imaging and treatment of various cancers. In this study, we use a top-down method. The top-down method can control the size and shape of the particles, has high loading contents, and thus varied functions and effects can be expected. We made Discoidal Polymeric Nanoconstructs (DPN) with an average diameter of  $3\mu$  m. These particles were evaluated by Multisizer, Dynamic Light Scattering (DLS) and fluorescence microscopy.

2-3-9

**항상된 줄기세포 유도 효과를 위한 산화철 나노입자에 관한 연구**

윤완수, 이재홍  
 연세대학교 의공학부

Stem cell-based therapies have received much attention in regenerative medicine. Bone marrow-derived mesenchymal stem cells are undergoing clinical trials for neural disease, inflammation, and tissue regeneration. Iron oxide nanoparticles induce the expression of specific membrane proteins of stem cells and show regenerative effects. We have reported engineered iron oxide nanoparticles encapsulated by poly(lactic-co-glycolic acid) for enhanced homing effects than conventional 10nm iron oxide nanoparticles.

2-3-10

**N-back task 수행 시의 뇌파를 이용한 인지부하정도 분류**

권주희<sup>1</sup>, 김의진<sup>2</sup>, 임창환<sup>2</sup>, 김도원<sup>3</sup>  
<sup>1</sup>전남대학교 의공학협동과정  
<sup>2</sup>한양대학교 생체의공학과  
<sup>3</sup>전남대학교 의공학과

This study investigated whether it is possible to classify the cognitive load of a person using electroencephalogram during a cognitive task with different difficulties. Ten healthy participants underwent four sessions of n-back task with different difficulties in a pseudorandom order. EEG was recorded from 32 channels and preprocessed to measure the amplitude and latency of P300 component. The P300 amplitude and latency of Fz, Cz, and Pz was used as a feature for classification. The classification was done using support vector machine and evaluated using leave-one-out cross-validation. The results show that we could successfully classify the difference between 1-back and 3-back condition with 5% error.

2-3-11

**뇌 재활 치료를 위한 전류제한 기반 4채널 경두개직류자극 시스템 제작**

전세현<sup>1</sup>, 정영진<sup>1,2</sup>

<sup>1</sup>동서대학교 대학원 융합방사선학과 & 보건환경연구센터  
<sup>2</sup>동서대학교 방사선학과

The purpose of this study is to develop a system that enables the multi-focal stimulation of tDCS with high precision by developing a current limiting circuit. In order to estimate the safety and performance, the simple experiment was conducted according to IEC60601-2. As a result, the developed 4X4 tDCS system has not only higher safety but also highest precision. The experiment showed that it can be directly applied to clinical practice.

2-3-12

**뇌전도와 심층신경망을 이용한 렘수면행동장애 환자의 질환 특이적 특징 추출**

여동훈<sup>1</sup>, 허성진<sup>1</sup>, 차광수<sup>1</sup>, 서부경<sup>1</sup>, 김현<sup>1</sup>, 최성운<sup>1</sup>, 정기영<sup>2</sup>, 김경환<sup>1</sup>

<sup>1</sup>연세대학교 의공학과  
<sup>2</sup>서울대학교 의과대학 신경과

REM sleep disorder (RBD) is known as a risk factor for neurodegenerative diseases. Although cognitive decline has been reported in patients with RBD, a clear neuro-physiological mechanism has not yet been identified. In this study, we tried to classify patients and normal controls by using EEGs and an artificial neural network, and to extract the disease-specific features by calculating spatiotemporal features helpful for classification. The current density of visual area and frontal lobe within 200-350 ms was the most important features. This may be due to decreased inhibitory attention ability of RBD patients and decreased function of top-down information processing to find target features.

## 2-3-13

### 딤러닝 뇌파 분석을 통한 멀티미디어 강의 시청 집중도 분류

이희준, 박철수

광운대학교 컴퓨터공학과

Attention of a student during a lecture is important for the learning efficiency. In e-learning circumstances, it is easy to lose their attentions to the lecture compared to the traditional offline classroom due to the lack of interaction between the students and lecturer. In this study, we designed an experiment to analyze EEG responses of students to the e-learning multimedia material with and without their attentions. It was conducted on 8 subjects and their EEG signals were analyzed using a proposed CNN structure to classify between two conditions, attention and non-attention. The classification accuracy between the two conditions were 72.67%(±10.63).

## 2-3-14

### 오픈소스 기반 뇌파 게임: Mind Car

정성준<sup>1</sup>, 김준호<sup>1</sup>, 엄수상<sup>1</sup>, 이성찬<sup>2</sup>, 전성찬<sup>2</sup>, 안민규<sup>1</sup>

<sup>1</sup>한동대학교 전산전자공학부, <sup>2</sup>광주과학기술원 전기전자컴퓨터공학부

Although BCI (Brain-Computer Interface) is a popular and hot research area, but establishing real-time system for conducting BCI and biofeedback researches is not easy due to the high technological requirements. In this paper, we introduce the open-source based real-time system featured with 'In-Game Training', 'Multi-modal Feedback', 'Gamification' and 'Customization'. We expect that this system will reduce the cost for building experimental systems, thus help BCI and biofeedback researchers focus on the brain research.

## 2-3-15

### 외부 잡음이 귀 주변 뇌파에 미치는 영향 및 특성 분석

최수인, 최가영, 황한정

금오공과대학교 메디컬IT융합공학과

In this study, we investigated the effect of physiological artifacts on electroencephalogram (EEG) measured around the ear, called Ear-EEG. When thirty subjects performed eye blinking, chin and neck movements, EEG is measured and two representative electrodes attached on frontal and ear areas were used for data analysis. Eye blink and neck movements influence frontal areas more significantly than ear areas in terms of amplitude, but chin movement did not considerably affect both frontal and ear areas. Event-related (de)synchronization (ERD/ERS) pattern maps also showed similar results with the amplitude analysis results.

2-3-16

**자극 주파수 대역이 안정상태 시각유발전위 기반 뇌-컴퓨터 접속 성능에 미치는 영향**

최가영<sup>1</sup>, 김현욱<sup>1</sup>, 장재홍<sup>1</sup>, 정영진<sup>2</sup>, 황한정<sup>1</sup>

<sup>1</sup>금오공과대학교 메디컬IT융합공학과

<sup>2</sup>동서대학교 방사선학과

The goal of this study is to share our steady-state visual evoked potential (SSVEP) dataset for brain-computer interface (BCI) in order to allow other researchers to increase the performance of SSVEP-based BCI by applying their advanced algorithms using our SSVEP dataset. Thirty subjects took part in the experiment, and they conducted three SSVEP experiments with low-, mid-, and high-frequency band, respectively, twice on different days. The mid-frequency band showed significantly higher classification accuracy than the low- and high-frequency band (low:  $78.73 \pm 10\%$ , mid:  $90.07 \pm 5\%$ , high:  $68.58 \pm 9\%$ ), demonstrating the feasibility of our dataset.

2-3-17

**수동형 상지 관절운동기기와 연동하는 기능적 전기자극 시스템 개발**

권혁찬<sup>1</sup>, 박은경<sup>1</sup>, 한재인<sup>2</sup>, 이현주<sup>2</sup>, 김국한<sup>3</sup>, 태기식<sup>1</sup>

<sup>1</sup>건양대학교 의공학부, <sup>2</sup>건양대학교 물리치료학과,

<sup>3</sup>대성마리프(주)

In this study, we developed a system for combining continuous passive motion (CPM) and functional electrical stimulation (FES), which are passive joint motion therapy devices, for active upper extremity rehabilitation of hemiplegic patients. The FES device consists of two channels and hardware is configured to produce the same output as the low frequency electric stimulation therapy. Each electrode with two channels was attached to the wrist extensor carpi muscle for wrist extension and the flexor carpi muscle for wrist flexion. The developed system provided a more efficient joint

rehabilitation treatment by interfacing CPM equipment for upper limb paresis.

2-3-18

**치과위생사의 근골격계 질환 예방을 위한 관성측정장치 기반 진료 자세 개선 연구**

이수호<sup>1</sup>, 고미미<sup>2</sup>, 정영진<sup>1,2</sup>

<sup>1</sup>동서대학교 대학원 보건과학과 & 보건환경연구소

<sup>2</sup>동서대학교 방사선학과

The purpose of this study is to prevent occupationally related musculoskeletal disorders (WMSD) diseases of dental hygienists. In the experiment, IMU was used to measure the subject's data and the angle of each IMU was calculated using Python. The results of the data analysis showed that each operation and angles of each axis were obtained by IMU. If more data is gathered, it will be a prevention of WMSD.

2-3-19

**섬유의 압박기능을 활용한 운동학적 기능성 이너웨어가 근육활성도, 스윙거리 및 방향각에 미치는 영향**

J.H. Oh<sup>1</sup>, C.U. Hong<sup>2</sup>, T.K. Kwon<sup>3</sup>, C.H. Sin<sup>4</sup>

<sup>1</sup>Department of Healthcare Engineering, Graduate School of Chonbuk National University, Jeonju, Korea

<sup>2</sup>Division of Biomedical Engineering, Collage of Engineering, Chonbuk National University, Jeonju, Korea

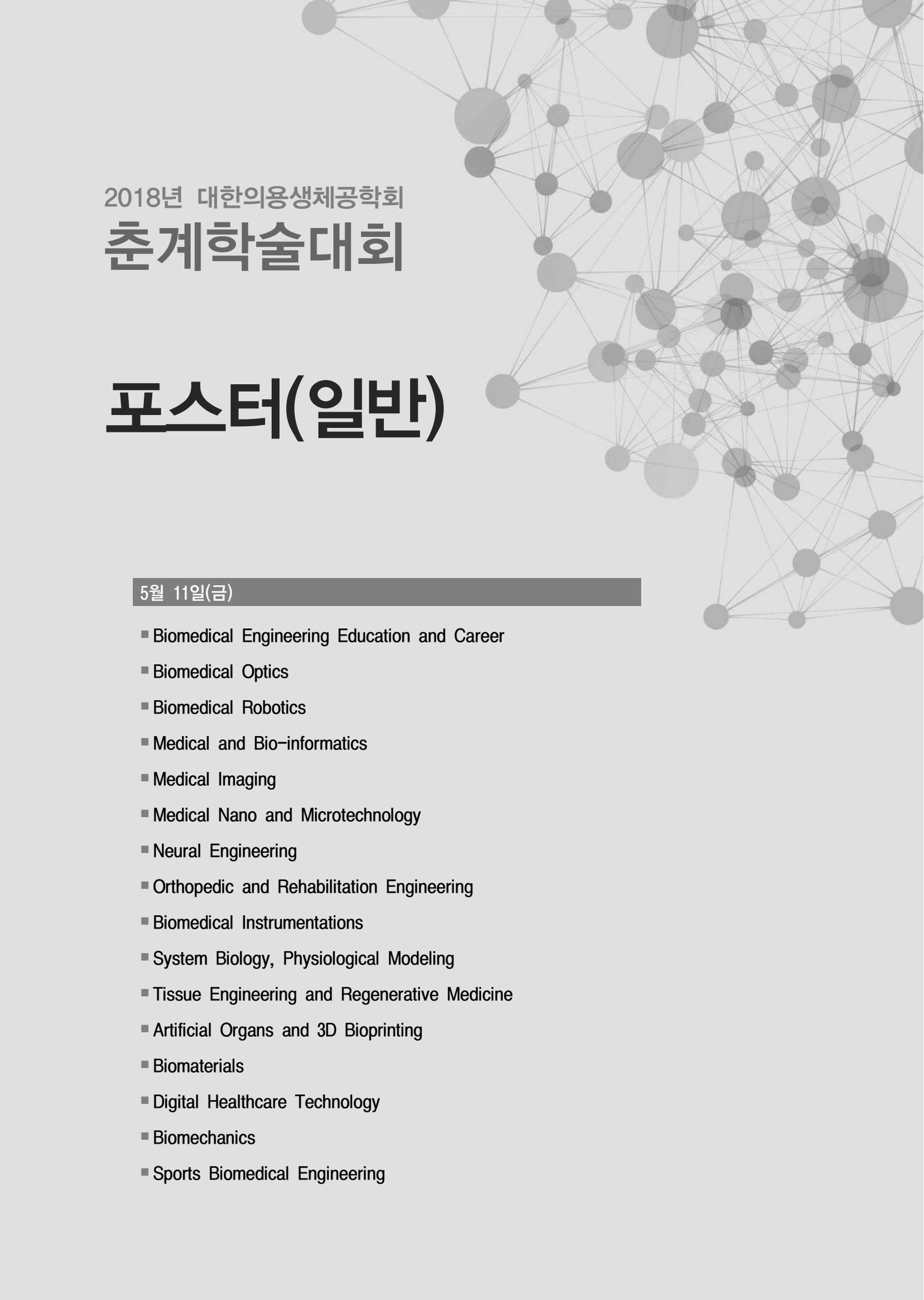
<sup>3</sup>Division of Biomedical Engineering, Collage of Engineering, Chonbuk National University, Jeonju, Korea  
 Research Center of Healthcare & Welfare Instrument for the Aged, Chonbuk National Univ

<sup>4</sup>Department of Physical education, Chonbuk National University, Jeonju, Korea

The purpose of the present study is to analysis the muscle activity and motion for effective slice and hook prevention before and after wearing innerwear with compression function. The change of muscle activity

## | 포스터(2분스피치 3) |

pattern before and after wearing innerwear was compared with the golf swing. The muscles of upper trapezius(UT), biceps muscle(BC), latissimus dorsi(LD), rectus femoris (RF), biceps femoris(BF), and gluteus medius(GM) were measurement. In addition, motion analysis equipment (swing baro)was utilized for further analyzes such as distance(m), direction angle( $^{\circ}$ ), projection angle( $^{\circ}$ ) and club speed(m/s). As a result of the experiment, the beginner showed the active state of the trapezius in the swing pattern of the muscles due to the tightness of the wrist and the functional gauge of the shoulder muscle, and also used the slice (R-29.9  $^{\circ}$ ) type slice in the swing motion analysis.

A background graphic consisting of a network of interconnected nodes and lines, resembling a molecular structure or a complex system. The nodes are represented by circles of varying sizes, and the lines are thin and grey, creating a dense, web-like pattern that fills the right side of the page.

2018년 대한의용생체공학회  
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# 포스터(일반)

5월 11일(금)

- Biomedical Engineering Education and Career
- Biomedical Optics
- Biomedical Robotics
- Medical and Bio-informatics
- Medical Imaging
- Medical Nano and Microtechnology
- Neural Engineering
- Orthopedic and Rehabilitation Engineering
- Biomedical Instrumentations
- System Biology, Physiological Modeling
- Tissue Engineering and Regenerative Medicine
- Artificial Organs and 3D Bioprinting
- Biomaterials
- Digital Healthcare Technology
- Biomechanics
- Sports Biomedical Engineering



P-001

### 3D 프린팅을 이용한 환자 맞춤형 이식 의료기기의 방사선 멸균 적용방안

엄용운

성균관대학교 의료기기산업학과

In the manufacturing process of medical devices, sterilization has a significant effect on the safety and effectiveness of the product, so appropriate material selection and validation through verification is necessary. In recent years, patient-customized medical devices using 3D printing have been developed and used in various fields, but it is not easy to verify the effectiveness of sterilization because designs are changed according to patients. Therefore, it is reviewed for the application of radiation sterilization : selection of materials, selection of representative sample for validation, determination of sterilization dose, and selection of packaging system to maintain sterilization of product.

P-002

### CPU pin array를 활용한 Omega( $\Omega$ ) 형상의 microwell

김기덕, 박종열

중앙대학교 기계공학과

The Omega well array could be made by CPU micropin array without applying high-cost materials or procedures. Due to the unique downward-curved entrance shape of the Omega well, seeded cells could be fallen into the Omega-well. The special function of this Omega well not only makes the cells more efficient to use, but also has the function of collecting cells falling into the wells, promoting the formation of more spherical cell spheroids. Various characteristic analyses were performed by experiment and computer simulation. It is demonstrated that cell loss is minimized during cell seeding, a spheroid once produced does not easily escape, and

crosstalk between microwells is significantly reduced. The novel fabrication method and Omega-well platform proposed in this study are highly practical, and thus will be useful tools in biology and pharmaceutical labs.

P-003

### 경구투여 백신전달을 위한 장용화 코팅 MCM-48 나노입자의 개발

민창희<sup>1</sup>, 김세나<sup>1</sup>, 최영빈<sup>1,2,3</sup>

<sup>1</sup> 서울대학교 공과대학 협동과정 바이오엔지니어링 전공

<sup>2</sup> 서울대학교 의과대학 의공학과

<sup>3</sup> 서울대학교 의학연구원 의용생체공학연구소

In this study, we proposed the MCM-48 nanoparticles for enhanced oral vaccine delivery. For this purpose, the MCM-48 were treated for pore expansion, as well as with polyethylene glycol grafting (i.e., PEG-MCM-48). The synthesized nanoparticles were characterized by X-ray diffractometry, N<sub>2</sub> adsorption/desorption, Fourier transform infrared spectroscopy and electron microscopy. To test this carrier, a model antigen, ovalbumin (OV) was impregnated in the PEG-MCM-48, which was then coated with Eudragit. The in vitro release study was performed in PBS. During 24 h, more than 50% OV was released at pHs 6.8 and 7.4 while less than 10% release was observed at pH 1.2.

P-004

### 미세구조 마스크를 사용한 자외선 조사과정에 의한 생체친화성 PEG 하이드로젤 마이크로패터닝

김영호, 공재성

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Biocompatible polyethylene glycol (PEG) hydrogel micro-patterning has been presented for biomedical applications. Recently, various small medical devices such as biosensor chips, microfluidic devices, lab-on-a-chips, minaturized

analytical devices have been rapidly investigated for biomedical and biotechnological applications. Furthermore, hydrogel polymers and their preparation procedures have gained high interested to fabricate microstructured patterning. The PEG hydrogel is a biocompatible and photopolymerizable polymers. In the preparation of PEG micropatterning, microstructured stencils in the ranges of 700-1000  $\mu$  m pattern widths were prepared. The PEG solution was exposed under UV light for 7-20 seconds at 26 mW/cm<sup>2</sup> intensity. Then the PEG micropatterned devices were prepared and characterized.

## P-005

### 치과용 임플란트 적용을 위한 PEEK Polymer의 재료 특성 분석

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Poly-ether-ether-ketone (PEEK) is a synthetic, this polymeric material that has been used as a biomaterial in orthopedics for many years, also PEEK use increases to replace conventional titanium alloy for dental implant with advantage of great mechanical and esthetic characteristics. To be sure as a dental material for implantation, implant stability and static/dynamic mechanical analysis were obtained for PEEK dental implant specimens. As based on the preliminary results, dental implant system with PEEK has an enough initial insertion stability and fatigue properties, could be considered one of alternative materials in particular for esthetic anterior tooth restoration.

## P-006

### Assessing the Biodegradability of PLLA(Poly-L-Lactide) for Rhinoplasty Feasibility

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The purpose of this study is to evaluate for biodegradation of PLLA in in vitro conditions to determine whether it meets with the macroscopic and microscopic physical properties required in rhinoplasty. PLLA scaffold samples were induced into PBS and lysozyme for 120 days and were tested for weight measurement, tensile strength evaluation, and scanning electron microscopy. No significant changes were found in weight, tensile strength, and SEM images.

**Keywords:** PLLA, biodegradation, macroscopic physical properties, microscopic physical properties, rhinoplasty

## P-007

### 이동 평균 필터를 이용한 수술 항법 장치에 사용되는 광학식 위치추적 장비의 정확도 향상

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The accuracy of the optical location tracking system used in surgery navigation devices in surgical operations is of paramount importance. Medical location tracking equipment used in surgical navigation systems is accurate enough to be used for surgery, but otherwise relatively inaccurate. In this study, the commercial optical tracking device using moving average filter was shown to be accurate enough to be used in surgical navigation system.

P-008

### 골전도 진동체의 효율 향상을 위한 진동막 형상 설계 방법

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Recently, the number of hearing loss patients have increased. because of aging population growth and excessiveness using multimedia devices. For hearing loss patients, hearing aids are used for a typical treatment. BAHA is a representative product of bone conduction hearing aids, which has different sound transmission mechanism. However it makes some problems such as causing skin dermatitis and discomfort of wearers because of percutaneous. To solve these problems, miniaturized implanted bone conduction hearing aid needs to be used. In this paper, not only torsion stress of membrane of transducer also displacement and stiffness by an edge area connected a fixed area have been studied. Therefore, an efficiency has increased secure displacement of resonance matched Acoustic Characteristics.

P-009

### 고막 타깃팅을 위한 초음파 트랜스듀서 배열의 방향성 분석

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Recently, due to the entry of an aging society and an increase of acquired auditory disorder, the population of hearing loss people is risen, which have induced gradual growth of the market. Despite positive points of the hearing aid market, Congestion of hearing aid market

have come because hearing aid has problem discomfort of wearer, feedback, and the apparent reasons. To overcome these weakness from feedback, the methods are targeted at the tympanic membrane by a way to stimulate a particular region in which acoustic impedance is different for each frequency. In this paper, we fabricated micro directional speaker that can be inserted into the external canal using parametric array. After audible sound wave was generated by prototype micro ultrasonic transducer, which attempted directional verification for the possibility of efficient tympanic membrane targeting.

P-010

### Sit-to-stand five times test를 이용한 고령자 낙상 위험도 평가에 대한 체계적 문헌고찰

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The purpose of this study was to systematic review that elderly fall risk evaluation by sit-to-stand five times test. Question of SR was “What is the difference between Faller and Non-Faller when performing STS5 test for the elderly?” The final selected literature were total five. There was difference between Faller and Non-Faller at total time variable.

P-011

### 판륜의 확장이 기능적 승모판폐쇄부전에 미치는 영향

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Functional mitral regurgitation (FMR) develops when regional or global enlargement of the left ventricle

occurs, which is frequently associated with annular dilatation. We investigated the biomechanical characteristics of FMR development utilizing our computational mitral valve (MV) evaluation protocol. A computational model of a healthy MV at end diastole was created. Based on clinical FMR studies, a series of annular dilation was modeled with an increment of 1% up to 10% enlargement. While an increase of 1% in annular dimension did not show considerable difference in both leaflet coaptation and leaflet stress distribution at peak systole, annular dilation greater than 2% clearly demonstrated the occurrence of leaflet malcoaptation and increased stresses. Simulation-based evaluation of MV function related to annular dilation allows us to better understand the biomechanical characteristics of FMR.

## P-012

### 생체모방요추모델을 이용한 pedicle screw system의 생체역학적 특성 분석

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In this study, biomechanical characterization of pedicle screw system have been investigated by static compression, tensile and torsion based on ASTM F1717 and motion analysis of flexion, lateral bending and axial rotation motion using biomimetic lumbar model. Results of static test were structural stability in comparison with literature. Range of motion (ROM) of intact lumbar model was decreased compared to lumbar model with pedicle screw system. The ROM ratio was greatly increased because the moment was concentrated at L4-L5 segment relative to L2-L3 segment.

## P-013

### 생체역학 기반 고령자 낙상 부상 완화 매트 개발을 위한 기초 연구

김정길<sup>1</sup>, 서정우<sup>1</sup>, 김태호<sup>1</sup>, 조혜미<sup>1</sup>, 이진수<sup>1</sup>, 최진승<sup>2,3</sup>, 탁계래<sup>2,3</sup>

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Although the fall of older people is very common in the home, studies on mats to prevent fall injuries are not enough. The purpose of this study is to find the optimum materials for the development of the fall injuries prevention mat. We compared the impact of three different types of mats and general flat on 10 healthy adults. The experiment was carried out by measuring the Max Acceleration(MaxAcc) and duration of the ankles and knees as they jumped from a 50cm square chair. All variables were measured by 3D Motion Analysis. Experiments have shown that PE(Cross-link) can reduce MaxAcc. of the knee and ankle joints. These results suggest that PE (Cross-link) is a suitable material for shock relief. In future development, it seems that mat development should be done by bonding other materials with PE(Corss-link) as the main material.

## P-014

### CITEC을 이용한 연령별 고령자의 근력분석기초연구

이진수<sup>1</sup>, 서정우<sup>1</sup>, 김태호<sup>1</sup>, 김정길<sup>1</sup>, 최진승<sup>2,3</sup>, 탁계래<sup>2,3</sup>

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The purpose of this study was to examine how the muscle strength affecting the occurrence of elderly falls varies with age. 97 healthy elderly participated in the experiment(age: 77.88±4.26years, weight: 60.51±10.62kg,

height: 154.42±8.76cm). Among them, 21 males and 45 females were in the 70s group, and 12 males and 19 females in the 80s group, respectively. CITEC was used to measure maximal voluntary contraction. In older males, the strength of foot dorsiflexors, which affects the increase in fall rates, decreased, but in older females, the strength of foot plantarflexors and hallux plantarflexors increased significantly, which needs further investigation.

**P-015**

**보행자 속도감응형 트레드밀 보행 시 지속시간에 따른 보행 변동성과 프랙탈 동특성의 재현성 패턴 차이**

최진승<sup>1,2</sup>, 서정우<sup>3</sup>, 김태호<sup>3</sup>, 이진수<sup>3</sup>, 김정길<sup>3</sup>, 탁계래<sup>1,2</sup>

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The purpose of this study was to identify the reliability of gait dynamics variables while self-paced treadmill walking according to walking durations, between-days and within-day. The intraclass correlation coefficient (ICC) and the standard error of measurement (SEM) for the mean, variability, and fractal dynamics of the stride time were used to evaluate the within-day and between-day reliability according to walking durations (3, 4, 5, 6, 7, and 8min). The results showed that all variables were consistent for within-day reliability for all walking durations and trials. For between-day reliability, the average stride time were consistent for all walking durations and trials. In the result of one trial, the variability of long walking durations (more than 6 min) and the fractal dynamics of relatively short walking durations (less than 5 min) had lower reliability.

**P-016**

**체계적 문헌고찰을 통한 균형 능력 평가 시 rambling trembling 기법 활용 연구 동향**

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The purpose of this study was to check the trend and validity of rambling trembling analysis by systematic review (SR). The question of SR is ‘When assessing the balance ability of standing posture, what is the characteristics of research using rambling trembling analysis?’ The final selected literature were total twelve. The literature selected is summarized the subject and purpose of the study, and to suggest the advantages and application methodology of the rambling trembling analysis techniques compared to the existing COP analysis techniques.

**P-017**

**국소 아킬레스건 진동 자극이 고령자 보행의 수직 및 전후 지면반발력에 미치는 영향**

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The purpose of this study was to investigate the effects of focal Achilles tendon vibratory stimuli on mobility and stability of the elderly gait via ground reaction forces. A total of 10 elderly participated in this study. 3D Motion analysis was performed to investigate the ground reaction forces with the focal vibratory stimuli. As a results, first peak of vertical and anterior-posterior GRF decreased. Second peak of vertical GRF slightly increased while anterior-posterior GRF was not. These results imply that the focal vibratory stimuli may affect mobility and stability of the elderly gait.

P-018

## 머신러닝 기반의 족부 압력 예측이 가능한 저가형 깔창 시스템

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The foot pressure distribution (FPD) is used to provide clinically useful information, such as checking in advance for concentrated pressure points that can lead to pressure ulcers. If it is possible to predict FPD across the feet with a small number of pressure sensors, it increases economic efficiency and can be used for a variety of purposes. We used the insole system to estimate major foot pressures, and trained Artificial Neural Network (ANN) with these. Correlation coefficient between the results of test and the actual values was 0.92, which is quite high.

P-019

## 장단기 기억 네트워크를 활용한 다양한 낙상 예측 모델

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The pre-impact various fall prediction model using long short-term memory network is proposed. The accelerometer is measured from IMU sensor and specific feature is selected for various fall and activity daily livings (ADLs). Total of 10 falls and 14 ADLs is predicted through multi-class LSTM model with average classification accuracy and misclassification number of 99.94 and 30, respectively. Therefore, the proposed model which predict fall prior to impact can reduce possible injuries by apply various fall protective systems.

P-020

## 척추경 나사못 디자인에 따른 고정력 및 구동 토크에 대한 생체역학적 평가

최선각, 차은종, 김경아, 안윤호

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This study was performed to evaluate the pullout strength and driving torque of newly designed pedicle screws (Type A : standard pedicle screw, Type B : single pitched and dual lead threaded screw, Type C : dual pitched and dual lead threaded screw). The tests were performed in accordance with the ASTM standards using polyurethane (PU) foam blocks. Pedicle screws newly developed with dual pitched and dual lead threaded design showed higher driving torque without decrease in pullout strength compared to the standard pedicle screw and could be inserted more rapidly with the same number of revolutions.

P-021

## 단일공 내시경 수술을 위한 모듈형 수술로봇 포셉의 설계

윤치순, 김영일, 이상식

가톨릭관동대학교

If surgery is possible with minimal invasion, rapid recovery of the patient will accelerate return to daily life. One of these minimally invasive procedures, endoscopic surgery, involves surgery from two to three perforation and one perforation. Among these, single-hole endoscopic surgery in which a single hole is used is limited in size of the robot for surgery, and it is difficult for the force to be exerted to be greater than a certain level. In this paper, we focus on forceps design that meets the requirements of a single hole surgical robot.

P-022

### 파킨슨병 환자와 SWEDD 환자의 보행 특성 비교

최윤혁<sup>1</sup>, 권유리<sup>1,2</sup>, 김지원<sup>1,2</sup>, 권도영<sup>3</sup>

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SWEDD (Scans without evidence of dopaminergic deficit) refers to patients diagnosed with PD (Parkinson's disease) who have no dopamine transporter scan. The purpose of this study was to investigate whether the gait variables of PD and SWEDD are different. Eight patients with PD and 12 patients with SWEDD participated in this study. As outcome measure, integrated pressure over time (P\*t) were derived from pressure data in hind, mid and fore section. P\*t of SWEDD patients were significantly smaller than that of PD patients in hind and mid sections ( $p < 0.05$ ). In contrast, P\*t of SWEDD patients were significantly greater than that of PD patients in fore section ( $p < 0.01$ ). These results suggest that gait variables would be useful for distinguishing SWEDD patients from PD patients.

Keywords: SWEDD, Parkinson's disease, gait, foot pressure

P-023

### 콜레스테롤함량의 증가에 따른 DOPC 인지질

#### 이중층의 표면 전위 관찰

이은진, 여강인, 이상현, 김채원, 임종원, 최승엽, 이상우

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Cholesterol is a key component of cell membranes because it constitutes about 30 % of cell membranes. It has been studied in endocytosis, exocytosis, and the assembly of sphingolipid/cholesterol-enriched domains. Moreover, physical properties of lipid membrane (e.g., stiffness and surface potential) depend on cellular cholesterol levels. 1,2-dioleoyl-sn-glycero-3-phosphatidylcholine(DOPC) is

one of the components of the cell membrane. In this research, we observed the structure of DOPC membranes that containing cholesterol each different concentration. It was studied using Kelvin probe force measurement. When the lipid bilayer is containing high cholesterol levels, it observed more negatively charged. One of the reasons is zwitterionic properties of DOPC molecules. Their polar heads can reorient when the ionic strength changes. And at the high pH, molecules are dissociated to negative charged. This parameter characterizes surface charge. This data can offer better conditions for testing the liposome.

P-024

### 다채널 배열전극기반 생체 임피던스 프로브를 이용한 대장염 동물모델의 전기적 특성 차이 분석

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Back-shu point is used for evaluation and treatment in Korean medicine. However, there is no quantitative evaluation method for the state of back-shu point. We developed multi-electrode based bioimpedance spectroscopic probe to measure the electrical property of back-shu point to detect any variation. We prepared the mouse model for colitis and control group to measure the electrical property on the back. Bioimpedance spectrum were collected at 6 local regions in the back. From the experimental results, we observed a change in electrical properties between the control and colitis group at the lower level, especially at the S3 region.

P-025

## 진동 및 충격 시험이 홈헬스케어 환경에서 사용하는 의료기기 신뢰성에 미치는 영향에 대한 분석

김은혜, 강민재, 김태형, 정재훈

대구경북첨단의료산업진흥재단 첨단의료기기개발지원센터

As third edition of the basic safety standard for medical electrical equipment (IEC 60601-1) was issued in 2005, the vibration and impact tests were added to ensure the stability of the medical devices used in home healthcare environments. Accordingly, the interest in vibration and impact test for the reliability of medical devices has been increased, because the vibration and mechanical shock tests are added to the design process of the medical devices used in the home healthcare environment. To investigate the effect of vibration and impact tests on home health care devices in IEC60601-1-11, the tests are conducted based on the IEC 60601-1-11 using a blood glucose meter. From the results, we show the effect of these tests on reliability of the medical devices used in the home health care environment.

P-026

## 3-리드 심전도 장치에서 유도한 12-유도 심전도에 관한 연구

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The 12-lead electrocardiogram (ECG) is a vital diagnostic tool for cardiologists. The standard 12-lead system requires 10 electrodes to be attached on a wide bare area of the human body. However, to be applied in a mobile system, a reduced number of electrodes is mandatory. For these reasons, we propose the 3-lead patch-type ECG device. With the signals obtained from

the device, we synthesized 12-lead ECG using linear regression, equation of which was established in 15 normal subjects. These reconstructed ECGs were compared with standard 12-lead ECG. Reconstruction of 12-lead ECG using a 3-lead patch-type device is feasible and possibly provides additional information compared to the single lead-ECG. However, further study is needed to verify its clinical usefulness.

P-027

## 이식형의약품주입펌프의 안전성 및 성능평가

김현영, 권정훈, 서효창, 임동준, 주세경

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This paper presents an investigation on international standards and guidance related to evaluation of safety and performance for implantable infusion pumps. The relevant international standards and guidance are provided as a table. The safety and performance can be evaluated by general requirements for safety(ISO14708-1) and particular requirements for implantable infusion pumps(ISO14708-4). Based on this results, we will suggest new guidelines for mechanical and biological safety evaluation of implantable infusion pumps.

P-028

## 인공달팽이관장치의 안전성 및 성능평가

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의과대학

This paper presents an investigation on international standards and guidance related to evaluation of safety and performance for cochlear implant systems. The safety and performance can be evaluated by general requirements for safety(ISO14708-1) and particular requirements for cochlear implant systems(ISO14708-7). Based on this results, we will suggest new guidelines for

mechanical and biological safety evaluation of cochlear implant systems.

**P-029**

**골편 재위치 시술에서 인공신경망을 이용한 골편 충돌위치 검출**

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Repositioning of bone segments is a surgical procedure to restore a bone segment to the correct alignment. Conventionally, the bone segments was handled freely by a surgeon based on the preoperative plan. Robot-assisted surgery systems have been recently studied for helping surgeons, but they need safety equipment and algorithms to avoid injury during the surgical procedure. To enhance safety issue, a force-torque sensor was attached to the end-effector of the robot arm, and force-torque information was collected during the bone repositioning. Estimation algorithm of collision detection was developed in condition of octant on contact surface of the maxillary bone.

**P-030**

**의료기기 임베디드 소프트웨어에 대한 국제 규격의 요구사항과, 요구사항을 문서화하기 위한 사례연구**

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성균관대학교 삼성융합의과학원 의료기기산업학과

As regulations for medical devices are being strengthened around the world, proportionally the requirements on the embedded software are crucially handled. Namely, the embedded software governing the safety of medical device is required for software quality. For the entry to the global market, it's essential to align with international requirements and to secure the good

quality. Through the review of international requirements and a case, the requirements on such software are analyzed and the effective model is suggested. Also, this study may be implemented as a suitable model for standardization as development methodology to each manufacturer in need.

**P-031**

**문헌적 고찰을 통해 각 국가의 의료 3D 프린팅 기술에 대한 규제현황 비교분석**

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With the introduction of 3D printing technology in the medical science, governments in many countries have proposed regulatory measures for public health and safety. This study provided a comparative analysis of the current state of regulations in Korea, US, and Europe. As a result, the viewpoints of regulating 3D printing technology varied, but the main purposes were the same. In addition, since they are in the initial stages of regulation, they need to be supplemented. Therefore, Many countries exchange information with each other and communicate with manufacturers. Then, 3D printing technology will become a promising in the medical science.

**P-032**

**국내 의료기기 소프트웨어의 품질관리 현황 연구**

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As the type of industry changes, the functions of medical devices become more sophisticated, and the medical device software that controls them is increasing rapidly.

## 포스터(일반)

This study investigated the status of software quality management of domestic medical device manufacturers and the regulations and management status of domestic medical device software through literature review. In order to effectively manage the quality management of domestic medical device software, voluntary efforts of the companies, implementation of the government's support policy and suggestion practical guidelines of the regulatory authorities are necessary.

P-033

### 레이저와 드릴을 활용한 하이드로콜로이드 드레싱 홀 가공 시제품 제작

신윤호, 김상호, 윤정호, 박충환, 승성민

대구경북첨단의료산업진흥재단, 첨단의료기기개발지원센터

본 연구의 목적은 하이드로콜로이드 드레싱에 홀 가공을 수행하고자 하였다. 실험 재료는 시중에 판매되고 있는 하이드로콜로이드 드레싱을 사용하였고 홀 가공을 위하여 드릴, 레이저, 드릴과 레이저 병합의 세가지 방법으로 실험을 수행하였다. 그 결과 드릴을 사용한 가공에서는 이물질(burr)이 발생하였고 레이저 가공은 흡수층에 그을림을 발생시켰다. 이를 보완하기 위하여 레이저를 활용하여 보호필름층 가공 후 드릴을 통해 홀을 가공하는 방식으로 수행하였다. 드릴과 레이저를 병합한 가공 과정에서 흡수층이 홀 가공 중 압착현상을 보였으나 홀 가공의 외부 형태를 알아보기 위해서는 충분함을 알 수 있었다.

P-034

### 의료기기 품질관리 국제조화를 위한 의료기기단일심사프로그램 분석

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The International Medical Device Regulatory Forum (IMDRF) developed The Medical Device Single Audit Program (MDSAP) which allows the conduct of a single

regulatory audit of a medical device manufacturer's quality management system that satisfies the requirements of multiple regulatory jurisdictions. This program enable appropriate regulatory oversight of medical device manufacturers' quality management systems while minimizing regulatory burden on industry and promote more efficient and flexible use of regulatory resources through work-sharing and mutual acceptance among regulators. This study reviewed audit model and guidelines for MDSAP

P-035

### Assessment of Neurometabolic Alterations Induced by Repeated Exposure to MK-801 on Prefrontal Cortex of Schizophrenic Animal Model: In vivo Proton Magnetic Resonance Spectroscopy (<sup>1</sup>H MRS) Study at 9.4T

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Repeated exposure to dizocilpine (MK-801) can be used as a model of schizophrenia that incorporates disease progression. Proton magnetic resonance spectroscopy (<sup>1</sup>H MRS) has been widely used to investigate schizophrenia-related alterations in glutamate (Glu). The purpose of this study was to investigate metabolic alterations in the prefrontal cortex (PFC) in an animal model of schizophrenia by using *in vivo* <sup>1</sup>H MRS. The results suggest that high-field *in vivo* <sup>1</sup>H MRS with short TE can quantify Glu and Gln with reliably low level of cross-contamination and that repeated exposure to MK-801 induces the progressive development of schizophrenia.

P-036

### 낙상 경험이 있는 고령자 여성의 sagittal plane에서 하지 보행 분석

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건국대학교 의학공학과

Fall is closely related to the body's moving gait, and it affects the quality of life. Also, there are many cases in elderly women. Therefore, the purpose of this study is to investigate the gait patterns of elderly women who have fallen experience. Ten elderly women participated in this study. Kinetic and kinematic data were collected with a single force plate and motion capture camera. The angle, force, and moment on the sagittal plane were compared on both legs. There was no significance in the angle of walking on the faller but a larger force and moment appeared on the dominant side. The non-dominant side in the gait is considered to perform only the balance function.

P-037

### Introducing Fast Brain Cortical Surface Extraction Pipeline for GPU-Based Parallel Computer

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We are developing a new application to extract brain surface from a volumetric Magnetic Resonance Image (MRI) on nVidia CUDA programming platform using GPU-Based parallel computer. The application is based on well-known CIVET version 1.x pipeline and Constrained Laplacian Anatomic Segmentation using Proximities (CLASP) brain surface algorithm [1]. Because CIVET and CLASP algorithm is using a deformable-model based algorithm and is originally written with no parallelism, its completion time takes

over several hours to extract a surface model from a volume image. To shorten pipeline completion time and to provide more immediate access to brain surface from a volume image, we applied a parallel computing and redesign a new pipeline system to them. We propose methods and software design to enhance the overall throughput performance. We also mix Marching Cube algorithm and Sphere mesh topology mapping method [5] to generate initial mesh to produce more accurate shape.

P-038

### 적외선 기반의 PSD 센서를 이용한 인체 관절각도 측정 연구

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In the field of rehabilitation, joint angles are used as an important measure to evaluate the degree of recovery before and after treatment. In this paper, optical sensor based on the principle of triangulation is used. This method calculates the distance as a ratio of the current that is reflected by the distance and returns, so that it has an advantage that accurate output can be obtained without being affected by the color. Using these characteristics, the bending angle was detected using the output signal obtained from the experiment of adjusting the attachment slope and the attachment position of the sensor to the joint model. The system proposed in this study can measure the bending angle without restraining the center axis of the joint and has the advantages of being small, lightweight, and free from space - time constraints.

P-039

## 비침습적 진단기기를 이용한 일시적 토끼 당뇨 모델에서의 누당 측정

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A non-invasive diagnostic device was developed to enable concurrent safe tear collection and glucose measurement, to overcome the current limitations in noninvasive measurement of tear glucose. The diagnostic device is comprised of an enzyme-based electrochemical sensor for tear glucose measurement, and a lid for safe contact to the preocular tissue surface during tear collection and measurement. The device was evaluated in diabetic rabbit model and exhibited fast collection of tear fluid, and high resolution to distinguish diabetic and normal tear glucose concentrations. Using the device, we confirmed there is a strong correlation between blood glucose concentration and tear glucose concentration in rabbit.

P-040

## 식염수 분사와 PI 컨트롤을 고려한 전극도자절제술용 전극의 수치해석

안진우, 김영진, 이승아, 정하철, 윤송우, 문진희

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제품개발부 첨단융합팀

Radiofrequency catheter ablation is the interventional therapy that be employed to eliminate cardiac tissue caused by arrhythmias. During radiofrequency catheter ablation, The thrombus can occur at electrode tip if the temperature of tissue and electrode is excess 100°C. To prevent this phenomenon, we investigated numerical model of electrode for radiofrequency catheter ablation considering saline irrigation and temperature-controlled

radiofrequency system. The numerical model is based on coupled electric-thermal-flow problem and solved by COMSOL Multiphysics software. The numerical model result shows that larger lesions are obtained when the position of electrode is placed horizontally.

P-041

## 깊이 인식 카메라를 이용한 CT영상과 전자기적 위치추적장치간 즉시적/자동적 정합 방법

최민혁<sup>1</sup>, 이상정<sup>1</sup>, 우상윤<sup>1</sup>, 유지용<sup>1</sup>, 강세룡<sup>1</sup>, 이원진<sup>2</sup>

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Recently, minimally invasive endoscopic surgery (MIS) has been widely used. However, because of the limited surgical view, it is difficult to define the exact location of the anatomic structures. To solve this problem, an image guided surgery navigation system using a 3D position tracking device has appeared. For using the navigation system, registration is essential to align image coordinate system to patient physical coordinate system. Conventional registration was used manually, so accuracy and time efficiency are poor. In this study, we developed on-demand automatic registration method. By using this method, accuracy and time efficiency are better than that of conventional method.

P-042

## 주변온도 및 측정거리를 이용한 온도 보정 방법 : 예비연구

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This study proposes a method for temperature compensation using ambient temperature and measurement distance. We developed a system for temperature measurement using MLX90614. Data were obtained

according to American Society for Testing and Materials (ASTM) thermometer test guide. The target temperature is 35.5°C to 40.5°C, the ambient temperature and humidity are 13.5°C to 40.5°C and 0% to 95%, and were tested at distances of 0cm, 3cm, 6cm, respectively. Multiple regression analysis and polynomial regression analysis were performed to deduce the compensation formula using ambient temperature and measurement distance. The compensation results showed root-mean-square error (RMSE) of  $\pm 0.1^{\circ}\text{C} \sim \pm 0.2^{\circ}\text{C}$ . Therefore, this method has potential to accurately measure body temperature.

**P-043**

**용량성 전극 배열을 이용한 심박수 추정**

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Electrocardiograph(ECG) is widely used to measuring irregular rhythm of heart activity, which is a gold standard to diagnose heart related disease such as heart attack. ECG measuring system using capacitive electrode has advantage of unobtrusiveness, without user's consciousness. However, the signal quality of capacitive electrode is poor when the contact between user's body and the surface of electrode is not firm. Also capacitive electrode is prone to motion artifacts. In this study, we designed capacitive electrode array and performed a pilot study for estimating heart rate when the source of noise is unknown. The correlation coefficient between estimated R-R interval and reference R-R interval was 0.90 and mean absolute error was 1.54 bpm.

**P-044**

**호흡 기체 분석법을 이용한 천식 모니터링 장치**

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Recently, asthma patients are increasing due to environmental factors. it is impossible to continuously monitor diseases such as X-rays and CT which are used continuously for asthma diagnosis. Therefore, researches are being actively carried out to develop a portable analyzing apparatus. We use to NO and VOCs gas sensors for understand the respiratory diseases which are representative gas biomarkers of respiratory diseases. In addition, to monitor physical conditions, we constructed a system to simultaneously analyze the chemical and physical state of the respiratory organ in single respiration by measuring the peak flow through a single pressure sensor and structure design.

**P-045**

**개인용고주파자극기의 안전성 시험평가 방법**

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 김호철<sup>2</sup>, 박수강<sup>3</sup>, 권범선<sup>1</sup>, 남기창<sup>1</sup>

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Recently, interest and use of personal medical devices available at home has been increased. Because personal electrical stimulators utilize electrical and physical characteristics, safety and performance tests are required to ensure patient safety. Adverse events have been reported due to apply high frequency energy on the skin. Because they are used indiscriminately without the

## 포스터(일반)

regulation of maximum output power and maximum skin contact temperature. In this study, safety test for personal radiofrequency stimulator is proposed according to the characteristics of the device.

P-046

### 정형외과 수술용 초음파 핸드피스에 관한 연구

이주학, 최종균, 정세미, 김대관, 송태하, 차경래

대구경북첨단의료산업진흥재단

The ultrasonic handpiece has excellent performance in protecting soft tissue and preventing excessive removal of bone tissue during orthopedic surgery. In this study, natural frequency analysis of horn and tip was performed because the natural frequency and oscillation frequency of horn and tip are set equal. As a result of analysis of natural frequency, only the fourth mode was analyzed in the single analysis of the horn, and the sixth mode was analyzed in the coupled model of the horn and tip. The results of this study will be referred to the setting of the oscillation frequency of the ultrasonic handpiece, and it is necessary to carry out the analysis of the natural frequency according to the shape of the tip.

P-047

### 심장 허혈 재관류 손상 쥐에 시행한 전침과 저강도 레이저 치료 연구

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The aim of this study was to investigate the cardioprotective effects of electroacupuncture (EA) and low-level laser therapy (LLLT) in rats with cardiac ischemic-reperfusion (IR) injury. Ejection fraction and fractional shortening with transthoracic echocardiography were preserved after IR injury in the LLLT group as much as in the sham operation group. There was no

significant difference between EA and IR groups. LLLT at acupoint PC6 more effectively preserves cardiac function than EA. Our result implies that LLLT could be applied as a non-invasive treatment modality for cardiovascular disorders.

P-048

### 순환보조장치 테스트를 위한 혈류역학적 혈압 시스템 개발

이도연, 강성민, 최성욱

강원대학교 기계융합공학과

Patients with heart disease are able to extend life until cardiac function is restored by using mechanical circulatory support device. Accordingly, development of a circulatory support device is underway and the method that evaluates performance of circulatory support device is needed. This study designed hemodynamic blood pressure system that uses rotary gear pumps. Also it can control minimum pressure and maximum pressure. By copying blood pressure of human body, it is expected that performance of circulatory support device can be evaluated and reliability can be improved.

P-049

### 급성 천식 동물 모델을 이용한 의료용 흡입기 성능 평가

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Nebulizers create an aerosol by agitating a medication solution, and deliver rapidly and directly aerosolized drugs into the airways to treat chronic respiratory illnesses such as asthma and chronic obstructive pulmonary disease. The nebulizer is continually developing to improve patient comfort and drug delivery efficiency in the airway. Three types of nebulizers have

been developed over the last 50 years: jet nebulizers, ultrasonic nebulizers and mesh nebulizers. There is a need to develop small animal models that can easily evaluate the *in vivo* drug delivery performance by nebulizer. We evaluated the therapeutic effect of salbutamol delivery by three different types of nebulizers on ovalbumin induced asthmatic mice. The results of this study showed that the treatment results of salbutamol were similar in the three different types of nebulizers, but the concentration of salbutamol in the serum was different.

**P-050**

**자동마사지의자를 통한 마사지가 체간 및  
 하지부종에 미치는 영향**

최유라, 임정환, 전철진, 조수현

(주)바디프랜드, 메디컬 R&D센터

The study evaluates the effect of massages through automatic massage chair (AMC) with lymph massage principle applied on the trunk and lower extremity edema. The study categorized healthy 40 adults without specific diseases into an AMC group in which subjects are massaged by the AMC (Bodyfriend Inc., Seoul, Korea) and a resting group in which subjects rested without massages. Then, the study compared the two groups' changes in extracellular water ratio (ECW ratio), which is an index of edema. The changes in ECW ratio before and after each intervention was compared. The results of the two groups were compared for analysis. The analysis showed that the AMC group showed a reduction of ECW ratio in both the trunk and two legs. On the other hand, the result of the resting group showed that there was a reduction of ECW ratio only in the left legs of the subjects. Further, the analysis showed that the AMC group had a greater reduction in the ECW ratio for the amount of changes. From the preliminary results, the study confirmed that the massage through an automatic massage chair is effective for ECW ratio for the trunk and lower extremity edema.

**P-051**

**비선형 광학 결정을 이용한 중적외선 지방분해  
 레이저 시스템 개발**

이지영, 오석원, 유한영, 서영석

원텍(주)

In this study, we developed a mid-infrared lipolysis laser system has two wavelength of 1980 nm and 2300 nm. The wavelengths of 1980 nm and 2300 nm are very absorbent of fat and water. We developed the world's first commercially available lipolysis laser system using these wavelength characteristics. The laser system was compactly designed using 808 nm LD and Nd:YVO<sub>4</sub> to generate 1064 nm wavelength, which is the pumping beam of the non-linear crystal. We measured the wavelength according to the temperature conditions of the non-linear crystal.

**P-052**

**비침습 레이저 지방분해 시스템 개발**

오석원, 이지영, 서영석

원텍(주)

Recently, Non-invasive body contour system using radio frequency(RF), high intensity focused ultrasound(HIFU), Cryolipolysis and Laser is increasing rapidly market of aesthetic medicine for fat reduction. We have developed a single handpiece proto-type laser diode system with 1060nm and tested fat reduction of mini pig using developed system. Finally, based on the results we have developed 4-channel handpiece laser lipolysis system with function of contact cooling.

P-053

## 미니어처 형광 현미경을 이용한 마우스 뇌혈관 이미징

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Vascular imaging is important for the understanding of neural activity in the brain via neurovascular coupling and studying brain-associated disease such as stroke. A conventional tabletop microscope cannot allow microscopic imaging of the animal brain with an awake or freely moving mouse. We built a custom-made miniaturized fluorescence microscope weighing 3.3 g, which enables video-rate imaging of an anesthetized mouse brain vasculature. This miniscope can be utilized as a portable imaging tool for animal brain revealing neural activity in addition to the vascular imaging.

P-054

## 새로운 형광 대장내시경을 위한 형광 영상의 Spectral Unmixing

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In order to detect colon polyps with less miss rate, we devised a linear unmixing algorithm that distinguish fluorescein isothiocyanate (FITC) and autofluorescence for a novel fluorescence colonoscopy. We scanned fluorescence imaging using the FITC green-fluorescent dye. Reference library was generated using the spectra of FITC and autofluorescence. Using the generated library, we found the optimal weighting matrix of linear unmixing method and apply it to the observed mixture spectrum

image to identify and distinguish the FITC and autofluorescence. We found the similar results of the two-unmixed data as found in commercial software. Therefore, we suggest our proposed linear unmixing algorithm as spectral unmixing method for a novel fluorescence colonoscopy.

P-055

## 카테터 삽입 메커니즘 설계 및 제어

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This paper proposes a catheter inserting mechanism. The mechanism is a dual-gripper mechanism for inserting and rotating the catheter. The proposed mechanism has the advantage of large contact surface between the grippers and the catheter, like the human finger, for stable grip of the catheter. However, for continuous insertion, the grippers should be controlled interactively. To achieve this, we explain the motion-planning and trajectory-generation methods.

P-056

## Electrical Impedance Characterization of 3-aminopropyltrimethoxysilane Coating on Silicon Dioxide Surface Using Interdigitated Microelectrode Array

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For label-free and real-time monitoring of the morphological and physiological changes in DNA, protein, and cells, the electrical impedimetric biosensors attract an attention. To increase the affinity of the target, the modification of sensor surface using the self-assembled monolayer can be employed. In this study, the electrical impedance of the 3-aminopropyltrimethoxysilane coated on the surface of silicon dioxide was characterized using an interdigitated microelectrode. The experimental result showed that APMS affected the ionic distribution resulted in the increase of the impedance magnitude at low frequencies. It is required to understand how the APMS on SiO<sub>2</sub> between the electrodes affect the electrode interfacial impedance.

**P-057**

**초음파 하지정맥류 치료프로토콜 개발을 위한  
 혈관 팬텀의 수축률 변화 관찰**

정태웅, 신경원, 김성철, 노수미,  
 김주영, 윤창한, 최흥호

*인제대학교 의용공학부*

Recently, many researches for ultrasonic varicose vein treatment have been reported due to the benefits of safety and real time monitoring. The ultrasonic treatment method uses the thermal contraction induced by High-intensity focused ultrasound. In this study, the contraction ratio of blood vessel mimicked tube by adjusting the duty ratio were compared, in order to evaluate the contraction ratio of blood vessels due to residual heat in the surrounding tissues by ultrasound treatment of varicose veins. Consequently therefore, the effects of residual heat was confirmed by the results of experiments. These result could be useful for the development of the varicose vein ultrasonic therapy protocol.

**P-058**

**임부의 심전도 측정을 통한 자궁근전도 신호측정  
 가능성 확인 연구**

정순희

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The purpose of this study is to develop a wearable patch type preterm birth prediction monitoring system, which analyzes the results of ECG signals collected during pregnancy over 25 weeks. The bio-signal data for this result is collected, and the clinical evaluation items and the clinical research procedures are constructed to develop the clinical protocol. Through the exploratory clinical trials, we construct basic biometric data DB for development of the preterm birth prediction system, and validate bio signal validation through VOC consultation and derive VOC.

**P-059**

**목표 체온 유지 치료를 위한 비침습적 뇌 온도  
 추정 모델**

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This paper introduces a temperature model that can estimate the deep brain temperature based on two temperatures acquired from a double sensor thermometer. Although there are some differences between a brain temperature and a core body temperature, the temperature of pulmonary artery, which is the gold standard of a core body temperature, is used during the therapeutic hypothermia. However, there are no safe way to measure the exact brain temperature. Therefore, we applied double sensor thermometer, which is one of the non-invasive thermometer that can measure core body

temperature. Invasive and non-invasive brain temperature was acquired from nine different pigs, which have been through swine cardiac arrest model. Leave one-subject out cross validation was conducted and the root mean square error between the invasive and non-invasive brain temperature was  $0.196^{\circ}\text{C}$ . Additionally, the average of concordance correlation coefficient was 0.982.

P-060

## 치과보험청구 소프트웨어 발전 방향

이동현

성균관대학교 삼성융합의과학원 의료기기산업학과

With the development of IT, various technologies are converging to create synergy effect. Dental software is also required to combine technologies from other fields. Patient image identification, various dental equipment control, and marketing functions are being added to the software functions that were limited to existing insurance claims, and customer demands are also increasing. Through this study, we will analyze the newly added functions and the effects that can be obtained when they are added.

P-061

## 심층 순환신경망 기반의 심방세동 예측

에르덴바야르, 박종욱, 강동원, 이경중

연세대학교 의공학과

In this study, we proposed a prediction model of atrial fibrillation (AF) based on deep long short-term memory (LSTM) using arbitrary normal ECG signal. The proposed model was designed with 3-layers LSTM units that selection experimentally. Batch-normalization and dropout were used to improve the learning rate and optimization. The performance was evaluated for three AF databases, the results showed the precision of 86.0%, recall of 83.0% and F1-score of 83.0%, respectively.

LSTM can be used effective tool for prediction of the AF to accurately diagnose.

P-062

## 심혈관 질환의 실시간 자동진단을 위한 건식 전극 바이오센서가 있는 스마트의류

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계명대학교 의과대학 의용공학과

The typical method of monitoring arrhythmia is to use a body patch type sensor with a wet electrode. It has several problems caused by wet electrodes for long-term monitoring. Thus, we develop a Smart Outdoor Shirts equipped with a dry electrode electrocardiogram (ECG) sensor for a cardiac arrhythmia computer aided diagnosis system in this study. The sensor can be inserted in a console close to the chest, charged, used to communicate wirelessly, and connected with a smartphone application. According to experiments, the ECG signals measured by the smart shirt indicated that  $97.5\pm 1\%$  of the signals could be measured in an immobile state and at least  $85.2\pm 2\%$  of the signals could be measured during movement. In addition, we propose a computer aided diagnosis system for detecting cardiac arrhythmia. It was determined through experiments that the system can detect arrhythmia with an accuracy of  $98.2\pm 2\%$ .

P-063

## 정신적 스트레스에 대한 심박변이도 측정을 위한 광용적 맥파 적용 비교 연구

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한양대학교 생체공학과

Recently, people are very interested in mental stress by circumstance or work, because of their individual healthcare. Our body regulate stress through the autonomic nervous system(ANS). In many bio-signals showing ANS, Heart rate variability (HRV) is mainly

one of the indicators. However, for the HRV measurement, it is necessary to measure the R peak of the electrocardiogram (ECG), and a large number of electrodes are required to indicate this. Therefore, in this study, we measured the electrocardiogram and photoplethysmogram (PPG) simultaneously in the mental stress situation, and compared the peak interval variabilities of the two signals. Finally, it will be possible to measure mental stress through optical application pulse waves, not electrocardiograms, which require many electrodes for stress measurement.

**P-064**

**전동 안마기를 통한 마사지중 웨어러블 디바이스를 이용한 파장 별 광응적맥파 평가**

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Recently, various kinds of electrical massagers for the stress and health care of modern people are increasing rapidly. Generally, electrocardiograms and photoplethysmography are used to check the stress and physical condition of electrical massagers. However, photoplethysmography is a method using light and is very susceptible to noise such as motion noise. In this paper, we compared the motion artifacts according to wavelength by measuring the noise effects of light sources in the massage state. As a result, it was concluded that the green light in the wrist area is less affected by the movement than the other wavelengths light source and it is easy to measure during the massage.

**P-065**

**사이클로그래를 이용한 무릎 관절염 분류**

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Until now various radiological or clinical classification criteria are used to defining knee osteoarthritis (OA), but there is no gold standard. It is needed to develop other classification criteria for consensus on which criterion should be used as gold standard to define knee OA. In this paper, we propose a new criterion to define and classify knee OA using the change of bilateral lower limb's joint angles during locomotion. To analyze the joint angle change, we used a cyclogram for hip joint angle and knee joint angle. We extracted geometric characteristics from cyclogram and classified them by PCA and FNN.

**P-066**

**3축 가속도계를 이용한 개인 걸음걸이 식별**

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 I. Y. Kim, J. S. Lee

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Recently, a large number of studies on behavioral biometric gait of the person is being conducted in a sense of characteristics of gait using the IMU sensor. In this paper, 3-axis accelerometer data obtained from H-IMU, which we developed using a combination of accelerometer, gyroscope and magnetometer sensors are measured on the left thigh. By using gravity and direction vector component, 3-axis accelerometer data are compensated for disorientation error and displacement error. The compensated acceleration data are converted into a 2D plane to extract 22 features. Using SVM(Support Vector Machine), identification accuracy is 97%. This would bring smartphone gait authentication into reality in the near future.

P-067

## 심전도의 위상공간에서의 기하학적 특징을 이용한 개인인증

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In this paper we propose a new method for human recognition by phase-space reconstruction (PSR) of a single-lead ECG signal. To reconstruct a single-lead ECG signal into phase space, we used a time delay technique. We extracted the geometric features through the trajectory from the phase space and performed the recognition by using support vector machine. The results were performed on 14 subjects. The accuracy was 95.8% when the delay was 10ms. Based on this result personal authentication was conducted. The results show 96.5% accuracy, 2.54% FAR and 4.33% FRR.

P-068

## pH 조건에 따른 포도당의 통증 완화 효과연구

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Of various kinds of sensory receptors, TSPV1 (transient receptor potential vanilloid 1) is inseparably linked not only to the aforementioned neurogenic inflammation but also to interleukin, e.g. IL-3, IL-13, IL-31. TLSP is delivering pruritic signals through TRPV1 at nerve endings and TRPV1 receptors are caught in a vicious circle to expedite TSLP secretion. It's in regards to a compound mainly made of glucose, which satisfies at pH 6.0-8.0 to serve either as prevention or improvement purpose for inflammation related diseases.

It generates the effects similar to RVPV1 antagonist by opening of TREK1 or control of neurons' stimulation of the nerve resulted by hyperpolarization due to opening of TREK1. Thus, it has effects to prevent, improve or treat inflammation related diseases or pains.

P-069

## Radiomics를 이용한 Glioblastoma 환자들의 생존기간 예측

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Glioblastoma is a primary malignant brain tumor with poor prognosis. Predicting patient survival in a noninvasive manner can be of great help in clinical planning to deal with this aggressive tumor. Combining the latest machine learning algorithms with image processing, Radiomics has recently emerged as one of the powerful analytical methodologies in the field of radiology. In this study, radiomics has been applied to four MRI modalities 162 glioblastoma patients to predict overall survival. Five radiomics features were found to be significant. Both training and validation performance of the model showed a significant level of p-value <.05.

P-070

## TCGA 데이터베이스를 이용한 위암 예측을 위한 진단 인자와 모델링

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Although stomach cancer-related death decreased constantly by treatment of advanced technology, Stomach cancer is one of the most commonly diagnosed cancers in Korea. Here we describe a diagnosis factor and prediction modeling for diagnosis. From The Cancer Genome Atlas(TCGA), We studied race classified 334 transcription profiling cancer & normal sample. 205 genes selected by comparison analysis in IPA(Ingenuity pathway analysis) with p-value(p=0.001) and fold-change

(FC=3). Construction Stomach cancer prediction modeling with IPA and finding the most significant diagnosis factor(ADAM12, ENSG00000148848.13) with ROC(Receiver operating characteristic) curve for diagnostic ability.

P-071

비ST분절상승 심근경색 환자의 주요심장사건  
판별을 위한 심근표지자

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Cardiovascular diseases are the main cause of death in the globe and also have been increasing in Korea. Especially, as recently living environment has been westernized with socio-economic development in Korea, the rate of cardiovascular diseases have been increasing steadily. Also, along with the aging of our society the mortality caused by acute myocardial infarction has been increasing. In this paper, using KorMI (Korea Working Group of Myocardial Infarction) data, we performed the discriminant analysis and ROC analysis of significant factor to find out the cardiac marker that causes MACE (Major Adverse Cardiac Events) of NSTEMI patients among the patients with cardiac infarction. These results can be used as biological marker to diagnose and prognose NSTEMI patients.

P-072

의료용 바코드 스캐너의 사용성 평가에 관한  
연구

박영상, 윤지영, 최해룡, 임형규,  
황현이, 금창윤, 제희광, 서수원

대구경북첨단의료산업진흥재단 첨단의료기기개발지원센터

The aim of this study is to evaluate usability of Medical Barcode Scanner based on design. Two type barcode scanners were developed to evaluate usability: Wearable Barcode Scanner(WBS) and Gun-type Barcode Scanner(GBS). Both devices were evaluated by hospital practitioner and related expert. Although the WBS was worn on the wrist and was excellent in mobility, it caused pain in the wrist for a long time. GBS was able to easily target the barcode compared to WBS, and was highly evaluated for usability. These results are expected to be used as a key measure to improve usability.

P-073

현미경 영상을 통한 세포 표현형 특징 추출 및  
정량화

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Information extracted from an image of cancer cells is closely connected to cancer medicines. In order to analyze the information, in this paper, we propose a method to generate quantitative data after the normalization by dividing the threshold algorithm-based nucleus region in cell images obtained from a fluorescence microscopy, extracting numerical values related to morphology and fluorescence intensities on segmented regions. This method can be useful for drug reaction level prediction by extracting information from the change of cell level after drug treatment.

P-074

## 무구속 생체 인증 및 생체 데이터 측정 시스템 개발

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Acute manifestation of diseases during driving is difficult to predict. In this case, taking immediate action is the only way to prevent secondary accidents. To solve this problem, full-time biometric measurement that does not require any action from the user is necessary. So, many wearable medical devices are developed to measure and collect biosignal data. However, even though wearable devices have become more miniaturized and simplified, several problems remain such as allergic reaction to the device or wearability in everyday setting. To solve these problems, we propose patch-less biosignal measurement system in driving environment. This allows measurement of biometric data without requiring any action from the user's end. And since there is no contact between the device and the user, this measuring method makes it possible to monitor in real time without causing allergic reaction.

P-075

## 음성 신호 기반 비접촉식 거짓말 분류 알고리즘 개발

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Lie detection used in existing criminal investigations is a contact-type that requires the consent of the subjects for investigation. Furthermore, different results are produced according to the inspector's judgment criteria. These are the significant flaws of Polygraph. The purpose of this research is to develop a more objective

artificial intelligence-based contactless lie classification using voice signals with deep learning. It takes five features for the classification of target's voice comprised of 'Yes or No'. The four features are generated from pitch (the maximum and minimum values of truth and false) and the other is the response time to be answered to question. The learned Deep Neural Network(DNN) gives an average precision of 92.75 % and a standard deviation of 0.0799.

P-076

## DCNN을 이용한 치과 X-ray 파노라마 영상 기반 치주염 검출

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In this paper, we will examine the method of periodontitis detection using DCNN and its accuracy. DCNN-based neural network was used to detect periodontal disease in dental X-ray panoramic images. We constructed neural network structure and learning data using NVIDIA DIGITS. The deep convolutional neural network was modified with the structure based on NVIDIA's DetectNet, which was made by modifying googleNet. Based on the results of the clinician's reading, the accuracy was assessed by 5-fold cross validation. The mean mAP was 0.68, the precision was 0.8, and the recall was 0.75. To improve accuracy, it is necessary to modify the neural network structure, and further data acquisition for the detection of other types of periodontitis is being set as a future research goal.

P-077

**유방암 내 뇌전이의 ADC 히스토그램 분석과  
 아형 분류**

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A breast cancer is the second most frequent cause of brain metastases after lung cancer, with metastases occurring in 10-16% of patients. Since treatments depend on the molecular subtype of breast cancer, it plays a key role in a prognosis and treatment selections. In this study, we aimed to investigate imaging characteristics extracted from apparent diffusion coefficient (ADC) which could assist in differentiating breast cancer molecular subtypes. We used features from ADC histogram analysis to classify subtypes of breast cancer.

P-078

**딥 러닝을 활용한 자기공명영상에서의 표준화  
 섭취 계수 비율 예측**

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한양대학교 생체공학과

Many researches have been done on Alzheimer's disease. Amyloid PET imaging is helpful in diagnosing these Alzheimer's diseases. However, it is difficult for patients to recommend amyloid PET because it is an expensive brain imaging technique. Now, it is possible to acquire PET images from MRI images with the development of deep learning. Here, we obtained the SUVR value of amyloid PET on MRI images using deep learning, and based on it, we performed classification of the positivity of beta amyloid.

P-079

**딥러닝 신경망을 활용한 해마 영역 분할**

홍진우, 방성규, 이종민

한양대학교 생체공학과

In many neuroscience and clinical studies, some of region-of-interest (ROI) in the human brain are frequently investigated due to their relationship with brain diseases such as dementia. ROI quantitative analysis of human brain structures has crucial role to understand various brain disorder or brain degeneration. However, automatic hippocampus segmentation remains challenge due to their complexity and limitation of MRI. This study investigates a 3D deep learning networks for hippocampus segmentation in human MRI and evaluate an efficiency. The proposed method achieves high accuracy of segmentation using an end-to-end approach.

P-080

**영상유전학분석을 통한 파킨슨병 진단모델개발**

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Imaging genetics is a tool to extract genetic variants associated with imaging features as intermediate phenotypes. We applied imaging genetics to diagnose Parkinson's disease (PD) by extracting significant genetic variants associated with chosen imaging features. The imaging features were related to the differences between the normal controls and PD. We built a linear regression model with only genetic features obtained from imaging genetics. Our model explained the presence or absence of PD with only genetic information (adjusted  $R^2=0.77$ ). Our model was applied to a test set, which yielded high correlation ( $r=0.9765$ ,  $p<0.01$ ) and low root mean square error (RMSE=0.1078) between the predicted and actual diagnosis of PD.

P-081

## 하이브리드 위치추적 기술 기반 악교정수술 가이드 시스템

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An orthognathic surgery is performed for treating maxillofacial deformities related to the acquired and inherited faults. In conventional image-guided orthognathic surgery, in general, researchers choose an optical tracking system or an electromagnetic tracking system to track the maxillary and mandibular bone segments. However, the optical tracking system had limitations due to the line-of-sight requirement and the relatively bulky tracking tools. In the case of the electromagnetic tracking system, there were disadvantages that interference occurred due to the metal-made surgical tools and the electronic surgical devices. In order to overcome these drawbacks, in this study, we developed a hybrid tracking technology that could complement each other's disadvantages by using both tracking systems simultaneously

P-082

## TRACULA 기반 특발성 정상뇌압 수두증 환자에 대한 주요 백질 경로의 분할 비등방성 분석

신인태 김선직 윤의철

대구가톨릭대학교 의공학과

In this paper, a fractional anisotropy of idiopathic normal-pressure hydrocephalus (INPH) was investigated in a set of major white matter pathways using TRACULA (TRActs Constrained by UnderLying Anatomy, <https://surfer.nmr.mgh.harvard.edu/fswiki/Tracula>). Our findings may suggest a possibility for considering in white matter integrity differentiation between INPH and

AD, and may help us understand the potential pathophysiology of disturbances associated with INPH.

P-083

## 영역간 부피 상관관계를 이용한 그래프 이론에서의 정상인과 연소성 근간대성간질 환자 사이의 형태학적 연결성 변화

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Various methods have been developed to investigate the human brain, especially the graph theory, one of human brain network analysis methods, has an advantage that it can grasp the characteristics of the brain network. In this study, we quantitatively analyze the network change of morphological association between normal and JME patients, and investigate hub regions to find their network characteristics using graph theory.

P-084

## 몬테칼로 시뮬레이션을 이용한 진단용 엑스선장치의 선량계측 표시 방법론 개발 및 환자의 유효선량 평가

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Radiation exposure is on the rise due to the continuous progress and frequent use of radiation devices for diagnosis and treatment in the medical field. Therefore, The International Electrotechnical Commission(IEC) requires displaying the radiation doses measured during diagnostic radioactive examinations. This study inspected the efficacy of methodology for dose measurement through the Monte Carlo simulation and provided a methodology for dose measurement. As a result of comparing MCNPX(Monte Carlo N-Particle eXtended

v2.7, USA) results and actual measured values, the relative errors were 3.4% and 3.6%. As a result of calculating the mean effective doses of general X-ray examinations, the range of mean effective doses per test varied from <0.01 mSv to 0.87 mSv.

**P-085**

**뇌혈관장벽 조절 모니터링을 위한 경 두개골 케비테이션 매핑**

김창수, 박주영

첨단의료기기개발지원센터, 대구경북첨단의료산업진흥재단

In this study, the feasibility of transcranial passive acoustic mapping (PAM) with a linear acoustic array receiver was investigated via *ex-vivo* experiment. Two focused ultrasound transducer, 653 kHz and 1 MHz central frequency, were adopted to generate a localized acoustic pressure field. A thin tube, which served as a flow channel for microbubble, was placed on the focal point to expose the microbubble in a controlled pressure field. The raw data received by 128 channel linear array was collected in the ultrasound imaging system for later post mapping process. A coherent factor was incorporated into a conventional passive beamforming algorithm in order to suppress the incoherence signal on the mapped image. The performance of PAM was tested on a tissue mimicking phantom prior to the transcranial mapping. A good matching of source location shown on ultrasound imaging and PAM was achieved. Finally, passive imaging of microbubble cavitation through the intact skull was shown with the linear imaging array. A negligible distortion of mapped source location was observed on 635 kHz sonication. However, a significant distortion of source location was shown on 1MHz sonication and the appropriate compensation is desirable. This technique may be useful for the monitoring and control of transcranial focused ultrasound treatment, such as FUS-induced blood-brain barrier disruption, for which no real-time monitoring technique currently exists.

**P-086**

**자체차폐 방사선 수술 시스템의 정확도를 높이기 위한 영상 정합**

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The ZAP-X is a novel self-contained and first-of-its-kind self-shielded therapeutic radiation device dedicated to brain and neck radiosurgery. To complete the accurate tracking system, a precise registration of KV and DRR images is required. To improve the registration process, we apply a noble segmentation method on the skull of head. Experimental results with a phantom demonstrate the effectiveness of the proposed method.

**P-087**

**휴지상태의 기능적 자기공명영상에서 주파수에 따른 고유 연결 네트워크의 변화**

박영훈, 박미진, 이종민

한양대학교 생체공학과

Intrinsic connectivity network (ICN) is defined as 10 ICNs in resting state brain and regions of ICNs are used as functional ROI. However, based on the fact that strength of each ICN varies with frequency, it is unlikely that ROI of each ICN will belong exclusively to one ICN along the frequency. To observe ROI of each ICN changes along the frequency, we first constructed 9 frequency connectivity matrixes with 141 ROIs overlapped of 10 ICNs. Next, ICN connectivity ratio of each ROI was calculated. We found that ROI of each ICN changes along the frequency.

P-088

## 심혈관 기능모니터링을 위한 다채널 다중 모드 패치형 프로브 개발

윤상연<sup>1</sup>, 이기준<sup>2</sup>, 김재관<sup>3</sup>, 황재윤<sup>1</sup>

DGIST 정보통신융합전공

When patients suffering cardiac arrest are occurred, the emergency medical service(EMS) is one of the most important procedures to save their life or escaping for critical damages to internal organs. In particular, implementation of cardiopulmonary resuscitation(CPR) is usually determined by using a carotid artery palpation method which is a conventional method measuring the heart pulse by tactile sense directly. However, this method has several shortcomings in the determination such as blockage of the cerebral blood flow, low detection accuracy, and damage to internal organs. Therefore, in order to overcome these shortcomings, we develop a multi-channel multimodal patch-type probe based on Doppler ultrasound and pulse oximeter techniques which allow to measure blood flow rate and blood oxygen concentration on the carotid artery simultaneously for quantitative monitoring of cardiovascular functions of patients.

P-089

## 유전자 기반 영상 유전 분석을 통한 알츠하이머 위험 유전자 발굴

김보현, 최용호, 이종민

한양대학교 생체공학과

Many genetic studies have identified novel genetic loci for Alzheimer's disease (AD) including APOE over the past several decades, but all of them except APOE seem to have very modest effects. Imaging genetics is an integrated research field that combines neuroimaging and genetics to assess the impact of genetic variation on imaging measures as an endophenotype. Imaging genetics

could improve the power of association studies by reducing the phenotypic heterogeneity therefore, could find additional genetic factors attribute to AD. In this study, we performed the gene-based association study with cortical thickness in order to identify novel AD susceptible genes.

P-090

## 3D U-net을 이용한 백질 병변 자동 분할

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White matter hyperintensities (WMH) are brain regions of abnormal signal in T2-weighted magnetic resonance images (MRI). These regions are correlated with several neurological and vascular disorders. So, the studies of these disorders are need to precise detection and quantification of WMH. In this study, we propose a novel method for automatic WMH segmentation using 3D U-net which is deep learning based semantic segmentation method. The proposed method shows better segmentation performance (mean Dice index: 0.7638) than intensity-based WMH segmentation method (mean Dice index: 0.4560) that was conventionally used.

P-091

## 정상 백질과 백질 병변의 미세구조 통합성 비교

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White matter hyperintensities (WMH) are typically detected on fluid-attenuated inversion recovery (FLAIR) or T2 weighted MRI and are commonly observed in older adults and patients with vascular cognitive impairment. In this study, we investigated whether integrity of NAWM or those of WMHs are an

appropriate risk-stratification tool to distinguish patients with vascular cognitive impairment from cognitively normal elderly in identically same degree distribution of patients' WMHs. We hypothesized that integrity of NAWM would have more predict for cognitive impairment than those of WMHs, because it is likely that the compromised integrity of NAWM reflects overall dysfunction of the brain although they may be influenced by under same pathology of the presence of WMH.

**P-092**

**첨단수사기법 개발을 위한 얼굴 지표  
 데이터베이스의 통합 및 활용**

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This paper presents facial landmark extraction algorithm for detection micro facial expression using CNN (Convolutional Neural Network). At the time of speech, people reveal personal psychological states with micro facial expressions. Face databases were used to extract facial landmarks for comprehending personal psychological states. To take advantage of each face database, we integrated MUCT DB, 300-W DB, and 3D MENPO DB. Neural network was trained by the integrated face database. Through the performance analysis, artificial neural network learning successfully extracted facial landmarks based on human facial characteristics. This result shows that the face database integration was effective in extracting facial landmarks.

**P-093**

**첨단 수사기법 개발을 위한 복합 생체정보  
 데이터베이스 구축 및 활용**

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This paper proposes acquisition of multi-modal biometrics information to overcome limitations of existing forensic science techniques and polygraph. The multi-modal biometric information is composed of ECG, PPG and GSR which are well known as conventional contact type biometric information, and non-contact biometric information including real video, thermal video and voice. The lie was obtained by requesting to produce a lie when the first visit and measuring the lie status during the second visit. A total 45 of lie subjects were collected and a simple artificial neural network learning and testing was conducted to verify this data. Among the 45 data, C3D-LSTM artificial neural network was learned based on 132 question data of 6 participants who had a high level of immersion, and 70% of them were used as learning data and 30% as verification data. As a result, the accuracy of the learning data converged up to 95%. This leads to an interpretation that there is a specific pattern in the lie data and that learning is possible through this pattern. However, in the result of using the verification data, it is interpreted that over-fitting has occurred, so additional collection of data is required.

P-094

## 딥러닝 기반 비접촉식 거짓말 탐지기술 개발을 위한 RGB영상의 IR영상 근사화 알고리즘 기술 개발

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Since John Larson developed polygraph in 1921, which has measured variations in breathing, blood pressure, and pulse simultaneously, there is a persistent controversy that the suspect's human rights are infringed. To overcome this, studies are being made on non-invasive polygraph based on the subject's speech, RGB image, and IR images. This paper proposes IR image data augmentation algorithm which could be an basis for further studies of non-invasive polygraph. We developed an IR image simulation of RGB images by red scale weighting and colormap changing in matlab. The algorithm hasn't received a quantitative assessment, but it shows similarity between IR simulation images and real IR images.

P-095

## PET/CT 영상 내 폐 영역 분할 및 폐 종양 추출 알고리즘 연구

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In the traditional lung segmentation algorithms, those not consider juxta-pleural nodules or large tumors, sufficiently. In this paper, we proposed that a novel fully automated lung segmentation algorithm which is aim at lung cases containing tumor or SPNs. The proposed methods consist of initial lung segmentation, adaptive maximum intensity projection, tumor candidate extraction, optimal lung segmentation. The validation was

accomplished by comparing automated analysis results to the manual assessment. The experimental results show that our method effectively performed to segment in various lung cases that large tumors, SPNs, and lung wall stick together.

P-096

## 초음파 영상에서 좌심실 경계를 추출하기 위한 딥러닝 기반 알고리즘

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국가수리과학연구소 산업수학전략연구부

In this paper, we propose a deep-learning based automated left ventricle (LV) segmentation method. The proposed method is designed to enhance the performance LV segmentation by using the U-net architecture. In order to evaluate the proposed method, we perform some numerical experiments with clinical echocardiography data, consisting of apical four chamber view images. Despite small amounts of dataset, the experimental results show that the proposed method is promising.

P-097

## Thiol-ene 반응을 통한 습/건식 DNA 코팅의 비교

여강인, 이은진, 최승엽, 이상우

연세대학교 의공학과

Bio-chip is useful for sensing of biomedical agents and in vitro diagnosis such as hemodiagnosis, genetic mutation, or protein detection for the early diagnosis of diseases. One of the important factor in ensuring bio-chip efficacy for accurate data acquisition is its uniform coating. Recently, direct and quick reaction of monothiolated oligonucleotides on alkenylated silicon surfaces is reported. However, Thiol-ene techniques about immobilization condition (e.g., medium, temperature, and coupling agent concentration) are still not stable. Our first

investigation aimed to study the deposition quality of the silane functional group (i.e., vinyltrimethoxysilane) depending on different coating methods (i.e., wet and evaporation treatment). We observed that the vacuum evaporation treatment showed lower RMS roughness using Atomic Force Microscopy (AFM), suggesting more uniform deposition on silicon dioxide (SiO<sub>2</sub>) substrate. To verify their influences on DNA immobilization, we coated the oligonucleotides with modified thiol functional group and Cy5<sup>TM</sup> on vinyl-functionalized SiO<sub>2</sub> substrate with thiol-ene reaction. We evaluated macro coating quality by fluorescence microscopy and micro-coating quality by AFM. Congruously, we observed uniformed coating in both macro and micro scales. This suggests that evaporation methods may be better than traditional wet coating methods.

**P-098**

**세포의 물리적 환경 제어를 위한 코팅 방법**

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Cell adhesion plays an important role in cell function and differentiation. However, conventional cell culture methods, the shape or position of cell attachment is very randomly attached, resulting in the function of a single cell and difficulty in tracing it later. Here, we fabricated patterned PDMS membrane and coated the gelatin with the desired shape. A dark field microscope was used to confirm that the gelatin was coated in the desired shape. When the cells were cultured on the coated area, it was confirmed that the cell shape was formed similar to the coated shape.

**P-099**

**마이크로웨이브를 이용한 아밀로이드 응집체 합성 기술**

이원석<sup>1</sup>, 최예성<sup>2</sup>, 이상원<sup>2</sup>, 이규도<sup>2</sup>, 이상우<sup>1</sup>, 윤대성<sup>2</sup>

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<sup>2</sup>고려대학교 바이오의공학부

Amyloid aggregates have emerged as a significant hallmark of neurodegenerative diseases such as Alzheimer's diseases. Though it has been recently reported that the microwave heating assists the amyloid aggregation compared to the conventional heating method, the mechanism how microwave induces the formation of amyloid aggregates has remained unclear. In this study, we investigate the formation of oligomeric amyloid aggregates by the microwave irradiation at a microscale volume of solution. We believe that this microwave technology has the potential to be a simple and facile manner for the study of amyloid aggregation in the presence of chemical agents or nanomaterials.

**P-100**

**세포막 코팅된 전기화학적 혈당센서: 포도당에 대한 고선택성 구현**

김인수, 이규도, 윤대성

고려대학교 바이오의공학과

Since diabetes mellitus patients are increasing year by year, not only treatment but glucose monitoring has been one of the major concerns. In this regard, several electrochemical devices for glucose monitoring have already been developed. However, it has still suffered from unwanted electrochemical signals by innumerable molecules which are dissolved in the human blood and some of which interfere the enzymatic interaction with glucose. In this study, we developed an electrochemical enzymatic biosensor with greater selectivity for glucose than conventional ones, which is achieved by coating of

## 포스터(일반)

cell membrane extracted from red blood cells or cancerous cells.

P-101

### 현장진단형 분자진단을 위한 산화 그래핀과 핵산분해효소를 이용한 등온 신호증폭 기술

정찬호, 김종현

대구경북첨단의료산업진흥재단 첨단의료기기개발지원센터

Here, we present a novel way to detach multiple RNA probes per single target DNA from graphene oxide (GO) with RNase H(RH) for a POCT. Because of the action of RH and preferential adsorption of single-stranded nucleic acids to GO, single target DNA could be used to detach up to 10 thousands of probes allowing detection of target DNA as low as 2 attomoles within 30 minutes. In the presentation, we will discuss the details in the results.

P-102

### 유체역학적 집속을 위한 마이크로유체칩 시뮬레이션

최준혁, 이덕호, 이화연, 박강백, 여인규, 천정무, 김다혜, 정봉수

DGMIF 첨단의료기기개발지원센터 생체적합성평가팀

We present a model of microfluidic flow and use it to simulate a whole flow focusing device. Microfluidic devices present a unique powerful platform for working with living cells. We simulated to find an optimal structure for red blood cell and white blood cell flow rates, flow pressures in microfluidic channels using COMSOL multiphysics®. From the result, we found that S-shape(5-curved) structure is better than 1-curved shape and 3-curved structure in vertical distribution rate(VDR). S-shape and 1-curved shape, 3-curved shape structures have VDR of 27.74 % and 38.70%, 33.35 %, respectively.

P-103

### 다중 채널 뇌전증 환자의 뇌파와 EMD를 통한 발작과 백그라운드 신호의 특징 비교

도대국<sup>1</sup>, 서슬아<sup>1</sup>, 이민우<sup>1</sup>, 김태형<sup>2</sup>, 천송이<sup>1</sup>, 문치웅<sup>1,3</sup>

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<sup>3</sup>인제대학교 u-향노화헬스케어 연구소

The aim of this study is to compare feature between seizure and background signal using EMD in multi-channel epilepsy EEG. it is important to identify the features of seizures using EEG for epilepsy patient. Empirical Mode Decomposition (EMD), which is one of the methods to find the feature of EEG, can extract the basis functions from the data itself. Several studies have been conducted to characterize seizures, but most have been compared on a single channel. So this study compare feature between seizure and background signal using multi-channel EMD. Coefficient of variation and fluctuation index was calculated by each Intrinsic Mode Functions (IMFs) from EMD. Each value statistically verified using normality test and 2 sample t-test.

P-104

### Deep Learning을 이용한 MSA 환자의 SWI와 R2\* 영상간 성능 비교

서슬아<sup>1</sup>, 이재혁<sup>2</sup>, 김태형<sup>3</sup>, 천송이<sup>1</sup>, 이민우<sup>1</sup>, 도대국<sup>1</sup>, 문치웅<sup>1,4</sup>

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<sup>3</sup>양산부산대학교병원 의생명융합연구소

<sup>4</sup>인제대학교 u-향노화헬스케어 연구소

MSA patients increase atrophy and iron deposition in subcortical structures depending on disease progression. In this study, we used Deep Learning to identify MRI techniques that distinguish between MSA patients and normal subjects. From each images, we extracted regions, caudate nucleus, putamen, globus pallidus, as a

region of interest in each of the left and right hemispheres. In the case of SWI, train accuracy reached 100% for about 60 iterations, but for R2\*, train accuracy reached 90% for about 800 iterations. The test accuracy of the SWI is 100% and the test accuracy of the R2\* is about 63.6%.

**P-105**

**시뮬레이션 환경에서 뇌경막외 피질뇌파(epidural ECoG) 측정을 위한 나사 타입의 전극(Screw type Electrode) 효용성 연구**

임석빈<sup>1</sup>, 최호석<sup>1</sup>, 이세호<sup>1</sup>, 이경민<sup>2</sup>, 김인영<sup>1</sup>, 장동표<sup>1</sup>

<sup>1</sup>한양대학교 의공학교실, <sup>2</sup>서울대학교 신경과

Recently, several studies have adopted epidural electrocorticogram (eECoG) which has advantage both EEG and depth recording for BCI. However, previous research which using screw type eECoG cannot be acquire the clear brain signal because it could be influenced by skull and scalp artifact. For advanced research, we design new screw type titanium electrode which has high electric conductivity and zirconia ceramics socket that reduce artifact signal. we investigate validity of new screw type electrode with ceramics socket compared with reference electrode. As results, electrode with socket distributed high EM field inner socket from brain source and decreased current density of artifact source.

**P-106**

**과민성 방광치료를 위한 전임상 실험용 이식형 경골신경자극 시스템**

이재웅<sup>1,2</sup>, 박은경<sup>2,3</sup>, 이규성<sup>1,2,3</sup>

<sup>1</sup>성균관대학교 삼성융합의과학원 의료기기산업학과  
<sup>2</sup>삼성서울병원 스마트헬스케어.의료기기융합연구센터  
<sup>3</sup>성균관대학교 의과대학 삼성서울병원

Overactive bladder have generally been treated with medication. However, there is a high probability of side effect for each individual. Therefore, method of treating

electric nerve stimulation associated with micturition has been studied. Especially, treatment through tibial nerve electrical stimulation has already been reported to improve the problem of overactive bladder in many studies. However, preclinical experiments to develop optimal stimulation parameters are performed in anesthetized laboratory animals. it is necessary to implant the electrical stimulator completely into a laboratory animal to see what physiological changes after stimulation in a free environment. Therefore, in this study, we planned a fully implanted tibial nerve stimulation system capable of electric stimulation or optogenetic stimulation.

**P-107**

**무선전력전송을 이용한 전임상용 삽입형 신경자극기의 개발 및 유효성평가**

김태우<sup>2</sup>, 박은경<sup>2,3</sup>, 이규성<sup>1,2,3</sup>

<sup>1</sup>성균관대학교 삼성융합의과학원 의료기기산업학과  
<sup>2</sup>삼성서울병원 스마트헬스케어.의료기기융합연구센터  
<sup>3</sup>성균관대학교 의과대학 삼성서울병원

The treatment and recovery of peripheral nerve injuries in society is becoming a very important topic. but the clinical application of peripheral nerve regeneration due to problems such as biological interaction, walarian degeneration, complicated pathological response of injured tissue much research is needed. In addition, peripheral nerve regeneration studies are mostly non-clinical experiments using small animals with the size of the stimulator is very limited. In order to solve this problem, it was necessary to use new electrical stimulation system for a small animal experiment with a simpler method than the existing system. In this study, we developed an implantable wireless neurostimulator using an animal model of sciatic nerve injury and verified the effectiveness of the neurostimulator developed using behavioral evaluation.

P-108

## 메시지-모듈 기반 객체지향적 뇌-기계 인터페이스 플랫폼 개발

정인혜, 현성용, 김성민, 강봉근, 최종률, 오성석, 이성준, 이병훈, 김민건, 손정우

대구경북첨단의료산업진흥재단 첨단의료기기개발지원센터

Brain-machine interface (BMI) research is carried on for medical purpose in several research groups. However, there is no unified platform to incorporate each groups' result for better system. In this study, we have constructed an object-oriented, message-based BMI platform that provides compatibility of multiple programming languages and easy connection to devices. The platform is composed of three components: modular components, control module and communication modules. The platform handles message by defining the message type, analyzing and sending the message to target modules. This platform can be used for universal brain-machine interface due its object-oriented nature.

P-109

## 국소 진동자극 주파수 특성이 Mu rhythm의 활성화에 미치는 영향

김희균<sup>1</sup>, 곽기영<sup>1</sup>, 고승훈<sup>2</sup>, 김재성<sup>2</sup>, 김유정<sup>2</sup>, 김동욱<sup>2,3</sup>

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<sup>2</sup> 전북대학교 공과대학 바이오메디컬공학부

<sup>3</sup> 전북대학교 고령친화복지기기연구센터

The purpose this study was to estimate the effect of vibration stimulus and frequency characteristics on the sensorimotor area applied to peripheral senses through the activity analysis of Mu rhythm. 10 adult males participated in the study. EEG measurements and analyzes were performed to investigate brain activity in the sensorimotor area. Mu rhythm activity was decreased as a result of the subthreshold intensity vibratory stimulation, and the Mu rhythm activity was different by

stimulus position and frequency. This means that stimulation of subthreshold intensity induces activity in the sensorimotor area and dependent on stimulus location and frequency.

P-110

## 분화 유도된 중뇌 복측 신경줄기세포에서의 실시간 도파민 분비 측정

조현우, 오윤배, 강유민, 신호진, 박천호, 김인영, 장동표

한양대학교 의생명공학전문대학원 생체의공학과

Monitoring dopamine(DA) release in dopaminergic cell culture is crucial for stem cell study. Fast scan cyclic voltammetry(FSCV) could be an applicable technique due to high sensitivity, selectivity, and temporal resolution. Nevertheless, the instability of background currents in FSCV technique limited the monitoring time. To overcome this drawback, we applied charge-balancing multiple fast-scan cyclic voltammetry (CBM-FSCV) combined with dual background subtraction method. With CBM-FSCV, we could monitor endogenously released DA concentration change from ex-vivo live dopaminergic cell media over 24 hours with no background drift detected. it is expected that this tool could be useful for cell culture related study.

P-111

## 고속순환 사각파형 전압전류법을 이용한 신경전달물질 분류

박천호, 김재경, 강유민, 신호진, 조현우, 김인영, 장동표

한양대학교 생체의공학과

We proposed a new type of voltammetric technique, which we called large amplitude Fast Cyclic Square Wave Voltammetry (FCSWV), for improving a selectivity of neurotransmitters in the brain. FCSWV

consists of a large amplitude periodic square pulse signal ( $>0.3V$ ) superimposed on a staircase waveform. By combining principal component regression, we showed a significant improvement in the differentiation of dopamine, epinephrine and norepinephrine in their mixture compared to FSCV. In addition, it was evaluated for the detection of dopamine in the striatum in vivo. In conclusion, large amplitude FCSWV would be one of promising tools in neuroscience research area.

**P-112**

### 기계적 변형에 따른 유연성 평면코일의 무선 전력 전달 효율에 관한 시뮬레이션

윤승현, 서정민, 김성준

서울대학교 공과대학 전기정보공학부

Inductive link is a method of wireless power transmission within a short distance. Power transmission efficiency decreases drastically as the distance increases. The transmission coil can be designed as a patch type to fix it to the skin and maximize the transmission efficiency. In this case, mechanical deformations of the coil can occur depending on body shape or other physical characteristics of the wearer, which in turn changes the electrical characteristics of the coil. In this study, we investigated how the electrical characteristics of the coil change according to the mechanical deformation through simulation and calculated the power transmission efficiency.

**P-113**

### 다중파형 고속스캔 순환 전압전류법을 사용한 장기간 신경전달물질 측정을 위한 사용하기 쉬운 톨 박스

강유민, 신호진, 박천호, 조현우, 김인영, 장동표

한양대학교 의생명공학전문대학원 생체공학과

FSCV(Fast scan cyclic voltammetry) has been used as a technique that estimate the changing concentration of neurotransmitters in the brain. Conventional FSCV has a limitation for long-term measurement due to unstable background signal. Recently, we had developed charge-balancing multiple waveform and dual background subtraction technique to minimize temporal variation in its background current. In this research, we will present the software package that consists of multiple waveform generation, and real-time data acquisition and processing, and multiple waveform FSCV displays modules.

**P-114**

### 신경 보철용 유도 코일에 전류를 공급하는 방법에 대한 고찰

김채빈<sup>1</sup>, 권태목<sup>1</sup>, 성재훈<sup>1</sup>, 김경환<sup>2</sup>, 김성준<sup>1</sup>

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Neural prosthetic device is an implanted device that electrically stimulate the neural tissue for the regeneration of the senses, movement, or brain function. A coil pair is widely used for transmitting the power and data to the implanted unit. The operation principle of the coil link is that electric current flowing through the transmitting coil generates the magnetic field, and the magnetic field induce the voltage across the receiving coil, where the induced voltage can be used for power supply and communication. Although numerous transmitter circuit designs are explored for better power efficiency, data rate, and tolerance to distance variation, the most simple method suitable for the beginner is perhaps the current generator attached to the transmitting coil. In this paper, we propose a method of configuring simple current generator for the coil links in the neural prosthetic devices.

P-115

## 서로 다른 압력 자극으로 유발된 ERP 패턴 차이에 관한 연구

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건국대학교 과학기술대학 ICT융합공학부 의학공학전공

In this study, the stimulation of the puff and the suction of the air were applied to the index finger to compare the event related potential (ERP) from the C3 and the FC5 area. One session consisted of Preparing Phase (3sec.), Operation Phase (3sec.) and Rest Phase (9sec.). This session was repeated to 60 times for each puff and suction. In result, when the same strength of suction and puff stimulation were presented to the fingers, the suction stimulation caused a more sensitive response in the somatosensory area (C3) and the motor area (FC5) than the puff stimulus.

P-116

## 신경자극장치 제어를 위한 FPGA 기반의 데이터 송신 장치

심신용, 윤승현, 김성준

서울대학교 전기정보공학부

Recently, a fully-implantable neural stimulator is constructed and wirelessly operated in a body. Especially for the stimulator powered by batteries, it is expected to work at longer range than that of inductively-coupled coils, while the data of stimulus parameters are transmitted precisely. In this paper, an FPGA-based data transmitter to control a neural stimulator is presented. The transmitter was fabricated using FPGA and ZigBee module, which can modulate the data conveniently without an error and transfer them with low power at 10 m or more. The data were successfully transmitted and measured on a display of a receiver.

P-117

## 특발성 렘수면행동장애 환자의 회귀억제 결함 및 베타대역에서 비정상적 대뇌활동

허성진<sup>1</sup>, 여동훈<sup>1</sup>, 차광수<sup>1</sup>, 서부경<sup>1</sup>, 김현<sup>1</sup>, 최성운<sup>1</sup>, 정기영<sup>2</sup>, 김경환<sup>1</sup>

<sup>1</sup>연세대학교 의공학과 <sup>2</sup>서울대학교 의과대학 신경과

Idiopathic rapid-eye movement (REM) sleep behavior disorder (IRBD) is a sleep disorder characterized by dream enactment behavior and the loss of muscle atonia during REM sleep. We investigated spatiotemporal and spectral characteristics of cortical activities during visuospatial attentional task with recording electroencephalogram (EEG) in IRBD. We found a behavior inhibition of return deficit and abnormal cortical activities in beta-band in IRBD patients.

P-118

## 운전 피로도와 뇌파 스펙트럼 파워 간 상관관계 분석

서부경, 여동훈, 김현, 허성진, 최성운, 김경환

연세대학교 의공학과

In this study, to develop real time driver's vigilance/fatigue tracking system, we tried to detect driver's fatigue from short EEG and autonomic nervous system signals. In the 90 min monotonous driving situation, 64 channel EEG from scalp, PPG, GSR and SKT were measured from both hands, and the expression of the driver's face were recorded. The videos of the subjects were evaluated on a scale of 9 points per minute based on the Karolinska Sleepiness Scale (KSS). Short-time Fourier transform was performed to EEG. We found the significant correlation between KSS and delta-, alpha-band power. As a result of training the artificial neural network, average classification performance was 67.21% and maximum 68.90%.

P-119

### 레이저 광 출력에 따른 광화학적 뇌손상 발현 차이의 조직학적 분석

박혜진<sup>1</sup>, 오성석<sup>1</sup>, 최종률<sup>1</sup>, 김준식<sup>2</sup>, 유래형<sup>2</sup>,  
 안상현<sup>2</sup>, 이성준<sup>1</sup>, 강봉근<sup>1</sup>, 손정우<sup>1</sup>

<sup>1</sup>대구경북첨단의료산업진흥재단 첨단의료기기개발지원센터  
<sup>2</sup>대구경북첨단의료산업진흥재단 실험동물센터

Photo-thrombosis is a modality of an artificial induction of blood clots in blood vessels on selected areas by photochemical activations with Rose Bengal and LASER light irradiations. In this study, we induced photo-thrombosis in rat brains with various output powers of irradiated LASER light to seek optical power conditions for efficient photo-thrombosis generations with minimized burning tissue damages. The result of this study can be employed to develop a quantified brain damage animal models that could be applied in preclinical tests of advanced diagnostic or therapeutic modalities.

P-120

### 온라인 게임 중 게임중독군과 정상군간의 뇌 활동의 차이

김주리<sup>1</sup>, 황종호<sup>1</sup>, 김선애<sup>1</sup>, 박진식<sup>1</sup>,  
 정영철<sup>2</sup>, 남궁기<sup>2</sup>, 장동표<sup>1</sup>, 김인영<sup>1</sup>

<sup>1</sup>한양대학교 의공학교실  
<sup>2</sup>연세대학교 정신과학교실

The purpose of this study is to extract objective indicators for Internet game addiction monitoring. Through Young's Internet Addiction Test (YIAT), subjects were classified into normal group (YIAT <50) and addiction group (YIAT > 50) and brain waves were measured during the game (more than 20 min, 3 times). In this study, the results showed that the theta power decreased due to the cognitive dysfunction in the addicted group compared to the normal group during the game, and the beta power decreased due to the decrease in attention.

As a result, it was confirmed that the theta and alpha power could be used as an indicator of internet game addiction.

P-121

### 레이저 절삭 시닝 기술로 제작된 폴리머 기반의 심부전극

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서울대학교 전기·정보공학부

The polymer-based neural depth electrode applicable to conventional connectors is proposed. The thicknesses of the connection pad and the electrode shank were controlled by applying a laser ablations to only a specific region. The fabricated depth electrode has a thickness of 370  $\mu$  m at the connection pad and 250  $\mu$  m at the electrode shank, respectively. Moreover, *in vitro* measurements were performed to evaluate the feasibility as a neural stimulation electrode.

P-122

### 양측 대뇌피질 자극을 위한 액정폴리머 기반 평면형 신경 전극

안승희, 윤승현, 김성준

서울대학교 전기·정보공학부

A surface-type neural electrode using liquid crystal polymer is suggested. This electrode is designed for bilateral cortical stimulation of rat. The electrode has Y-shape, therefore two branches are targeting each left and right somatosensory cortex. Each branch has two round stimulation channels with 300  $\mu$ m diameter. The electrode is fabricated by MEMS based patterning process, thermal pressing process, and UV laser process. After the fabrication, the electrodes are verified by electrochemical impedance spectroscopy.

P-123

## 생체 삽입 장치를 위한 향상된 ASK 복조 회로

서정민, 심신용, 윤승현, 김성준

서울대학교 전기정보공학부

An improved amplitude shift-keying (ASK) demodulation circuit is developed for implantable devices in this paper. Conventional ASK demodulator consisting of an envelope detector and filters is widely used for wireless power and data transmission due to its simplicity. However, its performance depends on external factors such as distance and alignment between antennas. To remove the dependency, an envelope detector, a set of diodes, and a comparator were utilized in our newly designed circuit. An experiment for wireless transmission was conducted varying distance between the coils from 3.0 mm to 11 mm to compare performances of the conventional and the suggested demodulation circuits. According to the results, the devised ASK demodulation circuit was superior than the conventional demodulation circuit in either transmission distance and demodulation accuracy.

P-124

## 연관 기억 기능 평가를 위한 클러스터 기반 뇌파 분석

송솔웅, 조재욱, 최재영, 최정봉, 박진식, 김인영, 장동표

한양대학교 생체의공학과

Integration of visual working memory features is called binding memory or relational memory. We measured EEG while subjects performed object-location relational memory task. With Regression ERP and Cluster-Mass analysis, we found that there is difference between binding and swap error conditions when 500ms after recall at right posterior electrode sites.

P-125

## 차량용 음파진동시트 연구

오승용<sup>1</sup>, 강승록<sup>2</sup>, 홍철운<sup>3</sup>, 권대규<sup>3,4</sup>

<sup>1</sup>전북대학교 헬스케어공학과, <sup>2</sup>전북대학교병원 의료기기중개입상시험지원센터,

<sup>3</sup>전북대학교 바이오메디컬공학부, <sup>4</sup>전북대학교 고령친화복지기기연구센터

The purpose of this study was to develop a vehicle seat that provides sound vibration in order to reduce fatigue caused by driving a vehicle and to analyze its effectiveness. They exercised gait with slope of 8.5 degree and 4km/h during 30min as high intensity exercise. We measured the lactate level in the blood during rest with vibration and zero-G posture. The results showed that lactate level in the blood decreased by 55.6% with vibration stimulus but it decreased at 38.5% without vibration. We found that the relaxation rest provided with the vibration could be the more effective method for reducing the fatigue of human body.

P-126

## 상과염 환자를 위한 휴대용 전기자극 치료기기 개발

권혁찬<sup>1</sup>, 박은경<sup>1</sup>, 김규리<sup>1</sup>, 한재인<sup>2</sup>,

이현주<sup>2</sup>, 김국한<sup>3</sup>, 태기식<sup>1</sup>

<sup>1</sup>건양대학교 의공학과, <sup>2</sup>건양대학교 물리치료학과, <sup>3</sup>대성마리프(주)

The purpose of this study is to develop electric stimulation therapy suitable for treatment of lateral and medial phase epicondylitis and to have portability for use anywhere, anytime. The electrical stimulation mode is designed to output the electrical characteristics that are used in clinical applications for inflammation relief therapy. In addition, lateral and medial phase epicondylitis can be caused by a recurrence of illness or chronic pain without continuous treatment. Therefore, it was designed to be able to charge by using a lithium polymer battery, so that a device

having portability was developed and it was possible to receive treatment anytime and anywhere. This portable stimulation system will be useful for rehabilitation of lateral and medial phase epicondylitis.

**P-127**

**성별에 따른 한국어 음성 기반 연령 분류 딥러닝 알고리즘 기술 개발**

소순원<sup>1</sup>, 유승민<sup>2</sup>, 김영명<sup>2</sup>, 김지윤<sup>2</sup>,  
 조백환<sup>3</sup>, 육순현<sup>1</sup>, 김인영<sup>1</sup>

<sup>1</sup>한양대학교 일반대학원 생체공학과  
<sup>2</sup>한양대학교 의생명공학전문대학원 생체의공학과  
<sup>3</sup>성균관대학교 삼성융합의과학원 의료기기산업학과

Speaker recognition technology through voice information is a technology that has attracted attention in modern society, and it is emerging as an important technology for confirming the identity in systems such as electronic commerce and forensic medicine. In this study, we aimed to develop deep learning algorithm for gender age classification by combining deep learning and speaker recognition technology. Here, the 13<sup>th</sup> order MFCC(Mel Frequency Cepstral Coefficient) were extracted from the spoken voice data of males in their 20s, 30s, 50s and females in their 30s, 40s, 50s and datasets were constructed to learn the models. Our model confirmed the classification accuracy of 78.6% and 71.9% for males and females, respectively.

**P-128**

**미소유체칩 기반 배양액 흐름의 조절을 통한 PC12 세포의 분화 연구**

이승아, 박하나, 정하철, 안진우, 문진희, 김영진  
 오송첨단의료산업진흥재단 첨단의료기기개발지원센터  
 제품개발부

Understanding the factors promote neuronal cell differentiation is important for the design of neuronal tissue and

neuronal interface models. We prepared a microfluidic-based chip enables a continuous flow of medium to the cells through osmotic pumping without external power source. The flow effect on the growth and differentiation of PC12 cells into neuronal-like cells was investigated using cell viability, morphology, and immunostaining of GAP43. We demonstrate that flow effects have the potential to improve the neuronal differentiation such as elongation and neurite extension compared to the control models for 7 days.

**P-129**

**원심미세유체기반 3차원 세포배양 기술을 이용한 치주 세포 거동 관찰**

이기훈<sup>1</sup>, 이의룡<sup>2</sup>, 박종열<sup>1</sup>

<sup>1</sup>중앙대학교 기계공학부, <sup>2</sup>중앙대학교병원 구강악안면외과

Various forms of three-dimensional cell co-culture are very important culturing methods to simulate the actual environment and observe the cell reactions and interactions. In this study, a centrifugal microfluidic system was used to form a complex three - dimensional tissue structure of periodontal ligament and alveolar bone. Periodontal ligament cells and bone marrow stem cells were co - cultured. As a result, it was confirmed that the co - cultured tissue was cultured in the form of bone marrow stem cells surrounding periodontal ligament cells.

**P-130**

**탈세포화 과정의 정량평가를 위한 영상처리 기법에 관한 연구**

김기한, 이정한, 김형식

건국대학교 과학기술대학 ICT융합공학부 의학공학전공  
 BK21+ 의공학실용기술연구소

In this study, we proposed a method that can evaluate decellularization process of rate of change for cell necrosis and tissue structure using an image processing

## 포스터(일반)

method. To extract feature of cell, colored raw images were converted into grayscale and indexed images. Also tissue structure is extracted by separating the RGB components from the original image. To evaluate the proposed method, a custom made electroporator was used in range of 250 volts and pulse width of 100  $\mu$  s on the arotic valve of the pig. From the results, the cell and tissue structure extracted and a numerical calculation of ratio was possible at each time after electroporation.

P-131

### 집속초음파 이용 뇌혈관장벽 조절을 통한 뇌 약물전달 향상법

정병진, 한문, 박주영

대구경북첨단의료산업진흥재단 첨단의료기기개발지원센터

The purpose of this study is to develop a new blood-brain barrier disruption (BBBD) protocol to enhance drug delivery into the target brain. "FUS protocol" (1 Mpa, 10 ms tone burst, 1 Hz PRF, 120 sec, without microbubbles) was additionally applied before "BBBD protocol" (0.47 or 0.6 Mpa, 10 ms tone burst, 1 Hz PRF, 120 sec, with microbubbles). In targeted brain, we found that an anticancer agent, Doxorubicin (DOX) was 2~3 times more delivered with the "combined FUS+ BBBD" protocol compared with the "BBBD" protocol. This study showed that the "combined FUS+BBBD" could be applied clinically to effectively deliver therapeutic agents into the target brain without brain tissue damage.

P-132

### 꿀잠 슬립 센서: 무구속 심탄도 측정 센서

박찬용

바이텔스(주)

Ballistocardiography is a signal that records the heart-beat. We propose a signal processing device that detects a heartbeat based on a healthy subject's ballistocardi-

gram. This device is designed to be applied to the micro controller of the low-end, low-memory devices being used in a wearable or portable device. We implemented a device for measuring heart rate and find large peak for heart rate. The agreement of the proposed device with an ECG reference has been evaluated. A sensitivity of 93.1, positive predictivity of 93.3 was achieved on 7 hour recordings from 6 subjects.

P-133

### The effects on mental fatigue and the cognitive function of mechanical massage and binaural beats provided by automatic massage chairs

Jeong-Hwan Lim, Hyeri Kim,  
Chul Jin Jeon, Soohyun Cho

Medical R&D Center, Bodyfriend, Seoul, Korea

In the present study, we verified whether the mechanical massage using automatic massage chairs (AMC) and binaural beats affect the mental fatigue recovery and cognitive enhancements. 25 healthy adults used an AMC (Bodyfriend Inc., Seoul, Korea) that could provide mechanical massage and binaural beats for 20 minutes. Mental fatigue and sustained attention were assessed before and after receiving mechanical massage and listening binaural beats using electroencephalogram (EEG) and d2-test. As the results of EEG analysis, the mental fatigue statistically significantly decreased further in receiving a mechanical massage and listening to the binaural beats on the AMC compared to taking a rest or receiving a mechanical massage only on the AMC. In addition, sustained attention was statistically significantly increased after using the mechanical massage and binaural beat. From these results, we demonstrated that the mechanical massage and binaural beats using AMC are effective in reducing mental fatigue and improving the cognitive function.

P-134

### 심근 섬유화 조건하에서의 심장세동 발생 기전에 대한 전기생리학적 분석

김유석, Aroli Marcellinus, 이지영, 임기무

메디컬IT융합공학과, IT융복합공학과

In this study, we analyzed the effect of myocardial fibrosis with atrial fibrillations causes cardiac remodeling. We used the 3D electrophysiology model of the finited element human atrium and ventricle model with CRN and TN2006 cell ion model. We simulated electrical conduction through myocardial tissue with fibroblast regions. AF and VF induced at fibrotic cardiac model through rapid pacing and then it sustained re-entrant wave forms.

P-135

### 스펙트럼 이동을 이용한 청진음 강화

정동근

동아대학교 의과대학 의공학교실

The heart sound of a healthy normal person is concentrated in the frequency region where the auditory sensitivity of the human body is low. Moving the frequency components of the stethoscopic sound to high frequencies can enhance the auditory stimulation of the human body by transforming the spectrum rather than amplifying the sound. For this purpose, the spectrum of the stethoscopic sound was shifted to the right and the inverse FFT was performed to reconstruct the sound. This study suggests that spectral shift can enhance auditory stimuli during auscultation without increasing the intensity of the stethoscopic sound.

P-136

### 자연광 LED의 사용이 야간 수면 중 자율신경계의 활성화에 미치는 영향

권현빈<sup>1</sup>, 최상호<sup>1</sup>, 진형원<sup>1</sup>, 오성민<sup>2</sup>, 이유진<sup>2</sup>, 박광석<sup>3</sup>

<sup>1</sup> 서울대학교 공과대학 협동과정 바이오엔지니어링 전공

<sup>2</sup> 서울대학교병원 수면의학센터

<sup>3</sup> 서울대학교 의과대학 의공학교실

Previous studies have demonstrated the effect of light spectrum on sleep architecture across the nocturnal time and sleep electroencephalography. This study investigated effect of different LED light spectra on autonomic nervous activity. Ten healthy subjects were exposed by general light and blue-wavelength filtered light during three hours before sleep. The results showed that blue-wavelength light reduces sleepiness after light exposure and increased sympathetic nervous activity during first half sleep.

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SM720SJD	7F	20	Super Large Curl	2-10-2-10-2-10-2-10-2-10-2-10-2-10-2-10-2-10-2 mm	950	Steerable
SM720SKD	7F	20	Super Large Curl	5-5-5-5-5-5-5-5-5-5-5-5-5-5-5-5 mm	950	Steerable
SM720SMD	7F	20	Super Large Curl	2-5-2-5-2-5-2-5-2-5-2-5-2-5-2-5-2 mm	950	Steerable
SM720SND	7F	20	Super Large Curl	2-20-2-2-2-2-2-2-2-2-2-2-2-2-25-2-25-2 mm	950	Steerable
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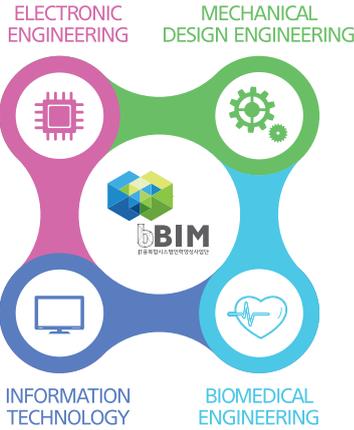


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자문위원회

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**사업부단장**  
바이오 양윤석 교수



## IT융복합시스템인력양성사업단

전북대학교 CK-1 IT융복합시스템인력양성사업단은 2014년 교육부의 대학특성화사업에 선정되어, 사업단 구성 4개 학부(과) 재학생이 졸업 후 동일/유사분야로 진출하기 위해 융복합적 교과과정의 유기적인 다학제 교육을 실현하고 특화된 교육을 통해 창의적 인재를 양성하고 있습니다.



## 프로그램 진행 현황 (2014년~2018년 현재 기준)

대학명	국가/도시	기간	인원
University of Texas at San Antonio(미국)	미국: 텍사스	2014.12.22~2015.01.21	4명
North Carolina A&T State University(미국)	미국: 노스캐롤라이나	2016.01.04~2016.02.01	1명
Harward Medical School(미국)	미국: 매사추세츠	2015.02.05~2015.02.01	4명
University of Minnesota(미국)	미국: 미네소타	2016.01.13~2016.02.15	4명
San Jose State University(미국)	미국: 캘리포니아	2017.01.08~2017.01.13	1명
Capital City College Group(영국)	영국: 런던	2018.01.22~2018.02.04	1명
Ulster University(영국)	영국: 벨파스트	2018.01.22~2018.02.04	1명
University of Texas at San Antonio(미국)	미국: 텍사스	2016.01.04~2016.02.01	4명
North Carolina A&T State University(미국)	미국: 노스캐롤라이나	2016.01.04~2016.02.01	1명
Harward Medical School(미국)	미국: 매사추세츠	2015.02.05~2015.02.01	4명
University of Minnesota(미국)	미국: 미네소타	2016.01.13~2016.02.15	4명
San Jose State University(미국)	미국: 캘리포니아	2017.01.08~2017.01.13	1명
Capital City College Group(영국)	영국: 런던	2018.01.22~2018.02.04	1명
Ulster University(영국)	영국: 벨파스트	2018.01.22~2018.02.04	1명
University of Texas at San Antonio(미국)	미국: 텍사스	2016.01.04~2016.02.01	4명
North Carolina A&T State University(미국)	미국: 노스캐롤라이나	2016.01.04~2016.02.01	1명
Harward Medical School(미국)	미국: 매사추세츠	2015.02.05~2015.02.01	4명
University of Minnesota(미국)	미국: 미네소타	2016.01.13~2016.02.15	4명
San Jose State University(미국)	미국: 캘리포니아	2017.01.08~2017.01.13	1명
Capital City College Group(영국)	영국: 런던	2018.01.22~2018.02.04	1명
Ulster University(영국)	영국: 벨파스트	2018.01.22~2018.02.04	1명

## 프로그램 진행 예정

대학명	국가/도시	기간	인원
Japan Prober(일본)	일본: 도쿄	2018년 하반기	15명
Harward Medical School(미국)	미국: 매사추세츠	2018년 하반기	10명
CCG(영국)	영국: 런던	2018년 하반기	12명

학술대회명	일자 및 장소	논문 제목	이름	지도교수
ISITC 2017	2017. 10. 18. ~ 10. 22.	Robust MMSE Design of Linear Transceivers for Multi-User MIMO Systems with Full-Duplex Base Station	유대성	박석환
대한의생명공학학회 2017	2107.11.10. ~ 11.11.	조도에 따라 조절되는 스마트 블라인드	김가희	곽영태
		비포장도로를 지원하는 자율주행자동차	이지향	곽영태
		증강현실을 이용한 캠퍼스 안내 어플리케이션	임동민	곽영태
		멀티코어 환경에서 분할 트랜잭션을 이용한 하드웨어 트랜잭셔널 메모리	마현국	장재우
		고감도 마이크로 가스 센서를 위해 카본 필름 위에 성장시킨 다중벽-탄소나노튜브(Multi-Walled CNT)의 성능 향상 연구	최솔비	오종현
		도플러 초음파 및 유체-구조 상호작용 모델을 이용한 경동맥에서의 비뉴턴성 혈액 흐름에 대한 Fluid-structure Interaction 모델 연구	이상건	정진무
		능동적 기술임 운동 시 운동경로에 따른 체간 근활성도 분석	우현지	권대규
		당뇨 위험군의 생활 습관 개선을 위한 스마트 어플리케이션	장수빈	양윤석
		D2D 통신의 주파수 효율 향상을 위한 MIMO 신호처리 기술	유대성	박석환
		Animal Study: Adult Zebrafish Treated with Contrast agent and Imaged using Dual Modality Photoacoustic tomography and Ultrasound Imaging	이청수	송철규
제어 로봇 시스템 학회	2017.12.08.	편백나무로 제작된 힐링 침대에서의 후각 자극을 통한 산림욕 효과	안윤 등	권대규
		능동적 기술임 운동 시 운동경로에 따른 체간 근활성도 분석	우현지 등	권대규
CEDC 2017	2017.12.14. ~ 12.17.	링크를 이용한 손가락 재활 보조기구 (Assistive Device of Finger Rehabilitation using Linkage Mechanisms)	박홍정 등	강희용
		청각장애인을 위한 진동 알람기 '나의 주파수가 보여' (A frequency analysis based sound detector for deaf : SeeVibe)	조아현 등	김수용
ICS 2017	2017.4.20. ~ 4.21.	Design and manufacture of low cost upper limb robot for children with disabilities	강현재 등	김영천
ICS 2018	2018.4.19. ~ 4.20	생체 센서를 기반으로 헬스케어 서비스를 제공할 수 있는 노인 복지 케어 시스템을 개발	조영현	김정자
		실시간 광음향 단층영상을 이용한 쥐의 신장 염증 판별	유수민 등	송철규
		광섬유 센서를 이용한 동맥경화 초기의 다중물리량 상태 감지 시스템	소승수 등	송민호
		다중벽-탄소나노튜브(Multi-Walled CNT)의 성능 향상을 위한 카본 필름 적용 마이크로 가스 센서 연구	조준희	정진무