9th International Biomedical Engineering Conference

IBEC 2023

9.Thu~11.Sat Nov. 2023

Korea University, Seoul, Korea

Biomedical Engineering for Innovating Healthcare

대한의용생체공학회
The Korean Society of Medical & Biological Engineering

고려대학교 BK21 정밀보건과학교육연구단
BK21FOUR R&E Center for Precision Public Health

인하대학교 BK21 정밀의학·스마트공학 융합 교육연구단
Precision Medicine& Smart Engineering

연세대학교 BK21 맞춤형 NBIT 융복합 의료기기 교육연구단
BK21Four Education and Research Center of NBIT- Integrated Medical System for Personalized Healthcare

SHELFAS TEAM
Smart HEalthcare Leaders For Active Seniors

강원대학교 BK21 Four 맞춤형 스마트 헬스케어 사업단

FOUR BK21

SNU AI.MED
서울대학교 의료 인공지능 융합인재양성사업단

Korea Disease Control and Prevention Agency
National Institute of Health

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9th International Biomedical Engineering Conference

Welcome Letter

President of the KOSOMBE

Dear KOSOMBE members, colleagues, and guests,

In the beautiful fall season, we sincerely welcome you to the 2023 International Biomedical Engineering Conference (IBEC 2023), which will be held at Korea University in Seoul, Korea, from November 9 to 11, 2023.

The Korea Society of Medical and Biological Engineering, which hosts this conference, has grown into a leading academic society in this field based on the effort and dedication of its members over the past 44 years. Meanwhile, we have reached a position where we lead global research activities and serve healthcare in our country and worldwide.

In this sense, the theme “Biomedical Engineering for Innovating Healthcare” presented at this year’s conference is timely. In particular, it is very meaningful that this conference will be held at Korea University, which is contributing to the development of the medical device industry by nurturing biomedical engineering talent and conducting research and development of new future medical technologies.

As President of the society, I am happy to meet outstanding speakers and excellent papers. I have no hesitation in recommending you to take advantage of our excellent programs and sessions. Fellow researchers and graduate and undergraduate students will have a great opportunity to see and learn about creative ideas in various academic fields at our conference.

I sincerely thank the IBEC 2023 Organizing Committee and Brain Korea 21 (BK21) Institutes for their precious time and effort in preparing for IBEC 2023. we would also like to express my sincere gratitude to everyone and the exhibitors who supported this conference.In addition to presentations and discussions, take some time to enjoy the beautiful culture and atmosphere of Seoul, Korea.Thank you.

Myoung Nam KIM

President of the Korea Society of Medical and Biological Engineering

Welcome Letter

Conference chair

Welcome to IBEC 2023!

Dear IBEC friends and colleagues,

It is with immense pleasure and excitement that we extend a warm welcome to IBEC 2023 and to the vibrant city of Seoul, KOREA! IBEC 2023 marks the 9th International Biomedical Engineering Conference organized by the Korean Society of Medical & Biological Engineering (KOSOMBE), and we are truly honored to host our esteemed IBEC community from the 10th to the 11th of November 2023.

The Korean Society of Medical & Biological Engineering has a rich history of making remarkable scientific and technological contributions, backed by a dynamic biomedical industry. Against the backdrop of a global pandemic that has spotlighted vulnerabilities in healthcare systems worldwide, our conference theme titled "Biomedical Engineering for Innovating Healthcare" takes on profound significance. Our scientific tracks will encompass the traditional areas of expertise of KOSOMBE's technical committees, complemented by an additional theme in alignment with our overarching goal.

Our conference program is designed to explore themes such as precision medicine, AI data science, NBIT, personalized health, and translational research. In tandem with our scientific sessions, an exhibition will feature a diverse array of biomedical engineering companies, publishers, start-ups, institutes, and universities. IBEC 2023 is poised to provide invaluable networking opportunities for engineers, clinicians, scientists, entrepreneurs, as well as students and young professionals.

Seoul, an iconic city known for its beauty and dynamism, will serve as the backdrop for our conference which will be held at the Inchon Hall, Korea University. To echo our commitment to responsible and eco-friendly practices, IBEC 2023 will be a sustainable conference.

As we gear up for November 2023, we eagerly anticipate your arrival in Seoul. Join us for an extraordinary journey into the realms of cutting-edge science and technology, a captivating social program, and an unforgettable experience that will last a lifetime. Together, let's embark on this journey, making leaps and bounds in the field of biomedical engineering.

Sincerely,

Honggu Chun
Conference Chair
Professor at Department of Biomedical Engineering, Korea University

Conference official

Chair	**Honggu Chun** (Korea University)
Co-Chairs	**Ju_Hee Lee** (Korean National Institute of Health)
	Jongmo Seo (Seoul National University)
	Sang Woo Lee (Yonsei University)
	Byeong Hee Kim (Kangwon National University)
	Jae-Seon Lee (Inha University)
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	Jahyun Koo (Korea University)
	Beop-Min Kim (Korea University)
	Joon-Kyung Seong (Korea University)
	Jung-Yeol Yeom (Korea University)
	Yong-Sang Ryu (Korea University)
	Dae Sung Yoon (Korea University)
	Myonggeun Yoon (Korea University)
	Kisung Lee (Korea University)
	Aram Chung (Korea University)
	Youngwoon Choi (Korea University)
	Yeonho Choi (Korea University)
	Kyu Back Lee (Korea University)
Poster Award Chairs	**Jahyun Koo** (Korea University)
	Yong-Sang Ryu (Korea University)

KOSOMBE officers and directors

Former President	Dong Keun Jung	Dong-A University
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Editor-in-Chief (Biomedical Engineering Letters)	Jae Sung Lee	Seoul National University
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	Jong-Ha Lee	Keimyung University

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	Rena Lee	Ewha Womans University
	Junghwan Oh	Pukyong National University
	Chang–Hwan Im	Hanyang University
	Jin Seung Choi	Konkuk University
	Yoon Uicheul	Daegu Catholic University
	Yang Sejung	Yonsei University
	Kyung Min Byun	KYUNG HEE UNIVERSITY
	Jung, Young–jin	CHONNAM NATIONAL UNIVERSITY

Exhibitors

한국의료기기안전정보원	김해의생명진흥원
딥노이드	헬스리안
엘티바이오	성균관대 의료기기산업학과
연세대학교 의료기기산업학과	원주의료기기테크노벨리
엠아이텍	넥스트바이오메디컬
연세대학교 융합의학과	오송첨단의료산업진흥재단
엠큐브테크놀로지	클라리파이
바텍	서울대학교병원 혁신의료기술연구소
알지인스트루먼트	동국대학교 의료기기산업학과
나노엔텍	레메디
연세 혁신의료기기 실증지원센터	인성메디칼
주식회사 뷰노	계명대학교 사용성평가연구센터
네오다임	레티마크
제이엘케이	코어라인소프트
바이오팩코리아	BMEL

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Youngro Lee (Seoul National University, Korea)

High resolution deep learning-powered chi-separation reveals detailed iron and myelin distribution of human brain in vivo
Sooyeon Ji (Seoul National University, Korea)

Session III
NBIT-driven Medical Technologies Innovations

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Chair: Prof. Dasol Lee (Yonsei University, Korea)

Engineering neuro MRI application at 7T
Prof. Wanyong Shin (Cleveland Clinic Lerner College of Medicine, USA)

Validating neuroimaging biomarkers for transcranial neuromodulation in traumatic brain injury
Prof. Junghoon Kim (City University of New York, USA)

Localization of Epileptogenicity Using Multi-modal MRI and Deep Learning Network: Incomplete MRI sequences in Pediatric Cohort
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Data-driven computational approaches for identifying novel therapeutic targets and drug repositioning opportunities
Prof. Namshik Han (University of Cambridge, UK)

Advancements in deep tissue optical blood flow monitoring technology
Prof. Myeongsu Seong (Xi'an Jiaotong-Liverpool University, China)

Session IV
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Chair: Byeong Hee Kim, Kwang Suk Lim (Kangwon University, Korea)

Development of Flexible sensor using liquid metal and 3D printing
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Biomechanics of the Middle Ear: From Mechanical Insights to Surgical Optimization
Merlin Schar (University Hospital of Zurich, Switzerland)

Single-shot panoramic 3D functional retinal imaging and processing

MyeongJin Ju (University of British Columbia, Canada)

Patent-specific analysis of aortic dissection using numberical simulation and 4D flow MRI

GyuHan Lee (Kangwon National University, Korea)

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ChangHwa Joo (Kangwon National University, Korea)

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Chair: Prof. Su-Geun Yang, Prof. Kyeong Jin Kim (Inha University, Korea)

Biodegradable Melanin-like Electroactive Materials for Bioelectronics

Prof. Bong Sup Shim (Inha University, Korea)

Nanotherapeutic-inspired metabolic remodeling in disease — Prof. Elvin Blanco (Weill Cornell Medical College, USA)

State-of-the-art Metabolomics Techniques-based Study of Fuel — Prof. Dong Wook Choi (Korea University, Korea)

Translational Research: Polymeric Implants Loaded with Anticancer

Prof. Norased Nasongkla (Mahidol University, Kingdom of Thailand)

Image Guided Locoregional Drug Delivery and Therapy: Pros and Cons

Dr. Su-Geun Yang (Inha University, Korea)

PROGRAM

November 10 (Friday)

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November 10 (Friday)

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November 10 (Friday)

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13:35–13:42	**Session II** **Youngro Lee** (Department of Electrical and Computer Engineering, Seoul National University) Stability of calibration in smart watch-based blood pressure estimation	
13:42–13:50	**Session II** **Sooyeon Ji** (Department of Electrical and Computer Engineering, Seoul National University) High resolution deep learning-powered chi-separation reveals detailed iron and myelin distribution of human brain in vivo	
14:00–14:20	**Session III** **Prof. Wanyong Shin** (Cleveland Clinic / Imaging Institute, Department of Diagnostic Radiology, Cleveland Clinic Lerner College of Medicine) Engineering neuro MRI application at 7T	

November 10 (Friday)

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15:30-15:50	**Session III** **Prof. Myeongsu Seong** (Xi'an Jiaotong-Liverpool University / Department of Mechatronics and Robotics) Advancements in deep tissue optical blood flow monitoring technology	

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16:40-17:00	**Session IV** **MyeongJin Ju** (University of British Columbia) Single-shot panoramic 3D functional retinal imaging and processing	
17:10-17:30	**Session IV** **Chang Hwa Joo** (KangwonNational University) The effect of acute and chronic exercise on the physcialfitness and immune response of HIV/AIDS	
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10:25-10:50	**Session V** **Prof. Elvin Blanco** (Research Institute Houston Methodist Weill Cornell Medical College) Nanotherapeutic-inspired metabolic remodeling in disease	
10:50-11:15	**Session V** **Prof. Dong Wook Choi** (Department ofoBiotechnology, Korea University) State-of-the-art Metabolomics Techniques-based Study of Fuel Metabolism and the Human Disease Relevance	
11:15-11:35	**Session V** **Prof. Norased Nasongkla** (Department of Biomedical Engineering, Faculty of Engineering, Mahidol University) Translational Research: Polymeric Implants Loaded with Anticancer Agents for the Treatment of Brain Cancer	
11:35-12:00	**Session V** **Dr. Su-Geun Yang** (BK21 Four Precision Medicine & Smart Engineering, InhaUniversity) Image Guided Locoregional Drug Delivery and Therapy: Pros and Cons	

Friday PROGRAM

Session I Diagnostics technologies for precision medicine

Chair: Prof. Yongsang Ryu, Korea University, Korea

Auditorium B115

Advanced nanoplasmonic technologies for multiplex tumor-derived extracellular vesicle analysis

Hyungsoon Im
Center for System Biology, Massachusetts General Hospital, Harvard Medical School, USA

Smart Toilet: Artificial Intelligence and Advanced Data Science

Seung-min Park
School of Chemistry, Chemical Engineering and Biotechnology, Nanyang Technological University, Singapore

Wearable bio-electronics for health monitoring, diagnostics, and therapeutics

Hyoyoung Jeong
Depratment of Electrical and Computer Engineering, University of California Davis, USA

The Transformative Power of SLACS in Drug Discovery and Diagnostics

Amos Chungwon Lee
Meteor Biotech, Co. Ltd, Seoul, Korea.

"Lean" bio-instrumentations via the synergy of lean optical architectures and computational algorithms.

Chulmin Joo
Department of Mechanical Engineering, Yonsei University, Seoul, Korea

Session II AI/ML for Healthcare Data Science

Chair: Prof. Ju Hee Lee, Korea Disease Control and Prevention Agency
Prof. Jongmo Seo, Seoul National University, Korea

Auditorium B115

Control possibilities of a prosthetic hand

Miklos Koller
Faculty of Information Technology and Bionics, Pazmany Peter Catholic University, Hungary

The Future of Microbiome Manipulation: Genomic Language Models Meeting Global Needs

Balazs Ligeti
Faculty of Information Technology and Bionics, Pazmany Peter Catholic University, Hungary

The Role of AI in medical imaging: decisions or assistance?

Andras Hovath
Faculty of Information Technology and Bionics, Pazmany Peter Catholic University, Hungary

Healthcare data collection and its role of KNIH: focusing on data management and sharing

Sang Cheol Kim
Division of Healthcare and Artificial Intelligence, Korea National Insitiute of Health, Korea

Health-related Data Collection from Wearable and Mobile Devices in Everyday Lives

Jaeseok Yun
Department of Internet of Things, Soonchunhyang University, Korea

Stability of calibration in smart watch-based blood pressure estimation

Youngro Lee
Department of Electrical and Computer Engineering, Seoul National University, Seoul, Korea

High resolution deep learning-powered chi-separation reveals detailed iron and myelin distribution of human brain in vivo

Sooyeon Ji
Department of Electrical and Computer Engineering, Seoul National University, Seoul, Korea

hosted by the GoGE/SDG of Seoul National University (SNU) BK21 Education and Research Program for Future ICT Pioneers, the SNU Project Group for Education and Research in Medical AI, and the MD-PhD/Medical Scientist Training Program of SNU.

Session III NBIT-driven Medical Technologies Innovations

Chair: Prof. Dasol Lee, Yonsei University, Korea

Auditorium B115

Engineering neuro MRI application at 7T

Wanyong Shin
Imaging Institute, Cleveland Clinic, USA

Validating neuroimaging biomarkers for moderate-to-severe traumatic brain injury

Junghoon Kim
Department of Molecular, Cellular, and Biomedical Sciences, CUNY School of Medicine, New York, USA

Localization of Epileptogenicity Using Multi-modal MRI and Deep Learning Network: Incomplete MRI Sequences in Pediatric Cohort

Justin Jeong-Won Jeong
Pediatrics, Neurology, and Translational Neuroscience Program, Wayne State University School of Medicine and Graduate School, USA

Data-driven computational approaches for identifying novel therapeutic targets and drug repositioning opportunities

Namshik Han
Milner Therapeutics Institute, University of Cambridge, UK
Cambridge Centre for AI in Medicine, University of Cambridge, UK
Wellcome-MRC Cambridge Stem Cell Institute, University of Cambridge, UK

Advancements of Optical Technology Toward Deep Tissue Blood Flow Monitoring

Myeongsu Seong
Department of Mechatronics and Robotics, School of Advanced Technology Xi'an Jiaotong-Liverpool University, China

Session IV Convergence Technology in Personalized Smart health for Active Senior

Chair: Byeong Hee Kim Kwang Suk Lim, Kangwon University, Korea

Auditorium B115

Development of Flexible Sensor Using Liquid Metal and 3D Printing Techniques

Yong-Jai Park
[1]Department of Mechatronics Engineering, Kangwon National University, Chuncheon, Korea

Biomechanics of the Middle Ear: From Mechanical Insights to Surgical Optimization

Merlin Schaer
Department of Otorhinolaryngology, Head & Neck Surgery, University Hospital Zurich, University of Zurich, Switzerland

Single-shot panoramic 3D functional retinal imaging and processing

Myeong Jin Ju
Department of Ophthalmology and Visual Sciences, School of Biomedical Engineering, Faculty of Medicine, Faculty of Applied Science, University of British Columbia, Canada

The effect of acute and chronic exercise on the physical fitness and immune response of HIV/AIDS

Chang-Hwa Joo
Department of Sport Science, Kangwon National University, Chuncheon, Korea

Patent-specific analysis of aortic dissection using numberical simulation and 4D flow MRI

Gyu-Han Lee
Institute of Medical Devices, Kangwon National University, Chuncheon, Korea

Session V New Technique-Based Translational Research for Human Health

Chair: Prof. Su-Geun Yang, Prof. KyeongJin Kim, Inha University, Korea

Auditorium B115

Biodegradable Melanin-like Electroactive Materials for Bioelectronics

Bong Sup Shim
Department of Chemical Engineering, Program in Biomedical Science and Engineering, Inha University, Incheon, Korea

Nanotherapeutic-inspired metabolic remodeling in disease

Elvin Blanco
Department of Nanomedicine, Houston Methodist Research Insititue, USA
Weill Cornel Medical College, USA

State-of-the-art Metabolomics Techniques-based Study of Fuel Metabolism and the Human Disease Relevance

Dong Wook Choi
Department of Biotechnology, College of Life Sciences and Biotechnology, Korea University, Seoul, Korea

Translational Research: Polymeric Implants Loaded with Anticancer Agents for the Treatment of Brain Cancer

Norased Nasongkla
Department of Biomedical Engineering, Mahidol University, Thailand.

Image Guided Locoregional Drug Delivery and Therapy: Pros and Cons

Su-Geun Yang
Department of Biomedical Science & Engineering, Inha University College of Medicine, Incheon, Korea

Saturday PROGRAM

IP-001	**Novel PCDA Sensor for Rapid Detection of Nicotine in Tobacco Products** Jiyeon Kim[1,*], Youngwoo Lee[1], Jinwoo Song[1], Jawoon Kim[1], Jaewon Jang[2] and Donghyuk Park[1,*] [1]Program in Biomedical Science and Engineering, Inha University, Incheon, Korea [2]Dept of Chemical Engineering, Inha University, Incheon, Korea. [3]Division of Physics and Semiconductor Science, Dongguk University, Seoul, Korea.
IP-002	**Unraveling the CVD Growth Mechanism of Two-Dimensional WSe2 Using Molten Salt Precursors** Yebin Lee[1], Hyukjin Song[2,3], and Naechul Shin[1,2,3,*] [1]Program in Biomedical Science and Engineering, Inha University, Incheon, Korea [2]Program in Smart Digital Engineering, Inha University, Incheon, Korea [3]Department of Chemical Engineering, Inha University, Incheon, Korea
IP-003	**Exploring User Demand for Personalized Healthcare Solutions Via Digital Biomarkers** Seoyoung Chon[1], and Sesil Lim[1,2*] [1]Program in Biomedical Science and Engineering, Inha University, Incheon, Korea [2]Department of Industrial Engineering, Inha University, Incheon, Korea
IP-004	**Mitomycin C suppressed human tracheal fibroblast growth via cell death associated autophagy** Eun Jeong Jeon[1,2], Jeong Mi Kim[1,2], Jin-Mi Park[1], Jeong-Seok Choi[1,2,*] [1]Department of Otorhinolaryngology-Head and Neck Surgery, Inha University College of Medicine, Incheon, Republic of Korea [2]Department of Biomedical Science, Program in Biomedical Science and Engineering, Inha University, Incheon, Republic of Korea
IP-005	**Basic research on an automatic hearing impairment discrimination system based on ABR after AI-based chirp stimulation** Sanghoon Nam[*], Yeoeun Choi, Bomin Seo, Taemin Shin Department of Biomedical Engineering, Yonsei University, Wonju, Korea

IP-006	**PVA/SiO2/ND nanofiber with radiative cooling for Thermal Management of wearable devices** Seokgyu Kwon[1], Changhwan Hyeon[2], Minseo Jeong[3], Dasol Lee[1*] [1]Department of Biomedical Engineering Yonsei University, Wonju, Korea
IP-007	**Detection of Mismatch of DNA inside a device based on dielectrophoretic surface charge analyzer** Gyeongjun Min, Gwak Youn Woo, Jin Seon Park, Sang Woo Lee[*] Department of Biomedical Engineering Yonsei University, Wonju, Korea
IP-008	**Improved survival rate and minimal side effects of doxorubicin for lung metastasis using engineered discoidal polymeric particles** Sanghyo Park[1], Yoonho Hwang[1], Yujin Park[1], Hyeyoun Cho[1], Seonmin Choi[1], and JaehongKey[1,*] [1]Department of Biomedical Engineering Yonsei University, Wonju, Korea
IP-009	**Development of Paclitaxel-Silk Compound Nano Drug Delivery System for the Treatment of Ovarian Cancer** Yujin Park[1], Hyeyoun Cho[1], Yoonho Hwang[1], Sanhyo Park[1], Jaehong Key[1*] [1]Department of Biomedical Engineering, College of Software and Digital Healthcare Convergence, Yonsei University, Korea
IP-010	**Development of an embedded system for monitoring upper and lower extremity rehabilitation exercise equipment capable of remote monitoring** Bomin Seo[1], Yeoeun Choi[1], Sanghoon Nam[1], and Teamin Shin[1,*] Department of Biomedical Engineering Yonsei University, Wonju, Korea
IP-011	**TiNNanoring Broadband Absorber for Accelerated PCR Sensor Thermal Cycling** Sangmin Shim[1], Kyunghyun Yu and Dasol Lee[1*] [1]Department of Biomedical Engineering, Yonsei University, Wonju, Korea
IP-012	**Enhancing Laser Speckle Contrast Image using Meta-Hologram** Kyung-Hyun Yu[1], Sangmin Shim[2], and Dasol Lee[1*] [1]Department of Biomedical Engineering Yonsei University, Wonju, Korea

IP-013

Development of targeted drug delivery system for effective treatment of pulmonary embolism

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IP-014

Production and Performance Study of Radiative Cooling Thermally Conductive Fibers Using Electrospinning

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IP-015

Development of Drug Delivery System for Lung Cancer Treatment Using Silk Protein

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IP-016

Basic research on a stimulus embedded system for motor response evaluation of the Glasgow Coma Scale

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IP-017

Comparative Study of Radiative Cooling Performance of PVA-Based Fibers Additives Utilizing Electrospinning

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IP-018

Investigating Transdermal Absorption Enhancement: Quantifying the Effects of Plasma and Sono Skincare Devices

Yoonho Hwang[1], Yujin Park[1], Hyeyoun Cho[1], Sanghyo Park[1]and Jaehong Key
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IP-019

Investigating the effect between vasodilating and cognitive impairment in Alzheimer's disease mouse model using SD-OCT

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IP-020	**A 3D Microstructure-Based Platform for mRNA SpatialBarcoding** Chaewon Park[1,2], and Honggu Chun[1,2*] [1]School of Biomedical engineering, Korea University, Seoul, Korea [2]Interdisciplinary Program in Precision Public Health, Korea University, Seoul, Korea
IP-021	**In-situ light-directed oligonucleotides synthesis using photocleavable phosphoramidite** HaewonShin[1,2], David Baek[1,2]and Honggu Chun[1,2*] [1]Interdisciplinary Program in Precision Public Health, Korea University, Seoul 02841 Republic of Korea [2]School of Biomedical Engineering, Korea University
IP-022	**Oligonucleotide DNA synthesis on substrate using colloidal** David Baek[1,2], Haewon Shin[1,2],and Honggu Chun[1,2*] [1]Interdisciplinary Program in Precision Public Health, Korea University, Seoul 02841 Republic of Korea [2]School of Biomedical Engineering, Korea University
IP-023	**Fabrication of nanoporoussilicon nitride membrane for diffusion-based exosomes separation** Mingyu Seo [1,2], Gijung Kim [1], and Honggu Chun[1,2,*] [1]Department of Biomedical Engineering, Korea University, Seoul, Korea [2]BK21 FOUR Institute of Precision Public Health
IP-024	**Automated In situ Inkjet Oligonucleotide Synthesizer for DNA Microarray Fabrication** Seokwoo Jo[1,2], Sung-yune Joe[1,2] and Honggu Chun[1,2*] [1]BK21 FOUR Institute of Precision Public Health [2]Department of Biomedical Engineering, Korea University, Seoul, Korea
IP-025	**Generation of Synthetic CT(sCT) Images from MRI Images Using Cycle-Consistent GAN** Youngjoo Park[1,*], Hakjae Lee[1,2], Inbum Lee[1], Donghui Seo[1], Kangwoo Jeon[2], Jaewon Jeong[2], Kisung Lee[1,2] and Jin Sung Kim[3] [1]Department of Biomedical Engineering, Korea University, Seoul, Korea [2]ARALE Laboratory, Co., Ltd, Seoul, Korea. [3]Department of Radiation Oncology, Yonsei Cancer Center, Heavy Ion Therapy Research Institute, Yonsei University College of Medicine, Seoul, South Korea.
IP-026	**Huntingtin Exon 1 Mimic-Enveloped Plasmonic Nanoparticles for Huntingtin Aggregates-Degrading Drug Screening** Yeon Ho Kim[1,2], Hyo Gi Jung[1,2], and Dae Sung Yoon[1,2*] [1]Department of Biomedical Engineering, Korea University, Seoul, Korea [2]Interdisciplinary Program in Precision Public Health, Korea University, Seoul, Korea.

IP-027

Cell membrane bicellebased biomimetic detection of SARS-CoV-2

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IP-028

Development of cell-membrane-coated electrochemical sensor for CA-125 monitoring

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IP-029

Tau amyloid corona-based drug screening platform for tau oligomer-degrading drugs

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IP-030

Fabrication of BMP-2 and OPG-Fc encapsulating scaffold for enhancing bone regeneration

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IP-031

DT-Net: A novel convolutional neural network architecture specialized for diffusion tensor images in predicting Alzheimer's disease

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IP-032

Optimization of Plate Geometry for Sensitive Measurement of Fringe-Field Capacitive Senor

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IP-033

Wireless Muscle Monitoring Device for Rehabilitation Exercise Assistance

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IP-034

Long-Term Biocompatibility of Biodegradable Sensors for Intracranial Pressure Measurement: Clinical Implications

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IP-035

3D Printing Of ZnO/silica Ceramic Resin Composite With Antimicrobial Effect Using 3D Printing Techcique

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IP-036

Manufacturing and Characterization of Dental Crowns Made of 5-mol% partially stabilized zirconia (5Y-PSZ) by Digital Light Processing

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IP-037

Synthesis of Porous Hydroxyapatite Microspheres by Photocuring of Emulsions containing Terpene crystals

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IP-038

Fabrication of functionally graded multi-ceramic structure using digital light processing (DLP) 3D printing technique with passive in-line mixing concept

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IP-039

Ceramic 3D printing of arranged dense and porous microstructures

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IP-040	**Guided cold atmospheric plasma surface treatment technology for selective erasing surface functional groups on biomaterials** Won-HyoungChoi[1], JiheeYun[2], Min-GyoSong[1], Hae-in Kim[3], Kyu Back Lee[1,2,3*] [1]School of Biomedical Engineering, Korea University, Korea [2]Global Health Technology Research Center, Korea University, Korea [3]Interdisciplinary Program in Precision Public Health, Korea University
IP-041	**Constructing a cardiac cycle synchronized low-frequency electrical stimulation system to improve blood flow** Min Jeong[1], YejinKim[1], YoungminRyu[1], WoongkiJang[1], HojinHa[1], SukjinHa[1], HeewonPark[2], ByeongheeKim[1*] [1]Department of Smart Health Science and Technology, KangwonNational University, Chuncheon, Korea [2]Department of Rehabilitation Medicine, KangwonNational University of Medicine, Chuncheon, Korea
IP-042	**Design of bicycle saddle geometry for ideal pudendal blood flow** Sangho Ko, Hakseon Kim, Haifeng Du and Hojin Ha[*] Department of Smart Health Science and Technology, KangwonNational University, Chuncheon, Kangwon, Korea
IP-043	**Deep Learning for Tumor Marker Misidentification Error Detection: inter-center model performance comparison** Hyeon Seok Seok[1,3], Sollip Kim[2] and Hangsik Shin[3,*] [1]Department of Biomedical Engineering, Graduated School, Chonnam National University, Yeosu, Korea [2]Department of Laboratory Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea [3]Department of Convergence Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea
IP-044	**Development of an Emotional State Prediction Model Using Acceleration Signal, Heart rate, Electrodermal Activity, and Emotional Questionnaires** Changwon Wang[1], and Hangsik Shin[1,2,*] [1]Biomedical Engineering Research Center, Asan Medical Center, Seoul, Korea [2]Dept. of Convergence Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea
IP-045	**VR-Enabled SSVEP: Expanding Brain-Computer Interfaces with Virtual Reality** Jimmy Alexander Pulido Arias[1], Pan-Gyu Kim[2], and Do-Won Kim[1,2*] [1]Interdisciplinary Program of Biomedical Engineering, Chonnam National University, Yeosu, Korea [2]Department of Biomedical Engineering, Chonnam National University, Yeosu, Korea

IP-046	**Histological Analysis of Regions Affected by IRE in Porcine Liver Using Monopolar Electrodes** EunbinJi[1,2], Sung-Min Jeon[2], Phuong Hoa Tran[1,2], Seok Jeong[3], Su-GeunYang[1,2*] [1]Department of Biomedical Science, InhaUniversity College of Medicine, Incheon, Korea [2]Biomedical Science, BK21 FOUR Program in Biomedical Science and Engineering, InhaUniversity College of Medicine [3]Division of Gastroenterology, InhaUniversity Hospital, InhaUniversity College of Medicine, Incheon, Korea
IP-047	**The Effect of Number of Layers on chiroptical response of crescent chiral Metasurface** Semere Araya Asefa[1], and Dasol Lee[1*] [1]Department of Biomedical Engineering, Yonsei University
IP-048	**New Electrode Positions in ECG for Assessing Autonomic Activity using Frequency Domain Measures** Lina Agyekumwaa Asante[1], Jun won Choi[1], and Han Sung Kim[2*] [1]Department of Biomedical Engineering, Yonsei University, Republic of Korea [2]Department of Biomedical Engineering, Yonsei University College of Software and Digital Healthcare Convergence, Republic of Korea
IP-049	**Fucoidan-Sericin Conjugates: AI Guided Design and Wet Lab Evaluation for Precise Breast Cancer Cell Targeting** Rumana Ferdushia[1], HyeyounCho[1], Yujin Park[1], YoonhoHwang[1], SeonminChoi[1], and JaehongKey[1,*] [1]Department of Biomedical Engineering, Yonsei University, Wonju, Korea
IP-050	**Assessment of Cell Safety and Verification of Mass Transfer Potential Using a Low-Temperature Atmospheric Pressure Plasma Jet** Min-GyoSong[1], Hae-in Kim[2], Won-HyoungChoi[1], JiheeYun[3], Kyu Back Lee[1,2,3*] [1,3]School of Biomedical Engineering, Korea University, Korea [2]Global Health Technology Research Center, Korea University, Korea [3]Interdisciplinary Program in Precision Public Health, Korea University

Poster

Novel PCDA Sensor for Rapid Detection of Nicotine in Tobacco Products

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“Tobacco products, including e-cigarettes, contain nicotine, a substance with potent addictive properties, posing health risks not only to users but also to those around them. Consequently, there is an urgent need for swift and precise methods to detect nicotine in these products. In this study, we introduce a novel approach for the rapid detection of nicotine using a PCDA (pyrene-1-carboxylic acid) sensor. The PCDA sensor, a fluorescence-based detection system, has previously been demonstrated to be highly sensitive and selective for a variety of analytes, including PAHs (polycyclic aromatic hydrocarbons) and other organic compounds. Herein, we showcase the utilization of the PCDA sensor for the expeditious detection of nicotine in tobacco products, including cigarettes and e-cigarettes. Our findings indicate that the PCDA sensor can identify low concentrations of nicotine within minutes, exhibiting high sensitivity and selectivity. We believe our methodology holds potential as a valuable tool for monitoring nicotine levels in tobacco products, aiding in informing tobacco control policies and advancing public health."

Keywords: nicotine, pcda, sensor

Unraveling the CVD Growth Mechanism of Two-Dimensional WSe_2 Using Molten Salt Precursors

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Two-dimensional transition metal dichalcogenides (TMDs) have attracted significant attention for their potential in electronic and optoelectronic devices. While chemical vapor deposition (CVD) is a principal technique for producing large-area monolayer TMDs, the use of metal oxide precursors with high melting points poses various synthetic challenges. As an alternative, metal salt-based precursors, especially Na-based oxides, have emerged because of their water-solubility and low melting points [1]. However, producing a consistent monolayer (ML) with large-area coverage using these precursors still necessitate optimized strategies. In this study, we provide a systematic investigation of the influence of various process variables on the CVD growth of monolayer (ML) WSe_2 using $Na2WO_4$ and Na_2SeO_3. We investigated parameters such as precursor concentration, substrate distribution, and CVD growth variables like temperature and carrier gas flow rate to discern their relationship with the resultant quality of ML WSe_2. Our findings offer valuable insights into the fabrication of large area TMD MLs, which hold promise for electronic and optoelectronic applications.

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Keywords: WSe_2, CVD, 2D material, Molten-salt precursor

Exploring User Demand for Personalized Healthcare Solutions Via Digital Biomarkers

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The increase in chronic diseases has shifted healthcare from solely focusing on treatment towards management and prevention. Consumer interest in digital healthcare has also expanded to encompass disease management. The utilization of medical big data and AI technology in data-driven healthcare drives increased interest in healthcare services and treatments incorporating digital biomarkers. Digital biomarker serves as a major source of health information for predicting, diagnosing, and monitoring diseases. In digital health, commercially accessible digital biomarkers are primarily acquired through wearable devices. Thus, to identify user demand for digital health, we applied the covariate LDA model to Twitter data on wearable devices obtained through web crawling for topic modeling. Users showed time-varying interest in conditions like hypertension, heart attacks, myocardial infarctions, and chronic diseases, desiring continuous tracking, risk detection, and early diagnosis of relevant ailments. In Korea, however, the lack of regulations and laws for digital health hampers the commercialization of disease prediction, diagnosis, and monitors using digital biomarkers. Therefore, to meet user demands, it is necessary to reform proper regulations and laws, along with implementing policies supporting the Korean digital health industry.

Keywords: digital health; digital biomarker; user demand, topic modeling

Mitomycin C suppressed human tracheal fibroblast growth via cell death associated autophagy

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[Objective] A large number of studies have shown that topical application of mitomycin C after surgical decompression effectively reduces scar adhesions. However, the underlying mechanism remains unclear. The purpose of this study was to evaluate in vitro cytotoxicity and autophagic effect of mitomycin C on normal human tracheal fibroblasts (hTF) and human tracheal epithelial cells (hTEC).
[Materials and Methods] Both hTF and hTEC were subjected to mitomycin C treatment at 0.01, 0.1 and 1 ug/ml for 24, 48 and 72 hours. After mitomycin C treatment for both cell types, cell proliferation, autophagy and autophagy related protein levels were checked. And migration and related protein level and trans-differentiation of hTF post mitomycin C treatment were evaluated.
[Results] In hTEC, mitomycin C slightly suppressed proliferation but did not induce autophagy. However, mitomycin C suppressed the growth of hTF in a dose- and time-dependent manner as well as induced autophagy of hTF. Mitomycin C upregulated the expression levels of LC3, ATG5 and Rab7 and it downregulated cyclin D1 expression on hTF. Elevated α-SMA expression of hTF following TGF-β exposure was decreased after mitomycin C treatment.
[Conclusion] Our results suggested that mitomycin C suppressed human tracheal fibroblast growth through cell death associated with autophagy.

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Keywords: Mitomycin C, human tracheal fibroblast, cell death, autophagy

Basic research on an automatic hearing impairment discrimination system based on ABR after AI-based chirp stimulation

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Every year, the number of people with disabilities is increasing as the population ages. As we age, our behavior and physical functions gradually decline. In particular, hearing impairment accounts for the largest proportion of disabled people over the age of 65, excluding the physically disabled. And for newborns, hearing tests are essential during childhood. Because communication is not possible, it is impossible to know externally whether a sound stimulus has been heard, so the only way to know is through brainstem responses. Hearing impairment refers to a situation where communication is difficult due to severe hearing loss. In the case of hearing loss, it is possible to communicate to some extent using a hearing aid, but in the case of hearing loss, communication is difficult even with the use of a hearing aid. To diagnose hearing impairment, a test method called ABR is mainly used. ABR, also known as Audifory Brainstem Response, is a test method that listens to a specific sound stimulus and measures the response using brain waves. Therefore, in this study, we simultaneously stimulated the cochlea using the Chirp signal as a stimulus and conducted basic research on the resulting brainstem response measurement system. It was designed to check ABR by providing a chirp signal at certain times and then measuring eeg for 20ms, and attempted to remove noise and extract singular points of the signal through Analog Front End and software programming.

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Keywords: ABR, Chirp signal, hearing loss, EEG, Noise

PVA/SiO_2/ND nanofiber with radiative cooling for Thermal Management of wearable devices

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Recently, with the advancement of wearable devices, the components of the devices have become smaller and more integrated. As various functions are integrated into a single component, heat generated within the component naturally concentrates in one place, which can shorten the device's lifespan or lead to damage. [1] It is crucial to dissipate the integrated heat. However, in the case of pure polymer films, it is difficult to dissipate heat due to weak thermal conductivity. However, in the case of pure polymer films, it is difficult to dissipate heat due to weak thermal conductivity. In this research, we fabricated Polyvinyl alcohol (PVA)/Silicon dioxide (SiO_2)/Nanodiamond (ND) nanofibers with radiative cooling capability and enhanced thermal conductivity through the electrospinning. To enhance the weak thermal conductivity of polymers like PVA, fillers are added. [2] Among various filler types, we choose Nanodiamond (ND) due to its higher thermal conductivity. Upon examining thermal conductivity, we observed that the new material exhibited higher thermal conductivity compared to the conventional PVA film. Upon examining radiative cooling, we were able to confirm that the nanofiber we fabricated exhibited lower temperatures compared to both aluminum and the ambient temperature. In this study, we fabricated PVA/SiO2/ND nanofibers for heat management. It is anticipated that this material can help address wearable device's heat problem.

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Keywords: Nanofiber, Thermal conductivity, Radiative cooling, Electrospinning

Detection of Mismatch of DNA inside a device based on dielectrophoretic surface charge analyzer

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Surface charge/potential sensors have shown great potential for highly sensitive and selective sensing of mismatched DNA. However, these methods have difficulties of in the complex calibration process and interference in the analyte detection measurement signal. In our study, we developed a dielectrophoretic force based system that is able to arrange the particles on the microelectrode chip and levitate them vertically using negative DEP force. While the AC input was applied with the frequency modulation, the optical discrimination of the dielectrophoretic behaviors of multiple microparticle probes was observed. We used probeDNA aptamer functionalized particle for annealing with target DNA which has mismatch. Depending on the number of mismatch, the surface charge/potential formed with probeDNA changed, and each mismatch DNA can be detected accroding to the number of mismatch.

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Keywords: DNA mismatch, Biomems, DEP system, Ultra sensitive

Improved survival rate and minimal side effects of doxorubicin for lung metastasis using engineered discoidal polymeric particles

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The search for efficient cancer treatments continues to be difficult despite advancements in cancer therapy. In this study, a straightforward technique was created to improve the effectiveness of doxorubicin (DOX) distribution in a model of lung metastasis. This approach uses precise engineering to modify the size, shape, loading content, and biodegradability of the drug delivery system in order to maximize delivery efficiency. This apparatus exerted 90% burst release of the medication within the first 24 hours and had a 3 mm discoidal shape. The drug carrier exhibited no cytotoxicity up to a concentration of 1 mg ml^{-1}, and DOX was transported into the cancer cells from the carrier, demonstrating an anticancer effect similar to that of the free drug. The ex vivo findings showed a significant association between the site of DOX given by this drug delivery system and the location of lung cancer cells. It has been demonstrated that these drug carriers effectively transport DOX to lung cancer cells while having few unintended side effects. These results suggest that this delivery system, which does not require the use of polyethylene glycol or targeting ligands, may represent a novel strategy for increasing the survival rate and lowering the negative effects of anticancer medications.

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Keywords: lung metastasis, doxorubicin, drug delivery system, discoidal polymeric particles

Development of Paclitaxel-Silk Compound Nano Drug Delivery System for the Treatment of Ovarian Cancer

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Ovarian cancer, the most prevalent tumor in women of 185 countries, accounts for approximately 4% of global cancer incidence. Its Complex structure and low early detection rates cause difficulties for Complete removal of the tumor site, leading to higher risks of residual cancer tissue and recurrence. Therefore, a chemotherapy is essential. Chemotherapy with paclitaxel (PTX) is an important process of treatment. PTX necessitates non-aqueous solvents like cremophore EL and ethanol because of its high hydrophobicity. However, these solvents are a possibility of causing hypersensitivity reactions. In addition, PTX cause non-specific cytotoxicity effects on healthy cells and low drug delivery efficiency. This study proposes a novel approach utilizing silk proteins—Silk Sericin (SS) and Silk Fibroin (SF)—known for their excellent biocompatibility, biodegradability, and biostability. Paclitaxel-Loaded Silk Sericin-Silk Fibroin (PTX-SSSF) nanoparticles, a spherical nano drug carrier system, was successfully developed. And then we demonstrate it in terms of size, zeta potential and stability, etc. Using the Enhanced Permeability and Retention (EPR) effect, the drug was delivered to the cancer site, reducing exposure to normal areas and other organ and increasing therapeutic efficacy. This strategy shows promise in overcoming challenges associated with conventional drug delivery methods.

Acknowledgement : This work was supported by the National Research Foundation of Korea (NRF) (NRF-2022R1-A6A3A13070053).

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Keywords: drug delivery system, ovarian cancer, paclitaxel, silk protein

Development of an embedded system for monitoring upper and lower extremity rehabilitation exercise equipment capable of remote monitoring

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This study developed an embedded system for monitoring upper and lower extremity rehabilitation exercise devices that can be remotely monitored. Due to the rapid aging of society and the increase in the disabled population, the development of various types of exercise equipment for rehabilitation treatment is increasing. Since most rehabilitation devices were developed for functional purposes, it is difficult to collect information on exercise intensity or exercise posture, and for this purpose, additional external equipment is used to measure it. Therefore, in this study, four load cells are attached to measure the force of the rehabilitation device user and the rotation angle is measured using a magnetic encoder. These sensor data can be viewed remotely on a web server, and the data can also be saved for later data analysis.

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Keywords: embedded system, upper and lower extremity rehabilitation exercise equipment, remote monitoring

IP-0011

TiN Nanoring Broadband Absorber for Accelerated PCR Sensor Thermal Cycling

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Polymerase chain reaction (PCR) sensors have become an indispensable tool in the fields of molecular biology and diagnostics. These sensors leverage nucleic acid amplification techniques to detect and quantify specific DNA sequences with exceptional sensitivity and specificity. Their significance in clinical diagnostics lies in their ability to deliver rapid and reliable results. However, one significant drawback of PCR sensors, which have a wide range of applications, is the time-consuming process of thermal cycling, including denaturation, annealing, and extension, which can take several hours to complete [1]. To address this challenge, we propose the use of a TiN nanoring broadband absorber for photothermal heating, which has enabled us to expedite the PCR thermal cycling process. This model overcomes the limitations associated with conventional PCR sensors, thereby actualizing quicker diagnostics. Our proposed model demonstrates an absorption rate exceeding 95% across a broad spectrum of wavelengths. This absorption is achieved through the localized surface plasmon resonance (LSPR) of the nanoring, which enhances absorption at specific wavelengths. For the remaining wavelengths, the TiN layer plays a crucial role in light absorption due to its intrinsic loss [2]. It is expected that fast diagnosis will be possible by accelerating the cycling of PCR sensors through our proposed model.

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Keywords: PCR sensor, Photothermal, TiN nanoring, Broadband absorber

Enhancing Laser Speckle Contrast Image using Meta-Hologram

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Laser Speckle Contrast Imaging (LSCI) is a technique for non-invasive measuring real-time motion of blood flow within the body by analyzing the changes in speckle patterns. However, the randomness of the speckle patterns imposes limitations on the image's resolution and clarity, presenting challenges in analyzing precise biophysical information [1]. In this study, we propose a solution to these issues through the integration of metasurface technology. Metasurfaces are composed of artificially fabricated sub-wavelength nanostructures and exhibit unique optical responses not found in nature, enabling the miniaturization of optical devices and enhanced imaging resolution [2]. Meta-hologram, the application of metasurface, has the capability to intricately control the flow and interaction of light, serving as a potential tool to overcome the inherent resolution and clarity limitations of LSCI. Utilizing the high-resolution reconstruction capabilities of meta holograms, it's possible to generate systematic speckle patterns that mitigate the constraints induced by the randomness of traditional speckle patterns. Furthermore, the structural design of meta-hologram allows for the simultaneous control of multiple wavelengths within a single device, facilitating the acquisition of accurate real-time information at varied depths within biological tissues. This integration of technologies promises significant enhancements in the accuracy and efficiency of diagnostics and research.

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Keywords: LSCI, metasurface, meta-hologram, multiple wavelengths

Development of targeted drug delivery system for effective treatment of pulmonary embolism

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Pulmonary embolism is a dangerous disease in which blood clots block blood vessels in the lungs, and is the third most common cause of cardiovascular death [1]. A treatment method commonly used clinically is the use of thrombolytics. However, because it has a short half-life and needs to be injected in high doses, it can cause serious side effects [2]. In this study, we developed a drug delivery system that reduces the side effects of existing thrombolytics and improves the effective treatment of pulmonary embolism through blood clot-targeted drug delivery. A disk-shaped drug carrier with a diameter of 3 μm was designed using a combination of PLGA-PEI polymer, fucoidan, and drug (rtPA), and its physicochemical properties were analyzed. To verify the targeting effect and therapeutic effect of the drug carrier in an in vitro environment, the platelet targeting effect of the drug carrier was evaluated under static and physiological flow conditions, and the therapeutic effect was evaluated through evaluation of blood clot solubility. Additionally, in order to evaluate the efficacy of the drug delivery system in an in vivo environment, the efficacy was evaluated in an animal model of pulmonary embolism using mice. Therefore, this study presents the possibility of a ‘targeted drug delivery system’ that can reduce the side effects of existing thrombolytics and enable effective drug delivery by targeting pulmonary blood clots and delivering drugs.

Acknowledgement : This work was supported by the National Research Foundation of Korea (NRF) (NRF-2022R1-A6A3A13070053).

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Keywords: Pulmonary embolism, Drug delivery system, Fucoidan, P-selectin, Biodegradable

Production and Performance Study of Radiative Cooling Thermally Conductive Fibers Using Electrospinning

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This study focuses on the fabrication of thermally conductive nanofibers with radiative cooling capabilities. Given the continued rise in global temperatures, there is a growing interest in energy-efficient technologies, particularly radiative cooling. Passive radiative cooling operates on the principle of dissipating heat into outer space through the atmospheric window, effectively cooling objects without consuming energy. [1] In this study, we employed the mass production technique of "electrospinning" to fabricate nanofibers with radiative cooling capabilities. We combined polyvinyl alcohol (PVA) and SiO2 as materials to enhance radiative cooling performance and incorporated nano-diamonds to improve thermal conductivity [2]. Through the electrospinning process, these three materials were successfully combined to produce dual-function nanofibers that serve as radiative coolers and thermal conductors. The radiative cooling performance of these fibers was thoroughly evaluated, revealing excellent solar reflectance and high emissivity within the 8-13 μm, commonly referred to as the atmospheric window. Outdoor temperature measurements confirmed an average cooling effect of 6.2°C compared to the surrounding environment. Notably, the cooling effect was especially significant, reaching up to 9°C between 2 pm and 3:30 pm when temperatures were at their highest during the day. This highlights the practical potential of these fibers for cooling applications.

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Keywords: Radiative Cooling, Electrospinning, Polymer, Nanofiber

IP-0015

Development of Drug Delivery System for Lung Cancer Treatment Using Silk Protein

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Lung cancer presents significant challenges in terms of both high mortality and morbidity rates. Current treatment modalities for lung cancer encompass surgical resection, radiation therapy, and chemotherapy. However, these treatments have limitations in their efficacy and may inflict damage on healthy tissues. Therefore, the development of efficient drug delivery systems is imperative to enhance lung cancer treatment outcomes. Prior studies have indicated that particles with a size of 3μm and a discoid shape tend to accumulate in the lungs[1]. Silk Protein, derived from Bombyx mori silk, has garnered substantial attention due to its biocompatibility and mechanical properties. Silk Protein consists of Silk Sericin (SS) and Silk Fibroin (SF), with SF exhibiting excellent biocompatibility, controlled biodegradability, and low immunogenicity[2]. In this research, we designed docetaxel-loaded SF microparticles with a diameter of 3μm in a discoidal shape. The research methodology involved the extraction of SF from Bombyx mori silk by eliminating impurities and sericin through autoclaving and lithium bromide solution treatment. We administered the docetaxel-loaded SF microparticles to mice with lung cancer and gauged their therapeutic effect by monitoring tumor growth and survival rates.

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Keywords: Drug Delivery System, Lung Cancer, Silk Protein, Silk Fibroin, Microparticle

Basic research on a stimulus embedded system for motor response evaluation of the Glasgow Coma Scale

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The Glasgow Coma Scale, one of the evaluation methods to evaluate and calculate a patient's level of consciousness, is widely used for diagnosing emergency situations and predicting prognosis for a variety of patients. Evaluation items include eye opening, verbal response, and motor response. Among them, motor response is the largest and most important item in evaluating the score. In the motor response evaluation, the medical staff applies painful stimulation to the patient and evaluates the patient's response, and the score is scored using a subjective method by the operator. Therefore, in this study, to overcome these limitations of GCS, we developed a stimulator that helps medical staff provide a quantitative amount of force when stimulating a patient. The stimulator communicates wirelessly using Wifi to increase portability and accessibility, and uses a web socket method where the client and server communicate in two directions. When medical staff presses a patient with a stimulator, the amount of force measured by a load cell can be checked in real time on the web. It is believed that the system developed in this study can overcome the limitations of existing GCS evaluation and help objectify GCS through visual data. In future research, if the intensity of stimulation and response are simultaneously datated in combination with a system that measures the patient's response, it will be possible to provide quantitative indicators for each stage of the GCS score.

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Keywords: GCS, motor response, stimulator, wifi, load cell

IP-0017

Comparative Study of Radiative Cooling Performance of PVA-Based Fibers Additives Utilizing Electrospinning

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Radiative cooling is a cooling method that utilizes the phenomenon that far-infrared regions with wavelengths of 8- 13 μm can be easily emitted into space. Since it is a method of increasing the radiation heat of the relevant wavelength on the surface, there is no need for additional energy for heat dissipation. High solar reflectance and high infrared emissivity are required in the atmospheric transparent window. In this study, PVA/ SiO_2, PVA/ Al_2O_3, and PVA/ SiO_2/ Al_2O_3 films were produced to compare radiative cooling effects.[1] The manufactured film exhibits a very high solar reflectance of over 90% and a high atmospheric window emission of over 95%. Compared to PVA-based fibers with only one of either Al_2O_3 or SiO_2 added, it was observed that the optical properties of the film containing both types of particles were more effective in radiative cooling. [2] The combination of Al_2O_3 and SiO_2 resulted in the formation of a nano-porous structure, leading to better optical properties for radiative cooling. In conclusion, materials such as radiative cooling substances which can provide cooling effects without energy consumption can be used for temperature regulation and cooling in medical devices and patient treatments. Especially in the case of patients with heat-related illnesses, it is expected that these materials can be utilized in treatment equipment to achieve both cooling and therapeutic effects.

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Keywords: Radiative cooling, Electrospinning, Solar reflectance, Infrared emissivity

Investigating Transdermal Absorption Enhancement: Quantifying the Effects of Plasma and Sono Skincare Devices

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The end of the COVID-19 pandemic has led to increased demand for skincare, prompting a focus on devices and technologies aimed at enhancing cosmetic delivery. However, there is still a lack of quantitative analysis for transdermal absorption effects of Plasma and Sono skincare medical devices. In this study, we quantified enhanced transdermal absorption effects of Plasma and Sono devices. In addition, we evaluated which settings and treatment conditions result in a more significant increase in transdermal absorption through Strat-MTM (in-silico), porcine skin model (ex-vivo) experiment. The Sono treatment showed a 10% to 13% increased penetration compared to the control group in the in-silico experiment, and 159% and 184% increase in the ex-vivo experiments. The Plasma treatment revealed increased transdermal absorption effects, with a 1.0% to 2.5% penetration difference in the in-silico experiment, and a 124% increase in the ex-vivo experiment. We also observed a synergistic effect resulting from the combined treatment of Plasma and Sono, as indicated by the highest increases of 197% and 242% in penetration. Furthermore, we confirmed that higher on/off durations (intensity levels) and longer Sono treatments resulted in greater transdermal absorption effects.

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Keywords: Transdermal absorption, Skin care medical device, Cosmetics, Cold plasma, Sonophoresis

IP-0019

Investigating the effect between vasodilating and cognitive impairment in Alzheimer's disease mouse model using SD-OCT

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We demonstrated longitudinal label-free in vivo optical coherence tomography (OCT) imaging in an Alzheimer's disease (AD) mouse model. We conducted the continuous tracking of individual vessels over time (1 year), providing a comprehensive analysis of temporal changes in vasculature and vasodynamics through OCT angiography and Doppler-OCT. The AD group exhibited an exponential decline in both vessel diameter and blood flow changes with the critical timepoint before 20 weeks of age, preceding the cognitive decline observed at 40 weeks of age. Interestingly, arterioles showed a dominant decrease in diameter in the AD group, while this pattern was not observed in blood flow changes. In contrast, three mice groups that underwent early vasodilatory intervention did not show any significant alterations in vascular integrity or cognitive function compared to the wild-type group. Our findings confirm the presence of early vascular alterations and their correlation with cognitive impairment in AD.

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Keywords: Alzheimer's disease, OCT, Cognitive test, Blood flow, vasodynamics

A 3D Microstructure-Based Platform for mRNA Spatial Barcoding

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Transcriptomics analyzes cellular diversity through gene expression levels in cells, using methods like Bulk and Single-cell RNA-seq[1]. While these techniques provide detailed information, they involve cell dissociation, which leads to the loss of important spatial tissue data related to cell interactions. However, most commercial spatial transcriptomics platforms suffer from low mRNA capture efficiency because DNA, which can capture mRNA, binds to the surface of the substrate. To address this issue, we devised a method of attaching barcodes to a 3D structure instead of a flat surface. The microwells on a glass substrate have a diameter of 80 μm and a depth of 40 μm filled with hydrogel which is binding with anchor DNA. Different barcodes are delivered to hydrogel wells through PDMS channels. Using vertical PDMS channels, additional barcodes are flowed, allowing barcode DNA molecules to ligate with each other. The ligation is verified using fluorescent imaging and denaturing PAGE analysis. The captured mRNA, tagged with these barcodes, is sequenced by Next-Generation Sequencing (NGS). Subsequently, a custom R code is used to classify them according to their respective barcodes. This platform, with DNA attached to a hydrogel mesh instead of a flat solid substrate, can accommodate a greater amount of DNA. This platform's analysis is anticipated to yield new biological insight, including findings of significance in oncology and embryology research, among others.

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Keywords: Spatial transcriptomics, Hydrogel, DNA barcoding

IP-0021

In-situ light-directed oligonucleotides synthesis using photocleavable phosphoramidite

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The parallel synthesis of multiple DNA strands is essential across diverse fields, particularly in the domain of DNA-based data storage technology. DNA microarray technology represents one of the advanced methodologies for this purpose, which has been commercialized through inkjet printing-based, electrochemical-based, and light-based methods. Light-based DNA synthesis, in particular, stands out as a robust technology owing to its rapid processing and its ability to significantly enhance resolution. The cycle of light-based DNA synthesis closely mirrors the conventional phosphoramidite method [1], differing primarily in the selective removal of 5′-terminal protecting groups through controlled UV light exposure. In this study, 5′-terminal photolabile protecting groups were selectively removed using controlled UV light exposure. By employing BzNPPOC, a photocleavable phosphoramidite, the optimal UV intensity was determined. A 25-mer poly-T sequence was synthesized by varying durations of UV irradiation. Following the synthesis of the 25-mer poly-T sequence, the efficiency of the synthetic process was assessed by hybridizing it with a Cy3-labeled complementary strand, followed by fluorescence image scanning. This in situ synthesis system, based on light irradiation, enables rapid and precise DNA synthesis.

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Keywords: Light-directed DNA synthesis, In situ microarrays synthesis, DNA data storage, photocleavable phosphoramidite

Oligonucleotide DNA synthesis on substrate using colloidal silica

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Phosphoramidite synthesis is the industry standard for creating DNA sequences. In this method, protecting groups in phosphoramidite monomers are removed through chemical means, thereby exposing a hydroxyl (-OH) group at the 5’ end. This enables coupling to with other incoming phosphoramidite monomers [1]. Column-based phosphoramidite synthesis uses controlled pore glass beads, which increases the surface area where oligonucleotides can couple to. However, column-based synthesis is limited by the fact that it is unable to synthesize different sequences in a parallel manner. Parallel microarray-based synthesis addresses the limitations of column-based DNA. Glass has been a popular choice in microarray-based synthesis due to its favorable optical and chemical properties. Here, we use using colloidal silica (i.e., SNOWTEX) to produce high density DNA microarray substrates. Cleaned microscope glass slides were spin coated with colloidal silica. Then, the glass coated with the colloidal was functionalized with N-(3-triethoxysilylpropyl)-4-hydroxybutyramide. Synthesis on the colloidal silica substrate resulted in increased concentration of DNA.

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Keywords: Phosphoramidite synthesis, DNA microarrays, Glass substrate, Chemical method, Colloidal silica

Fabrication of nanoporous silicon nitride membrane for diffusion-based exosomes separation

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Exosomes have gained increasing attention as biomarkers and therapeutic agents due to their ability to mediate intercellular communication and transport bioactive molecules. However, their small size (~200 nm) poses a challenge for efficient isolation, and the commonly employed methods, including ultracentrifugation (UC), ultrafiltration (UF), and immunoaffinity-based approaches, could induce physical or chemical stress that can potentially alter the biological properties of the isolated exosomes. Thus, there is a growing demand for isolation methods that preserve the biological integrity of exosomes.
In our previous work, we introduced a physical/chemical stress-free exosome separation method based on their diffusion through a polycarbonate (PC) membrane. Although we successfully separated exosomes from human serum using this method, it was time-consuming (12 hours). This was attributed to the high thickness (15 μm) and low porosity (5.6%) of the PC membrane. To overcome these limitations, we developed a silicon nitride membrane with low thickness (300 nm) and high porosity (~38%). Using this membrane, we were able to separate exosomes from human serum within 3 hours. The isolated exosomes were analyzed by nanoparticle tracking analysis (NTA), western blotting, and transmission electron microscopy (TEM). The recovery rate obtained from the NTA data was 90.8%, and TEM confirmed that intact exosomes were successfully isolated without physical or chemical stress.

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Keywords: Exosome separation, silicon nitride membrane, nanopore

Automated *In situ* Inkjet Oligonucleotide Synthesizer for DNA Microarray Fabrication

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DNA synthesis technology is witnessing increased demand across various research applications, including vaccines, drug delivery devices, and data storage. Despite its increasing prominence, the synthesis of DNA strands exceeding 200 base pairs poses a formidable challenge due to the notable reduction in elongation coupling efficiency, which may plummet to as low as 13% [1]. Several methods have been reported as viable means to address the challenge of synthesizing lengthier DNA molecules, among them the utilization of DNA assembly technology that hinges on assembling short oligonucleotide fragments [2]. However, to synthesize a number of oligonucleotides in parallel, it is essential to develop a technology that can increase the throughput of oligonucleotide synthesis. In response to this need, we have developed an automated system capable of high-throughput oligonucleotide synthesis using an inkjet printing system. This system achieves *In situ* oligonucleotide synthesis functionality by synchronizing with the supervisor PC, reagent solution delivery system and the motion controller. We confirmed the successful synthesis of an oligo-dT 25mer through hybridization with complementary DNA labeled with Cy3. The synthesis of a circular pattern with a diameter of 60 μm was verified using a microarray scanner. These results demonstrate the efficacy of our automated system for high-throughput oligonucleotide synthesis.

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Keywords: DNA Synthesis, Oligonucleotide Microarray Chip, Inkjet Printer, Automation System

Generation of Synthetic CT(sCT) Images from MRI Images Using Cycle-Consistent GAN

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Image registration is the process of aligning two or more images to a common coordinates system. Recent deep learning-based image registration methods rely on predicting deep similarity metrics based on pre-aligned pairs of multi-modal images. However, this approach is iterative and slow. It's also challenging because ground truth for multi-modality images is often not available, and most similarity metrics are designed for single-modality registration. To overcome these limitations, we developed a method to transform multi-modal images into a single-modality using cycle-consistent GAN making image registration more feasible. This system consists of two main networks: a generator and a discriminator. The generator creates fake data based on input data and is constructed based on U-Net architecture. The discriminator distinguishes between the fake data and generated by the generator and real data, serving as a simple classifier; true or false. We trained this system using 1,700 pairs of MR and CT images. For the generation network, MRI-to-CT generation achieved a mean-square-error (MSE) of less than 21.9, mean-absolute-error (MAE) of less than 33.2, and peak-to-signal-ratio (PSNR) of less than 40. As a result, we've successfully generated synthetic images using cycle-GAN and transformed muti-modality images into single-modality images. In future research, we will optimize each network to achieve better results and attempt the registration of multi-modality images.

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Keywords: Generative AI, Image registration, Synthetic image, Cycle-GAN, U-Net

IP-0026

Huntingtin Exon 1 Mimic-Enveloped Plasmonic Nanoparticles for Huntingtin Aggregates-Degrading Drug Screening

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Huntington's disease (HD) is an autosomal dominant neurodegenerative disease characterized by involuntary movements, cognitive decline, and movement disorders. It affects 4-10 per 100,000 people worldwide and result in death 20-30 years after onset. HD is caused by an extension of the polyglutamine (polyQ) domain of the huntingtin protein, which induces the amyloidogenic behavior of the huntingtin exon 1 (HTTex1) protein fragment. HTTex1 protein fragments with extended polyQ are known to cause neuronal cell damage by forming amyloid-like aggregates that inhibit the expression of essential neurotrophins such as brain-derived neurotrophic factor (BDNF) in the nucleus of cells, but the detailed mechanism is unknown. Existing drugs, such as tetrabenazine, only relieve symptoms but cannot cure HD because they cannot remove HTTex1 aggregates. Here, we propose HTTex1 mimic-enveloped plasmonic nanoparticles (HEMEP) as a HTTex1 aggregate-degrading drug screening platform for the discovery of novel HD treatments. To confirm the capability of the HEMEP as a drug screening platform, we treat HTTex1-degrading proteases (protease XIV) and subsequently EPPS, reported as an Aβ-degrading chemical, to verify that the HEMEP selectively responds only to drugs that degrade HTTex1 protein. We propose that the HEMEP-based drug screening platform has the power to find novel HD curative drugs.

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Keywords: Polyglutamine, Huntington’s Disease, Huntingtin, Plasmonic Nanoparticle, Drug Screening

Cell membrane bicelle based biomimetic detection of SARS-CoV-2

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Recent struggle with coronavirus 2019 has emphases the need for rapid and accurate detection of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). Here, we introduce a novel approach in the development of biosensor for SARS-CoV-2 detection using Indium Tin Oxide (ITO) electrode and electrochemical impedance spectroscopy (EIS). S1 subunit of Spike protein on virus surface binds to angiotensin-converting enzyme 2 (ACE2) receptor on lung cell surface[1]. This specific binding makes SARS-CoV-2 to enters human body. Immobilization of ACE2 receptor overexpressing A549 cell membrane onto ITO electrode surface allows specific binding interactions with S1 subunit of SARS-CoV-2. The introduced sensor utilize remarkable properties of cell membrane such as their ability to biomimetic process of the endocytosis of virus and interact with viral proteins. To overcome inconsistency of conventional cell membrane based electrochemical sensor, we manufactured the cell membrane bicelle which enable uniform cell membrane layer on working electrode. In addition, cell membrane bicelle is made up of short chain, DHPC and long chain, A549 cell membrane. Therefore, the newly introduced ITO sensor coated with cell membrane bicelles, enabling rapid point-of-care detection, demonstrates significant potential in aiding the worldwide response to the COVID-19 pandemic and in preparing for potential future viral outbreaks.

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Keywords: SARS-CoV-2, electrochemical sensor, cell membrane, biomimetic

Development of cell-membrane-coated electrochemical sensor for CA-125 monitoring

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Cancer antigen 125 (CA-125) is a well-known biomarker of ovarian cancer that binds to mesothelin on the mesothelial cell membrane. CA-125 is a significant biomarker for ovarian cancer staging and monitoring, not just for diagnosis. Many researchers have attempted to develop a point-of-care biosensor for detecting CA-125 in blood samples, which is primarily used as a tumor marker test for ovarian cancer treatment prognosis observation. In a previous report, we introduced an electrochemical sensor that utilizes the cell membrane to detect molecules that are bound to specific membrane proteins [1]. On the same principle, we coat the mesothelial cell membrane on the screen-printed electrode (SPE) to induce a specific bind between CA-125 and mesothelin. Our product is more cost-effective than existing blood tests [2] and is based on an electrochemical sensor, ensuring stability, high selectivity, and sensitivity. This makes it more useful for point-of-care monitoring for ovarian cancer.

Acknowledgment: This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korean Government (MSIP) (NRF-2022R1A6A3A13072828, and NRF-2022R1A2C1091756), and BK21 Four Institute of Precision Public Health.

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Keywords: CA-125, Cell membrane, supported lipid bilayer

IP-0029

Tau amyloid corona-based drug screening platform for tau oligomer-degrading drugs

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The pathological hallmark of neurodegenerative diseases, such as Alzheimer's disease (AD) and tauopathies, is the production of tau tangles by oligomerization. Thus, such oligomers that initiate entanglement and have cytotoxicity are promising targets for drug development. However, difficulties in purifying tau oligomers and limited screening platforms make drug discovery challenging against tau oligomers. Herein, we suggest the drug screening platform for tau oligomers based on tau amyloid corona-shelled nanoparticles (TACON). The strategy of our platform is to monitor the ability of the drugs to degrade tau oligomers through the colorimetric response of TACON solutions. The TACON-based screening platform's ability to sort out tau oligomer degrading agents is verified by testing with some proteases (protease XIV and plasmin) and small molecules (EGCG, 1, 4-Naphthoquinone, rosmarinic acid, and fulvic acid). We have concluded that our screening platform has a great deal of potential for finding therapeutics that target tau oligomers and assisting to develop therapeutics for tau-related neurodegenerative diseases.

Acknowledgement : This work was supported by the National Research Foundation of Korea (NRF) Grant funded by the Korean Government (MSIP) (NRF-2022R1A2C1091756). This study was also supported by the BK21 Four Institute of Precision Public Health.

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Keywords: Alzheimer's disease, Drug screening, Tau oligomer, Plasmonic Nanoparticle

IP-0030

Fabrication of BMP-2 and OPG-Fc encapsulating scaffold for enhancing bone regeneration

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Aging populations worldwide face escalating concerns related to osteopenia, osteoporosis, and bone fractures. Traditional treatments of bone defect caused from trauma and fracture entail challenges related to treatment methods involving bioactive molecules and biomaterials to improve bone regeneration outcomes. Notably, the burst release of bioactive molecules can incur negative side effects. In this study, we introduce COHAS, a collagen-hydroxyapatite scaffold, designed for the sequential delivery of Bone Morphogenetic Protein-2 (BMP-2) and Osteoprotegerin-Fc (OPG-Fc). This tandem of BMP-2, stimulating osteoblasts, and OPG-Fc, inhibiting osteoclasts, synergistically promotes new bone formation. Specifically, OPG-Fc is released with temporal precision through poly D L-lactide-co-glycolide (PLGA) microspheres. Bioactive agents co-loaded in COHAS shows excellent cell viability and enhanced bone regeneration capacity in vitro. Furthermore, in vivo assessments utilizing a critical bone defect model have unequivocally underscored the remarkable efficacy of new bone formation and the commendable biocompatibility of COHAS. These findings can offer significant insights into a promising approach of sequential releasing multiple drug scaffold for bone regeneration.

Acknowledgement : This study was supported by the BK21 FOUR (Fostering Outstanding Universities for Research).

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Keywords: Bone regeneration, osteoporosis, scaffold, BMP-2, OPG-Fc

DT-Net: A novel convolutional neural network architecture specialized for diffusion tensor images in predicting Alzheimer's disease

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Convolutional neural networks (CNNs) using 3D magnetic resonance (MR) images have been applied to predicting Alzheimer's disease (AD). While CNNs capture overall brain anatomy from structural MR images, their utilization with diffusion-weighted MR images detects the diffusion properties of water molecules within brain tissue, typically represented as diffusion ellipsoid or diffusion tensors (DTs). However, CNNs are not directly compatible with DTs because elements in DTs are interdependent and must form real symmetric positive definite matrices, which are crucial for constructing the diffusion ellipsoid. In this study, we propose a novel CNN architecture designed for 3D DT images, DT-Net, which preserves the essential characteristics of diffusion ellipsoids throughout consecutive convolutions. We first transformed DTs into pure quaternions by considering three eigenvectors of a DT as rotated standard bases in 3D Cartesian coordinates. We then devised a convolution operation using quaternion filters, including parameters for scaling and rotation of the pure quaternions, while the rotation axes were fixed across all voxels. We evaluate our approach on 3D synthetic tensors and the Alzheimer's Disease Neuroimaging Initiative dataset through 5-fold cross validation. The results demonstrate superior performance, showing the effectiveness of DT-Net by integrating neighboring diffusion ellipsoids based on rotation in addition to scaling in conventional convolution.

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Keywords: Diffusion tensor magnetic resonance images, Deep learning, Three-dimensional convolutional neural networks, Alzheimer's Disease prediction, Quaternion

Optimization of Plate Geometry for Sensitive Measurement of Fringe-Field Capacitive Senor

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Implantable electronic devices are playing an increasing role in the biomedical field, enabling novel and improved approaches to diagnose, treat, and monitor diseases and conditions. Despite their advantages in medical use, these implants have the potential of introducing the risk of Health-associated Infections (HAIs). This major contributor to unplanned in-hospital deaths prevails especially when devices are connected externally, leaving an opening to surroundings.[1] Therefore, measures have been taken to dissolve the device inside the biological environments and to apply and receive signals remotely, outside the human body. [2] To ensure the dissolution and secure the function of device simultaneously, achieving high functionality within limited dimension, so as to be minimally invasive, remains imperative at this juncture. This study proposes optimization of design to promote sensitivity of a fringe-field capacitive sensor while occupying the same area. This design accomplishes efficiency and safety without compromising size, marking a promising direction for enhanced functionality of a fringe-field capacitive sensor in biological context.

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Keywords: Implantable electronic device, biodegradable, minimally invasive, fringe-field capacitive sensor.

Wireless Muscle Monitoring Device for Rehabilitation Exercise Assistance

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Rehabilitation exercises serve as a critical therapeutic approach in restoring motor function subsequent to fractures, ligament injuries, and nerve damage. Nevertheless, executing these exercises effectively without expert supervision can be challenging. Moreover, incorrect rehabilitation exercises may decelerate the recovery process and potentially lead to secondary injuries.
Surface electromyography (sEMG), which measures electrical signals produced by muscle contractions via the skin surface, provides an indispensable measure of muscle activation levels. In this research, we propose a wireless sEMG monitoring device designed to assist in performing proper rehabilitation exercises.
This device is specifically designed to differentiate between muscles that should be activated versus those that should remain inactive during particular rehabilitation exercises. Additionally, it examines the order of muscle engagement with the aim of monitoring and ensuring appropriate muscle activation consistent with each exercise's therapeutic objectives.
The development of this muscle monitoring device is a attempt to improve the effectiveness of rehabilitation by aiding patients in need of motor function recovery in performing their prescribed exercises accurately.

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References

Keywords: Wireless, Surface Electromyography, Rehabilitation Exercise

Long-Term Biocompatibility of Biodegradable Sensors for Intracranial Pressure Measurement: Clinical Implications

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Brain diseases remain a significant cause of global morbidity and mortality, with stroke accounting for 162,890 deaths in 2021[1]. The measurement of Intracranial Pressure (ICP) via implantable sensors is a critical diagnostic tool. However, these implants carry the risk of Health-associated Infections (HAIs), which are a major cause of unplanned in-hospital deaths, particularly when devices are implanted in the body[2]. This study assessed the long-term (1-6 months) biocompatibility of a biodegradable sensor for ICP measurement in an environment mimicking clinical conditions. Our findings advance the development of biodegradable sensors by confirming their long-term biocompatibility in relevant clinical scenarios.

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Keywords: Biodegradable sensor, Biocompatibility, Intracranial pressure sensor

3D Printing Of ZnO/silica Ceramic Resin Composite With Antimicrobial Effect Using 3D Printing Techcique

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In the dental crown or bridge, the permanent implants are manufactured using CAD/CAM process or 3D printing. however, the manufacturing time for permanent implant takes a long process time. The temporary crown is applied to prevent damage and structural changes of tooth tissue and ensure the manufacturing time. In the long-term application, temporary crowns and bridges should be not broken until permanent implants are fabricated. So, the temporary implants should possess high mechanical properties to resist fracture. The photocurable resin with only acrylate monomer has low mechanical properties. To solve this problem, the filler such as carbon fiber, metal or inorganic filler is added to the resin composite. the incorporation of inorganic fillers can enhance the mechanical properties of resin composite. but cured resin with high content of pure inorganic filler has low organic-inorganic adhesion, so resulting in a decrease of mechanical strength. however, the silane treated inorganic filler has higher organic-inorganic adhesion than pure inorganic filler because of silane organic surface. In the oral cavity, the temporary crown is exposed to the saliva composed of bacteria and protein, which can result in demineralization or secondary caries. So, the dental temporary implants need to resist bacteria and protein adhesion. The metal oxide based antibacterial agents can be applied to solve the above problems. The reactive oxygen species (ROS) or metal ion, which is produced from the metal agents, directly attack bacteria [1]. I herein demonstrate 3D printing of acrylate resin composite incorporated ZnO/SiO2 and MPC using 3D printing technique.

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Keywords: Antimicrobial, metal oxide, photocurable resin, 3D printing, dental resin

Manufacturing and Characterization of Dental Crowns Made of 5-mol% partially stabilized zirconia (5Y-PSZ) by Digital Light Processing

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Bio-ceramics such as alumina, calcium phosphate, and zirconia have been employed in medical and dental industry due to their distinctive characteristics. Especially for artificial crowns in dental applications, crowns made of yttria stabilized zirconia have exhibited extraordinary mechanical performances and esthetic satisfaction compared to those made of traditional materials such as gold and porcelain [1]. In view of that, various methods to manufacture zirconia crowns have been developed including computer-aided design/ computer-aided manufacturing (CAD/CAM) and vat polymerization like stereolithography (SLA) or digital light processing (DLP). In particular, a tape-casting based DLP is appropriate for relatively high solid loading suspensions which are rarely utilized by conventional DLP. In this paper, we herein carefully optimized processing parameters for tape-casting based DLP process to manufacture 5Y-PSZ dental crowns with desired mechanical properties, optical translucency, and dimensional accuracies. The use of a high solid loading of 50 vol% in 5Y-PSZ suspensions allowed sintered 5Y-PSZ to have high relative densities (98.93 ± 0.39 %), thus offering high flexural strength (625.4 ± 75.5 MPa) and optical transmittance (35 ± 1.2). In addition, high dimensional accuracy (RMS for marginal discrepancy = 44.4 ± 10.8 μm and RMS for internal gap = 22.8 ± 1.6 μm) was achieved by precisely designing initial dimensions of dental crowns and photocuring time for 3D printing.

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Keywords: 3D printing, digital light processing, zirconia, dental crowns, strength

IP-0037

Synthesis of Porous Hydroxyapatite Microspheres by Photocuring of Emulsions containing Terpene crystals

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Camphene is one of the most widely used as pore-forming agents for freeze-casting of porous ceramics, which solidified camphene crystals can be sublimated, leaving pores in ceramic objects [1]. However, there was a limitation to the previous methods that microspheres synthesized using only camphene were fragile to maintain their shapes and did not show dendritic growths enough when observed by scanning electron microscopy. Therefore, we employed camphene-camphor alloys together as porogens, since the solidification temperature of slurry is increased by adding camphor compared to the slurry with camphene alone, thus an increase in solidification rate is followed when frozen at the same temperature. In addition, adding camphor showed higher rigidity after freezing, making it easier to retain spherical shape [2]. As a ceramic material, hydroxyapatite (HA) with good biocompatibility and biodegradability is used to fabricate porous microspheres. Experimental procudure is conducted by following steps: slurry preparation, emulsion method, freezing, photocuring, ultrasonic-cleaning, freeze-drying. A number of elongated pores were observed inside green bodies, which are the typical feature of dendritic growth of the camphene-camphor alloys during freezing. The fraction and size of pores could be tailored by adjusting terpene contents in HA slurries. Microspheres after heat-treatment can be used for biomedical purposes such as bone grafting, bone fillers or drug delivery carriers.

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Keywords: Emulsions, Freezing vehicle, Photopolymerization, Porous microsphere

IP-0038

Fabrication of functionally graded multi-ceramic structure using digital light processing (DLP) 3D printing technique with passive in-line mixing concept

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To fabricate multi-ceramic material structure in a gradient manner based on the digital light processing (DLP) principle, a novel 3D printing technique with passive mixing system was developed. 4-mol% and 5-mol% yttria partially stabilized zirconia (PSZ) materials were used to additively manufacture functionally graded material (FGM) ceramic parts. With in-line mixing concept using static mixer being adopted to DLP 3D printing technique, FGM structure was created with using two different ceramic suspensions. In the process, the extrusion ratio of both suspensions are controlled, which flows through a static mixer attached onto custom-built DLP 3D printer. After extrusion, layers of suspensions are solidified in a functionally graded manner at stacking direction, hence, compositionally graded zirconia products are fabricated [1]. Besides to the printing technique, two highly-loaded suspensions with 50 vol% were prepared to obtain similar viscosity and curing behavior by powder modification and suspension optimization. Furthermore, to fully prove the gradient within a single printed body, comprehensive mechanical, optical and microstructural analysis were performed to demonstrate controlled compositional change according to the initial design.

Acknowledgement : This research was supported by the Technology Innovation Program (Contract No. 20001155, Development of highly Transluscent/Tough Ceramic Materials and Manufacturing Technique for Tailor-made Crown) funded by the Ministry of Trade, industry & Energy (MI, Korea), and BK21 FOUR (BrainKorea21 Fostering Outstanding Universities for Research) funded by the Ministry of education and National Research Foundation of Korea (NRF)

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Keywords: Functionally graded materials, Zirconia, Additive manufacturing, Digital light processing

IP-0039

Ceramic 3D printing of arranged dense and porous microstructures

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Delicately combined dense and porous microstructures can realize advanced features. However, there is lack of 3D printing techniques that can achieve them, especially in the case of ceramic materials. So, herein, we introduce novel digital light processing (DLP) ceramic 3D printing technique for locally controllable dense and porous microstructures. Complex macrostructures of ceramics in which dense and porous microstructures are delicately positioned could be manufactured. Crystallization from camphene/photopolymer solution was employed to form homogeneous phase at room temperature (25°C) and thermally induce phase separation at moderately low temperature (e.g., 10°C). In the printing process, selective photopolymerization of layered ceramic slurry was performed twice for each printing layer w/ and w/o the phase separation of camphene. Alumina (Al_2O_3) was used as model ceramic and was able to substituted with other bio-ceramic materials such as hydroxyapatite (HA) for customized bioactive bone scaffolds.

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Keywords: Microstructures, 3D printing, ceramics

Guided cold atmospheric plasma surface treatment technology for selective erasing surface functional groups on biomaterials

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Cold atmospheric plasma has been mainly used in clinical settings to modify surfaces in an entire area of surgical instruments or biomaterials. Recently, it has been utilized in various forms, such as selectively treating areas with plasma using pipette or pen-type devices to increase treatment efficiency for the desired area or impart functionality to localized surface areas of biomaterials [1]. However, this selective area plasma treatment technology has limitations in forming clear boundaries of surface treatment area and limiting treatment areas. To address this, there is a growing trend in developing technologies that enhance the ability to restrict the region of plasma surface treatment using additional devices such as masks and electrical grounding systems [1]. This approach of adding a supplementary device to enhance the boundary formation of the surface treatment area and the ability to limit the treatment area has limitations in terms of convenience, price, time, device usage, applicability, and the restriction in the range of applications. In this regard, this study proposes a new method by utilizing newly developed plasma guide tips to control only the flow of plasma gas, forming clear plasma surface treatment boundary areas, enhancing the ability to limit treatment areas, and allowing the formation and removal of functional groups in specific surface areas. The plasma guide tips used in this study were designed to ventilate the plasma gas emitted from the discharge port of the cold atmospheric plasma pipette device. Through indicator sheets that change color due to radicals and ions in the plasma, it was confirmed that a clear plasma surface treatment boundary area was formed, and the ability to limit the treatment area was enhanced. To identify the controllability of the surface functional group, the entire surface area of polystyrene was treated using a Dielectric Barrier Discharge (DBD) driven low-pressure oxygen plasma. Primary amine groups were induced through silane treatment. Using fluorescein isothiocyanate (FITC) that selectively binds to primary amine, it was confirmed that the functional group could be removed in a limited surface area by the cold atmospheric plasma equipped with the plasma guide tip capable of ventilating plasma gas.

Acknowledgment: This work was supported by the BK-21 FOUR program through the National Research Foundation of Korea (NRF) under the Ministry of Education.

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Keywords: Surface treatment, Plasma, Guide tips, gas flow control, biomaterials

IP-0041

Constructing a cardiac cycle synchronized low-frequency electrical stimulation system to improve blood flow

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Thrombosis is a disease in which blood clots and blocks blood vessels and can occur throughout the body. It occurs due to factors such as reduced blood flow and damage to blood vessels, and is more likely to develop in individuals who cannot move for a long time, such as the elderly or patients with limited mobility.[1] Blood clots often form in the veins of the legs where blood flows back up. If a blood clot moves along the blood and blocks another blood vessel, it can lead to an embolism, which has a high fatality rate. Intermittent pneumatic compression and neuromuscular electrical stimulation are used to prevent and improve thrombosis.[2] Intermittent air compression is a method of improving blood flow by sequentially compressing from the toes by wearing an inflatable sleeve. As the use time increases, the efficiency may decrease due to reduced swelling and sweating. The electrical stimulation method improves blood flow by providing electrical stimulation to the muscles near the veins. Results show that this method is more effective than the air compression method. Therefore, we focused on configuring a system that can improve blood flow by synchronizing the electrical stimulation cycle with the heart rate cycle. We confirmed the correlation between the R wave of an ECG and heart rate. Additionally, we conducted research on voltage and stimulation cycle using existing low-frequency stimulation devices in order to construct and verify a system that can simplify the device.

Acknowledgement : This research was supported by “Regional Innovation Strategy (RIS)” through the National Research Foundation of Korea(NRF) funded by the Ministry of Education(MOE) in 2023 (2022RIS-005)

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Keywords: Cardiac cycle, Thrombosis, Electrical stimulation, Low-frequency, Blood flow

Design of bicycle saddle geometry for ideal pudendal blood flow

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In these days, because of the prevalent and undesirable diet, interest of health care and disease such as obesity is increased. Therefore there are many people who used to ride the bicycle and belong to bicycle club. Riding bicycle, however, there would be problem related to saddle. By the pressure with weight on saddle, blood vessel nearby hipbone would get stress and diameter of vessel can be decreased. Because of the less diameter of blood vessel, velocity of blood vessel is incresed thereby shear stress is increased as we can see from Hagen-Poiseuille equation. This increased shear stress cause pressure drop and reduced flow rate thus it would be bad to transport of nutrition and oxygen with blood flow. In addition because blood vessel nearby hip bone is close to genital area, urological problem can be caused. There were multiple researches related to bicycle saddle but they investigated blood vessel related things in indirect way such as observation of pressure distribution or FEM(Finite Element Method). Although there were several researches with in vivo measurement but they only pointed out problem of saddle, They didn’t suggest solution. So in the present study, we suggest idealized geometry of bicycle saddle to improve blood flow and prove it by using in-vitro measurements

Acknowledgement : Department of Smart Health Science and Technology

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Keywords: Bicycle saddle, MRI, Hemodynamics

Deep Learning for Tumor Marker Misidentification Error Detection: inter-center model performance comparison

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Accurate tumor marker testing is crucial for cancer diagnosis and treatment. However, preanalytical errors, such as sample misidentification, can occur during the laboratory tests process. While the delta check method has been used to detect such errors, it is still difficult to implement their own delta check method except in large hospitals [1]. This study aim to develop deep neural network (DNN) model to detect sample detect misidentification error and to validate compared with conventional delta check method such as DPC and absDPC [2]. We collected clinical laboratory tests data from Asan Medical Center, Haeundae Paik Hospital, Pusan National University Hospital, and Ilsan Paik Hospital, including 181,211, 26,082, 27,064, and 7,338 previous and current paired results of AFP tumor markers, respectively. DNN models and conventional delta check models were developed for each hospital, and DNN models were trained with a development dataset simulated with 1% of misidentification error rate. All developed models were evaluated using independently simulated dataset with 1% of random sample misidentification error, and average detection performance was calculated by 100 times of repetitions. As a result, the DNN models developed for each hospital demonstrated superior performance with accuracies of 0.820, 0.713, 0.788, and 0.806, respectively, compared to the conventional delta check methods; DPC (0.779, 0.691, 0.741, 0.759), absDPC (0.758, 0.665, 0.739, 0.758).

Acknowledgement: This research was supported by the Korea Medical Device Development Fund grant funded by the Korea government (RS-2022-00141473), and the Asan Institute for Life Sciences, Asan Medical Center (2023IP0039-1), all in the South Korea.

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Keywords: Clinical Laboratory Tests, Deep Learning, Deep Neural Network, Delta Check, Tumor marker, Sample Misidentification Error Detection

Development of an Emotional State Prediction Model Using Acceleration Signal, Heart rate, Electrodermal Activity, and Emotional Questionnaires

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The recognition of emotions remains a topic of most importance, and there is rapid growth in research dedicated to predicting emotional states using various sensors [1]. In this study, we developed a model to predict emotional states using data from a 3-axis accelerometer, heart rate, electrodermal activity, and emotional questionnaire scores. A total of 26 subjects was used in this study. Features for the model included the mean, SD, variance, max frequency, skewness, kurtosis, mean frequency, entropy of the SVM (signal vector magnitude), Root Mean Square, peak-to-peak values from the 3-axis accelerometer data, heart rate, and EDA(electrodermal activity) values. The emotional questionnaire scores were bifurcated into two categories: emotion positive and tension, with scores ranging from 1 to 7. The emotion positive survey scores were designated as the label data for predicting emotional states, and based on the median, they were categorized into two groups (positive and negative). The data was split with a 7:3 ratio for training and testing, and the validation dataset constituted 25% of the training dataset. A RandomForest model was used, with hyperparameter tuning conducted via the GridSearchCV method. Consequently, the proposed model performance was observed to be 0.87 (AUC). Based on the model's feature importance calculations, EDA (0.0796), HR(heart rate) (0.0702), and the mean value of SVM (0.0738) emerged as the most influential factors in order of significance. These results indicate that EDA and HR play a crucial role in emotion prediction, aligning with findings from previous research.

Acknowledgement: This study was supported by a grant (2023IP0133-1) from the Asan Institute for Life Sciences, Asan Medical Center, Seoul, Korea. This work was supported by the Korea Medical Device Development Fund grant funded by the Korea government (the Ministry of Science and ICT, the Ministry of Trade, Industry and Energy, the Ministry of Health & Welfare, the Ministry of Food and Drug Safety), Republic of Korea (No. RS-2022-00141473).

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Keywords: Emotional state prediction, RandomForest, Accelerometer

VR-Enabled SSVEP: Expanding Brain-Computer Interfaces with Virtual Reality

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In this work, we implemented an immersive Brain-Computer Interface (BCI) using a Virtual Reality Head-Mounted Display (VRHMD) to elicit Steady-State Visual Evoked Potential (SSVEP) responses [1]. The study involved EEG data acquisition from four healthy subjects during SSVEP stimulation using a 3D virtual keypad, with 12 different stimulus frequencies presented in a 3x4 matrix [2]. In the SSVEP reaction experiment, EEG data were collected with 32 channels and sampled at a rate of 256 Hz. However, only 3 electrodes (O1, O2, Oz) were necessary for the analysis. Employing canonical correlation analysis (CCA) and Frequency-Based CCA (FBCCA) in conjunction with linear machine learning models, we achieved rapid data processing and classification. We utilized the output vectors from CCA and FBCCA as features in our classifiers. In addition, to ensure an unbiased evaluation of our models, we employed a Leave-One-Out cross-validation approach. Notably, our results demonstrated remarkable accuracy, with classifications ranging from 93% to 100% for 5-second recordings encompassing 12 different classes across the four subjects. Future research focuses on conducting extensive human studies to develop applications that empower individuals with severe motor impairments. These applications aim to enhance their lives by enabling device control, communication, internet access, and immersive experiences in Virtual Reality.

Acknowledgement: This research was supported by Chonnam National University (Grant number: 2023-0807-01) and by a grant from the Ministry of Food and Drug Safety in 2023 (RS-2023-00215716).

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Keywords: Brain-Computer Interface, Virtual Reality, Steady-State Visual Evoked Potential (SSVEP)

Histological Analysis of Regions Affected by IRE in Porcine Liver Using Monopolar Electrodes

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IRE (Irreversible Electroporation) is a technique known for its advantage in being applicable to tissues adjacent to blood vessels and nerves, making it suitable for percutaneous tumor ablation. We observed histological changes in normal liver tissue of miniature pigs caused by IRE after monophasic square pulse delivery. A pair of monopolar needle electrodes (19-G) were inserted into the hepatic lobe. The IRE parameters were 1,500 V/cm, 0.1 ms pulse duration, and 90 pulses. H&E and TUNEL-stained liver tissues revealed hepatic sinusoid dilatation, infiltration of blood cells into the widened sinusoids, and intact preservation of vascular structures (bile ducts, hepatic arteries). The above results demonstrate that our IRE parameters have the potential for effective tumor ablation while preserving delicate structures such as blood vessels.

Acknowledgement : This work was supported by the Basic Science Research Program and the Bio & Medical Technology Development Program of the National Research Foundation (NRF) funded by the Korean government (MOE and MSIT); RS-2023-00208587, 2021H1D3A2A02045561, 2018R1A6A1A03025523.

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[2] Dai Z, Wang Z, Lei K, et al. *Cancer Lett 2021*, 503: 1-10 (2021)

Keywords: IRE (Irreversible Electroporation), Tumor ablation

IP-0047

The Effect of Number of Layers on chiroptical response of crescent chiral Metasurface

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This study investigates the effect of layer numbers on the chiroptical response of multi-layered crescent chiral metasurfaces. Chiral metasurfaces, which are made up of subwavelength chiral nanostructures, have fascinating optical features such as circular dichroism (CD) and optical rotation. While single-layer crescent chiral metasurfaces have extraordinary chiroptical properties, multi-layered configurations in metamaterials remain an unexplored realm. The goal of the research is to figure out how the number of layers affects chiroptical properties, with a focus on CD. To do this, the nanostructures was simulated using COMSOL Multiphysics. The results show a clear relationship between the number of layers and the chiroptical response. CD values improved noticeably as the number of layers grew from 2 to 3, ranging from 0.6 to 0.8 for various configurations. The tunability afforded by varying layer count offers up interesting new possibilities for building metasurfaces. Furthermore, experimenting with different materials and shapes for these metasurfaces provides chances to fine-tune their optical properties. This work contributes to advancing the field of metamaterials and nanophononics, offering insights into designing metasurfaces for diverse practical applications.

Acknowledgement : This research was supported by 'Regional Innovation Strategy (RIS)' through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (MOE) in 2023(2022RIS-005).

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Keywords: Chiroptical response, circular dichroism (CD), chiral metasurface

IP-0048

New Electrode Positions in ECG for Assessing Autonomic Activity using Frequency Domain Measures

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ECG is widely used for monitoring autonomic activity, typically using lead II configuration [1]. However, there is recent interest in alternative electrode positions for improved sensitivity and reliability. In a study involving 16 subjects (mean age: 29.5±5.13; weight: 71.19±16.30 and height: 166.93±11.31) in supine state, new positions (nape, left wrist, and right leg) were compared to lead II in two 10-minute sessions, using BIOPAC MP150. We aimed to investigate frequency domain measures (LF, HF, LF/HF ratio) and heart rate (HR) over 2-minute intervals. Fifteen subjects consistently showed decreasing HR over time for both positions. The new position exhibited lower HR (-2.42BPM). Also, decreasing LF (9.27x10-5ms-1) and LF/HF ratio (5.61x10-1) trends were observed, while HF (11x10-4ms-1) increased, suggesting increased parasympathetic dominance. This indicates that the new position may be advantageous in assessing autonomic activity, especially in anxiety or stress-related disorders and improving diagnostic accuracy in conditions like arrhythmias. It is important however to note that, one outlier was detected; necessitating further investigation due to potential technical errors or physiological differences. Our study suggests promise in the new electrode position with lower HR and enhanced parasympathetic influence. Individual differences and precise electrode placement are crucial. Further research is needed to validate these findings and explore practical applications.

Acknowledgement : This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (No.RS-2023-00221762).

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Keywords: Autonomic activity, electrode position, HR, Frequency Domain (LF, HF, LF/HF ratio)

Fucoidan-Sericin Conjugates: AI Guided Design and Wet Lab Evaluation for Precise Breast Cancer Cell Targeting

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We have capitalized on the distinctive qualities of two extraordinary biomaterials, fucoidan and sericin, in our endeavor to enhance the efficacy of targeted cancer treatment. By affecting the PI3K/AKT signaling pathway, which induces apoptosis, fucoidan has demonstrated promising results in slowing the growth of particular breast cancer cells like MDA-MB-231. However, Sericin has demonstrated comparable effects on many breast cancer cell types, including MCF, also via the PI3K/AKT pathway. Additionally, the capacity of fucoidan to control autophagy aids in lowering cell proliferation. For improving the accuracy and efficacy of targeted cancer treatment delivery we combine Fucoidan with Sericin and applying conjugation techniques. But the Anti-cancer drug design has been acknowledged as a complicated, expensive, time-consuming, and challenging task. In this study, we used molecular docking system to target the binding area for our materials. After finding the target area we decided to make the nanoparticles with our materials to release the drug in the target area for better efficacy and low toxicity.

Acknowledgement: This work was supported by the National Research Foundation of Korea (NRF) (NRF-2020R1A2C3010322).

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Keywords: fucoidan, sericin, breast cancer, docking system

IP-0050

Assessment of Cell Safety and Verification of Mass Transfer Potential Using a Low-Temperature Atmospheric Pressure Plasma Jet

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Plasma generates reactive oxygen and nitrogen species (RONS) through its high energy. These plasma characteristics are widely utilized in surface modification, deposition, biology, tissue engineering, and dermatology. Particularly in biology, plasma is distinguished by direct and indirect reactions based on its high energy. Recently, there has been a growing interest in exploring the entry of CAP into the human body in the medical and life sciences fields. Studies focusing on delivering specific substances into cells using CAP in intracellular delivery technology have gained attention. Therefore, our research team presents the results of a new approach to studying the ability of CAP to effectively deliver substances into cells based on plasma generation conditions and cell viability. For plasma treatment, the low-temperature plasma device, Plazmax, was used, provided by Agnes Medical Co., Ltd. After subculturing cells at a density of 7.2 x 10^5 cells in a 24-well plate, plasma was applied to the cultured 24-well plate at a specified intensity for 5, 10, 15, 20, 25, 30, 60, 120, 240, 360, 480, and 600 seconds at a height of 0.8 cm above the media surface. Subsequently, the cells were incubated in the incubator. Then, the cell toxicity assessment based on plasma treatment duration was verified using the MTT assay and a microplate reader. In addition, cells were subcultured in a 12-well plate at a density of 0.4 x 10^6 cells to verify intracellular delivery effects. Plasma was applied to the cells in the 12-well plate. After plasma exposure, Opti-MEM and FITC-Dextran were exposed to the cells irradiated with plasma, and the results were observed using a fluorescence microscope.

In the results of this study, it was observed that cell viability was maintained at around 80% up to 30 seconds after plasma irradiation, but the survival rate rapidly decreased after 60 seconds. Furthermore, through fluorescence microscopy results, it was confirmed that plasma exposure enhances the permeability of the cell membrane, enabling intracellular substance delivery. Moreover, the potential of intracellular pathways was observed. Based on the results of this study, it is indicated that the gas used for plasma and the resulting ionized plasma does not affect cell death and that plasma enhances the substance permeability of the cell membrane, enabling intracellular delivery.

Acknowledgment: This work was supported by the BK-21 FOUR program through the National Research Foundation of Korea (NRF) under the Ministry of Education.

References (Maximum 2 References)

[1] CHEN, Zhitong, et al. *Materials Today* 54, 153-188 (2022)

Keywords: Cold atmospheric plasma, Cytotoxicity, Intracellular delivery

Session I
Diagnostics technologies for precision medicine

Chair: Prof. Yongsang Ryu Korea University, Korea

Nov. 10 (Fri.) **Multimedia (B115) 10:00~11:55**

Hyungsoon Im Havard University, USA
Advanced nanoplasmonic technologies for multiplex tumor-derived extracellular vesicle analysis

Seungmin Park Nanyang Technological University, Singapore
Smart toilet:A window to precision health

Hyoyoung Jeong University of California, USA
Wearable bio-electronics for health monitoring, diagnostics, and therapeutics

Amos Chungwon Lee Meteor Biotech, Korea
The Transformative Power of SLACS in Drug Discovery and Diagnostics

Chulmin Joo Yonsei University, Korea
"Lean" bio-instrumentations via the synergy of lean optical architectures and computational algorithms

Advanced nanoplasmonic technologies for multiplexed tumor-derived extracellular vesicle analysis

Hyungsoon Im

Associate Professor

Center for Systems Biology, Massachusetts General Hospital, Harvard Medical School

Abstract:

Exosomes, more broadly extracellular vesicles (EVs), represent new opportunities for cancer screening, diagnosis, and longitudinal treatment monitoring. Current EV analyses encounter technical challenges since sensitivities are often limited to bulk analyses. EVs In clinical samples are inherently heterogeneous, with various cellular origins and subtypes that differ in size and molecular composition. It is thus critical to develop a novel EV sensing technology that enables single EV analysis. We have designed plasmonic nanostructures that exhibit strong resonances and thus significantly amplify EVs' weak optical signals. The nanoplasmonic sensor chips were fabricated on a wafer scale for low-cost, high-throughput chip production. We demonstrated robust signal enhancements in multiple optical channels. This allows us to significantly improve the detection sensitivity (x1,000) by capturing EVs on our plasmonic sensor chip compared to bead-flow cytometry. More importantly, we could quantify total EVs, cell-specific or marker-specific subpopulations, and protein and RNAs at a single EV level for cancer detection and monitoring. Using the single EV sensing platform, we demonstrated the sensitive detection of ovarian cancer and cholangiocarcinoma from EV analysis in human clinical samples and the potential of EV analysis to evaluate patients' responses to therapy from longitudinal tumor-derived EV quantification. The simple, robust, and sensitive multiplexed single EV assay could improve our understanding of EV biology and accelerate clinical translation for various diseases.

Brief Biosketch

Dr. Hyungsoon Im is Associate Professor of Radiology at Harvard Medical School and a Principal Investigator at the Center for Systems Biology at Massachusetts General Hospital. He received his Ph.D. in Electrical Engineering from the University of Minnesota. His research aims to bridge engineering and medicine fields by developing next-generation diagnostic sensing technologies to better understand the makeup of human diseases and changes associated with disease progression and therapy. He has expertise in plasmonics, photonics, nanofabrication, spectroscopy, imaging, and microfluidics, with a good understanding of how these skills can be integrated and utilized for clinical applications. His lab has been actively working with clinical investigators both in and outside of MGH to validate technologies developed in his lab for clinical samples and apply them in clinical settings, which has been critical for translating and commercializing new diagnostic technologies for patient care in clinical settings.

Smart Toilet: Artificial Intelligence and Advanced Data Science

Seung-min Park
Assistant Professor
School of Chemistry, Chemical Engineering and Biotechnology, Nanyang Technological University

Abstract

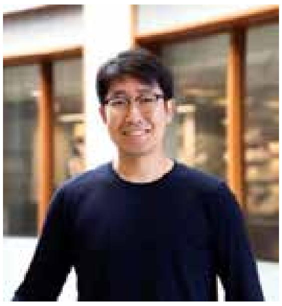
Precision Health is an emerging area of medicine that utilizes longitudinal monitoring over the course of a person's lifetime, with the potential to understand disease risk, detect disease early, and enable preventive interventions. While there have been numerous attempts at creating technologies for longitudinal monitoring, there are few devices that have both produced clinically actionable biometric data and have been integrated smoothly into the clinical workflow. In this talk, I will introduce one such medical device that can overcome some of these limitations. The "Precision Health Toilet" is a non-invasive, clinically applicable strategy for the long-term assessment of human excreta. I will discuss strategies for the implementation of assay modules in toilet, which can directly analyze human excretions with physical sensors backed by advanced computer vision. The collected heterogeneous health data are converted to a machine-readable format for establishing predictive modeling and for implementing actionable response determination. Important issues such as user identification, user acceptance/compliance, limitations of the system and its implication in the context of Precision Health impact will be also discussed.

Brief Biosketch

Dr. Seung-min Park is an Assistant Professor in the School of Chemistry, Chemical Engineering, Biotechnology at Nanyang Technological University. He received his Ph.D. in Applied Physics from Cornell University in 2008. During his postdoctoral training (Bioengineering) at the University of California, Berkeley, he was also a visiting scholar at the Universidade Federal do Rio de Janeiro in Brazil as part of his devotion to Global Health. Afterwards, he joined Stanford University as an Instructor and focused on developing cancer diagnostics based on nanotechnologies. His research interests lie at the convergence of nanobio-engineering, disease diagnostics, artificial intelligence, and their applications to those who suffer from healthcare disparities.

Wearable bio-electronics for health monitoring, diagnostics, and therapeutics

Hyoyoung Jeong
Assistant Professor
Department of Electrical and Computer Engineering, University of California Davis



Abstract
Emerging classes of soft, skin-integrated sensors are of interest due to their potential for precise, continuous monitoring of physiological parameters in the hospital and the home, with broad relevance to the future of human healthcare. The growth and momentum in personalized bioelectronic healthcare have laid the foundation for multi-disciplinary teams to innovate at the interface of the physical and life sciences and solve grand challenges in medicine and human health. In my talk, I will discuss the intersection of ergonomic wireless system design and real-world applications as the next generation of tools for ambulatory biometric monitoring. Point-of-care diagnostics and therapeutics for personalized medicine will be highlighted, including the monitoring of COVID19 patient recovery, identifying atypical motion development in infants, real-time fetal/maternal biometric monitoring while laboring, and closed-loop pacemaker for cardiovascular disease.

Brief Biosketch
Hyoyoung Jeong is an assistant professor in the Electrical and Computer Engineering department at the University of California, Davis. He completed his Ph.D. at The University of Texas at Austin in the department of Electrical and Computer Engineering (UT ECE), where he developed a wireless stretchable electronic tattoo (e-tattoo) for personalized healthcare monitoring. Before pursuing his Ph.D., he worked for the Samsung mobile division and Samsung Advanced Institute of Technology (SAIT) for five years as a researcher and developer in the advanced smartphone hardware group and mobile healthcare group. Prior to joining UC Davis, his work as a postdoctoral scholar with Professor John Rogers at Northwestern University focuses on the development and characterization of wireless soft wearable platforms for measuring and analyzing multimodal clinical-grade bio potentials.

The Transformative Power of SLACS in drug discovery and diagnostics

Amos Chungwon Lee
CEO, Co-founder
Affiliation: Meteor Biotech, Co. Ltd.

Abstract:

In the rapidly evolving landscape of medical engineering, cutting-edge technologies are instrumental in driving advancements that redefine the boundaries of healthcare. Among these innovations, Spatially-resolved Laser Activated Cell Sorting (SLACS) emerges as a transformative force poised to revolutionize the future of medicine.

SLACS, initially conceived within the confines of a research laboratory, has traversed the arduous journey from concept to commercialization. This lab-start-up manufactured instrument is now positioned at the vanguard of medical breakthroughs. This presentation sheds light on how SLACS stands as a pivotal enabler for a new era in healthcare.

SLACS capitalizes on spatial precision and laser activation to selectively sort and isolate individual cells within heterogeneous biological samples. This groundbreaking technology transcends the limitations of traditional cell sorting techniques, offering unprecedented capabilities in the fields of genomics, proteomics, and beyond. Demonstrations of SLACS in cancer, infectious disease, and neurodevelopmental disease are shown.

Brief Biosketch

Research interests: Spatial omics, Genetics, Research translation, Food technology

Lab homepage: http://meteorbiotech.com

Sep.2022 – Current: Meteor Biotech, Co. Ltd.

Sep.2020 – Feb.2023: Bio-MAX Institute, Seoul National University

Mar.2014 – Aug.2020: Dept of Bioengineering, Seoul National University, Ph.D.

Sep.2008 – Aug.2012: Dept of Biomedical Engineering, UC Berkeley, B.S.

"Lean" bio-instrumentations via the synergy of lean optical architectures and computational algorithms

Chulmin Joo

Professor

Dept. of Mechanical Engineering at Yonsei University

Abstract:

Advances in computational algorithms and hardware, along with optoelectronic devices, have enabled emergence of simple, robust and cost-effective sensor and imaging technologies for biomedical applications. In this presentation, I will present a couple of optical biosensor and imaging technologies that have been realized through synergetic integration of simple optical architecture and computational algorithms. I will first describe highly sensitive sensor platforms for hemoglobin concentration ([Hb]) and lateral-flow immunoassay (LFA) by exploiting photo-thermal response of Hb and gold nanoparticles, a common transducer in LFA. Highly sensitive [Hb] and biomarker measurements in blood samples was achieved by using low-cost laser pointer and webcam. The second part of my talk will introduce various forms of computational microscopy that employs state and color-coded illumination with a LED. Specimen image is recorded by a color image sensor, and utilized to compute bright-field, dark-field, differential phase-contrast, quantitative phase images and tomographic refractive index maps of biological cells. Several clinical applications of those imaging platforms will also be presented.

Brief Biosketch

Dr. Chulmin Joo is a Professor in the Department of Mechanical Engineering of Yonsei University, Seoul, Republic of Korea. He obtained S.M. and Ph.D. degrees in mechanical engineering from Massachusetts Institute of Technology, USA, in 2003 and 2008, respectively. Prior to joining Yonsei University, he worked as a lead engineer at GE Global Research, USA, involving and leading research programs for the development of various optical imaging and sensing devices. His primary research interests lie in the development and application of novel optical instrumentations to resolve unmet needs in biology and medicine. He strives to integrate fundamental understanding of optical imaging and computational technologies with the insights and needs from clinicians and biologists. He is a senior member of Optica (formerly Optical Society America), and has been a program committee member of Optica Imaging Systems and Applications since 2017. He served as the program and general chairs of Optica Imaging Systems and Applications (2020, 2021). He is also a member of Academic Editorial Board of PLoS One, JMST Advances, and Advaced Imaging.

Session II
AI/ML for Healthcare Data Science

Chair: JuHee Lee Korea Disease Control and Prevention Agency, NIH,
Jongmo Seo Seoul National University

Nov. 10 (Fri.) **Multimedia (B115)** **12:20~13:50**

Miklos Koller Pazmany Peter Catholic University, Hungary
Control possibilities of a prosthetic hand

Balazs Ligeti Pazmany Peter Catholic University, Hungary
The Future of Microbiome Manipulation: Genomic Language Models Meeting Global Needs

Andras Horvath Pazmany Peter Catholic University, Hungary
The Role of AI in medical imaging: decisions or assistance?

Sang Cheol Kim NIH, Korea
Healthcare data collection and its role of KNIH: focusing on data management and sharing

Jaeseok Yun Soonchunhyang University, Korea
Health-related Data Collection from Wearable and Mobile Devices in Everyday Lives

Youngro Lee Seoul National University, Korea
Stability of calibration in smart watch-based blood pressure estimation

Sooyeon Ji Seoul National University, Korea
High resolution deep learning-powered chi-separation reveals detailed iron and myelin distribution of human brain in vivo

Control possibilities of a prosthetic hand

Miklós Koller

Associate professor

Faculty of Information Technology and Bionics, Pázmány Péter Catholic University

Abstract:

The number of prosthetic abandonments among upper limb prosthetic users is somewhere between one- fifth and one-third (depending on age, type of device, and the study itself), with the main reasons cited being the difficulty of using the device, low comfort level, and a lack of fit with the body image.

The design of currently available hand prostheses on the market more closely reflects the structural and functional properties of industrial robot arms and hands rather than the specific structure of the human hand. Structurally, they are typically made up of rigid components, with the components only able to move along the joints, and the axis of each joint is fixed. In contrast, the human hand has various layers of different softness and elasticity on top of the rigid structure; the precise location and orientation of joint axes potentially depend on their range of motion. The soft and adhesive covering (fatty tissue and skin) allows for highly adaptive behavior, acting as a form of local optimization, especially when performing gripping tasks. Functionally, the most noticeable difference lies in the relationship between the actuators and the articulated joints. In robotic systems, there is typically a one-to-one relationship (one motor moves precisely one joint), while in the human hand, there is a many-to-many relationship (one muscle can affect the angular position of multiple joints through the associated tendons, and multiple different muscles can influence one joint).

Concerning the control of the Anatomically Correct Biomechatronic Hand being developed at the PPKE ITK Robotics Laboratory, two approaches are being studied in more detail:

1) Human-interface solutions are being explored, both the commonly used modalities in commercial prosthetic solutions and those in the research phase. The most prevalent solution in the commercial market today is based on surface electromyography (sEMG), which operates non-invasively by measuring nerve control signals to muscles on the skin's surface, typically through simultaneous measurement of 2-3-8 channels. Additionally, the usability of high-density electromyographic signals (HD- EMG) is being investigated, as well as the usability of ultrasound-based (US) measurements, including B- mode and A-mode measurement possibilities. The high-level measurement of various modalities aims to track the activity of hand/finger-moving muscles on the forearm and simultaneously record the precise dynamics of hand/finger movements using a data glove. Deep learning is employed to create mappings between the two. A well-trained model can later be used to make estimations about hand movements based on forearm muscle activity.

2) The other approach is automation: in everyday life, we perform many movements without conscious supervision or concentration, whether it's drinking from a slippery glass or opening a familiar but worn lock mechanism. Since information transfer can be a bottleneck in human-machine interfaces, it would be beneficial to automate fine mechanical movements that do not require conscious concentration. These possibilities are being examined using deep reinforcement learning on the simulation model of our built robotic hand (due to the extensive data collection requirements of the method).

Brief Biosketch

PhD in Information Science from PPKE, (Hungary). Research interest: robotic control with deep reinforcement learning, prosthetic interfaces, biomechanical models and Cellular Neural Networks.

The session and the talk are supported by the GoGE/SDG of Seoul National University (SNU) BK21 Education and Research Program for Future ICT Pioneers, the SNU Project Group for Education and Research in Medical AI, and the MD-PhD/Medical Scientist Training Program of SNU.

The Future of Microbiome Manipulation: Genomic Language Models Meeting Global Needs

Balázs Ligeti
Associate professor
Faculty of Information Technology and Bionics, Pázmány Péter Catholic University

Abstract:

A key and fundamental question in quantitative biology is how to uncover novel patterns and structures in biological data, which is crucial for modeling, predicting, and manipulating complex organizations like a microbiome. Considerable advances have been made in areas like protein structure prediction, metagenomics, transcriptomics, and metabolomics, but there is still much to understand about the complex, spatial, and temporal behavior of living organisms. To address today's challenges, like engineering microbiomes for specific functions, optimizing soil, and helping crops adapt to changing environments, we need to continue our efforts to understand these processes.

We have developed *a neural network-based, universal, reusable representation and algorithmic framework for nucleotide sequences* tailored specifically for microorganisms. Such an approach typically helps us to overcome typical problems like, the scarcity of available labeled data, context-dependency and low signal-to-noise ratio. We demonstrate that our models can solve various classification tasks crucial in microbiome applications such as promoter identification, gene expression prediction and phage detection, and outperform the state-of-the-art tools.

Microorganisms play a vital role in sustaining life on earth through their vast metabolic capabilities; thus, understanding their operation is critical in addressing issues such as antimicrobial resistance, climate change, and pathogenic threats.

Brief Biosketch

I earned my PhD in 2016 from Pázmány Péter Catholic University, where I delved into the topic of network analysis in bioinformatics tasks. I focused on how to use machine learning methodology to discover non-trivial patterns in biological data: i.e. predicting efficient drug combinations from protein-protein interactions networks, or understanding microbiome interactions.

Currently, I'm serving as an associate professor and bioinformatics researcher at the same institution. My primary research areas include bioinformatics sequence analysis, and deep learning and sequence representations.

The session and the talk are supported by the GoGE/SDG of Seoul National University (SNU) BK21 Education and Research Program for Future ICT Pioneers, the SNU Project Group for Education and Research in Medical AI, and the MD-PhD/Medical Scientist Training Program of SNU.

The Role of AI in medical imaging: decisions or assistance?

András Horváth
Associate professor
Faculty of Information Technology and Bionics, Pázmány Péter Catholic University

Abstract

The integration of artificial intelligence (AI) in medical imaging has rapidly advanced the field, sparking a critical debate on the nature of AI's role: decision-maker or assistant? This talk explores the evolving landscape of AI in medical imaging and the crucial questions surrounding its use and robustness. We delve into the capabilities and limitations of AI algorithms, through a number of case studies which aim to reveal the challenges of machine learning pipelines in safety critical fields such as medical imaging.
Along the role of machine learning in diagnosis and treatments we will also analyze the data-hunger of these approaches and investigate their robustness to adversarial attacks, where malevolent attackers can modify the input data to generate arbitrary outputs in the system.

Brief Biosketch

András Horváth, PhD is an Associate Professor at the Faculty of Information Technology and Bionics at Pázmány Péter Catholic University. His research is mostly focused on computer vision and artificial intelligence, especially on the efficient implementation of modern machine learning algorithms with emerging devices. He took part in the DARPA-UPSIDE (Unconventional Processing of Signals for Intelligent Data Exploitation) project between 2012 and 2018 in a consortium with Intel, MIT, which aimed the development of an object recognition pipeline with oscillatory based computing, implemented on emerging devices (e.g.: spin-torque and resonant body oscillators) and was involved in multiple international research grants sponsored by the European Union and ONR. He is author or co-author of more than 50 publications which appeared in various international journals. He is an active Reviewer for various peer reviewed journal papers. (e.g.: IEEE Transaction on Signal Processing, IEEE Transactions on Circuits and System, etc.). He is a member of the IEEE Circuits and System Society and the IEEE Computational Intelligence Society and the elect chair of the Cellular Nanoscale Networks and Array Computing Technical Committee.

The session and the talk are supported by the GoGE/SDG of Seoul National University (SNU) BK21 Education and Research Program for Future ICT Pioneers, the SNU Project Group for Education and Research in Medical AI, and the MD-PhD/Medical Scientist Training Program of SNU.

Healthcare data collection and its role of KNIH: focusing on data management and sharing

Kim, Sang Cheol
Senior Staff Scientist
Division of Healthcare and Artificial Intelligence, Korea National Institute of Health

Abstract:

The healthcare industry is on the brink of a paradigm shift, driven by recent advancements in high-throughput digital technologies and the growing significance of big data. This shift is characterized by a transition towards artificial intelligence-based prediction, prevention, and personalized healthcare services, all of which harness the power of big data. To align with public health policies, there's an urgent need to systematically collect and manage extensive prospective data on a national scale, leveraging various data types, including imaging data (such as brain imaging - MRI and PET scans), lifelog data (such as wearable devices), and multi-omics data (such as genomics, transcritomics and proteomics). In response to these challenges, the Korea National Institute of Health (KNIH) has taken the lead in conducting large-scale cohort studies, ensuring the comprehensive acquisition of high-quality data across these diverse data domains. Here, we share valuable insights gained from these cohort studies, encompassing crucial aspects such as data standardization, the formulation of effective data policies, legal regulations, including privacy concerns, and the availability of publicly accessible datasets from KNIH's cohort studies.

Brief Biosketch

I received my Ph.D. in statistics from the Department of Applied Statistics at Yonsei University, South Korea, with a topic in statistical methodology for analyzing metadata. Currently, I hold the position of senior staff scientist at the Healthcare and Artificial Intelligence Research Division, National Institute of Health, South Korea.

My research has been focused on the analysis of multiomics data obtained from various diseases and their integration. Recently, I have been conducting research on the development of dementia prediction models by integrating brain imaging data with clinical and genomic information.

This talk is supported by the BK21 FOUR Education and Research Program for Future ICT Pioneers of Seoul National University.

The session and the talk are supported by the GoGE/SDG of Seoul National University (SNU) BK21 Education and Research Program for Future ICT Pioneers, the SNU Project Group for Education and Research in Medical AI, and the MD-PhD/Medical Scientist Training Program of SNU.

Health-related Data Collection from Wearable and Mobile Devices in Everyday Lives

Jaeseok Yun

Associate professor

Soonchunhyang University

Abstract: We present an empirical study of collecting health-related data like sensor signals and lifelog from wearables and mobile devices. We have developed a health-related data collection framework for everyday lives, called Health24, composed of collecting data in a standard IoT platform from wearables like Galaxy watch, Apple watch, and Fitbit watch and smartphones like iPhone and Android phones. Raw sensor signal is collected from accelerometers, gyroscopes, and pressure sensors, and lifelogs such as activities and sleep time are extracted from smartphone- or cloud-supported APIs. Our study is designed to collect datasets from 300 subjects for 60 days in daily activities including sleep. We expect that health-related data could help people understand what aspects of the habits or activities in everyday lives will increase risk of disease and thus prevent it.

Brief Biosketch: Jaeseok Yun is an associate professor with the Department of Internet of Things at Soonchunhyang University. Prior to his current position, he worked as a senior researcher with IoT Platform Research Center at the Korea Electronics Technology Institute (KETI) from 2009 to 2016. He also worked as a postdoctoral research scientist with the Ubiquitous Computing Research Group in the School of Interactive Computing at Georgia Institute of Technology, USA from 2006 to 2009. He earned his M.S. and Ph.D. in mechatronics from Gwangju Institute of Science and Technology (GIST) in 1999 and 2006, respectively, and B.S. in electronics engineering from Chonnam National University in 1997. His research interests include ubiquitous computing, Internet of Things (IoT), and AI-enabled applications in everyday lives.

The session and the talk are supported by the GoGE/SDG of Seoul National University (SNU) BK21 Education and Research Program for Future ICT Pioneers, the SNU Project Group for Education and Research in Medical AI, and the MD-PhD/Medical Scientist Training Program of SNU.

Stability of calibration in smart watch-based blood pressure estimation

Youngro Lee

Ph.D Course

Department of Electrical and Computer Engineering, Seoul National University

Abstract:

This study investigates the reliability of smartwatch-based blood pressure (BP) estimation, utilizing real-world data from a Samsung Galaxy Watch campaign. The research assesses calibration stability by comparing average systolic blood pressure (SBP) before and after calibration and identifies factors influencing stability through regression analysis. The findings highlight that calibration instability decreases during nighttime measurements and when averaging multiple readings in the same time frame. The study suggests user-level strategies to address calibration instability, emphasizing the importance of guideline adherence, especially for specific demographic groups such as the elderly, females, and individuals with hypertension. Overall, the research contributes to enhancing the reliability of BP measurements through extensive datasets and insights into calibration stability.

Brief Biosketch:

Research interests: medical informatics, bioinformatics, machine learning, interpretable AI

Personal homepage: https://youngrolee94.github.io/#page-top

Mar.2019 – Current: Dept of Electrical and Computer Engineering, Seoul National University

Sep.2021 – Feb.2022: UNIVERSITY OF PADOVA, ITALY

Mar.2013 – Feb.2019: Dept of Electrical and Computer Engineering, Seoul National University

The session and the talk are supported by the GoGE/SDG of Seoul National University (SNU) BK21 Education and Research Program for Future ICT Pioneers, the SNU Project Group for Education and Research in Medical AI, and the MD-PhD/Medical Scientist Training Program of SNU.

High resolution deep learning-powered chi-separation reveals detailed iron and myelin distribution of human brain in vivo

Sooyeon Ji

Postdoctoral researcher

Dept. of Electrical and Computer Engineering, Seoul National University

Abstract:

Using deep learning-powered χ-separation, detailed features within the human brain are highlighted in the positive and negative susceptibility maps generated in under 25 minutes of Magnetic Resonance Image (MRI) scan. The reconstruction process involves four distinct deep neural networks, each specializing in multi-echo denoising for SNR enhancement, high quality quantitative susceptibility map (QSM) reconstruction using single orientation data, susceptibility source separation, and super-resolution. The reconstructed positive and negative susceptibility maps, each representing iron and myelin information, reveal two distinct layers within the globus pallidus, the internal capsule's fiber bundle-like structures, and the structures of the nigrosome in the substantia nigra.

Brief Biosketch

Research interests: Computational biomedical imaging, Deep learning

Personal homepage: sites.google.com/view/sooyeonji/home

April.2023 – Current: Dept of Electrical and Computer Engineering, Seoul National University

The session and the talk are supported by the GoGE/SDG of Seoul National University (SNU) BK21 Education and Research Program for Future ICT Pioneers, the SNU Project Group for Education and Research in Medical AI, and the MD-PhD/Medical Scientist Training Program of SNU.

Session III NBIT-driven Medical Technologies Innovations

Chair: Prof. Dasol Lee Yonsei University, Korea

Nov. 10 (Fri.) **Multimedia (B115) 14:00~15:50**

Prof. Wanyong Shin Cleveland Clinic Lerner College of Medicine, USA
Engineering neuro MRI application at 7T

Prof. Junghoon Kim City University of New York, USA
Validating neuroimaging biomarkers for transcranial neuromodulation in traumatic brain injury

Prof. Justin Jeong-Won Jeong Wayne State University,USA
Localization of Epileptogenicity Using Multi-modal MRI and Deep Learning Network: Incomplete MRI sequences in Pediatric Cohort

Prof. Namshik Han University of Cambridge, UK
Data-driven computational approaches for identifying novel therapeutic targets and drug repositioning opportunities

Prof. Myeongsu Seong Xi'an Jiaotong-Liverpool University, China
Advancements in deep tissue optical blood flow monitoring technology

Engineering neuro MRI application at 7T

Wanyong Shin

Assistant Staff

Imaging Institute, Cleveland Clinic

Abstract:

While 7T MR scanner has been FDA-approved for the clinical diagnosis purpose of neuro-/vascular and knee imaging application in 2017, there are many aspects of the challenge to utilize 7T MR clinical protocol under the clinical routine. In this talk, I present the benefit and concern of 7T neuro MR protocols to be compared with the conventional MR image (3T) from the clinical cases and discuss the possible solution and future direction of clinical neuro MRI application at 7T.

Biosketch

EDUCATION / TRAINING

1994-2001	Seoul National University, Seoul, Korea
	BS in Mechanical Engineering
2001-2007	Northwestern University, Chicago, IL
	Ph.D in Biomedical Engineering
2007-2010	National Institute on Drug Abuse, National Institutes of Health, Baltimore, MD
	Postdoctoral Research fellow

POSITIONS / EMPLOYMENT

2007-2010	Research Fellow, Neuroimaging Research Branch, National Institute on Drug Abuse, National Institutes of Health, Baltimore, MD
2010-2018	Project Staff, Imaging Institute, Cleveland Clinic, Cleveland, OH
2013-current	Assistant Professor, Cleveland Clinic Lerner College of Medicine, Cleveland, OH
2018-current	Assistant Staff, Imaging institute, Cleveland Clinic, Cleveland, OH

Journal Articles

Recent papers are presented here. Complete List of Published Work in MyBibliography is found: http://www.ncbi.nlm.nih.gov/sites/myncbi/1d5sWVQIuz3Ab/bibliography/49209851/public/?sort=date&direction=ascending

1. Sidhu JS, Sakaie K, Shin W, Lowe M. Leveraging redundancy in simultaneous multislice acquisitions to improve spike detection. Magn Reson Med 2022;87(6):2972-2978.

2. Shin W, Koenig KA, Lowe MJ. A comprehensive investigation of physiologic noise modeling in resting state fMRI; time shifted cardiac noise in EPI and its removal without external physiologic signal measures. NeuroImage 2022;254:119136.

Validating neuroimaging biomarkers for moderate-to-severe traumatic brain injury

Junghoon Kim

Assistant Professor

Department of Molecular, Cellular, and Biomedical Sciences CUNY School of Medicine, New York

Abstract:

Neuroimaging biomarkers of various endophenotypes of traumatic brain injury (TBI) are essential for the development of personalized precision treatment. My lab's research has been dedicated to validating MRI-based imaging biomarkers for the diagnosis, prognosis, and monitoring of individuals with TBI. In this presentation, I will provide a brief overview of the key findings from the morphometric, axonal, and microvascular MRI biomarker studies that my team has conducted over the past decade in a longitudinal cohort of moderate-to-severe TBI patients.

Brief Biosketch

Dr. Kim is an Assistant Professor and the Director of the Clinical Neuroimaging Lab at the CUNY School of Medicine. Dr. Kim's current research utilizes state-of-the-art neuroimaging and neuropsychological methods to address various neurorehabilitation issues in traumatic brain injury. His research has received funding from the National Institute of Health, the Pennsylvania Department of Health, and the Albert Einstein Society.

Localization of Epileptogenicity Using Multi-modal MRI and Deep Learning Network: Incomplete MRI sequences in Pediatric Cohort

Justin Jeong-Won Jeong
Professor
Pediatrics, Neurology, and Translational Neuroscience Program
Wayne State University School of Medicine and Graduate School

Abstract:

Artificial intelligence (AI) technology holds a leading role across various sectors in our society including healthcare and stands out as profoundly significant in the context of patient's well-being and clinical management. Our current NIH-funded grant projects (R01NS089659, R01NS064033, F30NS115279, F30NS129239) also use AI technology to further improve clinical management of pediatric epilepsy patients. We are accomplishing this improvement by developing an innovative deep learning-powered cloud telemedicine system designed to non-invasively identify epileptogenic brain tissue, commonly referred to as the "epileptogenic zone (EZ)." Our system utilizes a series of multi-scale residual neural networks (msResNet) to leverage (or profile) the heterogeneity of multi-modal MRI features clinically acquired for diagnosis of drug-resistance epilepsy. To enhance the practical applicability and adaptability of our system across different medical institutions, this study focuses on a significant challenge: the issue of incomplete data. Specifically, physicians encounter situations where certain MRI sequence data, such as T1-weighted, T2-weighted, FLAIR, DWI, and whole-brain tractography, may be missing in some patients. This limitation reduces the available sample size for training our msResNet, hindering its ability to learn effectively. To overcome this challenge, this study has first devised a novel approach known as "Modality-Agnostic Learning through Multi-modality Self-distillation" (MAG-MS) that can adapt "knowledge distillation" to transfer knowledge from a large model (i.e., teacher network using complete data) to a smaller one (i.e., student network using incomplete data) by selectively minimizing mean square loss between the deep features of individual sequence data and their fused feature (i.e., average of individual features). This innovative approach was incorporated into our msResNet framework to tackle the challenge posed by incomplete MRI sequence data, enabling more robust and reliable results in localizing the EZ site. A set of clinical multi-modal MRI feature vectors, X_i were obtained from 68 children with intractable epilepsy (10.5 ± 6.2 years old), balanced, and augmented for a 5-fold cross validation to train and test the proposed incorporation in the end-to-end fashion, so that one can predict one of two output labels: Y_1: EZ and Y_2: Non-EZ from a given input feature vector: X_i. Briefly, at each patient, the node-wise prediction was performed in the connectivity network of the epileptogenic hemisphere, $G = (W_{i=1\text{-}499}, A_{i=1\text{-}499,j=1\text{-}499})$, where W_i defines the i^{th} brain node of the Lausanne 2008 cortical parcellation atlas and A_{ij} represents pair-wise white matter pathway edge connecting W_i and W_j (e.g., the total count of connecting tracts normalized by the total volume of W_i and W_j). From each node W_i, a surface laminar analysis extracted a multi-modal MRI feature vector X_i consisting of I: relative intensity (RI) values of T1-weighted, T2-weighted, FLAIR, apparent diffusion coefficient (ADC), fractional anisotropy (FA) at two gray matter surfaces (outer/middle for cortical layer II and III), D: RI values at the deep white matter surface of FA, ADC, apparent fiber density (AFD), and C: DWI connectome (DWIC) (i.e., $A_{i,j=1\text{-}499}$ sorted from the nearest to the farthest node). A total of 32

combinations of missing sequence data scenario was assumed to train and test the proposed incorporation. A balanced accuracy (i.e., mean of sensitivity and specificity) was evaluated at each combination. While in its initial stages, our integration of MAG-MS and msResNet has yielded promising results, achieving a high level of accuracy (92-95%) in correctly identifying the intracranial EEG (iEEG)-defined epileptogenic zone (EZ), which serves as the ground-truth label Y_1: EZ, even when working with subsets of complete MRI sequence data, e.g., 92% from T1-weighted alone, 95% from T1-weighted and DWIC, and 96% from T1-weighted and T2-weighted. In conclusion, our intriguing discovery has the potential to pave the way for the clinical application of MRI in non-invasively and objectively pinpointing epileptogenicity, without the necessity of a complete routine MRI prescription. Moreover, it may provide valuable insights into neural disorganization associated with the presence of epileptogenicity, offering a novel approach to optimize the placement of invasive iEEG procedure at potential EZ sites and tailor the selection of the most appropriate surgical plans. Future study should replicate our findings at the multi-center study, with the goal of enhancing presurgical evaluation by predicting the EZ sites as accurately as possible even when faced with incomplete MRI sequence data.

Brief Biosketch

Justin Jeong-Won Jeong, Ph.D., is a tenured professor of Pediatrics, Neurology, and Translational Neuroscience Program at Wayne State University School of Medicine and Graduate School, located in Detroit, Michigan, USA. Dr. Jeong is also an MRI physicist at Children's Hospital of Michigan and University Health Center. He earned his Master of Science degree in the Ming Hsieh Department of Electrical and Computer Engineering and then completed his Doctorate in the Alfred E. Mann Department of Biomedical Engineering at the University of Southern California, located in Los Angeles, California, USA. His training and experience in MRI and AI technology place him uniquely in implementing advanced research projects to benefit patients with neurological disorders. He has always tried to use his abilities to help children and adults afflicted with neurological diseases so that they can enjoy life and live it to the fullest. His research and clinical interests include functional and structural imaging biomarkers for early diagnosis of epilepsy, developmental delay, autism, hypoxic brain injury, and brain gliomas. Over the past two decades, he has been dedicated to instructing MRI physics and spearheading numerous research initiatives supported by the National Institutes of Health. These projects delve into advanced diffusion MRI connectome methodology for pediatric epilepsy surgery, with the goal of minimizing postoperative deficits and maximizing postoperative benefits through the application of AI technology. Additionally, he has been at the forefront of developing innovative multi-modal neuroimaging methodology combining MRI, PET, and intracranial EEG to enhance patient management and diagnosis in a wide range of neurological disorders affecting infants, children, and adults. Up to date, he has published more than one hundred peer-reviewed original research papers available at https://www.tilwayne.dev.

Data-driven computational approaches for identifying novel therapeutic targets and drug repositioning opportunities

Namshik Han
Professor, Group Leader
Milner Therapeutics Institute, University of Cambridge
Cambridge Centre for AI in Medicine, University of Cambridge
Wellcome-MRC Cambridge Stem Cell Institute, University of Cambridge

Abstract:

The challenges in drug discovery, including high attrition rates in late development stage, are well documented. This has led to an increased interest and need for applying machine learning and artificial intelligence across the drug discovery pipeline from target identification to chemical lead selection and optimisation. It has also been demonstrated that drugs with human genetic validation data are more likely to succeed in the clinic. To address this, it is essential to unravel genetic networks to identify new or better targets for which the underlying mechanism is clear. Despite the significant advances in next generation sequencing technologies and evolving databases of patient cohorts, the sheer complexity of these datasets makes their integration and interrogation a daunting task. Through the development and application of cutting-edge computational approaches, such as artificial intelligence, machine learning and mathematical modelling, to pharmacogenomics and drug discovery, we identify novel therapeutic targets, biomarkers and drug repositioning opportunities. In this talk I will focus on (1) systematic integration and harmonisation of biomedical big data (2) multi-omics disease association study and (3) network theory-based analysis of targetable pathway which have significant potential to provide unprecedented insights into vital biological processes and the control hubs that underpin cancers.

Brief Biosketch

Research interests: Artificial Intelligence, Drug Discovery, Multi-omics analysis, Network analysis, NLP and text mining

Lab homepage: https://www.bio.cam.ac.uk/staff/namshik-han

2023 ~ present Wellcome-MRC Cambridge Stem Cell Institute, University of Cambridge

2023 ~ present National Cancer Center Graduate School (Visiting Professor)

2023 ~ present Inha University College of Medicine (Visiting Professor)

2022 ~ present Yonsei University College of Medicine (Adjunct Professor)

2021 ~ present Cambridge Centre for AI in Medicine, Department of Applied Mathematics and Theoretical Physics, University of Cambridge

2021 ~ present CardiaTec Biosciences Ltd (Co-founder & Founding CTO)

2019 ~ present KURE.ai (Co-founder)

2017 ~ present Milner Therapeutics Institute, University of Cambridge

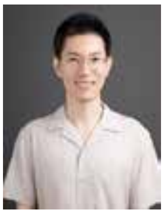
2017 ~ present OpenTargets, European Bioinformatics Institute (EMBL-EBI) (Scientific Visitor)

2017 ~ present Centre for Therapeutics Discovery, LifeArc (Visiting Bioinformatics Lead)

2013 ~ 2016 The Gurdon Institute, University of Cambridge

Advancements of Optical Technology Toward Portable Deep Tissue Blood Flow Monitoring

Myeongsu Seong
Assistant Professor
Department of Mechatronics and Robotics, School of Advanced Technology
Xi'an Jiaotong-Liverpool University



Abstract:

Blood flow deals with the delivery of oxygen and hormones and the discard of biowaste. Thus, depending on where and how problems in blood flow happen, ulcers, paralysis, and even death can happen. Blood flow monitoring technologies can be used to prevent such unwanted situations. While there are multiple blood flow monitoring technologies, such as Doppler ultrasound and Xenon-enhanced CT, the use of such technologies in continuous, multiple measurements of blood flow is not a viable option. Among alternative technologies, optical technologies can be a strong candidate for blood flow monitoring due to low cost, noninvasiveness, label-free, and small form factor. In the talk, we will briefly overview the working principles of relevant optical technologies and recent advancements of the relevant technologies toward portable deep tissue blood flow monitoring.

Brief Biosketch

Dr. Myeongsu Seong is currently working as an Assistant Professor at the Department of Mechatronics and Robotics, School of Advanced Technology, Xi'an Jiaotong-Liverpool University (XJTLU) from August 2023. In 2018, Dr. Seong received his Ph.D. from the Department of Biomedical Science and Engineering, Gwangju Institute of Science and Technology, Gwangju, Republic of Korea. Before joining XJTLU, Dr. Seong worked as an Associate Professor and a postdoc at Nantong University, China, and Shanghai Jiao Tong University, China, respectively. Dr. Seong has received multiple awards and distinctions including Young Foreign Talent Plan of National Foreign Expert Project from the Ministry of Science and Technology of China and Global Ph.D. Fellowship from the National Research Foundation of Korea. Dr. Seong's research interest includes the development of new opto-mechatronic imaging/spectroscopic and therapeutic systems that can be used in both preclinical and clinical studies, relevant signal/image processing methods, and applications of the developed systems in neurology or oncology studies for the translation of the systems to the clinics.

Session IV
Convergence Technology in Personalized Smart health for Active Senior

Chair: Byeong Hee Kim, Kwang Suk Lim Kangwon University, Korea

Nov. 10 (Fri.) **Multimedia (B115) 16:00~17:50**

Yongai Park Kangwon National University, Korea
Development of Flexible sensor using liquid metal and 3D printing

Merlin Schar University Hospital of Zurich, Switzerland
Biomechanics of the Middle Ear: From Mechanical Insights to Surgical Optimization

MyeongJin Ju University of British Columbia, Canada
Single-shot panoramic 3D functional retinal imaging and processing

GyuHan Lee Kangwon National University, Korea
Patent-specific analysis of aortic dissection using numberical simulation and 4D flow MRI

ChangHwa Joo Kangwon National University, Korea
The effect of acute and chronic exercise on the physcial fitness and immune response of HIV/AIDS

Development of Flexible Sensor Using Liquid Metal and 3D Printing Techniques

Yong-Jai Park
Associate Professor
Dept. of Mechatronics Engineering at Kangwon National University

Abstract:

For active seniors, it's crucial to increase and maintain physical activity for a healthy life. To accurately measure their activity, flexible sensors are required. Traditional rigid sensors fall short in capturing the nuances of human movement. To address this gap, many researchers are focusing on the development of flexible sensors. In this study, we fabricated two types of the sensors; 1) using filaments embedded with carbon nanotubes, 2) using liquid metal with flexible material, and tested their functionality. Each sensor was affixed to the shoulder to assess its usability, and the results were analyzed. In the future, we plan to conduct more practical research by mounting them on wearable devices.

Brief Biosketch
I received my PhD in Mechanical Engineering from the Department of Mechanical Engineering, Seoul National University, South Korea. My work at the Biorobotics Laboratory of Seoul National University involved developing novel robotic mechanism. Currently, I am an Associate Professor in the Department of Mechatronics, Kangwon National University.

Research interests: Soft Robotics, Novel Mechanism Design, Bio-inspired Robot, Soft Gripper, Robot Manufacturing with 3D Printer, Wearable Device, Visual Inspection with Machine Learning
Lab homepage: https://www.yongjaipark.com/

Sep.2018 – Current: Dept of Mechatronics Engineering, Kangwon National University
Mar.2014 – Aug.2018: Dept of Mechanical Engineering, Sun Moon University

Biomechanics of the Middle Ear: From Mechanical Insights to Surgical Optimization

Merlin Schaer
Postdoc
Department of Otorhinolaryngology, Head & Neck Surgery
University Hospital Zurich, University of Zurich

Abstract:

This talk will demonstrate why pushing the boundaries of middle-ear surgery requires a thorough understanding of basic middle-ear mechanics. The presentation will explain how these insights are obtained and how they guide emerging technologies to improve the surgical procedures.

After a brief introduction to the field of middle-ear mechanics and middle-ear surgical approaches, it will be outlined how the complex mechanical and geometric properties of the middle ear pose significant challenges for surgical reconstructions. The role of basic research in middle-ear mechanics for improvement of otologic surgery will be demonstrated based on select examples from past and current research projects. Finally, we will explore how emerging strategies and technologies will be applied in the future to address major remaining challenges in the field.

Through this talk, I hope you will gain insights into the relationship between middle-ear mechanics and otologic surgery, including the current challenges in the field and the need for innovative solutions driven by interdisciplinary collaborations between medical doctors and engineers.

Brief Biosketch

Research interests: Middle-ear mechanics, otology, emerging assistive technologies for otologic surgery, mathematical modeling, computational science.
Lab homepage: https://www.otobm.uzh.ch/en.html

Mar. 2022 – Current: Postdoc, Department of Otorhinolaryngology, Head & Neck Surgery, University Hospital Zurich, University of Zurich
2017 – 2022: PhD Program in Neuroscience of the ZNZ Graduate School, (Faculty of Science, University of Zurich, Switzerland), PhD thesis on "Protective and Adaptive Functions of the Human Middle Ear: Roles of the Stapedial Annular Ligament and the Stapedial Muscle"
2016 – 2017: Resident, General Surgery (Spital Bulach, Switzerland)
2009 – 2015: Medical School (University of Zurich, Switzerland)

Single-shot panoramic 3D functional retinal imaging and processing

Myeong Jin Ju
Assistant Professor
Department of Ophthalmology and Visual Sciences School of Biomedical Engineering
Faculty of Medicine Faculty of Applied Science University of British Columbia

Abstract:
Since its inception in the 1990s, optical coherence tomography has become a crucial tool in the practice of ophthalmology by informing diagnosis, disease monitoring and long-term prognosis. The ability of this technology to capture the peripheral retina has allowed for new and expanded clinical application. In the course of its use and development, OCT technology has spawned widefield and ultra-widefield imaging in addition to high-speed and high-resolution imaging. In 2019, the international Widefield Imaging Study Group defined widefield imaging as a field-of-view (FOV) of approximately 60- to 100-degree, capturing the mid-periphery of the retina up to the posterior edge of the vortex vein ampulla. Until recently, capturing the far periphery of the retina with OCT was nearly impossible. However, the Heidelberg Spectralis HRA-OCT (Heidelberg Engineering USA), the Silverstone (Optos PLC Edinburgh), the Plex Elite 9000 (Zeiss, Oberkochen, Germany) and the Xephilio OCT-S1 (Canon Medical Systems, Japan) have introduced widefield OCT imaging capabilities. A company called Toward Pi has also developed a swept-source OCT machine with an 81 x 68-degree field of view and an A-scan speed of 400-kHz. Recently, our group developed a molecular contrast retinal OCT system with a 400-kHz vertical-cavity surface-emitting laser (VCSE) source, polarization diversity (PD) detection, and ultra-wide FOV retinal scanning device. The ultra-wide FOV PD-OCT system is capable of acquiring melanic contrast imaging as well as scattering contrast over 120-dgree FOV in a single shot with a non-contact approach. Using the system, our team has initiated studies investigating the clinical utility of wide FOV PD-OCT imaging. In this presentation, I will introduce our clinical cases studies including retinitis pigmentosa and choroidal melanoma. In addition, pathological features extracted from the our data will be compared with other conventional imaging modalities such as retinal fundus, fundus autofluorescence.

Brief Biosketch
Dr. Myeong Jin Ju's research is focused on the development of optical imaging systems and signal processing algorithms, with a specific technology concentration on medical imaging and with knowledge translation and applications to preclinical and clinical vision research.

Research interests: Development of optical imaging systems and signal processing algorithms, with a specific technology concentration on medical imaging and with knowledge translation and applications to preclinical and clinical vision research.

Jan.2020 – Current: Assistant Professor, University of British Columbia, Canada
Jan.2019 – Oct.2019: Assistant Professor, Dankook University, South Korea
Oct.2015 – Dec.2018: Research Fellow, Simon Fraser University, Canada

The effect of acute and chronic exercise on the physical fitness and immune response of HIV/AIDS

Joo, Chang-Hwa

Senior Lecturer

Dept. of Sport Science at Kangwon National University

Abstract:

The number of people living with HIV/AIDS is increasing every year in South Korea, but few studies have identified the relationship between HIV infection and exercise. The purpose of this study is to analyze the effects of acute and chronic excise on physical fitness and immune response in people living with HIV/AIDS. The participants completed acute (moderate and high-intensity exercise) and chronic exercise (3 times a day for 4 weeks). Interleukin-6 and immunoglobulin A did not change after acute exercises, but cortisol significantly decreased at immediately after moderate-intensity exercise and 3 hours after high-intensity exercise than pre-exercise. Chronic exercise for 4 weeks caused increases in physical fitness and testosterone levels. In conclusion, regular exercise can improve quality of life and health of people living with HIV/AIDS.

Brief Biosketch

Research interests: Sports medicine, HIV & exercise, Football sciences
Lab homepage: N/A

Mar.2019 – Current: Dept of Sport Science, Kangwon National University
Mar.2014 – Feb.2019: Dept of Football Science, Honam University
Aprt.2013 – Feb.2014: Technical Committee, Korea Football Association

Patient-specific analysis of aortic dissection using numerical simulation and 4D flow MRI

Gyu-Han Lee
Senior Researcher
Institute of Medical Devices at Kangwon National University

Abstract: Aortic dissection (AD) is a life-threatening condition characterized by the separation of the layers within the aortic wall, leading to altered blood flow and potentially resulting in severe complications such as malperfusion, aortic aneurysm, and rupture. Understanding the hemodynamics in AD is crucial, as it is intricately linked to the risk of these complications. The methodology of this study involves sophisticated techniques, including the use of the Windkessel model to simulate blood flow dynamics. By integrating these simulations with 4D flow MRI data obtained from individual patients, the study provides a comprehensive view of the disease's progression. In summary, this comprehensive study not only advances our understanding of the hemodynamics in aortic dissection but also paves the way for transformative personalized, targeted treatments.

Brief Biosketch

Research interests: Computational fluid dynamics, 4D flow MRI, Hemodynamics, Fluid-structure interaction

Education and Professional Experience

Sep 2023 – Current: Institute of Medical Devices, Kangwon National University

Mar 2019 – Aug 2023: Ph.D. Degree in Department of Interdisciplinary Program in Biohealth-Machinery Convergence Engineering, Kangwon National University

Laboratory homepage: http://fel.kangwon.ac.kr

Session V New Technique-Based Translational Research for Human Health

Chair: Prof. Su-Geun Yang, Prof. Kyeong Jin Kim Inha University, Korea

Nov. 11 (Sat.) **Multimedia (B115) 10:00~12:00**

Prof. Bong Sup Shim Inha University, Korea
Biodegradable Melanin-like Electroactive Materials for Bioelectronics

Prof. Elvin Blanco Weill Cornell Medical College, USA
Nanotherapeutic-inspired metabolic remodeling in disease

Prof. Dong Wook Choi Korea University, Korea
State-of-the-art Metabolomics Techniques-based Study of Fuel

Prof. Norased Nasongkla Mahidol University, Kingdom of Thailand
Translational Research: Polymeric Implants Loaded with Anticancer

Dr. Su-Geun Yang Inha University, Korea
Image Guided Locoregional Drug Delivery and Therapy: Pros and Cons

Biodegradable Melanin-like Electroactive Materials for Bioelectronics

Bong Sup Shim

Professor

Department of Chemical Engineering, Program in Biomedical Science & Engineering

Inha University

Abstract:

Natural systems intelligently construct multifunctional biocomposites by a bottom-up assembly of nanomaterials, leading to intricate hierarchical and multiphasic architectures. Drawing inspiration from these natural wonders, we have fabricated multifunctional nanocomposites using naturally sourced materials, with an emphasis on conductive melanin-like polydopamine (PDA). Traditionally, PDA's potential in bioelectronics remained untapped due to its limited electrical conductivity and suboptimal material properties. In contrast, we demonstrate that natural melanin nanoparticles can be engineered to exhibit modulated electrochemical conductivities, adaptive optical reflectivity, and enhanced shape stability, all while preserving biocompatibility. Leveraging a novel method from our laboratory that endows PDA with electrical conductivity, we spotlight its distinct functional attributes in biosensor and bionic interface applications. These melanin-analogous PDA composites hold immense promise as foundational materials for pioneering bioelectronic endeavors, spanning biotic-abiotic interfaces, ingestible sensors and actuators, and sustainable green electronics.

Brief Biosketch

Research interests: Extraction of Functional Nano-Biomaterials, Processing of Biomimetic Structural Nanocomposites, Biodegradable/Biocompatible/Implantable Bioelectronics

Lab homepage: www.sbongs.com

Sep. 2011 – Current: Professor (Assistant, Associate, Full) Dept of Chemical Engineering, Inha University, Korea

Mar.2009 – Aug.2011: Postdoc Researcher, University of Delaware & University of Michigan, USA

Sep. 2002 – May. 2009: MS., Ph.D. Dept of Chemical Engineering, University of Michigan, USA

Nanotherapeutic-inspired metabolic remodeling in disease

Elvin Blanco

Assistant Professor

Depart. of Nanomedicine at Houston Methodist Research Institute Weill Cornell Medical College

Abstract:

Over the past few decades, nanotherapeutic constructs have undergone a widespread and aggressive application towards cancer diagnosis and treatment. This is owed primarily to impaired vasculature in tumors that leads to higher site-specific accumulation of drugs/imaging agents/genetic material. Enhanced vascular permeability in diseased tissues due to endothelial dysfunction is also present in diseases such as heart failure, atherosclerosis, and pulmonary arterial hypertension (PAH). Importantly, mitochondrial dysfunction represents a hallmark of all these conditions. Our objective is to exploit unique transport phenomena, at the systemic and local levels, for metabolic reprogramming and re-establishment of proper mitochondrial function in various disease settings.

Brief Biosketch

Research interests: Mitochondrial biogenesis, Mitochondrial transplantation, Nanoengineering

Lab homepage: https://blanco.hmailabs.org/

BS, Case Western Reserve University 1998 ~ 2002

MS, Case Western Reserve University 2002 ~ 2005

PhD, U.T Southwestern Medical Center 2005 ~ 2009

Assistant Professor of Nanomedicine in Medicine, Weill Cornell Medical College 2020 ~

State-of-the-art Metabolomics Techniques-based Study of Fuel Metabolism and the Human Disease Relevance

Dong Wook Choi

Associate Professor

Department of Biotechnology, College of Life Sciences and Biotechnology, Korea University

Abstract:
Fuel metabolism has evidently been implicated in a myriad of human pathophysiology. However, biochemical mechanisms underlying the functional relevance of fuel-based metabolic crosstalk and dysregulated fuel metabolism in certain physiological and pathological conditions are not fully understood, presumably due to relevant analytic tools which have recently been appreciated.
Introducing fundamental metabolic questions in my lab, talk will be focused on two aims of my science regarding 1) efforts on developing *various state-of-the art metabolomics, fluxomics-based platforms that allows for identification of the disease relevant metabolic pathways*, and a priority-lab-plan for establishing single cell metabolomics techniques, and 2) biological questions on physiological relevance of fuel metabolism in human diseases and the underlying mechanisms including lung fuel metabolism and immuno-metabolic crosstalk during pulmonary inflammation with an example of study going on our lab; discovery of a specific metabolite modulating metabolic crosstalk between neutrophils and macrophages.

Brief Biosketch

Research Interests	- Fuel Metabolism - MAFLD - Lung Inflammation - Metabolomics - Stable Isotope Tracing Analysis
Education	2010 –2014 Ph.D. in Molecular Cell Biology Department of Biological Sciences, Sungkyunkwan University (Advisor: Cheol Yong Choi, Ph.D.) 2008 –2010 M.S. in Molecular Cell Biology Department of Biological Sciences, Sungkyunkwan University (Advisor: Cheol Yong Choi, Ph.D.) 2004 – 2008 B.S. in Biological Sciences Department of Biological Sciences, Sungkyunkwan University
Experience	2023/09 - Associate Professor Department of Biochemistry, Department of Biotechnology, College of Life Sciences and Biotechnology, Korea University, 2021/03 - Assistant Professor Department of Biochemistry, College of Natural Sciences, Chungnam National University 2016/04 - Research Fellow Division of Metabolic Diseases, Department of Cancer Biology, Dana Farber Cancer Institute, Harvard Medical School (Mentor: Nika N. Danial, Ph.D.) 2014/03 - Postdoctoral Fellow Lab of Molecular Genetics, Department of Biological Sciences, Sungkyunkwan University (Mentor: Cheol Yong Choi, Ph.D.)

Translational Research: Polymeric Implants Loaded with Anticancer Agents for the Treatment of Brain Cancer

Norased Nasongkla

Associate Professor

Dept. of Biomedical Engineering at Mahidol University

Abstract:

A significant proportion of patients afflicted with brain tumors have encountered delayed diagnoses and treatments, largely attributable to the indistinct growth dynamics and primary symptomatology of such malignancies. While chemotherapy represents a primary modality of intervention, its therapeutic efficacy has been hampered by the considerable toxicity of the administered agents and their limited accumulation within the tumor site, leading to treatment failures and associated complications.

To address these challenges, a drug delivery system has been devised, employing injectable, self-solidifying polymeric depots fashioned from a biomedical polymer with non-toxicity and biodegradability properties. Researchers have undertaken investigations into the encapsulation of the anticancer agent known as 7-ethyl-10-hydroxycamptothecin (SN-38), probing its anti-tumor efficacy against human glioblastoma U87MG cells and an animal model. The findings have unveiled notable tumor growth suppression, affirming the biocompatibility of this drug delivery platform. Ongoing clinical investigations among patients afflicted with brain cancer are currently underway in Phase II, and preliminary results are indicative of a promising therapeutic approach.

Brief Biosketch

Research interests: Antibacterial applications in biomedical applications / Polymer chemistry: Polymer synthesis, characterization / Nanoparticle fabrication: Nanosphere, microsphere, micelle / Drug Delivery Systems: implant, nanocarrier / Molecular Imaging: SPECT, MRI probes / Nano-coating: Spray and dip coating, plasma treatment

Lab homepage: www.BioNEDD.org

2022-2023	Vice Dean of Research, Faculty of Engineering, Mahidol University, Thailand
2014- 2022	Chair: Department of Biomedical Engineering, Faculty of Engineering, Mahidol University, Thailand

2020-present Lab manager, Laboratory for Biocompatibility Testing of Medical Devices ISO 17025

Adress Department of Biomedical Engineering, Faculty of Engineering, Mahidol University

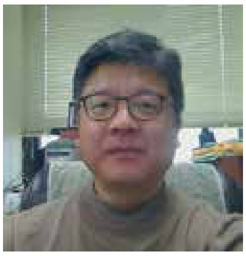
Email norased.nas@mahidol.ac.th

Image Guided Locoregional Drug Delivery and Therapy: Pros and Cons

Su-Geun Yang

Professor

Depart. of Biomedical Science & Engineering, Inha University College of Medicine



Abstract:

New functional drug delivery system has been developed for decades and now successfully applied to clinical fields. Particularly, imaging technology allows detection of pin-point size cancer, and we can approach cancerous tissue using the imaging technologies, such as MR, CT and PET. In this presentation, we will discuss about imaging-guided cancer treatment. The first topic is MR imaging agent which can allow the most sensitive detection of cancer in the body. Iron oxide nanoparticles as a T2 contrast agent, decorated with integrin-targeting peptide, and T1 contrast agent, gadolinium chelated with macromolecular natural polymer, for liver imaging will be discussed. Additionally, hepatic caner targeting doxorubicin eluting drug delivery system will be presented. Hepatic cancer targeting embolic particles were fabricated using capillary fluidic devices. Its drug eluting and embolic properties was tested on swine animal models. Now it is under the clinical development for the treatment of late-stage hepatic cancer. The third topic is drug-eluting gastro-intestinal stents, especially used for the treatment of bile duct cancer. Our group designed photosensitizer-embedded self-expanding nonvascular metal stent (PDT-stent) which allows repeatable photodynamic treatment of cholangiocarcinoma. Photodynamic activity of PDT-stent was evaluated through laser exposure on stent-layered tumor cell lines, HCT-116 tumor-xenograft mouse models and endoscopic intervention of PDT-stent on bile duct of mini pigs. The PDT-stent after light exposure successfully generated cytotoxic singlet oxygen in the surrounding tissues, inducing apoptotic degradation of tumor cells and regression of xenograft tumors on mouse models.

Brief Biosketch

Research interests: Therapeutic gene delivery (Aptamer, miRNA), Polymeric drug, Space science

Lab homepage: https://orosyang.wixsite.com/nanomedic

2003 ~ 2006	Ph.D. in Pharmaceutical Science, Seoul National University College of Pharmacy.
1993 ~ 1995	B.S. in Pharmaceutical Science, Chung-Ang University College of Pharmacy.
1989 ~ 1992	M.S. in Pharmacy, Chung-Ang University College of Pharmacy.

WBC2024

12th World Biomaterials Congress

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- **João F. Mano** — The University of Aveiro, Portugal
- **Nicholas A. Peppas** — The University of Texas at Austin, USA
- **Pamela Habibovic** — Maastricht University, The Netherlands
- **Paula T. Hammond** — Massachusetts Institute of Technology, USA
- **Takao Hanawa** — Tokyo Medical and Dental University, Japan
- **Yunbing Wang** — Sichuan University, China

※ Listing Names in Alphabetical Order.

초록접수 마감 2023년 11월 30일

조기등록 마감 2024년 1월 31일

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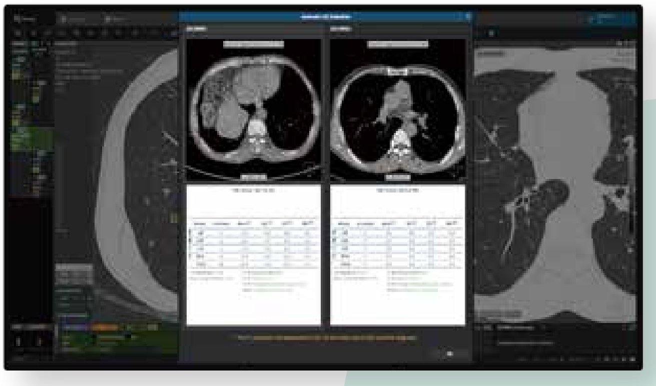
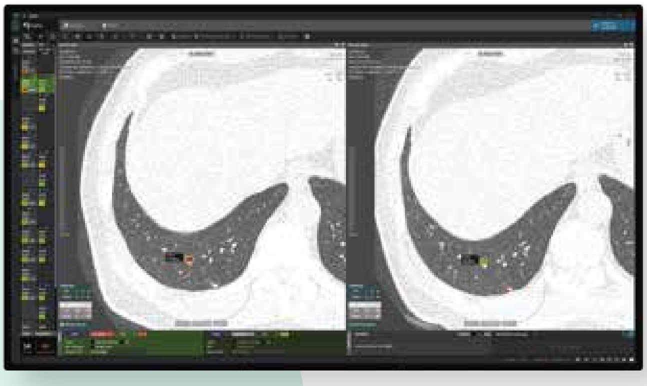
Staying ahead of symptoms
aview:

코어라인소프트는 국내 의료 영상 연구자 1세대인 카이스트 출신 CO-FOUNDER 세 사람이 2012년 설립한 의료 영상 인공지능 기업입니다. 의료 AI 기업 중 유일하게 **국가 폐암검진 솔루션에 5년 연속으로 선정** 되었으며, 미국, 독일, 이탈리아, 일본 등 전 세계 의료 선진국에 성공적으로 진출하며 글로벌 AI 의료 시장을 리드하고 있습니다.

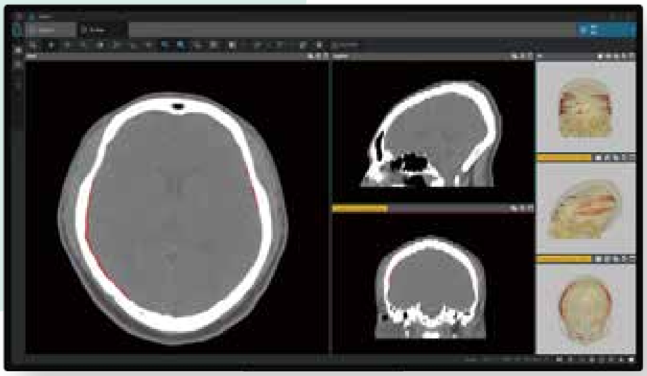


aview:CAC

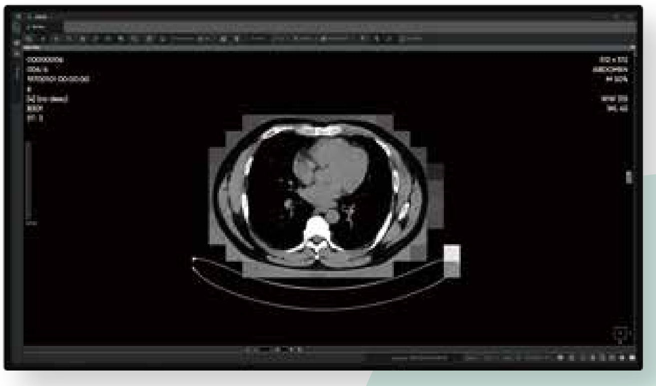


aview:LCS

aview:Research



aview:NeuroCAD



aview:가명화서버

aview:Modeler

(주)제이엘케이

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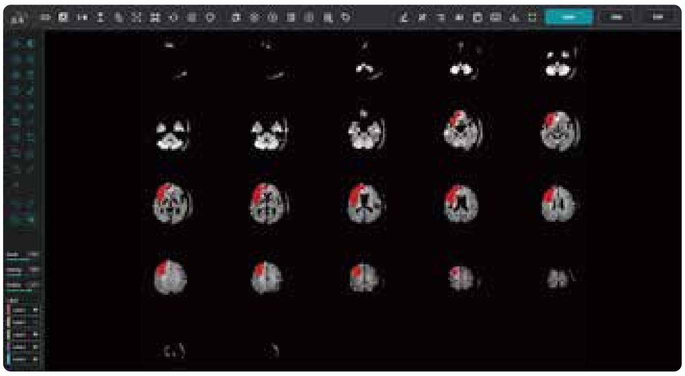
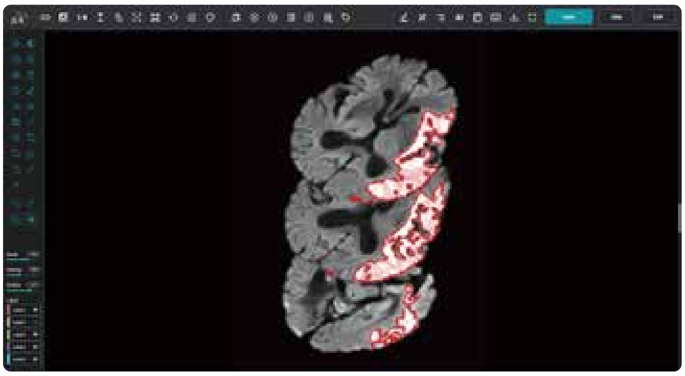
분석된 결과를 기반으로 뇌경색 발병 원인인 큰혈관뇌경색, 심장색전증, 작은혈관뇌경색에 대한 각각 확률값을 전문가 수준으로 제시합니다. 제공된 정보는 환자 맞춤 치료 결정을 할 수 있고 의료진의 진단과 치료 과정을 보조합니다.

AI 분석 결과



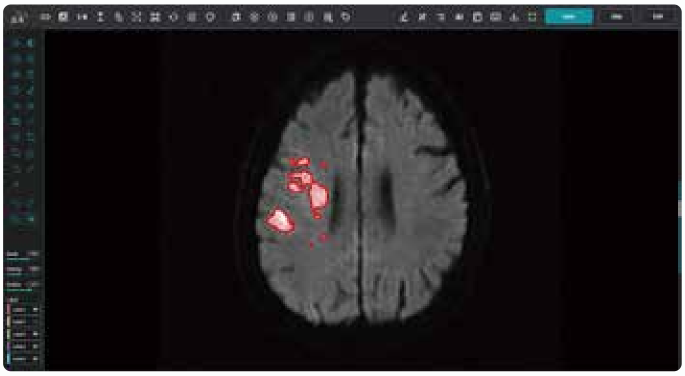
2D Summary View

인공지능이 검출한 뇌경색 의심 영역을 원본 영상 위에 입힌 뒤, 전체 영상 요약 정보를 제공합니다. 한 눈에 뇌경색 의심 병변 정보를 파악할 수 있습니다.



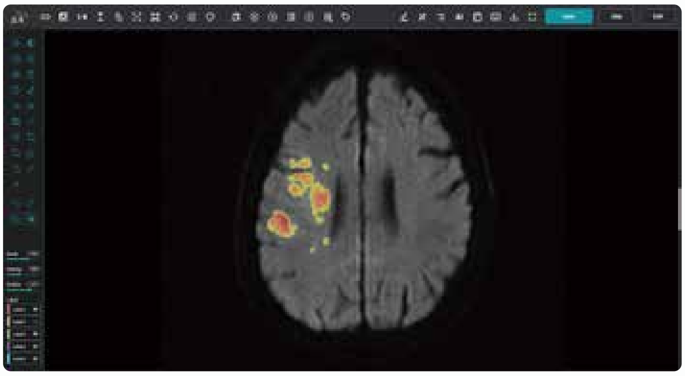
3D Scroll View

인공지능이 검출한 뇌경색 의심 병변 정보를 3차원으로 제공합니다. 3차원으로 제공된 정보를 병변의 해부학적 위치를 구조적으로 파악하는 데 도움을 줍니다.



Voxelized Segmentation View

개별 Slice 위에 뇌경색 의심 병변을 픽셀 단위를 표시합니다. 표시된 정보를 통해 뇌경색 병변의 위치를 정확하게 알 수 있으며, 뇌경색 크기의 정량 정보를 함께 파악할 수 있습니다.



Classification with Heatmap View

Segmentation 결과와 독립적으로 Slice 별 뇌경색 분류 인공지능 학습 결과를 히트맵과 함께 표시합니다. 뇌경색 병변 여부를 더 민감하게 찾아내는 인공지능 기능을 탑재하고 있습니다.

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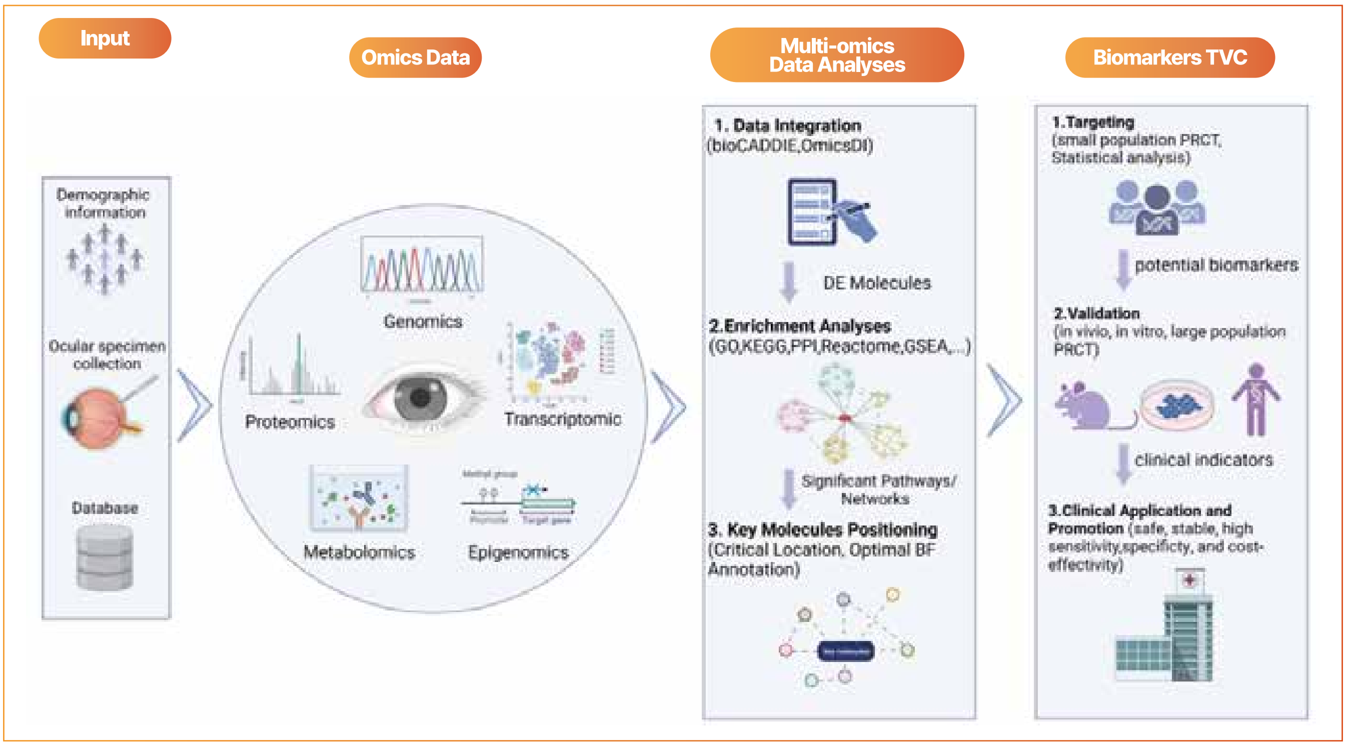
Recent studies have shown that integrative (or multi-omics) analysis approaches can improve the classification of disease into clinically relevant subgroups and potentially identify biomarkers of health or disease. Most of the ophthalmological diseases are multifactorial diseases, meaning that combinations of genetic and environmental factors underlie the diseases.



Multi-omics approach to identify biomarkers for retinal vascular diseases
(Cells 2023, 12(1), 103; https://doi.org/10.3390/cells12010103)

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2024학년도 전기 대학원 신입생모집

연세대학교 의과대학
융합의학과

[디지털헬스케어전공]

접 수 2023.10.12.(목) ~ 30.(월) 17:00 마감
100% 인터넷접수 (연세대학교 일반대학원 홈페이지 : http://graduate.yonsei.ac.kr)

모집과정 석사, 박사, 통합과정

선발인원 석사 00명, 박사00명, 통합 0명 ※ 통합과정은 전일제(Full-Time)만 선발

지원자격 국내외 정규 대학에서 학사학위 또는 석사학위 취득(예정)자

전형방법 서류 및 구술시험

전형일정
1) 구술시험 대상자 발표 : 2023.11.24.(금) 17:00
2) 구술시험 일정 및 장소 : 합격자 개별통보 예정
3) 최종합격자 발표 : 2023.12.14.(목) 17:00
4) 합격자 등록 : 2024.1월 중(예정)

제출서류
[석사과정/통합과정] 입학원서, 대학졸업증명서, 대학성적증명서, 학업 및 연구계획서, 공인영어성적표(선택)
[박사과정] 입학원서, 대학 및 대학원 졸업증명서, 대학 및 대학원 성적증명서, 학업 및 연구계획서, 공인영어성적표(선택), 석사 논문 초록

특 전
- 장학금지원

구분	석사과정	박사과정	통합과정
전일제	등록금 60%지원	등록금 40%지원 (영어성적 충족시 60%지원)	
부분제	등록금 25%지원		-
리더십장학금	등록금 10%지원		

※ 대학원 융합의학과 장학금 규정에 따라 지급

문 의 MRA@yuhs.ac, 02-2019-5440(대학원 융합의학과)

연세대학교 의과대학
YONSEI UNIVERSITY COLLEGE OF MEDICINE
융합의학과
디지털헬스케어 전공

제품화 단계별 전주기 지원

| 멘토링 사업 |

멘토링 사업

소개

혁신·신개발·첨단의료기기 등의 제품화 성공률을 높이기 위해 식품의약품안전평가원에서 지원하고 있는 단계별 맞춤형 멘토링 사업

내용

혁신·신개발·첨단의료기기 등의 신속제품화 집중 지원을 위해 선정한 제품을 대상으로 연구개발(R&D), GMP, 시험검사, 임상시험, 인허가, 해외 인허가까지 단계별 전주기 지원하는 맞춤형 멘토링 사업

목표

<u>혁신·신개발·첨단의료기기 등의 제품화 성공률 제고</u>

제조자는 개발단계부터 시판되는 모든 단계를 예측 할 수 있어, 최적의 설계 및 전략적인 제품 개발

<u>신속제품화를 통한 시장 진입기간 단축</u>

시행착오 최소화 및 허가 준비 기간 단축으로 최종 시장진입 단계까지 소요되는 시간 절감

성과 (16년~22년)	• 혁신·신개발·첨단의료기기 등의 신속제품화를 위한 150여개의 의료기기 대상 선정 • 제품화를 위한 연구개발(R&D), GMP, 임상시험, 인허가 등 각 분야별 전문가 및 전문기관을 통한 제품화 전주기 단계별 지원 * 연구개발(의료기기 설계·개발 및 시험검사) 단계 237건, GMP(제조 및 품질관리) 단계 147건, 임상시험계획 단계 165건, 국내외 인허가 단계 316건 • 첨단의료기기의 신속제품화 및 시장진출 지원을 통한 시험성적서, GMP, 임상시험성적서, 국내외 인허가 등 220여건의 주요 성과 달성

멘토링 지원

차세대 의료기기 맞춤형 멘토링

R&D, GMP, 인허가, 임상 등 통합지원

R&D
- 기초연구 단계 학술자문
- 디자인, 설계 및 시제품 제작관련 자문
- 국내·외 제품 개발 현황 및 시장정보 등 분석 제공

임상
- 임상적 사용 평가
- 임상시험 설계, 임상통계 및 임상 논문 분석 등
- 임상시험실시기준(GCP) 관련 자문 등

GMP
- 품질문서 구축
- 제조시설 및 설비 구축 등 기술지원
- GMP 심사 관련 자문 등

인·허가
- 인·허가 관련 규정
- 허가신청서 작성, 심사자료 준비 등
- 시험검사 결과 예비 타당성 검토
- 기타 성능시험 방법·기준 등

멘토링 운영절차

제품 진단 [제품화 단계 및 지원 필요사항 진단]

멘토링팀 구성

분야별 전문가
- 분야별(R&D, 임상, GMP 등)전문가 중 지원 대상, 지원환경에 따라 필요한 전문가 5~10명 구성
- 다양한 분야의 전문가 POOL 구성

분야별 전문기관
- 업체의 자문요청 빈도가 높은 의료기기 유관기관들을 전문기관으로 지정 운영

멘토링 전담조직
- 분야별 전문가 및 멘토링 지원 대상간 연계·조정, 멘토링 진도관리 등 멘토링 관리·운영

맞춤형 멘토링 [멘토링팀을 통해 전문 분야별 상시 기술지원(서면/방문)]

R&D 지원 — 시험검사 지원 — GMP 지원 — 임상 지원 — 인·허가 지원 — 해외 인·허가 지원

모니터링, 피드백 [멘토링 진도관리, 추가지원 필요사항 파악 및 피드백]

식품의약품안전처 식품의약품안전평가원

NIDS 한국의료기기안전정보원

성균관대학교

의료기기 산업학과

Department of Medical Device Management and Research, SAIHST, Sungkyunkwan University

의료기기 개발에서 실용화의 전 과정을 다학제적 및 현장 중심으로 교육 하여, 우리나라를 의료기기 선진국가로 발전시키는데 기여할 수 있는 융합적 실무형 전문가를 양성하는 학과

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병원 중심 산·학·연·병 학습생태계 구축

❶ 의료기기 기업의 요구를 반영한 현장 수요 맞춤형 교육 제공
❷ Case study 등 실습 중심의 교과목을 통한 실무 현장형 교육 제공
❸ 의료기기 개발과정의 전주기를 포괄하는 학제 융합형 교육 제공
❹ 의료기기산업을 선도하는 글로벌 리더 양성 교육 제공

입학전형

모집학과	• 석사과정 • 박사과정 • 석·박사 통합과정
입학요건	• 국내/외 4년제 대학졸업자 및 졸업예정자 (학사/석사 학위 소지자) • 타 기관 재직 중인 자 (관련기관 재직 경력 우대)
모집인원	• 전일제 (00명) • 부분제 (계약학과 포함 00명)
문 의	• 삼성융합의과학원 • T: 02-2148-7799 • E: medevice@skku.edu

특전 및 장학제도

전 일 제	• **등록금 100% 지원 (입학금 제외)** • 소속 연구실별 인건비 협의 가능 • ※ 예산사정에 의해 유동적임 • 국내외 인턴십 지원
부 분 제	• 석사학위 논문대체 졸업가능 • 평일 야간, 주말 수업 운영 • 특성화대학원 예산에 따라 장금학 지급 될 수 있음
공 통	• 학회, 교육 참가 지원 • 연구 인센티브 지원
교육장소	• 삼성생명 일원역빌딩 캠퍼스 (MAIN) • 삼성서울병원

SAIHST 삼성융합의과학원 SAMSUNG 삼성서울병원 성균관대학교 saihst.skku.edu

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Since its establishment in 1993, Insung Medical Co., Ltd. has been developing and manufacturing products with value for excellent quality and innovative technology.

We have been constantly researching and developing innovative medical devices with quality and safety in Korea, and have been at the forefront of localization of medical devices.

Insung Medical's goal is to provide the best medical solutions to mankind not only in Korea but also around the world based on high technology.

Insung Medical Co., Ltd. promises to become a model that grows into a global company that leads the global medical device market with its excellent technology, development capabilities, and thorough quality control.

Company History

2023.05 Selected as on of top 10 Medical Device Research & Develop-ment Project, Korea Medical Device Development Fund
2022.05 Factory expansion and Manufacturing process expansion
2017.12 Silicon, PICC Manufacturing process expansion
2015.05 Moved the Main Factory from Yangpyeong-sito Wonju-si
2014.12 Certified as INNO-BIZ Corporation
2014.09 Acquired CE certification (CLASS III products)
2014.05 Certified as IP STAR Corporation
2013.08 New R&D center in Daegu-si
2013.04 HUMAN CATHETER 1FR development completed
2012.12 CEP inaugurated as Chairman of Korea Medical Devices
2008.06 Industry Association
2006.02 Acquired KGMP Certification
2004.11 Silicone Product Plant at Yangpyeong Factory
2003.11 Established Insung China(Joint Venture Factory)
2002.06 Exportation of PCA Honey Run
2000.12 Acquired CE certification (CLASS II-A products)
2000.10 Registered as an Outstanding Technology Company by Korea
2000.05 Technology Credit Guarantee Fund
1993.11 Established Yangpyeong Factory
1984.11 Registered as a venture company by the Small and Medium Business Administration

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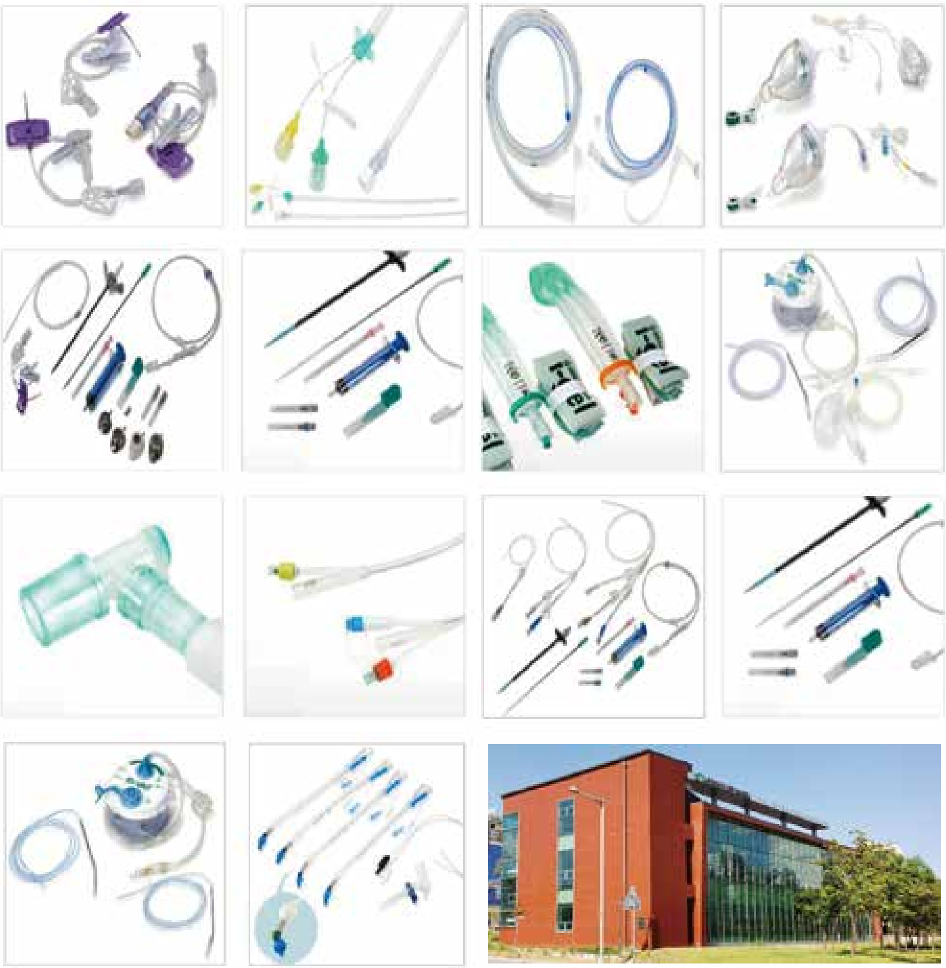
Insung Medical Product



Certificates

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168, Gieopdosi-ro, Jijeong-myeon, Wonju-si, Gangwon-do, 26354, Republic of Korea
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Wearable 12-Lead Holter Monitor

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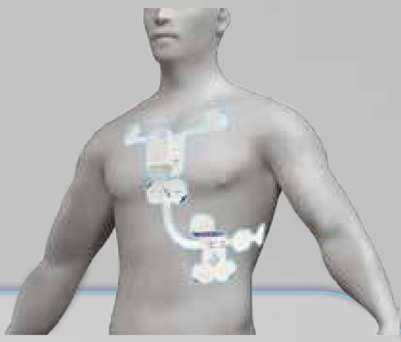
- 방수방진 등급 IP68
- 실시간 및 장시간 심전도 측정가능
- 심전도 기록이 가능한 내장메모리 탑재



Product Brochure QR

Korean English Chinese

측정된 심전도는 어플리케이션을 통해서도 확인이 가능합니다.

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