www.kterms-conference.or.kr

THE 22ND ANNUAL MEETING OF
KOREAN TISSUE ENGINEERING AND REGENERATIVE MEDICINE SOCIETY

KTERMS 2021

| 제 22차 한국조직공학·재생의학회 학술대회 |

Regenerative Medicine for a better life and for an advanced future

2021.

6.18 FRI - **06.19** SAT

온라인 학술대회(e-Conference)

| HOSTED BY |

한국조직공학·재생의학회
Korean Tissue Engineering and Regenerative Medicine Society

DAY 2 06. 19. Sat.

시간		Room A		Room B	
09:00 ~ 10:20		**S09**	**Exosomes**	**S10**	**Dentistry**
		Chair	박귀덕(KIST)	Chair	최성호(연세대)
	09:00 ~ 09:20	S09-1	**(Keynote)** Bio-mimetic Nanovesicles for Epigenetic Reprogramming **박재성**(POSTECH)	S10-1	**(Keynote)** Cell therapy in Oral and Maxillofacial diseases **이부규**(서울아산병원)
	09:20 ~ 09:35	S09-2	Hydrogel-based hybridization chain reaction (HCR) for detection of urinary exosomal miRNAs **최낙원**(KIST)	S10-2	The role of GPCRs in pulp-dentin complex regeneration **김진만**(서울치대)
	09:35 ~ 09:50	S09-3	Discovery Of Lactoferrin as stimulant for Enhanced Secretion Of Adipose-Derived Stem Cells Extracellular Vesicles **김준호**(바이오솔루션)	S10-3	Bone marrow-Inspired extracellular matrix using chimeric MAP for In Vivo Bone regeneration therapy **전상호**(고려의대)
	09:50 ~ 10:05	S09-4	Polydiacetylene liposome based immune-sensor for the exosome detection **이강원**(서울대)	S10-4	Application of 3D Bioprinting for Bone Tissue Reconstruction in Dentistry **허동녕**(경희치대)
	10:05 ~ 10:20	S09-5	Adipose Stem Cell Exosome (ASCE) - based Regenerative Therapeutics & Aesthetics **하대현**(엑소코바이오)	S10-5	Programmed release of growth factors for optimal bone regeneration **차재국**(연세치대)
10:20 ~ 11:00		**MM2**	**Meeting Mentors 2**	**SP2**	**Student Presentation 2**
		Chair	최병현(인하대)	Chair	최성우(동국대)
	10:20 ~ 10:30	MM2-1	The value of long-term partnership and setting research goals **임정옥**(경북대)	SP2-1	Respiratory dysfunction induced by dust particles in inkjet bioprinted alveolar barrier **강다윤**(POSTECH)
	10:30 ~ 10:40			SP2-2	Reproduction of Tumor Microenvironment in the Multicellular 3D Bioprinted Drug Testing Platform using Patient-derived Tumor-laden Tissue-specific Bioinks **최유미**(POSTECH)
	10:40 ~ 10:50	MM2-2	융합 연구와 혁신 기술 그리고 벤쳐 창업 **조용우**(한양대)	SP2-3	Bioprinting a functional multi-scale microvasculature with patternable capillary network **손정현**(UNIST)
	10:50 ~ 11:00			SP2-4	A patient-specific 3D breast tumor model with morphological heterogeneity for personalized medicine **한종혁**(UNIST)
11:00 ~ 11:10		**Coffee Break**			
11:10 ~ 12:30		**S11**	**Young Investigator 2**	**S12**	**Gene Therapy**
		Chairs	김태형(중앙대), 박태은(UNIST)	Chair	박인규(전남대)
	11:10 ~ 11:30	S11-1	**(Keynote)** Machine learning to predict mesenchymal stem cell efficacy for cartilage repair & a novel cell preservation solution **Steve Oh**(A*STAR, Singapore)	S12-1	**(Keynote)** Polymer-based Gene and Cell Delivery for Immunocancer Therapy **김원종**(포항공대)
	11:30 ~ 11:45	S11-2	Development of hybrid nanomedicine for active delivery system **조현열**(국민대)	S12-2	Double Controlled Release of RNA Modules via RNA-DNA Hybrid Hydrogel **이종범**(서울시립대)
	11:45 ~ 12:00	S11-3	Tissue microenvironment engineering for regenerative medicine **이정승**(성균관대)	S12-3	Lipid-DNA micelles for delivery of biological molecules **곽민석**(부경대)
	12:00 ~ 12:15	S11-4	Chemical Manipulation of Cell Viability via Molecular Self-Assembly **김범진**(울산대)	S12-4	Delivery strategies for gene therapy **이소진**(삼양 홀딩스)
	12:15 ~ 12:30	S11-5	Panel discussion	S12-5	Therapeutic Development using Chemically Modified Asymmetric Small Interfering RNAs **홍선우**(올릭스)

STUDENT PRESENTATION 2

SP2 TIME 10:20~11:00 VENUE ROOM B

SP2-1	10:20~10:30	Respiratory dysfunction induced by dust particles in inkjet bioprinted alveolar barrier	강다윤(POSTECH)
SP2-2	10:30~10:40	Reproduction of Tumor Microenvironment in the Multicellular 3D Bioprinted Drug Testing Platform using Patient-derived Tumor-laden Tissue-specific Bioinks	최유미(POSTECH)
SP2-3	10:40~10:50	Bioprinting a functional multi-scale microvasculature with patternable capillary network	손정현(UNIST)
SP2-4	10:50~11:00	A patient-specific 3D breast tumor model with morphological heterogeneity for personalized medicine	한종혁(UNIST)

SP2-1

Respiratory dysfunction induced by dust particles in inkjet bioprinted alveolar barrier

Dayoon Kang[1], Sungjune Jung[2]

[1]School of Interdisciplinary Bioscience and Bioengineering, POSTECH, Pohang, Korea
[2]Department of Material Science and Engineering, POSTECH, Pohang, Korea

[1]kminh0630@postech.ac.kr
[2]sjjung@postech.ac.kr

Fine dust particles in the air travel through the airways to our bodies, damaging our respiratory system. The need for research to analyze the effects of dust particles on the respiratory system has been highlighted because such damage causes serious respiratory problems. However, most studies of dust toxicity have been conducted in two-dimensional cell culture, animal models, and epidemiological investigations. To find out how dust can cause respiratory problems, researchers should investigate using a reliable three-dimensional structural model that mimics human nature alveoli. In this study, dust particles were applied to the previously developed three-dimensional alveoli barrier created by the inkjet bioprinting process. As a result, we observed dramatic cell apoptosis, reduced proliferation and lung dysfunction in inkjet bioprinted alveolar barriers exposed to dust particles. Based on cell-level damage, we also observed an increase in pro-inflammatory cytokines that stimulated the secretion of matrix metalloproteinase (MMP). To analyze the effect of increasing immune response from dust, dust was treated in dose- and time-dependent manner, and alveolar tissue collapse was identified to induce structural collapse and reduced barrier robustness. We further investigated lung surfactant protein-related genes in dust-treated alveoli tissues and then estimate the harmful effects of dust on lung surfactant dysfunction. This study demonstrated the physiological effects of dust on cytotoxicity, alveolar barrier stiffness and surfactant secretion at gene expression level using inkjet bioprinted alveoli barriers. It has also been demonstrated that dust can have serious consequences that can lead to the collapse of the alveoli barrier. Using *in vitro* inkjet bio-printed 3D alveoli barriers, we expect this strategy to be a useful tool for identifying air pollutant exposure-related diseases.

Keywords : Inkjet bioprinting, Alveolar barrier, Dust particle toxicity

SP2-2

Reproduction of Tumor Microenvironment in the Multicellular 3D Bioprinted Drug Testing Platform using Patient-derived Tumor-laden Tissue-specific Bioinks

Yoo-mi Choi[1], Deukchae Na[2], Jisoo Kim[3], Seoyeon Min[2], Hee-Gyeong Yi[4], Charles Lee[2,5], Jinah Jang[1,3,*]

[1]Department of Convergence IT Engineering, Pohang University of Science and Technology (POSTECH), Korea
[2]Ewha Institute of Convergence Medicine, Ewha Womans University Mokdong Hospital, Korea
[3]School of Interdisciplinary Bioscience and Bioengineering, Pohang University of Science and Technology (POSTECH), Korea
[4]Department of Rural and Biosystems Engineering, Chonnam National

University, Korea
[5]The Jackson Laboratory for Genomic Medicine, USA

dbal134@postech.ac.kr

Accurate and precise drug efficacy and toxicity evaluation are required for the development of new drugs. Recently, *in vitro* drug screening tests have been variously attempted using the conventional cell culture method in the early stages of clinical trials to increase the similarity with humans. In particular, the patient-derived xenograft (PDX) model is principally used to assess the toxicity and efficacy of anticancer drugs and evaluate the effectiveness of drug combinations. However, the PDX model still has significant limitations such as high cost, low engraftment rate, long production time, difficulty in high-throughput drug screening studies. Also, PDX model lacks human interstitial components (*e.g.*, extracellular matrix, immune cells, and fibroblasts of human origin). Since the interaction of cancer cells with interstitial cells is a key factor on properties such as metastasis, invasion, and drug responsiveness of cancer cells, the absence of interstitial cells makes it difficult to mimic drug responses as in the actual tumor microenvironment (TME). In this study, we successfully developed *in vitro* high-throughput anticancer drug screening platform using gastric cancer PDX tissue, porcine gastric tissue-derived decellularized extracellular matrix (g-dECM), and 3D tissue printing technology. We produced about 150 printed tissues with bioinks made by chopping one PDX tissue and encapsulating it in g-dECM. The gastric cancer cells in the printed tissue retained the same cancer properties as the original PDX and survived well up to 28 days. Especially, the printed tissues showed different drug resistance depending on the type of gastric cancer, and drug resistance increased when the tissue was co-cultured with human gastric fibroblasts. In addition, the printed tissues co-cultured with gastric fibroblasts revealed significant increases in gene expression associated with drug resistance. Furthermore, the combinational therapy in the printed tissues exhibited higher apoptosis at a lower concentration of the drugs than that of the single treatment. The developed platform can improve production efficiency, reduce the time and cost of drug testing, and achieve multicellular drug screening under the reproduction of TME. Therefore, this *in vitro* high-throughput drug screening platform can be used to evaluate a variety of drugs, including anticancer drugs, and is expected to rapidly validate patient-specific drug responses.

Keywords : *Patient-derived xenograft, Tumor tissue printing, High-throughput drug screening, Decellularized extracellular matrix*

SP2-3

Bioprinting a functional multi-scale microvasculature with patternable capillary network

Jeonghyun Son[1], Sungjoon Hong[1] and Hyun-Wook Kang[*1]

[1]Biomedical Engineering, Ulsan National Institute of Science & Technology, Korea

[*]corresponding author: hkang@unist.ac.kr

Various methods have been introduced to produce microvasculature, which is an essential element in artificial tissues and disease model designs. Although the introduced strategies could produce a patterned vasculature, the engineered vasculature could not properly mimic the intricate capillary network of native vasculatures, which are only tens of micrometers wide. Here, we propose a new bioprinting strategy that enables the multiscale production of functional and biomimetic microvasculatures. A multicellular construct comprising endothelial cells and angiogenic-factor-secreting cells was designed to guide angiogenesis in a desired direction; endothelialized channels were printed directly, and capillary network into a computer-designed pattern was induced. The successful induction of capillaries into diagonal, wave, and branch patterns confirmed that angiogenesis could be sophisticatedly controlled in vitro. Moreover, the secure connection of endothelialized channels and capillaries was confirmed by the dextran infiltration test. Additionally, this strategy successfully produced a hepatic-lobule-like microvasculature that significantly improved the functions of the hepatocytes. Finally, using the chick embryo chorioallantoic membrane(CAM) assay, we showed that the bioprinted microvasculature was capable of integrating into host vasculature and functioning. We believe this technique may contribute to development of biomimetic vasculatures with physiologically relevant length scales.

Keywords : *Tissue Engineering, 3D bioprinting, microvasculature, multiscale, capillary network*

References :

[1] Kolesky DB, Truby RL, Gladman AS, Busbee TA, Homan KA, Lewis JA (2014) 3D bioprinting of vascularized, heterogeneous cell-laden tissue constructs. Advanced Materials 26: 3124-3130

[2] Miller JS, Stevens KR, Yang MT, Baker BM, Nguyen D-HT, Cohen DM, Toro E, Chen AA, Galie PA, Yu X, Chaturvedi R, Bhatia SN, Chen CS (2012) Rapid Casting of Patterned Vascular Networks For Perfusable Engineered Three-dimensional Tissues. Nature Materials. 11: 768-774