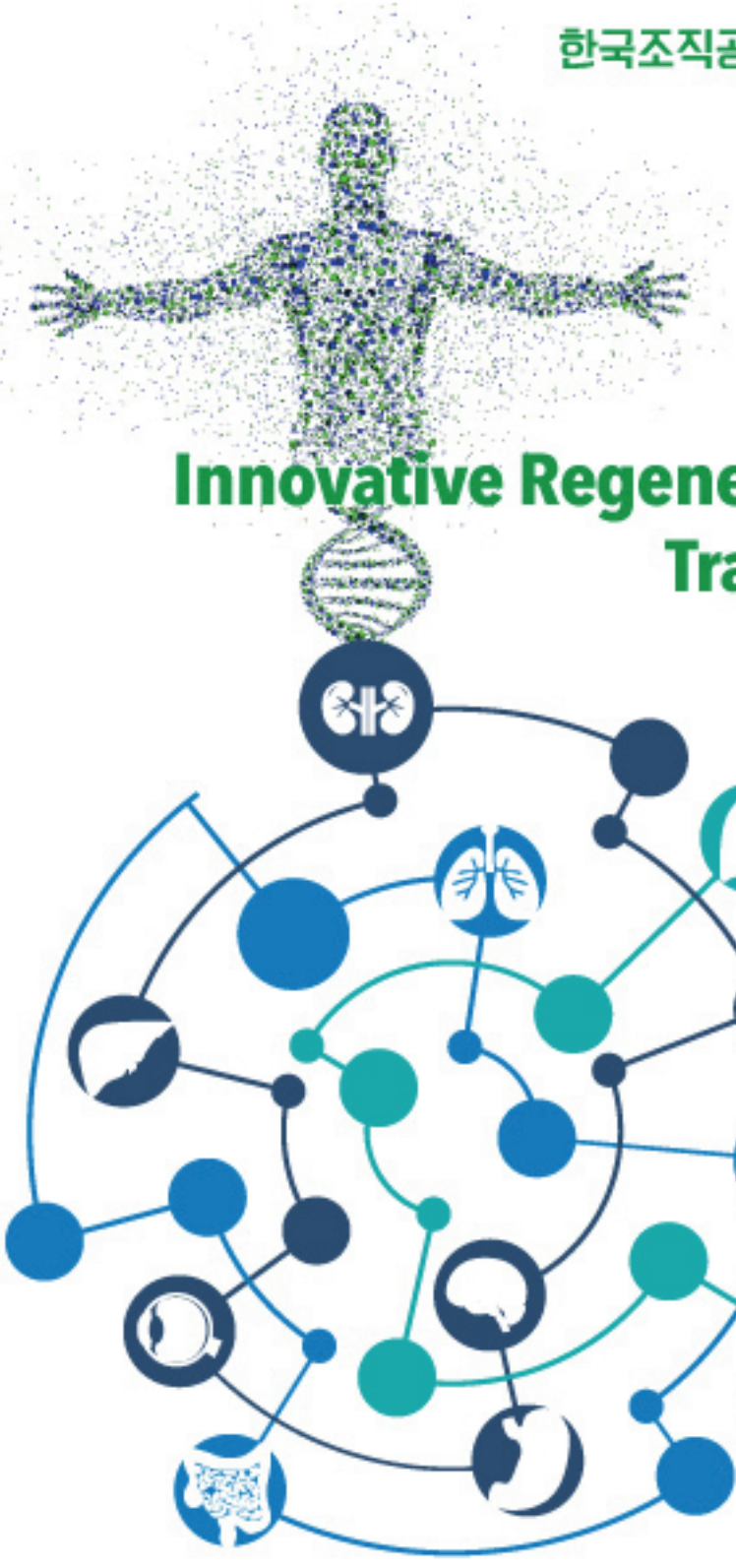
2023 KTERMS

한국조직공학 · 재생의학회 제23차 학술대회

2023. 05. 19(금) ~ 05. 20(토)

서울대학교병원 의학연구혁신센터, 어린이병원



Innovative Regenerative Medicine for Translation to Human

한국조직공학·재생의학회

Korean Tissue Engineering and Regenerative Medicine Society

PS11-08
3D Bioprinting of Diabetic Wound Healing Patch using Adiposederived MSCs-laden Placenta-derived Extracellular Matrix Bioink
Hye Jin Kim[1], Yeonggwon Jo[2], Ji Hwan Kim[3], Yoo-mi Choi[1], Hwan Yong Choi[3], Jinah Jang[1,2,3,*]
[1]Department of Convergence IT Engineering, Pohang University of Science and Technology, Republic of Korea
[2]School of Interdisciplinary Bioscience and Bioengineering, Pohang University of Science and Technology, Republic of Korea
[3]Department of Mechanical Engineering, Pohang University of Science and Technology, Republic of Korea

PS11-09
Development of 3D Bioprinted Vascularized Respiratory Modular Assembly for Inflammatory Respiratory Disease
Hyoryung Nam[1], Yoo-mi Choi[1], Sungkeon Cho[2], Ge Gao[2], Donghwan Kim[3], Jongmin Kim[2], Hwanyong Choi[2], Se-Hwan Lee[1], and Jinah Jang[1,2,3,*]
[1]Department of Convergence IT Engineering, POSTECH, Republic of Korea
[2]Department of Mechanical Engineering, POSTECH, Republic of Korea
[3]School of Interdisciplinary Bioscience and Bioengineering, POSTECH, Republic of Korea

PS11-10
Engineering Peri-islet Niche and Cellular Organization for Stem Cell-derived Islets and Vasculatures using Bioprinting Technology
Myungji Kim[1], Seungyeun Cho[4], Dong Gyu Hwang[1], Jinah Jang[1,2,3,4,*]
[1]School of Interdisciplinary Bioscience and Bioengineering, Pohang University of Science and Technology, Republic of Korea,
[2]Department of Convergence IT Engineering, Pohang University of Science and Technology, Republic of Korea,
[3]Mechanical Engineering, Pohang University of Science and Technology, Republic of Korea,
[4]Center for 3D Organ Printing and Stem Cells, Pohang University of Science and Technology, Republic of Korea

PS11-11
Accelerated Blood Vessel Infiltration using Platelet-Rich Plasma Bioink for Adipose Tissue Regeneration
Hanan J. Mohamed, Wonwoo Jeong, Hyun-Wook Kang*
Department of Biomedical Engineering, Ulsan National Institute of Science and Technology (UNIST), Ulsan, Republic of Korea

Biomaterials

PS13-01
Enhanced mechanical properties of decellularized tissue-derived adhesive hydrogel for tissue regeneration
Eunseon Jeong[1] and Seung-Woo Cho[1,2*]
[1]Department of Biotechnology, Yonsei University, Seoul, Republic of Korea
[2]Center for Nanomedicine, Institute for Basic Science (IBS), Seoul, Republic of Korea

PS13-02
Resealable anti-thrombotic artificial vascular graft integrated with a self-healing blood flow sensor
Kijun Park[1], Soojung An[2], Jihyun Kim[1], Sungjun Yoon[2], Jihyang Song, Daekwang Jung[2], Jae Park[1], Yeontaek Lee[1], Donghee Son[2*], and Jungmok Seo[1*]
[1]School of Electrical and Electronic Engineering, Yonsei University, Seoul 03722, Republic of Korea
[2]Department of Electrical and Computer Engineering, Sungkyunkwan University, Suwon 16419, Republic of Korea

PS13-03
Photonic Crystal Hydrogel Patch for Continuous and visible monitoring of Wound
Yonghoe Koo, Jinmyoung Joo*
Biomedical engineering, Ulsan national institute of science and technology, Republic of Korea

PS13-04
Blood Coagulating Factor Conjugated Hyaluronic acid Hydrogel for Multifunctional Hemostat
Soohwan An[1], Jihoon Jeon[1], Seung Yeop Han[1], Young Seok Song[1], Seung-Woo Cho[1,2,3]
[1]Department of Biotechnology, Yonsei University, Republic of Korea
[2]Center for Nanomedicine, Institute for Basic Science (IBS), Republic of Korea
[3]Graduate program of Nano Biomedical Engineering (NanoBME), Advanced Science Institute, Yonsei University, Republic of Korea

PS11-10 Biofabrication

Engineering Peri-islet Niche and Cellular Organization for Stem Cell-derived Islets and Vasculatures using Bioprinting Technology

Myungji Kim[1], Seungyeun Cho[4], Dong Gyu Hwang[1], Jinah Jang[1,2,3,4,*]

[1]School of Interdisciplinary Bioscience and Bioengineering, Pohang University of Science and Technology, Republic of Korea,
[2]Department of Convergence IT Engineering, Pohang University of Science and Technology, Republic of Korea,
[3]Mechanical Engineering, Pohang University of Science and Technology, Republic of Korea,
[4]Center for 3D Organ Printing and Stem Cells, Pohang University of Science and Technology, Republic of Korea

Human pancreatic islets are dense cellular clusters composed of various hormonal cells including α, β, and δ cells, which control blood glucose homeostasis. The metabolic functions of islets are affected not only by interactions between each different type of hormone-producing cells, but also by the surrounding microenvironments and phenotypic three-dimensional structure [1]. Especially, adhesive proteins (e.g., connexins, cadherins, ephA/ephrin-A) are abundant in the microdomains of islets and adjacent vascular networks that facilitate intercellular crosstalk and synchronized insulin release [2]. In this regard, current *in vitro* systems for stem cell-derived islets require more *in vivo*-like niches and architectural cues to comprehend the critical phenomena in fully matured islets ranging from healthy and diabetic states. Here we propose two engineering strategies to improve functional maturation of stem cell-derived islets, (1) reproducing islet-specific niche with native pancreatic tissue-derived extracellular matrix supplemented with basement membrane proteins and (2) inducement of bioprinting-based self-assembly of islets and vasculatures to recapitulate the spatial organization of islet periphery. The developed islet bespoke niche markedly enhanced beta cell-specificity and robust glucose-stimulated insulin secretion of stem cell-derived islets via combinatorial extracellular cues. Geometrically guided stem cell-derived human islet-like cellular aggregates (HICAs) and vasculatures within the tailored pancreatic environment enabled formation of dense vascular networks and adhesive molecules via juxtracrine and paracrine signaling, advancing metabolic regulation of islets (e.g. stable glucose responsiveness and high expression levels of genes related to glycolytic metabolism (GLUT1, glucokinase, insulin, chromogranin A, mafA)). In addition, physiological responses of printed HICAs-vasculatures were investigated under the diabetic conditions. Our engineering approaches regarding the optimization of niche properties to replicate tissue-specific organization expand the translationally relevant applications of islet models to investigate islet development, maturation and diabetic disease modeling.

Keywords : Bioprinting, Pancreatic tissue-specific ECM, Stem cell-derived islets, vasculatures, Diabetes

References

[1] Beydag-Tasöz, B.S., Yennek, S. & Grapin-Botton, A (2023) Towards a better understanding of diabetes mellitus using organoid models. Nat Rev Endocrinol 19:232-248
[2] Geron, E., Boura-Halfon, S., Schejter, E. D., & Shilo, B. Z. (2015) The edges of pancreatic islet β cells constitute adhesive and signaling microdomains. Cell Rep 10.3:317-325

PS11-11 Biofabrication

Accelerated Blood Vessel Infiltration using Platelet-Rich Plasma Bioink for Adipose Tissue Regeneration

Hanan J. Mohamed, Wonwoo Jeong, Hyun-Wook Kang*

Department of Biomedical Engineering, Ulsan National Institute of Science and Technology (UNIST), Ulsan, Republic of Korea

The use of autologous fat grafting for tissue reconstruction is limited by the lack of blood vessels in the transplanted fat tissue, which can result in necrosis and fibrosis. Platelet-rich plasma (PRP) has been identified as a promising approach to enhance vascularization and tissue regeneration. PRP-based bioinks have been developed for bioprinting applications, which have shown positive effects on wound healing1, cell viability and proliferation2, bone and skin regeneration3, and angiogenesis4. However, the challenges of immature and shallow surface-level vessel formation remain significant. To address this limitation, we have developed a strategy of combining a viable adipose tissue bioink with a PRP bioink. The integration of these two bioinks has resulted in the successful creation of adipose