Digital Twin–Guided Development of Stem Cell Organoids for Disease Modeling and Tissue Repair

Proposal for HORIZON-HLTH-2026-01-TOOL-03: Integrating New Approach Methodologies (NAMs) to advance biomedical research and regulatory testing

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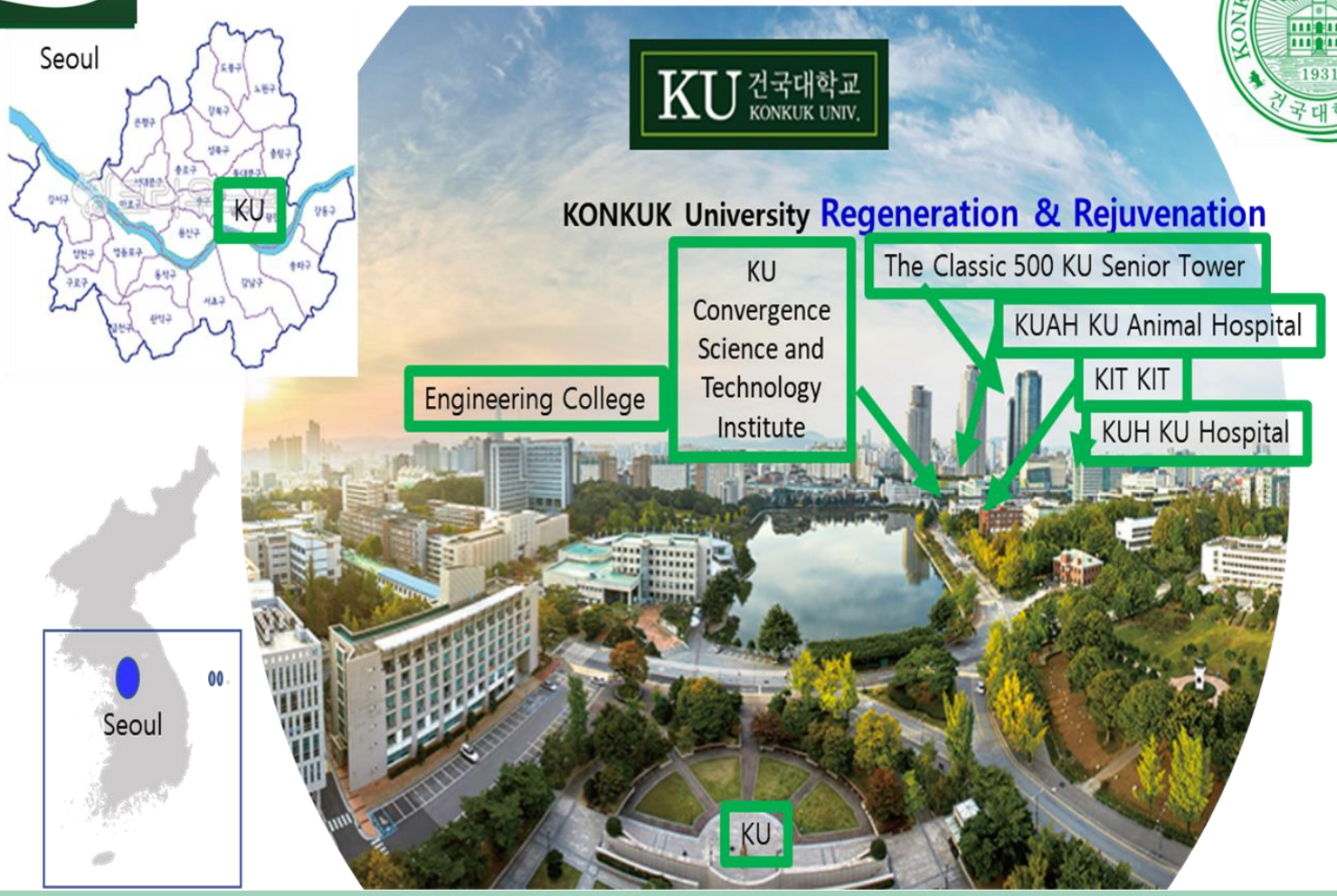
https://www.konkuk.ac.kr/abt/34833/subview.do#none

Our university (Konkuk University)

Konkuk University location and facilities



Target Applications

✓ **Disease modeling:**

•Autoimmune diseases

•Neurodegeneration

•Dry eye/gland degeneration

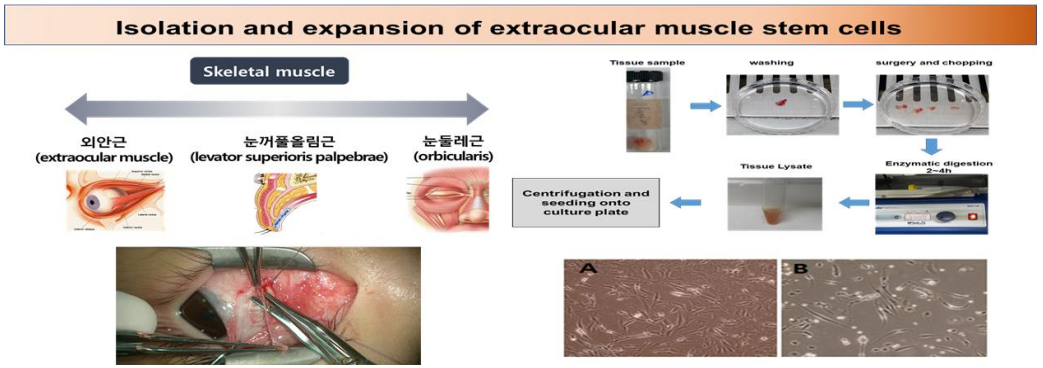
✓ **Regenerative medicine:**

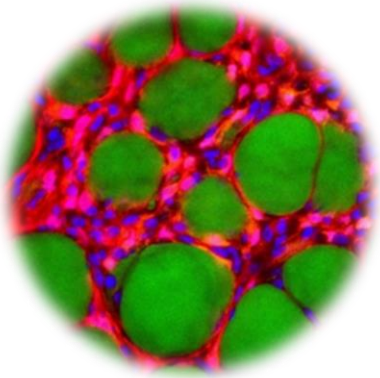
•Lacrimal gland organoids

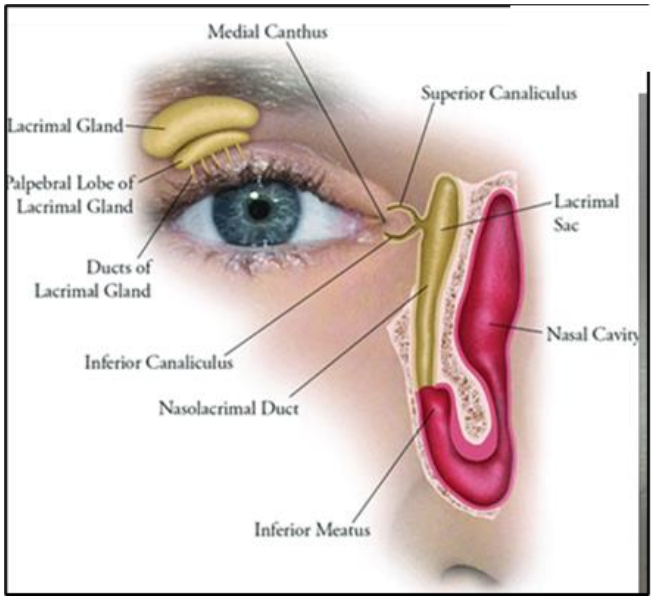
•Neural organoids

•Cartilage / bone organoids

✓ Drug screening & toxicology







Our Expertise & Projects

- **Konkuk University team expertise:**
- iPSC differentiation
- Organoids (lacrimal gland, neural, cartilage)
- Microgravity 3D culture systems
- Hydrogel-based 3D culture
- Stem cell transplantation models
- Exosomes & regenerative medicine
- Disease models (dry eye, neuroinflammation)

Our Expertise & Projects

antioxidants
MDPI
Article

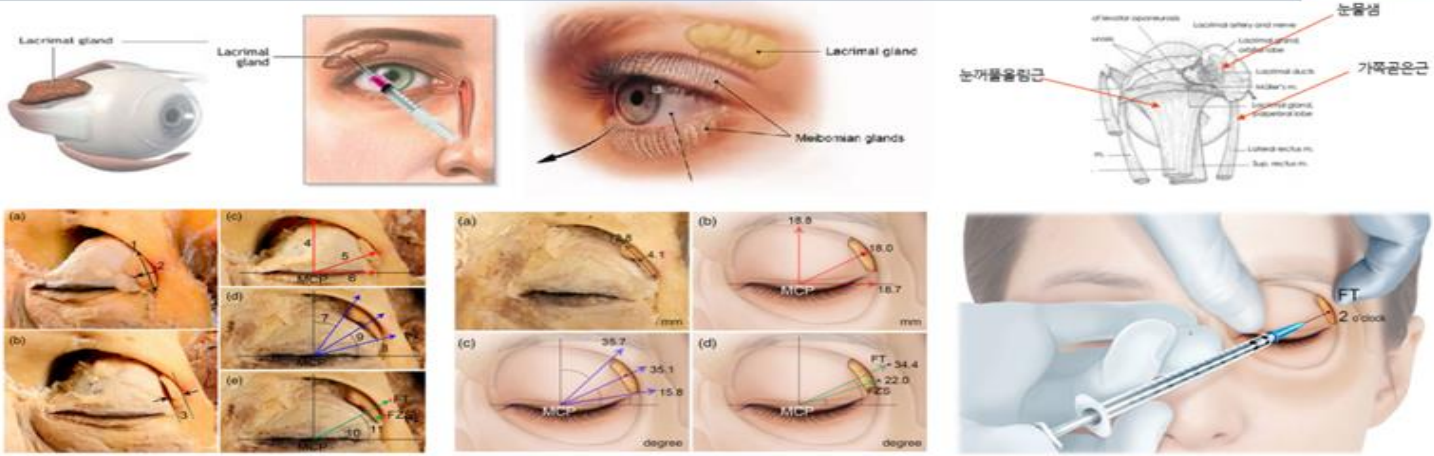
High Therapeutic and Esthetic Properties of Extracellular Vesicles Produced from the Stem Cells and Their Spheroids Cultured from Ocular Surgery-Derived Waste Orbicularis Oculi Muscle Tissues

Kyung Min Lim [1,†], Ahmed Abdal Dayem [1,†], Yujin Choi [1], Yoonjoo Lee [1], Jongyub An [1], Minchan Gil [1], Soobin Lee [1], Hee Jeong Kwak [1], Balachandar Vellingiri [2], Hyun Jin Shin [3,*] and Ssang-Goo Cho [1,*]

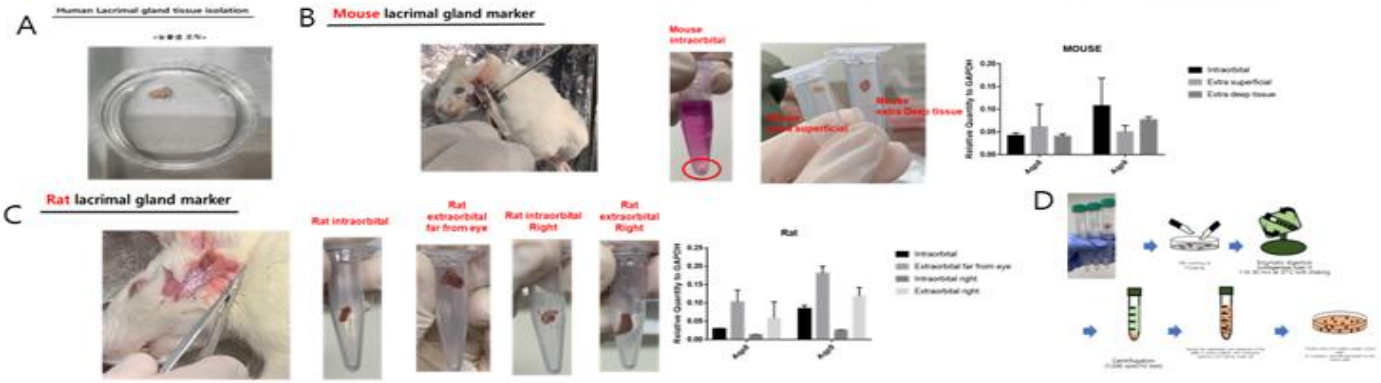
MSCs Ocular tissue-derived stem cells

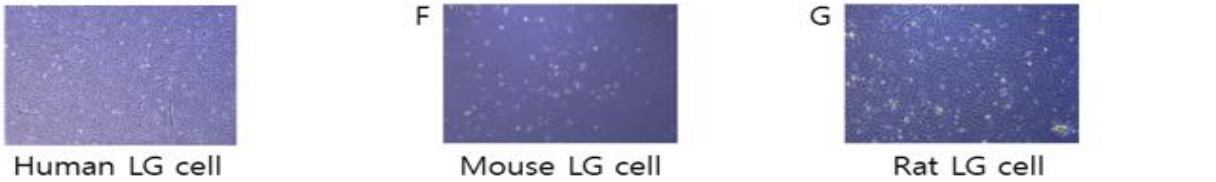
KU KONKUK UNIVERSITY

Human

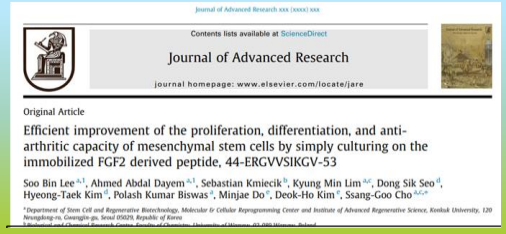


Murine





Our Expertise & Projects


Journal of Advanced Research

Contents lists available at ScienceDirect

Journal of Advanced Research

journal homepage: www.elsevier.com/locate/jare

Original Article

Efficient improvement of the proliferation, differentiation, and anti-arthritic capacity of mesenchymal stem cells by simply culturing on the immobilized FGF2 derived peptide, 44-ERGVVSIKGV-53

Soo Bin Lee, Ahmed Abdal Dayem, Sebastian Kmiecik, Kyung Min Lim, Dong Sik Seo, Hyeong-Taek Kim, Polash Kumar Biswas, Minjae Do, Deok-Ho Kim, Ssang-Goo Cho

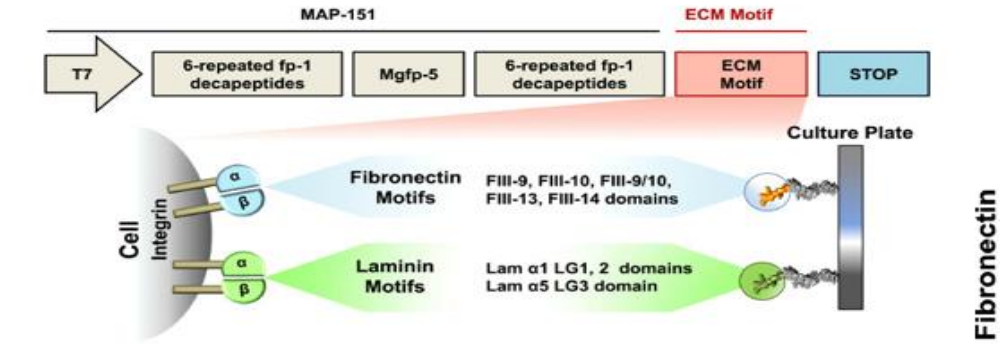
ECM-derived peptide enhances the adhesion and the pluripotency of the human pluripotent stem cells

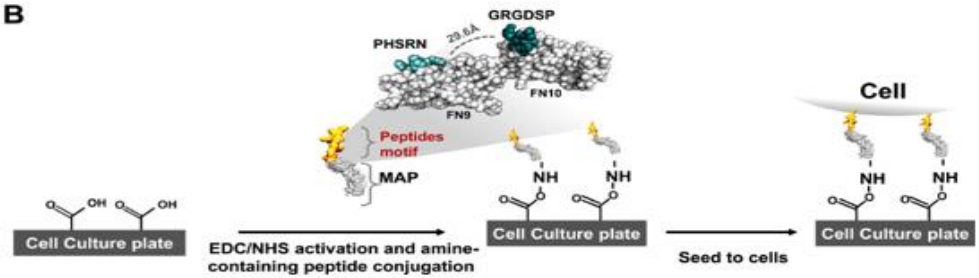
KU KONKUK UNIVERSITY

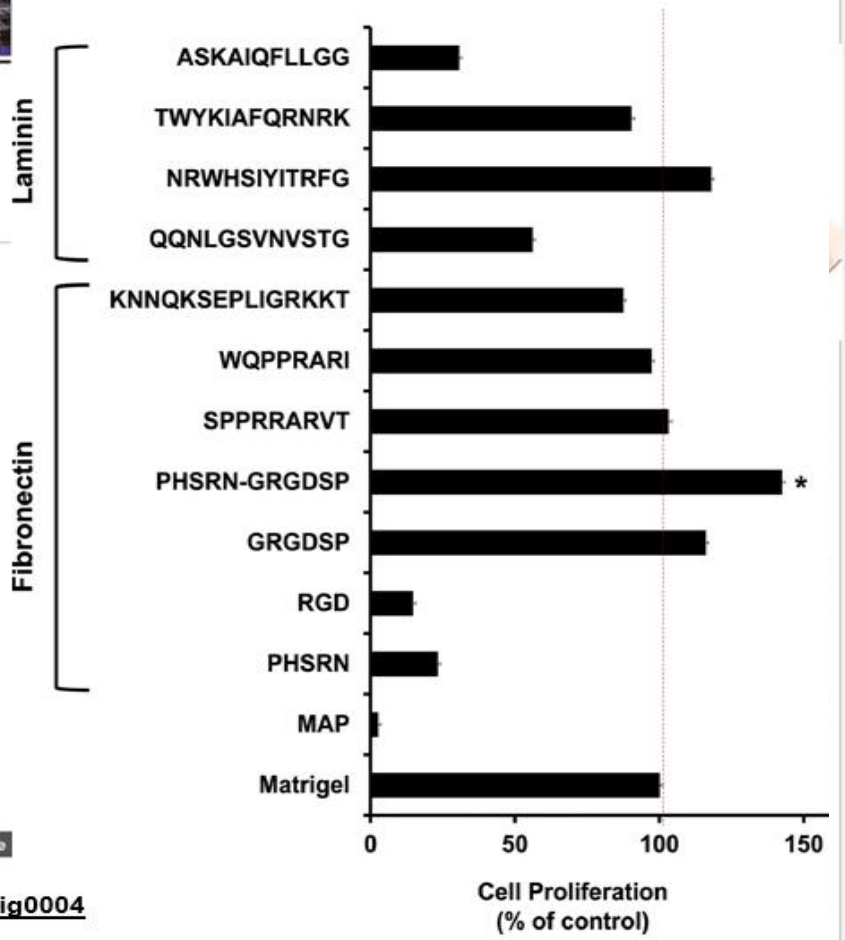
Stem Cell Research

The immobilization of fibronectin- and fibroblast growth factor 2-derived peptides on a culture plate supports the attachment and proliferation of human pluripotent stem cells

Ahmed Abdal Dayem, Jihye Won, Hui-Gwan Goo, Gwang-Mo Yang, Dong Sik Seo, Byeong-Min Jeon, Hye Yeon Choi, Sang Eun Park, Kyung Min Lim, Seon-Ho Jang, Soo Bin Lee, Sang Baek Choi, Kyeongseok Kim, Geun-Ho Kang, Gyu-Bum Yeon, Dae-Sung Kim, Ssang-Goo Cho



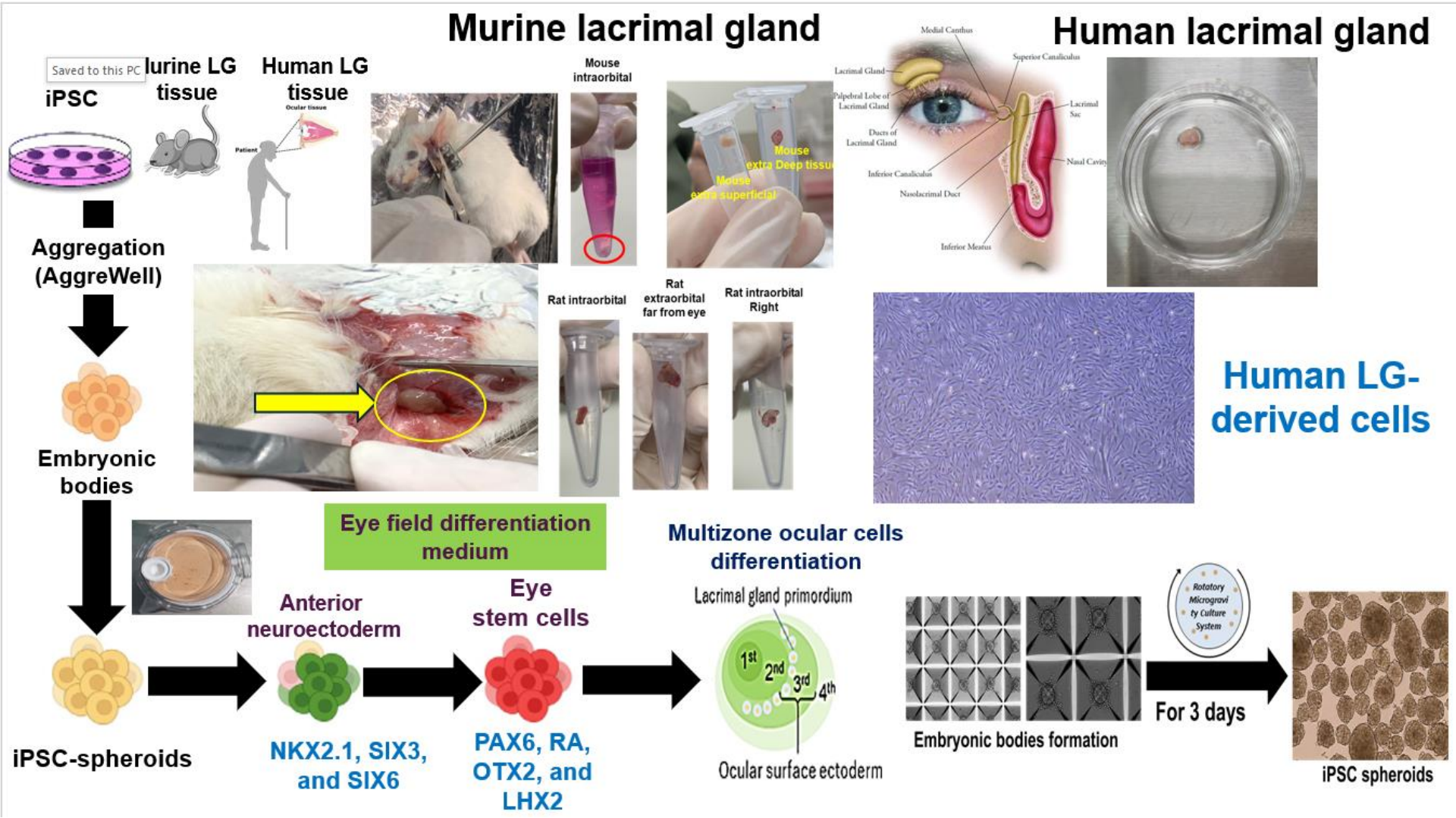




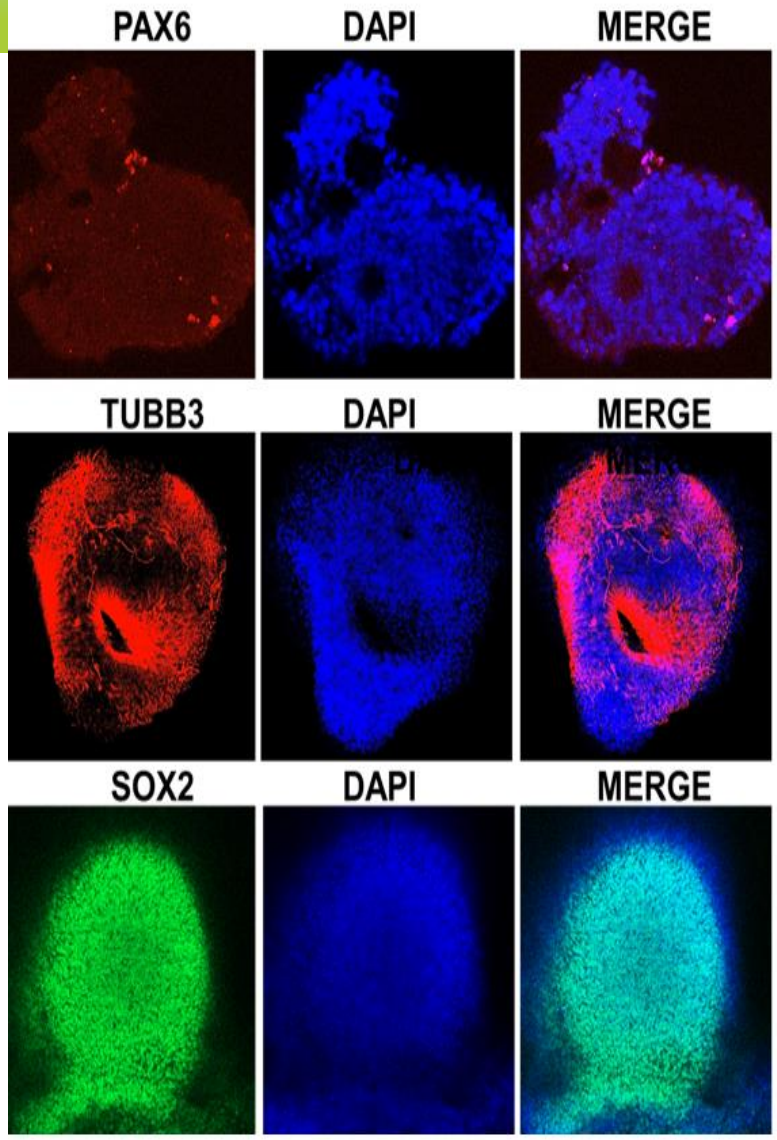
https://www.sciencedirect.com/science/article/pii/S1873506120300027#fig0004

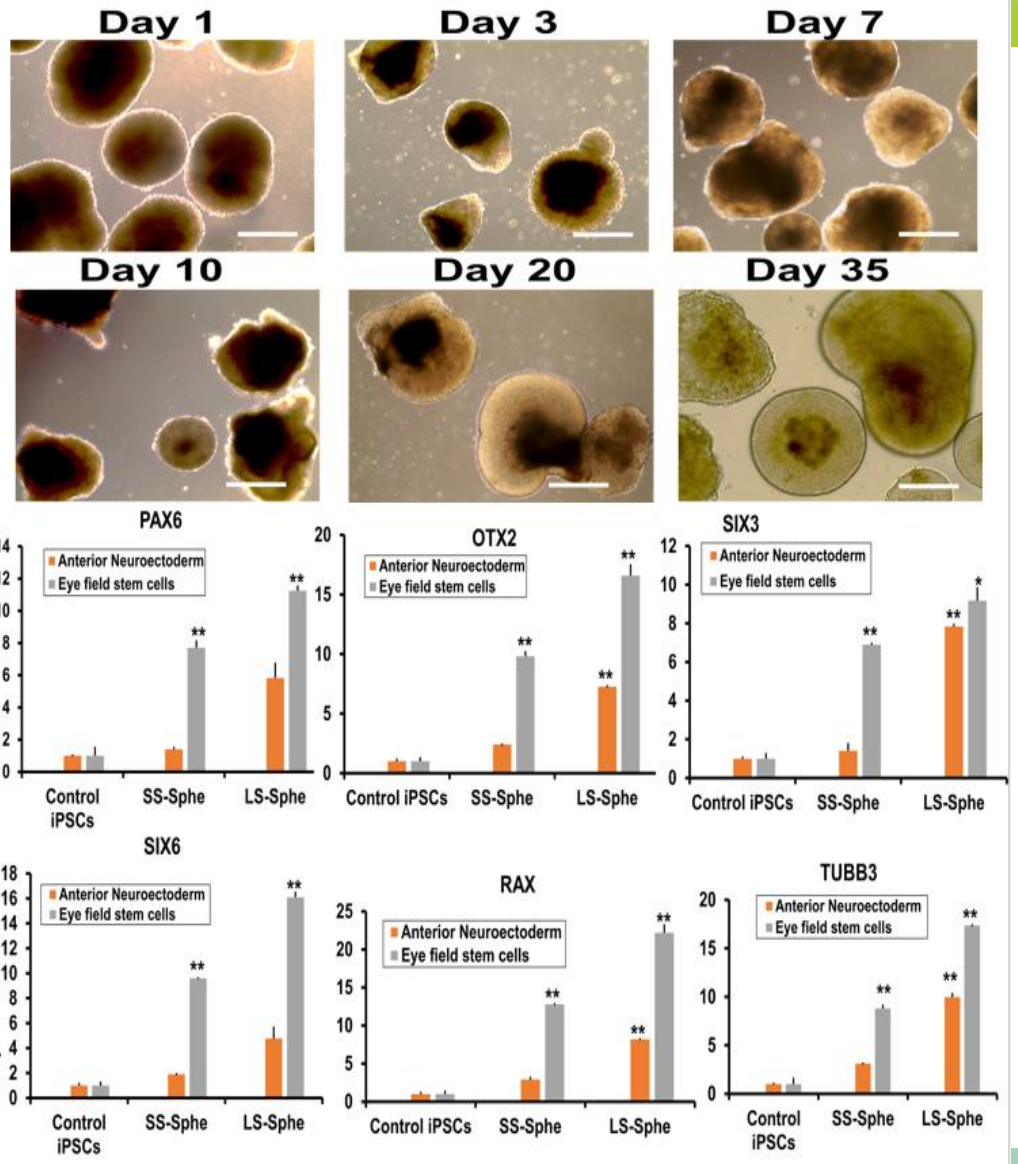
Fibronectin-derived peptide, PHSRN-GRGDSP, significantly promoted adhesion, enhanced alkaline phosphatase activity, and increased pluripotency-related gene expression in hPSCs compared to Matrigel.

Our Expertise & Projects



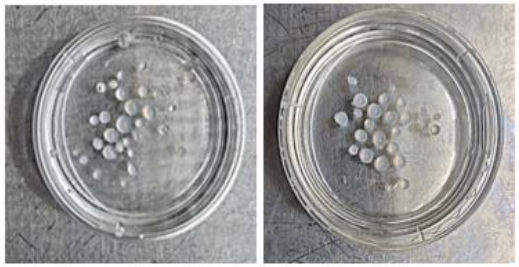
Our Expertise & Projects

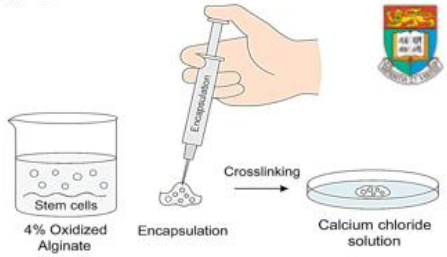




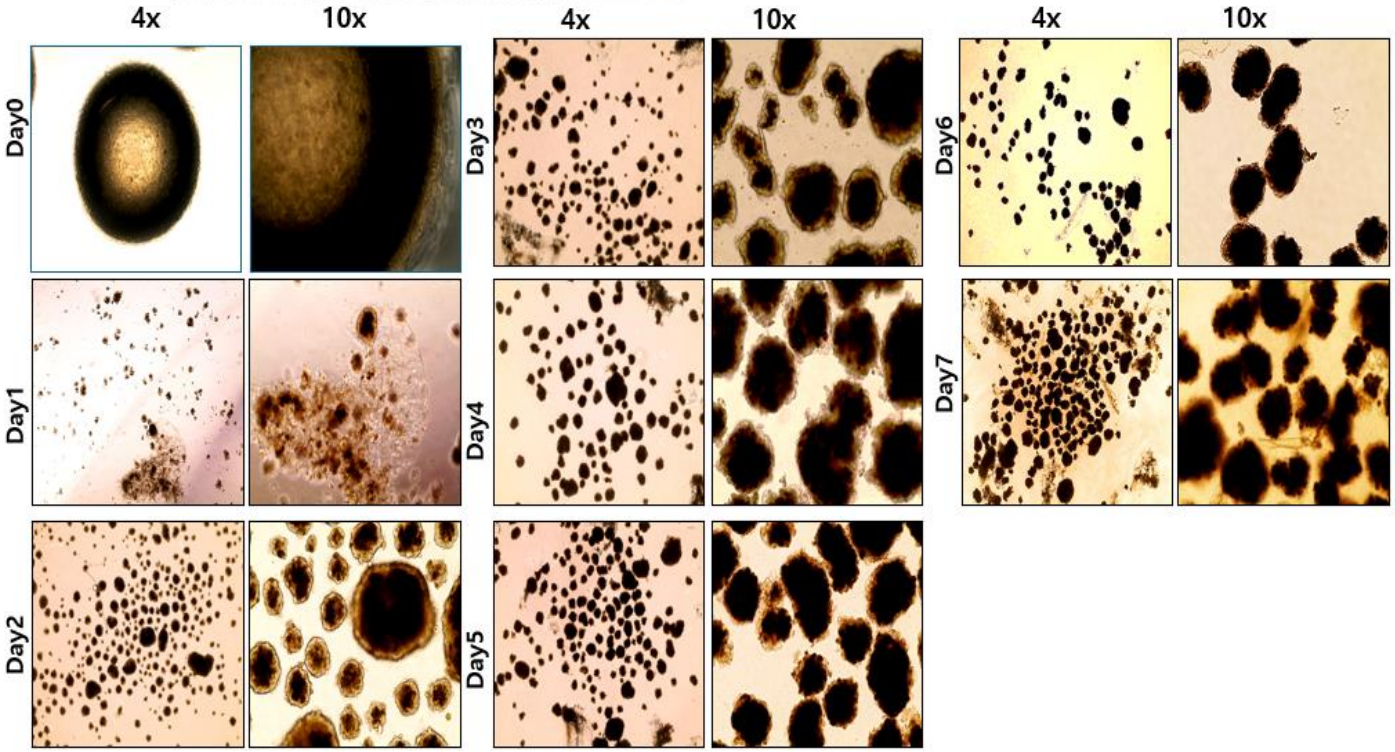
Our Expertise & Projects

Hydrogel-based stem cell 3D culture





HKUDentistry
Faculty of Dentistry - The University of Hong Kong
香港大學牙醫學院



Our Expertise & Projects

KFRM Korean Fund for Regenerative Medicine

Ministry of Science and ICT

Ministry of Health and Welfare

NRF National Research Foundation of Korea

What Partners We Are Looking For

We seek collaborators in:

- ✓AI / Machine learning Experts
- ✓Immunology Experts
- ✓Digital twin modeling
- ✓Advanced data analysis
- ✓**Clinical** partners (access to patients; patients with autoimmune diseases)
- ✓Small molecules library experts
- ✓Microfluidics & immune organoids culture experts
- ✓Mechanism and small molecules/drug and protein interactions analysis
- ✓Bioinformatics / multi-omics integration Experts

Expected Outcome

- **Researchers** gain access to improved, human-relevant **New Approach Methodologies (NAMs) platforms** that capture the genetic, phenotypic, age-related, immune, microbiome, and environmental exposure variability of the human population.
- These innovations support more **equitable healthcare solutions** and **personalised treatment strategies** across diverse life stages.

THANK YOU

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