SONG IH AHN

INVITED TALK 8

Microengineered Blood-Brain Tumor Barrier Model for Personalized Glioblastoma Therapy

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Abstract

Glioblastoma (GBM) is the most common and aggressive primary brain tumor, characterized by extensive heterogeneity and invasive behavior. A significant challenge in treating GBM is the formation of the blood brain tumor barrier (BBTB), which restricts drug delivery, particularly in tumor margins where GBM cells infiltrate healthy brain tissue and exhibit strong resistance to therapies. Understanding tumor progression in these margins is critical yet complex.

In this study, we introduce a micro engineered model that mimics the BBTB at the GBM margin. This model incorporates a 3D network of healthy astrocytes and patient-derived GBM cells from recently diagnosed cases. Our findings reveal that interactions between GBM cells and surrounding stromal cells enhance vascular permeability, induce reactive gliosis, and alter astrocyte activity, collectively driving tumor invasion and progression.

We further demonstrate the model's utility in evaluating patient-specific responses to conventional chemotherapies, providing insights into treatment efficacy. The BBTB-on-a-chip platform offers a robust, personalized tool for studying tumor-stroma interactions and streamlining drug screening processes. This approach holds promise for advancing precision medicine in GBM treatment by tailoring therapeutic strategies to individual patients.

Keywords: Tissue engineering, Bioelectronics, 3D-printing

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Education History

[Doctorate]	2015-2019	2015-2019 Bioengineering, Mechanical Engineering, Georgia Institute of Technology
[Master]	2012-2014	Department of Mechanical Engineering, KAIST
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Professional Background

2024 - Present	Assistant Professor, Department of Mechanical Engineering, KAIST
2021 - 2024	Assistant Professor, School of Mechanical Engineering, Pusan National University
2020 - 2021	Postdoctoral Associate, Department of Mechanical Engineering, University of Minnesota
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Selected Awards and Honors

1.	2024	Excellent Paper Award, The Korean Society of Medical & Biological Engineering
2.	2022	Young Engineer Award, The Korean Society for Precision Engineering
3.	2014	Excellent dissertation award, The Korean Society of Mechanical Engineers
4.	2012	Honorary award, Department of Mechanical Engineering, KAIST

Selected Publications

1. Ryoo, Noh, Kim, and Ahn, 3D-printed electronics for biomedical application, International Journal of Bioprinting, 2024
2. Su*, Park*, Ouyang, Ahn, and McAlpine, 3D Printed Flexible Organic Light-Emitting Diode Displays, Science Advances, 2022
3. Ahn et al., Human blood-brain barrier on chip: featuring unique multicellular cooperation in pathophysiology, Trends in Biotechnology, 2021
4. Lee*, Choi*, Ahn* et al., Engineered heterochronic parabiosis in 3D microphysiological system for identification of muscle rejuvenating factors, Adv Funct Mater., 2020
5. Ahn et al., Microengineered human blood-brain barrier platform for understanding nanoparticle transport mechanisms, Nature Communications, 2020