



Education

Ph.D. in Mechanical Engineering Korea Advanced Institute of Science and Technology (KAIST) Dissertation: Dynamic Behaviors of In Vitro Pathophysiological Models Advisor: Prof. Jennifer H. Shin	Mar. 2018 - Feb. 2023
M.S. in Mechanical Engineering Korea Advanced Institute of Science and Technology (KAIST) Thesis: Correlations between Spheroidal Phenotype and Functionality as Cancer Model Advisor: Prof. Jennifer H. Shin	Mar. 2016 - Feb. 2018
B.S. in Mechanical Engineering Sogang University <i>Summa Cum Laude</i> Advisor: Prof. Naksoo Kim	Mar. 2012 - Feb. 2016

Selected Honors & Awards

BME Engaged Postdoctoral Mentorship Award, Brown University (2026) Rising Stars in Mechanical Engineering, MIT (2025) Hibbitt Engineering Postdoctoral Fellowship, Brown University (2023-2025) Venture Research Program for Graduate and PhD students, KAIST (2019)	Google Scholar
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Teaching & Mentoring

Teaching Biomedical Engineering Design and Innovation I (ENGN0930L/1930L), Co-instructor: Prof. Anubhav Tripathi, Brown University (2024)	LinkedIn
Outstanding Teaching Assistant Awards Fluid Mechanics, Department of Mechanical Engineering, KAIST (2021, 2022) Capstone Design, Department of Mechanical Engineering, KAIST (2020)	

Research Highlights

Rotating spheroids pave their way for invasion
Collective Transitions from Orbiting to Matrix Invasion in 3D Multicellular Spheroids
Jiwon Kim *et al.* | Nature Physics (2026)

Cell trajectory
Matrix deformation

Cumulative matrix deformation (μm)
Outward (10 μm) Inward (10 μm)

Collagen fibres Nuclei
Collagen fibre alignment

Orbiting phase
Approaching Encountering Leaving Collagen alignment Transition to invasion

Cell trajectory (circumferential)
Cell trajectory (radial)
Cell traction
Bead trajectory
Boundary retraction
Matrix deformation
Collagen fibres

- Tractions exerted by orbiting cells remodel the matrix in radial directions due to the sharp curvature near the initial poles. The spheroid-matrix interface also retracts as the spheroids compact into a rounder morphology during the orbiting phase.

0% PEG 4% PEG

- Transient osmotic pressure can delay collective orbiting and even reverse matrix invasion of 3D multicellular spheroids.

Arrested Global orbiting Peripheral orbiting

f_a^{cc}/F_c f_a^{cm}/F_c $r_l(\tau)$

- Our computational model of self-propelled particles with tunable cell-cell and cell-matrix interactions mapped distinct orbiting regimes in the cell-cell/cell-matrix adhesion parameter space.

Ovarian cancer cells remember how stiff their hometown was
Collective Mechanical Memory Encoded by Long-Lasting Supracellular Cytoskeletal Structures in Multicellular Spheroids
Jiwon Kim *et al.* | ACS Applied Materials & Interfaces (2025)

Primary tumor Malignant spheroids Mesothelial adhesion/invasion

Mechanical priming Hanging drop culture Spreading/invasion simulation

SKOV-3-2kPa SKOV-3-11kPa SKOV-3-90kPa

PCA of Haralick texture features extracted from actin images

PC1 (70.03%) PC2 (22.93%)

SKOV-3-2kPa SKOV-3-11kPa SKOV-3-90kPa

Day 0 Day 4

Intensity

Priming stiffness (kPa)

- Dynamic alterations in the mechanical environment observed during ovarian cancer metastasis were modeled using cancer cells primed on soft, intermediate, and stiff environments.

- Soft-primed cells demonstrated stronger cell-cell adhesions than stiff-primed cells. Upon aggregation into multicellular spheroids, the soft-primed spheroids exclusively developed a dense cage-like supracellular actin-CK18 structure at their peripheral surfaces.

- Soft-primed spheroids exhibited impaired collective migration due to confinement by the long-lasting cytoskeletal cage.

Close-up: When a fat cell spits out its fat pocket and becomes a stem cell
Ceiling culture chip reveals dynamic lipid droplet transport during adipocyte dedifferentiation via actin remodeling
Jiwon Kim, Kun-Young Park *et al.* | Lab on a Chip (2022)

Fat pads Cell isolation Ceiling culture chip

scWAT vWAT Mature Adipocyte SVF

Phase Mechanical vibration Lipo-extrusion Contracting rim closure Lipid droplet isolation

Boundary Merge BODIPY MT

Time (hour)

- We developed a microscope-mountable ceiling culture chip that provides a stable yet tunable culture environment for long-term live-imaging of dedifferentiating adipocytes.

- Spatiotemporal analysis revealed that dynamic actin remodeling contributes to lipid droplet (LD) secretion during adipocyte dedifferentiation.

Organizers

