No.	K25-2174	
Project Title	Tissue-engineered VivoSpheres for cancer modeling and drug screening	
Principal Investigator	Elizabeth Ann Lipke (Auburn University・Professor)	
Project Member(s)	IMSUT Host Researcher	Yoichi Furukawa (The Institute OF Medical Science, The University Of Tokyo・Professor)
	Project Member (s)	Kiyoshi Yamaguchi (Div. Clinical Genome Research・Associate Professor)
	Project Member (s)	Yoichi Furukawa (Div. Clinical Genome Research・Professor)
	Project Member (s)	Seiya Imoto (Div. Health Medical Intelligence・Professor)
	Project Member (s)	Elizabeth Lipke (Auburn University / Dept. of Chemical Engineering・Professor)
	Project Member (s)	Kwaghtaver Samuel Desongu (Auburn University / Dept. of Chemical Engineering・Graduate student researcher, Ph.D. Candidate)
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(Form 2)

Principal Investigator
Elizabeth Lipke

IMSUT International Joint Usage/Research Center Project <International>

Joint Research Report (Annual/Project Completion)

Annual Report

Report

Tissue-engineered VivoSpheres for cancer modeling and drug screening

Background

Patient-derived tumor cells are more pathophysiologically relevant in comparison with cancer cell lines, making them a great cell source for cancer disease modeling and drug discovery. The ability to maintain these cells in vitro long-term and prepare them in an assay-ready format maximizes their potential for high-throughput drug screening. Dr. Elizabeth Lipke from Auburn University in the United States has developed a VivoSphere technology, which combines tissue engineering tools with a microfluidic system. VivoSphere technology enables the rapid encapsulation of patient-derived tumor cells in 3D hydrogel scaffolds. These microspheroidal, cell-laden VivoSpheres are highly uniform in size and shape and have high cell density, ensuring high-quality data in drug screening. The poly (ethylene glycol)-fibrinogen (PEG-Fb) hydrogel scaffold, a hybrid biomaterial, consists of synthetic and natural components to create a physiologically relevant 3D environment. The synthetic PEG component allows for quick photocrosslinking and precise control over tumor microenvironment parameters, such as mechanical properties. Meanwhile, the fibrinogen component provides cell adhesion sites and can be enzymatically degraded as the encapsulated cells secret their own extra cellular matrix.

This joint research project is a collaboration among (1) Dr. Elizabeth Lipke, professor at the Department of Chemical Engineering at Auburn University, United States, (2) Dr. Yoichi Furukawa, Professor and Dr. Kiyoshi Yamaguchi, associate professor at the Division of clinical Genome Research at IMSUT, and (3) Dr. Seiya Imoto, director of Human Genome Center at IMSUT. The project aims to establish the capability to generate patient-derived VivoSpheres at IMSUT, evaluate their fidelity in recapitulating patient samples, and utilize them for drug screening.

2025 (First year)

Establishing VivoSphere Production System at IMSUT

The VivoSphere Production Platform was installed in IMSUT by the joint team and training was provided in operation of the system to enable independent operation by the IMSUT team. Adjustments were made onsite at IMSUT to the system. Modulation of operating parameters to account for differences in chemicals, cells, and other variables between locations and cell isolations was tested.

Following installation, we tested uniformity in size, shape, and cell density within the VivoSpheres produced at IMSUT using a colorectal cancer cell line and cells dissociated from colon tumors obtained from patients at the IMSUT Hospital.

Cancer VivoSpheres made at IMSUT were evaluated and cell growth over time tracked initially using phase contrast imaging. Initial evaluation of cell viability was conducted using live/dead (calcium AM/ethidium homodimer) staining and fluorescence imaging. Three different initial cell densities (20, 15, and 10 million cells/cm^3) were evaluated for the colorectal cancer cell line VivoSpheres; this equates to approximately 5000 to 2000 cells initially per VivoSphere, which depending on cell growth over time in culture is the order of magnitude needed for downstream experiments.

We are working on more detailed evaluation of the properties of these cancer VivoSpheres, including cell growth and maintenance of the multiple cell types within the VivoSpheres. Unlike in patient-derived organoids/tumoroids, it is possible to maintain both cancer cells and supporting cell types, such as stromal cells or fibroblasts, from the original tumor microenvironment in the VivoSpheres. Ongoing initial evaluation of cell phenotype will include cryosectioning and immunostaining and flow cytometry analysis; cancer cell (CD44, CK20), fibroblast (TE7) and proliferation markers (Ki67) will be evaluated. Results for colon cancer cell lines will be compared between Auburn University and IMSUT.

The Auburn University team is working on adjustments to the cartridges and polymer formulation used

in the VivoSphere production instrument to account for differences observed between sites and modifications based on IMSUT team feedback to aid in more user-friendly operation.

(Visits to IMSUT)

- Ms. Singh, a Ph.D. student at Auburn University, is visiting IMSUT from November 1, 2025 (to November 28), to install the VivoSphere Production Platform, provide training, and learn tumor tissue preparation for organoid establishment.
- Dr. Tian, a Chief Technical Officer at VivoSphere and an Auburn University Affiliate, voluntarily visited IMSUT from November 1 to November 14, 2025, to help set up the VivoSphere Production Platform and provide training.
- Dr. Lipke, a professor at Auburn University, is planning to visit IMSUT in the second year to discuss this ongoing project. Dr. Lipke's Auburn University teaching obligations did not allow her to travel in November 2025.