3D Organoid-on-a-Chip in a Microphysiological System

Novel Technologies to Improve Predictivity of Non-Clinical Studies and Replace, Reduce, and Refine Reliance on Animal Testing

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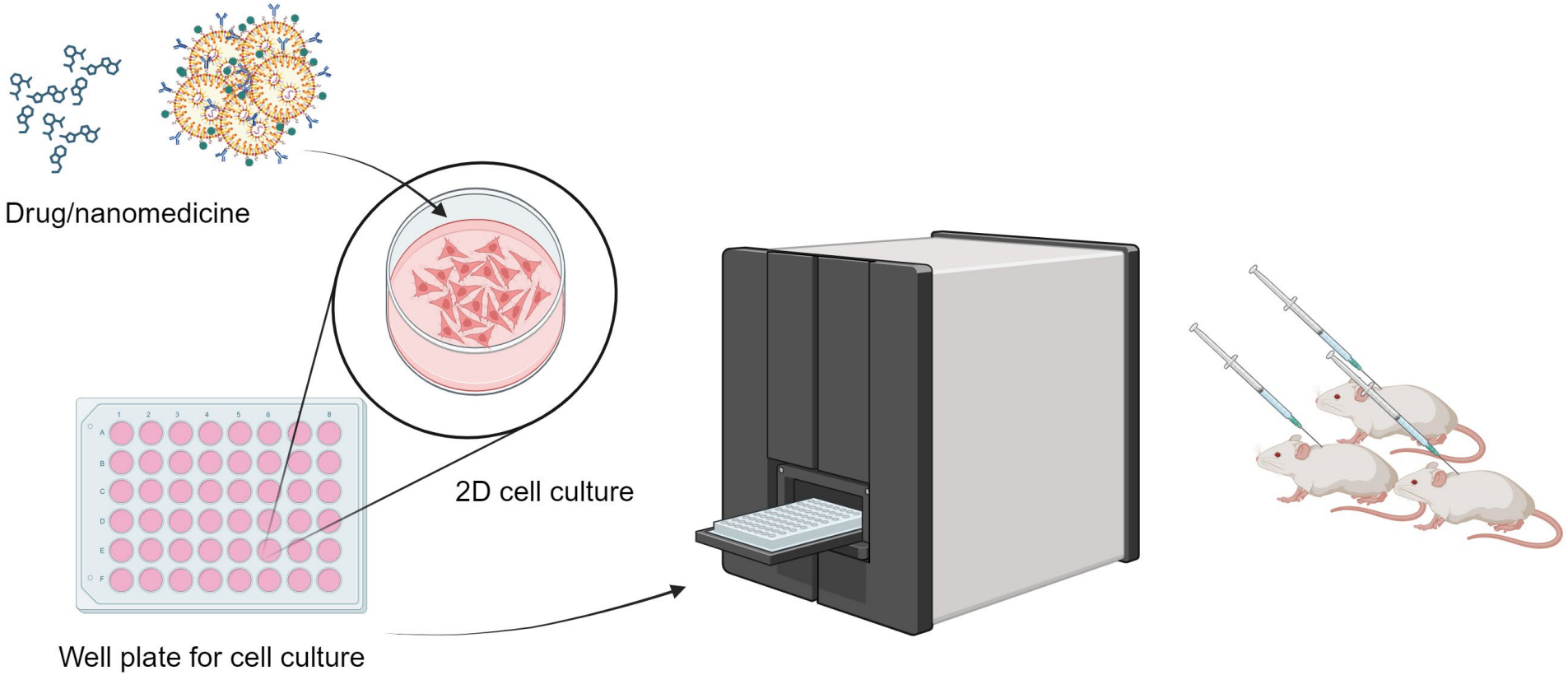
Two-Dimensional (2D) Monolayer Cultures and *In Vivo* Animal Models cannot Adequately Replicate the Human Tissues



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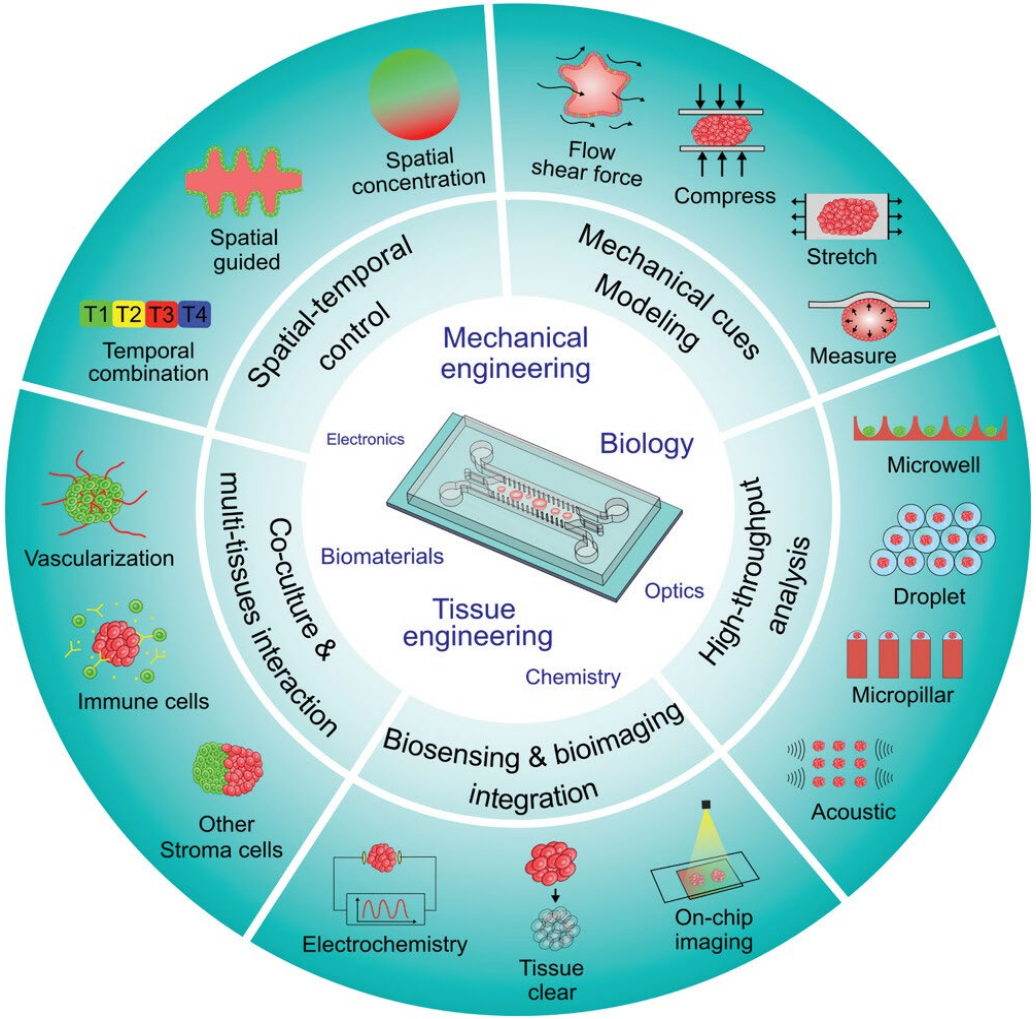
Organoid-on-a-Chip can Model *In Vivo* Tissue Microenvironment

- Spatial-temporal control
- Ability of perfusion culture
- Mechanical cues modeling
- **High-throughput analysis with more reliable drug screening results**
- Multi-tissues or organs interaction
- Integration of biosensing and bioimaging
- **Reduction use of animal models**
- **Closer features to *in vivo* natural systems**



Fang, G et al. *Advanced Functional Materials,* 2023

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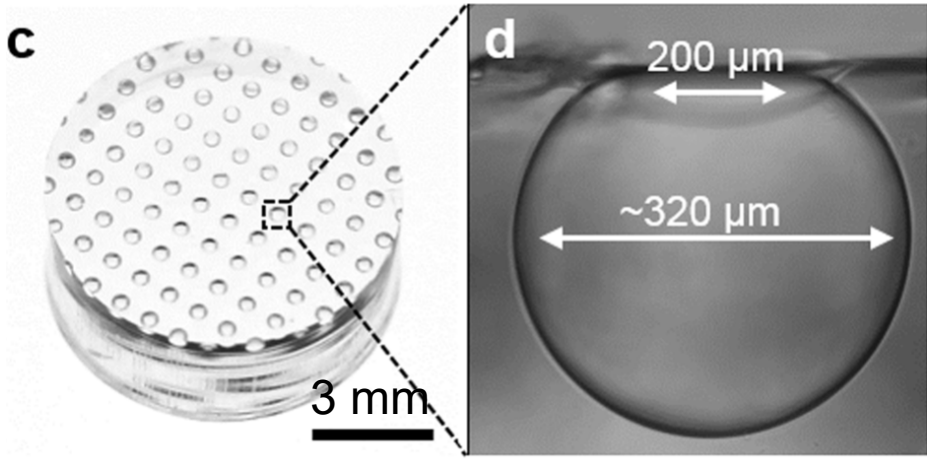
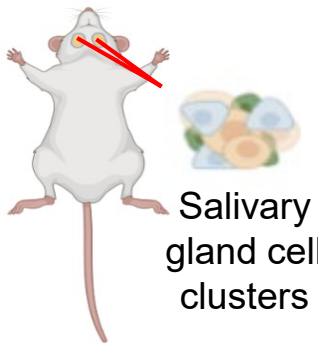
Tissue Chip Models Support Cell Viability in 3D Tissue Microenvironment and can Reduce the Use of Animal Models

Microbubble (MB)

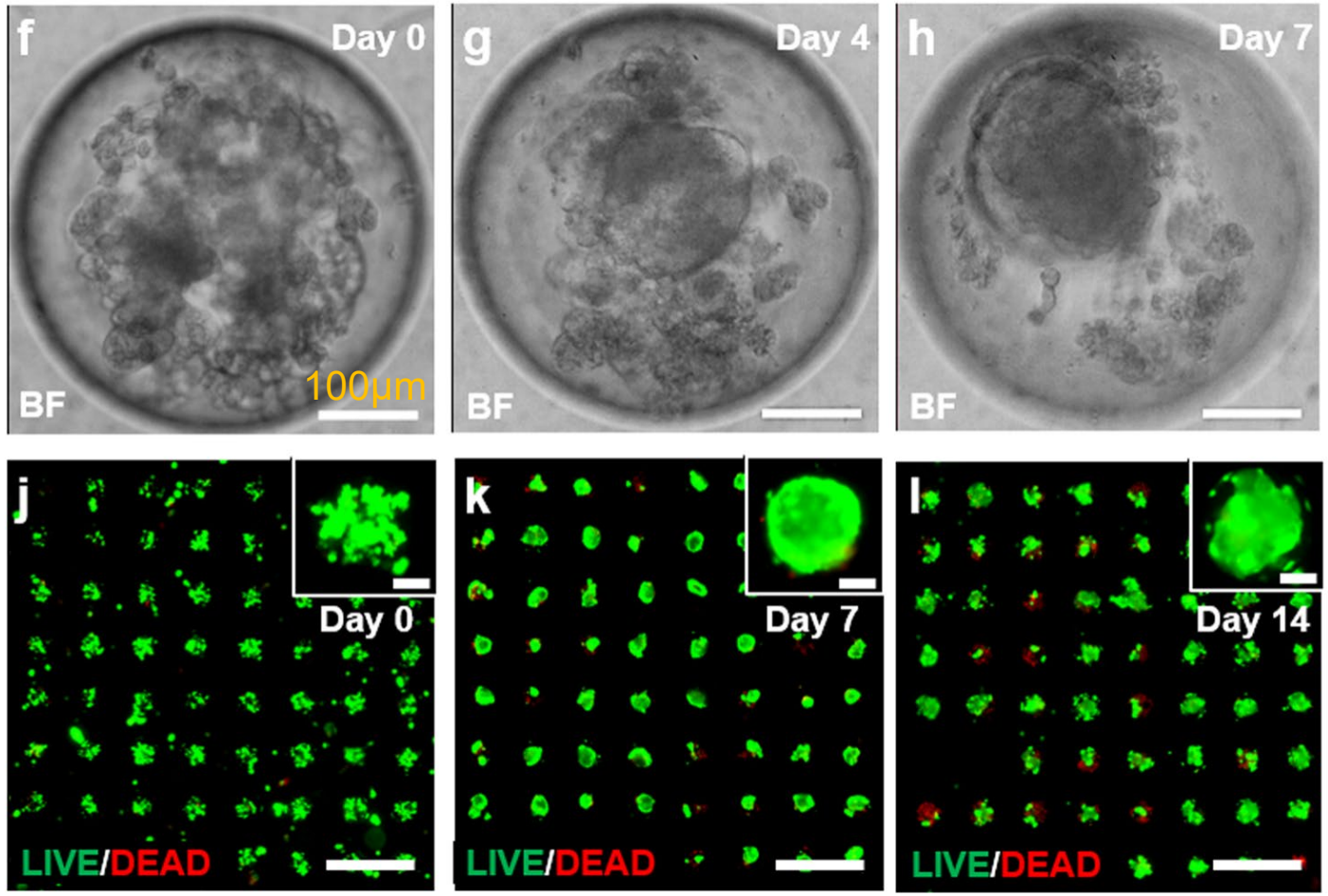


~ 50 MBs/chip

40 experiments with
n=50 from one mouse



Salivary gland tissue chip



Song, Y et al. *Communications Biology,* 2021

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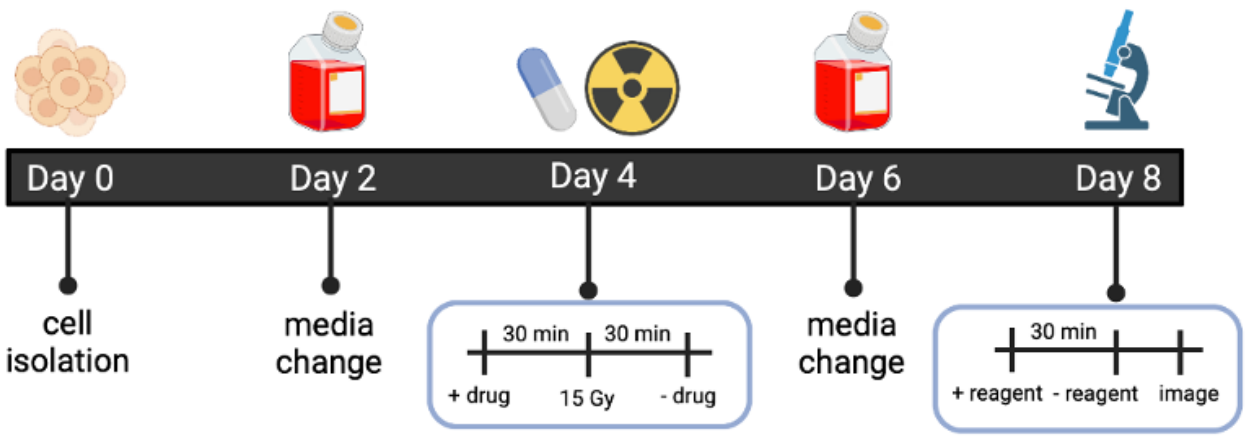
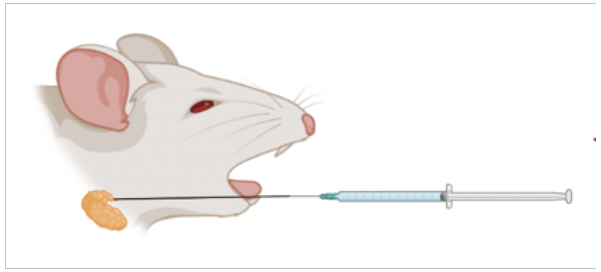
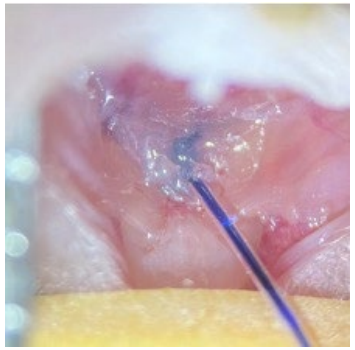
Tissue Chips Support High-Throughput Screening for Drug Discovery

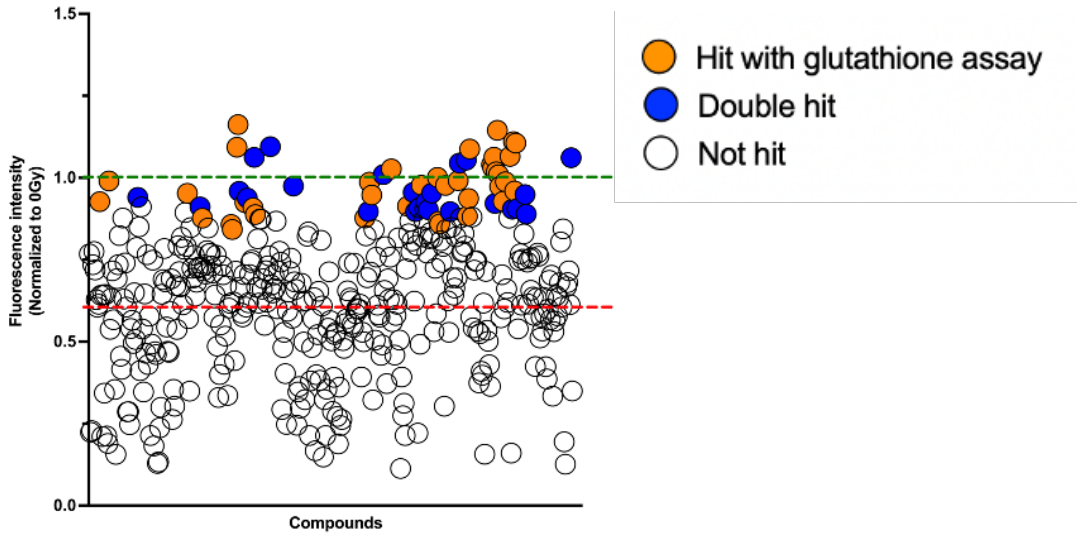


Defined Biomarkers for Radiosensitivity: Glutathione, Senescence





Results were confirmed by *in vivo* mouse model testing



SelleckChem library screening	
Drugs screened with glutathione assay	438
Hits with glutathione assay	62
Hit rate (percentage)	14.2%
Hits with Glutathione and Senescence assays	25
Double hit rate (percentage)	5.7%

Piraino, L et al. *BioRxiv,* 2023

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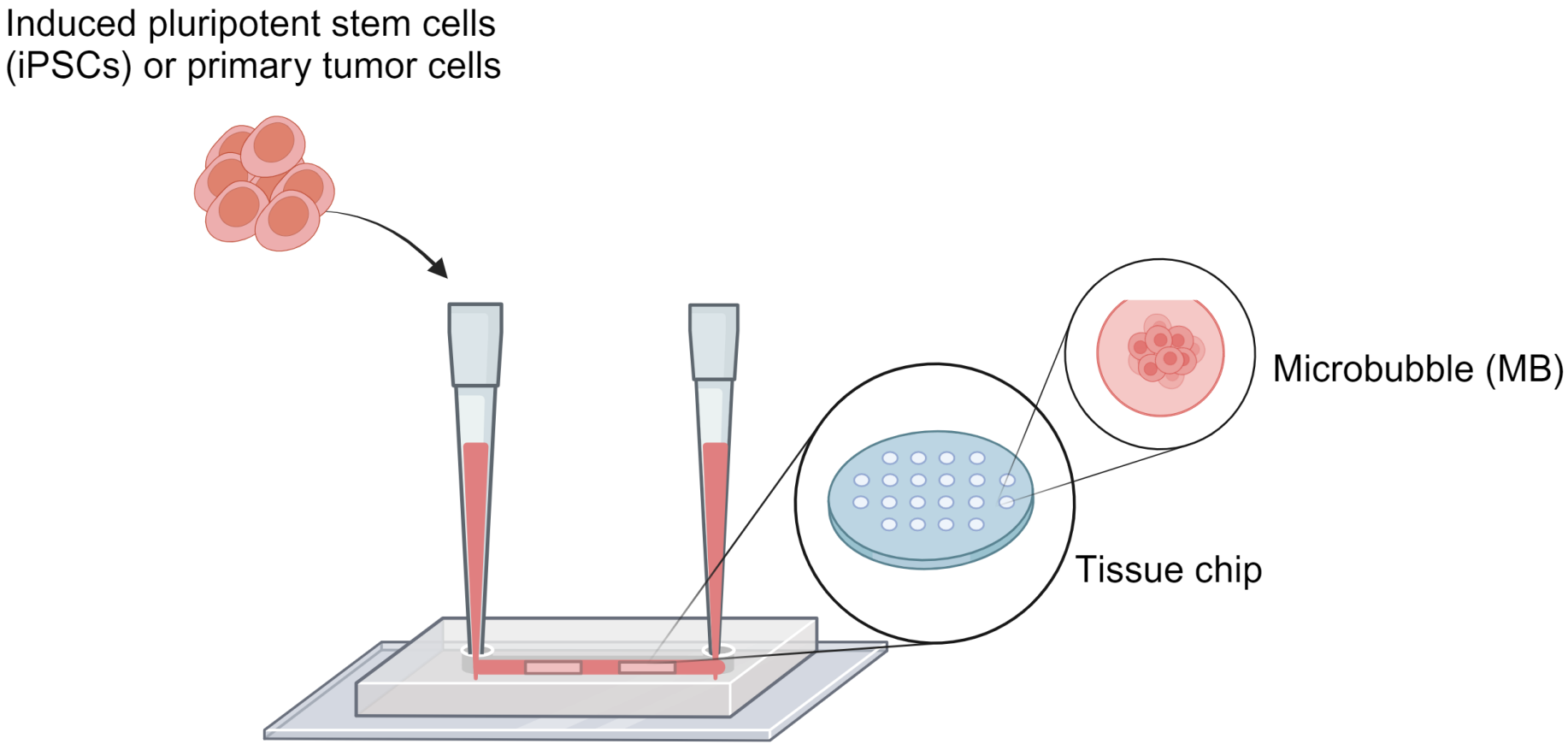
Tissue Chips Under Flow in Microfluidic Devices can Provide Individualized Therapies and Precision Medicine



Microphysiological organoid-on-a-chip System

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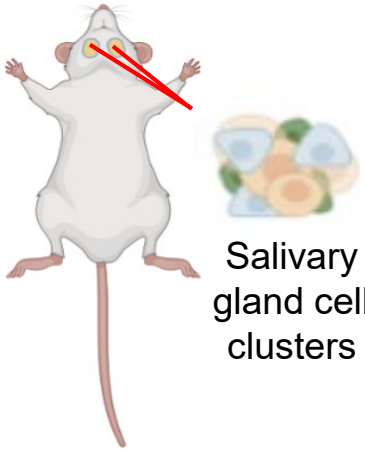
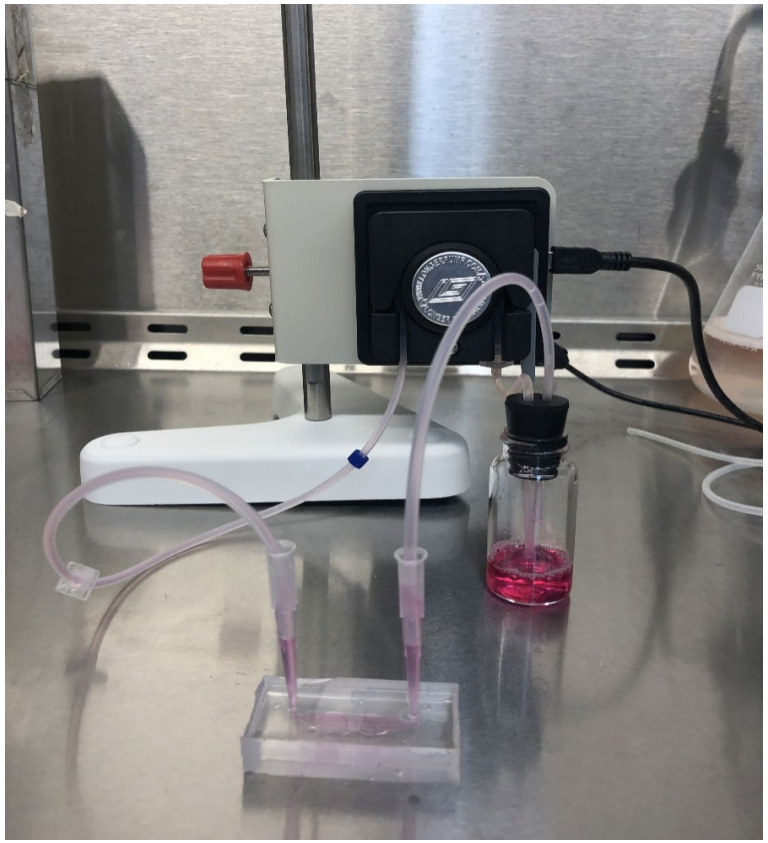
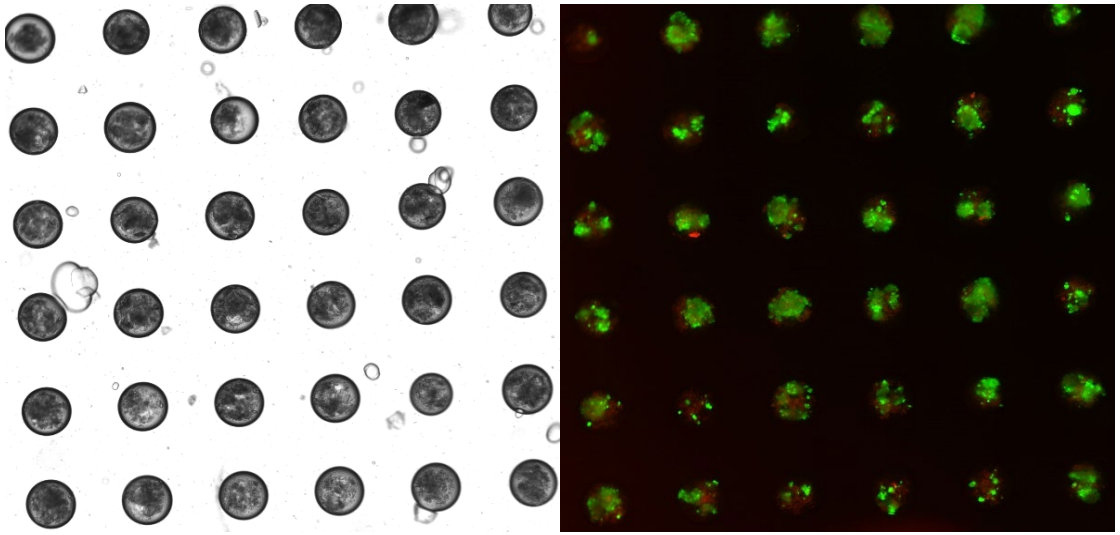
Salivary Gland Tissue Culture in a Microfluidic Device



Salivary gland cell clusters



Organoid-on-a-chip system in a microfluidic device



Live/Dead Assay on Day 7

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Summary and Conclusions

- Tissue chips support cell viability in 3D tissue microenvironment and promote cell growth in the form of 3D spheroid/organoid model
- Tissue chips enable high-throughput drug screening with defined biomarkers
- Organoid-on-a-chip microphysiological system can be used for personal medicine applications
- **The models can Replace, Reduce, and Refine Reliance on Animal Testing**

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Thank You!
Any questions?
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