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Microenvironment-mimetic 3D tumor models integrating dECMs and SERS technologies

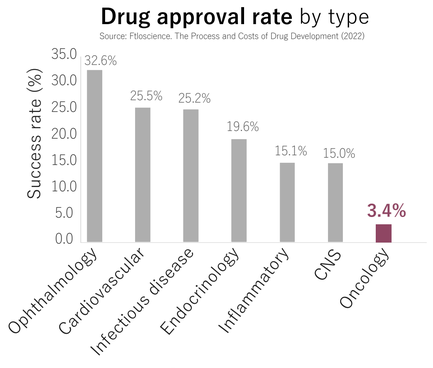
ONKO REPLICA

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The problem | High investment, low efficiency

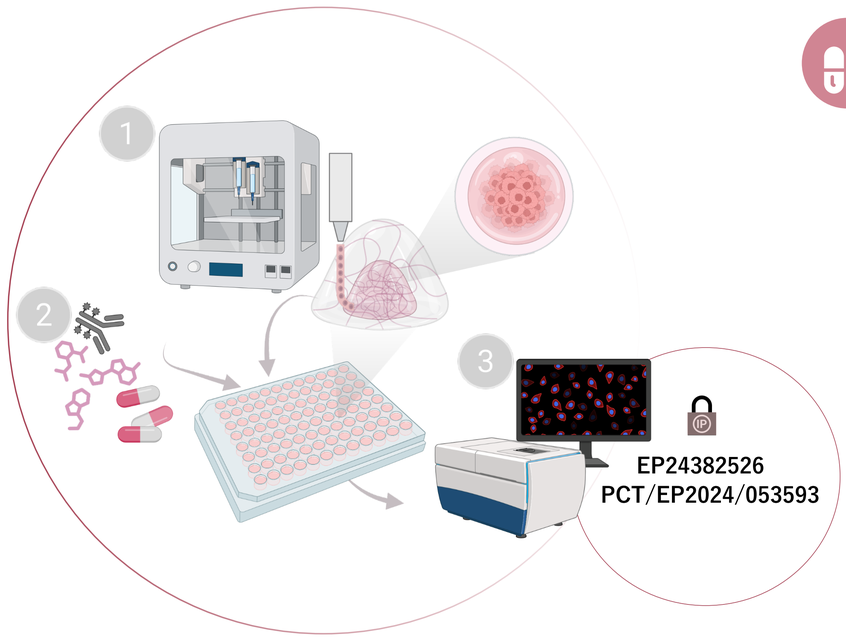


13.8% → Overall drug approval rate



Especially in oncology, it is necessary to **increase efficiency** and the **success rate** in drug discovery

The solution | New Approach Methodologies (NAMs)



High-throughput cancer drug testing
Simultaneous evaluation with customized assays

3D printable dECM-derived biomaterials
Tissue-specific decellularized extracellular matrices

Breast | Skin | Others



Sustainable and zero waste policy
Biomaterials derived from food industry and surgical surplus

3D tumor/stroma model

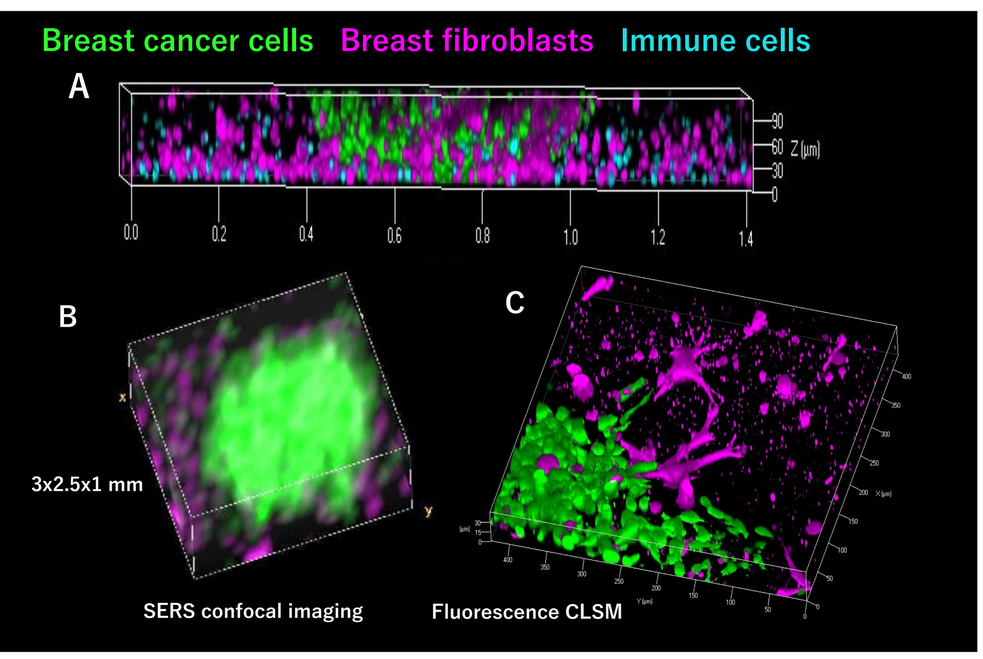


Fig. 1 | (A) 3D reconstruction of the 3D-printed breast tumor–stroma model incorporating breast dECM, breast cancer cells, fibroblasts, and immune cells arranged in a core–shell architecture. (B) Volumetric reconstruction of tumor and stromal regions acquired using SERS confocal microscopy. (C) Fluorescence CLSM imaging of tumor–stroma cellular interactions.

Breast PDOs

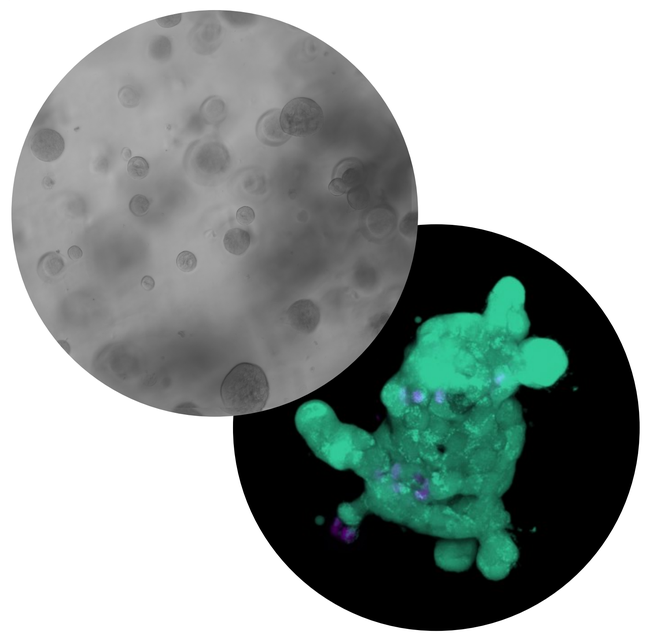


Fig. 2 | Breast cancer–derived and healthy tissue–derived organoids visualized using coherence imaging and live-cell fluorophores

Invasive ductal carcinoma on-a-chip

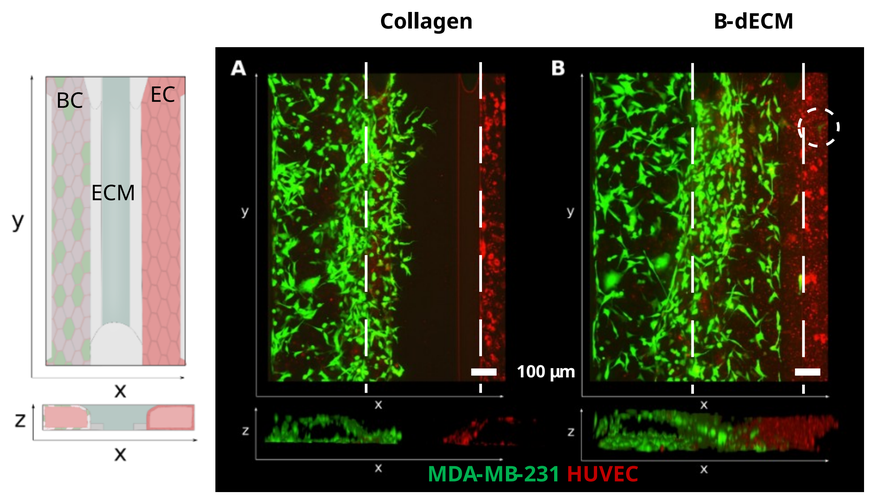


Fig. 3 | Design of an invasive ductal carcinoma (IDC) model comprising a lumenized breast duct, an ECM compartment, and a lumenized endothelial vessel. (A) XY and XZ views of the IDC model constructed within a collagen ECM. (B) XY and XZ views of the IDC model constructed within breast decellularized ECM. The circle highlights a cancer cell undergoing intravasation into the endothelial vessel, as a consequence of the differential migration induced by the different ECMs.

Layered skin melanoma model

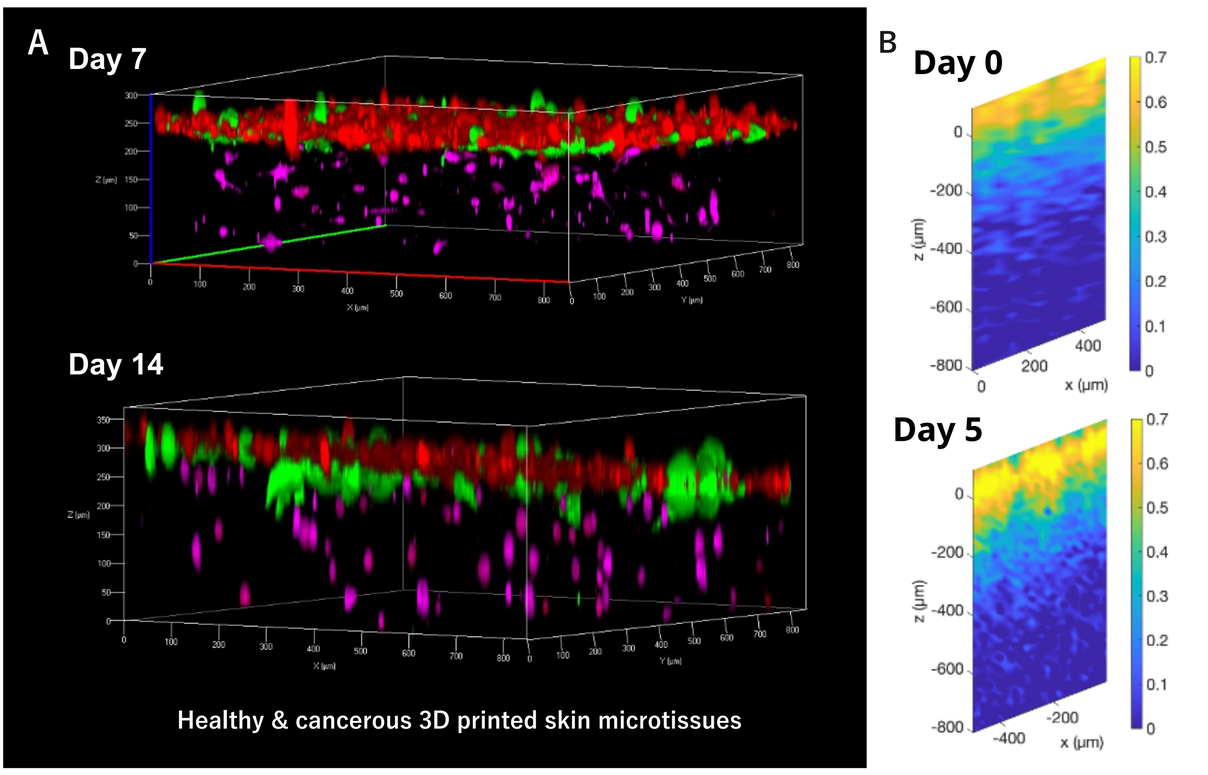


Fig. 4 | 3D printed layered melanoma model to simulate cancer cell invasion. (A) 3D reconstruction of the 3D printed model after 7 days (top) and 14 days (bottom) in culture. Epidermal layer (green: 451Lu; red: WM164) on top of the HDF loaded dermis (magenta). (B) Distribution of 451Lu-derived 4BPT SERS signal along the Z axis by means of the Pearson's correlation coefficient, with reference AuNS@4BPT, after 0 days and 5 days in culture.

Vascular–Lymphatic Melanoma Chip

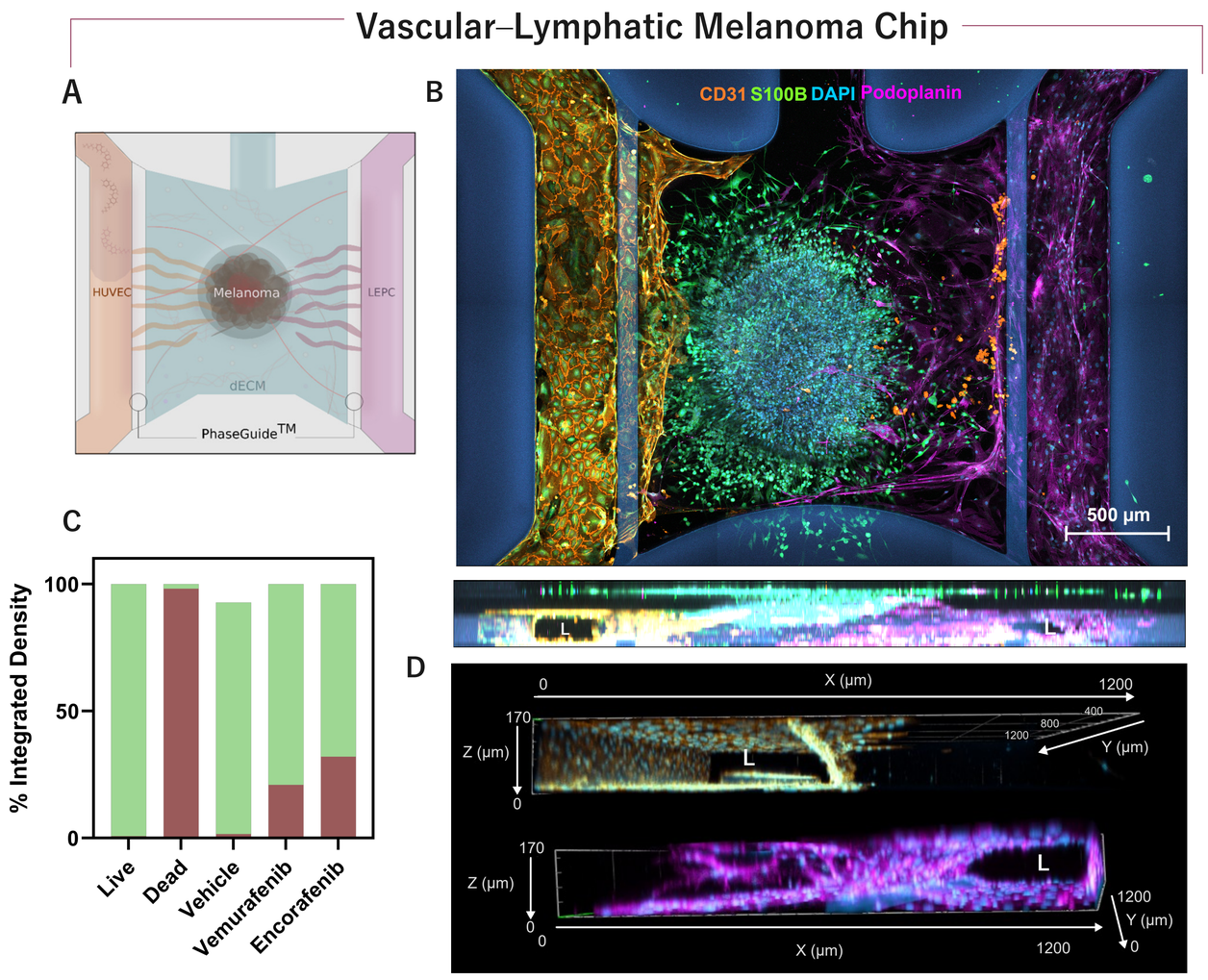


Fig. 5 | (A) Schematic illustration of the system. (B) Maximum intensity projection in the XY plane (top) and XZ plane (bottom) of the immunostained melanoma-on-a-chip model. (C) Live/Dead quantification of control and models exposed to drugs for 72h (calcein, live signal, green; and PI, dead signal, red). ROI: 1000x1000px. (D) Immunostaining of sprouted HUVECs (top) and LEPCs , both toward dECM gel. Lumen is marked as (L).

Related publications

González-Callejo P, et al. ACS Appl Mater Interfaces. 2024;16(21):27151-27163.

González-Callejo P, et al. Mater Today Bio. 2023;23:100826.

Vázquez-Aristizabal P, et al. Adv Healthc Mater. 2024;13(27):e2401136.

Vázquez-Aristizabal P, et al. ACS Appl Bio Mater. 2026;16;9(6):2971-2979..

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