

Scaling human biology for AI-driven drug development: Towards relevant biology, controlled environment, multimodal data, and scalability

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In drug discovery, over 90% of drug candidates fail during clinical trials. Traditional models, such as 2D cell cultures and animal testing, often fail to accurately predict human biology, driving substantial costs and delays for biotech and pharmaceutical companies. At the same time, advanced systems such as organ-on-chip and microphysiological systems offer more human-relevant biology but remain limited by operational complexity, low throughput, and poor integration into standard laboratory workflows. Meanwhile, AI is transforming drug discovery, but its performance is highly dependent on the quality and relevance of the underlying data. Today's bottleneck is clear: we lack data generated from **human-relevant models**, in **controlled environments**, with **multimodal measurements**, at **scale**.

Syntopia fulfills these needs by providing a platform that enables **3D tissue-like cell models** in a **consistent-by-design system**, allowing **multiple readouts from a single sample** in a **high-throughput plate format**.

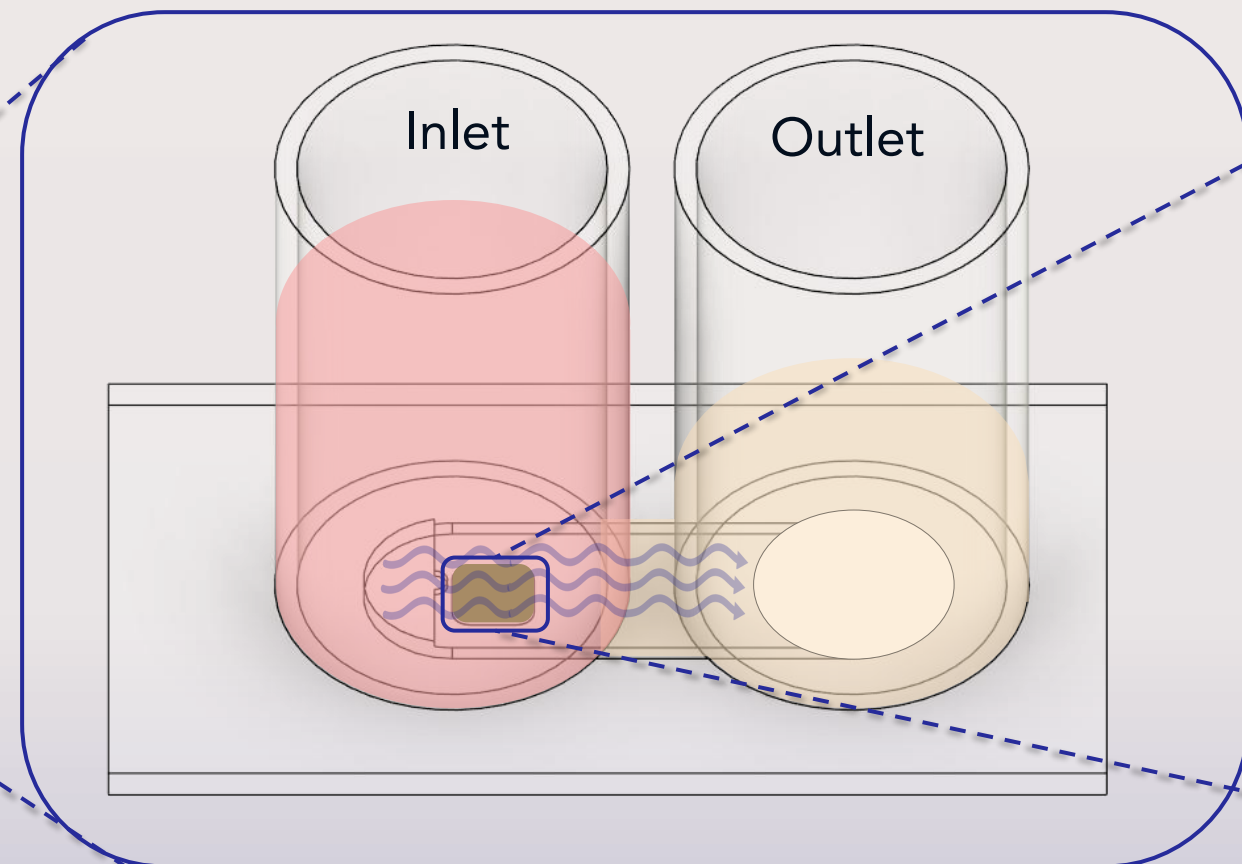
SYNTOPIA'S DEVICE



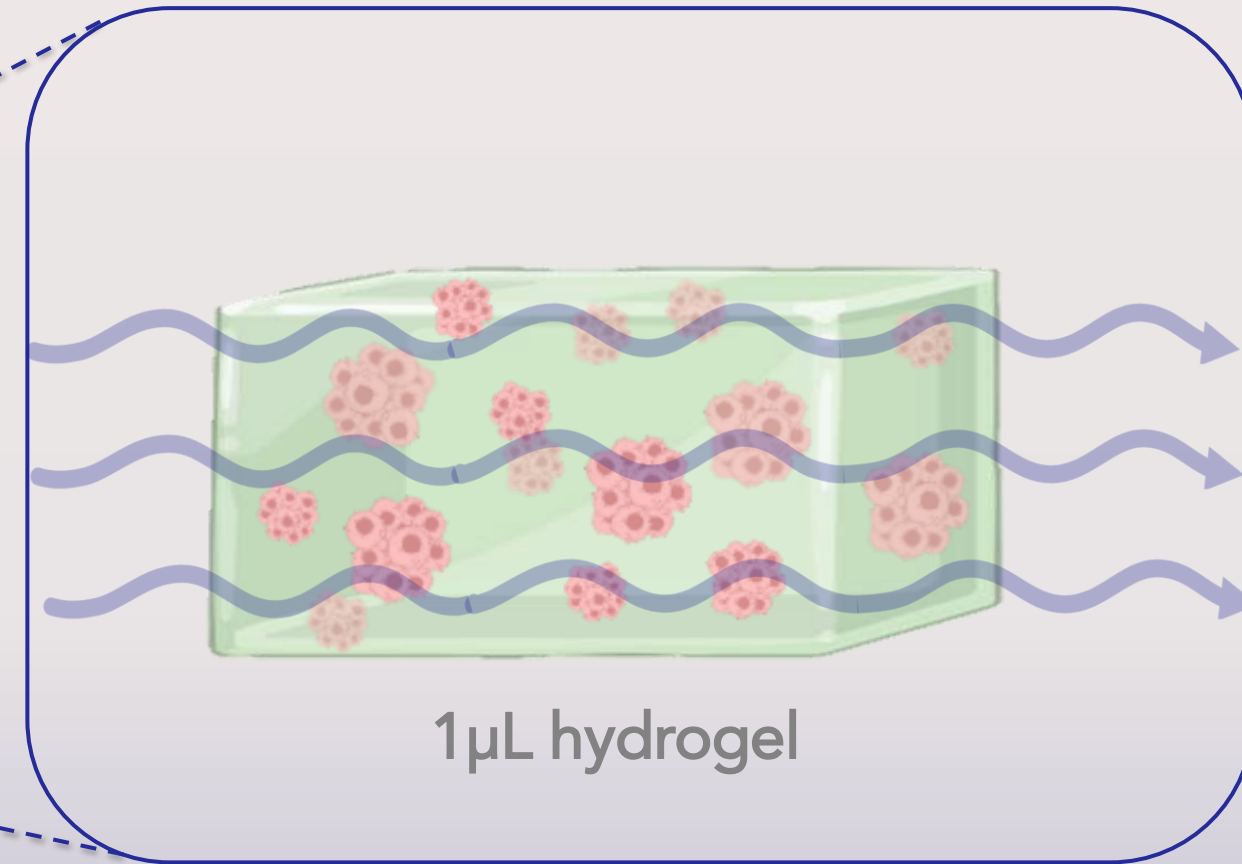
Syntopia's device

also
384

Pump free perfused unit



3D cell culture chamber



Look at our video !

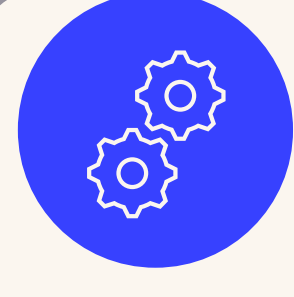


Or speak to one of our scientists to know more !



Relevant biology
Tissue-like environment

- ✓ 3D structure
- ✓ ECM mimetic environment
- ✓ Cell and hydrogel agnostic
- ✓ Perfused sample



Controlled environment
Consistency by design

- ✓ Homogeneous sample
- ✓ Long term cell growth and viability
- ✓ Rapid and reproducible seeding (patented technology)



Multimodal data
More data from every sample

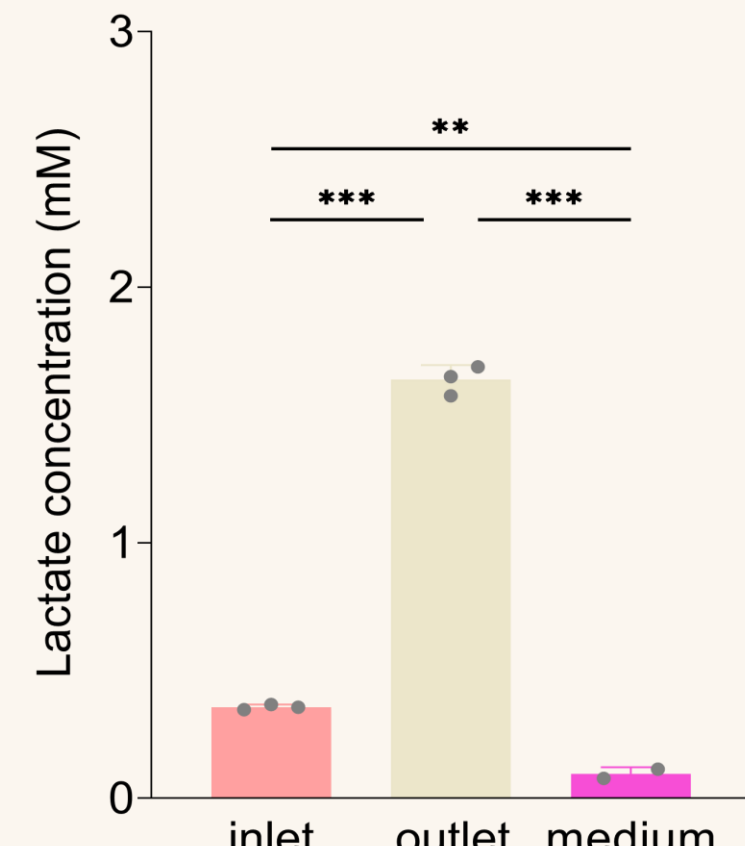
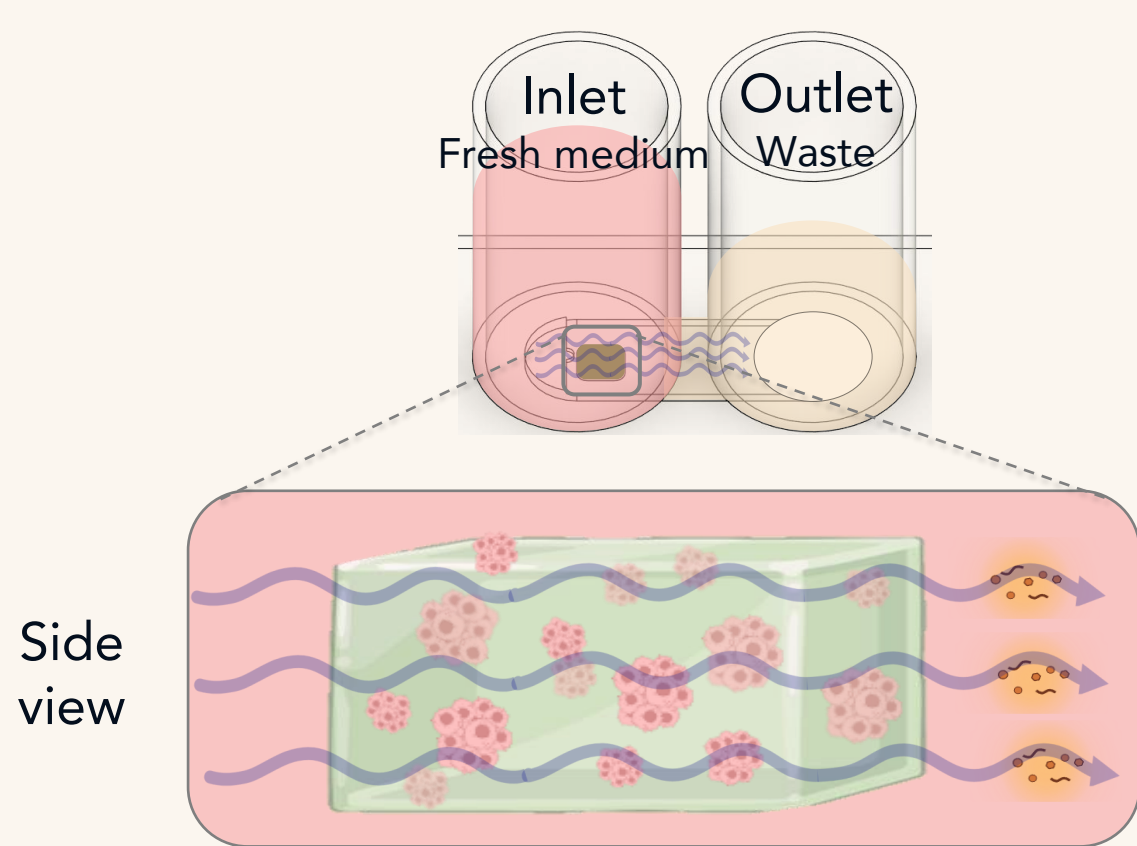
- ✓ Spatio-temporal imaging readout
- ✓ Optical readouts (absorbance, luminescence)
- ✓ Supernatant analysis



Scalability
Increase tested conditions

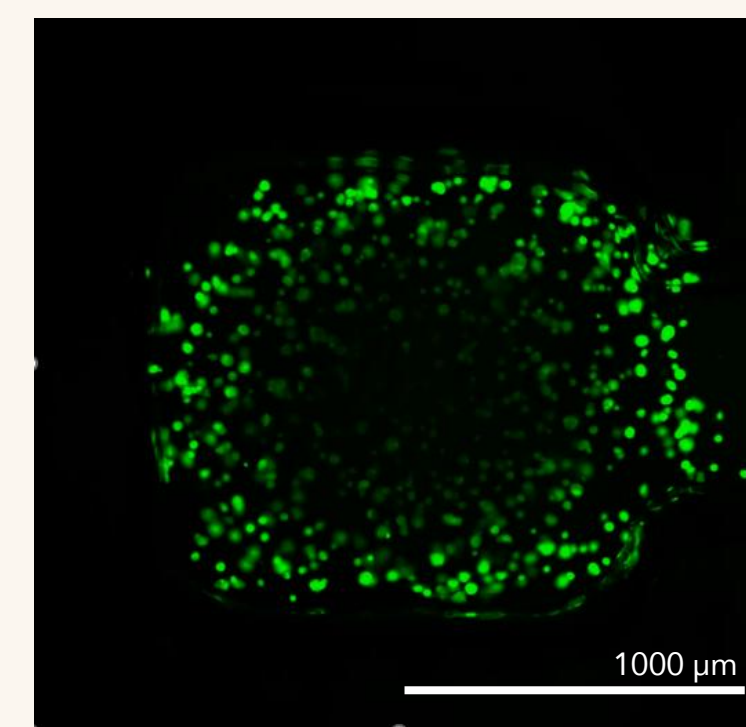
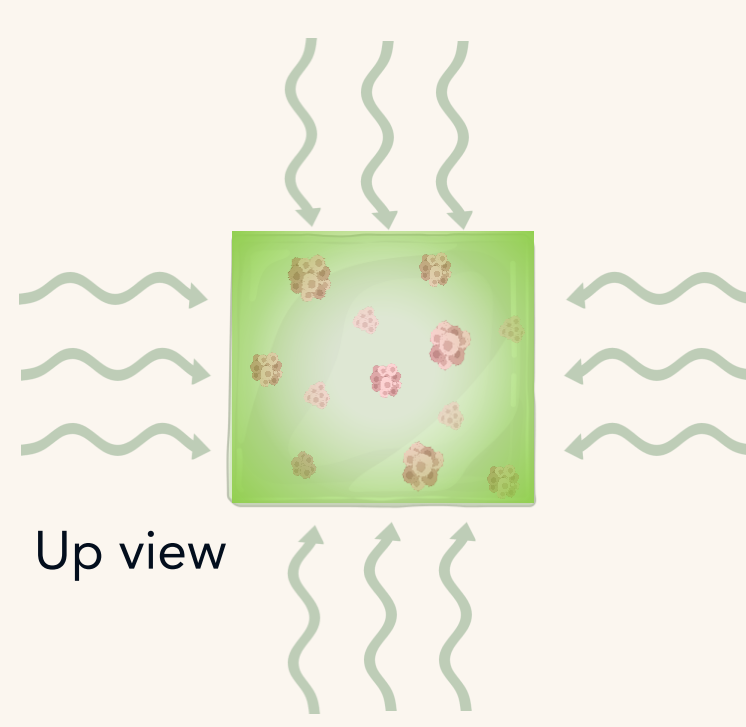
- ✓ High-throughput
- ✓ Low input biological sample
- ✓ Reduced data acquisition & size

Continuous medium refresh and waste wash



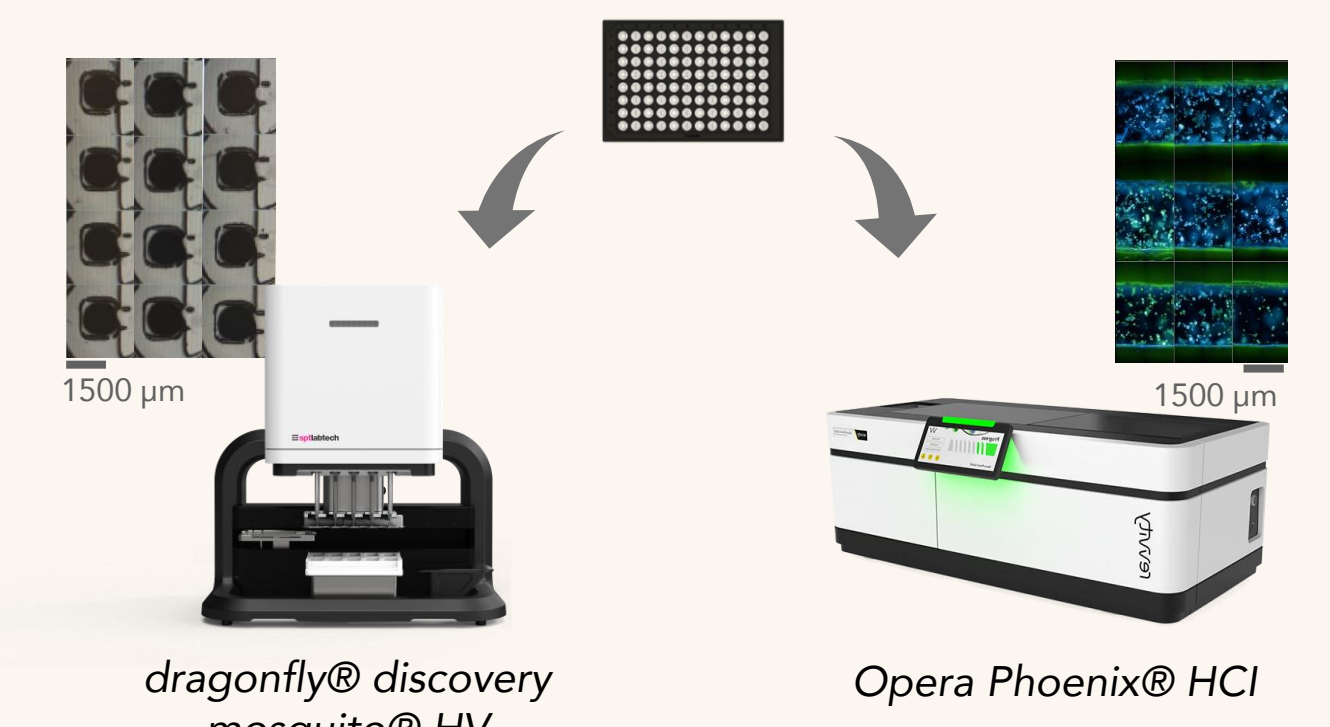
Schematic representation of waste washout during continuous passive perfusion, followed by lactate quantification in the supernatants of inlet and outlet wells after 10 h of perfusion. Medium alone served as a negative control. Statistical significance was assessed by one way ANOVA after verification of normality.

Controlled drug exposure and diffusion
with spatio temporal resolution



Schematic representation of drug diffusion through the hydrogel, followed by representative fluorescence imaging of Calcein-AM diffusion in Cultrex™ after 20 min of incubation.

From sample generation to data acquisition
compatible with automated lab-workflow



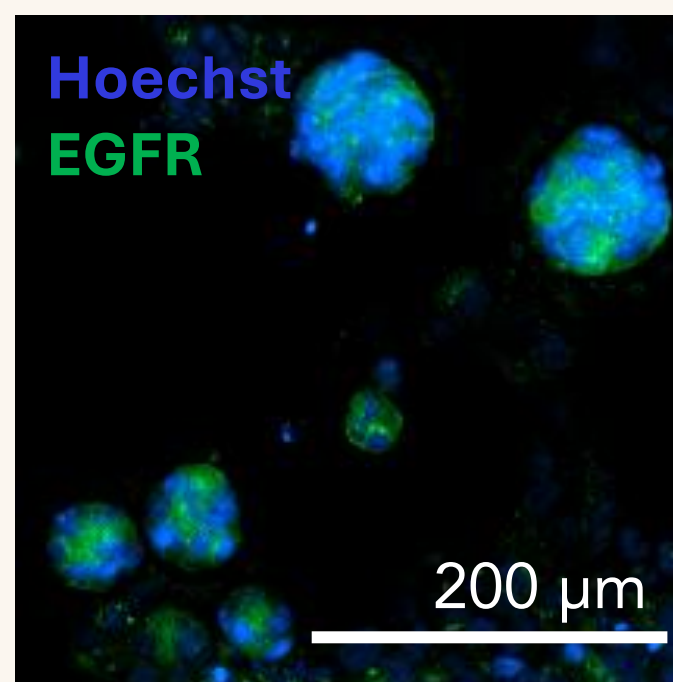
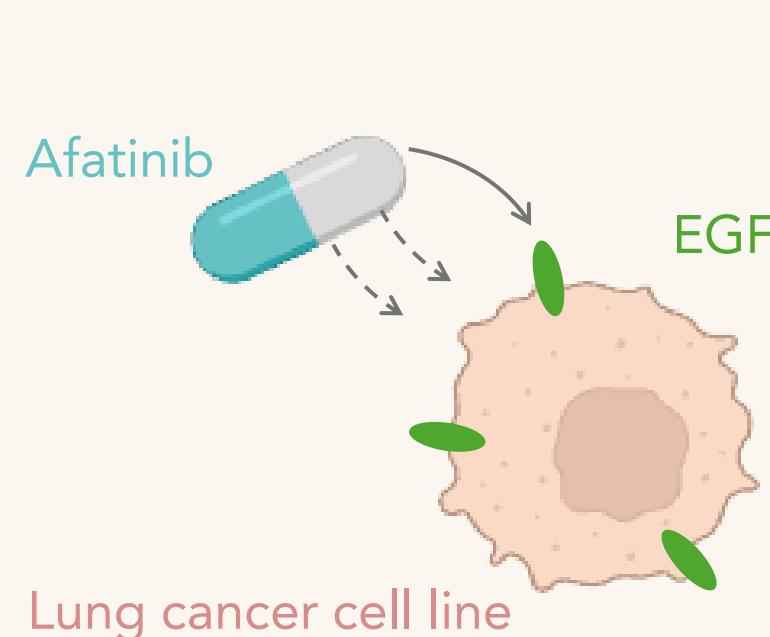
dragonfly® discovery
mosquito® HV
sptlabtech
Liquid and hydrogel
handlers

Opera Phoenix® HCI
revvity
High content
imagers

DRUG DEVELOPMENT

Small molecule

Oncology model for small molecule testing

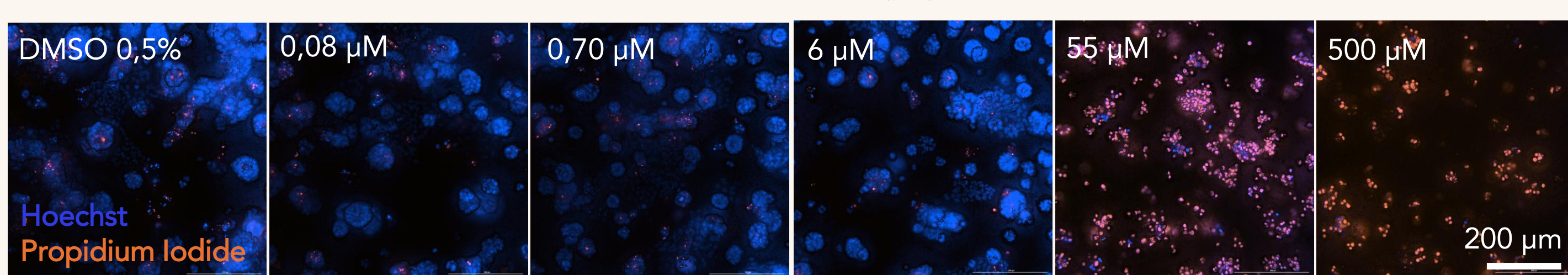
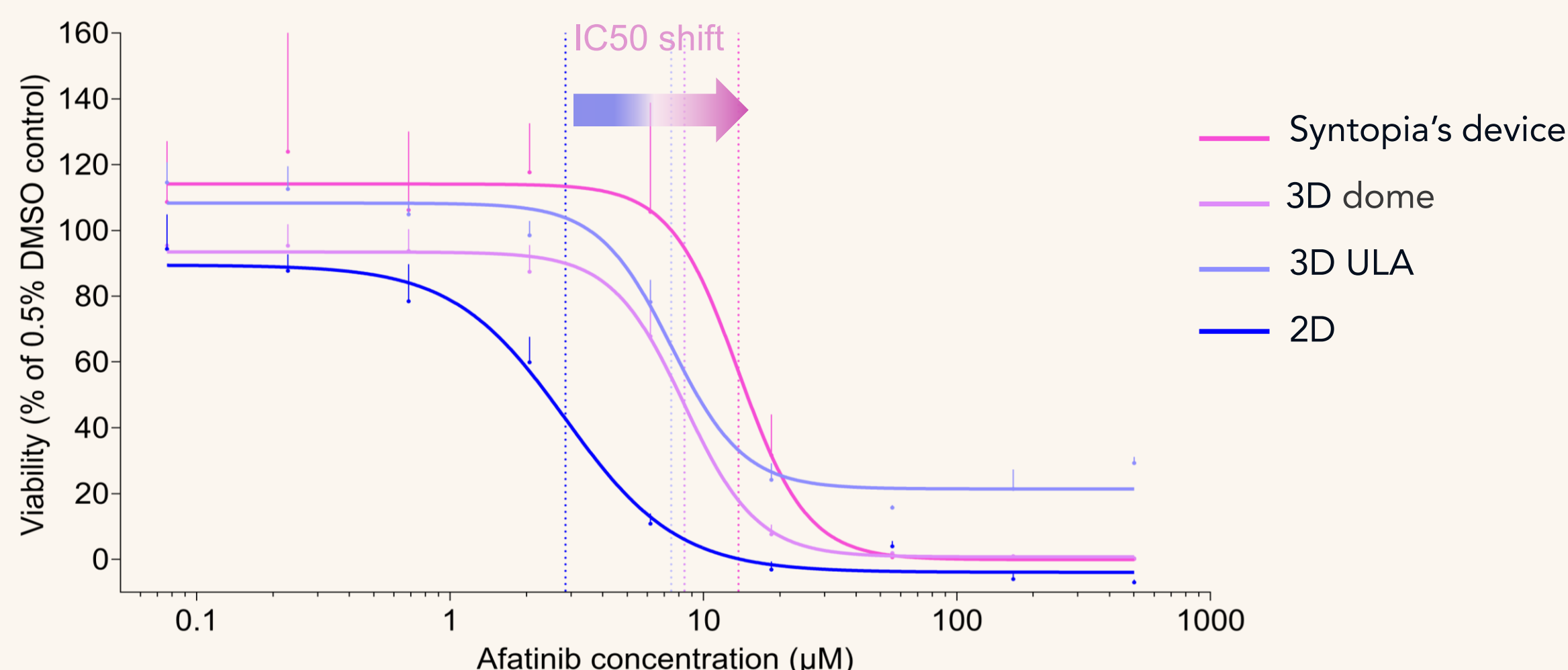


Schematic representation of afatinib-mediated inhibition of ErbB receptor kinase activity, including EGFR, in lung cancer cells (A549) expressing low but detectable levels of EGFR.

EGFR protein expression by immunostaining of A549 grown in 3D in Natural Cultrex™ in Syntopia's device.

Afatinib cytotoxicity in Syntopia's device

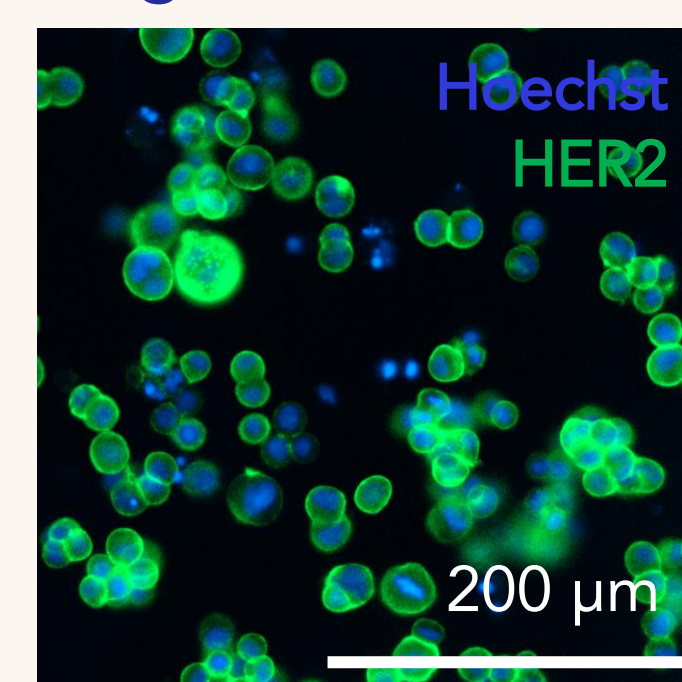
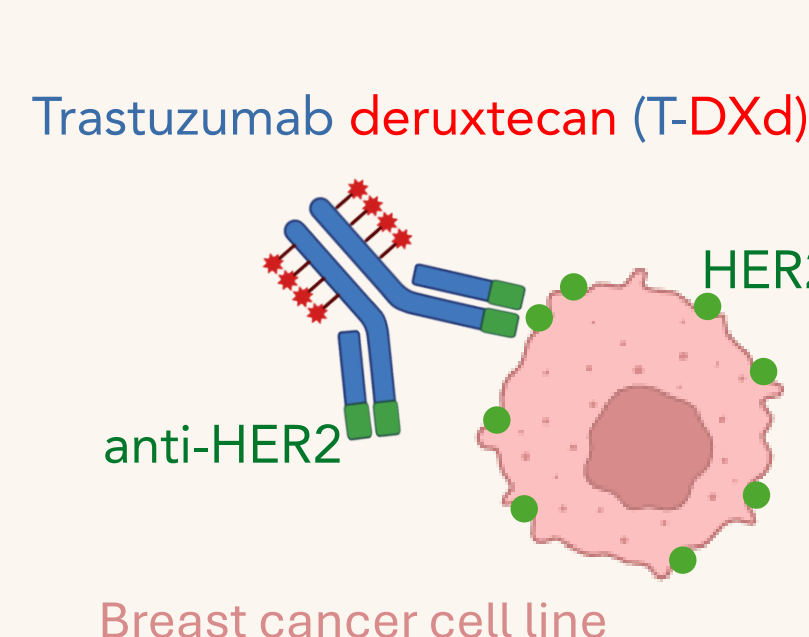
3D models created with SyntoPl8 show IC₅₀ that are higher than other standard methods, suggesting more complex & resistant response to drugs



Afatinib dose-response curves in A549 cells after 72 h of treatment following 3 days of culture in different culture formats. Cell viability (CellTiter-Glo) was normalized to 0.5% DMSO (n = 4); IC₅₀ values were derived from 4-parameter logistic fits. Representative Syntopia images show dead cells (propidium iodide, orange) and nuclei (Hoechst, blue) across increasing afatinib concentrations.

Antibody drug conjugate

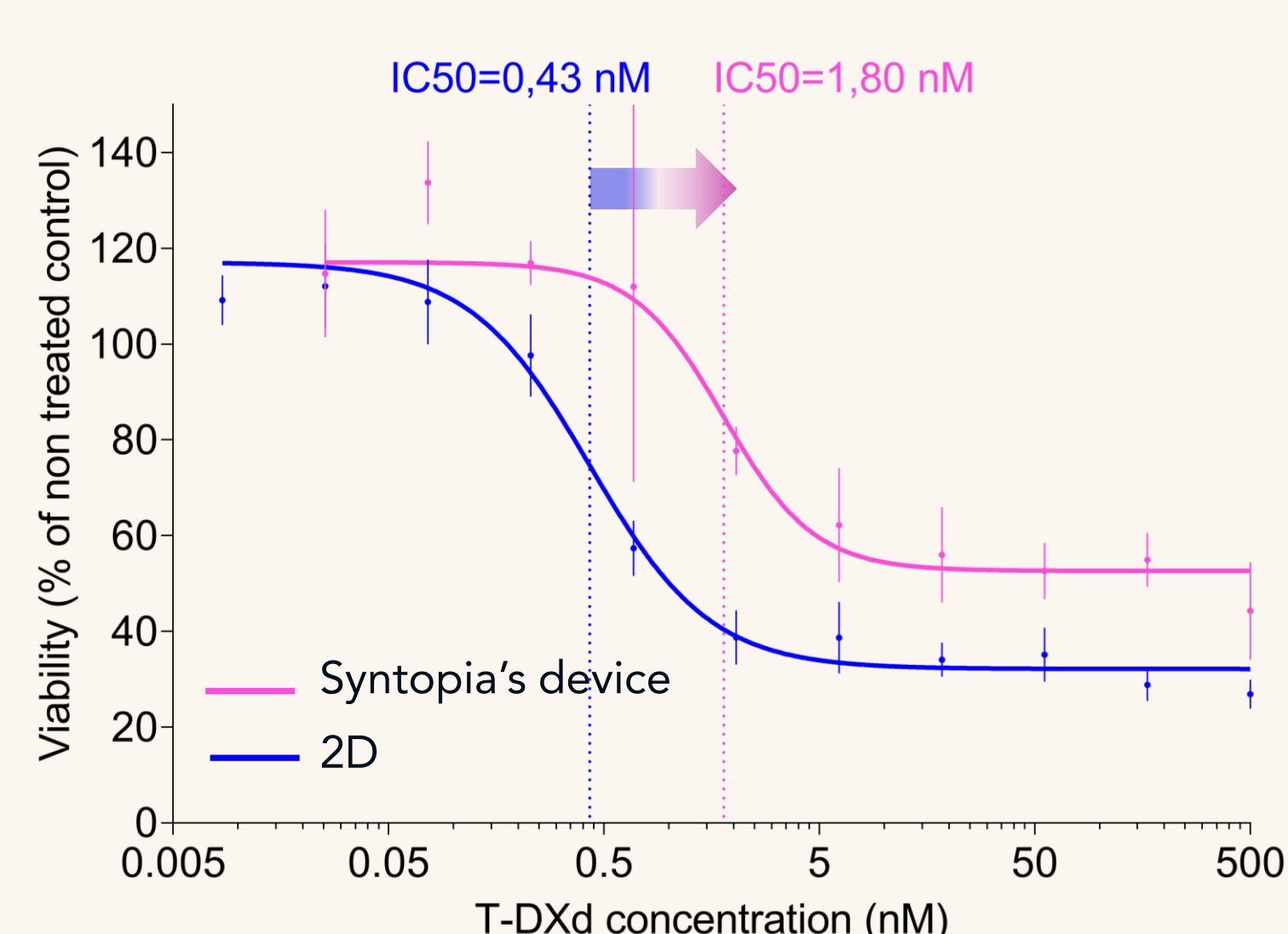
Oncology model for ADC testing



Schematic of Trastuzumab deruxtecan (T-DXd) recognition of HER2-positive breast cancer cells (SKBR3), followed by internalization, DXd payload release, and cell killing by DNA damage.

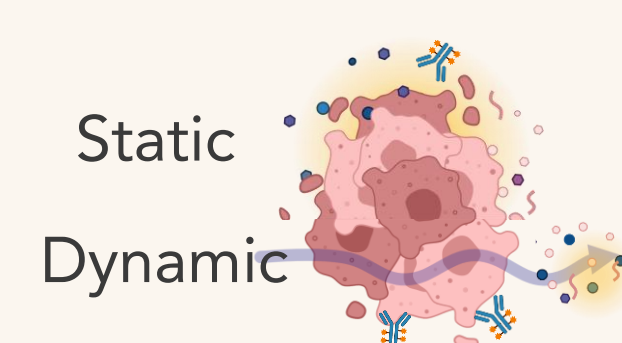
High HER2 protein expression by immunostaining of SKBR3 grown in 3D in Natural Cultrex™ in Syntopia's device.

Trastuzumab-DXd cytotoxicity in Syntopia's device

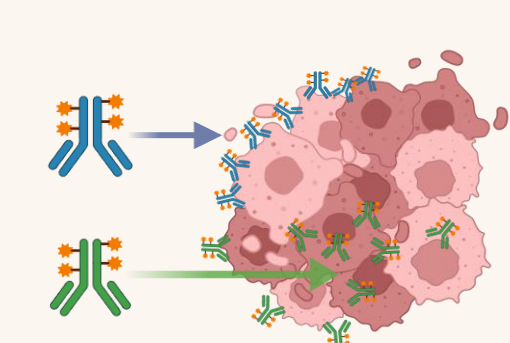


T-DXd dose-response curves in SKBR3 cells after 96 h of treatment following 4 days of culture in 2D or 3D Syntopia's device. Cell viability (CellTiter-Glo) was normalized to non treated condition (n = 4); IC₅₀ values were derived from four-parameter logistic fits.

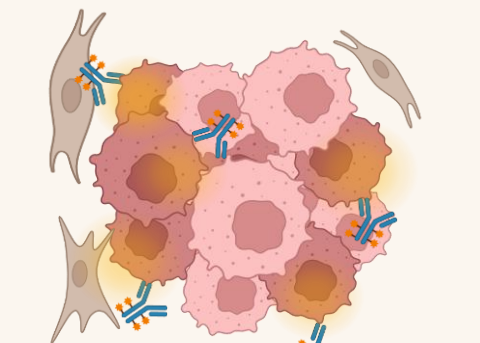
Relevant measurements enabled by Syntopia's device



True cytotoxicity
By reducing non-specific
cytotoxicity allowed by perfusion



Tumor penetration
& target engagement
With spatio-temporal readout



Bystander effect evaluation
With spatio-temporal readout
in a 3D and multicellular model

We enable a new generation of drug discovery:

- Faster and more cost-efficient development : Reducing time, cost, and risk across the drug development pipeline.
- Better prediction of human responses : Reducing clinical failure rates by improving the relevance of preclinical models.
- Acceleration of AI-driven discovery : Providing high-quality, standardized datasets required to train robust predictive models.
- Transition away from animal testing : Supporting the adoption of scalable, human-relevant New Approach Methodologies.

<https://www.syntopia.bio>

