

Cost-Effective Unidirectional Micro-Perfusion for 3D Tumor Models :

Towards Robust, Physiologically Relevant Drug Response at Scale

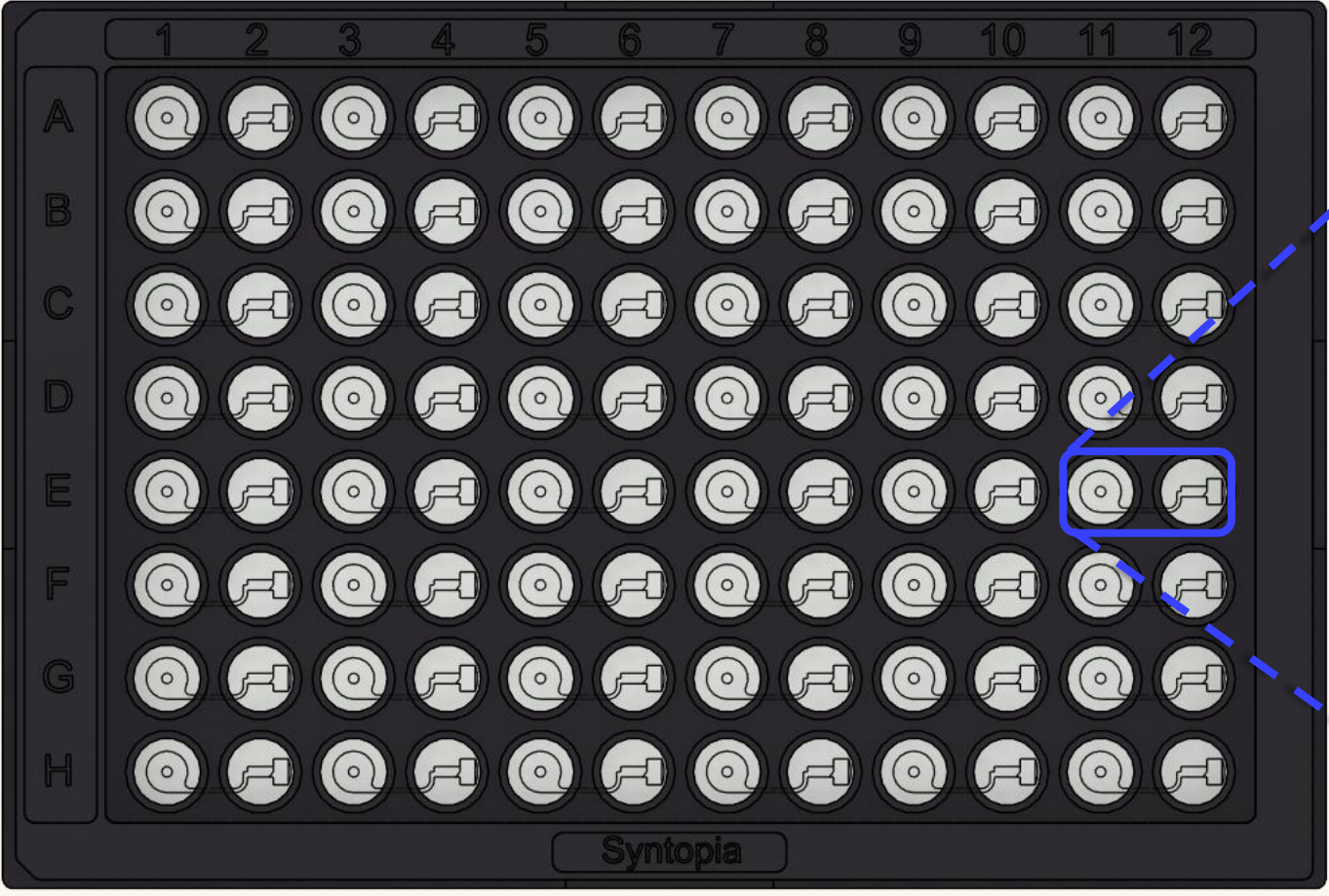
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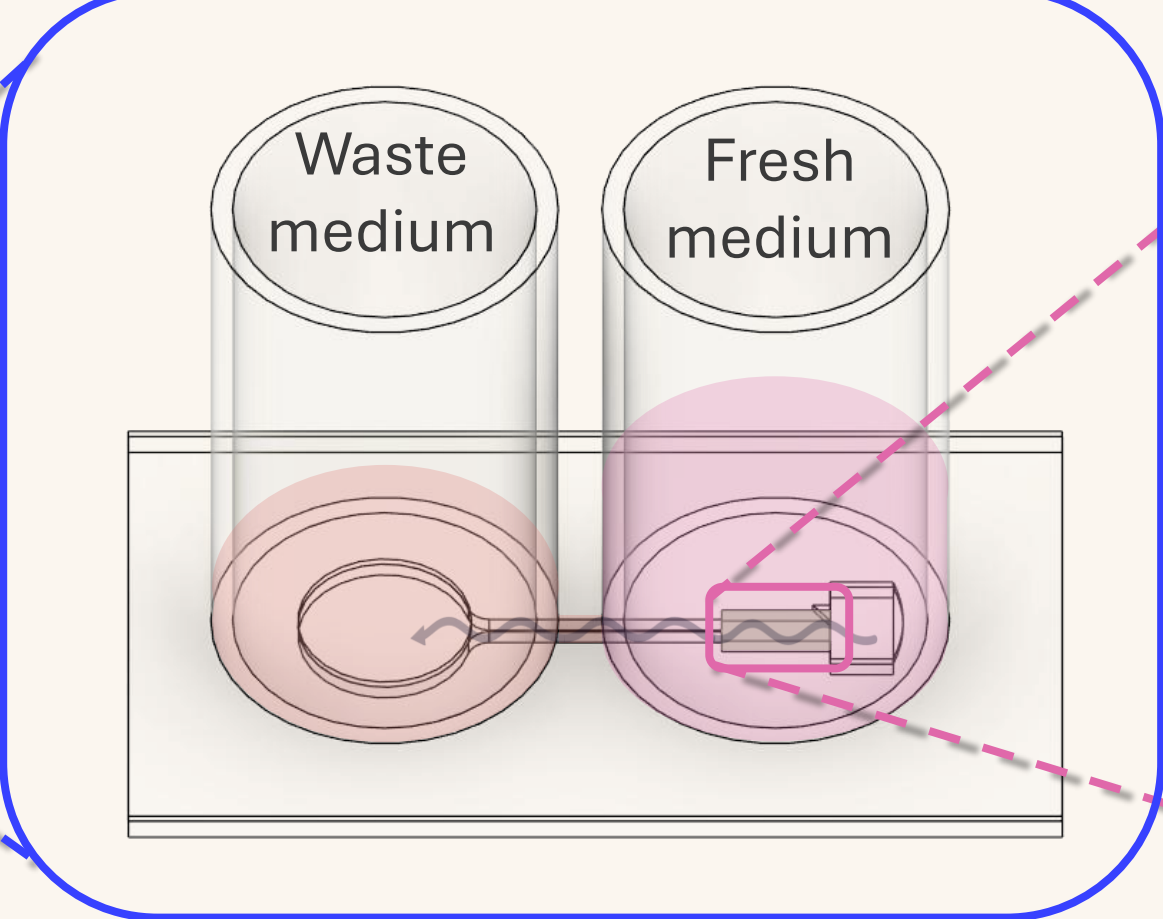
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In drug discovery, over 90% of drug candidates fail in clinical trials. Traditional models such as 2D cell cultures and animal testing poorly predict human biology, driving huge costs and delays for biotech and pharma. At the same time, advanced systems like organ-on-chip and micro physiological systems promise better biology, but remain limited by operational complexity, low throughput, and poor integration into standard lab workflows. Meanwhile, AI is transforming drug discovery, but its performance is entirely dependent on the quality of the underlying data. Today's bottleneck is clear: **we lack scalable, easy to implement, high-quality, human-relevant datasets.** **The Syntopia's solution fulfill this need.**

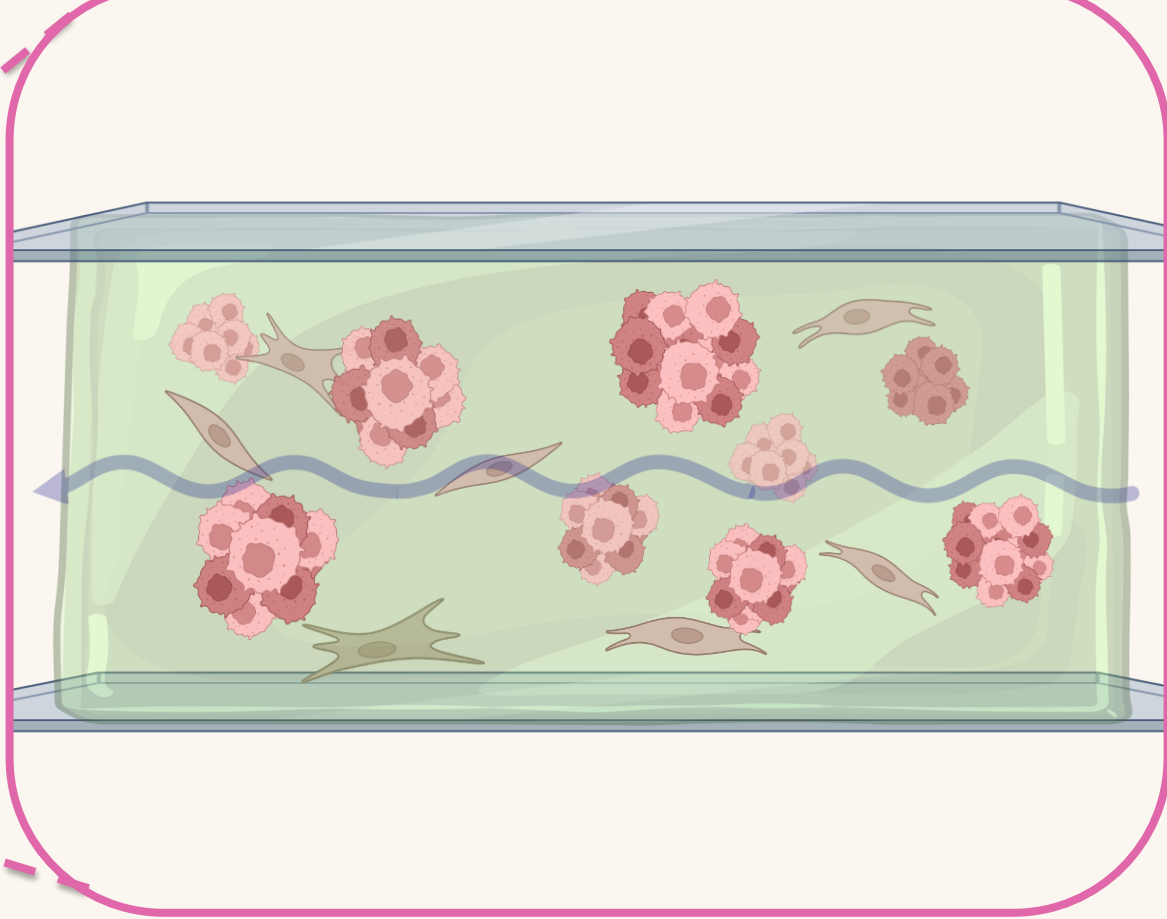
1 96 Well-Plate format



2 Perfused matrix

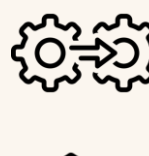


3 3D cell culture

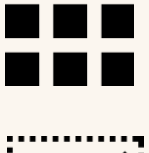


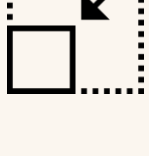
 Syntopia

 Easy adoption

 Interfaceable

 Reproducible

 Scalable

 Reduced samples

Look at our video !



 High-throughput screening
Robust, Scalable, Reliable

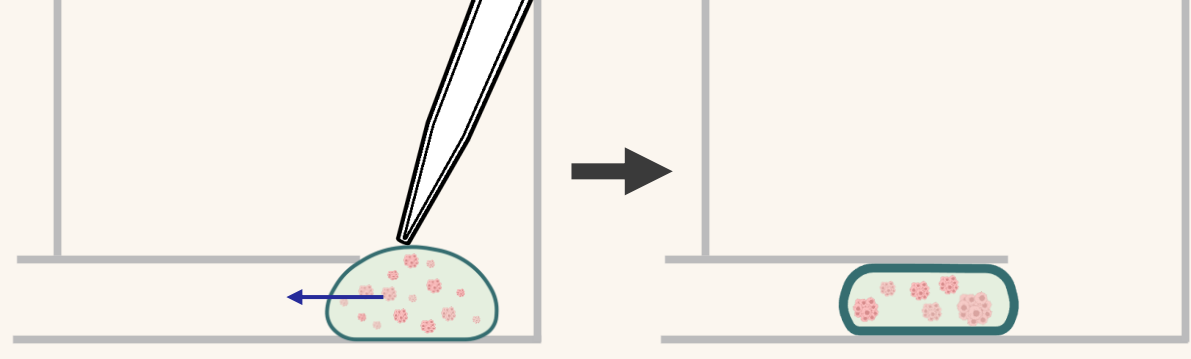
 Controlled microenvironment
Functional, Homogeneous, Tunable

 Physiologically relevant
3D, Tissue mimetic, Predictive

Workflow integration

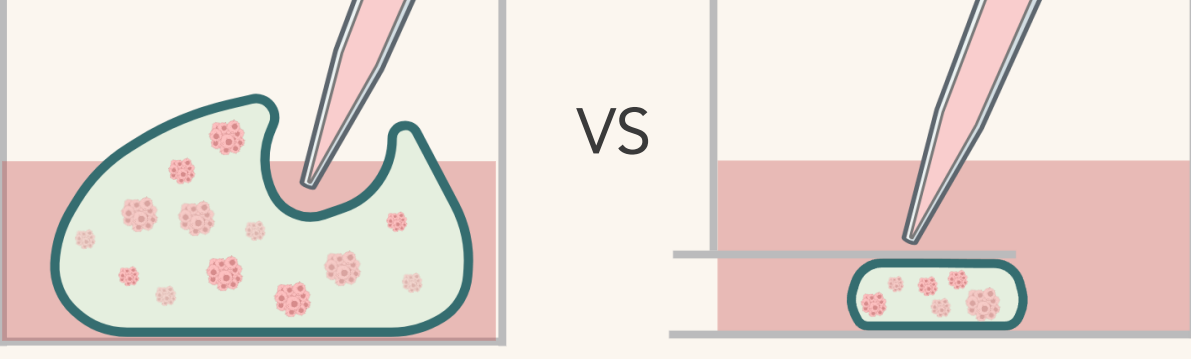
Easy to operate

Easy hydrogel loading



Patented technology for localized and confined hydrogel trapping

Protected sample



Exposed to damage VS Protected in a confined chamber

One platform. Multimodal data. Single experiment.

Imaging

Transmittance

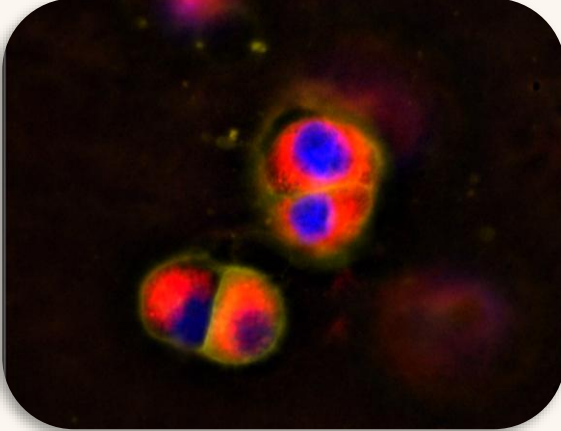
Morphology
Spatial organisation

Fluorescence

Viability
Gene expression

Time Lapse

Migration, Proliferation



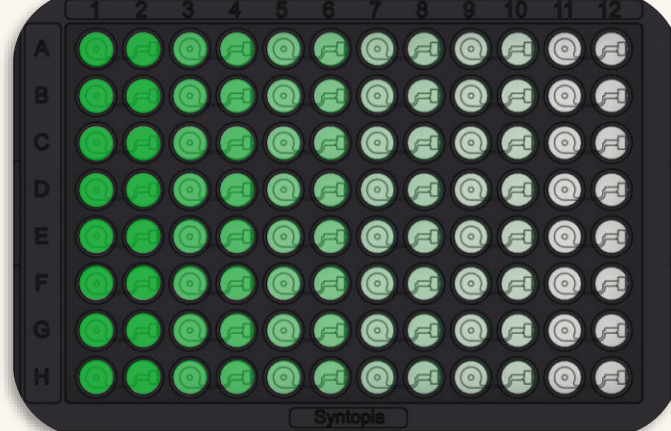
Optical readout

Absorbance

Enzyme activity,
viability

Luminescence

ATP, Reporter assays



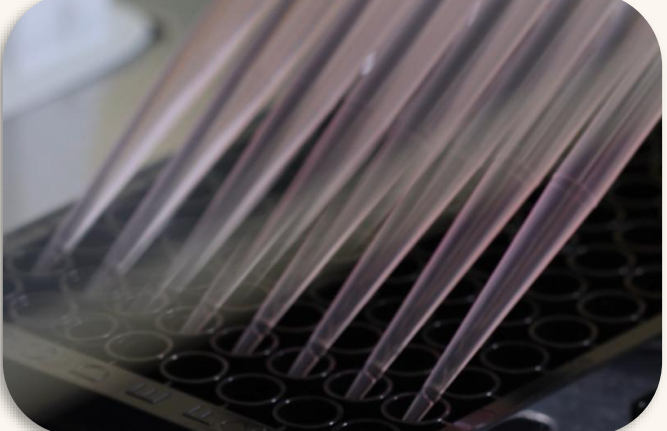
Secretome

Metabolites

Nutrients, Lactate
ATP

Proteins

Cytokines, Growth
factors, Enzymes



Omics

Transcriptomics

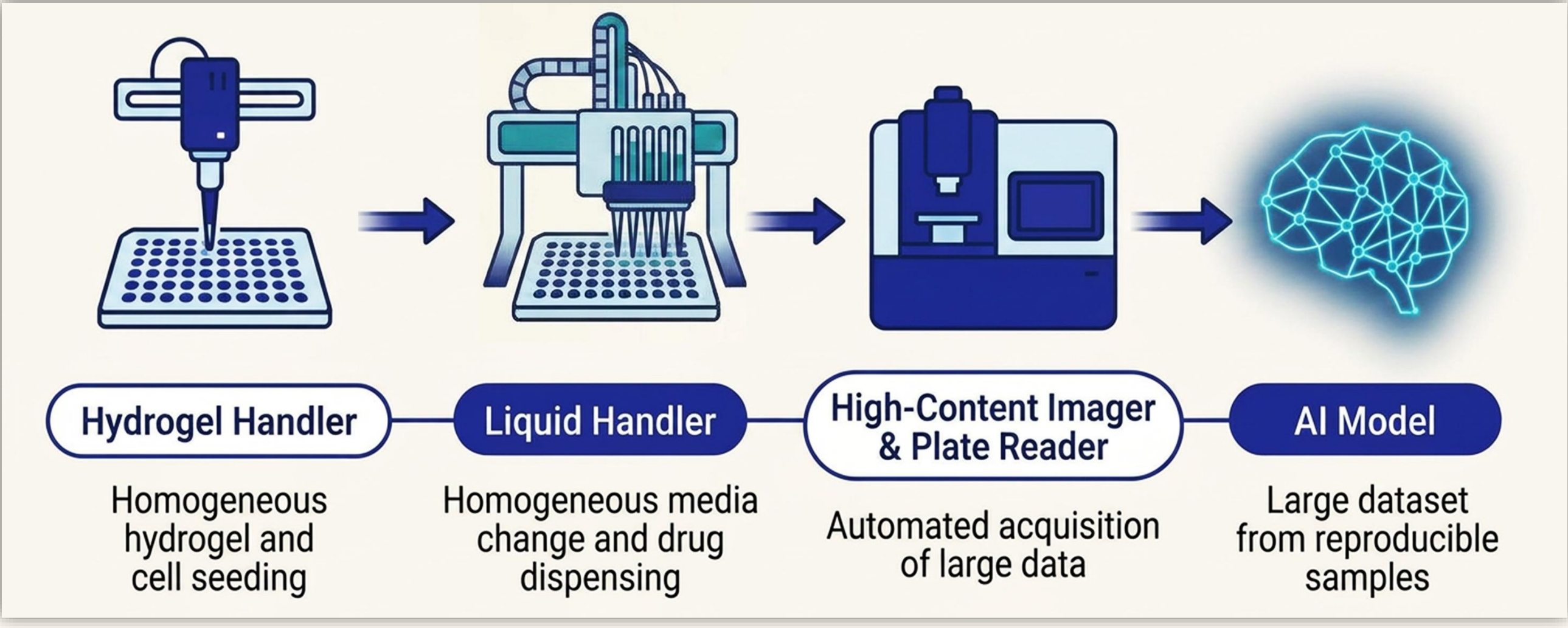
Bulk, Single-cell,
RNA-seq



Cost effective throughput

Automation compatible

Fully compatible with automatized workflow to generate the robust data needed to power next-generation AI-driven drug design.



Hydrogel Handler

Liquid Handler

High-Content Imager & Plate Reader

AI Model

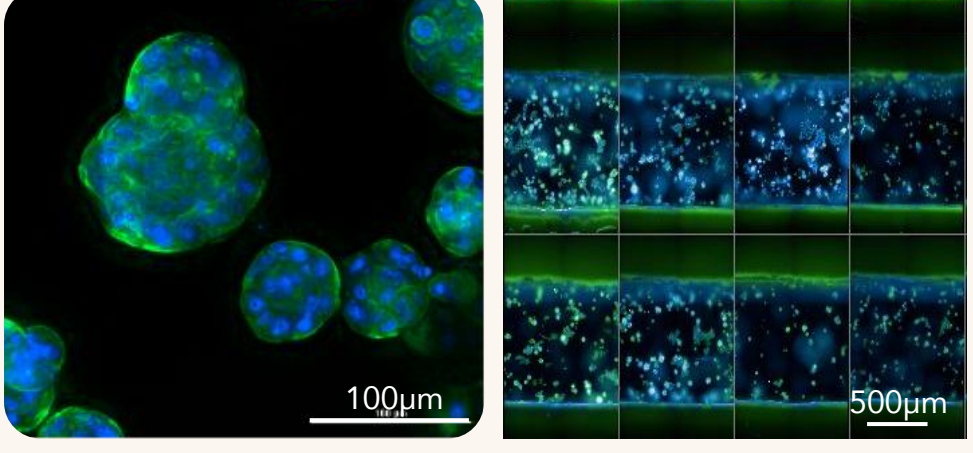
Homogeneous hydrogel and cell seeding

Homogeneous media change and drug dispensing

Automated acquisition of large data

Large dataset from reproducible samples

revvity



"System's images were acquired successfully with Opera Phenix Plus and Operetta CLS, confirming its compatibility with high-throughput imaging."

20× air widefield image of A549 spheroids (1000 cells/μL) in Cultrex after 5 days of culture; representative of 12 wells. Scale bar = 500μm.

Reduced sample cost

✓ 10 times less hydrogel and cells needed VS standard practices

✓ 3 times less z acquisition, acquisition time, and data size

Standardized data

Controlled microenvironment

Passive pump-free perfusion

Static

Diffusion dominated

Flow

Steady-state transport

VS

Waste accumulation

Continuous refresh

Controlled treatment exposition

Static

Flow

Measure true cytotoxicity by reducing non-specific cytotoxicity

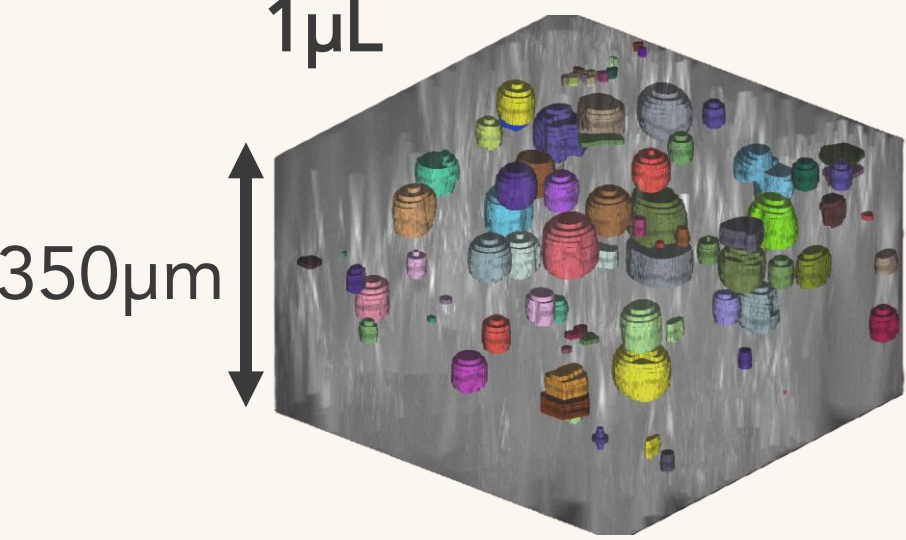
Syntopia behaves as a steady-state system :

✓ Uniform nutrient distribution → Reduced gradient (Nutrients, O₂, etc.)

✓ Accurate drug exposure → no overestimation of effective concentration

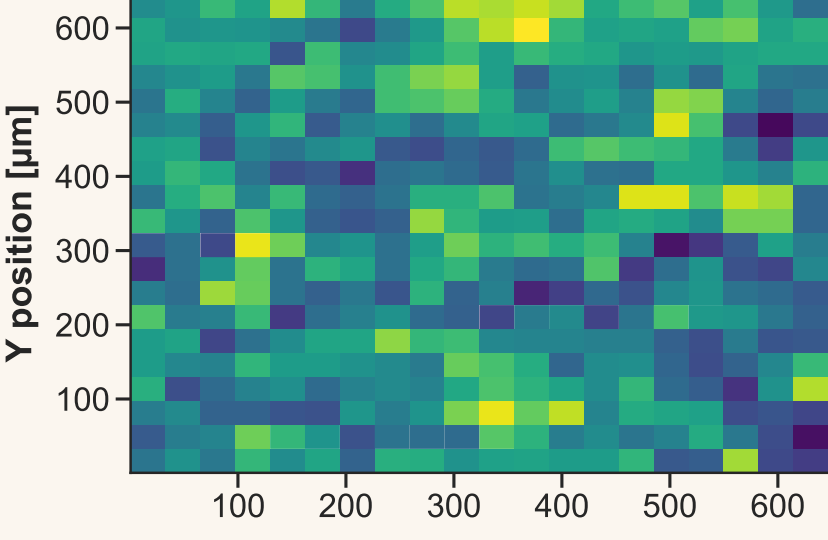
✓ e.g. ADC testing: accurate concentration exposure, more physiological bystander effect

Homogeneous model



1μL
350μm

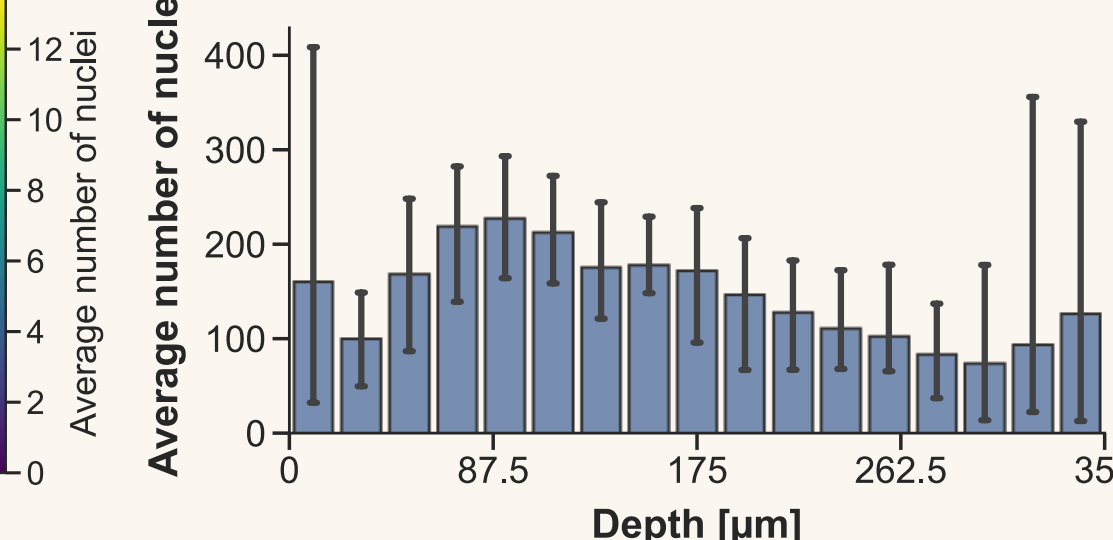
XY density of nuclei



Y position [μm]

X position [μm]

Z distribution of nuclei



Average number of nuclei

Depth [μm]

3D reconstruction of A549 spheroids generated in Syntopia (in-house Image software), with corresponding XY cell density heatmap and Z-axis cell distribution showing homogenous distribution of spheroids. (n=8, 1000 cells/μL, Cultrex).

Physiologically relevant

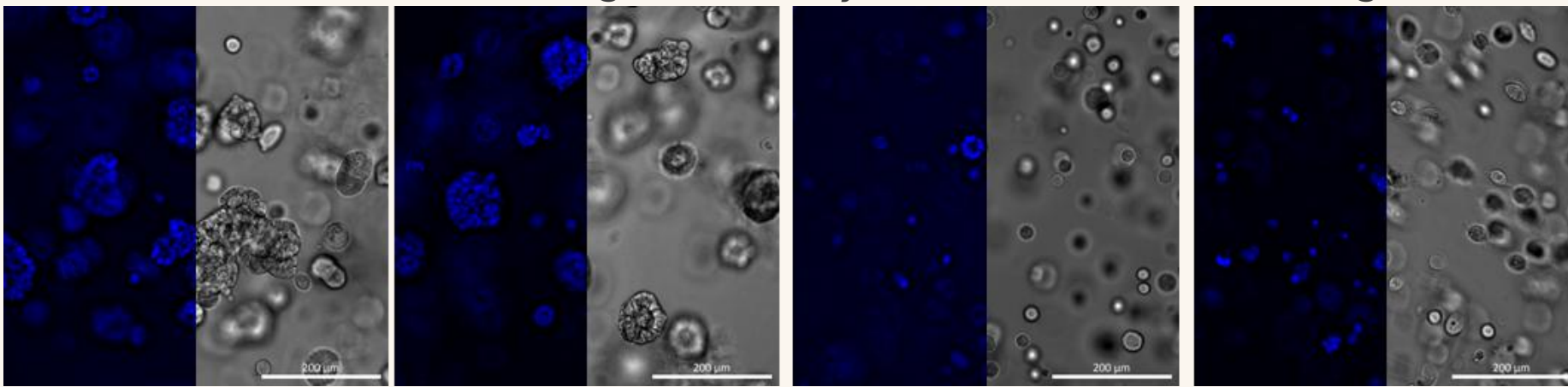
3D Cell culture in hydrogel mimics the extracellular matrix

Natural Cultrex®

Matrigel®

Synthetic Cultrex®

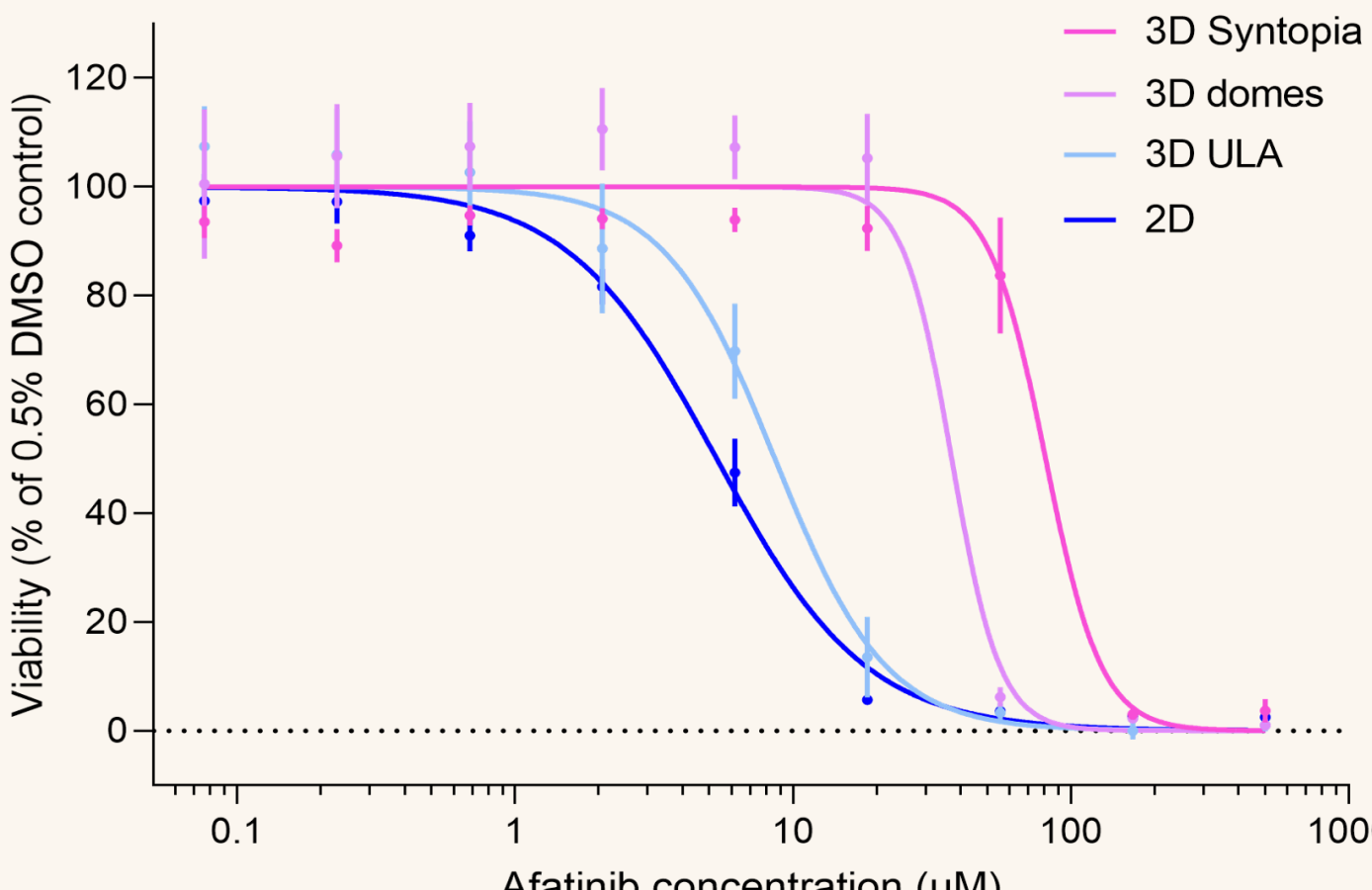
Vitrogen 3D®



Representative day 7 brightfield (20×) and Hoechst-stained images of A549 cells (1000 cells/μL) cultured in various hydrogels in Syntopia.

Syntopia allows the culture of different cell line in several kind of hydrogel. Our device allows both in situ self-assembly of spheroids and the integration of pre-formed spheroids.

3D Pharmacological test – Dose/response assay



Viability (% of 0.6% DMSO control)

Afatinib concentration (μM)

3D Syntopia

3D domes

3D ULA

2D

Conditions	IC50 (μM)*
Syntopia	80,95
3D domes	37,19
3D ULA	8,600
2D	5,310

* Calculated from non linear regression (sigmoidal fit normalised to top 100%)

0.08μM

0.23μM

0.69μM

2.06μM

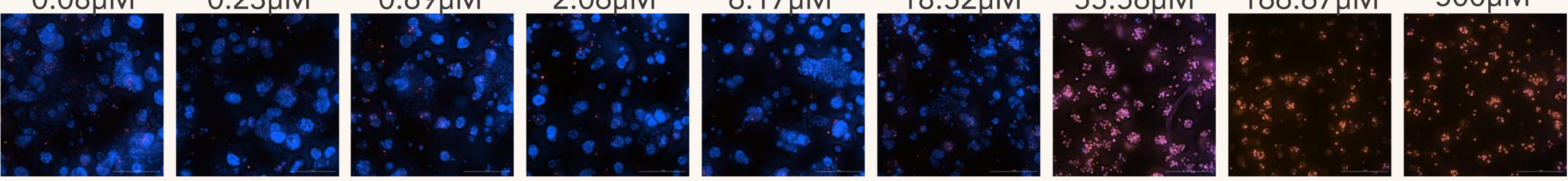
6.17μM

18.52μM

55.56μM

166.67μM

500μM



Representative images of A549 cells in Syntopia across increasing afatinib concentrations, with PI (red) and Hoechst (blue) staining

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.



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