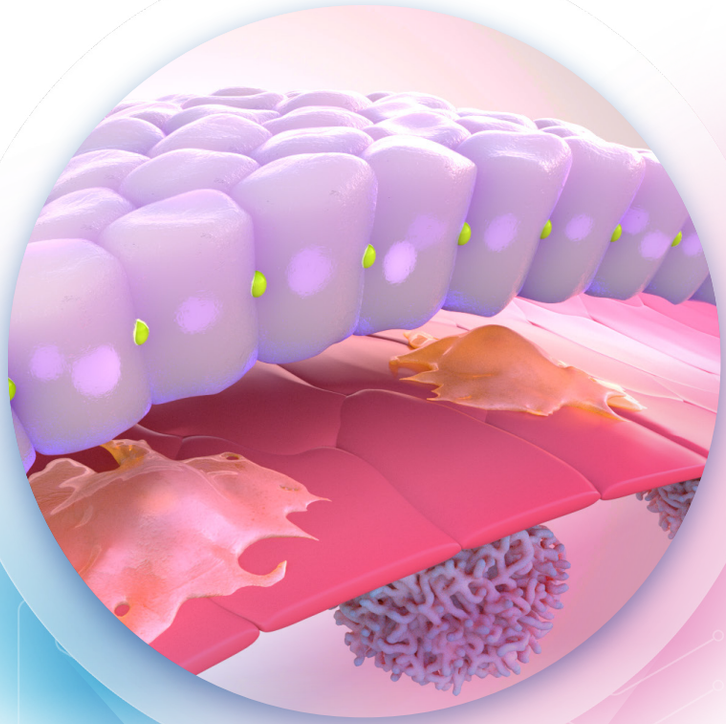
emulate

Save time.
Discover more.
Join the future.



Emulate Organ-on-a-Chip Technology

Complete Organ-Chip solutions to fast-track your drug discovery & development programs

Table of Contents

Technology Overview

Emulate Product Offerings

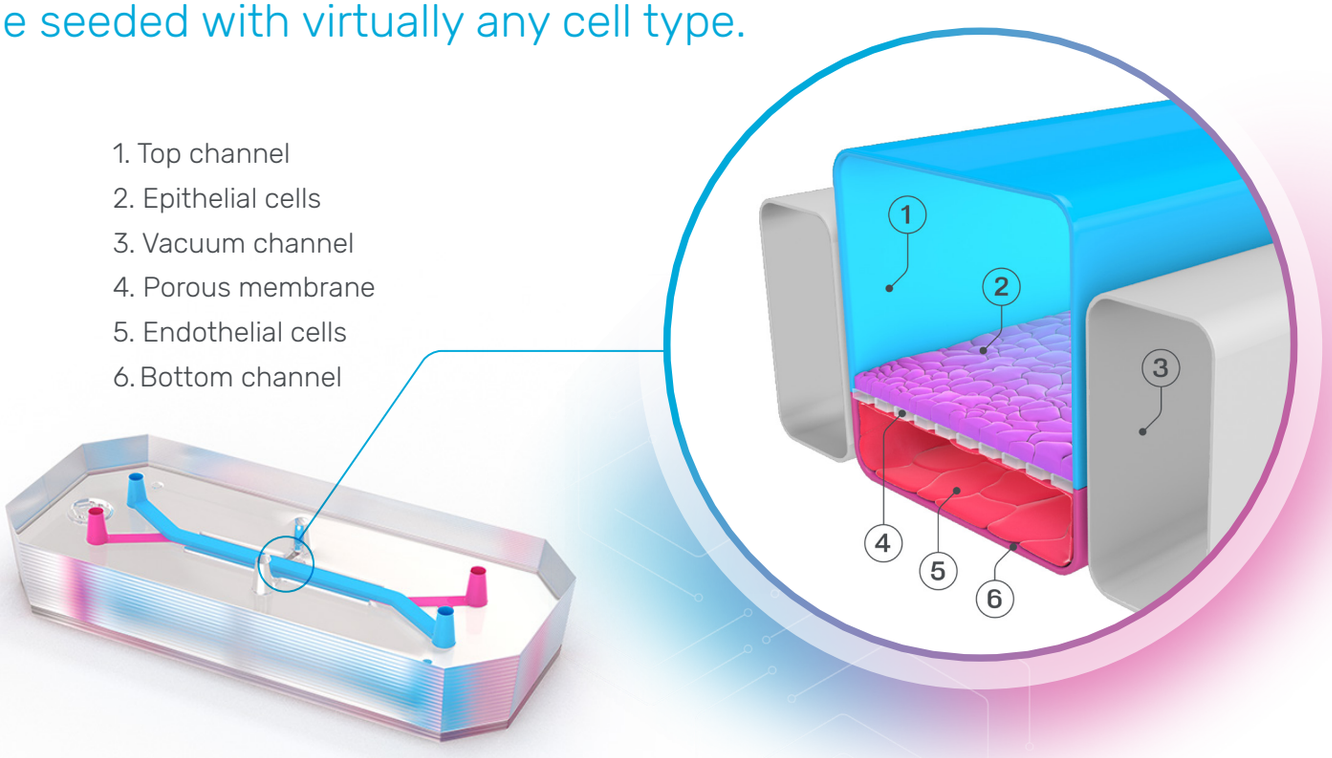
What are Organ-Chips?

Organ-on-a-Chip technology recreates the functional unit of an organ using living human cells and an organ-specific microenvironment, giving researchers a real-time view of human biology. These small devices consist of two parallel channels, which can be seeded with multiple human-relevant cell types—including primary cells, iPSCs, organoids, and immune cells—and are separated by a thin, porous membrane that allows cell-cell communication across a tissue-vascular interface.

A defining advantage of Organ-Chips is the precise control users have over biomechanical forces. When subjected to media flow and cyclic strain, cells experience the same stresses they would in the body, including intestinal peristalsis, breathing, and vascular flow. Collectively, this organ-specific microenvironment drives more *in vivo*-relevant gene expression, morphology, and function than standard culture methods, enabling deeper insights into human biology.

Schematic of Chip-S1 Stretchable Chip, an Organ-Chip consumable. Organ-Chip consumables are cell-agnostic and can be seeded with virtually any cell type.

1. Top channel
2. Epithelial cells
3. Vacuum channel
4. Porous membrane
5. Endothelial cells
6. Bottom channel



Fluid flow

Cyclic stretch

Tissue-specific ECM

Physiologically relevant culture conditions...

Cellular cross-talk

Vascular dosing

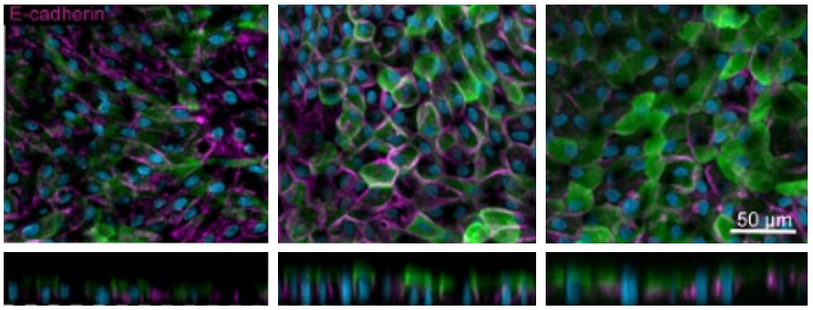
Tissue-specific vasculature

Circulating immune cells

Improved cell maturation

Flow & stretch improve the maturation of epithelial cells, including:

- Improved cell polarization
- Increased cell height
- Increased microvilli density

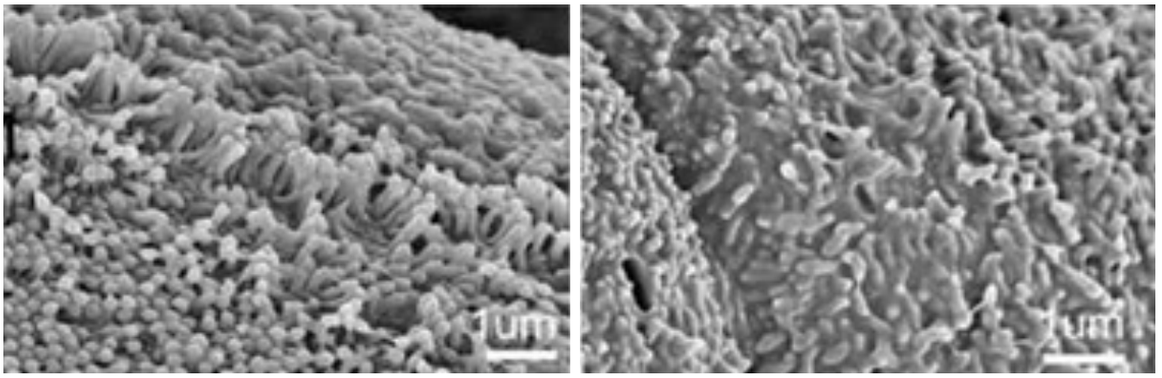


Static | Flow | Flow + Stretch

Flow and stretch increase epithelial cell height and microvilli formation in the organoid-derived Duodenum Intestine-Chip.

+endothelium

-endothelium



Endothelial co-culture increases the density of microvilli in the Colon Intestine-Chip.

Closer to *in vivo* gene expression

Tighter barriers

Improved toxic response

Immune cell recruitment

... lead to more *in vivo*-like response.

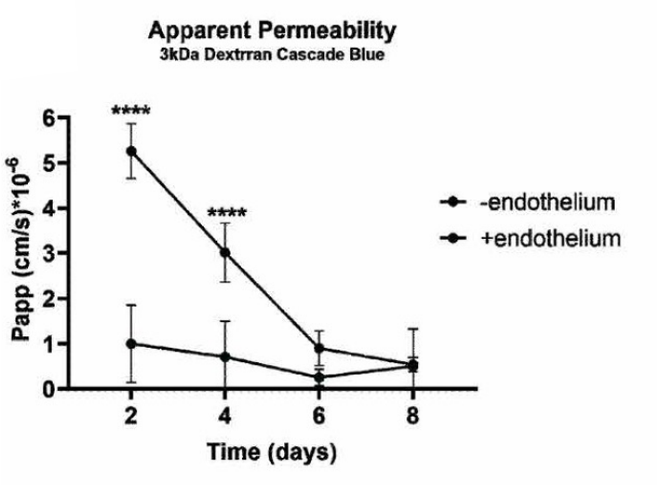
Cell polarization

Denser microvilli

Improved functionality

Mucus production

Improved tissue functionality

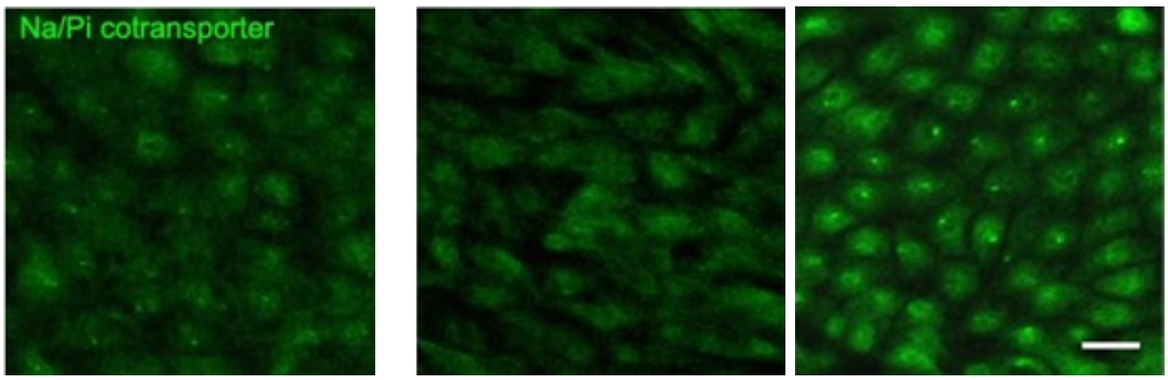


Co-culture with organ-specific vasculature improves the functionality of the tissue, such as:

- Improved barrier formation
- Closer-to-*in vivo* expression of relevant transporters
- Physiologically relevant biomarker production

Monoculture

Co-culture

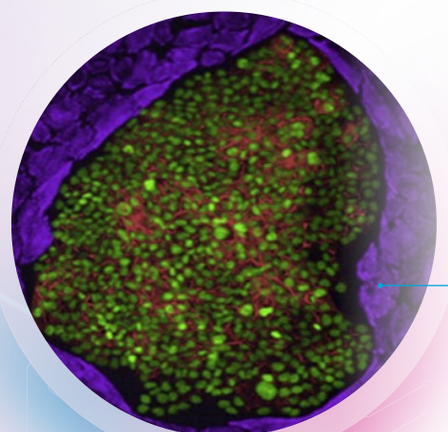


RPTECs | RPTECs + HUVECs | RPTECs + RMVECs

Co-culture with organ-specific vasculature (HRMECs) improves Na/Pi cotransporter expression in the Proximal Tubule Kidney-Chip.

From early screening to clinical translation

Organ-Chips are accelerating safer, more effective therapies across a multitude of application areas.



Cancer

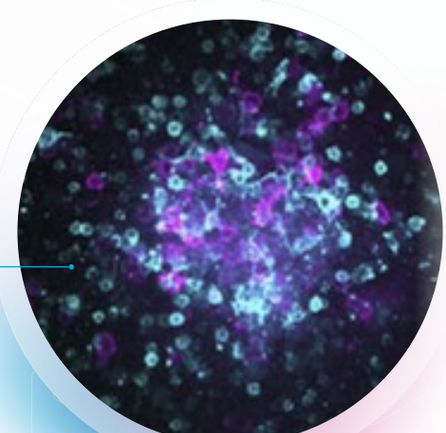
Create complex models of epithelia, stroma and vasculature to interrogate mechanisms of metastasis and better understand cancer progression.

Colorectal Cancer-on-a-Chip

Ellison Institute, *iScience (2021)*

Vaccine Evaluation

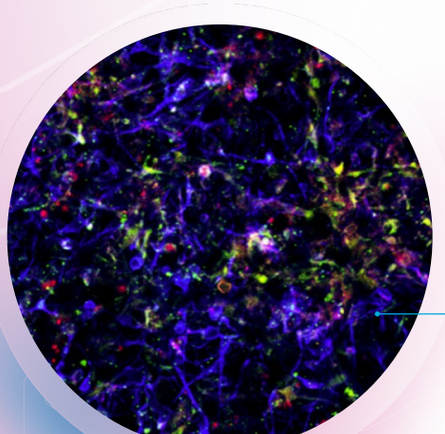
Recapitulate human vaccine and adjuvant responses in lymphoid tissues to support vaccine boosting strategies



Lymphoid Follicle-Chip

Institut Pasteur, *J Exp Med (2024)*

Wyss Institute, *Advanced Science (2022)*



Blood–Brain Barrier Screening

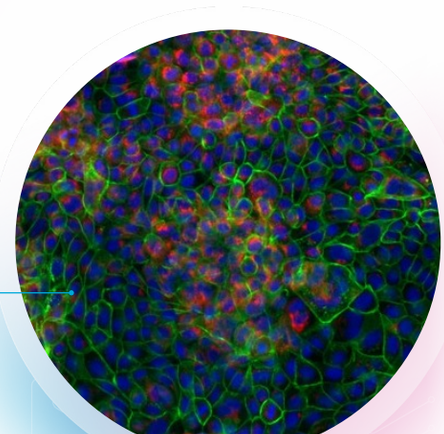
Screen for therapeutics that can cross the blood-brain barrier *in vivo* and capture cell-specific contributions in human disease-associated pathology

BBB-Chip

Regeneron, *Pharmaceutics (2024)*

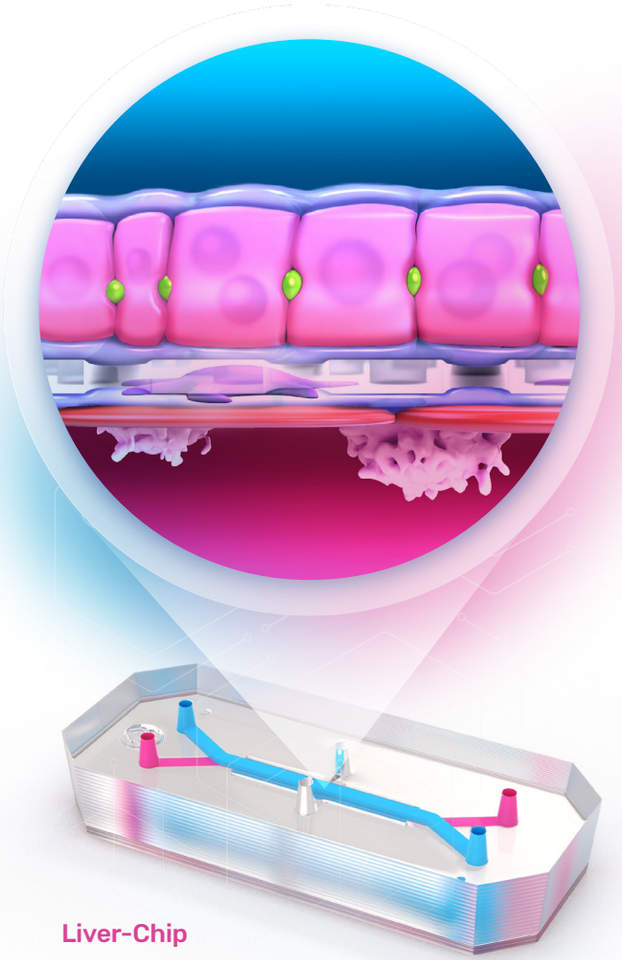
Immunotherapy Safety Testing

Predict on-target, off-tumor toxicities of immuno-therapeutics such as monoclonal antibodies and T-cell bispecific antibodies



Lung-Chip, Duodenum & Colon Intestine-Chips

Roche & Emulate, *eLife (2021)*



Liver-Chip
Emulate, *Communications Medicine (2022)*

Predictive Toxicology

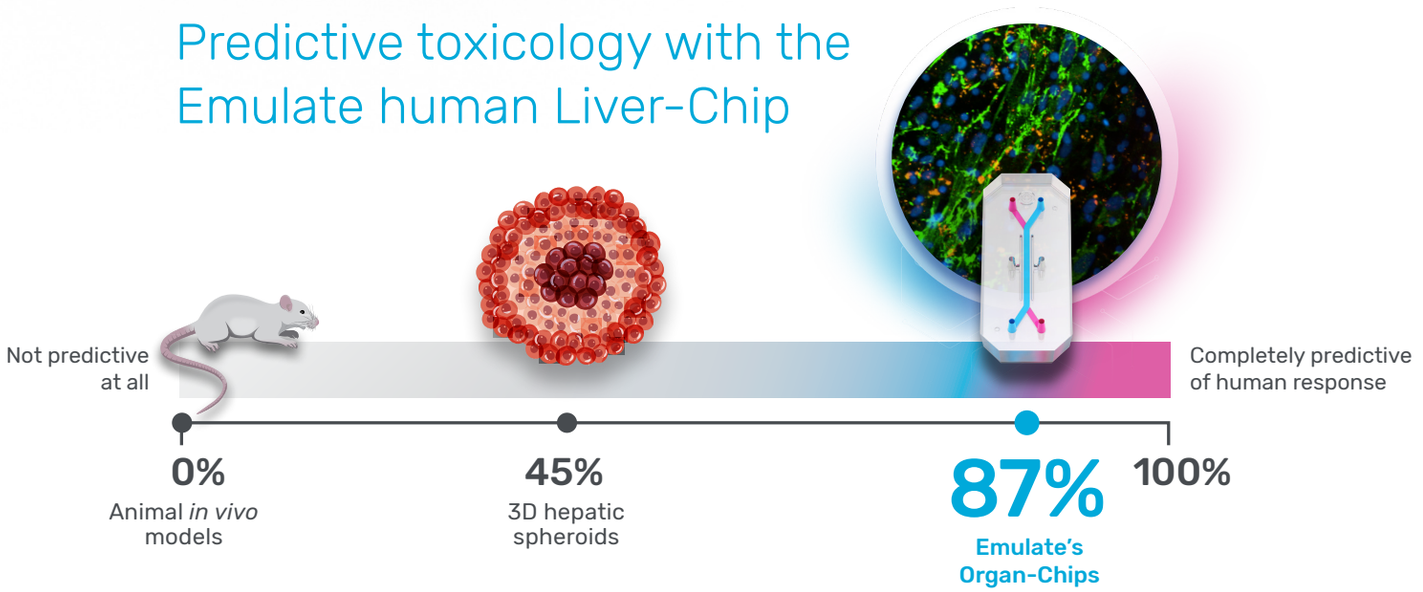
Drug-induced liver injury (DILI) remains a leading reason for clinical trial failures and withdrawal from the market. But it doesn't have to be.

In the largest study of its kind, the Emulate human Liver-Chip S1 was able to correctly identify 87% of the tested drugs that caused drug-induced liver injury in patients—despite passing animal testing evaluations[1].

More importantly, if the Liver-Chip had been used to screen these drugs, *242 lives could have been saved*.

Today, the Liver-Chip S1 is on track for FDA approval in the ISTAND program. Upon completion of the program, the Liver-Chip S1 will be approved for assessing the risk of DILI in a drug's investigational new drug (IND) submission.

Predictive toxicology with the Emulate human Liver-Chip



The Emulate human Liver-Chip was able to correctly identify 87% of the tested drugs that caused drug-induced liver injury in patients despite passing animal testing evaluations.

1. Ewart et al. (2022). *Communications Medicine*. 2 (154).

30+ published organ models across the scientific community

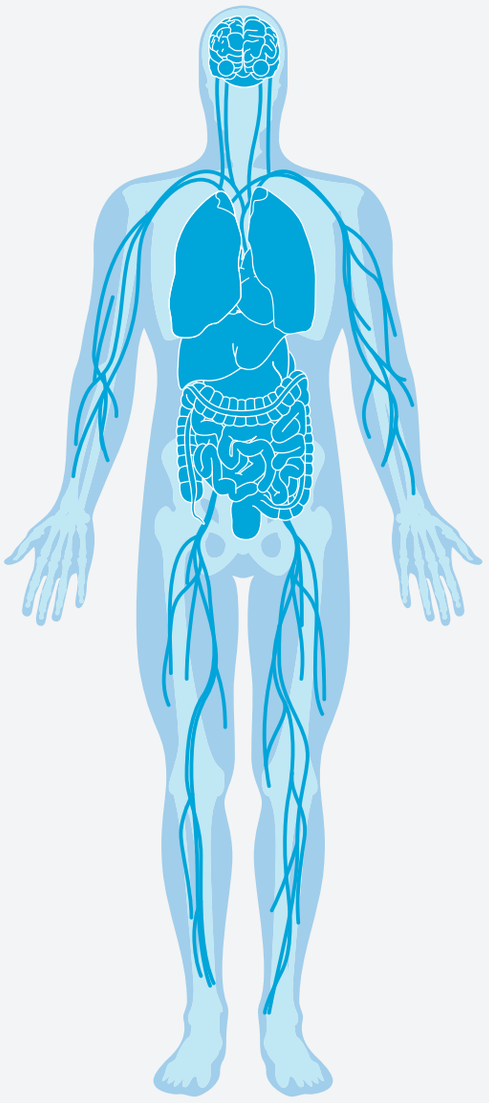
Respiratory System
Alveolus
Airway

Central Nervous System
Brain
Blood-Brain Barrier

Musculoskeletal System
Bone
Synovium
Cartilage

Cardiovascular System
Heart
Vasculature

Cancer
Breast
Colorectal
Prostate
Barrett's Esophagus



Urinary System
Glomerulus
Kidney
Bladder

Reproductive System
Vagina
Cervix

Digestive System
Esophagus
Duodenum
Jejunum
Ileum
Colon

Lymphatic System
Bone Marrow
Lymph Node

Skin

Two ways to create models:

Create your own models with Basic Research Kits (BRKs)

BRKs contain blank Organ-Chip consumables for users to create custom Organ-Chip models with their own cell sources. BRKs are available for all Emulate Organ-Chip consumables, including Chip-Array, Chip-S1, Chip-R1, and Chip-A1.

Use Ready-to-Assay models with Emulate BioKits

Emulate BioKits provide the components needed to create fully functional Organ-Chip models, including pre-qualified cells, Organ-Chip consumables, and validated protocols, with guarantees on characterization and functionality.

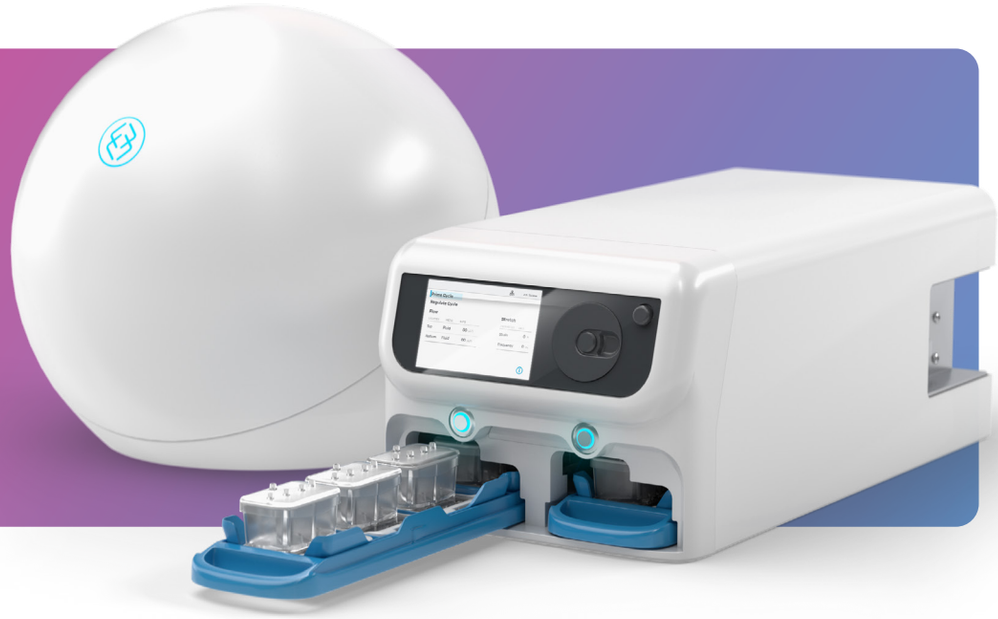
Please refer to the Emulate website for full product details.

Organ-Chip systems to power drug discovery

Sophisticated and user-friendly platforms that make it easy to incorporate Organ-on-a-Chip technology across the drug discovery & development pipeline.

Zoë-CM2®
Culture Module

With its versatile modeling capabilities and 12-Chip capacity, Zoë is ideally suited for developing functional models of human biology and disease to identify and validate drug targets.



AVA™
Emulation System

Capable of 96 Organ-Chip samples per run, AVA unleashes unprecedented experimental power to rank order lead candidates and optimize the preclinical safety and efficacy of your drug candidates.

Zoë-CM2®
Culture Module

A versatile system for model development & target validation

The Zoë-CM2 Culture Module provides a seamless interface for culturing up to 12 Organ-Chips at a time. As an open platform with multiple Organ-Chip consumable designs, Zoë enables researchers to build a wide variety of organ models for myriad applications—from disease modeling, to target validation, to drug candidate safety and efficacy evaluation.

Key features

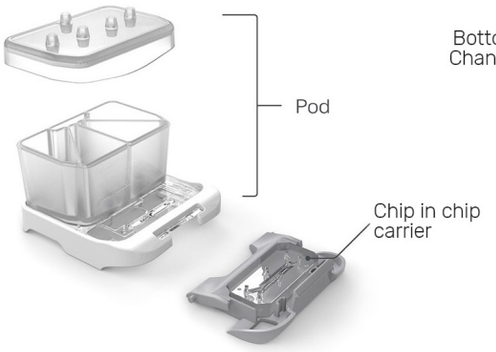
- Media Flow
- Cyclic Stretch
- Bubble Reduction
- Versatile Biological Modeling

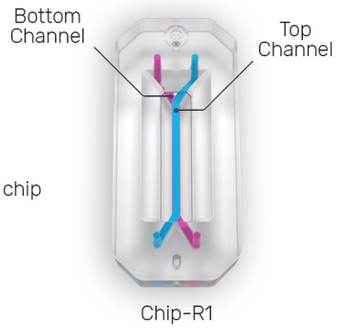
Zoë at a glance

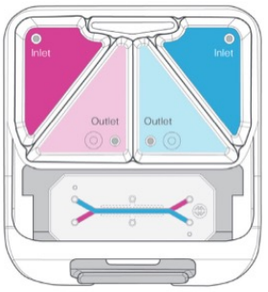
Organ-Chip capacity	12
Independent flow in both channels	Yes
Stretch	Yes (Chip-S1 and Chip-A1)
Tissue-vascular interface	Yes
Air-liquid interface	Yes
Compound dosing options	Vascular dosing via Pod Epithelial dosing via Pod Direct topical treatment (Chip-A1 only) Direct aerosolized treatment (Chip-A1 only)
Maximum flow rate	1,000 µl/hr (Chip-S1 and Chip-A1) 2,000 µl/hr (Chip-R1)

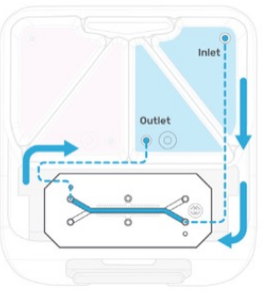
Chips & Pods

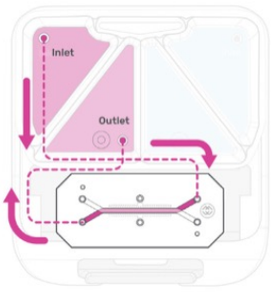
Each Chip connects to a Pod which, through Zoë, enables automated control of media flow and dosing while maintaining ease of portability for routine microscopy observation. The Pod stores 4 mL of media for each microfluidic channel, enabling automated media flow for up to 5 days. Media effluent can be easily collected from the outlet reservoirs for downstream analysis.







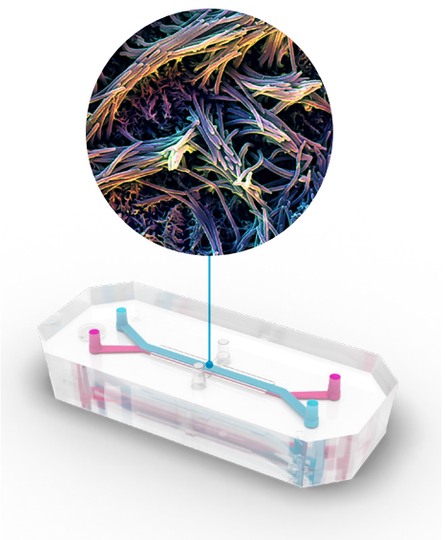




Zoë Organ-Chip consumables

Chip-S1® Stretchable Chip

The pioneering Organ-Chip design that started a revolution in human-relevant *in vitro* modeling

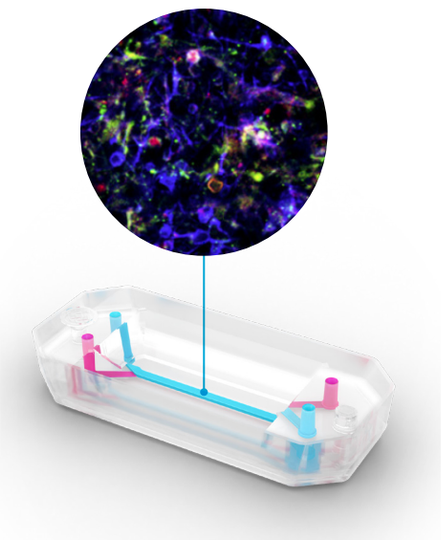


Recommended biological models:

- Epithelial-endothelial models that require stretch

Chip-R1™ Rigid Chip

Improve precision in ADME and toxicology applications with a low-drug-absorption profile

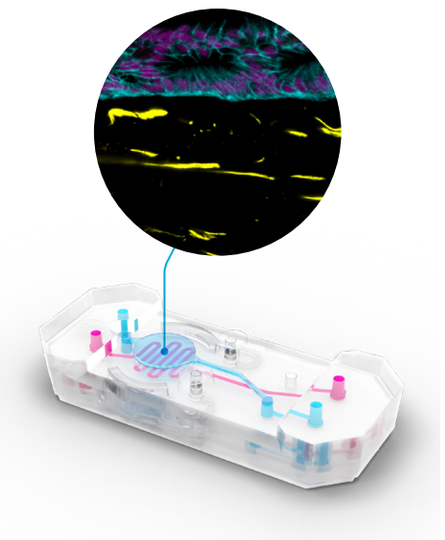


Recommended biological models:

- Epithelial-endothelial models that do not require stretch
- Models that will be treated with lipophilic small molecules

Chip-A1™ Accessible Chip

Model complex 3D tissues with the ability to directly apply topical or aerosolized drugs



Recommended biological models:

- ECM gel-based models
- Stratified or 3D models that require direct epithelial access for compound/drug exposure

AVA™ Emulation System

A high-throughput Organ-Chip platform that generates human-relevant data at scale

The AVA Emulation System is our groundbreaking "Ad Vivo Architect," bridging the translation gap by merging the throughput of *in vitro* studies with the fidelity of *in vivo* models to create more human-relevant biology at scale.

By supporting up to 96 individual Organ-Chip samples ("Emulations") per experiment, AVA delivers high-powered insights that enable faster, more confident decision-making in drug development.

A 3-in-1 Organ-Chip System

High-Throughput Organ-Chip Culture Module

AVA supports up to 96 independent Organ-Chip Emulations per run, for maximum insights with minimum hands-on time

Self-Contained Incubator

AVA is a free-standing benchtop unit that minimizes your lab's footprint while maximizing data output—all while seamlessly controlling temperature, humidity, and CO_2

Automated Microscope

Capable of phase contrast and 3-channel fluorescence imaging, AVA's fit-for-purpose microscope automatically acquires images of each Emulation under flow throughout the course of the experiment to capture tissue morphology and biomarker expression levels over time

Key Benefits

High throughput

Run up to 96 independent samples in a single experiment

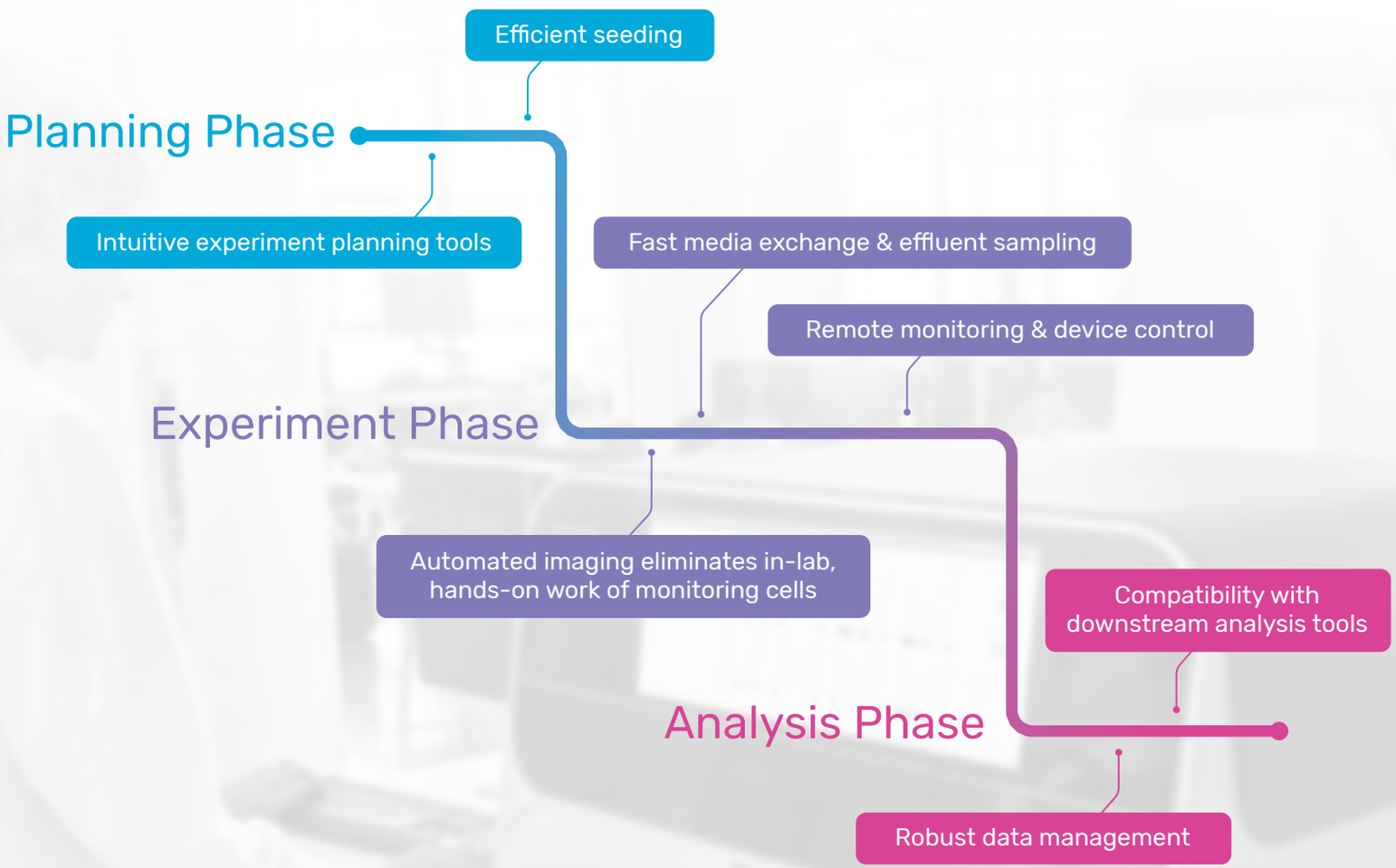
Low operating costs

4X reduction in cost of consumables & 50% reduction in cells & media per Emulation*

Save time and labor

60% reduction in hands-on, in-lab time*

Workflow improvements at every stage



*Compared to equivalent experiments on Zoë

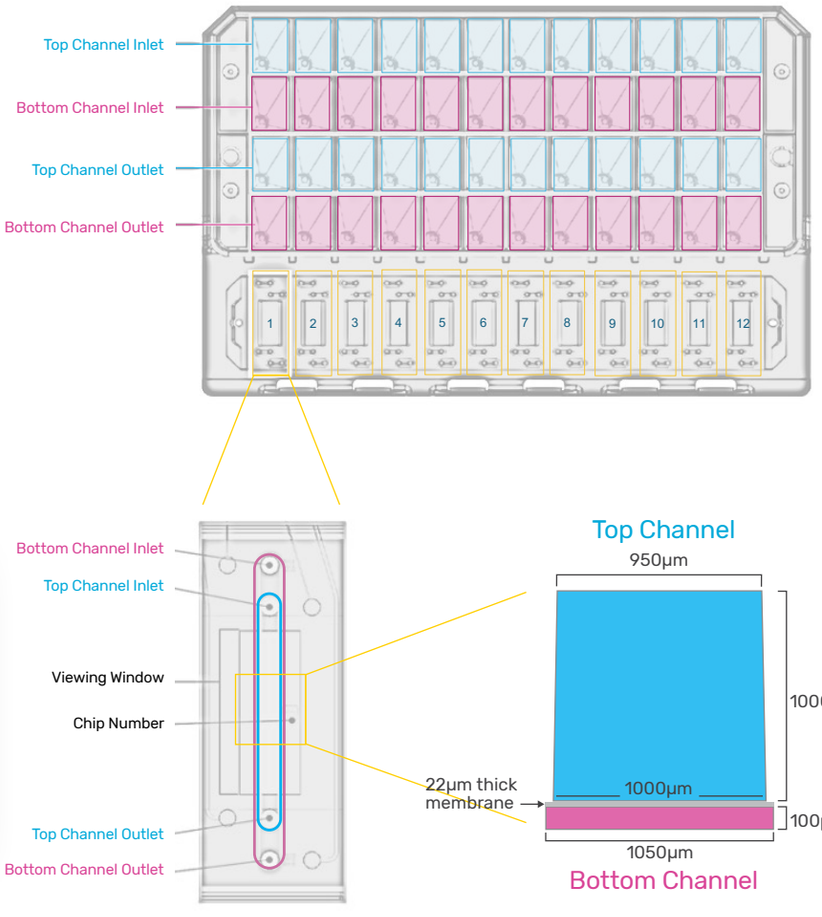
AVA Organ-Chip Consumable

Chip-Array™

A revolutionary Organ-Chip empowering high-throughput studies

- 12 Organ-Chip Emulations per Chip-Array
- Low-drug-absorbing
- Multichannel pipette compatible
- SBS plate footprint

Chip-Array brings the proven low-drug-absorbing architecture of the Chip-R1™ Rigid Chip into a 12-Chip parallel format, letting you run more conditions in every experiment—without compromising data quality. Housed in an SBS-compatible plate footprint and engineered for seamless integration with automated liquid handlers, robotic arms, and multichannel pipettes, Chip-Array accelerates throughput while maintaining the physiological fidelity that defines Organ-on-a-Chip technology.



What is an "Emulation"?

An Emulation is an independent Organ-Chip sample within a Chip-Array. Each Chip-Array supports up to 12 Emulations.

See page 19 for full specifications.

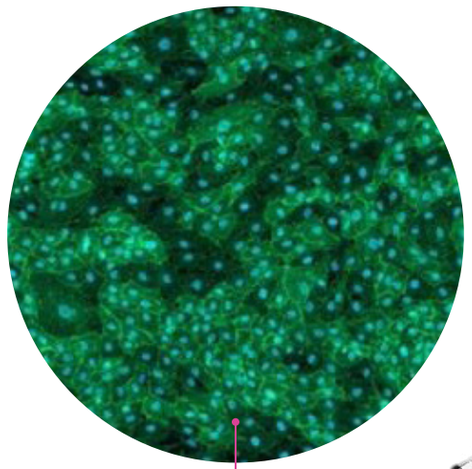
Engineered for streamlined workflows & automation

Scale up throughput while saving time. AVA was designed with automation-friendly features so that you can spend less time at the bench and more time progressing science.

Automated imaging

AVA's software lets you fully customize your automated imaging routines. The intelligent auto-focus feature ensures that you capture the most important images throughout your experiment.

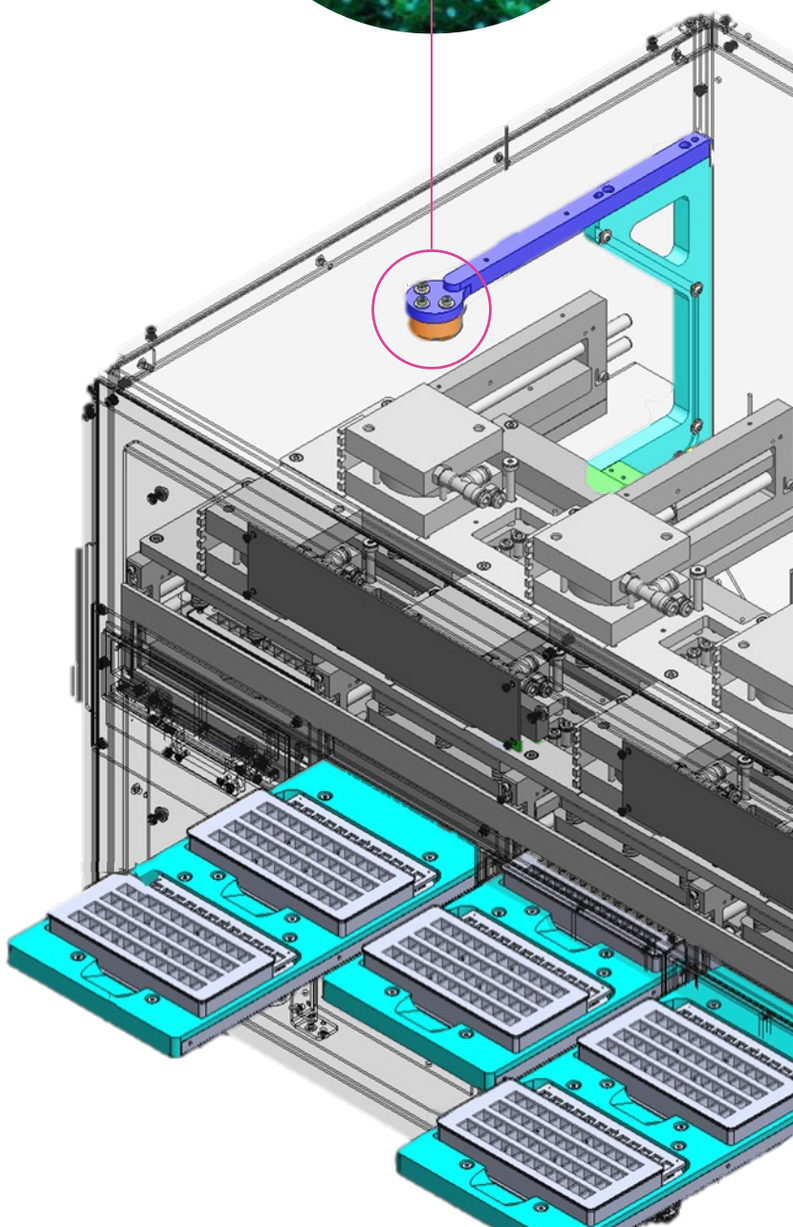
Using the live imaging feature, you can quickly view any emulation in real-time, providing immediate insight into the state of your study.



Remote monitoring & data management

Access your experiment data from anywhere.

When configured with network access, you can remotely view & engage with your AVA using a third-party application like Microsoft Remote Desktop™, as well as store data in your preferred shared directory to ensure data is secure and accessible.



Standard well plate footprint with multichannel pipette compatibility

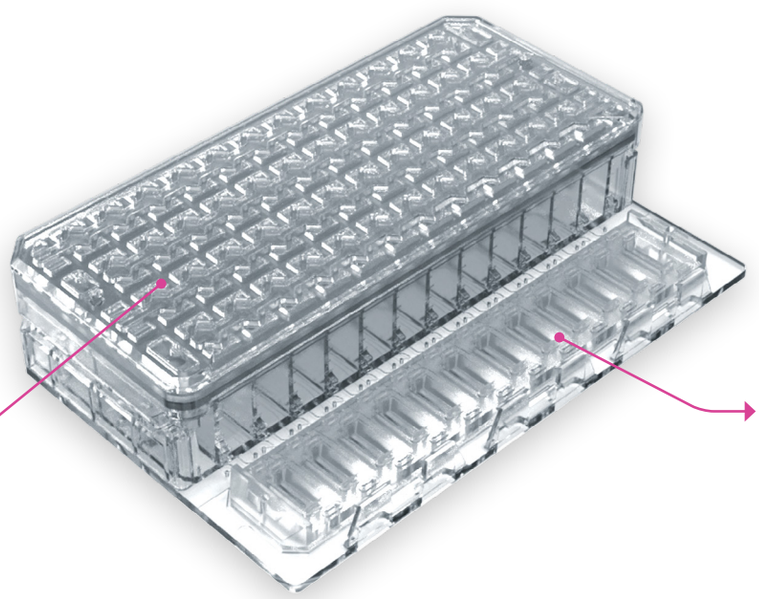
Make short work of seeding, media exchange, and effluent sampling.

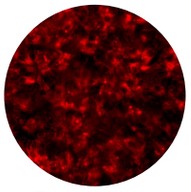
Chip-Array features the same footprint as a 96-well plate, making it compatible with lab automation equipment such as multichannel pipettes, robotic arms, and liquid handlers.

AVA enables multi-modal data generation to support AI training – from thousands to millions of data points

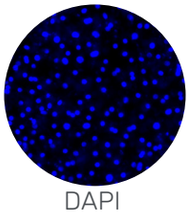
Experimentation phase on instrument

Daily sampling & imaging can yield **30,000+** data points per experiment

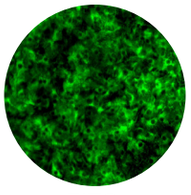




Texas Red



DAPI

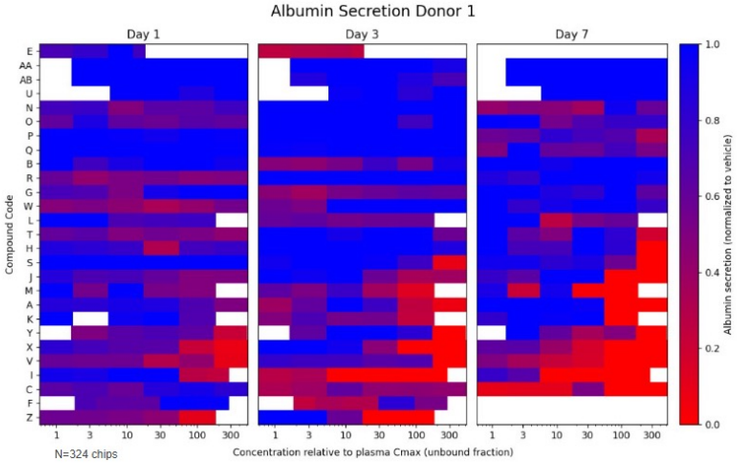


FITC

Phase contrast

Effluent-based assays

~1300 data points per day



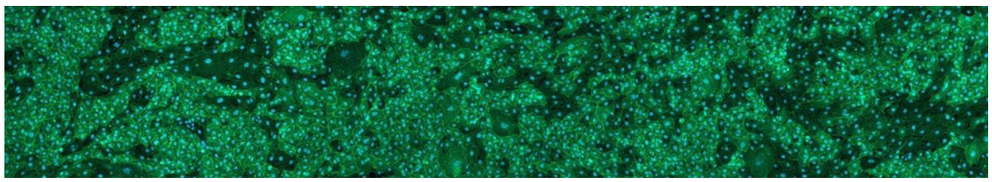
Automated Microscopy: Phase contrast & fluorescence

~3000 images per day

Endpoint assays & analysis

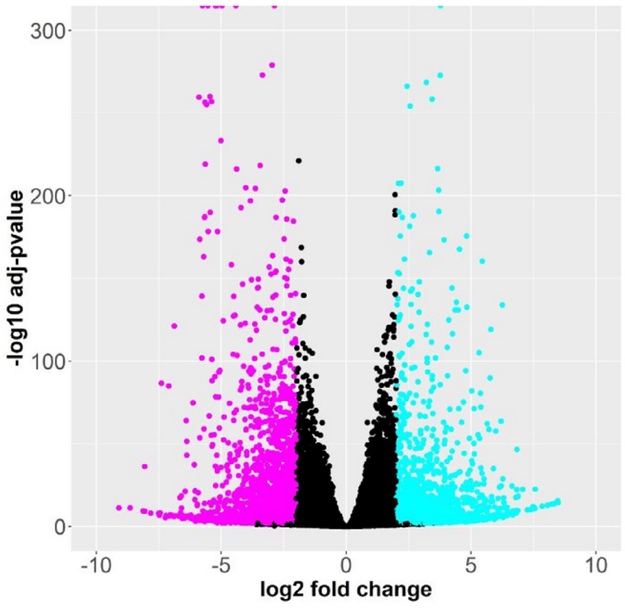
8 Post-takedown assays can generate millions of data points

On-Chip **Quantitative Fluorescence Microscopy**



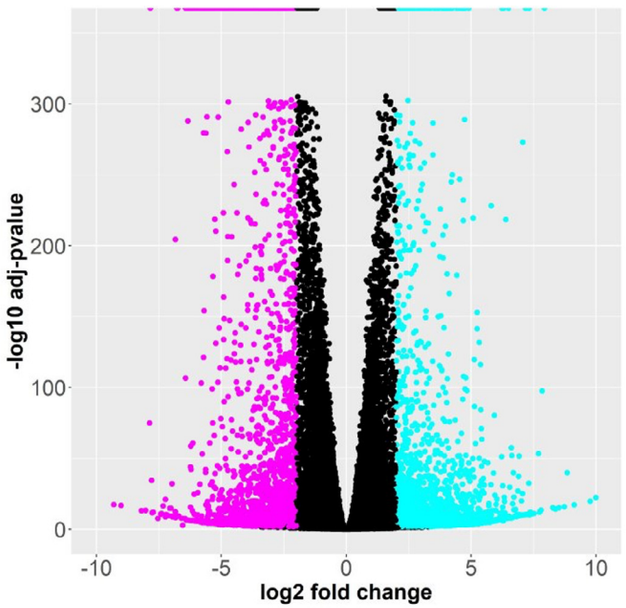
Off-Chip **Transcriptomics**
Proteomics
Metabolomics

Day 3, Compound J



Day 3	# DE genes	# up-regulated	# down-regulated
Cpd J v Vehicle	3625	1665	1960

Day 5, Compound J



Day 5	# DE genes	# up-regulated	# down-regulated
Cpd J v Vehicle	4214	2122	2102

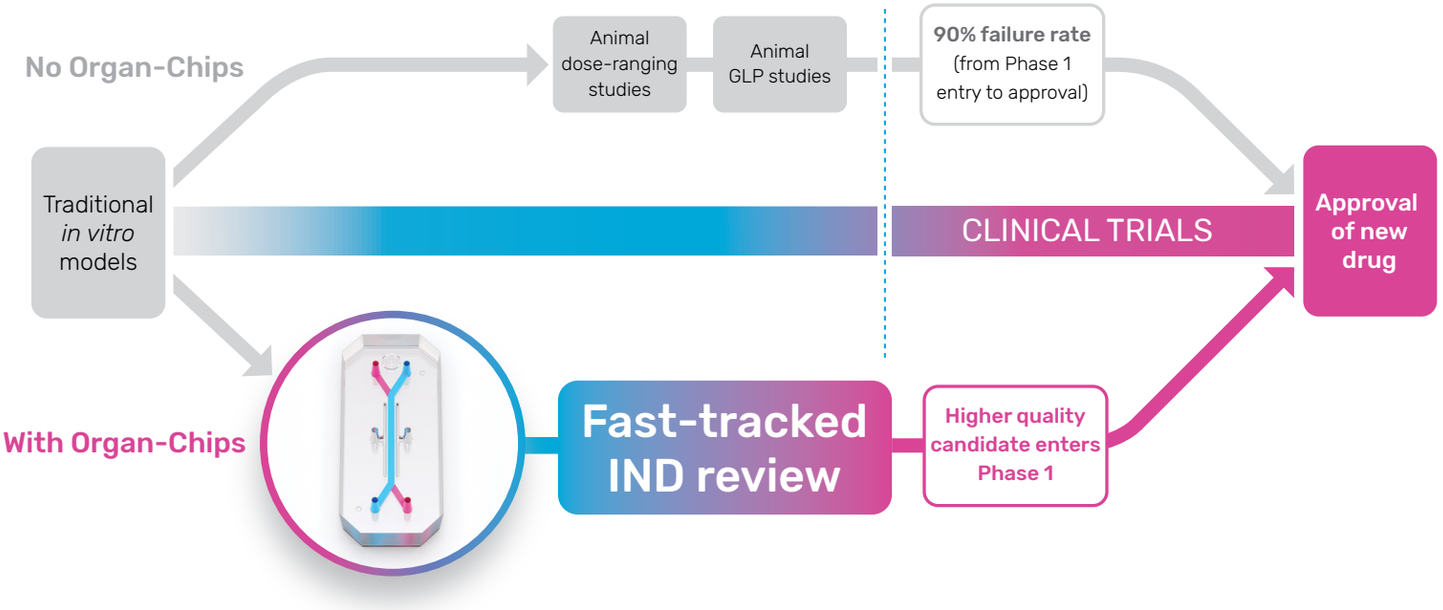
Now is the time to adopt Organ-on-a-Chip Technology

The future of preclinical safety is clear: **by 2030, the FDA expects animal studies to be the *exception* rather than the norm** for pre-clinical safety/toxicity testing[1].

Organ-Chips are the human-relevant alternative the agency is actively encouraging today. Adopting Emulate's validated Organ-on-a-Chip technology doesn't just keep you ahead of this mandate; it can **fast-track your IND review**[1].

Backed by a uniquely close collaboration with the FDA—including the first and only Organ-Chip accepted into the ISTAND program for DILI evaluation[2]—Emulate is the partner positioned to help you meet tomorrow's regulatory standards, accelerate development timelines, and bring safer therapies to patients faster.

Learn more about the rapidly evolving regulatory landscape through our website.



1. https://www.fda.gov/media/186092/download
2. As of June 2025: https://www.fda.gov/drugs/drug-safety-and-availability/fdas-istand-pilot-program-accepts-submission-first-organ-chip-technology-designed-predict-human-drug

Platform Specifications

		AVA	Zoë
Culture	Flow range	0 µL/h, or 10-2,000 µL/h ± 10%*	0 µL/h, or 10-1,000 µL/h ± 10%*
	Stretch range	N/A	0–12%
	Stretch frequency	N/A	0.0–0.40 Hz
	Temperature	37°C	(Requires separate incubator)
	Humidity	80-95%	(Requires separate incubator)
	CO_2	5%	(Requires separate incubator)
		*Flow tolerances may vary.	*Flow tolerances may vary.
Microscope	Objective	10X air	N/A
	Digital zoom	200%	N/A
	Light source	LED	N/A
	Camera	CMOS sensor, 8.3 MP resolution	N/A
	Imaging modalities	Phase contrast, 3-channel fluorescence	N/A
	Filters	• Blue (e.g., DAPI): Excitation 370-410 nm; Emission 429-462 nm • Green (e.g., FITC): Excitation 473-491 nm; Emission 502-561 nm • Red (e.g., Texas Red): Excitation 580-598 nm; Emission 612-680 nm	N/A
	Image format	TIFF	N/A
General	Overall size	762 x 445 x 559 mm (30 x 17.5 x 22”)	178 x 218 x 429 mm (7.0 x 8.6 x 16.9”)
	Weight	63.5 kg (140 lbs)	10.9 kg (24 lbs)
Operating requirements	Instrument rating	24 VDC	24 VDC
	Gas input composition	100% CO_2	100% CO_2
Recommended computer specifications	Internal storage	10 TB	N/A
	RAM	16 GB	N/A
	Operating System	Windows 10 or 11 (64-bit)	N/A

Consumable Specifications

	AVA Emulation System	Zoë Culture Module		
	Chip-Array	**Chip-S1**	**Chip-R1**	**Chip-A1**
Bottom channel height	100 µm	200 µm	100 µm	200 µm
Top channel height	1,000 µm	1,000 µm	1,000 µm	3,700 µm
Maximum bottom channel shear	2.3 dyn/cm^2	0.3 dyn/cm^2	2.3 dyn/cm^2	0.75 dyn/cm^2
Maximum flow rate	2,000 µL/h	1,000 µL/h	2,000 µL/h	1,000 µL/h
Membrane pore size	3 µm	7 µm	3 µm	7 µm
Membrane thickness	22 µm	50 µm	22 µm	50 µm
Imaging distance from bottom of chip to top of membrane	172 µm	850 µm	172 µm	900 µm
Co-culture surface area	12.8 mm^2	17.1 mm^2	16.6 mm^2	15.2 mm^2
Chip material	Low drug-absorbing rigid plastic with a polycarbonate tissue culture membrane	PDMS	Low drug-absorbing rigid plastic with a polycarbonate tissue culture membrane	PDMS
Emulations per chip	12	1	1	1
Media reservoir volume	1.3 mL	4.2 mL	4.2 mL	4.2 mL
Independent flow in both channels	Yes	Yes	Yes	Yes
Stretch	No	Yes	No	Yes
Direct access to top channel	No	No	No	Yes
Air-liquid interface	Yes	Yes	Yes	Yes
Tissue-vascular interface	Yes	Yes	Yes	Yes

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