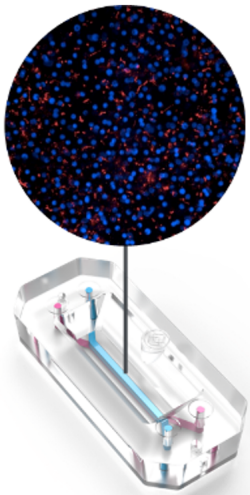
Liver-Chip R1 BioKit

A human-relevant liver model with minimal drug absorption



Overview

The Liver-Chip R1 combines up to four human cell types in the dynamic microenvironment of the Chip-R1™ Rigid Chip. Chip-R1 features a rigid plastic design that minimizes small-molecule drug absorption while retaining the stacked, two-channel architecture of Chip-S1® Stretchable Chip. The Liver-Chip R1 is well suited for the human-relevant assessment of drug toxicology, efficacy, and ADME profiles, even for compounds with PDMS absorption liability.

Model Configuration

The Liver-Chip R1 is available in co-culture or quad-culture configurations:

- **Co-Culture:** Primary human hepatocytes and liver sinusoidal endothelial cells (LSECs)
- **Quad-Culture:** Primary human hepatocytes, LSECs, stellate cells, and Kupffer cells

Both configurations support complex cell-cell interactions, which are essential for modeling hepatic physiology and drug response. Unlike static hepatocyte sandwich monocultures, albumin secretion is comparable to *in vivo* ranges and sustained over time, indicating enhanced functionality.

1. Epithelial Channel
2. Extracellular Matrix
3. Hepatocytes
4. Porous Membrane
5. Stellate Cells
6. Kupffer Cells
7. Liver Sinusoidal Endothelial Cells
8. Endothelial Channel

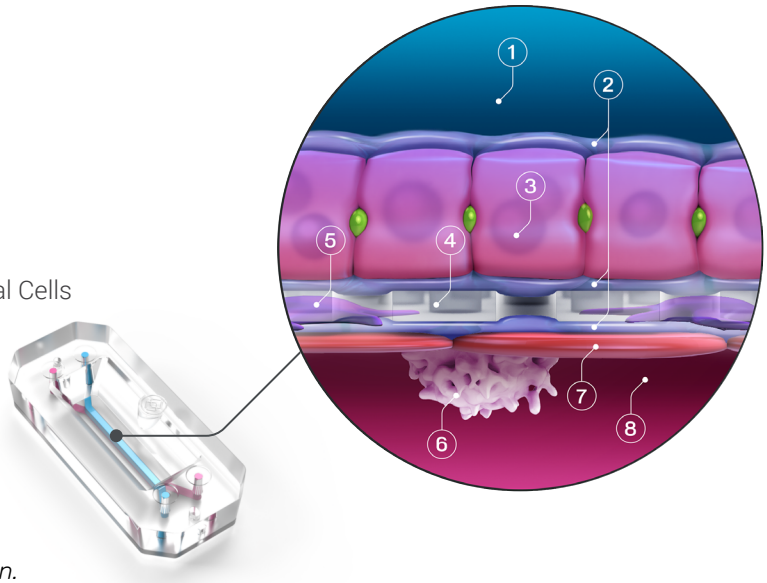


Figure 1: *Liver-Chip R1 Cross Section.*

Model Characterization

The Liver-Chip R1 replicates the 3D multicellular architecture and shear stress needed to accurately model the human liver. The Liver-Chip R1 displays morphological and functional characteristics of mature hepatic tissue for up to 12 days in culture, with an experimental window of up to seven days for drug exposure and assessment of cellular response.

- **Human-based model:** Avoids translational issues caused by species differences.
- **Multicellular complexity:** Incorporates four hepatic cell types to capture complex cell-cell interactions.
- **Hepatic functionality:** Displays robust albumin production and liver metabolism (see **Figure 2**).

Learn more in the Liver-Chip R1 Application Note.

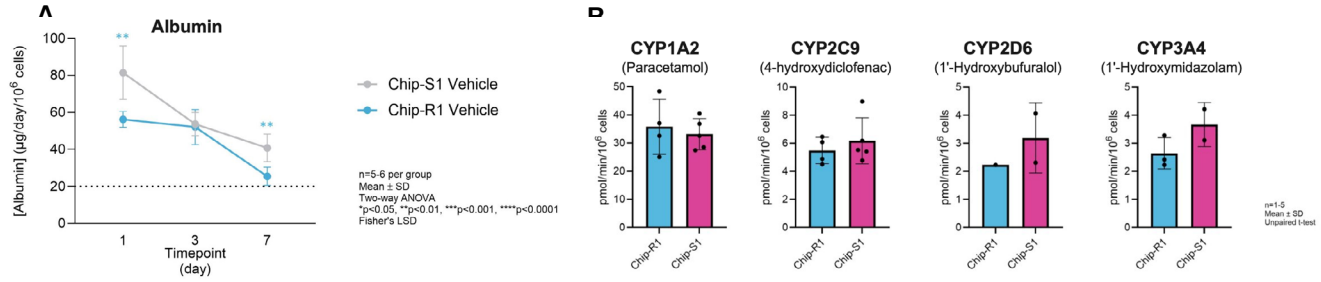


Figure 2: *Figure 2: Liver model characterization. A) Albumin secretion on days 1, 3, and 7 post-vehicle administration, measured by ELISA. Dotted line represents healthy albumin acceptance criteria of 20 µg/day/million cells. B) CYP cocktail metabolite formation, assessed 1 hour post-dosing at 150 µL/h and measured via LCMS. n=4 chips/group for Chip-R1, n=5 chips/group for Chip-S1. Metabolite formation rate could not be determined for all replicates due to some effluent concentrations being below the lower limit of quantification of the assay.*

SUPPORTED APPLICATION

Toxicology

In a toxicology equivalency study between the Liver-Chip R1 and Liver-Chip S1, three compounds with varying toxicity and PDMS absorption profiles were evaluated. The Liver-Chip R1 demonstrated greater sensitivity in detecting the hepatotoxicity of nefazodone, a highly hepatotoxic compound with high PDMS absorption. This was evident through observable cell death, reduced albumin secretion (see **Figure 3A**), and increased ALT release (see **Figure 3B**).

The Liver-Chip R1 also matched the sensitivity of the Liver-Chip S1 in differentiating between more and less hepatotoxic compounds when treated with the analogs trovafloxacin and levofloxacin, respectively.

Learn more in the Liver-Chip R1 Application Note.

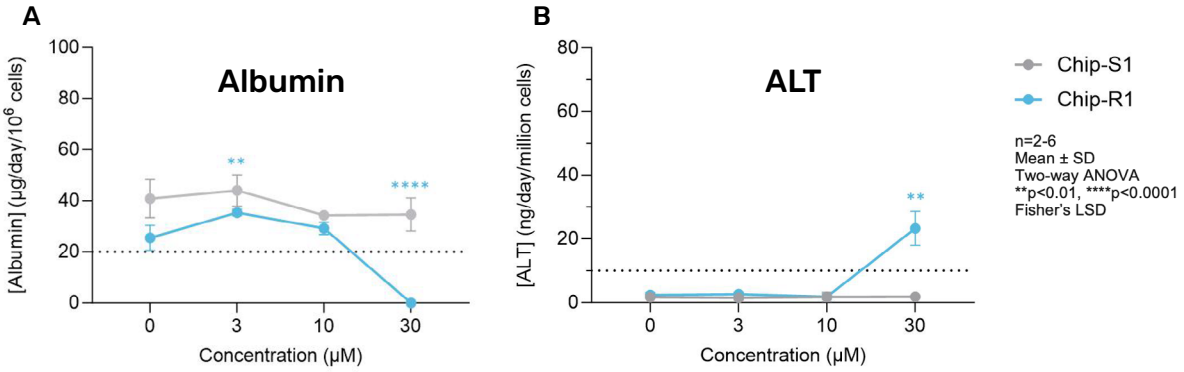


Figure 3: Nefazodone toxicity assessment. A) *Albumin secretion and* ***B)*** *ALT release on day 7 post-vehicle administration, measured by ELISA. Asterisks represent significance level compared to 0 µM control of respective chip type. ALT levels above 10 ng/day/million cells were considered indicative of liver toxicity.*

Minimal Drug Absorption

The rigid plastic design of the Chip-R1 significantly reduces drug absorption compared to the Chip-S1. In a panel study with eight drugs of varying physicochemical properties, the acellular Chip-R1 demonstrated improved compound recovery for three of the eight drugs, with no significant absorption observed for the remaining five drugs in either chip. This supports the utility of the Chip-R1 for ADME and toxicology applications, including drugs prone to PDMS absorption.

Learn more in the Liver-Chip R1 Application Note.

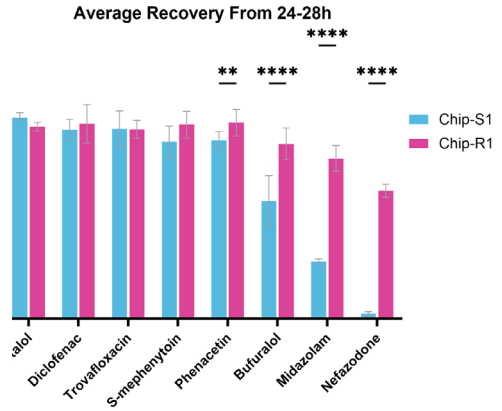
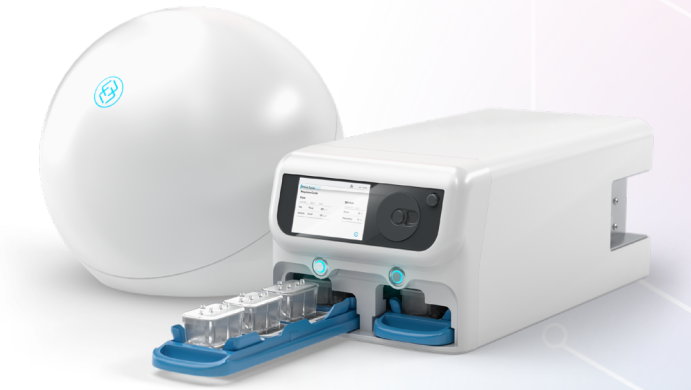


Figure 4: *Average Compound Recovery between 24–28 hours of Flow.*

Compatible with Zoë Culture Module®

The Liver-Chip R1 is designed to be cultured using a Zoë Culture Module, a complete Organ-on-a-Chip platform that provides the dynamic conditions needed to culture up to 12 Organ-Chips per Zoë.



Liver-Chip R1 Specifications:

Specification	Details
Validated application	Toxicology
Storage conditions	• Cells: Store in liquid nitrogen • Other kit components: Ambient temperature (15–25°C)
Shelf life	• Cells: 6 months from date of shipment • Organ-Chip consumables: 1 year from manufacture
Cell types	Available in two configurations, both using primary human cells • Co-Culture: Hepatocytes + LSECs • Quad-Culture: Co-culture + Kupffer cells + stellate cells
Characterization endpoints	Viability: • Morphological assessment • Immunofluorescence staining Functionality: • Albumin production • Metabolic activity

Ordering Information

Each Liver-Chip R1 BioKit includes the essential components needed to create the Liver-Chip R1—including Emulate-qualified cells—and is available in multiple configurations. Each kit contains:

- Chip-R1™ Rigid Chips
- Pod-2™ Portable Modules
- Steriflip® Filter
- Corresponding set of Emulate-qualified primary human cells, shown in the table below

To learn more, visit emulatebio.com/liver-chip

Product Name	Primary Human Cells	Chips per Kit	Catalog Number
Liver-Chip R1 BioKit Co-Culture	Hepatocytes and LSECs	12 24	BIO-LH-C012R1 BIO-LH-C024R1
Liver-Chip R1 BioKit Quad-Culture	Hepatocytes, LSECs, Kupffer cells, and stellate cells	12 24	BIO-LH-QUAD12R1 BIO-LH-QUAD24R1