Alveolix

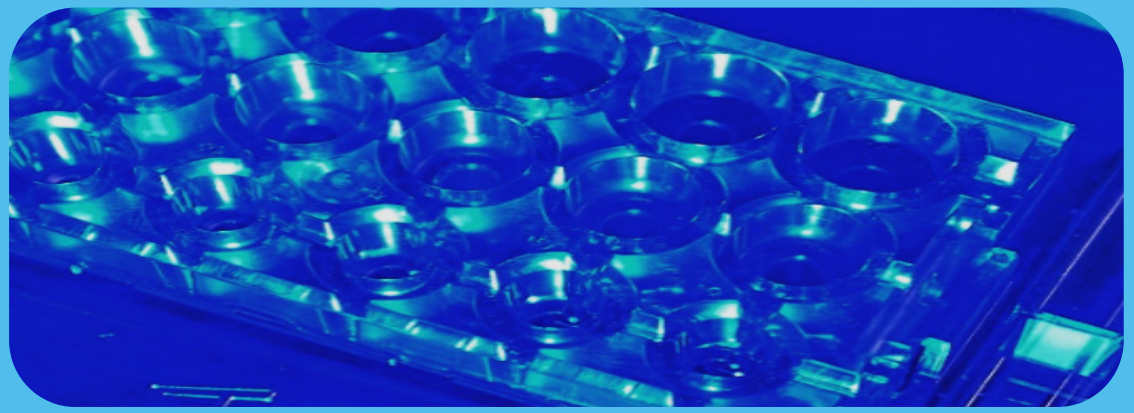
In-vitro models inspired by nature

Dr. Janick Stucki - CTO

A breathing lung-on-chip for inhalation toxicity assessment

Organs-on-Chip

Organs-on-Chip in a nutshell

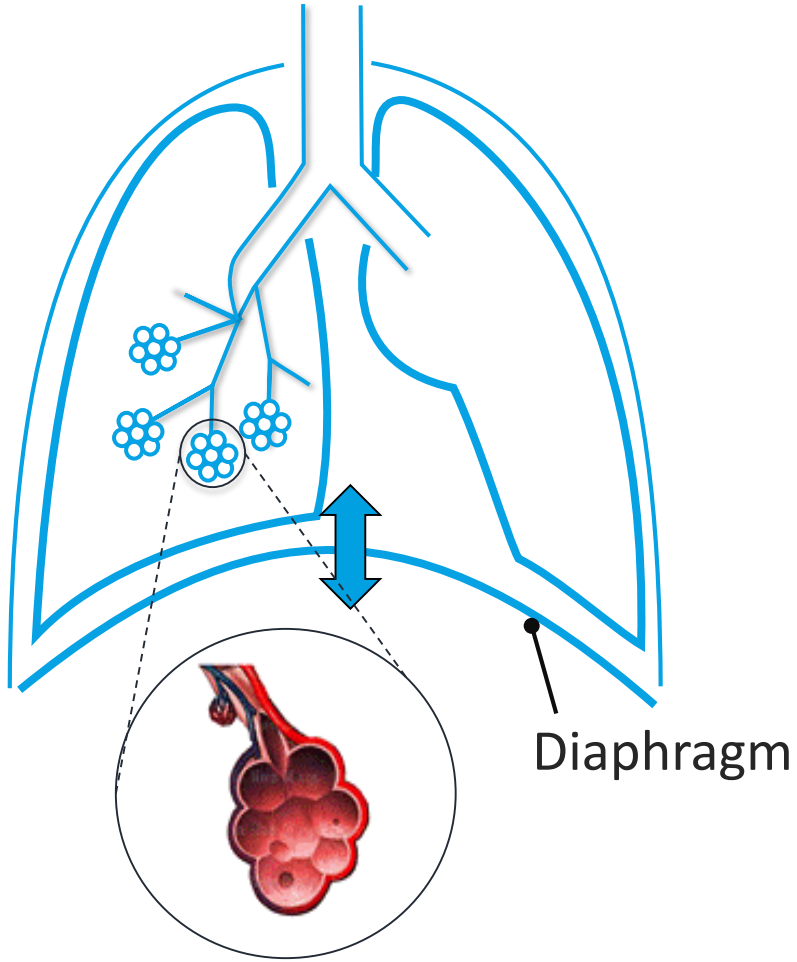


- Mimic the **smallest functional unit** of an organ
- Reproduce **biophysical parameters** of the cellular environment (3D, flow, stiffness,...)
- Keep the cells in the **right shape**
- **Better predict responses** in human

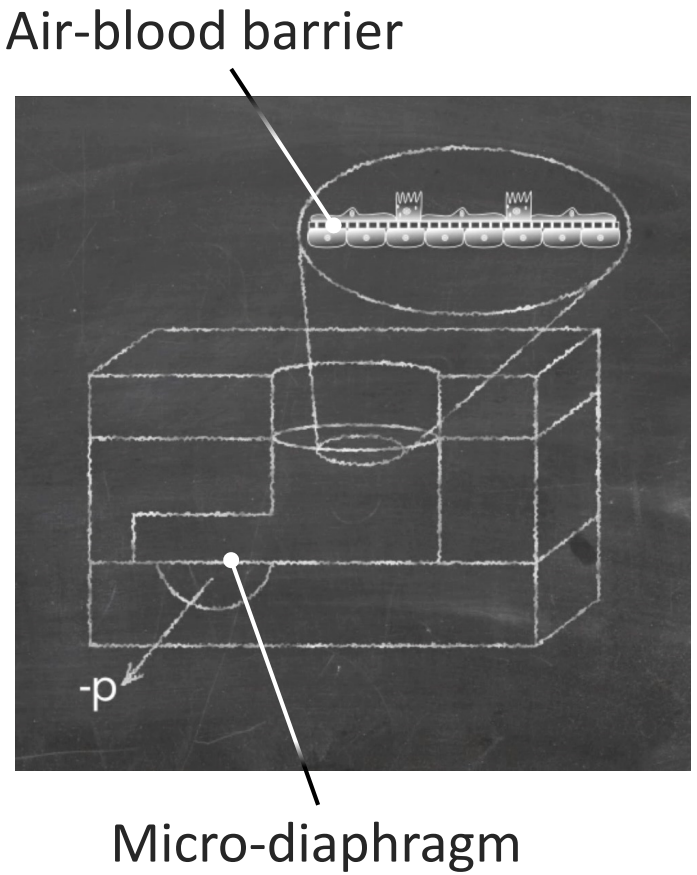
Breathing Lung-on-Chip

Bio-inspired breathing concept

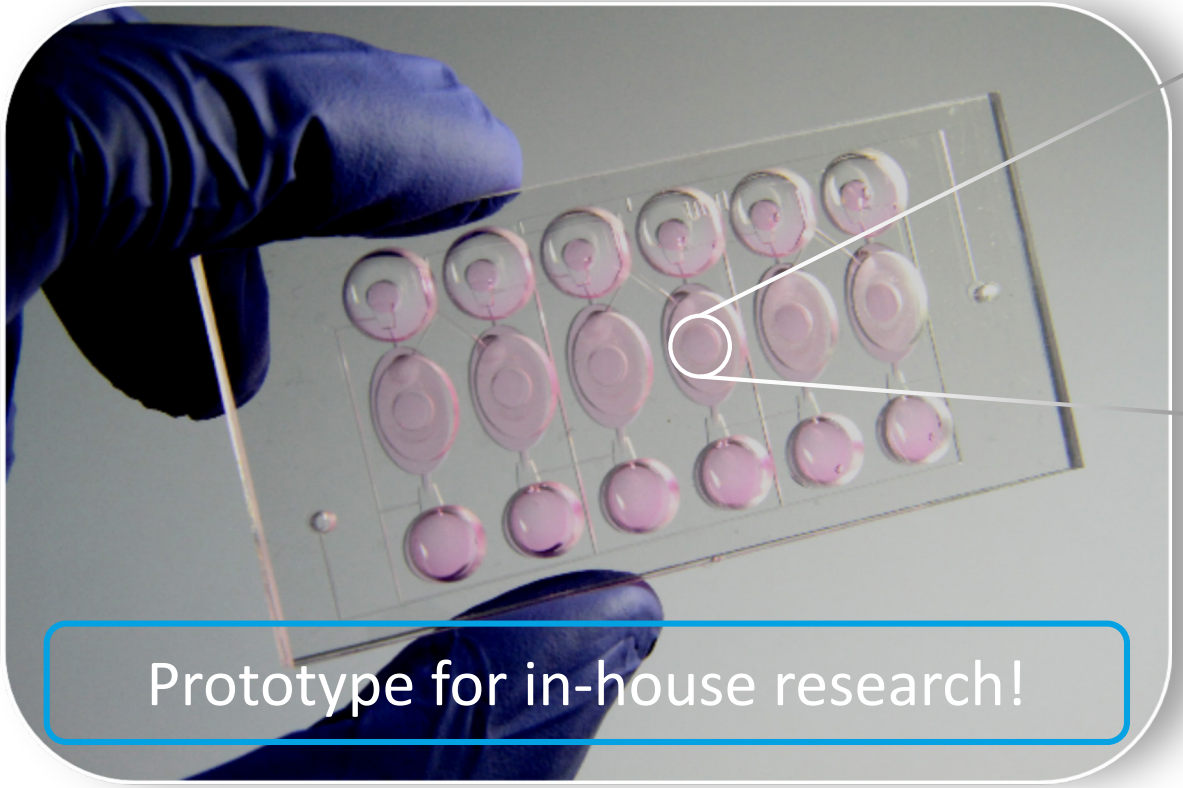
In Vivo

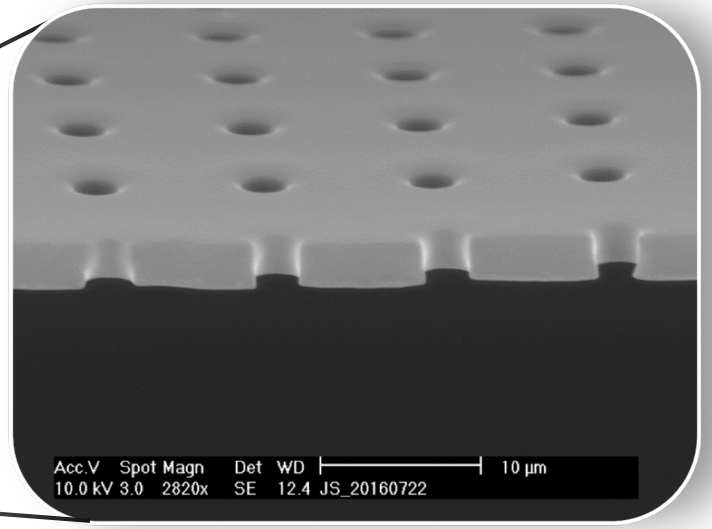


In Vitro Lung-on-Chip



Lung-on-chip

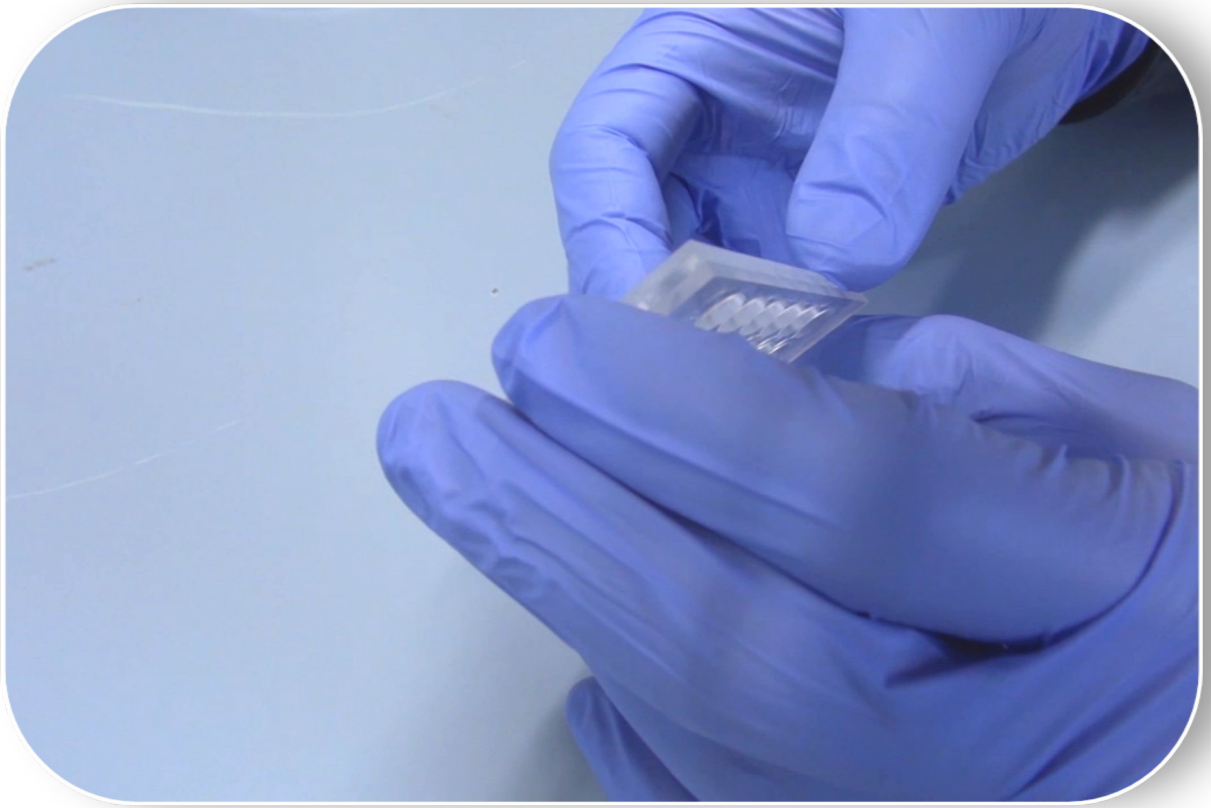




Elastic membrane:

- Thickness: 3.5µm
- Pores: ∅3µm

Two-Part chip design



- Accurate cell seeding on either a side of the membrane
- Multi-pipette and automated pipetting system compatibility

Breathing primary lung cells on chip

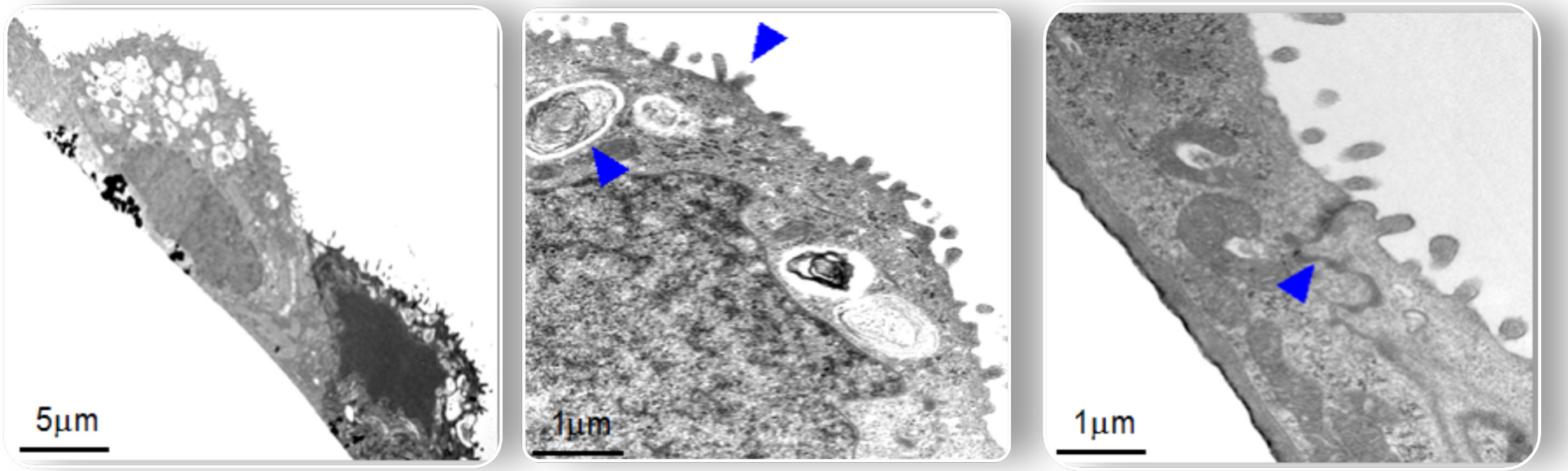
Stucki et al, 2015

Human Primary Cells

Having the right cells on chip

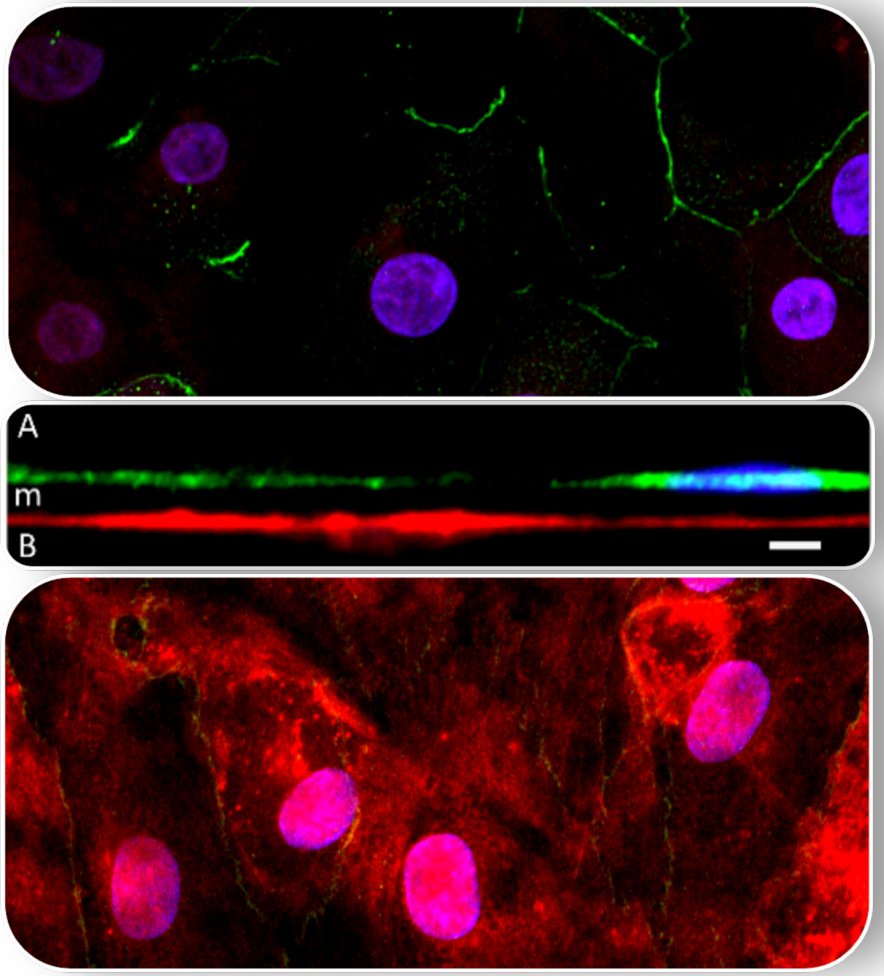
Human primary alveolar epithelial cells

- Intact lamellar bodies
- Microvilli expression
- Tight junction expression
- In-vivo like thin barrier

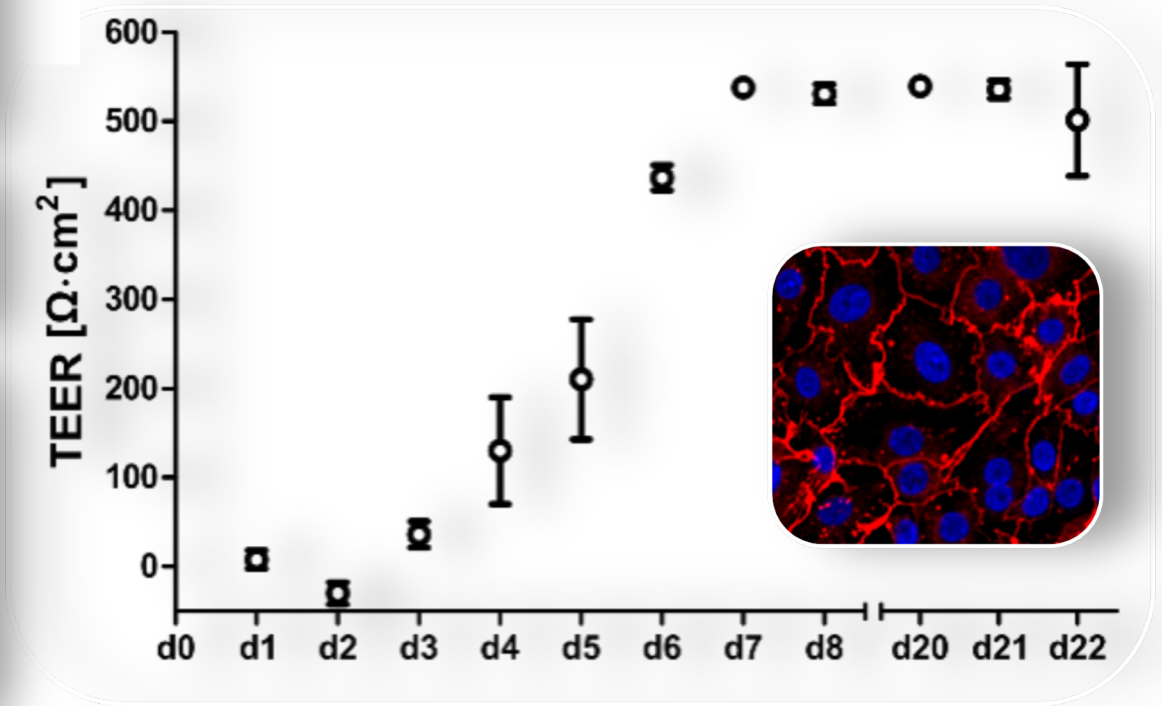


Stucki and Hobi et al., submitted

Long-term co-culture



- Co-culture system
- Long-term culture system
- High barrier functionality

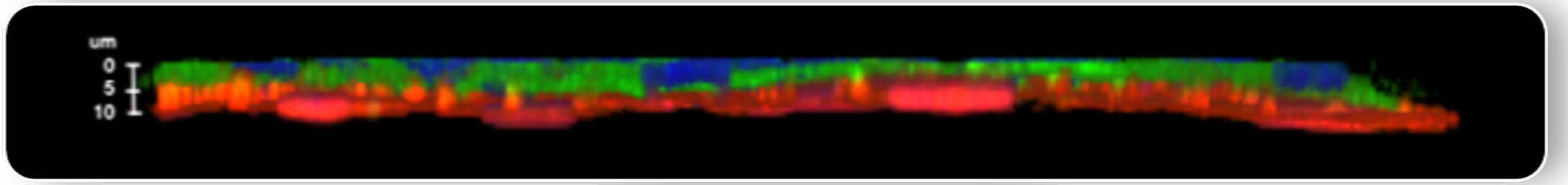


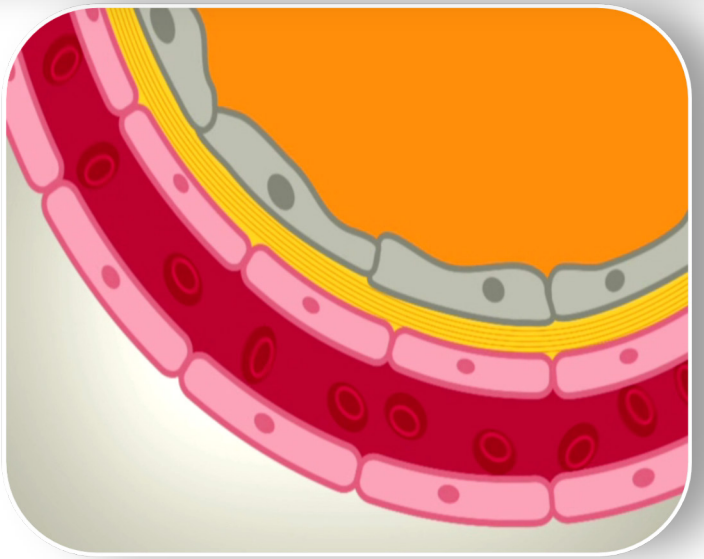
Stucki and Hobi et al, submitted

Inhalation Toxicity

What can be modelled?

Breathing air-blood barrier ⟶ Portal-of-Entry





Which toxicological end-points and read-outs can be performed?

Acute Toxicity

- 48-72h

Subacute & Chronic Toxicity

- 14 or 28 days

Subcronic Toxicity

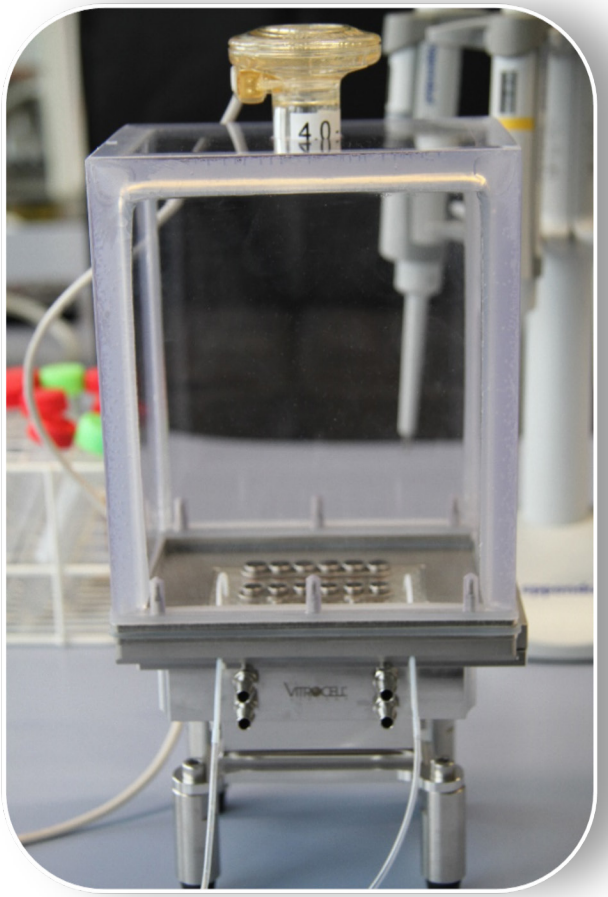
- 90 days

Read-outs

- Live Cell Imaging
- High Resolution Imaging
- Electron Microscopy
- Cytokine/ATP assays
- LDH
- CellTox
- ROS-GloTM
- Permeability assay
- Transepithelial/transendothelial electrical resistance (TEER)
- Capillary westernblot
- Real time PCR
- Etc…

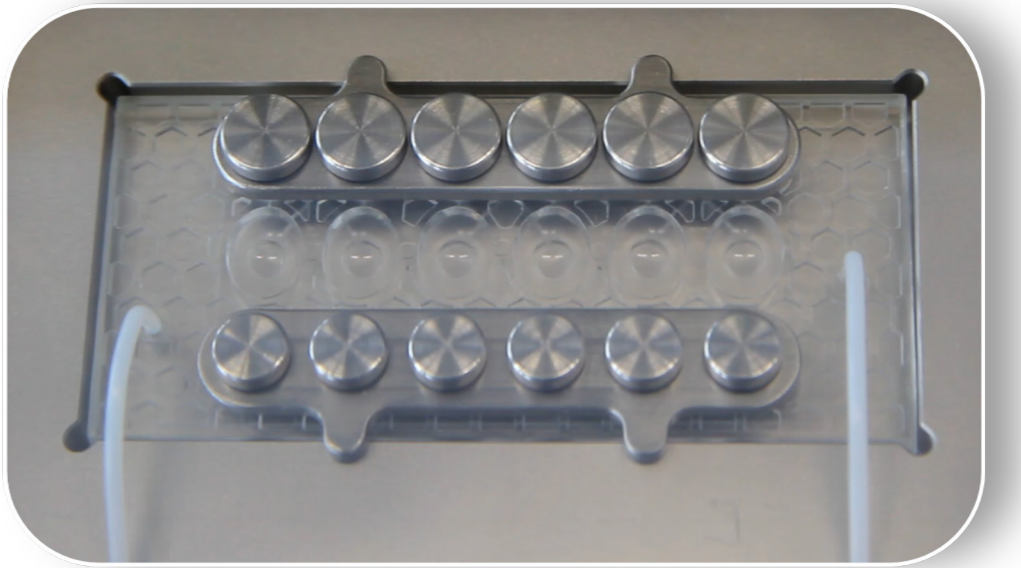
How can inhalation toxicity tests be performed?

VITROCELL® Cloud System



Liquid aerosols

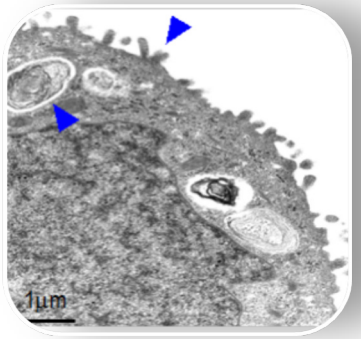
- All substances in saline solution
  - Particles (<10 µm)
  - Nanomaterials
  - Medical compounds
  - …

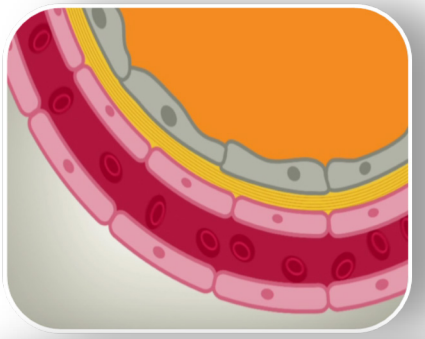


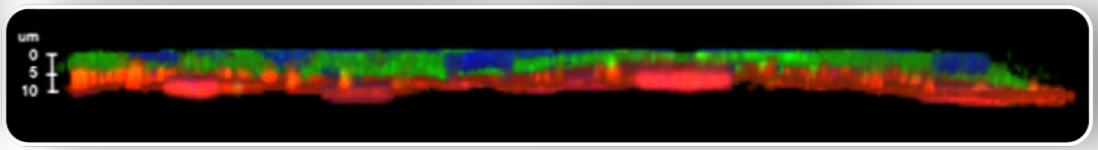
VITROCELL® SYSTEMS

What are the advantages?

- Model the microenvironment
  - Forces due to breathing
  - Air-liquid interface
  - Thickness
- Alveolar model
  - Primary HUMAN cells







- Array of air-blood barriers (n=6/Chip)
- Semi-open design: Simple integration in existing exposure systems (e.g VITROCELL® Cloud System)
- Easy cell seeding procedure
- No peristaltic or syringe pumps for medium exchange

Alveolix

In-vitro models inspired by nature

Dr. Olivier Guenat
Dr. Nina Hobi
Msc. Giulia Raggi
Msc. Andreas Hugi
Msc. Stefan Guggisberg

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Innosuisse – Schweizerische Agentur für Innovationsförderung

VENTURE KICK

be advanced

GEBERT RÜF STIFTUNG

b UNIVERSITÄT BERN

ARTORG CENTER
BIOMEDICAL ENGINEERING RESEARCH

Prof. Dr. Olivier Guenat
Dr. Nuria Roldan
Dr. Andreas Stucki
Dr. Artur Galimov
Msc. Dario Ferrari
Msc. Pauline Zamprogno
Msc. Soheila Zeinali
Bsc. Simon Wüthrich
Msc. Serena Sigrist
Bsc. Simon Schweizer

VITROCELL SYSTEMS

Tobias Krebs

Academic Partners
Pulmonary Medicine Division, Inselspital Bern
Division of General Thoracic Surgery, Inselspital Bern
General Physiology, University Ulm
Helmholtz Zentrum für Infektionsforschung, University Saarland

Links:
http://pubs.rsc.org/en/Content/ArticleLanding/2015/LC/C4LC01252F#!divAbstract

http://www.alveolix.com/technology/

https://www.vitrocell.com/

http://www.artorg.unibe.ch/research/organs_on_chip_technologies/index_eng.html