



Biomimicking Cell Culture Technologies



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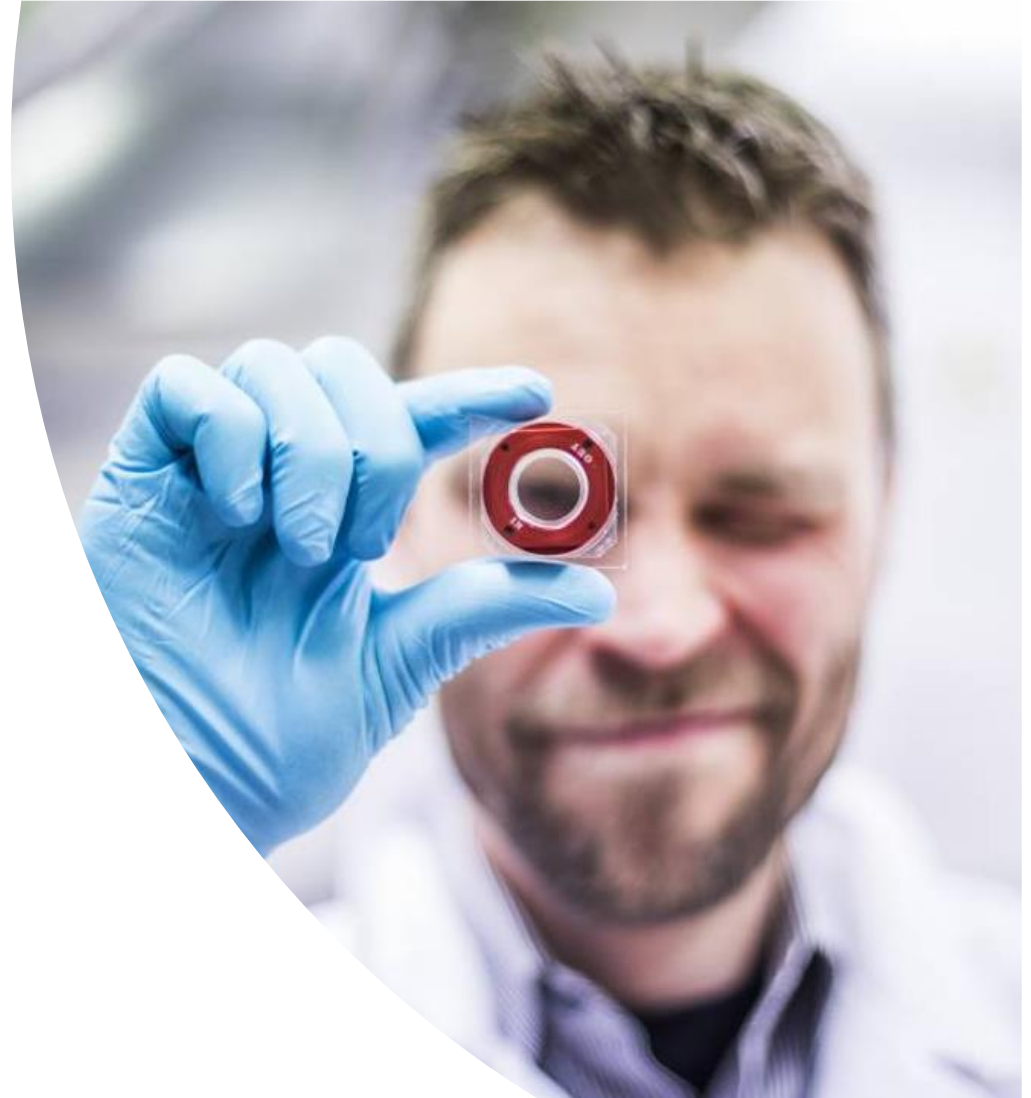
www.biogenium.fi



BioGenium

MICROSYSTEMS

- Established 2018
 - Spin-off from Tampere university (Finland)
- Core knowhow
 - Designing of biological applications
 - Physiological oxygen / hypoxia
 - (Micro)fluidics and (Micro)fabrication
 - Organ-on-a-chip
 - Sensors and actuators
 - Manufacturing
 - Silicone (injection) moulding
 - Hardware and software
 - System thinking



Objective of BioGenium

MICROSYSTEMS

BioGenium develops **innovative**
engineering systems and solutions
for **life science applications**
mimicking human physiology

With cells, tissues, organs or
other biological samples



BioGenium

MICROSYSTEMS

- Own manufacturing and development
 - OxyGenie – portable cell incubator
 - Novel approaches to mimic human physiology
- Engineering design services and contract manufacturing for biological applications
- Distributor of other products in FINLAND
 - Baker Company – e.g. Hypoxia/anoxia workstations
 - Lucid Scientific – Oxygen consumption rate



www.biogenium.fi



www.bakerco.com

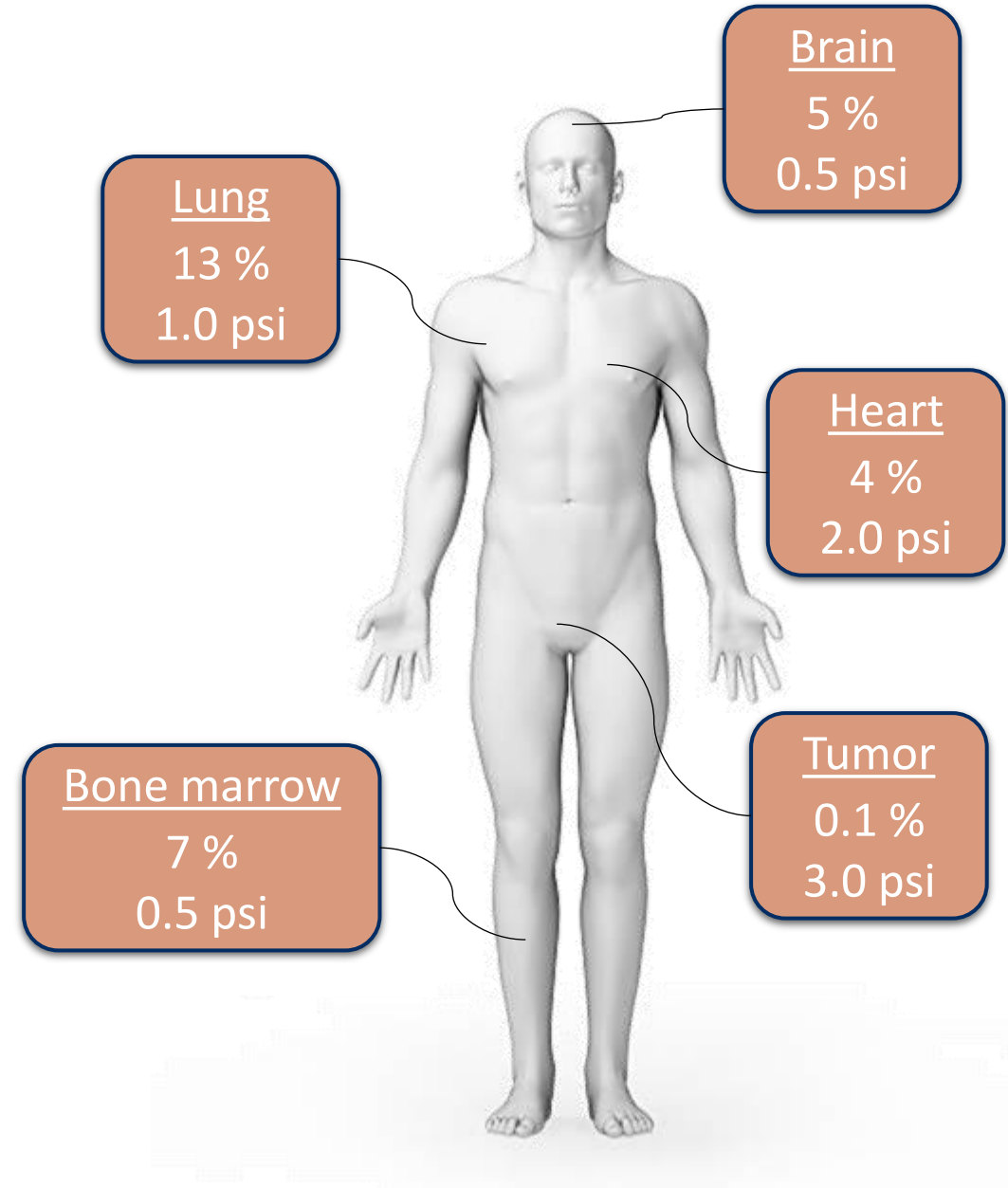


www.lucidsci.com

Core Problem

What does 21% O₂ and
atmospheric pressure
mimic in cell, tissue or organ
experiments

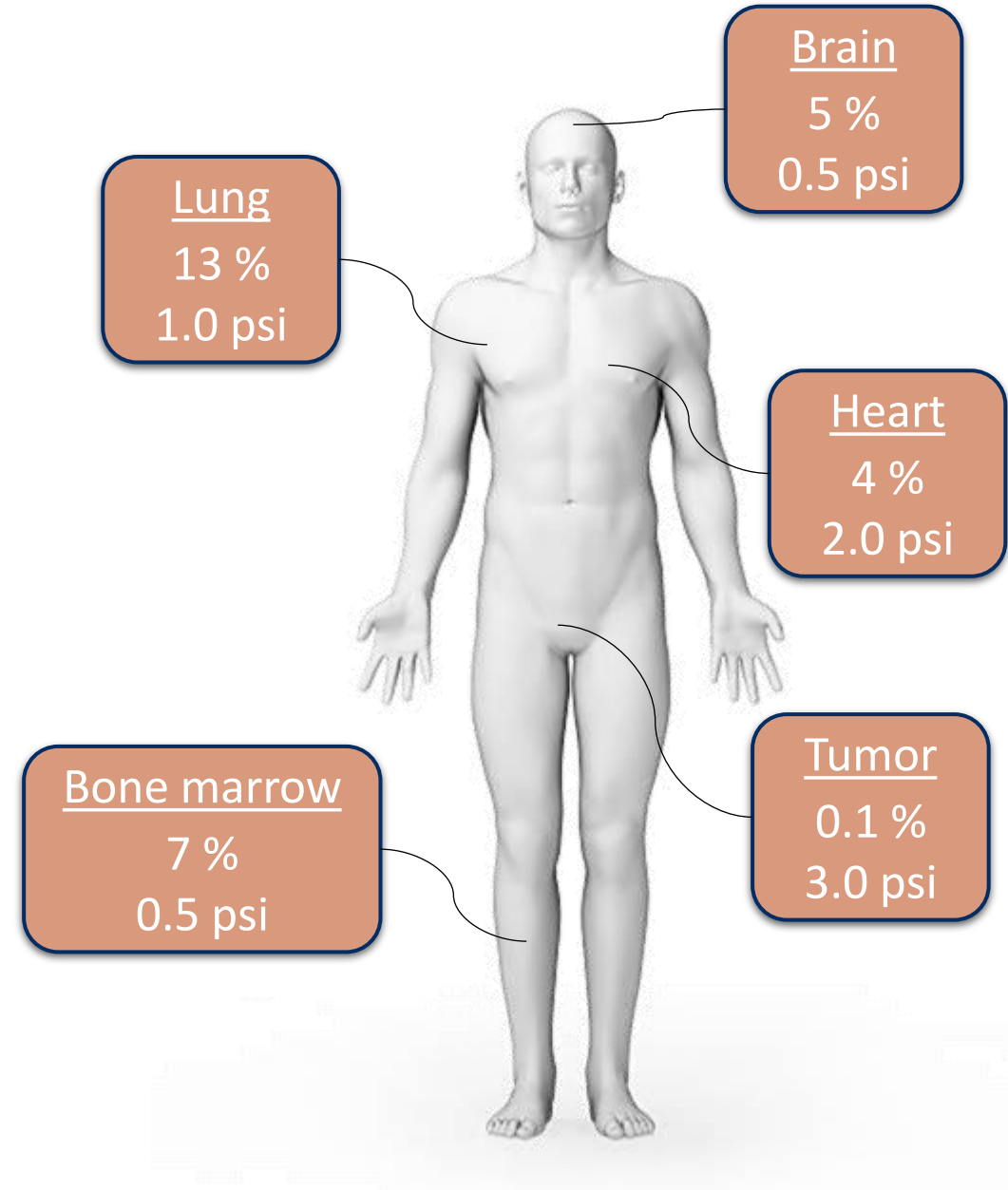
?



Vision of BioGenium

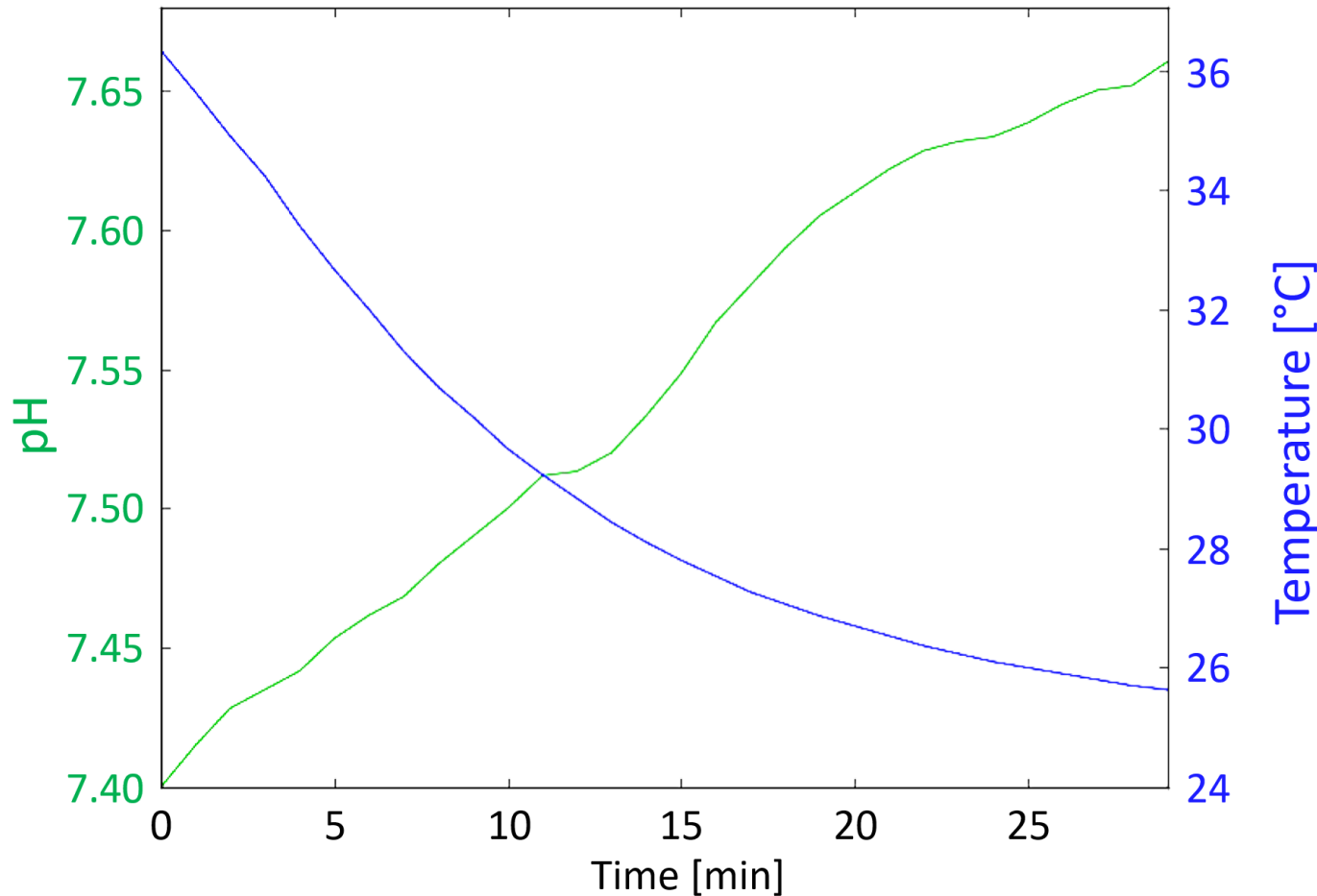
MICROSYSTEMS

Relevant, stable and controlled
culture environment for
advanced biological research
and
drug development



Relevant, stable and controlled culture environment

Example: Oxygen, Temperature and pH variations



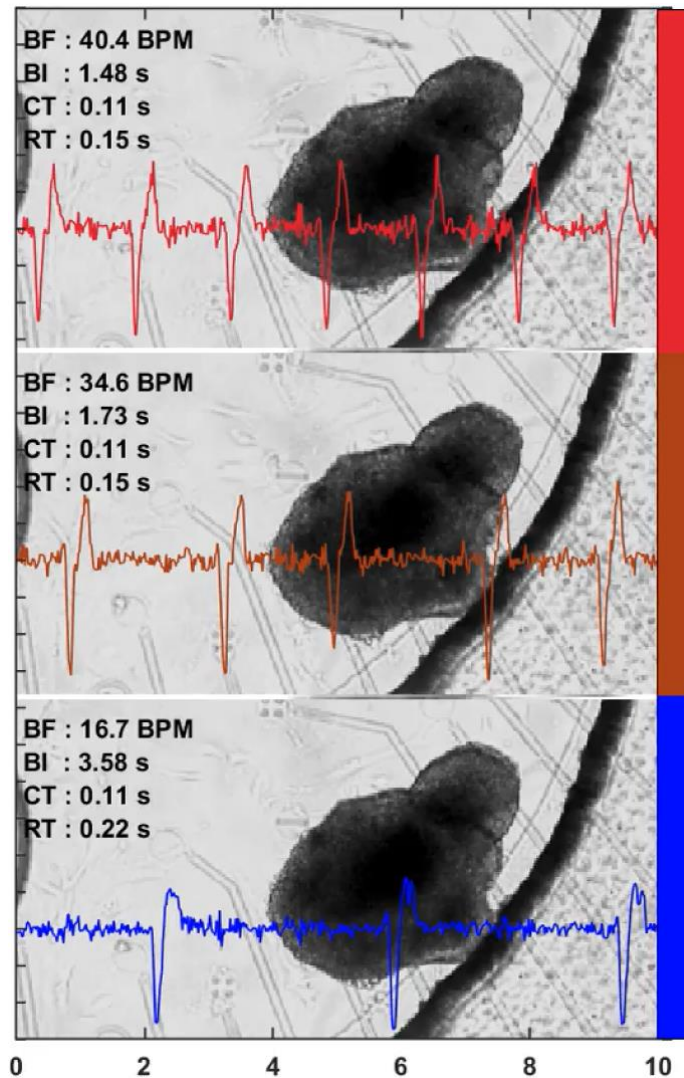
Petri dish taken out from an incubator to a laminar hood

→ Temperature drops rapidly

→ pH increases

Relevant, stable and controlled culture environment

Example: Oxygen, Temperature and pH variations



pO₂ = 10kPa

pO₂ = 4.5kPa

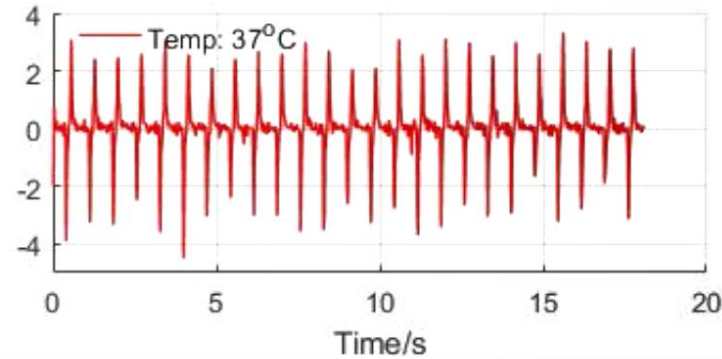
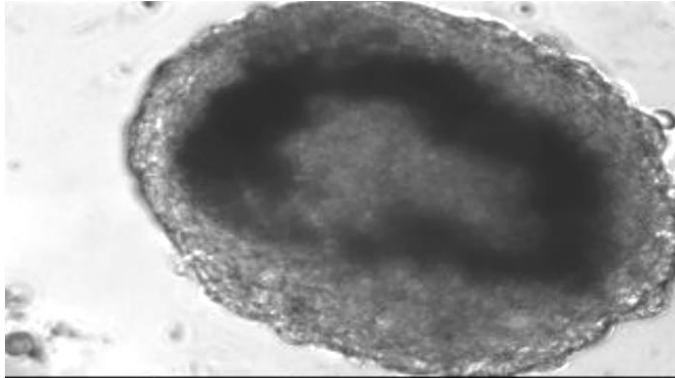
pO₂ = 1.1kPa

Decreased partial oxygen pressure
affects to
electrophysiological activity
(and other biological functions)

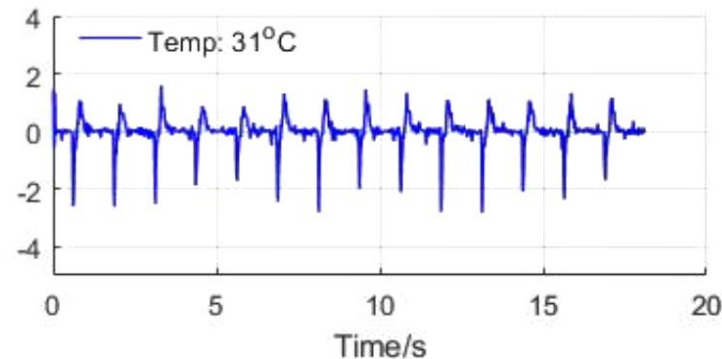
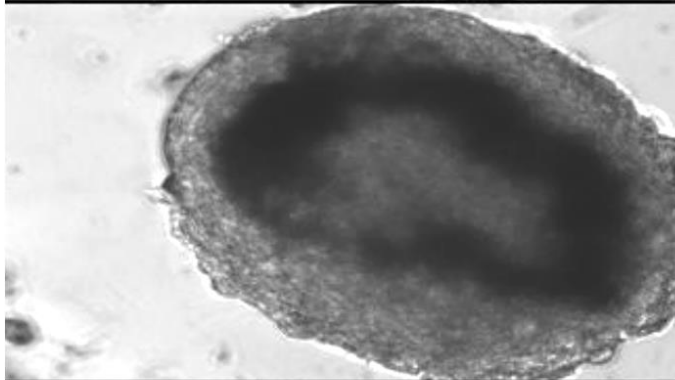
Relevant, stable and controlled culture environment

Example: Oxygen, Temperature and pH variations

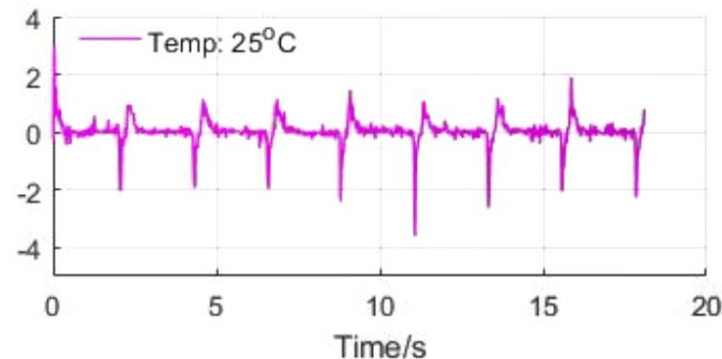
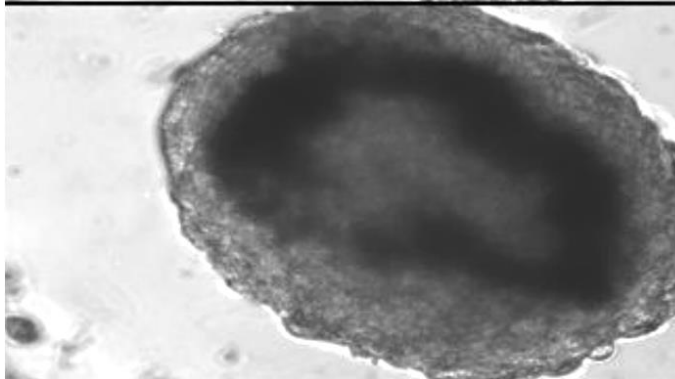
37°C



31°C



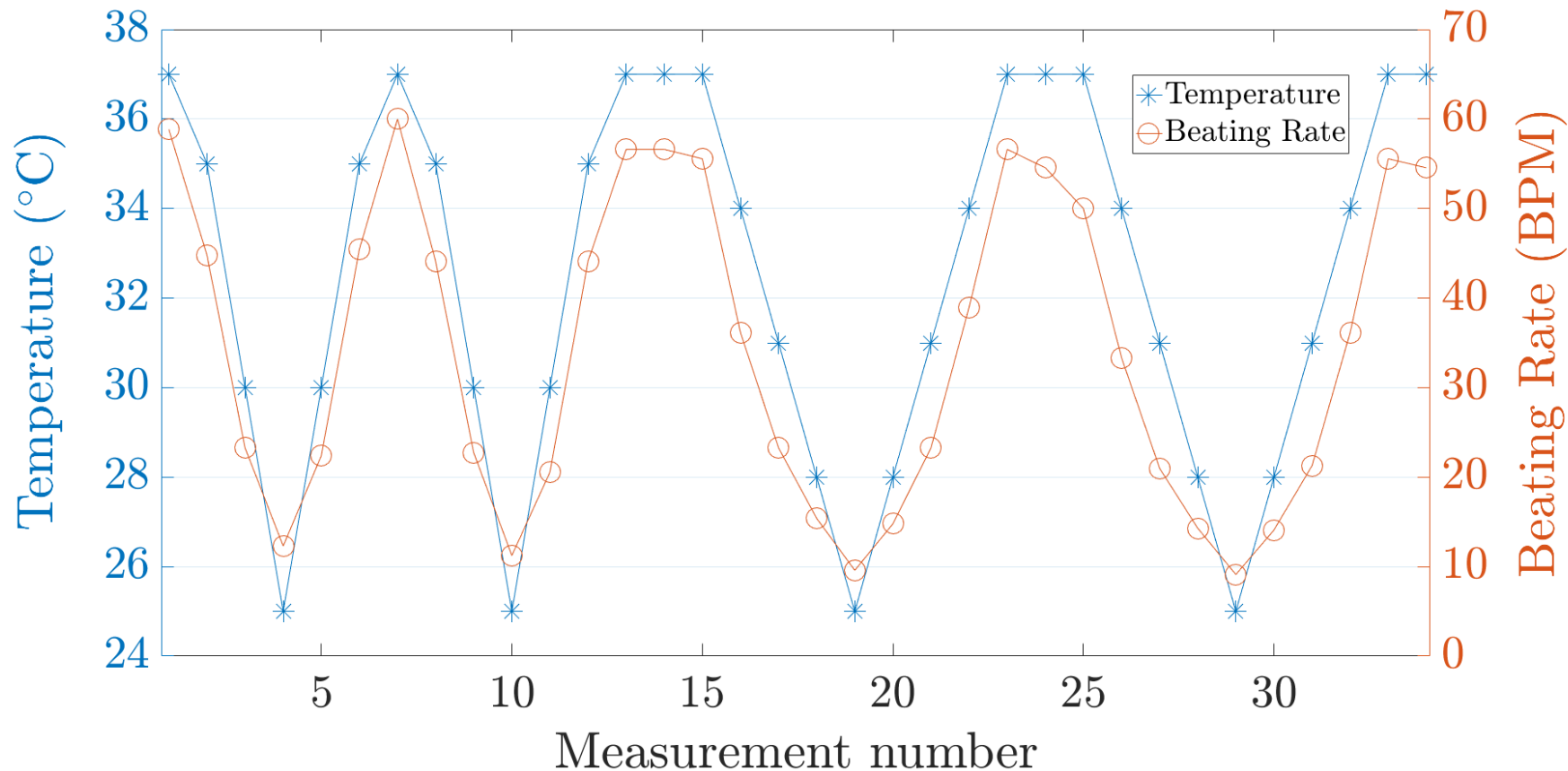
25°C



Decreased temperature
affects to
electrophysiological activity
(and other biological functions)

Relevant, stable and controlled culture environment

Example: Oxygen, Temperature and pH variations



2°C drop decrease beating rate of hiPSC-derived cardiomyocytes by ¼ from origin

OxyGenie™: Portable Cell Culture Device



The first in the world:
Culture, maintain, transfer and observe
your cells under stable and controlled
physiological conditions

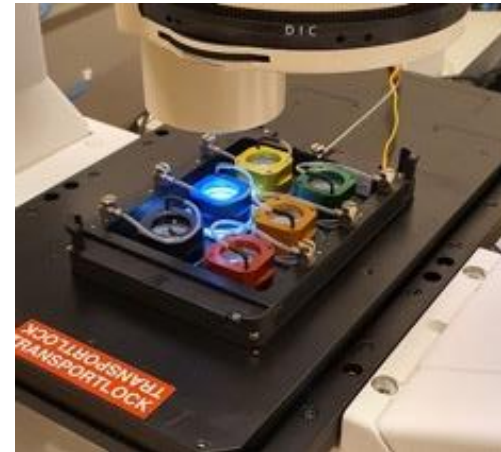
OxyGenie™: Portable Cell Culture Device



Instrument



Flow Divider



www.BioGenium.fi

Metsälä et al. *Rad. Onc.* 2018

Shah et al. *Cells* 2019

Häkli et al. *Sci. Rep.* 2021

Gaballah et al. *Cells* 2022

Aalto et al. *FEBS* 2022

Häkli et al. *Stem Cell Int.* 2022

Santiago et al. *Front. Neurosci.* 2023

Pelkonen et al. *BioRxiv.* 2025

Ha et al. *Radiother. Oncol.* 2022

Barghouth et al. *Radiother. Oncol.* 2023

Bragulat-Teixidor et al. *EMBO Rep.* 2024

OxyGenie™: 1-well Sample Cup



* Multi-use components

** Disposable

One Sample Cup → Multiple Applications

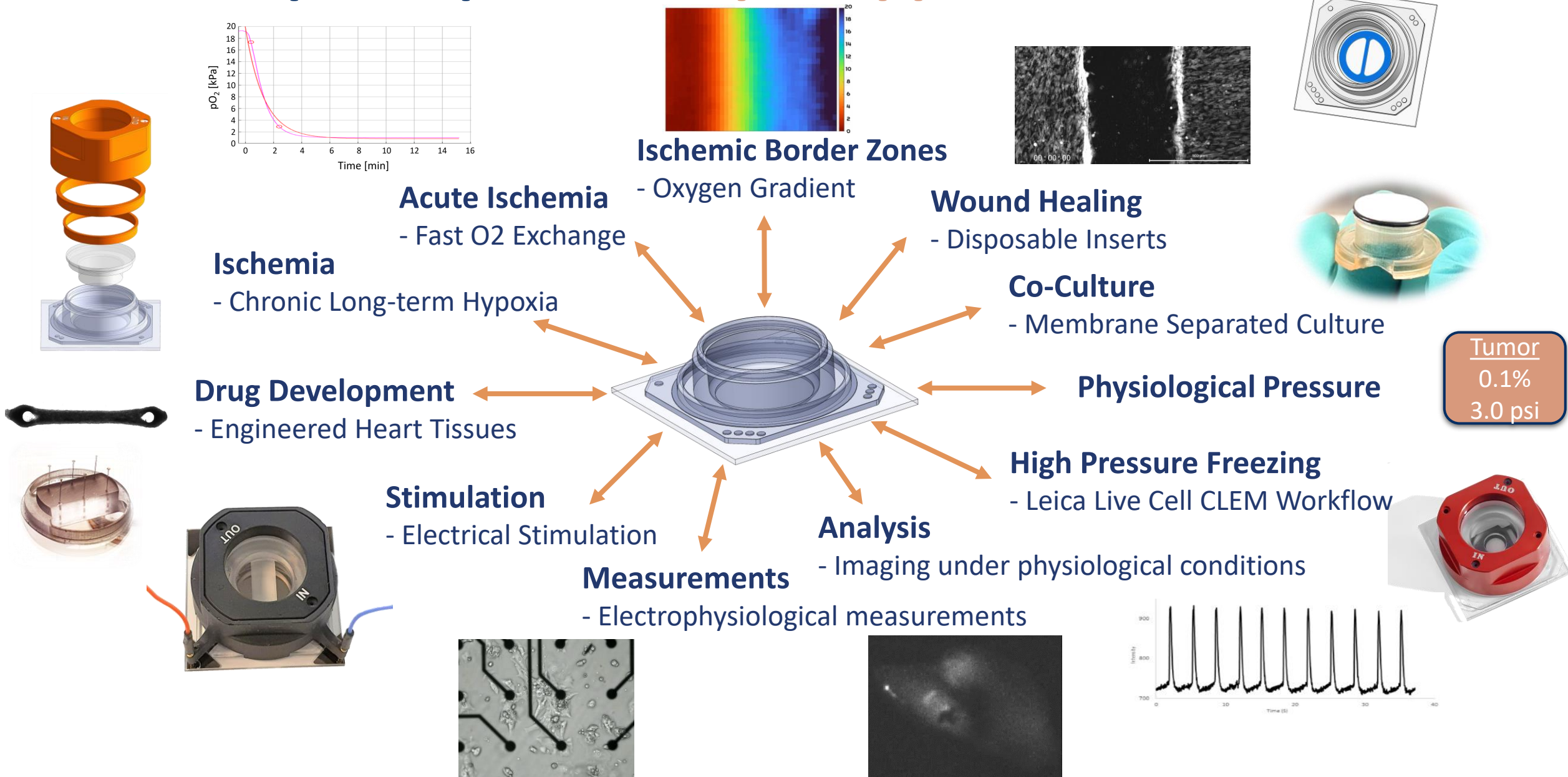
- Chronic hypoxia (Standard glass LID)
- Acute hypoxia (Acute LID)
- O₂ Gradient (Gradient LID)
- Co-culture (Co-LID)
- Engineered Heart Tissue (EHT LID)
- Wound healing (Wound Inserts)
- Electrical Stimulation (Pace Plate)
- Physiological Pressure
- Transfer of biological samples



* Multi-use components

** Disposable

One Sample Cup → Multiple Applications



Irradiation of HeLa cells under physiological oxygen

Irradiation of HeLa cells

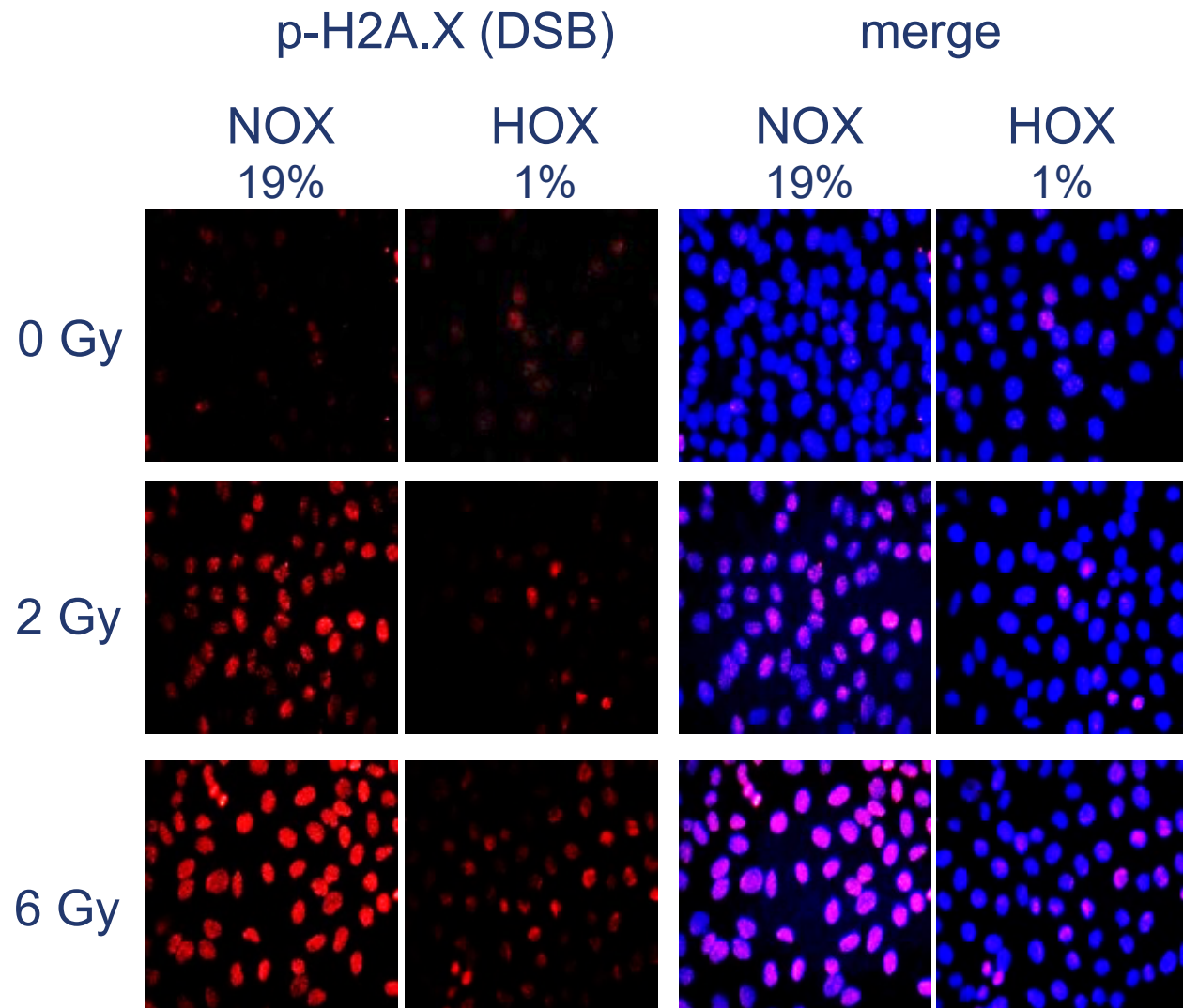
0 Gy

2 Gy

6 Gy



Irradiation of HeLa cells under physiological oxygen



p-H2A.x
used as a marker
of double strand breaks,
indicative of irradiation response

→ Presence of O₂ breaks more DNA

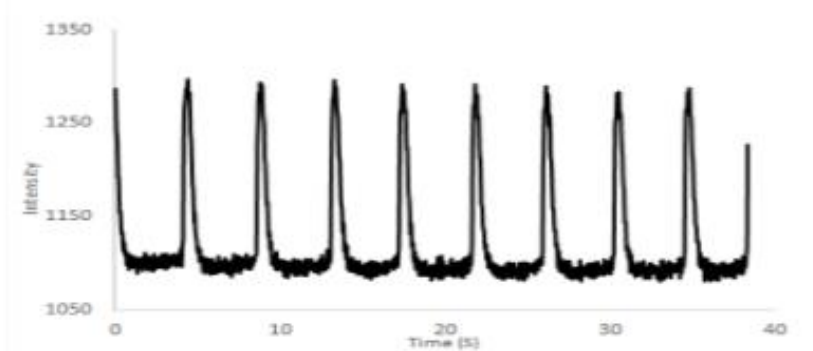
→ High O₂ do not correlate to conditions *in vivo*

Similar effect e.g. with
photoactivated molecules
used for drug development

hiPSC derived Cardiomyocytes: Calcium imaging

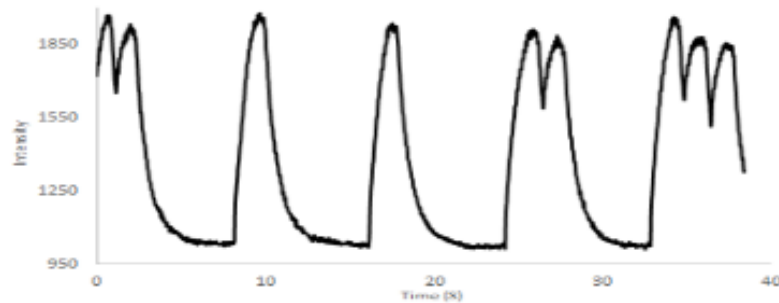
Response to Hypoxia – drug development

Control



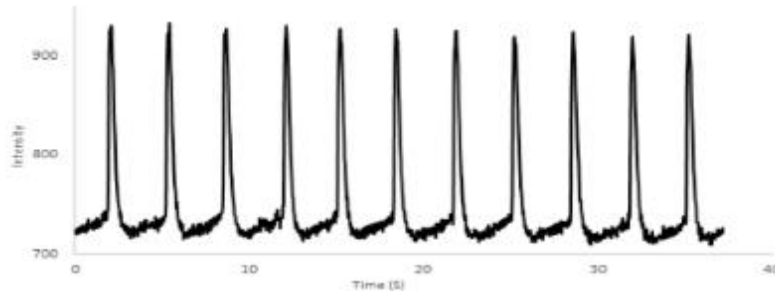
No visible abnormalities in the Ca^{2+} data

Hypoxia

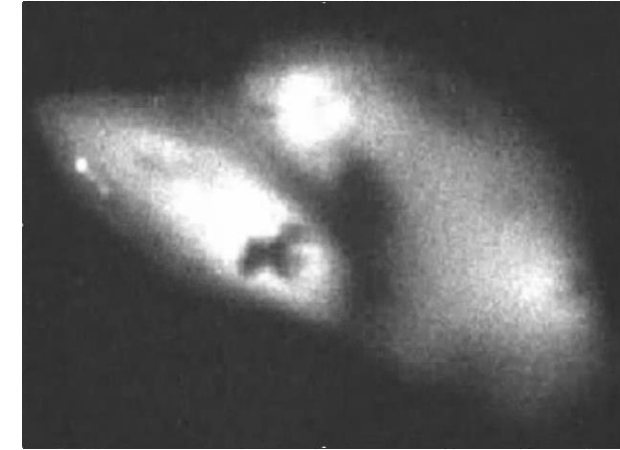


Hypoxia reveals the hidden disease

Hypoxia & drugs



“Patient” healed with the commercial heart drug (Levosimendan)



Ca^{2+} imaging

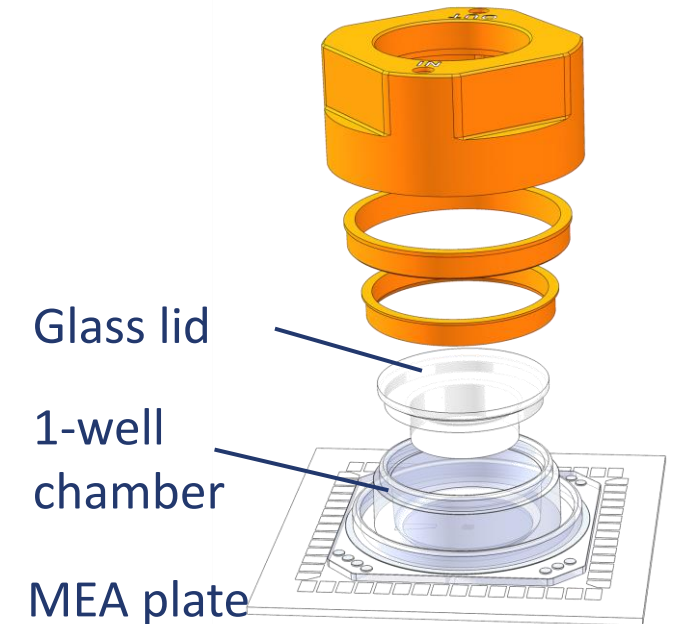
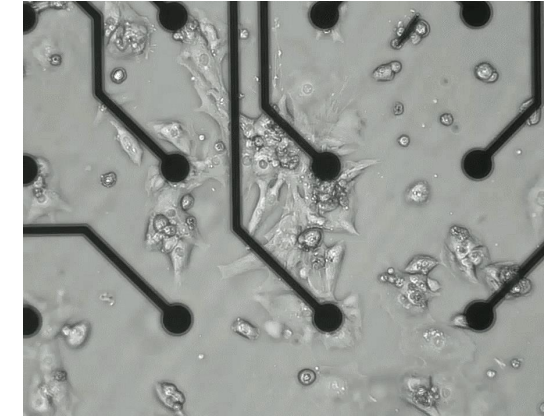
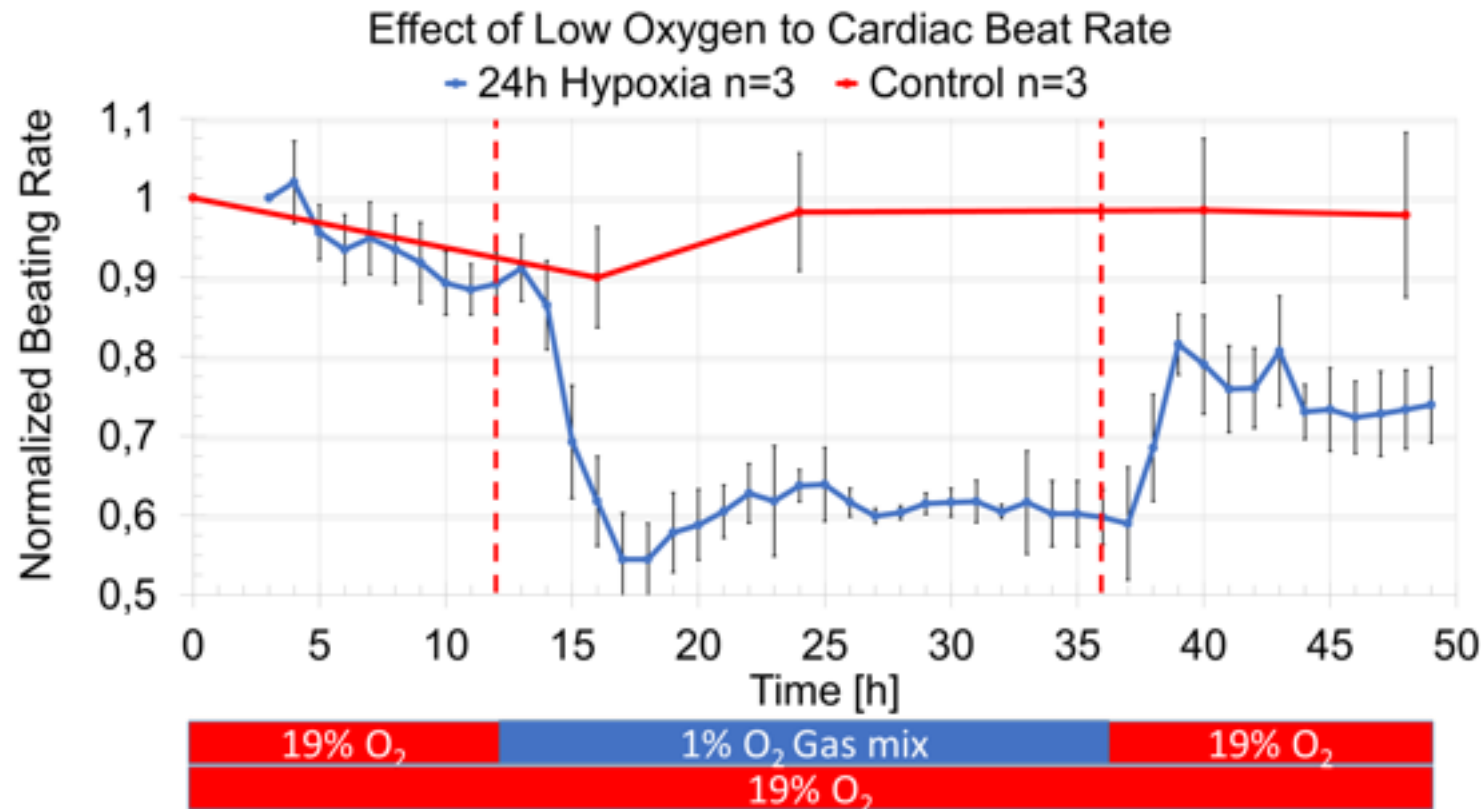


1-well Assembly

hiPSC derived Cardiomyocytes: MEA recordings

Response to Hypoxia

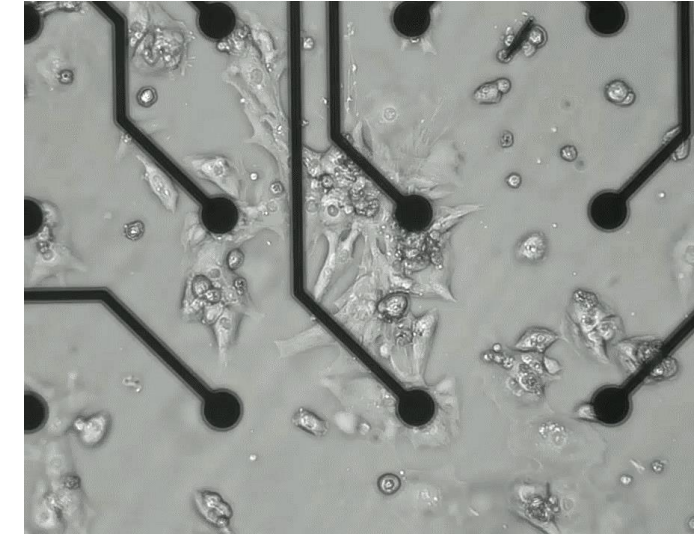
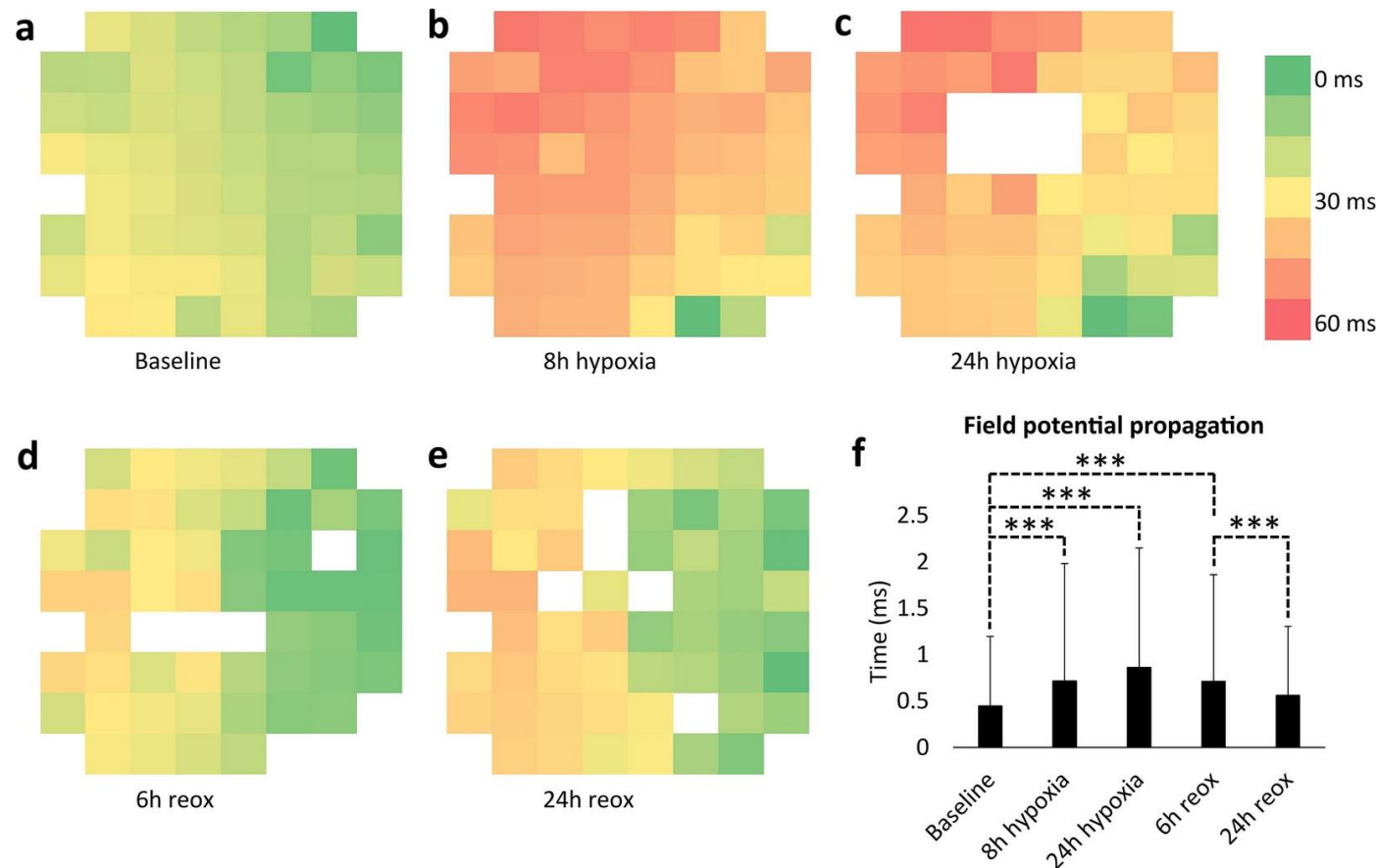
Multielectrode Array (MEA) recordings



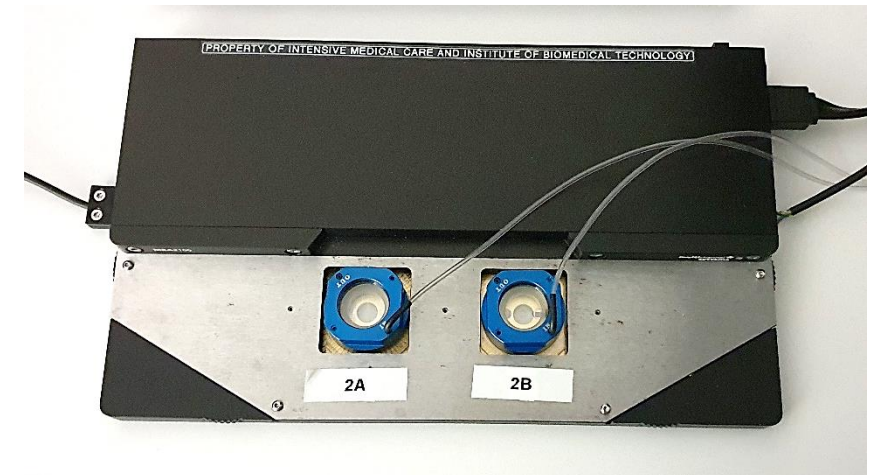
hiPSC derived Cardiomyocytes: MEA recordings

Response to Hypoxia

Field potential propagation reduced under hypoxia

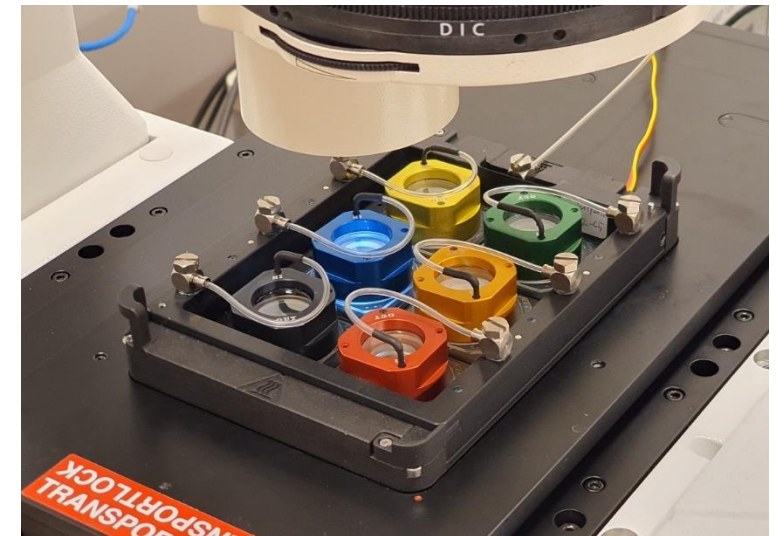
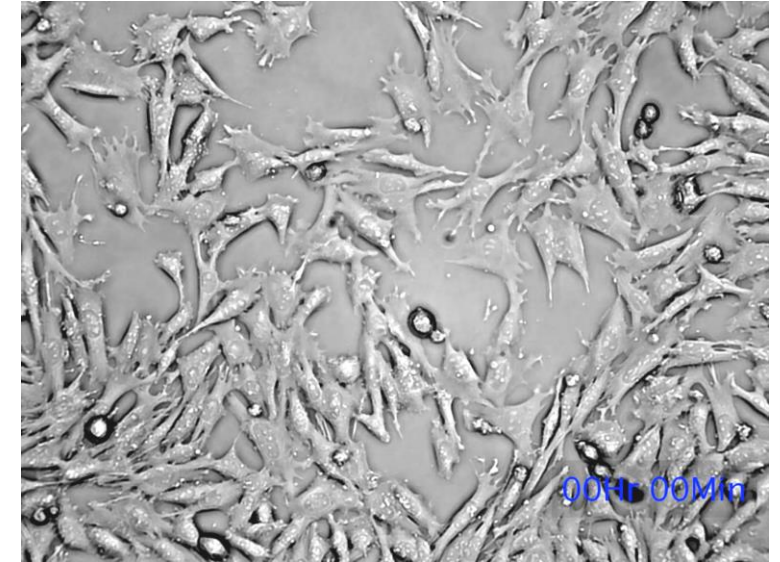
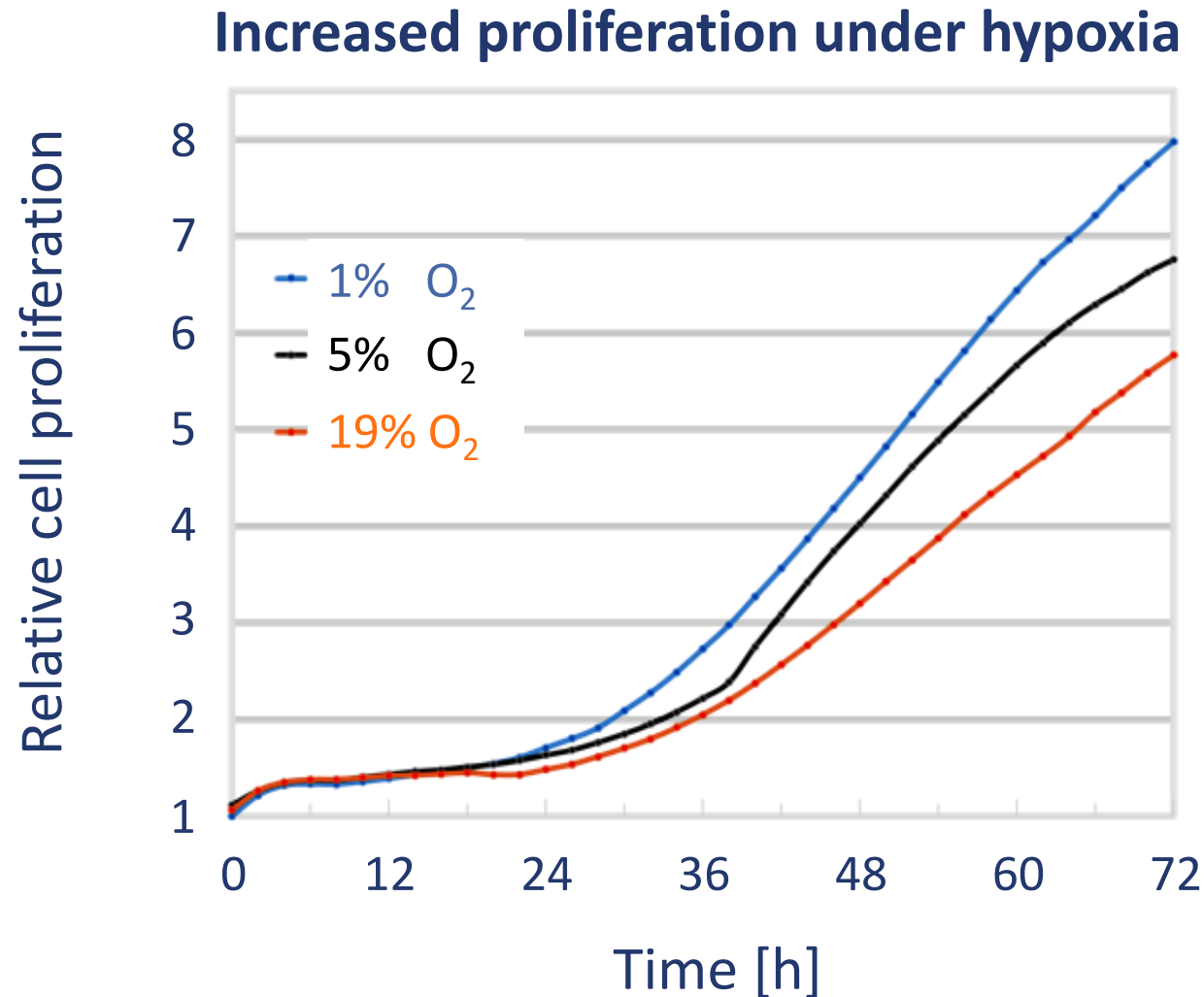


Multielectrode Array (MEA) recordings



Fibroblasts: Phase-Contrast Time Lapse Imaging

Response to Hypoxia

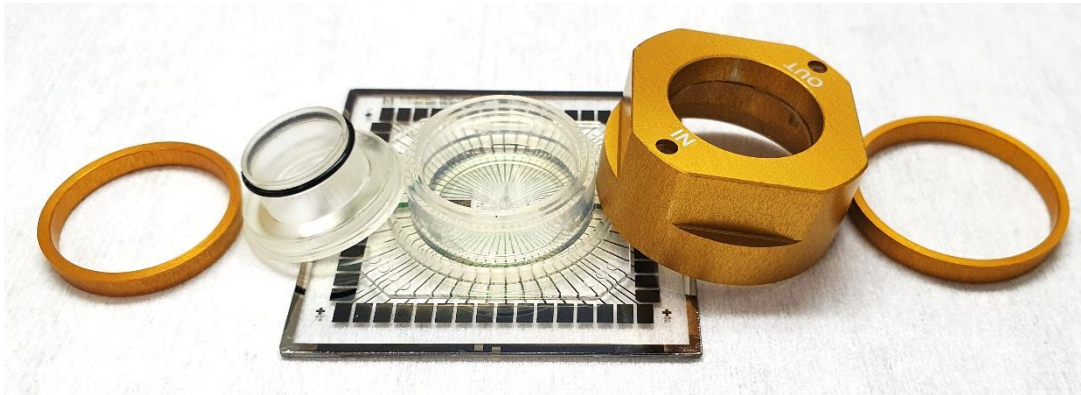


LID Variants: Acute Ischemia on Chip

Ischemia =

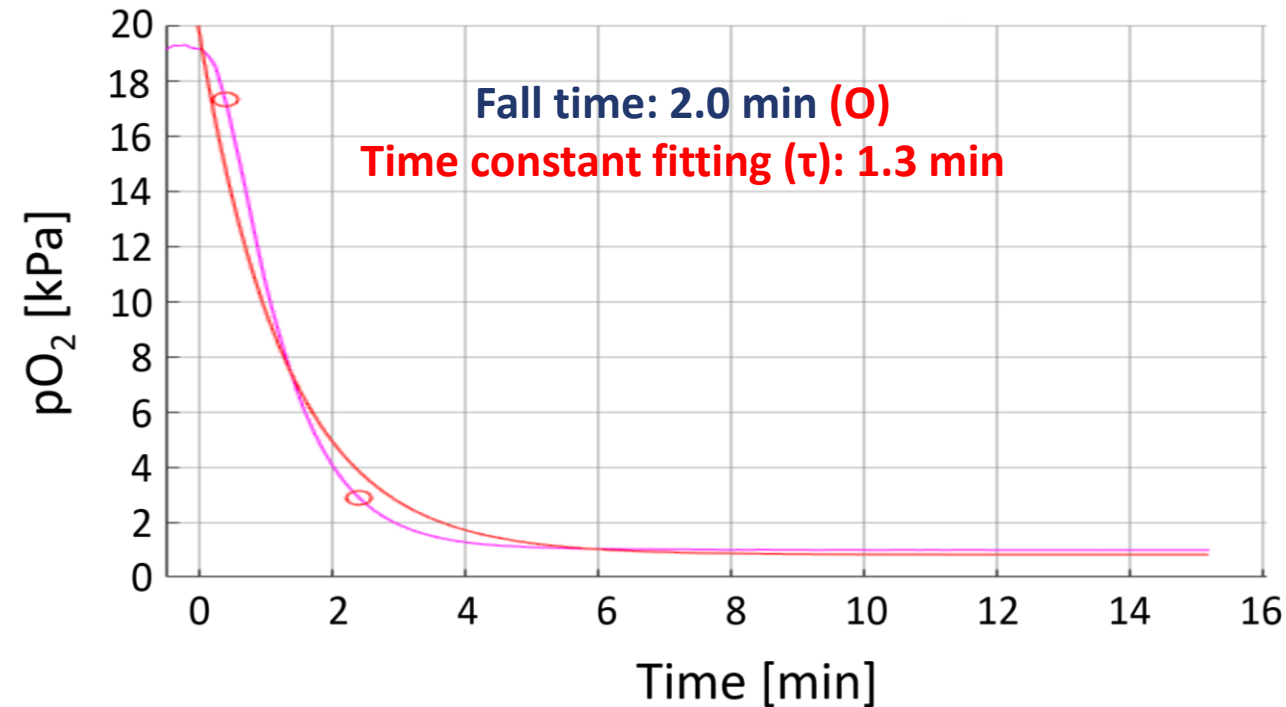
restriction in blood supply to tissues,
causing a shortage of oxygen

Effective in minute(s) in nature

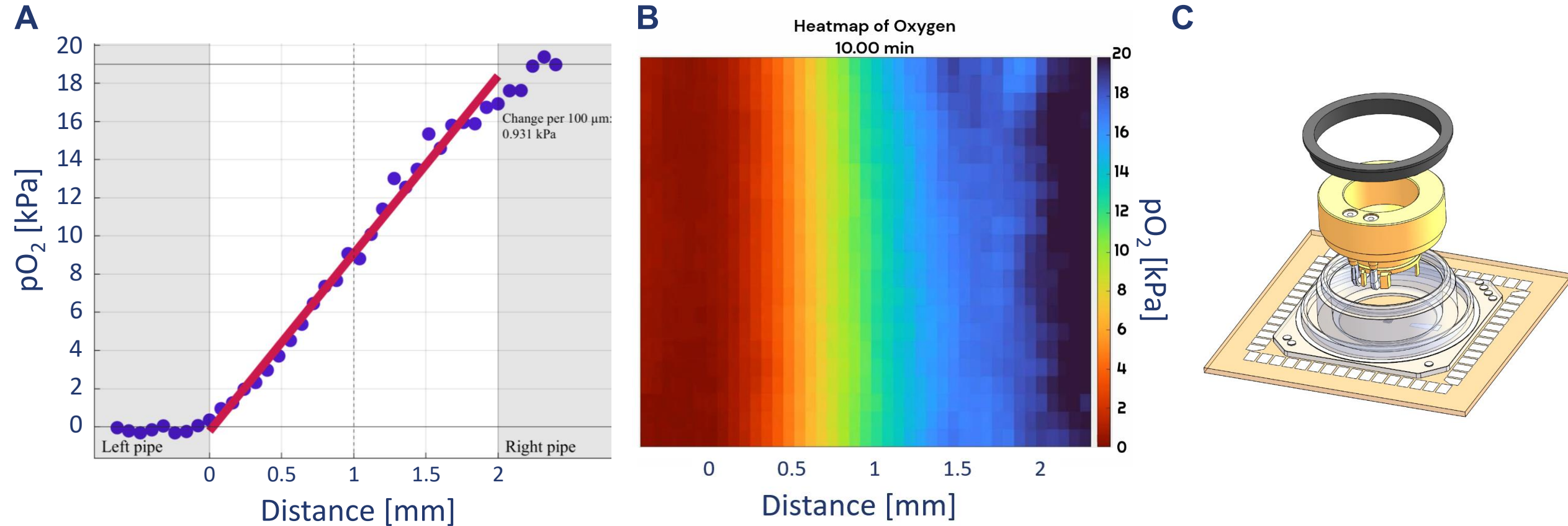


Example:

Oxygen Dynamics with Acute LID for step response
from 19% to 1% O_2



LID Variants: O₂ Gradient on Chip



- (A) Linear oxygen gradient between “the walls” forming the gradient (2mm gap; gap distance can be varied)
- (B) 2D oxygen distribution between “the walls” (Oxygen measurements in Tampere University)
- (C) 1-well Chamber on top of the multielectrode array with gradient LID

LID Variants: Co-culture with “Co-LID”

Different membranes attached to the LID

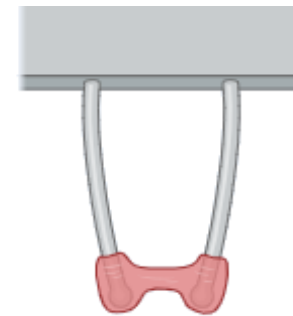
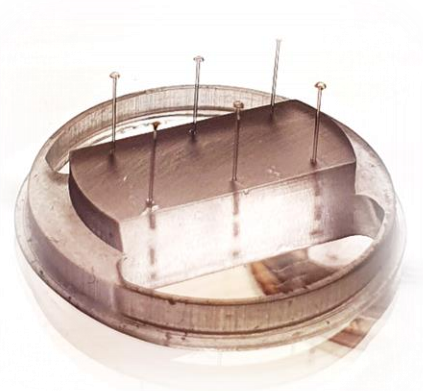
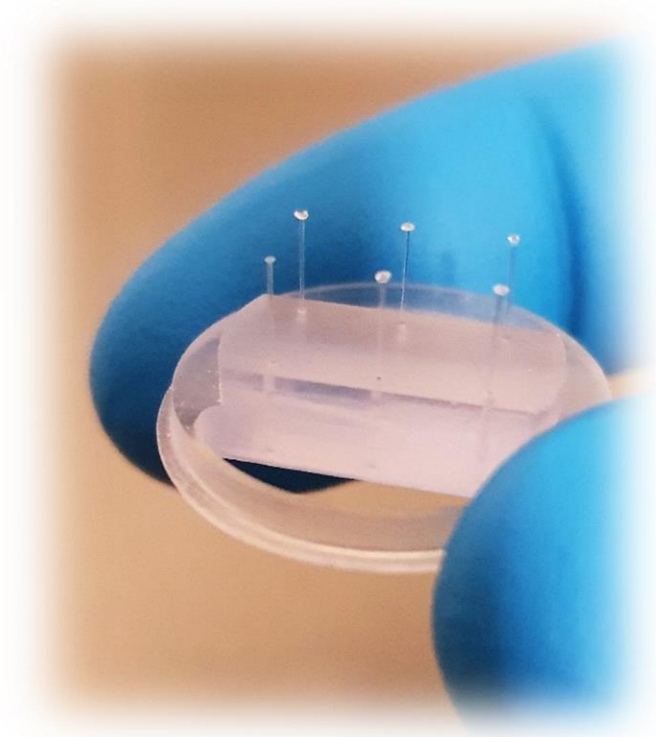
! Use your own membrane !

e.g. Dialysis and microporous membranes

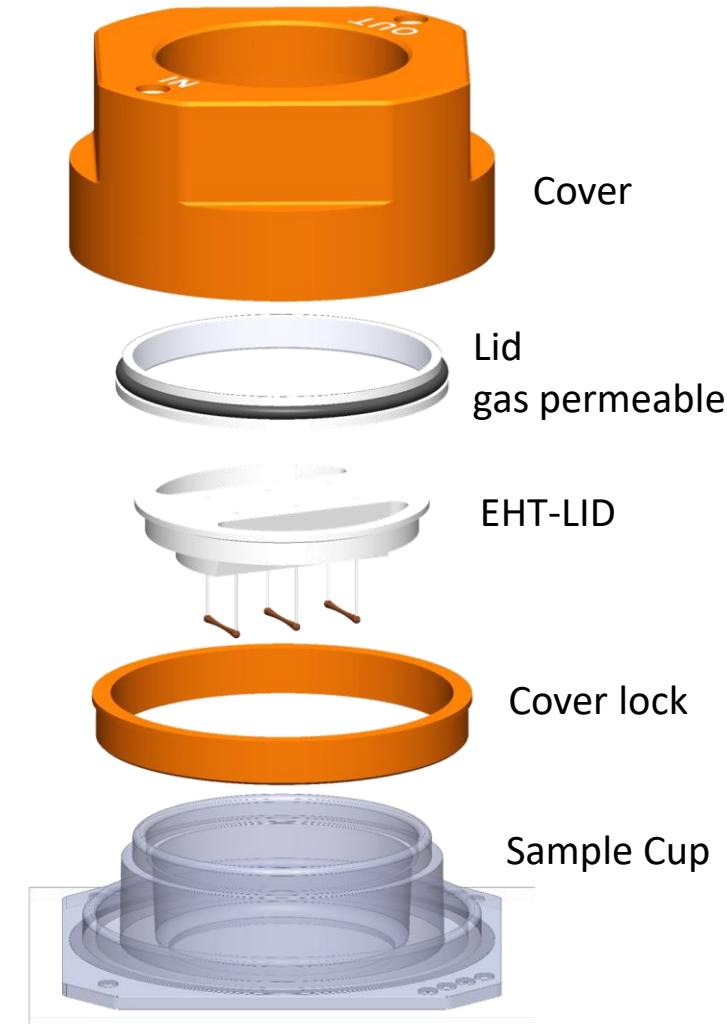


LID Variants: Engineered Heart Tissue “EHT LID”

Pairs of pillars on the LID to hold the EHT cluster

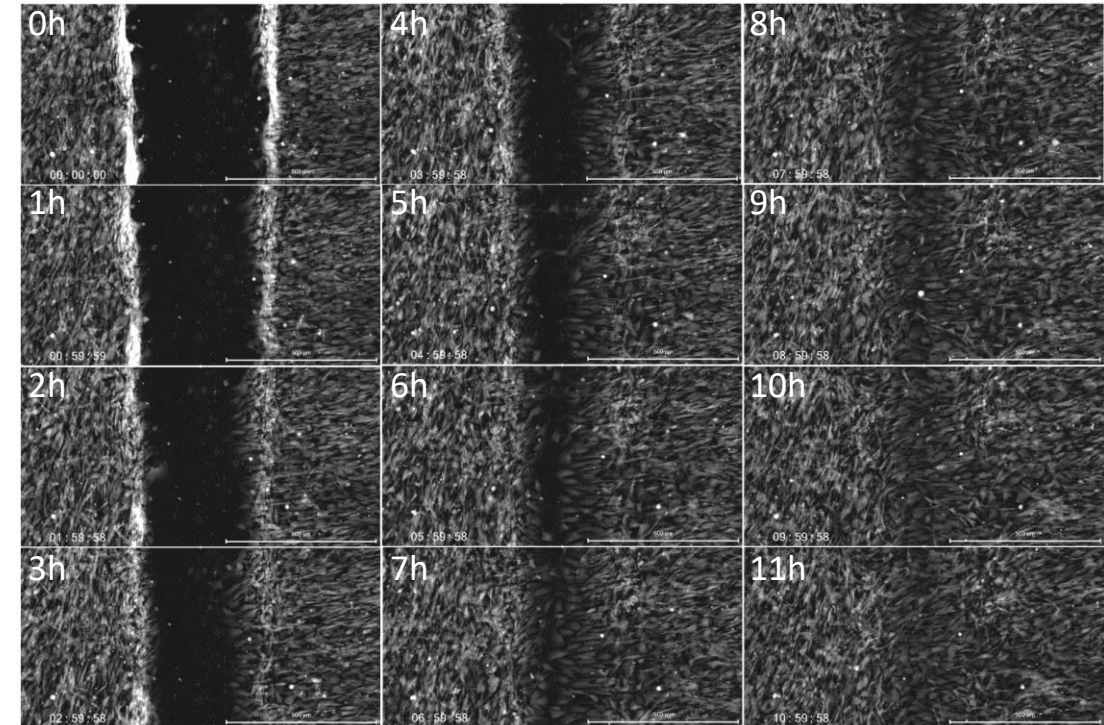
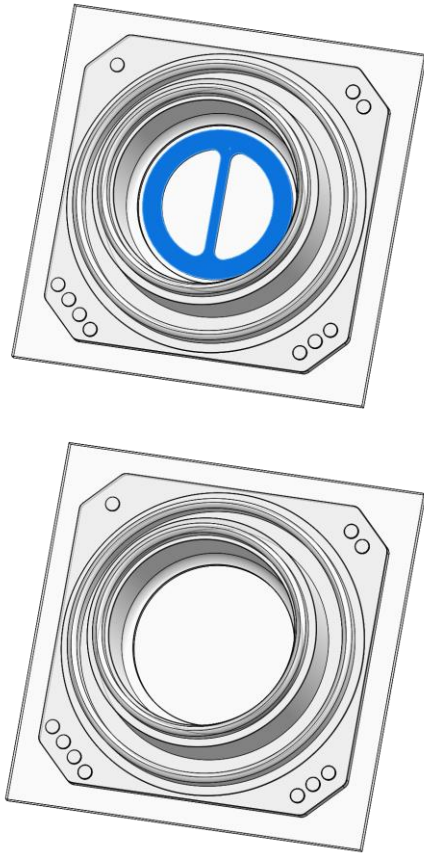


2mm

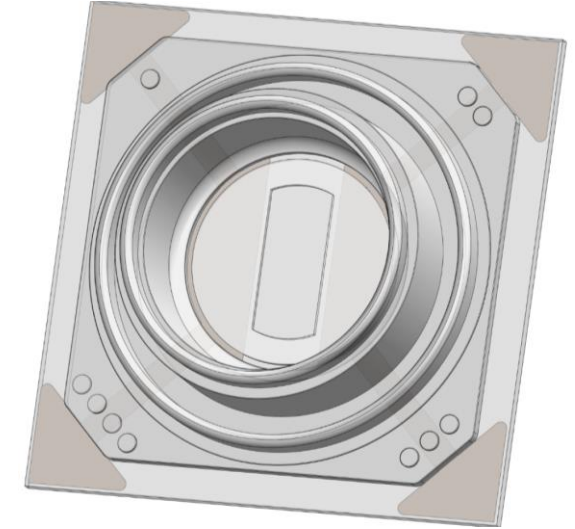
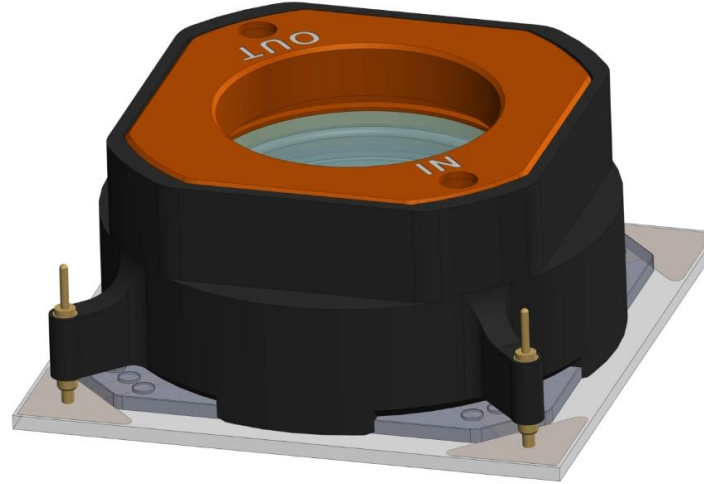
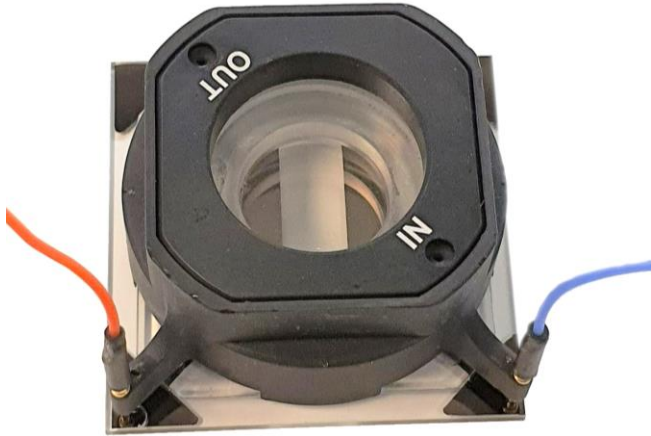


Wound healing assays with inserts

Insert to create straight and repeatable scratch for wound healing applications



Electrical Stimulation with planar electrodes

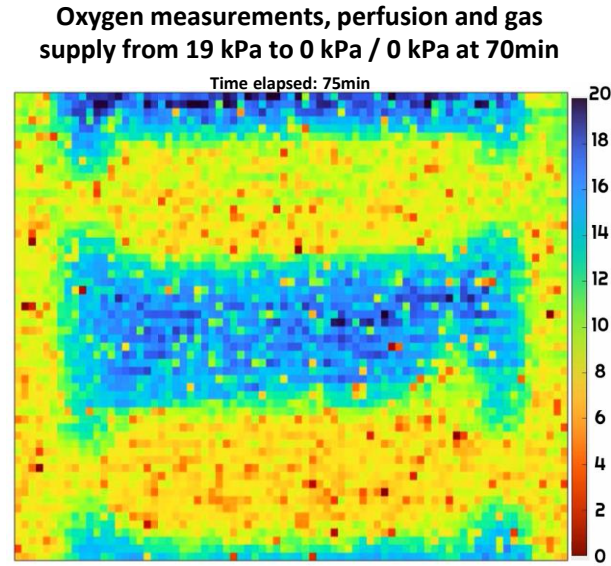
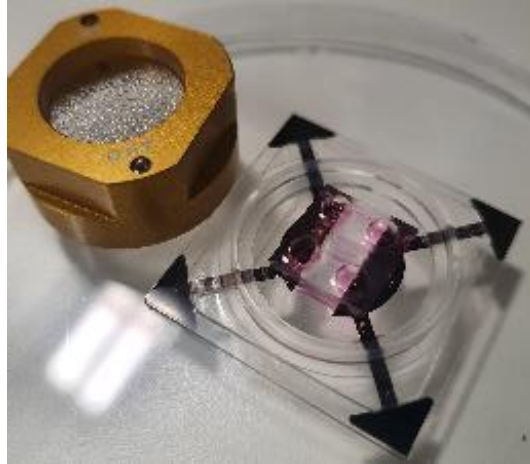
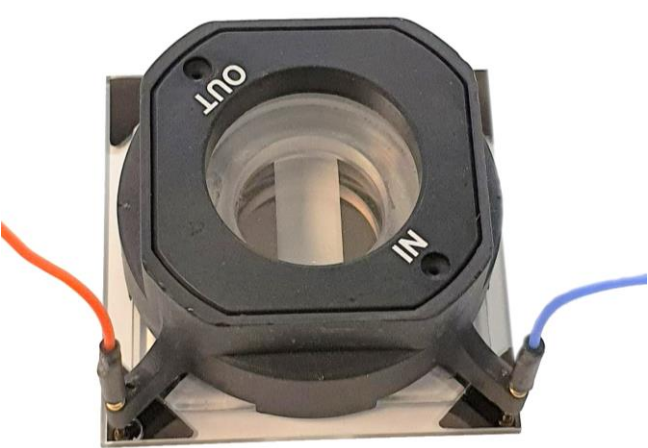


- Planar stimulation plate
- 1-well culture chamber
- Acute LID
- LID lock and Cover locks
- Chamber cover
- Connecting adapter with spring loaded contacts

- Planar stimulation plate
- 1-well culture chamber
- +
- Removable cell plating insert

Electrical Stimulation with planar electrodes

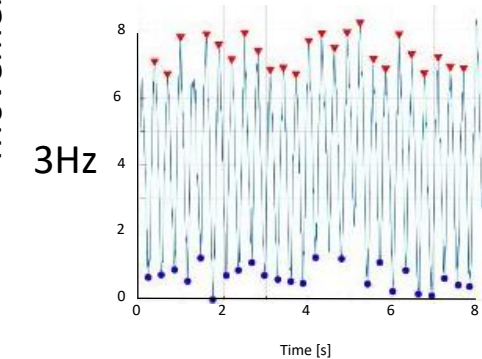
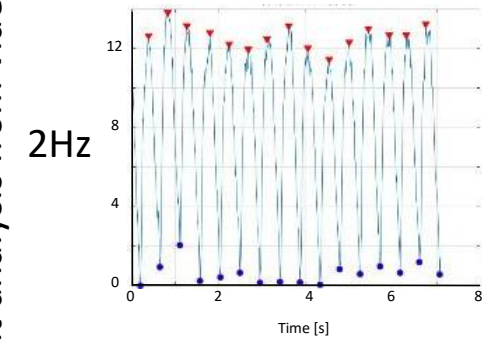
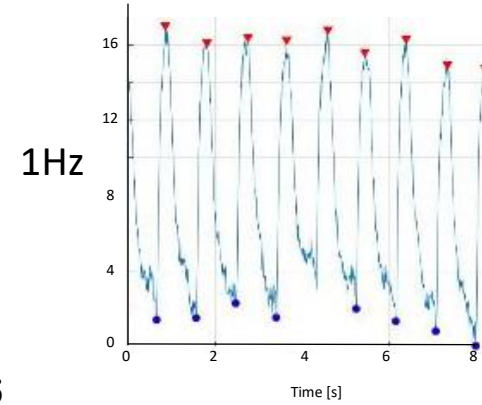
Engineered Heart Tissues (EHTs) under hypoxia, perfusion, and electrical stimulation



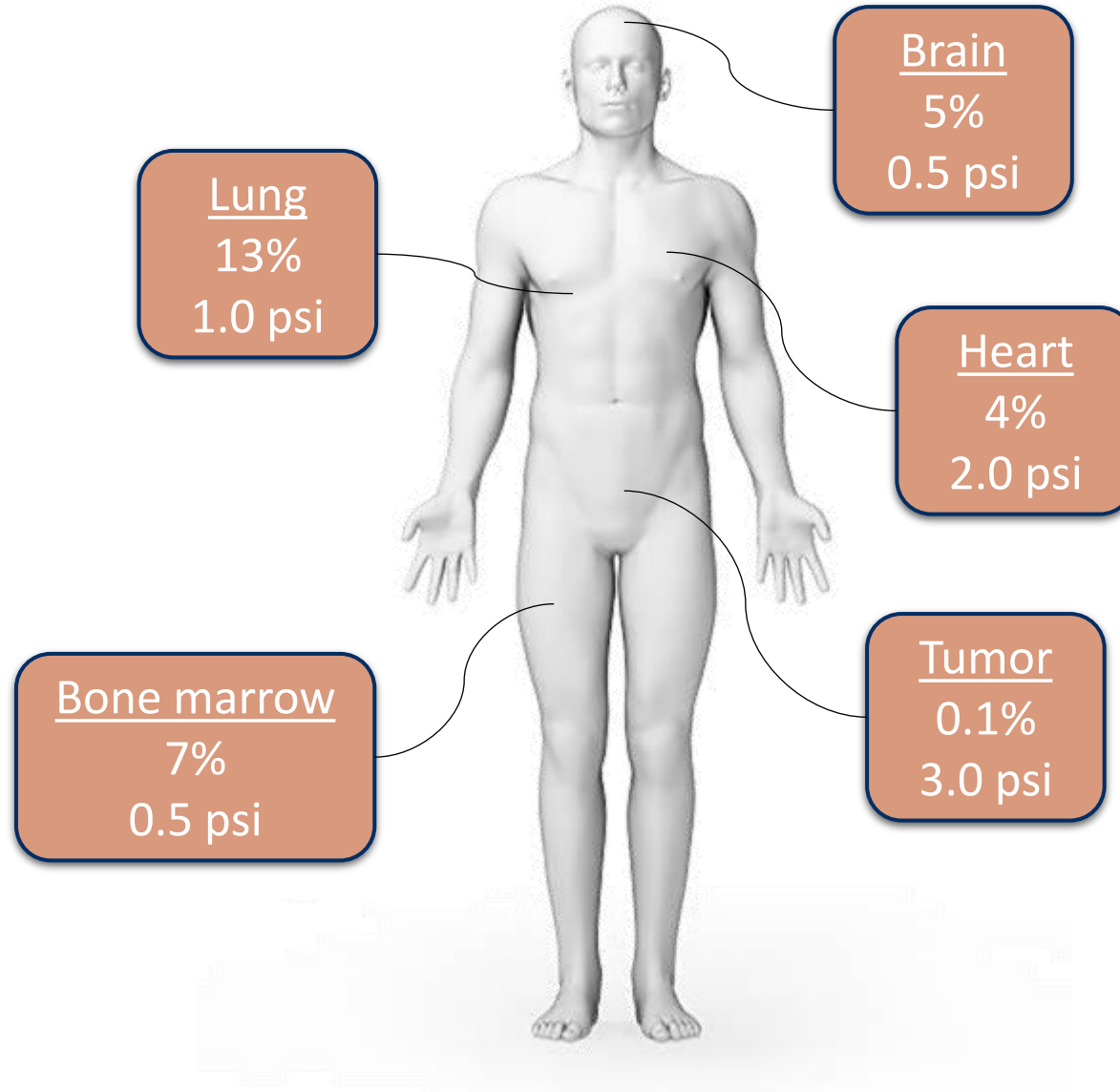
μ EHT made with hiPSC-CMs and cardiac Fibroblasts

Video by Cofiño-Fabres, C., et al. *Adv. Healthcare Mat.* (2024)

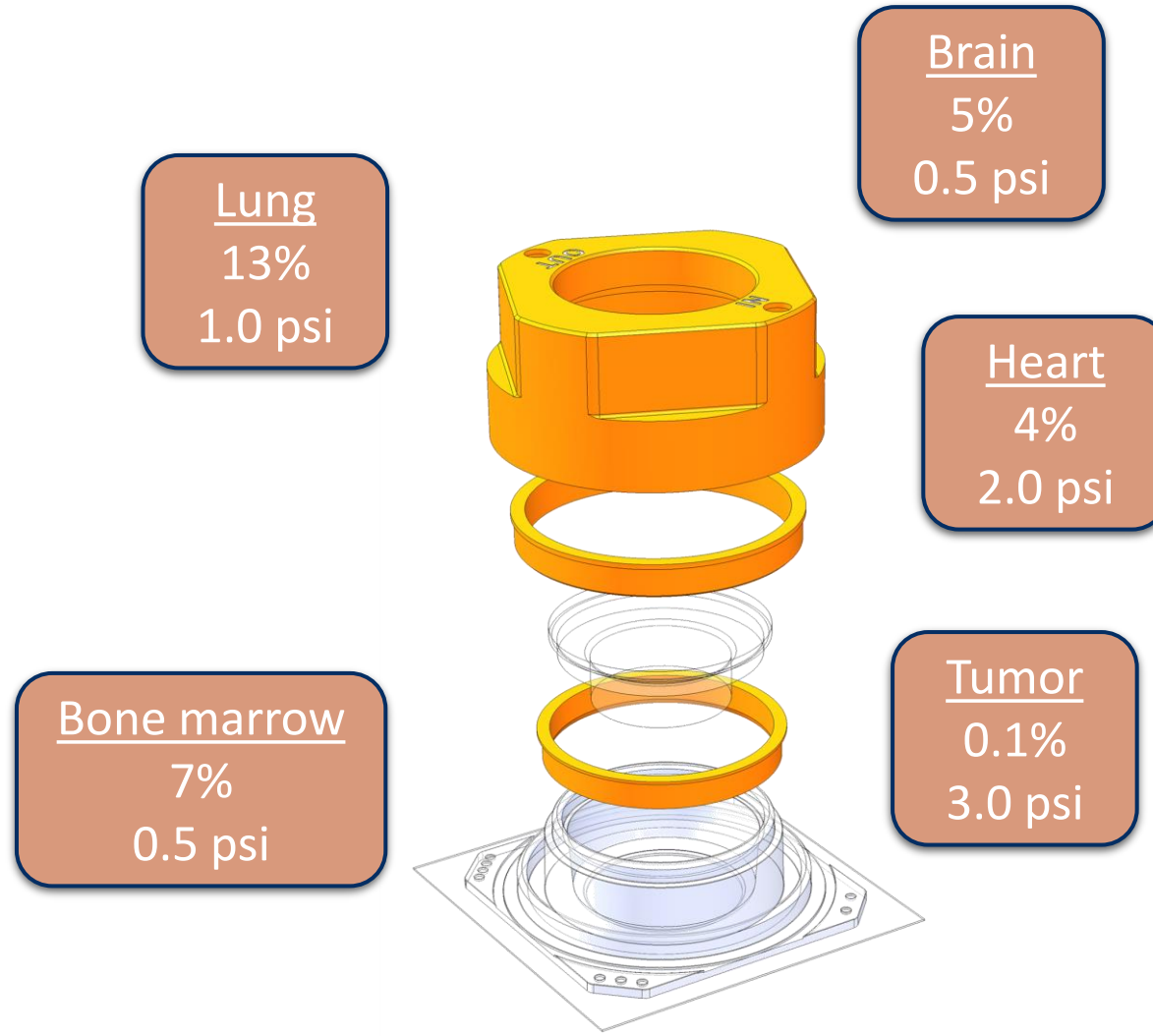
Electrical stimulation with different frequencies.
Movement analysis from videos.



Physiological Pressure



Physiological Pressure

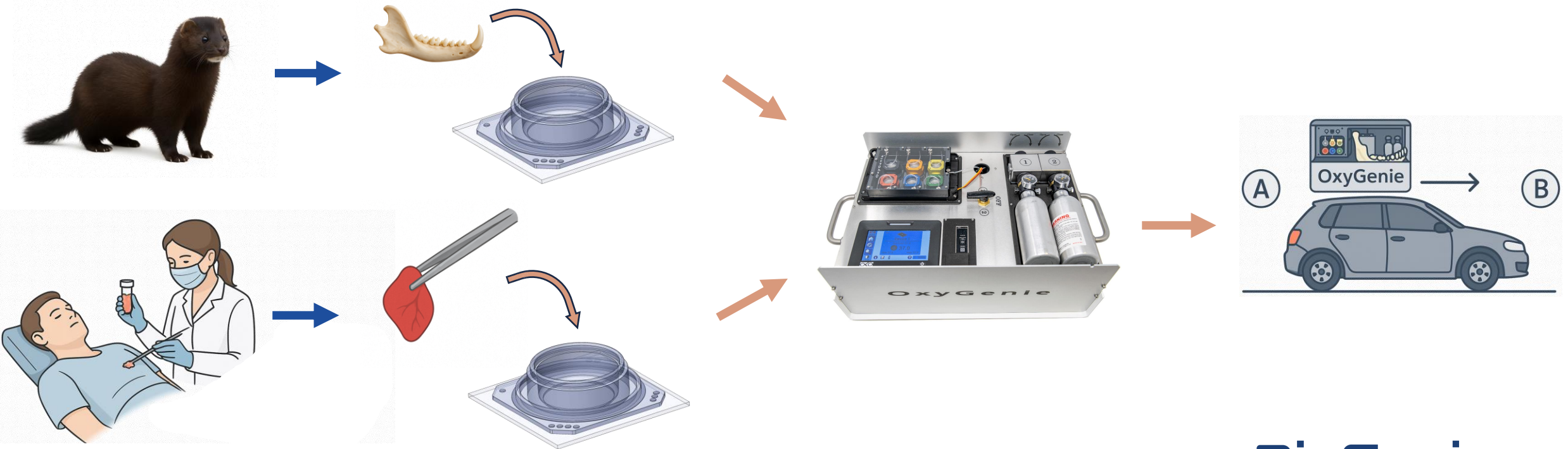


Physiological pressure possible to maintain inside the culture chamber

- Ask more about the details

Transfer of Biological Samples: e.g Mink's jaws

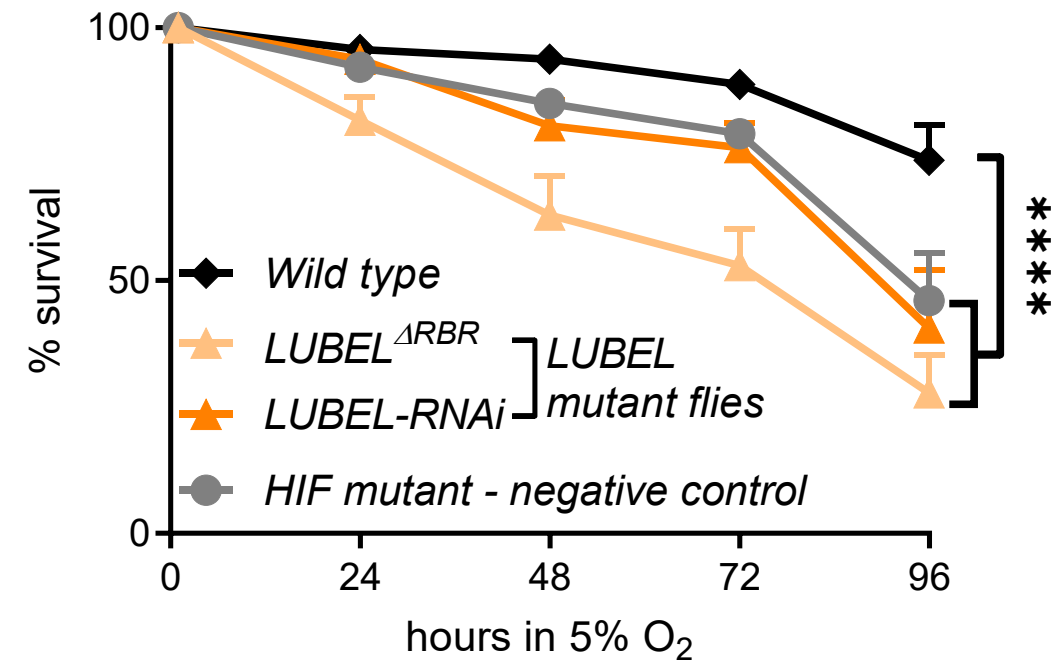
- Maintains physiological integrity during transport
- Ensures reproducibility and reliability of research
- Extends viability for advanced analyses
- Human-derived biopsies supported (*OxyGenie is currently intended for research use only*)



Small animals: *Drosophila melanogaster*



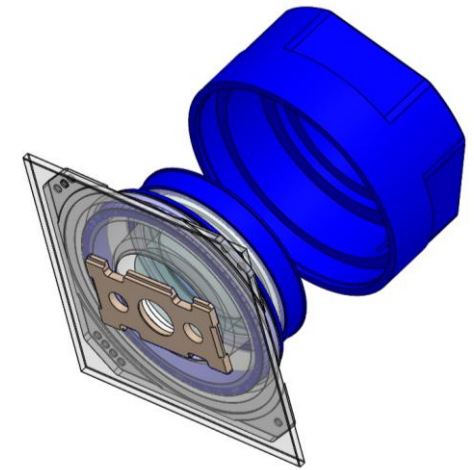
- Gene mutated *Drosophila melanogaster* in hypoxia
- No liquid, no heating
- LUBEL is required for survival during hypoxia



Leica Microsystems: High Pressure Freezing

www.leica-microsystems.com

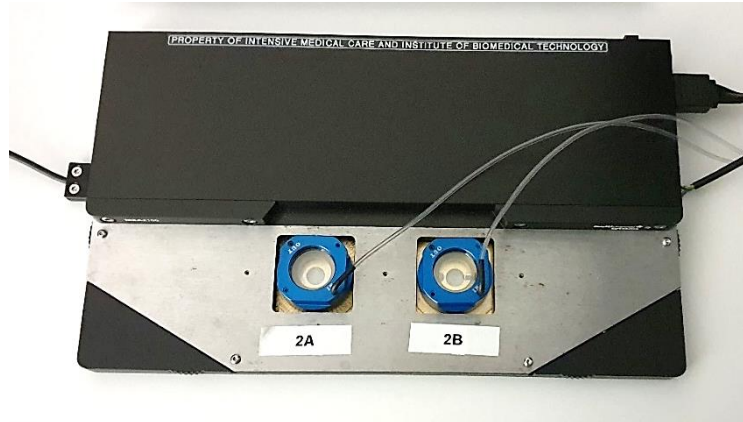
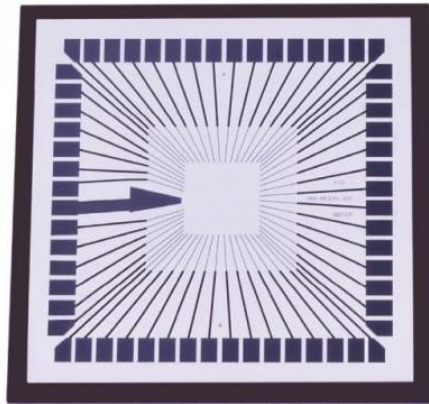
- [Live Cell CLEM Workflow – Coral Life](#)
- High resolution imaging + high pressure freezing of cells
- SampLink chambers
- [How to Keep Your Samples Under Physiological Conditions](#)



Multi Channel Systems GmbH

www.multichannelsystems.com

- OxyGenie Flow Divider for holding 4 MEA plates
- Electrophysiological experiments under hypoxia on MEA
 - Shah et al. *Cells* 2019
 - Häkli et al. *Sci. Rep.* 2021
 - Häkli et al. *Stem Cell Int.* 2022
 - Santiago et al. *Front. Neurosci.* 2023



Ask Details

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BioGenium
MICROSYSTEMS



Portable Instrument



Flow Divider



* Multi-use components

** Disposable

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