BEOnChip

Biomimetic Environment On Chip

Microfluidic devices for cell culture in biomimetic environments

X Jornada REMA, Madrid 12/12/2019

ORGAN ON A CHIP

BEOnChip
Biomimetic Environment On Chip

DRUG RESEARCH
First studies
Drug discovery

PRECLINICAL
Lab and animal experiments

CLINICAL TRIALS
THREE PHASES
1000-11000 patients

EVALUATION/ APPROVAL
(Up to 2 years)

PHASE IV STUDIES
(More than 2 years)

10000
Test compounds

<250
Test compounds

<5 Test compounds

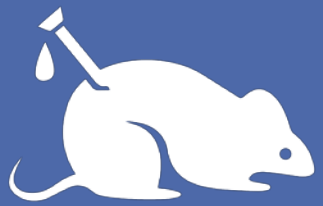
1 DRUG APPROVED BY HEALTH AUTHORITIES

>1 BILLION EURO

0 2 4 6 8 10 12 YEARS

Developing a new drug is too slow and expensive

PETRI DISH
Lack of natural environment



ANIMAL EXPERIMENTATION
Expensive and controversial

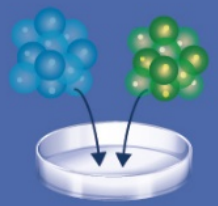
TIME AND MONEY
Too many false positives

ORGAN ON A CHIP

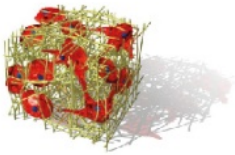
BEOnChip
Biomimetic Environment On Chip

2D CELL CULTURE

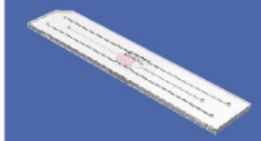
3D CELL CULTURE



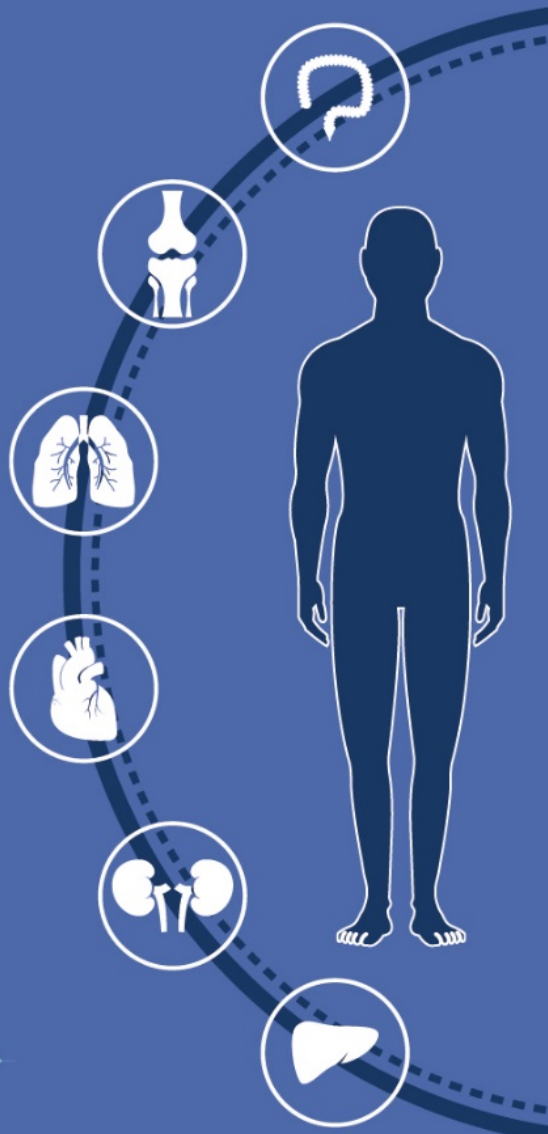
CO-CULTURE



SCAFFOLD-BASED 3D TISSUE

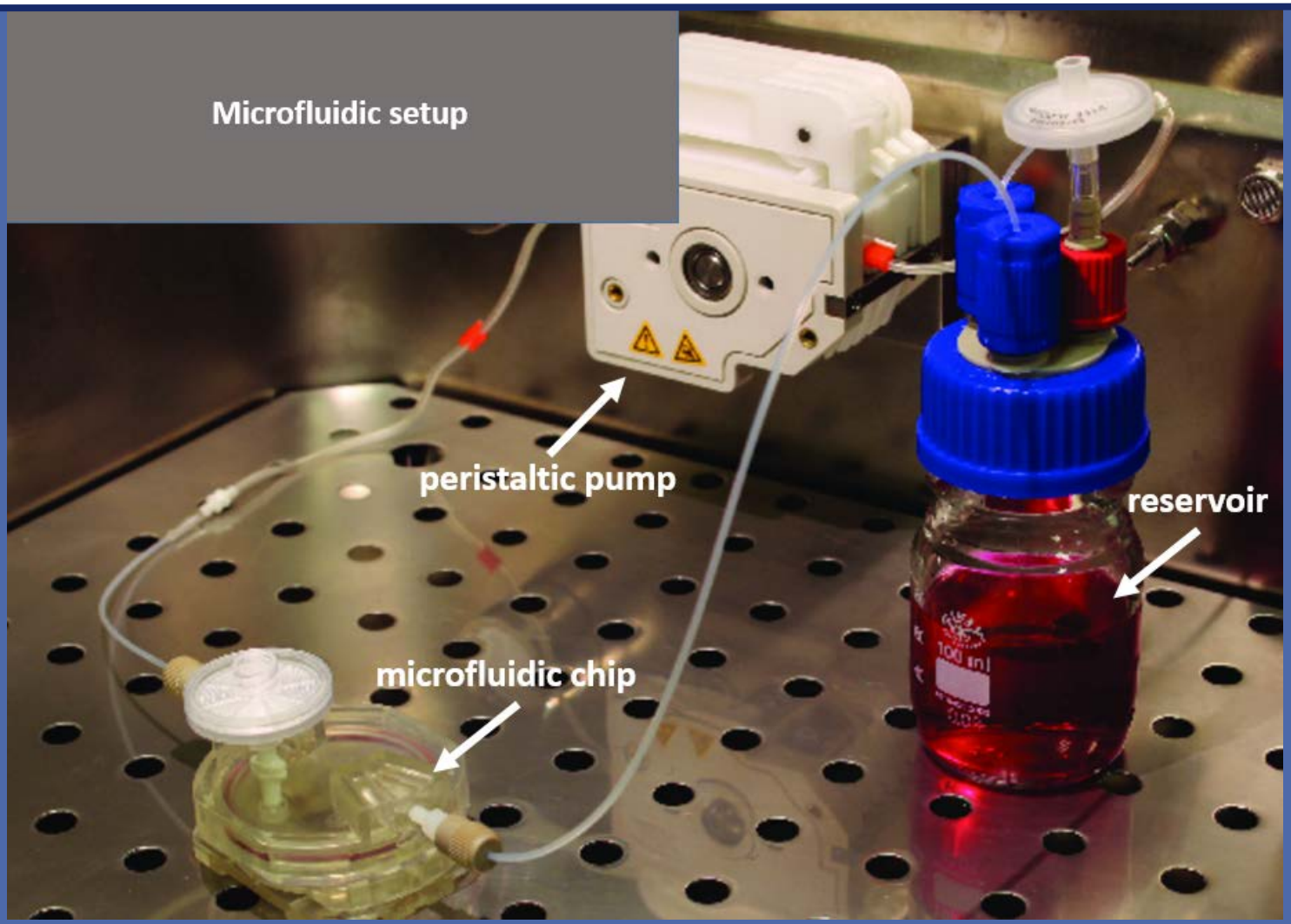


ORGAN ON A CHIP



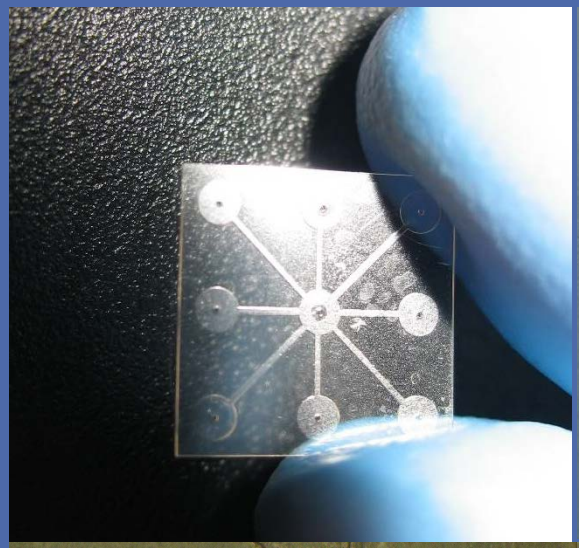
YEARS

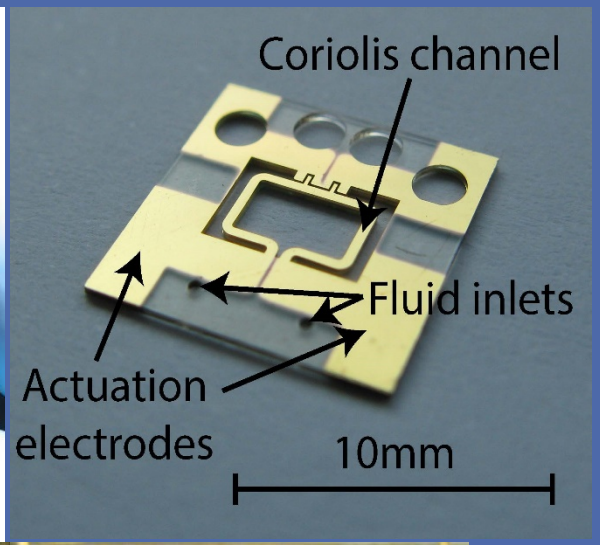
Microfluidic setups

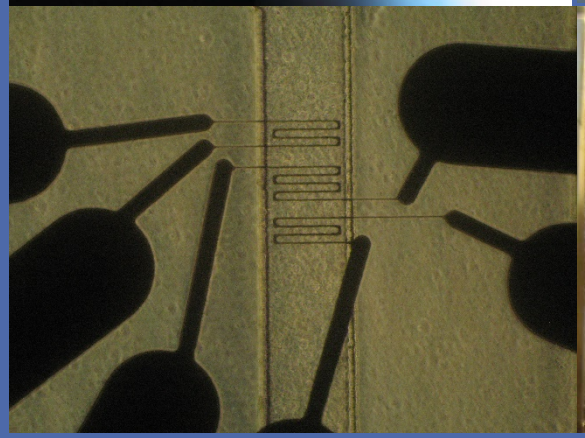


Microfluidic

Valve/pump







Coriolis and thermal flow sensors

Microfluidics for cell culture applications

Advantages in tissue engineering and cell culture aplications.

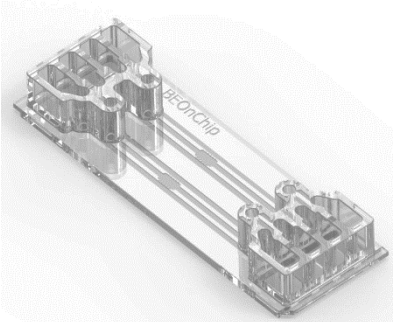
- Reduced size: cost savings, easy storage.
- High parallelization: several experiments in same chip, high-through output screening.
- Reduction of human error: automatization (less human handling).
- Faster response time (micrometric scale): diffusion, changes in pH, temperature, flow.
- Real time monitoring: optical Access, controlled results.
- Stimuli performance: mechanical, chemical, electrical stimulation.

Microfluidics for cell culture applications

Biomimetic environment

Our goal is to make OoC available to everyone

BE-GRADIENT



APPLICATIONS

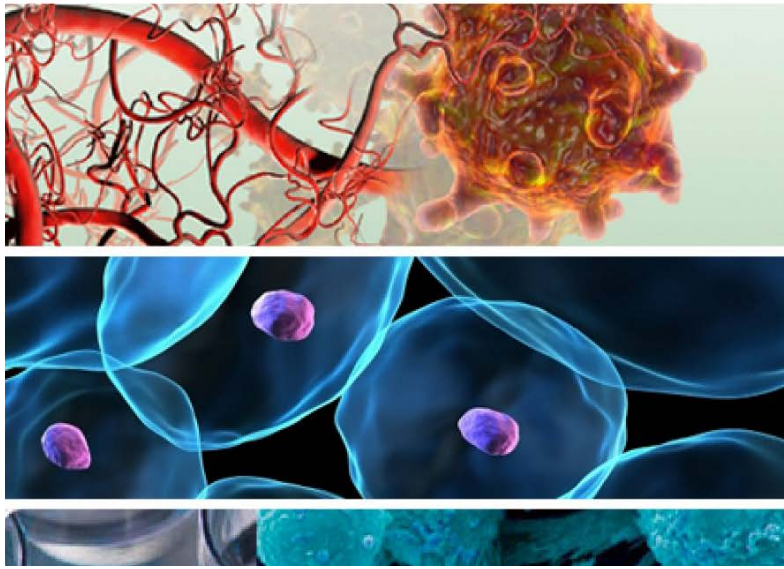
Cell migration

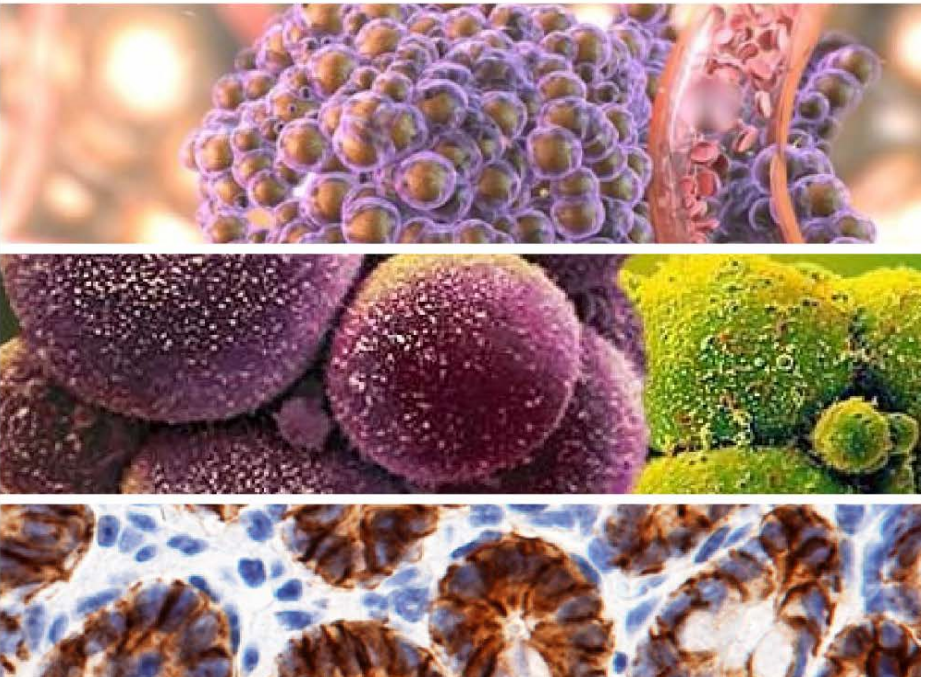
Spheroid substitution

Necrotic core

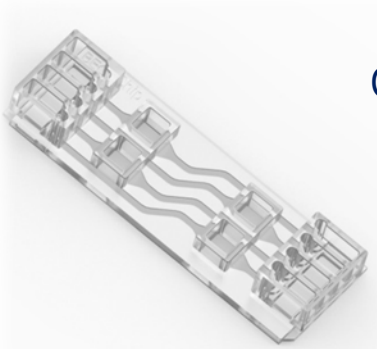
Immune system

Nutrient, O2 and drug gradient





BE-TRANSFLOW



APPLICATIONS

Cancer-metastasis

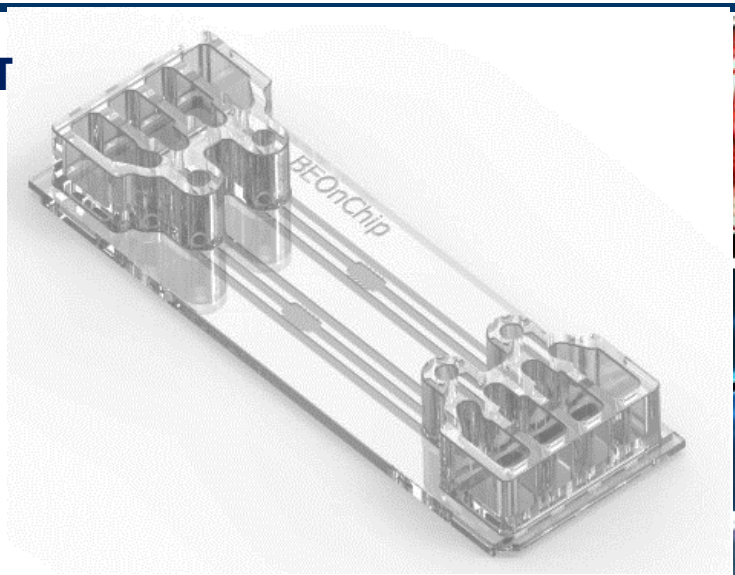
SKIN on chip

GUT on chip

Toxicity testing

Our goal is to make OoC available to everyone

BE-GRADIENT

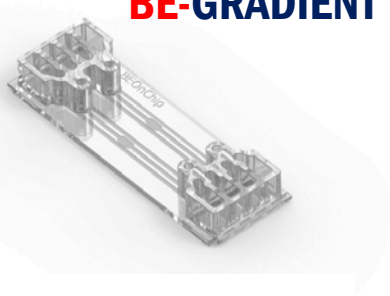


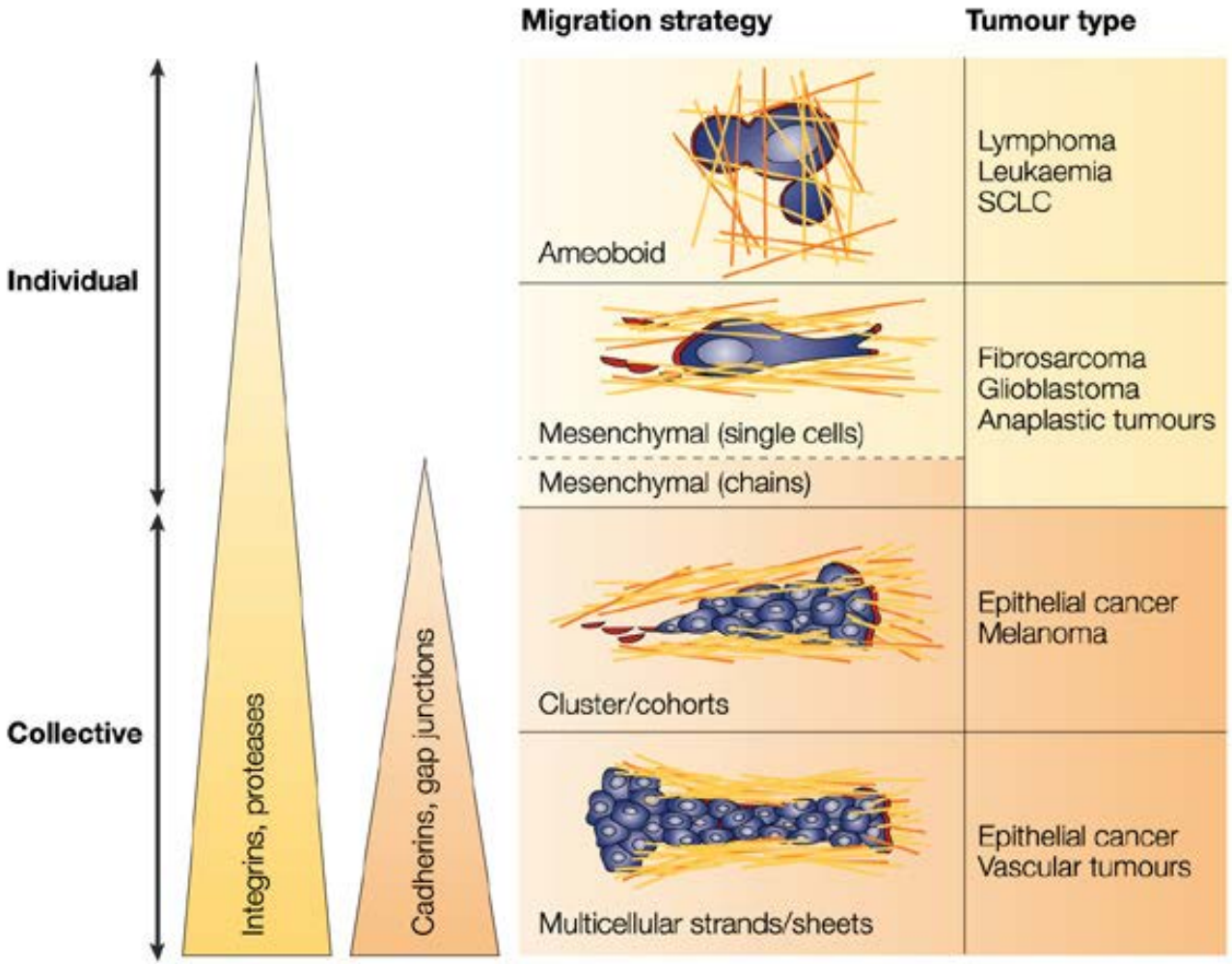
In vitro model of tumours migration in 3D

In vitro model of Glioblastoma based on microfluidics

In vitro model of tumours migration in 3D

BE-GRADIENT





Peter Friedl & Katarina Wolf; Nature Reviews Cancer volume 3, pages 362–374 (2003)

Institute of Cancer Therapeutics

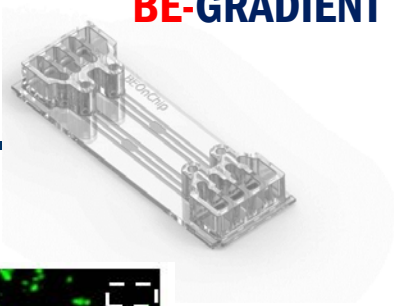
UNIVERSITY OF BRADFORD
MAKING KNOWLEDGE WORK

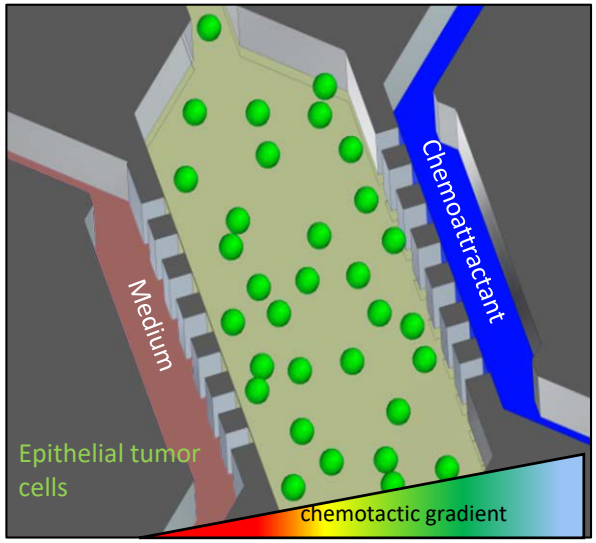
Universidad Zaragoza

Instituto de Investigación Sanitaria Aragón

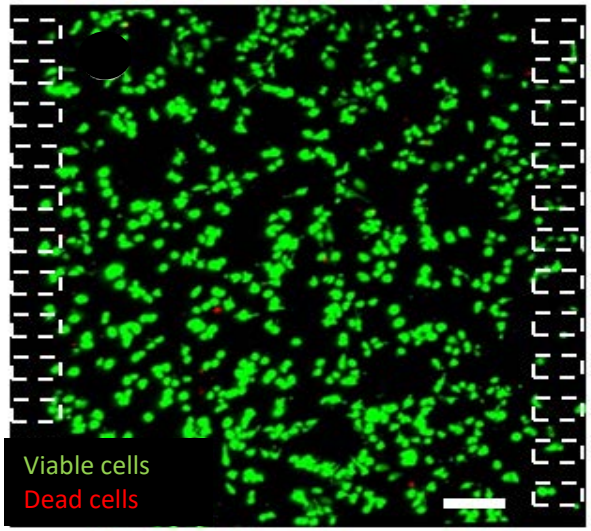
In vitro model of tumours migration in 3D

BE-GRADIENT

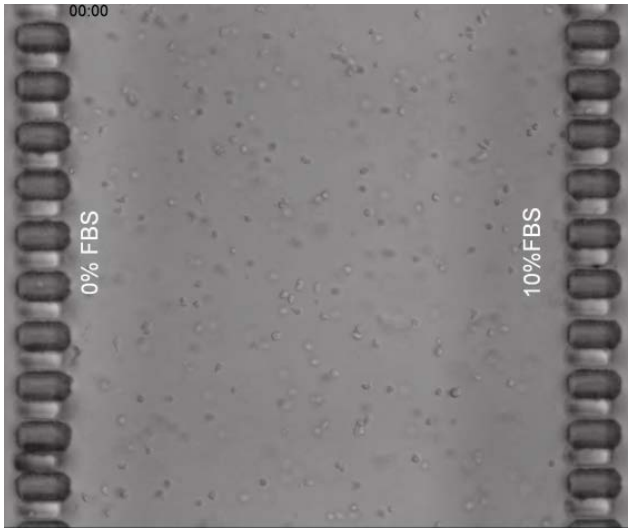


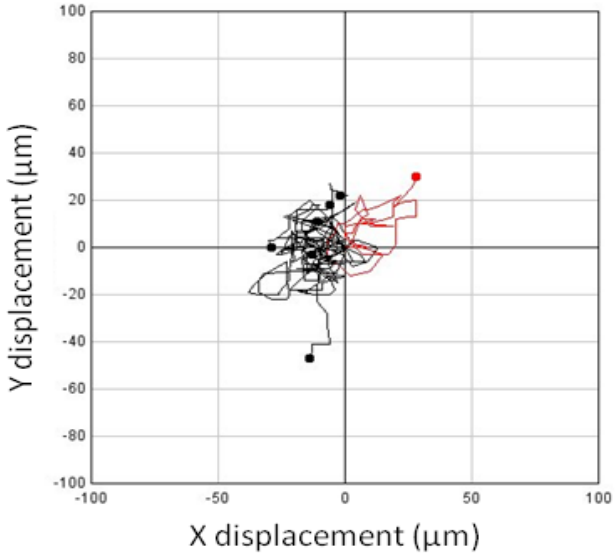


OSC-19 and U-87 cells at 2 millions cells/ml in collagen hydrogel at 1,5 mg/ml.



Cell viability was evaluated, showing viable cells in green and dead ones in red. Scale bar is 200 µm.

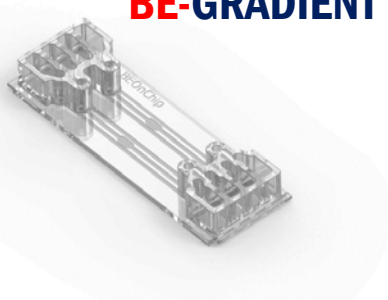




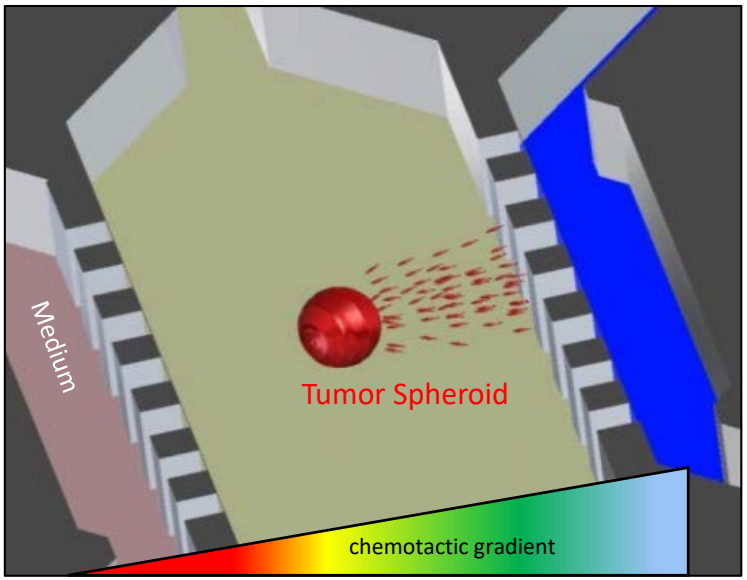
FBS-free medium was perfused through the left lateral microchannel, whereas 10% FBS-containing medium was used on the right lateral microchannel.
Scale bar is 200 µm.

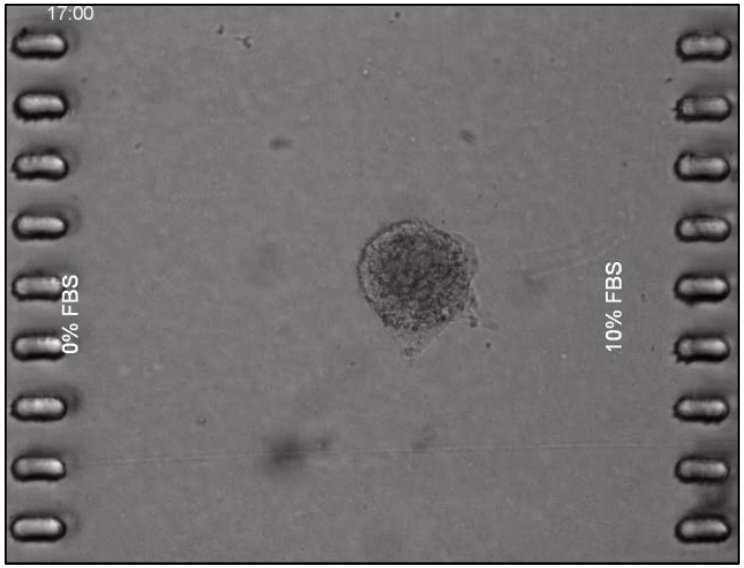
In vitro model of tumours migration in 3D

BE-GRADIENT



Head and Neck (epithelial tumour)

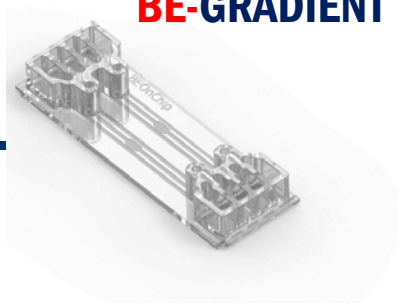




Ayuso JM et al. PLOS. 2015 Oct 7;10(10)

In vitro model of tumours migration in 3D

BE-GRADIENT



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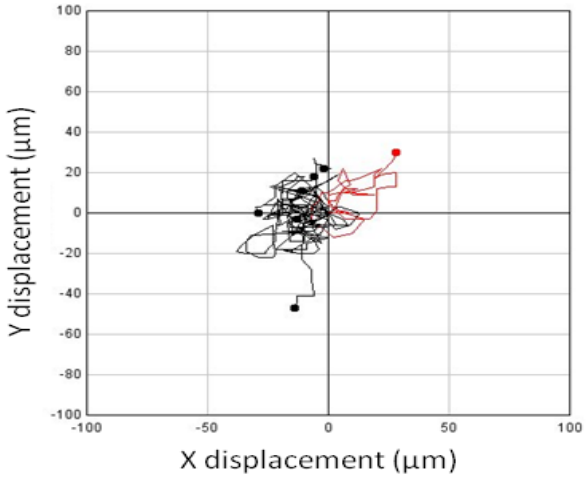
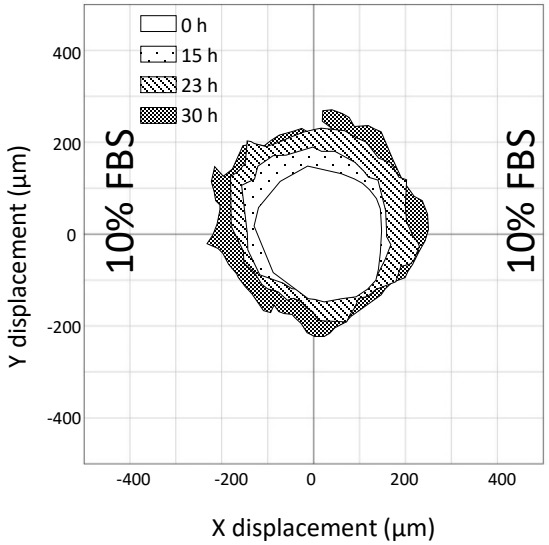
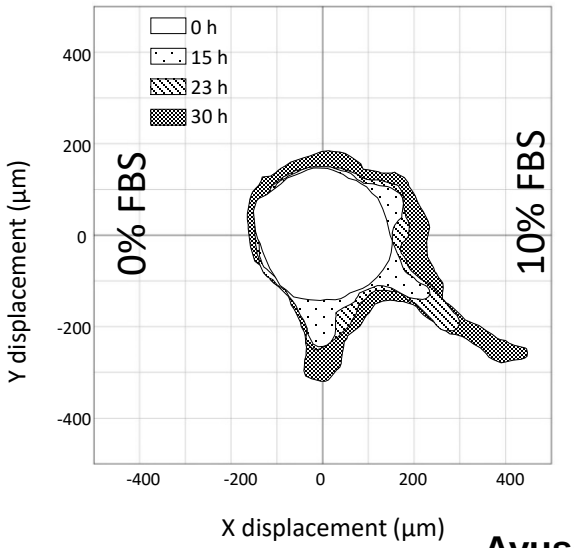
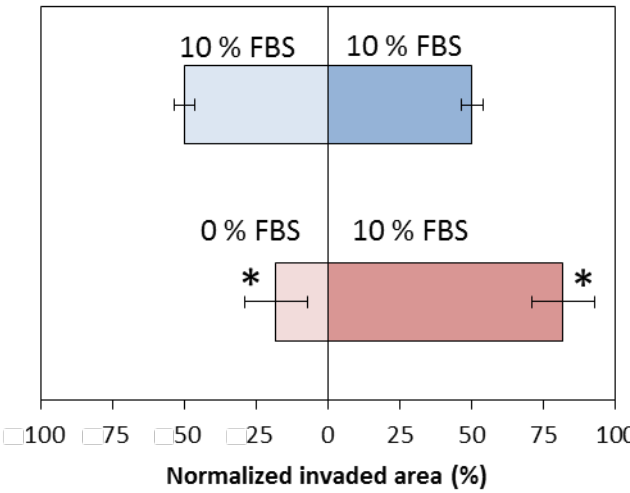






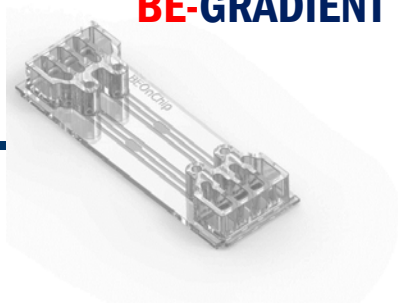
Invasion ratio

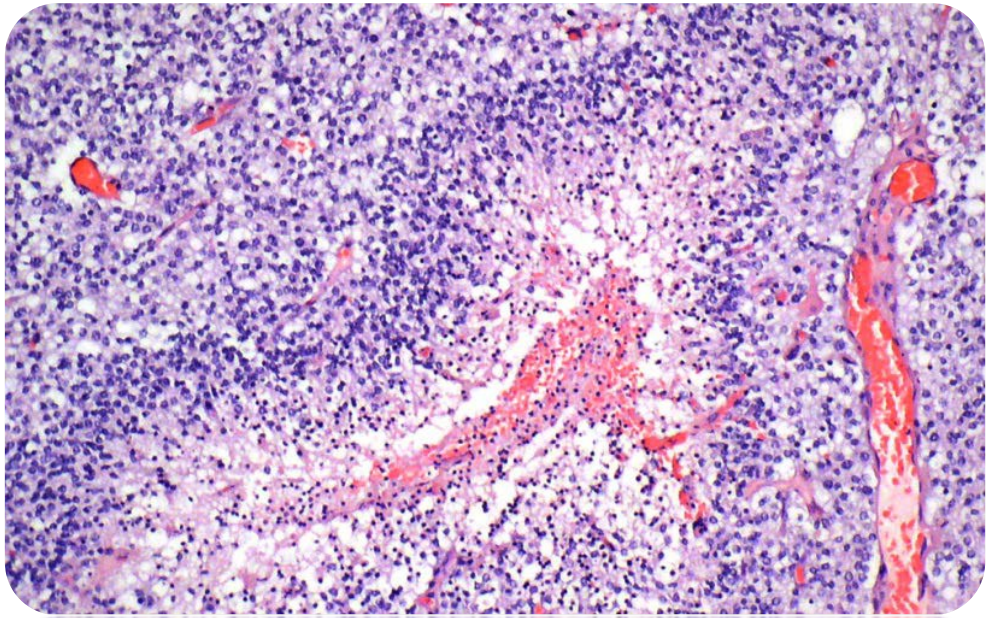


Ayuso JM et al. PLOS. 2015 Oct 7;10(10)

In vitro model of Glioblastoma

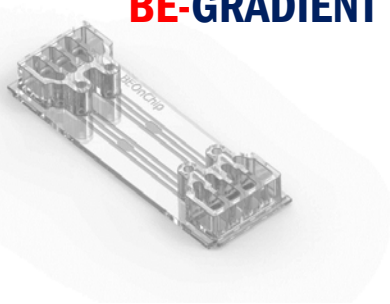
BE-GRADIENT



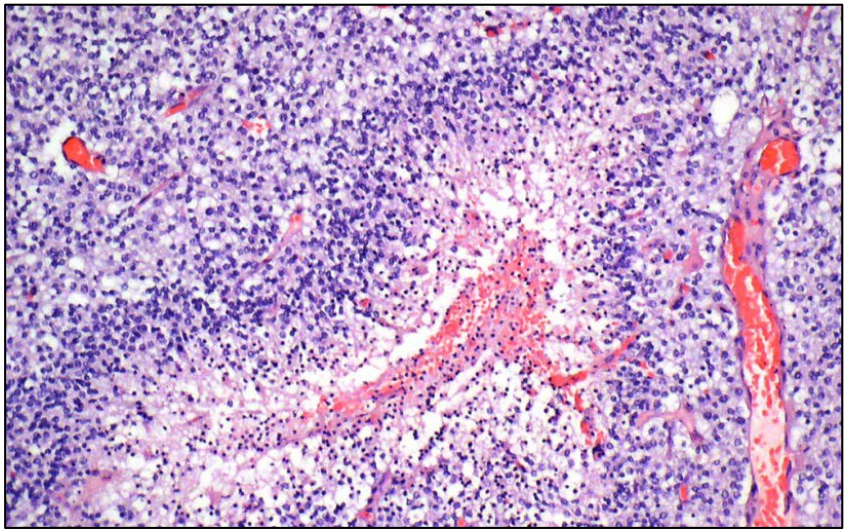


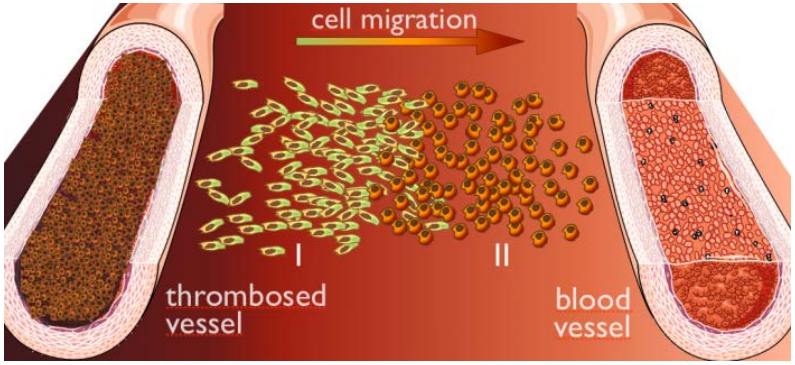
In vitro model of Glioblastoma

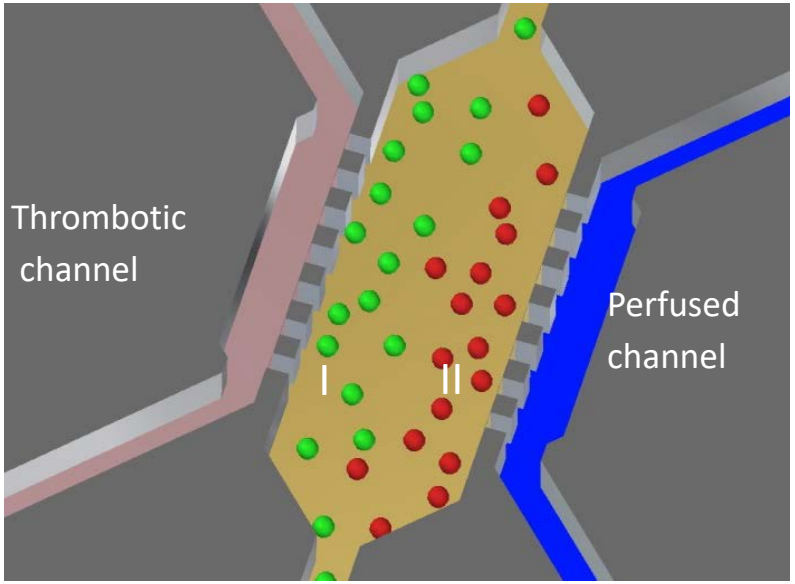
BE-GRADIENT



Vascular-tumour interactions







In vitro model of Glioblastoma

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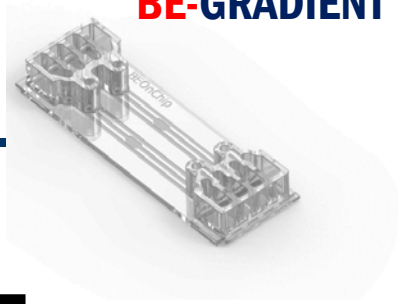
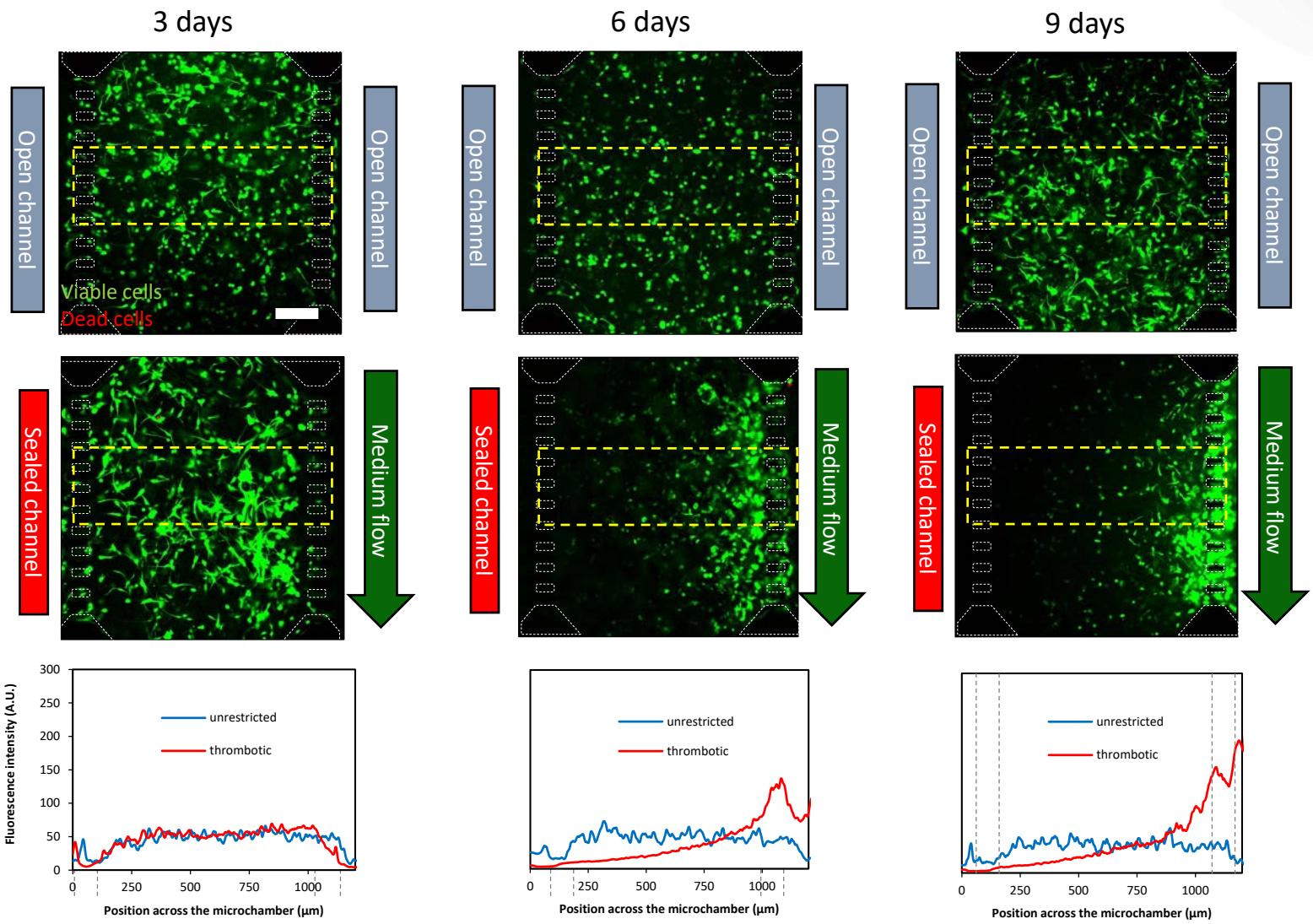
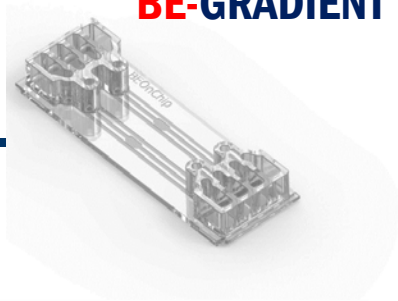


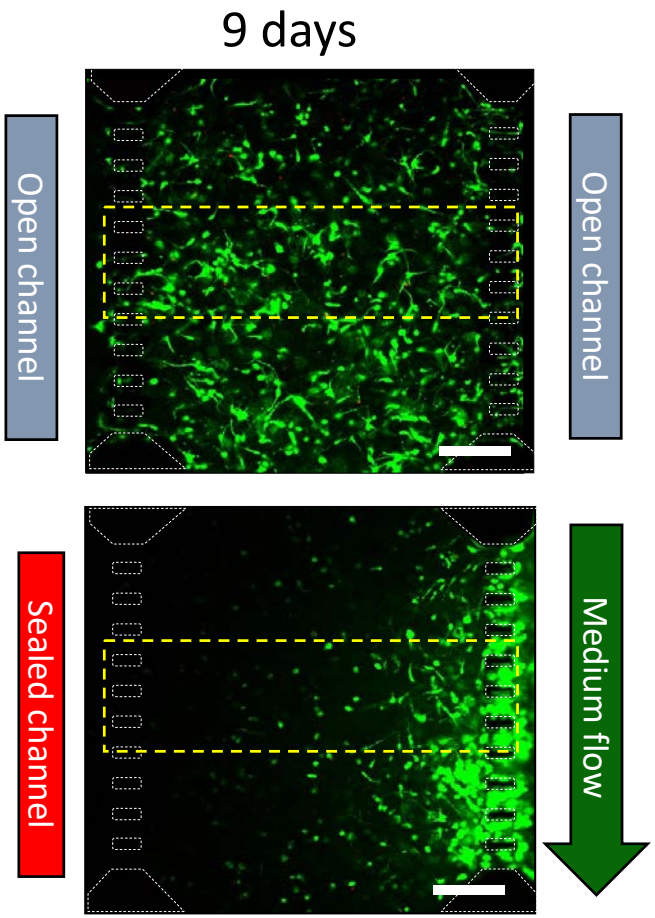


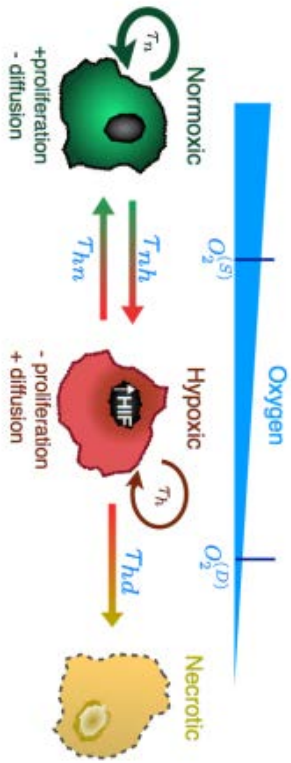
U-251 at 4 millions cells/ml in collagen hydrogel at 1,5 mg/ml. Medium flow was enable only through right microchannel.
Cell viability was assessed using fluorescein diacetate 5 µg/ml (green) and propidium iodide 4 µg/ml (red).
Scale bar is 200 µm.

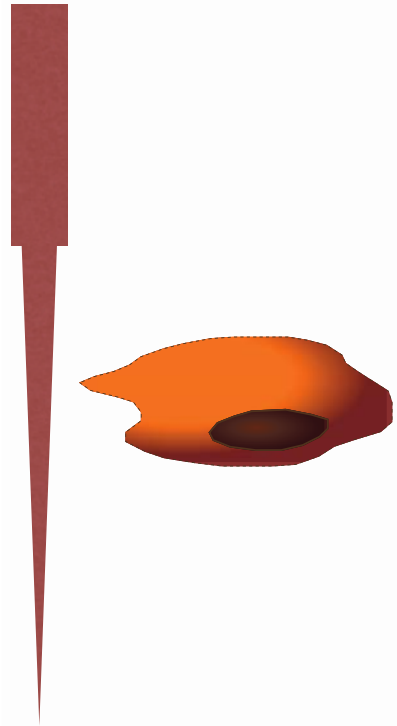
In vitro model of Glioblastoma

BE-GRADIENT







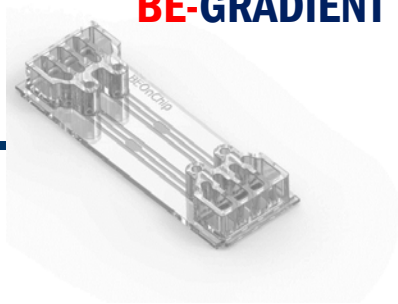


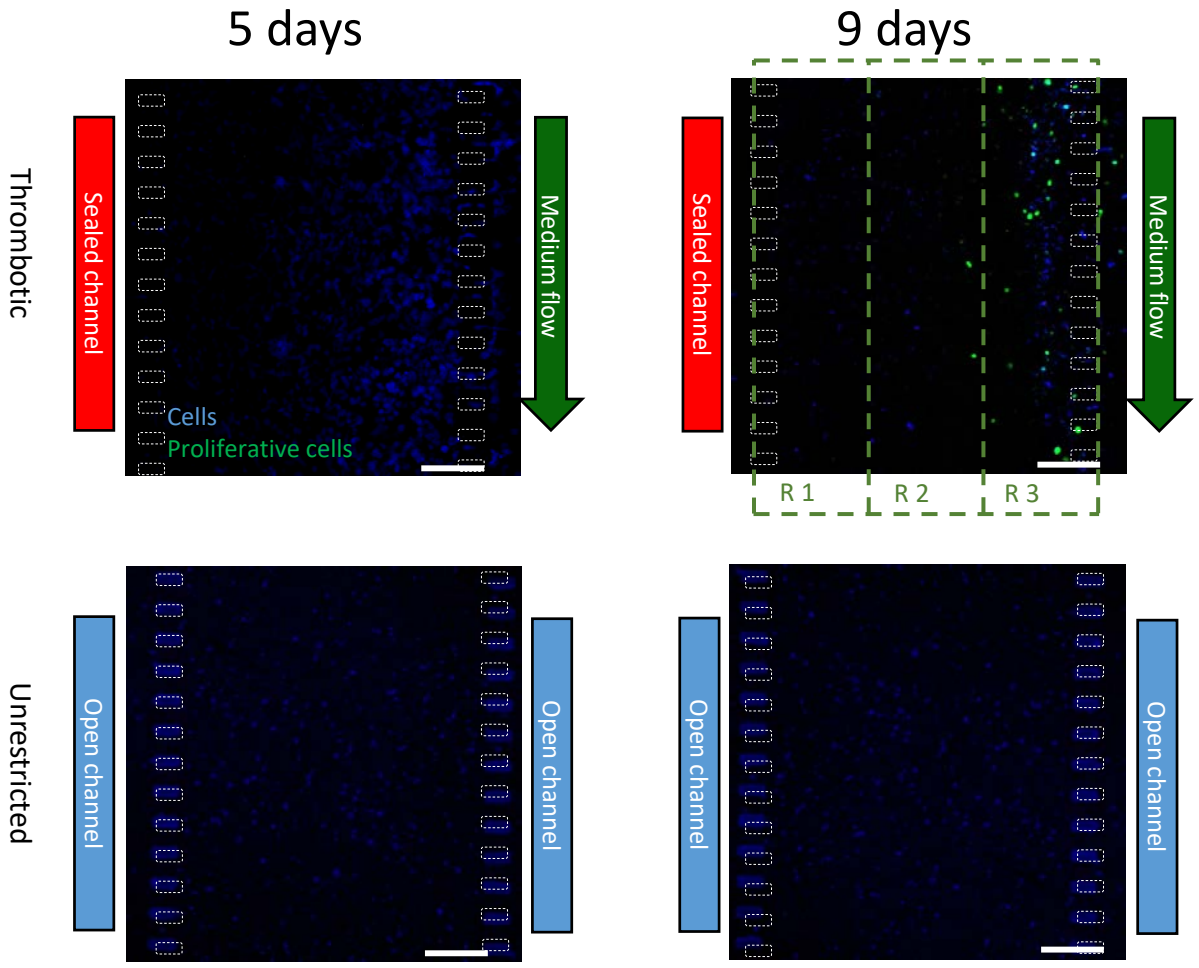
MôLAB
MATHEMATICALONCOLOGYLABORATORY

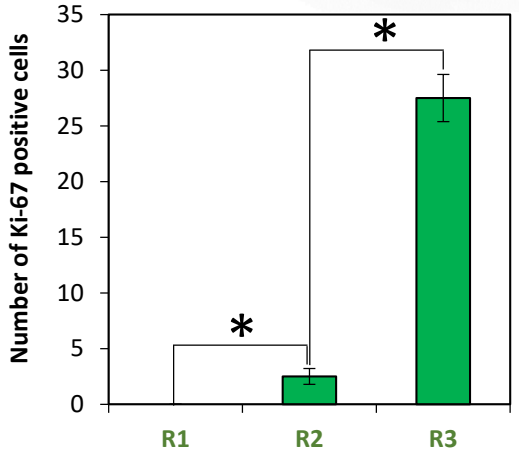
UCLM
UNIVERSIDAD DE CASTILLA-LA MANCHA

In vitro model of Glioblastoma

BE-GRADIENT







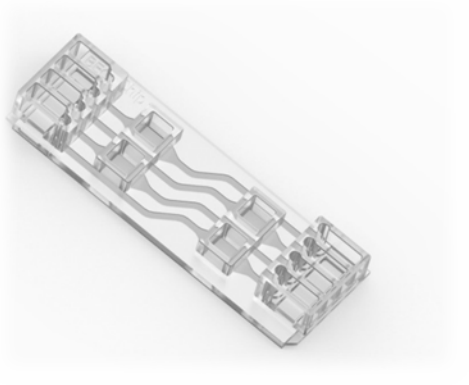
Ki-67 immunofluorescence showing GBM cell proliferation. U-251 MG at 4 millions cells/ml in collagen hydrogel at 1,5 mg/ml. Scale bar is 200 µm.

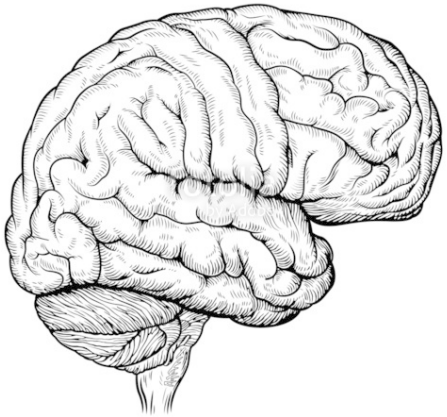
Ayuso JM et al. Neuro-Oncology. 2017

What do we do

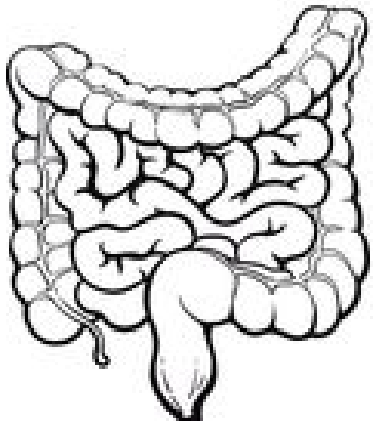
We are validating different organ models in our devices

BE-TRANSFLOW



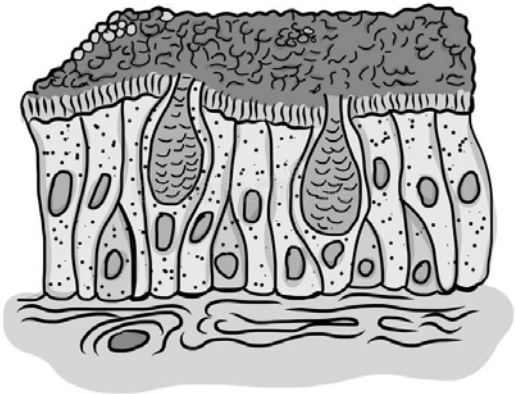


Blood-Brain-Barrier



Gut model

Bone model

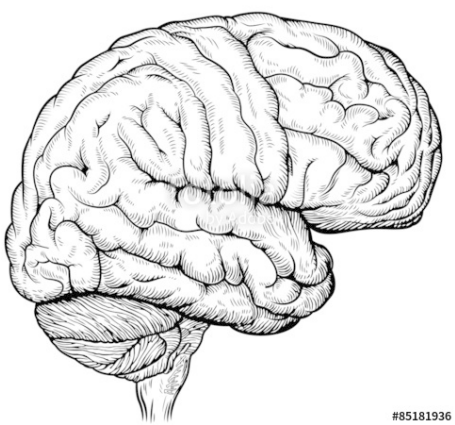


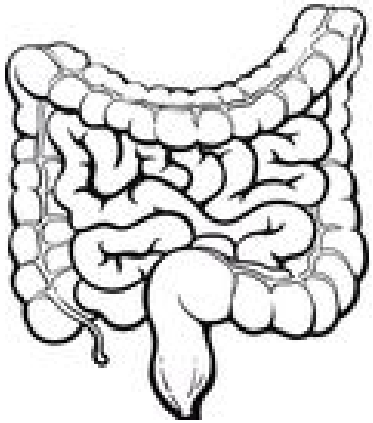
Skin model

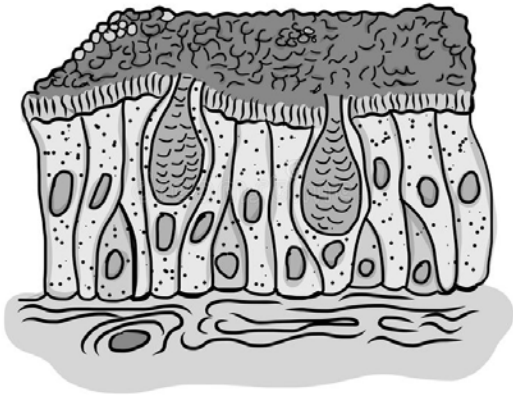
eurostars™

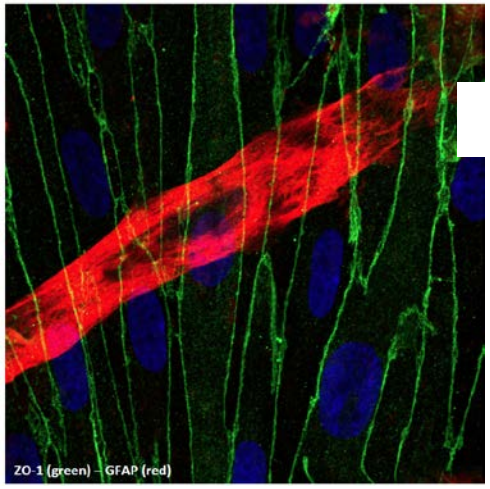
What do we do

We are validating different organ models in our devices

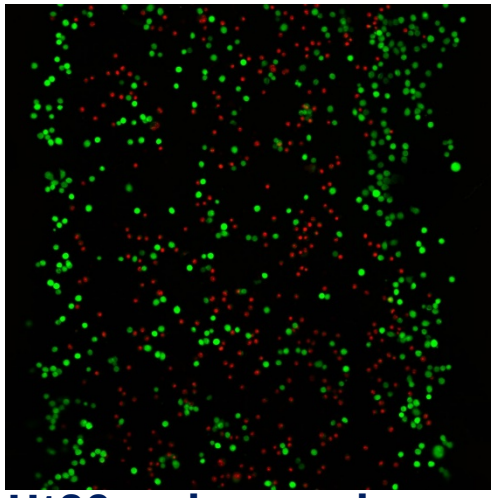




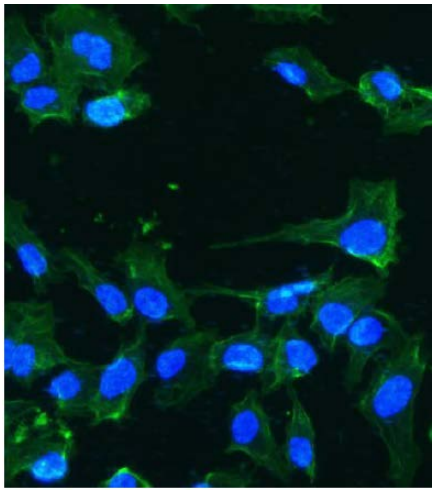




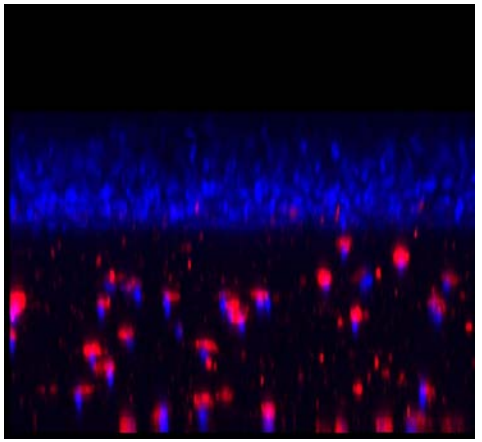
BMEC + astrocytes



Ht29, colon carcinoma



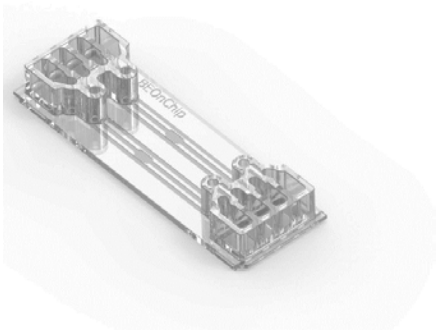
U2OS



Epithelial+HaCaT

Business model

OWN DISTRIBUTION (Device + protocol)



- Europe
- China, Japan
- Central America
- South America

MICROFLUIDIC CONSULTANCY

- **IDEA**
- **DESIGN**
- **PROTOTYPE**
- **VALIDATION**
- **INDUSTRIALIZATION**

PARTNERS

Flow control companies

FLUIGENT
SMART MICROFLUIDICS™

Research Institutions

Instituto de Investigación Sanitaria Aragón

Inserm
La science pour la santé
From science to health

European projects

- H2020-FETOPEN-2018-2020Advanced and versatile PRInting platform for the next generation of active Microfluidic dEvices- PRIME
- BEONCHIP is leading a EUROSTARS project (BONAFIDE E!10530, EU). Project leaders. 1,647,240.15 €, 36 months
- SME Instrument phase I (H2020-SMEInst_762315_B-On-Chip, EU) 50.000€
- CISTEM (MSCA H2020 RISE, Project number: 778354). 364.500€, 48 months
- At the national level, BEONCHIP is participating in a RETOS project (PRENOMON, Spanish Government). 691.482,27€, 48 months

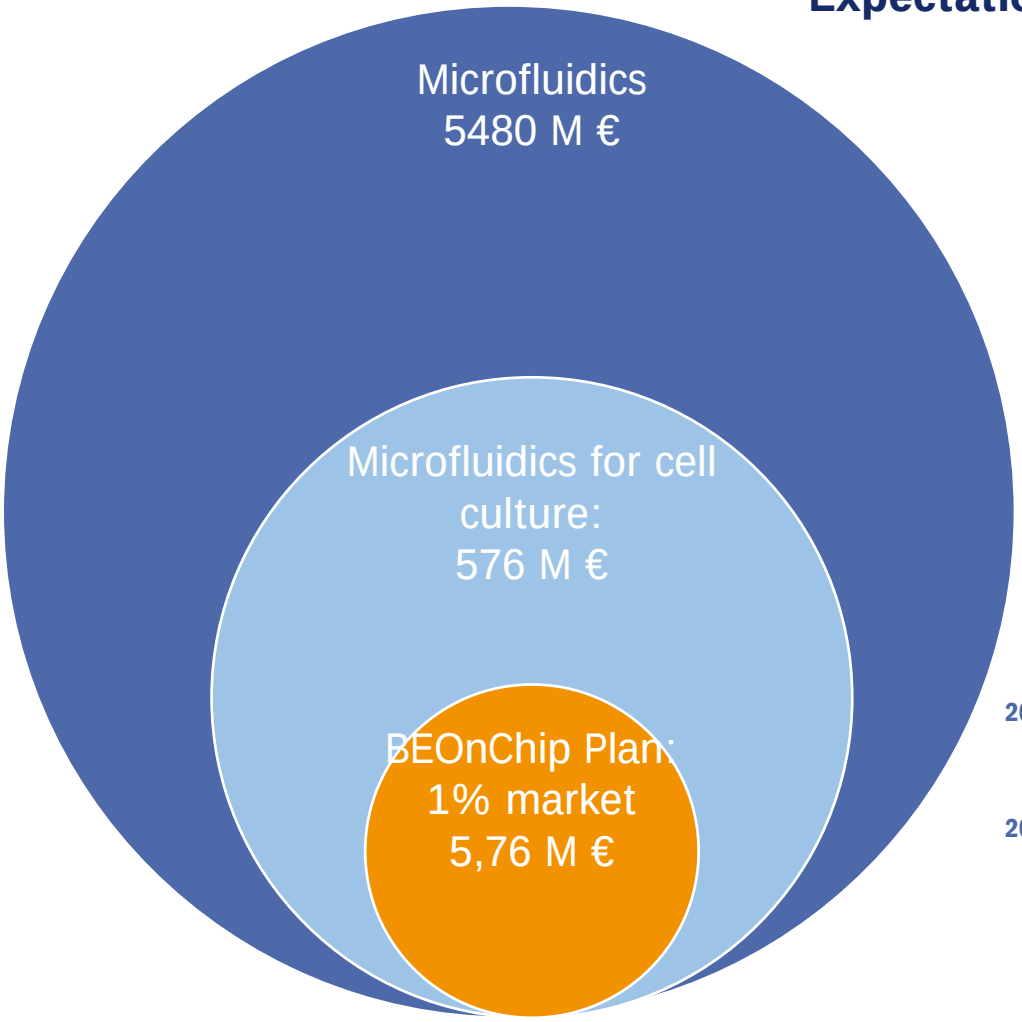
eurostars™

HORIZON 2020

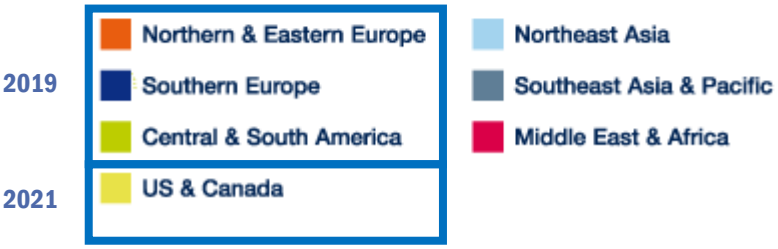
Competition

		micronit MICROFLUIDICS	MIMETAS the organ-on-a-chip company		ibidi cells in focus
Easy to use					
biomimetic environment					
range of products					
services					

OoC is an emerging market with a huge potential

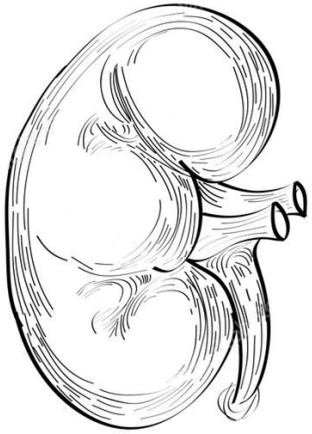


Expectations 2021 ↑ 20 %

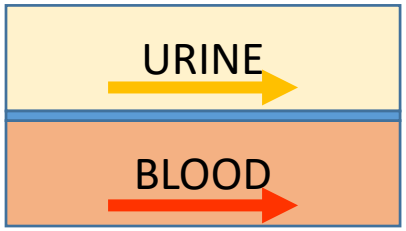


What's next? 2019

New devices and models



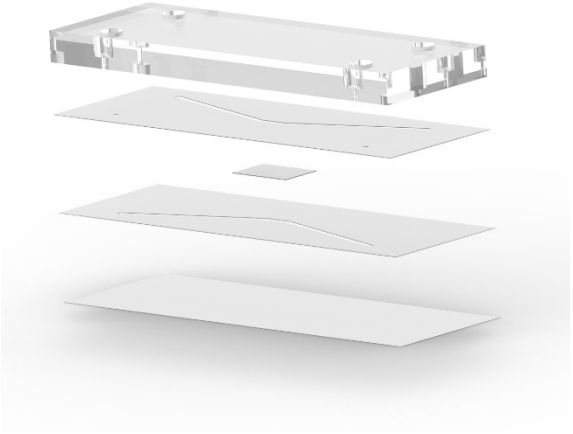
Kidney-on-a-chip

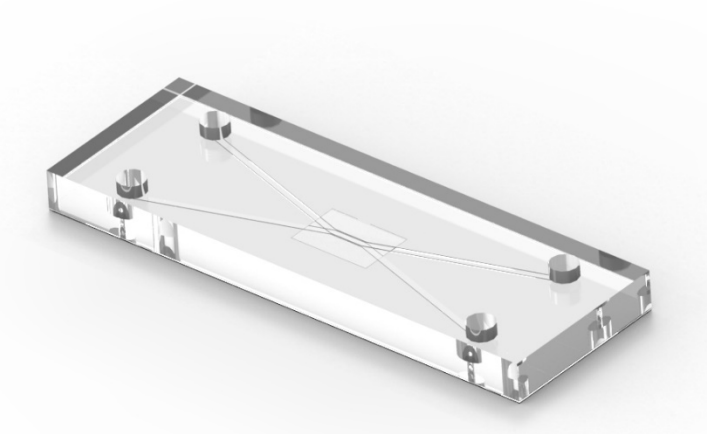


Channel

Porous membrane

Channel





What’s next? 2019

BE-TRANSFLOW FAMILY

Black material:
improving microscopy analysis

Custom porous membrane:
pore size, material

What's next? 2020

BE-ROCKER

Novel design of a rocker device for the laboratory.

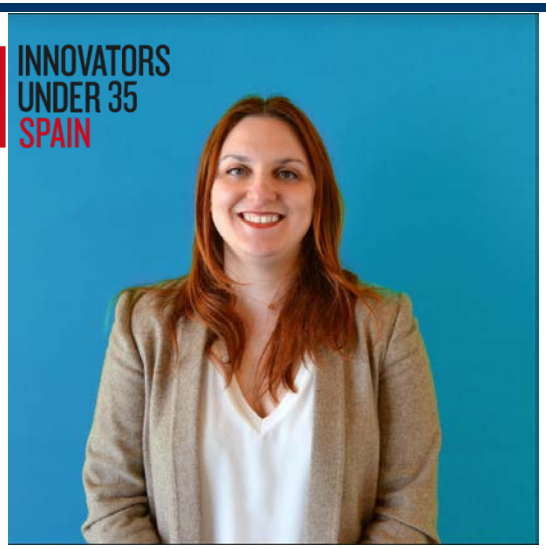
Its **compact design** and material selection **allow** its introduction in **cell culture incubators** in conditions of **saturated humidity**.

The device is equipped with a **high precision silent rotor**.

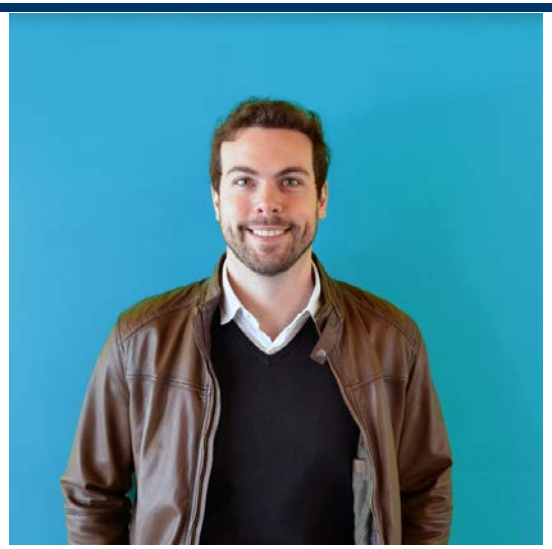
The dimensions of the device are: 295x255x185 mm.

Connection to computer via **USB**.

Working team



Dr. Rosa Monge
CEO



Dr. Luis E. Serrano
Head of sales

Sara Aldea
Head of product

Lara Pancorbo
R&D technician

Sandra González
Biologist technician

Working team

Collaborators

Bea Cativiela

Javi Henriques-Gil

Raquel Naranjo

Ruth Sánchez

Advisory board

Dr. Manuel Doblaré

Dr. Ignacio Ochoa

Dr. Luis J. Fernández

BEOnChip

Biomimetic Environment On Chip

X Jornada REMA, Madrid 12/12/2019