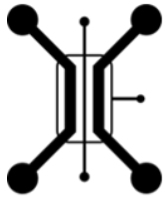
MiMic Lab

Microfluidics and biomimetic Microsystems

www.biomech.polimi.it/mimiclab

Prof. Marco Rasponi
Prof. Paola Occhetta



MiMiC Lab

Per informazioni, contattare:
Marco Rasponi (marco.rasponi@polimi.it)
Paola Occhetta (paola.occhetta@polimi.it)

MiMic Lab Team

Senior Scientists

Marco Rasponi

Paola Occhetta

Experienced researchers

Mattia Ballerini

Cecilia Palma

Affiliates

Roberta Visone
(BiomimX)

Erika Ferrari
(BiomimX)

Andrea Mainardi
(Uni Basel)

Early-stage researchers (PhD students)

Alessandro Cordiale

Elisa Monti

Karol Kugiejko

Giacomo Cretti

Rodrigo Torres

Ferran Lozano

Teresa Lucifora

Alessandro Cacioppo

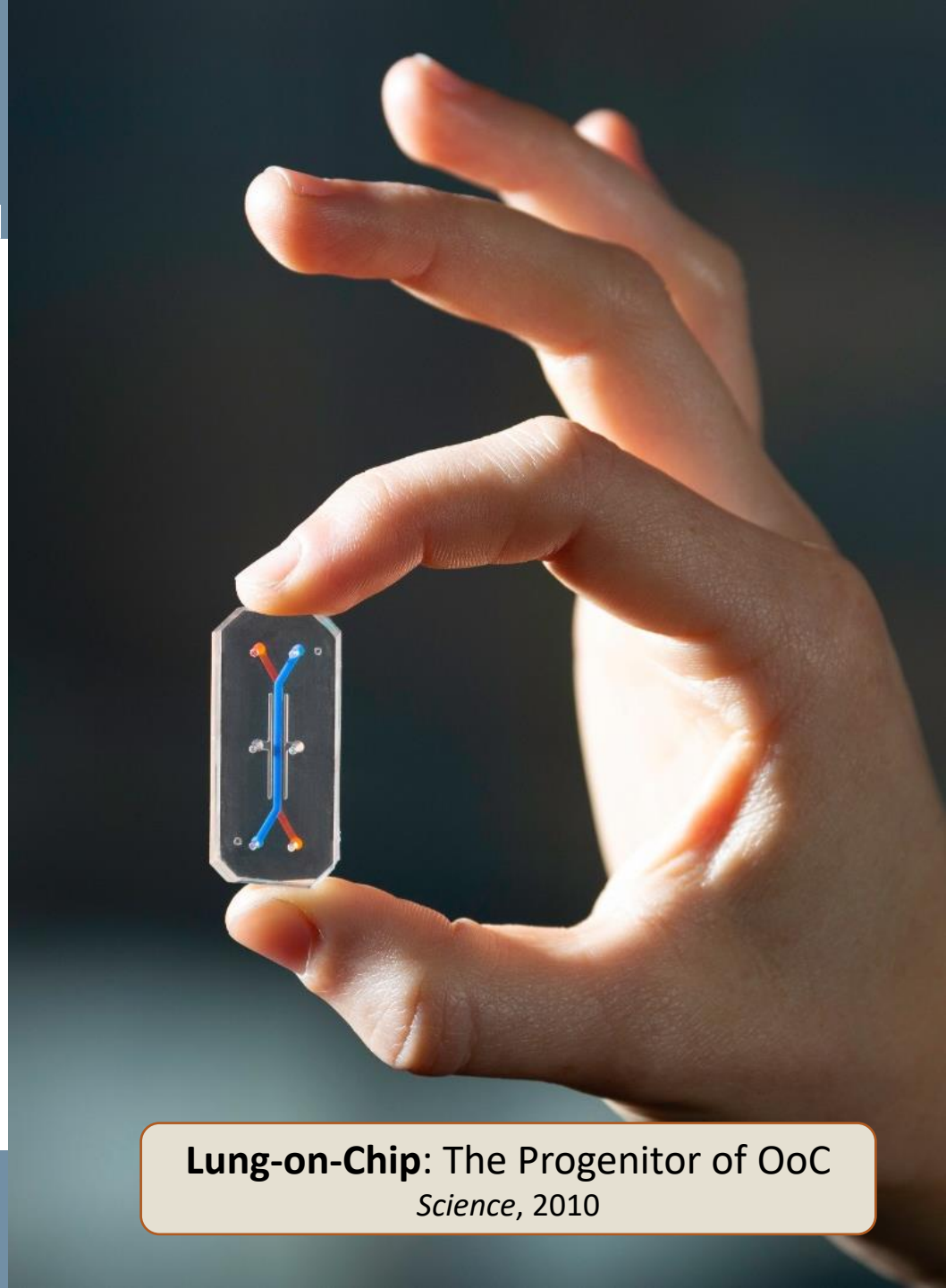
Bianca Aterini

Organs-on-Chip

Pseudo-definition
An Organ-on-Chip (Ooc) refers to a population of **tissue cells** in a "smart" microenvironment (**chip**). The goal of an organ-on-chip *"is not to build a whole living organ but rather to synthesize minimal functional units that recapitulate tissue- and organ level functions"* (Don Ingber).

Applications
Understanding mechanisms of pathologies
Drug discovery
Development of advanced therapies
Precision medicine

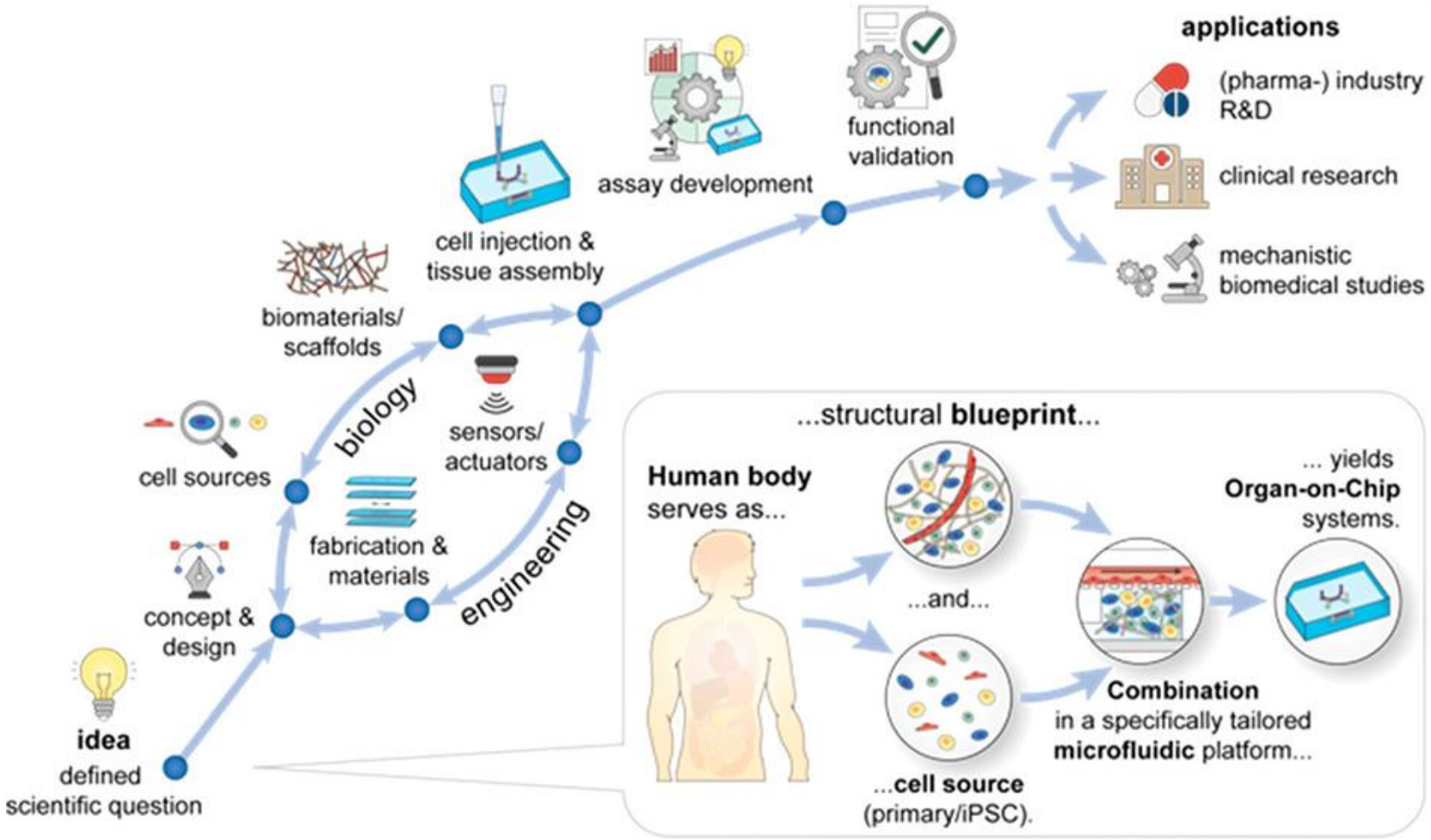
Reduction of animal use in research



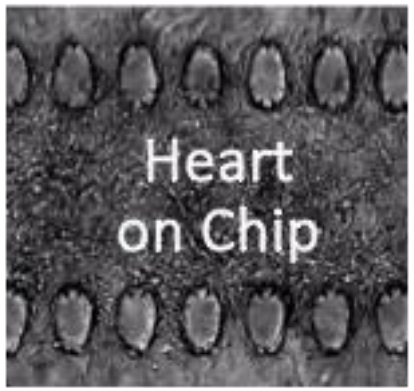
Lung-on-Chip: The Progenitor of OoC
Science, 2010

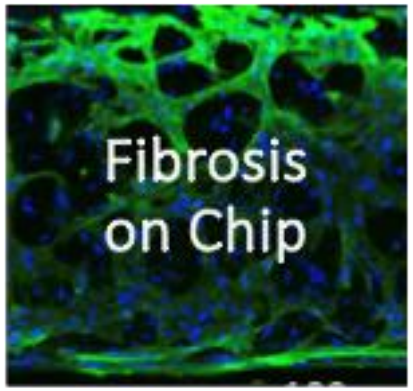
Organs-on-Chip roadmap

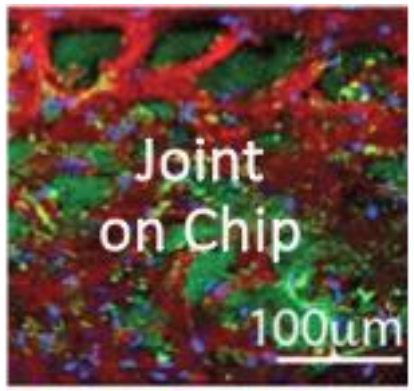
Rogal et al., ACS Biomater. Sci. Eng. 2022, 8, 4643−4647

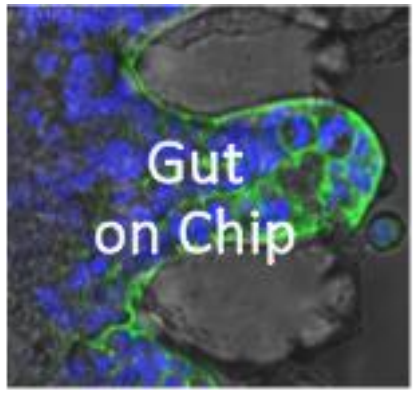


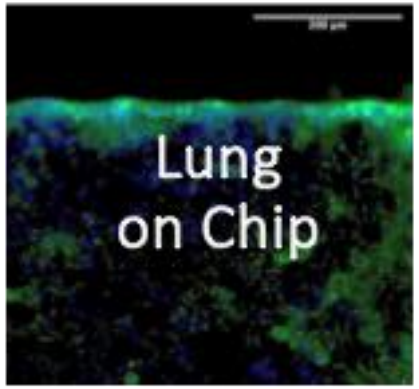
Organs-on-Chip in MiMic Lab

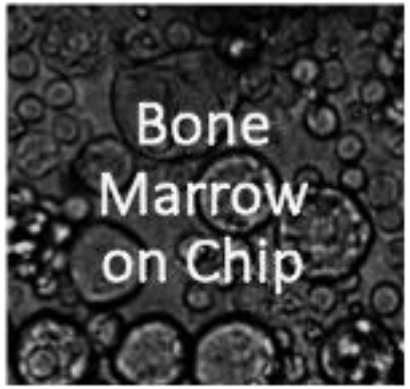


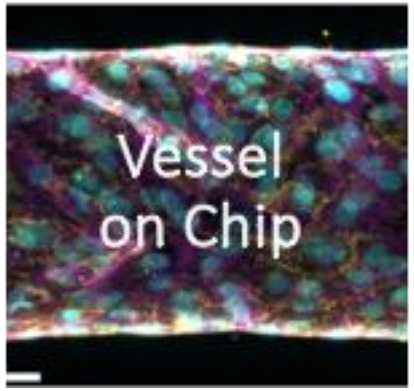


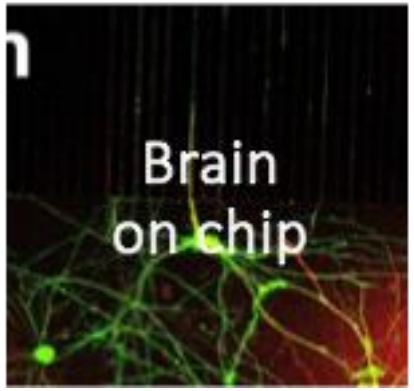




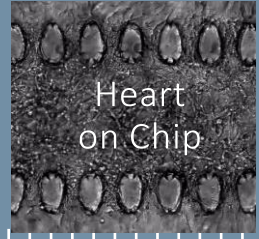




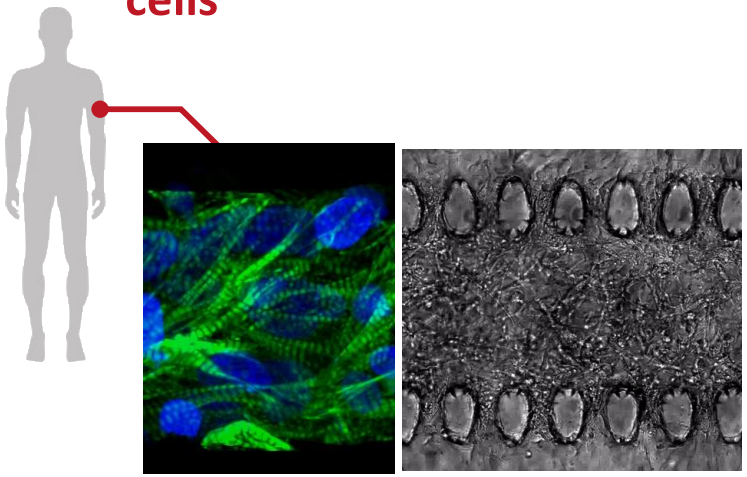




Example 1: heart-on-chip



Human cells



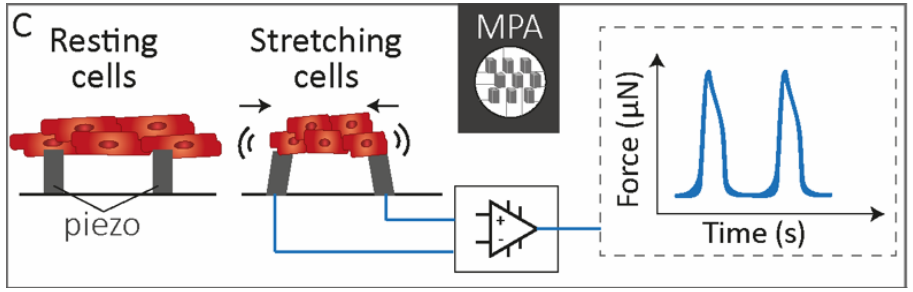
BiomimX THE BEATING ORGANS-ON-CHIP · HUMANITAS RESEARCH HOSPITAL · FNUSA ICRC

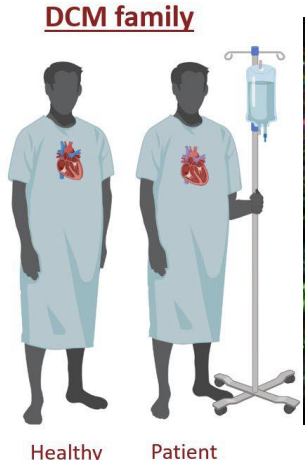
Output

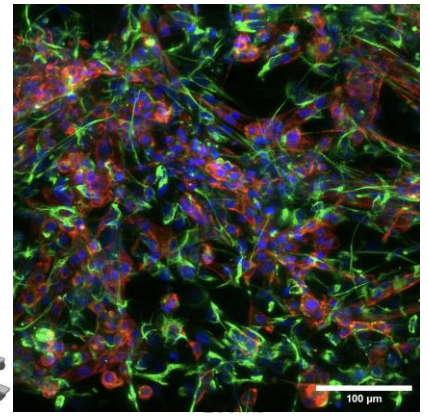
- Physiological model for drug screening (cardiotoxicity)
- Disease models (laminopathies, dilated cardiomyopathy)

- Commercially available healthy iPSC-derived cardiomyocytes
- iPSC-derived cardiomyocytes from patients with genetic mutations

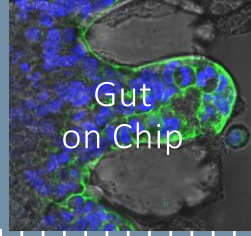
Sensors' integration and AI algorithms for data analysis





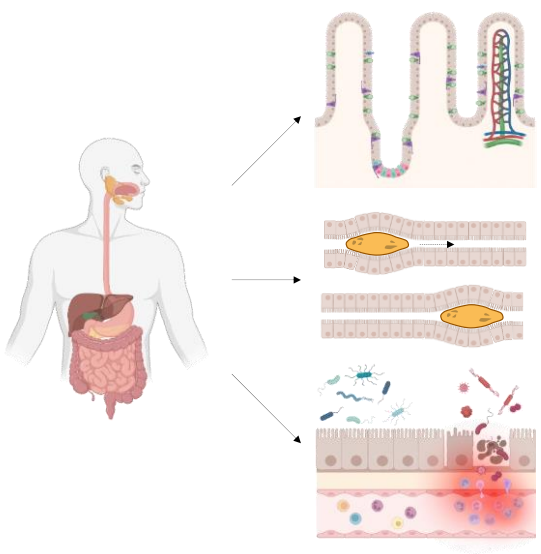


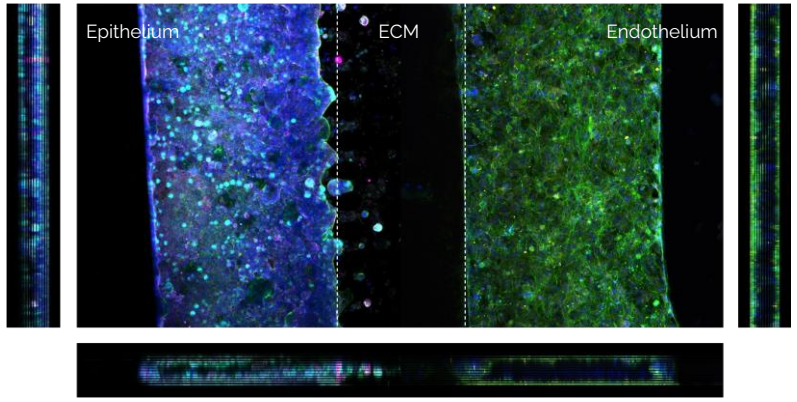
Example 2: Gut on chip



IEO
Istituto Europeo
di Oncologia

Mechanically active 3D gut on chip model



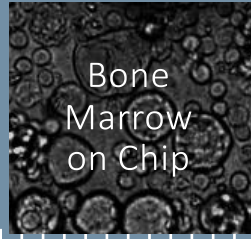


PATH 1:
Testing of immunotherapies on- and off-target effects (through integration in multi-organs on chip)

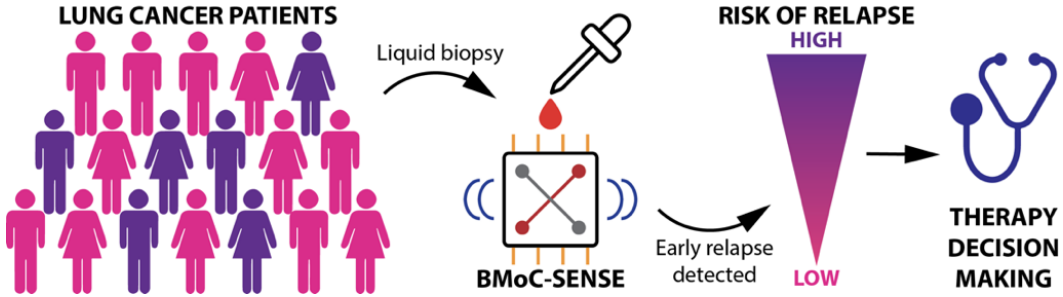
PATH 2:
Modelling gut-related disorders (e.g. IBD)

PATH 3:
Screening drug absorption and integration of online readouts (e.g. TEER)

Example 3: bone marrow on chip

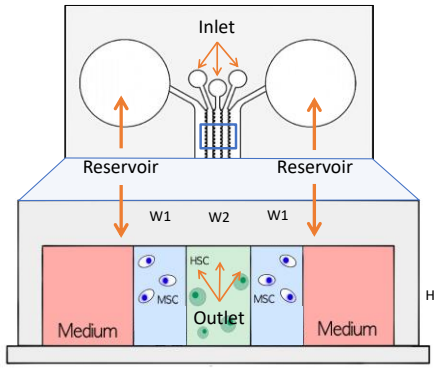


Clinical need: development of an organ on chip based-sensor for early detection of tumor relapse



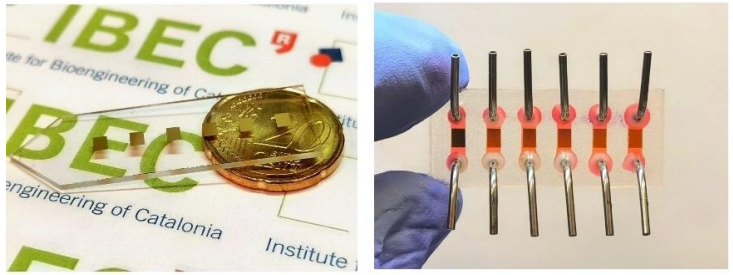
FONDAZIONE IRCCS ISTITUTO NAZIONALE DEI TUMORI

STEP1 - New chip design
recapitulating bone marrow niche

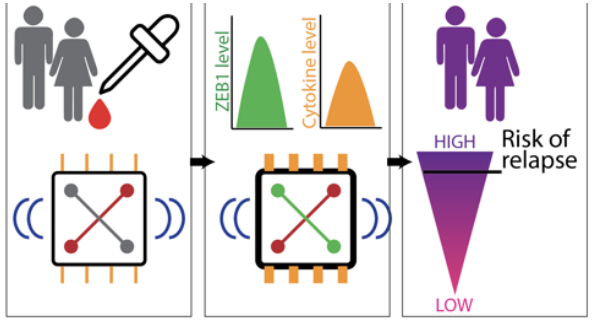


LUNDS UNIVERSITET

STEP2- Online sensors
to detect niche changes



STEP3- Clinical validation
chip data correlated with patient prognosis



Active Collaborations

Italy:

- BioCell (gene delivery/report cell lines)
  Prof. Gabriele Candiani
- IRCCS Galeazzi (joint, tumor)
  Dr. Matteo Moretti, Dr. Silvia Lopa
- IRCCS Humanitas Hospital
  Dr. Elisa Di Pasquale (heart)
  Dr. Ana Lleo De Naldo (liver/tumor)
  Dr. Simona Lodato (Brain)
- Istituto Europeo Oncologia
  Dr. Luigi Nezi (Gut)
  Dr. Camilla Cerutti (tumor)
- San Raffaele Hospital (Brain circuits)
  Prof. Vania Broccoli
- Politecnico di Torino (Cardiac fibrosis)
  Prof. Valeria Chiono
- IRCCS Istutito Nazionale dei Tumori (Bone Marrow)
  Dott. Sabina Stangaletti
- Human Technopole (Brain)
  Dott. Elena Taverna
- Università di Parma (Heart)
  Dott. Michele Miragoli
- Università Roma Torvergata (heart/AI)
  Prof. Eugenio Martinelli
- Campus Biomedico Roma/CNR Nanotec Lecce (imaging/gut)
  Prof. Alberto Rainer

Abroad:

- University Hospital Basel (joint)
  Prof. Ivan Martin
  Prof. Andrea Barbero
- King's College London (cardiac/other)
  Dr. Giancarlo Forte
- Imperial College London (gut/vessel)
  Prof. Anna Randi
- Houston Methodist Research Institute
  Dr. Francesca Taraballi (joint)
- NMI (U Tubingen) (cardiac)
  Dr. Udo Kraushaar
- Lund University (bone marrow)
  Prof. Paul Bourgine
- Institute for Bioengineering of Catalonia
  Prof. Javier Ramon (sensors)

Per informazioni, contattare:
Marco Rasponi (marco.rasponi@polimi.it) - Tel. 3377