

# Les « Organoïdes » dans le Master 1 BME Paris

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Les Rencontres du **GDR**  
**Organoïdes**

Mathéa PIETRI

Vendredi 2 Décembre 2022

# Master BME Paris



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A unique partnership  
between Health and Engineering Sciences



Leading institutions in their respective fields

# BME Paris in Numbers

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More than **100** students graduating every year



More than **1000** alumni since 2010

**50 nationalities** represented since the creation of the Master



**50%** of the BME graduates continue their education with a **PhD**



About **10%** of the **medical students** continue their education with a **PhD**



About **3%** of the **engineering students** continue their education in **medical school**



# Master BME Paris- Organization



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A two-year Master's program addressing strategic issues in Biomedical Engineering

**M1**

Interdisciplinary courses and training

**M2**

**BIN**

*Bioengineering  
& Innovation  
in Neuroscience*

**BIM**

*Bioimaging*

**BioMAT**

*Biomaterials*

**BioMECH**

*Biomechanics*

**MCB**

*Molecular  
Cellular  
Biotherapies*

Objectives:

Provide students with the tools and skills to address the challenges in Bioengineering

# Master 1- BME Paris

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## Objective

To strengthen and broaden students' capacities in specific engineering and biomedical subjects

One full year to learn fundamental and practical concepts that are required to obtain an interdisciplinary core before following a specific track of the M2.

- an **integration week**
- a **Scientific thinking module**
  - Scientific communication
  - Medicine and Science
  - Open Your Mind seminars
  - Culture and language
- Courses are proposed at **two levels**, basic or advanced, to fill-in gaps in individual students' capacities in a wide spectrum of fundamental science subjects.

# Master 1 – Semester 1 courses

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## Proposed M1 track for “Biologists”

Semester = 30 ECTS

*Compulsory courses:*

- Scientific thinking module (6 ECTS)
- A mathematical introduction to data analysis (basic) (4 ECTS)
- Computer Programming with JAVA and Python (basic) (4 ECTS)
- BioMedical modeling with Matlab (basic) (4 ECTS)
- From molecular to cellular and tissue biology (advanced) (4 ECTS)

*Two elective courses among:*

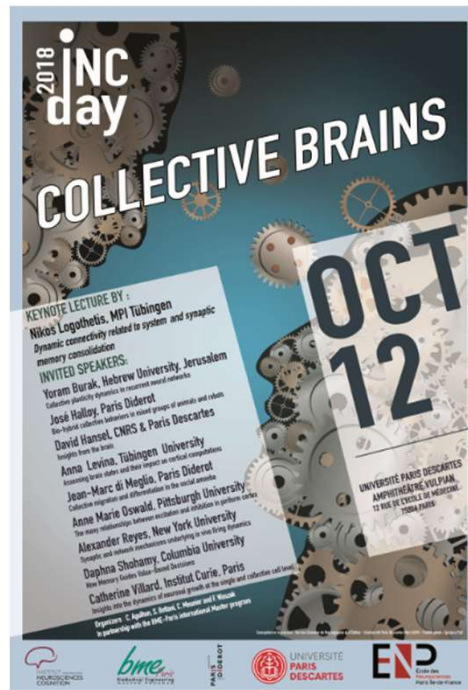
- Mechanics I: Basics in non-deformable solid mechanics (basic) (4 ECTS)
- Physics for BioImaging I (basic) (4 ECTS)
- Chemical Engineering of nanoparticles for therapy and diagnostic (advanced) (4 ECTS)

# UE Medecine & sciences

## Content:

Several aspects of modern research through participation to scientific symposium and article analysis

## Scientific symposium examples;



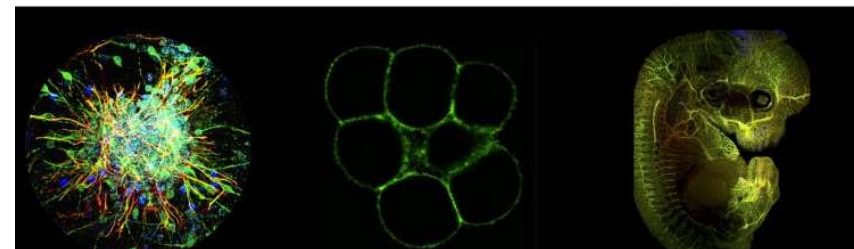
[INC Day 2020 :](#)  
The embodied Brain



November 16-17th, 2020

## **From cells to embryo** Patterning and Self-Organization

Gene regulation and Epigenetics - Patterning and Cell fate specification  
Mechanobiology and morphogenesis



[ITMO BCDE 2020 :](#)  
From cells to embryo

# Master 1 – Semester 2 courses

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The second semester is mainly devoted to complementary and experimental skills:

- Ethics and Patents 3 ECTS
- Scientific writing 3 ECTS

- |         |                             |
|---------|-----------------------------|
| 8 weeks | • Internship 12 ECTS        |
| 8 weeks | • BioFabLab project 12 ECTS |

- Two periods:
- ① February-March
  - ② April-May



# UE Ethics and Research Integrity



## Programme 16-19 janvier 2023

Monday, January 16:

### BIOETHICS FUNDAMENTAL

13:45 – 14:00 *Presentation of the programme. Claude Forest & Jacques Haiech*

14:00 – 17:00 *Evil thinking: thinking against morality. Eva Segura*

Tuesday, January 17:

### ETHICAL ISSUES in TECHNOLOGY

9:00 – 11:00 *Organoids and ethical issues. Jacques Haiech*

11:00 – 12:00 *Artificial Intelligence and ethical issues. Jacques Haiech*

### SCIENTIFIC ETHICS and RESEARCH INTEGRITY (Part 1)

14:00 – 16:30 *Scientific integrity: from its definition to the consequences of its breaches. Claude Forest*

17:00 – 18:30 *Science quality. Philippe Beaune*

Wednesday, January 18:

### MEDICAL and VETERINARY ETHICS

9:00 – 12:00 *Introduction to veterinary ethics and animal research. Geneviève Marignac*

14:00 – 17:00 *Introduction to medical ethics and human research. Côme Bommier*

Thursday, January 19:

### SCIENTIFIC ETHICS and RESEARCH INTEGRITY (Part 2)

9:00 – 12:00 *Virus and research. François Graner*

Part I - Should we stop scientific research?

Part II - Preventing fraud, preventing risky research: Why? How?

Discussion & Conclusion. Claude Forest & Jacques Haiech

+ 2 séminaires ?  
Février & Mars

Raja Chatilla  
Boris Barbour  
Alexei Grimbaum  
Nathand Peiffer-Smadja

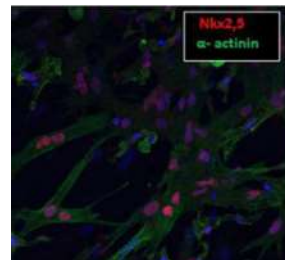
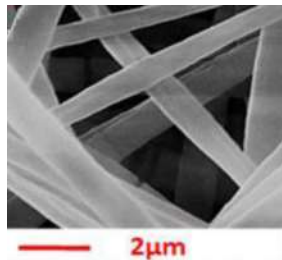
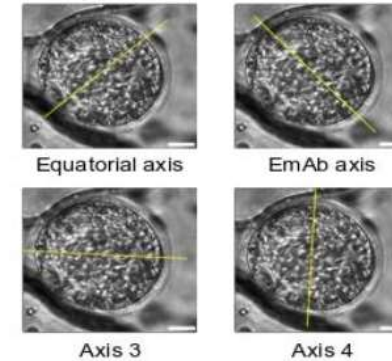
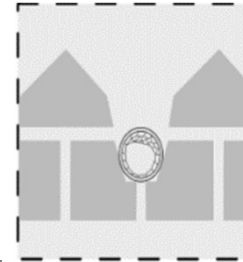
# Master – Internship examples

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## Dynamic control of the size of the mouse blastocyst using microfluidics

O. Polzer, JL Maître

U934, Institut Curie - PSL, France

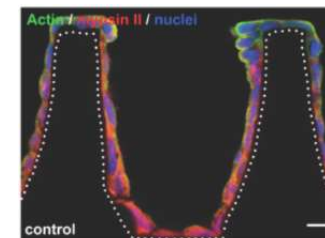
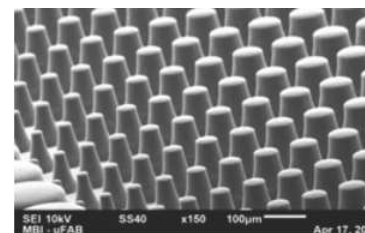


## Cell-seeded patches for cardiac repair

PARCC , Hopital Saint Louis, France

## Model substrates to study intestinal endothelium

Institut Jacques Monod, France



# Master 1 – student's project

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**The BME team  
2018-2019**

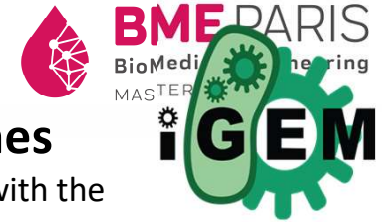


Creating Organoids for Medicine and Biology  
by International Engineering Students



**Production of anterior part of pituitary gland  
organoid using microfluidic chip**

# Master 1 – Team IGEM-BME\_UParis

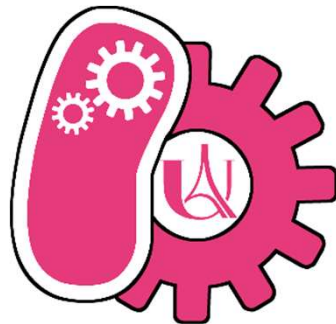


## International Genetically Engineered Machines

A worldwide synthetic biology competition to tackle real world issues with the help of synthetic biology



**ExoSwitch** – liquid biopsy for early-stage cancer screening  
Using Toehold switch for quantitative RNA screening



Supervised by: Mathéa Pietri

Ekaterina



Marc



Louise



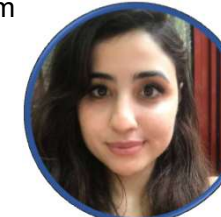
Artem



Mathis



Candice



Nour



<https://biomedicale.u-paris.fr/igem-page/our-project/>



[Igem.uparis@gmail.com](mailto:Igem.uparis@gmail.com)

# BioFabLab projects

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## Objective

The aim of these interdisciplinary projects is to promote active learning by real case studies to face

- Instead of an internship
- An experimental project for **3 to 4 M1 students**
- 2 months to explore and find a solution by designing and developing your own experiment and collect data
- Led by a researcher
- Access to labs and technological platforms to: build, engineer design and make a prototype for your project



# BioFabLab projects: Organization

Where do you perform your experiments?

- In the research lab of your advisor
- [OpenLab](#) for prototyping  
Campus Saint-Germain-des-Près, 3rd floor – room H318
- [FabLab](#) Campus des Grands Moulins Bâtiment Halle aux Farines,  
Hall C – 4th floor – room 446



- [BioMedTech facilities](#) Campus Saint-Germain-des-Près

Team meetings & Braimstorming:

Sabatier A & Sabatier B classrooms

Open access from Monday 9am to Friday 6pm

# BioFabLab projects: management



**BME** PARIS  
BioMedical Engineering  
MASTER'S PROGRAM

- Organize your teamwork and manage your project:
  - ▶ Bibliography
  - ▶ Gantt chart with precise tasks for each team member
  - ▶ Laboratory notebook – to complete everyday
  - ▶ Weekly progress report: 1 page
  - ▶ Protocols
  - ▶ Cost of your project: Excel file

Project follow-up by TikiWiki

<https://tiki.org/HomePage>

[https://2021.igem.org/Team:UParis\\_BME](https://2021.igem.org/Team:UParis_BME)

- You have to meet your project manager at least once a week
- You may not work remotely more than one day per week. This must be indicated in the lab notebook.

A **scientific poster** to design: one per team but individual presentation during a dedicated session organized at the end of June.

# Project #10

## Tumor-on-chip for immunotherapeutics

### Description

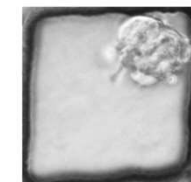
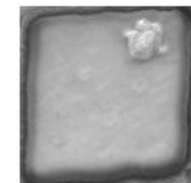
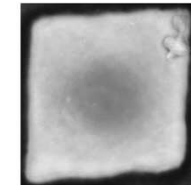
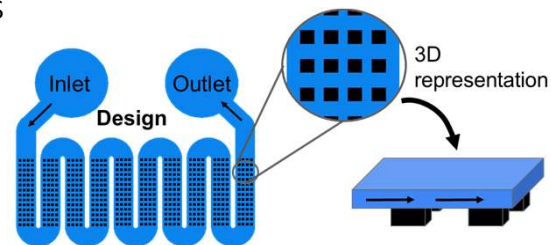
Tumors on microfluidic chip (Tumor-on-chip) and tumoroids are increasingly exploited as pharmacological assays. Our labs are now optimizing a device for forming a large set of spheroids and perform IF assays with applications for onco-immunotherapies.

**Workflow:** The biofablab project consists in

- optimizing the current device for well plate cell culture
- studying the kinetics of tumoroid formation
- performing live / dead assays

### Expertise required:

- cell biology
- mechanics
- bio-imaging



### Supervisor & Lab

Hugo SALMON, MSC-Med & T3S, Campus Saint-Germain-des-Près  
Johanne SEGUIN, UTCBS, Campus Pharma

**Period:** February-March



# Student Survey

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20 M1 students  
20 M2 BME students

Original by Mikko Haavala  
Frei



35% French  
75% foreign student  
(mainly USA)



Career objective  
100% researcher



40% Biologists  
30% BMEs  
30% Engineers

# Student Survey

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## What is an organoid for you?

Don't know:

50% in Master 1  
25% in Master 2

Definition:

A human-  
engineered organ.

An organ model  
created from  
stem cells

A smaller  
version of an  
organ

A 3D cell structure that  
allows to model some  
functions of an organ.

# Student Survey

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## Did you ever take a course on "organoids" during your Bachelor degree?

- ✓ Only **5% of the student (0% French)** have taken a course on "organoids" during their undergraduate degree

**=> Longer than 5 hours**

- ✓ **30% of the student (30% French)** have taken a non-dedicated course during which organoids were presented:

- Cell Biology
- Fundamentals of Bioengineering
- Molecular biology
- Stem cells
- Tissue engineering

# Student Survey

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## Did you personally learn on organoids?

✓ **50% of students** personally learned about organoids

✓ **Supports used for self-study on organoids:**

- 50% scientific articles
- 50% On line (non scientific articles/websites, you tube, conferences, etc...)

## Do you believe that you will have to use organoids during your career?

✓ **90%** of the students (30% yes + 60% May be) believe that they will have to use organoids during their career

✓ **In which field do you think organoids could be more useful?**

1. Drug development
2. Tissue engineering
3. Fundamental research
4. Toxicology

# Conclusions

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1. Few training/courses dedicated to Organoids (France and abroad).
  2. Personal interest of students for Organoids
  3. Students are aware of the usefulness of organoids for research
- => Need for specialized training/courses on organoids

BME Paris = an interdisciplinary master that gives basics to  
work with organoids  
BioFabLab Projects ↔ INOContest?