



2025

## 5<sup>th</sup> International School on BioMEMS

### Fundamentals of microfabrication

- Design and simulation
- Microfabrication
- Characterization

### Biological techniques & analysis

- Microscopy
- Cellular biology
- Molecular biology

### Device integration & applications

- Microfluidics
- Organ-on-a-chip
- Single cell characterization

### Link to translational medicine

- Clinical cancer management
- Techniques of tissue sampling
- Pathological sample processing

### Additionally...

- Group projects
- Social events

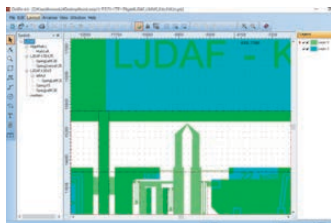


## What is SMMiL-E / UTC School?

SMMiL-E / UTC School aims at an introductory educational program for students new to BioMEMS. Sessions introduce each step from the initial device design to applications. A day at Centre Oscar Lambret, the regional reference hospital specialized in cancer, allows observing some cancer therapies to build a link between technology and translational medicine. Students, from Japan and France, have the opportunity to spend time with high-level researchers during lectures, experiments, and projects sessions. In addition to the BioMEMS-related classes, students also work on projects both in Lille and Compiègne. Major concepts related to BioMEMS will, first be covered at SMMiL-E. Then, a deeper view of organ-on-a-chip systems will be featured at UTC as proposed by the international chair with UTokyo "DOT- Disruptive Organoid Technology".

## Students learn...

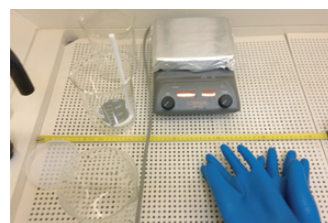
### Fundamentals of microfabrication



Design & simulation  
(CAD, COMSOL)

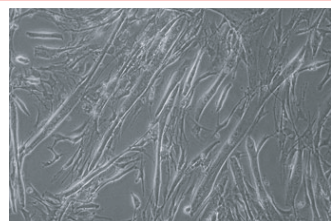


Microfabrication  
(Metal patterning, Mold for PDMS microfluidics)



Rapid prototyping  
(3D printing, CNC, 2PP)

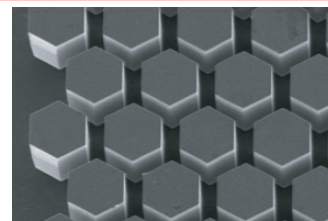
### Biological techniques and analysis



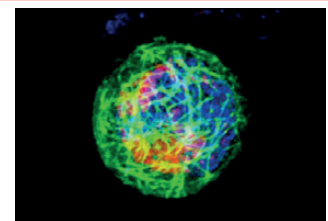
Cellular bio. fundamentals  
(Cell culturing)



Mol. biology fundamentals  
(Western blotting, PCR)



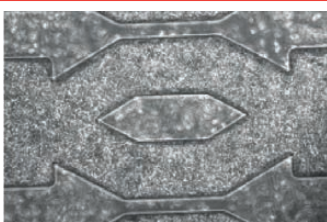
Imaging techniques:  
Electron & optical microscopy (BF, FI, PC, DIC and confocal)



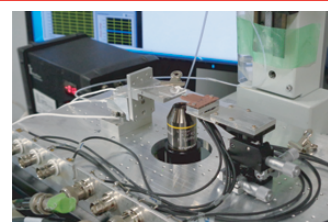
### Device integration and applications



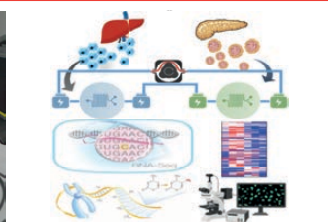
Microfluidics  
(Laminar flow, flow charact.)



Organ-on-a-chip  
(3D cell culture)

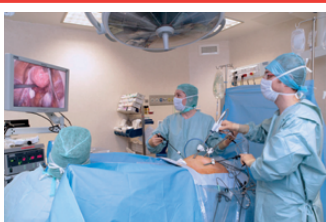


Cell characterization  
(Imp. spec. & mech. charact.)



Predictive Toxicology

### Link to translational medicine



Cancer therapies  
(Surgery, chemotherapy and radiation therapy)

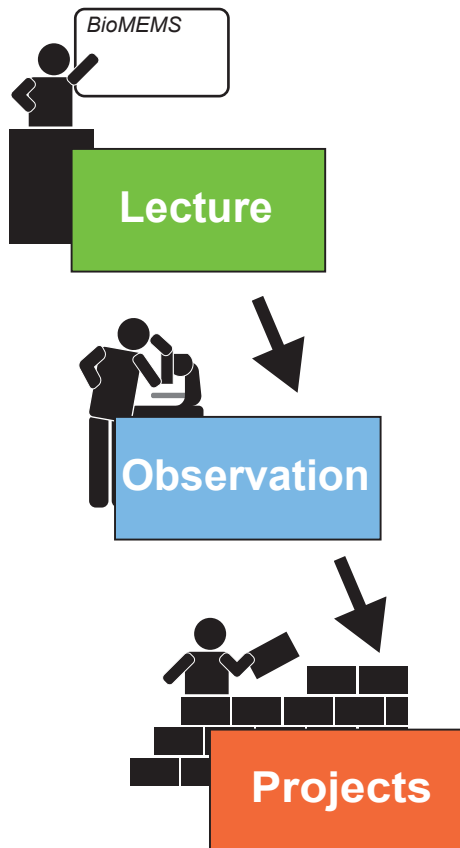


BioMEMS projects  
(Handled by students)



# Class content

SMMiL-E / UTC School consists of three types of classes. Each day starts with a lecture on the topic of the day. The lectures are supported with observation sessions where students can observe researchers performing experiments on given topics. The last type of class permits students to handle sample projects as a part of BioMEMS projects.



## I. Device & setup development

1. Microfabrication
  - a) *Fundamental techniques*  
(e.g. *lithography, deposit., etching*)
  - b) *Rapid prototyping tools*  
*Nanoscribe, 3D printer, CNC*
2. Observation & characterization
  - a) *Microscopy (optical & electron)*
  - b) *Profilometer & probe station*
3. Operating BioMEMS systems

## III. Applied systems

1. Vessel-on-a-chip
  - Mimicking blood vessels
2. Biophysical cell charact.
  - a) Single cell analysis
  - b) Handling BioMEMS systems

## II. Fundamental techniques

1. Cellular biology
  - a) *Cell culturing*
  - b) *Flow cytometry*
  - c) *Plasmid transfection*
2. Molecular biology
  - a) *PCR*
  - b) *Nucleic acid extraction*
  - c) *Gene expression*
  - d) *rtPCR*
  - e) *Western blotting*
3. Microfluidic systems
  - a) *PDMS molding*
  - b) *Laminar flow microfluidics*
4. Cancer therapies
  - a) *Imaging*
  - b) *Pathology*
  - c) *Chemotherapy*
  - d) *Radiotherapy*

## IV. Special feature: Organ-on-a-chip systems

1. Application
  - a) Toxicology studies
  - b) Regulatory issues
  - c) Predictive toxicology
2. Device overview
  - a) Flow characterization
  - b) Cell seeding
  - c) Perfusion devices

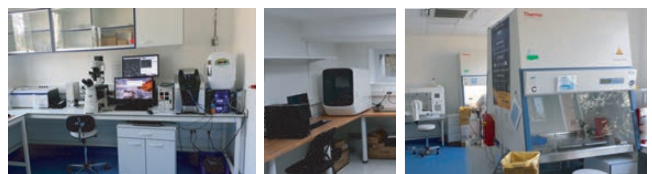
# Facilities

## Microfabrication and imaging



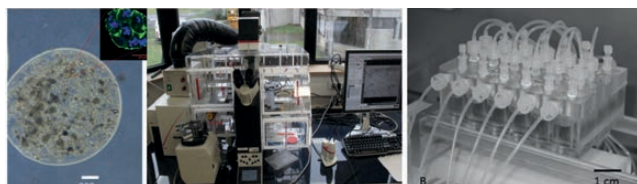
- Lithography
- Deposition
- Etching
- Characterization
- Rapid prototyping
- FE-SEM
- Airyscan confocal microscopy
- Inverted and upright microscopes

## Molecular and cellular biology



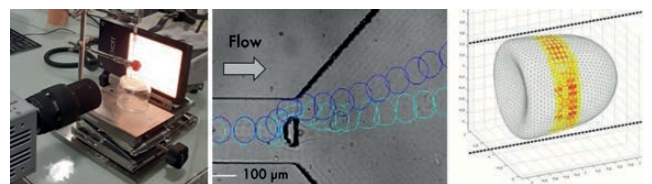
- Cell culturing
- Bioprinter
- Culture under perfusion
- Abs/Lum/Fluo/Alphascr. plate reader
- Classic & real-time PCR
- DNA/RNA & protein quantification & analyses
- Nucleic acids & protein gel imaging systems

## Tissue Engineering



- Organoid formation
- Cell encapsulation
- Bioreactors
- Micro/nano indentation
- Dynamic cell culture
- Perfusion systems
- Time lapse microscopy
- Immunocytochemistry

## Microfluidics



- High speed camera
- Micro Particle Imaging Velocimetry
- Pressure controllers
- Flow and image analysis
- Viscosimetry
- Fluid Structure Interactions Simulations

# Timetable

2025

	17 / Feb Tue	18 / Feb Tue	19 / Feb Wed	20 / Feb Thr	21 / Feb Fri
9:00	Introduction to Organ-on-chip	Organoid and OoC Application to liver	Organ-on-chip for toxicology studies	Mathematical model, system biology & predictive toxicology	Regulatory issues with organ-on-chips
10:15	C. Legallais	C. Legallais	E. Leclerc	M. Nishikawa	J-M. Prot C. Legallais
10:30	How to manufacture a biochip @ BMBI	Microfluidics and cell behavior - Postprocessing-	Organ-on-chip for toxicology studies	Sensors for biochips	Training oport @LIMMS S.H. Kim
12:00	JR. Jellali	A. Le Goff	Y. Sakai	T. Minami	Mini project
	Lunch	Lunch	Lunch	Lunch	Lunch
14:00	Biochip design	Biochip microfabrication	Cell seeding in different biochips	Flow and pressure characterization in microfluidic devices	Mini project
	and	and	and	and	
	Mini project	Mini project	Mini project	Mini project	Project presentation
	A. Le Goff R. Jellali	R. Jellali	R. Jellali	A. Le Goff	
18:00				Compiègne tour and Dinner	Get together party

## Professors

## Compiègne

## Lille



R. Jellali  
(UTC)  
Biomaterials



T. Minami  
(LIMMS, UTokyo)  
Biosensors



L. Ceugnart  
(COL)  
Clinical  
Medicine



A. L. Gagez  
(COL)  
Clinical  
Medicine



A. Le Goff  
(UTC)  
Physics of fluids



M. Nishikawa  
(UTokyo)  
Bio simulation



M. P. Chauvet  
(COL)  
Clinical  
Medicine



J.-C. Gerbedoen  
(LIMMS)  
Microfabrication



E. Leclerc  
(LIMMS, UTC)  
Organ-on-chip,  
omics



J. M. Prot  
(UTC)  
Regulat. affairs,  
Biomedical eng.



D. Collard  
(LIMMS)  
MEMS



K. Hannebicque  
(COL)  
Clinical  
Medicine



C. Legallais  
(UTC)  
Tissue  
engineering



Y. Sakai  
(LIMMS, UTokyo)  
Biochemical syst.  
engineering



F. Feutry  
(COL)  
Clinical  
Medicine



M. Jafari  
(COL)  
Clinical  
Medicine

					2025
24 / Feb Mon	25 / Feb Tue	26 / Feb Wed	27 / Feb Thr	28 / Feb Fri	
Opening remarks Introduction to BioMEMS  D. Collard S.H. Kim M.C. Tarhan	Fundamentals of Micromachining  M. Kumemura M. C. Tarhan	Cancer Therapy  E. Lartigau S. Meignan	Fundamentals of Cellular Biology  F. Soncin	Single cell biophysical characterization  D. Collard	8:30
					10:15
Group meeting for project management	Fundamentals of Microfluidic Systems  S.H. Kim	Cancer Therapies: Biopath, Surgery, Transl. research Clinical research Y. Robin, L. Ceugnart, X. Mirabel, N. Penel, M.P. Chauvet	Fundamentals of Molecular Biology  F. Soncin	Organ-on-a-chip Systems  A. Treizebre	10:30
Lunch	Lunch	Lunch	Lunch	Lunch	12:30
Organoid platform visit  A. Vincent	Fabrication tech. J.C. Gerbedoen  Rapid prototyping F.A. Shaik	Cancer Therapies: Imaging, Radiotherapy, Chemotherapy  A.L. Gagez, M. Jafari, F. Feutry	Confocal microsc. C. Lagadec  Elect/optic microsc. M.C. Tarhan	Cell culturing/PCR F. Soncin  Western blotting S. Meignan	13:30
Project work	Project work	Project work	Project work	Group presentation	14:30
	Group meeting		Group meeting	Closing remarks Kim/Tarhan	17:00
					17:30

## Lille

## Professors



S.H. Kim  
(IIS)  
Microfluidics



G. Marliot  
(COL)  
Clinical  
Medicine



N. Penel  
(COL)  
Clinical  
Medicine



F. Soncin  
(LIMMS)  
Molecular biol.  
Cellular biol.



M. Kumemura  
(Kyutech, IIS)  
Microfluidics



Y. Matsunaga  
(IIS)  
Organ-on-chip



Y. M. Robin  
(COL)  
Clinical  
Medicine



M. C. Tarhan  
(IEMN, Junia)  
MEMS



C. Lagadec  
(CANTHER)  
Cellular biol.



S. Meignan  
(COL)  
Molecular  
biology



F. A. Shaik  
(IEMN)  
Design & sim.



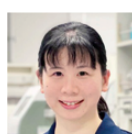
A. Treizebre  
(IEMN)  
Microfluidics



E. Lartigau  
(COL)  
Clinical  
Medicine



X. Mirabel  
(COL)  
Clinical  
Medicine



M. Shinohara  
(IIS)  
Organ-on-chip  
Biology



A. Vincent  
(CANTHER)  
Organoids



## Where is SMMiL-E located?

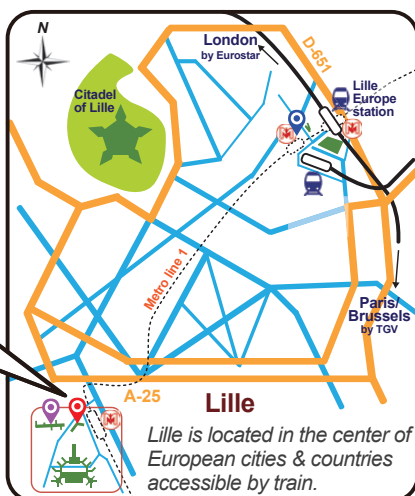
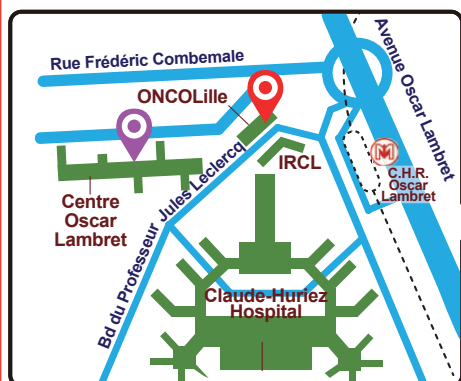
ONCOLille building



Possible Accomodation  
at the Lille center



- SMMiL-E facilities @ONCOLille
- Centre Oscar Lambret

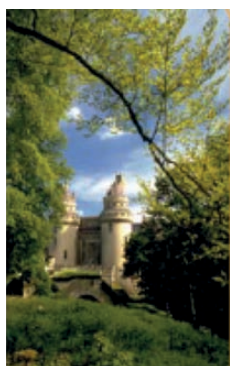


Centre  
Oscar  
Lambret



Université  
de Lille

## Where is UTC located?



Compiègne is a historical city, 45 min away from Paris and CDG airport.



UTC Research Center



ALLIANCE  
SORBONNE  
UNIVERSITÉ

utc Recherche  
BMBI