

Mention de master  
"Biologie Moléculaire & Cellulaire"  
" From fundamental molecular biosciences to biotherapies "  
International program of master



CHARLES UNIVERSITY



UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386



Objectives

The field of biotherapy relies on the use of molecules designed from a living organism. Biotherapies comprise cell and tissue therapy, gene therapy and therapies using human molecules synthesized by eukaryotic cells or bacteria, as antibodies and bioactive proteins. This domain has considerably evolved during the recent years thanks to the research progress in vectorology, stem cells, biomaterials, omics and computational biology. Future researchers in this field require a strong education in the molecular basis of physio-pathological processes to develop new biotherapy strategies. The aim of the international master « From fundamental molecular biosciences to biotherapies » is to offer a strong training in fundamental molecular biosciences applied to biotherapies through a multidisciplinary approach given by renowned partner universities.

Program Overview

The program, taught in english, consists of four semesters (120 ECTS) and offers students the opportunity, in addition to a high quality education in Molecular Biosciences delivered at Sorbonne Université (Paris), to choose a specialisation among the different fields of biotherapies in different partners universities:

**Cancer biology:** Heidelberg university (Germany)

**Immunology and biotherapies:** Prague Charles university (Czech republic), Sao Paulo university (Brasil)

**Stem cell, Development and Evolution:** Lisbon university (Portugal), Heidelberg university (Germany)

**Bioinformatics for health sciences:** Heidelberg university (Germany) and Barcelona Pompeu Fabra university (Spain).

**Fundamental molecular biosciences in biotherapies:** Sorbonne Université (Paris)

The program's objective is to attract motivated students to a fully integrated Master course that combines the best elements of existing courses by the consortium members. Graduates will emerge with critical understanding of basic and applied scientific knowledge and excellent professional and personal skills. The specializations allow students to obtain original multiple high qualifications in complementary disciplines and generate career opportunities in academic research, pharmaceutical industry and biomedical research with an emphasis on molecular aspects of biotherapies.

Laboratories in partner universities:

**Heidelberg university (Germany):**

Center for Organismal Studies  
Bioquant center  
German cancer research center  
EMBL



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**Prague Charles University (Czech Republic) :**



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Institute of Microbiology of the Czech Academy of Sciences  
Institute of Molecular Genetics of the Czech Academy of Sciences

**Sao Paulo university (Brasil):**

Instituto do Cancer do Estado de Sao Paulo



**Lisbon university (Portugal):**

Gulbenkian Institute of Sciences  
Institute of Molecular Medicine



**Barcelona Pompeu Fabra university (Spain):**

Center for Genomic regulation  
IMIM-Hospital del Mar research Institute



**Sorbonne université (Paris):**

Institut Pasteur  
Institut Curie  
Institut Biologie Paris Seine  
Saint Antoine Research center  
Institute of Myology  
Research center in Immunology and Infectious diseases



## Program Structure

### FIRST YEAR

#### Semester 1: Sorbonne Université (30 ECTS)

Practical training in molecular and cellular biology	12 ECTS
Fundamental Molecular Biosciences	15 ECTS
Language course (English for French students, French for foreign students)	3 ECTS

#### Semester 2: 12 ECTS theoretical courses, 18 ECTS junior internship (30 ECTS)

##### **Option Cancer biology:**

###### **Heidelberg University**

Course : Molecular principles of cancer development

##### **Option Immunology and biotherapies:**

###### **Prague Charles University**

Courses : Advances in Immunology, Animal models in Immunology, Clinical cases in immunology, Innate immunity, Medical virology and viral pathogenesis, Biomedical research, Molecules of Life & Mutations

###### **Sao Paulo University**

Courses : Fundamental Immunology, Onco-Immunology

##### **Option Stem cells, Development and Evolution:**

###### **Lisbon university**

Courses : Genes and molecules in development, Stem cell biology and technology, Evolution and Development, Developmental and Comparative neurobiology, Evolution and Development of the immune system

###### **Heidelberg University**

Courses : Developmental genetics and epigenetics, Stem cell biology

##### **Option Bioinformatics for health sciences:**

###### **Heidelberg University**

Course : Systems Biology « Systems Cell Biology »

###### **Barcelona Pompeu Fabra university**

Courses : Computational systems biology, Applied genomics : genome-phenome analysis in human health

##### **Option: Fundamental molecular biosciences in biotherapies:**

###### **Sorbonne université**

Courses : Molecular biology of eucaryotes, Introduction to epigenetics, Introduction to stem cell biology, Embryonic models for genetic diseases and cancer , Fundamentals in immunology, Seminars in immunophysiology, Flow-cytometry (3 ECTS)

### SECOND YEAR

#### Semester 3: Sorbonne Université (30 ECTS)

##### **Introductory course**

Transverse and translationnal approaches applied to biotherapies 6 ECTS

##### **Specialisation course**

*The specialization course depends on the option chosen in M1*

Molecular biology of the cell : Institut Pasteur

Stem cell biology : Sorbonne Université

Advanced course in Cell Biology : IBPC, Sorbonne Université

International developmental biology course : from stem cells to morphogenesis :

Institut Curie/Sorbonne Université

Translational Immunology and biotherapies

Systems immunology

12 ECTS

##### **Optional course:**

6 ECTS

*The optional course depends on the option chosen in M1*

Seminars in developmental biology: Institut Curie

Seminars in stem cell biology: Sorbonne Université

Development of marine organisms: Marine station of Villefranche/mer, Sorbonne Université

Regulation of gene expression: translation and cell cycle: Marine station of Roscoff,

Sorbonne Université Proliferation and cell death: Sorbonne Université

Advanced course in cell dynamics: Institut Curie

Cell biology and cancer: Institut Curie

Digital Image Processing in Cell Imaging: Sorbonne université

Conferencies in Allergy and Hypersensitivity: Sorbonne université

Data analysis in Immunology : Sorbonne Université

Immunomonitoring: Sorbonne Université

##### **Design of a research project**

6 ECTS

Presentation of the reseach project that will be developed during the senior internship

#### Semester 4: Sorbonne université or partner universities (30 ECTS)

##### **Senior internship**

30 ECTS

*Senior internship abroad is mandatory for students who have chosen the M1 option: "Fundamental molecular biosciences in biotherapies".*

**Website:** <http://www.master.bmc.sorbonne-universite.fr/en/>

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