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 physiological 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 specialization among the different fields of biotherapies in different partner universities:

- **Cancer biology**: Heidelberg university (Germany)
- **Immunology and biotherapies**: Prague Charles university (Czech Republic), Sao Paulo university (Brazil)
- **Stem cell, Development and Evolution**: Lisbon university (Portugal), Heidelberg university (German)
- **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

- **Prague Charles University (Czech Republic):**
  - Institute of Microbiology of the Czech Academy of Sciences
  - Institute of Molecular Genetics of the Czech Academy of Sciences

- **Sao Paulo university (Brazil):**
  - 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)**

<table>
<thead>
<tr>
<th>Course</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical training in molecular and cellular biology</td>
<td>12</td>
</tr>
<tr>
<td>Fundamental Molecular Biosciences</td>
<td>15</td>
</tr>
<tr>
<td>Language course (English for French students, French for foreign students)</td>
<td>3</td>
</tr>
</tbody>
</table>

**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

**SECOND YEAR**

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

<table>
<thead>
<tr>
<th>Course</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductory course Transverse and translationnal approaches applied to biotherapies</td>
<td>6</td>
</tr>
<tr>
<td>Specialisation course The specialization course depends on the option chosen in M1</td>
<td>12</td>
</tr>
</tbody>
</table>

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

**Optional course:**

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
Conferences in Allergy and Hypersensitivity: Sorbonne université
Data analysis in Immunology: Sorbonne Université
Immunomonitoring: Sorbonne Université

**Design of a research project**

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

6 ECTS

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

**Senior internship**

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


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