

INSTITUT PASTEUR COURSE - EDUCATION CENTER

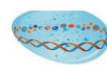
# Programme 2025-2026 Advanced immunology

Institut Pasteur, Paris, November 17, 2025 - January 9, 2026

Ana Cumano, Rachel Golub, Milena Hasan

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Milieu Intérieur  
Vers une médecine personnalisée



# ADVANCED IMMUNOLOGY COURSE

2025 - 2026

MASTERS (M2) UNIVERSITE PARIS CITE ET SORBONNE UNIVERSITE

## THEMES

- Development of the immune system.
- Molecular basis for antigen recognition by B and T lymphocytes.
- Repertoire selection and auto-immunity.
- Lymphocyte interactions
- Immune responses and immunotherapy
- Innate immune system

## DIRECTORS OF THE COURSE

### **Ana CUMANO**

Unité de Lymphocytes et Immunité  
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Tel +33(0)1 45 68 87 66  
**Mobile** : +33 (0)6 24 70 46 36  
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## HEAD OF PRACTICAL COURSES

### **Milena HASAN**

Single Cell Biomarkers UTechS  
Institut Pasteur - Paris  
Tel +33(0)1 40 61 30 27  
**Mobile** : +33(0)6 84 39 43 52  
**E.mail** : milena.hasan@pasteur.fr

**NOVEMBER 17 TO DECEMBER 5, 2025**

**WEEKS 1 - 3**

**PRACTICAL COURSES 1<sup>ST</sup> FLOOR**

**CLASSROOM 4**

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**DECEMBER 8 TO DECEMBER 19, 2025**

**WEEKS 4 - 5**

**CONFERENCES - CLASSROOM 4**

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**JANUARY 6, 2026**

**EXAM - CLASSROOM 2 & 3**

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**JANUARY 7 TO JANUARY 9, 2026**

**BIBLIOGRAPHY SEMINARS - CLASSROOM 2 & 3**

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## **ADVANCED IMMUNOLOGY PRACTICAL COURSES**

**Application of cutting edge technologies in the characterization  
of age-dependent differences in the immune response of healthy individuals**  
(supported in part by "Milieu Intérieur" LabEx project)

**HEAD OF PRACTICAL COURSES: Milena HASAN**

See dedicated booklet for the full program of practical courses

**Designed and organized by:**

**Laura Barrio Cano, Laurie Choux, Slobodan Culina, Stephan Fischer, Milena Hasan, Bernd Jagla, Esma  
Karkeni, Léo Leclerc, François Le Guerroue, Isabelle Lequeutre, Carolina Moraes Cabe, Sandrine  
Schmutz, Valerie Seffer, Tatiana Traboulsi, Yakov Vitrenko**

**THURSDAY 17 NOVEMBER**

**13:00 - 14:00** Pre Start (IT tools connexions)  **Visio** Change link

Education Center

**Week 1 - Classroom 4 & 1<sup>st</sup> Floor**

**MONDAY, NOVEMBER 17 - INTRODUCTION - PBMC THAWING AND STIMULATION**

|                      |                                                                     |                                                                                                                                       |
|----------------------|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>09:30 - 10:30</b> | Reception of students<br>& Introduction                             | <b>S. Hellou, L. Leclerc, I. Lequeutre<br/>S. Malot, M. Perez, V. Ponticelli</b><br>(Centre d'Enseignement, Institut Pasteur - Paris) |
| <b>10:30 - 11:00</b> | Presentation of students                                            | <b>R. Golub, A. Cumano, M. Hasan</b><br>(Institut Pasteur - Paris)                                                                    |
| <b>11:00 - 12:30</b> | Introduction to Practical Courses                                   | <b>M. Hasan</b><br>(Institut Pasteur - Paris)                                                                                         |
| <u><b>All</b></u>    |                                                                     |                                                                                                                                       |
| <b>13:30 - 14:00</b> | Presentation of laboratory rules                                    | <b>I. Lequeutre</b><br>(Institut Pasteur - Paris)                                                                                     |
| <b>14:00 - 16:30</b> | PBMCs thawing, leave in resting 1h, counting,<br>immune stimulation | <b>L. Leclerc, I. Lequeutre<br/>S. Schmutz</b><br>(Institut Pasteur - Paris)                                                          |
| <b>16:30 - 18:30</b> | Staining of cells for cytometry,                                    | <b>L. Leclerc, I. Lequeutre<br/>S. Schmutz</b><br>(Institut Pasteur - Paris)                                                          |

**TUESDAY, NOVEMBER 18 - CELL PHENOTYPING - FLOW CYTOMETRY**

|                         |                                        |                                                               |
|-------------------------|----------------------------------------|---------------------------------------------------------------|
| <u><b>All</b></u>       |                                        |                                                               |
| <b>09:00 - 10:00</b>    | Seminar Flow cytometry                 | <b>S. Schmutz</b><br>(Institut Pasteur - Paris)               |
| <u><b>Group A+B</b></u> |                                        |                                                               |
| <b>10:00 - 12:00</b>    | Cytometer setup and sample acquisition | <b>S. Culina<br/>S. Schmutz</b><br>(Institut Pasteur - Paris) |
| <b>14:00 - 16:00</b>    | Preparation of Journal Club            |                                                               |
| <u><b>Group C+D</b></u> |                                        |                                                               |
| <b>10:00 - 12:00</b>    | Preparation of Journal Club            |                                                               |
| <b>14:00 - 16:00</b>    | Cytometer setup and sample acquisition | <b>S. Culina<br/>S. Schmutz</b><br>(Institut Pasteur - Paris) |
| <b>14:00 - 16:00</b>    | Preparation of Journal Club            |                                                               |

**All**

|                      |                                                                                                                     |                                                               |
|----------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| <b>16:00 - 17:00</b> | Collection of supernatants after O/N stimulation;<br>Freezing of supernatants<br>and cell pellet for RNA extraction | <b>L. Leclerc, I. Lequeutre</b><br>(Institut Pasteur - Paris) |
|----------------------|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|

**WEDNESDAY, NOVEMBER 19 - FLOW CYTOMETRY AND RNA EXTRACTION**

**All**

|                      |                                                        |                                                                                                                          |
|----------------------|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>09:00 - 10:00</b> | Seminar imaging cytometry MARK II                      | <b>F. Le Guerroue</b><br>(Institut Pasteur - Paris)                                                                      |
| <b>10:00 - 12:00</b> | Extraction of RNA, QC using Nanostring,<br>keep on ice | <b>L. Leclerc, I. Lequeutre</b><br><b>C. Moraes Cabe, V. Seffer</b><br><b>T. Traboulsi</b><br>(Institut Pasteur - Paris) |
| <b>13:00 - 18:00</b> | Flow Cytometry data analysis, FlowJo                   | <b>L. Choux, S. Culina</b><br><b>S. Schmutz</b><br>(Institut Pasteur - Paris)                                            |

**THURSDAY, NOVEMBER 20 - IMAGING CYTOMETRY AND CELL METABOLISM**

**All**

|                      |                  |                                                     |
|----------------------|------------------|-----------------------------------------------------|
| <b>09:30 - 10:00</b> | Seminar seahorse | <b>L. Barrio Cano</b><br>(Institut Pasteur - Paris) |
|----------------------|------------------|-----------------------------------------------------|

**Group A**

|                      |                     |                                                     |
|----------------------|---------------------|-----------------------------------------------------|
| <b>10:00 - 13:00</b> | Seahorse experiment | <b>L. Barrio Cano</b><br>(Institut Pasteur - Paris) |
|----------------------|---------------------|-----------------------------------------------------|

**Group B**

|                      |                   |                                                     |
|----------------------|-------------------|-----------------------------------------------------|
| <b>10:00 - 13:00</b> | MARKII experiment | <b>F. Le Guerroue</b><br>(Institut Pasteur - Paris) |
|----------------------|-------------------|-----------------------------------------------------|

**Group C+D**

|                      |                              |                                               |
|----------------------|------------------------------|-----------------------------------------------|
| <b>10:00 - 13:00</b> | Flow Cytometry data analysis | <b>L. Choux</b><br>(Institut Pasteur - Paris) |
|----------------------|------------------------------|-----------------------------------------------|

**Group A+B**

|                      |                              |                                               |
|----------------------|------------------------------|-----------------------------------------------|
| <b>14:00 - 17:00</b> | Flow Cytometry data analysis | <b>L. Choux</b><br>(Institut Pasteur - Paris) |
|----------------------|------------------------------|-----------------------------------------------|

**Group C**

|                      |                     |                                                     |
|----------------------|---------------------|-----------------------------------------------------|
| <b>14:00 - 17:00</b> | Seahorse experiment | <b>L. Barrio Cano</b><br>(Institut Pasteur - Paris) |
|----------------------|---------------------|-----------------------------------------------------|

**Group D**

|                      |                   |                                                     |
|----------------------|-------------------|-----------------------------------------------------|
| <b>14:00 - 17:00</b> | MARKII experiment | <b>F. Le Guerroue</b><br>(Institut Pasteur - Paris) |
|----------------------|-------------------|-----------------------------------------------------|

**FRIDAY, NOVEMBER 21 - IMAGING CYTOMETRY AND CELL METABOLISM**

**09:15 - 09:45**    **Seminar** “human samples for research”

**E. Mottez**  
(Inserm - Paris)

**Group A+B**

**10:00 - 13:00**    Preparation of Journal Club

**Group C**

**10:00 - 13:00**    MARKII experiment

**F. Le Guerroue**  
(Institut Pasteur - Paris)

**Group D**

**10:00 - 13:00**    Seahorse experiment

**L. Barrio Cano**  
(Institut Pasteur - Paris)

**Group C+D**

**14:00 - 17:00**    Preparation of Journal Club

**Group C**

**14:00 - 17:00**    MARKII experiment

**F. Le Guerroue**  
(Institut Pasteur - Paris)

**Group B**

**14:00 - 17:00**    Seahorse experiment

**L. Barrio Cano**  
(Institut Pasteur - Paris)

## MONDAY, NOVEMBER 24 – RNA SEQUENCING – LIBRARY PREPARATION

## All

**L. Leclerc, I. Lequeutre  
Y. Vitrenko**  
(Institut Pasteur - Paris)

**L. Barrio Cano, L. Choux, S. Fischer  
S. Culina, S. Fischer, M. Hasan, B. Jagla  
E. Karkeni, L. Leclerc, F. Le Guerroue  
I. Lequeutre, C. Moraes Cabe, S. Schmutz  
T. Traboulsi, V. Seffer, Y. Vitrenko  
(Institut Pasteur - Paris)**

**L. Barrio Cano**  
(Institut Pasteur - Paris)

**M. Hasan, F. Le Guerrou  
E. Karkeni**  
(Institut Pasteur - Paris)

**All**

**E. Karkeni**  
(Institut Pasteur - Paris)

**E. Karkeni, V. Seffer**  
(Institut Pasteur - Paris)

**E. Karkeni, V. Seffer**  
(Institut Pasteur - Paris)

**All**

**E. Karkeni**  
(Institut Pasteur - Paris)

|                      |                                                                 |                                                                            |
|----------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------|
| <b>13:15 - 14:30</b> | <b>SEMINAR SEQUENCING</b><br>+ Summary of the wetlab experiment | <b>Y. Vitrenko</b><br>(Institut Pasteur - Paris)                           |
| <b>14:30 - 15:30</b> | <b>SEMINAR Single Cell Transcriptomics</b>                      | <b>C. Moraes Cabe</b><br><b>T. Traboulsi</b><br>(Institut Pasteur - Paris) |
| <b>16:00 - 18:00</b> | <b>RNA sequencing (RNA-Seq) data analysis: intro</b>            | <b>B. Jagla, S. Fischer</b><br>(Institut Pasteur - Paris)                  |

#### FRIDAY, NOVEMBER 28 - SEQUENCING - DATA ANALYSIS

|                      |                                                                                                               |                                                           |
|----------------------|---------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| <b>09:00 - 10:00</b> | <b><u>Seminar</u></b> “The IL-23 pathway in inflammatory diseases,<br>from basic biology to therapy and back” | <b>L. Rogge</b><br>(Institut Pasteur - Paris)             |
| <b><u>All</u></b>    |                                                                                                               |                                                           |
| <b>10:00 - 12:00</b> | <b>RNA-sequencing - data analysis</b>                                                                         | <b>S. Fischer, B. Jagla</b><br>(Institut Pasteur - Paris) |
| <b>13:30 - 17:30</b> | <b>RNA-sequencing - data analysis</b>                                                                         | <b>S. Fischer, B. Jagla</b><br>(Institut Pasteur - Paris) |

### Week 3 - Classroom 4 & 1<sup>st</sup> Floor

#### MONDAY, DECEMBER 1 - SEQUENCING - DATA ANALYSIS

**09:00 - 10:00**    **Seminar** "The human spleen filtering red blood cells and their vacuoles : malaria, transfusion, sickle cell disease"  
**P. Buffet**  
(Institut Pasteur - Paris)

#### All

**10:00 - 12:00**    RNA-sequencing - data analysis  
**S. Fischer, B. Jagla**  
(Institut Pasteur - Paris)

**13:30 - 17:30**    RNA-sequencing - data analysis  
(module on scRNA-Seq)  
**S. Fischer, B. Jagla**  
(Institut Pasteur - Paris)

#### TUESDAY, DECEMBER 2 - SINGLE CELL SORTING AND TRANSCRIPTOMICS

#### All

**09:00 - 10:00**    SEMINAR CELL SORTING  
**S. Schmutz**  
(Institut Pasteur - Paris)

#### Group A

**10:00 - 11:30**    Cell sorting and single cell partitioning for scRNA-Seq  
**S. Schmutz, V. Seffer  
T. Traboulsi**  
(Institut Pasteur - Paris)

#### Group B

**11:30 - 13:00**    Cell sorting and single cell partitioning for scRNA-Seq  
**S. Schmutz, V. Seffer  
T. Traboulsi**  
(Institut Pasteur - Paris)

#### Group C

**14:00 - 15:30**    Cell sorting and single cell partitioning for scRNA-Seq  
**S. Schmutz, V. Seffer  
T. Traboulsi**  
(Institut Pasteur - Paris)

#### Group D

**15:30 - 17:00**    Cell sorting and single cell partitioning for scRNA-Seq  
**S. Schmutz, V. Seffer  
T. Traboulsi**  
(Institut Pasteur - Paris)

#### All

**10:00 - 17:00**    Preparation of presentations

#### WEDNESDAY, DECEMBER 3 - CONFERENCE ASSOCIATED TO THE PRACTICAL COURSES

**09:30 - 17:30**    Preparation of presentations

## THURSDAY, DECEMBER 4 - CONFERENCE ASSOCIATED TO THE PRACTICAL COURSES

09:00 - 10:00 Preparation of presentations

10:00 - 11:00 **Seminar** "Genetic determinants of the Immune response"

**L. Quintana-Murci**  
(Institut Pasteur - Paris)

11:00 - 18:00 Preparation of presentations

*hand in presentations by midnight*

## FRIDAY, DECEMBER 5

### All

09:00 - 16:30 Presentation of the TP results (per pair) **L. Barrio Cano, L. Choux, S. Fischer  
S. Culina, S. Fischer, M. Hasan, B. Jagla  
E. Karkeni, L. Leclerc, F. Le Guerroue  
I. Lequeutre, C. Moraes Cabe, S. Schmutz  
T. Traboulsi, V. Seffer, Y. Vitrenko**  
(Institut Pasteur - Paris)

17:00 Concluding remarks & Party **L. Barrio Cano, L. Choux, S. Fischer  
S. Culina, S. Fischer, M. Hasan, B. Jagla  
E. Karkeni, L. Leclerc, F. Le Guerroue  
I. Lequeutre, C. Moraes Cabe, S. Schmutz  
T. Traboulsi, V. Seffer, Y. Vitrenko**  
(Institut Pasteur - Paris)

## MONDAY, DECEMBER 8

**L. du Pasquier**  
(University of Basel - Switzerland)

**A. Cumano**  
(Institut Pasteur - Paris)

**L. Deriano**  
(Institut Pasteur - Paris)

**A.-M. Lenon**  
(Institut Curie - Paris)

**Ph. Bousso**  
(Institut Pasteur - Paris)

**L. Klein**  
(Institute for Immunology - Munich, Germany)

**G. Anderson**  
(University of Birmingham - UK)

**B. Becher**  
University of Zurich - Switzerland)

**M. Veldhoen**  
(Institute of Molecular Medicine - Lisbon - Portugal)

**B. Silva Santos**  
(Institute of Molecular Medicine, Lisbon, Portuga)

## Week 5- Classroom 2 & 3

### MONDAY, DECEMBER 15

- 09:00 - 12:00** Immune response and vaccination strategies to Plasmodium **R. Amino**  
(Institut Pasteur - Paris)
- 13:30 - 16:30** Lymphocyte activation and Immunological synapses **C. Hivroz**  
(Institut Curie - Paris)

### TUESDAY, DECEMBER 16

- 09:00 - 12:00** Lymphoid tissue development **T. Cupedo**  
(Erasmus University - Rotterdam - The Netherlands)
- 13:30 - 16:30** Innate lymphoid cells **J. di Santo**  
(Institut Pasteur - Paris)

### WEDNESDAY, DECEMBER 17

- 09:00 - 12:00** Commensals, the Immune System and the Brain **G. Eberl**  
(Institut Pasteur - Paris)
- 13:30 - 16:30** Lymphoma pathogenesis **R. Küppers**  
(University of Duisburg - Essen - Germany)

### THURSDAY, DECEMBER 18

- 09:00 - 12:00** Genetic basis of Immune Pathologies **V. Beziat**  
(Institut Imagine - Paris)
- 13:30 - 16:30** Effector functions of antibodies **M. Daeron**  
(Centre d'Immunologie Marseille - Luminy)

### FRIDAY, DECEMBER 19

- 09:00 - 12:00** Neuroimmunology **A. Deczkowska**  
(Institut Pasteur - Paris)
- 13:30 - 16:30** B cell memory **D. Calado**  
(Francis Crick Institute - London - UK)

Week 6- Classroom 2 & 3

TUESDAY, JANUARY 6, - CLASSROOM 2 & 3

09:00 - 13:00 EXAM

BIBLIOGRAPHY SEMINARS

WEDNESDAY, JANUARY 7

09:30 - 12:30 **SEMINAR 1:** Innate immunity  
**S. Faure-Dupuy** (Institut Cochin - Paris)  
**M. Rousseau** (INSERM - Paris)

14:00 - 17:00 **SEMINAR 2:** Lymphocyte Trafficking  
**E. Donnadieu** (Institut Cochin - Paris)  
**L. Dupré** (Toulouse University)

THURSDAY, JANUARY 8

09:30 - 12:30 **SEMINAR 3:** Molecular basis of B cell differentiation  
**S. Mancini** (Université Rennes)  
**P. Vieira** (Institut Pasteur - Paris)

14:00 - 17:00 **SEMINAR 4:** T cell responses  
**Ch. Bourgeois** (Faculté de Médecine - Université Paris Sud)  
**C. Tanchot** (Hôpital Européen Georges Pompidou - Paris)

FRIDAY, JANUARY 9

09:30 - 12:30 **SEMINAR 5:** Lymphocyte activation and transcriptional regulation  
**E. Bianchi** (Institut Pasteur - Paris)  
**V. di Bartolo** (Institut Pasteur - Paris)

14:00 - 17:00 **SEMINAR 6:** Antibodies in health and disease  
**F. Jönsson** (Institut Pasteur - Paris)  
**H. Mouquet** (Institut Pasteur - Paris)

