

INSTITUT PASTEUR COURSE - EDUCATION CENTER

# Programme Course 2024-2025 Medical Mycology

Institut Pasteur, Paris, March 24 - April 18, 2025  
Dea Garcia-Hermoso & Olivier Lortholary

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# MEDICAL MYCOLOGY COURSE

March 24 to April 18, 2025

## Directors of the Course

Dea GARCIA-HERMOSO, PhD and Olivier LORTHOLARY, MD, PhD

## Head of Practical Sessions

Dea GARCIA-HERMOSO, PhD

National Reference Center for Invasive Mycoses & Antifungals (NRCMA)  
Institut Pasteur

Education Center - Institut Pasteur

28 rue du Dr Roux – 75015 Paris, France

**Pavilion Louis Martin – Building 9**

**Lectures:** Room 1

**Practical Sessions:** 1st floor

## WELCOME INTRODUCTION

Paris, March 24, 2025

Dear Speakers and Students of the 2025 edition of the Medical Mycology (MM) Course, welcome to the Institut Pasteur, Paris and thanks for your active participation.

As Directors, we had in mind to select across Europe some among the best researchers / teachers in medical mycology as lecturers and students worldwide. We also tried to do our best to optimize individual logistics and hosting conditions.

Our sincere thanks to all of our lecturers, training session collaborators and especially to our guest speaker Professor Tom Chiller, CDC, Atlanta, USA and to Professor Souha Kanj, American University of Beirut, Lebanon for active participation to the debate session. We extend our thanks to all of those who contributed to practical sessions logistics (Aude Sturny-Leclère, Guylène K'ouas, Camille Carpentier and Sophie Robert), and finally to all of those from the Education Center IP (Monica Sala, Hervé Waxin, Virginie Ponticelli, Sylvie Malot, Murielle Almoussa, Céline Corbin and Sheida Kashani) for their precious contribution.

The course divided into four thematic modules includes focused lectures and practical sessions. The first week will deal with generalities in Medical Mycology. The second and third weeks will be focusing on yeast and mold infections, respectively. Finally, on the last week, we will cover veterinary mycology (fungal diseases in animals) and fungal risks encountered in the environment.

In order to improve the quality of subsequent MM courses, please let us have your feedback on a daily basis for speakers or in a weekly basis for students!

We hope that the 2025 edition of the MM Course, taking into account the comments received following the 2023 edition, will be successful in both scientific and friendship aspects creating an unforgettable true team spirit! Finally, we have no doubt that your permanent interactions with the top speakers, during the four weeks, will contribute to your emerging seniority in Medical Mycology.

Best fungal wishes from

**Dea Garcia-Hermoso & Olivier Lortholary**

## GENERAL PRESENTATION

**This four-week course is intended for microbiologists (MDs, PharmDs, PhDs & veterinarians) willing to catch up with the most recent advances in diagnosis and identification procedures and principles of therapy for fungal infections.**

**Training** is provided through bench works, lectures and panel discussions and will cover:

**Technical aspects:** choice of media, slide cultures, storage of isolates, molecular diagnosis and identification (PCR, qPCR, sequencing, MALDI-TOF), typing techniques (microsatellite, MLST), antifungal susceptibility testing (CLSI/EUCAST microbroth dilution methods, commercially available tests), antigen/antibody detection, histopathology.

**Practical aspects:** spectrum of action and pharmacokinetics/dynamics of antifungal drugs, role of the laboratory in the diagnosis and monitoring of patients (direct examination, histopathology, antigen detection, antifungal susceptibility testing results, qPCR ...), limitation and use of public and specific databases for molecular identification, discussion of clinical cases.

**Fungal aspects:** sexual and asexual reproduction, phylogeny, species identification, resistance mechanisms.

**Medical aspects:** Pathogenic concepts, recent trends in fungal epidemiology, diagnosis criteria for infections due to common and emerging yeasts or filamentous fungi (including invasive and mucocutaneous infections, endemic mycoses), principles of therapeutic management, practical guidelines.

**Thursday, 20 March**

11:45-12:30 Administrative pre start

**WEEK 1**

*Institut Pasteur Laboratory Training team:*

**Dea Garcia-Hermoso, Guylène K'ouas, Aude Sturny-Leclère, Camille Carpentier**

**Monday, 24 March**

|             |                                                               |                                                                                                                                                                            |
|-------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9:00-10:00  | Student reception & introduction to the course                | <b>Dea Garcia-Hermoso</b><br>(Institut Pasteur, France)<br><b>Olivier Lortholary</b><br>(Université Paris-Cité, Hôpital Necker-Enfants Malades & Institut Pasteur, France) |
| 10:00-11:00 | Basic techniques / <i>Lecture</i>                             | <b>Dea Garcia-Hermoso</b><br><b>Aude Sturny-Leclère</b><br>(Institut Pasteur, France)                                                                                      |
| 11:00-12:00 | Establishing a medical mycology laboratory/<br><i>Lecture</i> | <b>Katrien Lagrou</b><br>(University Hospitals Leuven Department of Laboratory Medicine and National Reference Center for Mycosis, Belgium)                                |
| 13:00-17:00 | Basic techniques / <i>Practical</i>                           | <b>Dea Garcia-Hermoso</b><br><b>Aude Sturny-Leclère</b><br>(Institut Pasteur, France)                                                                                      |

**Tuesday, 25 March**

|             |                                         |                                                                            |
|-------------|-----------------------------------------|----------------------------------------------------------------------------|
| 9:00-10:00  | Asexual multiplication / <i>Lecture</i> | <b>Alberto Stchigel</b><br>(Universitat Rovira i Virgili, Spain)           |
| 10:00-12:30 | Fungal morphology / <i>Practical</i>    | <b>Alberto Stchigel</b><br><b>Dea Garcia-Hermoso</b>                       |
| 13:30-14:30 | Sexual reproduction / <i>Lecture</i>    | <b>Yasmina Marin</b><br>(Helmholtz Centre for Infection Research, Germany) |
| 14:45-16:30 | Sexual reproduction/ <i>Practical</i>   | <b>Yasmina Marin</b><br><b>Dea Garcia-Hermoso</b>                          |

**Wednesday, 26 March**

|             |                                                                        |                                                              |
|-------------|------------------------------------------------------------------------|--------------------------------------------------------------|
| 9:00-10:00  | Systemic antifungal drugs: mode of action, PK/PD, TDM / <i>Lecture</i> | <b>Vincent Jullien</b><br>(Hôpital Avicenne Bobigny, France) |
| 10:00-11:00 | Antifungal susceptibility testing / <i>Lecture</i>                     | <b>Jesús Guinea</b><br>(Hospital Gregorio Marañón, Spain)    |
| 11:00-12:00 | Antifungal susceptibility testing I / <i>Practical</i>                 | <b>Jesús Guinea</b>                                          |
| 13:00-14:30 | Antifungal susceptibility testing II / <i>Practical</i>                | <b>Jesús Guinea</b>                                          |

|             |                                                                                        |                                                                                                            |
|-------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| 14:45-15:45 | Antifungal resistance in yeasts / <i>Lecture</i>                                       | <b>Oliver Kurzai</b><br>(University of Wuerzburg, Germany)                                                 |
| 16:00-17:00 | Antifungal resistance in molds / <i>Lecture</i>                                        | <b>Eric Dannaoui</b><br>(Université Paris-Cité, Hôpital Necker-Enfants Malades & Institut Pasteur, France) |
| 17:00-18:00 | <b>RoundTable I:</b> "Antifungals: everything you wanted to know that you never asked" | <b>Vincent Jullien, Oliver Kurzai<br/>Jesús Guinea &amp; Eric Dannaoui</b><br><i>Chair: O. Lortholary</i>  |

#### Thursday, 27 March

|             |                                                                                     |                                                                                               |
|-------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 9:00-10:00  | Introduction to molecular biology/ <i>Lecture</i>                                   | <b>Alexandre Alanio</b><br>Université Paris-Cité, Hôpital St-Louis & Institut Pasteur, France |
| 10:15-11:15 | Molecular diagnostics for invasive diseases (including genotyping) / <i>Lecture</i> | <b>Alexandre Alanio</b>                                                                       |
| 11:30-12:30 | Molecular techniques for fungal strain identification / <i>Lecture</i>              | <b>Dea Garcia-Hermoso</b>                                                                     |

#### 13h30 Group picture

|             |                                                                   |                                                                                  |
|-------------|-------------------------------------------------------------------|----------------------------------------------------------------------------------|
| 14:00-15:00 | Diagnostic contribution of fungal antigens / <i>Lecture</i>       | <b>Paul Verweij</b><br>(Radboud University Nijmegen Medical Center, Netherlands) |
| 15:15-16:15 | Importance of databases in fungal identification / <i>Lecture</i> | <b>Vincent Robert</b><br>(Westerdijk Fungal Biodiversity Institute, Netherlands) |
| 16:30-18:00 | <b>Project Distribution</b>                                       | <b>Dea Garcia-Hermoso<br/>Olivier Lortholary</b>                                 |

#### Friday, 28 March

|             |                                                                              |                                                                     |
|-------------|------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 9:00-12:15  | Molecular Biology (yeast and molds): / <i>Practical</i>                      | <b>Aude Sturny-Leclère</b><br>IP Laboratory Training team           |
| 13:30-15:00 | Time for project                                                             | <b>IP Laboratory Training team</b>                                  |
| 15:15-16:15 | Capacity building in low resource countries / <i>Lecture</i>                 | <b>Aude Sturny-Leclère</b>                                          |
| 16:30-17:30 | Interest of WGS in the evolution of fungal pathogens / <i>Online Lecture</i> | <b>Christina Cuomo</b><br>(Broad institute of MIT and Harvard, USA) |

**Weekly survey on MyPE**

## WEEK 2

### *Institut Pasteur Laboratory Training team:*

Dea Garcia-Hermoso, Guylène K'ouas, Aude Sturny-Leclère, Camille Carpentier

#### Monday, 31 March

8:30- 9:00 Autotest

9:00-10:00 Yeast Biology / *Lecture*

**Marie Desnos-Ollivier**  
(Institut Pasteur, France)

10:15-11:15 Yeast Identification Procedure / *Lecture*

**Andy Borman**  
( UK mycology reference laboratory, UK)

11:30-12:30 **Time for Project**

**IP Laboratory Training team**

13:30-14:30 Risk factors for invasive fungal diseases IFDs /  
*Lecture*

**Olivier Lortholary**

15:00-16:00 Development and clinical use of new systemic  
antifungals / *Online Lecture*

**Oliver Cornely**  
(University of Cologne, Germany)

#### Tuesday, 1 April

9:00-10:15 Uncommon yeast species / *Online Lecture*

**Sharon Chen**  
(Westmead Hospital, Australia)

10:30-11:30 Invasive *Candida* spp. Infections / *Online Lecture*

**Matteo Bassetti**  
(University of Genoa, Italy)

11:45-12:45 Superficial candidiasis and *Malassezia* infections  
/ *Lecture*

**Marie-Pierre Hayette**  
(Université de Liège, Belgium)

14:00-16:00 Yeast Identification Flowchart/ *Practical*

**Marie Desnos-Ollivier**  
**Aude Sturny-Leclère**

16:15-17:30 **Time for Project**

**IP Laboratory Training team**

#### Wednesday, 2 April

9:00-10:00 Ten highlights on *Cryptococcus* biology / *Lecture*

**Alexandre Alanio**  
(Université Paris-Cité, Hôpital St-Louis  
& Institut Pasteur, France)

10:15-11:15 *Pneumocystis* and Pneumocystosis / *Lecture*

**Alexandre Alanio**

11:30-12:30 **Time for project**

**IP Laboratory Training team**

13:30-14:45 Epidemiology, clinical manifestations and  
therapeutic principles of cryptococcosis / *Lecture*

**Olivier Lortholary**

15:00 -15:45 Pathogenesis of mucosal and invasive  
candidiasis / *Lecture*

**Frank Van De Veerdonk**  
(Radboud University Nijmegen, Netherlands)

16:00-16:45 Critical article reading in yeast biology and  
related infections / *Lecture*

**Olivier Paccoud**  
(Hôpital Necker-Enfants Malades, France)

## Thursday, 3 April

8:30-9:15 **Breakfast**

9:15-10:30 Epidemiology, clinical manifestations and therapeutic principles of endemic invasive mycoses / *Lecture* **Olivier Lortholary**

10:45-11:45 Dimorphic fungi and diagnosis of related diseases / *Lecture* **Ana Alastruey-Izquierdo**  
(Centro Nacional de Microbiología, Spain)

13:00-14:15 **Time for project** **IP Laboratory Training team**

14:30-15:45 Rapid test for the diagnosis of cryptococcal meningitis / *Lecture & Practical* **Aude Sturny-Leclère**

16:00-16:45 Interactive clinical cases on yeast infections and Pneumocystosis / *Lecture* **Florent Morio**  
(Nantes Université, France)  
**Emmanuel Lafont**  
(Hôpital Européen Georges Pompidou, France)

## Friday, 4 April

9:00-10:30 **Time for project** **IP Laboratory Training team**

10:30-11:00 Presentation of the new French National Reference Center for Invasive Mycoses & Antifungals" / *Lecture* **Dea Garcia-Hermoso**  
**Olivier Lortholary**

11:15-12:15 Interactive "clinical cases on mould infections" / *Lecture* **Dea Garcia-Hermoso**  
**Olivier Paccoud**

14:00-15:00 Mucormycosis and entomophthoromycosis / *Lecture* **Olivier Lortholary**

16:00-16:30 Weekly Summary & autotest correction **Dea Garcia-Hermoso**  
**Olivier Lortholary**

**Weekly survey on MyPE**

### WEEK 3

*Institut Pasteur Laboratory Training team:*

**Dea Garcia-Hermoso, Guylène K'ouas, Aude Sturny-Leclère, Camille Carpentier**

#### Monday, 7 April

|             |                                                                                                           |                                                                              |
|-------------|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 8:30-9:00   | Autotest                                                                                                  |                                                                              |
| 9:00-10:30  | Mucorales / <i>Lecture</i>                                                                                | <b>Dea Garcia-Hermoso</b>                                                    |
| 10:30-11:45 | Infections due to <i>Fusarium</i> , <i>Scedosporium/Lomentospora</i> & phaeohyphomycetes / <i>Lecture</i> | <b>Patricia Muñoz</b><br>(Hospital General Universitario, G. Marañon, Spain) |
| 14:00-15:00 | Diagnosis of mold infections from biological samples / <i>Online Lecture</i>                              | <b>Lewis White</b><br>(Public Health Wales Microbiology, UK)                 |
| 15:15-16:00 | Key determinants of immunoprotection against fungi / <i>Lecture</i>                                       | <b>Anne Puel</b><br>(Insitut Imagine, France)                                |
| 16:15-17:30 | <b>Time for Project</b>                                                                                   | <b>P Laboratory Training team</b>                                            |

#### Tuesday, 8 April

|             |                                                                                                                                                                |                                                                               |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| 8:30-9:15   | Invasive aspergillosis / <i>Lecture</i>                                                                                                                        | <b>Olivier Lortholary</b>                                                     |
| 9:30-10:15  | Chronic aspergillosis / <i>Lecture</i>                                                                                                                         | <b>Jean Pierre GANGNEUX</b><br>(Université de Rennes, France)                 |
| 10:30-11:15 | Ten highlights on <i>Aspergillus</i> biology / <i>Lecture</i>                                                                                                  | <b>Darius Armstrong</b><br>(Imperial College, UK)                             |
| 11:30-12:30 | Dermatophytosis / <i>Lecture</i>                                                                                                                               | <b>Malcolm Richardson</b><br>(Manchester University NHS Foundation Trust, UK) |
| 13:30-16:00 | Keys to <i>Aspergillus</i> , <i>Penicillium</i> , <i>Talaromyces</i> , <i>Paecilomyces</i> , <i>Rasamsonia</i> identification / <i>Lecture &amp; Practical</i> | <b>Dea Garcia-Hermoso</b>                                                     |
| 16:00-18:00 | <b>Time for project</b>                                                                                                                                        | <b>IP Laboratory Training team</b>                                            |

### Wednesday, 9 April

|             |                                                                                                            |                                                              |
|-------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| 9:00-10:00  | Pathogenesis of mould respiratory diseases / <i>Lecture</i>                                                | <b>Agostinho Carvalho</b><br>(University of Minho, Portugal) |
| 10:15-12:00 | <i>Scedosporium/Lomentospora/Scopulariopsis/Microascus</i> Identification / <i>Lecture &amp; Practical</i> |                                                              |
| 13:15-15:00 | <b>Time for project</b>                                                                                    | <b>IP Laboratory Training team</b>                           |
| 15:00-16:30 | Subcutaneous mycoses / <i>Lecture</i>                                                                      | <b>Olivier Lortholary</b>                                    |
| 16:30-18:00 | <b>Time for project</b>                                                                                    | <b>IP Laboratory Training team</b>                           |

### Thursday, 10 April

|             |                                                                                                                          |                                                                                        |
|-------------|--------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 9:15-10:00  | Critical article reading in mold biology and related infections / <i>Lecture</i>                                         | <b>Alexandra SERRIS</b><br>(Hôpital Necker-Enfants Malades & Institut Pasteur, France) |
| 10:15-11:15 | Dermatophytes / <i>Lecture</i>                                                                                           | <b>Pierre Becker</b><br>(Sciensano, Belgium)                                           |
| 11:30-13:00 | Dermatophytes / <i>Practical</i>                                                                                         | <b>Pierre Becker</b><br>(Sciensano, Belgium)                                           |
| 14:00-15:30 | <i>Fusarium Phaeoacremonium Acremonium</i> Identification / <i>Lecture &amp; Practical</i>                               | <b>Dea Garcia-Hermoso</b>                                                              |
| 15:45-18:00 | <i>Fonsecaea/Phialophora/Cladophialophora/Acrophialophora/Ochroconis</i> Identification / <i>Lecture &amp; Practical</i> | <b>Dea Garcia-Hermoso</b>                                                              |

### Friday, 11 April

|             |                                                        |                            |
|-------------|--------------------------------------------------------|----------------------------|
| 9:00-9:45   | Autotest correction                                    | <b>Dea Garcia-Hermoso</b>  |
| 10:00-11:15 | Coelomycetes / <i>Lecture &amp; Practical</i>          | <b>Dea Garcia-Hermoso</b>  |
| 11:30-12:30 | Levures Noires / <i>Lecture &amp; Practical</i>        | <b>Dea Garcia-Hermoso</b>  |
| 14:00-15:00 | TD implementation qPCR/clinical trial / <i>Lecture</i> | <b>Aude Sturny-Leclère</b> |
| 15:15-17:00 | Revisions                                              | <b>Dea Garcia-Hermoso</b>  |

**Weekly survey on MyPE**

## WEEK 4

### *Institut Pasteur Laboratory Training team:*

Dea Garcia-Hermoso, Guylène K'ouas, Aude Sturny-Leclère, Camille Carpentier

#### Monday, 14 April

10:15-12:30 **Time for project SEQUENCES** IP Laboratory Training team

14:00-15:00 The importance of Biobanks / *Lecture* **Fay Betsou**  
(Biological Resource Center of Institut Pasteur - CRBIP)

#### Tuesday, 15 April

9:30-10:30 Animal mycoses / *Lecture* **Jacques Guillot**  
(École Nat. Vétérinaire de Nantes, France)

10:45-11:15 IRIS / *Lecture* **Olivier Lortholary**

13:30-15:30 **Time for project** IP Laboratory Training team

#### Wednesday, 16 April

10:00-12:00 **DEBATE:** Fungal outbreaks differ from bacterial outbreaks  
**For YES** **Tom Chiller** (CDC, USA)  
**For NO** **Souha Kanj** (American University of Beirut, Lebanon)

14:00-15:00 **Guest star Conference:** *Fungal Outbreaks following catastrophic natural disasters* **Tom Chiller** (CDC, USA)

15:15-17:15 Last minute questions & Revisions

#### Thursday, 17 April

10:00-13:00 Written exam

#### Friday, 18 April

8:00-12:00 Project Presentations  
13:00-16:00 Directors debriefing with students  
**Weekly survey on MyPE**

16:00 **Farwell party**

## **TEACHING STAFF**

### **DIRECTORS OF THE COURSE**

**Dea GARCIA HERMOSO, PhD**

Centre National de Référence Mycoses Invasives et Antifongiques (CNRMA)

**Olivier LORTHOLARY, MD, PhD**

Université Paris Cité

Centre Infectiologie Necker-Pasteur Hôpital Necker enfants Malades

Centre National de Référence Mycoses invasives et Antifongiques (CNRMA)

### **HEAD OF PRACTICALS**

**Dea GARCIA HERMOSO, PhD**

### **PRACTICAL SESSIONS TEAM**

**Aude STURNY-LECLERE** CNRMA, Institut Pasteur

**Guylène K'OUAS** Education Department, Institut Pasteur

**Camille CARPENTIER** Education Department, Institut Pasteur

**Sophie ROBERT** Education Department, Institut Pasteur

### **ADMINISTRATION INSTITUT PASTEUR**

**Education Department**

**Sheida KASHANI**

**Registrar's Office**

**Céline CORBIN**

## MEDICAL MYCOLOGY COURSE 2025

### A. AUTOTESTS

The “autotests” will consist on **six multiple choice questions** (MCQ) starting on the 2nd and 3d weeks of the course. Baseline knowledge (before training courses) will be evaluated, and the same questions will be asked at the end of the week followed by the appropriate answers. These “autotests” are important for self-evaluation and will not be integrated in the final evaluation

### B. FINAL EXAMINATION

#### a. **WRITTEN EXAM** (1-20 scale, coefficient 1)

**Thursday April 17 from 10:00am to 1:00pm**

The exam will involve **two sections**:

- On the first section the student will have **10 Multiple Response Questions (MRQ)** and will be required to make none, one or more than one choice (30 min).
  - On the second section, the student will have **4 General Questions**. The student will explain, complete or choose the correct answers.

#### b. **ORAL EXAM** (1-20 scale, coefficient 1)

On **March 27**, we will organize a draw. Each student will get an unknown yeast or mould isolate. Each isolate will be associated with a clinical history. In the following 3 weeks, the student will work to achieve identification to the species level and will present it at the day of the exam.

Each student will prepare **a short PowerPoint file (10 min max)** to present the entire procedure and the key features allowing identification, including morphology (pictures welcome), differential diagnosis and key elements of the clinical history.

On **April 15**, there will be another draw to decide the order of the presentations. The PowerPoint presentation should be handled to the Head of Studies on **April 16, before 4pm**.

On **April 18**, the **oral presentation (10 min max) in English** (with slides in English) will take place in front of ALL students and the course directors. Directors and fellow students will ask questions during the subsequent 10 minutes.

#### c. **ACTIVE PARTICIPATION TO LECTURES AND PRACTICAL COURSES** (1-20 scale; coefficient 0.5)

Student's investment, quality of work, general attitude, participation to discussions during roundtables and elsewhere, will be evaluated throughout the duration of the course by directors.