

INSTITUT PASTEUR COURSE - EDUCATION CENTER

Program 2024-2025 Tuberculosis

Institut Pasteur, Paris, June 02 - June 13, 2025

Philippe MORAND

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Milieu Intérieur
Vers une médecine personnalisée

EXPERTISE
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L'INITIATIVE
aids, tuberculose, paludisme

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INSTITUT
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Lectures: Room n°1 - Building n°9 - Ground floor
Practical works: Building n°9 – 1st floor.

We warmly thank our sponsors for their support to the course



Special thanks to the companies that supported the course's practical work



SUMMARY

Tuberculosis (TB) is as ancient as humanity and, even today, one quarter of the global population is estimated to have been infected with TB. The WHO estimates that there are more than ten million new TB cases and 1,2 million deaths from TB each year. Thus, after some years of COVID-19 pandemic, TB returns to being the worldwide leading cause of death from a single infectious agent.

TB is a preventable and, usually, a treatable infectious disease, although drug-resistance adds tremendous complexity to reach antibiotic efficacy. Over the years, there has been great progress with the introduction of more rapid diagnostic tools based on molecular biology, which are still complementary to culture-based methods. The growing availability of high-throughput sequencing has opened new doors for understanding host-pathogen interactions and immunological responses by identifying critical determinants in both the bacterial and the human genomes.

The course will include lectures by international experts to provide up-to-date information on new developments in the study and control of TB. Lectures will cover general aspects of TB including the immune response, diagnosis, drug susceptibility testing, treatment of MDR-TB, evolution of the *M. tuberculosis* complex and molecular epidemiology. In the practical sessions the participants will work with a whole range of tools available, from culture-based methods and microscopy to whole genome sequencing analysis.

The Tuberculosis Course at the Institut Pasteur in Paris promotes intercontinental interaction, and it is an opportunity for the participants to acquire new knowledge, to exchange experiences and to critically analyse the utility of the techniques in the context of their own settings.

WEDNESDAY, MAY 28

13:30 - 14:30 Pre-start of the Course  Zoom link

Education Center

PASTEUR TUBERCULOSIS COURSE 2024-2025 - 1ST WEEK

MONDAY, JUNE 2

- 9:00 - 10:00 Welcome and introduction to the course
- Brigitte GICQUEL**
(Institut Pasteur, Paris, France)
- Philippe MORAND**
(Université Paris Cité, Paris, France)
- Typhaine BILLARD-POMARES**
(APHP-GHU Nord site Beaujon, Clichy, France)
- Guislain REFREGIER**
(Université Paris-Saclay, Gif sur Yvette, France)
- Adrien LE MEUR**
(Université Paris-Saclay, Gif sur Yvette, France)
- Education Center**
(Institut Pasteur, Paris - France)
- 10:00 - 12:00 Lecture: Tuberculosis in 2025: Is ending it possible? **Lucica DITIU**
(Stop TB Partnership, Genève - Suisse)
- 12:00 - 13:30 **LUNCH**
- 13:30 - 15:00 Lecture: Biological diagnosis of TB **Philippe MORAND**
(APHP.Centre - Université Paris Cité, Paris - France)
- 15:15 - 16:45 Lecture: Treatment of TB: past, present and future **Nicolas VEZIRIS**
(CNRMyRMA, Hôpital Pitié Salpêtrière, Paris - France)
- 16:45 - 17:00 Pause
- 17:00 - 17:30 Practical works: Laboratory presentation and safety **Isabelle LEQUEUTRE**
- 17:30 - 18:00 Practical works: Culture methods (video) **Typhaine BILLARD-POMARES**
Isabelle LEQUEUTRE

TUESDAY, JUNE 3

- 9:00 - 10:30 Lecture: **Mechanisms of resistance to anti-TB drugs** **Alexandra AUBRY**
(AP-HP- Sorbonne-Université, Cimi-Paris, INSERM, Paris - France)
- 10:30 - 10:45 Pause
- 10:45 - 12:45 Practical works: **Typhaine BILLARD-POMARES**
Molecular determination of ATB resistance **Isabelle LEQUEUTRE**
- 12:45 - 13:45 **LUNCH**
- 13:45 – 15:15 Lecture: **Latent infection and subclinical TB; which place for IGRAs?** **Harleen GREWAL**
(University of Bergen, Haukeland University Hospital - Norvège)
- 15:15 – 15:30 Pause
- 15:30 - 16:00 Practical works: **Typhaine BILLARD-POMARES**
Molecular determination of ATB resistance **Isabelle LEQUEUTRE**
- 16:00 - 17:00 Practical works: **Typhaine BILLARD-POMARES**
- **Smear staining and microscopy** **Isabelle LEQUEUTRE**
- **Culture methods**
- 17:00 - 18:00 Practical works: **Typhaine BILLARD-POMARES**
- **LPAs** **Isabelle LEQUEUTRE**
- **Molecular determination of ATB resistance**
- 18:30 Social Event : « **Café du coin** »

WEDNESDAY, JUNE 4

9:00 - 10:15 Lecture: **Pediatric TB**

Christophe DELACOURT
(Necker Children's Hospital, Paris - France)

10:15 - 10:30 **Pause**

10:30 - 12:00 Lecture: **Susceptibility testing for anti-TB drugs**

Emmanuelle CAMBAU
(CNRMyRMA, Hôpital Pitié Salpêtrière, Paris - France)

12:15 - 13:15 Lecture: **TB typing ; which methods and what for ?**

Daniela BRITES
(Swiss Tropical and Public Health Institute, Allschwil - Switzerland)

13:15 – 14:15 **LUNCH**

14:15 - 14:30 **PHOTO**

14:30 - 15:30 Practical works:
NAATs / GeneXpert

Sophie PEASE
(Cepheid, Toulouse - France)

15:30 - 18:00 Practical works:
- **LPAs**
- **NAATs / Fluorotype**

Typhaine BILLARD-POMARES
Isabelle LEQUEUTRE

THURSDAY, JUNE 5

- 9:00 – 10:00 Lecture: **Ludovic TAILLEUX**
Immunology of Tuberculosis;
From Innate Defense to Adaptive Immunity (1)
(Institut Pasteur, Paris - France)
- 10:00 - 10:15 Pause
- 10:15 – 11:15 Lecture: **Ludovic TAILLEUX**
Immunology of Tuberculosis;
From Innate Defense to Adaptive Immunity (2)
(Institut Pasteur, Paris - France)
- 11:15 - 11:30 Pause
- 11:30 – 13:00 Lecture: **Treatment of MDR/XDR TB** **Lorenzo GUGLIELMETTI**
(MSF, CNRMyRMA, Hôpital Pitié Salpêtrière, Paris - France)
- 13:00 – 14:00 **LUNCH**
- 14:00 – 15:00 Lecture: **Computer Assisted Reading for Chest Xrays** **Guillaume CHASSAGNON**
(Université Paris Cité - APHP Centre, Paris - France)
- 15:00 - 18:00 Practical works: **Typhaine BILLARD-POMARES**
- **NAATs / Fluorotype interpretation** **Isabelle LEQUEUTRE**
- **Smear staining and microscopy**

FRIDAY, JUNE 6

9:00 – 10:30 Lecture: **One Health**

Maria Laura BOSCHIROLI
(ANSES, Maisons-Alfort - France)

10:30 - 10:45 Pause

10:45 - 11:45 Lecture: **TB and HIV / Diabetes**

Olivier MARCY
(Université de Bordeaux, Bordeaux - France)

11:45 - 12:00 Pause

12:00 - 13:00 Practical works:
DEEPLEX / principles

Philip SUPPLY
Nelly BADALATO
Alice FERRE
(Genoscreen, Lille - France)

13:00 - 14:00 **LUNCH**

14:00 - 15:30 **FORUM: TB Speed Dating**

15:30 - 16:00 Coffee break

16:00 - 18:00 Practical works: **Discussion / End of first week**

- Smear staining and microscopy
- Culture methods
- NAATs
- LPAs
- MIRU demo (optional)

Typhaine BILLARD-POMARES
Isabelle LEQUEUTRE
Philippe MORAND

MONDAY, JUNE 9

Day OFF

TUESDAY, JUNE 10

9:00 - 10:30 Lecture: **Elimination of tuberculosis: Mission (im)possible.** **Christoph LANGE**
(Research Center Borstel, Leibnitz Lung Center, Borstel - Germany)

10:30 - 10:45 Pause

10:45 – 11:45 Lecture: **Diversity of *M. tuberculosis* complex.** **Roland BROSCHE**
(Institut Pasteur, Paris - France)

11:45 - 12:00 Pause

12:00 – 13:00 Practical works: **Guislaine REFREGIER**
Bioinformatics / introduction to gene sequence analysis **Adrien LE MEUR**

13:00 - 14:00 **LUNCH**

14:00 - 14:30 Lecture: **Pitfalls in the molecular diagnosis of TB** **Nicolas VEZIRIS**
(Hôpital Pitié Salpêtrière, Paris - France)

14:30 - 16:00 Clinical case studies: Part 1 **Nicolas VEZIRIS**
(Hôpital Pitié Salpêtrière, Paris - France)

16:00 - 16:15 Pause

16:15 - 18:00 Practical works: **Guislaine REFREGIER**
Bioinformatics / gene sequencing analysis **Adrien LE MEUR**

WEDNESDAY, JUNE 11

9:00 – 11:00 Clinical Case Studies: Part 2 **Cathy HEWISON**
(MSF, Paris - France)

11:00 - 11:15 Pause

11:15 – 12:30 Practical works: **Guislaine REFREGIER**
Bioinformatics / introduction to whole genome analysis **Adrien LE MEUR**

12:30 - 13:30 **LUNCH**

13:30 - 15:00 Practical works: **Philip SUPPLY**
DEEPLEX / results and interpretation **Nelly BADALATO**
Alice FERRE

15:00 - 15:15 Pause

15:15 – 17:30 Practical works: **Guislaine REFREGIER**
Bioinformatics / WGS analysis – Part 1 **Adrien LE MEUR**

THURSDAY, JUNE 12

- 9:00 - 10:30 Lecture: **BCG and new TB Vaccines** **Carlos MARTIN**
(University of Zaragoza, Zaragoza - Spain)
- 10:30 - 10:45 Pause
- 10:45 – 11:45 Lecture: **Single-cell analysis : who does what ?** **Guilia MANINA**
(Institut Pasteur, Paris - France)
- 11:45 - 12:00 Pause
- 12:00 – 13:00 Practical works: **Bioinformatics** / introduction to phylogenomics **Guislaine REFREGIER**
Adrien LE MEUR
- 13:00 - 14:00 **LUNCH**
- 14:00 – 17:30 Practical works: **Bioinformatics** / WGS analysis – Part 2 **Guislaine REFREGIER**
Adrien LE MEUR

FRIDAY, JUNE 13

- 9:00 - 10:30 **EXAM**
- 10:30 - 11:00 Pause
- 11:00 - 12:30 Lecture: **NTM Detection and speciation, when to treat?** **Jean-Louis HERRMANN**
(Université de Versailles - St Quentin en Yvelines ; Hôpital Raymond Poincaré - Garches - France)
- 12:30 - 14:00 **LUNCH**
- 14:00 - 15:00 Correction of Tests **Philippe MORAND**
Brigitte GICQUEL
- 15:00 – 15:15 Pause
- 15:15 - 16:00 Group Discussion, Course Evaluation **Philippe MORAND**
Brigitte GICQUEL
Isabelle LEQUEUTRE
- 16:00 - 16:30 Presentation of Diplomas and course closure

ORGANIZATION OF EXAMINATIONS

The students will be evaluated based upon their:

- score on the final exam;
- participation in class discussions;
- completion of bioinformatics exercises;
- performance in the laboratory practicals.

The evaluation of the laboratory performance will be based on elements of a good laboratory worker, including completion of protocols, results, ability to work in teams, time management and especially the laboratory notebook.

The lab notebooks will be reviewed and evaluated at the end of the course. It should record exactly what was done and the results, with any modifications from the given protocols. They should include enough detail so that with the notebooks and the protocol book, the experiments could be successfully repeated by someone else.

Lecturers

Ms AUBRY Alexandra

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