



## Advanced Course on Antibiotics (AdCAb)

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Organized by **Fondation Mérieux** and **Institut Pasteur**

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**Objective:** The increasing occurrence of resistance to antibiotics and the emergence and spread of bacteria resistant to all drug classes seriously threaten all branches of modern medicine. There is currently no course providing advanced instruction on antibiotic discovery, development, and rational use. The specific goal of AdCAb is to bring leaders and innovators in academics and industry together with highly trained scientists at the dawn of their careers. Cutting-edge approaches and technologies for determination of antibacterial activity, detection of potential resistance mechanisms, antibiotic discovery, chemical optimization and usage that maximizes their utility and minimizes the development of resistance will be examined.

**Course:** AdCAb was conceived and developed by an international group of thought leaders from the Institut Pasteur, Harvard Medical School, McMaster University, diagnostic, biotech, and pharma industry, teaching hospitals, health care, and governmental and non-governmental agencies. The faculty will be composed of 35 internationally recognized scientists and physicians who have made important contributions to antibiotic development, infectious diseases management, and understanding the problem of resistance. Every faculty will provide lectures, supervise working groups, and will be accessible for informal interactions as they will be in residence for a minimum of 2 days during the course. Graduates will emerge with a state-of-the-art understanding of existing antibiotics: modes of action, pharmacology, toxicology, mechanisms of resistance, impact of antibiotics on human and other ecologies, current approaches for mining chemical space for antimicrobial activity, the process of advancing hits to leads, the application of next generation nucleic acid-based technologies for antibiotic discovery and resistance detection, and perhaps, most importantly, training and experience in thinking creatively and innovatively about solutions to the problem. The course aims to build an international cadre of collaborative, well networked, and highly trained specialists.

**Audience:** AdCAb is intended to early career scientists – assistant professors, new industry scientists, MDs, and postdoctoral research associates needing to learn from and interact with international leading scientists in all fields related to antibiotics. Successful applicants will include members from medical and training centers, leading pharmaceutical and diagnostic companies, innovative biotech, as well as from developing areas contending with the practical challenge of managing the antibiotic resistance problem with limited resources. Attendance will be limited to 40 students and will reflect the global nature of the problem. Select Continuing Medical Education and other education credits will be offered.

**Format:** The course will be administered over 11 business days and will consist of full days of formal instruction, review of the literature, hands-on practical training, innovation-driven brainstorming sessions, network building, small group problem solving and discussion sessions. Sightseeing and adventure opportunities will be offered over the weekend.

<http://www.fondation-merieux.org/advanced-course-on-antibiotics-adcab>

For more information on how to apply and related details, please contact:  
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## Advanced Course on Antibiotics (AdCAb) Programme outline

### Understanding of current infectious disease management practice and antibiotic use

The problem of antibiotic resistance in the developed and developing world  
Evaluation of activity by phenotypic techniques and clinical categorization  
The interpretative reading of antibiogram

### Antibiotic discovery, development, and approval

History and current strategies  
Hit to lead: Turning an inhibitor into a preclinical candidate:  
Structure/activity relationship; antibiotic medicinal chemistry  
PK/PD characterization/optimization, *in vivo* efficacy  
Lead to candidate: Preclinical toxicity assessment; compound scale-up  
Pathways to approval and commercialization

### Modes of action and mechanisms of resistance of existing classes

- *Cell wall*: Structure, biosynthesis, targets  
β-lactams, β-lactamase inhibitors, PBPs  
Glycopeptides, lipopeptides, lipoglycopeptides
- *Membrane*: Structure, cationic peptides, daptomycin; overcoming toxicity
- *Ribosome*: Structure  
Aminoglycosides, tetracyclines, fusidic acid, chloramphenicol  
Macrolides-Lincosamides-Streptogramins, pleuromutilins, oxazolidinones
- *Nucleic acid synthesis, replication, transcription*  
Inhibitors of metabolism, quinolones, rifampicin, fidaxomicin
- *Efflux*: structure-function of efflux systems; substrates, inhibitors  
Overcoming Gram-negative barrier  
*Mycobacteria* : Hitting the targets

### Origin, transfer, and spread of antibiotic resistance

Origins, mutations, biological cost, compensation  
Mobile genetic elements

### New technologies for determination of antibiotic activity and detection of resistance

Rapid techniques and point-of-care in the developed and developing worlds  
Mass spectrometry

### Strategies for antibiotic activity discovery

Antibiotic chemical space  
New sources of natural products  
Innovation in antibiotic screening  
Adjuvants and potentiators of antibiotics  
How to elucidate the mode of action of new antibiotics

### Strategies for exploring new chemical space

Chemical libraries: availability, design, limitations, novel approaches  
Accessing new space with novel synthetic chemicals  
Diversity-oriented synthesis  
Synthetic biology to access and expand nature's chemical diversity

### Strategies for more focused applications of antibiotics

Narrow spectrum/diagnostic pairs  
Targeting virulence, biofilm

### New bioinformatic approaches for managing and exploiting "Big Data"

Next generation sequencing and beyond  
Databases for antibiotic resistance and virulence  
Finding the patterns with bioinformatics  
Bioinformatic analysis of outbreaks and within host evolution

### Relationship between antibiotic use and resistance

Surveillance of resistance and antibiotic stewardship  
Veterinary use, "One Health"  
Non-medical, unregulated use

### Non-antibiotic promising alternatives

Antibodies, bacteriocins, bacteriophages, probiotics, vaccines, CRISPR/Cas9