International Course on Antibiotics and Resistance (ICARe)

November 11-19, 2017, Les Pensières, Annecy (France)

Course Director: P. Courvalin, Institut Pasteur
Scientific Advisors: M. S. Gilmore, Harvard Medical School, G. D. Wright, McMaster University
Scientific Committee: C. Arias, K. Bush, S. Lory, A. Myers, S. Projan, H.-G. Sahl, M.-W. Tan

Organized by Institut Pasteur

Objective: The emergence and spread of bacteria resistant to many drug classes seriously threaten all branches of modern medicine. There is currently no course providing advanced instruction on antibiotics and resistance. The specific goal of ICARe is to bring leaders in academics and industry together with trained scientists at the dawn of their careers. Cutting-edge approaches for detection of resistance, antibiotic discovery, chemical optimization, and use of antibiotics that minimizes the development of resistance will be examined.

Course: ICARe was conceived by an international group of thought leaders from the Institut Pasteur, Harvard Medical School, McMaster University, biotech, diagnostic, and pharma industry, and teaching hospitals. The faculty is composed of 35 internationally recognized scientists and physicians who have made important contributions to antibiotic development, and infectious diseases and resistance management. Faculty will be in residence for a minimum of 2 days and accessible for informal interactions. 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: ICARe is designed for early career scientists – assistant professors, new industry scientists, MDs, and postdoctoral research associates - as well as members 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.

Format: The course will be administered over 8 days and will consist of formal instruction, review of the literature, small group problem solving, including hands-on use of relevant computational tools, innovation-driven brainstorming sessions, and network building.

Organizing committee: C. Grillot-Courvalin, B. Pansier, M. Sala

http://www.pasteur.fr/en/ICARe

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Programme outline

Infectious disease management and antibiotic use

The problem of antibiotic resistance in the developed and developing world
Evaluation of susceptibility by phenotypic techniques and clinical categorization
History and History and current strategies for antibiotic discovery
Biochemistry and genetics of resistance

Modes of action and mechanisms of resistance of existing classes

Cell wall: Structure, biosynthesis, targets
β-lactams, β-lactamases and inhibitor combinations
Glycopeptides, lipopeptides, lipoglycopeptides, daptomycin
Membrane: Structure, cationic peptides, polymixins,bacitracin
Ribosome: Structure and function
Aminoglycosides, tetracyclines, fusidic acid, chloramphenicol
Macrolides-Lincosamides-Streptogramins, pleuromutilins, oxazolidinones
Nucleic acid synthesis, replication, transcription
Inhibitors of biosynthesis, quinolones, rifampicin, fidaxomicin
Efflux: structure-function of efflux systems and inhibitors
Outer membrane barrier

Origin, mutations, and identification of antibiotic resistance mechanisms

Mutations, selection, biological cost, compensation
Origins of resistance genes
Antibiogram interpretation

Antibiotic discovery

Antibiotic chemical space
Antibiotic chemical matter: Natural products, Synthetics
Target *vs* non-target based strategies
Screens and hit generation

Antibiotic development and approval

Hit to lead
PK/PD key elements and optimizing leads
Preclinical toxicity assessment, compound scale-up
Pathways to approval and commercialization
Antibiotics under development

New topics in antibiotic discovery

Systems biology to guide antibiotic discovery and MOA
Antibiotic adjuvants and inhibitors of resistance

Strategies for more focused applications of antibiotics

Narrow spectrum antibiotics
Targeting virulence, biofilm
Targeted delivery
Antibody-antibiotic conjugates

New technologies for determination of antibiotic activity and detection of resistance

Rapid and point-of-care techniques for resistance detection
Prediction of resistance by mass spectrometry

New bioinformatic approaches for managing and exploiting "Big Data"

Next generation sequencing and beyond
Databases for antibiotic resistance and virulence
Mobile genetic elements
Finding the patterns with bioinformatics
Bioinformatic analysis of outbreaks
Genome-wide association studies for bacterial pathogens
Identifying and exploring novel biosynthetic pathways in metagenomes

Non-antibiotic anti-infective strategies

Antibodies,, vaccines, microbiome, CRISPR/Cas9, synthetic biology

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Core faculty

D. Andes, University of Wisconsin, USA
C. Arias, University of Texas, USA
D. Bikard, Institut Pasteur, France
E. Brown, McMaster University, Canada
K. Bush, Indiana University, USA
V. Cattoir, Université de Rennes 1, France
G. Challis, University of Warwick, UK
J.-P. Charrier, bioMérieux, France
L. Chesnel, Merck, USA
P. Courvalin, Institut Pasteur, France
L. Debarbieux, Institut Pasteur, France
J.-D. Docquier, University of Siena, Italy
T. Dougherty, Harvard Medical School, USA
M. Gilmore, Harvard Medical School, USA
C. Giske, Karolinska Institutet, Sweden
C. Grillot-Courvalin, Institut Pasteur, France
R. Hancock, University of British Columbia, Canada
D. Hooper, Massachusetts General Hospital, USA
D. Hughes, Uppsala University, Sweden
D. Kohane, Harvard Medical School, USA
S. Lahiri, Macrolide Pharmaceuticals, USA
F. Lebreton, Harvard Medical School, USA
S. Lory, Harvard Medical School, USA
A. Mankin, University of Illinois, USA
H. Moser, Novartis, USA
A. Myers, Harvard University, USA
M. Page, Basel, Switzerland
R. Peeling, London School of Hygiene & Tropical Medicine, UK
K. Pos, Goethe University, Germany
S. Projan, MedImmune, USA
M. Pucci, Spero Therapeutics, USA
D. Rasko, University of Maryland, USA
G.-M. Rossolini, University of Siena, Italy
H.-G. Sahl, University of Bonn, Germany
J. Schrenzel, Geneva University Hospitals, Switzerland
M.-W. Tan, Genentech/Roche, USA
Y. Taur, Memorial Sloan Kettering Cancer Center, USA
M. Trent, University of Georgia, USA
T. Walsh, Cardiff University, UK
G. Wright, McMaster University, Canada

Fact issues:

40 highly trained participants

35 international speakers

10 interactive sessions

8 days of knowledge–sharing

Who should apply?

Assistant professors, post-doctoral and ID fellows, new scientists from diagnostic and pharmaceutical industry or from biotech, either working in or contemplating entering the field of antibiotics. Decision-makers involved in the discovery, development, and approval of new antibiotics, in the elaboration of programs for better use of antibiotics and reducing the development of resistance. From both the public and private sectors

Selection Criteria

Participants (maximum 40) will be:

- Selected by the International Scientific Committee that will ensure that the participants reflect the global nature of the problem with a special attention to applicants from the developing world and gender equality.

- According to their :

  - Educational background
  - Involvement in the field of antibiotics. Research projects, scientific or industrial, which could be presented during the course are welcome.
  - Decision-making responsibility in the finding of new antibiotics and of their appropriate use.
  - Expected impact of the course at personal, institutional, and national levels (maximum one per institute).