

International Course on Antibiotics and Resistance (ICARe)

Director:

P. Courvalin, Institut Pasteur, France

Scientific Advisors:

G. Wright, McMaster University, Canada

M. Gilmore, Harvard Medical School, USA

Scientific Committee:

C. Arias, University of Texas, USA

G. Challis, University of Warwick, UK

T. Dougherty, Harvard Medical School, USA

S. Lahiri, Macrolide Pharmaceuticals, USA

S. Lory, Harvard Medical School, USA

A. Myers, Harvard University, USA

S. Projan, MedImmune, USA

H.-G. Sahl, University of Bonn, Germany

M.-W. Tan, Genentech/Roche, USA

Organizing Committee :

C. Grillot-Courvalin, Institut Pasteur, France

M. Sala, Institut Pasteur, France

B. Pansier, Fondation Mérieux, France

Core faculty

J. Ambler, Wockhardt Pharmaceuticals, USA

D. Andes, University of Wisconsin, USA

C. Arias, University of Texas, USA

M. Arthur, Sorbonne Université, France

D. Bikard, Institut Pasteur, France

S. Brisse, Institut Pasteur, France

E. Brown, McMaster University, Canada

G. Challis, University of Warwick, UK

J.-P. Charrier, bioMérieux, France

P. Courvalin, Institut Pasteur, France

J.D. Docquier, University of Sienna, Italy

M. Doubovetzky, Sanofi, France

T. Dougherty, Harvard Medical School, USA

F. Fang, University of Washington USA

M. Fisher, St Georges University, UK

K. Gallant, CARB-X, USA

M. Gilmore, Harvard Medical School, USA

L. Hall-Stoodley, Ohio State University, USA

S. Harbarth, Hopitaux de Genève, Switzerland

D. Hughes, Uppsala University, Sweden

S. Lahiri, Macrolide Pharmaceuticals, USA

F. Lebreton, Harvard Medical School, USA

M. Lipsitch, Harvard Medical School, USA

S. Lory, Harvard Medical School, USA

B. Luisi, University of Cambridge, UK

A. Mankin, University of Illinois, USA

S. Mobashery, University of Notre Dame, USA

H. Moser, Novartis, USA

A. Myers, Harvard University, USA

K. Outtersson, CARB-X, USA

M. Page, Basel, Switzerland

E. Pamer Memorial Sloan Kettering Cancer Center, USA

S. Projan, Arsanis Inc, USA

M. Pucci, Spero Therapeutics, USA

J. Rex, F2G, UK

H.-G. Sahl, University of Bonn, Germany

L. De Sordi, University de Paris 6, France

M.-W. Tan, Genentech/Roche, USA

U. Theuretzbacher, CAIA, Austria

M. Trent, University of Georgia, USA

N. Vazquez-Laslop, University of Illinois, USA

G. Wright, McMaster University, Canada

Program

Saturday, October 19

14:00 **General orientation of the course:** P. Courvalin, M. Gilmore, and G. Wright

14:15 Les Pensières : B. Pansier

Opening Lectures

14:30 Antibiotic resistance is a global problem (S. Harbarth, CH)

16:00 *Break*

16:30 Overview of antibiotic R&D: history and strategies (T. Dougherty, US)

17:30 The socio-economic challenges of antibiotic discovery (K. Outterson, US)

18:30 Presentation of the participants

19:30 *Dinner*

Sunday, October 20

Modes of action and mechanisms of resistance of existing classes

Cell wall

8:30 Cell wall structure, synthesis, and targets (H.-G. Sahl, DE)

10:00 *Break*

10:30 Outer membrane barrier (M.Trent, US)

11:15 Inner membrane structure and function (M. Trent)

12:00 *Lunch*

14:00 Penicillin-binding proteins (M. Arthur, FR)

14:45 β -lactams and β -lactamases (J.-D. Docquier, IT)

15:30 *Break*

16:00 β -lactamases inhibitors (J.-D. Docquier)

16:45 Glyco-lipopeptides (P. Courvalin, FR)

17:30 Bioinformatics (F. Lebreton, S. Brisse, C. Arias, S. Lory)

Evaluation

18:30 Posters

19:30 *Dinner*

Monday, October 21

Modes of action and mechanisms of resistance of existing classes (continued)

Ribosomes

8:30 Ribosome structure and function (A. Mankin, US)

10:00 *Break*

10:30 Antibiotics active against the large subunit (N. Vazquez-Laslop, US)

11:30 Antibiotics active against the small subunit (A. Mankin)

12:30 *Lunch*

14:00 Aminoglycosides resistance (S. Mobashery, US)

14:45 Inhibitors of biosynthesis (E. Brown, CA)

15:30 *Break*

Nucleic acid synthesis, replication, transcription

16:00 Inhibitors of type II topoisomerases (M. Fisher, UK)

16:45 Rifampicin, fidaxomicin (G. Wright, CA)

17:15 Bioinformatics (continued)

Evaluation

18:30 Posters

19:30 *Dinner*

Tuesday, October 22

Modes of action and mechanisms of resistance of existing classes (end)

Efflux

8:30 Structure-function of efflux systems and inhibitors (B. Luisi, UK)

9:30 Influx-efflux in *Pseudomonas aeruginosa* (S. Lory, US)

10:15 *Break*

10:45 Cationic peptides (M. Pucci, US)

11:30 Daptomycin (C. Arias, US)

12:15 *Lunch*

Origin, mutations, and transfer of resistance

14:30 Origins of resistance genes (G. Wright)

15:15 Mutations, selection, biological cost, compensation (D. Hughes, SE)

16:00 *Break*

16:30 Mobile genetic elements (P. Courvalin)

17:15 CARB-X goals and progress (K. Gallant, US)

17:30 Bioinformatics (continued)

Evaluation

18:30 Posters

19:30 *Dinner*

Wednesday, October 23

Antibiotic discovery

Antibiotic chemical space

8:30 Antibiotic chemical space: Gram-positives (S. Lahiri, US)

9:15 Antibiotic chemical space: Gram-negatives (H. Moser, US)

10:00 *Break*

Antibiotic chemical matter : Natural products

10:30 Historical approaches, new sources (G. Challis, UK)

11:15 New strategies, synthetic biology (G. Challis)

12:00 *Group picture, lunch, afternoon off*

17:00 Bioinformatics (hands-on, optional)

19:30 *Dinner*

Thursday, October 24

Antibiotic discovery (end)

Antibiotic chemical matter: Synthetics

8:30 Antibiotic chemical matter: Synthetics (A. Myers, US)

10:00 *Break*

10:30 Target vs. non-target based strategies (E. Brown, CA)

11:15 Screens and hit generation (M.-W. Tan, US)

12:00 *Lunch*

Antibiotic development and approval

13:30 Hit to lead (T. Dougherty)

14:15 Preclinical PK/PD and optimizing leads (D. Andes, US)

15:00 Preclinical toxicity assessment (M. Doubovetzky, FR)

15:45 *Break*

16:15 Compound scale-up, CMC, GLP, GCP, and GMP (M. Page, CH)

17:00 Bioinformatics (continued)

Evaluation

18:30 Posters

19:30 *Dinner*

Friday, October 25

Antibiotic development and approval (end)

8:30 Pathways to approval and commercialization (J. Ambler, US)

9:15 New pathways to antibiotic registration (J. Rex, US)

10:00 *Break*

New topics in antibiotic discovery

10:30 Systems biology to guide antibiotic discovery and MOA (E. Brown)

11h:15 Antibiotic adjuvants (G. Wright)

12:00 *Lunch*

Strategies for more focused applications of antibiotics

14:00 Targeting biofilm (L. Hall-Stoodley, US)

14:45 Targeting virulence (S. Lory)

15:30 *Break*

16:00 Targeted delivery (M. Gilmore, US)

16:45 Microbiome and antibiotics (E. Pamer, US)

17:30 Bioinformatics (end)

Evaluation

19:00 Posters

19:30 *Dinner*

Saturday, October 26

Susceptibility determination and identification of resistance mechanisms

8:30 Antibiogram: phenotypic techniques and clinical categorization (F. Fang, US)

9:15 Rapid techniques and point-of-care diagnostics (F. Fang)

10:00 *Break*

10:30 Resistance testing during drug discovery and development (D. Hughes)

11:15 Mass spectrometry (J.P. Charrier, FR)

12:00 *Lunch*

New antiinfective strategies

14:00 Antibody-antibiotic conjugates (M.-W. Tan)

14:45 Vaccines (M. Lipsitch, US)

15:30 *Break*

16:00 Bacteriophages (L. De Sordi, FR)

16:45 CRISPR/Cas9 (D. Bikard, FR)

Evaluation

18:00 Closure of the course and certificate awards (M. Sala, P. Courvalin, M. Gilmore, and G. Wright)

19:30 *Dinner*

Sunday, October 27

8:30 Antibiotics under development (U. Theuretzbacher, AS)

9:30 Diagnostic stewardship: Optimizing the treatment of infections (F. Fang)

10:30 *Break*

11:00 How to return to the future (S. Projan, US)

12:00 *Lunch*