New Frontiers in Antibacterial Resistance Research

US-Nordic-European Symposium

January 20\textsuperscript{th}-21\textsuperscript{st} 2016

Karolinska Institute
Stockholm
Objectives

Antibacterial resistance is accelerating at an alarming pace, leading to a global increase in morbidity and mortality due to resistant bacterial infections. The U.S. National Institute of Allergy and Infectious Diseases of the U.S. National Institutes of Health and the EU Joint Programming Initiative on Antimicrobial Resistance (AMR) are committed to funding basic, translational, and clinical research to address this growing public health threat. “New Frontiers in Antibacterial Resistance Research” will increase the Trans-Atlantic dialogue and scientific collaboration to enhance research addressing antibacterial resistance. The workshop objectives are:

1. To discuss cutting-edge approaches to address antibacterial resistance
2. To foster communication and research collaborations among scientists in the US and the EU
3. To share information on funding opportunities to advance antibacterial resistance research

Sponsors:

- The Joint Programming Initiative on Antimicrobial Resistance
- The Swedish Research Council
- The U.S. National Institutes of Health: National Institute of Allergy and Infectious Diseases (NIAID); Office of Rare Diseases; Fogarty International Center

Participants: Approximately 80 invited scientific leaders and researchers drawn primarily from leading European, Nordic, and U.S. institutions, as identified by the Scientific Planning Committee
# DAY 1 – 20th January 2016

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<tr>
<th>Time</th>
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<td>8.00-8.30</td>
<td>Registration</td>
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## WELCOME ADDRESS

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<th>Time</th>
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<tr>
<td>8.30-9.00</td>
<td>Welcoming remarks</td>
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*Anders Lönn*
*State Secretary*
*Ministry for Higher Education and Research, Sweden*

*Mr. Robert Gilchrist*
*Chargé d’Affaires, U.S. Embassy Sweden*

## KEYNOTE PRESENTATIONS

**Moderator: Mats Ulfendahl (Karolinska Institute/JPIAMR)**

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<tr>
<th>Time</th>
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<tr>
<td>9:00-9:30</td>
<td>Antibacterial resistance: Overview of the threat</td>
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*Fernando Baquero*
*Ramón y Cajal Institute for Health Research (IRYCS)*

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<th>Time</th>
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<tr>
<td>9:30-10:00</td>
<td>Antibacterial resistance: Research efforts</td>
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*Henry F. Chambers*
*University of California*

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<th>Time</th>
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<tr>
<td>9:50-10:20</td>
<td>Current AMR Activities- TATFAR, CARB, etc.</td>
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*Dennis M. Dixon*
*NIH/NIAID*

*Mats Ulfendahl*
*Karolinska Institute/JPIAMR*

*Arjon Van Hengel*
*European Commission*

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<th>Time</th>
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<td>10:20-10:50</td>
<td>Tea and Coffee Break</td>
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## FOR EACH SESSION PRESENTATIONS WILL BE 20 MINUTES, WITH Q&A 5 MINUTES

**SESSION 1**  
**MOLECULAR EPIDEMIOLOGY AND EVOLUTION OF ANTIBACTERIAL RESISTANCE**

**Moderator: Henry F. Chambers (University of California)**

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<th>Time</th>
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<tr>
<td>10:50-11:15</td>
<td>EU molecular epidemiology</td>
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*Jordi Vila Estape*
*University of Barcelona*

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<tr>
<td>11:15-11:40</td>
<td>Molecular epidemiology of carbapenem-resistant Enterobacteriaceae in the US</td>
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*Barry N. Kreiswirth*
*Public Health Research Institute, Rutgers New Jersey Medical School*

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<tr>
<td>11:40-12:05</td>
<td>Ecology of emerging resistance and genetic evidence of inter-species “cross-over”</td>
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*Lance B. Price*
*George Washington University*

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<td>12:05-12:45</td>
<td>Discussion/Questions</td>
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<tr>
<td>12:45-13:45</td>
<td>Lunch – with presentation on research funding opportunities supported by NIH</td>
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*Jane Knisely*
*NIH/NIAID*
SESSION 2  
APPROACHES TO COMBAT ANTIBACTERIAL RESISTANCE: ENABLING TECHNOLOGIES

Moderator: Otto Cars (Uppsala University)

13:45-14:10 Systems biology and antibacterial resistance  
Roy Kishony  
Technion University and Harvard Medical School

14:10-14:35 Insights into gram-negative permeability and efflux  
Michael Mourez  
SANOFI

14:35-15:00 Pharmacological approaches to address antimicrobial resistance  
George Drusano  
University of Florida

15:00-15:30 Discussion/Questions

15:30-16:00 Tea and coffee break

16:00-16:25 Diagnostic technologies to guide the use of narrow spectrum therapeutics  
Herman Goossens  
University of Antwerp

16:25-16:50 The art nouveau of microbial cultivation and renaissance in antibiotic discovery  
Slava Epstein  
Northeastern University

16:50-17:30 Discussion/Questions

DAY TWO – 21st January 2016

8:00-8:30 Registration

SESSION 3  
NON-TRADITIONAL APPROACHES TO PREVENT AND TREAT Antibacterial Resistant INFECTIONS

Moderator: Frank DeLeo (NIAID/NIH)

8:30-8:55 Modulating the immune system to combat bacterial infection  
Birgitta Agerberth  
Karolinska Institutet

8:55-9:20 Bacterial vaccines  
Olaf Schneewind  
University of Chicago

9:20-9:55 Monoclonal antibodies for prevention and treatment  
Steven J. Projan  
MedImmune

9:55-10:30 Discussion/Questions

10:30-10:50 Tea and coffee break

10:50-11:15 Anti-virulence strategies  
Fredrik Almqvist  
Umeå University
SYNTHETIC MICROBIOTA: An ecobiological approach
Matthew Henn
Seres Therapeutics

BACTERIOPHAGE THERAPY
Anders Nilsson
The Wenner-Gren Institute

PREDATORY BACTERIA
Ilana Kolodkin-Gal
Weizmann Institute of Science

LUNCH – with presentation on research funding opportunities supported by European funders
Arjon Van Hangel
European Commission
Laura Marin
JPIAMR

SESSION 4  CLINICAL RESEARCH ON ANTIBACTERIAL RESISTANCE
Moderator: Niels Frimodt-Møller (University of Copenhagen)

OVERVIEW OF CHALLENGES IN THE CONDUCT OF INTERVENTIONAL TRIALS TO ADDRESS ANTIMICROBIAL RESISTANCE
John Rex
AstraZeneca

THE ANTIMICROBIAL RESISTANCE LEADERSHIP GROUP
Vance Fowler
Duke University

IMI ND4BB COMBATTING BACTERIAL RESISTANCE IN EUROPE (COMBACTE)
Marc J M Bonten
University Medical Center Utrecht

SESSION 5  SUMMARY AND CLOSING REMARKS
Moderators: Dennis Dixon and Mats Ulfendahl

RAPPORTEUR SUMMARIES AND GENERAL DISCUSSION OF PROMISING COLLABORATIVE RESEARCH.

CLOSING REMARKS FROM NIH AND SRC
Speaker Biographies

Birgitta Agerberth

Birgitta Agerberth is professor of Medical Microbial Pathogenesis at Karolinska Institutet, Department of Laboratory Medicine, Division of Clinical Microbiology. She was one of the principal researchers in the discovery of the human antimicrobial peptide LL-37 of the cathelicidin family on cDNA level, isolation of the mature active peptide from granulocytes, and characterization of the gene structure. The present aim of her research is to develop a novel strategy to combat infectious diseases by inducing endogenous antimicrobial peptides (AMPs) with small molecules. The multiplicity of AMPs with different mechanisms of action, including lysis of the pathogens, is the key to restrict the development of resistant bacterial strains.

Fredrik Almqvist

Fredrik Almqvist (FA) received a Ph.D. in Organic Chemistry in 1996 from Lund University. After a postdoc at Washington University in St. Louis FA joined Umeå University in Sweden as an assistant professor. In July 1999 FA was tenured (Universitetslektor) and he was appointed docent 2003. FA was appointed Professor in Organic Chemistry in August 2007 and currently he is deputy head of the department of Chemistry at Umeå University as well as co-research director for the Laboratories for Chemical Biology. Almqvist was awarded the Göran Gustafsson award in Chemistry 2013 for his contributions within organic chemistry and chemical biology.

Fernando Baquero

Fernando Baquero is a research professor at the Department of Microbiology at the Ramón y Cajal Institute for Health Research (IRYCIS) in Madrid. He was awarded the André Lwoff Award of the Federation of European Microbiological Societies in 2015 and is a member of the American Academy of Microbiology, the European Academy for Microbiology, and the European Academy for Clinical Microbiology and Infectious Diseases.

Marc Bonten

Marc Bonten earned his MD and PhD at the Maastricht University Medical School (UMC), the Netherlands. Since August 2008 he has been head of the Department of Medical Microbiology at the UMC Utrecht, where he has been professor of molecular epidemiology of infectious diseases since 2002. He has been a principal investigator in many large-scale epidemiologic studies and investigator-initiated randomized trials of prevention and treatment of infectious diseases. Specific research interests include the epidemiology of antibiotic-resistant bacteria such as VRE, MRSA, and MDR Enterobacteriaceae, selective decontamination in intensive care unit patients, prevention of ventilator-associated pneumonia, treatment of community-acquired pneumonia, and prevention and treatment of community-acquired pneumonia.
Henry F. Chambers

Henry Chambers is Professor of Medicine at the University of California, San Francisco and Director of Clinical Research Services for the UCSF Clinical Translational Science Institute. He is editor for the Sanford Guide to Antimicrobial Therapy and an editor for Antimicrobial Agents and Chemotherapy. He is Co-Principal Investigator of the Antibacterial Resistance Leadership Group with Vance Fowler. His clinical and research interests are antimicrobial drug resistance, staphylococcal infections, experimental therapeutics, and epidemiology and pathogenesis of disease caused by Staphylococcus aureus. He has over 200 original publications and textbook chapters in the field.

Dennis Dixon

Dennis Dixon is Chief of the Bacteriology and Mycology Branch, NIAID, NIH. He serves on numerous advisory panels on dangerous pathogens and also antimicrobial resistance, including the Trans-Atlantic Task Force on Anti-Microbial Resistance (TATFAR) and the Presidential Advisory Committee for Combating Antibiotic Resistant Bacteria. His doctorate in microbiology is from the Medical College of Virginia. He held academic positions at Loyola College in Baltimore, the University of Maryland Medical School, and Albany Medical College. He was a Visiting Scientist at Hoffman LaRoche, Switzerland and was Director for the Mycology Reference Laboratory, New York State Department of Health. He is a member of the American Academy of Microbiology.

George L. Drusano

George Drusano is Professor and Director, Institute for Therapeutic Innovation, University of Florida. He is the author of over 300 articles in peer-reviewed journals. He has served as an ad hoc member of the NIAID Council on two occasions to support issues regarding bacterial resistance. He has won a number of awards including Distinguished Investigator of the Year (2003) by the American College of Clinical Pharmacology, the Maxwell Finland Award for Scientific Achievement (2012) from the National Foundation for Infectious Diseases, the Cubist-ICAAC award from ASM (2013), and the Paul Ehrlich Magic Bullet Award (2015).

Slava Epstein

Slava Epstein is a Distinguished Professor at the College of Science, Northeastern University in Boston, U.S.A. For the past 15 years, Slava’s lab has been working on one of the most intriguing biological phenomena: why 99% of microbial diversity has gone missing from the lab. The basic and applied potential of this microbial “dark matter” is unprecedented, and so his lab has focused on, developed, and reduced to practice innovative approaches to sample and utilize this pool of unexplored species. These approaches have created a novel platform for drug discovery that beats the industry standards by orders of magnitude.
Jordi Vila Estape

Jordi Vila Estape is currently the Head of the Department of Clinical Microbiology of the Hospital Clinic in Barcelona and Professor of the School of Medicine, University of Barcelona, Barcelona, Spain. His field of research interest is in the molecular bases of antimicrobial resistance and the development of new antibiotics. He was the Programme Director of the Congress of the European Society of Clinical Microbiology (ESCMID), and for 4 years he was member of the ICAAC Scientific Program Committee. He has published 350 articles in peer-reviewed journals and has patented three molecules.

Vance Fowler

Vance Fowler has extensive expertise in clinical and translational research in bacterial infections that has led to 20 years (1999-2019) of continuous NIH funding as a Principal Investigator (PI). He is currently Contact PI of the Antibacterial Resistance Leadership Group. He created the S. aureus Bacteremia Group (SABG), co-founded the International Collaboration on Endocarditis, and was lead author on several registrational clinical trials involving daptomycin and the V710 S. aureus vaccine. He has received numerous awards for his research. In 2012, he received the Clinical Research Achievement Award from the Clinical Research Forum for publishing one of the top ten clinical research papers in the United States.

Robert Gilchrist

Robert Gilchrist is the Chargé d’Affaires at the U.S. Embassy in Stockholm. In 2015, he was promoted by the Department of State to the rank of Minister Counselor. A 25 year veteran of the U.S. Career Foreign Service, he has served numerous postings in Washington and abroad. Outside of the State Department, he has served as a Foreign Policy Advisor to U.S. Congressman William Delahunt of Massachusetts, and as an International Observer at the Multinational Force and Observers peacekeeping mission in the Sinai Desert, Egypt. A native of Florida, he received an MA in Foreign Affairs from the University of Virginia, and a BA in Politics from Wake Forest University. He has received multiple Superior Honor Awards, Meritorious Honor Awards, and other notable recognitions throughout his career. In 2009, Secretary of State Hillary Clinton recognized his leadership on LGBT equality with the Department of State Equal Employment Opportunity Award.

Herman Goossens

Herman Goossens is a professor of Medical Microbiology at the University of Antwerp and the director of the Laboratory of Clinical Biology of the University Hospital Antwerp. He has published more than 500 full papers in peer-reviewed scientific journals. He is the founder and Chair of the Belgian Antibiotic Policy Co-ordination Committee (BAPCOC). He has been coordinating several European projects funded by DG Research, DG SANCO, IMI and ECDC. He is the founder of the annual European Antibiotic Awareness Day (EAAD). Herman Goossens is the chair of the Scientific Advisory Board of the Joint Programming Initiative on Antimicrobial Resistance. His professional goal is to bridge the gap between clinical research and public health, with a major focus on antibiotic resistance.
Arjon van Hengel

Arjon van Hengel studied biology at the University of Utrecht (NL) and received his PhD in molecular biology from the University of Wageningen (NL), after which he worked as a research scientist at the John Innes Centre (Norwich, UK). Since 2005 he has worked for the European Commission, where he initially led a research group that develops and validates analytical detection methods. Since 2009 he has worked at the Directorate General for Research and Innovation as scientific officer responsible for research funding and research policy in the area of antimicrobial resistance.

Matthew Henn

Matthew Henn is the Senior Vice President and Head of Drug Discovery & Bioinformatics of Seres Therapeutics. His research has focused on microbial populations and the functional role of microbes in both environmental and infectious disease applications and also the development of genomic tools to study these populations. Prior to joining Seres, he was the Director of Viral Genomics and Assistant Director of the Genome Sequencing Center for Infectious Diseases at the Broad Institute of MIT and Harvard. He earned his Ph.D. in ecosystem sciences from the University of California at Berkeley where he was a NASA Earth Systems Sciences Fellow and trained as a NSF Postdoctoral Fellow in Microbiology at Duke University.

Roy Kishony

Roy Kishony is the Marilyn and Henry Taub Professor of Life Sciences at the Departments of Biology and Computer Science at Technion-Israel Institute of Technology and a Visiting Professor at the Department of Systems Biology at Harvard Medical School. Prof. Kishony received his B.A. in Physics and Mathematics from the Hebrew University and his Ph.D. in Physics from Tel-Aviv University (1999).

Jane Knisely

Jane Knisely is a Program Officer in the Bacteriology and Mycology Branch of the Division of Microbiology and Infectious Diseases at the National Institute of Allergy and Infectious Disease, NIH, where she oversees scientific programs related to antimicrobial resistance and antibacterial drug development. Jane is a member of the Trans-Atlantic Task Force on Antimicrobial Resistance (TATFAR) and is involved in the implementation of the US Combating Antibiotic-Resistant Bacteria (CARB) National Action Plan. She joined the government in 2007 as a Presidential Management Fellow (PMF), a program that allows trainees to rotate throughout the NIH and to pursue training and leadership development opportunities.
Ilana Kolodkin-Gal

Ilana Kolodkin-Gal completed her PhD Summa cum laude in 2009 at the Department of Molecular Biology, The Hebrew University of Jerusalem, Israel. Her research linked programmed cell death in bacteria with a quorum sensing peptide. Her post-doctoral study at Harvard was focused on the assembly of microbial biofilms. Currently, her lab in the Weizmann Institute of Science is especially interested in novel mechanisms that balance the rigidity and flexibility in microbial multicellular communities and the importance of these mechanisms to bacterial resistance and virulence.

Barry N. Kreiswirth

Barry Kreiswirth is the founding director of the Public Health Research Institute (PHRI) TB Center, a Professor of Medicine at the New Jersey Medical School, an adjunct faculty member in the Department of Medicine at New York University, a lecturer at the Mailman School of Public Health at Columbia University, and a visiting professor at the Museum of Natural History. He joined PHRI as a graduate student in 1978 in Richard Novick’s laboratory working on the molecular biology of Staphylococcus aureus and ultimately cloning and characterizing the genetic determinant responsible for toxic shock syndrome.

Laura Marin

Laura Marin coordinates the Joint Programming Initiative on Antimicrobial Resistance managing its Secretariat at the Swedish Research Council. Previously she was responsible for Science Policy and Member Relations at the European Science Foundation. Earlier on she was also the team leader of the European Science Open Forum in 2008 in Barcelona (ESOF2008) and Director of Operations at the Catalan Foundation for Research and Innovation. She has several years of experience in Brussels and Germany managing research and innovation projects and facilitating numerous fora on science governance issues.

Michael Mourez

Michael Mourez obtained his PhD in Bacteriology at the Institut Pasteur in Paris in 1998 and completed postdoctoral training at Harvard Medical School in Boston, training in the fields of Gram-negative bacteria envelope physiology and Bacillus anthracis toxins. In 2003 he joined the Department of Microbiology, School of Veterinary Medicine, University of Montreal as an assistant and then as a tenured professor. His research program focused on multifunctional adhesins of Escherichia coli. In 2011 he joined the Infectious Diseases Unit of Sanofi R&D where he is in charge of programs to fight severe bacterial infections.
Anders Nilsson

Anders Nilsson is an Associated Professor in Genetics at the Stockholm University where he has headed a bacteriophage biology group since 2007. He obtained his PhD in genetics in 2003 for evolutionary studies on bacteriophages (bacterial viruses). He has extensive teaching experience in general genetics, population genetics, evolutionary genetics, general microbiology, and bacteriophage biology. His main research area is in the genome evolution of bacteriophages with a particular focus on P2-like bacteriophages but lately has also worked on recently isolated and uncharacterized bacteriophages. Other research areas include theoretical and non-clinical studies of phage therapy – the use of bacteriophages to treat bacterial infections.

Lance B Price

Lance Price is the Director of the Antibiotic Resistance Action Center and Professor, Department of Environmental and Occupational Health, The George Washington University Milken Institute School of Public Health. He has pioneered the use of genomic epidemiology to understand how the misuse of antibiotics in food animals affects public health. Prior to joining the GW faculty, Dr. Price served on the faculty of the Arizona-based non-profit Translational Genomics Research Institute (TGen). He maintains an appointment at TGen and continues to direct their Center for Food Microbiology and Environmental Health and Center for Microbiomics and Human Health.

Steve Projan

Steve Projan is the Head of Infectious Diseases & Vaccines Innovative Medicines unit (iMED) at MedImmune, leading a cross-functional team dedicated to the therapeutic area strategy, prioritization, and advancement of the company's infectious disease and vaccine portfolio. He joined MedImmune in 2010 as senior vice president of research and development and head of the Infectious Diseases & Vaccines iMED. Prior to joining MedImmune, he served as vice president and global head of Infectious Diseases at Novartis. He previously spent 15 years at Wyeth in roles of increasing responsibility with his last post as Vice President and Head of Biological Technologies.

John H. Rex

John Rex is Senior Vice President and Chief Strategy Officer for AstraZeneca Infection, a Non-Executive (Independent) Director of F2G, Ltd., Expert-in-Residence at the Wellcome Trust, and a member of the Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria. He thus brings a global perspective to the challenge of AMR as well as a combination of small and large pharmaceutical company experience. As an example, he is one of two Industry-based cofounders of the Innovative Medicines Initiative’s New Drugs for Bad Bugs program bringing Industry and Academic collaborators together on a range of antibiotic discovery and development projects.
Olaf Schneewind

Olaf Schneewind is the Louis Block Professor and Chairman of the Department of Microbiology at the University of Chicago. His research program examines the mechanisms and strategies whereby pathogenic bacteria cause human diseases, focusing primarily on *Staphylococcus aureus* and its sortase-anchored surface proteins. His research has produced more than 250 peer-reviewed publications. He is editor for the Journal of Bacteriology and Annual Review of Microbiology. Additionally, he has served as a consultant to many well-known pharmaceutical companies and founder of biotech start-up companies, lending his expertise to translational research efforts.

Mats Ulfendahl

Mats Ulfendahl was the Secretary-General for medicine and health at the Swedish Research Council 2010-2015. In 2004 he was appointed Professor of experimental audiology and otology (Karolinska Institutet). He is member of the board and Chair-elect of the Swedish Society for Medical Research and acting Chair of Delegation for research of The Swedish Society for Medicine. He has served on several national and international boards, including the National priority board for highly specialized health care, the Governing Council of International Agency for Research on Cancer (IARC), and the High Level Group for Joint Programming (GPC). He is now serving his second term as Chair of the management board of JPIAMR, the Joint Programming Initiative on Antimicrobial Resistance.
Moderator Biographies

Otto Cars

Otto Cars is a senior professor in infectious diseases at Uppsala University, Sweden. His research has focussed on pharmacokinetics and pharmacodynamics of antibiotics, resistance epidemiology and antibiotic policies. He was the chair of Strama (the Swedish strategic programme against antibiotic resistance) from its inception in 1995 until 2011. He has been involved in numerous European and international initiatives on antimicrobial resistance and is a member of the WHO Strategic and Technical Advisory Group (STAG) on AMR. Since 2004 Otto Cars has been engaged in building an international network React, Action on Antibiotic Resistance (www.reactgroup.org) focusing on the global aspects and consequences of antibacterial resistance.

Frank DeLeo

Frank DeLeo received his Ph.D. in microbiology from Montana State University in 1996, studying the molecular basis of superoxide generation by human neutrophils under the mentorship of Mark T. Quinn, Ph.D. He did his postdoctoral training with William M. Nauseef, M.D., in the area of innate immunity and infectious diseases in the Department of Medicine at the University of Iowa (1996–2000). He joined the staff at NIAID’s Rocky Mountain Laboratories (RML) in 2000 as a tenure-track investigator and is currently Chief of the Laboratory of Bacteriology.

Niels Frimodt-Møller

Niels Frimodt-Møller, MD, Specialized in clinical microbiology in 1986 and defended his doctoral thesis in 1988. In 2006 he became adjunct Professor in clinical microbiology for Aarhus University. His current position is Senior Consultant at the Department of Clinical Microbiology to Hvidovre Hospital in Copenhagen. His research has focused broadly on antibiotic activity, antibiotic resistance, and urinary tract infections and resulted in over 300 peer-reviewed scientific papers and several book chapters. He has served as an expert and consultant on antibiotic policy issues at the national and international level, as co-founder of the DANMAP monitoring program, co-editor of the national antibiotic treatment guidelines, the Danish representative on various European boards and programs, and on various boards of the European Society of Clinical Microbiology and Infectious Diseases. He has served as a member of the organizing and scientific committees of several international conferences including ECCMID and ICAAC. He also served for nine years as a member of the SSAC / NSCMID board and during this period was President of the Society for three years.
List of Participants

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<tr>
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