

JPIAMR Virtual Research Institute: Modeling a dynamic network for AMR research

Road map & Workshop Report



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THE JPIAMR VIRTUAL RESEARCH INSTITUTE ROADMAP

As we enter the post-antibiotic era, we need to address the global issue of antimicrobial resistance (AMR) by increasing collaboration between countries, governments, industry, research and other AMR initiatives. The Joint Programming Initiative on Antimicrobial Resistance (JPIAMR) is a unique global collaborative platform that coordinates national funding and supports research to address antimicrobial resistance. The shared Strategic Research Agenda (SRA) with a One Health approach encompassing six priority topics (Figure 1) provides guidance for nations to align their AMR research nationally and internationally, and establish a number of joint research priorities. Since its inception in 2011, 27 nations have joined the JPIAMR, contributing a total funding of 53 million euro to AMR research.

One of the strengths of the JPIAMR is the close contact between the research community and the national funding agencies, providing an arena to address the AMR issue in a way that the member nations cannot do on their own. By mobilising new and existing resources, JPIAMR will globalise AMR research, encompassing the SRA priorities in a One Health approach, through the creation of the JPIAMR Virtual Research Institute (JPIAMR-VRI). The vision, mission and goals of the JPIAMR-VRI are:

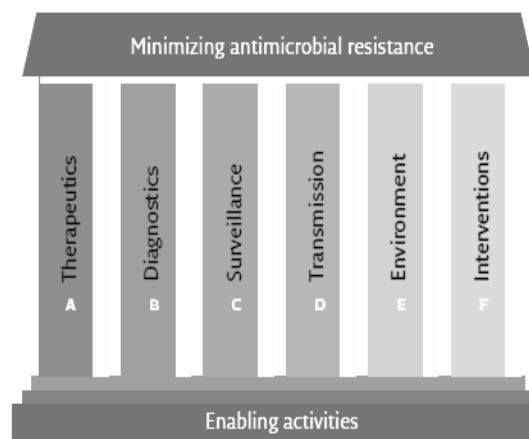


Figure 1. The strategic pillars of the JPIAMR Strategic Research Agenda.

Vision & Mission Statements

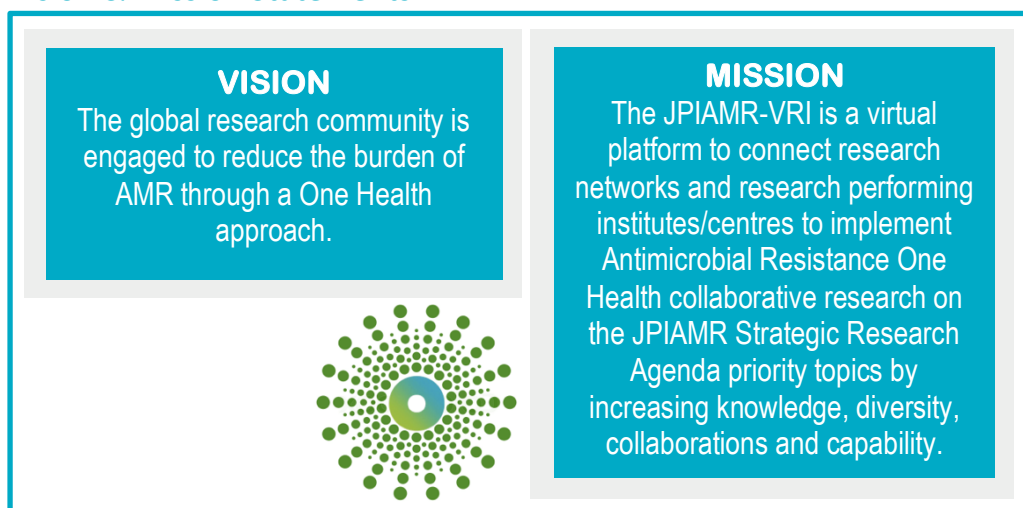


Figure 2. JPIAMR-VRI Vision and Mission.

Main Goals

The JPIAMR-VRI will build on and leverage existing research centres and networks, and extend the reach of JPIAMR by creating a virtual global network of researchers, facilities, and infrastructures and connect them to each other. Such a network will establish a platform to support an unprecedented level of knowledge exchange, research coordination, and sharing of resources, databases, and research results (published and

unpublished) that will reduce duplication of effort and expedite progress towards reducing the global burden of AMR. The JPIAMR-VRI will build a virtual "corridor" to facilitate new, multi-dimensional partnerships and collaborations. It will reach diverse research disciplines and resources in order to implement the SRA.

Key elements of the JPIAMR-VRI

The JPIAMR-VRI will achieve the main goals by the activities outlined in Figure 3:

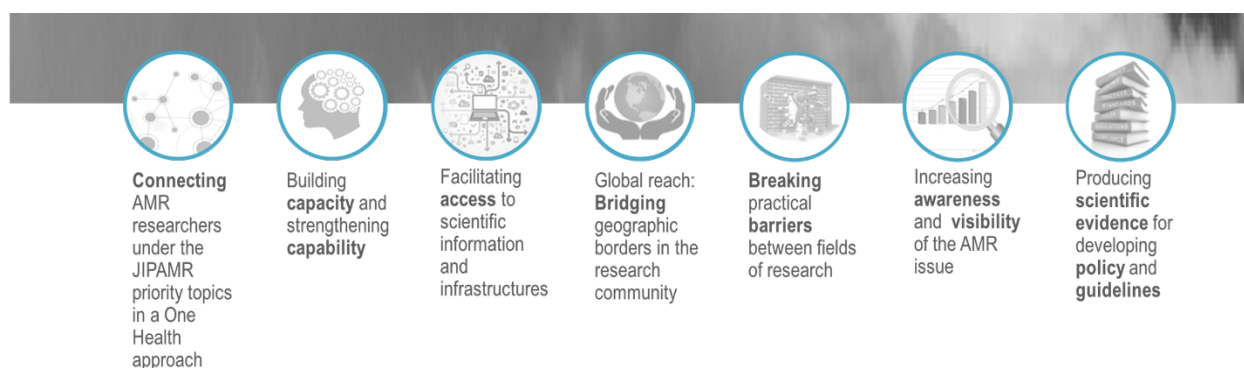


Figure 3. Concrete actions fulfilled by the JPIAMR-VRI.

Potential Outcomes

- Integration of activities among networks: joint research programmes / work plans across research centres and research networks
- Development of exchange programmes between researchers (e.g. fellowship schemes, travel grants etc.)
- Networking activities (e.g. workshops)
- Creation of educational and training programmes (not only scientific but also on translational research and requirements for updating other skills outside the scientific framework, including business skills (in areas such as intellectual property (IP), regulatory frameworks, manufacturing policies, marketing, technology development and application, and policy development, etc.)
- Stocktaking of existing networks/centres/projects
- Facilitation of rapid responses to emerging pathogens by connecting thought leaders and content experts with industry, public health and policy makers;
- Development of knowledge gap analysis based upon and further enhancing the JPIAMR mapping/database of AMR research projects and research centres increasing visibility of the research performed
- Increase data sharing, including sharing of negative results
- Production of scientific evidence for developing policy and guidelines.

Governance

The JPIAMR-VRI will be an entity under the JPIAMR. The governance of the JPIAMR-VRI will initially lie with the JPIAMR Management Board, driven by the JPIAMR-VRI working group and supported by the JPIAMR Secretariat.

The following report along with the above roadmap are representing an evolution of the discussions that occurred during the JPIAMR-VRI workshop, and include input from the JPIAMR Steering Committee, JPIAMR Secretariat and VRI Task Group co-leads.

WORKSHOP EXECUTIVE SUMMARY

Background: The growing resistance of microbes to previously effective therapeutic interventions is rapidly becoming a public health crisis. Antimicrobial resistance (AMR) is of particular concern in our efforts to control clinically important bacterial infections. Although the discovery of antibiotics in the 1940s heralded a new era in the control of bacterial infections, saving millions of lives, it was soon realized that bacteria rapidly develop resistance. This resistance has now escalated to the point where some of the bacteria causing human infections are resistant to most, if not all, available antibiotics. Combined with the lack of development of new antibiotics by the pharmaceutical industry, we now have a global crisis that has garnered the attention of world leaders and spurred an international effort to find effective solutions.

Health and research stakeholders engaged with the AMR challenge have launched a wide range of activities and initiatives focused on reducing the impact of AMR in humans, animals, agriculture, agri-food, and the environment. One example is the EU-based Joint Programming Initiative on AMR (JPIAMR). JPIAMR is an alliance of [27 countries](#), combining their resources to support research addressing key knowledge gaps in AMR; promoting innovation and translation of research results; and bridging the gap between research and policy. JPIAMR recognizes a need to extend the breadth and scope of AMR research. To address this need, JPIAMR plans to create a Virtual Research Institute (VRI) to build capacity, increase the coordination of the AMR researcher base, and attract new talent and expertise. It is anticipated that the JPIAMR-VRI will accelerate progress in finding solutions for AMR by mobilizing the research community, and other key stakeholders, to build extensive networks capable of tackling large research questions/projects, and improve the sharing of knowledge, data, resources and infrastructures across the field.

JPIAMR VRI Workshop: The workshop brought together researchers from JPIAMR member countries and AMR opinion leaders to provide input on the most appropriate and effective model for the JPIAMR-VRI. A series of presentations on Day 1 provided insights on key related activities and initiatives across the AMR landscape, setting the stage for plenary discussions and small working group sessions on Day 2 (Participant List -Appendix 1; Agenda- Appendix 2).

Workshop Feedback and Suggestions: The workshop generated many different ideas on the unique selling point for the JPIAMR-VRI, its relationship to the current JPIAMR structure, governance, funding, infrastructure, researcher and partner engagement, and implementation. It was suggested that workshop consultations should be extended to different areas of the world through a series of regional planning workshops to reach more stakeholders and enlarge the scope of the virtual network in preparation for potential pilot projects. Participants recommended that the JPIAMR consider similar models of virtual networks in their design of the JPIAMR-VRI to identify of best practices, and to achieve optimal return on investment.

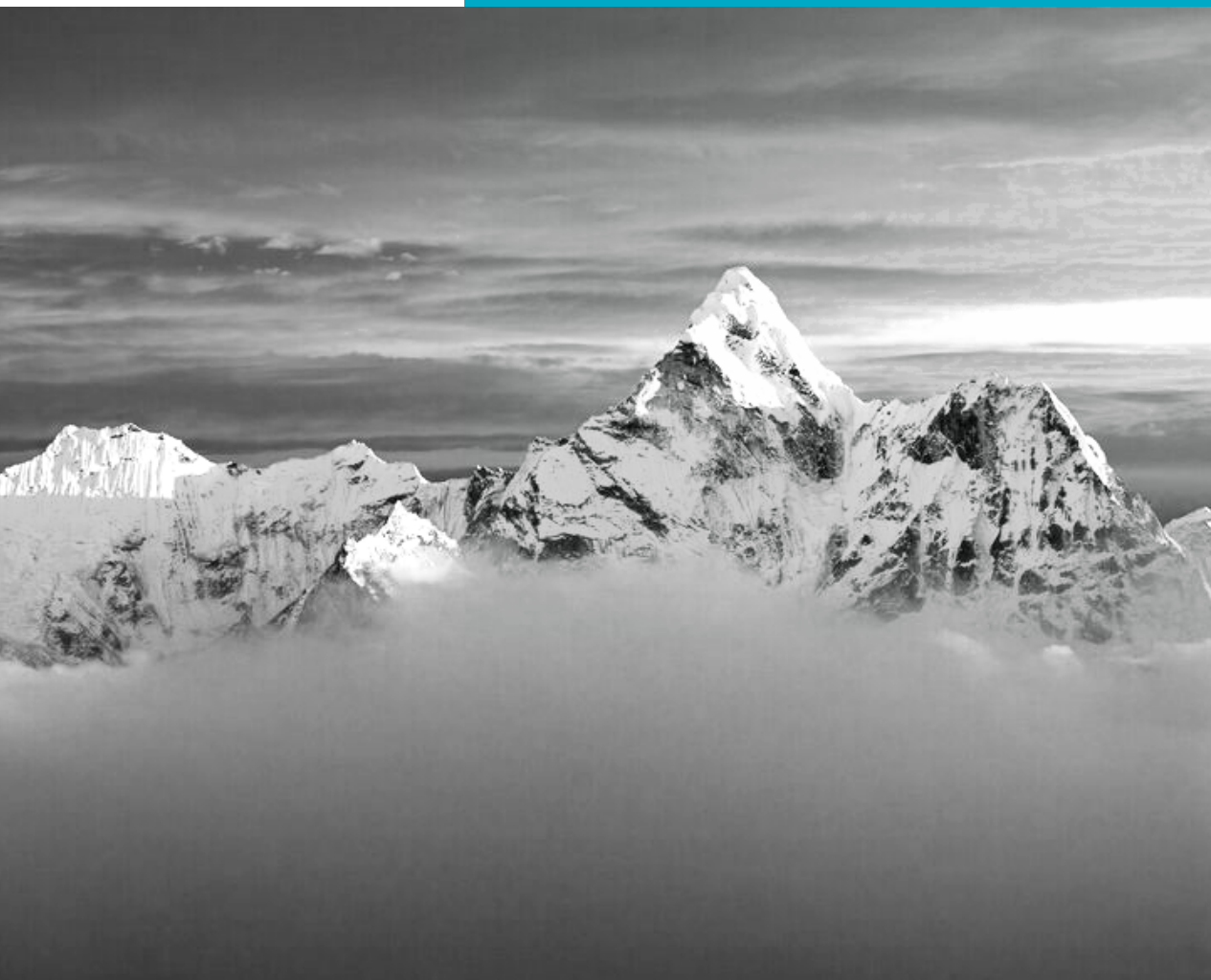
It was suggested that the strategic focus of the JPIAMR-VRI should be aligned with the six pillars of the JPIAMR Strategic Research Agenda (Figure 1) encompassing a One Health approach, and making the JPIAMR-VRI a platform for engaging researchers from all research pillars and sectors.

The incentives to attract researchers into the network include

- The ability to expand their knowledge base by belonging to a multidisciplinary and multi-sectoral network of experts from multiple disciplines and sectors

- The potential for more publications
- An increased visibility in the AMR community abroad
- Increased training and mentoring opportunities
- Participation to ambitious research and innovation projects
- The opportunity to tackle global challenges together with excellent International scientists
- Access to world class research infrastructures
- Increased international mobility
- Access to new networks and alliances

By coordinating and aligning research programs and agendas, the JPIAMR-VRI will become a key resource for funding agencies and other stakeholders, such as industry and policy makers, and will facilitate gap analysis of funding and policy activities.



BACKGROUND

Antimicrobial resistance (AMR) threatens the effective prevention and treatment of an ever-increasing range of infections caused by bacteria, parasites, viruses and fungi. Of particular concern, is the dramatic increase in antibiotic resistance among bacterial populations. Since the discovery of penicillin, in 1941, antibiotics have become one of the greatest therapeutic successes in modern medicine, saving millions of lives each year. As drugs that are easy to administer, fast acting, highly effective, and relatively inexpensive, antibiotics have been widely used in clinical practice to control bacterial infections, as well as in the agriculture and agri-food sectors, to support infection control and enhance productivity.

However, antibiotics rapidly generate resistance in the bacteria they target, rendering them therapeutically ineffective. The same is true for drugs targeting other pathogens such as viruses, fungi and parasites with the result that AMR has now become a global health crisis that threatens our ability to cure common infections and treat minor injuries; safely perform complex surgeries and deliver cytotoxic therapies; and protect the ecosystem, including vital crops and water supplies. The AMR crisis has led to a global response that has accelerated in the last decade, as organisations such as the World Health Organisation (WHO), the United Nations General Assembly, and the G7 and G20 international groups have rallied to coordinate efforts to combat AMR.

Research is a key element in global efforts to control AMR, providing the evidence to guide the development of new interventions, policies and practices. Many countries have developed action plans and research agendas and invested in research organisations, centres and networks to combat AMR, while the public and private sectors have entered into new alliances to expedite the discovery and implementation of new drugs and other interventions. The awareness that AMR freely crosses all borders has generated a new era of coordination and collaboration among nations as they unite to overcome a common threat.

THE JOINT PROGRAMMING INITIATIVE IN ANTIBIOTIC RESISTANCE (JPIAMR)

JPIAMR coordinates multidimensional AMR research and funding on a global scale and supports collaborative action for filling knowledge gaps on antimicrobial resistance with a One Health perspective. JPIAMR works to understand AMR today and to overcome AMR tomorrow. Since its inception, the JPIAMR has collaborated with more than 300 partners to fund 50 plus research projects and networks, representing a joint investment of more than €53 million to date. The 27 member nations have supported advances in our understanding of AMR in areas such as discovery of new therapies, antibiotics, transmission dynamics and interventions.

The overarching goals of JPIAMR are:

- To align national and international research programs
- To support and coordinate transformative research
- To support and coordinate the JPIAMR Virtual Research Institute
- To promote innovation and translation of research results
- To bridge the gap between research and policy

JPIAMR recognises that overcoming AMR will require more than providing collaborative research funding and that the organisation needs to play a bigger role in coordinating and mapping research activities and infrastructures both within and beyond JPIAMR member countries to inform the global community of strengths, gaps and opportunities for positive action. To address this need, JPIAMR plans to launch both an international mapping exercise and a Virtual Research Institute (VRI) in 2018.

Rationale for a JPIAMR- VRI, Laura Marin - Head, JPIAMR Secretariat, Sweden



JPIAMR is a recognized leader in supporting collaborative research, but there is a need for greater inclusivity among the wider research community and the formation of sustainable linkages across diverse sectors and disciplines to deliver a One Health approach that truly addresses the challenges of AMR across the spectrum (humans, animals, agriculture, agri-food, and the environment). We need strategies to attract and engage the next generation of AMR researchers who will bring fresh, new ideas into the field to facilitate sustainability. JPIAMR is seeking guidance on the most appropriate model for a virtual research institute that would connect

JPIAMR research groups with each other and with the broader community. We anticipate that the JPIAMR-VRI will mobilise the research community and other key stakeholders to build resilient networks capable of tackling large research questions/projects, and improve the sharing of data, resources and infrastructures among all AMR stakeholders. Such a structure would expedite the uptake of research outcomes into effective new policies and practices aimed at reducing the global burden of AMR. This workshop was convened to gather input on how to design the JPIAMR-VRI to best meet the needs of the AMR global community. Participants were nominated by JPIAMR member countries to represent multiple disciplines and sectors.



WORKSHOP OBJECTIVES

- Identify a unique role and/or niche for the JPIAMR-VRI and the added value for the scientific community, funders and policy makers; Share information and experiences on comparable networks/VRIs and how they could inform the development of JPIAMR-VRI
- Discuss different approaches and brainstorm an optimal design for a JPIAMR-VRI, including strategic focus and potential models for governance and implementation
- Suggest solutions to the potential challenges of establishing a network and/or virtual institute
- Discuss models for sustainable funding

WORKSHOP FORMAT

In all, 60 participants, from 20 countries attended this one-and-a-half-day workshop, which began at 13.00 on Wednesday, November 8th 2017 and ended at 17.00 on Thursday, November 9th 2017 (Participant List-Appendix 1). Day 1 commenced with a brief welcome by Carlos Segovia, Chair of JPIAMR and introductory remarks by Marc Ouellette, Scientific Director of the Canadian Institutes of Health Research - Institute of Infection and Immunity (CIHR-III). CIHR-III is the leader of the JPIAMR working group for developing the JPIAMR-VRI. A series of presentations followed to provide a snapshot of activities in AMR; examples of existing virtual platforms in AMR; and an overview of comparable networks/institutions to set the stage for more in-depth discussions. On Day 2 workshop participants were divided into five, three-hour concurrent working group sessions (amended from original agenda – Appendix 2) followed by a report back and a plenary discussions.

Workstation topics were:

- Strategic focus
- Governance, funding, infrastructure and operations
- Engagement
- Implementation
- Innovative "out of the box" ideas

Each of the five groups began by discussing the unique selling point for the JPIAMR-VRI followed by an in-depth discussion on their assigned topic. The workshop allowed ample time for Q&A and plenary discussions between segments following the working group session, and ended with a group discussion on a potential vision and mission for the JPIAMR-VRI.

SCIENTIFIC PROGRAMME COMMITTEE

Special thanks are due to the members of the Scientific Programme Committee that was established by the Planning Committee of this workshop. The Scientific Programme Committee members' bios can be found in appendix 3.

Dr. **Éric Brown**, McMaster University, Canada

Dr. **Martin Krönke**, Executive Director, DZIF, University Hospital Cologne, Germany

Dr. **Évelina Tacconelli**, Division of Infectious Disease and Comprehensive Infectious Diseases Centre, Germany

For several months prior to the event, this small expert group contributed to:

- The selection of workshop participants representing the many disciplines and sectors engaged in AMR research and activities
- The development of workshop objectives
- The construction of an agenda that would deliver on these objectives
- The smooth management of workshop breakout sessions and plenary discussions
- The review of this workshop report

ORGANIZING COMMITTEE AND WORKPACKAGE LEAD

The Organizing Committee operated under the leadership of **Dr. Marc Ouellette**, Scientific Director of Canadian Institutes of Health Research - Institute of Infection and Immunity, in his role as the leader of the JPIAMR Workpackage on the development of a Virtual Research Institute (bio in appendix 3).

This workshop could not have happened without the precious help and dedication of the following Organizing Committee Members:

Akin Akkoyun

Deutsches Zentrum für Luft- und Raumfahrt (DLR),
Germany

Laura Plant Fuentes

Swedish Research Council,
Sweden

Édith Brochu

CIHR-Institute of Infection and Immunity,
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Germany

Barbara Junker

Deutsches Zentrum für Luft- und Raumfahrt (DLR),
Germany

AN OVERVIEW OF ACTIVITIES IN AMR

The following is a high-level summary of the key points from each presentation.

Global Action Plan on Antimicrobial State of Play, Marc Sprenger, Director, AMR Secretariat, WHO



AMR is a multi-dimensional problem driven by many diverse factors, and dominated by the overuse and misuse of antibiotics in humans, animals and the environment. AMR has severe global health and economic implications, especially in low-income countries battling poor sanitation, inadequate infection control measures, and a lack of affordable access to drugs and other interventions. In 2015, the World Health Organisation (WHO, www.who.int) released its "Global Action Plan on Antimicrobial Resistance", directing attention to the following five strategic priority areas:

WHO Priority Areas

- Improving awareness and understanding;
- Strengthening knowledge through surveillance and research;
- Reducing the incidence of infection;
- Optimising the use of antimicrobial medicines;
- Ensuring sustainable investment in R&D.

The release of the Action Plan ignited a flurry of activity around the world, including the development of many national action plans, surveillance initiatives, and guidelines. WHO is now addressing each priority area through a One Health approach, developing programs to increase awareness; influence behavior and better educate the health workforce on AMR; and coordinate efforts on infection prevention and control. A Global Antimicrobial Resistance Surveillance System (GLASS) is currently under development to collect standardised, comparable and validated data on AMR that can be analysed and shared across borders to inform decision-making, drive local, national and regional action, and provide the evidence base for action and advocacy. In addition, WHO guidelines on antibiotic categories for clinical use and the WHO priority pathogen list provide a foundation for the focus of global R&D efforts.

EU Action Plan on AMR and International Activities, Arjon van Hengel, Director General Research and Innovation, European Commission



The European Commission (EC, www.ec.europa.eu) first entered the AMR research arena in 1998 following the "Microbial Threat" conference in Copenhagen and, in 2009, joined forces with the US by establishing the Transatlantic Task Force on AMR (TATFAR, www.cdc.gov/drugresistance/tatfar/index.html). In 2011, the first EC Action Plan was released, stimulating action across the EU, and emphasising the need for a One Health approach.

In the last six years this plan has spurred the development of veterinary medicinal products and medicated feed regulations, promoted public-private collaborations on drug development, boosted international cooperation (G7, G20, UN, WHO) and coordinated research efforts through the creation of the JPIAMR and other initiatives. The new EC Action Plan, launched in June 2017 is built around three pillars: 1) making the EU a best practice region; 2) boosting research, development and innovation; and 3) shaping the global agenda. Research development and innovation is at the centre of this new action plan, organised around six main themes that rely heavily on the creation of new tools to accelerate the application of knowledge, drugs, and diagnostics into interventions to reduce the global burden of AMR.

EC Action Plan themes:

- Improve knowledge on detection, infection control and surveillance
- Develop new therapeutics and alternatives
- Develop new preventive vaccines
- Develop novel diagnostics
- Develop new economic models and incentives
- Close knowledge gaps on AMR (environment & transmission)

The EC's efforts focus on maintaining a strong EU presence by contributing to international frameworks, guidelines and methodologies and the development of a global research agenda. For the coordination and alignment of different initiatives in AMR research, the EC will work closely with JPIAMR as well as other initiatives like the Global AMR R&D Hub. In addition, the EC will work with developing countries on clinical trial partnerships as well as on AMR strategies in food safety and animal health. The EC Action Plan includes a specific action committed to supporting the establishment of a JPIAMR-VRI to improve further global research collaboration.

AMR Projects are central to the IMI Public-private Partnership, Isabelle Bekerédjian-Ding, Co-Chair, IMI Scientific Committee



Launched in late 2007 and funded jointly by the European Union (represented by the EC) and the European pharmaceutical industry (represented by the European Federation of Pharmaceutical Industries and Associations- EFPIA), the Innovative Medicines Initiative (IMI, www.imi.europa.eu) is the world's largest public-private partnership in the life sciences with a total budget for IMI2 (2014-2020) of €3.3 billion. IMI responds to industry needs and public health challenges by bringing new knowledge closer to the patient through an integrated platform involving

stakeholders from the public and private sectors. IMI's AMR program "New Drugs for Bad Bugs" (ND4BB) was initiated in 2011 in response to a call from the EC for increased collaboration in AMR R&D efforts. The ND4BB program has a total budget of €700 million and has grown into a highly successful initiative. ND4BB focuses on increasing the success rate in clinical trials, developing new therapies, and reducing the failure rate of vaccine candidates. ND4BB clinical trials networks include:

- CLIN-Net: A clinical investigator network comprised of >800 hospitals in >450 cities across > 40 EU countries
- LAB-Net: A laboratory surveillance network of >600 EU laboratories
- STAT-Net: Improvements in trial design
- EPI-Net: Epidemiology support for ND4BB programs and beyond

ND4BB encompasses:

- the COMBACTE suite of initiatives which build and use the ND4BB networks;
- ENABLE which serves as a drug discovery engine for novel mode of action therapeutics;
- TRANSLOCATION which focuses on Gram-negative bacteria and the challenge of "keeping drugs inside the bugs"; and
- DRIVE-AB, which is driving a new economic model for antibiotic R&D.

After four years, ND4BB has catalysed change and increased antibiotic drug discovery and development activities. By asking the right questions at an early stage in the drug pipeline, ND4BB has demonstrated that it is possible to accelerate the drug discovery process by terminating less successful projects early in order to focus on more promising targets and compounds. Going forward, IMI hopes to broaden its scope and networks and mobilise the diagnostics industry to establish an end-to-end R&D accelerator. The ND4BB open source InfoCentre is "open for all AMR data".

Global AMR R&D Hub, Marit Ackermann, Policy Officer, Federal Ministry of Education and Research, Germany



At the July 2017 G20 summit in Hamburg, G20 leaders, for the first time, highlighted R&D for AMR as part of their declaration, including the launch of a new international R&D collaboration hub for AMR research. The intention of the Global AMR R&D Hub is to maximise the impact of new and existing basic and clinical research initiatives and product development to become a driving force for R&D in AMR. Objectives include:

- To inform on R&D pipelines, identify and prioritise gaps and investment opportunities
- To facilitate the efficient allocation of resources
- To foster international research collaboration
- To keep momentum and visibility of the topic
- To fill product pipelines with priority candidates

It is envisioned that the Global AMR R&D Hub will connect governments and important non-governmental donor organisations from around the world to facilitate information exchange on funding streams, promote high-level alignment of funding, and mobilise additional resources for push and pull incentives. The Global AMR R&D Hub follows a One Health approach aligned with WHO, FAO and OIE priorities and focused on

the WHO priority pathogens, but will initially concentrate on bacterial infections in humans (prevention, treatment and diagnosis). Membership will be open to senior representatives of organisations/groups that have a clear commitment to investing in AMR R&D, such as the governments of G20 and non-G20 countries and major philanthropic organizations active in AMR R&D. To date, 15 countries have expressed interest in membership and plans are underway to form an interim board tasked with designing a modest governance structure, developing a provisional work plan, engaging a lean secretariat, and preparing for an official inauguration in early 2018. As the Global AMR R&D Hub will be entering an already crowded landscape, emphasis will be placed on identifying a unique niche, avoiding duplication of effort, and providing benefit to existing initiatives already successfully well established in the global AMR research space, such as JPIAMR. An initial planned mapping of R&D activities will highlight gaps and track achievements to form the basis of future discussions with key stakeholders in the AMR field, including JPIAMR. The Global AMR R&D Hub currently has no plans to develop an independent research agenda or engage in funding calls. It will work closely with key international AMR stakeholders, such as JPIAMR.

EXAMPLES OF VIRTUAL PLATFORMS IN AMR

Antimicrobial Resistance R&D Initiatives: CARB-X, Kevin Outterson, Executive Director



Launched in Boston, in 2016, the Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator (CARB-X, www.carb-x.org) is a non-profit partnership, jointly funded by the Wellcome Trust (US\$155.5 million) and the Biomedical Advanced Research Development Authority (BARDA) (US\$250 million), with preclinical services provided by the NIH's National Institute of Allergy and Infectious Diseases (US\$50 million). The initial five-year goal was to accelerate a diverse portfolio of 20 or more high-quality antibacterial products towards clinical development focusing on priority drug-resistant bacterial pathogens identified by the WHO and CDC. In just 16 months, CARB-X and partners have far exceeded this goal and have funded, or approved for funding, 34 projects in seven countries in North America, Europe and Asia. Successful projects were selected through a competitive review process and the majority are led by small SMEs with less than 50 employees, addressing the need to make it easier for small companies to bring a new product to market. CARB-X is committed to open science based on a collaborative approach that facilitates accessibility to new knowledge and products through workshops, webinars and other virtual and face-to-face interactions.

GARDP and the AMRP, Giovanni Salerno, Head, Transversal Programs



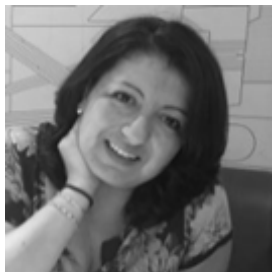
A joint initiative between the WHO and the Drugs for Neglected Diseases initiative (DNDi), the Global Antibiotic Research & Development Partnership (GARDP, www.dndi.org/diseases-projects/gardp/) was established in 2016 as a non-profit virtual organisation tasked with developing new treatments for bacterial infections and promoting their responsible use for optimal conservation, while ensuring equitable access for all in need. GARDP focuses on four main areas: sepsis, sexually transmitted infections (STIs), pediatric antibiotic platforms, and the antimicrobial memory recovery program (AMRP). The goal of the AMRP is to find forgotten, discontinued or discarded antibiotics and build a pipeline to repurpose them for important indications, including STIs, neonatal sepsis and global pediatrics. A team of more than 124 experts from multiple disciplines and more than 26 countries is the driving force behind the effort to create a knowledge legacy in the form of an antibiotic "tool box". As is the case for CARB-X, collaboration will be the key to success and GARDP plans to create a virtual hub (REVIVE), which will be an open forum for educational webinars and workshops and a venue for networking and partnership building. Four venues have already been identified for 2018 for workshops on a variety of topics.

SPARK: A Shared Platform for Antibiotic Research and Knowledge, Joe Thomas, Senior Associate, The Pew Charitable Trusts



The Pew Charitable Trusts (www.pewtrusts.org), an independent non-profit organisation, was created as the sole beneficiary of seven individual charitable funds established between 1948 and 1979. Since then, the organisation has evolved to meet many new challenges, while remaining true to the original philanthropic goals of its founders. In 2017, PEW announced the launch of a new program to facilitate antibiotic innovation: The Shared Platform for Antibiotic Research and Knowledge (SPARK). Currently, both published and unpublished information on antibiotics is scattered across decades of literature, making it difficult to build on previous research. SPARK is a user-friendly, cloud-based, information-sharing platform that will bring together curated antibiotic discovery data from multiple sources, integrated with public databases, and easy-to-use analytical tools to generate new models and hypotheses and, ultimately, new antibiotics. SPARK will enable users to search widely across high-quality curated discovery data, and provide visualisation and modeling tools to help identify and optimize leads, and put machine learning capabilities into the hands of non-experts to accelerate the drug discovery process. A pilot version of SPARK is currently under review and the platform will be publicly accessible in the summer of 2018.

Wellcome Trust's Priorities to Fight AMR, John Rex, Expert-in-Residence, and Ghada Zoubiane, Science Lead Drug-resistant Infections



Founded in 1936 as the legacy of Sir Henry Wellcome, a medical entrepreneur, collector and philanthropist, the Wellcome Trust (www.wellcome.ac.uk) is a global charitable foundation that helps researchers tackle big problems in science, population health, medical innovation, the humanities and social sciences, and public engagement. Wellcome recently approved £175 in funding, over five years, to support research in four major

areas in the AMR field: new therapeutics and diagnostics (in partnership with CARB-X, GARDP, IMI, and WHO); accelerating clinical assessment to reduce the time and cost of clinical trials; epidemiology and surveillance, including the launch of the Surveillance and Epidemiology of Drug Resistant Infections Consortium (SEDRIC); and global governance and advocacy policy in alignment with the G20 process and in collaboration with the UN and WHO. The overall objective is to forge strategic collaborations to accelerate early stage product development and reduce the global burden of AMR.

The presentations highlighted the enthusiasm among key stakeholders to work with the JPIAMR-VRI to coordinate complementary efforts in a global response to AMR. Dividing tasks and responsibilities will position the community to address more efficiently the challenges posed by the different legal and regulatory restrictions among countries and jurisdictions, resulting in a coordinated effort that builds on individual strengths.

AN OVERVIEW OF COMPARABLE NETWORKS/INSTITUTIONS

CoVetLab, Europe, Wim van der Poel, Member



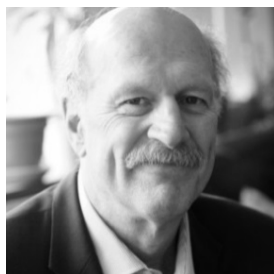
Collaborating Veterinary Laboratories (CoVetLab, www.covetlab.org), a partnership among national veterinary (public) health institutes from Denmark, France, the Netherlands, Sweden and the United Kingdom, coordinates research and surveillance activities across member countries, as well as national and international reference laboratories for animal diseases. CoVetLab activities include developing and sharing diagnostics; internal and international research collaborations; joint research proposals for EU projects; providing assistance during infectious disease outbreaks; and organising joint scientific meetings and workshops. CoVetLab also contributes to the Euroference Magazine, which covers animal and plant health, and food and drinking water safety. One CoVetLab spin-off is EPIZONE, a partnership of more than 400 experts that spans 12 countries, and focuses on epizootic diseases, diagnosis and control. Coordinated by Wageningen Bioveterinary Research, EPIZONE serves as a research coordination and communications network that maintains databases, and runs workshops, training courses, and a young scientist program. Another spin-off network is the European Joint Program (JPI), One Health: Zoonoses-Emerging Threats, which is comprised of an equal mix of partners from the veterinary and public health fields and is focused on preventing, detecting and responding to foodborne zoonoses. In addition, the Global One Health program at Wageningen University Research, brings together the agri-food sector with the pharmaceutical industry, and includes at least two projects on AMR.

DZIF, Germany, Martin Krönke, Executive Director



Established in 2011, by the German Federal Ministry for Education and Research, the German Centre for Infection Research (DZIF, www.dzif.de) brings together university and government research centres in an integrated approach to address infectious diseases. DZIF is comprised of 35 partner institutions at seven sites across Germany, engaging more than 350 principal investigators. DZIF has a budget of €38.5 million, supplemented by significant in-kind contributions from partner institutions. The DZIF mission is to tackle global challenges, including AMR, through an integrated One Health approach that covers basic research, epidemiology (surveillance, diagnosis, prevention, intervention), translational research (biomarkers, anti-infectives and vaccines), and clinical trials. To date, DZIF has produced 36 diagnostics, identified 64 biomarkers and 192 new anti-microbial compounds (viral as well as bacterial), developed 18 vaccines and adjuvants, and performed 26 clinical trials in AMR epidemiology and antibiotic stewardship - an impressive achievement in just five years. DZIF credits much of this success to the leveraging of in-kind contributions from member partners, and more than 70 industrial partners. DZIF focuses on sustainability, and recruiting and training the next generation of researchers, especially translational and clinician scientists, by offering long-term funding and support to provide sustainable career paths.

Canadian Experiences in Models for Discovery and Commercialisation of Novel Anti-infectives, Robert Hancock, Director, Centre for Microbial Diseases and Immunity Research, Canada



In 1990, the Government of Canada launched its Networks of Centres of Excellence (NCE) program with an initial slate of multidisciplinary networks that included the Canadian Bacterial Diseases Network (CBDN, www.cbdn.ca). Despite initial skepticism that scientists could transcend the highly competitive research environment, CBDN built a highly successful network of researchers over time scaling up to 93 researchers from 21 Canadian universities, and 26 federal and provincial laboratories, supported by 134 industry and 61 foundation/international partners.

CBDN, like all the NCEs, encompassed additional dimensions of research, such as training, networking, and IP management and was led by both a scientific director and a business director. Projects were peer reviewed biennially and less productive projects were terminated. In its 15 years of operation, CBDN established many enduring collaborations, some of which continue to this day, and generated Can\$221 million of total economic impact from an initial Can \$56.7 million in NCE funding. More recently, it is through a series of governmental fundings from Canadian Foundation for Innovation, BC provincial government funds, and Centres of Excellence for Commercialisation and Research program, that the Centre for Drug Research and Development (CDRD) was launched followed by a spin-off from CDRD, ABT Innovation, a virtual biotech company within academia. All allowing for rapid translation of discoveries into innovative therapeutic products and improved health outcomes. CDRD has raised more than Can\$150 million to support more than 80 employees working in three drug development centres. The flexibility associated with a virtual company and the ability to bring in new technologies, as needed, to attract investment have been among the key drivers of CDRD's success.

PLENARY DISCUSSION

A short plenary session followed the presentations, during which participants commented that:

- Point-of-care diagnostics are urgently needed for nurses, physicians and pharmacists, accompanied by a change in culture so that diagnostic tools, including those that have been available for years, are rapidly applied in the clinic. Recently, there has been a move towards refocusing attention on diagnostics. For example, CARB-X and the EC have ramped up research on diagnostics; the JPIAMR has completed an analysis of what is being funded in this area; and the NIH recently offered US\$20 million in prize money for new diagnostic tools to detect and distinguish antibiotic resistant bacteria.
- Participants were reminded that although the presentations focused primarily on "push" incentives, designed to make drug development more attractive to industry, we should not forget the importance of outcome-based "pull" incentives in driving the research agenda.
- The presentations focused heavily on activities in the EU and US, but a broader focus is called for that includes low- and middle-income countries, where the lack of diagnostics is a primary concern and the need for antibiotics may be superseded by the need for improved public health and sanitation or infection prevention and behavioural change. "A hospital in Europe and a clinic in Africa are very different environments".

KEY MESSAGES FROM DAY 1

Day 1 set the stage for the workshop by introducing participants to the idea of the VRI as a vehicle for leveraging JPIAMR-funded research to create a virtual global network of researchers, facilities, and infrastructures. A series of presentations from AMR opinion leaders provided a snapshot of the breadth and scope of key activities, creating a rich context for discussions. Many participants while both surprised and encouraged by the extent of global AMR activities in both the public and private sectors, and the degree of existing coordination and collaboration, recognized the need for increased alignment of activities to avoid duplication and address remaining gaps. Topics highlighted for further discussion included:



- Determining best practices in changing behaviour and encouraging the more prudent use of antibiotics in the health, agriculture, and veterinary sectors
- Encouraging the interdisciplinary, multi-sector collaborations required to drive change using a One Health approach, and engaging not only researchers but all stakeholders of the AMR community
- Broadening the scope of current research to include other pathogens in addition to bacteria (e.g. fungi, parasites, viruses)
- Coordinating R&D efforts and promoting new economic models and incentives
- Expanding the research focus beyond drug development to include alternative therapies, vaccines, novel diagnostics, and modes of transmission in the environment
- Developing mechanisms for training and capacity building, especially among low- and middle-income countries, which have unique needs

One important gap identified was the need to coordinate the researchers themselves. Very little mention was made during the presentations about the coordination of scientists planning together. This is the potential niche for the JPIAMR-VRI. With a successful history of coordinating the funding activities of multiple funders, the JPIAMR-VRI presents a vehicle for increased coordination of the international research community by expanding and combining capacities (researchers, institutions, resources) to produce more research outcomes in a shorter timeframe, for the same effort.



DAY 2, November 9th

Workshop participants were divided into five concurrent working group sessions comprising approximately 7-10 participants with diverse backgrounds in AMR. Each of the five groups spent three hours discussing the unique selling point for the JPIAMR-VRI and an in-depth discussion on their assigned topic: Strategic focus; Governance, funding, infrastructure and operations; Engagement; Implementation, and; Innovative "out of the box" ideas. Each of the five working groups presented a summary of their discussions on the unique selling point, or niche, for the JPIAMR-VRI followed by their recommendations on their discussion topics.

FEEDBACK FROM THE WORKING GROUP SESSIONS

The JPIAMR-VRI Unique Selling Point

The Unmet Need: JPIAMR is a well-established international alliance of research funders dedicated to supporting excellent research in AMR through a One Health approach. However, the competitive funding model of JPIAMR and the limitations created by inconsistencies in available funding from individual countries highlights a need to increase the inclusivity and diversity of the ongoing effort. To paraphrase a comment from one participant: "I review a lot of grants for AMR and when I see the excellence and breadth and scope of the applications, I often think wouldn't it be great if we could get all these people together". The JPIAMR-VRI will address this need.

The JPIAMR-VRI model: The niche, or unique selling point for the JPIAMR-VRI, as an initiative of JPIAMR, is to build on and leverage existing research groups and networks, take full advantage of the planned JPIAMR mapping exercise, and extend the reach of JPIAMR by creating a virtual inter-connected global network of research centres and networks, facilities, and resources.

The scope will evolve over time to cover multiple disciplines and sectors, as well as all areas of the world. Such a network will establish a platform to support an unprecedented level of knowledge exchange, research coordination, and sharing of resources, databases, and research results (published and unpublished) that will reduce duplication of effort and expedite progress towards reducing the global burden of AMR. Many of the great breakthrough moments in science originate from casual conversations among colleagues, often from different fields and disciplines, in workplace corridors or cafeterias, through the so-called "water cooler" effect. The JPIAMR-VRI will build a virtual "corridor" to facilitate new, multi-dimensional partnerships and collaborations, filling a gap that no one else is currently addressing in this space.

The **Value Added:** There was much discussion about the need for research funding to engage and retain researchers in the JPIAMR-VRI. Although modest funding is available to establish the JPIAMR-VRI networks, the intent of the JPIAMR-VRI is not to provide project funding, but rather, to facilitate the capacity and breadth of networks working together. Incentives for research centres and networks to join the JPIAMR-VRI include a chance to expand their scope and knowledge base by belonging to a network of experts from multiple disciplines and sectors, the potential to achieve more publications, the possibility to access increased visibility, training opportunities, improved access to industry, and most importantly, a real possibility of improving health outcomes by facilitating rapid responses to emerging pathogens and connecting thought leaders and content experts with industry, public health and policy makers;

Training and Capacity Building: The JPIAMR-VRI will build capacity in the AMR field by attracting new people from different fields to bring fresh perspectives to AMR research, such as social scientists, engineers, communications experts, economists, and others, as well reaching out to countries not currently participating in JPIAMR and engaging additional ministries and governments in the AMR research agenda. Training the next generation of researchers will be a key goal of the JPIAMR-VRI. Sustainability depends on attracting "new" brains (students, post-graduates, and junior faculty) and providing opportunities for not only scientific but also on translational research and requirements for updating other skills outside the scientific framework, including business skills (in areas such as intellectual property (IP), regulatory frameworks, manufacturing policies, marketing, technology development and application, and policy development, etc.), lab exchanges, on-line training modules, multidisciplinary workshops, mentorship programs, and access to new IT tools geared towards a generation that has grown up in a world driven by technology and virtual communication networks.

Key linkages: The JPIAMR-VRI will become a virtual "focal point of activity" for AMR research, providing a solid, evidence-based resource for public policy and practices, and forging links between public and private sector groups.

JPIAMR-VRI Strategic Focus

The JPIAMR-VRI strategic focus should span all six pillars of the JPIAMR Strategic Research Agenda (Figure 1), and encompass a One Health approach. The research community itself will initially develop the specific priorities and topics of the JPIAMR-VRI.

The key is to bring together experts from as many disciplines and sectors as are needed to address any given area of need comprehensively and innovatively. Overcoming silos by bringing different specialties together around a common challenge is most likely to increase possibilities, attract funding and improve outcomes.

Governance, Funding, Infrastructure and Operations

Links to the JPIAMR: The JPIAMR-VRI is part of the JPIAMR governance structure, managed by the JPIAMR under the leadership of Canadian Institutes of Health Research Institute of Infection and Immunity, and will be aligned with the six pillars of the SRA. There will be a continuous bi-directional flow of information between the JPIAMR-VRI and the JPIAMR governance to allow room for growth .

Learning from Other Models: JPIAMR was strongly advised to consider similar models in making decisions about the structure of JPIAMR-VRI. For example, the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) connects 22 countries around an effort to build an integrated European Research Area addressing the interconnected challenges of sustainable agriculture, food security

and impacts of climate change. An even better example might be the Network of Centres of Excellence in Neurodegeneration (COEN). The overall aim of this initiative is to build collaborative research activity in neurodegeneration research across borders, focusing on the critical mass and excellence. COEN is aligned with the broader European Joint Programming Initiative in Neurodegeneration (JPND), but it operates as an independent entity. Another example provided was the UK-MRC vaccine network that receives about £2 million in funding. The network, which is not directly linked to the MRC, has brought researchers together, facilitated networking, and has developed a roadmap for vaccine development. The Network is left open to attract new members. New funders have also been attracted because of the growing critical mass of expertise.

Funding: There was discussion around sustainable funding for the JPIAMR-VRI, given that there is currently only sufficient funding to set up the JPIAMR-VRI networks within a JPIAMR Network Call. Potential solutions included charging membership fees, and directly allocating costs to member countries and organisations. It is evident that extra resources must be committed to support the JPIAMR-VRI governance so short-term funding will be necessary.

Timing: There was a strong feeling that regardless of the details of the governance model, the JPIAMR-VRI should be launched as soon as possible, as the momentum is here now and JPIAMR has already done a lot of the preparatory work and has working groups in place to guide the launch. This should be possible if short, medium and long-term goals are established and if, in the short term, the JPIAMR-VRI builds on what is already in place.

Engagement

JPIAMR is already a trusted brand with a proven record of accomplishments including an investment of 53 million euro to AMR research. The group recommended that engagement be a "bottom up", stepwise process based on success, in which the first level will be the researchers and research institutions and networks, followed by the knowledge translation and dissemination experts, then industry, SMEs, and public health and animal regulators, and finally the policy makers, e.g. WHO. Additional partners would include groups such as CARB-X, GARDP, SPARK, Pew Charitable Trusts (SPARK Platform), and external funders. JPIAMR-VRI should also bring in lower and middle-income countries and the development agencies. The group recommended that JPIAMR look at other groups established in global areas of concern, such as climate change, tobacco control, the physics of the universe (CERN) and space exploration (Space Station) to determine how they formed their partner base and engaged the relevant stakeholders, including the research community. Strong vision and mission statements for the JPIAMR-VRI would engage participants. One innovative suggestion to facilitate networking and communication and build the network, perhaps in partnership with SPARK, was to create an on-line presence for the JPIAMR-VRI, loosely based on the LinkedIn model. In this model, researchers could make connections, find specific expertise, build networks, invite people to join their group, and share information on research projects, funding opportunities, career opportunities, upcoming workshops, training sessions, and key publications and news items of potential interest. The group recommended that JPIAMR plan for something bold and exciting but that the process should be both feasible and carefully staged to build on success, piece by piece.

Implementation

There is currently no virtual institute quite like the JPIAMR-VRI and this group suggested that the JPIAMR-VRI should to be built slowly, with a clear vision and mission, and defined goals and objectives. The implementation should begin with the virtual space that will house it and the IT tools needed to create the platform. The group suggested that the JPIAMR-VRI could provide a "hotel" function and a "yellow pages"

for partners, an idea that has many similarities to the suggestion by the Engagement group for a LinkedIn-type platform to connect networks, expertise and a broad stakeholder group. The group also raised the issue of the importance of consequent funding, as it is necessary to attract network participants. An example, from the UK, was cited in which £10 million was provided for interdisciplinary research on AMR in low-income countries. Ten of 40 applications were awarded a small amount of "pilot" money with the expectation that three or four of these will eventually get bigger grants.

Innovative "Out of the Box" Ideas

The group admitted to some challenges in coming up with "crazy ideas" on demand, which led to the recommendation that one role for the JPIAMR-VRI could be to provide an open and flexible environment to encourage and promote the generation of new, innovative ideas on a continuous basis. The group proposed several ideas for consideration, including (in no particular order):

- Facilitating rapid responses to emerging pathogens by connecting thought leaders and content experts with industry, public health and policy makers;
- Identifying new and emerging infectious disease threats;
- Equipping academics with business skills in areas such as intellectual property (IP), regulatory frameworks, manufacturing policies, marketing, technology development and application, and policy development, perhaps mediated through courses, training programs, webinars, sabbaticals, scholarships etc.;
- Developing stronger connections with the lay public, including children, and engaging them as end-users, especially in stewardship programs. Citizen science gets people involved, raises awareness and could be applied across all JPIAMR pillars;
- Supporting work on alternatives to antibiotics in humans, animals, agriculture and the environment (e.g. drinking water), such as phages, immune modulation, biological response modifiers, serotherapy, anti-endotoxins, and connecting people with non-traditional ideas to groups who are receptive and could help them access trials;
- Developing and implementing, rapid diagnostics, especially during epidemics/pandemics to enable rapid screening; and
- Helping researchers with interesting products, compounds and technologies to access industry and teaching them how to navigate regulatory processes.

WORKSHOP OUTCOME & RECOMMENDATIONS

Outcome

The major outcome of the workshop was the confirmation that the AMR community supported the development of the JPIAMR-VRI and recognised the usefulness of this structure in coordinating and facilitating enhanced collaborations to address the AMR issue.

Recommendations

- Hold scientific consultations through a series of regional planning workshops, in diverse locations (including LMIC), to engage and survey the needs of the global community.
- Act on the current momentum and start to build the JPIAMR-VRI by engaging different pillars of the Strategic Research Agenda in a step-wise manner, and focusing on the One Health Approach.
- Avoid duplication by identifying a unique niche for the JPIAMR-VRI.
- Build on a clear vision and mission with defined short-medium-long goals and objectives to facilitate the planning and execution of the JPIAMR-VRI.
- Assess similar successful virtual networks and use their models to build the JPIAMR-VRI.
- Build a strong IT infrastructure to facilitate information sharing and networking. Develop the website and then incorporate different AMR networks into the structure.
- Build a networking function into the JPIAMR-VRI to encourage linkages, which could be inspired by the LinkedIn model, for example.

SUMMARY AND NEXT STEPS

An enormous amount of information was presented during the day and a half of the workshop, which formed the basis for many "on" and "off" the record discussions among participants both during the workshop sessions and in the free time in between. The workshop identified a clear need for a structure, such as the JPIAMR-VRI, to coordinate all the activities, reduce duplication, leverage existing programs and reduce overall costs by streamlining the global AMR research effort.

There was considerable enthusiasm for a rapid launch of the JPIAMR-VRI to capitalise on the momentum generated at the workshop and take advantage of JPIAMR's pre-planning and established working groups that are poised to make JPIAMR-VRI a reality.

Next Steps

The **immediate next steps** for the planning and execution of the JPIAMR are:

- Host a series of focused regional workshops around the world to extend the reach of the consultation process and kick-start the process of engaging the research community, including those in lower and middle-income countries. These workshops would also provide a platform for the development of collaborative pilot projects to get the JPIAMR-VRI up and running.
- Engage the global research community and support the development of JPIAMR networks for inclusion in the JPIAMR-VRI through a JPIAMR Network/Working Group call.
- Map existing networks/centres/projects.



Appendix 1: Participants list

Last Name	First Name	Affiliation	Country
Ackermann	Marit	Federal Ministry of Education and Research	Germany
Aeschlimann	Andreas	Federal Department of Economic Affairs	Switzerland
Akkoyun	Akin	Deutsches Zentrum für Luft- und Raumfahrt (DLR)	Germany
Batoux	Martine	Agence Nationale de la Recherche	France
Bekeredjian-Ding	Isabelle	Federal Institute for Vaccines and Biomedicines (PEI)	Germany
Bergeron	Michel G.	Centre de recherche en infectiologie	Canada
Bjers	Anders	JPIAMR	Sweden
Bloemers	Margreet	ZoonMw	Netherlands
Bogdan	Iorga	CNRS, Institut de Chimie des Substances Naturelles	France
Bray	Judith	Consultant - Professionnal Facilitator	Canada
Brochu	Edith	CIHR-Institute of Infection and Immunity	Canada
Brown	Eric	McMaster University	Canada
Bukholm	Geir	Norwegian Institute of Public Health	Norway
Carmeli	Yehuda	Division of Epidemiology and Preventive Medicine, Tel Aviv Medical Centre	Israel
Cornely	Oliver	University Hospital Cologne	Germany
Courvalin	Patrice	Pasteur Institute	France
De Andrés Medina	Rafael	Instituto de Salud Carlos III	Spain
Delgado	Annette	Deutsche Zentrum für Luft- und Raumfahrt (DLR)	Germany
Fiore	Anthony	US Centres for Disease Control and Prevention	USA
Frimodt-Møller	Niels	Department of Clinical Microbiology at Aarhus University	Denmark
Fujie	Akihiko	Japan Agency for Medical Research and Development (AMED)	Japan
Gonzalez-Zorn	Bruno	Veterinary Faculty- Complutense University of Madrid	Spain
Goossens	Hermann	Laboratory of Medical Microbiology Vaccine & Infectious Disease Institute, University of Antwerp	Belgium
Gordon	Richard	South African Medical Research Council	South Africa
Hancock	Robert EW	Department of Microbiology and Immunology, University of British Columbia; & Canadian Anti-infective Innovation Network	Canada
Harris	Caroline	Medical Research Council Head Office	United Kingdom
Hryniewicz	Waleria	Department of Epidemiology and clinical Microbiology - Narodowy Instytut Lekow	Poland
Jönsson	Jan-Ingvar	Swedish Research Council	Sweden
Jouvin-Marche	Evelyne	French National Institute of Health and Medical Research	France
Junker	Barbara	Deutsches Zentrum für Luft- und Raumfahrt (DLR)	Germany
Kacelnik	Oliver	Norwegian Institute of Public Health	Norway
Kim	Kyeong Kyu	Sungkyunkwan University School of Medicine	South Korea
Klein	Joachim	Federal Ministry of Education and Research	Germany
Krönke	Martin	University Hospital Cologne	Germany
Kuipers	Oscar	University of Groningen	Netherlands
Marin	Laura	JPIAMR	Sweden
McAllister	Tim A.	Agriculture and Agri-Food Canda	Canada
Miyashita	Yumiko	Japan Agency for Medical Research and Development (AMED)	Japan
Müller	Rolf	Helmholtz Institute for Pharmaceutical Research Saarland (HIPS)	Germany

Naas	Thierry	Faculté de Médecine Paris Sud	France
Noad	Lindsay	Public Health Agency of Canada	Canada
Ouellette	Marc	CIHR-Institute of Infection and Immunity	Canada
Outterson	Kevin	CARBX	International
Plant Fuentes	Laura	Swedish Research Council	Sweden
Radwan	Amr	Academy of Scientific Research and Technology	Egypt
Rex	John	Wellcome Trust	International
Rossolini	Gian Maria	Clinical Microbiology and Virology Unit at Florence Careggi University Hospital	Italy
Ruiz Alvarez	Maria Josefina	Ministero della Salute. D.G.R.I.S.	Italy
Sadowy	Ewa	Department of Molecular Microbiology, National Medicines Institute	Poland
Salerno	Giovanni	GARDP	International
Segovia	Carlos	Instituto de Salud Carlos III	Spain
Sprenger	Marc	World Health Organisation	International
St-Jean	Danièle	Canadian Institute of Health Research	Canada
Suzuki	Satowa	AMR Research Centre at National Institute of Infectious Diseases(NIID)	Japan
Tacconelli	Évelina	Division of Infectious Disease and Comprehensive Infectious Diseases Centre	Germany
Thomas	Joe	Pew Charitable Trusts	International
van der Poel	Wim	Wageningen Bioveterinary Research	Netherlands
van Duijken	Engeline	National Institute for Public Health and the Environment - Utrecht (RIVM)	Netherlands
van Hengel	Adrianus (Arjon)	European Commission	International
van Üüm	Jan	Deutsches Zentrum für Luft- und Raumfahrt (DLR)	Germany
Vuopio	Jaana	National Institute of Health, University of Turku	Finland
Walsh	Fiona	Maynooth University	Ireland
Woolhouse	Mark	Infectious Disease Epidemiology, Division of infection and pathway medicine, University of Edinburgh	United Kingdom
Zoubiane	Ghada	Wellcome Trust	International

Agenda



JPIAMR Virtual Research Institute Workshop: Modelling a dynamic network for AMR Research

Date: Wednesday, 8 November 2017

Time: 1.00 to 6.00pm

Venue: Hotel Berlin, Lützowplatz 17, 10785 Berlin, Germany, ([Montreal room](#))

Objectives: To develop the scope, aims and a model for a JPIAMR Virtual Research Institute

TIME	ITEM	SPEAKER
1.00-1.05	1. Welcome	Carlos Segovia Chair of JPIAMR Head of the unit of Accreditation of Health Research Institutes at the National Institute of Health Carlos III, Spain
1.05-1.10	2. Opening Remarks Aims and Objectives of the Workshop	Marc Ouellette Scientific Director, Canadian Institutes of Health Research - Institute of Infection and Immunity Lead of the JPIAMR VRI work package Canada
1.10-1.15	3. Introduction and logistics	Judith Bray Facilitator
1.15-1.45	4. Introduction and positioning of the JPIAMR VRI	Laura Marin Head of Secretariat, JPIAMR, Sweden
First Panel - An overview of activities in AMR		
1.45-2.05	5. World Health Organisation (WHO) Perspective	Marc Sprenger Director, World Health Organisation secretariat for antimicrobial resistance, Switzerland
2.05-2.25	6. European Commission and Transatlantic Taskforce on Antimicrobial Resistance (TATFAR)	Arjon van Hengel Scientific Officer, Health Directorate, DG RTD, European Commission
2.25-2.45	7. Innovative Medicines Initiative (IMI), Drive-AB, Combacte, annual work plan 2018	Isabelle Bekerredjian-Ding Co-Chair of IMI Scientific Committee to the SGG "Infectious Control", Germany
Second Panel - Examples of virtual platforms in AMR		
2.45-3.25	8. Collaborative approaches to building virtual R&D networks for antibacterials: examples from Wellcome Trust, GARDP, CARB-X, and Pew Trusts	Kevin Outterson Executive Director, CARB-X Giovanni Salerno Head of Transversal Programs, GARDP Ghada Zoubiane, John Rex Wellcome Trust Joe Thomas Associate, Pew Charitable Trust
3.25-3.55	9. Open microphone session <i>Discussions and short statements</i>	All speakers from First and Second Panels

3.55-4.10	HEALTH BREAK	
Third Panel - Collaboration between JPIAMR VRI and Global AMR R&D Hub		
4.10-4.30	10. Global AMR R&D Hub	Marit Ackermann Policy Officer, Federal Ministry of Education and Research, Germany
Fourth Panel – An overview of comparable networks/institutions		
4.30-4.50	11. Collaborating Veterinary Laboratories (Covetlab)	Wim van der Poel Wageningen Bioveterinary Research, Member of CovetLab, The Netherlands
4.50-5.10	12. German Centre for Infection Research (DZIF)	Martin Krönke Executive Director, DZIF, Germany
5.10-5.30	13. Canadian Experiences in Effective Networking Canadian Bacterial Diseases Network (CBDN)	Robert Hancock Director, Centre for Microbial Diseases and Immunity Research, Canada
Day 1 Closure		
5.30-6.00	14. Way Forward - Key Takeaways Identify scientific AMR research gaps which could be tackled by a JPIAMR-VRI.	Marc Ouellette Judith Bray
6.00	ADJOURNMENT	

Agenda

JPIAMR Virtual Research Institute Workshop: Modelling a dynamic network for AMR Research



Date: Thursday, 9 November 2017

Time: 9.00am to 5.00pm

Venue: Hotel Berlin, Lützowplatz 17, 10785 Berlin, Germany ([multiple meeting rooms](#))

Objectives: To develop the scope, aims and a model for a JPIAMR Virtual Research Institute.

TIME	ITEM	SPEAKER
9.00-9.15	1. Welcome and re-cap of Day 1 (Montreal room)	Judith Bray
9.15-9.30	2. Introduction to Working Stations (Montreal room) <i>Participants will be assigned to specific tables</i>	Judith Bray
9.30-12.30	3. Working Stations Session (Health break around 10.30) Working Station 1: Strategic focus (Montreal room) Working Station 2: Unique Selling Point (USP)/Value Added (Bangkok room) Working Station 3: Governance, Funding, Infrastructure and Operations (Buenos Aires room) Working Station 4: Engagement (New York room)	All

	Working Station 5: Implementation (Washington room) Working Station 6: Innovative “Out of the box” Ideas (Sydney room) <i>Note: See attached workstation overviews for specific questions related to each working station.</i>	
12.30-1.45	LUNCH	
1.45-3.45	4. Report back and plenary discussion (Montreal room) Rapporteur for each of the 6 working stations, 10 minutes to report back to the plenary followed by 10 minutes for plenary debate	Judith Bray All Rapporteurs In consultation with M. Ouellette, L. Marin, C. Segovia, E. Tacconelli, E. Brown and M. Krönke
3.45-4.05	HEALTH BREAK	
4.05-4.45	5. First attempt at developing the Vision & Mission for JPIAMR-VRI from the working station session feedback (Montreal room)	Judith Bray In consultation with M. Ouellette, L. Marin, C. Segovia, E. Tacconelli, E. Brown and M. Krönke
4.45-5.00	6. Conclusion (Montreal room) Next Steps Upcoming Network Call Closing Remarks	Carlos Segovia Marc Ouellette Judith Bray
5.00	END OF MEETING	

Contact for meeting: Annette Delgado Malagon (Annette.DelgadoMalagon@dlr.de)

Appendix 3: Bios for Speakers and Scientific Programme Committee members

(In alphabetical order by last name)

Dr. Marit Ackermann

Dr. Ackermann joined the German Federal Ministry of Education and Research in March 2015. She is responsible for pharmaceutical research and AMR in the Division for Global Health Research.

From 2013 to 2015, she was working as a National Contact Point for Life Sciences for the EU Framework Programme for Research and Innovation "Horizon 2020" at the DLR Project Management Agency. In 2013, Marit Ackermann completed a traineeship at the European Commission, Directorate General for Research and Innovation, where she worked on research policy for neglected and poverty-related infectious diseases. After having earned her diploma in statistics with a focus on biometrics, she completed a doctorate in statistics at Biotechnology Center Dresden and Technical University Dortmund.

Dr. Isabelle Bekerédjian-Ding

Isabelle Bekerédjian-Ding is the head of the microbiology division at the Paul-Ehrlich-Institut in Germany. She is associate professor at the University of Bonn. She has published > 90 papers and is currently involved in research projects focused on the immune response to nosocomial bacterial pathogens. Her current offices include Vice Chair of the IMI Scientific Committee, member in the EMA vaccines working party and lead of the subgroup for infectious diseases of the Blood Working Group of the German Ministry of Health. Before joining the PEI she was head of the medical microbiology lab and deputy medical director at the Institute of Medical Microbiology, Immunology and Parasitology at the University Hospital in Bonn. She received her board certification in immunology in 2009 and in medical microbiology, virology and epidemiology of infection in 2011, both at the University Hospital in Heidelberg. Her research training included a PhD equivalent in immunology in Heidelberg and post-doc experience at the Baylor Institute of Immunology Research in Dallas, Texas and in the Clinical Pharmacology department in Munich.

Dr. Judith Bray

Dr. Judith Bray (moderator) completed her post-secondary education in England, obtaining a B.Sc. in Biology from London University, a M.Sc. in Immunology from the University of Birmingham, and a PhD in Cancer Immunology from the Cancer Research Campaign Laboratory, Nottingham. Following a two-year postdoctoral position, Judith moved to Canada to accept a position at the Cross Cancer Institute in Edmonton, Alberta. After a successful career as an independent investigator in cancer research for over six years, she took a leave from the workforce to raise her three sons. Judith then changed direction, joining the Canada Science and Technology Museum in Ottawa (CSTM) as an education officer, creating and delivering educational school science programs for CSTM as well as the Canadian Museum of Nature and the Department of National Defense. In November 2000, Judy moved to the newly created Canadian Institutes for Health Research (CIHR) to manage the launch of three Institutes: the Institutes of Genetics, Cancer Research, and Infection and Immunity. Judith remained the Assistant Director of the Institute of Infection and Immunity and the Institute of Cancer Research for 14 years working extensively on partnership development with organizations from both the public and private sector. In February 2014, Judith left CIHR, to become an independent consultant. Since 2014, Judy has worked for a large variety of clients in the health sector, preparing business cases, research frameworks, strategic plans, meeting reports and asset maps and organizing and facilitating workshops.

Dr. Eric Brown

Dr. Eric Brown is a Professor in the Department of Biochemistry and Biomedical Sciences and member of the M.G. DeGroote Institute for Infectious Disease Research at McMaster University.

Dr. Brown is a Fellow of the American Academy of Microbiology and has received a number of other awards including the Canadian Society of Microbiologists Murray Award for career achievement, the Canadian Society for Molecular Biosciences Merck Frosst Prize for new investigators and a Canada Research Chair in Microbial Chemical Biology.

Dr. Brown is a former department Chair and is currently the Director of a leading edge educational program at the nexus of science and commerce, the Biomedical Discovery and Commercialization program. He has served on advisory boards for a variety of companies as well as national and international associations, including a term as President of the Canadian Society of Biochemistry, Molecular and Cellular Biology, member of the Medical Review Panel of the Gairdner Foundation and member of the Institute of Infection and Immunity of the Canadian Institutes of Health Research. Currently, he is a member of the editorial board of ACS Infectious Diseases, a member of the Advisory Board of the Joint Programming Initiative on Antimicrobial Research and serves as a College Chair advising the Canadian Institutes of Health Research on peer review.

Brown Lab researchers are searching for the Achilles heels of drug-resistant superbugs. To this end, they are using tools of chemical biology and molecular genetics to probe the complex biology that underlies bacterial survival strategies. The goal of these studies is to contribute to fresh directions for new antibacterial therapeutics.

Dr. R.E.W. (Bob) Hancock

Dr. R.E.W. (Bob) Hancock is a leading microbiologist in Canada and has researched and taught at the University of British Columbia for nearly 40 years.

The fundamental interest of Hancock and his laboratory is in designing new therapeutic strategies to treat infections in the light of increasing antibiotic resistance coupled with a dearth of new antibiotic discovery. His research interests include cationic host defense (antimicrobial) peptides as novel antimicrobials, anti-biofilm agents and modulators of innate immunity, the development of alternatives to antibiotics for resistant infections, the systems biology of innate immunity, inflammatory diseases and *Pseudomonas aeruginosa*, and antibiotic resistance, particularly multidrug adaptive resistance. He has published nearly 700 papers and reviews, is an ISI highly cited author in Microbiology with more than 75,000 citations and an h-index of 142, and has 64 patents awarded.

Hancock has trained to date 140 Graduate Students and Postdoctoral Fellows and won the Killam Prize for excellence in Mentoring in 2010. Those trainees who graduated are currently employed in a variety of positions covering the gamut from academia to industry to government laboratories.

In recognition of his work, Dr. Hancock has received numerous awards and honours including: the Prix Galien (Highest Award for Canadian Pharmaceutical Research and Innovation), the Killam Prize (Canada Council's prize for Health Research), Michael Smith CIHR Researcher of the Year, the ICAAC Aventis Antimicrobial Research Award (Leading award worldwide for antimicrobial research) and in 2001 he was inducted as an Officer of the Order of Canada (Canada's second highest honour).

He is the co-founder of Migenix, Inimex Pharmaceuticals, ABT Innovations, Sepset and the Centre for Drug Research and Development.

Prof. Martin Krönke

Prof. Martin Krönke, is the Chairman of the German Center for Infection Research (DZIF). DZIF uses an integrative approach to meet major global infectious disease challenges. DZIF's mission is to translate research results from the laboratory to clinical practice and medical care rapidly and effectively. Over 600 scientists and physicians from 35 member institutions throughout Germany (university hospitals, non-university research institutes and specialized federal research institutions) with outstanding expertise, both in basic infection research and clinical infectious diseases, are closely networked in the centre. The Federal Ministry of Education and Research (BMBF) and the federal states annually make a budget of €38.8 million euros available to the DZIF. The tremendous scientific and infrastructural in-kind contribution of all participating member institutes creates a unique setting unfolding DZIFs potential and capacity for the accomplishment of its translational mission. During the past five years, DZIF scientists have developed innovative vaccines, novel antibiotic drug candidates, and diagnostic methods that will benefit patients over the coming years.

Laura Marin

Laura Marin heads the Joint Programming on Antimicrobial Resistance (JPIAMR) global alliance Secretariat/Executive Office hosted by 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.

Dr. Marc Ouellette

Dr. Marc Ouellette is the Scientific Director of Canadian Institutes of Health Research Institute of Infection and Immunity since January 2010. He obtained his Bachelor of Science (Honours) in Biochemistry at Ottawa University and received his PhD at Laval University on antibiotic resistance in bacteria. He performed postdoctoral studies under the mentorship of Pr. Piet Borst of the Netherlands Cancer Institute in Amsterdam, where he further developed his expertise in antimicrobial resistance studying protozoan parasites.

In 1990, he joined the Centre de Recherche en Infectiologie, of Laval University as an Assistant professor and is now full professor. Dr. Ouellette's research is focused on antimicrobial resistance where he has made seminal discoveries on resistance mechanism in protozoan parasites. More recently, he has implemented proteomic and DNA microarray strategies to study antimicrobial resistance in the parasite *Leishmania* and the bacteria *Streptococcus pneumoniae*.

Dr. Ouellette has received numerous awards for his work including a New Investigator Award in Molecular Parasitology from the Burroughs Wellcome Fund, a MRC Scientist Award, a Scholar Award in Molecular Parasitology of the Burroughs Wellcome Fund, and a Tier 1 Canada Research Chair in Antimicrobial Resistance. He is a Fellow of the Royal Society of Canada and of the Canadian Academy of Health Sciences. He has served on numerous panels for national and international granting agencies, and strongly supports scientific exchanges with developing countries.

Prof. Kevin Outterson

Professor Kevin Outterson (J.D., LL.M), Professor and N. Neal Pike Scholar in Health and Disability Law, teaches health care law at Boston University, where he co-directs the Health Law Program, currently ranked #5 in the country by US News. He serves as the Executive Director and Principal Investigator for CARB-X, a \$455m international public-private partnership to accelerate global antibacterial innovation. Key partners in CARB-X include the US Government (BARDA & NIAID) and the Wellcome Trust.

His research work focuses on the law and economics of antimicrobial resistance. He is an Associate Fellow at the Royal Institute of International Affairs (Chatham House). Professor Outterson was a founding member of the Antimicrobial Resistance Working Group at the CDC. He was a senior consultant on the Eastern Research Group study on antibiotic markets for FDA/HHS. Starting in October 2014, he joined DRIVE-AB, a three-year €9 million project on antibiotic business models sponsored by the European Union's Innovative Medicines Initiative. Professor Outterson also serves on the Advisory Panel for the Longitude Prize for an inexpensive rapid point-of-care antibiotic diagnostic. Professor Outterson was given the 2015 Leadership Award by the Alliance for the Prudent Use of Antibiotics for his research and advocacy work. He has testified before Congress, Parliamentary working groups, WHO, and several state legislatures.

Dr. John H. Rex

Dr. John H. Rex (MD, FACP) is a physician and drug developer with approximately 30 years of development and policy experience focused on antimicrobial agents. He currently is the CMO for F2G, Ltd. (an antifungal biotech), holds board-level roles in two biotech (F2G Ltd, Adenium Biotech ApS), supports a charitable foundation (Wellcome Trust), is an operating partner role with a venture capital group (Advent Life Sciences), and is a voting member on the Presidential Advisory Council on Combating Antibiotic Resistant Bacteria (PACCARB).

His past experience has included moving compounds from early preclinical development through all development phases in the context of academic positions (NIH, Bethesda, MD; Univ. of Texas Medical School-Houston) and VP-level roles at a multinational pharmaceutical firm (AstraZeneca), and support of a public-private partnership (CARB-X). Other past activities have included advancing novel regulatory paradigms for antibacterial agents, publications on novel reimbursement models for antibiotics, founding of the New Drugs for Bad Bugs (ND4BB) program of Europe's Innovative Medicines Initiative (IMI), and a 4-year term as Industry Representative on the FDA Anti-Infective Drugs Advisory Committee (AIDAC, 2007–2011).

Giovanni Salerno

Mr. Salerno, Head of Transversal Programmes, GARDP, joined DNDi in January 2017. Previously Senior Vice President of Technology at Evolva (Reinach, Switzerland), Mr. Salerno started his career in Italy working for Pfizer Italia in medical sales, and then moved to the Imperial College in London where he managed a flow cytometry facility. In 2000, he joined DakoCytomation (a Colorado-based company) in Freiburg, Germany, where he worked for five years running EU, Middle East and Japanese operations. Giovanni joined Evolva in 2005 where he spent his first five years managing a program to develop immune-boosters and for three years worked on GC-072, a novel broad-spectrum antibiotic. He has spent the last two years living in the United States working on the development of Nootkatone (a grapefruit derived insecticide) covering R&D, manufacturing and sales. Mr. Salerno has a background in Chemical and Technological Pharmaceutical Sciences and he is a certified Pharmacist.

Dr. Carlos Segovia

Dr. Carlos Segovia was appointed Chair of the Joint Programming Initiative on Antimicrobial Resistance in January 2016. He has been Head of the unit of Accreditation of Health Research Institutes at the national Institute of Health Carlos III (ISCIII) in Spain since 2013 and is currently the coordinator of the EU's Joint Action-CHRODIS. He was Deputy Director for International Research Programmes between 2009 and 2013 and was involved in several European and international health research initiatives. He has been member of the Management Boards of the JPI Healthy Diet for a Healthy Life and of the JPI Antimicrobial Resistance. He also has been national representative at IARC, TDR, RIMAS, and IVI. He was coordinator of JPis to Co-Work (Joint Programming Initiatives: a process of mutual learning Towards a Common adoption of Framework Conditions) and EU-LAC Health (to support cooperative health research between European (EU) and Latin America and Caribbean (LAC) countries).

Carlos Segovia is a primary care physician and obtained a Master of Public Health from Harvard University. Before joining ISCIII, Carlos was coordinator of a Regional Department of Health for two years, and deputy medical director for the Regional Department of Health in Castilla and Leon province for ten years.

Dr. Marc Sprenger

Dr. Marc Sprenger is Director of the World Health Organization (WHO) secretariat for antimicrobial resistance since May 2015. Marc and this secretariat focus on coordination of an Organization-wide approach to antimicrobial resistance, working with WHO programmes carrying out technical activities required for the implementation of the global action plan on antimicrobial resistance.

Prior to joining WHO, from 2010 Dr. Sprenger was Director of the European Centre for Disease Prevention and Control (ECDC) in Stockholm, Sweden. Before that, he was Director-General of the National Institute for Public Health and the Environment (RIVM) in Bilthoven, the Netherlands. A national of the Netherlands, Marc is a medical doctor, medical microbiology specialist and has a PhD in epidemiology from the Erasmus University of Rotterdam.

Dr. Evelina Tacconelli

Dr. Evelina Tacconelli (MD, PhD) is Professor of Infectious Diseases, Head of the Division of Infectious Disease and Medical Director of the Comprehensive Infectious Diseases Center (CIDiC) at the University Hospital of Tübingen, Germany. She has been Lecturer on Medicine at the Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, USA. She was recipient of award from the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) for research excellence. Consultant for WHO and ECDC on antimicrobial resistance and infection control. Main areas of her scientific interest are epidemiology, clinical and therapeutic aspects of healthcare-associated infections and preventive measures aimed to reduce the spreading of antibiotic-resistant bacteria. She is the ESCMID Education Officer for Infectious Diseases and Clinical Microbiology. Author and co-author of more than 150 papers listed in SCI-JCR and NIH Medline.

Joe Thomas

Joe Thomas is a Senior Associate on the Pew Charitable Trusts' antibiotic resistance project. Joe conducts research and advocates for policies to help spur the discovery and development of urgently needed antibiotics. Prior to Pew, he worked at the London School of Economics and Political Science (LSE) studying the economics of rapid diagnostic device development and the use of web search data for modeling infectious disease prevalence in low-income countries. He has bachelor's degrees in biology and political science from the University of Pittsburgh and an MSc from the LSE.

Dr. Arjon Van Hengel

Dr. Arjon Van Hengel studied biology at the University of Utrecht and received his PhD in molecular biology from the University of Wageningen. He then worked as a research scientist at the John Innes Centre in Norwich, UK. Since 2005, he works at the European Commission, first leading a research group that developed and validated analytical detection methods. Since 2009, he is policy officer for antimicrobial resistance at the Directorate General for Research and Innovation.

Dr. Wim van der Poel

Dr. Wim van der Poel research interests include: i) Emerging Veterinary Viruses, ii) Foodborne Viruses, iii) Zoonotic Viruses and iv) One Health. In the first three areas, his research has primarily been focusing on the detection and characterization of viruses in the different hosting animals, as well as in food and environmental matrices. This included the development of new virus extraction methods, new virus detection methods, characterization methods, and antibody detection tests to study infections, antibody prevalence and dynamics of infections in susceptible hosts and reservoir populations. Research in the field of One Health was based on collaboration between human and veterinary medicine but has been extended to multidisciplinary approaches including much more health related research disciplines. Dr. Wim van der Poel is the coordinator of EPIZONE, the largest international network on animal diseases, the European Research Group for epizootic diseases diagnosis and control. Dr. Wim van der Poel is also a coordinator of the Wageningen University investment theme Global one Health. Controlling the risks of infectious diseases and reducing chronic diseases are crucial to food security, public health, climate change and biodiversity. They use the phrase 'A Global One Health', as it reflects the interconnectedness and global nature of health care for humans, animals, plants and the environment.

Dr. Ghada Zoubiane

Dr. Ghada Zoubiane is the Science Lead for Drug-Resistant Infections at Wellcome. In her role, she is shaping and delivering Wellcome's antimicrobial resistance strategy bridging the gap between research and policy. Previously, Ghada has been at the UK Medical Research Council leading on different areas of research including antimicrobial resistance as well as representing the UK at the JPIAMR Management Board and Steering Committee between 2013 and 2017. Prior to the MRC, Ghada had over 8 years of experience in basic research and early stage drug discovery and development.

