

LEARNED SOCIETY PARTNERSHIP ON ANTIMICROBIAL RESISTANCE

A partnership of seven learned societies representing tens of thousands of members of the scientific community, raising awareness of antimicrobial resistance, and supporting UK research to tackle this global challenge.

SUMMARY

LeSPAR ECR workshop on diagnostics for antimicrobial resistance



1. INTRODUCTION

On 20 Nov 2017, the Learned Society Partnership on Antimicrobial Resistance (LeSPAR) convened a multi-disciplinary workshop for early career researchers (ECRs) on diagnostics for infectious disease. 72 delegates attended on the day, representing a broad range of disciplines including chemistry, microbiology, biochemistry, clinical science and social science.

Throughout the day, invited speakers explored the themes of framing the issue and pathways to success, bringing together perspectives from global health, industry, academia, metrology, behavioural science and clinical practice. Delegates participated in panel discussions and took part in a multi-disciplinary group activity, working together to design a hypothetical funding call. Each group focused on research challenges in the field of AMR and diagnostics, and discussed ways to support the interdisciplinary work of PhD students, postdoctoral researchers and early career scientists.

This summary reflects the discussions held throughout the workshop, highlighting the views and specific needs of the ECR participants. The points expressed in this summary represent the opinions of workshop attendees and not the positions of the individual learned societies which comprise LeSPAR.

2. CROSS-CUTTING THEMES

The following underpinning themes were identified by the workshop attendees as important to realising success in the field of diagnostics research. These themes were brought to bear throughout discussions on research challenges and ways to support ECR career development:

One Health¹

- It is important to consider detection of AMR across humans, animals and the environment.
- Aside from the obvious public health benefits, diagnostic tools are also needed to control the use of antibiotics in aquaculture, agriculture, and veterinary settings.

Collaboration

- Knowledge sharing and capacity building across scientific disciplines.
- Working across sectors (industry, academia, clinical) and stakeholders (patients, public, funders, policy).
- International approaches to data sharing and clinical trials.

Behaviour change

- Collaborating with social scientists, clinicians and the public to ensure that diagnostics are seen as integral to antimicrobial stewardship.

¹ The World Health Organization defines 'One Health' as 'an approach to designing and implementing programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes'. Tackling AMR effectively will require the collaboration of researchers from different scientific fields, social scientists, industry bodies, funders, policymakers and the public.

3. RESEARCH CHALLENGES & NEEDS

Throughout the workshop, delegates and invited speakers discussed the challenges and needs facing the field of AMR research and the development of diagnostic tools. Several themes were identified.

FUNDAMENTAL RESEARCH AND KNOWLEDGE

Understanding resistance

- The genetic mechanisms by which AMR arises are still not fully understood, and require further study across different hosts (i.e. humans and animals) and environments.
- Understanding how resistance spreads across clinical and non-clinical settings (and the wider environment) is also important.

Biomarkers and detection

- Identifying novel host biomarkers and unique biomarker patterns that may be used to identify specific infections.
- Understanding how biomarker levels change throughout an infection, so that diagnostics may inform prognosis and direct treatment regimens.
- Defining a robust, efficient way to distinguish between viral and bacterial/fungal (i.e. antibiotic-treatable) infections is a must.
- Understanding the link between genotype and phenotype² is crucial to determining whether the detection of a resistance gene means treatment failure.

DATA AND RESOURCES

Access

- Open access of data networks and repositories will encourage collaboration and data sharing.
- Repositories should be expanded to include data and samples from different geographies (e.g. Low and Middle-Income Countries (LMICs)), communities and environments.
- Access to primary patient samples (e.g. sputum, urine, blood) will help test the capability of diagnostic tests.
 - Supporting researchers to engage with clinicians and patients may help increase the availability of such samples.

Quality

- The quality of bioinformatics databases can be improved through:
 - Standardising biomarker data gathered from different techniques (e.g. microarrays, RNA-sequencing, RT-qPCR).
 - Best practice standards & procedures for uploading data that is accurate and comprehensive (e.g. complete with relevant metadata).
- Integrating microbiology and biochemical marker data with epidemiology data will support cross-disciplinary links and the development of clinical decision-making pathways.

² In other words, how an organisms genetic information relates to its observable characteristics (e.g. how the presence of AMR genes translates to drug-resistance during an infection).

WIDER ENGAGEMENT

- Researchers should engage with patient groups and the general public to raise awareness of the need for new diagnostics, and to encourage participation in research (such as helping to provide specimens).
- Clinicians need to be included at an earlier stage of research and should be involved at various points during the diagnostic development process.
 - In particular, researchers need to have a better understanding of what clinicians require from a diagnostic tool.
 - Additional support is needed to enable clinicians to engage with research. This could be done through the provision of grants and mechanisms for clinicians to give feedback to researchers and developers.

DEVELOPING NEW TECHNOLOGIES

Technology requirements

- Open platform technologies are needed,³ which can be used in line with the One Health agenda (i.e. for human, animal and environmental testing).
- Developing tools to detect the transmission of resistant microbes and resistance genes throughout clinical and non-clinical environments is important.
- Maximising the potential of next generation sequencing (NGS) and whole genome sequencing (WGS) technologies, including the testing of primary samples with minimal/no preparation.

Development pathways

- Researchers need a better understanding of the practical settings in which diagnostics will be used and how these differ (primary care, secondary care, communities, environments).
 - A clearer understanding of care pathways will enable researchers to structure their research to fit the need.
- Researchers should be encouraged to consider the cost effectiveness of a diagnostic tool, including an appreciation for logistical elements (e.g. trade barriers and distributor mark-ups).
 - This could be achieved through the development of training materials and guidelines, alongside opportunities to collaborate with and learn from health economists and social scientists.

4. SUPPORTING ECR CAREER DEVELOPMENT

During the group discussion session, delegates considered how a hypothecated funding call with a £10m budget might be used to support ECRs, whilst tackling some of the previously identified research challenges. Some common themes from across the groups are listed below.

SKILLS GAPS

Support is needed to address the following gaps, through training opportunities for researchers and the creation of knowledge-sharing networks.

- Statistical analysis and bioinformatics.
- Multidisciplinary skills and knowledge that relate to the wider context of laboratory and clinical research (i.e. social/behavioural aspects, epidemiology).

³ Open platform technologies in this context are those designed around interoperability, where data may be used across different systems, components from various manufacturers can be used, or researchers can develop their own materials to work with the technology. For further information, see http://www.who.int/phi/Open_DX_Platform_WHO_Call_for_Expressions_of_Interest.pdf

BOOSTING DATA CAPACITY

A number of groups agreed that resources are needed to develop an open, internationally accessible online platform to enable data sharing. The following points were discussed:

- One Health focus, compiling clinical, veterinary, epidemiological and environmental data.
- Supported by centralised facilities, making use of pooled resources and utilising state-of-the-art technology (e.g. NGS).
 - Facilities can develop and disseminate standard operating procedures.
 - Equipment should be accessible to researchers not based at these facilities.
 - In addition, positions should be available for PhD and postdoctoral researchers.

BRINGING DISCIPLINES TOGETHER

- ECRs would benefit from opportunities to collaborate or draw on expertise across the sciences, including the social sciences.
- Collaboration of academia and industry towards ECR training and career development.
- Many delegates called for specific ECR consortia to be established to remove 'siloes' and encourage PhDs and postdocs to collaborate across disciplines and internationally.
- Other groups discussed the possibility of a 'central repository' of fundamental research questions, to help bring researchers together whilst reducing the risk of unnecessary duplication.

OPPORTUNITIES FOR PROGRESSION

- A number of the identified research challenges have been the focus of recent funding programmes, such as the Cross Council Initiative.⁴ Going forward, a portion of such AMR-specific funds should be earmarked for ECRs. In addition, more effort is needed from funders to engage with ECRs to raise awareness of the opportunities available.
- There was an overarching call from delegates for more opportunities for ECRs who wish to transition to independent research, particularly fellowship-type awards.
- Delegates also indicated a desire for mechanisms through which ECRs can work outside of traditional fields to further develop their skills. Suggestions include training workshops and cross-disciplinary PhD positions.
- ECRs would benefit from opportunities to understand the funding process and the types of funding available, including typical costings and resource requirements.

⁴ <https://www.mrc.ac.uk/research/initiatives/antimicrobial-resistance/tackling-amr-a-cross-council-initiative>

5. FUNDING EARLY CAREER RESEARCHERS

The following examples demonstrate how two groups on the day decided to spend the hypothetical set budget of £10m.

Example 1: Developing a data repository

An international prize would be launched, challenging teams of Early Career Researchers (and mentors) to develop and pilot data platforms that analyse trends in AMR. The most successful platforms will be easily accessible to researchers, clinicians, veterinarians, and the wider public. The EU-funded InfluenzaNet system is an example model which might be emulated.

The challenge prize money would be distributed in the following way:

- Initial funding for networking meetings, bringing together key stakeholders and several teams to discuss what is needed (teams selected based on their initial project proposals).
- Teams 'pitch' their refined proposals, and 3 groups are selected for the next stage of funding. The focus of this funding will be capacity- and network-building, training and access.
- The three remaining proposals are judged on their potential to be utilised internationally; with the winning team receiving the remaining prize fund to fully develop their platform.

Example 2: Establishing an ECR consortium

The £10m fund would be used primarily to enable ECRs to transition to independent research status. Researchers supported by this fund will be encouraged to establish a consortium, which will have gathered sufficient research outputs to give weight to future funding applications.

A call for applications would be released, under the theme of holistic approaches to the development of an open platform, biomarker-based diagnostic technology, in line with the One Health agenda. Researchers with backgrounds in human health, animal health, social science and environmental science would be supported. Funding would be broken down as follows:

- Up to £9m would be shared evenly across three Fellowship schemes, to support newly independent researchers establish their own body of work (including resource for PhD/postdoc researchers). The Fellowship schemes will focus on:
 - o Discovery of new host biomarkers
 - o Open platform technology development
 - o Behavioural aspects associated with diagnostic use.
- The remainder would be applied to the formation of a consortium, comprising the supported Fellows. This fund would cover networking events, secretariat and a number of cross-disciplinary PhD positions.

6. ABOUT LESPAR

The Learned Society Partnership on Antimicrobial Resistance (LeSPAR) is a partnership of seven UK learned societies who have come together to support actions that can mitigate the global challenge of antimicrobial resistance. Collectively, these societies represent around 75,000 scientists.

LeSPAR aims to provide a single, unified voice and mobilise the UK's collective research community in order to enhance understanding and knowledge-sharing between academia, industry and clinicians. The group is focused on taking action, championing best practice and raising awareness of the global challenge of antimicrobial resistance. LeSPAR will achieve these aims by:

- Supporting researchers in creating, sharing and applying knowledge.
- Organising focused events to enable networking and knowledge exchange, and to promote effective collaborations across disciplines and sectors.
- Engaging with government and other funders to achieve policy and funding support for the antimicrobial research community and connecting expertise from our membership to policy-makers.
- Assembling information on relevant resources and meetings.

BIOCHEMICAL SOCIETY

The Biochemical Society works to promote the molecular biosciences; facilitating the sharing of expertise, supporting the advancement of biochemistry and molecular biology and raising awareness of their importance in addressing societal grand challenges.

We achieve our mission by:

- Bringing together molecular bioscientists
- Supporting the next generation of biochemists
- Promoting and sharing knowledge
- And promoting the knowledge of our discipline

 www.biochemistry.org

BRITISH PHARMACOLOGICAL SOCIETY

The British Pharmacological Society (BPS) is the primary UK learned society concerned with research into drugs and the way they work. The Society has around 4,000 members working in academia, industry, regulatory agencies and the health services, and many are medically qualified. The Society covers the whole spectrum of pharmacology, including laboratory, clinical, and toxicological aspects. Pharmacology is a key knowledge and skills base for drug development in the pharmaceutical and biotech industries, and is therefore fundamental to a thriving UK pharmaceutical and healthcare industry and the future of research and development. The Society publishes three scientific journals: the British Journal of Pharmacology, the British Journal of Clinical Pharmacology, and Pharmacology Research and Perspectives.

 www.bps.ac.uk

BRITISH SOCIETY FOR ANTIMICROBIAL CHEMOTHERAPY

BSAC is an inter-professional organisation with more than 40 years of experience and achievement in antibiotic education, research and leadership. Dedicated to saving lives through the appropriate use and development of antibiotics, it supports a large global network via workshops, professional guidelines and its own high-impact international journal.

 www.bsac.org.uk

MICROBIOLOGY SOCIETY

The Microbiology Society is a membership charity for scientists interested in microbes, their effects and their practical uses. It is one of the largest microbiology societies in Europe with a worldwide membership based in universities, industry, hospitals, research institutes and schools.

Our members have a unique depth and breadth of knowledge about the discipline. The Society's role is to help unlock and harness the potential of that knowledge.

 www.microbiologysociety.org

ROYAL SOCIETY OF BIOLOGY

The Royal Society of Biology is a single unified voice for biology: advising Government and influencing policy; advancing education and professional development; supporting our members, and engaging and encouraging public interest in the life sciences. The Society represents a diverse membership of individuals, learned societies and other organisations.

 www.rsb.org.uk

ROYAL SOCIETY OF CHEMISTRY

The Royal Society of Chemistry is the world's leading chemistry community, advancing excellence in the chemical sciences. With over 50,000 members and a knowledge business that spans the globe, we are the UK's professional body for chemical scientists; a notfor- profit organisation with 175 years of history and an international vision for the future. We promote, support and celebrate chemistry. We work to shape the future of the chemical sciences – for the benefit of science and humanity.

 www.rsc.org

SOCIETY FOR APPLIED MICROBIOLOGY

The Society for Applied Microbiology (SfAM), the oldest microbiological society in the UK, aims to advance the science of microbiology in its application to the environment, human and animal health, agriculture and industry. SfAM is the voice of applied microbiology, with members across the globe, and works with sister organisations and microbiological bodies towards enabling microbiologists to inform policymaking within the UK, in Europe and worldwide.

 www.sfam.org.uk