Position statement

Antimicrobial Resistance

May 2024

Antimicrobial resistance (AMR) is a threat to global health, food security and sustainable development. Disease-causing microbes, including bacteria, fungi, parasites and viruses, are developing resistance to the drugs we rely on to control them. Chemical scientists in a range of disciplines and sectors are working with others to address the challenge of AMR from several perspectives – such as materials science, antimicrobial drug discovery, diagnostics and environmental science.

Our asks in brief

We call on the UK government to take the following actions for tackling issues on AMR and other areas of biological security:

1) Maintain a strong science base through long-term and balanced funding, which includes research and innovation;
2) To prioritise cross-disciplinary collaboration to support a One Health strategy across a range of sectors, including human health, animal health, environment and agriculture;
3) Continue a commitment to international collaboration and provide global support for surveillance programmes;
4) Optimise UK engagement on global activities, including the **United Nations intergovernmental panel on Chemicals Waste and Pollution prevention** and the **United Nations joint plan of action for One Health;**
5) Support further research into miniaturisation of analytical instrumentation and sensors to enable rapid, in-field testing;
6) Further capitalise on wastewater surveillance technology established during the COVID-19 pandemic to expand our capability to detect biological concerns; and
7) Share knowledge, expertise and financial support that could help identify biological threats earlier, and ensure that research can be more efficient and effective.

AMR: A global health crisis

AMR has been widely recognised as one of the most pressing challenges facing society today, with the World Health Organisation (WHO) highlighting AMR as one of the top 10 global public health threats.

Read more on antimicrobial resistance

The impacts of AMR on public health are already evident, with the global burden of deaths in 2019 as a direct result of antibiotic-resistant bacterial infections estimated to have been over 1.2 million people. Furthermore, a recent report anticipates that antimicrobial resistance will kill 300 million people by 2050, in the absence of any intervention.

Antimicrobials are the foundation of modern medicine. Not only used to **treat** infections, antimicrobials are also used to **prevent** infections, for example, permitting invasive surgery and enabling specific treatments for cancer to be possible.

Yet, development of new antibiotic treatments is lacking. WHO have reported that only 12 antibiotics have been approved since 2017, 10 of which belong to existing classes where there are established mechanisms of AMR.

The development of AMR is a natural and expected process; however, overuse and misuse of antimicrobials in human health, agriculture and animal health has accelerated its development. This has been further exacerbated by globalisation. AMR is an issue that concerns all countries, but disproportionately affects those living in low- and middle- income countries.

As resistant microbes become more common and our defences against them become less effective, the need for research and development to tackle AMR is becoming critical. A One Health approach has been highlighted as key to tackling AMR. One Health is a collaborative and interdisciplinary strategy that recognises the interconnectedness of human, animal and environmental health. Adopting a One Health approach therefore facilitates a coordinated strategy across multiple stakeholders from relevant sectors.

There are examples of a One Health approach being implemented voluntarily on an international scale, with prominent United Nation organisations; WHO, the Food and Agriculture Organisation, the United Nations Environment Programme and the World Organisation for Animal Health, coming together to form the Quadripartite Alliance. This joint initiative reflects coordinated action in addressing the complex, interlinked nature of AMR.

Chemistry within AMR research

The chemical sciences are a critical component of AMR research, underpinning the impacts related to global challenges covering healthcare, environment and sustainability. Current research by pharmaceutical companies, small and medium enterprises and universities that involves the chemical sciences includes:

- Rejuvenating old antimicrobials as well as developing new ones;
- Developing alternative therapies to antimicrobials (for example, 'phage therapy', which uses small cells known as bacteriophages to infiltrate the bacterial cell);
- Understanding the genes and mechanisms that cause resistance in microbes (for instance, drug resistant bacteria can transfer their genes to non-resistant bacteria through links between bacterial cells);
- Developing new diagnostics to detect infections, to ensure they are treated correctly and minimise the possibility of resistance arising;
- Developing materials and coatings to prevent the spread of infection in various settings, including hospitals, industry and at home;
- Developing vaccines to prevent infectious diseases, and reducing the need for treatment via antimicrobials;
- Monitoring AMR in humans (genetic surveillance) and the environment (through wastewater-based epidemiology, for example) to monitor occurrence and evolution of resistance; and
- Measuring levels of antimicrobials in the environment (e.g. in water, soils and sediments).

The potential impact chemistry research can have on AMR and disease spread has been acknowledged in the UK's Research Excellence Framework 2021.

Impact case studies included research at Queen's University Belfast, where a new class of compounds was discovered leading to a major new antibiotic, Ridinilazole. This is used to treat *Clostridium difficile* infections and is now in Phase II clinical trials.

In the area of diagnostics, research at the University of Bath has led to the development of point-of-care diagnostics for chlamydia and gonorrhoea infections. This test produces rapid results within 30 minutes, allowing accelerated patient treatment and thus stemming further spread of disease.

What we want

AMR remains a significant challenge to modern medicine and compromises efforts to achieve the United Nations Sustainable Development Goals. The scientific community continues to warn of the increasing threat posed by AMR and the need for concerted national and international action to address this threat.

We welcome the UK government funding aid efforts to monitor AMR in the 25 most affected countries. However, further research, collaboration and support are needed to keep AMR on the agenda, both in the UK and globally. We call on the UK government to take the following actions to tackle issues on AMR and other areas of biological security:

1) **Maintain a strong science base through long-term and balanced funding, which includes research and innovation.** Sustained financial support is essential to advance progress across the key areas of chemistry within AMR;

2) **To prioritise cross-disciplinary collaboration to support a One Health strategy across a range of sectors.** Collaborative and multidisciplinary approaches can leverage expertise and mandates across different sectors (including human health, animal health, environment and agricultural sectors), enabling a comprehensive approach to addressing the complex nature of AMR;

3) **Continue a commitment to international collaboration and provide global support for surveillance programmes.** There is a recognised data gap in low- and middle- income countries which makes estimating the scale of the problem a significant challenge. Continued commitment to international collaboration is vital for establishing harmonised analytical methodologies, as well as providing vital data to fill knowledge gaps;

4) **Optimise UK engagement on global activities**, including for the UN intergovernmental panel on Chemicals Waste and Pollution prevention and the UN joint plan of action for One Health;

5) **Support further research into miniaturisation of analytical instrumentation and sensors to enable rapid, in-field testing.** This will allow for rapid and on-site detection, allowing healthcare professionals to make timely decisions on appropriate treatments, as well as facilitating wide-spread and routine monitoring of AMR to help identify emerging resistance patterns;

6) **Further capitalise on wastewater surveillance technology established during the COVID-19 pandemic to expand capability to detect biological concerns.** This, combined with the correct infrastructure and alert systems, could be used to facilitate a rapid response to new biological threats or public health crises; and

7) **To share knowledge, expertise and financial support that could help identify biological threats earlier, and ensure that research can be more efficient and effective**. For example, in the chemical sciences the Pan Africa Chemistry Network supports analytical chemists in Africa on training courses in analytical techniques.

What we do

The Royal Society of Chemistry supports the chemical sciences research community in sharing knowledge, developing collaborations and engaging with funding agencies and policy makers to ensure that the chemical sciences can contribute their full potential to tackle this challenge.

We hold scientific meetings and wider community engagement activities focused on the many ways in which chemistry contributes to tackling AMR. These include scientific research meetings such as Novel strategies for combating anti-bacterial resistance and Antibiotics in the Water Environment:- Occurrence, Detection, Fate.

You can read more in our *Chemistry World* magazine about the design of new antimicrobials and strategies to tackle AMR, including a recent explainer on a new antibiotic class or in the special feature collection on AMR. Articles here included Charting the rise in antimicrobial resistance, The drug developers fighting the antibiotic resistance problem and If the drugs don't work. This collection also included a special webinar feature: Antimicrobial resistance: Exploring the One Health perspective and wastewater monitoring.

Publishing outputs

Through RSC Publishing, we also showcase the latest advancements in chemistry to combat AMR. We recently published a themed article collection on AMR, where the latest medicinal chemistry advances in tackling drug resistance were highlighted. In addition to our recent themed journal article collection, we have also recently published a book on microbial biofilm mitigation and drug development.

Consultations

In March 2022, we responded to the UK Cabinet Office's call for evidence on the refresh of the 2018 Biological Security Strategy. Our submission highlighted three key priority areas critical to addressing biological security challenges, one of them being AMR. The remaining two priorities – climate change and chemicals and waste pollution – are closely interlinked with AMR and are known drivers.

Brought to you by Chemistry podcast

The third series of our award-winning podcast *Brought to you by Chemistry* has focused on the theme of AMR. This six-part podcast series interviewed experts from chemistry, environmental science, medicine, public health, veterinary medicine amongst others, to learn about the nature of the threat of AMR and what can be done to tackle it.

Listen to the RSC's podcast series on AMR.

Other health-related policy work

The Royal Society of Chemistry has previously worked with Compound Interest to produce a series of sharable graphics, to demonstrate some of the ways the chemical sciences helped tackle the COVID-19 pandemic.

While we were not able to cover all the scientific moments from 2020, our timeline was a snapshot of some of the extraordinary science achieved under extraordinary circumstances.

You can read more about the contributions of the chemical sciences in tackling COVID-19 through Chemistry World's pharmaceutical round-up 2021: Providing pathways through the pandemic.

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Contact

The Royal Society of Chemistry would be happy to discuss any of the issues raised in this position statement in more detail. Any questions should be directed to **policy@rsc.org**.

About us

With about 50,000 members in over 100 countries and a knowledge business that spans the globe, the Royal Society of Chemistry is the UK's professional body for chemical scientists, supporting and representing our members and bringing together chemical scientists from all over the world. Our members include those working in large multinational companies and small to medium enterprises, researchers and students in universities, teachers and regulators. There are numerous ways in which chemical scientists are working towards a sustainable, clean and healthy planet, and this position statement is part of The Royal Society of Chemistry's contribution to do so.