

## ANTIMICROBIAL RESISTANCE EXPLAINED

A guide to antimicrobial resistance and how UK excellence is helping tackle this global challenge



October 2018

## Foreword

The 21st century is proving to be one of the most exciting and prolific periods of innovation in biosciences and healthcare. Advances across biology, technology, engineering and data science are converging to help create new, potentially life-changing solutions for individuals and societies across the globe.

**Genomics** – the study of our genetic material, or DNA – is enabling truly personalised medicines, designed to effectively address particular patients’ disease with as few side-effects as possible. It is also paving the way to more accurate, convenient diagnostic products that help characterise and potentially prevent disease, by picking up signs much earlier.



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As engineers and biologists join forces to build ever-more sophisticated gene-editing tools, new classes of medicines are emerging, including **cell and gene therapies**. These involve altering cells or genes, usually outside the body, to provide a patient-specific therapy that is re-injected into the patient. Scientists’ growing understanding of how genes exert their influence, and of the crucial impact of multiple environmental factors on those genes (“epigenetics”), is opening up new frontiers of drug research. It has led to an explosion of activity around the gut microbiome – the colonies of micro-organisms residing in our gut – and its role in health and disease.

Genomics, **engineering biology** and related data and analytics tools are also helping fuel innovative approaches to tackling pathogenic bacteria. These may provide new, more effective and less toxic medicines for a range of life-threatening infections. Importantly, they may also help address the growing global challenge of **antimicrobial resistance**.

UK bioscience companies are at the forefront of these innovative, converging disciplines. These companies are a key part of the UK Bioindustry Association (BIA)’s membership and as the trade association for innovative life science companies in the UK, the BIA provides a home for these groups through our Advisory Committees and working groups on antimicrobial resistance, cell and gene therapy, engineering biology and genomics.

Given both this focus of our membership and the increasing external interest in how these innovations can tackle key challenges that society faces and contribute to the growth of a 21st century economy, the BIA is delighted to publish this series of four explainers on antimicrobial resistance, cell and gene therapy, engineering biology and genomics.

Within these explainers, we describe what these areas are all about, the important contributions made by UK bioscience firms, and the external environment required to ensure that these innovative approaches continue to benefit patients, the economy and society as a whole.

I hope you enjoy reading them.

**Steve Bates OBE**  
CEO, UK Bioindustry Association

## What is antimicrobial resistance?

Antibiotics are a triumph of modern medicine. Alexander Fleming's famously serendipitous discovery of penicillin during the 1920s led to one of the most effective treatments for bacterial infections, still in use today. But the success of penicillin and many other antibiotics developed since has created an entirely new, arguably even bigger healthcare challenge, that of antimicrobial resistance (AMR).

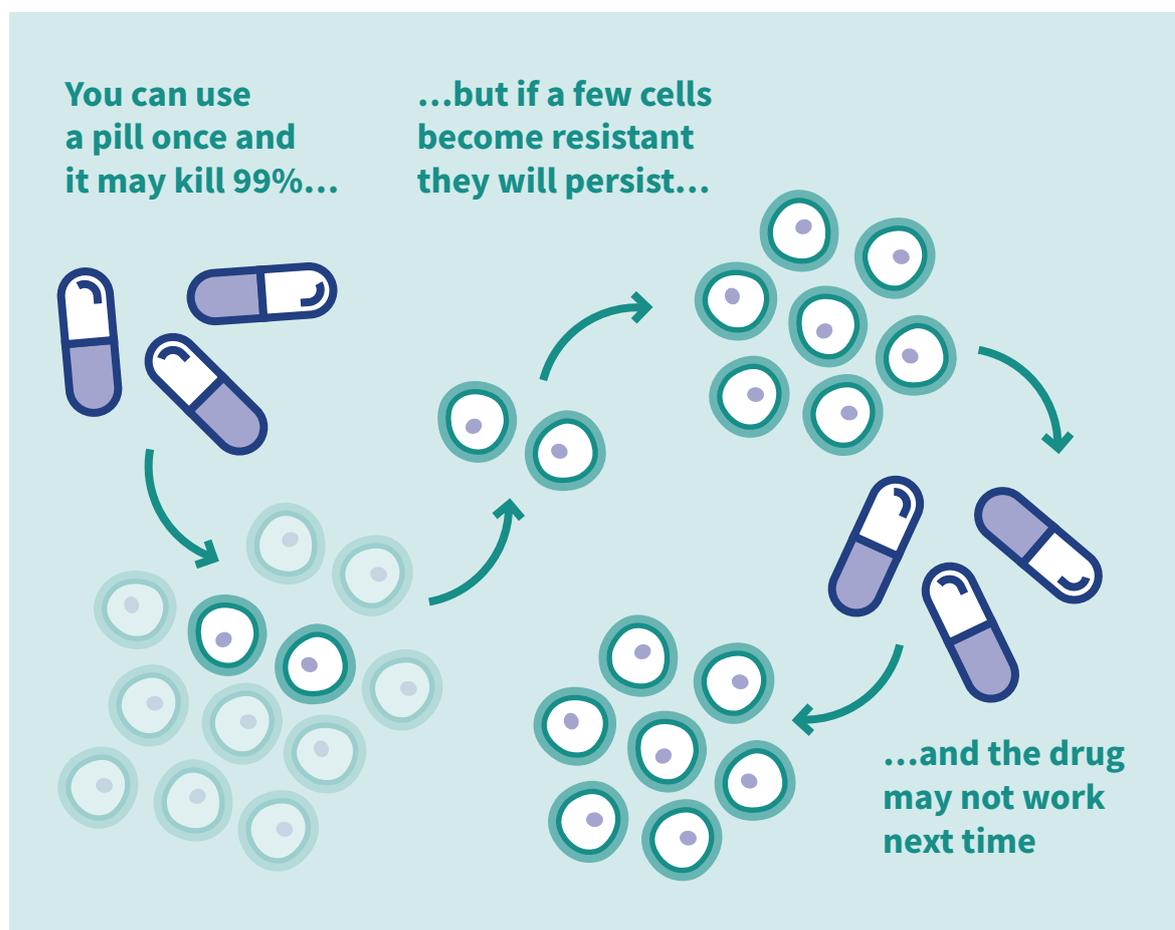
Most modern antibiotics work by breaking down bacterial cell walls, or by inhibiting bacterial growth or repair through interfering with DNA or protein synthesis. But some harmful bacteria have developed ways to out-smart these attackers. They have become resistant. Bacteria reproduce and evolve far faster than humans and most animals, and they can share helpful DNA easily among each other, not just with their offspring. So genes that encode antibiotic resistance are passed around far and fast.

AMR has huge implications for human health.

Routine procedures, like appendectomies or caesarian sections, may become life-threatening. Already, over 700,000 people are estimated to die each year due to drug-resistant infections such as methicillin-resistant *Staphylococcus aureus* (MRSA). These so-called 'superbugs' are responsible for increasing outbreaks of hospital-acquired infections. Without new, effective medicines, the annual death toll from resistant bugs could reach over 10 million by 2050, according to some estimates.<sup>1</sup>

AMR also affects anti-fungal drugs, indicated for a range of infections commonly affecting the skin, mouth, throat, blood and other areas. Many fungi, such as the

<sup>1</sup> The Review on Antimicrobial Resistance, Chaired by Jim O'Neill, May 2016 [https://amr-review.org/sites/default/files/160525\\_Final%20paper\\_with%20cover.pdf](https://amr-review.org/sites/default/files/160525_Final%20paper_with%20cover.pdf)



*Candida* and *Aspergillus* species, have become resistant to existing medications. Similarly, viruses such as the seasonal influenza virus can change as they replicate and become resistant to anti-viral medications.

## The problem

Many existing anti-infective drugs are part of the same chemical family (such as the beta-lactam or quinolones antibiotic families). Their structural similarities mean bugs can quickly develop resistance to all members of that family. The problem is compounded by 'broad spectrum' antibiotics, which combat a range of disease-causing bacteria by targeting growth or protection mechanisms common to many pathogens. They're very useful when the specific culprit is unknown. But growing use – and in many cases overuse – of these medicines has given large numbers of harmful bacteria more opportunity to develop resistance. For example, broad-spectrum antibiotics like vancomycin are commonly administered to prevent infection ahead of major surgery. This may reduce immediate infection risk, but also opens the door to more rapidly-developing resistance.



**The growing global problem of more resilient pathogens, and fewer treatment options, requires for its resolution a collaborative effort as transformative as the treatment revolution brought about by first-generation antibiotics.”**

Six particular bacteria, referred to as ESKAPE, have proven most adept at developing resistance to multiple drugs. This group – *Enterococcus faecium*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Acinetobacter*, *Pseudomonas aeruginosa* and *Enterobacter* – are the leading cause of hospital infections around the world. Some bacteria have also learnt to aggregate in

highly drug-resistant biofilms – slimy layers that adhere to the surface of a wound or tissue, causing chronic infection.

As first-line antibiotics lose their efficacy, physicians are forced to select from a dwindling range of more expensive, and often more toxic and complex-to-administer antibiotics. The result: longer recovery times, reduced quality-of-life, and higher costs and risks.

Many large drug companies have cut or discontinued antimicrobial drug R&D due to diminishing returns: the use of any novel antibiotic that does reach the market may be tightly restricted in order to slow the development of resistance and preserve the drug's utility. The number and novelty of antibiotics approved over the past 30 years has fallen sharply as a result.

In late 2017 England's Chief Medical Officer Professor Dame Sally Davies led a successful campaign, with BioIndustry Association support, to drive the AMR challenge firmly onto the agendas of intergovernmental groups including the G7, G20, the UN and the World Health Organisation. AMR is now one of the WHO's top three health concerns. The growing global problem of more resilient pathogens, and fewer treatment options, requires for its resolution a collaborative effort as transformative as the treatment revolution brought about by first-generation antibiotics.

## New anti-microbial drugs and diagnostics

UK researchers and bioscience companies are helping address part of the AMR challenge: the lack of effective treatments. They're seeking next-generation antibiotics, completely novel anti-bacterial drugs and approaches and anti-fungals that can outwit resistant bugs. They are exploring compounds that kill or deactivate pathogens using entirely new mechanisms of action, more likely to evade resistance strategies. They're uncovering more targeted approaches, hitting specific bacterial or fungal strains, infection sites or organs more precisely, akin to the more targeted therapy approaches in cancer. They're finding ways to disrupt bacterial and fungal communication, and with it the creation of biofilms.

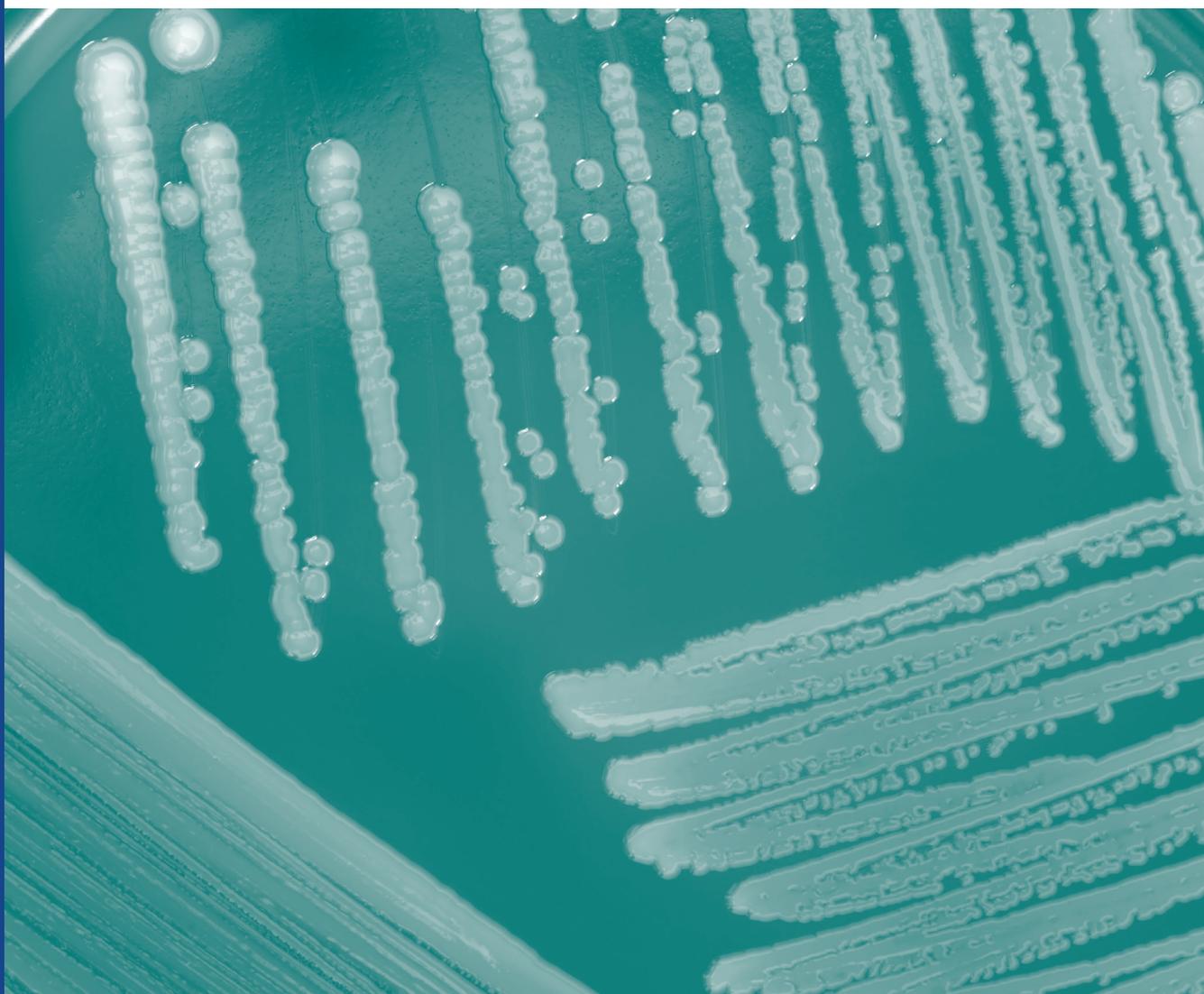
These innovative approaches are designed to provide effective treatments for patients with highly-drug resistant infections, after standard therapies have failed. They may also open up new, improved first-line treatments for certain conditions.

Genomics has accelerated anti-microbial drug research. Sequencing and analysing microbial genomes (much quicker and easier to do for bugs than for humans) allows scientists to better understand and exploit infection and resistance mechanisms. Genomics data also helps more accurately diagnose certain infectious diseases, enabling more targeted and responsible medication strategies. Many broad spectrum antibiotics, for example, indiscriminately wipe out helpful bacteria in our digestive systems, alongside their harmful counterparts. Understanding what those friendly bacteria look like is paving the way toward more targeted anti-infective

approaches. Even without genomics, anti-microbial drug development often has the advantage of a clearly-identifiable and measurable target: the bug. It is often harder to discern the effects of drugs designed to interfere with particular molecules or biochemical processes within the body.

## Solutions to AMR must go beyond science

Great science is a big part of the effort to fight AMR. We need more effective drugs, and better diagnostics. But this isn't enough on its own. Solving the AMR challenge requires action across a number of fronts. Global surveillance of the emergence and spread of drug-resistant infections must improve. Public awareness needs to grow. Countries across the globe must enact appropriate policies around hygiene and antibiotic use – including in agriculture.



## UK excellence in tackling antimicrobial resistance

The UK is addressing the AMR challenge with outstanding science, focused research and development efforts, collaborative policy leadership and committed funding.



**Public awareness of AMR has grown; tackling antibiotic resistance was chosen, by popular vote, as the focus of the £10 million Longitude Prize in 2014.”**

UK research institutions including the Wellcome Trust and several of the country's leading universities are combating AMR with dedicated, multi-disciplinary centres of excellence spanning research and clinical development. Imperial College's AMR Collaborative, the University of Liverpool's Centre for Antimicrobial Pharmacodynamics (CAP), the University of Bristol's multi-disciplinary BristolBridge and AMR-focused PhD programme, the University of Warwick's Antimicrobial Interdisciplinary Centre and the London School of Hygiene and Tropical Medicine's Antimicrobial Resistance Centre are just a few examples. Many of these are supported by the Medical Research Council and UK Research and Innovation. The AMR Centre at Alderley Park in Cheshire also offers integrated development capabilities and support for AMR programmes, including international partnerships.

Alongside its great science and expanding AMR research infrastructure, the UK has led the drive to ensure that AMR remains firmly at the top of the national and international policy agenda. England's Chief Medical Officer Professor Dame Sally Davies headed an international campaign, endorsed by then-Prime Minister David Cameron, which culminated in a United Nations declaration in late 2016. The agreement committed all 193 signatory countries to raise public awareness of AMR, encourage R&D and to ensure appropriate use of antimicrobial medicines.

Dame Sally's campaign also helped anchor AMR onto the priority lists of other intergovernmental organisations such as the World Health Organisation (WHO) and the Group of Twenty (G20) countries, including the United States and China. It also triggered further collaborative funding efforts. Among them are CARB-X (Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator), a public-private partnership between UK charity the Wellcome Trust and the US government's Biomedical Advanced R&D Authority (BARDA) and the National Institutes of Health, and the UK government's Global Antimicrobial Resistance Innovation Fund (GAMRIF).

Economist Jim O'Neill's 2016 report outlining the economic, social and regulatory actions required to tackle AMR was another important policy catalyst. The O'Neill Review on Antimicrobial Resistance, commissioned by David Cameron, called for \$2 billion in global innovation funding and proposed a range of regulatory, pricing and reimbursement incentives to help encourage the development of AMR drugs, and to ensure they can be successfully, and sustainably, commercialised and distributed.

These calls-to-action in the fight against AMR have already led to substantive progress. Public awareness of AMR has grown; tackling antibiotic resistance was chosen, by popular vote, as the focus of the £10 million Longitude Prize in 2014. More funding and resources have become available for AMR-focused R&D.

Scientific and technological advances, for instance in genomics and engineering biology, are also accelerating drug discovery efforts.

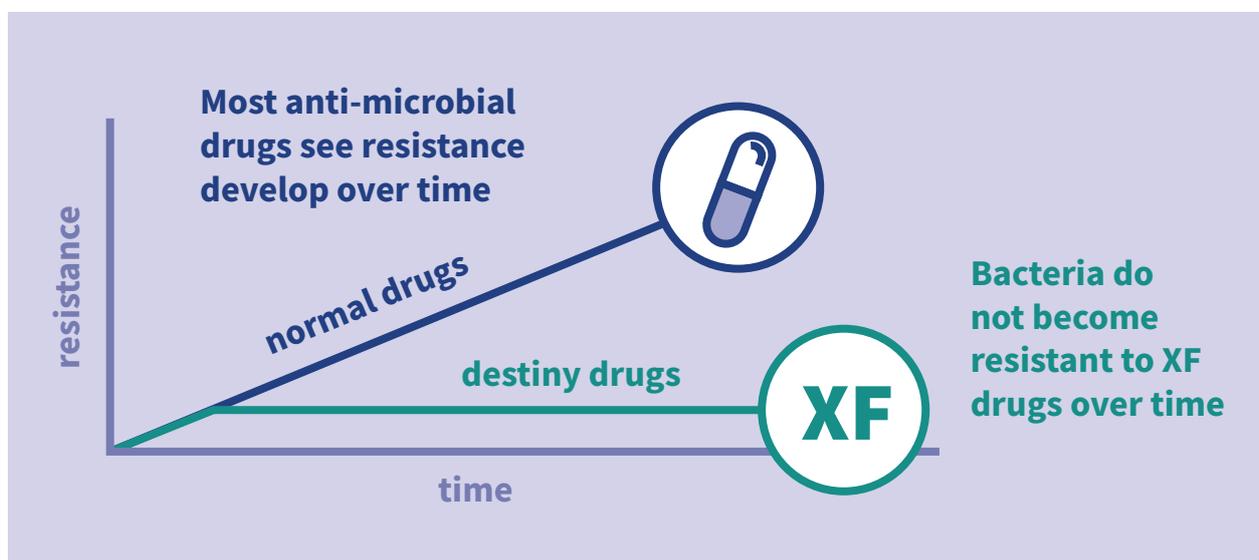
Within this context, new drug discovery and development approaches to tackling treatment-resistant microbes are emerging from the UK biotech sector. The case studies enclosed highlight a selection of those efforts, and the extraordinary innovation and creativity underpinning them. To find out more about the community of BIA member companies working in this field visit: <https://www.bioindustry.org/bia-membership/advisory-committees/antimicrobial-resistance-working-group.html>.

## Destiny Pharma plc

Destiny Pharma's drug candidates attach to and kill harmful bacteria in a different way to existing antibiotics, generating no resistance to date.

Destiny Pharma's scientists are tackling one of the most significant threats to human health: antibiotic-resistant bacteria. The Sussex-based company has developed anti-bacterial drug candidates that work very differently to existing antibiotics. Studies suggest that they have a very low potential to elicit bacterial resistance, even in one of the most dangerous multi-drug resistant pathogens, methicillin-resistant *Staphylococcus aureus* (MRSA). This is in part because they act ultra-rapidly – within minutes – leaving little time for the superbugs to develop avoidance mechanisms.

Destiny Pharma's lead compound, exeporfinium chloride, (codenamed XF-73), is a positively-charged molecule that binds rapidly to the bacteria's outer membrane and makes it leaky, causing the loss of compounds critical to the superbug's survival. Unlike some antibiotics, XF-73 doesn't burst the bacteria's membrane, but renders it ineffective by acting on multiple sites across the surface. This multi-pronged, ultra-rapid action explains the non-existent resistance levels, according to Founder and Chief Scientific Officer, Dr Bill Love.

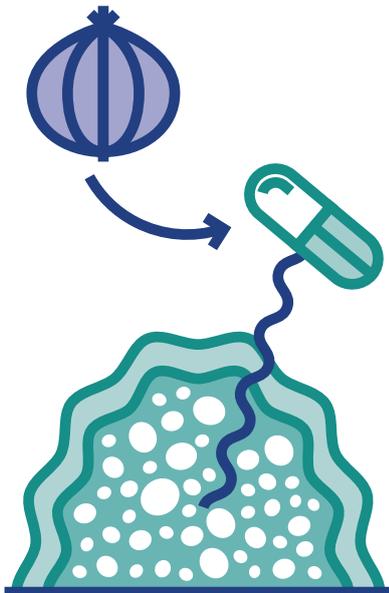


XF-73 is starting mid-stage human trials for the prevention of post-surgical MRSA infections, one of the leading causes of hospital infections. Drug-resistant bacteria like MRSA are thought to cause over 700,000 deaths each year, a figure that could increase more than ten-fold by 2025.

The drug candidate XF-73 is administered as an intra-nasal gel. It has already been shown to be safe and effective in reducing nasal bacteria that cause post-surgical infections, in studies involving over 200 subjects. An effective, easy-to-administer preventative medication for resistant bacteria like MRSA would bring significant value to patients, health systems and economies across the globe. Reflecting this, XF-73 has been granted Qualified Infectious Disease Product (QIDP) status by the US regulatory authorities (FDA). QIDP expedites approval – XF-73 was granted Fast Track status in March 2018 – and adds an additional five years' US market exclusivity.

Destiny Pharma is built around a platform of novel-mechanism drugs – the XF drug series – being developed as preventative medicines and as treatments for a range of bacterial infectious diseases. Some of its compounds have shown activity against *Staphylococcal* bacteria that assemble into biofilms – slimy, highly-resistant bacterial layers that adhere to the surface of a wound or tissue. Biofilms are a growing problem across a range of chronic conditions, including diabetic foot ulcers and burn infections.

Destiny Pharma's technology has already attracted a range of international investors and partners. Early research was part-funded by the European Union and the opening US clinical trial by the US National Institutes of Health. In December 2017, Destiny secured a collaboration with China Medical Systems Holdings (CMS) for XF-73 in China and certain other Asian countries. Hong Kong-listed CMS also invested £3 million in the group, supplementing the £15 million Destiny raised at its September 2017 IPO on the London Alternative Investment Market (AIM).



**Neem Biotech are producing drugs made from garlic, which are able to penetrate the bacterial slime**

## Neem Biotech

Neem Biotech's anti-bacterial candidates disrupt biofilms – slimy layers of bacteria associated with some of the most stubborn infections, including those found in the respiratory tract and in wounds. Bacteria in biofilm communities, typically stuck to a surface like skin or airways, are less sensitive to antibiotics than their free-floating counterparts. Neem's candidates interfere with the bacterial communication channels necessary to organise and build biofilms. This slows their formation and can also eradicate existing biofilms.

Neem's novel approach has its roots in garlic, long known for its healing properties as well as its pungent flavour. *"The company was built around expertise in identifying and isolating natural products from plants,"* explains Chief Executive Officer Graham Dixon. Academics at the Technical University of Denmark (DTU) identified ajoene – one of several sulphur-based compound found in garlic – as responsible for disrupting the bacterial communication (known as quorum sensing) in biofilms. Neem's team of microbiologists, chemists and biochemists have designed synthetic, well-characterised variants of ajoene which are more stable and easier to make than the original. It is developing these derivatives



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The Wales-based company plans to begin human trials of NX-AS-911 for infection control in venous leg ulcers within 12–18 months, at the Welsh Wound Innovation Centre. The topically-administered candidate has been shown in the laboratory to prevent biofilm formation among *Pseudomonas aeruginosa* and *Staphylococcus aureus* bacteria, making these bugs vulnerable to both the immune system and to existing antibiotics and/or antiseptics.

Pre-clinical program NX-AS-401 is an inhaled formulation of another ajoene-inspired active ingredient. It is designed to treat chronic lung infections caused by *Pseudomonas* and *Staphylococcus* bacteria in patients with cystic fibrosis.

## Novabiotics

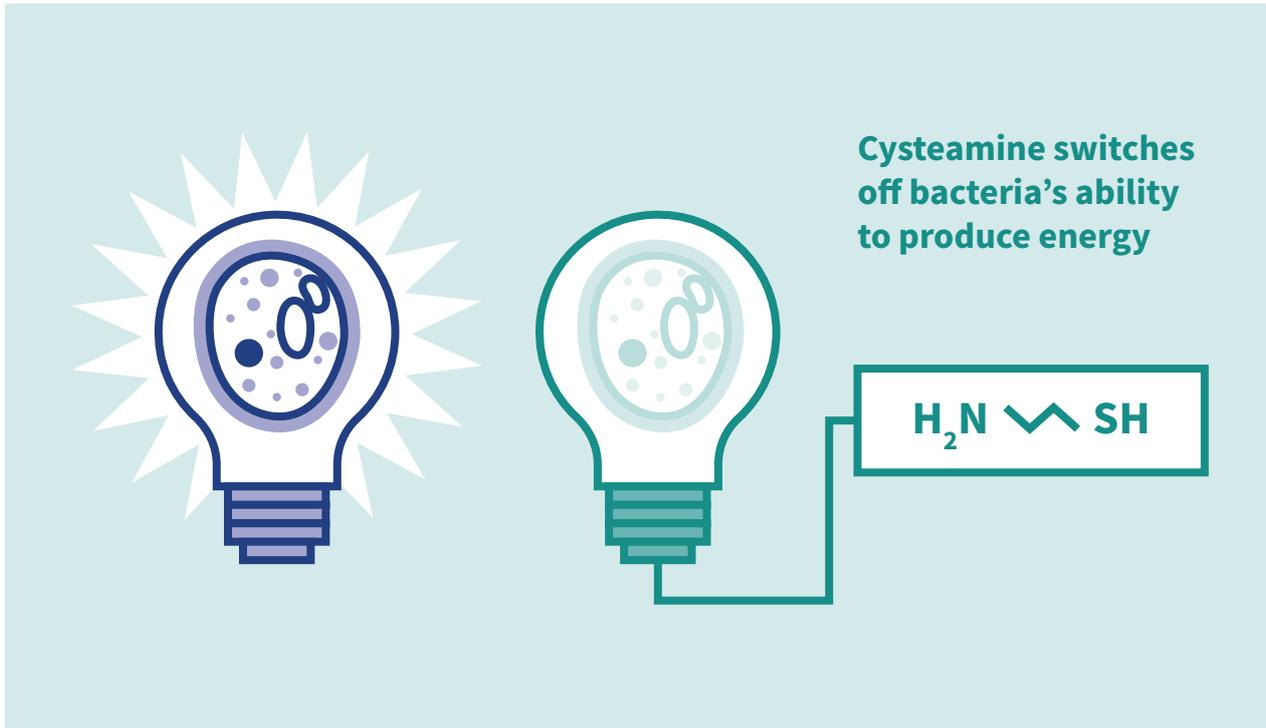
Aberdeen, Scotland-based NovaBiotics is using some of the body’s own infection-fighting mechanisms as the basis for entirely novel antimicrobial medicines. The company’s scientists have taken inspiration from two kinds of rapid-response unit within our immune systems: aminothiols, a type of molecule produced during infection and inflammation, and anti-microbial peptides made by epithelial cells which form the barrier between our bodies and the outside world.

Both these approaches kill bacteria or fungi very fast, preventing them from developing resistance. But since they’re only a first-line defense before the full-blown immune system kicks in, they can’t always successfully fight infection. NovaBiotics is trying to turbo-boost these systems, building products that enhance the effectiveness of existing antibiotics, and/or that are bug-fighters in their own right. The company hopes to address many of the most challenging, drug-resistant bacterial and fungal infections.

Lead compound Lynovex is on the cusp of a Phase III pivotal study to boost the effectiveness of anti-infective treatments used in cystic fibrosis. CF is an inherited condition that causes sticky mucus to build-up in the airways and other areas, leading to recurring infection. The intensive, long-term antibiotic therapy that many CF patients need leads to high levels of resistance to the most common medicines.

Lynovex is a formulation of a naturally-occurring aminothiol called cysteamine. Cysteamine is involved in several important human cellular activities. It also cripples bacteria by switching off their ability to produce energy. This disables the tactics that bacteria use to resist existing treatments, such as pumping out antibiotics through their cell walls. One third of CF patients in a Phase IIa trial, who were previously resistant to antibiotics, became sensitive to the drugs following treatment with Lynovex. “*We’re boosting one aspect of what’s already there in nature,*” sums up NovaBiotics CEO, Scientific Officer and Founder Deborah O’Neil. An oral formulation of Lynovex is expected to start Phase III in 2019.

Similarly, NovaBiotics’ anti-microbial peptides are simplified versions of natural molecules, slimmed down to include only the components that are essential for



anti-microbial activity. The endogenous peptides are very complex, affect multiple systems and are difficult to produce. NovaBiotics' mono-functional peptides are much easier to make. They also specifically target microbial cells, sparing host (human) cells. This lowers the risk of toxicity.

Novarifyn is a peptide antibiotic that has shown activity against multiple stubborn pathogens, including the ESKAPE bacteria responsible for the most challenging drug resistant and multi-drug resistant hospital infections. It is set to enter the clinic in 2019. Novamycin, another peptide, attacks fungal cells, and may help address the growing burden of infections caused by *Aspergillus*, *Candida* and other moulds and yeasts. Resistance in these pathogens to conventional anti-fungals is escalating. Novamycin's rapid, highly-targeted action leaves little scope for resistance.

NovaBiotics has raised over £20 million in private investment.

## Summit Therapeutics

University of Oxford spin-out Summit Therapeutics is developing a pipeline of new mechanism antibiotics to counter the serious healthcare threat from bacterial infections. Summit is currently advancing novel antibiotics against infections caused by *Clostridium difficile* bacteria, and gonorrhoea.

*Clostridium difficile* infections (CDI), which affect the colon, are often stubborn and recurrent, presenting an increasing burden on patients and healthcare systems worldwide. Summit's lead candidate, ridinilazole, has been shown in clinical trials to attack pathogenic *C. difficile* strains in a highly selective fashion, sparing the many helpful gut bacteria that keep us healthy. Most antibiotics currently used for CDI are 'broad spectrum', designed to hit a wide range of bugs. The problem is that



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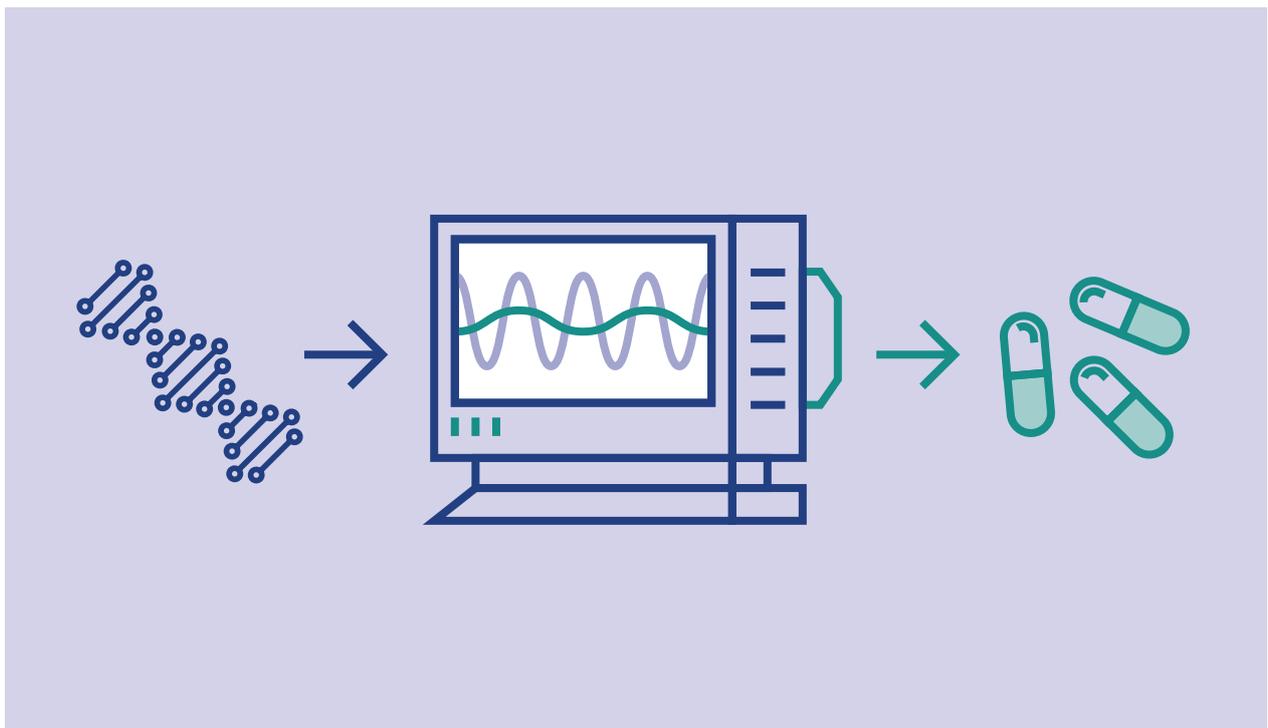
by wiping out the good bacteria as well, these drugs make us more vulnerable to further infections. “Our strategy [with ridinilazole] is to reduce collateral damage to other gut bacteria, by building a targeted antibiotic”, sums up David Powell, SVP research. “A good gut microbiome is all about diversity.”

Reflecting the significant global need for new *C. difficile* antibiotics, ridinilazole’s discovery and early development attracted funding from the UK’s Wellcome Trust, while the US Biomedical Advanced Research and Development Authority (BARDA), set up to counter infectious diseases and other threats to population health, is supporting later-stage trials. Ridinilazole is due to enter Phase III trials in early 2019 and has Qualified Infectious Disease Product (QIDP) status in the US, opening up a faster route to approval.

Ridinilazole’s precise mechanism of action isn’t fully understood. Yet it’s clear that the drug works differently from other antibiotics and is highly targeted.

Summit is going after precisely these characteristics – novelty and precision – in the rest of its pipeline. The company’s Discuva Platform combines high-density mutagenesis – creating lots and lots of DNA mutations in bacteria – with next generation sequencing capabilities and bioinformatics to identify new drug targets and to design compounds that are less likely to induce bacterial resistance.

The Discuva approach involves inserting lots of promoter sequences – genetic ‘on’ switches – into the bacterial genome and looking at the consequences of those insertions. The process exploits a natural genetic quirk whereby sections of DNA (called transposons) jump, apparently randomly, from one part of the genome to another. Genomic insertion of the transposon and promoter has a number of potential effects on an individual gene. It may inactivate the gene completely, it may increase its transcription, or it may inhibit it.





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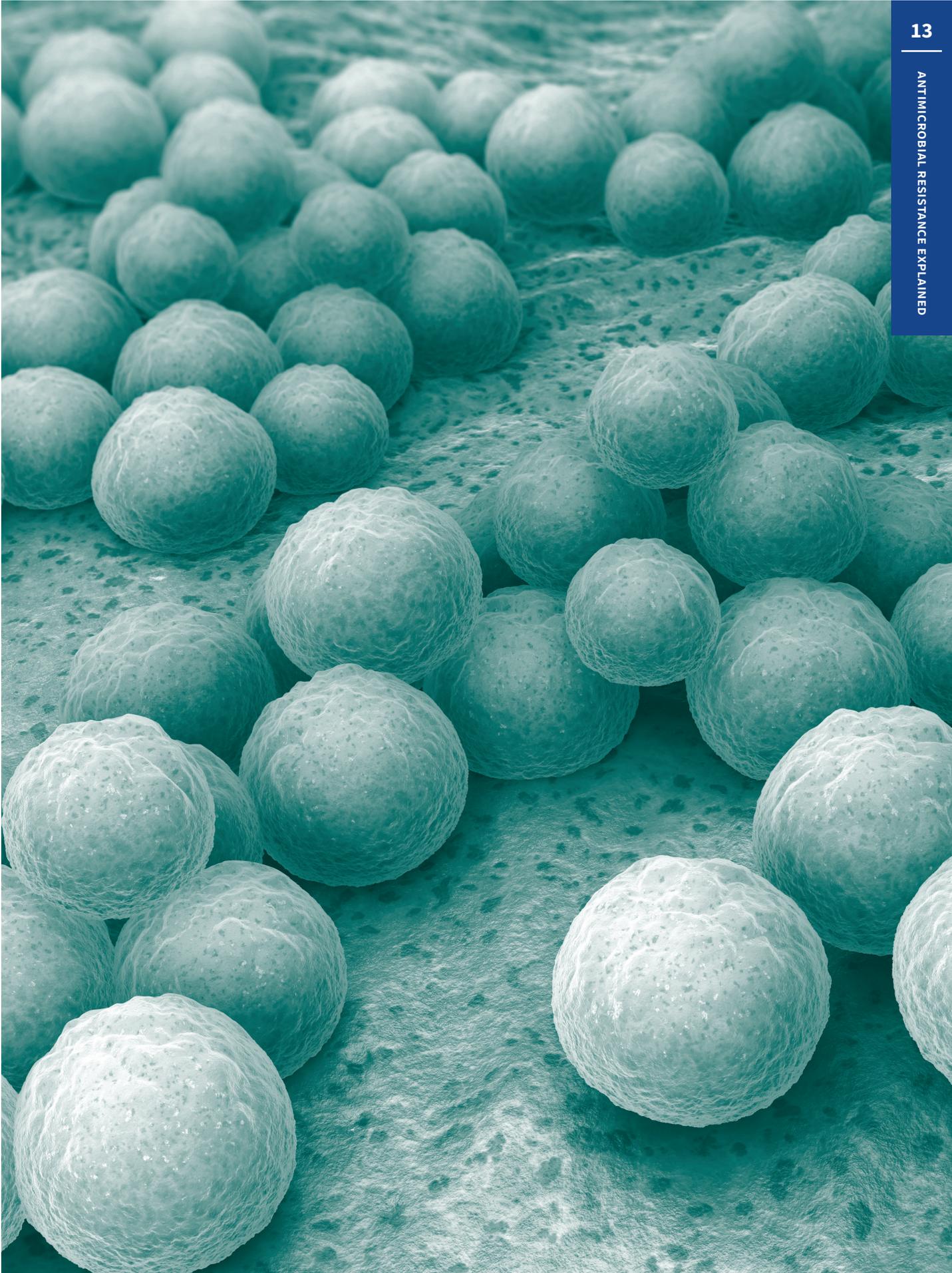
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Summit scientists can assess the selective consequences of these insertion events by the way the individual bacteria respond to potential new antibiotics. This allows them to determine which genes are essential to bacterial survival, for instance, or which genetic and molecular pathways are involved in resistance mechanisms. That knowledge enables the design of better antibiotic candidates.

The Discuva Platform has generated a very targeted compound that kills the bug responsible for gonorrhoea, a sexually-transmitted infection designated ‘urgent’ by the US Centers of Disease Control and Prevention, due to high levels of resistance to existing medication. Thanks to Discuva, *“we understand how the bacteria respond to this [new] compound’s presence, and the levels of resistance are extremely low,”* says Powell. That candidate is on the cusp of clinical trials and recently attracted research funding from the CARB-X consortium. The platform has also generated a second series of compounds with another novel mechanism of action, and is being used to research other bacterial targets as Summit looks to expand its pipeline.

Summit is listed on London’s AIM Market and on the US NASDAQ, and has offices in Oxford, Cambridge, UK and Cambridge, MA.





## What next?

As the previous case studies have demonstrated, UK bioscience is generating highly innovative approaches to address antimicrobial resistance, supported by a strong network of academic and publicly-funded research. But the UK has more work to do to retain its leadership in the global effort to combat AMR. In particular, the UK has fallen behind the pace in introducing market-driven incentives to stimulate anti-microbial drug development. Such ‘pull’ incentives help ensure that new drugs fighting resistant pathogens are profitable, thereby encouraging companies to invest in R&D.



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The problem with many antimicrobial drugs – and the reason many firms have exited the field – is that their use is likely to be restricted to only the most urgent or severe cases, precisely to avoid the emergence of further resistance. This makes recruiting and running clinical trials tricky and shrinks the market. Better-adapted regulatory pathways, and new kinds of commercial reward structures, other than sales volume or market size, are therefore required to encourage greater interest and investment in antimicrobial drug R&D.

Other countries have moved faster than the UK to create a more attractive environment for developers of new antimicrobial drugs. In the United States, the Generating Antibiotic Incentives Now (GAIN) Act, passed in 2012, offers accelerated approval and bonus market exclusivity to drug candidates tackling certain resistant pathogens – those with ‘qualified infectious disease products’ (QIDP) status. In June

2018, a bipartisan bill, REVAMP, proposed awarding an additional 12 months of market exclusivity to drugs designated as priority antimicrobials – with the added carrot that the exclusivity is transferable to other products. The US regulator, the Food and Drug Administration, continues to discuss with the European Medicines Agency and Japan’s Pharmaceuticals and Medical Devices Agency how to address the particular challenges associated with anti-microbial drug development.

Notwithstanding its growing range of funding sources for antimicrobial R&D (“push” incentives), we have yet to see the UK follow through on the proposed “pull” incentives in Lord O’Neill’s 2016 AMR review. The report suggested a one-off market-entry reward payment for developers when their product is approved, thereby de-coupling profitability from sales volumes and offering companies the certainty of commercial pay-back if they successfully make a product that serves an unmet need. The size of the reward would be linked to the degree of unmet need, but also to other aspects of a product’s value to society, such as toxicity and efficacy. Developers would in exchange commit to providing appropriate supply of, and access to, the drug globally. Other new pricing models were also put forward for narrow-spectrum antibiotics used in very specific patient populations.

These proposals require time and commitment in order to become reality. Details must be thrashed out. Changes to the methods used to assess drugs’ cost-effectiveness may be required for certain antimicrobials, to better reflect the important societal gain offered by new treatment alternatives for highly-resistant pathogens.

The effort will be worth it, though. Market-based solutions can work extraordinarily well to stimulate research in given areas – witness the transformation in treatment of HIV and rare diseases, for instance. Funding and other “push” measures remain vital to continue to build this still nascent field in the UK, particularly in support of therapeutic development. But a properly-functioning market still offers the

best opportunity to create a sustainably vibrant AMR industry.

There have been some encouraging steps. The UK-based industry is in discussions with the National Institute of Health & Care Excellence (NICE) and academics about a more appropriate health economic framework for drugs that address resistant pathogens. Industry has also been working with the UK government on a new economic model which would de-link volume from sales and ensure access to new antibiotics whilst rewarding innovation. Yet our bioscience community needs to see more, faster progress towards a sensible, proportionate reimbursement system for AMR drugs in the UK and elsewhere.

The UK has already played a major part in ensuring that the global AMR challenge is top-of-mind. It continues

to work with multiple stakeholders, including national governments, international consortia, academic institutions and industry networks such as BEAM (Biotech companies in Europe combating AntiMicrobial Resistance), the US's Biotechnology Innovation Organization (BIO), the IFPMA (International Federation of Pharmaceutical Manufacturers and Associations) and through the Innovative Medicines Initiative backed Drive-AB project to find a global solution.

Global cooperation will always be required to tackle this international challenge. The UK has played a pivotal role on this agenda to date. However, progressing UK efforts to build market-driven incentives to stimulate anti-microbial drug development will be crucial to both delivering against the challenges posted by AMR as well as anchoring the success of innovative companies in the UK.





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