

Antibiotics Unearthed

'Antibiotics Unearthed' was a public engagement venture inspired by the [Small World Initiative](#)[™], organised and managed by the Microbiology Society for four very successful years.

Antibiotics Unearthed gave the general public, students and educators throughout the UK and Ireland a unique opportunity to work with scientists as part of a global initiative to discover new antibiotics from soil bacteria.

Most antibiotics in current use have come from soil bacteria. The [Small World Initiative](#)[™], first organised by Yale University, continues to be an innovative and authentic research project, which uses crowdsourcing to discover new antibiotics from soil bacteria. The Society took the project further by including school pupils and the general public.

During the project, undergraduate and school students analysed their samples for antibacterial compounds and investigated any potential compounds found. By taking part in real research, they experienced what it would be like to follow a scientific career and hopefully think about a future career in science.

A series of 'pop-up' events also took place across the UK and Ireland, giving members of the public an opportunity to submit their soil samples, make observations, speak to scientists and track online through the analysis process after the event.

1. Antibiotics and Antibiotic Resistance

Antibiotics are important medicines for treating bacterial infections in both humans and animals. Unfortunately, many of the bacteria which cause these infections are becoming resistant to existing antibiotics. The more we use antibiotics, the more bacteria become resistant.

With antibiotic resistance on the rise, increasing numbers of people die every year of infections caused by bacteria that have become resistant to the antibiotics previously used to treat them. It is estimated that, by 2050, the global cumulative cost of antibiotic resistance will reach 100 trillion US Dollars (USD).

In the 1950s and 1960s new antimicrobial compounds were being isolated all the time. The rate of drug discovery has slowed markedly. This lack of effective new antibiotics means that drugs previously set aside as 'reserve' antibiotics, meant to be used only when no other treatment is available, are being used more and more regularly - and resistance is developing to them, too. Some of these reserve antibiotics are also more toxic or have more severe side effects than more standard antibiotic treatments.

1.1 Discovering New Antibiotics

Antibiotics Unearthed enabled the public and school, university and college students to join the hunt for new antibiotics in soil. They took soil samples and were involved in the analysis of them to see if they contained antibiotic producing bacteria.

1.2 Why Soil?

Soil is an abundant habitat for microbes: it has been estimated that there are 260 billion billion billion prokaryote cells in the soil across the globe. Research on bacteria indicates that one gram of soil contains tens of thousands of species.

Soil also represents a well-validated habitat for identifying a wide range of micro-organisms that produce bioactive metabolites (secondary metabolites) including antibiotics. For example, Actinobacteria already produce 60% of clinically important antibiotics.

1.3 Raising Awareness

Antibiotics Unearthed also helped to raise awareness of antibiotic resistance. Through its Citizen Science events, members of the public were able to visit a Microbiology Society stand to submit their sample and learn about different aspects of antibiotic resistance.

1.4 Inspiring the next generation of scientists

School, university and college students involved in the project had the opportunity to design and carry out their own research project to hunt for new antibiotics in soil. By taking part in real research, students experienced what it is like to follow a scientific career.

2. Citizen Science Project

As part of Antibiotics Unearthed, our aim was to engage with people about the global issue of antimicrobial resistance through a practical soil-based activity, to address some of the challenges associated with the discovery of novel antibiotics.

2.1 Public

A series of 'pop-up' events took place across the UK and Ireland. At each event, there were a variety of hands-on activities for visitors to engage with the issue of antimicrobial resistance and drug discovery. Members of the public were encouraged to collect a soil sample during their visit and then prepare it for scientific analysis at the interactive stand. Participants were able to track their sample and subsequent analysis online.

2.2 Schools/Colleges

Throughout the UK, 17 schools/colleges were partnered with a university, research institute, hospital laboratory or similar. Selected students sampled a soil of their

choice before taking part in a series of laboratory sessions where they looked for new antibacterial compounds, experiencing real research.

At **Newton Abbot College**, teacher Alicia Widerman (MSc, BEd) said of the experience:

“As a result of my past academic endeavours in the fields of both cell biology research and science education, I am always looking for opportunities to engage my students in authentic inquiry-based scientific research opportunities. The Microbiology Society’s Antibiotics Unearthed project (AUP) has provided Newton Abbot College A-Level Biology students a unique and rare opportunity to do just that, alongside researchers at the University of Exeter.

This project enabled students to engage in inquiry-based learning, using state-of-the-art molecular biology research techniques, in an attempt to discover novel antibiotic-producing soil bacteria to combat the worldwide issue of antibiotic resistance. Integrating the AUP within the context of an A-Level Biology class proved to be pedagogically beneficial on numerous levels, such as complementing and challenging the students’ understanding of their curriculum content, strengthening scientific literacy skills and encouraging authentic inquiry-based science. The teacher in me was inspired by the educational value of the project and the impact it had on the students.”

2.3 Universities

Throughout the UK and Ireland, 18 universities also joined our venture into the world of drug discovery. Through undergraduate programmes, the aim was to encourage enthusiasm for the subject and engage staff and students. The programme was designed to be flexible and allowed each institution to develop investigations to suit their own skills and requirements. Each institution received full training, protocols and was given the opportunity to present results at our Annual Conference. Dr Alwyn Edwards at Aberystwyth University has since implemented an antibiotic resistance element into his undergraduate teaching programme.

1.1.1.1.1 School/university partnerships

St Mary’s Malne and University of Bristol	Sir Roger Manwood’s School and University of Kent	Barton Court Grammar School and University of Kent
The Haberdashers’ Aske’s Boys’ School and Middlesex University	Dundee & Angus College/Baldragon Academy and the University of Dundee	Edward Jenner School

UTC Oxfordshire and Oxford Brookes University	St Francis College and University of Hertfordshire	Kent College and University of Kent
Cokethorpe School and University of Oxford	Sir Jonathan North Community College and Loughborough University	Parrs Wood High School and Manchester Metropolitan University
Liverpool Life Sciences UTC and University of Sheffield	Boroughbridge High School/New College Pontefract and University of York	Newton Abbot College and University of Exeter
Gresham's School and University of East Anglia	Sir Isaac Newton Sixth Form College and University of East Anglia	

1.1.1.1.2 Participating universities

University of Edinburgh	University of Westminster	University of Leeds
University of the West of England	Edinburgh Napier University	Cork Institute of Technology
University of Glasgow	Northampton University	Aberystwyth University
Nottingham Trent University	Royal Veterinary College	University of South Wales
University of Warwick	University of Birmingham	Bath Spa University
University of York	Blackpool and Dylde College	University College Cork

3. How we continue to learn and unearth antibiotics

3.1 Match-funded PhD studentship

As part of our work with Antibiotics Unearthed and leaving a legacy, the Society collaborated on a cross-disciplinary match-funded PhD studentship with the University of East Anglia (UEA). We worked closely with Professor Laura Bowater, Professor Elena Nardi and Dr Gary Rowley who drew on their expertise in searching for new antibiotics in soil, public engagement in science and educational theory in this multi-disciplinary project.

Images: PaaschPhotography/Thinkstock.