BRI Journal

A fascinating dive into the research carried out by students in the Baltic Research Institute at Liverpool Life Sciences UTC and the Studio School located in Liverpool's Baltic Triangle

In this edition, read about biomimicry and a project which used birds as an inspiration for redesigning aircraft. We also introduce an exciting new BRI project to raise awarensess of antimicrobial resistance (AMR) amongst young people.

BRI Baltic Research Institute

Liverpool Life Sciences UTC

THE STUDIO

Northern Schools Trust

4th April 2025 Volume 3 **Issue No.2**

In this issue

Meet the editorial team...

Foreword from the editorial team

This is the spring edition of the Baltic Research Journal. The release of this journal was fueled by the exciting few months we've had at the BRI including presenting at the BioInfect conference and beginning our antimicrobial resistance research project. As always, there will be features of original research within the BRI but we also wanted to highlight outreach activities we have taken part in so far this year.

The variety of AMR focussed articles include original student research aiming to combat AMR, our visit to the BioInfect conference and research around the lack of knowledge about AMR. Within the BRI, we are all passionate about this issue and see it as something we need to tackle before it's too late. We hope you enjoy this issue and we look forward to hearing any feedback. Thanks for taking the time to read our articles.

Original Research Article

Researcher - Khaled Al Saqaf
Editor - Dominion Ekhator Ogie

Biomimicry: using birds as an inspiration for aircraft design.

Biomimicry is a growing field that seeks to interpolate natural biological mechanisms and structures into a wide range of applications.

Khaled investigated how to make an environmentally friendly aircraft attempting to make it as aerodynamic and as light as possible. He also wanted to consider how the aircraft would perform in a range of different conditions including varying wind speeds and directions.

Prototype Designs

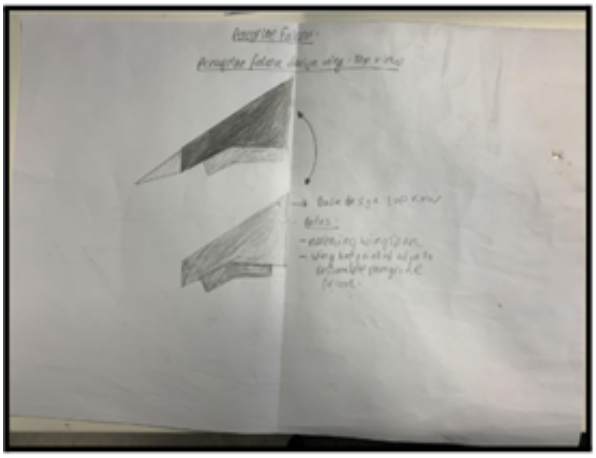
His decision was to modify a basic wing model by using the wong profiles of an Albatross and the peregrine falcon for his different prototypes. The Peregrine Falcon is adapted for speed and is the fatest animal ever diving at speeds of pver 200mph. The albatross is adapted to fly efficiently over huge distances.

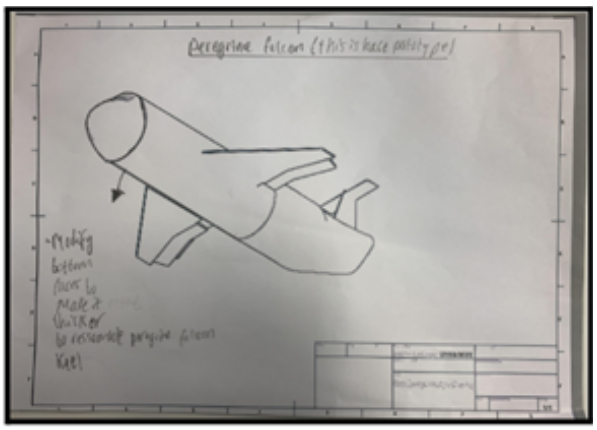
Peregrine Falcon

Royal Albatross

Khaled's EPQ explores the development of planes where mankind has taken the inspirations from nature, for example the Albatross. One of the first examples of biomimicry was the creation of a glider, by Otto Littinthal, who spent a lot of time observing birds before designing his gliders.

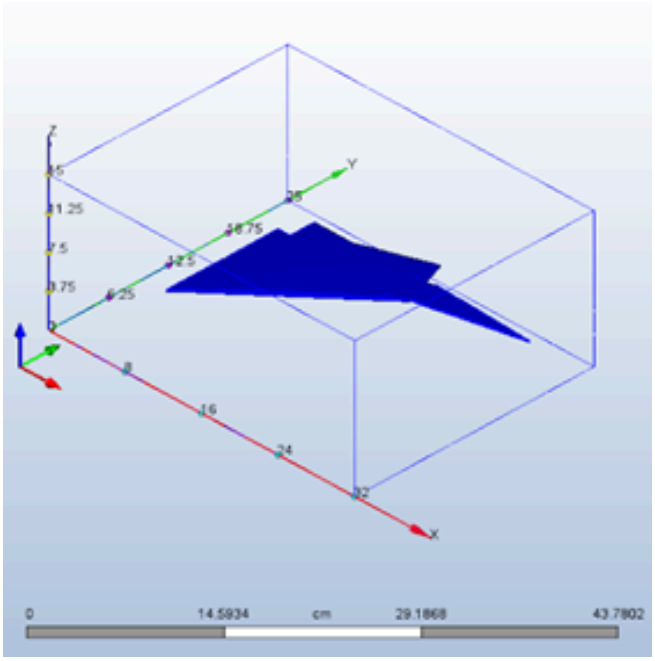
Khaled designed a basic wing prototype and modified it to imitate a bird's characteristics using CAD (computer aided design) and CFD to analyse the aerodynamics and adjust the design according to the bird's characteristics to show improvement in flight of the plane.





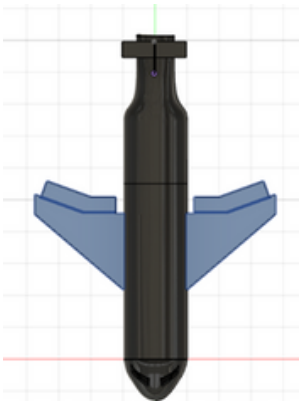
Early Sketches of the modified base prototype for the peregrine falcon and the albatross

Khaled initially created his 3D designs using Autodesk Fusion CAD software. He then decided to analyse his designs using computational fluid dynamics (CFD) within the software package. CFD can be thought of as like a virtual wind tunnel which can give useful information about how aerodynamics of each of the wing desings. There are many benefits to using CFD rather than testing a design in a wind tunnel. The most obvious is that you can test multiple prototype models without wasting resources manufacturing them. It also helps to modify errors more quickly whereas manufacturing the models is more expensive and can lead to many random human errors, leading to multiple wastes and inefficiencies. As an engineer he knew that reducing cost and waste was necessary for his project, so he decided to apply lean manufacturing principles to maximize productivity and minimize waste.



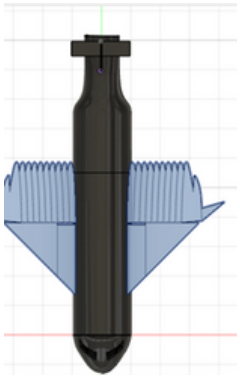
Comparing Each Wing Design

Below are prototype aircraft with their specific wing design. Khaled was able to determine the masses of the plane by using the properties feature in Fusion 360 which allows him to see what the physical properties of this design are.



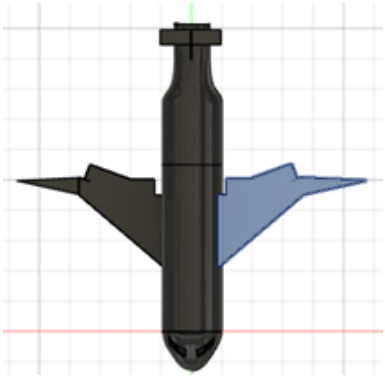
Base Wing Design

The base wing design that Khaled adapted based upon bird wings.



Peregrine Falcon

This is the wing design inspired by a peregrine falcon wings.



Albatross

This is the wing design inspired by a royal albatross' wings.

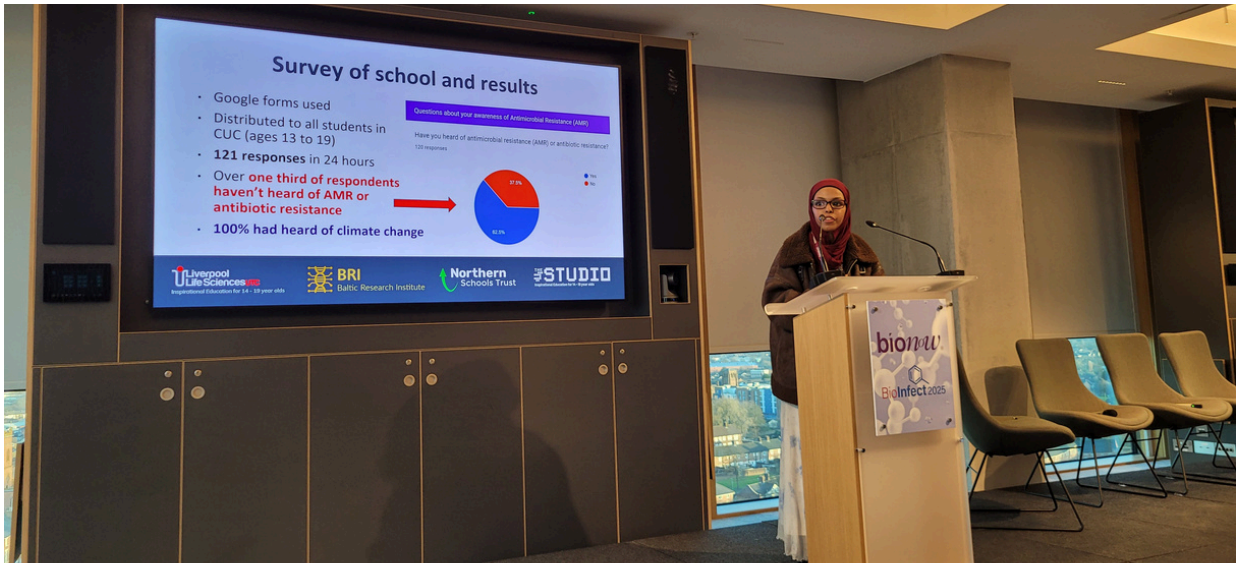
Conclusions

Khaled demonstrated that a wing design inspired by the albatross led to the greatest reduction in aircraft mass with an 11% decrease in total mass. This design also performed best in the CFD analysis demonstrating that it was also the most aerodynamic wing design.

Original Research Article

Researched and Reported by
Fatima Mohamed

Awareness of antimicrobial resistance (AMR) amongst young people



INTRODUCTION

What is antimicrobial resistance?

Antimicrobial resistance occurs when pathogens, e.g. bacteria, viruses e.t.c no longer respond to Antimicrobial medicine,(1). This causes antimicrobials such as antibiotics to no longer work and infections are harder to control.

The Scale of the Problem

Over 1 million lives lost each year between 1990 and 2021, suggesting an estimated 39 million deaths from antibiotic infections between 2021 and 2050. There were 1.06 million deaths directly due to AMR which increased in 2021 to 1.14 million deaths, (2), Costing the country £180 million annually,(3).

Causes of AMR

AMR is a natural phenomenon of genetic changes in a pathogen but can be accelerated by misuse of antibiotics e.g. agriculture, over the counter antibiotics e.t.c

Comparing awareness of AMR to Climate Change

Public global awareness of antimicrobial resistance is so low that it is difficult to quantify how the percentage of people aware of Antimicrobial resistance. With climate change however significant numbers were found. The top 10 countries aware of climate change had a global percentage awareness of above 90%, whilst the ten lowest aware countries, had a percentage awareness percentage of at least above 20%,(4).

METHODOLOGY

Survey Design

We designed an online survey, with google forms, which used a mixed approach of quantitative and qualitative questions. Likert scale, multiple choice and open ended questions were used in the survey.

Ethical considerations

Within the survey we ensured informed consent with full disclosure on what the research contained and how we would use the data collected. Using google forms to allow us to guarantee anonymity. We also considered avoiding leading questions or bias which was especially more important with samples containing young people.

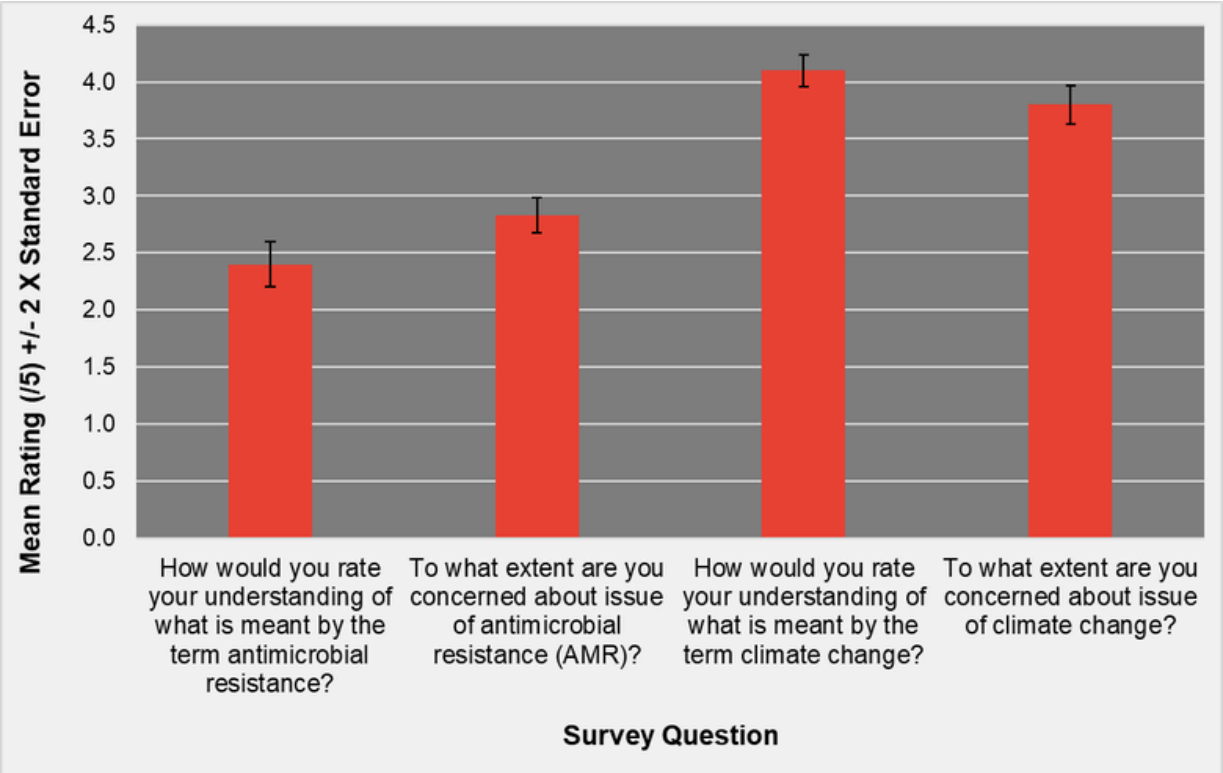


Figure 1. *Mean (+/- 2 x standard error) Self-reported awareness (/5) and concern (/5) about the issues of climate change and AMR. Results based on survey of 166 respondents who are mostly students aged 13-18 at Liverpool Life Sciences UTC and The Studio School Liverpool.*

Sample / Participants

Our sample contained a range of 13-19 year old students from Liverpool Life Sciences UTC and The Studio. Within 24 hours we received 121 responses which increased further to 166 responses before analysis for this .

RESULTS

Awareness of AMR Vs Climate Change

When asked if they had heard about AMR we found only 2/3 of the students had heard of antimicrobial resistance, meanwhile 100% of students had heard of climate change. We asked the students about these two issues and turns out climate change is on everybody's radar. When asked to rate their understanding of what is AMR the average rating was 2.4 but when asked the same question on climate change the rating skyrocketed to 4.2 out of 5, with a difference of 1.8 (see figure 1).

Students were also far more worried about climate change (mean = 3.8) than AMR (mean = 2.8) (see figure 1).

Antibiotic Use and Compliance

Respondents were asked to rate to what extent they agreed or disagreed with several statements about their antibiotic use and compliance with instructions. This used a Likert scale ranging from 5 = strongly agree to 1 = strongly disagree.

Respondents gave a rating to the following statements in the survey:

- "I would always finish a full course of antibiotics"
- "on one or more occasion, i have stopped taking antibiotics early because I felt better"
- "On some occasions I have forgotten to take antibiotics at the time I am supposed to and missed doses"

The results suggest that patient compliance with correct antibiotic use is quite variable amongst young people (see figure 2). Although most respondents claimed they always finish a course of antibitoics, the results suggest

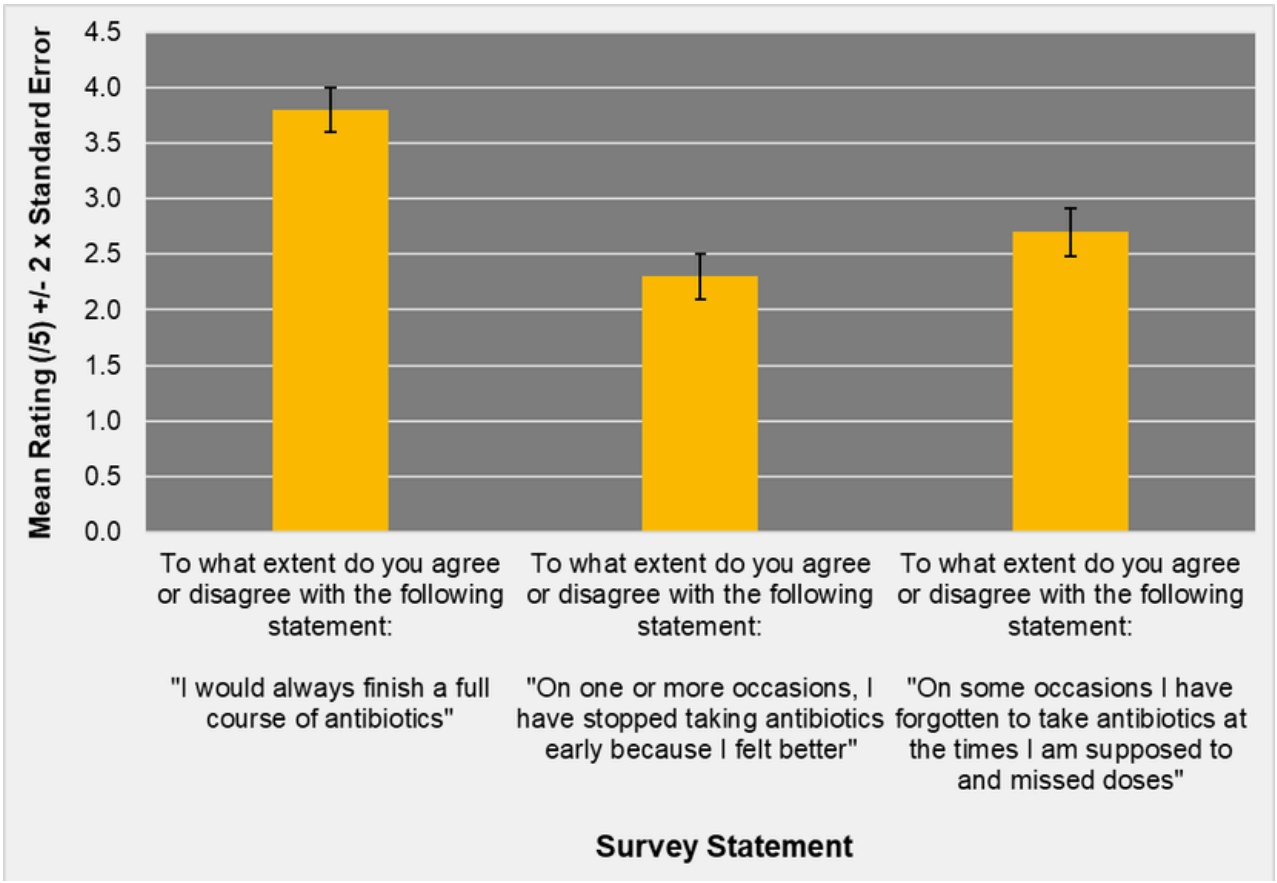


Figure 2. *Mean (+/- 2 x standard error) Self-reported rating (1 = Strongly Disagree, 5 = Strongly Agree) on different aspects of patient compliance with antibiotics. Results based on survey of 166 respondents who are mostly students aged 13-18 at Liverpool Life Sciences UTC and The Studio School Liverpool.*

that many people have finished a course early and/or missed doses.

The survey found that over two thirds of respondents had a course of antibiotics in the last 3 years whilst 40% had at least 2 courses. It's also important to note that some respondents (25) were unable to answer this question as they were unsure.

CONCLUSION

We found a notable disparity in awareness levels between climate change and antimicrobial resistance. This could be due to successful awareness tactics in the climate change campaign and a targeted campaign towards youth groups

Climate change has also received a lot of press attention and there is a clear need to raise awareness of AMR through the media in order to get governments and other organisations to pay more attention to this increasingly urgent issue.

NEXT STEPS

We presented these findings at the Bioinfect conference 2025 which is attended by a range of academics and science businesses and focusses on the theme of AMR. We surveyed delegates at the conference using the same survey used in this research and usurprisingly found much greater awareness and concern about AMR amongst this expert group. In fact, our initial analysis shows greater concern over the issue of AMR than climate change for attendees at the Bioinfect conference. Many of these respondents are working on solutions to AMR and are fully aware of the scale of the threat facing humanity from this important issue.

We plan to increase awareness of AMR amongst young people through desinging campaigns, practical activities and AMR themed industry insight days for schools and colleges. We also plan to repeat our survey regularly to assess the impact of our campaign.

Editor - Ava Knowles

BRI at Bioinfect 2025

At the beginning of February, the BRI had the honour of presenting at the BioNow conference in the Spine Building. The conference's focus was antimicrobial resistance (AMR) and how to tackle it. Our presentation was about how we could raise awareness about AMR by creating a youth movement and ultimately bringing the work of scientists into public consciousness. Throughout the day we also listened to talks from AMR pioneers and gained more knowledge about the issue from different perspectives.

The BRI was invited to the event by Neil Murray who worked with us to create a presentation that would allow the audience to have a fresh perspective on how the youth can help progress communication of the solutions to AMR to a new generation.

Before arriving at the conference we assumed that it would be highly concentrated with scientific research and presentations.

However, we were surprised when in the first talk we heard from Erin Duffy, who was discussing the business and funding aspect of AMR research and prevention. Erin is Chief of Research and Development at CARB-X which is a company that primarily focuses on the treatment and diagnosis of bacterial infection. Her presentation was one of many throughout the day which demonstrated the different specific areas that go into raising the issue of AMR.

After a break, we heard from Charlotte Hemmingway, a social scientist focussing on the impact of AMR on specific communities based in the Liverpool area. She spoke about how there is a lack of education within low income communities and groups who are new to the country. The project she was working on focussed on educating these communities and what the impact would be on incorrect use of antibiotics in the future, again linking to why widespread knowledge of AMR is fundamental to its reduction.

Baltic Roadshow...

Editor, Ava Knowles speaks about AMR on "the message" podcast.

Also presenting at the conference was Lloyd Payne who spoke about (topic, company they work for and what vaguely that company does). This helped to deepen our understanding of the lab based research that is constantly in development across the country and although it may feel like AMR is not an issue that is being given air time, there will always be someone working to tackle it on a small or large scale.

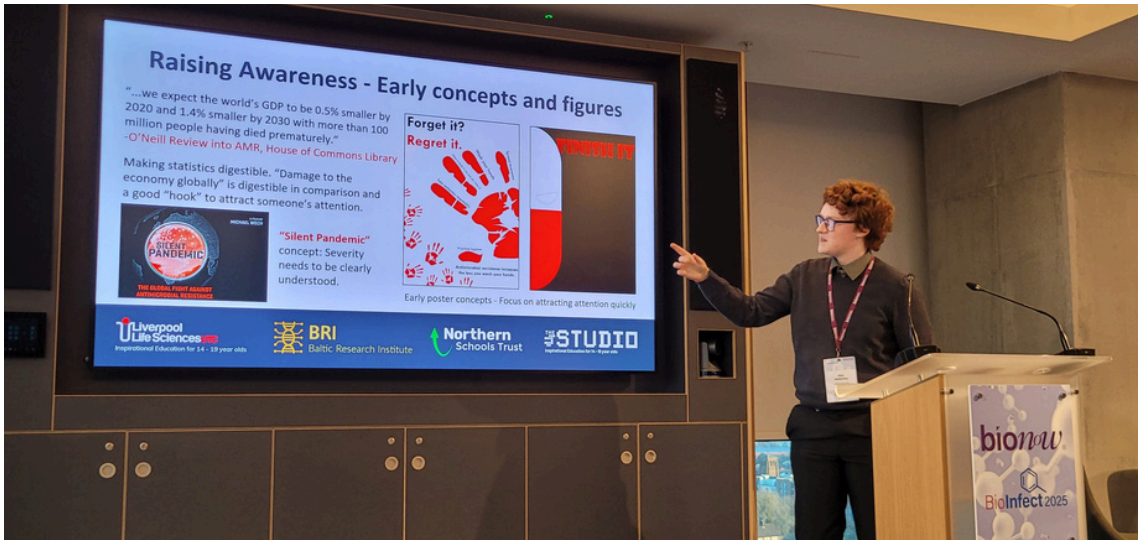
These different perspectives made us realise that collaboration from different groups is key to bringing light to AMR and helping the general public understand how they will be affected by it. By expanding the different types researchers and scientists involved in AMR it automatically makes the issue more solvable. In the BRI we also hope to create a youth movement that educates school age children about AMR so they go into adulthood prepared and able to understand the risks of AMR and knowing what they can do about it.

One main issue that was repeated across the conference was that many big pharma companies don't want to touch AMR. Although there is lots of groundbreaking research happening, the majority of this is going on in smaller firms with minimal funding that will never enable their research to be widespread or their product to be distributed.

An increase in public awareness and therefore public pressure would force these major companies into action rather than lots of research essentially going to waste. This proves ultimately that there are only positives to educating the public on AMR and that education is the first step to igniting widespread action with those who have the most power by holding them accountable, whether that is government or large scale drug companies.

Not only were we given an opportunity to speak to the audience who attended the conference but I was able to record a podcast with Jane Hemmingway (iiCON) and Neil Murray (ReNewVax). I was privileged to be in the company of two of the leaders in AMR development and we spoke about the issues around communication of AMR and why it wasn't cutting through to the public. We concluded that the issue needed to focus more on things that everyone can relate to, for example the global economic impact of AMR which is estimated to be (something trillion here). Another topic we discussed was how to simplify the message so a regular audience was able to not just understand the importance of AMR but know how to help stop the increase of it. Finally we hoped that the young generation would be the leaders in bringing widespread knowledge of AMR but also forcing governments and pharmaceutical companies to act on an existential threat to life as we know it.

BRI Roadshow - Bioinfect 2025



At the end of the day the BRI were given a chance to present to the delegates many of whom we'd already heard from during the day. As a whole our presentation focussed on how we, as the younger generation, are in a unique position to target not just the highly invested scientists but also the general public. I began the presentation by introducing our aims, mainly we wanted to explain to the scientific experts in the audience that clear messaging and making AMR digestible to an ordinary person is key to creating a wider sense of urgency across the broader population. Fatima then took the audience through her research that she conducted within the UTC, demonstrating the stark lack of knowledge the youth have about AMR, even in a science oriented institution. Finn and Suzo explained their research into the specific ways to run a campaign to not just raise awareness about the issue but start to get across how to prevent it. They wanted to get involved in the presentation because they felt that "AMR was an important issue that needs different perspectives" and more generally enjoyed getting the chance to develop public speaking skills and listening to experts talk about a topic they already have interest in.

Finally, we asked the audience of experts to help us develop our plans to run specific sessions targeting students within the UTC and the Northern Schools Trust and we are grateful for the enthusiasm people have shown already wanting to get involved further.

The conference as a whole enabled us to gain contacts we would never previously have had and also develop our understanding of why AMR is such a pressing issue. It has only sparked our interest in the topic more and given us hope to pursue our passion further and hopefully make a difference to the youth view of AMR.

Thank you to Geoff Davison (CEO of Bionow), Neil Murray (CEO of Renewvax) and Geoff Wainwright (COO of Impact Data Metrics) for supporting us with this project.

Editor - Ava Knowles

Editors - Finn Hattersley, Suzo Costley, Rhys Wilcox

Red Hot Chili Peppers, Syrian Spices and Antibiotic Cocktails!

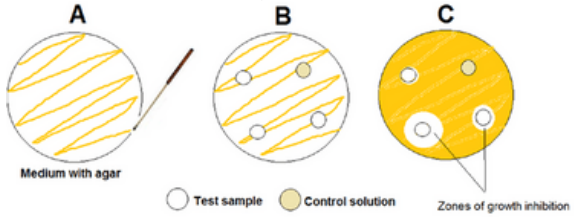
This is not a restaurant review but an article which summarises three pieces of original research in the BRI where students have taken an interest in the issue of AMR and completed extended research projects with the aim of contributing towards combating AMR. We have published these as a trio as they demonstrate the interesting approaches that students in the BRI have used to investigate the potential of natural antimicrobials and combinations of existing antibiotics in the fight against AMR.

Red Hot Antimicrobial Peppers!

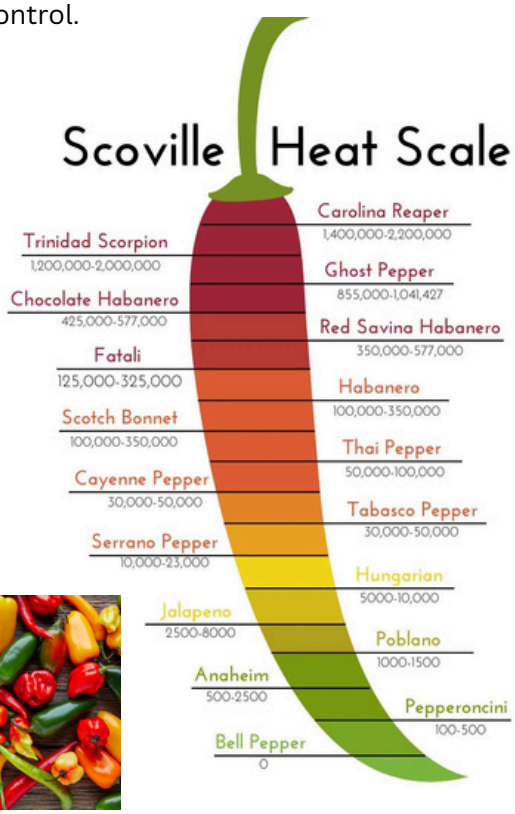
Research by Alan Mehko
Edited by ZuSo Costley

Alan Mehko completed his EPQ with an interest in spicy food and a worry about antimicrobial resistance. He aimed to produce a viable alternative to antibiotics by using natural resources such as peppers to help combat the worldwide issue of antimicrobial resistance.

Alan hypothesised that an increase of a chilli peppers placement on the Scoville scale (the scale used to measure the spiciness of peppers) would lead to an increase in antimicrobial activity from the pepper. To work out whether the spiciness of a peppers was directly correlated to the antimicrobial activity he used the disc diffusion method in which, he spread *E.coli* on an agar plate (using aseptic techniques) and added discs soaked in a homogeneous extract of each pepper as well as positive and negative control discs. He then measured the size of the zones of inhibition from each disc as a measure of their antimicrobial activity.



Alan chose six different peppers to test which represented a good spread of scoville ratings ranging from the bell pepper with a scoville rating of zero through to the carolina reaper which has a scoville rating of over one million and in some cases over two million. He also chose to test water and ethanol as negative controls due to using these as solvents to make his extracts. He used vancomycin mast discs for his positive control.



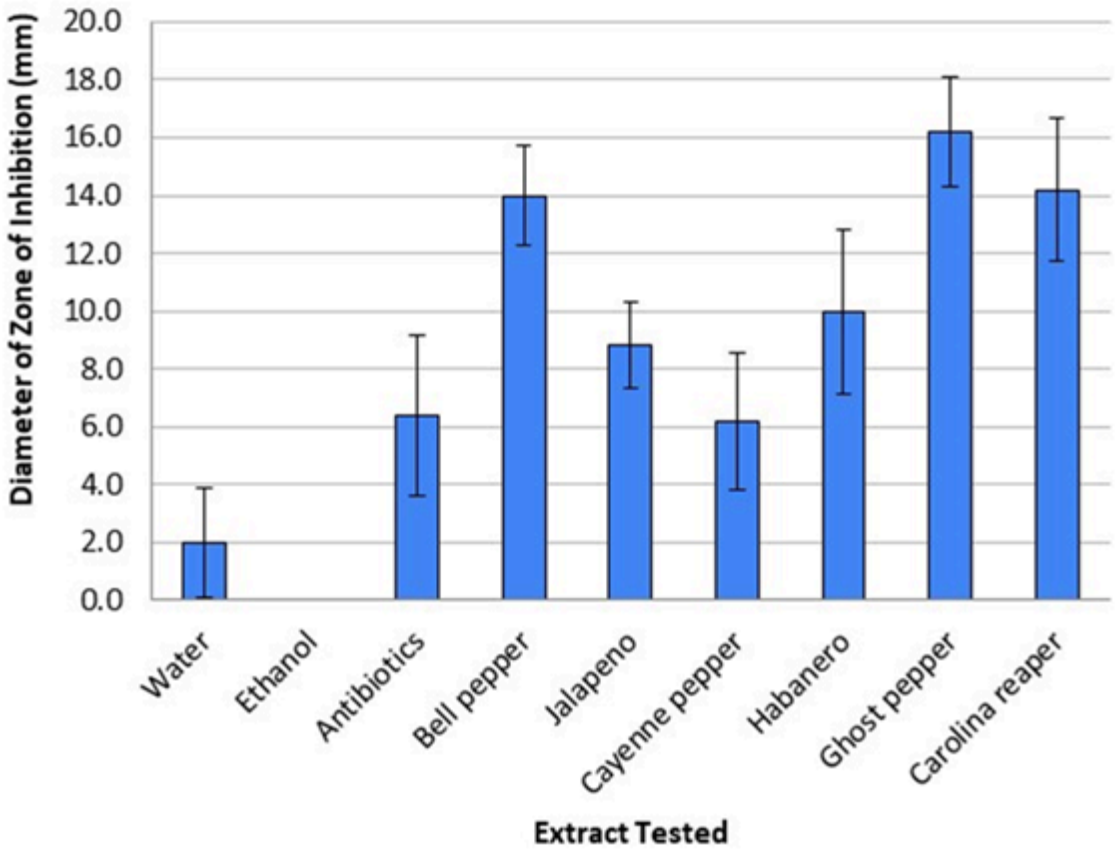


Figure 1. *Antimicrobial effect of a range of chili pepper extracts against E.coli bacteria*

Alan concluded that in most cases the heat rating of a chilli pepper on the Scoville scale did appear to have an impact on the antimicrobial activity of the pepper (see figures 1 & 2). However, there was one exception to this rule which was the Bell Pepper. This had one of the highest levels of antimicrobial activity despite the fact that it has the lowest Scoville rating.

The heat of a chilli pepper as reflected by its Scoville rating is a direct result of the concentration of capsaicin within the pepper. Alan suggested that although the capsaicin concentration may be an important determinant of antimicrobial activity, there are potentially other compounds present that also have an effect. This could explain why the bell pepper with a very low concentration of capsaicin has a high antimicrobial activity. Further research should look at the activity of specific components of peppers against a range of pathogens.

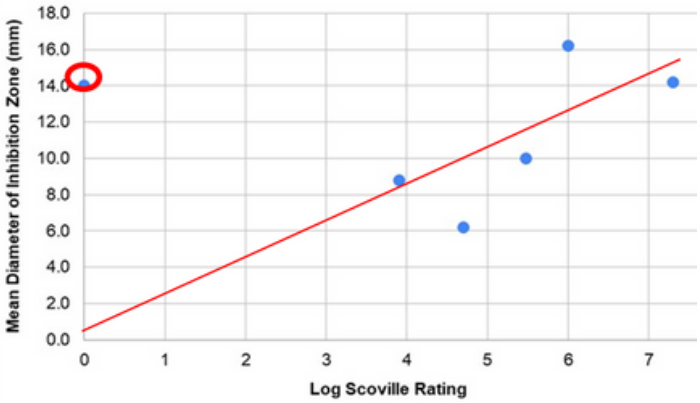


Figure 2. *The correlation between log Scoville rating and antimicrobial activity for the six chilli extracts.*

Alan said that his EPQ has provided him with great experience in lab techniques and aseptic techniques that will greatly benefit him in the world of research as he goes on to become an amazing pharmacologist.

We think this is a red-hot piece of research and a spicy topic for further investigation!

The Antimicrobial Potential of Syrian Cuisine

Research by Aram Baker
Edited by Rhys Wilcox

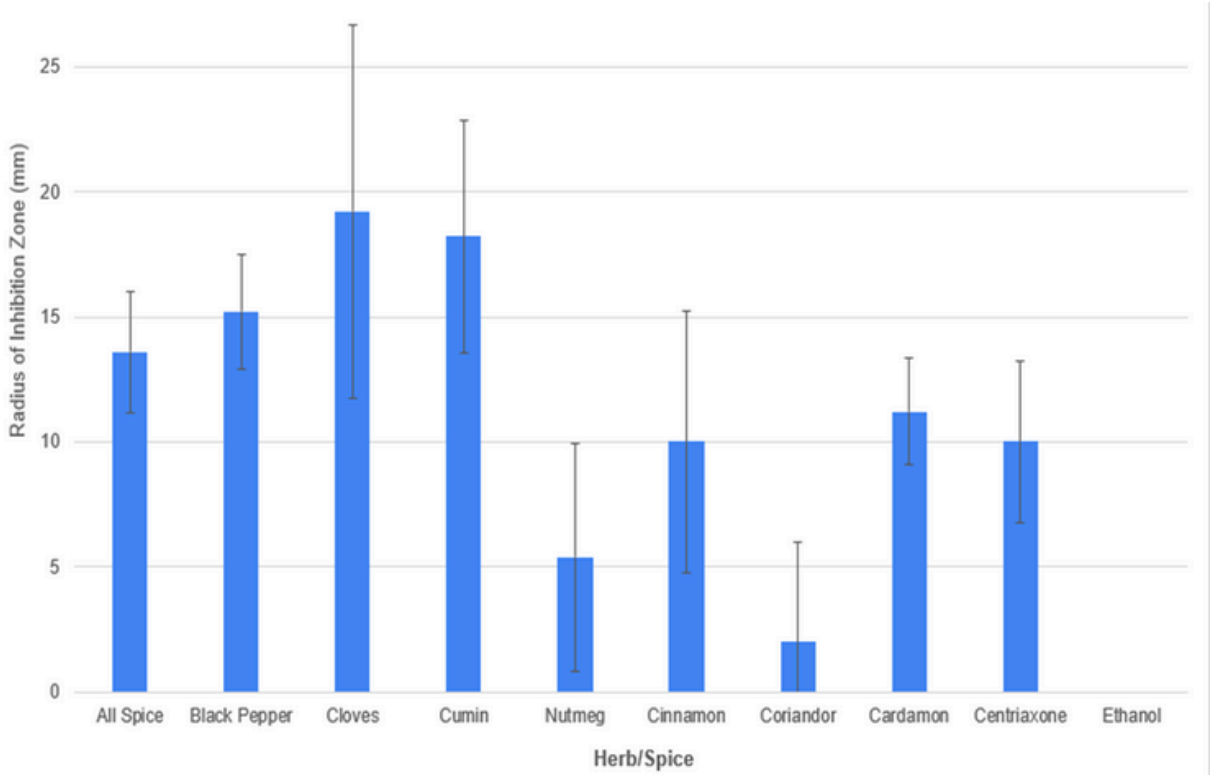
Aram Baker was interested in the antimicrobial properties of Syrian herbs and spices. He completed an EPQ on their potential effects on E.Coli. The inspiration behind the project was a combination of the problem of AMR and an interest in Syrian cuisine. This led him to test a range of commonly used herbs and spices from Syrian cuisine to determine whether they had antimicrobial properties.

Before beginning his experiment, Aram had chosen eight herbs/spices to test, for various reasons: Nutmeg, Cloves, Cinnamon, Black Pepper, Cumin, Allspice and Coriander. His background research suggested that each of these was commonly used in Syrian cuisine and also had research suggesting health benefits including antimicrobial potential.

Aram's experiment consisted of homogenising each of the herbs/spices into a powder using an electrical grinder, each powder would be weighed to 10 grams on an analytical balance to keep precise and accurate measurements, after which 30 ml of 50% ethanol was added to each using a Gilson pipette. With the extract mixed with the ethanol solution, a centrifuge was used to remove any undissolved solids, ensuring all that is left is the solution, otherwise errors would occur.

Aram tested each of the herb and spice extracts using the disc diffusion technique on agar plates lawn spread with E.coli. Each plate also had a negative (50% ethanol) and a positive (Ceftriaxone) control. The plates were incubated at a constant temperature of 26 degrees celsius for 48 hours, after which they were transferred to a refrigerator to halt any further microbial growth.

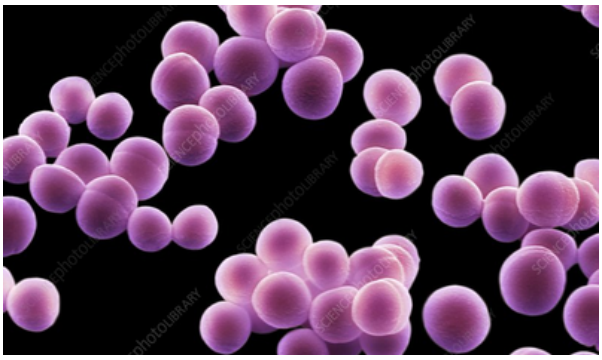
The results of Aram's experiment (figure 1) demonstrate that all of the herbs and spices tested had some level of antimicrobial activity. Cloves and cumin seemed to have the greatest antimicrobial effect. Further research should test these at a range of different concentrations and against a range of bacteria.



Anitibiotic Cocktails! Are Antibiotics in Combination More Effective?

Research by Alex Stravaridou
Edited by Finn Hattersley

Summary
Alexandra Stravaridou was interested in the problem of antimicrobial resistance and decided to conduct her extended research on the potential of using antibiotics in combination, sometimes referred to as antibiotic cocktails. Alex planned and carried out a laboratory investigation where she tested several established antibiotics in isolation and in combination to test the potential of this approach to treating resistant pathogens.

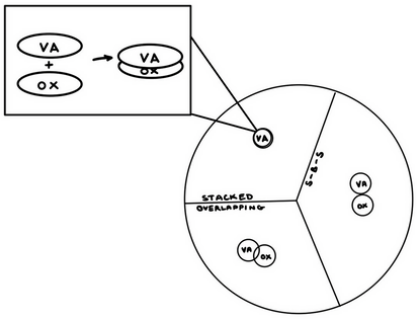


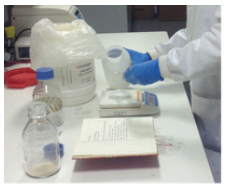
Due to safety considerations Alex was unable to use a resistant or pathogenic strain for her investigation. The experiment was conducted with a non-pathogenic strain of *Staphylococcus epidermidis*, similar to those which inhabit the surface of the skin. The pathogenic strain of this bacterium exploits vulnerabilities such as wounds to cause infection.

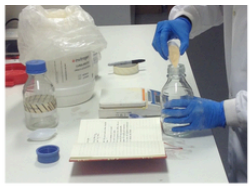
Alex decided to test three different antibiotic, which were Vancomycin, Oxacillin and Linezolid kindly provided by our industry partner Mast Group (independent world class manufacturer and supplier of diagnostic products for clinical, industrial & veterinary testing). Scientists at Mast (including pharmaceuticals studies manager Jon Hobson) supported Alex during her initial research, in planning the investigation and when she presented her findings. This enabled Alex to develop outstanding skills in a range of microbiological techniques, experimental design and analysis of results.

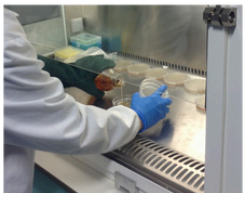
Alex also demonstrated amazing resilience and problem-solving skills during her EPQ, through conducting a preliminary trial, identifying problems with the method, developing her technique to minimise contamination and making several changes for before the main experiment.

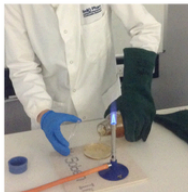
Alex tried several methods for combining the antibiotic discs including side-by-side versus stacking as summarised by the diagram below.

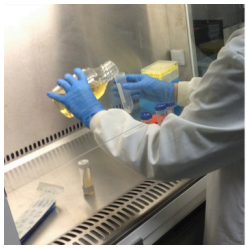


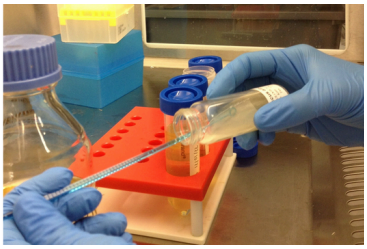


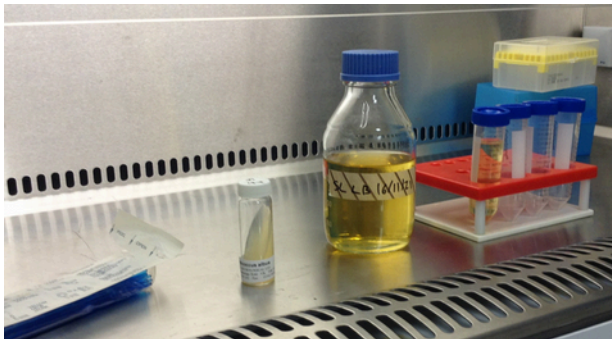












Alex compared the size of inhibition zones for antibiotics in isolation and in different combinations. An example of this can be seen in the photograph of one of her plates (figure 1).

Alex's results showed that Vancomycin was most effective when combined with other antibiotics, in particular Linezolid. This may be because these two antibiotic have a different mode of action with vancomycin inhibiting bacterial cell wall production and linezolid inhibiting the production of bacterial proteins involved in translation at the ribosome.

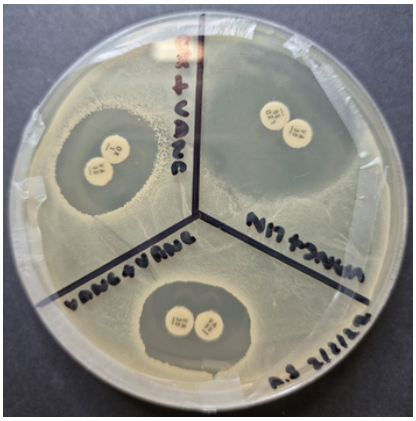


***Figure 1**. One of Alex's plates showing combinations of three antibiotics.*

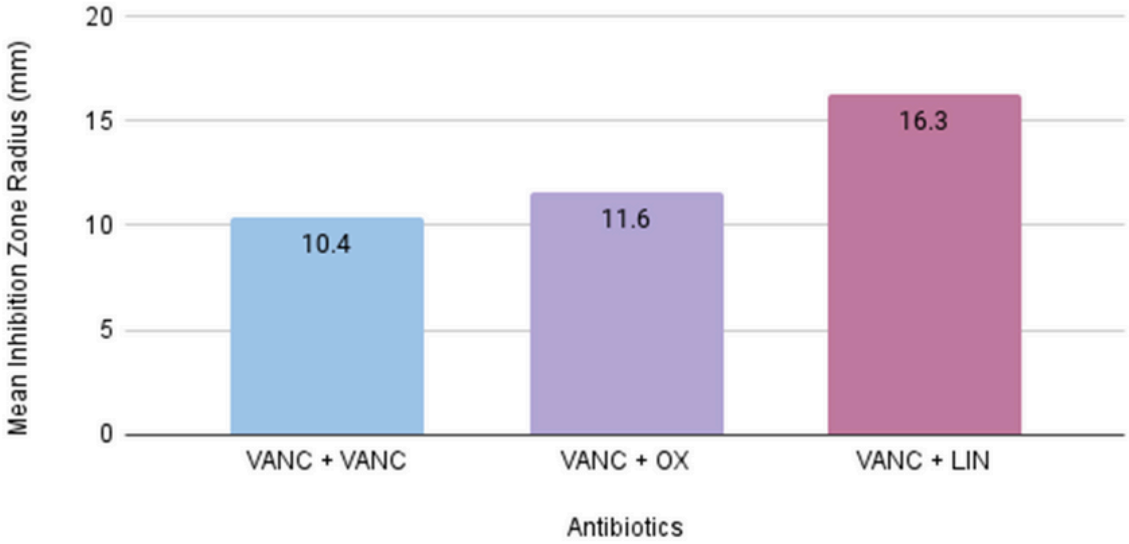


***Figure 2**. Antimicrobial activity of three different combinations of vancomycin, linezolid and oxacillin.*

The level of research conducted by Alex was amazing and she repeated the experiment many times using a wide range of approaches, techniques and combinations.

Despite finding some evidence of benefits to combining antibiotics Alex didn't find any direct evidence of synergistic effects (see figure 3 for example). When two separate antibiotics have different modes of action, there is the potential for a synergistic effect when they are used in combination. This can be observed by a distortion/extension of the inhibition zone around the antibiotic discs when loaded close together on a plate. This would demonstrate great potential to using

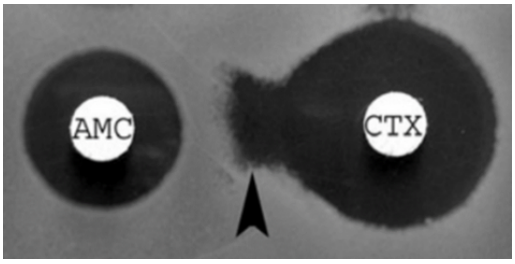


***Figure 3**. Alex didn't find any evidence for synergistic effects as demonstrated above.*

these two antibiotics in combination to combat resistant strains.

Despite not finding this evidence, Alex conducted a fascinating and high-level piece of life sciences research and demonstrated great skill development.

AMR Awareness Activities for British Science Week

Lead Editor - Holly Brennan
with Utieyin Eghagha Enearu
and Thomas Davies

The 10 day British Science Week celebrating all things STEM took place from the 7-16th of March this year and we at the UTC and the Baltic Research Institute felt it was our duty to get involved. The theme this year was “Change and Adapt”; we took this opportunity to educate our students about the dangers of antimicrobial resistance and what they can personally do to change their behaviours in relation to it.

Our initial plans were to focus our tasks on 3 main sections of AMR: hand hygiene, bacterial resistance and antibiotic use. We wanted our priority to be on bacterial resistance and explaining the science behind it as it has been drawn to our attention that people (especially the younger generation) do not know much about AMR, therefore our aim is to educate on this prominent problem. Antibiotic misuse/overuse is a leading factor in the rise in AMR and it is something that we feel can easily be taught to avoid. We planned out 3 tasks to undergo with 2 groups of Year 10 students, however we intend to branch this out to younger years too.

The first task with the students focused on hand hygiene; we represented this using UV glow powder/gel. This was used to highlight the importance of hygiene in relation to bacterial infections. It was also a great opportunity to teach the students areas they tend to miss out when cleaning their hands. Our aim was for the students to understand how easy it is for bacteria to remain on our hands if not properly cleaned. We used the NHS’s own step-by-step guide as a way to teach them the proper hand washing technique.

The methodology consisted of three easy steps: firstly, apply the UV gel, then look at their hands under the UV lights, then wash their hands (following NHS guidelines), and finally checking under the light again to see if they were fully clean.

We assisted the students throughout the entire process, and also gave them UV torches so they were able to personally check themselves and each other's hands. This gave them the opportunity to say whether or not they thought they were washing their hands correctly. Additionally, we also spread the powder across surfaces that would be in high contact such as doors. We then gave them the chance to do a “scavenger hunt” to see how easily bacteria can spread across surfaces.

This task overall went very well, resulting in students completely understanding the correct way to wash your hands. Both of the activities went very well from our perspective as the students appeared to be having fun whilst also learning the importance of the spread of bacteria from ourselves to the surfaces we touch daily. This task was tested on our Year 10 students, but we believe that this task would still be well received by younger years. Overall, the hand hygiene task went as planned, with no problems arising.

The second task focused around the idea of AMR, specifically trying to get the students to understand what it is exactly and an idea of how it works. To do so, we planned an activity modelling bacteria as Orbeez. We represented antibiotic resistance by having 3 different colours of Orbeez representing different levels of resistance within a bacterial population. The students were told that one colour (e.g. pink) was the least resistant strain and were then given the command to squash this colour as if they were antibiotics killing the bacteria. As they were conducting the tasks, we went around each group of students and asked them to elaborate on what they were doing; this was to solidify and test their understanding of what the task was showing them.

We then repeated this for a second time with a slightly more resistant bacteria. After this, there was only one colour left (the most resistant bacteria) so, at this point, we asked the students what they thought would happen if we finished the “antibiotic course” earlier than we needed to. Most students correctly answered that these bacteria would multiply and the new population of bacteria would be highly resistant to the antibiotic. We then gave a final command that they could “finish their antibiotic course”, meaning they would squash all the remaining bacteria to simulate what would happen if they finished the course.

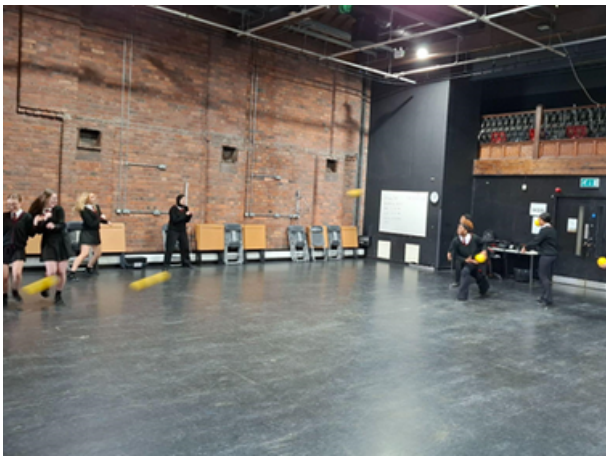
This task went as planned, with all students being able to correctly explain what was happening in each stage. We feel like the use of the task being tactile allowed for greater understanding as the students could clearly both see and feel what the antibiotics were doing.

To adapt the Orbeez task for younger years, the explanations and commands used throughout would need to be simplified. For example, rather than talking about “resistant strains”, this phrasing could be changed to “stronger and weaker types”.

The third task focused on teaching the importance of safe use of antibiotics actively. For this, he students engaged in a game of antibiotics dodgeball which required three groups:
1- Doctors (start with 2-4 depending on group size)
2- Bacteria (remaining students)
3- Super bacteria (1 in every 10 players) had an extra life.

Each round of the game represented different courses of antibiotics. The doctors were tasked with eliminating bacteria by hitting them with the antibiotics (dodgeballs) during the time limit.

Round one was the shortest, highlighting the idea that the first course is not always fully effective as the majority of bacteria survive. Any bacteria eliminated in the first round become doctors for the next round to represent a stronger course. Round two was slightly longer to represent a stronger second course with more doctors. Any bacteria eliminated in this round would again become doctors for the final round. Round three represented the strongest course of antibiotics with the majority of players as doctors. Any bacteria remaining would be the most resistant. In this round, if there are some bacteria remaining, it can be explained to students that super resistant bacteria, such as MRSA, can’t be cured by mainstream antibiotics.



This activity was received positively as students enjoyed getting active. The students were also provided with a worksheet containing an AMR wordsearch and a small quiz to consolidate & apply their knowledge. They were correctly able to identify the importance of completing the whole antibiotics course regardless of the fact that you feel better. They also understood that untreated bacteria become "stronger" and are harder to treat. We finally explained the idea that self-prescribing antibiotics is just as harmful as not finishing the course as it too can contribute to antimicrobial resistance.
After conducting our first set of activities, we have been able to reflect upon them and spot any issues that arose. It overall went very smoothly, however there were a few small issues that will be changed for next time. In the instance of the Orbeez, it was suggested that the different types of bacteria could be more obviously different (for example, using larger balls for stronger strains). The dodgeball task also could've been improved by using visible identifiers for different groups. We also conducted the activity in a smaller room which was unsuitable; a sports hall would've been more fitting.

We also asked students for their response to each task, these were as follows:

"We played a game of dodgeball and we represented the bacteria as we ran away from the balls that represented the antibiotics. As we dodged it showed us how the bacteria can stay even after several doses so it's important to take the amount as advised by a doctor!" - Kathryn E.

"We used Orbeez to represent resistant bacteria. The orbeez were good for sensory issues, with feeling different textures."- Michelle B.

"It [the glow powder] showed how much bacteria there is in the world around us and how easily it is spread on hands and surfaces, which is scary"- Mabel S.

To conclude, our antimicrobial resistance focused science week was a great success with our students and we received lots of good feedback. We intend to continue this project, with extending the activities to both more pupils in our own school and other schools within the trust, especially primary schools. We appreciate that our results of these activities came from a science specialist school, so the outcome may be different in other schools, therefore some ideas may need to be either expanded on or simplified. We are all looking forward to continuing this project and teaching the next generation about issues like AMR.

In the Next Edition...

Following our insightful day at the BioInfect conference, we want to pursue the topic of AMR further so for the next edition we are planning an AMR specific journal.
If you are interested in working with us on this next edition or have any topics suggestions for the future please contact us here

Acknowledgements

In addition to the amazing individuals we have acknowledged in the individual articles in this edition, we would like to thank the following industry-partners for your outstanding support for projects reported on here.

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Happy Easter break from Ava Knowles and all at the Baltic Research Institute

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