

# Building bridges: overcoming barriers to higher education for underrepresented students in the Warwickshire area

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The University of Warwick's Biology Society hosted a 'murder mystery'-themed lab experience day for high school students from underrepresented backgrounds. The day consisted of taster lectures, engaging lab experiments and useful university application advice.

## Introduction

Students from low socio-economic and underrepresented backgrounds face significant challenges in progressing to higher education, particularly in comparison to their more advantaged peers. This discrepancy can be attributed in part to the lack of adequate guidance and preparation they receive prior to university application, along with the absence of familial precedent for attending university. Our aim was to level the playing field, providing these students with the tools and knowledge necessary to pursue a degree in the biosciences at their desired university. By empowering them to make informed decisions about their future and unlocking their potential, we sought to give them a valuable head start in acquiring essential laboratory skills for university-level studies.

The University of Warwick's Biology Society (BioSoc) organized their second annual outreach event, 'BioMystery', to tackle this issue. To fund this initiative, Ranudi Kudellage, the Vice President of Academics, secured a grant from the Biochemical Society following the success of their inaugural outreach event in 2022.

BioSoc's outreach officers, Morgan Barr and Simran Suman, devised an innovative approach: murder mystery-themed laboratory experiments. In this unique setting, students were tasked with unravelling the identity of the 'murderer' through a series of scientific experiments conducted throughout the day. The aim was to promote learning through an interactive and engaging format. The experiments were designed to reinforce the A-level curriculum while allowing students to apply exciting techniques to these topics (Figure 1).



**Figure 1.** The outreach officers prepping reagents prior to the lab experience day.

The students targeted were from underrepresented backgrounds and the schools they attended fit at least some of the following criteria:

- Over 30% of students claiming Free School Meals
- Over 20% of Polar 4 quintile Students
- Over 40% of IMD (Index of Multiple Deprivation) quintile students
- Less than 70% of students reaching expected standards in reading, writing and maths at the end of KS2.

## The event

During the event, students were treated to a taster lecture delivered by Dr Robert Spooner, a distinguished Reader specializing in cell biology at the University of Warwick. The lecture delved into essential concepts such as polymerase chain reaction (PCR), a vital tool in biology, as well as short tandem repeats (STRs) and their significant roles in forensic science. This comprehensive



**Figure 2.** Dr Spooner giving a taster lecture on scientific tools used in forensic science.

introduction provided students with a solid foundation in these analytical techniques before they engaged in hands-on laboratory activities. Moreover, experiencing a genuine university lecture helped demystify the academic environment, particularly for those who would potentially be first-generation college students. Creating a comfortable atmosphere was paramount to ensuring students felt at ease and prepared for the prospect of higher education (Figure 2).

Following the lecture, the students were escorted to the teaching labs where they received instruction on essential laboratory protocols and safety measures. This included guidelines on proper waste disposal and strategies for mitigating potential harm.

Afterwards, students were introduced to the first skill of the day: micropipetting (Figure 3). This technique is akin to a chef's knife in importance, as it significantly influences the quality of experimental data depending on its execution. Given that most students are not typically exposed to micropipetting until their first year of university, mastering this skill at this stage was incredibly valuable.



**Figure 3.** Morgan introducing students to micropipetting.

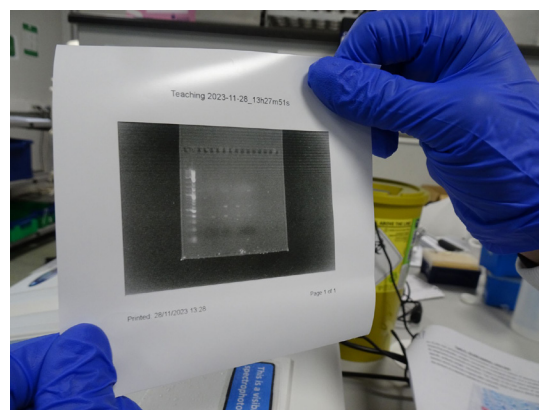
The students were guided through the process of selecting the appropriate pipette, setting the dial correctly and accurately drawing liquid into the pipette. They then compared the uniformity of their droplets with their peers, reinforcing their understanding of the technique and its precision.

Following the micropipetting exercise, students proceeded to prepare suspect samples using PCR amplification. With guidance from demonstrators, they loaded the suspect samples into prepared agarose gel wells, putting their pipetting skills into practice. Once all groups had successfully loaded the samples onto their gels, the gels were set to run.

Students then attended a talk focused on the steps involved in applying to university and received advice on crafting competitive personal statements. It was encouraging to witness some students already actively preparing, with some even having a list of their top five universities. Providing them with this information helped break down barriers and encouraged them to take the initial steps towards applying. Additionally, students had the opportunity to have their burning questions answered, receiving valuable assistance with their higher education applications.

Following the informative session, students took a lunch break where refreshments were provided to alleviate any financial concerns associated with attending, especially amidst the on-going cost of living crisis. Meanwhile, the dedicated BioSoc team worked diligently to visualize and print clear images of the gels so that students could analyse them effectively (Figure 4).

Upon their return, students engaged in discussions with laboratory demonstrators and their peers regarding the quality of their gels. They reflected on their gel electrophoresis results, identifying areas for improvement and discussing what they could have done differently to enhance their outcomes.



**Figure 4.** Visualizing and interpreting gel electrophoresis results showing the DNA bands of suspects.



**Figure 5.** Students learning the technique of using nanodrop to determine concentration.

Following the discussions, Dr Christine Lockey delivered a presentation on the likely toxin responsible for the suspect's death. Utilizing nanodrop analysis, the students were equipped to determine the toxin as ricin. Nanodrop, a valuable tool in biochemical analysis, allows for the precise determination of compound concentrations in samples using only a minuscule droplet (approximately 1  $\mu\text{l}$ ) (Figure 5).

Dr Lockey further elucidated various absorbance measurements for different compounds, emphasizing their significance in forensic science. Subsequently, students proceeded with ELISA (enzyme-linked immunosorbent assay) testing, leveraging the catalytic properties of enzymes to quantify immunological reactions. The results tested positive for two of the culprits if performed correctly.

For the concluding presentation of the day, Dr Lockey provided a comprehensive recap of all the experimental results. Students were then tasked with making an informed guess regarding the culprit based



**Figure 6.** The summarizing presentation revealing the 'murderer' by Dr Christine Lockey.



**Figure 7.** Dr Spooner with a group of students from President Kennedy School.

on their findings. Majority of students were successful – it was Dr Robert Spooner! (Figure 6)

To gather feedback, we utilized QR codes on the day's agenda, prompting both students and their teachers to share their thoughts. The responses were overwhelmingly positive from both schools, recognizing the event for its role in imparting valuable laboratory skills and providing insight into the life of bioscience students.

Mr John Green, a biology teacher from President Kennedy School said, 'I cannot express how grateful I am and amazed by the event today. The mix of practical, lecture and personal statement gems provided an outstanding and useful experience for my students. All staff were helpful, friendly, and professional.'

Dr Robert Spooner added, 'The day was engaging, funny and scientifically accurate. I was asked to give the starter lecture, and I cannot describe how proud I am that I was included in this venture' (Figure 7).

In addition to this, we got some tips to improve for next year, such as simplifying our STRs experiments and conducting a collaborative quiz so students can connect with pupils from the other schools.

At BioSoc, we take great pride in achieving this significant milestone, with an increase of over 30% in attendees compared to our previous outreach event. Building upon our efforts from the previous year, we have successfully imparted valuable laboratory skills to over 120 students from the Warwickshire area.

Furthermore, we were pleased to offer certification for the lab skills acquired by the students, recognizing the importance of such credentials in their pursuits of higher education and early careers. Additionally, we have set our sights on tracking the progress of these students in their applications to higher education institutions, collaborating closely with their teachers. This initiative will allow us to assess the event's impact on their attitudes



**Figure 8.** The BioMystery team, from left to right: Morgan Barr, Sim Suman, Ranudi Kudellage, Dr Robert Spooner and Dr Christine Lockey.

and skills pertaining to tertiary education, enabling us to continually refine and enhance our outreach efforts.

## Next steps

With a substantial cohort of trained volunteers at our disposal, organizing an event of this scale, or even larger, is certainly within reach with adequate funding. The valuable skills and knowledge amassed by our team will be passed on to future outreach teams, along with the invaluable contacts and connections we've cultivated along the journey.

Expanding our outreach efforts beyond Coventry and Leamington Spa to encompass a broader geographical area is our next objective. We aspire to collaborate with initiatives promoting free summer internships in the biosciences for high school students.

Additionally, our on-going 'Topic in a Box' initiative (<https://warwick.ac.uk/fac/sci/sem/scienceinschools/resources/tiab/>), featuring engaging and interactive activities using readily available supermarket items, will continue. Popular activities from the past year, such as DNA extraction from strawberries and exploring the digestive system, will remain staples.

Moreover, our dedicated volunteers will continue to host informative talks on various topics for local school students. These talks cover a wide range of subjects, including urban farming and immuno-cancer therapy, providing valuable insights into emerging areas of interest in the research world (Figure 8). ■

## Acknowledgements

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## Author information



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