

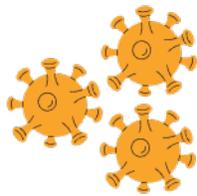
ESCAPE LAB

A JOURNEY INTO DRUG DISCOVERY

An outreach project by Shivkumar Lab

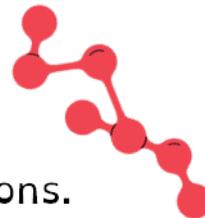
Leicester School of Pharmacy, De Montfort University

Report by Dr Maitreyi Shivkumar



Viruses are bugs that can make us feel unwell.

In our lab, we work on medicines called antiviral compounds to stop infections.



We need your help to find a new antiviral compound to fight the virus!

Introduction

Escape Lab is an interactive outreach activity that aims to illustrate the drug discovery process in an accessible way. Inspired by our lab's antiviral drug discovery research, we designed an escape room-style activity, where participants conduct experiments and solve clues to uncover the structure of our antiviral drug. This final structure is based on our current research on natural product-derived antivirals.

What did we do?

The Biochemical Society Scientific Outreach Grant supported us towards adapting Escape Lab to different audiences across five events between March and June 2025. Among these, two local Leicester primary schools with widening participation criteria were chosen, with the aim to target students who typically would not have access to such science-based activities.

- 1) One Year 5 class (9-10 years, 29 participants) at a local Leicester primary school
- 2) Three Year 5 classes (9-10 years, 89 participants) at a local Leicester primary school
- 3) Five groups of secondary school children (11-16 years, 48 participants) during the De Montfort University (DMU) Teen Tech Festival
- 4) Family Day at the Science Oxford Centre (~3-12 years, 71 participants)
- 5) Post-graduate research (PGR) students based in the DMU Leicester Institute of Pharmaceutical Health and Innovations (LIPHI) (>18 years, 22 participants)

Our main aims were to:

- Engage young people in our scientific research via gamification.
- Introduce students to the process of drug discovery through our interactive activity.
- Inspire young people to pursue careers in science by providing diverse and active researchers as role models, who the students can interact with directly.

What did we achieve?

Details about the activity

The interactive activity consisted of three stages that mimic our drug discovery research, and participants worked in teams to undertake simulated experiments and interpret data (Figure 1, left).

- 1) Screening: Colour-changing reaction to identify hit compounds.
- 2) Checking cytotoxicity: Using cups to represent viruses and cells, balls as compounds, participants aimed to knock off viruses without disturbing cells at the Cytotoxicity Station.
- 3) Chemical modification / compound building: Teams interpreted data to identify the key side-group and construct a 3D model of the final structure.



Figure 1: Images on the left show the different stages of Escape Lab. The set up at different venues is shown on the right. Participants took approximately 30-45 minutes to complete the activity.

Participants were guided by our volunteers throughout, and support was tailored to each group to ensure they were age appropriate. The primary school students worked in groups of 5-6, on tables set up in the school hall, and had a worksheet to work through each stage. The Teen Tech activity for secondary school-aged students and the LIPHI event for PGR students were in mock labs set up like an escape room and used clues (e.g. lab notebook with protocols and data) to solve each stage more independently. At the Science Oxford Centre activity, the room was divided into three tables, each with an activity, to accommodate large number of participants moving at their own pace through the activities (Figure 1, right).

Everyone who completed the activity were given a sticker when the structure was identified, which allowed us to accurately track the number of participants at each event. In the Teen Tech and LIPHI events, times to escape the lab were recorded on a leaderboard to enhance competition, and all teams received a certificate (Figure 2).



Figure 2: Stickers were given to all participants who completed Escape Lab. At the DMU Teen Tech and LIPHI PGR events, teams were also given certificates and completion times recorded on a live leaderboard to give the events a competitive spirit.

The primary school activities started with a brief interactive assembly (~20 minutes) to introduce viruses and how infections can be controlled by antiviral drugs and vaccines. For the Teen Tech and LIPHI events, this was replaced by a 5-minute introduction to antivirals and place Escape Lab in context of our research. At the Science Oxford Centre, in addition to the brief introduction, we also organised a 30-minute lunchtime "Infection Fighters" lecture about antiviral drugs and vaccines (Figure 3). All activities were also ended with a Q&A and feedback session (~1 hour at primary schools and ~10 minutes for the other events). As the final structure is based on an antiviral compound under investigation in the Shivkumar Lab, this allowed us to share our latest results to highlight the link to our research.



Primary school assembly



Primary school assembly



Infection Fighters lecture

Figure 3: The primary school events started with an interactive 20-minute assembly to place the activity in context and introduce viruses and infection control methods. The Science Oxford Centre event introduced these topics in an "Infection Fighters" lunchtime lecture.

Evaluation

Throughout, the curiosity of participants and enthusiasm for the experiments was evident by their excitement at watching the colour changing reaction (screening stage) or knocking off the viruses at the Cytotoxicity Station. The final Q&A sessions were very interactive, leading to some fantastic discussions ranging from the earliest and “best” medicines, the most interesting places viruses can be found, and what it is like to study at university.

Each team was also supported by PhD students or postdoctoral researchers based in the Shivkumar Lab or other groups in the Infectious Diseases Research Group, Leicester School of Pharmacy. These are a diverse group of researchers who have taken different paths in their scientific careers. Throughout, children also took the opportunity to ask them questions about their work, viruses, infection control, what working in a lab is like, and discussed what they would like to do in future – all potential opportunities for our volunteers to act as role models and encourage students to pursue science.

At each event, participatory feedback was collected anonymously by token voting surveys, where participants picked balls of different colours to add to opaque bottles, each colour representing a different option for each question. This was completed in a quiet corner of the room without supervision from our volunteers, to ensure the participants did not feel coerced to respond in any specific ways. A majority of the participants enjoyed the activity, rating it 4* or 5* (Figure 4). 79% or more also reported wanting to learn more about viruses, and for most events, 83% or more said they learnt something new during the event. At the Science Oxford Centre, only 59% reported learning something new, however, this could be a result of random voting, particularly due to the lower age range of the participants.

A post-it note board was also used for free text comments, a selection of which are shown in Figure 5. Again, this was not supervised, so feedback could be left anonymously. Overall, the comments from participants and their guardians were positive, and I feel we were successful in our aims to engage young people in science and our research.

In addition, written pre-session and post-session questionnaires were provided to students at the two primary school events (n=110) to get structured feedback as well as information about the students’ science capital. Analysis of the dataset is ongoing, however, preliminary results indicate that 60% of children felt they understood what scientists do (11% Strongly Agree; 49% Agree), while 49% reported that they did not know any scientists, including any famous scientists they might have heard of. When asked about their future aspirations, only 24% mentioned ‘scientist’ or another STEM-related career. In the post-session evaluation, 95% of children reported that they had a better understanding of what a scientist does (45% Strongly Agree; 49% Agree).

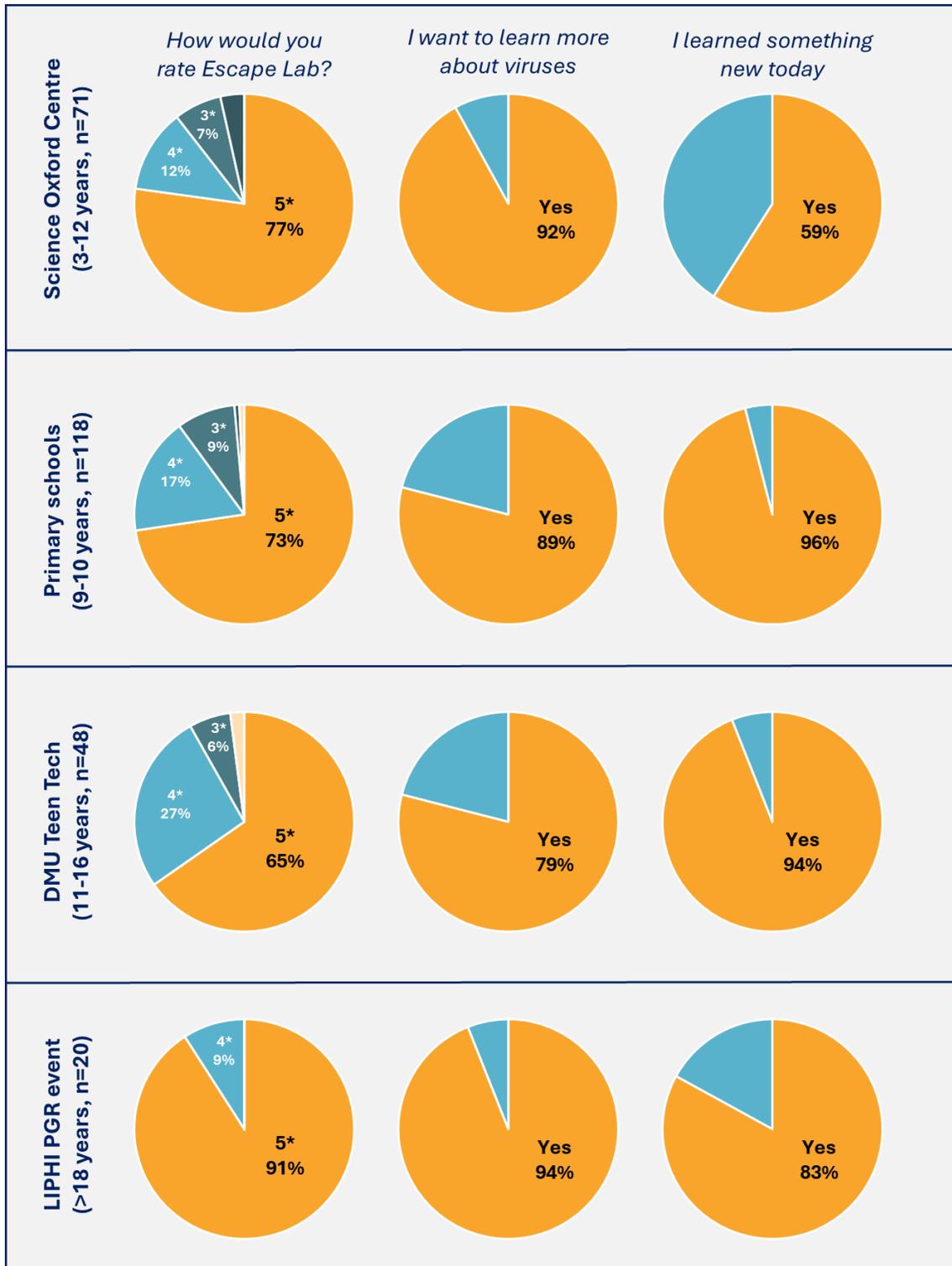


Figure 4: Feedback from token-based surveys; results from the two primary schools are grouped together. After completion, participants were asked to add balls to opaque bottles, where the colour of the balls represented the different options for each of the three questions. For Question 1, yellow represents 5* and the shades of blue represent 4*-1*, as rated by the students; in Questions 2 and 3, yellow represents Yes and blue represents No.



Figure 5: A selection of post-it note comments from three events, all comments were positive. We had a total of 30 comments at the Science Oxford Centre, 6 comments at the DMU Teen Tech event, and 6 comments at the LIPHI PGR event.

In free-text comments at the end of the post-session questionnaire at the primary schools, several students had generally positive feedback, or asked questions which suggested that Escape Lab sparked wider interest in viruses and drug developed. A selection of comments is provided below:

“Really fun would want to do it again and again”

“I liked doing the cells and compounds”

“The puzzle was kind of hard”

“I really liked it especially wearing the lab coat! It made me feel like an actual scientist”

“I really liked working as a scientist and how did bacteria and viruses start from the very beginning”

“The staff are kind. You should visit our school often”

“How could compound medicines, drugs and virus have an effect on our body?”

“What do you need to do to make a cure for disease?”

“What was your first medicine that YOU made? What is the most deadly virus?”

“What else do you get to do in the lab?”

“How do people become scientists?”

Feedback from teachers at the primary school events (n=5) was overwhelmingly positive, a selection of quotes are provided below:

“It was brilliant.”

“Fantastic activity for British Science week. ... Hands on experience of language and equipment. Thank you for a fantastic experience.”

“The children were all engaged and learned quite a bit. The lesson introduced scientific vocabulary and explained different processes.”

“Very engaging and practical. We take the children's career aspirations termly so will be interesting to see if any now want to be scientists and researchers etc”

Bringing outreach to post-graduate research students

One of our aims was to inspire young people by enabling them to interact with diverse and active researchers. As described above, our volunteers were a group of PhD students and postdoctoral researchers based in the Infectious Diseases Research Group at the Leicester School of Pharmacy, DMU. As each group of students had a dedicated volunteer, there were many opportunities for conversations about their own career paths, their research and broader scientific topics.

In addition to inspiring the participants, this provided an avenue for PhD students and postdoctoral researchers to engage with outreach activities, a key part of being a scientist. Making our lab's research accessible to a wide range of audiences, as well as having to simplify their work has developed their scientific communication skills beyond what presenting at conferences alone could achieve. Working on Escape Lab has also given my students the confidence to design their own outreach activities and workshops at other science fairs. Two of my PhD students who were closely involved with me in developing or running the activities spoke positively about their experience:

“Working on Escape Lab has influenced me to become a STEM Ambassador. I also developed my own activity for a school fair, on the antimicrobial activities of oils. The students really enjoyed the hands-on part of the activity, which encouraged lots of questions and made them excited about science. Since then, I’ve been able to mentor my peers in developing their own activities.”

“[Doing outreach] has highlighted the requirement to tailor activities to various age groups and backgrounds, and with [Maitreyi’s] support, I have been able to develop an interactive ‘Battleships’ activity for HLS [Faculty of Health and Life Sciences] staff and students. This experience has also given me the confidence to encourage others to become STEM Ambassadors, and I was invited to give a talk at the HLS PGR conference on our outreach activities.”

Next steps

Overall, Escape Lab was very well received, and we are pleased to have had over 250 individuals participating in the activity. Reflecting on all our events, we found that the activity worked well at the primary schools and Science Oxford Centre – deconstructing Escape Lab into three distinct steps allowed the participants to get a good sense of the stages of drug discovery. The DMU Teen Tech and LIPHI PGR event were set up as competitive escape rooms, with each team spending no more than 30 minutes in the ‘lab’; therefore, these

offered relatively fewer opportunities to talk to the students about our research. Despite this, as the LIPHI PGR event consisted of postgraduate research students and attracted those who were familiar with escape rooms, all participants actively engaged with Escape Lab. However, engagement at the DMU Teen Tech event was widely varied. Some groups participated with much enthusiasm and used the short post-session feedback period to ask questions about our research. However, we noticed that several students were less engaged and participated minimally. Providing a longer pre-session introduction to provide context, and an extended post-activity Q&A session (as we did with the primary schools) may help encourage more active involvement from all students.

We have maintained communication with the primary schools, and along with the DMU Widening Access team, are planning further Escape Lab events for the new cohort of Year 5 students at these and other local primary schools in the 25/26 academic year. In addition, we are planning to run Escape Lab for Year 8 students at a Leicester secondary school, to trial if adapting the activity to a classroom setting will help us engage with secondary school-aged students more effectively. We hope to continue running these events annually with the schools we have established links with, allowing us to assess if Escape Lab has longer-term impacts on students' understanding of viruses, drug discovery, and their interest in scientific careers.

Analysis of the feedback questionnaires is still underway, and we plan to make our findings available to the public via publication in a peer-reviewed journal. The Escape Lab workbooks are available on the Shivkumar Lab website (shivkumarlabor.co.uk/escape-lab), where we will continue to add resources as they become available. A behind-the-scenes video filmed at the LIPHI PGR event by the Microbiology Society is available on YouTube (youtu.be/VZnxlkXLUag)

Acknowledgments

This project was originally designed by Dr Maitreyi Shivkumar and developed in collaboration with Dr Gemma Cooper (PhD student and currently PDRA in Shivkumar Lab). The activity was supported by the DMU Widening Access Team to identify and work with the two local Leicester primary schools and provide support during the DMU Teen Tech event. We were also supported by several volunteers: Brandon Moulds, Katie Silver, Ayesha Siddiqi (PhD students, Leicester School of Pharmacy), Dr Caroline Cayrou (PDRA, Leicester School of Pharmacy), and Karla Juerges, Philippa Manning and Praneal Mistry (DMU Widening Access Team).



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