Microbiology for BGE

At SSERC, we are continuing to build a range of practical resources aimed at CfE Level 3 and 4 experiences and outcomes for Science. In September, we launched our microscopy resource "Our World Through A Lens" [1], supporting practical opportunities to explore the structure and variety of cells - *SCN3-13a* (Figure 1).

In November, "Investigating Micro-organisms" [2] was released and outlines three experimental opportunities to explore *SCN3-13b*, looking at different types of micro-organisms and how their growth can be controlled (Figure 2).

Good Microbiological Laboratory Practice

"Investigating Micro-organisms" covers the health and safety aspects of the three experiments explored in this investigation, reinforcing the importance of good microbiological laboratory practice in all classrooms working with micro-organisms.
A general principle is that all microbiological materials, cultures, media, environmental samples, etc., from whatever source should be treated as though they were a potential source of pathogens. All teachers/technicians working with micro-organisms should be familiar with SSERC's Code of Practice for Safety in Microbiology [3].

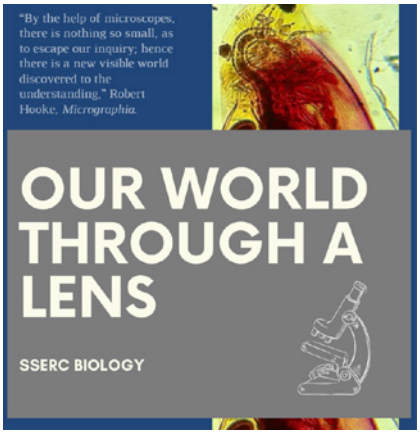

Figure 1 - Our World Through a Lens – a resource to support microscopy techniques in the classroom (many suitable for *SCN3-13a*).

Throughout the three experiments, control measures to reduce the risk of contamination of the operator (e.g. pupil), others, cultures and surroundings must be highlighted and reinforced. These measures include hand-washing, before and after working with micro-organisms; cleaning the workspace with a recommended disinfectant (e.g. 1% hypochlorite solution) before and after use; and the application of aseptic techniques during the experiment (Figure 3).

All teachers delivering the experiments outlined in this resource should be trained (e.g. this could be achieved in-house) in dealing with a small-scale spill and should feel competent in the microbiological techniques explored. The practical techniques outlined in the investigation vary in levels of technical challenge, while all being classed as Level 2 activities according to SSERC's Code of Practice; teachers should assess whether their learners can safely perform the experiments. Finally, to carry out these experiments in your school, our guidance states that your school should have a technician who has completed the SSERC Level 3 Safety in Microbiology course [4].

The experiments

All three experiments are supported by both written and video step-by-step guides [5]. The first experiment outlines how to safely carry out an environmental swab, incorporating

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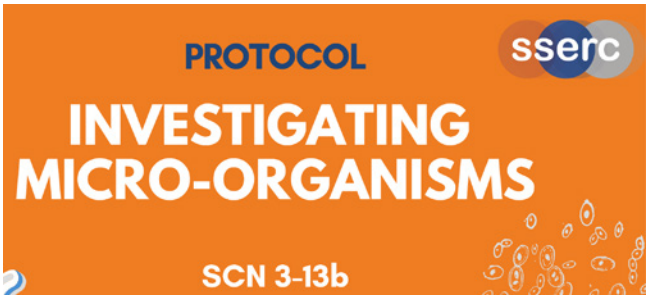

Figure 2 - Investigating micro-organisms, a resource providing practical work to support *SCN3-13b*.

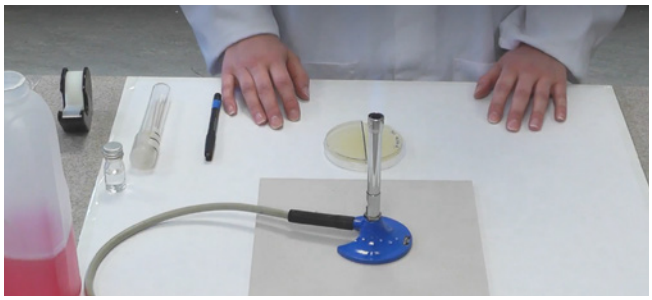

Figure 3 - Preparing your workspace for microbiological work.

aseptic techniques such as the pinkie-palm technique (Figure 4) and flaming the neck of a bottle. In class, this experiment is often met with learner requests like “can we swab the toilet seat?”, “can I sample my face?”, “what about the bottom of my shoe?”. Our resources support you in how to identify a safe sampling location.

The second experiment requires learners to produce a lawn plate of *Saccharomyces cerevisiae* and then, aseptically, transfer a filter paper disc coated with anti-fungal medication (Figure 5). Learners will assess the inhibition of fungal growth, as observed by the zone of clearance around the filter paper disc following a period of incubation.

Reflecting on the safety of this experiment, the use of *Saccharomyces cerevisiae* as the micro-organism here is important since a sample of a liquid culture must be transferred to an agar plate. If this was a bacterial sample, the activity would be classified as a Level 3 task and could not be carried out by anyone other than an S6 pupil supervised by a Level 3-trained member of staff. Working with *Saccharomyces cerevisiae* keeps this experiment at Level 2. However, it is important that all teachers carrying out this experiment are competent in dealing with a small-scale spill [6]. This could be achieved by running an after-school, in-house professional learning event led by your Level 3-trained Science Technician.

The final experiment illustrates how to carry out a vital stain of *Saccharomyces cerevisiae* and observe cells using microscopy. A live sample of the yeast culture is added to a microscope slide and a coverslip is placed on top of the culture. To stain the cells, blotting paper is used to draw neutral red stain from one side of the coverslip to the other

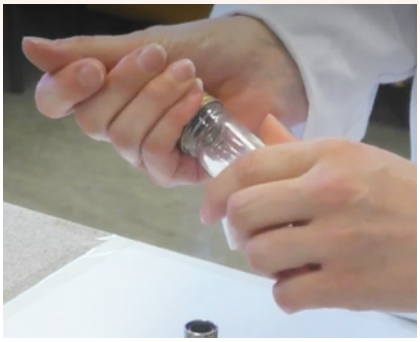

Figure 4 - The pinkie-palm technique is an important technique to share with learners to reduce the risk of contamination.

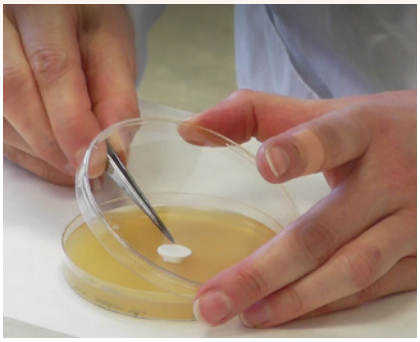

Figure 5 - Investigating the effect of an anti-fungal medication on the inhibition of *Saccharomyces cerevisiae* growth.

(Figure 6). This procedure prevents the cells from being washed off the slide. After a short period of time, living yeast cells will appear red/pink under the microscope.

Through these series of experiments, young people can investigate the different types of micro-organisms around them and how their growth can be controlled. Importantly, they will develop a range of safe microbiological laboratory techniques and skills that highlight the potential hazards associated with micro-organisms.

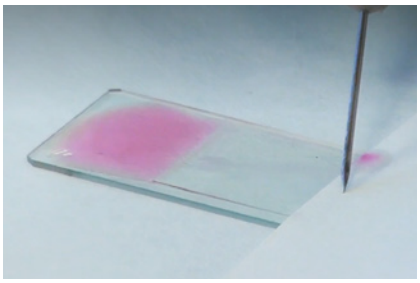

Figure 6 - Vital stain of S. cerevisiae to assess cell viability.

Further opportunities for training

SSERC have now developed two online, self-study courses, focused on safe microbiological laboratory practice [7, 8]. “Microbiology for the Classroom” is aimed at Secondary Science Teachers while “Introduction to Safety in Microbiology” is aimed at School Technicians. You can enrol for free and complete these at your own pace. <<

References

[1] SSERC (2021), Our world through a lens, available at https://sserccltd-my.sharepoint.com/:b:/g/personal/enquiries_sserc_scot/Efj_qrvRqaVIl5C916lro1IBeGFIw1aEfKvRKo-DD4pChA?e=tT9Ee6.

[2] SSERC (2021), Investigating micro-organisms, available at https://sserccltd-my.sharepoint.com/:b:/g/personal/enquiries_sserc_scot/EXLu9q9D8KtJmjHPz-KbCDYBHEZwRMno32YoCFeSo6JneQ?e=RfjZ8g.

[3] SSERC (2018), Safety in Microbiology: A Code of Practice for Scottish schools and colleges, available at https://www.sserc.org.uk/wp-content/uploads/2018/06/SSERC-Safety_in_Microbiology_Code_of_Practice.pdf.

[4] SSERC, Safety in Microbiology Course, Professional Learning Calendar, available at https://www.sserc.org.uk/professional-learning/technicians-pl/35349-2-3/.

[5] SSERC, SSERC TV YouTube Playlist, available at https://youtube.com/playlist?list=PLVez4VOGTRM-LUlrs0LTOq63x0h1fI5y5.

[6] SSERC, Micro Techniques Microbiological Spill, SSERC TV, available at https://youtu.be/aOehBjCIXXI.

[7] SSERC, Microbiology for the Classroom, self-study course, available at https://onlinelearning.sserc.org.uk/.

[8] SSERC, Introduction to Safety in Microbiology, self-study course, available at https://onlinelearning.sserc.org.uk/.