Studying animal cells at BGE using liver cells

The study of cells, including comparison between plant and animal cells, is a common feature of Broad General Education (BGE) science courses [1]. At this level in the curriculum practical activities would typically include the preparation of slides of onion cells and human cheek cells, each stained with iodine solution, and subsequent comparison of the cells as viewed under a microscope.

Figure 1 - Transfer the scraped tissue to a clean microscope slide.

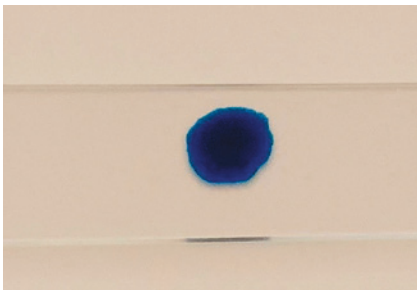

Figure 2 - Add a small drop of 0.1% methylene blue stain.

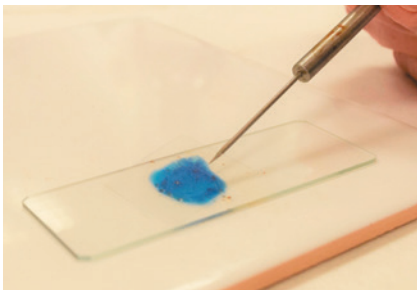

Figure 3 - Use the mounted needle or cocktail stick to carefully lower a coverslip over the stained tissue.

In this time of COVID-19, SSERC has received several enquiries from teachers and school technicians about the safety and desirability of carrying out cheek cell sampling for microscope work with BGE students. Our answer to these enquiries has been that as long as the guidance in the Code of Practice, Materials of Living Origin [2], is followed, and SSERC's general back-to-school guidance [3] is in place, it is safe for BGE students to do this. The main caveat to the guidance is that a teacher's risk assessment should take account of the ability of their learners to adhere strictly to the guidance.

However, all of that said, we appreciate that, in the current climate of enhanced hand and respiratory hygiene, some teachers might remain uncomfortable with carrying out this practical work with their classes.

Here we set out a protocol using fresh liver as a readily available and cheap source of animal cells suitable for microscopic examination by learners. Treated as follows, the cell membrane and nucleus of the cells are easily visible with a school microscope.

We are grateful to our colleagues at CLEAPSS [4] for sharing their protocol 'Staining and observing liver cells' which in turn is based on the work of Ian J. Burton [5].

For this activity we used fresh lamb's liver purchased from a butcher. Pig's liver is also suitable. Frozen liver and chicken liver are not suitable. The cells were stained with a 0.1% w/vol methylene blue aqueous solution. Methylene blue can be purchased in two forms: 1% solution which can be further diluted or solid powder which can be dissolved in water. The prices for each sourced from Scientific and Chemical [6], November 2020 (other suppliers are available) are:

- 100 cm^3 methylene blue solution - £2.58;
- 5 g methylene blue powder - £2.27.

Safety measures

- Learners should wash their hands before and after carrying out this work.
- There are no associated hazards with using small quantities of 0.1% methylene blue, therefore eye protection is unnecessary.
- Learners should be provided with a small pre-cut piece of fresh liver - 1-2 cm^3.
- Learners should be reminded of the fragility of coverslips and the care needed to avoid their breakage.
- Used slides and coverslips should be placed in a suitable disinfectant solution, e.g. *Virkon*, or 1% bleach, for several hours. Slides can then be rinsed and dried for re-use.

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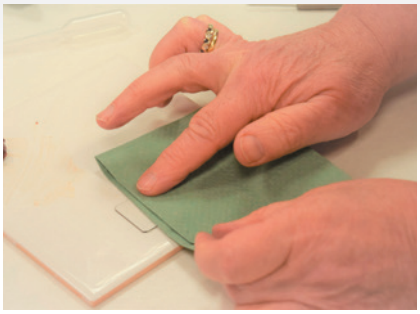

Figure 4 - Remove excess stain.

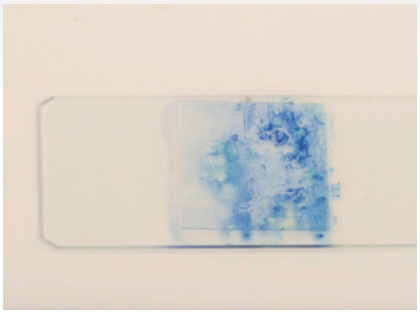

Figure 5 - The slide ready for viewing.

- Coverslips can be wrapped and disposed of via normal refuse, or placed in a broken glass bin.
- Liver can be bagged and disposed of via normal refuse.
- Work surfaces should be cleaned with detergent, or disinfectant solution on completion of this work.

SSERC 'Guidance for school Science & Technology coming out of lockdown' contains the following statement relating to microscopes. "Items that might come into direct contact with the face, such as microscope/spectroscope eyepieces should still be wiped with an antiseptic between users." [7]

Materials

- Microscope.
- Microscope slides and coverslips.
- Spatula or spoon.
- Mounted needle or cocktail stick.
- White tile.
- Small piece of liver.
- Dropping bottle containing 0.1% methylene blue.
- Paper towels.

Method

1) Scrape the cut surface of a small piece of fresh liver with a blunt instrument - spatula or small spoon.
2) Transfer the scraped tissue to a clean microscope slide and smear over a small area in the middle of the slide creating a thin layer (Figure 1).
3) Remove any obvious lumps using a mounted needle or cocktail stick.
4) Add a small drop of 0.1% methylene blue stain (Figure 2).
5) Mix the stain with the smeared liver tissue and leave for 1 minute.
6) Use the mounted needle or cocktail stick to carefully lower a coverslip over the stained tissue (Figure 3).
7) Fold a paper towel 2 or 3 times and place over the coverslip. Apply gentle pressure. This helps to spread the cells into a single layer and removes excess stain (Figure 4).
8) Carefully clean any excess stain from the surface and around the coverslip.
9) The slide is now ready for viewing under the microscope (Figure 5).

Figures 6 and 7 show images of liver cells as viewed under the microscope at magnifications of x100 and x400 respectively.

For the study of animal cells, this simple and straightforward technique would make a suitable alternative to sampling and staining cheek cells. <<

References

[1] *Curriculum for Excellence: Sciences experiences and outcomes* availabe at https://education.gov.scot/media/jcxpmwd5/sciences-eo.pdf (accessed November 2020).
[2] *Materials of Living Origin – Educational Uses A Code of Practice for Scottish Schools and Colleges* (SSERC 2018), Appendix 2 availabe at https://www.sserc.org.uk/health-safety/biology-health-safety/codes-of-practice/.
[3] Guidance for school Science & Technology coming out of lockdown availabe at https://www.sserc.org.uk/health-safety/covid-19-back-to-school/.
[4] https://www.cleapss.org.uk/.
[5] Ian J. Burton, *Journal of Biological Education,* (1999) 33(2).
[6] Scientific and Chemical availabe at https://www.scichem.com/.
[7] Guidance for school Science & Technology coming out of lockdown availabe at https://www.sserc.org.uk/health-safety/covid-19-back-to-school/, page 12.

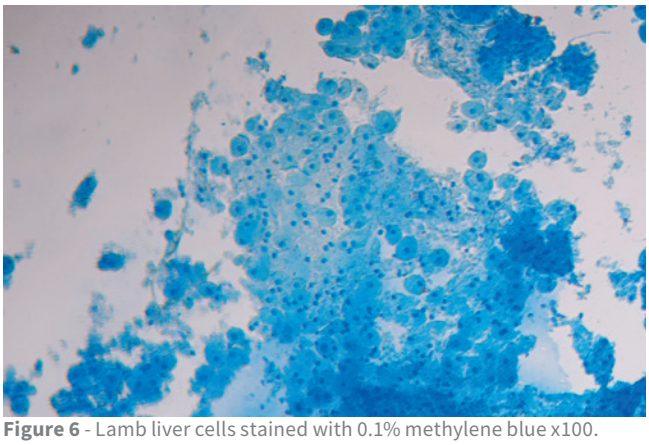

Figure 6 - Lamb liver cells stained with 0.1% methylene blue x100.

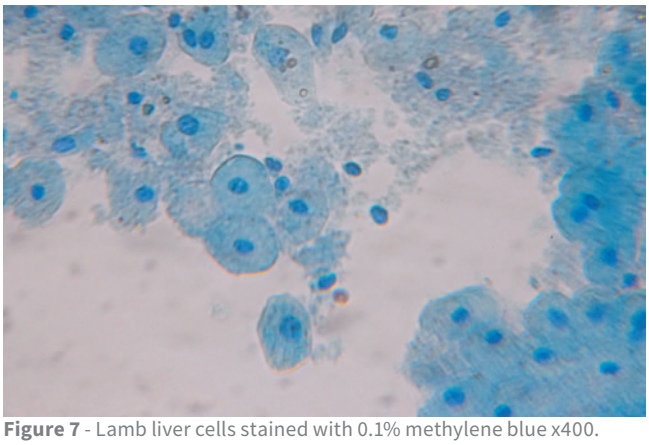

Figure 7 - Lamb liver cells stained with 0.1% methylene blue x400.