MiSAC matters
MICROBIOLOGY IN SCHOOLS ADVISORY COMMITTEE
50th Anniversary Articles

A positive view on health and safety in school microbiology

Phil Bunyan

The accumulated evidence suggests that secondary school science is safer than other practical subjects, particularly those involving physical exercise. Nevertheless, science has more than its fair share of concerns over health and safety. Sometimes these involve chemicals, which may be explosive, corrosive or even toxic. Radioactivity provides a constant stream of potential alarm. The reasons for these apparent concerns are often more than anything to do with the failure of secondary science teaching in the past to adequately educate the public, as parents and grandparents of current students. For example, the perception is that acids are well known to be dangerous, and possibly ought to be prohibited in schools. Plus, science teachers and technicians often wear white coats at work, a clear indication of danger!

Among the periodic outbursts against the dangers inherent in school science, microbiology stands out. It is never a public concern, nor a subject for alarming press reports. Does it not happen in secondary schools? Is it not taught at all, or only in theory?

Of course, the truth is that it is taught, and teaching includes practical activities where children incubate microbes from their fingers, bags and workplaces. *Escherichia coli* is regularly tested with antimicrobial chemicals of one sort or another to demonstrate their efficacy. Students handle agar plates on which a variety of microbes have been grown. Why does this not cause alarm? The explanation is that from its inception as a subject worthy of school science, microbiology practical work has always assumed the strictest of safety measures. So strict that, even though individual teachers, technicians or even science departments might fail to maintain fully all these standards, the outcome is rarely truly dangerous. And the educational world has the founding member of MiSAC, among others, to thank for that.

What are these standards? Well, firstly there are a few simple rules, including:

- Microbiology practical work should start with sterile equipment and materials (cultures excepted).
- Wherever possible only microbes deemed appropriately safe are used.
- Staff and students are taught to work aseptically (**Figure 1**).
- Incubation temperature should generally be below 30°C to reduce the chance of human pathogens being encouraged.
- Most practical microbiology takes place in Petri dishes with solid agar (agar plates), which reduces the opportunity for spills, and the creation of contaminating airborne aerosols.
- Agar plates are closed with tape shortly after being set up, and are not reopened.
- At the end of the practical all materials and equipment are sterilised prior to re-use or disposal.

In addition, sterilisation is generally achieved using high temperature steam at elevated pressure in a pressure cooker or autoclave

(**Figure 2**), which is straightforward and very effective. Suitable disinfectants are widely used on work surfaces, and when wiping up spills

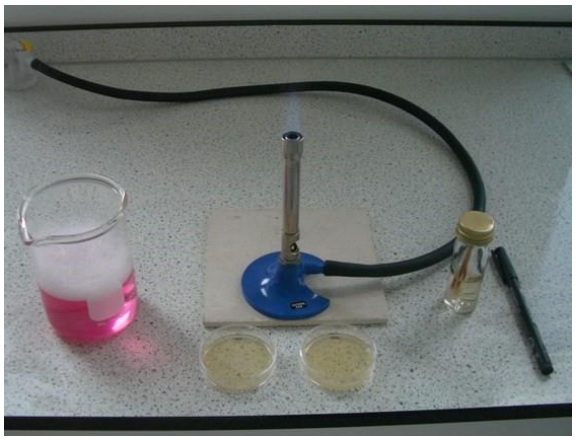

Figure 1. A typical equipment layout for aseptic transfer of microbes in school microbiology.

Figure 2. Small autoclaves or pressure cookers are used to sterilise equipment and materials before and after practical work.

Trained secondary science teachers and technicians follow these rules pretty well. The outcome: microbiological accidents or incidents are rare, and have not yet led to significant concerns in departments, among students and their parents, nor the wider public.

There are scientifically, well-reasoned arguments for occasions when one, or more of these rules might not be followed. Such a risk assessment determines that the risks of harm from failing to follow a rule are not significant. This is permissible as long as most of the time the rules are followed.

Interestingly, following these rules never detracts from the enjoyment of doing the practical, nor from its potential for learning. Students like microbiology, even when their part in it is restricted by time or facilities. There is a good case for students to be given more opportunities to practise aseptic techniques, if only for the fun of it. Plus, there is the considerable satisfaction of producing an uncontaminated culture on an agar plate.

Our collective future depends on more of the population understanding and appreciating the role microbes play, and will play, in maintaining our health and well-being. It is vital to the curriculum. Lucky, therefore, that microbiology is not considered too dangerous for schools.

AUTHOR PROFILE

Phil Bunyan was, until 2012 the director of CLEAPSS. He began his working life as a teacher in a comprehensive school in South London, from where he moved to teach in rural Northamptonshire. Subsequently he ran the county Science Centre, before becoming the science inspector for Nottinghamshire. Between this and moving to CLEAPSS, he spent 5 years working as a senior regional director for the government's National Strategy.