Teaching Bioscientists to be Green

As future generations face threats to energy, water, biodiversity and food resources, bioscience departments are responding to the global climate change challenge through education and research. The challenge for higher education is to provide all students with an understanding of sustainability and environmental issues. As well as teaching sustainability in theory, there is the opportunity for institutions and departments to 'walk the talk' by demonstrating sustainability through their practices, with the 'greening' of research labs and teaching practices providing students with a platform to integrate sustainability into their own lives and future careers.

In providing a brief overview of greening labs and teaching in the biosciences two initial constraints emerge: time and money. While monetary savings may be expected from more sustainable practices, implementation costs money and time. However, the indirect benefits should not be underestimated. For example, green schools and sustainability-literate pupils means in the future environmental expectations on higher education will be high. In 10 years time, it is conceivable the new generation of students would not consider studying at an institution that doesn't have strong green operating credentials.

Green changes can be implemented across an institution but environmental tokenism should be avoided (e.g. solar panels on buildings without insulation). Pressures on UK universities and colleges over the next five years through funding cuts are likely to result in reductions in energy and water consumption. New buildings are also expected to be green and low in operation costs. However, people ultimately hold the key to greening operations and working practices at ground level.

Environmental educators (technical and academic) have a responsibility to train the generation likely to face the impacts of climate change. Labs can be wasteful in terms of resources but are essential environments for teaching and research. Lab managers and users can make a difference, save resources and make teaching and learning cost and environmentally effective. Energy saving is an ideal starting point. For managers, choosing 'A' rated new equipment and maximising use, sharing facilities and being sympathetic to people's needs can all be implemented. Watching out for standby functions and fitting electrasave power monitors can help students understand the need to switch off equipment not being used. For example, leaving a standard PCR machine on standby overnight can consume a staggering 153.30 kW h $year^{-1}$ of energy. Sensible placing of some equipment can also reduce energy use, for example, installing a plant growth cabinet in a room with a low background temperature means more energy is used in maintaining the cabinet temperature.

As for procurement, it is desirable to try and source some lab goods locally (UK) but the majority are manufactured abroad. There is an increasing tendency for many protocols to use 'ready packs' which may not necessarily be bad practice as resources are used as required. However they can be expensive and sometimes wasteful in that everything purchased is not always used. Moving such preparation time from lab to the manufacturer is something that has entered into our labs as well as our homes.

Lab equipment is another aspect which should be considered. Every lab has a collector that stores goods or procures second hand items. Lab goods can be found on-line but care should be taken as to the origin and authenticity of items purchased. Older items can be effectively used in the lab but often require more maintenance. For example, glass Petri dishes require time for cleaning and for this reason they have been essentially phased out from microbiological research. As for plastic Petri dishes, waste plastic can be recycled but health and safety must be considered. It is also often not clear what grade of plastic is used in lab consumables making recycling difficult.

Sensible lab practices can reduce the need to clean more equipment than necessary. Good experimental practices can also reduce waste e.g. unnecessary pipette tip changing. Experimental design should also be carefully considered as replication can be reduced at no expense to the design. However, experiments with insufficient replication are the most wasteful as they have no reliable outcomes (Ruxton and Colegrave, 2006). The most important element for a good working lab is its occupants. Do the inhabitants want to change their activities to reduce resource consumption? Several barriers to change can be identified including lack of: time, resources, information / knowledge and motivation. Every lab has traditions and a working structure, occupants must buy in and work together to develop their own green ground rules.

Bioscience students leave higher education and enter into a wide range of careers. They take with them practical experience and education that will inform their futures. Bioscience educators therefore surely need to implement greener working practices that reflect their desire to understand and preserve the environment. While the student generation may want to respond to climate change, educators need to learn from what they teach.

Reference

Ruxton, G.D. and Colegrave, N. (2006) *Experimental design for the life sciences*. Oxford University Press, Oxford

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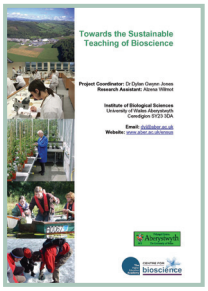

A report into greening the biosciences and a Green Laboratories Manual, developed as part of Dylan's project '*Towards Sustainable Teaching of Bioscience*' are available from *www.bioscience.heacademy.ac.uk/funding/currentprojects/gwynnjones.aspx*