Developing creativity amongst first year science undergraduates: art assignments in science curricula

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For several years, a range of innovative assignments have been incorporated into the microbiology component of the undergraduate biology/biomedical science curriculum. These assignments have been designed to encourage the development of transferable skills, and have included the design of leaflets and posters providing information to the public, production of video, and other ‘live’ projects – that is, work that has been commissioned by a real ‘client’. Thus in addition to student learning, additional enterprise and communication skills are acquired (Verran, 1992 a, b; 1993).

A recent and ongoing assignment has built on these activities, and has been designed to encourage communication and creativity, using microbiology as the focus. Discussions amongst the microbiology community regarding the content of the microbiology undergraduate curriculum tends to divide (simplistically) between those who teach fundamental principles in early years in order to subsequently address applied aspects, and those who work to initially enthuse students in the subject in whatever way possible, for example by focusing on applications of microbiology and subsequently investigating the underlying scientific principles. Happily at MMU we combine both approaches!

MMU has provided opportunities for unusual interdisciplinary collaborations, one being links between microbiology and art. Thus art students have visited the microbiology laboratories to explore and develop project work. Science and art students worked together to design displays for the new John Dalton foyer (Dawson, Bailey, Dunbar and Verran, 2005). One proposed installation illustrated the importance of repeating, yet evolving structures in science (DNA, fractals, polymers). Staff have collaborated on various art installations, for example through Arts for Health, and Water and Wellbeing. Thus MIRIAD (David Haley), MISST (Tim Edensor) and the DRI (the author) have worked together to progress communication of science and art.

Art provides an opportunity for visualisation and communication of science. Thus, current first year undergraduate biology/biomedical science students (typically around 200 students) receive a lecture as part of their microbiology module, on microbiology and art. Assessment for the module comprises laboratory (practical) exercises (50%), multiple choice tests (30%), and an assignment related to lectures (20%). Students choose one assignment from six offered: one of these relates to the art lecture, where students have the opportunity to produce, alone or in small groups (two or three), an item to illustrate some link between art and microbiology, hopefully having been stimulated by the examples given in the lecture. There is no upper limit to the number of students who can take this option. Over the past four iterations of the work, in total over 100 students have taken the opportunity to express their creativity! Ideas are discussed during a tutorial, and assessment criteria are negotiated between myself and the student(s). The outcomes are diverse, often creative and inspiring, and several have been used to illustrate this article (see Figures 1-7).

The topics covered in the lecture are:

Deterioration of Art

Microbially-induced spoilage of art and heritage material is perhaps the most obvious link between the subjects, but I also describe aspects of conservation, prevention and control of such deterioration, and...
Figures 1 and 2: David Wickens, first prize winner in the 2008 competition sponsored by Yakult. David’s 8 foot long board used two differing artistic styles (Lichtenstein and da Vinci) to represent some aspects of eucaryote microorganisms (fungi). The board was also submitted with a beautifully illustrated and researched notebook.

Figure 3: Jeni Hutchinson made an educational board game ‘Germs!’
give examples of microbiologically-induced remediation. Students are especially interested to hear of this unusual example of applied microbiology. The Mary Rose, cave paintings of Lascaux, North West Film Archive, algal biofilms on Manchester fountains and statues...students often have not connected this aspect of heritage with microbiology. Subsequent collaborations with human geographers regarding dereliction and biofilms, and with the Film Archive has resulted in final year laboratory based research projects (Edensor, 2005). To illustrate this aspect, one student used a Van Gogh painting to create a three dimensional picture which when viewed from one side appeared uncontaminated, but from the other a range of different types of microbiologically-induced spoilage were illustrated.

Beauty of microorganisms

Sophisticated imaging techniques enable differentiation of components of microbial communities, or individual cells, and such images are not only informative, but often also beautiful. Inspired by some of these examples, students have customised lab coats, and produced microbiology-inspired textiles, jewellery, and some very attractive artwork.

Microorganisms in art

Surprisingly, microorganisms themselves may provide material as well as inspiration for art: pigmented bacteria can be used to ‘paint’ images on agar plates; pictures made on microscope slides from diatoms can be purchased for educational use; models of toadstools are a craft shop staple. The 20-sided polygon, the icosahedron, provides the maximum volume for the minimum building material, thus is an ideal structure for both viruses and geodesic buildings such as the Eden project.
During the assignment, some students produced 3-D models of viruses as teaching resources, film of fruit going mouldy, paintings of agar plates which had been contaminated by aerial fall-out of microorganisms in student housing (!), parodies of World War I and II posters where microorganisms were NOT the enemy, a tablecloth embroidered to represent an animal cell, with condiments replaced by yeast, bacteria and virus models, to scale.

The consequences of bacterial and viral diseases, rather than the microorganisms themselves, provide ideal subjects for visualising the destruction wreaked by plagues through history, and upon individuals. Students created Powerpoint presentations outlining the influence of plague on contemporary art; produced conceptual images using fluorescent in-situ hybridisation technology; painted a representation of the history of science; produced a collage in 1930s style of the importance of tuberculosis in literature; designed panels for the AIDS quilt; profiled artists who interpret science through the medium of paint, and others who work more overtly through sci-art collaborations (specifically with microbiologists).

Microbiology and...

It may have initially seemed surprising that such apparently disparate subjects can be combined in a science curriculum. Microbiology would easily link with other subjects such as literature (a bookclub anyone?!), where the impact of disease on the development of particular novels can be explored; or music, where composition or lyrics can assist in recall of complex terminology, is easily possible. This year, two students composed a ‘rap’ on puerperal (childbed) fever. Subjects such as history, geography, politics, ethics, economics are inevitably associated with the epidemiology and management of emerging and re-emerging disease - thus whatever the interest of the audience, microbiology becomes of interest and relevance! Indeed, this lecture has been given externally to a range of different audiences who have enjoyed its rather different slant on science.

Evaluation

This academic session (2007-8) marks the fourth iteration of the assignment. From a small initial group in the first year (approximately 20 students and 12 products), to over 50, 10 and 30 in subsequent years, the feedback from students has been very positive. Since the students are self-selecting, there is no sense of inadequacy, and there is significant enthusiasm to employ talents other than those perceived as ‘scientific’.

Marks awarded are generally good, provided that the students adhered to the negotiated assessment criteria (See Table 1).

It would be interesting to include some collaboration with artist colleagues in the assessment.

<table>
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<tr>
<th>Table 1: Marks awarded for product in two academic years</th>
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<tbody>
<tr>
<td><strong>Number of students</strong></td>
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<tr>
<td>2005-6</td>
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<tr>
<td>Taking the unit</td>
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<td>Number of Products</td>
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<tr>
<td>Number of Products achieving 90-100% [%]</td>
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<td>Number of Products achieving 80-89% [%]</td>
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<td>Number of Products achieving 70-79% [%]</td>
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<td>Number of Products achieving 60-69% [%]</td>
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<td>Number of Products achieving 50-59% [%]</td>
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“Surprisingly, microorganisms themselves may provide material as well as inspiration for art”
The assignment has a number of added value attributes. Students are very excited and proud to hand their work in – and to collect it back. The work has been displayed at events for which external sponsorship was obtained – for example, Leica Microsystems, and Yakult. Prizes are awarded, with the winning products being mounted for display within the School corridors. The Society for Applied Microbiology used images of some of the work in their 2008 calendar, and duly acknowledged images have been included in various other publications (Verran, 2007, 2008).

An awareness of the different interests and learning methods of students is important in providing an appropriate stimulating educational environment, particularly when class sizes can be large, and their entry qualifications and abilities are more varied. Not only does the assignment demonstrate very clearly the latent creativity amongst scientists, it also encourages students to think across subject boundaries, to be confident, to communicate – and to appreciate the wonders and versatility of microbiology!

In addition to the products illustrated (Figures 1-7) other items submitted this year included an experimental report documenting attempts to modify a printer to enable printing onto agar, to represent new developments in implant science (Jamal Zahid); a film of deteriorating fruit (Callum Badger) and clothing with patterns inspired by microorganisms (Colette Boles and Siobhan O’Leary).

References


