

## Using Creativity to Enhance Biology

### Introduction

When pupils are asked why they enjoy Biology, one of their most common answers is “because it is relevant to my life”. They are fascinated about topics such as disease transmission, inheritance and physiology, often asking insightful questions and making links between news events and their own learning. However when they hit a topic they find more challenging or more conceptual, you may face a barrier to learning – the “I can’t see it or picture it so how do I know it really happens”. Whilst as scientists we often look for experimental evidence for phenomena to explain new ideas, there are times when this isn’t possible or where a more creative approach might work more effectively.

### Why use creativity in Biology lessons

#### 1. Engagement

It is important that as teachers we do not become too precious about our own subject. Some students will find our subject fascinating; others will have very different interests and talents. However as the sciences are compulsory up to Key Stage 4, and a good understanding of many aspects of biology is vital to make informed decisions about our own lives, it is vital that we provide activities that will engage those who do not see themselves as natural scientists. Providing opportunities to showcase talents that might not normally be evident in biology lessons can engage the student and help the biology teacher learn more about their students.

#### 2. Collaborative learning works

“We learn by doing. Research shows that active learning is much better recalled, enjoyed and understood. Active methods require us to ‘make our own meaning’, that is, develop our own conceptualisations of what we are learning. During this process we physically make neural connections in our brain, the process we call learning. Passive methods such as listening do not require us to make these neural connections or conceptualisations.” – Geoff Petty, *Active Learning Works*.

I am passionate about active learning (I have delivered whole school training on active learning in the past year) and most lessons will incorporate activities where students are developing their teamwork skills in a number of different ways. Collaboration on creative tasks can develop students’ social skills as well as their scientific understanding and the atmosphere in a classroom totally changes when they are asked to create something new.

#### 3. Modelling processes and structures

My lab technician often jokes with me about getting the plasticine out. I use modelling a lot in lessons to demonstrate processes such as genetic engineering, yet the most interesting uses are always when you allow students time to create their own models, with minimal instruction. Recently, I gave each class a different selection of equipment and asked them to develop their own models of mitosis. One group drew the short straw and got a bag of plastic cutlery, with which I anticipated they might struggle. However, after only half an hour they had broken the bowls on the spoons off the handles to represent nuclei and were busy fashioning spindle fibres from the tines of the forks.

Every biologist knows that one of the challenges of studying biology is the volume of scientific terminology you must learn and any misconceptions pupils have must be challenged and corrected – modelling provides a clear method to check understanding and learning.

#### 4. Creative activities can challenge the most able, giving them the freedom to develop and immerse themselves in a topic, encouraging independent learning. Gifted and Talented students often face the problem of simply being given extension work or more challenging questions. Using creativity can allow a different type of extension – not simply by giving them more to read or learn but instead an opportunity to extend their understanding in a topic they find interesting, where skills are enhanced too.

#### 5. It is memorable and good fun! I hope that my pupils enjoy the range of experiences I provide for them and that in future years they will look back and still think fondly about the activities they participated in.

## Video Commentary submitted to judges for this year's award

Clip	Commentary
<b>Carbon Cycle Song</b>	<p>This was written collaboratively, by 4 pupils last year (in year 10). The class were given a choice between:</p> <ul style="list-style-type: none"> <li>- Creating a video</li> <li>- Writing a song</li> <li>- Designing a board game</li> </ul> <p>They were given no further instruction, allowing them to develop their own ideas. We had fantastic board games, a rap as well as this song, and a video (featured later on the video). The whole class performed the song and one pupil commented that during her GCSE mock exam she remembered the words and they helped her to write about the carbon cycle.</p>
<b>Anti-Smoking Song</b>	<p>This was the product of a creative piece of homework by Year 9, performed by two pupils without accompaniment. The surprising element here was that these two pupils were not particularly enthusiastic biologists, yet given the opportunity to use their creative talents they found the courage to sing in front of 30 of their peers and used the correct terminology – words like carcinogen and life expectancy.</p>
<b>The DNA model</b>	<p>A Year 12 class were tasked with designing and constructing a model of DNA, to be hung up in a skylight in one of the biology labs. They worked in groups to come up with innovative designs, and then evaluated each other's models until they agreed on a plan. In only two lessons they had completed the sugar phosphate backbone and made all the bases, only for it to be assembled. Initially they had thought about painting the helices, but then decided the different densities of print on them showed the bands of the chromosomes and could be interpreted as different genes.</p>
<b>Surface Area:Volume ratio animals</b>	<p>This simple activity, using plasticine to model an animal with a large SA:vol ratio and then change it to another animal with a small SA:vol ratio enables them to understand how the SA changes whilst the volume remains constant. It is such a key concept in biology, yet often pupils struggle with the idea or accept it without really thinking it through.</p>
<b>Stop Motion Protein Synthesis</b>	<p>This was an ambitious project which stemmed from looking at clips on YouTube of other people's efforts. We critiqued a number of other videos, looking for elements that were missed e.g. enzyme action, the association of tRNA with new amino acid after delivering one to the polypeptide chain, and the importance of the stop codon. This then informed the girls' design of models. They were extremely self-motivated, insisting that the bases were correctly colour-coded and that the amino acids added related to the correct codon on the mRNA. The final product is really impressive and all the model moving and photography was carried out by the pupils.</p>
<b>Blood Vessel modelling</b>	<p>Another open-ended challenge, this time to ensure they fully understood the key features of blood vessels, including the different layers of tissues and the size difference between them. The 3D models were particularly useful to show the valves in veins, and many girls took photos of their models to enhance their revision notes.</p>
<b>Nerve Impulses with Year 10</b>	<p>A simple activity that involves passing balloons as quickly as possible along the three neurones; sensory, relay and motor. This was interactive and the girls enjoyed trying to beat their time on successful attempts! The key here was to build up the model, so the inclusion of synapses where the balloons have to be thrown demonstrated the diffusion of neurotransmitter and how this process was slower than the electrical impulse along the axon. Girls also suggested a Mexican wave would work, although the synapse would have been more difficult to demonstrate.</p>
<b>Phototropism modelling</b>	<p>I work very hard to challenge the notion that plant biology is less interesting than physiology or genetics, yet with a high proportion of our Y13 students going on to study medicine and dentistry, it often falls on deaf ears! We created these models after a problem-based learning activity where they were shown the experiments and had clue cards to explain what was happening, so they had to put the entire story together themselves. They then visited each other's models and listened to explanations, asking questions and clarifying each other's definitions, until they all felt confident enough to explain the action of IAA on plant shoot growth.</p>
<b>Carbon Cycle film</b>	<p>This film was created by four girls in Year 10 and impressed me because it was produced</p>

	in one lesson and a homework, demonstrating young people' aptitude for technology. The entire video is much longer, with carbon passing through herbivores and carnivores, but you can see how much the girls enjoyed developing their own video, with no teacher input. It was shown to the class and they evaluated the final film.
<b>Anti-Smoking Advert</b>	Another piece of homework, demonstrating editing skills and the use of a very apt soundtrack. We had previously watched what has been called the best anti-smoking video and their challenge was to produce something equally moving and effective. These two girls worked on this over a weekend and the final product is thought-provoking and quite a mature piece of work.
<b>Biology and Art competition</b>	This piece of artwork amazed the department when it was handed in – particularly as it was produced by a girl in Year 8. Both the quality of the painting and the research that had gone into it were so impressive it was easily the winner and Shriya received the National Geographic Wildelife Photographer of the Year book as her deserved prize!
<b>Biology Cakes</b>	Creativity in the kitchen is also encouraged! The key to these cakes success was not just in the ingredients, but the thought that went into them and the detail they included!
<b>Interview</b>	Three Y13 students.

## Conclusion

Often pupils will feel that they are either “science-y” or “arty” and do not appreciate that the best scientists are those that have creative and imaginative minds. I hope that some of these examples enable them to develop an appreciation for the need to be both!

Creativity in science can often be maligned – the inevitable ‘poster lesson’ at the end of term. Similarly, if creativity is too teacher driven it will not succeed – you have to give pupils the time and support to develop themselves. By giving creative activities as much importance as more traditional teaching methods, pupils are stimulated, enthusiasm for the subject is raised and ultimately attainment improves. I firmly believe in the teaching methods I have developed over the past ten years and continue to develop, and I now share them more widely through delivering training on Prince’s Teaching Institute New Teacher training days, on Saturdays, in Manchester, Birmingham and London. I am also about to start delivering training through a Science Learning Centre Partnership and I have worked with people from other schools on developing teaching in their departments.

Catherine Russell