

Biology is amazing, it is life, it is everything. Understandably, that is not always the way students see it and I think it is part of a Biology teacher's job to bring it to life for them as much as possible. I don't believe that there is one sure fire way to do this, and indeed, what inspires one student will not necessarily work for the next, however I have learnt that there are some key factors that enable us to engage the majority of students with a subject that is sometimes seen as academic and not accessible for everyone, yet matters very much to us all. What follows is simply a collection of ideas which encapsulate what I have learnt about inspiring a love of Biology in students.

Passion and empathy.

The educators, speakers and colleagues that have inspired me have always been those whose love of their subject shone through. I am a marine biologist by training and I try to incorporate that into lessons wherever possible, as this is where my passion naturally lies. Over 70% of the Earth is water and I use this as a contextual tool whenever it is appropriate, whether introducing ecological keywords and food chains using Finding Nemo or discussing endangered animals and ethics using the example of shark finning. A part of my room is dedicated to dolphins and the ocean, to encourage the students to share their interests and to demonstrate my own love of my subject.

Trying to inspire a sense of awe and wonder in a topic that holds no joy for the facilitator is a doomed endeavour. On occasion, this means finding the awe and passion for ourselves first. For example, osmosis, a concept of inestimable importance, is a topic that, whilst I appreciated its significance, I didn't view it as the most fascinating of subjects in and of itself. This meant that I could convey how critical it was to life on the planet but the sense of interest was lacking. This is also a topic that students tend not to engage with, especially at the end of a day. To remedy the problem, I first spent time trying to find the awe for myself. I found numerous practical ideas through workshops and websites and now teach this topic in



a very different style. Having the class prepare slides of plant cells, first with distilled water, then salt solution, allows students to see osmosis in action. Being able to watch the cells change makes the process of osmosis very real for them. Later came the addition of the balancing potato demonstration, where two pieces of potato of equal mass and surface area are suspended on string from a horizontal piece of dowel. One potato piece is immersed in distilled water, one in sugar solution. By the end of the lesson, the potato in the distilled water has gained enough mass to make the dowel tilt. This, as with the microscopy, has become an integral part of teaching osmosis for me. The ideas themselves are not ground breaking, and many other teachers will doubtless be utilising them already. However, they serve as an example of a topic in which I was less than inspired myself, in which I had to find practicals and demonstrations that ignited my interest, to be able to then look at a student's

experience of the lesson and create something more concrete, intellectually stimulating and visually interesting for them.

This leads me to the first, and possibly, the single most important revelation I have had about teaching; that you should always imagine how you would feel as part of that lesson, in other words, empathise with the students. As practitioners, we plan lessons to cover content and provide assessment opportunities whilst trying to factor in a myriad of other pedagogical considerations. This can make it very easy to forget the experience of the person taking that lesson. If we view lessons from both standpoints, our own and the students, we can start to see how best to proceed. Passion and empathy may seem like two disparate points but one naturally leads to the other. If we can find the passion for ourselves, then we can share this with a class and the method for doing so, is best chosen empathically, by contemplating their experience of the lesson.

Sometimes empathy for the students learning experience is not about being creative, for many students the stumbling block may not be understanding the concept but applying that knowledge to questions. Again, this requires us to see the lesson from the students point of view, as after engaging with the learning objectives and seeing this phenomenon in action, they will still need assistance to apply that knowledge in many cases. For that reason, the next part of the osmosis lesson gives the students sentence starters for answering long questions on osmosis. Utilising pictures as a visual aide memoire, we can then practise using the language and understanding we have acquired to answer exam-style questions.

There are times when we can read the mood of a class and see that we need to do something to get the learning enthusiasm back on track. As difficult as it can be with such a content heavy subject, these are times when we need to take a quick 'motivational break'. This can be done by looking at awe-inspiring images, something I keep a bank of and add to wherever possible, or taking a quick quiz on something visually interesting, such as types of young and the animals they came from. Looking at the wonder of nature and taking a moment to remind ourselves why Biology is important and wondrous is always worth the time taken. Occasionally, I've taken a short learning detour to discuss motivation explicitly, as a class needs to be focussed to best make use of the learning time we are allotted. Sharing a passion for Biology, and seeing classes as groups of individuals, allows us to foster engagement in our subject and, hopefully, means that our students want to be in our lessons. This is a winning combination for students to either progress into careers in Biological Sciences or simply be more logical, science aware citizens, both of which are admirable goals.

Finally, and most importantly, in terms of empathy, students are human beings and should always be regarded as such, discipline is important but so is rapport. I very much see each class as a team, I lead the team but am also a member of that team. Dialogue in the classroom is never them and me, it is we. I work on the basis that students are smart enough to understand that someone works very hard on their behalf and simply ask them to put in the same effort for themselves. Every student has a massive potential and I think it is part of the job of a teacher to instil in them the skills to reach that; be it the ability to critically evaluate data or by building self-confidence.

Variety and context.

Students have the same timetable for a year, thus attend the same lessons with the same teacher up to five times a week, we all have our styles of teaching, so to ensure the learning experience does not become monotonous, wherever possible, I try to make the lessons enjoyable and varied. This could involve the way in which students are asked to present their learning; demonstrating natural selection using plasticine, modelling DNA/cell

division/mutations with sweets, writing a poem about the role of worms in soil, designing a heart from plastic bottles (it has to be capable of showing the passage of blood) or presenting findings in the form of a short video using puppets. Sometimes the interest comes from a 'hook', a short engaging idea which can be a picture, demonstration, activity, video (I



highly recommend the BioRad PCR song¹), or snippet of information; students are always fascinated to learn that wind turbines have been known to make bats lungs explode².

Practical science is extremely important and we conduct practicals whenever opportunities arise. It is, of course, important that practical science is carefully chosen and valid to ensure that it is not a tacked-on activity with no learning worth. When done for the right reasons, practical science can turn the abstract concrete, can consolidate or further learning and can allow students a sense of wonder, whilst building their skill set. Some student favourites have been; looking at *Daphnia* under the microscope, the SAPS protocol for examining lignin under the microscope³, immobilising enzymes in algae⁴, investigating catalase activity in liver⁵, maggot choice mazes and rat dissections. Every year I try to find new ideas or adapt current activities, to continue to improve lessons and engagement.

Context allows students to see the validity of learning Biology and its real-world applications and I try to use it wherever possible, this can range from looking at newspaper reports of the latest clinical trial issues in France⁶ to the potential use of insects as a food source⁷. This also extends to outside the classroom, the school has used platforms such as Google Classroom and OneDrive to enable teachers to share information with students, and I have used these to post regularly. The material posted includes homework and lesson PowerPoints, but it is also a great way to share a wider array of biological information, from cutting edge medical breakthroughs from *New Scientist* to blogposts about the best maternal animals from Arkive⁸ to careers advice for biologists^{9, 10}, all of which has really helped students engage with Biology in the real world.

Providing variety and context can also extend outside of individual classes, any opportunity to engage students with Biology is a worthwhile endeavour. I have provided PowerPoints for whole school use, for events such as Earth Hour and World Ocean day, to promote Biology around the school. This extends beyond the school itself when we invite Year 5 students, from various primary schools in the area, to attend Science mornings. Raising awareness of Biology is also aided by entering students into competitions such as the Biology Challenge and Biology Olympiad, as well as other Biology competitions that come along. We regularly take part in "I'm a Scientist get me out of here!" web chats, as a department, so that students can converse with scientists from a range of fields and students have opportunities to attend workshops, trips and seminars at locations such as Birmingham University and Chester Zoo. We have recently taken part in the Rocket Science citizen science campaign and shared our results with the RHS and ESA. I believe that the range and breadth of experiences and information that the students are exposed to is important, as it allows them to make more informed choices about their future options and understand the scope of Biology in the real world.

Variety is also important for ourselves and I have had the opportunity to deliver training to other staff on techniques such as group work, reflective teaching and stretch and challenge. As well as leading a department of talented teachers and technicians, I have coached staff and mentored trainee teachers through their first two years of teaching and I strongly believe that the sharing of our experience allows us all to grow.

I am very lucky to have taught a multitude of amazing students, many of whom have gone on to study Biological Sciences at University, many of whom have inspired me. I have learnt that the best way to teach Biology, for me, is with passion, empathy, variety and in context, so that the young people, who attend my lessons, get the best possible Biology education and enjoy the experience as they learn.

1. <https://www.youtube.com/watch?v=x5yPkxCLads>
2. <https://www.newscientist.com/article/dn14593-wind-turbines-make-bat-lungs-explode/>
3. <http://www.saps.org.uk/secondary/teaching-resources/770-microscopy-looking-at-xylem-and-specialised-cells>
4. <http://www.nuffieldfoundation.org/practical-biology/working-immobilised-enzymes-or-microscopic-organisms>
5. <http://www.rsc.org/learn-chemistry/resource/res00000425/testing-for-enzymes?cmpid=CMP00005921>
6. <http://www.bbc.co.uk/news/world-europe-35320895>
7. <https://www.engagingscience.eu/en/2014/11/28/eat-insects-2/>
8. <http://www.arkive.org/>
9. <http://intobiology.org.uk/>
10. <https://biologyheritage.rsb.org.uk/bcw>