**Biology in the Real World: Voyage of Discovery**

*A day full of challenging ideas and cutting-edge research at the ASE Conference 2015*

As the Society of Biology’s Teacher of the Year 2014 I was honoured to host a day of talks entitled ‘Biology in the Real World’ on behalf of NUCLEUS - a group of bioscience learned societies and similar not-for-profit organisations. My school kindly allowed me to participate in what proved to be a fascinating day and one which suggested a variety of ways of encouraging and extending learning in the classroom.

Dr Adrian Moore from pharmaceutical company UCB began with a talk on **Osteoporosis: the final frontier**. He talked through recent research into sclerostin, a glycoprotein coded for by the SOST gene, which inhibits bone formation. People with sclerosteosis, a rare high bone mass disorder, have a recessive mutation in the SOST gene and rats where the SOST gene was knocked out showed improved bone strength. This indicated that an antibody drug designed to prevent the action of sclerostin might be a suitable treatment for osteoporosis. The results of clinical testing of the antibody drug in humans is now one year away from publication. Finally Adrian suggested that the research may even have applications in space travel, which is known to cause bone deterioration. Mice will be sent into space in the near future to test the antibody treatment!  In addition to the clinical importance of Adrian's research, the material he presented would be valuable in the classroom as well - in illustrating the medical applications of genetic research and in providing a great problem-based learning task for A-level students through the use of the graphs and data he shared with us.

Professor Stefan Przyborski’s presentation **Growing cells in a new dimension** explained how traditional cell culture methods in Petri dishes – essentially two dimensional environments – did not provide a realistic model of cell behaviour in organisms. Delta signalling mechanisms were affected and the flattening of both the cytoplasm and the nucleus affected cell behaviour. The solution was to create a three dimensional scaffold for cells to grow on using a technique called emulsion polymerisation, creating a porous platform for cell growth. This material, named ALVETEX, has many potential uses: hepatocytes have been grown on it to investigate the toxicity and breakdown of new drugs; cosmetics companies use it to test new products; skin cancer can be modelled using it; tissues have been grown in a ‘vascular’ system to investigate the release of hormones from one tissue and their effect on another; and it has even been used on the international space station to simulate bone regeneration. The development company, originally funded by venture capitalists, was set up at Durham University and was recently sold to a Japanese company, illustrating the way in which many discoveries and technological developments can begin in academia and become commercial enterprises. Stefan’s talk provided an excellent case study for students: from recognising the need for a new product, through to development and refinement, trialling in a variety of applications and finally commercial success.

In **Space flight: a model of human ageing** Professor Stephen Harridge from King’s College London discussed the impact of microgravity experienced by astronauts on their skeletal muscle and whether this is an accurate model for the effects of ageing in muscles. Sarcopenia (the loss of muscle strength experienced in people as they get older) results in a loss of muscle fibres and a reduced cross-sectional area of muscles. These changes are similar to the losses observed in people who are bed-bound for long periods, in intensive care, for example. The difficulty in concluding whether the effects of ageing on muscles are similar to space flight is that inactivity is an additional factor which blurs interpretation and conclusions. Older people who stay active do not experience the same degree of sacropenia and in fact can substantially increase their muscle cross-sectional area through regular, suitable exercise. In the classroom, younger people often make broad generalisations about the elderly, assuming that they are inherently weaker, for example. Using Stephen's research in the classroom would challenge this preconception - as well as emphasising the importance of a less sedentary life style perhaps! In addition the fantastic animations and graphs on muscle contraction and muscle strength would make excellent teaching aids with A level students.

The fourth talk, **Life on Mars**, was from astrobiologist Dr Louisa Preston from Open University. The possibility of life on another planet constantly fascinates young people. By considering extremophiles on Earth it may be possible to consider the species that may survive in the conditions on Mars. In the iron-rich sediments of the Rio Tinto in Spain fossilised bacteria and filamentous, acid-loving algae have been found – organisms that might survive on Mars. In Antarctica ‘water bears’ (tardigrades) survive without oxygen, water and in extreme heat. They have already been to space on the Endeavour space shuttle and survived. All Mars rovers have mass spectrometers to analyse samples to search for biological molecules and in 2012 the Curiosity rover found evidence of river channels, minerals and, most excitingly, organic molecules on Mars (these may be from a meteor or could be evidence of life). Methane levels on Mars fluctuate and sometimes disappear, so could this be due to microbes releasing methane or simply rocks and chemical reactions? In 2018 the ExoMars rover will land on Mars and will look for signs of life or ‘biosignatures’ – something all science teachers might follow and use in their classrooms!

After lunch, in her talk about **Beloved Barnacles**, Miranda Lowe discussed Darwin’s less publicised fascination with barnacles. His interest began on the Beagle and he soon became an avid collector for the British Museum, from whom he demanded one of the newest and most expensive microscopes. He meticulously dissected some of his samples and, with the aid of an illustrator, documented each species he collected, often annotating the boards used to mount samples. Miranda now works on cataloguing Darwin’s barnacles, which is a huge task. He invited other explorers to send samples back too, and a mysterious cataloguing system was used that is yet to be cracked! The collection could be used to demonstrate to students how scientists work/worked, how classification systems have changed now that DNA codes are stored online and of course, to show that Darwin was interested in much more than the Galapagos finches that most textbooks focus on.

Linda Birkin, a PhD student from the University of Sussex, discussed urban biodiversity and citizen science in **Wildlife in Towns**. Urban environments, whether cityscapes and 'concrete cliffs' or managed green spaces such as gardens, graveyards and even road verges, provide valuable and accessible locations for the study of ecology. The factors responsible for an increase in populations of urban foxes and seagulls will fascinate students and succession can be studied on brownfield sites. Citizen science surveys are available on the Natural History Museum website and from organisations such as the RSPB and nature programmes such as Winterwatch. Linda’s own research interest is pollinators and she has designed her own citizen science project ‘Bees n Beans’ to investigate pollination of bean plants. The project is due to run from March to September and an internet search (ljbees.co.uk) can show you how to become involved. This is a valuable project where students can see how their own research builds into a much bigger national survey. The national curriculum now requires an understanding of food security and this might be a great way to encourage their learning.

The final talk of the day was from Professor Tim Guildford from the University of Oxford. His talk on **Wandering Seabirds** provided a real insight into the technology and patience required to truly understand the behaviour of seabirds such as the Manx Shearwater. Geolocation technology, which involves attaching sensors to the birds, records light and time to enable dawn and dusk to be calculated. From this it is possible to plot the position of the birds and it was found that they were migrating from Skomer island off Wales each winter, following a route down the coast of Africa to Argentina and back via the Caribbean. Tim also described studies using sensors that measure salt water immersion to log when the bird is in water, and diving data that can be collected to calculate feeding times. Finally we learnt about how birds might navigate over such long distances. Challenging the traditional theories that in addition to vision, magnetic fields are used by birds to navigate, studies by a colleague, Dr Gagliardo from the University of Pisa, have suggested olfactory cues might be used instead. The most recent research is about to be published and this investigates whether visual or olfactory cues have greater influence over migratory patterns. Animal behaviour often engages learners and the breadth of new information now becoming available through the development of increasingly sophisticated tracking technology will make students aware of how much there is still to discover in the natural world.

The day finished with a video taken from a seabird flying low over the sea and diving into the water to feed, perhaps providing the perfect analogy for the day. It was a great experience for a biology teacher who loves the subject but rarely gets time to become immersed in new research; I had taken a dip into some fascinating areas of current thinking and I left buzzing with ideas I could use in the classroom. From voyages into space, across oceans, back in time and into the future of our ecosystems and our medical treatments, the day was both intellectually stimulating and an amazing mix of specialisms.

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