

Genetics? No Problem!

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When I took over the third year of our Genetics degree programme several years ago, I inherited the weekly two-hour Genetics Problem sessions where students were given traditional genetics problems to resolve. Whilst the content was entirely appropriate, it was undeniably dry, abstract and not entirely inspiring. Consequently, attendance was patchy.

When rewriting the problem sessions, I decided to focus on three of the most important, but sometimes neglected, aspects of bioscience teaching, data-analysis, problem-solving and experimental design. I took inspiration from several sources. My favourite childhood book was *You Are the Ref!*, a comic book approach to learning the rules of football using various plausible (and some rather less plausible) short stories. I've also undertaken lots of Public Engagement work with Glasgow Science Centre (REF1) and have become a great fan of their *Inspire & Challenge* approach. In addition, I've spent much of the last ten years working with Time-Tastical Productions on our Wellcome Trust funded comedy science shows *Zombie Science* (REF2) and *Superhero Science* (REF3). We use a storytelling approach to engage children, teenagers and young adults. Images from the shows, which have been seen by 80,000 and 20,000 people respectively, are shown below (see figure 1).



Figure 1: *Zombie Science* and *Superhero Science*.

For our genetics students the premise is quite simple. If genetics problems are wrapped in an exciting, interesting and informative story, then students should find this more engaging and want to solve the problem by reaching the end of the story. Key aims include developing analytical and problem solving skills as well as investigating experimental design and strategy. Students should also discover that sometimes there is a better argument, rather than a right answer.

Around that time we hosted a *Women in Science Café Scientifique* in Glasgow. Biology is of course unusual among the STEM subjects in that it has no problem in attracting girls to study the subject. Indeed, it's not unusual for 75% of our genetics students to be female (see figure 2). However, this is not the case with senior faculty positions, reflecting issues of retention and progression, and leading to a lack of senior female role models. Having a teenage son and daughter really brings this into focus. Not only do I want my daughter to have the same opportunities as my son, I also want her to believe she has those same opportunities (REF4). So all the problem-solving scenarios have strong and successful female role models. All senior researchers, all professors, are female. Women also play many other key roles, such as the early nineteenth-century pioneering Dutch explorer Captain Faye Matt Laast, whose achievements are rediscovered and celebrated in *The Laast Eagles of Laast Island*.



Figure 2: University of Glasgow Genetics: Class of 2018.

Stories and topics that have been covered in these sessions include *The Legend of Neptune's Cutlass* (an eye condition on August Bank Holiday Island), *The Nuns of Gaborone* (a fatal cattle infection in Botswana), *The Red-Crested Dragons of Mythological Island* (who are close to extinction, but why?), *The Great British Bay Cough* (the re-emergence of a fatal viral infection in modern day California) and *The Roswell Incident* (trying to establish why cold-sensitive aliens have suddenly become cold-tolerant).

This change to a storytelling approach (REF5 & REF6) was praised by Moira Fischbacher-Smith, Assistant Vice-Principal (Learning & Teaching) at the University of Glasgow, in an unsolicited email in response to a proposal to start a storytelling teaching group. *I enjoyed that! What a phenomenal difference between your storytelling approach and the original approach. It's really brilliant. I have read it out to Denis* (he's cooking) – we both want to be geneticists now ☺ Thank you for sending that email. It was a joy and all the more so when compared to the rest of my inbox. *Denis is Moira's husband and Research Chair in Risk and Resilience.*

Another key advantage of these problem-solving sessions is that they can effectively be replicated under examination conditions. This helps us move away from the traditional essay style examinations, and test key skills in data-analysis, problem-solving and experimental design. The exams are in essentially the same style as the in course problem-solving sessions with two key modifications:-

- We provide the students with the introductory page or two of text a week before or so before the examination, so there is little or no pressure of time when they sit the examination. This is particularly useful for students with dyslexia or similar conditions (REF7).
- We are careful to ensure that no questions are dependent on getting the previous question correct (the problem of 'double-jeopardy').

The storytelling assessment approach was specifically praised by our External Examiner (Dr Jonathan Pettitt, University of Aberdeen and Honorary Secretary of the Genetics Society) in his 2016 report. *The diverse range of assessment elements is also to be commended, especially the commitment to developing the students' problem solving skills. This aspect of genetics education are often underdeveloped, with too much emphasis on knowledge acquisition, but the Advanced Studies exam is a good example of how to address this issue. The students to whom I spoke also singled this element out as being among the most enjoyable and rewarding aspects of the course.*

These sessions led directly to the development of what can perhaps be described as the world's first storytelling textbook. *Genetics? No Problem!*, (see figure 3), published by Wiley in March 2017, grows directly from the storytelling, problem-solving sessions developed with our genetics students, comprising thirty scenarios pitched at first, second and third year undergraduates.

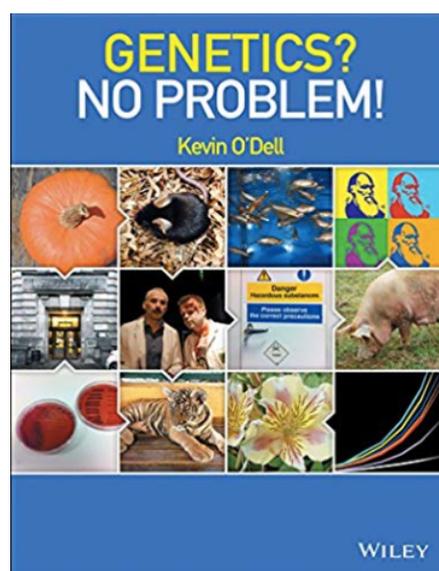


Figure 3: *Genetics? No Problem!*

In his forward to the book, Professor Steve Jones writes:- *I start teaching my first year genetics course at University College London by saying 'I am a geneticist, and my job is to make sex boring'. The students look rather baffled, but after twenty or so lectures, I can tell that they heartily agree. This book should brighten them up again. Instead of just slogging through reams of figures in a lecture or tutorial, each of its many exercises is embedded in a narrative, from illegitimacy to murder and from Bengal Tigers to guinea pigs. Genetics? No Problem! is not about the tedious accumulation of fact, but about a series of worked problems that lay the foundations upon which a sturdy factual edifice can be built. The book goes from the elementary to the advanced, and from plant flower colours to the mythic inhabitants of Titan, taking in some equally fanciful Scottish creatures (albino haggis anyone?) on the way.*

Four stories from the book have been used by Kevin Moffat at the University of Warwick for teaching and public engagement events, whilst *Grandma's Secret* has been published in *Biological Sciences Review*, a magazine hosted by the University of Liverpool that's targeted at 'A' level students.

The book has three 5* reviews on Amazon (REF8). The first states:- *This is an utterly amazing workbook. This sounds banal, it SO isn't. The first conundrum is after finding a suitcase full of cuttings and documents in the attic, you find out your Auntie Brenda may be the love child of your granny and a 60s rockstar. It's surprising how much you want to find out when it's a question of mutated genes causing zombie behaviour compared to your eyes misting over a conventional textbook.*

And from the second 5* review:- *I was prepared to say that this was a dry academic read, but no, O'Dell has thought of that one and presents the study of genetics in a different, and, dare I say it for an academic book on a very complex subject; entertaining way.*

And from the third 5* review:- *A considerably well thought out book dealing with genetic conundrums, mysteries and problem solving. The author really explains the whole mechanics of genetics almost covertly within an interesting scenario which doesn't simply provide the answers within the same situation but requires you to work through the science involved.*

From my perspective as the course co-ordinator, I can reflect on the success these problem-solving sessions over the last few years. The storytelling, problem-solving approach has clearly works, but there are other benefits too. Over 40 staff teach on our course, so the advantage of having a weekly interactive teaching session with the students, where we can pull all the material together in a coherent fashion, cannot be underestimated. The sessions also allow us respond to staff and student feedback, so we can address issues and misunderstandings as and when they arise. These sessions continue to evolve.

Inspiration (References).

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