

**Impact case study (REF3b)**

<p><b>Institution:</b> University of Glasgow</p>
<p><b>Unit of Assessment:</b> Unit 5; Biological Sciences</p>
<p><b>Title of case study:</b> Zombie Institute for Theoretical Studies: effectively engaging young people with bioscience</p>
<p><b>1. Summary of the impact</b></p> <p>Young adults are a notoriously difficult group to engage in science education – but how do they react to a ‘<i>Theoretical Zombiologist</i>’ from the University of Glasgow’s ‘<i>Zombie Institute for Theoretical Studies (ZITS)</i>’? Using an innovative platform to target the delivery of complex biomedical science to young people, the ‘Zombie Science’ comedy show has effectively engaged more than 26,000 young people and adults at more than 300 events, touring festivals and secondary schools around the UK. More than 90% of the audience members indicated that they had learnt something new about biosciences from the show. The show has received positive, enthusiastic reviews – lifting science from the pages of a textbook and bringing it, literally, back to life.</p>
<p><b>2. Underpinning research</b></p> <p>Dr Kevin O’Dell at the University of Glasgow, has had a research career in genetics spanning 30 years which revolves around the use of <i>Drosophila</i> (a type of fruit fly) as a model organism to link phenotype with genotype.<sup>1-4</sup> O’Dell’s research investigating the genetic basis of sex-specific behaviour in <i>Drosophila</i> complemented the molecular genetics skills of Professor Kim Kaiser, leading to publications which identified brain domains and the structures directing sex-specific behaviour.<sup>1</sup></p> <p>The success of this project led directly to the opportunity to develop whole-organism <i>Drosophila</i> models of human genetic disorders. For example, O’Dell’s expertise in identifying and characterising mutant phenotypes at the whole organism level was invaluable in the creation, with Professor Darren Monckton, of <i>Drosophila</i> models of the human muscle wasting disease Myotonic Dystrophy.<sup>2</sup></p> <p>A research collaboration with Professor Howy Jacobs also identified behavioural characteristics in <i>Drosophila</i> associated with a genetic abnormality in mitochondria. By defining these characteristics for the first time, this team showed they could be resolved by mating chosen generations to select against the genetic abnormality.<sup>3</sup> In 2009 this approach was extended to successfully reveal strategies and pathways that might be used in the development of treatments for disease-inducing genetic abnormalities.<sup>4</sup></p> <p>Based on this track record, O’Dell was invited to lecture at the prestigious annual Cold Spring Harbor residential course on <i>Drosophila</i> Neurobiology, where he presented a day-long session on his research on sex-specific behaviour in <i>Drosophila</i> each year from 1999 to 2004. It was clear from these sessions that O’Dell was not only an authority on <i>Drosophila</i> genetics but had exceptional presentational skills. As a result of this he was encouraged by the then head of the Institute of Biomedical and Life Sciences of University of Glasgow, Professor Paul Hagan, to develop outreach programmes that would utilise his skills in both genetics and communication to engage young adults with the world of genetics. Taking advantage of this opportunity, O’Dell produced the highly innovative Zombie Science shows which have been recognised by two Wellcome Trust public engagement funding awards (2010 and 2012; see details in section 3). As an extension to his commitment to public engagement with science, since 2009, O’Dell has been an active co-organiser of a successful series of the Glasgow Café Scientifique. Moreover, O’Dell’s outreach work led to his appointment to the editorial board of the Biological Sciences Review journal – a magazine specifically targeted at teenage school students (A/AS/Higher level) which publishes articles by contemporary researchers on all aspects of biology. Two recent papers illustrating O’Dell’s contributions to this journal are provided in section 3.<sup>5,6</sup></p> <p><b>Key University of Glasgow researchers:</b> Kevin O’Dell (Senior lecturer [(1989-present)]; Howy</p>

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Jacobs (Professor of Molecular Genetics [1984-2002], subsequently moved to IMT Tampere, Finland); Kim Kaiser (Professor of Neurogenetics [1994-2004]) & Darren Monckton (Professor of Human Genetics [1996-present]).

### 3. References to the research

1. KMC O'Dell, JD Armstrong, MY Yang, & K Kaiser. (1995). [Functional dissection of the \*Drosophila\* mushroom bodies by selective feminisation of genetically defined sub-compartments.](#) *Neuron* 15: 55-61. doi:10.1016/0896-6273(95)90064-0
2. JM Houseley, Z Wang, GJR Brock, J Soloway, R Artero, M Perez-Alonso, KMC O'Dell & DG Monckton. (2005) [Myotonic dystrophy associated expanded CUG repeat muscleblind positive ribonuclear foci are not toxic to \*Drosophila\*.](#) *Human Molec. Genet.* 14: 873-883. doi: 10.1093/hmg/ddi080
3. Kempainen E *et al.* [Phenotypic suppression of the \*Drosophila\* mitochondrial disease-like mutant \*tko\*<sup>25t</sup> by duplication of the mutant gene in its natural chromosomal context.](#) *Mitochondrion* 2009; 9: 353-363. doi: 10.1016/j.mito.2009.07.002.
4. Fernandez-Ayala DJM *et al.* [Expression of the \*Ciona intestinalis\* Alternative Oxidase \(AOX\) in \*Drosophila\* Complements Defects in Mitochondrial Oxidative Phosphorylation.](#) *Cell Metabolism* 2009; 9: 449-460. doi: 10.1016/j.cmet.2009.03.004.
5. O'Dell KMC. Why the Fly?. *Biol. Sci. Rev.* 2011; 23(3): 2-5.
6. O'Dell KMC. Blame Your Parents. *Biol. Sci. Rev.* 2012; 24(3): 26-29.  
*PDF copies of references 5 & 6 are available on request.*

#### **Wellcome Trust Public engagement grant funding**

- Wellcome Trust People's Award. Zombie Science 1Z. O'Dell KMC (PI), White K, Low A & Macdonald D, Oct 2010 - July 2011, £30,000.
- Wellcome Trust Society Award. Zombie Institute for Theoretical Studies: Public Engagement Project. O'Dell KMC (PI), White K, Low A & Macdonald D, August 2012 - July 2015, £150,000.

### 4. Details of the impact

University of Glasgow research expertise has constructed a credible bioscience foundation for the innovative and hugely successful 'Zombie Science'<sup>a</sup> programme, which entertains, inspires and educates young people in biological science within a broad genetics theme. Zombie Science engages young people through spoof tutorials on how to deal with a hypothetical zombie epidemic, thereby stimulating their interest in the underpinning biomedical science. The project has far exceeded predicted audience numbers, with direct engagement of more than 26,000 audience members at over 300 events in secondary schools and festivals for comedy, science and horror across the UK (February 2011 to July 2013)<sup>b</sup>, consistently receiving positive reviews from audience participants and the media.

#### **Delivering a scientifically accurate bioscience content**

The original version of the show 'Zombie Science 1Z' was developed in 2010 through a collaboration between Dr O'Dell and Time-Tastical Productions, a Glasgow based production company which has been creating and delivering science engagement shows since 2009. Aware of O'Dell's unique combination of experience in biomedical research and public engagement, Time-Tastical Productions approached O'Dell to seek his involvement in a biomedically-based production. This partnership led to the successful development of 'Zombie Science 1Z', centred on the biological science education of both young people and adults. Dr O'Dell's involvement in this show was pivotal to the scientific accuracy and design of the content and to securing initial Wellcome Trust funding.



#### **Culturally relevant show engages thousands of young people**

'Zombie Science 1Z' employs a unique approach to engage young people with complex scientific topics, by exploiting familiarity with literature, films and video games about the 'undead' and a

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hypothetical condition labelled 'Zombieism'. The format of the show is a spoof lecture featuring multimedia elements and live demonstrations. 'Doctor Austin', a Theoretical Zombiologist at the University of Glasgow's Zombie Institute for Theoretical Studies (ZITS) is the 'scientist', a character designed to challenge the preconceptions of 'nerd' scientists held by the target audience of young adults. By using comedy as a tool for science communication, audiences are guided through a process of scientific problem solving, in which the 'zombie' is presented as a model system exhibiting marked observable characteristics. Dr O'Dell has developed much of the accurate scientific content around his own work. For example, his studies of *Drosophila* with genetic abnormalities directly informs the 'module' of 'Zombie Science 1Z' that examines why some people might be more susceptible to Zombieism. The performance and the associated 'Course Notes' stimulate young people to think about how a new disease is identified, how it is treated, how infection can be controlled and how cures are developed – consequently educating them in genetics, viruses, infectious diseases and prion disease. The course notes include information on how fruit flies may be used as models to recognise and potentially cure an infectious condition in humans. To quote the course notes:

*“An excellent way to test such a theory [that humans maybe be genetically resistant to infection] is by using fruit flies. These amazing little insects share about 70% of their genes with us, and it's likely that the gene that could make some of us humans resistant to Zombieism could also be found in our fruit flies. By conducting some fiendishly clever DNA manipulation in our fruit flies, we'll try to generate flies that are resistant to Zombieism.”* (from *Zombie Science: Worst Case Scenario* course notes, p13).

This approach clearly reflects O'Dell's research strategy to exploit flies as models of human genetic disease, communicating the concept that genetic abnormalities result in observable characteristics. The show maintains an optimal balance between delivering an accurate explanation of complex science, and providing entertainment which captures and holds the interest of the primary target audience: young people aged 11-18.



Subsequent funding from a 3-year Wellcome Trust Society Award in 2012 enabled the development of three new Zombie-themed biomedical shows.

The first of these new shows, '*Zombie Science: Worst Case Scenario*', premiered at the London Horror Festival in October 2012. From written feedback forms<sup>c</sup>, 96% of respondents felt that they learned something new about biomedical science and 72% thought they would explore the subject further as a result of the show. This demonstrates extremely effective initial engagement, and 62% of the respondents agreed to give their details for a follow-up evaluation questionnaire. In addition, the project has attracted a significant amount of positive coverage in the media, including the Times Higher Education magazine and performance review articles, which has helped to broaden the audience<sup>d</sup>. The show has expanded its audience reach with performances at the Brighton Science Festival (February 2013, 187 audience members)<sup>e</sup> and the Green Man Festival (Wales, August 2013, 530 audience members).<sup>f</sup>

To encourage the audience to think about the science after attending a show, they are invited to visit the *Zombie Science* website and sit a multiple choice exam that is based on information, including aspects of the science, within the show. Drawing again on the theme of a genetic basis for zombieism and stimulating students to think about fundamental aspects of genetics the following multiple choice questions are included in the *Zombie Science Worst Case Scenario* exam : 'Your genome is like a genetic 'Book of You' with chapters we call chromosomes, but how many pairs of these chromosomes do you have? A) 23, B) 22, C) 32' (question 2). Similarly Question 5 reads 'Gathering a person's DNA and determining their entire DNA code is called DNA sequencing. The first complete Human DNA sequence was revealed in 2001. How long did it take researchers to do it? A) 13 years, B) They are still at it now, C) 13 minutes'.

### **Raising aspirations of pupils in areas of social disadvantage**

The original '*Zombie Science 1Z*' project, supported by a Wellcome Trust Peoples Award, resulted in direct engagement with 10,060 audience members (adults and young adults) during 130 lectures

at over 40 events in schools and festivals over a 10 month period<sup>b</sup>. School performances were specifically directed towards urban areas in a bid to raise aspirations of students from disadvantaged backgrounds. The team achieved this aim by delivering the show to 7,864 secondary school students (aged 11-18) in the Glasgow City Council district. An average of 60% of the student population in these schools visited came from the most deprived households (according to Scottish Government MD20 criteria). Feedback from teachers has been uniformly positive, with comments such as *'Entertaining, informative, funny'* and *'A fabulous show that captivated the interest of our pupils'*. Since its introduction in October 2012, the *'Zombie Science: Worst Case Scenario'* show has been performed to almost 15,000 people, 90% of which were secondary school students<sup>b</sup>. Similarly, evaluation of the show by teachers has confirmed the success of the engagement<sup>g</sup>; 88% agreed that the show had had a positive impact on the pupils and 94% rated the scientific content of the show and online materials as good or excellent (responses obtained from a total of 17 schools). Voluntary additional comments on the show's influence included *'Senior pupils [have been] asking about suitable courses to study biology as they have seen zombie science event set up at school'*, *'Pupils are still taking [sic] about how much they enjoyed it and the fun they had'* and *'The "hook" of zombieism and the excellent entertaining delivery helps get the messages across'*. When specific views on the impact were surveyed, over 70% of teachers agreed that the show and online materials had supported them in their teaching of genetics to pupils with one teacher reporting *'I gained more background knowledge and would be more confident to teach genetics'*.

**Extending the reach through significant online presence**

Supporting materials include free 'course notes' distributed at the performances, a website and a Facebook page. Through online interaction at the Zombie Science website, 1,700 visitors have completed the online 'exam' based on the science within the show (February 2011 to July 2013)<sup>b</sup>. The website also hosts a blog where scientific queries about the show are answered, with Dr O'Dell providing the scientific input. Over 55% of the current Zombie Science Facebook users are between 13 and 24 years of age; the page has had 1,650 'likes' since its establishment in 2012.<sup>h</sup>

**5. Sources to corroborate the impact**

- a. [Zombie Science Website](#) – content of the *'Zombie Science 1Z'* and *'Zombie Science: Worst Case Scenario'* shows, link to the course notes, online exam and blog.
- b. Audience information and show numbers, and number of online exam completions (February 2011 to 31<sup>st</sup> July 2013) were obtained through personal communication with Time-Tastical productions – all data are available on request.
- c. Audience feedback from London Horror Show – Audience evaluation of *Zombie Science: Worst Case Scenario* from audience members (main age group 25-34) in October 2012 - available on request
- d. Selected media coverage of *Zombie Science*
  - [Edinburgh Spotlight](#)
  - [Times Higher Education](#)
  - [EDP24 Theatre Review](#)
- e. [Brighton Science Festival - Zombie Science showing](#) – February 2013
- f. [Green Man Festival – Zombie Science showing](#) – August 2013
- g. School evaluations – Audience evaluation of *Zombie Science: Worst Case Scenario* from secondary school teachers conducted by Time-Tastical Productions - available on request.
- h. [Zombie Science Facebook Page](#), 1,650 'likes' on 31/07/13.