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| Institution: University of Sheffield |
| Unit of Assessment: 3C – Allied Health Professions: Biomedical science |
| Title of case study: <i>The Great Sperm Race</i> – encouraging public understanding of human reproduction. |
| <p>1. Summary of the impact (indicative maximum 100 words)</p> <p>Research conducted at the University of Sheffield between 1992 and 2006 was developed into a film (<i>The Great Sperm Race</i>) for Channel 4, distributed by ITV global media and shown on television in twenty-two countries between 2009 and 2010. The film had critical reviews in the national media (e.g. <i>The Daily Mirror</i>, <i>The Metro</i>) and stimulated public debate via its global distribution.</p> <p>An on-line game developed to support the film has been played over ten million times with excellent feedback about its educational value. The film won several television and film awards around the world and this helped the production company prosper and go on to make ground-breaking films in other areas.</p> |
| <p>2. Underpinning research (indicative maximum 500 words)</p> <p>From 1992 to 2006, Dr Allan Pacey (University of Sheffield since 1992) and his research team in the Department of Human Metabolism at the University of Sheffield undertook research focused on the basic biological processes of human sperm transport through the male and female reproductive tracts and on the molecular and cellular basis of sperm function and male fertility.</p> <p>In 1992, with funding from Birthright – now called Wellbeing of Women – the charitable arm of the Royal College of Obstetricians and Gynaecologists, and working with PhD student Jianjun Zhu, Pacey used a tissue-culture model to show that the secretions from the inner cell layer of the Fallopian tube helped to prolong sperm survival beyond that normally seen in tissue culture [R1]. Pacey and Zhu went on to show that the sequence of fluids from the female reproductive tract that sperm have to pass through on their journey are critical to ensure that the successful sperm have optimum physiology by the time they reach the egg [R2].</p> <p>In 1994, Pacey was awarded a three-year project grant from the Medical Research Council to investigate how the human fallopian tube might act as a sperm-storage site in the pre-ovulatory period. Using tissue culture and electron microscopy, Pacey was able to demonstrate the very first descriptions of the physical interaction made between human sperm and the cell layer that lines the inside of the fallopian tubes [R3]. With Helen Baillie (Research Assistant at Sheffield, 1994-97), he showed that the part of the fallopian tube closest to the uterus (called the isthmus) potentially stored the most sperm and that female hormones (which obviously vary across the menstrual cycle) did not alter the number of sperm that were stored [R4]. Pacey also found that to release themselves from this storage site, sperm must exhibit a characteristic and particularly vigorous form of movement (called hyperactivation) [R5].</p> <p>In 2000, Pacey worked with PhD student Louise Reeve to investigate the molecular mechanism of how sperm might be stored in the isthmus region of the fallopian tube. They found that a class of molecules called integrins were probably involved in tethering sperm to the inner surface of the fallopian tube at the storage site [R6].</p> |
| <p>3. References to the research</p> <p>University of Sheffield researchers shown in bold</p> <p>R1. Zhu, JJ, Barratt, C.L.R., Lippes, J., Pacey, A.A., Lenton, E.A., Cooke, I.D. (1994) Human oviductal fluid prolongs sperm survival. <i>Fertility and Sterility</i> 61: 360-366.</p> |

- R2.** Zhu, J.J., Barratt, C.L.R., Lippes, J., Pacey, A.A., Cooke, I.D. (1994) The sequential effects of human cervical mucus, oviductal and follicular fluid on sperm function. *Fertility and Sterility* 61: 1129-1135.
- R3.** Pacey, A.A., Hill, C.J., Scudamore, I.W., Warren, M.A., Barratt, C.L.R., Cooke, I.D. (1995) The interaction of human spermatozoa with epithelial cells from the human female uterine tube in vitro. *Human Reproduction* 10: 360-366.
- R4.** Baillie, H.S., Pacey, A.A., Warren, M.A., Scudamore, I.W., Barratt, C.L.R. (1997) Greater numbers of human spermatozoa associate with endosalpingeal cells derived from the isthmus compared with those from the ampulla. *Human Reproduction* 12: 1985-1992. doi: [10.1093/humrep/12.9.1985](https://doi.org/10.1093/humrep/12.9.1985)
- R5.** Pacey, A.A., Davies, N., Warren, M.A., Barratt, C.L.R., Cooke, I.D. (1995) Hyperactivation may assist human spermatozoa to detach from intimate association with the endosalpinx. *Human Reproduction* 10: 2603-2609.
- R6.** Reeve, L., Ledger, W.L., Pacey, A.A. (2003) Does the Arg-Gly-Asp (RGD) adhesion sequence play a role in mediating sperm interaction with the human endosalpinx? *Human Reproduction*. 18: 1461-1468. doi: [10.1093/humrep/deg296](https://doi.org/10.1093/humrep/deg296)

4. Details of the impact

The research by Pacey has had an impact on society through a public debate on human reproduction generated by a film called *The Great Sperm Race*.

Process to impact

As a result of his expertise in human fertility research Pacey was approached by a UK production company (Blink Television) in 2008 to help make a film called *The Great Sperm Race* [S1]. A consultancy contract was agreed with the University of Sheffield formalising the arrangement whereby Pacey would give advice to the producer and director over the script and shooting of the film (as well as appearing on screen). The script was based on the papers [R1 to R6] in addition to an invited review written by Pacey and Suarez (Cornell University), published in *Human Reproduction Update*. Pacey also helped in developing on-line resources for the Channel 4 website including an on-line game made by a small independent game developer in London, called Johnny Two Shoes, and 'Fertility Tips for Men', a short article authored by Pacey and available from the Channel 4 website.

Impact on society – public debate informed by research

The first UK broadcast of the film was on 23 March 2009 on Channel 4, where it was listed by *The Daily Mirror* and *The Sunday Times* TV critics as *Pick of the Day* and *Pick of the Week*, respectively. It was subsequently shown in Canada on 28 June 2009, France 5 December 2009 (where it was known as *Spermatozoïdes, que le meilleur gagne!*), Australia on 10 January 2010, and Finland on 22 April 2010 [S1, S2]. The estimated UK audience was almost 1.7 million viewers and the worldwide audience in the region of 10 million viewers [S1]. The film received many critical reviews in the media including:

"Lovely and packed with information – this should be a staple part of sex-education lessons"
The Sunday Times (Pick of the Week) [S1]

"Inventive, fun to watch and terrifically informative" *Radio Times* [S1]

"It's probably the best science lesson you'll ever have" and "my reproductive knowledge has been significantly enhanced by *The Great Sperm Race*; it contains a few interesting factoids that may help couples trying to conceive" OntheBox.com [S3].

“No nut was left unbusted in a highly entertaining romp that should be made compulsory viewing on the national biology curriculum” *The Metro* [S4].

“As far as Woody Allen is concerned in his movie *Everything You Ever Wanted To Know About Sex...* it's a comical journey. But according to this unusual documentary, the heroic struggle of sperm to achieve their glorious goal is more like a disaster movie, with impossible odds and a battlefield strewn with the bodies of millions of casualties.” *The Daily Mirror* Pick of the Day [S5].

It is clear from the number of informal blogs, forums and websites that discuss the film and its associated on-line resources that they have increased debate and improved public understanding of issues related to reproductive medicine. More personal comments come from the entries from individual viewers on bulletin boards associated with pregnancy and infertility, such as pregnancyforum.co.uk [S6, S7, S8], with comments such as:

“An amazing documentary showing how sperm gets to the egg. They scale the sperm up to human size to make it easier to understand. Really worth watching!” CholeNat 2011.

“you can see now why it can take so long to conceive!” Bellarina from Wales.

The on-line resources developed for the Channel 4 website [S9] are still being used today and the game produced with Johnny Two Shoes has been played nearly 10.5 million times since March 2009 [S10]. To date, over 400 comments have been left by people playing the game [S9] including:

“A friend at school found this game at school and played it during Science class last year. Really fun game.” Alex Smapons on 23 February 2013.

“keegan simpson and I love this game so much keegan does not under stand a lot about sex education and this game really helps him understand.” james bignell on 29 January 2013.

“THIS GAME IS ANAZING! MY FREINDS IN PSHE WERE (sic) LAUGHING AND LEARNING! GREAT GAME FROM ALL AT GREENACRE SCHOOL!” Jordan on 23 November 2012.

“This game is very good, educational and fun.” shawr on 05 March 2012.

“This is a wicked game and its very educational.” thefootballstig on 24 January 2011.

As a mark of its success, the film was nominated for a Royal Television Society award in 2010 and won a Canadian Society of Cinematographers award in 2009 for the best “Docudrama Cinematography” and an Academy of Canadian Cinema and Television, Gemini Award in 2010 for the Best Science Documentary [S1, S2]. These awards have helped Blink Films to go on and prosper as a production company and make further ground-breaking films in other areas [S1].

5. Sources to corroborate the impact

S1. Letter from Executive Producer and Managing Director of Blink Films

S2. Details of the Great Sperm Race film and cast (including Pacey) can be found at:
http://www.imdb.com/title/tt1461416/?ref=fn_al_tt_1

- S3.** Onthebox.com review of Channel 4 screening of the Great Sperm Race in 2009.
<http://channelhopping.onthebox.com/2009/03/23/the-great-sperm-race-review-come-again/>
- S4.** The Metro review of Channel 4 screening of the Great Sperm Race in 2009.
<http://www.metro.co.uk/metrolife/592744-inside-the-box-the-great-sperm-race>
- S5.** The Daily Mirror Pick of the Day review of Channel 4 screening of the Great Sperm race in 2009. <http://www.mirror.co.uk/tv/tv-previews/pick-of-the-day-the-great-sperm-race-384093>
- S6.** Pregnancyforum.co.uk recommendation of the film. <http://www.pregnancyforum.co.uk/trying-to-conceive/217537-great-sperm-race-documentary.html>
- S7.** Recommendation and discussion of the film and game on fertility blog, The Pitter Patter.
<http://thepitter-patter.blogspot.co.uk/2009/05/great-sperm-race.html>
- S8.** Recommendation and discussion of the film on Huggies Forum, Australia.
<http://www.huggies.com.au/forum/4-pregnancy-birth/37-planning-for-pregnancy/2681269-the-great-sperm-race>
- S9.** Link to Channel 4 The Great Sperm Race online game presented alongside a short accompanying article by Pacey, 'Fertility Tips for Men'.
<http://www.channel4.com/programmes/the-great-sperm-race>
- S10.** A document from Johnny Two Shoes showing website statistics and the number of 'plays' of the game, March 2009–May 2013.