Contents

Part A: Outputs, reports, metrics, activies

1. Publications

1.1. Full publications

- Illingworth, S., Prokop, A. (2017). Science communication in the field of fundamental biomedical research (editorial). *Sem Cell Dev Biol* **70,** 1-9 -- [LINK]
- Patel, S., Prokop, A. (2017). The Manchester Fly Facility: Implementing an objective-driven long-term science communication initiative. *Semin Cell Dev Biol* **70,** 38-48 -- [LINK]
- Patel, S., DeMaine, S., Heafield, J., Bianchi, L., Prokop, A. (2017). The droso4schools project: long-term scientist-teacher collaborations to promote science communication and education in schools. *Semin Cell Dev Biol* **70,** 73-84 -- [LINK]
- Roote, J., Prokop, A. (2013). How to design a genetic mating scheme: a basic training package for *Drosophila* genetics. *G3 (Bethesda)* **3,** 353-8 -- [LINK]
- Fostier, M., Patel, S., Clarke, S., Prokop, A. (2015). A novel electronic assessment strategy to support applied *Drosophila* genetics training on university courses. *G3 (Bethesda)* **5,** 689-98 -- [LINK]
- Prokop, A. (2016). Fruit flies in biological research. *Biological Sciences Review* **28,** 10-14 -- [LINK]
- Harbottle, J., Strangward, P., Alnuamaani, C., Lawes, S., Patel, S., Prokop, A. (2016). Making research fly in schools: *Drosophila* as a powerful modern tool for teaching Biology. *School Science Review* **97,** 19-23 -- [LINK]
- Patel, S., Prokop, A. (2015). How to develop objective-driven comprehensive science outreach initiatives aiming at multiple audiences. *bioRxiv* 10.1101/023838 -- [LINK]

1.2. Published resources

- Prokop, A., Patel, S. (2016). Resources for communicating *Drosophila* research in schools and on science fairs. *figshare***,** 10.6084/m9.figshare.4262921 -- [LINK]
- Prokop, A., Patel, S. (2015). Biology lessons for schools using the fruit fly *Drosophila*. *figshare,* m9.figshare.1352064 -- [LINK]
- Prokop, A. (2013). A rough guide to *Drosophila* mating schemes. *figshare***,** m9.figshare.106631 -- [LINK]
- Prokop, A. (2013). 2nd year *Drosophila* developmental genetics practical. *figshare***,** m9.figshare.156395 -- [LINK]
- Manchester-Fly-Facility (2013) For the public: Outreach resources -- [LINK]
- ManFly (2015). Manchester Fly Facility Resources. *figshare***,** 10.6084/m9.figshare.1328031 -- [LINK]
- Small fly: Big Impact, Part 1 Why the fly (educational YouTube video) -- [LINK]
- Small fly: Big Impact, Part 2 Making Research Fly (educational YouTube video) -- [LINK]
- Fly vs. Mite (online Scratch computer game) -- [LINK]
- droso4schools: bringing *Drosophila* back into classrooms (YouTube video about the project) -- [LINK]
- Further short films on the Manchester Fly Facility YouTube channel -- [LINK]

1.3. Webpages:

- Manchester Fly Facility / For the public (worldwide only resource page for *Drosophila* science communication, listing also all activities by the Manchester Fly Facility) -- [LINK]

- droso4schools (site accompanying the droso4schools project)-- [LINK]
- Fly Indonesia (official website supporting the collaboration between Firzan Nainu and the Manchester Fly Facility aiming to establish Drosophila research as an efficient and cost-effective model in Indonesia) -- [LINK]
- Brain Box (website accompanying the Brain Box science fair in June 2016 with >5K visitors; A. Prokop as key organiser) -- [LINK]

1.4. Blogs

- Prokop, A. (2017). Communicating basic science: what goes wrong, why we must do it, and how we can do it better. *In* "PLOS | BLOGS" (J. Organ, Ed.). PLoS -- [LINK tba]
- Prokop, A. (2017). Science communication in the biomedical science: challenges, opportunities and new approaches. NCCPE blog -- [LINK]
- Prokop, A. (2015) "Why do we have to learn this stuff?"- Establishing *Drosophila* as a modern teaching tool in schools - Guest blog for "Fly on the wall" (2 Feb) -- [LINK]
- Prokop, A. (2015) Bringing life into biology lessons: using the fruit fly *Drosophila* as a powerful modern teaching tool - Guest blog for "Pedagoo.org" (20 Aug) -- [LINK]; mirrored and regularly updated on "Gedankenexperimente" -- [LINK]
- Prokop, A. (2015) Maintaining a strong *Drosophila* community - starting with students - Guest blog for "Genes to Genomes (Genetics Society of America)" (3 March; this blog is currently being used as the key advocacy resource on flybase.org) -- [LINK]; mirrored on "Gedankenexperimente" -- [LINK]

1.5. Conferences and Seminars

- Prokop, A. (2017) *Drosophila* as an efficient and cost-effective replacement strategy for discovery processes in the biomedical sciences. The University of Manchester 3Rs Symposium, Manchester (30 Oct) -- [LINK]
- Prokop, A. (2016) Why and how to communicate fly research. Resources for the *Drosophila* Community (Org.: D. Bilder), Janelia Farm (Feb) -- [LINK]
- Prokop, A. (2015) A comprehensive strategy to communicate *Drosophila* research to the public [F1000Research 4, 820; slide presentation; v1; not peer reviewed]. 24th Europ *Drosophila* Res Conference (Org.: B. Edgar, I. Lohmann, A. Teleman, A. Ephrussi, E. Furlong, M. Leptin, M. Boutros), Heidelberg (09-12 Sept) -- [LINK]
- Prokop, A. (2016) “Communicating science communication example: Manchester Fly Facility outreach initiative”, Engagement@Manchester (16 Jan)
- Prokop, A. (2014) A concept for objective-driven science outreach: promoting *Drosophila* research through multifaceted, audience-specific strategies. Manchester Fly Club Seminar Series (Oct) -- [LINK]
- Prokop, A. (2015) "A comprehensive strategy to communicate *Drosophila* research to the public" (Chicago, American *Drosophila* Research Conference, March) -- [LINK]

2. Reports about the Manchester Fly Facilty and its work

2.1. External

- Get to Know Neuroscience at The University of Manchester (Makassar Tribun; 29/06/17) [LINK]
- The birth of nerves (BBSRC Blog) -- [no longer online]
- Research unravels nerve-wiring process (BBSRC Blog) -- [no longer online]
- The portrait of a fly (Part 1) (Wellcome Trust Blog) -- [LINK]
- The portrait of a fly (Part 2) (Wellcome Trust Blog) -- [LINK]

- A Research Update from the University of Manchester (Epilepsy research UK) -- [LINK]
- A how-to manual for fruit fly research has been created (Cambridge University News) -- [LINK]
- Struggling with your fly? Why not try reading the manual? (Science Omega) -- [no longer online]
- The scholarly kitchen: Small Fly, Big Impact: A History of Drosophila Research (and Why It Matters) -- [LINK]

2.2. Local

- Why use flies (FLS Internal_Bulletin; July 2012)
- Public engagement and the fruit fly (FLS Internal_Bulletin; Nov 2013)
- Fly Outreach Activity (FLS Newsletter; Issue 30 /Spring 2014)
- The Manchester Fly Facility: supporting and promoting *Drosophila* as a modern research and teaching tool (FLS Internal_Bulletin; Nov 2014)
- World first for Fly Research (UniLife) -- [LINK]
- Flies can make a buzz in schools (UoM page) -- [LINK]
- AGGS newsletter: Fly Lab -- [LINK]

3. Metrics

metrics from 16/11/2017				
site (launch date)	**views**	**visitors**	**Downloads**	**Altmetric**
droso4schools (04/15 - LINK)	**~33.2K**	**~17.2K**	**n.a.**	**n.a.**
Manchester Fly Facility (~Feb 2013 - LINK)	**~46.5K**	**~16.9K**	**n.a.**	**n.a.**
Figshare: Biology lessons (24/03/15 - LINK)	**>2.5K**	**n.a.**	**610**	**21**
Figshare: Mating scheme (16/01/13 - LINK) ** main article in G3 [LINK]*	**~19.6K** ***~37.4K**	**n.a.**	**~9.9K** ***~7.8K**	**57** ***33**
Figshare: 2nd Yr practical (10/02/13 - LINK)	**11K**	**n.a.**	**>7.9K**	**33**
Figshare: Outreach (27/11/16 - LINK)	**~2K**	**n.a.**	**187**	**102**
Figshare: Man Fly resources (07/03/15 - LINK)	**~5.2K**	**n.a.**	**~5.7K**	**n.a.**
YouTube film 1 (20/12/14 - LINK)	**>12K**	**n.a.**	**n.a.**	**n.a.**
YouTube film 2 (01/04/15 - LINK)	**~6K**	**n.a.**	**n.a.**	**n.a.**
BioRxiv article (05/08/15 - LINK)	**>2.7K**		**538**	**32**

4. Activities

4.1. Science fairs

- Science Uncovered / European Researchers Night, Manchester Museum, 29th Sept 2017
- Celebration of Philanthropy Showcase, University of Manchester, 6 April 2017
- Manchester Science Festival, Manchester Museum, 21 Oct 2017
- Body Experience, Manchester Museum, 18 March 2017
- National Student Conference, University Place, Manchester, 11 Feb 2017
- Behind the scenes of Manchester, Faculty of Life Science, 27 July 2016
- Brain Box, European City of Science event on Manchester Day, Manchester Town Hall, 19 June 2016
- Body Experience, Manchester Museum, 19 March 2016
- Community Open Day, Faculty of Life Sciences, University of Manchester, 9 May, 2015
- Manchester Science Festival, Manchester Museum, 25 Oct 2014
- Community Open Day, Faculty of Life Sciences, University of Manchester, 28 June 2014
- Wellcome Trust Brain Collection exhibition, MOSI, 2 Nov 2013
- Community Open Day, Faculty of Life Sciences, University of Manchester, 6 July 2013
- Body Experience, Manchester Museum, 16 March 2013
- Manchester Science Festival, Manchester Museum, 27 Oct 2012
- Community Open Day, Faculty of Life Sciences, University of Manchester, 30 June 2012
- Body Experience, Manchester Museum, 17 March 2012
- Manchester Science Festival, Manchester Museum, 29 Oct 2011
- Community Open Day, Faculty of Life Sciences, University of Manchester, 4 July 2011

4.2. School visits

- Animal Research Day, FBMH, Manchester University – 7 Dec 2017
- Discover Life Sciences Event, FBMH, University of Manchester – 28/29 Jun 2017
- Loreto sixth form college – 19 May 2017
- Manchester Grammar – 16 May 2017
- Trinity School, Manchester – 8 May 2017
- Animal Research Day, FBMH, Manchester University – 29 March 2017
- Withington Primary School – 23 March 2017
- Loreto sixth form college – 27 March 2017
- Manchester Grammar – 21 March 2017
- Loreto sixth form college, Manchester – 13 March 2017
- British Science Week, University of Manchester -14 to 17 March 2017
- Loreto sixth form college, Manchester – 19 Jan 2017
- Trinity School, Manchester – 16 Dec 2016
- Audiolab Project, Manchester- 1 Nov 2016
- Altrincham Grammar School – 11 Oct 2016
- Loreto Sixth Form College - 6 Oct 2016
- 9 month collaboration with Trinity CoE High School and Loreto Sixth Form College within the droso4schools project – Aug 2016 to June 2017
- Y12 Mini Summer School, Faculty of Life Sciences – 25 July 2016
- Y10 Work Experience Programme – 18 July 2016

- Discover Life Sciences Event, Faculty of Life Sciences, University of Manchester – 12 July 2016
- Visit of school pupils from Denmark, Faculty of Life Science – 27 April 16
- Ryburn Valley High, Fly Facility, 15 April 2016
- St John's RC Primary School, 05 April 2016
- Ormiston Bolingbroke Academy, Fly Facility – 22 March 2016
- British Science Week, University of Manchester -11 to 20 March 2016
- Acacias Community Primary School – 27 Jan 2015
- Discover Life Sciences Event, Faculty of Life Sciences, University of Manchester – 1 Dec 2015
- Kings' School, Chester, Genetics Roadshow – 19 Nov 2015
- St Peter's High School, Manchester – 19 Nov 2015
- Aquinas College, Stockport- 02 Nov 2015
- Cardinal Newman College, Lancashire, Collaboration – Nov 2015
- Nelson & Colne College, Nelson – 06 Oct 2015
- Year 12 Mini Summer School, Faculty of Life Sciences – 03 Aug 2015
- Year 10 Work Experience Programme, Faculty of Life Sciences, Manchester University – 13 July 2015
- Brookburn Primary School, Manchester – 6 June 2015
- Animal Research Day, Faculty of Life Sciences, Manchester University – 25 March 2015
- Ashton Sixth Form College, Manchester- 11 March 2015
- Trinity School, Manchester – 10 March 2015
- Xavarian Sixth Form College, Manchester- 4 March 2015
- Cambridge HE+ program, Loreto College, Manchester- 25 Feb 2015
- St Peter's High School, Manchester – 11 Feb 2015
- Manchester Grammar School – 02 Feb 2015
- St Christopher's CE High School, Lancashire – 28 Jan 2015
- Visit of school pupils from Norway, Faculty of Life Science – 22 Sept 14
- Trinity School, Manchester, Careers Day – Nov 2014
- Cardinal Newman College, Lancashire, Collaboration – 25 Sept 2014
- 3 month collaboration with Trinity CoE High School and Loreto Sixth Form College within the droso4schools project – Sept-Dec 2014
- Cheadle Hulme High School, Cheadle – 11 July 2014
- Bolton Muslim Girls' School – 27 June 2014 Aquinas College, Manchester – TBC
- Connell Sixth Form College, Manchester Fly Facility – 23 June 2014
- Manchester Communication Academy, Manchester – 20 June 2014
- Animal Research Day, Faculty of Life Sciences, Manchester University – 2 April 2014
- Bolton School Girls Division, Bolton – 13 Feb 2014
- St Christopher's CE High School, Lancashire – 28 Nov 2013
- St Mary's CE Primary School, Reddish – 18 Oct 2013
- Animal Research Day, Faculty of Life Sciences, Manchester University – 17 Oct 2013
- Bolton School Girls Division, Bolton – 9 Oct 2013
- Sacred Heart Catholic Primary School, Warrington – 13 June 2013
- Bramhall High School, Stockport – 16 Nov 2012
- The King's School, Chester – 15 Nov 2012

4.3. Teacher training

- School-University Partnership, Networking Event, Manchester University – 23 Oct 2017
- STEM Learning RCUK cutting edge programme – 13 July 2017
- Royal Society Science event – 15 March 2017
- MANCEP Teacher's conference at Manchester Metropolitan University – 17 Feb 2017
- Teacher's Summer School, Faculty of Life Sciences, Manchester University – 11 July 2016
- ASE Annual Conference, Birmingham – 8 Jan 2016
- School-University Partnership, Networking Event, Manchester University – 21 Oct 2014
- Teacher's Summer School, Faculty of Life Sciences, Manchester University – 27 July 2015
- Bringing Cutting Edge Science – CPD teacher event, Fly Facility, Manchester University 23 March 2015
- MANCEP Teacher's conference at Manchester Metropolitan University – 13 Feb 2015
- School-University Partnership, Networking Event, Manchester University – 15th Oct 2014
- Teacher's Summer School, Faculty of Life Sciences, Manchester University – 30 July 2014
- Maths and Sciences Teachers Conference, Manchester University – 25 June 2014
- Teachers' Visit, Faculty of Life Science, Manchester University – 4 Feb 2014
- School-University Partnership, Networking Event, Manchester University – 20th Nov 2013

4.4. Tours of the Fly Facility:

- Members of TEaM (Nov 17)
- HR department (Nov 14, Jan 15)
- Members of HERA (April 15)
- University fundraisers (Nov 14)
- Investors to the University (July 14, Aug 14, April 15)
- Costa Rican ambassador (Jan 16)
- Society of Biology Panel (May 15)
- Chinese delegation (Life Sciences of Shan Dong University) (Oct 13)
- Teachers (Feb 14)
- Board of Governors (Feb 12)
- Alumni (March & Nov 12)

5. Student placements:

- Charlotte Blackburn (Univ. Edinburgh) - droso4schools, Nov. 17
- Sophie DeMaine (Univ. Manchester) - droso4schools placement, Aug 16- Jun 17
- Joshua Heafield (Univ. Manchester) - droso4schools placement, Aug 16- Jun 17
- Jennifer Harbottle (Univ. Aberdeen) - droso4schools placement, Jan-March 15
- Patrick Stangward (Univ. Manchester) - droso4schools placement, Jan-March 15
- 39 Summer placements of A-level students (up to June 17)

6. Impact:

6.1. Awards

- The droso4schools project was highly commended for the "Making a Difference Award" for social responsibility by the University of Manchester (May 2016) -- [LINK]

- The Genetics Training package was warded a "Special Commendation for Training *Drosophila* Biologists" by the Genetics Society of America at the 55th Annual *Drosophila* Research Conference (San Diego; 03/14) -- [LINK]

6.2. Proof that resources are being used

6.2.1. Use of advocacy and outreach materials

- Our page is the key resource for science communication ("Public, Teachers, Students") linked out on FlyBase
- Sylvie Larsen (MLIS): I am a librarian at Memorial Sloan Kettering Cancer Center's Medical Library where we write a blog on new and interesting tidbits in the scientific community. I saw your lab's 'Small Fly: Big Impact" video and am hoping we can use it on our blog to highlight some of the interesting research being done. Could I have your permission to share it on our blog? (You would be credited as the creator of course.)
- Lewis Held (PI at Texas Tech): I tried to get onto your website today. http://www.lab.ls.manchester.ac.uk/flyfacility/ AND http://www.flyfacility.manchester.ac.ukforthepublic/whythefly/ But I could not connect to your server. I want to give these URLs to students. Best wishes
-  Thomas Merritt @tjsmerritt 27 June 2017: Great talk from @EstherVerheyen on the importance of science outreach and advocacy. Fantastic slides from @Poppi62 CanFly 2017 – at The Banff Centre
- 
-  Thomas Merritt @tjsmerritt - 4 Sep 2017: @Poppi62 I'm going to Tweet about Fly Outread and Education resources - what links would you like me to include?
- Inspired by our genetics activity and genotype builder - MRC MBU @MRC_MBU 28Jun17: Here we are... at the Big Bang Eastern...ready and waiting for our visitors @TBB_Eastern Eastern @AngliaRuskin Chelmsford 😎
 Finding mutant fruit flies! 
-  SeYeon Chung @seyeon_chung Sep 18: Great educational movies by @ManFlyFacility! Used them to explain to my new undergrads why we study Drosophila
- Alessandro Bonfini (Cornell University): I was wondering if you knew the genotype for the flies we were using for open days event, the ones that faint if you bang them and the temperature sensitive ones. Do you know if they are available on Bloomington? If not, do you think it would be possible to send them to me? We may have to do some open day event here at Cornell as well, and my new boss liked the idea about these flies.

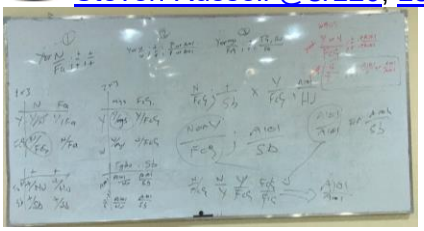
- Showing advocacy presentation at the 2017 JEDI meeting in Italy - Thomas Vaccari (PI at Milan Univ., 02/11/2017): Hi Andreas, the session went well. As usual, lots of passion/participation. about half of the people in the audience knew you/your page. We went into a discussion also of necessity of EU lobbying by people with power (a la Hugo Bellen in the US) which is an aspect that I don't know how much is covered by people like maria leptin for example. I'll rise the issue with her. In any instance, we also agreed that to not leave words just blowing in the wind, I am going to write up few considerations about the topic for the flyjedi mailing list so that they are accessible to not only the ppl at the meeting. In my mind this is going to cover not only your flavor of advocacy but also others/problems of the community and it is meant to rise a discussion (hopefully).If you would like to contribute to drafting it, that'd be great. pls let me know.
- Showing advocacy material at the Drosophila Neurobiology Conference at CSHL:
  - Pavel Tomancak (PI at Max Planck, Dresden; 5 Oct 2017; *in response to a request to show an advocacy slide at the CSHL Drosophila Neurobiology conference*): Dear Heather, Troy, Andreas Prokop (in cc) is one of the most vocal advocates for fly research that is in many places under siege. He has been fighting the fight often alone (at least in Europe). I think that meetings like this one are a great fora to raise the awareness of the issue and highlight the resources that are being assembled to promote our favorite model organism. I am attaching a slide prepared by Andreas. Would you be willing to include it in the slide roll shown on the screens between sessions? We think this would be a great service to the Drosophila community and could potentially boost Andreas efforts. Andreas can add more about his motivation. All the best, PAvel
  - Troy Littleton (PI at MIT; 5 Oct 2017): Hi David, Would it be possible to add this slide to the 3-4 slides that cycle on the projector before and between the talks. Pavel and Andreas bring up a nice point on advocating for the fly model.Thanks so much, Troy
- K. VijayRaghavan (PI at NCBS, Bangelore, India; 05 October 2017 (in response to requesting advocacy at the Drosophila Crete meeting): Dear Andreas, First, what you are doing is fantastic. Please don't give up, Second, I am not surprised at the poor traction though. That's the way people are, most are caught up in their day, few have the ability or drive to mange their science and do something for the public good that you are doing. That said, even a few people can make a big difference. So, I would talk at Crete and at fly meetings but have a low bar for expectations. What we need is a communications team (funded by philanthropy?) that drives a global communication campaign. The Simons Foundation is someone one could approach. John Carlson's sister Marian Carslon head Biology there and as a former yeast geneticist, she may well be sympathetic. Lest push them and sent up a structure that is a mini David Attenbourogh show about what the fly does for humanity. Happy to help. Best Vijay
-  Ines @zwickauhex Sep 23: Jordan Raff encourages us to advocate Drosophila - check out @ManFlyFacility for great arguments #EDRC2017
-  Caramelised Onion @caramalised - 26 Jul 2017 - Replying to @Poppi62: We use your material all the time! You do phenomenonal work, and 'wasted time' is as far from what you do as is possible!

6.2.2. Use of the Training Package

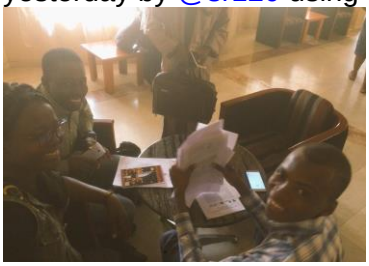
- Use as a standard training element at Hasannuddin University, Indonesia (see 6.4.)
- Use as a standard training element on TReND in Africa courses:
  - Steven Russell, (University of Cambridge, Nov. 2016): Just a note to let you know that I used your training package (the powerpoint and the exercise) for teaching fly genetics during the TReND course in Tanzania a couple of weeks ago (http://trendinafrica.org/blog-posts/2016-neuroscience-school-in-full-swing/). It is

excellent, I had read the paper and looked over the material before but it was not until I used it to teach that I appreciate how very good it is. Fantastic job. Thanks

- Steven Russell @sr120 Nov 10: Used Prokop & Roote training package http://www.g3journal.org/content/3/2/353.full … during #trendneuro16 excellent & highly recommended for intro to Fly pushing
- Steven Russell @sr120, 14 Nov 2017: The fly genetics training from Prokop & Roote is fantastic, students at #trendneuro17 doing a great job in getting to grips with it. Thanks @Poppi62
- Steven Russell @sr120, 15 Nov 2017: Some fly crosses #trendneuro17



- TReND in Africa @TReNDinAfrica, 14 Nov 2017: Students of the #trendneuro17 this morning before breakfast going over the #drosophila #genetics explained yesterday by @sr120 using exercises from @Poppi62 in #Nigeria



- Sara Mertel (AG Sigrist) Freie Universität Berlin: Ich bin ja ganz begeistert vom Manual: "How to design a genetic mating scheme: a basic training package for Drosophila genetics". Ich habe nur die Problematik, dass wir die genannten stocks für den praktischen Part leider nicht alle hier bei uns haben. Meine Suche bei Bloomington war auch nur in Teilen erfolgreich. Sean (Sweeney) meinte, Sie würden mir vielleicht die verwendeten Stocks schicken können? Das wäre super lieb und würde meine Arbeit ungemein erleichtern. Vielen lieben Dank schoneinmal und ein "BITTE WEITER SO" :-)
- Annette Schenck, (Radboud University, the Netherlands): I wanted to compliment you to your Drosophila teaching guide! It is appreciated a lot in my lab and I already recommended it to other labs!
- Charalambos P Kyriacou (University of Leicester): Brilliant chapter by the way...where will it be published as I'd like to have it for the lab?
- Prof Esther Verheyen (Simon Fraser University, Canada): I discovered your G3 article describing Drosophila mating schemes and I wanted to thank you for putting together such an amazingly comprehensive, accessible and well-written manual. The “rough guide to Drosophila mating schemes" in particular has become required reading for all new members of my lab. I have not previously come across something which does such an excellent job of explaining the fundamentals of how we work with flies.Your hard work is VERY appreciated!
- Giovanna Collu (Mssm.edu): I wanted to tell you how useful I found your intro guide to Drosophila! Around the time I had a high school student working with me this summer, I

saw the link to your guide on the flybase homepage. I gave her the information to read before she came and then the diagrams for scoring phenotypes when she arrived and she picked everything up perfectly! It saved me time and I am sure she learned everything more thoroughly than if I had had to teach her all that myself, so thank you!

- Plamen Georgiev (MPI for Immunobiology and Epigenetics in Freiburg, Germany): Yes, it is fantastic, already used it selectively in the annual introduction I give to the new wave of PhD students here and have recommended it to everyone who has shown desire to start working with flies. The feedback from people who have used it for learning here so far is also great. A very good job indeed! Thanks to both you and John.
-  Kavitha Kannan @kavkannan 28 Feb 2017: I learnt to design crosses using the genetics training package. It is a great resource to learn basics of Drosophila genetics!
- Okubo Tatsuo Okubo (harvard.edu):
  - Thank you for preparing materials to make Drosophila genetics accessible to beginners. I have recently started working on Drosophila, and found your materials to be extremely helpful. Especially, I benefited from clearly explained figure and figure captions, and lots of references and links on "A rough guide to Drosophila mating scheme."
  - Thank you for letting me know the updates. I think it looks great! These sets of documents are wonderful contributions to the field, and being a beginner in fly genetics myself, I benefited a lot from them.

6.2.3. Use of school resources

- David Bilder (PI at Berkley): I wanted to let you know that I gave a talk to local high school students today and found the figures on your website and video extremely useful in putting together a talk. Of course I pointed them to the website for more info. Hope that others are finding it as convenient as I did for getting some help for popular talks.
- Lisa Clarke (University of Alabama): Hi. I found your fly lessons extremely helpful. I prepare lessons for teachers in the Western Alabama, USA region. I have been carrying out experiments on artificial selection regarding bristle count and comparing the shifts to replicated experiments in which flies have been raised in the dark to see if there is a melatonin-induced epigenetic effect on the parallel population. It would be helpful to use some of your pictures (gender of flies, etc.) in my lab. I will, of course, cite your source in the reference section. However, I wanted to check in with you before I used them. The site said “for the public.” However, I just wanted to double check. Our organization, Alabama Science in Motion is a free resource to our teachers. This is certainly not for profit in any way.
- Alison Latham (Nelson Colne College): Just to let you know we had amazing success with our fruit fly inheritance project. The flies breed so well- we had hundreds to count!!! I've attached our data sheet in case you are interested. The Chi square analysis was absolutely spot on, too. I think the main reason for our success this year was the help and support you gave us, we really appreciated everything you did for us. The students gained a great deal from this investigation as they could actually "see" the results, and it's a practical I don't think they'll forget in hurry! Many thanks again for all your help, and we'll get the payment sorted ASAP. I look forward to working with you again next year.
- Gemma Coles (Ashton Sixth Form College):
  - Hi Sanjai, You recently visited Ashton Sixth Form College and ran a session for our A2 Biology students. We are putting together a wall display about your facility and the session and I was wondering if you had any posters or other resources I could include in the display.
  - The images are fantastic! Thank you so much, really appreciated.

- Phil Armstrong (Birkenhead School):
  - Thanks a lot Sanjai, they came safely on Tuesday. The whole department asked me to pass on their thanks as well; it means we can do so much more for our students.
  - Thank you very much, we really appreciate your service as always and have the delight of using the excellent paper and computer poster resources you sent us in the past.
  - You have been so helpful and efficient; I can't thank you enough. I'll let you know about food. Thanks again
  - All the little chaps are doing great and causing great interest with every year group.
- Ross Parish (Loughborough Grammar School):
  - Thanks very much for the email and resources, and an excellent day at the University. I would be very interested to show the year 13s the temperature and pressure/force sensitive mutants. Is there any source of these *Drosophila* which I can use? I am based in Loughborough so I am a bit of a distance from Manchester. Thanks again
  - There isn't any possibility of having some more, particularly the heat sensitive ones. They went down really well with all the primary school children who visited for National Insect Week
- Jorge Morgadias (Ponte de Lima, Portugal): Your material is being used in the laboratory classes of the biology discipline of the 12th year of secondary education. It aims to study Mendelian and Morgan heredity. The results have been excellent because the practical work in Portugal in regular secondary education has been little used and as it is natural the students like to make experiments. It also allows students to train and develop procedures and techniques during practical work. We intend to continue the *Drosophila* project for the next few years and since we do not have an incubator for the flies, we only have an improvised incubator, our professional school courses will build an incubator for next year. So we will continue to request your material and support.
- Helen Faulkner (The King's School, Chester):
  - I just wanted to let you know how valuable your *Drosophila* for schools resources have been. As you are aware our students follow Edexcel A Level specification B and your flies have really helped us teaching the following from the spec:

    8.2 Transfer of genetic information

    i Understand the terms 'genotype and phenotype',' homozygote andheterozygote', 'dominance', 'recessive', 'codominance' and 'multiple alleles'.

    ii Be able to construct genetic crosses and pedigree diagrams.

    iii Understand the inheritance of two non-interacting unlinked genes.

    iv Understand that autosomal linkage results from the presence of alleles on the same chromosome and that the results of crosses can be explained by the events of meiosis, including black/grey body and long/vestigial wing in *Drosophila*.

    You may be interested to know that we sought feedback from our students as they approach the end of their course. A number of the core investigations (designed by Edexcel) were not thought to help them but the flies you provided together with the resources on your website were cited as being 'instrumental in learning about autosomal linkage'. Indeed, when we looked at our end-of-topic test results we found that for many students this section was their highest performing topic. We asked them to reflect on their scores and several students said they understood genetic linkage much better for having performed the crosses. On another note, Atharva Salvi, continues to love Biology and is really thriving at A Level. You may remember you kindly hosted him for several days experience in your labs over the summer a couple of years ago. He is still hoping to study a life sciences course at University.

- I was amazed how they were in perfect syncrony with each other. Flies we have bought from Timstar have been rather sporadic going through the life cycle….

- Julia Stanworth (Cardinal Newman College):
  - Our college runs 5 additional sessions to year 12 A level Biology students form numerous Lancashire Sixth form colleges, who have been identified as being high achievers and have shown an interest in pursuing an undergraduate course in a Biology/Science. One of these sessions has been based on the dros4schools KS4 alcohol session. This has allowed students to gain an understanding of how genetics has been studied using Drosophila. It has helped students appreciate how genetic mutations in Drosophila can affect how they metabolise alcohol and that using Drosophila as a model has given us an understanding as to why there are differences in humans as well. The session not only provides material that is useful for extension but also has direct links to the A2 specification on genetics, mutations, variation and natural selection. Students have been made aware that the fruit fly is currently used as a model to study human diseases including the neurodegenerative disorders Parkinson's, Huntington's, spinocerebellar ataxia and Alzheimer's disease as well as being used to study mechanisms underlying aging and oxidative stress, immunity, diabetes, and cancer, as well as drug abuse.Droso4schools have provided an excellent service. They have provided the relevant drosophila, vials and reagents that we have required, they have provided advice and have been an excellent support and have been willing to make any adaptations that we have needed. Students have not only found the sessions, interesting and relevant but have found the extension activities have given them an insight into the type of work that is being carried at university and possible research links involved in such activities. We encourage the students at the end of each session to go away and research the area further. Hopefully the sessions will inspire them to want to take their Science education further. Students on the programme complete a handbook of all of the sessions and the majority of them will refer to the programme in their UCAS personal statements to show their interest for the subject area when trying to secure places at university and would be able to discuss the sessions if asked for interview.
  - Thank you for the flies, we had plenty of the flies and larvae and it went really well. The students seem to really enjoy it and it is great that it is at the right level for their exam specification, yet there is plenty of application and extension related to the practical and uses of Drosophila. Please let me know if there are any further issue on the payment side. I appreciate that it has been a lot of effort on your part and I do want to say how professional and helpful your support has been, you have been wonderful! I'm not sure whether this is something you regularly do for schools or colleges and am therefore not sure whether it is something you would be prepared to repeat next year, or if we could do anything to make less work for you? I fully understand if you would rather not be involved, but just wanted to see how you would feel about doing it again so that I can plan for the sessions next year. Thanks again
  - Just to let know that everything went extremely well last night. Everything worked and the students thoroughly enjoyed the session. A great success. Thank you so much for all your hard work. Everything went really well, if anything better than last time I explained it better and the flies did as they were supposed to. We managed fine with the number of flies, despite the problems you had at your end. Our biology technician was off ill but another stepped in to help make the flies drunk! The students have been really enjoying it and it seems to go down well! Thanks so much for your support, it is really appreciated.

-  Haifa Alhadyian @haifaalhadyian 25 Oct 2017: I used activities from @ManFlyFacility in the most recent outreach event I organized. Thanks for amazing work!

-  Andrew Bellemer @AndrewBellemer28 Sep 2016: @Poppi62 I wanted to let you know that I am teaching a workshop for international secondary ed teachers on Drosophila. - @Poppi62 The resources that you have developed have been tremendously valuable. We will be running trials of your wall-climbing assay.
-  Andrew Bellemer @AndrewBellemer 21 Sept 17 : Worked with the Teaching Excellence and Achievement fellows this morning. --- We used the wall-climbing unit developed by @Poppi62 to illustrate how model organism research is conducted and how it can be translated... --- ... to a middle or high school classroom. --- This is the second time I've used this one, and it worked perfectly both times. It's a rare demo that works as expected with novice students --- I'll also mentioned that the work these fellows are doing is phenomenal. Emmanuel (just over my left shoulder) teaches science... --- ...at a school for the blind in Rwanda. Wants to know how Drosophila experiments can be adapted for his students.

- Andrés Garelli **(**Universidad Nacional del Sur; Argentina; comments on droso4schools): Hi Andreas,Your material is fantastic, we have used it many times during school visits to our institute. I would like to point to a minor mistake in one of your images. The spleen has been placed on the right side of the body, while it is actually on the left. thanks for all the hard work that helps to spread the benefits of flies as a model organism
- Julie Simpson (PI at Univ California St. Barbara; 13 September 2017): Dear Andreas, I am writing to ask permission to use a graphic from your Dros4schools website in a Genetics Flybook article. Would this use be allowable? Thanks very much and best wishes, Julie
- Lee D. Gambol (Distance Learning Coordinator-Museum Instructor, The Cleveland Museum of Natural History, 15/08/2017): Hello, fellow EntoEducators! I work at the Cleveland Museum of Natural History (www.cmnh.org) , creating and teaching virtual lessons for students both in the US and in several other countries (https://www.cmnh.org/ivc). Currently, I'm working on a lesson that highlights research being done by our Curator of Invertebrate Zoology, Dr. Gavin Svenson: (https://www.cmnh.org/c-r/invertebrate-zoology). My challenge is this: We have specimens aplenty, but no graphics designer on staff. This inability to generate my own images often sends me into the wilderness of the Internet, which is how I found you! The illustrations here: https://droso4schools.wordpress.com/organs/ are 100% perfect for our introduction to the evolutionary links in cellular function. How may I obtain permission to use your images during our educational program? We're a non-profit museum, and all images used would have a "Used with permission by" notation clearly placed at the bottom of the screen. Thank you for creating such valuable graphics for teachers! - Lee
- Alexis T:
  - May I use some of the pictures on this website? I am making my own site and I love the simplicity of the photos! Thank you for the helpful information!
  - Thank you to the team, I love this website. The pictures will be only to be downloaded for education purposes.
  - I am making a website for my gifted class, to inform them of the reproduction of maggots.

- Carlos Ribeiro (Drosophila neurogeneticist at the Champalimaud Neuroscience Programme): Big thanks to @Poppi62 for great #drosophila droso4schools resource - used it to explain impact of flies to physicians working on #diabetes
- May Khanna (Arizona): I would love to use the cartoon shown below for talks and grants. Do I have your permission to do so? I don't like to use figures that I have not generated in my talks and especially grants without getting consent from the creators. I absolutely love this cartoon! I look forward to hearing from you.
- Lotte Stauch (University of Freiburg, Germany): For my medical thesis I would like to use one of the images of nephrocyte populations in Drosophila melanogaster from the site droso4schools.wordpress.com. Is it possible that you grant me that permission? Thank you in advance and kind regards,
- Iris Salecker (NIMR): Perhaps you remember that I contacted you concerning a London school hoping to teach *Drosophila* genetics in flies. They would like to do the experiment, using the climbing assay comparing young and old flies. From the talk, you shared with me, I tried to guess, the details - but couldn't. Are wild type OregonR flies ok for this? And how old or young do they need to be to show differences? For ageing flies, I just would need to start to think ahead already! Thank you so much!
- Pepe Urbano (University of Cambridge): My name is Pepe Urbano and I am a Drosophilist at the University of Cambridge. Together with Alix Rey, we are organizing an activity at the Genetics department about Genes and Heredity. We will run an activity very similar to your climbing assay lesson. After the activity we want to provide a sticker for children and we were wondering if we could use one of the images uploaded on the droso4schools blog. We especially like the rainbow one you used to explain the segmental anatomy. I attached an image of our first draft. As we need to adhere guidelines on copyright compliance we need that you agree that we use it to print it out for stickers. Thank you very much in advance
- Niamh O'Sullivan (University College Dublin): I have been asked to submit a 'layman's summary' of my recent publication to Atlas of Science (http://atlasofscience.org/). As I would like to highlight the relevance of fly models of neurodegenerative disease it would be nice if I could include an image comparing the nervous system of flies and humans. I was therefore wondering if it would be possible to use your 'comparison of spinal cord and ventral nerve cord' figure (http://www.prokop.co.uk/Research/Drosi-Info/nerve-cords.html)? I would of course reference you as the source of the image and any copyright items that would require referencing (e.g. a publication reference?). I have only recently set up my independent research lab and the paper I'd be discussing is my first senior author manuscript so I am keen to draw as much attention to it as possible. However, I understand if you do not want to give permission to use this image.
- Katherine Whitley (University of Sheffield): I manage the fly facility at The University of Sheffield and am just starting to gather information and resources to start some fly outreach in the next academic year. This will consist of:

  1. A room of experiments/craft activities for Discovery Night during science week
  2. Going into Primary schools during science week for 3 x 1 hour sessions
  3. Running workshops here at the university for 3 hour sessions

  Most of these activities will be aimed at children aged 7-10. You have some fantastic resources at Manchester and I would be grateful if we could use some of them in Sheffield. I am especially interested in using the cartoon fly pictures and organs/systems pictures as part of a workbook I am preparing. I would, of course, acknowledge anything I use as your work. Please let me know what you think. Any additional help or advice would also be appreciated.
- Nanci Kane (Waksman Institute, Rutgers University):
  - I would like to use images generated by Genotype Builder Photoshop file S5 for a figure in a paper I am writing. How should I cite it? Should I cite "Genotype Builder

Photoshop file S5" or your G3 paper "Scheme: A Basic Training Package for Drosophila Genetics" or both? Thank you,

- Thank you. It's a really great program for creating figures for fly crosses!

- Frédérique Peronnet (UPMC "Fête de la science" web site): I am writing to ask if you would accept that I use one of your pictures to put on the UPMC "Fête de la science" web site. "Fête de la science" is a special event in Paris in the fall to inform about Science and, in my case, about Drosophila research. I have translated the legends and I join the modified picture. I have to say that I like very much you pictures and movies and that I will probably be inspired of them for my presentation. Thank you by advance for your answer, Best regards.
- Potochnik, Angela (PI at University of Cincinnati, 16 Nov 17): Dear Sanjai and Andreas (if I may), I'm coauthoring a general education textbook on scientific reasoning from a philosophical perspective, which will be called Recipes for Science. My coauthors and I would like to use the attached image, from your website, as a figure in the book. I couldn't locate any information on the website regarding whether the figure is public domain, creative commons licensed, or requires permission for use. Could you advise me on whether we can use this figure in our textbook, and if so, if you would like attribution in the figure caption (and in what form)? Thanks, and best wishes, Angela
- Jens Bohnekamp: ich benutze schon seit einiger Zeit Teile Ihrer Drosophila-Präsentationen (die bei figshare verfügbar sind) um Studenten Fliegen als Versuchstiere nahe zu bringen. An dieser Stelle schon mal vielen Dank das Sie diese Materialien online gestellt haben. Zur Zeit arbeite ich an einer Publikation und würde gern, so weit es möglich ist, eine Ihrer Wildtyp Drosophila-Schemazeichnungen (siehe Anhang) in ein eigenes Schema integrieren. Sie würden mir viel Zeit und Mühe ersparen falls ich Ihre Abbildung verwenden könnte.

6.3. Impact of school resources on teachers', pupil's and researchers' choices

- Adele Campbell (Lab Technician, Wiltshire College Lackham, Wiltshire): Hi Andreas, We teach our HE learners about light and light perception so Lesson 5 on vision is of great interest. Please could you send the PowerPoint for this lesson, and advice on where to buy light emitting diodes (*LED*) of specific wavelength in order to carry out phototaxis experiments with *Drosophila*. Best regards, Adele
- Douda Bensasson (University of Georgia): Cool to interview a student who wants to be a science researcher as a result a high school visit from @poppi62 on *Drosophila*
- Abolaji Amos Amos (PI at Univ Ibadan Introducing, Nigeria; 12 September 2017): Dear Prof Prokop, I received your response with delight. Many thanks, Sir. Thank you for the links to the articles. Indeed, we will need your assistance in the area of science communication, and the articles in the links are great resource materials for us. We will carefully read through and gradually follow the instructions. In addition, I am working on a *Drosophila* Research Centre in Nigeria where we will carry out introducing *Drosophila* to secondary schools students. Your Droso4schools initiative materials would definitely be helpful to us in this regard. The need for such a centre cannot be overemphasised due to the demands for Drosophila research by scientists across Nigeria. We shall attempt to convince the government to introduce *Drosophila* into the Biology curriculum. We will also have a lab for the training of scientists and for workshops. The advice in your email can be better achieved with this forthcoming *Drosophila* Centre, because the fly is not currently widely accepted in my institution. I will update you on this regularly for advice, Sir. I will be glad if you could accept to serve as one of our international advisers in this new centre. As a teaching faculty in my present university, we train postgraduate students in their projects with the *Drosophila* model. Some of these trained scientists will be allowed to serve in the *Drosophila* Centre as resource faculty members from time to time. Another area we may need your assistance is to link us up with places where we can have mini grants for *Drosophila* research. Lastly, Sir, I will likely visit University of Cambridge in November for 6

weeks to work with Dr Tim Weil on a collaborative project. I will be glad if I am allowed to visit your facility in Manchester during my visit for further interaction. Please accept the assurances of my highest esteem.

- Ben Kelby (Denbigh High School, Luton): Last year my colleague Alex Martin was in contact with you regarding a project we were looking at running in school. We kept the flies and managed to breed them successfully, although we had a few teething problems with temperature-sensitive mutants in a hot prep room! I am aware that there was some confusion over the payment for the food that you sent us, and I just wanted to check that it had all been sorted out and you had received the payment as we would like to make a further order in the near future if this is possible. We would like to run the project as a silver CREST award project for a year 9 group, and were thinking that a natural selection experiment may be the best way to go with the equipment available in school, whereby the students could track the increase in numbers of flies with a favourable phenotype. From what I recall the white-eyed mutant might be the ideal variant, as the students will be able to track the numbers easily and I think I am right in saying it has reduced fitness. Would we be able to get white-eyed flies? Are there any other projects which would be suitable as an extended project for a high ability group of 13-14 year olds? It doesn't have to be original but does need to be written up in the manner of an academic paper.
- Alex Martin (Denbigh High school): Myself and a colleague (both science teachers at Denbigh High School, Luton) are interested in using drosophila as part of a STEM project working towards a CREST award. Our initial thoughts were to use the drosophila for a project for inheritance but we are also aware of other possibilities, such as ageing. We have been looking through your website and were wondering if it would be possible to obtain fly-related teaching materials, flies and food.
- Catherine Haworth (Cardinal Newman College): Dear Dr. Patel, I am currently teaching A level biology at Cardinal Newman college in Preston Lancashire. This year I attended the summer school held at Manchester University and was inspired by your work and outreach programme. This year our college has been designated as a HE hub. This basically means that we will be charged with providing "experiences" akin to those that may be obtained from visits to university, to other local college/high school students that are gifted and talented and expected to go to university (some of whom will be first generation in their family to attend HE). So I am emailing to see how feasible it would be to set up some fly experiments to do with these students. The "lesson" I will need to provide only lasts 1h and I would really like to focus discussion on neuroscience, ion channels and using "models" to understand how the basic infrastructure of the nervous system can be studied in non human models and how the findings are still relevant to humans, even though the models appear to be very much "not human". I would really love to "borrow" some Drosophilas., possibly with the same traits as those we were provided with in the summer school lesson. I would be able to come to Manchester to collect any materials, and would like very much to collaborate with you to get ideas on how best to structure the session to really pass on the enthusiasm that I experienced on my own visit. Initially I just wanted to touch base to see if this is something that would be possible? And also to thank you again for the great experience at the summer school.
- Suzanne Bluer (Oldham Hulme Grammar school): The flies were a success, though the bang ones refused to all lie down dead, so yes we could have done with keeping them all a bit warmer to start with. They are still being used in our normal lessons now even though we're not up to Genetics yet. The teachers who originally got your details are called John Dalziel and Will Atkins (our Head of department) who attended a day at Life Sciences in the Spring as part of the "Liverpool Group"..... Heads of Biology from Private schools. John was so excited to see the flies that he banged one tube half to death and split it....before I could find him a soft surface to do it on....luckily the kids who tried it were gentler. I did a small display about *Drosophila*, see attached photo. , and have also produced a poster and letter to go to all students about the Science spectacular, as it falls in the half term holiday. I haven't had time to research drosophila equipment for schools yet but I will keep in touch

as a talk and demonstration to our 'Gifted and talented' students and 6th form would be welcome. Many thanks

- Clare Pybus (Bury College): Thanks for getting back to me, we are looking at just trying to set up some simple crosses with our AS students w/c 13th June, TimStar seem to be able to supply some flies so we should still be able to do this but if you are able to provide fly food that would be helpful. Thanks for the link below. We will definitely use some of the resources, particularly the introduction to drosophila and its importance in the lessons. There is mention of a genetics lesson but it says coming soon - do you have any of these resources available yet as it will be the genetics aspects we will be focusing on with the students.
- Melissa F (pupil): I am currently on a Mission Discovery programme hosted by ISSET and we are researching potential experiments to carry out on the International Space Station. The winning group's experiment will then be sent to the ISS. I attended the Discovery Biosciences day a few weeks ago and was fascinated by the effects of temperature and motion on the fruit flies, which caused paralysis and epileptic seizures. The parallels between the drosophila flies genes and ours mean that this research in microgravity could be hugely beneficial if humans were to colonize other planets. Are there any other factors which you feel could be investigated in space which complement your ongoing research?
- Demetrius Green (Bronx, NY): Hello, My name is Demetrius Green and I am a high school science teacher in the Bronx, NY. I currently teach neuroscience to students in the 11th grade and thoroughly enjoy it. Instead of taking state exams, our students must write a formal lab report based on an original experimental design and present their findings to a panel of teachers, local college students, and other members of the community in order to successfully complete the course. Students have been designing simple, yet interesting experiments concerning the neuroscience field. However, our students have only been able to use human participants, which has led to an extreme amount of limitations. I am highly interested in possibly developing a partnership with your organization. Because I also want to teach a genetics course next school year, I think it would be a huge opportunity for both classes to use the fruit fly in their scientific research. I would need help on getting started building a strong curriculum that would involve this amazing organism to fully engage all students in scientific inquiry.
- Rebecca Steiger (AP Biology and Anatomy & Physiology Teacher at Junction City High School): Dear Andreas, I wanted to let you know I appreciated your guest blog about Drosophila outreach programs that was featured in GSA's "Genes to Genomes." I continue to try to find more ways to include flies in my classroom curriculum. As we have just begun summer break, I will be redesigning my curriculum and will review many of your resources for inclusion. Next year I will be teaching Human Anatomy & Physiology in addition to Advanced Biology. Do you have any thoughts about specific lessons/materials that might be especially applicable to this new course? Thank you again for sharing your views about the inclusion of education initiatives in current research. I will continue to push from my side (high school education) as well.
- Trish Kirkpatrick (Brisbane, Australia): Hello, My name is Trish Kirkpatrick and I am a biology teacher in Brisbane, Australia. I have just found your website which is really great because next semester, we are hoping that some of our students will be able to do some experiments with drosophila. In our course, we ask the students to develop a research

question and hypothesise themselves and carry out experiments to test this. We usually give them a few suggested variables to investigate to get them started so I was hoping you might be able to suggest some as we have never used drosophila before. I was wondering how the type of food might affect numbers of offspring, or perhaps something to do with alcohol as one of your experiments suggests. What about temperature? Any information or suggestions you have would be greatly appreciated. Thanks so much for your help.

- Jean Campbell (King Edward VI Grammar School): I teach biology at a secondary school in Chelmsford, Essex and our department is interested in introducing practical studies involving *Drosophila*. In starting to look at what we could do, I came across your site and wondered if you could offer some advice about the practicalities of using *Drosophila* in schools. We were thinking about buying an incubator (we have a small amount of money that has been awarded through the Jack Petchey scheme) and so would need some general advice on looking after and maintaining Drosophila (it has been a long while since any of us have done this).I can't tell you how excited I was to find all of the different ways that we could use these animals - I'm afraid we were thinking that we would have to confine ourselves to genetic crosses but your support material has certainly broadened our horizons.I am not sure if your remit is to work just with schools in the Greater Manchester area and apologise if my request for help is inappropriate but I would appreciate any advice you could offer. Many thanks,
- MC Randall (Birkdale School): Last summer I attended the teacher's summer school in your department. I would like to do a practical with a class on the effect of caffeine on *drosophila*. Do you have any ideas of where I could source some? Thank you so much for any help you can offer
- Lisa Carter (Holy Cross College): Thanks for the link. Thought it was really good. Was wondering whether I could bring some students in to see the work being done? Maybe sometime in February? I spent quite a bit of the final year of my degree looking at drosophila so find it all very interesting. Could you send a link to the second part movie?
- Marc Tillotson (Bolton School Boys' Division): Hello Sanjai, Many thanks for your email. We offer a number of drosphila practical activities in school and our technicians are quite skilled in looking after them. We tend to use simple mutants like vestigal and white eye. The temperature and motion mutants that we were introduced to were excellent. I would be very interested in speaking to you further about different ideas either by phone or in person. I look forward to hearing from you.
- Joanie Marion (Sidcot School, Somerset) Thank you for sending the fruit fly order to siscot School. The students have thoroughly enjoyed working with them, as they did last year. I hope to be in contact next year and perhaps will try the alcohol experiment
- Tomas Generalovic (research student at Swansea University):
  - (29 September 2017): Dear Sanjai Patel and Andreas Prokop**,** I am writing to enquire about your fly facility and services in Manchester and wonder if you could help me. I am a research student at Swansea University and beginning a new project in which we will be *using Drosophila melanogaster* as a model organism for a variety of genetic based experiments. However, the department does not use this species and therefore has no sourcing. Would you be able to provide some information on if you are able to provide a source stock as we have been unable to find a UK based supply and was recommended by Cambridge fly centre. Your website has provided some great information on rearing, storage and feeding of a maintained stock in which we will soon be ready to house. Many thanks, Tomas Generalovic
  - (5 Oct 2017): Dear Andreas Prokop, I have downloaded and read the genetics training package which has been great for showing why and how these are great model organisms. We will be validating a protocol set out by a company sponsor in which we will be carrying out Chromatin Immuno precipitation (ChIP-seq) on Burrowing Beetle tissue and then validating the protocol using D. melanogaster as either whole body or individual sections. This will be carried out using a range of life stages e.g. 3rd instar,

whole body adult and pupae. Using the species and data provided in the modENCODE project for D. melanogaster as a standard will allow us to determine if our method yields higher quality results and a reduced experimental time. As we have experienced with the beetle stock we have found it easier to flash freeze the organisms at the correct life stage ready for experimental use. Would you advise generating a breeding stock first then selecting individuals for flash freezing or is there a supply of individuals at different life stages available? Many thanks, Tom Generalovic

- Anna Digilio (Institute of Biosciences and BioResources, Naples 23 October 2017): Hi Andreas, I am an Italian researcher working in the Drosophila field. In the last few years I started to work with high school in my country, with the goal of using the fly to teach genetics and biology. Recently, I had the opportunity to visit your website and I was very impressed with it so I'd like to congratulate you for your excellent activities. I am very interested in engaging in such activities in my country. In particular, I am fascinated by two activities that I have never done during my lessons: Optogenetics (fly laser quest) and Seizures and Paralysis. So, I come to my request: can I use your lessons, with the appropriate citations? could you send me fly strains to carry on these activities? I look forward to hearing from you. Cordially, Anna Digilio
- Alexandre Neves (Fred Hutchinson Cancer Research Center , Seattle; 23 October 2017): Dear Dr. Prokop, My name is Alexandre Neves and I'm a postdoc in Bob Eisenman's lab at the Fred Hutch in Seattle. I'm also currently a Science Communication Fellow at our local Science Center, and am developing a *Drosophila*-based activity that works for both kids and adults. With that in mind, I was wondering you would be willing to share your classical genetics lesson mentioned in your blog. I would also like to check if it's ok to use the outreach resources in the Manchester Fly Facility website, with appropriate attribution. Best regards, Alexandre
- Eyal Schejter (Dept. Molecular Genetics Weizmann Institute of Science): I am a Drosophila researcher at the Weizmann Institute in Israel. I had the pleasure of listening to your talk describing the impressive educational and public outreach activities of the Manchester fly facility, at the recent DRC in Chicago. I have been asked to introduce/present the topic of "genetics" to grade school pupils (5th-6th grade) at a nearby elementary school (a single 45 minute session), and wanted to ask for your advice. Encouraged by your Chicago talk, I would like to make Drosophila a focal point of my presentation. I've been looking at the MFF website, which has given me some ideas, but the various activities seem to be geared primarily towards middle-school students and older. Do you have any specific advice regarding presentation content or can point me in the direction of relevant resources, when it comes to teaching grade school pupils, with minimal background? Thanks very much for any help you can provide. Best wishes,
- Joaquin De Navascues MeleroB (Cardiff University): Here, Biology students can do as final year a "public engagement" project, where instead of lab work they produce materials for the dissemination of biological knowledge. I would like to tap into this resource to create a permanent website that would explain the past and present of Drosophila research and its impact (expanding one student at a time; students would also benefit from having a stable platform where to contribute; a bit like a student radio station). It seems to me that in the realm of science communication and Drosophila, you are the person from where to get advice. I was wondering whether you would mind having a chat about this and if that is the case, when and how (Skype? Phone? email?) would it be convenient to you.
- Nara Muraro (PI at the IBioBA-MPSP, Buenos Aires, Argentina): Last year I got an independent position and I am starting my lab now studying sleep in flies, a bit of behavior, some confocal and, of course, electrophysiology. I´m only starting, but it is exciting times! The reason I am contacting you is that a friend, who is very into science education, stumble upon the great material you´ve produced for schools and forwarded it to me (mocking me about my photo there, of course!). I think the website and movies are great (Oliverio, who is now 10 years old and very into science, loved it as well). I automatically thought that it would be fantastic to have that sort of material in Spanish, do you think it is possible to

translate it? Maybe on the home page get a Language icon to choose English or Spanish? Do you think that may be something Manchester Uni would be happy with? And you? It would certainly open the material to big areas of the world. If you guys are on board I could do the translation of the text myself, then find some people to help with the technical aspects of the website and edition of the movies (welcoming all the help from you guys if you could manage some time and resources). I could also try to apply for some local funding to get a bit of professional help from here, I haven´t applied for that sort of funding here yet, but it would be educational for me to give it a try. I think getting youngsters excited about Drosophila is very important in a region like Latin America where science funding is so tight. Ridiculously, we don´t have that many fly labs around here...I hope we can change this. Actually, I am now collaborating with a high school teacher who is organizing an after-school program called "El cuarto de las moscas" to get kids to know flies and scientific activity, it´s fun and rewarding. PS: also, thanks for the "How to set up a genetic cross" material, I´ve been giving it to every new student in the lab, and they all have found it very useful!

- Jim Ryan (Hobart & William Smith Colleges, Geneva): I'm interested in using your climbing assay in my neurobiology lab. I want to use a mutant that would be considered a model for a human disease such as ALS or MS. The disease is not important as long as it effects the motor system and there is an analog in humans. What I'm most interested in is what mutants you think I could get a hold of (from Bloomington) that would show a reduced ability to climb as adults or to crawl as 3rd instant larvae. If you have any recommendations/stock numbers, I'd be grateful.
- Emma Wilson, (PI at University of Chester):
  - Dear Dr Prokop, I am a new lecturer at the fledgling institute of medicine at the University of Chester and find myself module lead on undergraduate genetics and evolution modules. I was hoping to do some engaging practicals with our undergraduates and I think they will revel with a drosophila practical. I used drosophila in my own degree (some 20 years ago now) and have lasting memories of the experience and hope to give our undergrads a similar experience. Having said that, that experience was the only experience I have had with drosophila since. I notice on your website that you offer some training courses and wondered if you thought that any of these courses will be suitable to help me feel more confident to run some basic practicals for 1st and second year undergraduates? And if so, do you have any plans to run any of these courses in the near future?
  - Thank you for this, I read up on the links you sent yesterday and they are such an excellent and positive resource. Sanjai has contacted me also this morning, so hopefully I will be able to get something organised with him. Thank you so much for your help, With many thanks
- Andrew Lin (University of Sheffiled): Many thanks again for the flies and the protocols you sent last month. It's the first time I've seen the bss and sda flies and the phenotype is pretty cool! We wanted to make some posters for our exhibit and I understand that the idea behind the outreach initiative you and Andreas Prokop are spearheading was that other labs could re-use resources like posters that you guys created. Would you be willing to share some of your posters and graphics with us to avoid reinventing the wheel (eg Illustrator or Powerpoint files)? We'd of course credit the Manchester fly facility. The topics we wanted to cover are: neuroscience, developmental biology, immune system, cancer, aging, and a general introduction to the fly. If you have any material that we could use on these topics, we'd be most grateful. For the last one I thought something like the attached which I pulled off your website would be perfect, if you have a file for that.
- Matthew Clark (Oregon): I am a grad student in Chris Doe's lab here in Oregon. I was visiting Richard Baines' lab a while back, and I noticed your wonderful outreach poster when you first enter the fly room. We are holding a free public screening of The Fly Room and would like to have a similar one up while we perform various optogenetic and thermogenetic experiments. Later we'd also like to hang it in the entrance of our fly room

and use it for outreach in the community. I recently saw the attached outreach talk. Would you happen to have suggestions or files we might use to make a similar poster (like on page 13)? Thank you for your time and all of the wonderful and inpsiring outreach work you do! p.s. I use the genetics training package whenever I have a new student in the lab. It is fantastic!

- Arzu Celik (Bogazici University, Istanbul, Turkey; 07 June 2017): I have been following you excellent work on science education something I would like to do more as well. Currently, I have been given a task in an area that I am not so experienced with. I have been asked to train high-school students for the biology olympiads in the field of biology in particular in Drosophila physiology! ... I have a few days to prepare for this. I was wondering if there are any experiments that pop up in your mind.
- Pavel Itskov (PI at Champalimaud, Lisboa, Portugal; 23 September 2017: Dear Andreas, We have not met, my name is Pavel Itskov. I am interested in developing tools and curriculum for introducing Drosophila to schools as a way to study multiple biological processes using real experimentation. While I was searching the web I have discovered that you have developed very nice educational resources. My main idea currently is to start a company that will among other things develop and tools that use Drosophila and other invertebrate model organisms in school education. In the past I have developed the flypad (flypad.pt) that I am planning to use as my first product that will allow to measure various aspects of feeding behaviour in flies. It will need to be redesigned to become more affordable first, but my experience is that there is a lot of interests in these kind of tools from the school STEM teachers. We have been using it extensively for school visits that are regularly scheduled in our institute (Champalimaud centre for the unknown, Lisbon, Portugal). I also presented in at the Maker Faire in Lisbon, and it was very popular (to my surprise) among 8-12 year old kids and their parents. Given your extensive interest in science communication I was wondering whether you will be interested in talking to me on skype. Looking forward to hearing back from you. Best regards, Pavel
- Queen Rashidat (06 Sep 2017): Dear Andreas Prokop, My names is Rashidat, Abdulazeez, a first year PhD student at Ahmadu Bello University, Nigeria. I am interested in genetically characterizing Drosophila melanogaster and sigma virus in the 8 vegetation zones of Nigeria with a goal of establishing a research and training center on Drosophila and outreach programs in high schools on the use of the fruit flies in improving teaching and learning of biology. During my MSc I characterized Drosophila melanogaster from 3 Savannah zones of Nigeria using microsatellite markers. The results were amazing indicating a high genetic diversity, reproductive isolation with great genetic differentiation. I have after attending some workshops like TReND in Africa in Tanzania last year October, molecular biology by TReND-Bingham in Abuja, 2017 and DrosAfrica Ibadan 2017, seen so many loopholes in my MSc research as I am the first to conduct such Research not only in my institution but in Nigeria and getting useful assistance and contribution hasn't been forthcoming.I am determined to establish this field in my country, the various faculties in the various workshops I have attended can attest to this fact. I am not yet gainfully employed like I earlier stated this field is new in my environment and the value is yet to be appreciated. I am inquiring if the fly facility program could collaborate with me in establishing this great field in my country and support my research in any way. I am willing to provide any further information about my self, referees and research. Thanks. Best regards

6.4. Impact on other activities

- Collaboration with NC3Rs to promote the Replacement strategy - Emma Stokes (NC3Rs; 31 October 2017): Hi Andreas, It was lovely to meet you at the symposium yesterday and I very much enjoyed your talk. I think there are good opportunities for us to work together. Kam and I will discuss together, and it's probably useful for you to discuss with her too as she's manchester based, and we'll come up with a plan of action. From what we discussed you have a lot of ideas, and initiatives on the go. It would be good to work out what the

priority areas are for you? Perhaps the www.flyfacility.ls.manchester.ac.uk/ website? So we can work strategically and prioritise activities. All the best, Emma

- "Fly Indonesia" collaboration between Dr. Firzan Nainu (Hasanuddin University, Makassar, Indonesia) and the Manchester Fly Facility (Faculty of Biology, Medicine, and Health/FBMH, The University of Manchester) to establish *Drosophila* research in Indonesia.
  - Firzan Nainu, Ph.D (Makassar, Indonesia): Greetings from Indonesia. I hope this email finds you in a great condition. First of all, please allow me to introduce myself. My name is Firzan Nainu and I am a lecturer in The Faculty of Pharmacy, Hasanuddin University, Indonesia.I have known your name and your exciting research and education contributions in the Drosophila field, since my PhD days in Japan. In my PhD days, I carried out researches using Drosophila as well and I have published one of the study in the Journal of Immunology. In fact, to be honest, I am really eager to visit your laboratory someday and if possible, learning some techniques about Drosophila in your laboratory that can be applied in Indonesia. After finishing my PhD in Japan, I came back to Indonesia and trying to establish a Drosophila laboratory in my university. With the help of the Dean of the faculty, I have managed to establish a small Drosophila workstation. Using this, I am currently trying to promote the application of Drosophila model system to solve some biomedical problems in Indonesia. It is a fair task since most of the people in here are get used to work with mammalian model system. In fact, I believe only a small number of people are working with Drosophila as a model organism in Indonesia at the moment and perhaps almost none tried to promote biological education using flies. I have used some of the resources such as presentations and documents created by you and your lab to engage young students' curiosity about biology and to secure funding from some agencies in my country, Indonesia. The result, I was able to secure a research grant from my university and currently in the final selection for two research grants from my government. Using the grant, I am currently hosting eight undergraduate students and one master student that are now doing some basic research using Drosophila. Many more had come but unfortunately, my funding could not cover more people. Therefore, please allow me to offer my gratitude to you for creating such great resources and beautiful images and for sharing them online. It has helped me a lot to promote Drosophila work in my university. Next month, I am going to promote Drosophila research at a national level conference and I hope people in my country will give a positive response. I am sorry for taking your time to read this long email. It is the nature of people in my country to write long email when we are so happy. Thank you very much for your kind understanding (and patience) and I am sorry for any inconvenience that may be caused by this email. Best Regards
  - A visit to start the collaboration was supported by Hasanuddin University (total £2,180) and FBMH (£1,700); first deliverable was the Fly Indonesia website
  -  Fly Indonesia @Firzan_Nainu - 12 Aug 2017: Just had a chat with head of the lab. We will introduce #Drosophila research in the students' practical, formally this year :) @Poppi62
  -  Fly Indonesia @Firzan_Nainu 24 Aug 2017- Replying to @Poppi62 @ManFlyFacility: @Poppi62, I am going to use all of your droso4schools resources for students practicals in Faculty of Pharmacy, Hasanuddin Univ.
  - Firzan Nainu (06 September 2017): Dear Andreas, I hope this email finds you in a great condition. I would like to inform you that I am still working on translating your resources ... we have started to use *Drosophila* in the practicals. We will use the bang-sensitive flies in the experiment next week. I remember in the Science Discover Days with Joshua and Sanjai, we shake the flies for a minute and those flies will develop seizure. But, I did not see the written protocol. Do you happen to have it? If yes, I will be happy to translate it right away. In addition, we are going to use the locomotor assay

using the Droso4schools protocol available in the website. We included it in the practical book. I will take pictures of student enjoying the practicals next week and send them to you, if you like. Please let me know. Cheers, Firzan

-  Fly Indonesia @Firzan_Nainu 1 Nov 2017: Half of speakers in 3rd MIPS (http://mips.farmasi.unhas.ac.id/) will talk about fly research. First to Indonesians!!! @Poppi62 @DrosAfrica @DrosDGRC
- Firzan Nainu (16/11/17): I am currently managing practicals for 2nd year students in my faculty. We just finished anatomy and physiology practicals using Drosophila. Number of students involved in the practicals are 142. Of ten practicals, we used Drosophila for three of them. The experiments were: 1) Basics of Drosophila anatomy and physiology using all of your resources (droso4schools website and G3 paper). 2) Learning nerve systems and problems in it. One of the practicals was using epileptic bang-sensitive flies. 3) Locomotor activities of organisms. We used Drosophila to show the age-dependent difference of locomotion in Drosophila and extrapolated the results and analysis to human. We have some pictures of students and my assistants conducting the locomotor activities comparing between young and old flies. In addition, we also did an experiment for the locomotion of flies under the influence of ethanol or not.

- Translation of our movie into Spanish
  - Patricio Olguin (Institute of Biomedical Sciences, University of Chile): Dear Andreas, I hope this finds you very well. We met at the Drosophila meeting in Chicago last year, I was with Jimena Sierralta from Chile.This year our labs will be working with students in a meeting in Chile doing a Drosophila mini lab demonstration and we would love to use your educational movies "Small fly: Big Impact" to introduce the kids into the fly world. I was thinking into translate the audio or maybe just do a little talk on top of the video before the activity, perhaps use subtitles. In any case I would like to know about the permissions to use the videos and some of the images that you designed as an educational resource during this activity. I have to say that they are incredible!!! I hope you can help us with this, I believe it will be very helpful!! all the best,
  - "Pequena mosca, GRAN impacto - pt 1"; translation of our first educational movie into Spanish (by Patricio Olguín and Daniela Medel, University of Chile, Santiago, Chile): -- [LINK]
- Translation of our movie into Arabic - Alhadyian, Haifa Abdulrahma (PhD student, The University of Kansas; 04 October 2017): Dear Dr. Prokop, I hope this finds you well. This is Haifa Alhadyian, a Ph.D. candidate at the University of Kansas. You may recognize my name from Twitter. In the beginning of this year, I discussed with you the possibility of translating Drosophila: Small Fly, Big Impact videos to Arabic and you asked me to email you when I am ready to work on the project. I will be working on the project with the help from Dr. Faten Taki (cc'd here), a postdoctoral associate at Weill Cornell Medical College. Both of us have experience working with model organisms. To start working on the project, Faten and I would like to meet with you over Skype to discuss the steps and ask few questions about translating the transcripts to recording and adding the voice-over to the original videos. If possible, please let me know what times and dates work for you to schedule the meeting. We are thrilled to have this opportunity to communicate the importance of model organisms to the Arab scientific community. We look forward to hearing from you. Sincerely, Haifa Alhadyian
- Translation of our droso4schools statistics classes into Spanish by Ana Fernández-Miñán (CABD, Sevilla):
  - "El ensayo de escalada: aprendiendo análisis de datos a través de experimentos reales con moscas de la fruta"; -- [LINK]
  - (30 October 2017): Hi Andreas, I am Ana Fernández from CABD. I am writing again because I would like to translate your KS5-Genes&Alcohol resources to use it like I did with the "Climbing Assay", if that is ok with you. Best, Ana

- Filming of one of our droso4schools classes at Loreto Sixth Form College by the Royal Society -- [LINK tba]
- The droso4schools project was selected as a case study for the BBSRC Excellence with Impact award application in 2016
- Statements/ideas from our website were used in newspaer articles:
  - Guardian article: Article in the Observer, 8 Oct 17 Six Nobel prizes – what's the fascination with the fruit fly?
  - David Bilder (PI at Berkeley; 12/10/2017): Just saw the Guardian article via the GSA link – congratulations and great work spreading the message! D
  - David Bilder (PI at Berkeley; 12/10/2017): Thanks to the many of you that have sent nice notes about the NY Times Op-Ed piece. For those who haven't seen it: www.nytimes.com/2017/10/04/opinion/nobel-prize-fruit-fly.html?_r=0. I want to mention that this is one of the things that we had in mind when the advocacy committee re-started a number of years ago, after Sarah Palin. In particular we talked about 1). being able to react quickly to breaking news and 2). having ready, succinct resources available on-line to show non-experts the value of the fly in biomedical research. To give you a sense of 1). I submitted the piece after midnight, woke up to an encouraging note from the Editor, and fact-checked/revised between 9 AM and noon (all while driving rapidly to meet my son's school field trip in Northern CA). It was online 15' after I finished. With respect to 2). I was able to point the NYT Editor working on the piece to Andreas' Manchester Fly Facility pages, including the videos. I don't know exactly which ones she checked out, but they clearly had the desired effect. So kudos again to Andreas! D
- Impact on scicomm teaching -  Sam Illingworth @samillingworth 11 Oct 2017: Discussed this paper today with @manmetuni MSc #scicomm students and they were very impressed with scope and resources provided! 😊👍🔬


Seminars in Cell & Developmental Biology

Review

The droso4schools project: Long-term scientist-teacher collaborations to promote science communication and education in schools

Sanjai Patel, Sophie DeMaine, Joshua Heafield, Lynne Bianchi, Andreas Prokop

- Stefan Pulver (02 July 2017): hey Andreas, just occurred to me----how would you feel about me sharing this link with the whole CSHL course and asking the students for feedback? Would be a chance for you to get feedback from a lot of people and would raise profile of you and Sanjay and manchester fly facility at same time. Would also be a nice opportunity for our students to act as peer reviewers. sound ok? S

6.5. Invitations

- Invitations to present at conferences (see 1.5)
- Michael Simonsen-jackson (Deputy Director BSF, Manchester; 31 October 2017): Hi Andreas, Thanks for your talk I which very much enjoyed yesterday. You kindly agreed to talk to BSF staff so please give me some dates early December and I will book a room. Thanks Mike

- Becky Randall (05/07/2017): By way of introduction, my name is Becky Randall and I am a Biology teacher at Haberdashers' Aske's Boys' School in Elstree, London. Currently, I am working on a conference that would be held here for Year 10 boys next June. The conference is tentatively entitled 'Frontiers in Biology' and it aims to give the boys an understanding of the cut - and - thrust of research, and also a taste of exciting, dynamic current work that's being done. My HoD recently went to a group meeting at Westminster School, London and he was told that you do a lot of outreach work and that you come into schools to present on the use of Drosphila in research. He also mentioned that you have a mutant strain that goes to sleep when they are warm! I used to work at Cancer Research UK as a research scientist, and now I'm looking to engage and inspire the next generation of scientists! Most of the boys we have here take GCSE Biology, and a large number go on to careers in the field of Biology. Hearing talks from leaders in their field will be a fantastic opportunity. I was wondering if it might be possible to arrange for you to come and talk to our boys?

Part B: Comments demonstrating quality of resources & activities

7. School Visits, droso4schools & Teacher Seminars (teacher comments)

- Catherine Alnuamaani (collaborating teacher on droso4schools; Trinity CoE High School): Josh and Sophie worked with me at Trinity for one term each. They acted as teaching assistants in lesson, working with children of all ages and abilities. They worked with special educational needs, Year 7, year 8, Year 11 and Year12. In year 11 classes they worked with a bright top set GCSE Biology group and also an all-boy GCSE science bottom set. Each of these classes provided challenge for Josh and Sophie, which they managed to combat, building positive relationships with the students. They supported both individual students and small groups to allow differentiation within the class room. With Year 7 and year 8 they started to deliver lesson starters and plenaries, teaching small parts of lesson to whole classes.

  Josh and Sophie were at their most effective with our Y12 AS Biology classes. Their current, up to date knowledge of their subject area's proved to supplement greatly class teaching and discussions. At all times Josh and Sophie were enthusiastic and engaging with our students and on occasion made the expectation on them for independent learning once at University very apparent to the students.

  Their experience in the class room led Sophie and Josh to develop lessons that are relevant to the curriculum being studied, at the right pedagogical level for the students to whom the lessons were aimed. They were able to learn from their discussion with myself and other teachers how to scaffold lessons so that learning is constructive and successful. Most importantly they were able to create lessons with clear learning outcomes that engaged students in research beyond the classroom within which they may play a role themselves in the future. They opened a world of scientific knowledge, research and excitement to our students from which they had previously been excluded.

- Sam Crawshaw (Manchester Grammar School): Thanks again for running such a brilliant session for our brightest Sixth Form students this evening. It was an absolute pleasure for me as a teacher, and I know that the pupils who attended were hugely stimulated; your session has generated a fantastic range of potential follow up enriching activities for them. I cannot think of a better recruiting tool for the University of Manchester, nor for the Life Sciences in general. The multiple experiments the pupils took part in were pitch-perfect, and I'm looking forward to seeing how they will process their data over the next week; I'll send you more feedback after our next session. As a former occupant of the Smith Building, I know that outreach work can be one of the less valued areas of academic activity within universities, so I took the liberty of copying in Martin Humphries, to ensure that he is aware of the stellar work that you are doing in providing low-cost, stimulating experimental

resources for schools: well beyond the bog-standard Mendalian fruit fly investigations. As we discussed, a copy of your PowerPoint would be most useful in following up the session with our pupils. I will direct the lads to your excellent Fly Facility website, and our Biology teaching staff to the excellent resources you have uploaded onto www.figshare.com. With best wishes for your continued excellent work – in and out of the lab.

- Martin Humphries (UoM): Dear Sam: Many thanks for copying me in to this email. I'm delighted that Andreas' session was so well received, and you can rest assured that his contributions to public engagement are well known to me and very, very highly valued! Regards,
- John Park (Cheadle Hulme High School): I'm really happy with how the day went. I think the genetics crossing exercise was potentially one of the most useful but the level of language and difficulty was perhaps not what the students were used to. I think the 3 main activities and the lecture were absolutely fascinating. I was wishing that I had no responsibility on the day so I could just join in! Thank you very much to all of your team, we really appreciate all of your efforts. Inspirational!!
- St John's RC Primary School: Thank you so much for preparing and delivering such an exciting interactive lesson yesterday. The children enjoyed it so much and we really appreciated it. The Year 5 Team
- Hayley Monk (UoM) - Priestly College visit: Thanks again, Sanjai, that was great. They were quite a tough crowd up to that point but you really engaged them and I've been asked specifically what degree they can take to do more fly work!
- Dan Virr (Manchester Grammar School): I have heard great reviews from the boys about Science Day. They seemed to really enjoy the sessions you ran. Thanks again for giving up your time to come and run them with your colleagues.
- Victoria Coyne (Manchester Grammar School): Just wanted to say a big thank you for coming to help with science day! I know Dan has had lots of positive feedback about the fly workshops from both students and teachers, and it was great to see you guys again. I know he was also most impressed with your set up and material for the day.
- Laura Holloway (St. John's Primary School, 05/04/2016): Dear Mr Prokop and Mr Patel, I'm just writing a quick note to let you know how much we appreciated having you visit today. The children enjoyed it immensely. We know how busy you both are so it was incredibly kind of you to support the children with their learning. All the children have mentioned how much they enjoyed the slides, videos and worksheets you brought with you. I can't imagine what time and effort went into creating them! They have all written in their evaluations that they would have liked more time with this activity. Luckility you anticipated this! You can't imagine how thrilled they all were to discover that you had left the microscopes and slides behind! We alos look forward to logging any changes in our larvae over the next few days.
- Heather Bishop (Cadbury Sixth Form College):
  - I am contacting you to see if there would be any possibility of your team coming down to Cadbury Sixth Form College, Kings Norton, Birmingham, to run a one day workshop. We teach OCR A level Biology. Next term we will be looking at Genetics and in particular we thought it would be a fantastic idea if you could bring to life dihybrid crosses using Drosophila for our students and if possible to include a section on epistasis. This comes from 5.1.2 Meiosis and Variation, outcome (h), (f) and (g). I can forward the syllabus and any other information you would like. We have 66 A2 students and 25 BTEC Level 3 second year students, who would also benefit from the day as they study Unit 18 - Genetics and Genetic Engineering in the second year. I attended a STEM day with you in July this year and really enjoyed the Drosophila workshop. I remember at the time that it was said that you were happy to visit colleges. Any help would be fantastic as I think this is an area that you would be able to really excite our students about. Please let me know your thoughts. Kind Regards,
  - Yes, we had a fantastic day last half-term. The students really enjoyed it and the genetics team were fantastic. Thanks for your help.

8. School Visits (a selection of the pupil comments)

8.1. Extracurricular school visits

- ‘The neurobiology was the most interesting as you got to see the mutated flies. It was really interesting and gave a good insight into what university is like’
- ‘I think it is very important to use the flies, because it can help the scientists discover how we work, and find cures to disease.’
- ‘I think it is a key part in scientific research and is very efficient way to collect information about genetics’.
- ‘Yes, useful to both my course and has stimulated my interests’.
- ‘It helps develop our understanding of human biology’
- ‘I am fascinated and want to learn more’
- ‘It was very interesting and I learned a lot- I never knew that fruit flies had a similar neurone structure to humans’
- ‘It was good and inspiring activity and I have learnt lots of new things’
- ‘I thought it was good because I got to learn how flies are useful and more about the nervous system’
- ‘They are very useful in finding out about the effects of aging’
- ‘They are really useful in understanding genes and how they affect us’
- ‘Essential to future understanding of human disease’
- ‘They are simple organisms with similar body plans to us there excellent specimens to use in order to research genes and drugs’
- ‘Today has provided a very interesting insight into how flies are used in research’
- ‘The session on the nervous system/neurobiology links into topics taught later in the A level syllabus’
- ‘My biology has been helped by studying this course, especially in genetics and neurobiology’
- ‘It was very interesting to see how nerves can affect memory and to understand how different factors eg light affects behaviour’
- ‘This will help me in my science and triple science class’
- ‘The genetics about flies was helpful to see other experiments linking to genetics at biology A level’
- ‘It was useful learning about the nervous system which we learn in Yr13’
- ‘I enjoyed the day and saw it as extremely interesting’

8.2. Within droso4school project

- ‘I found the help really benefical in neurobiology as I didn't understand the topic beforehand’
- ‘Josh has had a very positive impact on my lessons as he provides an alternate/more undertsandable answer on occasions’
- ‘Josh was very helpful during the lessons as he undrstood how to explain the work to students at our level' He also helped those who are interested in studying Biology’
- ‘The placement students explained things very well in lessons and I understood what was being taught fully’
- ‘They were very helpful because they could help with A level syllabus as well as answer relevant questions about University’

- 'Josh was very useful in lessons I found his explanations very clear and he greatly improved my understanding. I found that explanations given by Josh and Sophie to be more memorable and simple to understand'
- 'I think they were very helpful and often clearer than the actual teacher'

8.3. School Visits (Pupil reports and drawings)

- Cheadle Hulme High School Reports (PDF)
- St Christopher's Pupils Reports (PDF)
- St Johns' Pupil Reports (PDF)
- Manchester Grammar Junior School Reports (PDF)

9. Online Resources (Teacher comments)

-  Pete Sanderson @LessonToolbox - 4 Sep 2017 (about the fly Scratch game): Learning the life cycle of fruit flies as computer game via @Poppi62 https://scratch.mit.edu/projects/74443210/ … #asechat #ukedchat
-  Rose Edmondson @RoseEdmondson5 (trained secondary science teacher looking to move to primary teaching) 15 Jul 2017, replying to @Poppi62 @LynneBianchi: Fantastic idea- I absolutely LOVED studying fruit flies and first discovered them at UofA in Canada- would love to bring them to my class 😊
- Joe Bonfante (Mercahnt Taylor's School, Crosby): Would it be possible to order some more flies from you? I need about 50 wild type males (long wings) crossing with 50 vestigial winged (females) and the reciprocal? Many thanks for the flies and food you sent. They were great.
- Mythili Jagannath: very useful for teacher to explain to students would appreciate it can be downloaded for teaching purposes only thanks to the team for commendable work.
- Ulupi Barnett (Head of Science at Nottingham University Academy of Science and Technology), 02 September 2017: The website and outreach you have set up is amazing and the accompanying materials look great- well done and please keep it up!

10. Online resources (comments from other researchers)

- In response to tweeting about our fighshare oureach resources:
  -  Ruchi Jhonsa @JhonsaRuchi 6 Oct 2017: @ClubSciWri @ipsawonders @fuzzysynapse you can use these images for free for #scicomm.
  -  Soc for Devel Biol @___SDB 5 Oct 2017: Fantastic free resource!
  -  MadScientist @MadS100tist 5 Oct 2017: This is an awesome resource, my dudes
- in response to ManFlyFacility For the public:
  -  Raff Lab @JRafflab 4 Oct 2017: Thanks @Poppi62 for sharing this list of interesting #Drosophila facts, our favourite model organism! #WhyTheFly
-  IMPRS-TP @ImprsTp 24 Oct 2017: Free resources for Science Communication and Education and a wonderful platform for productive Interaction: visit https://droso4schools.wordpress.com

- referring to tweet about http://www.flyfacility.manchester.ac.uk/forthepublic/whythefly
  -  Drosophila Lab, UI. @DrosLabUI 14 Sep 2017: Thank you Prof @Poppi62 for this! Permission to share it with acknowledgement please
  -  Nichole Broderick @nabroderick - 14 Sep 2017 - retweeted and added: Love this! Why we like working with flies- they are great for understanding host-microbe interactions too.
  -  Jacob Kagey @6MileFlyGuy - 15 Sep 2017 - Retweeted and added: I want to include this image on all future grant proposals. And perhaps have it framed for the lab.
  -  Melanie Stegman SPX @MelanieAnnS - 16 Sep 2017 - Retweeted and added: This kinda silliness and seriousness is why I loved being a fly scientist. #drosophila #womenintech #scicomm
- Responding to a tweet about https://droso4schools.wordpress.com/organs:
  -  Meaghan smith @M3aghanKate - 14 Sep 2017 - Replying to @Poppi62: Great diagrammatic representation! Love it / It had never crossed my mind... but now I'm extremely glad it is! How cool!!
  -  Cathy Slack @cathy_slack - 14 Sep 2017 - retweeted and added: You're more like a fly than you think...
  -  Anna Sharman @cofactoranna - 14 Sep 2017 - retweeted and added: What a great graphic!
  -  Georgia Orton @GeorgiaRFO - 14 Sep 2017 - retweeted and added: Great graphic = powerful tool
-  J. Colomb, @pen @j_colomb, 23 Sep 2017, replying to @Poppi62 about collating arguments for fly research: #openscience #oer the world say thank you (or will).
-  A. Sánchez Alvarado @Planaria1 4 Oct 2017 (in response to a tweet about our outreach resources): A great resource!
-  Sean Coakley @stcoakley 17 Aug 2017 Retweeted: Andreas Prokop: Awesome resource to learn about wiring the sensory nervous system 💪👍🔌#neuroscience
-  Ghent Uni Research @ResearchUGent - 5 Sep 2017 - retweeted a tweet about our HAMA bead patterns and added: If you're looking for something to do with the kids this weekend, why not this?
- in response to a tweet about fatigue:

-  K. VijayRaghavan @kvijayraghavan - 26 Jul 2017 - Replying to @matthewcobb @Poppi62: What you are doing is fantastic @Poppi62 Should be publicised world over by @GeneticsGSA @___SDB___ etc translated widely. Hang on hero
-  Hammed Badmos @HammedBadmos - 27 Jul 2017: At least you inspired me and others alike. Not a waste of time at all but an exceptional use of it #innovativeminds
-  Bing Zhang @Goodflies - 26 Jul 2017 - Bing Zhang Retweeted Andreas Prokop: Don't. You have been an #inspiration for many of us. #FlyHigh!
-  Caramelised Onion @caramalised - 26 Jul 2017 - Replying to @Poppi62: We use your material all the time! You do phenomenonal work, and 'wasted time' is as far from what you do as is possible!

- CSHLflyneurocourse @CSHLflycourse - 28 Jul 2017 (about droso4schools): Happy Friday, Fly Friends! Please see this amazing resource from the #ManchesterFlyFacility @Poppi62 #TeachWithFlies http://goo.gl/X8UHFD
- Simon Sprecher (PI in Basel; comment on droso4schools): Andreas: a fantastic overview of organ system comparison and similarities. I was looking of a nice image depicting human and fly for a talk and found your images really perfect. Regards Simon
- comment on YouTube channel:
  -  Jorge Beira: Great stuff! really well made! congrats! This makes it much easier to explain to people
  -  朱瑞驰: I am Ruichi. It is so impressed and well performed!
  -  Mukesh Maharjan: Great work ! I am really grabbed by its flow... looking forward to more videos on fly..
-  the Node @the_Node Jul 14: Ah, the faithful funnel method...until you graduate to the quick flip! More great #Drosophila tips from @ManFlyFacility
-  Philipp Schlegel @uni_matrix Jul 2: Thanks @MichaelBReiser - inspired by the great resources from @ManFlyFacility
-  Kavitha Kannan @kavkannan Jun 14: Great going! Congratulations and may the impact keep growing!
-  Alexandre Carisey @**alexcarisey** 19 Jun 2017: Fantastic initiative from Manchester Fly Facility @FBMH_UoM to communicate top quality science, congrats @Poppi62! http://www.sciencedirect.com/science/article/pii/S1084952117303312 …
- retweets for https://ndownloader.figshare.com/files/8753464:
  -  CSHLflyneurocourse @CSHLflycourse 26 Jun 2017: and added: Andreas Prokop An excellent resource for #Drosophila advocacy and outreach. See the link and download to share!

- **Genetics Soc of Amer** @GeneticsGSA 26 Jun 2017: Genetics Soc of Amer Retweeted Andreas Prokop and added: nice list of resources & tips for ways you can conduct outreach & advocacy for #Drosophila. sing it loud & proud. thanks @Poppi62.

-  Sofia Araújo @sofiajaraujo 14Jul2017, added: Revamped #droso4schools, fantastic resource for taking #drosophila to school students

-  Carsten Timmermann @ctimmermann 30 Jun 2017: Carsten Timmermann Retweeted Andreas Prokop. This is a great school outreach programme.
- Lewis I. Held Jr. (Texas Tech Univ.; 10/07/17): Permit me one last observation about the *ethos* of your presentations--from a teaching angle. Your text & images exude the sort of pure *curiosity* that impels us nerds to do *basic* research. I tell my students that their inner *Alice* will be a better tool than their disciplined *White Rabbit!* Gratefully, Lewis
- Vanessa Comache: The way in which you explain every aspect in every paragraph is very entertaining and easy to understand; continue to write in this way!
- Elli Wurdeman: As a beginner practicioner I find any advice helpful and good resources and blogs are hard to find.
- Laurent Seugnet (University of Cambridge): great images for teaching
- Chris Richards (Monash University, Australia): These images are great! I was hoping to use them in a talk I am giving soon to a bunch of 'non-fly' people. Can I reference them to this website or is there a more appropriate reference for them?
- Rami Ajjuri (Universidad de NAVARRA, Pamplona): Thank you so much for this. Great article; I've already sent it to several colleagues and labs.
- David Bilder (PI at Berkley):
  - Still, it was enough to confirm all my positive thoughts about your tremendous initiative and accomplishments in this communication area. It is great news that you have joined GSA, and that we can coordinate efforts. As you say, our initial efforts are towards decision makers in government and funding agencies as well as the press. I am working with Raeka on a succinct but high-quality website about flies and biomedical research to begin with, while the Communications Committee that we just founded is going to take up some other initiatives. I plan to consult with you as we shape the content of the website, at the very least. With respect to communications with the fly community, I couldn't agree more. In fact I raised this issue at our Board Meeting on Wed. before the conference. The news feed is absolutely the way to go; the question is I believe whether someone in the Flybase project can add that to their existing responsibilities. As you may know, Flybase is going through some transition now so this may be a good opportunity for change. I will pursue this a bit and keep you posted. On the same subject, can you give me a transatlantic perspective on a question. Do you have a sense of whether most UK/European fly workers self-register at Flybase(with emails, etc. for communication?) —or whether they are unaware that this is useful/important? I think it's important to get a count of who our community is, and critical to disseminate information to all of them. I'm figuring out the best way to promote this now. So glad to have you on board!
  - Just a quick note to compliment you on the youtube video that you produced. We have been talking here in the US about putting together a website promoting fly work (cf Hugo's perspective now out in Genetics) and I came across your video —it is very effective and covers a lot of the ground that we have been thinking about. (looking forward to seeing the sequel). Raeka from GSA tells me that you are helping to organize a workshop at the fly meeting —unfortunately I won't be staying through Sat. but hope that we can say hello earlier.

- Prim Singh (Liverpool John Moores): Just a short note to thank you and Tom for being so helpful yesterday. I aim to undertake my first cross next week so “wings-crossed”!
- TReND in Africa @TReNDinAfrica 30 Apr 2015: @Poppi62 @figshare our outreach team will certainly benefit from this resource to teach about #Drosophila in #African schools!
-  Sarah @Drosophilista 16 Sept 2014: Great outreach stuff by @ManFlyFacility! "the equivalent of the population of London can be kept on a few trays in the laboratory"
-  Raff Lab @JRafflab 16 Sept 2014: FF @ManFlyFacility! Their website is well worth checking too, fantastic #outreach and #scicomms: http://www.flyfacility.ls.manchester.ac.uk/forthepublic/teachersandschools/#.VBgd5UtYVg0 …
-  Matthew Freeman @mjafreeman, 16 Sept 2014: I'm seriously impressed by @ManFlyFacility's outreach efforts. Includes plan for a Hama bead Drosophila http://www.flyfacility.ls.manchester.ac.uk/forthepublic/#.VBgKUkvWgfk …
-  Jim Woodgett @jwoodgett 15 Sept 2014: Why researchers work on fruit flies. Superb #scicomm outreach from @UoMNews. http://www.flyfacility.ls.manchester.ac.uk/forthepublic/ via @SimonBullock11 cc @caseybergman ½
-  Simon Bullock @SimonBullock11 Sep 12: Fixed link (I hope)....fantastic outreach activity from Univ of Manchester fly folk http://www.flyfacility.ls.manchester.ac.uk/forthepublic/#.VBN6gWK9KSN …
-  lisa landskron @lisa_landskron 14 Nov 2016: @Poppi62 @ManFlyFacility thank you for putting together a great #Drosophila resource for outreach! very helpful! http://bit.ly/2eWUe0F
-  K. VijayRaghavan @kvijayraghavan Jun 22: K. VijayRaghavan retweeted Genetics Soc of Amer. This resource is really worth a visit!
-  K. VijayRaghavan @kvijayraghavan 23 Jun 2015 New Delhi, Delhi: @Poppi62 Terrific service to scientists which we can use for communication with society and government.
- Genetics Soc of Amer @GeneticsGSA 22 Jun 2015: Human vs. #drosophila organs! http://bit.ly/1db5gv0 educational resource from @ManFlyFacility @Poppi62
-  Sonia Hall @SoniaHall 21 Dec 2016: we also benefit from the open science communication efforts of @ManFlyFacility @Poppi62

-  Firzan Nainu @Firzan_Nainu Jan 13: Firzan Nainu Retweeted Andreas Prokop - Happy to see another great Drosophila resources from @ManFlyFacility
- LINK out to our Drosophila movie -  Firzan Nainu @Firzan Nainu 4May 2017: @Poppi62 My recent Facebook post on why we should embrace the application of Drosophila in biomedical sciences in Indonesia. -

11. Fly training (training package and in-course training)

- David Bilder (PI at Berkley):
  - I think that the committee in the past has favorably looked upon images reflecting community resources --and I would encourage you to 'officially' submit it. As a personal note I think that your publication was very valuable, formalizing and beautifully organizing the way we have long trained researchers in our own lab --I salute you and think you did the community a great service.
  - I wanted to follow up on my praise for your G3 article by suggesting that you submit an image for this year's Drosophila Image Award. Although most of the entrants display primary research data, I think that your extremely useful 'genotype builder' kits are a wonderful resource for the community and their elegance and clarity might find favor with the judging committee.
  - Writing you from the fly meeting, where I announced your special commendation Image Award at the first plenary session. Your reference was up but I have also fielded a few questions at the meeting about your toolkit. Should be good publicity!
- The 2014 Image Award Committee: Dear Andreas- I'm delighted to tell you that the Image Award Committee has decided to award your submission from 'Rough Guide to Drosophila Mating Schemes' a Special Commendation for Training Drosophila Biologists. This is an unusual recognition that we grant when the committee feels that an image makes an exceptional contribution to educational resources. To date we have granted it only twice before, in 2007. The committee was uniformly enthusiastic about doing so this year for your submission. We would like to prepare for you a plaque and give you the opportunity to be recognized at the US fly meeting in a few weeks, if you plan to be there. Let me know, and in the interim could you send me a high resolution image of your submission?
-  Esther Verheyen @EstherVerheyen: Replying to @drosophilosophy: Have you given him the great @Poppi62 article? It is essential reading for new fly people!
- Elizabeth Stoops (former student, then PhD at Weizmann Inst., Israel; 12/06/2017): The genetics training course together with the training guide were both a comprehensive and well-explained method of teaching undergraduates with little previous experience in dealing with Drosophila and genetics. The course itself was interactive giving the opportunity for students to work out the results of mating schemes, and well-illustrated allowing for a greater understanding of the way crosses work and the phenotypes to expect. The course gave a broader understanding of fly genetics, from its relevance to biology and biomedical research, down to understanding the more complicated gene constructs found within the fly. When starting my masters I again found that the accompanying booklet to the course came in handy and it's a good reminder guide to everything we learnt.

12. Comments by students/postdocs

12.1. Students/postdocs who participated in Manchester Fly Facility initiatives

- Victoria Coyne (PhD student now teaching at Manchester Grammar School): For me the one thing that stands out about kids when teaching them something new is the great

questions they ask. That has always amazed me and that they can influence and change how you think about something by asking really interesting questions that you may not have thought of, but can also change your perspective. The other thing I enjoy about teaching anything is seeing that eureka moment when people finally understand the point you are trying to make and are amazed by how complex life on this planet is. I like the problem solving aspect of this, where I try to use different ways to explain or show something until people understand something. Having the chance to experience teaching during my PhD helped me see that I was quite good at it and that not all schools are as bad as the one I attended (where we made our teachers lives hell).

- William Fear (Undergraduate student going into teaching): The fly facility and its staff were absolutely vital in the preparation and completion of my final year project. The prepared Drosophila strains used in the project clearly had a significant impact on the students attending the outreach session. Their learning was shown to be significantly improved due to the use of optogenetic Drosophila in their lesson. The flies offer an unique opportunity to showcase advanced physiological concepts, such as optogenetics, clearly and effectively, to a wide range of student ages and abilities. The equipment, expertise and advice that the Manchester Fly Facility provided was invaluable throughout my project, and demonstrated the huge potential of the Droso4schools outreach programme in the promotion of science learning in schools.
- Abbie Saunders: The fly outreach events helped me consider a career in science communication and assisted me in obtaining my current position as a Writer for a Medical Communications agency. I further developed my skills for communicating to different ages and abilities by participating in the outreach events, and they were a key part of my CV when I applied for a Medical Communications job.
- Suzanne Wrigley (Post doc into teachning): At the end of my second postdoctoral research position I made the decision that I would like to change career and become a secondary school teacher. I wanted to gain experience in working with children so I began doing some outreach with schools in the local area. One such school was Bolton School; they wanted to give students the opportunity to find out what research scientists do. Working at the University of Manchester I was fortunate to have access to the fly facility where I could take a variety of flies into schools to help to explain genetics and the role of research scientists. This opportunity gave me a huge advantage when I came to applying for teacher training. It gave me the necessary 10 days experience that I needed to be accepted on the course and gave me plenty of experience in working with children. During my interview lesson I used resources from the university to explain endothermic and exothermic reactions and I got accepted onto the programme. I have kept close links with the fly facility especially in my teacher training year where I used flies to run practical sessions to help explain difficult concepts such as genetic crosses and inheritance.

12.2. droso4schools placement students

- Jennifer Harbottle:

  Outreach and public engagement are often perceived as unidirectional in that they only benefit the lay audience. However, I feel that my experience during this project has contributed towards my own professional and personal development. I have learned and developed simple tricks and new ways of communicating that will benefit the delivery of my own research to a wide range of audiences, and will help me to capture interest and maintain attention at conferences and in grant proposals. In addition to enhanced communication skills, I gained insight into the use of *Drosophila melanogaster* in scientific research, and this has given me ideas and inspiration for integrating this model organism into my own work.

  Seeing a whole project through, from observing at the back of a class and gaining an appreciation of a teacher's day-to-day life, to thinking of material that would be relevant and

of interest to schools, bringing a story together, linking different scientific theories together in a creative, appealing and concise format, and finally teaching this material myself and seeing the students' eyes light up proved to be incredibly rewarding. It was a steep learning curve in a setting and subject area that I was very unfamiliar with, but it was also a highly enriching experience for this same reason. Working with academics from a different research background to my own, as well as teaching a variety of biology topics to a lay audience, highlighted the importance of appropriately pitching my own work - facts are essential but creativity is key to put these across appropriately.

On a personal level, I gained a better understanding of the British schooling system, as well as teaching styles and techniques. I now appreciate the level and background of undergraduate students, and I feel that this will help me when demonstrating in lab practicals, helping out in tutorials, or even teaching classes myself one day. As a result, I also consider this placement opportunity as investment into the development of improved academic teaching.

- Joshua Heafield:

Back in August 2016 when I started on the droso4schools project, my teaching experience was very limited. I had taken informal lessons during a lunchtime revision session at school but I did not know the first thing about formulating a lesson to deliver so school pupils. My understanding of *drosophila Melanogaster* in biology was also very basic – I knew that it was an important model organism used in biological research but not a lot more.

Now, having spent nearly a year working on the project it is clear it has impacted me in a multitude of ways. My teaching experience has now rocketed – I spent three full days a week in schools for almost 6 months. In that time I've managed to plan and take lessons, mark work and get invaluable feedback on my teaching style. This time in schools has, according to the teachers with whom I worked, meant that I would easily be able to get a place on a PGCE course, if I so wanted to. Obviously that is the other main benefit of the time in schools – I was able to experience first-hand what life was like as a teacher and it has made me seriously consider it as a future career.

The feedback on my teaching from the schools was used constructively to help shape the lessons which I created. I was able to see how different activities benefitted different aptitudes of students, as well as experiencing how important it is to build a key base of understanding before going in to more detail on a certain topic.

The resources that I made were carefully and considerately built over a long period of time, establishing a key storyline throughout the lesson and making sure that new concepts brought in were done in an understandable manner. These considerations which I made are also key for teachers, the main difference being the time they have to create each lesson will be less. Having taken on board the core essence of tailoring lessons to allow students to understand specific concepts, again acts as a brilliant base if I were to go into a teaching profession.

Each lesson created on the droso4schools project has demonstrations and practical elements using *drosophila Melanogaster*. New practical experiments had to be developed for the lessons which I created, meaning I got the chance to use *drosophila* in a lab environment whilst developing these sections of the lessons. The experience I gained from using this model organism helped me to secure a final year project where I will use *drosophila Melanogaster* to study the benefits of a potentially new anti-epileptic drug.

Throughout the project, both of you have supported me fully with whatever problems may arise. The feedback on the resources created was thorough and extremely constructive. Although it was a steep learning curve, I am positive that the feedback I received throughout the project will benefit me enormously in final year. Sanjai, who manages the

Fly Facility, was a constant point of contact when developing the practical elements for the lessons as well as suggesting improvements to experimental designs I came up with.

Along with all the personal experience gained throughout this project, I also got the chance to be involved in publishing an article – an ambition of mine since joining university. Being able to appreciate the time and effort it takes to publish an article is something I feel is very valuable to me if I ever have opportunity to do so again.

Overall, the project has allowed me to develop skills which will not just be useful in an academic sense, but skills I feel will help me achieve all my goals in the future.

- Sophie DeMaine:

Taking part in the droso4schools project has been beneficial in improving many areas, not only developing my teaching ability but it has also helped me to gain the many skills necessary to complete a project on this scale. Although before beginning the project it did have some teaching experience, the opportunity to work within a classroom setting at different schools and levels has been invaluable. It has provided me with a realistic impression of the challenges and rewards of the teaching profession.

I have taken several lessons with large classes at several ages and ability levels. I have learnt how to communicate often complicated ideas to students in terms which they understand. Similarly, how to lead the class and question them in order to understand a concept, without simply giving ideas to them. A way of thinking which has also been incorporated in the lessons which I have developed, I have seen during my time in school students often have a higher level of understanding of concepts when an investigative and inquisitive approach is taken. The ability to be in a classroom on a regular basis has really fed into the project and allowed resources to be relevant and useful. It has also been of benefit as it allows ideas to be tested and direct feedback to be given by teachers.

I also gained an appreciation of the teaching profession during my time in school, the daily challenges such as behaviour, time pressures, production of resources as well as constant assessment. Before beginning this project, I was not as aware of these aspects of the job, being able to see how teachers cope and manage this has been useful should I face the same issues in the future. Being in schools on a regular basis has allowed me to see how schools are run which will benefit me should I pursue a career in this area.

Carrying out a project on this scale has also helped me to develop many key skills such as time management, organisation and communication. However learning the importance of critical evaluation and then how to use this to improve my work have been the most valuable. Also my ability to be self-critical and reflective has been improved though keeping a blog and reviewing my work regularly.

The project has also enlightened me to the importance of meaningful outreach in science, before I did not appreciate the true value of this work. Especially at school level where the curriculum can be restrictive, this is the age to enthuse pupils in science. Not only to encourage them to pursue a scientific career, but also that in the future they will have an appreciation of science in society. Although I was aware of the importance of *Drosophila melanogaster* in biology as a model organism before the project, I now better appreciate their role in understanding fundamental biology and how they can be used to capture the attention of students and the wider public to highlight important areas of biology.

- Patrick Strangward:

I have just compeleted a 3.5 year PhD in neuroimmunology. I undertook a 3 month PIPS placement in the second year of my PhD within the fly facility at the University of Manchester and Trinity Highschool.

The purpose of the project was to design a series of practical lessons that utilise fruit flies to teach curriculum-specified biological concepts to secondary school students. The project involved working as a teaching assistant within Trinity Highschool, whilst liaising with the fly facility, in order to identify, develop and test aforementioned practical lessons. Materials with the lessons plans included relevant paperwork such as risk assessment forms in order to minimise any addition to teachers existing workloads and thus streamline the inclusion of these lessons into schools.

The experience of working within Trinity school was enjoyable and well-supported by the teachers within the department. The placement enhanced a number of pedagogical skills, notably organisation and oral presentation. In particular, the ability to distill complex scientific ideas into simple concepts, which can be understood by a lay audience, without losing any veracity, has proven the most transferable to academia.

12.3. Work experience students at the Fly Facility

- Helen Faulkner (Kings School, Chester): I'm teaching Atharva for the first time since school started back and he is so enthusiastic about his visit to you! He has told me all about the drosophila, C. elegans, the aquarium and so on and is now determined to be a scientist. Thank you so much for hosting him. He is telling everyone about his experience.
- Sheena Cruickshank (UoM): Last year Sanjai hosted my niece for an hour or so at a time when she was considering dropping science. She had an amazing time and is now doing GCSE science and your lab was her favourite bit! (think I may have put her off worms :( ). She is hopingto get some work experience next year the week of the 22nd. Any chance she could spend some time in your lab again? I am offering cake bribes :)
- Georgie Milner: I just wanted to say thank you for letting me come into the fly facility. I really enjoyed today and I found it really interesting; I especially liked the microscope work at the end. Thanks again,
- Jessica Trevor: Thank you very much for showing me round yesterday it was very good of you and I enjoyed it! Thanks again.
- Alex Ford: I just wanted to say thank you for having Alex in the fly lab yesterday. I had chance to chat with him today and he was really excited about the things he had done with you.
- Kath Hinchcliffe: I also want to thank you again for hosting Emily for work experience. She thoroughly enjoyed her 3 days here and her Mum tells me she was telling her all about fly anatomy on the Monday night.
- Elliot Roebuk: Elliot had his best day with you. Thank you for your time with him

12.4. Other pupil comments

- Constantine F. (pupil from New Hall School; 20/06/17):

  (1) Dear Sirs, I am a year 12 student at New Hall School in Essex and I am doing an EPQ experiment involving Drosophila.I know you are both busy, but I would like to ask for some advice as I have no experience with handling drosophila . If you are too busy please can you forward this to anyone who can help. The question I am asking for my EPQ is : Will the findings in quantum biology one day prove that microwave cooking is dangerous ?

  I am summarising what we currently know about the safety of microwave cooking and what some of the recent findings in quantum biology are suggesting. I will also carry out an investigation using drosophila and a selection chamber experiment with two media. One will be prepared by boiling and the other by microwaving. The selection chamber will have three compartments: a central release chamber and a chamber with media on either side. (Please see pictures in the attached document) I will be releasing 25 male and 25 female virgin wildtype flies into the central release chamber. The flies will have been "starved" for

12 - 15 hours before released into the central chamber. After the flies have made their selection and mated they will be anaesthetised after 4 - 5 days and counted. After 12 - 15 days the hatched flies from each chamber will be counted. I will repeat this 3 times and do it with control media too (both chambers boiled). I will carry out a Chi square test (on the selection results) and a T test on the hatched off spring results. My questions to you are :

1) Do you think the selec□on chambers connected with funnels will work ? Or are the flies unlikely to fly through the funnel ?
2) Am I starving the flies long enough ?
3) How long after their arrival from the laboratory supply company should I let them se□le ? They will just be si□ng at room temperature in a school lab. Is that Ok ?
4) I have narrowed it down to 2 recipes, one with apple and another with molasses ? Which would

you recommend and is it OK to leave out the fungicide?

5) Are the timings right ? 4 - 5 days long enough to mate and lay eggs ? 12 - 15 days long enough to hatch before they mate and lay eggs?
6) Do you have any other advice ?

I will acknowledge any advice given in my project and would be very grateful for any hints or improvements as it has not been easy to put together a method. I have attached my mid way review and rationale that I have sent my teachers as it explains my choices.

I thank you in advance for your time.Kind regards, Dino

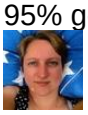
(2) Dear Professor Prokop, Thank you so much for your reply to my email. I really appreciate you looking over my outline and you having given me a lot of good points to think about. Thank you also for all those links to ar□cles, I've started reading through them and they are very user friendly and helpful! The other ar□cles online go way over my head. By the way I searched "fruit fly experiment high school" and that is where your website came up. Once again thank you so much for ge□ng back to me. Kind Regards. Dino

13. Teacher conferences

- Jodie Walker: I was extremely overwhelmed by most of what you said. Afterwards I asked how you knew that there were over 50 different microtubule motors and you said that if I emailed you, you would send me one of your articles. So here I am emailing and asking for your article! I was amazed at how much research have involved drosophila and how similar our genetics are to what people consider to be pests. I look forward to your reply.
- Rosie Walton (Burnley College): I would just like to say a belated a thank you for the summer school session I attended with you a few weeks ago, it was incredibly useful and hugely appreciated. I'm currently doing my planning for the upcoming A2 Biology and I was wondering if you had any resources/ideas to demonstrate monohybrid and sex inheritance, sex linkage as well as co-dominance, multiple allele genetic crosses as well as any data we can use to demonstrate the Hardy Weinberg principle.
- XXX:
  - Priniciples of the nervous system- The assocated experiments were simple and one could draw strong conclusions based on the results and connect to the theory
  - Neuroscience was the highlighte for me as it went into more detail than I previously understood with good gifs and images to model the concepts.
  - I liked best the overall description of how drosophila research can be applied to KS3 & KS4 curriculum as this was never something I had experienced at high school & with the lack of engaging biology practicals I found this very enlightening.
  - The Principles of the nervous system session took a complex subject and provided me with a greater understanding as well as interest in the subject
  - Our Vision: Understanding light and light perception lesson included a wide range of ideas that covered topics in all 3 sciences at a range of ability levels

- The Climbing Assay is most applicable for KS3 & KS4 teaching and could be used for all year groupsto differentiate levels in a period of 1/2 weeksto develop knowledge of doing research with real organisms & data handling

14. Faculty Events

- Keith Brennan (Uom): I interviewed a student yesterday who was so impressed with your bit on the Animal Research Day that they applied to us and have us as their first choice!
- Mahesh Nirmalan (UoM): Hawys told me that the Animal research went very well. Can I convey my most sincere thanks and gratitude to your personal commitment and involvement in this key area related to animal welfare.
- Charlotte Alcock (FLS): I am just writing to thank you for participating in the Year 10 work experience (2016) last week. The week is such a valuable experience for the pupils. 88% of the pupils said they enjoyed visiting the fly labs (the only one who really didn't enjoy it was afraid of flies!).
- Dean Hardy (UoM): Thanks again for helping out Tuesday. The feedback was excellent. Many people said your practical was the best due to the hands on experience, and the variation of the practical i.e. being able to learn as well as engage in practical skills. So thank you very much for your help, it is much appreciated. Best wishes,
- Victoria Ogunseitan (UoM): Thank you for your time, the flies and the microscope, they were very popular. The students really enjoyed learning about them and how useful the mutations were to research.
- Kath Hinchcliffe (UoM): I just wanted to thank you again for hosting the Yr10 work experience students a couple of weeks ago. We've been through their feedback now – the whole week was a resounding success, and of the various activities they did during it, 60% said they enjoyed the lab shadowing most of all. I thought you'd like to know that one of the pupils I spoke to was particularly captivated by his visit to the fly facility – thanks for that.
- Matthew Ronsahugen (UoM) - Developmental Biology Open Day You may remember the open day that was held a month or so ago. I just want you to know that where most other programs received feedback of good from 60% and excellent from 10-12% Dev Bio got 95% good or better and 68% excellent. You obviously did an amazing job.
-  Fiona Reeves @fionahreeves 7 May 2016: Tour of the fly lab @LifeSciencesUoM open day. Loved the practical activity identifying mutations through microscope

-  Anthony Cassidy 27 Jul 2016: Next #OpenLabsMcr stop: Fascinating @ManFlyFacility's world-leading fruit fly research @LifeSciencesUoM #ESOF16

15. External visitors

- Amanda Bamford (UoM)- Visit of the Costa Rican Ambassador: Sorry for dropping in on you like that! Great job and hope we didn't disturb you too much
- Sarah Gumusgoz (UoM): The tour that we gave to HR was such a success that they would like to organise another date in January. Could you please let me know if you are free to do this, it will be the same format as last time; however, this time there will only be one small group.. Thank you very much,
- Michelle Bebbington (Head of HR): I just wanted to take the opportunity of behalf of HR Services to thank you and your teams for your time today. The team found it informative and very interesting. I'm sure you will be pleased to know that the team have said it was the best session they have attended to date!
- Ken Fry (President of Genesee Scientific): I made it back to the US in one piece and I'm fondly looking back on my UK tour. Thanks again for taking time out a few weeks ago to talk about fly things. I am really impressed with your awesome facility! We sincerely appreciate your business and I am always at your disposal if we can ever be of support to you in any way. Have a great day!
- Moyin Kwok (Recruitment and Marketing Coordinator, UoM): Thank you very much for taking your time today and received our guests from Shandong University and Nanjing Medical University. Guests were very happy about the visit at your facility. Personally I have learnt a lot from you too!
- Louise Hewitt (TRM, UoM): The visit (Board of Governers) went extremely well and tour visitors were very impressed with the fly facility and the work that goes on there. It was good to see so many people working in there and thanks again for helping out
- Paul Winter (Development Officer): Thanks for that Sanjai, real shame about the alarm but I guess we cant plan for everything! Really great to be able to show a visitor some live science, especially if that live science has a glowing brain! Thanks again
- Liz Sheffield (Deputy Associate Dean for Teaching, Learning & Students): I really appreciate your time and effort – the panel seemed very impressed! Thanks again

16. Brain Box

- Ellie Turner (Producer & Project Director Walk the Plank): I was also in early meetings and could see the enthusiasm bubbling and starting to get exciting at the point we had to move focus to the outdoor activity. I have to say I think it was absolutely brilliant!!! I visited at 3 points during the day; pre parade when it was starting to get busy but there was enough space for me to dip into a few experiments, again when it was post parade and packed and then again near then end when I could see how delighted the whole team were at the success of the day. And rightly so, you really made something special happen. The public clearly loved the diverse and exciting hands on experiments, demonstrations and performances on offer. Thank you all for your hard work and ingenuity. Let's hope it's future collaborations are on the horizon.
- Candida Boyes (Creative director-Walk the Plank): Having been part of very early meetings about the Brain Box & then concentrating on all the outdoor activity on Manchester Day it was wonderful to visit the Brain Box on Sunday and see the results of all your hard work. I would like to express a huge thank you to you & all the fantastic members of your team who made the inside of the Town Hall shimmer with scientific inspiration on Sunday. It was wonderful to see so many people, young & old, captivated by all the various demonstrations & opportunities for hands on participation. There was a brilliant atmosphere & I am sure you have inspired some young scientists of the future. Thank you so much, very best wishes.
- members of the public (kept anonymous):

"*My son spontaneously wanted to paint a brain (all be it with a smiley face on it) and then an neurone and give me a lecture on how electricity in our brains helps us think and move. He said 'I loved that museum yesterday. Can we go there again please dad'. He took the squidgy brain into school today for a 'show and tell session' all about the brain. So the message clearly got across!*"

"*Just wanted to pop a quick line to let you know how much we enjoyed the brain box exhibition yesterday. We attended with our 4 children, aged 3 - 13 and all of them had a lovely time. We particularly enjoyed the brain hats (worn proudly to school this morning) and the dance presentation in the "Broken Brains" rooms. I think each child learned something new! We spent a long time by each of the rooms and were almost the last to leave*"

"*Thank you so much for organising the event. I really enjoyed the day and lots of the visitors were asking if it'll be an annual thing. They were very impressed.*"

"*.. it was a phenomenal achievement. There was such s buzz in the main Hall and a great mix of fun and pretty sobering stuff.*"

"*there were a wide range of brand new engagement techniques, equipment, games, interactive exercises etc used that will provide a great platform for other future science engagement opportunities*"

"*… my 5 - year - old keeps talking about how small a fly's brain is but with so much "stuff" inside – it has really captured her imagination.*"

"*We thoroughly enjoyed the event yesterday and just wanted to say that we received numerous positive comments. On behalf of everyone here at the Stroke Association in the North West, thank you very much for having us and we look forward to the next event!*"

"*…it was wonderful to visit the Brain Box on Sunday and see the results of all your hard work. I would like to express a huge thank you to you & all the fantastic members of your team who made the inside of the Town Hall shimmer with scientific inspiration on Sunday. It was wonderful to see so many people, young & old, captivated by all the various demonstrations & opportunities for hands on participation. There was a brilliant atmosphere & I am sure you have inspired some young scientists of the future.*"

"*I was well and truly in my element on Sunday (recently graduated with a MSc in Science Communication) and can say it was one of the best events I have had the pleasure to be involved with.*"

"*Thanks for the opportunity, I thoroughly enjoyed the day and judging by the visitors I spoke to they all did too.*"

"*This was an excellent event – so nice to see so many different stands all together and a great range of interactive activities which the visitors all seemed to really enjoy.*"

"*These type of events always make it clear how important our research is – people are counting on us to find answers and help the fights against diseases!*"

"*We had a fantastic day. Thank you so much for inviting us. It was wonderful to watch how involved and enthusiastic the children were.*"

"*… thanks very much … for inviting us to show off our [company's brain surgery] drills; It was really wonderful to see the reaction of the children (and some adults!) to the opportunity to try them out … I've already fed back to [our company] that I believe we should support future instances of this event so please let us know if you require our services again."*

"*… it was absolutely brilliant!!! I visited at 3 points during the day; pre parade when it was starting to get busy but there was enough space for me to dip into a few experiments, again when it was post parade and packed, and then again near the end when I could see how delighted the whole team were at the success of the day. And rightly so, you really made something special happen. The public clearly loved the diverse and exciting hands on experiments, demonstrations and performances on offer. Thank you all for your hard work and ingenuity. Let's hope it's future collaborations are on the horizon."*

"*I had a superp time. I was seriously impressed with some of the activities there, such as the "brain wave game", the dance and interactive demonstration of imitating an action potential, the staining game for kids, the ability to touch real brain tissue with gloves of course … I liked the set up and the structure of the event. Every room had its major theme and topic and it fit all well. The booklets, which were handed out were extremely valuable in order to gather information and to be rewarded with a nice sticker for every correctly answered question. Very nice idea indeed and great for kids… I really liked how very interdiscplinary it was (combining arts, science, creative writing in froms of poems/paintings etc.). I really hope we can re-create this experience with our table top activities for regenerative medicine.*"

"*I enjoyed the event a lot … only after spending more than an hour in one room we realised how much more there was in the other rooms!*"

17. Resource provision (flies and/or food)

17.1. to researchers

- Weizman Institute, (May 15)
- Cardiff University (Sept 14),
- Cornell University (Oct 14)
- NIMR (Dec 14)
- Univeristy of Birmingham (Jan 15)
- University of Liverpool, Sept 16)
- University of Sheffield (July 16),
- Makassar, Indonesia (Oct 16)
- Cambridge (Feb 16)
- Liverpool John Moores (Aug 16)
- University of Chester (Aug 16)
- Keele University (Aug 16)

17.2. to FLS/FBMH

- UCAS Open days (2013-2017)
- Developmental Biology Open Day (June 14, Sept 14, Oct 15)
- Neuroscience Open Day (June 15)
- University practicals and lectures (2013- 2017)

17.3. to schools

- Loughbrough Grammar School, Loughbrough (June 12, Oct 12,
- Hulme Grammar school, Oldham (Oct 12)
- Merchant Taylors School, Liverpool (Sept 13, Oct 14, Nov 14, Dec 14, Jan 15, Oct 15, Jan 17)
- Bolton Girls School, Bolton (Oct 13, Feb 14, June 14)

- Birkenhead High School, Birkenhead (Jan 14, Feb 14, May 14, Aug 14, Dec 14, Jan 16, April 17)
- Bolton Muslim Girls School, Bolton (June 14)
- Loreto Sixth form College, Manchester (July 14)
- Burney College, Burnley (Sept 14)
- The Kings' School, Chester (Sept 14)
- Trinity High School, Mnachester (Nov 14)
- Urmston Grammar (Nov 14)
- St Mary's School, Trafford (Jan 15)
- Bolton School, Lancashire (Feb 15)
- Cardinal Newman College, Preston (Sept 14, Nov 14, Dec 14, Feb 15, March 15, Nov 15, Dec 15, Feb 16, March 16, Nov 16, Feb 17, March 17, Nov 17, Feb 18, March 18)
- Ryburn Valley High School (April 15)
- Denbigh High School, Denbigh (May 15, Dec 15, Jan 16)
- Ashton sixth form college, Ashton (May 15)
- Sidcot School, Sommerset (July 16, July 17)
- Rossall School, Lancashire (Jan 16)
- NUAST, Nottingham (Oct 17)
- Nelson and Colne College, Nelson (March 16, March 17)
- St Johnfisher Catholic School, Medway (Nov 16)
- Xavarian College, Manchester (Jan 17, Oct 17)
- Wiltshire College, Lackham (Jan 17)
- Escola Secundária de Ponte de Lima,Portugal (Feb 17, April 17)