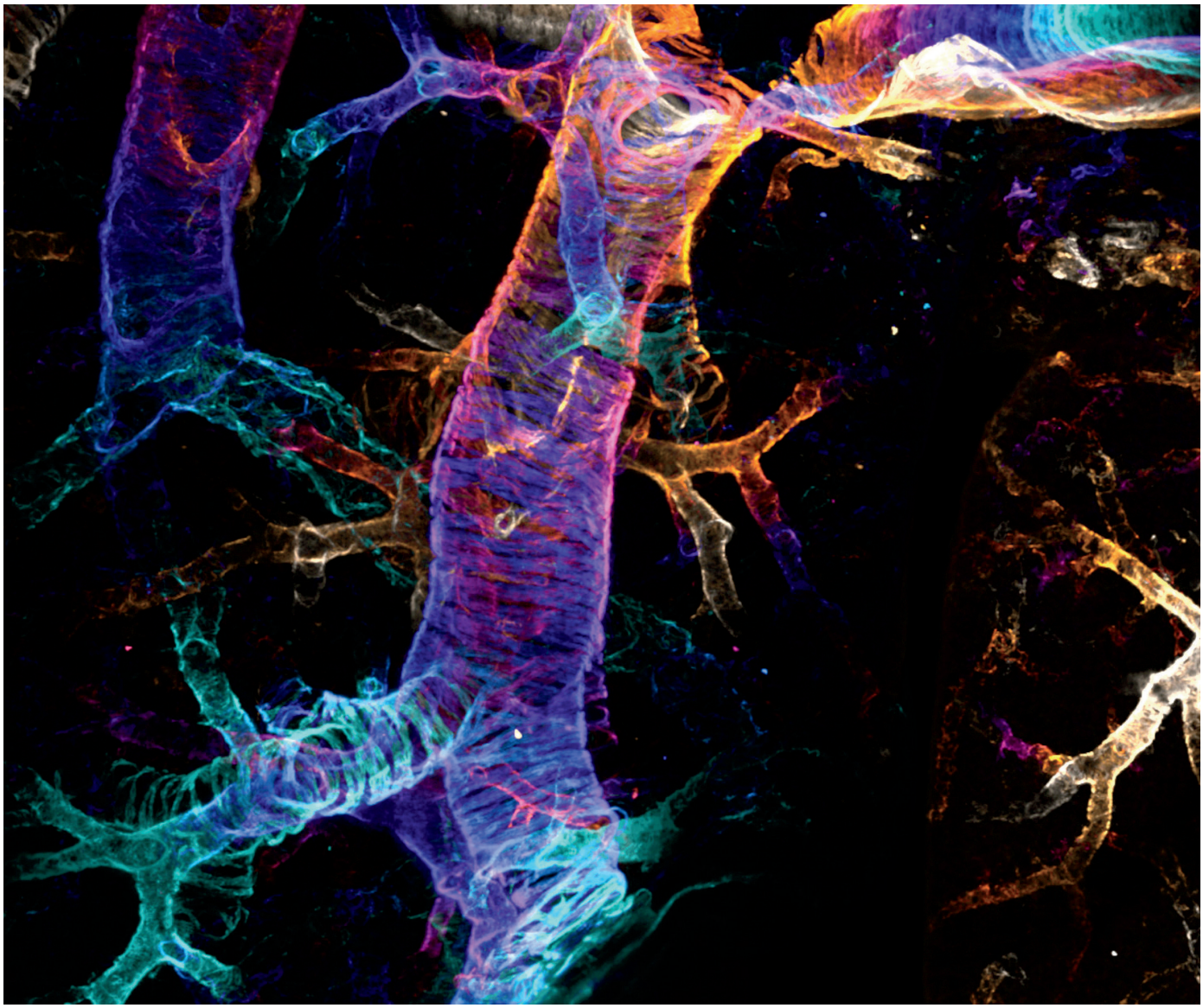
2024

BSCB Magazine

BRITISH SOCIETY FOR CELL BIOLOGY

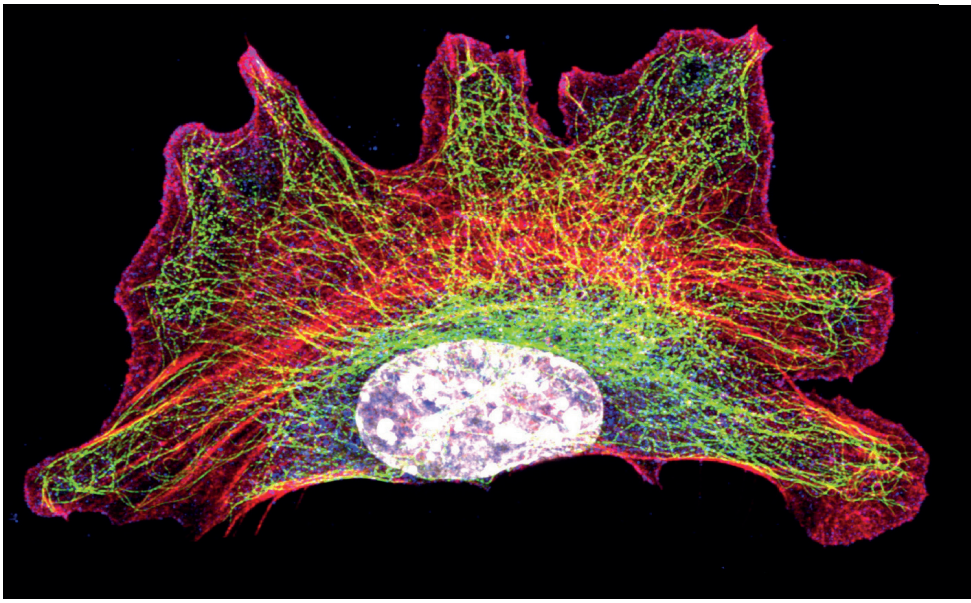


BSCB

90TH HARDEN CONFERENCE | EUROPEAN CYTOSKELETAL FORUM

BSCB-Biochemical Society 2024 Cell Migration meeting

15–18 April 2024
Birmingham, UK



Conference Themes

- Molecular regulation of cytoskeletal dynamics using *in vitro* reconstitution to dissect how actin powers migration
- Control of different modes of migration by environmental cues, such as chemical and physical cues
- The physical context of cell migration and how internal and external forces drive cell behaviour
- Computational and mathematical approaches to understanding cell migration
- Cell migration in multicellular organisms, in disease and development

Invited Speakers:

Katie Bentley
Lindsay Case
Yi Feng
Gregory Giannone
Nir Gov
Guillaume Jacquemet
Antoine Jegou
Darius Koester
Kate McDole
Verena Ruprecht
Samantha Stehbens
Daniela Vignjevic
Tobias Zech

Keynote Speakers:

Cynthia Reinhart-King
Michael Sixt

Organisers:

Peter Bieling
Susana Godinho
Matthias Krause
Karen Liu
Laura Machesky

Register online: **bit.ly/90Harden**
Abstract and Earlybird deadline: **15 February 2024**

BIOCHEMICAL SOCIETY
HARDEN CONFERENCE
BSCB

BSCB Magazine 2024

News 2
Features 5
Meeting Reports 24
Summer Students 28
Society Business 35

Editorial

Welcome to the 2024 BSCB Magazine.

As cell biologists, many of us are financed through government grants, both national and international. Funding from charities and from industry is affected by government policies and the overall state of the economy. This means that our science is very closely linked to political decision-making. An obvious recent example of this is the negotiations around the UK's access to the European Union's €95.5 billion research and innovation programme, Horizon Europe. It is crucial that politicians be aware of how science contributes to the common good. With general elections in prospect by Spring 2025 in both the UK and Ireland, we scientists should aim to increase our engagement with politicians at all levels. For example, as voters, ask candidates about their science policies and plans, in person and online. As scientists, consider inviting politicians to visit your labs to find out more about what you do and why it is important. The BSCB's Science Advocacy Officer is Dr. Darius Koester. If you have an interest in science policy or if you are keen to contribute more in this regard he would be delighted to have your input.

The 2024 edition of the magazine features articles on the importance of lab notebooks (and their role in scientific integrity) and the development of an advanced cell biology practical for undergraduate classes, providing much food for thought on both topics. There are interviews with the winners of the Hooke medal (Andrew Carter), the WiCB award (Anjali Kusumbe) and the BSCB post doctoral award (Tom Williams), images from the BSCB image competition and the winning entry to our science writing competition (Aleksandra Pluta). We also include reports from meetings and the summer studentships that showcase the supports BSCB has available for its members.

This year sees Sharon Tooze and Folma Buss leaving the BSCB committee after many years of service between them: we thank them for their work as coordinators of the Honor Fell awards, a key task for the BSCB which has benefitted many members over the years. We welcome new members joining the BSCB committee: Aymen al Rawi (University of Cambridge), Helen Matthews (University of Sheffield), Tom MacVicar (University of Glasgow) and Liz Miller (MRC LMB/ University of Dundee).

We are planning to provide more regular updates of upcoming events and award/funding deadlines per email, so that members will be more aware of what the Society can provide for you. As always, we are keen to encourage members to come forward with ideas for the BSCB and new initiatives we might pursue. Please get in touch.

Ciaran Morrison
Tom Nightingale

Front cover: Mouse airways, stained to reveal alpha-smooth muscle actin structures. To achieve this, adult mouse lungs were cleared using the FLASH method and imaged with a Zeiss LSM 710 confocal microscope at 10X magnification. Images were acquired as tile scanned-Z stacks and were colour coded in FIJI. Here, the colour corresponds to depth of the Z-stack in the maximum intensity projection.

Magazine Editors: Ciaran Morrison and Tom Nightingale **Production:** Giles Newton, Deadlift Media **Printer:** Hobbs
BSCB website: www.bscb.org

Society News

BSCB President's Report 2023

I am excited to write my first report as President of the BSCB, following on from Anne Ridley's term, from 2017–2022. It has been an honour and a pleasure to learn more about the role of BSCB President from Anne and to get to know the many dedicated committee members and their roles serving the BSCB. The BSCB has made a healthy recovery from the pandemic, with a vibrant membership and many exciting events this year and planned for the years to come.

The Dynamic Cell V meeting in Loughborough, together with the Biochemical Society was a great success, with excellent talks and posters, highlighting that cell biology continues to be strong in Britain. There was also great synergy between the Biochemical Society and the BSCB, providing an even broader view of the range of excellent science in these fields. The meeting venue was very successful, and the meeting went smoothly thanks to the excellent organisation by our meeting secretary Susana Godinho, who was helped by Tobias Zech (Liverpool University) and Alexis Barr (Imperial College London). The feedback was very positive, with one person noting "This was a great opportunity to learn about a wide range of topics and informally connect with many researchers in the field!" Highlights included a Keynote talk from Johanna Ivaska (University of Turku) and the medal talks, with Anjali Kusumbe (Women in Cell Biology), Andrew Carter (Hooke Medal), Luka Smalinskaite (Raff Medal) and Thomas Williams (Postdoc Medal). Don't forget to nominate talented scientists at all levels for the 2024 competition.

The BSCB Committee has undergone some changes in the past year, with Darius Koester taking over as our science policy advocate, Aymen Al Rawi (MRC-LMB) joining as postdoctoral representative, Emily Lucas (University of Southampton) joining as PhD student representative, Viji Draviram (Queen Mary's University) joining as the incoming Meetings Secretary, Simon Allinson (Huddersfield) joining as the incoming Secretary, Nathalie Signoret (Hull York Medical School) joining as incoming Membership Secretary, Daniel Booth (Nottingham) joining as incoming Honor Fell and Childcare grants officer. Our membership numbers are strong, indicating success of the ambassadors programme, which we will be refreshing soon. If you are interested in becoming an ambassador for BSCB at your institution, contact our membership secretary to find out how.

BSCB offers you many opportunities to participate in your cell biology community and we are always looking for new ideas and initiatives. If you would like to get involved in science policy, Darius would love to hear from you. If you are a cell biologist working in Ireland who would like to be more involved in the community, contact Ciaran Morrison, our Irish Committee Representative. If you have items for the BSCB newsletter or ideas about how the BSCB can better serve the community- get in touch and we will do all we can to make this your BSCB.

As we look ahead to 2024, I am looking forward to hopefully seeing many of you in Birmingham for our Spring Meeting April 15-18th, which is run jointly with the Biochemical Society and the European Cytoskeleton Forum. This will be the 90th Harden Conference, with an emphasis on cell migration, cytoskeleton and mechanical forces. The co-organisers are Matthias Krause (King's College London), Peter Bieling (MPI, Dortmund), Karen Liu (King's College London) and myself. We have a great lineup of speakers and we are super excited to see you there!

Schools News: A-level examination results, 2023

The marking of A level exams of pupils in England in 2023 reflected the wish of the Government to return to the marking standards of pre-Covid times of 2019. Total results indicate this has been largely achieved with the results just slightly more 'generous' than those of 2019.

Overall the proportion of pupils achieving A and A* level grades in England dropped from 35.9% in 2022, to 26.5% in 2023. This is slightly above 25.2% performance of 2019.

Detailed analysis shows an ever widening geographical gap between the London area, where pupils obtained a greater number of higher A level grades, than did pupils in the North East.

In 2023 there was a considerable difference between the higher number of top A level grades awarded to pupils from private schools, and the lower number awarded to those from secondary modern schools and F E Collages.

Within the 'top ten' choices, the A level subject of biology is holding its own as the third most popular choice. Mathematics is first and psychology second. Chemistry is third and physics tenth.

(Data from 'Schools Week'. 17/8/23. For further details see:

https://schoolsweek.co.uk/a-level-results-2023-7-key-trends-in-englands-data/

David Archer
BSCB Schools Liaison Officer

European Cytoskeleton Forum 2024
15–18 April 2024. Edgbaston Park Hotel, Birmingham

In 2024, our society will join forces with the Biochemical Society to co-organise the European Cytoskeleton Forum 2024. We are thrilled to bring back to the UK this conference that we are sure will be interesting to many of our members.

Our exciting programme will provide a platform for the cytoskeleton afficionados and the cell migration community. Cell migration touches upon a range of biological processes, including development, cancer and wound healing. This timely meeting will be an opportunity to bring together established experts and young researchers who have a common interest in understanding fundamental cell behaviour in contexts relevant to health and disease.

The meeting will focus on five main themes:

• Molecular regulation of cytoskeletal dynamics using in vitro reconstitution to dissect how actin powers migration;

• Control of different modes of migration by environmental cues, such as chemical and physical cues;

• The physical context of cell migration and how internal and external forces drive cell behaviour;

• Computational and mathematical approaches to understanding cell migration;

• Cell migration in multicellular organisms, in disease and development.

Our programme includes invited plenary speakers from all career stages, short talks chosen from the abstracts submitted, posters, and flash talks. We also include industry exhibits, a careers session and "meet the speakers" sessions. This format will provide ample opportunities for everyone to participate actively in the meeting and to promote collaboration. Poster sessions are given priority time slots to ensure maximum participation and poster prizes will enhance engagement and promote early career researchers.

Registration is now open! We Hope to see you there.

Susana Godinho
BSCB Meetings Officer

Meetings Calendar 2024–25

Astbury Conversation 2024: Illuminating Life
8–9 April 2024, University of Leeds
https://eu.eventscloud.com/website/11502/home/

European Cytoskeleton Forum 2024: Joint BSCB and Biochemical Society Meeting
15–18 April 2024. Edgbaston Park Hotel, Birmingham
bit.ly/90Harden

Microtubule Meeting UK 2024
13 May 2024 University of Edinburgh
https://www.ed.ac.uk/biology/microtubule/about

Journal of Cell Science Meeting: Diversity and Evolution in Cell Biology
24–27 June 2024. Montanyà Hotel & Lodge, Catalonia, Spain
https://www.biologists.com/meetings/jcsevocellbio24/

UK actin meeting 2024
December 2024 University of Bristol (date to be confirmed)

UK trafficking meeting 2024
December 2024 University College London (date to be confirmed)

Check the BSCB website for information about conferences and on how to apply for funding for 1-day meetings:
bscb.org/meetings/bscb-meetings/
bscb.org/meetings/sponsored-meetings/

Meeting announcement

Diversity and Evolution in Cell Biology

24 – 27 June 2024, Montanyà Hotel & Lodge, Catalonia, Spain

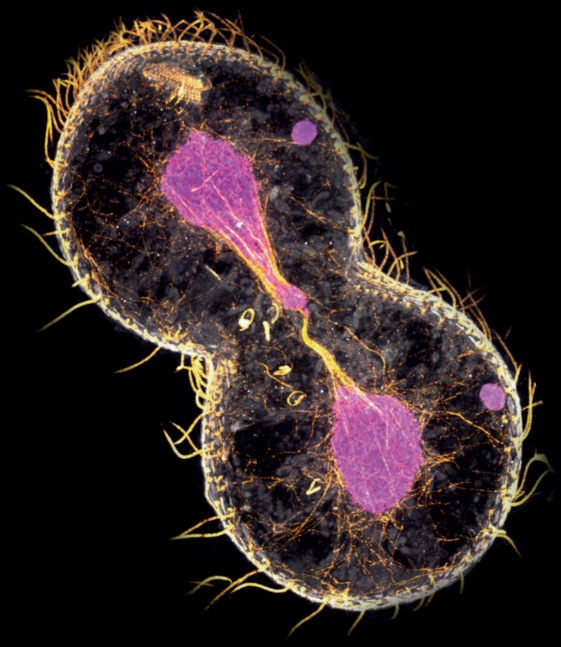
Register now

Early-bird deadline
19 January 2024

Abstract deadline
5 April 2024

Final deadline
3 May 2024

biologists.com/jcsevocellbio24
#JCSevocellbio



Organisers

Gautam Dey
Lillian Fritz-Laylin
Snezhka Oliferenko
Meg Titus
Michael Way

Speakers

Scott Dawson
Omaya Dudin
Laura Eme
Holly Goodson
Rebecca Heald
Greg Jedd
Eugene Koonin
Liedewij Laan
Wallace Marshall
Thomas Richards
Courtney Schroeder
Courtney Stairs
Mukund Thattai
Kevin Verstrepen

The Company of Biologists

Organised by
Journal of Cell Science

Image courtesy of Felix Mikus, EMBL Heidelberg, Germany

Hooke medal winner 2023: Andrew Carter

Andrew Carter studied biochemistry at the University of Oxford, where he discovered his love for structural biology, which prompted him to join Venki Ramakrishnan's lab at the MRC Laboratory of Molecular Biology (LMB) for his PhD. Here, he used X-ray crystallography to study the ribosome and its interactions with antibiotics. He then spent a year as a postdoc at Clare College, Cambridge, before moving to Ron Vale's lab at the University of California, San Francisco (UCSF), USA, where he first began his work on dyneins. Andrew has since devoted his research career to studying dynein, and in 2010 set up his own lab back at the MRC LMB, where his research has contributed significantly to the dynein and motor protein fields.

In recognition of this work, Andrew was recently awarded the British Society of Cell Biology (BSCB) Hooke Medal award for 2023 and we caught up with him to ask about this award, his research and his career.

Congratulations on winning the BSCB Hooke medal award. How do you feel about receiving this prize?
I'm very honoured to have been chosen. I'm really pleased that my lab's work on dynein has been recognised; I think it's a fascinating topic that is applicable to a lot of people in a lot of different fields. So, it is a real highlight. I would like to mention that I benefited a lot from my collaborators and colleagues during my postdoc and especially from the many people who have worked in my lab; I am very grateful to all of them and the ideas they have generated.

How did you first become interested in science?
My parents were both lecturers, and in particular for my mother (who was a leech neurobiologist), her office was also her lab. So, half of it was a desk full of papers and the other half was microscopes, electrophysiology equipment and all sorts of cool stuff. I used to really like going into work with her; I remember dissecting her spider plants under the light microscope a lot, and it was always fun to be in that environment. I also remember my parents always talking about science at the breakfast table; I didn't usually understand what they were discussing, but when I started studying it more at school, science became something I was able to easily become interested in. I also had some very enthusiastic teachers at school and they made science fun, maybe even a little bit dangerous and exciting.

I understand you discovered your love for structural biology during your undergraduate at the University of Oxford – were there any particular discoveries or scientists that inspired you?
At that time [during my undergraduate], there were a number of [protein] structures coming out. And back then, we still had paper journals, rather than online. So, you'd see the front cover of the journal, and there would be the structure of a protein you'd learned about previously and suddenly seeing it on the front page was very exciting. The one that really stands out to me was KcsA, the potassium channel described by Rob MacKinnon, because we had done a whole course on how it selects ions, going all the way back to work by Hodgkin and Huxley and working out that there must be a selectivity filter. And then, using molecular cloning, people had worked out that there were tyrosine residues involved and models were proposed. But suddenly, once the structure was resolved, it explained everything and made it clear that some of the previous models were wrong and it kind of 'fixed' it all; I thought that was very elegant and exciting, the way that the structures could explain all these aspects which had previously been slightly murky.

I was also inspired by some of the great lecturers at Oxford University. I should mention Professor Louise Johnson, who was very interesting in terms of her work on phosphorylases and various enzymes that we studied. She gave her lectures in a very calm and beautifully clear way, and she had a very interesting life story that we were all fascinated by; she'd been involved with solving the structure of one of the very first enzymes to be discovered, lysozyme. But despite my interest in structural biology, I wondered whether I would have the skills to pursue it, as the course introduction to crystallography was quite mathematical. But then a friend of mine did his 4th year project with David Barford, who is now one of the heads of division here, and this made it clear to me that actually, it was something I could do.

Did you consider working in any fields other than structural biology?
Yes, I was very tempted to become a fly neurobiologist.

I did some summer projects with Andrea Brand at the Gurdon Institute, who developed the GAL4 enhancer trap system. I was fascinated by neurobiology and I've still got some pictures on my wall of neurons growing out within the fly larva. So, it was a difficult decision between going down that route or crystallography.

In 2003 you made the big move to Ron Vale's lab over in San Francisco for a postdoc – what prompted this trans-Atlantic move and how did you find the change?
My PhD advisor, Venki Ramakrishnan, had moved from the University of Utah in the USA just before I joined his group at the LMB in Cambridge. I can't remember if it was his suggestion, but somehow, I knew that America was a good place to go and do a postdoc. So, I looked at a few different labs there, and Ron Vale was one of the ones I contacted, because I had met Ron when I was an undergraduate. I did my final year project at Oxford on kinesin motors and somebody told me about this open discussion meeting at the Royal Society; you could just turn up and it turned out all of the kinesin researchers were there. When I was there, Ron was really generous with his time and spent about half an hour talking to me about recent advances from his lab. And that really struck me, so I contacted him and visited his lab, which had a really good vibe and seemed very friendly.

Also, you mentioned the 'big move', and while it was very daunting beforehand, once I got there, it was fine, in part because the environment in the lab was very welcoming. There was this amazing mix of biochemists, structural biologists, cell biologists, lots of light microscopists and some physicists as well. There was this very broad range of topics and lots of different projects, and so there was plenty of help and lots of ideas from different perspectives, and that was a really wonderful environment to be in.

Would you say that team building and having that rapport is important in building an effective lab environment?
Absolutely. One thing my lab does, which was inspired by Ron, is a lab retreat. Each year Ron used to take us to various amazing places in California, the wine country, the Big Sur coast or several times we went to Tahoe and combined science with some skiing. We would usually rent a house and take sleeping bags. Everyone pitched in with cooking and someone in the lab was usually a fantastic cook; you could tell who because they would bring along their own cooking implements and take control of the kitchen. The thing that struck me about those retreats were how many ideas they generated and how many new projects in the lab came out of the presentations that everyone did. And so, soon after starting my lab, we started doing the same. Actually, we take over my parent's house for a couple of days, borrow the dogs, go for some hikes and talk science. It's good because it's more informal and it brings ideas up that you wouldn't think of in regular lab meeting format.

You started your own group in 2010 back at the MRC LMB – what made you decide to return there and how did you find the transition to group leader?
At that time, we had a first view of how the dynein motor worked, and I knew I wanted to work towards the next stages of understanding dynein, which seemed pretty challenging, because it was all crystallography still at that stage. Also, I wanted to focus more on the cell biology questions, such as how dynein finds its cargo. The LMB seemed to be a really good place to do this because it has amazing facilities, including crystallography and light microscopy [this was all before cryo-electron microscopy (cryoEM)!]. But importantly, there is also this culture of helping others and sharing reagents and advice, which is something I valued as a PhD student here. I also really enjoyed the fact there were a group of us who started

Right: Lab retreat in summer 2021. From left to right: Richard Wademan, Girish Mali, Sami Chaaban, Chris van Hoorn, Alex Fellows, Kashish Singh, Clinton Lau, Andrew, Giulia Manigrasso, Ferdos Abid Ali. With dogs Velocity, Laszlo and Rhona.

our labs at a similar time. Having a group of peers, who are going through similar challenges and that support and encourage each other was really helpful.

One of the discoveries your lab made was resolving the structural interactions of the adaptor protein BICD2 with dynein and dynactin – what would you say were the most fascinating or surprising findings you made?

I want to step back a bit, because the whole BICD2 story really launched us into studying dynein–cargo interactions, but it wasn't clear how we were going to do it. At this point, we knew that single yeast dyneins could walk in a processive manner over long distances, and we also knew that mammalian dynein didn't. If you put it on beads it could move, but on its own, it didn't. So, a number of us in the field wondered why that would be. Then, there was a paper by the Akhmanova and Hoogenraad labs, which showed that this protein, BICD2, helped dynein and dynactin interact. In sucrose gradients, they wouldn't really interact very well, but when you added this protein, they came together.

I had a postdoc, Max Schlager, who came from a cell biology background, and he knew about this work, and so he suggested that maybe BICD2 activates the dynein and makes it walk. He got together with a student from my colleague Simon Bullock's lab, and they did some single-molecule studies and showed that dynein needed BICD2 and dynactin to move long distances. That was a very exciting discovery, because it changed our view of how dynein and dynactin work. We'd always thought that dynactin was an adapter that was flexibly coupled to dynein and links it to cargo. So, it was a very surprising finding that these weren't two separate complexes, but intrinsically the motor function is a dynein–dynactin machine rather than just dynein on its own. We also never guessed there would be two dyneins per dynactin, which doubles the force. I love the way that solving a new structure gives us new insights into things that you just wouldn't have guessed.

More recently, you have focused on dynein in cilia, where you describe a new protein, Shulin, and its role in the axonemal outer dynein arms (ODAs). How did this project come about?

I worked on Tetrahymena ODAs, which are what power the beating of cilia, right at the beginning of my postdoc; I spent 6 months purifying and trying to crystalize them. Many years later, [the] Wellcome [Trust] asked me to do an Open Day at the Diamond Light Source, and I needed something for people to look at under the microscope. So, I bought some Tetrahymena and we had the live microscope images up on a TV screen and it worked really well. This led me to read more into Tetrahymena, and people had made good advances in terms of modifying the genome. In particular, Kazufumi Mochizuki had made a whole set of plasmids, which he very kindly sent me. Then, a summer student and I established a protocol in the lab for generating genetically tagged Tetrahymena, which turned out to be cool, because you have to use a biolistic gold bead gun to shoot them with your DNA constructs, and then select for incorporation with antibiotics for a month. We used this to tag ODAs.

Then Girish Mali, a first author (one of three) of the study, approached me about doing a postdoc because he was really interested in the assembly of dyneins, and so he came and did some work on ODA assembly factors. However, as a side project, we thought we'd try pulling out newly synthesized ODAs from the cell body to see if there was anything different about them compared to the ODAs found in the cilia. One of the reasons for doing that was at a conference many years earlier, Steve King, who has worked on axonemal dyneins his entire career, said "there must be something different about axonemal dynein when it's in the cytoplasm, because it doesn't move". And Girish identified

this protein, Shulin, which binds to cytoplasmic ODAs, and did some beautiful functional assays and cryoEM to show that it inhibits dynein movement. He also showed that this inhibition was really important for delivering those newly synthesized ODAs to their final location in the cilia. He had help with the cryo-EM from his co-authors, but Girish did a brilliant job of taking that initial 'here is a completely new protein' and working out what it did in the cell.

It's exciting that you got to name a new protein, too; where did the name Shulin come from?
Girish and one of his friends came up with it. It is from the Sanskrit and means 'he who controls the trident', and as the ODA is a three-headed motor that is being controlled by this protein, it seemed like a brilliant name.

Of the structural techniques you have worked with, including X-ray crystallography and cryo-electron microscopy, which would you say is the most challenging and/or most rewarding?
Crystallography was the most challenging because getting things to crystallize had become quite difficult and it took a lot of effort and a lot of protein. Sometimes it worked and it was beautiful, and very surprising things crystallized, and sometimes it seemed impossible. However, when cryoEM came along it was so impressive because suddenly it opened up all of these other complexes, such as dynactin and dynein, which would have been far too flexible to see by X-ray crystallography. So, that was a big step forwards. Regardless of the challenges, I think they're all enjoyable. I remember, as a PhD student, sitting in the computer graphics room late one night, and the structure of the antibiotic streptomycin bound to the ribosome came up. I knew that I was the first person to ever see that and it explained all this literature. I'd been thinking about it for ages and to suddenly see this structure, it was terribly exciting. The other thing that is hugely helpful for biologists nowadays is the software AlphaFold2, which has amazing predictive power. You can say 'I wonder if those two proteins interact', put it into AlphaFold2, and in many cases you can see almost immediately what this interaction could look like and come up with a hypothesis that you can then test. I think it has really revolutionized the field.

You are an organizer of The Company of Biologists Workshop 'The Cytoskeletal Road to Neuronal Function' planned for 2024 – what inspired this idea and what do you hope to take away from this Workshop?
This Workshop was originally scheduled for 2021, but due to the pandemic, it could not go ahead in person. We decided that this sort of meeting was not going to work as well online, so we reapplied for it when applications reopened and we were grateful to be selected again. My involvement came about due to a PhD student in my lab, Helen Foster, who wanted to try and start doing cryo-electron tomography (cryo-ET) of neurons. We've been interested in this approach because neurons are such a good model system for transport because of the need to move proteins and organelles along their axons. This project led to the paper that we published recently in Journal of Cell Biology (JCB), and also got us on the road to doing much more neuronal cell biology. Then, I was talking to Carsten Janke, who is organizing the meeting with myself and Oren Schuldiner, about what we were doing and he suggested applying for one of these Workshops. The goal is to bring together a wide breadth of scientists, from people working on protein structures to people working on neuronal cell biology, all the way up to whole organisms. A lot of these Workshops are aimed at bringing together people from different fields that wouldn't normally interact – and so that seemed to be a really fun thing to do and we're looking forward to it.

Outside of the lab, you are on the Editorial board for Life Science Alliance, and until recently, eLife – what is your opinion on the current publishing models in science and on efforts journals are making to increase the ease and accessibility of publishing?
I really like the model of collaborative reviewing, whereby the reviewers get to know who each other are and discuss their reviews; I think that is very helpful in terms of focusing on what's needed to make a paper better. I also think BioRxiv and preprints are really good, because it means that work can get out there quicker. I'm a big fan of peer review, because it always makes papers better, but actually having the data out there relieves some of those pressures that there used to be. Even with these improvements in the publishing process, there are still some bottlenecks. For example, the speed of the publishing process can still be slow. I realize that journals are under a lot of pressure and there are a lot of manuscripts, but it would be good to keep exploring ways to speed up that process if we could. One area of publishing that I think is often difficult to discuss is the question of ensuring the experimental design is right and the correct statistical approaches are used. I wonder if the journals could help here, by for example producing clearer statistical guidelines and some documentation of what to do and mistakes to avoid.
An initiative that I think is a very good thing is this push to make all data available. All the raw data should be deposited somewhere so that someone can look at it if they need to. I also think a discussion is needed about trying to standardize this process. In the same way that we require Protein Data Bank files (PDBs) to be deposited or cryoEM datasets to be deposited in a particular way. I think clearer guidelines from journals with their preferred databases could help. I also think the requirement to publish all the raw data encourages us to manage and organize our data better.

Finally, could you tell us an interesting fact about yourself that people wouldn't know by looking at your CV?
I am very fond of a breed of dog called Cardigan corgis. I have a couple of them, one called Velocity and another called Whiston, who's named after an 18th century Physicist and Fellow of Clare College, Cambridge. I've had Corgis all my life and my friends know that I have this slight obsession with them. They and I go for long walks on Sunday mornings. We try to follow a Physics-related theme for their names, and suggestions are welcome for the next one!

Andrew Carter's contact details: MRC Laboratory of Molecular Biology, Francis Crick Avenue, Cambridge, CB2 0QH, UK.
E-mail: cartera@mrc-lmb.cam.ac.uk

Andrew Carter was interviewed by Daniel Routledge, Cross-title Reviews Editor at The Company of Biologists, for Journal of Cell Science. This piece has been edited and condensed with approval from the interviewee.

Cell scientist to watch: Anjali Kusumbe

Anjali Kusumbe is the head of the Tissue and Tumour Microenvironments Group at the MRC Human Immunology Unit and MRC Weatherall Institute of Molecular Medicine and Director of the Oxford Tissue Imaging Centre, UK. She completed her PhD with a fellowship from the Council of Scientific and Industrial Research in India, before moving to the Max Planck Institute for Molecular Biomedicine in Germany for her postdoc, where she worked on endothelial heterogeneity in bone. She established her group in Oxford in 2017 and was awarded the 2023 BSCB Women in Cell Biology Early Career Medal, and more recently the ISRB 2023 Rising Star Award.

We caught up with Anjali over Zoom to ask about the BSCB award, her career path and her advice for new group leaders.

Congratulations on winning the BSCB Women in Cell Biology (WICB) Early Career Medal; what does winning this award mean to you?
My sincere gratitude extends to the BSCB for recognising my contributions with the WICB award. This recognition holds tremendous significance, not only for me as an early career group leader but also for the collective efforts and unwavering dedication of my lab members. I am truly overjoyed to have reached this milestone, particularly in the face of the challenges brought forth by the pandemic. I firmly believe that this accomplishment would not have been attainable without the exceptional contributions of my lab. Once again, thank you to the BSCB for bestowing this esteemed award upon me. I am determined to continue striving for excellence and making impactful contributions to the world of cell biology and fostering a collaborative and innovative environment.

What first inspired you to become a scientist and what was your career path?
The roots of my passion for science can be traced back to my early childhood, where biology emerged as my favourite subject. A significant influence came from my father and maternal uncle, both botanists. Although my father later went into banking, I used to love reading his books; I vividly remember eagerly absorbing the intricate details of plants, from their captivating images to the intriguing descriptions and names. Moreover, observing my uncle's role as a Group Leader at The Indian Agricultural Research Institute, where he embarked on inspiring journeys to international institutes and conferences, filled me with awe and excitement. The prospect of such exhilarating ventures abroad was enticing, although my introverted nature presented doubts. After completing my PhD, I embraced a new chapter in my scientific journey by venturing to Germany for my postdoctoral work. Undeniably, the transition posed challenges, testing my adaptability. However, I gradually acclimatized to the new country and environment. Initially, I was not sure whether I would become a principal investigator (PI) and my route to becoming a PI was gradual, but it worked out.

You've also been recognised with the 2022 Award for Life Sciences from the Royal Microscopy Society; what drew you to using microscopy in your research?
I would like to share my journey that began during my postdoctoral research, where microscopy played a pivotal role in my investigations. My focus was on exploring the vasculature in bones, which required imaging as an essential component. Previously, researchers had been examining bone using thin paraffin sections in 2D, which unfortunately limited their understanding of the intricate 3D organization of blood vessels. In response to this challenge, I dedicated my efforts to developing innovative methods utilizing thick sections of bone, enabling us to achieve high-resolution imaging. Moreover, my laboratory has been committed to advancing research methodologies and tools tailored for investigating vessel–tissue interactions in bones and soft organs. Most recently, my lab has developed a method that enables ultrafast immunostaining and light-sheet imaging of intact bones, leading to the exciting discovery of lymphatic vessels and their function in bones.

What are the main research questions that your lab addresses?
My lab's research questions are laser-focused on unravelling the mysteries of vascular and tissue ageing. We delve into understanding age-dependent changes in both blood and lymphatic vessels, while also investigating how ageing influences immune cells, cancer and tissue regeneration. Cancer exhibits a strong age-related component, with cancer cells lying dormant in the bones for decades before metastasizing. This enigma drives our pursuit to comprehend the effects of ageing vascular microenvironments on disseminated tumour cells. As we age, we are aware of the profound impact on the immune system's response, as also evidenced during COVID-19. Our primary objective is to illuminate the intricate ways in which the ageing vasculature affects immune cell production and migration. By uncovering these critical insights, we strive to unlock potential avenues for tackling age-related health challenges and empowering healthier ageing.

You mentioned COVID-19, did your research focus change because of the pandemic?
Our research, although not directly centred on COVID-19, does indeed highlight the profound interplay between ageing and the immune system, making the pandemic a relevant and topical example. The core research questions pursued in my lab have remained steadfast, delving into the fascinating realm of understanding how blood vessels undergo changes as we age and how these changes reverberate across various biological processes, including immune cells, stem cells, tissue and cancer dynamics.

How did the pandemic impact your lab?
The pandemic brought about a mix of challenges and opportunities for my research endeavours. Embracing the positive side, the imposed restrictions and halted travel allowed me to spend quality time with my family, particularly my daughter who is now 6 years old. Previously, my schedule was heavily lab-centric, but the pandemic compelled me to take a step back, granting me valuable moments for reflection and completing research papers. An unexpected silver lining was my 2-month trip to India to be with my family, and I managed to continue my work remotely. However, the closure of the Institute did have significant implications for our bench work, particularly mouse experiments, which had to be terminated prematurely. As a lab that thrives on hands-on experimentation, this undoubtedly had a substantial impact.

Developing imaging techniques seems to be a cornerstone of your work, is this something that you enjoy?
Absolutely, I find tremendous enjoyment in the process of developing imaging methods, albeit my primary motivation lies in using these techniques to answer pressing research questions. During my postdoctoral work, I had the exhilarating opportunity to delve into 3D imaging, which led to several ground-breaking discoveries. The spatial information obtained through imaging plays a pivotal role in my work, as it allows us to gain valuable insights into the intricacies of age-associated diseases. The ultimate goal of our efforts is to advance these imaging technologies to study and potentially treat age-related illnesses. I envision that the novel imaging tools we develop not only aid our own research pursuits but will also serve as valuable resources for other scientists grappling with their own research questions. Moreover, I aspire for these technologies to find practical applications in clinical settings.

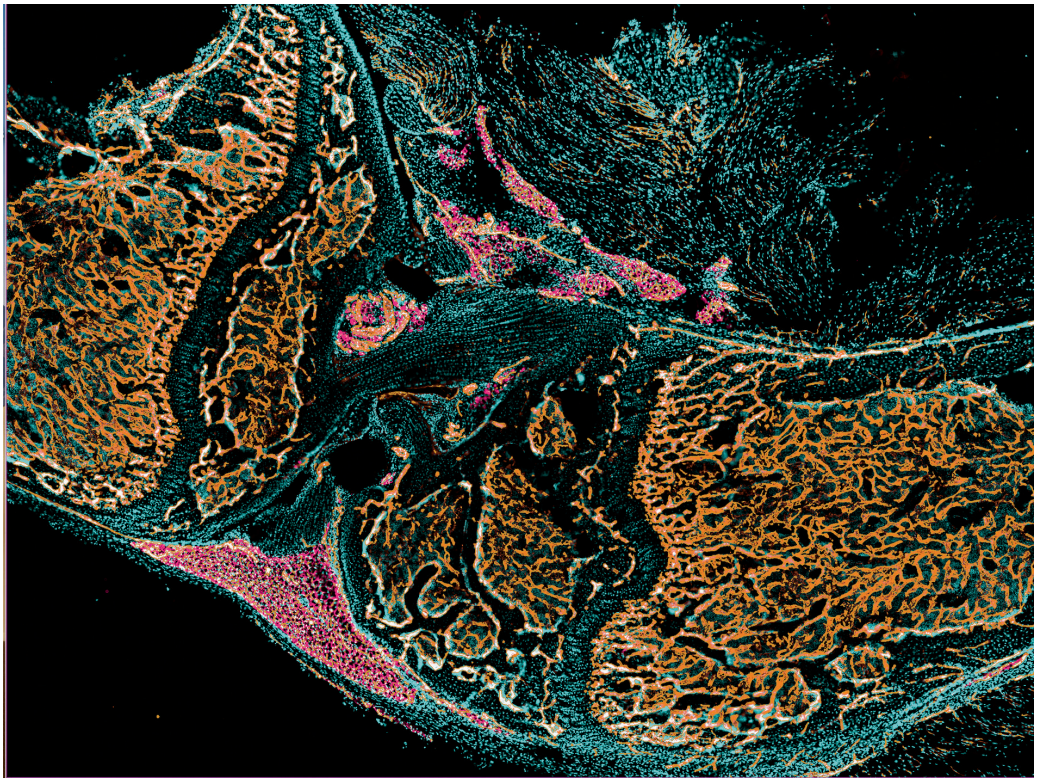
Which new methods are you most excited about in microscopy?
At present, we are deeply invested in the realm of microscopy, exploring exciting avenues that push the boundaries of imaging possibilities. One particularly captivating technique that we have been delving into is light-sheet microscopy. This methodology provides us with the remarkable advantage of fast imaging without compromising sample integrity. In particular, our interest lies in harnessing lattice light-sheet microscopy, a technique that promises to elevate our imaging capabilities to super-resolution levels. Undoubtedly, lattice light-sheet microscopy presents its own set of challenges. Previously, the technique required meticulous instrument maintenance and specific sample holders, rendering it difficult to use. However, we are thrilled to embrace the wave of progress as commercial instruments have emerged, offering user-friendly solutions.

Did you face any challenges when you started your lab that you didn't expect?
Absolutely, I faced several unforeseen hurdles during the initial stages of setting up my lab. One significant challenge revolved around the recruitment of students. In the UK, students are typically affiliated with specific institute and departmental PhD programmes, and not funded through research grants. Unfortunately, I was unaware of this, and I didn't secure a PhD student for several years. This was undoubtedly the most disheartening setback I experienced. I would strongly advise anyone embarking on establishing their own group in the UK to proactively delve into the student recruitment process to avoid such delays. As a researcher transitioning from a different system in Germany, I also encountered distinct differences in running a group and navigating the recruitment process in the UK. Adapting to these new dynamics required time and effort, and it reinforced the importance of thoroughly understanding the operational intricacies within the scientific community. Undeniably, one of the most challenging aspects for new PIs is the process of hiring the right personnel. Hiring the perfect fit for a lab's research vision and dynamic can be a complex task, particularly when new PIs themselves are yet to establish their names in the field.

Is there any other advice you would give to someone starting their lab?
Prioritize finding a supportive and nurturing environment that wholeheartedly invests in your professional growth. Seek out an environment where your voice is heard, your ideas are encouraged, and your growth is nurtured. While funding and resources are undoubtedly essential, the value of career development support from senior staff cannot be overstated in shaping your trajectory as a successful research leader. This advice holds particular significance for women and ethnic minorities in academia. These groups face unique challenges in the scientific community. Therefore, seeking an institution that offers a supportive community should take precedence over other considerations. A culture that fosters inclusion, diversity, and equitable opportunities will empower you to thrive and succeed. As you embark on this journey, surround yourself with people who believe in your potential and genuinely care about your professional growth. By prioritizing this, you will pave the way for a rewarding and impactful career, making a lasting difference in your field and beyond.

Did you have any mentors that helped you in your career?
Indeed, throughout my journey, I had the invaluable support of mentors. However, I must admit that it wasn't easy

for me to ask for help. Nevertheless, when I did, I was pleasantly surprised by the willingness of people to step up, support and help me. Over the course of my career, my mentors evolved and changed, each playing a vital role in distinct phases of my professional growth. Their diverse perspectives and experiences have been instrumental in moulding me into the researcher I am today. While some mentors were there during the early stages of my journey, others have stepped in to support me in more recent times.



Above: 3D image showing immunostaining for vascular and perivascular cells in a murine bone and knee joint.

What is your approach to mentorship with your lab members?
My approach to mentorship with my lab members revolves around fostering a supportive environment that empowers each individual's growth as a scientist. When a new member joins my lab, I recognize the importance of investing significant time during the initial six months or so. This period allows me to understand their career aspirations, preferred working style, and areas where they require mentorship and guidance. By tailoring my approach to suit their needs, I ensure a more effective and personalized mentorship experience. Adapting to their preferred communication style is another crucial aspect of my mentorship approach. Open and transparent communication facilitates a strong mentor–mentee relationship. As time progresses, I encourage and empower my lab members to work independently as this helps their scientific growth. To promote a culture of collaboration, I place great emphasis on team building within the lab.

Your lab was awarded a LEAF sustainability Gold Award, can you tell us a bit about the scheme and why it was important for your lab to be involved?
The sustainability Gold Award has been immensely beneficial to our lab for two reasons. Firstly, it fosters an environment conducive to conducting high-quality research by addressing crucial aspects like lab organization, meticulous tracking of samples, lab management software implementation and sharing negative data. As a newer PI, I saw this as an opportunity to establish a strong foundation for my research endeavours. Participating in the sustainability Gold Award also reflects our commitment to responsible resource management. As an early-career PI, resources are often more limited, making it even more critical to optimize and streamline our operations. Secondly, the environmental aspect of the scheme resonated deeply with us. As we all know, lab-based research is highly resource and energy intensive, leading to significant carbon emissions. Being conscious of this impact, we were eager to participate in the scheme to actively contribute to reducing our carbon footprint. By embracing sustainable practices, we ensure that our lab operates efficiently, minimizing wastage and contributing to a greener future.

As an introvert, how do you get the most out of the meetings you attend?
I tend to be quite reserved when it comes to networking and find that I get exhausted when attending conferences. I have benefited from receiving invitations to give talks at meetings, which have had a huge impact in my career by enabling me to present our data and elevate our lab's visibility. For early career researchers, I highly recommend submitting abstracts for oral presentations whenever possible as this can be a transformative opportunity to showcase your work and expand your network. I have also benefited from organizing meetings myself; I organize the Oxford Imaging Symposium and the Oxford Vascular Biology Symposium. These events have allowed me to get to know people within the scientific community. Through short chats and interactions during conferences, I have gained valuable insights and identified potential collaborators. While I acknowledge that reaching out to people before meetings for one-on-one chats can be beneficial, I must admit that it has been a challenge for me as an introvert. Presenting my lab's work and organizing conferences have opened exciting possibilities contributing to the lab's success.

Finally, could you tell us an interesting fact about yourself that people wouldn't know by looking at your CV?
I am a passionate foodie! I have completed a Food Science course, delving into the intricacies of culinary arts. I've even participated in cooking competitions and been given awards for my culinary skills. I aspire to start my own restaurant one day, creating a space where I can share my culinary creations with the world. I find immense joy in both savouring and preparing delectable dishes. I like to attend food festivals and I especially love dark chocolate!

Tissue and Tumor Microenvironments Group, MRC Human Immunology Unit, MRC Weatherall Institute of Molecular Medicine, Medical Sciences Division, University of Oxford, Oxford, OX3 9DS, UK
E-mail: anjali.kusumbe@rdm.ox.ac.uk

Anjali Kusumbe was interviewed by Helen Zenner, Online Editor at Journal of Cell Science. This piece has been edited and condensed with approval from the interviewee.

BSCB post doctoral award winner: Tom Williams

Could you describe your research in a nutshell?
I'm really interested in what cells do to adapt to changes in their environment, such as changes in nutrient availability. My work has most recently focused on how these changes affect specific translation of stress-responsive mRNAs through regulation of mRNA localisation and alterations in signalling pathways.

What inspired you to come into Cell Biology?
I've followed the subjects and questions that have most interested me, so I came into Cell Biology more by accident than design (so much so that I didn't actually do any Cell Biology modules in my final BSc year)! I love trying to figure out how life works and doing this in living cells where you can see the effects is by far the most satisfying approach for me.

What's been your best moment as a Cell Biologist?
I presented two back-to-back short prize talks on my research and outreach at the University of Dundee School of Life Sciences annual retreat last year. Weaving these stories together and showing how they complemented each other was extremely satisfying!

What do you feel are the biggest challenges facing Cell Biology?
Cell Biology research uses a lot of energy and a lot of plastic. Both of these are big problems, and we have to change our current single-use and convenience-based approach, as well as coming up with other ways of lowering our impact.

If you were to start your PhD today, what would be the emerging topic you would like to focus on?
I think it would be fascinating to investigate how cell signalling and environments change through different regions of tumours and organoids.

What's your favourite cell and why?
S. cerevisiae is genetically tractable, fast growing, and you can use it to make beer and bread – what's not to love?!

What made you get into science outreach?
I tried to explain my job to my son and realised I couldn't do it in a way that he could understand easily. I decided the only way I'd get better at it was by practising, which motivated me to do outreach! I quickly found that people were interested in what I had to share, and I enjoyed the challenge of simplifying really complicated concepts on the fly. Running these sessions reminds me of why I wanted to do research in the first place, gives me a wider perspective (making last weeks failed experiment less important), and means I can legitimately go to a park on a sunny afternoon for work!

How do you design your board games?
The first part of designing any outreach activity is knowing where you're going to use it, and how much time people may want to spend on it. If you're going to do something at a festival where people spend a few minutes at each table, you don't want to start a game of monopoly! Equally, if you have an hour with a school class you don't want to run out of things to do.

Once you know where your activity will take place, it's important to decide on a very simple, specific, learning outcome you want to get across and remove technical language. The hemingwayapp website is really useful for this! After you've decided on your message and the audience, try and adapt an existing game or activity to fit your topic – I've used Ludo, magnetic fishing, and memory games among others. It helps understanding if people have played something similar before! Make sure there's some jeopardy so it's interesting, and then get people to test it, and adapt it based on the feedback you receive. If you're going into a classroom have a backup such as activity sheets for people who finish early/don't want to get involved.

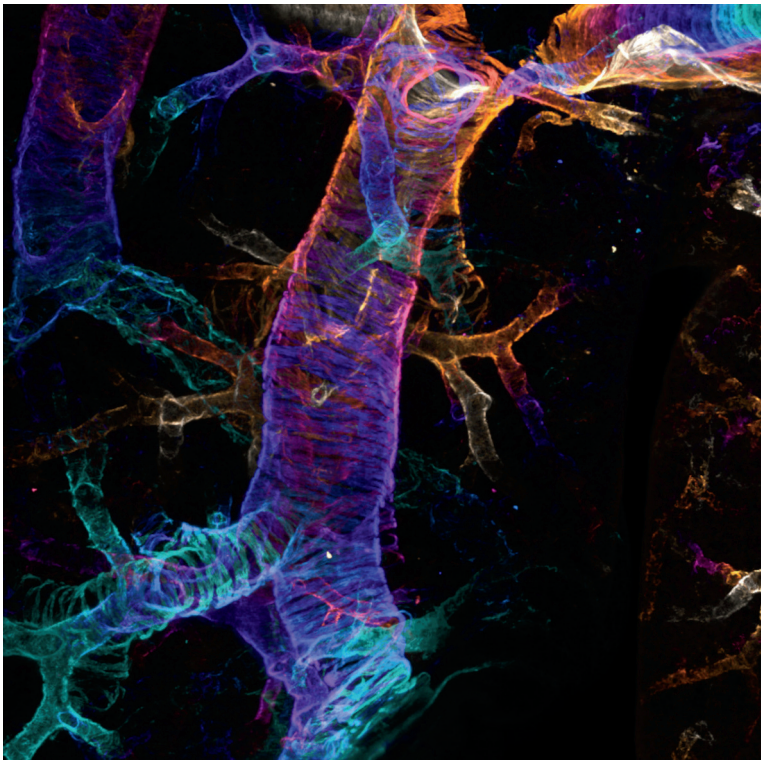
Any advice for making an outreach activity or doing outreach for the first time?
Just go for it! Try to relax and be friendly, and focus on the big picture, not on your specific topic – simplicity is key, and you can always add detail if you're asked. Expect unexpected unrelated questions. The best takeaway someone can have is that they liked you, had fun, and wouldn't mind working with you at some point in the future. Use different ways of presenting – I mix videos and animation into presentations to break up the amount of time people have to listen to me! If you have problems getting time out of the lab check your contract: it may have a defined amount of time you can spend on Ongoing Professional Development, which includes outreach (by improving scientific presentation and communication skills). Try not to take anything personally – kids can lash out if they're having a bad day for reasons totally unrelated to you (reviewer-three-itis). If you're unsure of how to adapt your topic to an outreach event or activity, there are probably local engagement officers you can contact for help and advice – you can also feel free to contact me and I'll be happy to help with ideas and templates!

Tom Williams was interviewed by Alex Fellows, BSCB Post-doctoral Representative

Image Competition 2023

1st place: Liam Hill

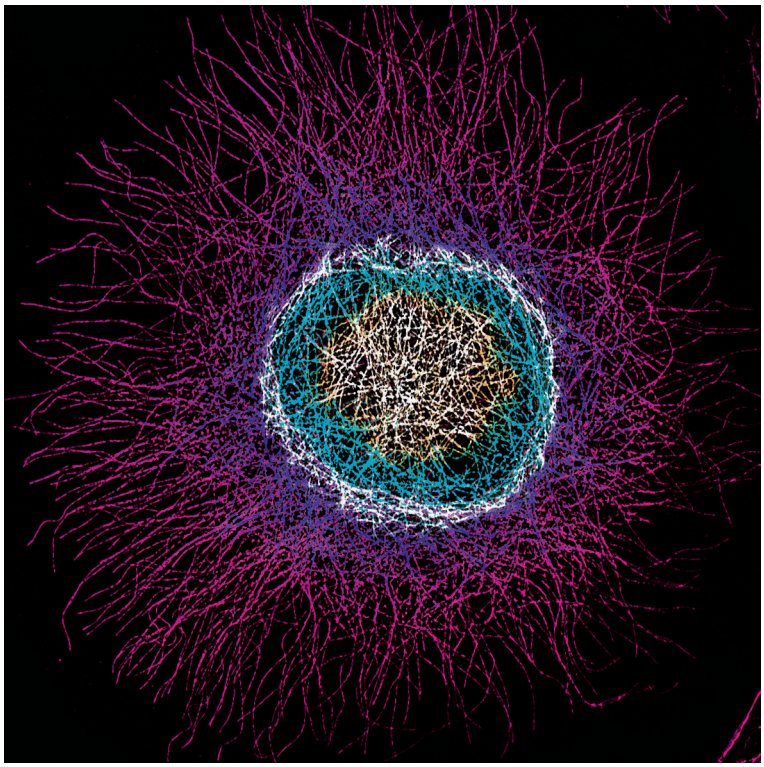
Mouse airways, stained to reveal alpha-smooth muscle actin structures. To achieve this, adult mouse lungs were cleared using the FLASH method and imaged with a Zeiss LSM 710 confocal microscope at 10X magnification. Images were acquired as tile scanned- Z stacks and were colour coded in FIJI. Here, the colour corresponds to depth of the Z-stack in the maximum intensity projection.



"I am a final year PhD student at Cardiff University, in the lab of Catherine Hogan. I studied biomedical science at Cardiff University, and after taking a placement year in the Max Perutz labs in Vienna, I decided that I wanted to pursue a PhD. At our lab we focus on the tumour suppressive role of cell competition and aim to understand what goes wrong in the process to give rise to early disease. My project aims to understand how different regions of the lung epithelium maintain homeostasis from the onset of KrasG12D oncogene activation."

2nd place: Nikki Paul

Microtubules in a B16F10 melanoma cell were imaged using a Zeiss Elyra 7 Structured Illumination Microscope (SIM). Cells were fixed and stained prior to imaging using a 63x oil objective with optimal Z-sectioning. Following SIM processing a colour-coded projection of the Z-stack was applied using Zen software.



"I am a Senior Scientific Officer working in the microscopy core facility at the CRUK Beatson Institute for Cancer Research in Glasgow, Scotland. I help our researchers to design, plan and perform their imaging experiments, and optimise unique ways of carrying out advanced microscopy. I also provide training, and help to maintain the microscopy equipment. I am a former postdoc and have worked on the cytoskeleton, and invasion and migration of cancer cells. During my PhD, I worked on focal adhesion complexes using a combination of mass spectrometry and microscopy techniques.

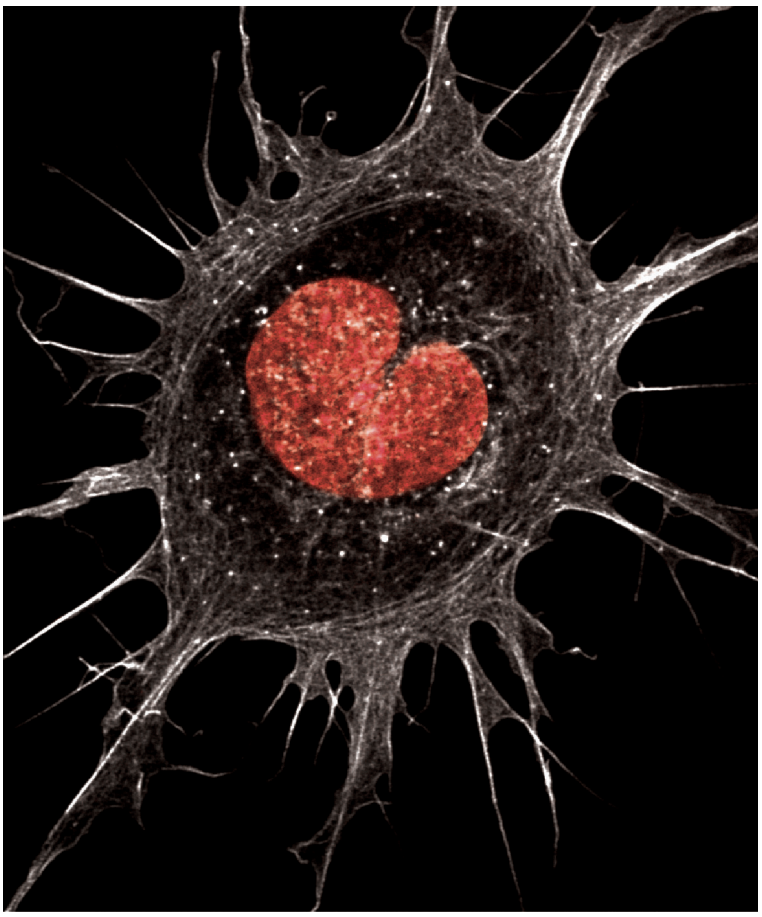
This image is of a B16F10 mouse melanoma cell, which are excellent models of cell migration, but move rapidly which can be quite scary! I imaged this cell using a Zeiss Elyra 7 super-resolution microscope using structured illumination microscopy (SIM). This is a widefield system, which allows rapid super-resolution imaging, meaning we can take movies and Z-stacks in a fraction of the time that it takes using a laser-scanning confocal microscope. To generate this image I took a Z-stack of the microtubule cytoskeleton, and colour-coded the Z-projection so you can see the microtubules in the different Z-planes. With this microscope we are able to image structures inside cells in super-resolution over time, such as the microtubule and actin cytoskeletons, mitochondria, endosomes and trafficking proteins, and it is incredibly useful for studying the dynamics of cancer cells."

3rd prize: Hoang Anh Le
University College London

My name is Anh and I'm currently working as a postdoc in the lab of Roberto Mayor at the University College London. I did my undergraduate degree in Biochemistry at the University of Bristol, before obtaining a PhD in Cancer Cell Biology with Laura Machesky when she was at the beautiful CRUK Beatson Institute in Glasgow, Scotland. For my PhD, I worked on understanding a novel negative regulator of the actin cytoskeleton named CYRI-A and discovered how this protein was involved in a process called macropinocytosis and integrin uptake.

The image submitted to this competition is of an Ewing's sarcoma cancer cell overexpressing CYRI-A (not shown in the image), many thin finger-like protrusions are formed because CYRI-A was actually suppressing the formation of branched actin network. It was a complete accident that I stumbled upon this cell with a very peculiar heart-shaped nucleus and I thought it would make a good contribution to the competition.

My current work at UCL, however, is completely different from what I was used to. I thought changing models and topics would enrich my experience and make science more exciting to me. I am currently looking at how embryonic immune cells behave during development using the Xenopus embryo as a model system.



Science Writing Prize Winner 2023 – Aleksandra Pluta

One small cell for a man

Having completed her undergraduate degree in Biomedical Sciences at the University of Manchester, Aleksandra Pluta is now pursuing a PhD in Molecular Biology at the University of Oxford. Currently in her third year, she is trying to elucidate the role of CDK1 in transcription in cancer cells, working under the supervision of Prof Shona Murphy and Prof Chris Norbury. She loves art – for the ability to create things that did not exist before, dance – for the joy and energy it gives her, and scuba diving – for its sense of weightlessness and wonder of discovery.

If you asked the 6-year-old me who she wants to be when she grows up, with no little sense of conviction she would reply she is becoming an astronaut. I can only hope being a biologist was somewhere close to the top of the list, as she could otherwise be a little bit disappointed, she ended up working in a lab and not on orbit. Perhaps she would argue that feeling violently nauseous after a spin on a playground carousel is not enough evidence she would be a terrible astronaut.

Despite the deep-rooted conviction that we are a generation born too late to explore the world, and too early to explore the galaxy, space research is a blooming area of science. Apart from studying rocket propulsion, black holes, and other things we traditionally associate with venturing into outer space, researchers also examine how our bodies react to spaceflight. Bioastronautics, as it is sometimes called, is an area of research concerned with biological effects of microgravity and cosmic radiation on living organisms.

And so it was shown, for example, that astronauts who feel fine on rollercoasters on Earth could get space sickness whilst living on a space station, while on the other hand, there is no certainty that people who normally suffer from motion sickness will experience it in zero-gravity. Fellow space enthusiasts with innate fear of playground carousels – rejoice! Not all hope is lost! That is, of course, if you are not too concerned about the deterioration of your musculoskeletal system, balance disorders, onset of anaemia, shifts of body fluids, disruption of sleep cycle, and more, that come with working in outer space.

Researchers in laboratories both on Earth and on orbit work tirelessly to elucidate the causes behind these spaceflight-associated conditions. The myriad of investigations is imperative for ensuring the safety of future space exploration. More importantly for now, their applications can be remarkably beneficial also on Earth. Examinations of retinal lesions, common in astronauts, might help people struggling with glaucoma or age-related vision issues. Similarly, the phenomenon of bone decalcification during spaceflight has many parallels with osteoporosis in terrestrial patients.

The microgravity environment also allows us to design new disease models, that are otherwise impossible to recreate on Earth. For instance, endothelial cells cultured in space are being tested as models for verifying the effectiveness of vascular drugs, as preliminary data suggests they share more features with human blood vessels than their lab counterparts grown in normal gravity[1]. If testing drugs in outer space does not sound futuristic enough for you, astronauts are now participating in the development of new drugs as well.

The latter has been made possible by a novel method of crystallising proteins in space, which is now estimated to be the single most common type of experiment performed on the International Space Station (ISS). Proteins are the molecular players and communicators of the natural world, and the human body alone needs a mind-boggling range of 100 000 different ones to ensure its proper functioning. When we fall ill, proteins become the targets of medical intervention; a drug which binds to a specific protein can alter its function and bring us back to health.

But how is specificity achieved? How can we ensure a drug knows which one of these 100 000 proteins it should stick to? This dilemma has always constituted as one of the biggest challenges in drug development, as creating highly-specific molecules results in greater efficacy of treatment and fewer side effects. However, to ensure a snug fit we first need to properly understand the structure of the protein we are trying to target.

Here come the protein crystals. One of the best ways to study the structure of a given protein is to grow it in crystalline form, which consists of producing millions of copies of the protein of interest and arranging them in a three-dimensional shape. Intriguingly, it was found that when it comes to protein crystallisation, a space environment of microgravity surpasses conditions found on Earth. With no convection, that is, no movement of warmer and cooler masses of air, the crystals can grow slower and achieve much higher quality.

This is how the orbiting ISS became a mobile laboratory for growing crystals (sounds oddly familiar to all “Breaking Bad” fans), which can then be transported back to Earth for X-ray structural analysis. This rather exotic approach has allowed researchers to find a new way to inhibit hematopoietic prostaglandin D synthase, a protein involved in the degradation of muscles in Duchenne muscular dystrophy (DMD) patients. A compound they have designed is now in phase 3 of clinical trials, with the potential to double the lifespan of people suffering from DMD[2,3]. These studies have also resulted in the creation of artificial albumin, which is the most abundant protein in blood[4].

Protein crystallisation is just one of many exciting avenues of biomedical research that is carried out on orbit. The equipment available on the ISS allows for performing an impressive range of molecular biology methods, including routine DNA sequencing, or even CRISPR, the current golden standard of gene editing. Astronauts have studied muscle loss in mice[5], chromosomal abnormalities in fruit flies[6], or the formation of amyloid fibres during Alzheimer’s disease[7], all aboard a satellite that makes 16 orbits around Earth in a day. One of the most captivating space investigations was that of NASA Twins Study, which examined cell behaviour and gene expression in identical twin astronauts, one working on the ISS, and one remaining on Earth[8]. For instance, it showed that telomeres, the protective ends of our chromosomes which shorten during aging, actually lengthened during spaceflight.

One thing is for sure – the field of bioastronautics is swiftly growing in importance, and will only continue to do so, as our human nature pushes us to explore the worlds

beyond Earth's orbit. Although nowadays intergalactic travel and zero-gravity laboratories sound more like work of science fiction, achievements of space research have an exquisite effect of taking away the "fiction", and emphasising the "science".

References

1. Cazzaniga, A., Moscheni, C., Maier, J. A. M. & Castiglioni, S. Culture of human cells in experimental units for spaceflight impacts on their behavior. https://doi.org/10.1177/1535370216684039 242, 1072–1078 (2016).
2. Taiho Pharmaceutical Co. Ltd. A Phase 3 Study of TAS-205 in Patients With Duchenne Muscular Dystrophy (REACH-DMD). ClinicalTrials.gov https://clinicaltrials.gov/ct2/show/NCT04587908 (2020).
3. Komaki, H. et al. Early phase 2 trial of TAS-205 in patients with Duchenne muscular dystrophy. Ann Clin Transl Neurol 7, 181–190 (2020).
4. Haruki, R. et al. Safety Evaluation of Hemoglobin-Albumin Cluster 'HemoAct' as a Red Blood Cell Substitute. Sci Rep 5, (2015).
5. Lee, S. J. et al. Targeting myostatin/activin A protects against skeletal muscle and bone loss during spaceflight. Proc Natl Acad Sci U S A 117, 23942–23951 (2020).
6. Ogneva, I. V., Belyakin, S. N. & Sarantseva, S. V. The Development Of Drosophila Melanogaster under Different Duration Space Flight and Subsequent Adaptation to Earth Gravity. PLoS One 11, e0166885 (2016).
7. McMackin, P., Adam, J., Griffin, S. & Hirsa, A. Amyloidogenesis via interfacial shear in a containerless biochemical reactor aboard the International Space Station. npj Microgravity 2022 8:1 8, 1–8 (2022).
8. Garrett-Bakelman, F. E. et al. The NASA Twins Study: A multidimensional analysis of a year-long human spaceflight. Science 364, (2019).

The FocalPlane Network: connecting the microscopy community

The FocalPlane Network is an international directory of researchers with expertise in microscopy. The goal of the Network is to facilitate promotion and networking, as well as assisting those seeking conference speakers, committee members, reviewers or collaborators. Membership is open to researchers in the microscopy community from all career stages, geographical locations or areas of expertise. Members can voluntarily provide details on aspects of diversity such as gender, race/ethnicity, LGBTQ+ identity and disability status. The Network is fully searchable based on these diversity characteristics, as well as on scientific expertise, career stage and location.

The FocalPlane Network was set up in collaboration with our Scientific Advisory Board [of the Journal of Cell Science] and we spoke with board member Ricardo Henriques to find out more about the motivation to create the database.

"I'm thrilled by the potential of the Network to create a positive impact. It's equipped to drive innovation, ensure equitable access to opportunities and nurture budding microscopy leaders. The platform promotes benefits like wider viewpoints, collaboration,

and diverse talent reflecting our global scientific base. I urge all microscopy community members to join the Network. It can advance science through knowledge sharing and networking, adding to its inclusivity. The directory signifies our collective effort to build an engaged community. I look forward to witnessing it grow into an inclusive ecosystem benefiting scientific innovation and humanity."

https://focalplane.biologists.com/network/

A new cell biology practical with flexibility for teaching life and medical sciences programmes

A challenge for academics is how to translate their research expertise into inspirational and effective teaching for undergraduate and postgraduate students. Here we describe our experience of devising and implementing a suite of inter-linked new cell biology practicals as a spin-off from our research work.

Our practicals are based on a live cell cycle reporter system created by Miyawaki and colleagues at the RIKEN Center for Brain Science in Saitama, Japan (Sakaue-Sawano et al., 2008). In this system, two different fluorescent proteins, monomeric Kusabira Orange (mKO) and monomeric Azami Green (mAG), are fused to protein domains which undergo cell cycle-dependent ubiquitination and proteolysis. This reporter, termed Fluorescent Ubiquitinated Cell Cycle Indicator (FUCCI), enables the visualization of actively dividing living cells by monitoring the G1 (red), S phase (yellow) and G2/M (green) phases using fluorescence microscopy. We used this versatile reporter expressed in human endothelial cells to assess the effects of vascular endothelial growth factor A (VEGF-A) on signal transduction pathways and the cell cycle (Fearnley et al., 2020). During this work, we realized that the FUCCI system could be a powerful tool for teaching cell biology concepts to undergraduate students in the life and medical sciences and combining this with statistical skills.

To develop a new set of undergraduate cell biology practicals, essentially a mini-project that runs over 8 weeks, we needed a new toolbox of kits, reagents, hardware and technical support. We also needed bespoke practical handbook(s) that could be used by academics, and PhD demonstrators (see Figure 1 flowchart). To develop this toolbox, we supervised 3-4 individual laboratory research projects undertaken by final year BSc or Masters project students (10-12 weeks). Prior to the commencement of any student work, we transduced different human epithelial cancer cell types with a lentiviral FUCCI reporter to generate stable FUCCI-expressing cell lines. The human epithelial adenocarcinoma line A431-FUCCI proved to be a robust line, with excellent visualization of the cell cycle (Figure 2). A range of biochemical, microscopy and quantitative techniques were established including immunoblotting, live cell imaging and statistical analyses. Key laboratory techniques included rapid immunoblotting, digital microscopy, quantitative analyses and statistics. After extensive troubleshooting, we produced a detailed practical handbook for Year 2 BSc students undertaking life sciences programs such as Biochemistry and Biological Sciences. One specific learning outcome is for students to understand how changes in the eukaryote cell cycle are linked to cancer, and the emerging use of anti-cancer therapeutics aimed at signalling pathways in this context. A second learning outcome is to support students in quantifying qualitative data (e.g. images) and statistically analyzing these numeric data sets.

We realized that specific equipment was needed at specific times in the practical class, with expert support from technicians and demonstrators who have a good grasp of the techniques. We were successful in raising institutional funds to support these new cell biology practicals, including purchase of easy-to-use research-grade fluorescence digital microscopes for undergraduate teaching. Since 2018, different iterations of this FUCCI cell biology mini-project have now been successfully implemented for undergraduate BSc programs in Biochemistry, Biological Sciences, Biotechnology & Business, Natural Sciences, Genetics and Medical Sciences, comprising >300 students annually (Figure 1). Our ongoing

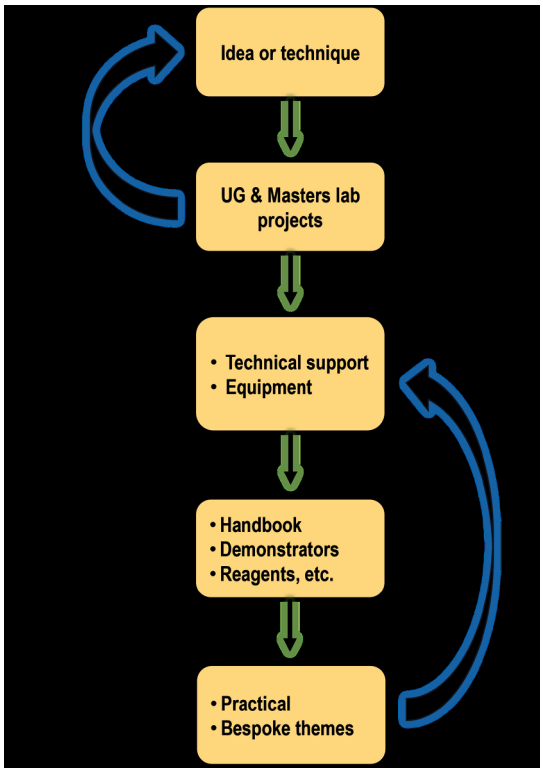


Figure 1. Flowchart for practical teaching development. A schematic description of a strategy for applying techniques used in research work towards new ways of practical teaching in undergraduate and postgraduate degree programmes. The central theme is continuous refinement and development of teaching methods to ensure that it is relevant and delivers on key skills learning and teaching outcomes that are essential for student development, progression and competition in the jobs marketplace.

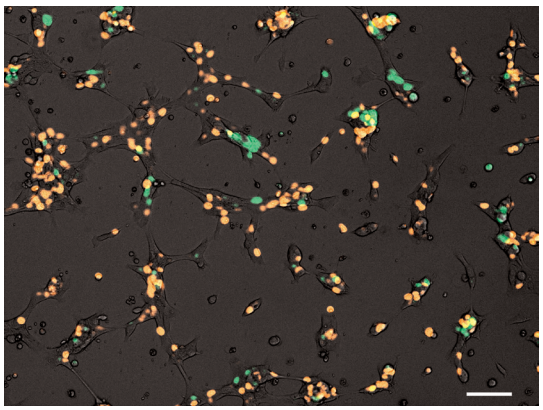


Figure 2. The human epithelial adenocarcinoma A431-FUCCI cell line. Expression of mKO (red) and mAG (green) denote cells in G1 and G2/M phases of the cell cycle respectively. Expression of both mKO and mAG denotes that the cell is in S phase (yellow). This image was captured by Level 2 undergraduate students using the EVOS Auto 2 imaging system (Bar, 100 μm).

DO	DON'T
Get institutional support for investing in equipment, demonstrator and technician time for supporting new practical development and delivery.	Assume that this can be done cheaply at the beginning; the cost savings in efficiency only become apparent after a few years
At least 3 weeks in advance, grow cell line(s), prepare reagents, solutions and test equipment .	Grow cell lines a few days before the practical begins; use equipment that has not been specifically used in practice dry runs.
Generate core and supporting teaching resources for delivery (practical handbook, references, techniques videos etc.) and make available to students in advance for pre-reading/preparation prior to attending practical classes.	Begin the practical without good online support including online rooms (if sessions online) for workshops and training.
Recruit sufficient number of demonstrators (PhD students/ Graduate Teaching Assistants) to support the delivery of laboratory practicals; and ensure they are well-inducted to support the teaching alongside the academic.	Assume that a lecturer and technician can cope with the practical, even for a relatively small group; PhD demonstrator support is essential.
Support the practical using online or in-person workshops to support discussions, data analysis, statistical training and student questions; groups of 10-12 students per session are typical	Ignore workshops, training and discussions; in our experience this has become very useful for scaffolding student learning.
Use the student, demonstrator and lecturer feedback constructively to refine the practical.	Ignore student, academic and support staff feedback

scrutiny of student feedback allows us to update and refine our practical teaching annually and build in new research updates. This cyclical development of our teaching practice has proved an invaluable help in supporting both students and teaching staff. We have reported this work recently in a teaching journal (Divan et al., 2023).

What are the lessons we have learnt from this example of research-led teaching? First, anything is possible with enthusiasm, drive and initiative. Next, preparation and projections on the need for staff, technical support and equipment are essential to ensure that complex practical teaching runs smoothly. Here, support from experienced or trained PhD students as demonstrators is particularly useful. Third, there will always be ongoing issues, whether major or minor. The important feature is to not get flustered and stick to the 'big picture' i.e. training students in quantitative cell biology. If things go wrong for students (quite a frequent occurrence), ensure you have a folder of raw data (collected from pilot projects and previous practicals) which can be provided if student efforts come to an untimely end with limited results. Our practical has inherent flexibility: it can be rapidly modified into bespoke practicals (1-2 sessions per week) that run for 2-8 weeks depending on the level of training needed by a specific degree program. Another feature we have built is teamwork and collaboration. We ask student pairs to work with particular growth factors or inhibitory molecules or specific signaling pathways and pool their data. This allows students to work with larger data sets and build up models to explain how the system may be working.

We attach a list to things to do or avoid in constructing in implementing such teaching practice:

We realize that our experiences in developing and teaching of cell biology are potentially useful to academic colleagues (Divan et al., 2023). The communication of our work in these and other formats will hopefully encourage others to use this cell biology tool, and also develop their own unique approaches. Our work has been recognized by the University of Leeds by the award of a 2023 Sustained Collaborative Teaching Award (Figure 3). We are committed to making our toolbox of reagents and handbooks widely available to other academics. We are currently developing a website to make our experience, handbooks and protocols available worldwide. In the interim, please contact any one of us for help directly through the email addresses provided above. We hope this that our work not only stimulates others to follow a similar path, but also to develop new and exciting teaching tools based on active research studies from their laboratories.

Sreenivasan Ponnambalam[1] (s.ponnambalam@leeds.ac.uk), Aysha Divan[1] (a.divan@leeds.ac.uk) and Michael A. Harrison[2] (m.a.harrison@leeds.ac.uk).
Schools of [1]Molecular & Cellular Biology and [2]Biomedical Sciences, University of Leeds, UK.

References

Divan A, Alzahrani A, Shaik F, Mitchell J, Harrison MA, Odell AF, Ponnambalam S (2023) A flexible research-led cell biology practical for biological sciences undergraduate and postgraduate degree courses. Biochem Mol Biol Educ. doi:10.1002/bmb.21735.

Fearnley GW, Latham AM, Hollstein M, Odell AF, Ponnambalam S (2020) ATF-2 and Tpl2 regulation of endothelial cell cycle progression and apoptosis. Cell Signal 66:109481. doi: 10.1016/j.cellsig.2019.109481.

Sakaue-Sawano A, Kurokawa H, Morimura T, Hanyu A, Hama H, Osawa H, Kashiwagi S, Fukami K, Miyata T, Miyoshi H, Imamura T, Ogawa M, Masai H, Miyawaki A (2008) Visualizing spatiotemporal dynamics of multicellular cell-cycle progression. Cell 132:487-498. doi: 10.1016/j.cell.2007.12.033.

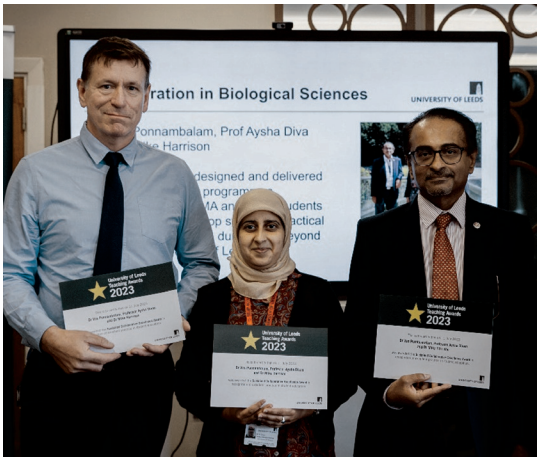
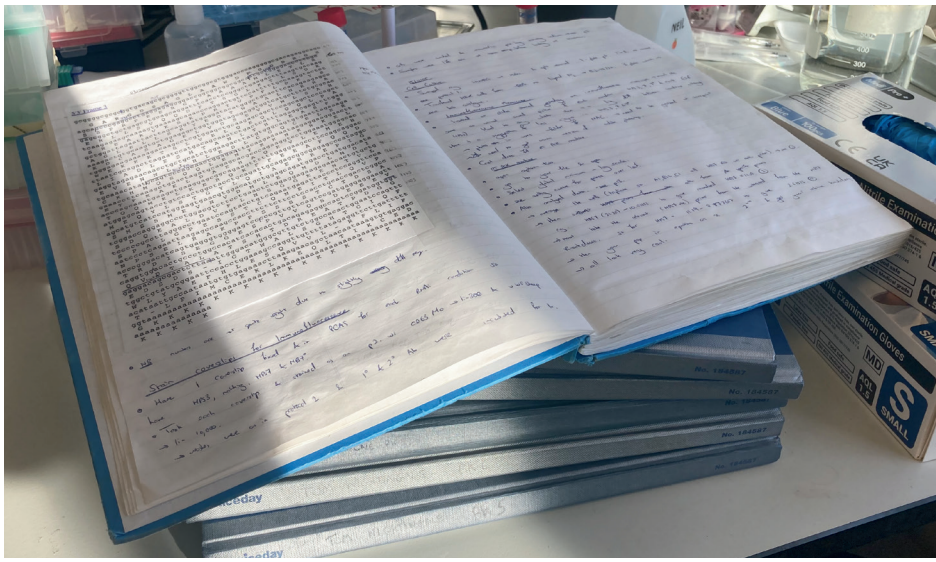


Figure 3. The academic team. From left, Dr Mike Harrison, Professor Aysha Divan and Dr Vas Ponnambalam receive the University of Leeds 2023 Sustained Collaborative Teaching Award (13 September 2023) for the work described in this article.

Lab notebooks: a short history

What links the HMS Beagle, the British Library and a Nobel prize lecture on GFP? Answer: the humble lab notebook. Whether observations from Charles Darwin's expeditions[1], the scientific notebooks of Dame Anne McLaren[2], a pioneer of *in vitro* fertilisation, or Ghia Euskirchen's meticulous recording[3] of the first bacterial cells expressing GFP (Figure 1), they were all written down in a lab book. Handwritten, dated; full of methods, results, observations and notes. All of which look pretty much like any well-kept laboratory notebook of today.



Andrew Porter
Research Integrity and Training Adviser, Cancer Research UK Manchester Institute
Email: Andrew.Porter@cruk.manchester.ac.uk

Laboratory notebooks – physical, handwritten objects – remain a common way of capturing biological research. Evolving from some combination of the private diaries of renaissance researchers and the recordings of alchemists[4], they became increasingly important for registering precedence of new discoveries for patent applications, and as a source of reliable information for writing publications. They have stood the test of time: it is easy to forget, that paper and pen are themselves highly developed technologies, allowing the rapid recording of information any time and almost anywhere. They are 'always on', relatively easy to store, and adaptable, with modern lab books containing printouts, scans, gel photos, digital file names (and possibly the odd scribbled computer password.)

With permanent ink and high-quality paper, physical lab books can store information for decades - even centuries. In April 2017, whilst I was working as a postdoc, a fire broke out in the Paterson Building in Manchester. Many labs were flooded by the tremendous amount of water used to extinguish the flames. While our first instinct on being allowed into the labs to rescue items was to grab our lab books and check if they were still readable, disaster recovery experts instead helped restore the books by freeze-drying. This removed the moisture, saving the pages from sticking together and tearing, and allowing the majority of the books to be recovered.

Physical lab books endure, but with disadvantages. They are linear, recorded event-by-event, which doesn't necessarily match how people conduct research, and they aren't easily searchable. They exist in only one place (how many researchers ended up with books stuck in COVID-restricted labs while working at home?) and while durable, a single copy leaves open the possibility of losing valuable records. Legibility varies with handwriting (just try to read the elaborate, looping copperplate writing of Alexander Graham Bell in his notebooks). In an age full of complex methods, metadata, bioinformatics and high-content screening – they are falling behind as a method of truly representing the breadth of modern biology. Perhaps most problematic – especially when thinking about research integrity and reproducibility – is how variable they can between researchers.

Lab notebooks: a deficit of training

Early in my PhD, I used to scribble notes in a spiral bound notebook, and then write up later in a hardbacked lab book. My supervisor gave me advice to record everything in my lab book immediately – even if it was a bit messy – because a separate notebook might get lost[5]. This was very much in line with best practice in terms of keeping contemporaneous records – and it was something I tried to do throughout my PhD. But this advice only related to one aspect of keeping a lab book.

I picked up other things informally or through trial-and-error. There were pragmatic considerations – writing thorough records takes a long time – and I also had a sense that it was for each person to derive their own process. Some researchers kept very detailed notes, but I reassured myself that my memory would help me fill in any gaps I was leaving. However, when I came to write my thesis, there were many things I wished I'd recorded better. Later, as a postdoc, trying to find details for publications in the books of people who had left the lab, I started to realise how this variation in approach can be unhelpful. What makes perfect sense to one person at the time they wrote it may be almost meaningless to another later on.

With these considerations in mind, I include this simple question during the research integrity induction at the Cancer Research UK Manchester Institute:

"What training have you had in keeping laboratory records?"

Researchers share their experiences in small groups and give feedback. From three years of running these sessions, some patterns have emerged.

First, formal training in keeping a lab notebook is very rare. Even experienced postdocs can rarely remember a time when someone has given them explicit expectations or guidance.

Second, people often receive informal advice from a more experienced colleague - PhD student or postdoc. This side-by-side training is common across academia and is a powerful way of learning and building a strong research community. But if those leading this informal training have not themselves been given clear instruction, it is also unfortunately a good way to spread questionable research practices.

Third, where researchers have received formal training, this tends to have been during industrial placements – where a greater emphasis is placed on standardisation – or in clinical laboratories which conform to Good Clinical Practice, where record keeping is covered by legal requirements around clinical trials management. Occasionally a new starter will have taken an undergraduate record keeping module, but applying this learning in a real-world lab setting is tricky.

Overall, it seems assumptions are being made throughout researcher training that people either instinctively know how to keep good lab records, or that sufficient training is happening organically. Some people even say things like "I've never really thought about how to keep a lab book before."

For something so fundamental to the whole structure of biological research, I suggest we should think much more about how we train researchers in record keeping.

A


Tuesday 13. October 1972

— continued —

Fluorescence Microscopy

– Used 'scope from 368 Eng. Terrace lab with fluorescein block. — Also viewed by Ding & Chuck. Viewed under oil immersion w/ 100x objective.

E. coli from Ding untreated — Check for fluorescence — no auto fluorescence could be seen although the field had a strong greenish cast

1 t=2hr (after induction) — fluorescing E. coli (strongly) fairly black field

2 t = 0 hr (before induction) — weakly fluorescing E. coli fairly black field

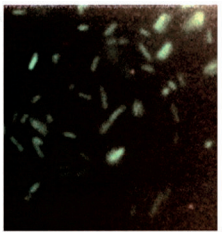
2 t = 2 hr (after induction) — same as # 1 t = 2 hr

With Vivian's camera, Kodak EKtar 100 ASA 35 mm set on 100 ASA

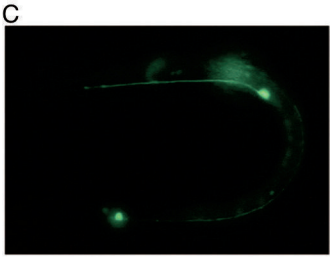
1st group of ~ exposures ~ < # 16 were the untreated E. coli from Ding
2nd group ~ < # 30 were # 2 t = 2 hr
3rd group (out of) were # 2 t = 0 hr

* For auto exposure time which was ~ 60 sec, cells had completely BLEACHED.

B



C



How can we improve record keeping?

During this session, people often ask how they should be keeping a lab book. I've found it surprisingly difficult to find good sources of information on this. Drawing on the online training provided by Epigeum for the University of Manchester[6], and the principles of The Concordat to Support Research Integrity (which states researchers should understand and maintain "the highest standards of rigour and integrity in their work at all times"[7]) I highlight four broad uses of a lab book:

How you can improve lab notebook use

• As a student or ECR - talk to your supervisor. There are many different and acceptable ways of keeping lab records, so it is important to have clear direction to ensure you're in step with your colleagues and supervisor. Some questions to ask might include:
• Do they expect to formally review and sign off your lab book?
• Do your local rules allow you to take your lab book in and out of the lab?
• Do they think that they would be able to read your work if you were away or ill?
• Have they got principles and practices which they think everyone shares but actually are unique to the lab which you need to know about?
• Check to see if your university or organisation offers guidance or training, particularly around data protection and record management, that you can engage with to support good practice.
• As a lab head or facility lead – add a discussion about record keeping to your lab induction. If you have a lab manual, add any local practices for record keeping – naming conventions, expectations about data management – so that everyone can work to clearly-defined rules.

If you don't have these already, consider:
• Using an index. Leave a few pages blank at the start of your lab book – or better still, write at the top of them that they will be the Index pages. Then when you make an important finding or write a protocol that you will revisit, make a note of the page in the index page of the notebook. (This is something I wish I'd thought to do when I was in the lab!)
• Choose a way to track experiments. Finding a way to create links – either written in a lab book or recorded digitally – between experiments, observations and data will save time when compiling reports or writing papers. This can be as simple as defining a unique code for each experiment. Experiment_001 can include reagents 001_A, 001_B and so on, and be recorded in Results_001 and mentioned in report 001.
• These can be written in a book, used in file names, referred to in presentations.
• Perhaps each lab member could use their initials in their code – such as 001_APP – to help coordinate between lab members.
• Do a digital audit. Even just getting a clearer picture of the tools you and your colleagues are using can be helpful. You could think about:
• Where else are you (or your lab members) keeping records? Even where organisations use hard copy lab books, individual researchers often keep important information in a variety of places – collaborative tools (Microsoft Teams, Slack, Google Drive); emails; in PowerPoint presentations from lab meetings
• Can you consolidate records (from email, Dropbox, shared drives) or at least write a short document describing where they all are and what they are that you can stick in your book?
• Your institutional information governance or research integrity teams might have advice that you can draw on here.
• If you're using tools outside those provided by your department or university, have you got a digital risk assessment in place?

Figure 1 (left). The first expression of GFP in heterologous organisms. (A) The page in Ghia Euskirchen's laboratory notebook where she noted that *E. coli* expressing GFP fluoresced. The microscope she used was not in our laboratory. (B) A picture of those first fluorescing bacteria taken by Euskirchen. (C) GFP expressed in the *C. elegans* touch receptor neurons. [From Chalfie et al. (1994) *Science* 263, 802–805 with permission from AAAS.] Figure taken from Chalfie (2009) *Proc. Natl. Acad. Sci. U.S.A.* 106, 10073-10080, with permission.

- Self-reference
- Information for colleagues
- Evidence should your work be challenged
- Support for intellectual property claims

Framing the conversation this way helps researchers understand the 'why' of record keeping, which in turn speaks to the 'how'. Once researchers see that a lab book is not just for them, but a resource for others, it makes sense that the records need to convey a shared understanding.

If you're reading this and worrying about your own record keeping, my aim isn't to be critical; I'm aware that many researchers struggle with perfectionism. Recognising that no-one is doing this perfectly, and that your positive action – however small – can benefit you and positively influence others, can be a helpful place to start. (Check out the "Lab Book Challenge" as a way to begin.)

Keeping records is time-consuming, and it may not even feel like 'real science' compared to transfecting cells, extracting DNA or using a microscope. But without good records, those other activities are less meaningful, harder to reproduce, and potentially wasted.

First, how can we speed up record keeping? Does your lab run a lot of similar experiments that could be turned into printable protocol templates, perhaps with checklists or step-by-step procedures along with spaces to add specific details. Could you agree common principles in recording experiments so that everyone in the lab can understand each other's notes?

Next, is there a small improvement to try – adding an extra sentence or two, recording observations closer to the time they were made, or discussing with your supervisor about their approach to record keeping (see the box on *How you can improve lab notebook use*) – to see if it makes a difference.

What about digital records? There is a growing divide between lab book records and the rest of research data. Researchers supplement paper records with data that are stored in digital documents (documents with reports and protocols, spreadsheets for raw data and presentations from lab meetings), which are sometimes printed and stuck into a notebook or referenced (maybe with the name of the file), but otherwise maintained separately. Many biologists write code and conduct bioinformatic experiments, using separate notebooks and markdown scripts. Sometimes the only link between a physical record and a digital one is in the mind of the researcher.

The Future of Lab Notebooks

Given the growing amount of digitisation in biology, it seems likely that we are in a transitional period of record keeping. Many other fields – physics, pharmaceutical research, chemistry – are moving (or have moved) to electronic notebooks (ELNs). These offer some significant advantages over paper-based systems[8] (see Electronic Lab Notebooks: Considerations for making the switch) and I've had many informal conversations with many biologists interested in using them or already testing them out.

What barriers might be preventing their widespread use in biology labs? One is the cost of the investment – both in time and finances – to make the switch. Even just choosing an ELN is time-consuming; there is no clear market leader, and each product has slightly different ways of working, so there's a lot to process before making a decision. Most products will give free trials, but it's time-consuming testing them.

The next barrier is a cultural shift. While digital notebooks were first proposed as a solution back in the 1950s, with much optimism about the power of computers to solve data management problems for researchers, the fully paperless lab has not yet arrived. Entering data on a desktop computer in an office, or waiting for the use of a shared lab laptop, cannot easily replace the ease of writing in your own lab notebook. However, as most ELNs use a web interface which can run on any web-enabled

Electronic Lab Notebooks: Considerations for making the switch

Digital-first and record integration
ELNs allow users to directly add links, files and images into their records. Much research generates digital content, so having a digital notebook allows smoother integration of compared with a paper-based system.
However, ELNs are not designed to directly handle 'big data' such as large image sets or sequencing data, and they may not be appropriate for sensitive data such as patient records. Therefore, users need to think about their whole workflow and data lifecycle. Looking for the simple solutions – such as adding unique identifiers or permanent URLs into the notebook – might be a good starting point.

Search and share more easily
Being digital and searchable, ELNs allow users to easily find experiments and can be a tool to support good project management. They allow users to link experiments together (which can be useful for preparing data for publication). They allow different ways of organising records: by date, by project or by people. Many ELNs contain some kind of database structure that can be used to track reagents and equipment, linking these directly to the research records.
Experiments can be shared with other lab members, supporting collaborations. Records can be accessed from any location (given suitable data access controls), so researchers can take their notes into the lab, use them when working from home, or when visiting collaborators and attending conferences.

Supporting research integrity
By building thorough and consistent research records, the entirety of a research project can be visualised more easily than with paper lab books. This makes retrieving data to share at publication more straightforward, supporting good research practice in data management. With two-factor authentication, data encryption and single sign on, records can be stored securely. With date stamping, changelogs and digital sign-off, researchers can have confidence in the integrity of their records and be protected from accusations of data tampering.

Guiding best practice
Most ELNs incorporate experiment templates and data entry forms. By deploying these within in a lab group or wider collaboration, they can help ensure researchers capture all the relevant metadata for their experiments and use the most up-to-date methods. Having structured templates can help with capturing necessary permissions and consent forms. At publication, these structured protocols can be used to help write methods and analysis sections of manuscripts, drawing directly on the processes captured in the lab books for each experiment.

The Lab Book Challenge

If you're an active lab researcher, when you finish reading this article, schedule a "Lab Book Review" for one month from now. Choose one of the following options to do on that date:

1) Look back at your lab book notes from today (while the details of the experiment are hopefully still in your memory). Are your notes from a month ago sufficient to understand what you did? If not, what do you need to add next time to be able to understand/repeat the experiment?

2) Show the notes from your lab book to one of your colleagues. Can they read your handwriting? What do they think you were doing on this day? Could they understand it enough to repeat your experiment? Can they understand how it relates to your other work? This kind of reflective practice – either individual or with a colleague – is almost certain to uncover something useful that you can put into practice.

Why not make a Lab Book Review part of your regular practice?

If you manage others in a laboratory setting, could you use this challenge as an opportunity to open some fresh engagement about laboratory record keeping?

device, they can be used in the lab as well as in the office. With options for voice typing, pen entry, in-built cameras and touchscreens, we may be reaching a point where a tablet-based ELN can finally replicate (or improve on) the functions of a physical notebook.

Another barrier is cost. Most commercial ELNs have a 'per user' license, typically in the low hundreds of pounds per year. Buying suitable hardware to make them accessible adds start-up costs, alongside an initial time investment to make the shift. This time commitment goes beyond just learning the software. ELN integration works best when time is spent on user testing and building a shared understanding of how the lab or institute will utilise them.

Moving research data into an ELN should be done with appropriate data risk management approval, especially where they will be used for sensitive data, as data protection is a concern for researchers, institutions and funders. Many ELN products are backed by big biotech companies whose infrastructure is certified to meet international data protection standards, but each product should still be considered on a case-by-case basis.

Finally, there is the consideration of obsolescence. Some platforms promise to integrate with common products like Microsoft Office, have in-built bioinformatics tools, or take advantage of developments in AI. But with the median lifespan of an ELN being about 7 years[8], there is also the possibility that companies stop supporting products, so it is important to think about what would happen to the data at the end of the life of the ELN. The more complex the datasets and the more specific the software, the harder it will be to transfer the data to another system. Perhaps it is worth considering each ELN as a solution for 5-10 years, and include an upgrade or transition plan from the start.

Putting these barriers together, it is not surprising that ELN adoption in biology remains limited. However, their many advantages over traditional lab notebooks mean we shouldn't dismiss them (see the box on *Electronic Lab Notebooks: Considerations for making the switch*).

One possibility to address some of these issues is to look at open source ELNs. Some of these are relatively simple, lightweight products that run on well-established software and code, and have openness and transferability built in. One example is ELabFTW[9], with a case study of use explored in this paper[8]. Not only is it free, which makes it scalable and very accessible, but an active community continue developing and building on this software. Using an open-source option also mean that a junior researcher trained in the platform has no cost barriers to taking it into their independent research career.

If you're exploring digital solutions for record keeping, there are great resources available, such as this article highlighting features of five popular ELNs[10], comparisons of products and case studies from the University of Cambridge[11] and this extensive guide[12]. Some researchers have recorded their experiences of moving to ELNs, which helpfully reveal that success relies on providing user-friendly tools and engaging with researchers[8] to ensure that the ELN meets their needs.

Over time I think ELNs could help support good research practice more widely. If researchers can keep better track of their experiments, use templates that encourage standardisation and reproducibility, and digitally link experiments and source data to help with open and FAIR principles, these would represent huge steps forward for lab record keeping.

Final thoughts

The humble notebook in your lab would likely be familiar to a Darwin or Curie if they happened to pop by. Its form is reassuringly familiar – and surprisingly robust – but for something so commonplace we spend little time learning how to use it. Any transition to new models – such as ELNs – not only provides an opportunity to draw on the benefits of digital technology, but also to reflect on how and why we record what we record. Putting a spotlight back on good record keeping – whatever form it takes – is a positive way to support good research practice and help ensure that research findings are as accessible and usable as possible.

References

1. 'Darwin Online: Introduction to Darwin's Beagle Field Notebooks (1831-1836)'. Accessed 24 November 2023. http://darwin-online.org.uk/EditorialIntroductions/Chancellor_fieldNotebooks.html.
2. 'Dame Anne McLaren: A Noted Career', 2016. https://blogs.bl.uk/untold-lives/2016/03/dame-anne-mclaren-a-noted-career.html.
3. Chalfie, Martin (2009) 'GFP: Lighting up Life'. Proc. Natl. Acad. Sci. U.S.A. 106, 10073–80. https://doi.org/10.1073/pnas.0904061106
4. 'Lab Notebooks - Handwriting at the Core of Science'. Accessed 24 November 2023. https://blogs.bl.uk/science/2019/01/lab-notebooks-handwriting-at-the-core-of-science.html.
5. Library of Congress, Washington, D.C. 20540 USA. 'Image 5 of Notebook by Alexander Graham Bell, from December 29, 1891 to June 5, 1893'. Image. Accessed 24 November 2023. https://www.loc.gov/resource/magbell.36500101/?sp=5.
6. Epigeum. 'Https://www.Epigeum.Com/', 2023. https://www.epigeum.com/.
7. Universities UK. 'The Concordat to Support Research Integrity'. Accessed 24 November 2023. https://www.universitiesuk.ac.uk/topics/research-and-innovation/concordat-support-research-integrity.
8. Higgins, Stuart G., Akemi A. Nogiwa-Valdez, and Molly M. Stevens. (2022) 'Considerations for Implementing Electronic Laboratory Notebooks in an Academic Research Environment'. Nature Protocols 17, 179–89. https://doi.org/10.1038/s41596-021-00645-8.
9. eLabFTW home page. 'ELabFTW - Open Source Laboratory Notebook', 2023. https://www.elabftw.net.
10. 'The Electronic Lab Notebook in 2022: A Comprehensive Guide', 2022. https://labfolder.com/electronic-lab-notebook-eln-research-guide/.
11. 'Electronic Research Notebook Products | Research Data Management'. Accessed 24 November 2023. https://www.data.cam.ac.uk/data-management-guide/electronic-research-notebooks/electronic-research-notebook-products.
12. ZB MED-Informationszentrum Lebenswissenschaften, Beatrix Adam, and Birte Lindstädt. 'Electronic Laboratory Notebooks in the Context of Research Data Management and Good Research Practice – a Guide for the Life SciencesELN Guide'. Application/pdf, 2021. https://doi.org/10.4126/FRL01-006425772.

Meet the BSCB Committee

Helen Matthews

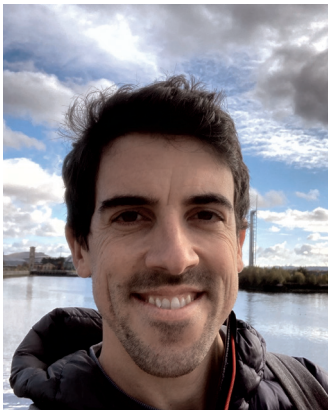
I am a research fellow in the School of Biosciences at the University of Sheffield. Our lab's research asks how cells grow and divide in normal tissues and during cancer progression, with an emphasis on pancreatic cancer. We are particularly interested in the actin cytoskeleton and its role in the regulation of cell shape and mechanics. Current projects in the lab focus on understanding how cell shape and adhesion is regulated during cell division, how Ras oncogenes alter actin organisation and how cell and tissue mechanics impact response to cancer therapy. To answer these questions, we take a multidisciplinary approach, combining cell biology and microscopy with biophysical techniques, such as atomic force microscopy and computational modelling.

I first became interested in the actin cytoskeleton during my PhD in the lab of Roberto Mayor at UCL, where I studied how directional cell migration is controlled in neural crest cells. I then joined Buzz Baum's lab as a Postdoc, where my focus shifted to understanding how actin and cell shape is regulated during cell division. During this time, I received a CRUK-funded travel grant to visit the lab of Matthieu Piel in Paris, where I spent my time squashing cells to study cell division under extreme confinement. In 2021, I was awarded a Wellcome Trust/Royal Society Sir Henry Dale Fellowship to establish my own lab at the University of Sheffield, working on the mechanobiology of cell division in normal cells and pancreatic cancer.

I've been a BSCB member since I was a PhD student. I've always enjoyed attending the annual Spring Meeting (and disco!) and have received frequent support from the Society in the form of travel grants and sponsorship for meetings and events. We recently hosted the North of England Cell Biology forum in Sheffield and were able to provide free registration thanks to generous support from the BSCB. So, I'm really looking forward to giving something back by joining the BSCB committee and supporting our UK cell biology community.

Lab website: https://www.helenmatthewslab.org/

Tom MacVicar

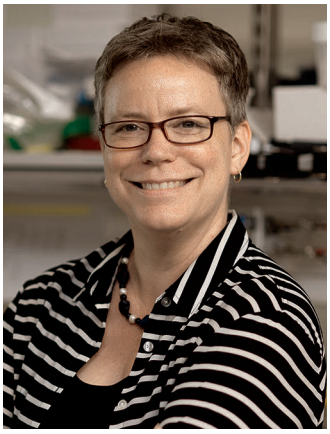


I am a Junior Group Leader and CRUK Career Development Fellow at the CRUK Scotland Institute (formerly Beatson Institute) and University of Glasgow. My research group explores the essential metabolic roles played by mitochondria in cancer. We use cell biology approaches, including genetic screening and high-content imaging, to investigate the mechanisms by which cancer cells adapt their mitochondria in response to environmental challenge and therapeutic intervention. My goal is to improve the basic understanding of mitochondrial reprogramming in cancer and to identify new ways to target tumour metabolic plasticity.

My fascination with mitochondria started during my PhD studies with Prof Jon Lane at the University of Bristol where I investigated the relationship between mitochondrial dynamics and the turnover of dysfunctional mitochondria via autophagy. I then moved to Prof Thomas Langer's lab at the Max Planck Institute for Biology of Ageing and University of Cologne, Germany. With the support of EMBO and Alexander von Humboldt postdoctoral fellowships, I studied how mitochondria rewire their proteome in response to hypoxia or nutrient starvation and examined the relationship between mitochondrial metabolism and innate immune signalling. The award of a CRUK Career Development Fellowship allowed me to establish my independent research group at the CRUK Scotland Institute in December 2021.

I'm delighted to join the BSCB Committee and look forward to interacting with the BSCB network. This will enable my group to establish new collaborations and gives me the chance to give back to the UK cell biology community. I was a member of the BSCB during my PhD, which helped me build my first research network. For instance, I was fortunate to receive an Honor Fell travel award to fund travel to my first international conference. Now, as a member of the committee, I look forward to contributing to a vibrant cell biology community and to support the next generation of cell biologists in the UK.

Liz Miller



Dr. Liz Miller holds joint roles as a Programme Leader at the MRC Laboratory of Molecular Biology in Cambridge, and Professor in the School of Life Sciences at the University of Dundee. Liz grew up in Melbourne, Australia, completing her undergraduate Honours degree in the School of Botany at the University of Melbourne. She then moved to La Trobe University's School of Biochemistry for her PhD under the supervision of Dr. Marilyn Anderson. Liz's PhD work on the intracellular trafficking of a plant defense protein sparked a long-term interest on mechanisms of protein folding and transport within the secretory pathway. She pursued this topic as a Jane Coffin Childs Fellow with Dr. Randy Schekman at the University of California, Berkeley. Her work in the Schekman lab focused on selective export of newly synthesized secretory proteins from the endoplasmic reticulum (ER) via COPII vesicles, and the molecular mechanism by which cargo proteins are captured into nascent vesicles. In 2005 she started her own lab in the Biology Department at Columbia University in New York City, studying the interface between protein folding within the ER and capture COPII vesicles. This quality control checkpoint represents a key decision point that ensures that cells only release folded, mature proteins, which are less likely to aggregate and cause toxicity in downstream compartments. In 2015 Liz moved to the MRC-LMB in Cambridge, where her lab continued to probe the mechanistic basis of protein quality control within the ER. In 2023, Liz took up a position at the University of Dundee, where her work on the mechanisms of protein secretion will focus on the mechanisms of secretory protein capture into COPII vesicles with the goal of developing small molecule inhibitors of these interactions for therapeutic benefit. Liz has been a BSCB ambassador at the LMB for several years, and is keen to take a more active role in the Society to promote UK cell biology.

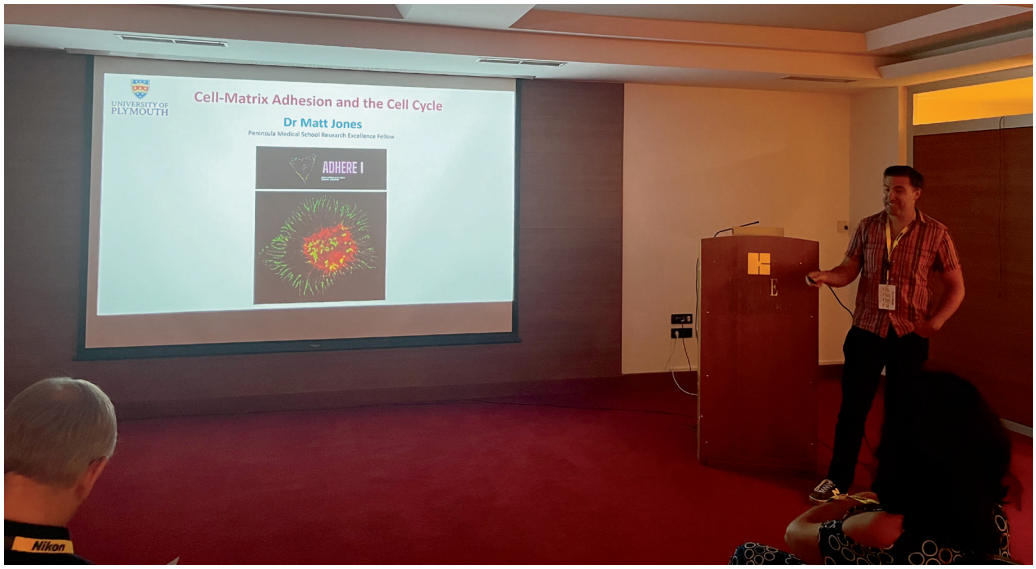
Meeting reports

Adhere1

6–9 September, 2023. Zadar, Croatia

This summer, I was lucky enough to be awarded a Company of Biologists Support grant via the BSCB to attend the Adhere1 conference. The Adhere conference is a new meeting series with the aim of bringing together the European cell-matrix adhesion research community and is organised by three researchers in the field: Andreja Ambriovic-Ristov, Vassiliki Kostorou and Ben Goult.

The first meeting took place in Zadar, Croatia in September of this year and was attended by around 60 researchers ranging from PhD students up to well-established professors and world-wide leaders in the field, with the size of the meeting meaning it was easy to discuss research with a range of people that may not be as easy at larger meetings. Attending was therefore an excellent opportunity to network and showcase the work being done in my lab at the University of Plymouth, where I started as an independent investigator in 2021. On the first night of the conference, Professor Reinhard Fässler from the Max Planck Institute of Biochemistry provided the EMBO Keynote Lecture and discussed his recent work investigating focal adhesion disassembly during mitotic entry. It was fantastic to see him talk about this work, especially as links between extracellular matrix adhesion and the cell-cycle are our main research focus in the lab. Over the following days there was an excellent range of speakers



presenting their work in sessions that included: The composition of adhesion complexes, adhesion in cancer, cytoskeleton, extracellular matrix, adhesion signalling and mechanobiology as well as a poster session where largely PhD students and postdocs presented their work. One of the most interesting aspects of the meeting was the range of techniques and models that people in the field use, ranging from mathematical modelling, single-molecule dynamics and structural biology to vascular biology and tumour studies in mice along with the use of model organisms such as Dictyostelium and sea urchin embryos. This made for enjoyable sessions that promoted a good deal of questions and discussions. I and the two PhD students from my lab came away with a huge number of thoughts and ideas for projects as well as new collaborations for future work. Another notable aspect of the meeting was the number of countries that attendees came from- there was a strong contingent from the UK, but there were also attendees from the Czech Republic, Israel, Croatia, Poland, Greece, Spain, Italy, Portugal, Finland and Sweden, so it really was a meeting of people in the field from across Europe.

Altogether, the Adhere1 conference was a very successful and enjoyable meeting that I would not have been able to attend if it was not for the support of the BSCB and the Company of Biologists. The support grant paid for my registration for the meeting as well as my travel, including a flight to Split and bus to Zadar, and attending was hugely beneficial for me as an early career researcher. On the back of this meeting, we have established a number of collaborations that will help the lab as it gets going and I look forward to meeting up with people next year for Adhere2.

Matt Jones

Biochemical Society Scientific Meeting: PI3K/PTEN pathway: a new era in basic research and clinical translation

13–15 September 2023. Barcelona, Spain

I was awarded £700 by the BSCB to subsidise my attendance at the 'PI3K-AKT-mTOR-PTEN pathway: a new era in basic research and clinical translation' meeting in Barcelona this past September. It was the first time I attended an international conference abroad, as well as the first conference I ever attended on my own. The experience was unlike anything I expected, and I returned to work with a completely renewed perspective and approach to my work.

I am a third year PhD student at the University of Sheffield and my research focuses on the roles of phosphoinositide 3-kinase (PI3K) isoforms in the formation of phagocytic and macropinocytic cups in *Dictyostelium discoideum*. In my immediate surroundings at university and previous meetings I had attended, I had never interacted with researchers working on closely related topics to my own. Even within my lab, where we study micropinocytosis and phagocytosis, my lab mates and I work on very different things and no one else works on PI3K, so my understanding

on PI3K signalling had mainly come from literature up until September 2023. Learning first-hand from the world-leading experts in PI3K signalling at the conference in Barcelona was truly refreshing and inspiring. It was especially interesting to learn about PI3K isoforms in humans, since up until the conference, I had primarily focused on *Dictyostelium* isoforms, and I hadn't previously learnt about the clinical aspects of isoform-specific defects in human disease.

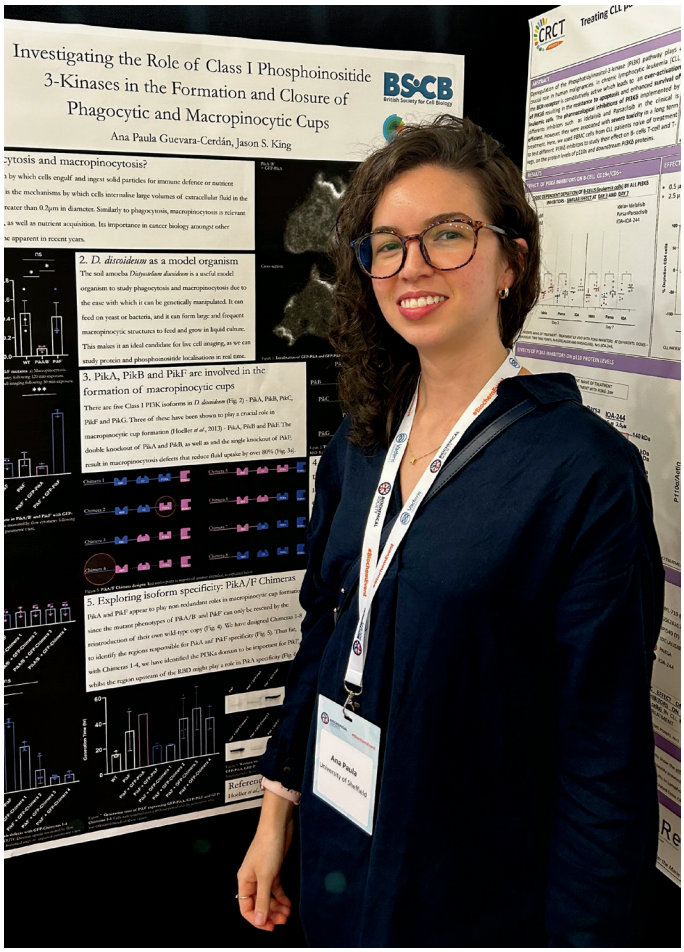
I learnt how PI3K isoforms are not only involved in immunodeficiencies and cancer progression, but also in the regulation of the circadian rhythm, and in rare diseases including PROS and SHORT syndrome. The most impactful session during the conference was one we had with a panel of patients, who shared their personal experiences with the crowd of scientists and clinicians. It was very powerful to hear their stories first-hand, and incredibly moving to learn what our work means to them on a personal level.

Another highlight for me was winning one of the four poster prizes awarded. I thoroughly enjoyed both poster presentation nights, and the poster prize was an encouraging bonus. I had great discussions with experts in my field, and this helped me gain a lot of confidence in my work. I got great comments and advice from people studying PI3K signalling from across a range of perspectives, and I also felt very proud to receive an invitation to apply for a job with a Paris-based PI after graduation.

Overall, the conference in Barcelona was a true turning point for me. I grew in confidence and knowledge in ways I could have never imagined, and I came away with great connections in the field who may potentially become important mentors as my career progresses. I also made a good friend who I quickly connected with during the conference and with whom I'm still in touch as she wraps up her PhD project in Birmingham. I am certain we'll continue to be in each other's support network for years to come.

I'd like to say a big 'thank you' to the BSCB for the financial contribution that enabled me to have such an incredible first professional experience abroad.

Ana Paula Guevara-Cerdán



NECB forum 2023

29 September 2023. University of Sheffield

The North of England Cell Biology (NECB) Forum 2023 was held within the stunning Edwardian Firth Court at the heart of the University of Sheffield on 29 September and was organised by a committee of postdocs, PhD students and PIs from the University.

The meeting was a one-day event, full of talks and posters presentations from ECRs with more than 100 attendees from diverse cell biology fields from universities all around the North of England. The event was sponsored by the BSCB with additional support from Fisher Scientific, Merck, Generon, PCR biosystems, Proteintech, Genewiz, Starlab, Stratech, Labtech, New England Biolabs, and Genscript and the Biochemical Society.

The first session was chaired by Elena Rainero and it started with an amazing talk by Anupama Prakash from the University of Sheffield who talked about the development of butterfly scale nanostructures and explained how by using a developmental time series of electron microscopy images, they could identify the important stages and differences in nanostructure formation between butterfly scales. This was followed by a talk by Emily Goodall from University of Manchester who showed their work using a triple negative breast cancer model to investigate the signalling pathways involved in co-stimulation with ECM ligands known to be linked to breast cancer. The final talk in the first session was by Wanzhu Jia from Hull York Medical School. Her study provided insights into the cellular

mechanisms underlying the impact of platelet Programmed death ligand-1 (PD-L1) expression in cardiovascular disease. The session was followed by a coffee break with poster session.

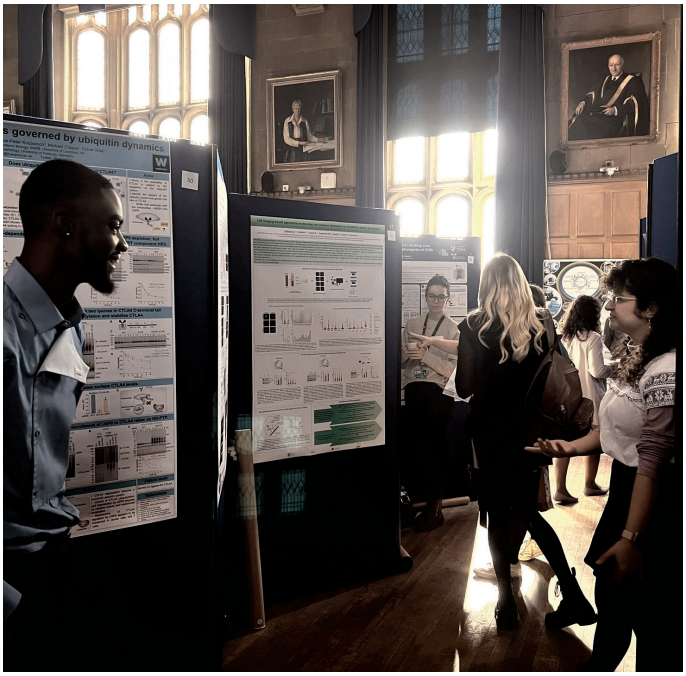
The second session was chaired by PhD student, James Birch, and it was kicked off by Joe Tyler from the University of Sheffield explaining how the actin polymerisation is organized during macropinocytosis. Using fluorescent microscopy and genetic perturbation, he tested an 'annulus model' of ring formation which attempts to explain how the cooperation of the small GTPases Ras and Rac may result in the formation of distinct actin networks across time and space. Next, we had Ana Teixeira from the University of Huddersfield who explained how the engraftment of cancer cells onto the chick chorioallantoic membrane in ovo enables cost-effective and rapid 'proof-of-concept' in vivo efficacy studies of promising novel anti-cancer agents. The final talk in the second session was by Yaw Asare-Amankwah from the University of Bradford, which showed the impact of RhoA deregulation on smooth muscle cell dysfunction in type 2 diabetes.

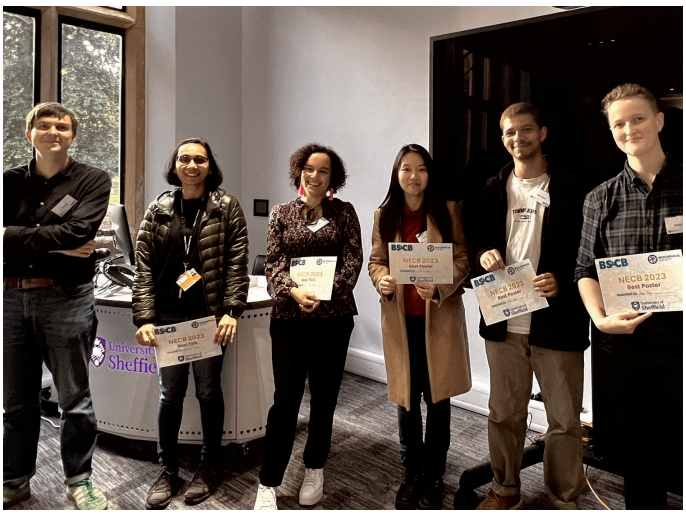
The third session started after a lunch break and it was chaired by Jason King who introduced the BSCB, its student membership and ambassadors. This was followed by a talk about expansion microscopy by Tom Sheard from the University of Sheffield who introduced a novel proteome-labelling strategy using fluorescently labelled N-Hydroxysuccinimide (NHS) esters. Next, Will Critchley from the University of Leeds talked about screening for VEGF-A-regulated gene expression which led to the identification of several novel proteins upregulated in the early response to angiogenesis stimulation. Last up was a fantastic talk by Ines Jmel-Boyer from the University of Dundee on cytokinesis regulation and polarity in asymmetrically dividing *Drosophila* neuroblasts.

The session was followed by a coffee break for the attendees to continue enjoying the posters and scientific discussions. The last session of the day was chaired by Helen Matthews, and it started with a talk by Blythe Wright from University of York. She showed how several of the effectors of the membrane traffic regulator, Vps45, are mutated in severe congenital neutropenia allowing them to identify functions of Vps45 that protect cells from apoptosis. This was followed by Joana Isabel Gomes-Neto from University of Liverpool who showed us how the deubiquitylase USP31 controls the Chromosomal Passenger Complex and spindle dynamics. The last talk for the day was given by James Tollitt from Lancaster University. His data suggest that CIZ1 facilitates recruitment of cyclin-CDK complexes to chromatin and contributes to the mechanisms that determine the threshold CDK activity required for the G1/S transition, thereby preventing DNA replication stress, and maintaining genome stability.

After listening to the fascinating talks and looking at an amazing selection of 42 posters throughout the day, we ended the forum with a drinks reception where the prize winners were announced. The poster prizes were awarded to: Katie Wraith (Hull York Medical School), Pei Yee Tay (University of Liverpool), Milan Collins (University of Liverpool), and Shane Terry (University of Bradford). And the prizes for best talks: Ines Jmel-Boyer (University of Dundee), Joe Tyler (University of Sheffield), and Anupama Prakesh (University of Sheffield). Overall, the meeting was a wonderful opportunity to meet biologists Universities across the North of England. Listening to talks and discussing posters from so many different aspects of cell biology was the biggest prize that all of us could win. We would like to thank all our attendees for joining us and a big thank you to our sponsors for their generosity.

Bian Yanes and Helen Matthews

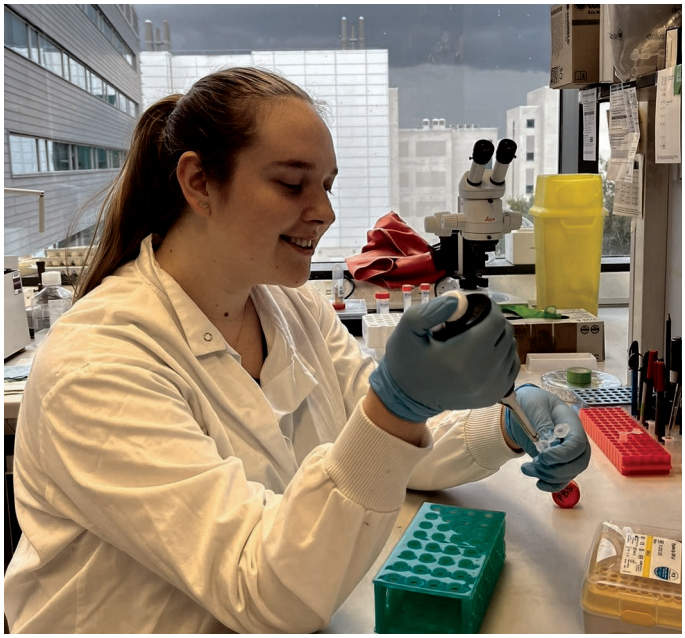




Summer studentships

Exploring the diversity of cargo traffic in the secretory pathway

Sarah Bristow held a studentship with Professor Martin Lowe at the University of Manchester



My project in the Lowe lab investigated the effects of different clinically-approved drugs on protein secretion, looking at their effects on the structure of the secretory system and the secretion rates of different proteins. I applied for a BSCB studentship as I have been interested in cell biology throughout my degree and I wanted to gain further research experience in this area to help confirm if I should pursue post graduate research in this field. This project aligned with my interests as I have previously enjoyed cell culture work and I wanted to develop my microscopy techniques.

The initial project description was a broader analysis of the different pathways taken by proteins with different properties through the cell but due to the current interests of my day-to-day supervisor, Tong Chen, I instead focussed on the effects of drugs on the secretory system. In the first part of the project, I treated human liver cell line HepG2 cells with 11 different drugs. These drugs had been shown to inhibit secretion of the major component of low density lipoprotein particles, apolipoprotein B (ApoB), in previous experiments performed in the Lowe lab. I observed the effects of these drugs on the structure of the secretory system using immunofluorescence microscopy, by staining the ER, Golgi, COPI, COPII and tubulin in treated cells. The majority of the drugs analysed appeared to affect the organisation of ER exit sites and some also caused the Golgi to disperse. This may support the hypothesis that the drugs cause a general inhibition of secretory traffic. I found it interesting to think about why these approved drugs may be causing the effect observed and if these effects could occur in patients.

In the next part of the project, I further investigated two of the drugs that appeared to have large effects on the structure of the secretory system, using the HiBiT split-nanoluciferase assay. In this assay, a protein of interest is tagged with HiBiT, allowing the amount of the protein secreted into the medium over time and the amount of the protein in the cell lysate to be measured by adding LgBiT to the samples. LgBiT binds to HiBiT forming active nanoluciferase, which can be quantitatively detected using luminescence. I added the two drugs individually to cell lines, where either albumin, a non-glycosylated protein, or alpha-2-macroglobulin (A2M), a large glycosylated protein, were tagged with HiBiT, and performed the HiBiT assay on them. The results showed that both drugs caused a decrease in albumin and A2M secretion, as seen with ApoB, in a related experiment. However, there was not an increase of albumin or A2M in the cell lysate despite inhibition of secretion. A reason for this may be that albumin and A2M protein synthesis are inhibited by the drugs, or that the accumulating protein in the cell is degraded. I wish that I had been able to validate these results with further repeats; however, as these results were obtained at the end of the project, I did not have time to do so. If further repeats aligned with these preliminary results, a live trafficking assay may help us understand if the proteins get blocked at a specific stage of the secretory pathway by the drugs analysed.

I greatly enjoyed the project and I have developed my microscopy skills and learnt more about the field of cell biology, which were my aims for this project. I also really enjoyed working in the collaborative lab environment of the Lowe lab and this has made me aspire to make time to collaborate and help others in future research. This experience has helped me become more confident to apply for PhDs this year whilst I complete my MSci in Biochemistry at the University of Cambridge. I am looking forward to applying the skills it has taught me in future research. I would like to thank the BSCB for providing a studentship for the project and the Lowe lab for having me in the lab and for all their help and advice.

Understanding the role of the centrosome clustering protein KIFC1 in cancer and human cells

Matthew Gray worked in Dr. Andrew Fielding's lab at Lancaster University

I applied for BSCB funding for several reasons. Firstly, I find cellular biology very interesting as I believe it gives more specific results than looking at whole biological systems such as tissues and organisms. I also find it more interesting to look at the wider cellular impacts of a specific change, rather than the properties of a singular protein on a more biochemical scale. Secondly, by applying for BSCB funding it allowed me to make a more personal choice in what I would be researching. Other internship

projects were defined by very strict project boundaries, but in applying for the BSCB funding, this allowed my supervisor and me to propose our own research question, one on which I had some input. Finally, by applying for BSCB funding, this allowed me to partially experience what possible future funding applications may look like and gave me valuable insight into how to structure a funding proposal.

My experience with this research project was enlightening and very valuable in terms of my personal scientific development. I found it exciting to experience both a mixture of practical lab work using materials, tools and techniques that I had not had a chance to use before, such as sterile cell culture, western blotting and confocal microscopy, as well as surprised by the level of data collation and analysis that is involved.

One of the main highlights of the project was the sense of purpose I gained. Throughout the project, I felt a genuine sense that the results I was gathering may help contribute something meaningful, especially as the project was directly involved with characteristics of cancer cells that may be a good target for treatment. As such, the possibility that I may contribute in some small way in the fight against cancer was very fulfilling. One of the lows, on the other hand, was when experiments failed or did not go to plan. Most of the experiments worked and, as a result, a lot of data was gathered implicating KIFC1 degradation with greater centrosome amplification, DNA damage and cell death in cancer cells. Additionally, KIFC1 degradation was involved in a change in the cell cycle, inferred by a much greater length of cell cycle phases.

I believe that this funding has made my CV much stronger, granting me a breadth and depth of lab experience that I would not have had the opportunity to gain otherwise. I believe that this has made me a much stronger candidate than I was before the internship. Furthermore, this experience has confirmed to me that I would like to work in a laboratory environment, especially one focusing on cell biology.

Is kidney uptake of lipids from the fatbody in *Drosophila* pupae protective and does it enable redistribution of lipids to other tissues in adulthood?

Molly Green joined Dr Helen Weavers' lab at the University of Bristol

This summer I was given the opportunity to undertake a research project at the University of Bristol in Dr Helen Weavers' lab. This project involved working with *Drosophila melanogaster* (fruit flies), which is one of the most used models for human disease. I researched different labs within the university and emailed lab heads to see if they had any spaces for undergraduates during the summer. Dr Weavers agreed to meet with me. I found this lab especially interesting as its focus is wound and tissue

repair using *Drosophila* models. I hadn't done anything like this during my first two years at University and thought it would be interesting to explore a different area of biochemistry as well as using *in vivo* models. After my placement in the lab was confirmed, Dr Weavers and I started working towards the BSCB summer studentship application. I liked the idea that I could write a report at the end and I was able to apply sooner in the year than some other studentships.

I spent the first couple of weeks researching the literature that had been published regarding kidney development during the pupal stages of fruit flies; however, this information is minimal. I then went on to read literature about lipid metabolism in *Drosophila* and found proteins that could be involved in lipid transport to the kidneys. I used websites such as Flybase and FlyAtlas2 to see the role of these proteins and to see where they are expressed the most. I found six proteins of interest. Dr Weavers and I ordered knockout flies for these proteins, which took around three weeks to arrive. During these three weeks, I practised dissection protocols on the different stages of *Drosophila* life. I analysed non-wild type flies with GFP-tagged actin and GFP-tagged kidney membranes to analyse the morphology of the kidneys during the pupal stages. I also analysed kidneys where GFP was tagged to ApopLPP, one of the main lipid carriers in fruit flies. I took pictures using a fluorescence microscope and quantified the level of ApopLpp in the kidneys. Although I very much enjoyed characterising morphology and using new software and microscopes, sometimes the dissections could be frustrating. I would spend hours dissecting and staining kidneys successfully. However, due to their delicate nature, it was easy to damage them. Transferring the kidneys from a dissection dish, to a well, and then mounting them on a slide meant there were many opportunities for the organs to get damaged. This was very frustrating and felt like a waste of time but once I was able to get the images it was very fulfilling. When the knockout flies arrived I crossed them with either a kidney driver fly or a fatbody driver fly. This was so I could target the gene knockout to a particular organ in *Drosophila*. I ended up with six crosses with knockouts for lipid carriers and lipid receptors in the fatbody and/or the kidney. By dissecting the kidneys out of these flies at different stages of pupal life and staining them, I was able to visualise and quantify the level of lipid in the kidney. I spent the last two weeks of the project doing this, which was tedious but very fulfilling in the end. I quantified the images using Image J.

Overall, there were differences in the lipid content between the flies, suggesting that some of these genes are important for the uptake of lipid from the fatbody to the kidney during pupal stages. When LpR2 was knocked out in the kidney, the lipid had a high concentration at the membrane. Is this because LpR2 is important for lipid transport to the kidney? Are these genes responsible for the redistribution of lipids to other tissues? ApoLTP was knocked out and the flies didn't make it to pupal life. Is this because ApoLTP is protective of the kidneys?

This year I am going into my 3rd year studying biochemistry with molecular biology and biotechnology at the University of Bristol. My summer project has made me less apprehensive, and I am excited to use the skills I learned as part of my studentship throughout my last two years at Bristol. In particular, my microscope skills with which I struggled a lot before this summer project. I enjoyed the six weeks a lot and I hope to see if I am able to use what I learned for the next two years at university.

How do hormones regulate the epithelial splicing protein ESRP1 in breast cancer cells?

Isabelle Heys held a studentship with Professor David Elliott at Newcastle University

Breast cancer is one of the most common cancers worldwide. Because it often exploits hormones to grow, a common treatment strategy is hormone therapy. However, hormone receptors can be lost during cancer progression and patients develop resistance to therapy. The ESRP1 and ESRP2 proteins are over-expresssed in breast cancer and counteract epithelial-mesenchymal transition, which allows the cancer to metastasise. An open question is, why would cancer over-express factors that oppose metastasis?

Recently Dr. Luzzi (my co-supervisor) found that different versions of ESRP1 are expressed at different stages of cancer progression due to alternative splicing, and that this is dependent on endocrine signalling. The two isoforms differ by four amino acids that help signal for nuclear localisation of ESRP1 protein. In early breast cancer the short isoform is expressed at higher levels, resulting in most ESRP1 protein retained in the cytoplasm. Instead, some advanced breast cancer subtypes that lost hormonal receptors mostly express the long isoform and ESRP1 protein localises in the nucleus. While nuclear ESRP1 has a characterised role in splicing regulation, the function of cytoplasmic ESRP1 is still unclear.

In this project we looked at ESRP1 splicing in different cell lines and after hormone inhibition to investigate ESRP1 regulation and function. Understanding ESRP1 regulation can, in the future, help find better treatment for patients who develop resistance to hormone therapy. Before this internship I was a Lab Assistant in Dr Schneider's lab and heard about research in Prof Elliott's lab. I really enjoyed my lectures on splicing and gene expression and wanted to develop my understanding of this topic. Furthermore, this project could allow me to have a closer look at breast cancer, about which I had already learnt in lectures.

At the beginning of the project, we assessed levels of ESRP1 splicing in three cell lines: MDA-MB-231, which model hormone-deficient advanced breast cancer; MCF-7, which model hormone-responsive advanced breast cancer; U2OS osteosarcoma cells, which we used as control. We extracted RNA and performed RT-PCR, and found that MCF-7 was the only cell line that expressed the short ESRP1 isoform. We also performed Western blot analyses to test a primary anti-ESRP1 antibody; however, we found this could not differentiate between ESRP1/2. Since ESRP2 is not present in the cytoplasm, we could still use this antibody to measure ESRP1 localisation after hormone inhibition. We therefore treated MCF-7 with 4-hydroxytamoxifen, which inhibits the oestrogen receptor, then measured splicing and localisation of ESRP1. Our PCR didn't show much difference between treated and mock-treated cells and if we were to repeat this part of the experiment we would increase the concentration of 4-hydroxytamoxifen. However, subcellular fractionation and Western blot showed an increased amount of ESRP1 in the cytoplasm after treatment. This was opposite to what we expected, as hormone-deficient cancers from patient data showed increased nuclear ESRP1. One explanation is that 4-hydroxytamoxifen can inhibit other hormone receptors with opposite function to the oestrogen receptor.

I had a very positive experience and found it very interesting seeing a project through from start to finish rather than just doing the experiment in a day like in my university practical sessions. There was more computer-based work than I had expected, although I did find it interesting to see how the raw data was processed. At first, I struggled to get the hang of these techniques but over the few weeks during my internship I was able to expand these skills and I became more confident and independent when quantifying the data. I really enjoyed being able to develop techniques that I had learnt about or watched during practicals like Western blots. I was frustrated when the MDA-MB-231 cell line showed a band in the western

for ESRP1 when we weren't expecting them to express high levels of ESRP1. As mentioned above, we then worked out that the antibody recognised ESRP1 and 2 but this did not affect our results for cell localisation of ESRP1 after tamoxifen treatment.

In September I am starting a 12 month professional placement at ApconiX. I will be working as an Ion Channel Scientist and will gain experience using Patch Clamps and will be carrying out my own project. Here I want to explore and gain experience in an industrial research environment before returning to Newcastle to complete my degree. The BSCB funding has enabled me to develop essential skills that will be important in the future in order to develop myself as a biochemist. It has also given me an insight into what life would be like in academic research both in and out of the lab, and has prepared me for my research project in my third year as part of my dissertation.

Elucidating the mechanism of action of kinetochore protein KNL-1 in dendrite branching

Nimrah Javaid undertook a studentship in Dr. Dhanya Cheerambathur's lab in the University of Edinburgh

KNL-1, a known kinetochore protein with roles in mitosis, has been shown by the Cheerambathur lab to have a novel role in the development of the nervous system. The nervous system is a complex connection of neuronal cells that spans the entire organism, with the exact wiring of these neurons determining the way in which signals are received/processed. Defects in these neuronal processes, such as aberrant dendrite branching, can lead to neurodevelopmental/degenerative diseases. I therefore chose this project as it is important to study how defects in proteins involved in neurogenesis, such as KNL-1, affect the shape of the nervous system. This lab was ideal in carrying out my project as I got first-hand experience in a wet-lab working with like-minded individuals who were as interested in the nervous system as I was. I worked with the C. elegans mechanosensory PVD neuron as an experimental model, which contained unique dendrite branching patterns, allowing for easy identification/analysis of patterning defects, and I applied genetic techniques to this model such as strain generation and protein tagging/localization. I applied for funding as I am passionate about doing research and contributing to my field.

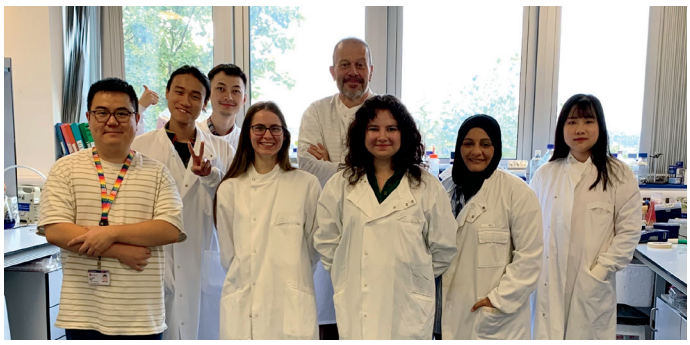
Cytoskeletal remodelling drives dendrite arborization. Previous experiments had shown that KNL-1 primarily affects PVD dendrite patterning by regulating the actin cytoskeleton. But the precise molecular mechanisms that KNL-1 employs are still unclear. I was interested in investigating how KNL-1 regulates actin to shape dendrite morphology. To study this, the lab had generated a C. elegans strain where KNL-1 was targeted to the plasma membrane of PVD neurons by fusing it with a myristoyl moiety. This myristoylated KNL-1, referred to as myr-KNL-1, was observed to induce membrane deformations. For my project, I used genetic techniques to introduce fluorescently labelled Lifeact and plasma membrane marker into myr-KNL-1 expressing worms to visualize the actin and membrane structures.

I used a spinning disk confocal microscope to image the PVD neuron and subsequently analysed the images using Fiji. I also generated a control strain, which expressed a myristylation motif fused to the TagBFP fluorophore, along with the actin and membrane marker. To analyse the neuron morphology, I focused on the late larval stage, L4. In the control strain, the cell body resembled the wild-type, but myr-KNL 1 appeared as puncta at the membrane and caused a local increase in actin polymerisation and cell body deformities. I then imaged actin and membrane across the L2-L4 larval stages to understand the timing of the appearance of the actin structures. I found that myr:KNL-1 induced actin structures in the cell body as early as the L2 larval stage, coinciding with the activation of the PVD specific promoter. Additionally, myr-KNL-1 expression resulted in defects in dendrite branches such as an increase in short ectopic processes extending out from the primary dendrite branch. Finally, I was interested in investigating the nature of actin structures induced by myr-KNL 1. The actin structures created by myr-KNL-1 were like those seen in contractile systems. To understand whether actin regulating pathways KNL-1 employs is similar to the contractile systems, I generated a strain that expressed the actin binding protein, myosin NMY-2. However, localization experiments failed to show any co-localization between KNL-1 and NMY 2. Hence, we can conclude that KNL-1 employs a different set of actin regulators to carry out its function, and further investigation will be needed to uncover what these are.

Overall, I enjoyed the research into neurogenesis and working with a dedicated PI from whom I gained invaluable experience, and even decided to stay on at the lab beyond my funding to see my project to completion. I found it very interesting imaging the nervous system and visualizing how it develops, but also how mutations resulted in abnormalities. This funding has made a difference to my career as it allowed to me to support myself while focusing completely on my project. It gave me an insight into how a lab is run and experience working in a research environment.

Investigating PDLIM protein function in hepatic stellate cells

Gabriela Marinescu was awarded a studentship with Prof. Harry Mellor at the University of Bristol



I applied for the BSCB funding as I wish to pursue a career in research. Throughout my time at university studying Biochemistry, I developed an interest in cell biology and wished to gain experience working with tissue cultures. I believe the Mellor lab was an amazing fit and the BSCB funding made it possible. I am very thankful to Prof. Harry Mellor and the members of the Mellor Lab, who made this summer studentship an invaluable experience.

I enjoyed the aspect of troubleshooting as it led me to break down and investigate each step of an assay. Had I not needed to determine where the issue was, I believe I would not have learned as much. This summer studentship exceeded my expectations as I was in a supportive environment that allowed me to navigate troubleshooting while maintaining my confidence. I enjoyed seeing a noticeable increase in my confidence and lab skills over the course of the summer studentship as by the end of the 8 weeks I was able to confidently conduct experiments independently. I enjoyed feeling integrated into the lab and having weekly meetings where we discussed my progress and strategies on how to overcome issues I faced. What I found frustrating was the times I would make mistakes during experiments, such as having issues with making a gel for DNA gel electrophoresis as I would not leave it to set long enough. However, I am thankful that I received constructive feedback on how to prevent this and am aware that occasional mistakes are normal when learning a new protocol.

I believe the BSCB summer funding and the opportunity to work in the Mellor Lab has made a massive impact on my career as I am currently in the process of applying for PhD positions to pursue a career in the field of cell biology. Prior to this summer studentship, I had limited experience working in a lab as I had only done university taught practicals. Over the summer, I learned how to manage experiments and how to overcome issues when the results obtained were not what we expected. I have gained confidence both in my practical skills and data analytical skills. This experience has validated my desire to become a researcher and I believe was an amazing stepping stone for my future in academia.

Analysis of the Roles of Protein Phosphatase 1 Catalytic Subunit During Mitosis Using the Auxin-Inducible Degron System

Deborah Martinuzzi joined Prof. Pier Paolo D'Avino's lab at the University of Cambridge

Beginning my studies during the COVID-19 pandemic meant that opportunities to experience wet-lab research have been limited. Applying for the BSCB Summer Studentship permitted me to participate in research at a top-tier UK university, thus providing me the opportunity to explore my scientific interests, learn new laboratory techniques, and gain valuable insight into a research career.

My summer research project focused on studying of the role of phosphatases during cell division. Phosphorylation is mediated by the activity of two counteracting enzymes, kinases and phosphatases, which regulate the intricate functions and fine-tuning of the protein networks responsible for the progression of the cell cycle and mitosis. Most of the research conducted to date has been focused on the role of kinases in the cell cycle, while the equally important and opposing role of phosphatases has been neglected. Recent studies have found that members of the protein phosphatase 1 (PP1) family are some of the most abundant phosphatases in the cell during mitosis. The active PP1 enzyme is a heterodimer composed of one catalytic subunit responsible for dephosphorylation of the target protein, and one regulatory subunit that specifies enzyme substrate and intracellular localization. In humans, there are three different PP1 catalytic subunits, PP1α, PP1β, and PP1γ, which have distinct functions and activity in mitosis, despite having over 90% conservation in their amino acid sequences. The host laboratory has employed a targeted protein degradation system, the auxin-inducible degron 2 (AID2) system, to induce rapid and selective proteosome-mediated degradation of the different PP1 catalytic subunits to precisely define the specific role of each

catalytic subunit during mitosis.

My project involved individually degrading the different PP1 catalytic subunits and quantifying the mitotic phenotypes using fixed cell imaging techniques (e.g., immunofluorescence). Initial analyses indicated some interesting and specific mitotic aberrations following PP1β and PP1γ depletion, such as defects in chromosome alignment/segregation and cytokinesis. However, later quantification of these phenotypes failed to demonstrate statistically significant differences due to low cell numbers. Therefore, I performed additional replicates of these experiments leading to statistically significant values suggesting increased abnormal phenotypes in cells at different stages in mitosis.

During this research experience, I discovered that in scientific work the optimization of a protocol is crucial to ensure that the most accurate, valid, and reproducible data are gleaned from the experiments. My original research plan included complementing the data collected from fixed cell imaging with time-lapse microscopy of dividing cells to determine the effects of PP1 depletion on mitotic progression more accurately. However, time constraints did not permit me to carry out these time-lapse experiments. Nevertheless, learning about the different microscopy techniques was both very exciting and informative. I will certainly apply what I have learnt to future projects.

In October, I will begin the final year of my course at UCL, which involves completing an 8-month lab-based research project. The skills and techniques I learnt during this summer research experience, especially the microscopy skills and immunofluorescence assays, will be invaluable for my project. Therefore, I am very grateful to the BSCB and the D'Avino Lab for giving me this opportunity.

Investigating centromere dynamics during spermiogenesis in *Drosophila melanogaster* males

Nial O'Reilly joined Dr. Elaine Dunleavy's laboratory at the University of Galway

I had just returned from a semester abroad at the University of California Berkeley, a life-changing experience that also left me with very few savings. The BSCB studentship helped me tremendously, as I secured short-term accommodation to complete my internship and put down a deposit on the house I'll be living in during the next academic year, which I would not have been able to do otherwise. I wanted to develop my lab skills in an environment that was similar enough to my genetic studies but different enough from them so that I would be learning about a different subject matter. Dr. Dunleavy's work on the CENP-A histone variant had been of interest to me, as I wanted to know how she studied it: with a transgenic CENP-A-GFP tagged strain or had she used a reverse genetics approach and RNAi to down-regulate certain genes to study the phenotypic variance of CENP-A. The experience was somewhat new to me; I had completed a similar project at Berkeley whilst working in the laboratory (researching background information, presenting, and discussing the results, and providing a succinct conclusion and future prospects).

However, this project was a lot more in-depth and required a lot more time to analyse and interpret the data with the software. The focus of these results was on producing a graph that measured the fluorescence emitted by CID (*Drosophila* CENP-A) within cells undergoing spermiogenesis, as well as processing images from fixed and live imaging and immunostaining. Once all the images had been obtained, I spent a week working with the images, making sure the results would be presentable by the end of the project. The work was more challenging than I had expected, but ultimately very rewarding. The most frustrating aspect of the project was getting to grips with the different protocols: some could take hours to complete and required immense concentration to ensure that every step was done correctly, otherwise the results would not be viable. I remember that for an immunostaining protocol, I had unintentionally placed an extra coverslip on the slide at the end of the slide preparation process, making it impossible to observe the cells on the microscope. However, the protocols became easier to complete the more I did them, and gaining this valuable experience in the lab was a highlight of the project. But what I enjoyed most was using the Image J/FIJI software to analyse the different images, highlighting the CID fluorescence peaks at the different foci and quantifying said peaks. The software was very confusing at first, but with the help of some very helpful PhD students, I was able to get to grips with it rather quickly. I was also fortunate enough to attend weekly presentations given by PhD students about their ongoing research and learned a lot about their work.

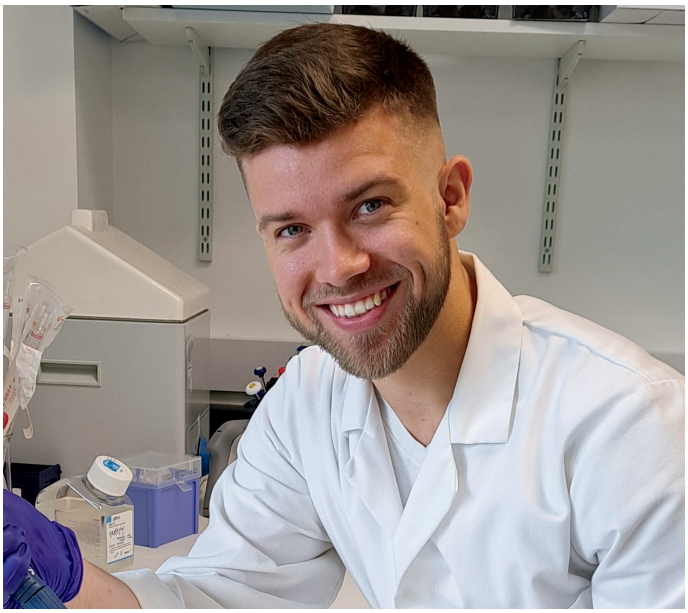
The experiments did work to varying degrees: the experiment where

we measured the amount of CID present at the centromeres revealed that it is quantitatively maintained throughout spermiogenesis. The results confirmed what had been observed in previous papers that had noted a decrease in CID quantities between the early and late canoe stage of spermiogenesis as well as providing information on the varying concentrations throughout the remaining stages. The other 7 experiments were focused on testing and familiarising myself with different protocols (live imaging, fixed imaging, immunostaining). CID was detected in all these experiments.

I want to sincerely thank the BSCB and Dr. Dunleavy for everything the amazing opportunity they gave me, and the PhD students and post-doc, Rachel, Frederica and Miriam, for their patience and kindness.

Tuning biophysical stimuli for electroimplants to optimise neural stem cell regenerative responses for neurological repair

Chai Plaza's studentship was supervised by Dr. Stuart Jenkins and Dr. Chris Adams at the University of Keele



I applied for BSCB funding to gain an intimate insight of the field I intend to participate in upon completion of my undergraduate studies. I have always been eager to develop my skills outside my undergraduate curriculum, but had met barriers of inexperience and lack of financial resources. The generous BSCB funding presented the opportunity to be guided by distinguished professionals, with appreciative expectations of my skillset.

Prior to commencing this project, I possessed reservations as to how engaging day-to-day scientific research could be, concerned that boredom would prevail whenever breakthroughs did not. This project not only abolished such preconceptions but taught me the great affinity I have for research. I was able to grasp concepts and execute new skills with confidence, this sense of internal gratification became addictive; manifesting itself in the occasional late night and weekend visit to continue research in an environment I felt privileged to have access to.

My experiences provided holistic insight to the multitude of components embodied in the life of an academic researcher. Whilst practising fluorescence microscopy I accidentally snapped one microscope slide in half, this was intensely embarrassing; fortunately, my supervisor made light of the situation dubbing it a true initiation into research, 'We've all done it. And your response suggests you're not likely to do it again'. Initial experiments showed unexpected lack of cell attachment. I was brought into a joint supervisor meeting to asses this problem, noting possible causes suggested by my supervisors. I was then allowed to prioritise tests and (successfully) troubleshoot this problem. Any frustration always developed into thoughtful consideration, permitting personal growth and discovery of optimised practises. Such processes provided the high points of conducting the research. Each time an experiment presented further promise than its predecessor I felt a profound sense of accomplishment; marvelling at my supervisor's intelligence in action, constantly encouraged by their enthusiasm matching my own.

The summer funding has provided an immersive perspective of a potential career avenue. It has permitted the development of skills in immunocytochemistry, fluorescence microscopy, and data analysis. I believe I am a better candidate for postgraduate opportunities and have reinforced my desire to pursue a career in research and development.

Novel approaches to study neuron–myelin interactions

Luna Nordenström joined Professor Ragnhildur Thóra Káradóttir's lab in Cambridge.

I am interested in neuroscience research and after having spent some time shadowing in a lab in my first year at university, I was determined to gain more experience in the field by undertaking my own project. During my second year of studying Biomedical Sciences at University College London (UCL), I therefore decided to apply for a BSCB summer studentship. It was my interest for neuroplasticity, the ability of the brain to reorganize itself, and the various roles of glial cells in the nervous system that led me to contact the Káradóttir group at the Wellcome/MRC Stem Cell Institute which is a world-leading centre for stem cell research at the University of Cambridge. Professor Káradóttir and her group have made key discoveries in the fields of activity-dependent myelin generation and plasticity.

Myelin is composed of multi-layered membrane sheaths, wraps around neuronal axons, and is essential for fast and reliable transmission of neuronal signals throughout the nervous system. There can be large differences in the myelination of axons. In fact, myelin is not always deposited equally along the length of axons and while some axons are fully myelinated, others only have a few myelinated segments which are separated by large gaps. This gives rise to a variety of myelin patterns.

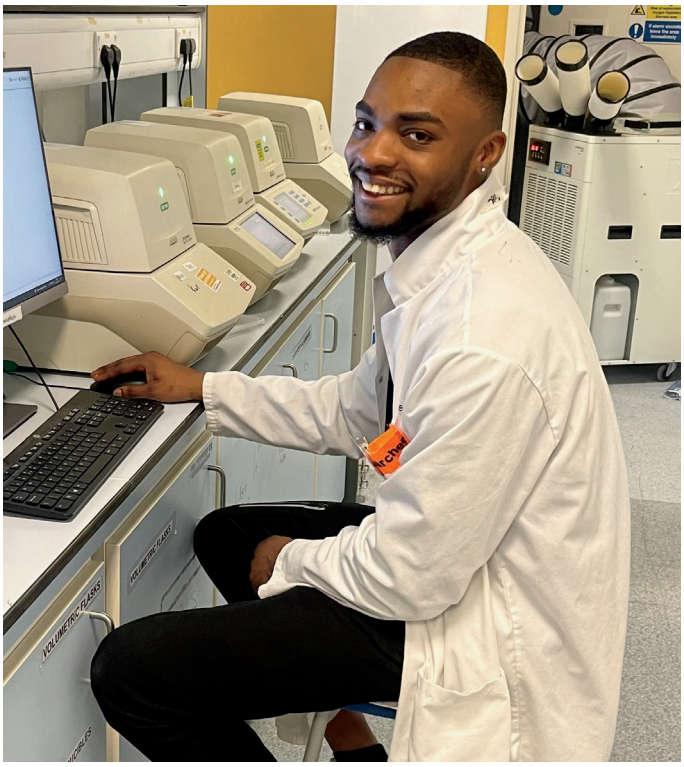
My summer project had two objectives. Firstly, the project aimed to assess the efficiency of a split-green fluorescent protein (GFP)-based labelling for myelin patterns *in vitro*. The GRAPHIC-system is based on two halves (N and C terminal) of the GFP that are attached to the extracellular membrane with a Glycosylphosphatidylinositol (GPI)-anchor. Non-fluorescent individually, they regain fluorescence when they are in close proximity. First, we tested the constructs in human embryonic kidney (HEK) cells via transfection and were able to image fluorescence caused by the split-GFP reconstitution in HEK cell-to-cell contact. The constructs were then introduced into mouse dorsal root ganglion (DRG) neurons and oligodendrocyte precursor cells (OPCs) via lentivirus transduction. We found that the cells expressed the constructs thanks to the presence of nucleus labels and furthermore, detected green fluorescence in DRG neuron and HEK co-cultures. However, we have not yet been able to see any clear signal along axons in the neuron-oligodendrocyte co-cultures. This might have been caused by the limited quality of one of the GRAPHIC construct lentiviruses. An interesting future step would therefore be to adapt or test a different gene delivery method on the DRG neurons and OPCs. It was still an important experience, as it allowed me to understand that unforeseen results can occur and to evaluate what could have been done differently in the process. Overall, the results were promising as we found that the GRAPHIC constructs can be expressed by several cell types and that the system works for some co-cultures but whether the system works for myelin labelling still remains to be assessed.

The second goal of the summer studentship was to study the correlation between neuronal activity and myelination *in vivo*. It allowed me to explore other techniques, such as immunofluorescence staining of mouse brain sections, followed by imaging using light microscopy. We wanted to test if regional neuronal activity at P10 could predict myelination of the same brain region at P21. We used c-fos antibody to label recent neuronal activity in sections of mice that were culled at 10 days old (P10) and myelin-binding protein (MBP) antibody to label myelin on mice that were 21 days old (P21). We found that there seems to be a correlation between c-fos activity at P10 and myelination at P21 for some regions of the cortex, which furthermore appears to be dependent on the developmental phase of that region. The second motive of the project allowed me to specifically improve my image analysis skills, by gaining confidence in using various analysis programmes, understanding and modifying macros as well as using machine-learning to assist with certain tasks.

Overall, the summer studentship was an incredible experience for me. Not only was I able to undertake an interesting project and produce considerable data, but also to get to learn and improve numerous skills, such as cell culture, light microscopy, and image analysis. Apart from the fascinating research programme, I was warmly welcomed and included by the whole team, who allowed me to learn about their day-to-day work and shared their expertise at our regular lab meetings. Finally, I was also able to explore and get to know Cambridge, a city full of history as well as innovation. After gaining this valuable insight into research, I feel prepared and motivated for the third and final year of my studies, during which I will undertake a laboratory-based project focusing on dementia.

Investigating PDLIM protein function in hepatic stellate cells

Joel Malungu joined Dr. James Pritchett's group at Manchester Metropolitan University



I applied for a BSCB studentship to support my ambitions of pursuing a career as a research scientist in cell biology. I sought the opportunity to work with Dr. James Pritchett, whose research focuses on understanding how extracellular matrix and mechano-signalling contribute to fibrosis. This aligns perfectly with my interest in understanding the molecular basis of diseases.

During my studentship, I learnt techniques including cell culture, RNA isolation, qPCR and western blots. I have also enriched many transferable skills to build my independence, including time management and organisation skills, planning tasks, and prioritising appropriately. During the placement, I had the benefit of attending a series of seminars given by different researchers and PhD students. I thoroughly enjoyed attending these lectures, as it gave me a brief yet informative insight into the range of research that takes place at different universities.

I am going to go into the 3rd year of my degree with a lot more confidence in my scientific writing and practical lab skills which is going to be beneficial for my independent lab project in the coming year. This placement has also solidified my thoughts on wanting to do a PhD and have a career as a researcher in cell biology. Without the help of the BSCB and Dr. Jim Pritchett, I know I couldn't have completed this project.

I am also thankful to the members of the Manchester Metropolitan Centre for Bioscience for their support and for assisting me in evaluating my affinity for experimental science.

Society Business

BSCB funding to support members throughout their careers

Full details of all schemes are on the BSCB website (https://bscb.org/).

The BSCB Honor Fell and Support Grants schemes continue to be popular and we ask that applications are uploaded at least 6 weeks ahead of time to allow for assessment and transfer of funds to successful applicants. We expect all successful applicants to acknowledge BSCB funding using our logos found on our website.

Honor Fell Travel Awards

Sponsored by the Company of Biologists, the Honor Fell Travel Awards provide financial support for BSCB members at the beginning of their research careers to attend meetings and courses. Applications are considered for any meeting or course relevant to cell biology.

BSCB members may apply for funds for both an online and in-person conference in the same calendar year (these together will count as 1 travel award only). The amount of the award depends on the location of the meeting or course. Awards will be up to £500 for travel within the UK (except for BSCB Spring Meeting for which the full registration and accommodation costs will be made), up to £700 for travel within European and up to £1000 for meetings and courses in the rest of the world.

The application form and complete information about the scheme are available at https://bscb.org/competitions-awardsgrants/travel-bursaries/honor-fell-company-of-biologists-travel-awards/

Company of Biologists Support Grants

These grants are available for independent group leaders/PIs with no current funds for travel to attend meetings, conferences, workshops, practical courses, PI laboratory management courses and courses to re-train. BSCB will also consider applications to attend virtual and online scientific meetings, conferences, workshops and courses.

For detailed information and to apply please see https://bscb.org/competitions-awardsgrants/cob-support-grants/

Childcare Award

The BSCB now accepts applications to provide financial help with childcare or care for dependents when the applicant is presenting at a scientific meeting. For example, these claims can be for:

- Home-based childcare/dependent care expenses incurred because of meeting attendance (funds may not be applied to normal ongoing expenses).
- Travel of a relative or other care provider to your home to care for your child(ren) or dependent while attending a meeting.
- Travel of a care provider to the meeting with you to care for your child(ren).

For more information and to apply please see: https://bscb.org/competitions-awardsgrants/travel-bursaries/childcare-award/

BSCB Imaging competition

THE BSCB runs an annual competition to shows the best of your research images.

Prizes: 1st Prize £200; 2nd Prize £100; 3rd Prize £50. Winners will be published on BSCB webpages and will also be used in the Magazine and other promotional material. Copyright will remain with the creator- if you do not agree that the images may be used as stated, you must state this on the entry form.

Submission: Entrants must supply their name, address, email address, and BSCB membership number on entry. Entries must be sent by email (10 x 11.96 cm 300 dpi) to stephen.robinson@quadram.ac.uk). Only one entry per person is allowed. The subject matter of competition entries is flexible but must reflect current research in cell biology.

Further details are at: https://bscb.org/competitions-awardsgrants/image-competition/image-competition-rules/

BSCB Science Writing Prize

The BSCB Science Writing Prize aims to encourage writing skill development in young researchers on topics of key relevance to cell biology. Entrants have either communicated their own research projects or science stories in the literature, in a clear and concise way aimed at a non-specialist audience, or written essays that were not be limited to research per se, but tackled a bioethical or science policy issue. The winner receives a prize of £500 and has their winning entry published in the BSCB magazine and online (both on the BSCB website and, subject to editorial acceptance, on the excellent www.lablit.com website).

Each year shortlisted entries are judged by an external expert. In previous years we have enlisted the kind help of Tim Radford (Writer and former Science Editor at The Guardian), Viv Parry (Science Writer and Columnist), Tania Hershman (Science writer, former science journalist and writer-in-residence at Bristol University), Dr. Jenny Rohn (a cell biologist at UCL, who is also a science writer, novelist, blogger, broadcaster, the editor of LabLit.com and the founder and chair of Science is Vital) and Barbara Melville (science writer, former writer-in-residence at the MRC Centre for Regenerative Medicine and board member with the Association of British Science Writers).

Remember: You must be a BSCB member to enter. The full rules and how to enter can be found at https://bscb.org/competitions-awardsgrants/science-writing-prize/

The British Society for Cell Biology

Statement of Financial Activities for the Year to 31 December 2022

	Unrestricted Funds	Restricted Funds	Total 2022	Unrestricted Funds	Restricted Funds	Total 2021
Income from:	£	£	£	£	£	£
Grants	35,000	–	35,000	35,000	–	35,000
Investments	453		453	36	–	36
Charitable activities						
Subscriptions	33,016	–	33,016	26,353	–	26,353
Other income	–	–	–			
Total income	**68,469**	**–**	**68,469**	**61,389**	**–**	**61,389**
Expenditure on:						
Charitable activities						
Grants payable:						
CoB	7,964	42,854	50,818	–	3,109	3,109
Other grants	5,723	–	5,723	148	–	148
Studentships	35,055	–	35,055	29,719	–	29,719
Costs of meetings	2,899	–	2,899	2,537	–	2,537
Website expenses	5,816	–	5,816	728	–	728
Newsletter costs	4,033	–	4,033	4,049	–	4,049
Membership fulfilment services	25,654	–	25,654	11,609	–	11,609
Examiner's remuneration	3,119	–	3,119	2,950	–	2,950
Miscellaneous	323	–	323	163	–	163
Subscriptions	705	–	705	1,558	–	1,558
Insurance	1,641	–	1,641	1,423	–	1,423
Total expenditure	**92,932**	**42,854**	**135,786**	**54,884**	**3,109**	**54,884**
Net (expenditure)/income	(24,463)	(42,854)	(67,317)	6,505	(3,109)	3,396
Transfer between funds	–	–	–	–	–	–
Net movement in funds	(24,463)	(42,854)	(67,317)	6,505	(3,109)	3,396
Funds brought forward at 1 January 2021	252,515	78,376	330,891	246,010	81,485	327,495
Funds carried forward at 31 December 2022	**228,052**	**35,522**	**263,574**	**252,515**	**78,376**	**330,891**

BSCB Committee 2024

The Society is run by a Committee of unpaid volunteers elected by the Members. The Officers of the Society, who are all members of the Committee, are directly elected by the Members. The BSCB committee is comprised of office-holders (President, Secretary, Treasurer, Meetings Secretary, Membership Secretary, Magazine Editor, Award Co-ordinators and Web Co-ordinator) and up to 12 other ordinary members, including one PhD student representative, one postdoc representative and a schools liaison officer, who are coopted onto the committee.

The committee is always interested in hearing from cell biologists who wish to contribute to the society's activities. Members of the society are encouraged to nominate candidates for the committee or officers positions at any time. Formal nominations should be seconded by another member of the society. The committee is also happy to receive un-seconded informal nominations. Nominations should be sent to the BSCB Secretary.

The committee generally meets twice a year, at the spring meeting and in the autumn in London. Additional meetings are arranged from time to time. Items for consideration by the committee should be submitted to the Secretary prior to the meetings. The BSCB has charitable status (registered charity no. 265816). The BSCB AGM is held every year at the Spring Meeting.

President: Professor Laura Machesky
Department of Biochemistry
University of Cambridge
Sanger Building, Old Addenbroke's Site
Tennis Court Road
Cambridge, CB2 1GA
lmm202@cam.ac.uk

Secretary (until 2024):
Dr Carine De Marcos Lousa
Drug Discovery Unit
University of Dundee,
Dundee
secretary@bscb.org

Secretary (from 2024): Dr Simon Allison
School of Applied Sciences
University of Huddersfield
Queensgate
Huddersfield HD1 3DH
S.Allison@hud.ac.uk

Treasurer: Professor Giampietro Schiavo
UCL-Institute of Neurology
Queen Square House
Queen Square
London WC1N 3BG
giampietro.schiavo@ucl.ac.uk

Meetings Secretary (until 2024):
Professor Susana Godinho
Barts Cancer Institute – CRUK Centre
Queen Mary University of London
Charterhouse Square
London EC1M 6BQ
s.godinho@qmul.ac.uk

Meetings Secretary (from 2024):
Professor Viji M. Draviam
Center for Cell Dynamics
School of Biological and Chemical Sciences
Queen Mary University of London
v.draviam@qmul.ac.uk

Honor Fell/COB Coordinator:
Dr Daniel Booth
Biodiscovery Institute-Room C208
School of Medicine
University of Nottingham
Science Road, Nottingham, NG7 2RD
Daniel.Booth@nottingham.ac.uk

Membership Secretary (until 2024):
Dr Jason King
School of Biomedical Sciences
University of Sheffield, Firth Court
Western Bank, Sheffield S10 2TN
jason.king@sheffield.ac.uk

Membership Secretary (from 2024):
Dr Nathalie Signoret
Department of Biology and Hull York Medical School, University of York
Wentworth Way, York YO10 5DD
nathalie.signoret@york.ac.uk

Science Advocacy Officer: Dr Darius Koester
Centre for Mechanochemical Cell Biology
Warwick Medical School
Division of Biomedical Sciences
Coventry CV4 7AL
d.koester@warwick.ac.uk

Magazine Editors: Dr Tom Nightingale and Professor Ciaran Morrison
Dr Tom Nightingale
Centre for Microvascular Research
William Harvey Research Institute
Barts and The London School of Medicine and Dentistry, Queen Mary University of London
London EC1M 6BQ
t.nightingale@qmul.ac.uk

Professor Ciaran Morrison
Centre for Chromosome Biology
University of Galway, Biomedical Sciences
Dangan, Galway H91 W2TY, Ireland
ciaran.morrison@universityofgalway.ie

Web and Social Media Officer: Dr Stephen Robinson
Quadram Institute Bioscience
Norwich Research Park, Norwich NR4 7AU
stephen.robinson@quadram.ac.uk

Postdoc Representative: Dr Alex Fellows
MRC Lab of Molecular Biology
Francis Crick Ave, Cambridge CB2 0QH
afellows@mrc-lmb.cam.ac.uk

PhD Student Representative: Ms Emily Lucas
School of Biological Sciences
University of Southampton
E.R.Lucas@soton.ac.uk

Summer studentship Coordinator: Professor Victoria Cowling
Cancer Research UK Scotland Institute
School of Cancer Sciences
University of Glasgow, Glasgow G61 1BD
Victoria.Cowling@glasgow.ac.uk

Schools Liaison Officer: Mr David F. Archer
British Society for Cell Biology
43 Lindsay Gardens
St Andrews, Fife KY16 8XD
d.archer@talktalk.net

Irish Area Representative: Professor Ciaran Morrison

Dr Aymen al-Rawi
MRC Toxicology Unit, Gleeson Building
Tennis Court Road
Cambridge CB2 1QR
asaa4@mrc-tox.cam.ac.uk

Dr Tom MacVicar
Cancer Research UK Scotland Institute
Garscube Estate
Switchback Road
Bearsden
Glasgow, G61 1BD
Thomas.MacVicar@glasgow.ac.uk

Dr Helen Matthews
School of Biosciences
University of Sheffield
Florey Building
Western Bank
Sheffield S10 2TN
h.k.matthews@sheffield.ac.uk

Professor Liz Miller
Division of Molecular Cell and Developmental Biology
School of Life Sciences
University of Dundee
emiller003@dundee.ac.uk

BSCB Ambassadors 2024

The BSCB Ambassadors are the society's advocates in the UK cell biology community. They should be your first point of call for information about what the society can do for you and also how you can get involved. They should also be the people readily available to ask about sponsoring you for membership.

Anyone who wishes to volunteer to become a BSCB ambassador at any Institutes not represented in the list below please contact the BSCB.

Barts Cancer Institute, Queen Mary University of London	Susana Godhino	s.godinho@qmul.ac.uk
University of Birmingham	Vicki Smith	V.E.Smith@bham.ac.uk
Bournemouth University	Paul Hartley	phartley@bournemouth.ac.uk
University of Bristol	Helen Weavers	Helen.Weavers@bristol.ac.uk
University of Bristol	Mark Dodding	mark.dodding@bristol.ac.uk
University of Cambridge, Institute for Cancer Research	Jon Pines	jon.pines@icr.ac.uk
Cardiff University	Catherine Hogan	hoganc@cardiff.ac.uk
CRUK Manchester Research Institute	Iain Hagan	iain.hagan@manchester.ac.uk
University of Dundee	Inke Nathke	i.s.nathke@dundee.ac.uk
University of Edinburgh	Ian Chambers	i.chambers@ed.ac.uk
University of Lancaster	Nikki Copeland	n.copeland@lancaster.ac.uk
Glasgow Beatson	Vicky Cowling	victoria.cowling@glasgow.ac.uk
University of Durham	Tim Davies	timothy.r.davies@durham.ac.uk
University of Dundee	Carine De Marcos Lousa	cdemarcoslousa001@dundee.ac.uk
University of East Anglia	Stephen Robinson	stephen.robinson@uea.ac.uk
University of East Anglia	Grant Wheeler	grant.wheeler@uea.ac.uk
European Bioinformatics Institute (EBI) Cambridge	Sheriff Rahuman	sheriff@ebi.ac.uk
University of Galway	Ciaran Morrison	ciaran.morrison@universityofgalway.ie
St George's University of London	Ferran Valderrama	fvalderr@sgul.ac.uk
Gurdon Institute	Emma Rawlins	e.rawlins@gurdon.cam.ac.uk
University of Huddersfield	Simon Allison	s.allison@hud.ac.uk
Keele University	Stuart Jenkins	s.i.jenkins@keele.ac.uk
King's College London	Claire Wells	claire.wells@kcl.ac.uk
King's College London	Simon Hughes	simon.hughes@kcl.ac.uk
University of Leicester	Andrew Fry	andrew.fry@le.ac.uk
University of Liverpool	Sylvie Urbe	Urbe@liverpool.ac.uk
University of Manchester	Martin Lowe	martin.p.lowe@manchester.ac.uk
MRC Laboratory of Molecular Biology	Liz Miller	emiller@mrc-lmb.cam.ac.uk
Newcastle University	Jonathan Higgins	Jonathan.Higgins@newcastle.ac.uk
Nottingham Trent University	Mark Turner	mark.turner@ntu.ac.uk
University of Nottingham	Bill Wickstead	Bill.Wickstead@nottingham.ac.uk
University of Nottingham	Alistair Hume	Alistair.Hume@nottingham.ac.uk
University of Oxford	Jordan Raff	jordan.raff@path.ox.ac.uk
Plymouth University	Claudia Barros	claudia.barros@plymouth.ac.uk
Queen Mary University of London	Tom Nightingale	t.nightingale@qmul.ac.uk
University of Reading	Jonathan Gibbins	j.m.gibbins@reading.ac.uk
University of Roehampton	Yolanda Calle-Patino	Yolanda.Calle-Patino@roehampton.ac.uk
The Royal Veterinary College	Steve Allen	sallen@RVC.AC.UK
University of Sheffield	Andy Grierson	a.j.grierson@sheffield.ac.uk
University of St Andrews	Judith Sleeman	jes14@st-andrews.ac.uk
University of Sheffield	Jason King	jason.king@sheffield.ac.uk
University of Sheffield	Liz Smythe	e.smythe@sheffield.ac.uk
University of Southampton	David Tumbarello	D.A.Tumbarello@soton.ac.uk
Swansea University Medical School	James Murray	j.t.murray@swansea.ac.uk
University College London	Chris Stefan	c.stefan@ucl.ac.uk
University of Warwick	Darius Koester	D.Koester@warwick.ac.uk
University of York	Chris Mac Donald	chris.macdonald@york.ac.uk

The BSCB Magazine is published once a year in winter in hard copy. News is updated frequently through our website and BSCB Twitter feed. Follow us at @Official_BSCB

Submission

If you have an idea for an article please e-mail the editors a brief outline first. It is preferable to send all articles, reports and images by e-mail (though alternatives can be arranged after contacting the editor). Attachments for text can be in txt, rtf or doc format. Please send images as 300dpi JPEG, TIFF or PSD files. Submission of articles and images should be made to Dr Tom Nightingale (t.nightingale@qmul.ac.uk) and/ or to Professor Ciaran Morrison (ciaran.morrison@universityofgalway.ie).

Advertising Information

Single advertisement: Back cover £600
Inside front cover £450 colour/ £300 b/w
Full inside page £240
1/2 Inside page £120
1/4 Inside page £60

Advertisements can by supplied on CD or by email. Please send as JPG, TIF or PSD at 300dpi, or as PDF (with fonts embedded). Page size A4: 210x297mm. There is no charge to advertise a scientific or educational meeting. Please contact the editor with details of any meeting you wish to advertise. For more information contact Dr Tom Nightingale (t.nightingale@qmul.ac.uk) and/ or Professor Ciaran Morrison (ciaran.morrison@universityofgalway.ie).

BSCB Subscription information

The online application form can be found at www.bscb.org. The annual fees are:

BSCB Individual Full £45.
BSCB Individual direct debit £35.
BSCB Student £50 (3-year membership) or £70 (4-year membership).

Membership runs from January – December. If you join after October 31st you will not be asked to renew until the January after next. Eligibility for some funding schemes requires 1 year membership or 1 membership renewal – whichever comes sooner.

Membership enquiries

To become a BSCB member please go to: https://bscb.org/members/become-a-member/

If any of your personal details have changed please login to the BSCB members area online and update your information. bscb.org/members/become-a-member/

Please email HG3 to report any difficulties with the membership page: bscb@hg3.co.uk

Invoices

Send to: Professor Giampietro Schiavo, UCL-Institute of Neurology, Queen Square House, Queen Square, London WC1N 3BG
giampietro.schiavo@ucl.ac.uk

Journals

BSCB members are entitled to a range of discounts from journal and book publishers. Members should check www.bscb.org for the latest information.

CRYOPRESERVATION WITH CONFIDENCE

Safe Storage

Whether storing your precious samples for many years or automating a high throughput system, your cryopreservation is only as good as its weakest link.

Make sure your cryovials are up to the job – **Top Class Cryovials from Alpha Laboratories:**

* High grade polypropylene, consistent strength at -196C (vapour phase)
* High throughput, quick close cap feature (only 1 ¼ turn)
* Range of designs and volumes compatible with most storage solutions
* Easy sample identification, colour-coded cap inserts and barcoding options
* Choice of cap styles with internal or external threading, o-ring or sealing washer

We also offer a wide range of **cryoboxes, workstations** and **vial storage canes**.
The cryogenic workstations securely hold up to 50 free-standing vials and are ideal when working with large batches of samples. They have an integral locking ring and anti-skid rubber feet to enable single handed tube opening.

Protect Your Cells

Damage can be caused by the formation of ice crystals during freezing, so cryopreservation methods may include controlled rate and slow freezing, vitrification or the addition of cryoprotectants to provide protection. Alpha Laboratories offers the BAMBANKER™ serum free cell freezing medium cryoprotectant. Designed to preserve delicate cells, including lymphocytes, during medium and long term ultra-low temperature storage.

* Ready-to-use with no dilution or additions necessary
* No requirement for stepwise temperature reductions or a programmable freezer
* BAMBANKER™ Direct offers an improved workflow solution
  + Can be added directly to culture media with no centrifugation required
  + Cell suspensions can then be transferred to cryogenic vials for immediate, long-term storage at -80°C

Simple, Secure and Reliable. Find out more at **www.alphalabs.co.uk/cryopreservation**

02380 483000 • sales@alphalabs.co.uk • www.alphalabs.co.uk

alpha laboratories
supplying quality to science