

Universities of Leeds, Sheffield & York

Newsletter

November 2017

Living at the Extreme

James Robson, Chong Group. Light and Heavy Isotope DNA UV Light & Camera



Letter from the Editor

I'd like to take this opportunity to welcome our new cohort of students for 2017! We have designed this newsletter to keep everyone up to date with news from the DTP, upcoming events, PIPS experiences and student articles whether that be lab-based, conference writeups, field trip stories or just general sciencey goings on!

The editorial board have decided to give each newsletter a loose, overall theme for the articles submitted and this release is entitled *Living at the Extreme*. We hope that this will give you all a better idea for articles should you wish to contribute to an edition!

Our upcoming editions are:

- Evolution and Extinction (February)
 - The Microbiome (May)
 - Health and Disease (August)

Enjoy FERA and we will see you all at the symposium in December!

<u>In This Issue</u>

- Life in Extreme Environments: Adaptation and evolution of the soda lake cichlids.
- All the buzz about the Insect Festival.
- PIPS experiences from Caitlin McQueen and Ellie Healicon.
- Old techniques breathing life into biogas production.
- Beware of the Predatory Publisher!
- Student Achievements.

Editorial Board:

Editor-In-Chief: Caitlin McQueen, cm841@york.ac.uk Scientific Features Editor- Rebecca Hall, rjh526@york.ac.uk PIPS/Careers/Features Editor- Caroline Pearson, cp751@york.ac.uk Sheffield Features Editor- Naomi Cox, NCox2@sheffield.ac.uk

Life in Extreme Environments: Adaptation and evolution of the soda lake cichlids

Lewis White, York



My PhD focuses on a single genus of fish, Alcolapia, which is the only vertebrate to survive the extreme environment of the East African soda lakes. Natron and Magadi. These lakes are considered some of the most extreme environments supporting fish life, with water temperatures of 30-42.8 °C, pH ~10.5 and fluctuating dissolved oxygen levels and a hypersaline -alkaline environment. Specifically, I am focusing on the adaptation and evolution of these fishes in Lake Natron, Tanzania, where three Alcolapia species live sympatrically. The Alcolapia are believed to have also diverged around 10,000 years ago making them an example of a rapid, small scale speciation event. These fishes have a number of physiological adaptations which deal with the many stressors imposed by their environment, making them unique.

The question of adaptation to soda lake conditions is of current interest due to the effects of climate change on freshwater ecosystems, meaning more fishes may be exposed to similar stressors. As such they are a very interesting model for examining rapid evolution and adaptation to extreme environments. The aim of the current research is to investigate how environmental pressure affects both the genes themselves and their regulation which is important for survival. Furthermore, we aim to characterise the functional importance of genes seen to be under positive selection within the *Alcolapia* genome.

Fieldwork to Lake Natron, Tanzania, was planned to collect live specimens of the three endemic species in an attempt to produce stable breeding populations back in the UK. Having direct access to fish will allow functional analysis of candidate genes and proteins determined to be important for survival in these conditions. I flew into the Tanzanian capital, Dar es Salaam, where supplies and paperwork were collected, before further travelling to Lake Natron. A number of colleagues and I camped there for 10 nights, which allowed us the time to take environmental data and samples as well as collect the live fish for export to the UK. Environmental data included water chemistry

and ecological reading (such as water depth and species numbers and community interactions). We also collected a number of fish for DNA sampling and for examining stomach contents. Seeing these fish in their natural habitat put my research into perspective and, through observation of behaviour and species differences, has given me ideas for future experiments into the adaptations of these extraordinary animals. Live fish were all collected from a single spring containing all three species found in Lake Natron. Small individuals were preferentially selected and more females taken than males to ensure good numbers for maintaining breeding populations. Fish have since arrived at the University of Bangor aguaria facilities where they have been successfully acclimatised to community tanks under the supervision of Prof George Turner. Once fish have begun breeding and the population size has increased they will be available for experimental work.

During our time at Lake Natron we were also filmed as part of a new documentary examining extreme lakes. I was filmed (and re-filmed) carrying out fieldwork and at the end of the week spent an entire day being interviewed on camera about what is already known about the fish in Lake Natron and the future of research in this area. Filming was a very enjoyable experience that introduced me to number of other experts who are working on Lake Natron, from various fields, and allowed me to complete an ambition of many biologists and pretend to be David Attenborough for a week.

I would like to thank the Genetics Society and FSBI for funding this fieldwork and helping enhance my PhD experience and the work that I am now able to carry out, to the TAFIRI officials for helping on the fieldwork and to my supervisors Dr Kanchon Dasmahapatra, Dr Betsy Pownall and Dr Julia Day for their continued support. I would also like to thanks Prof George Turner and Dr Antonia Day for all their help and expertise whilst in the field.

All the Buzz about the

Rebecca Hall, York

As part of my PIPS at the Yorkshire Museum, I was able to spend the day at the Royal Entomological Society's Insect Festival chatting about some of the Museum's collections. The event event, hosted in the Hospitium in Museum Gardens, was packed full of visitors for the whole day.

The Museum brought some specimen trays containing beetles, flies, moths and butterflies. These had been chosen to try to debunk some common myths: namely, that moths are only brown, only fly at night and are all (and only) attracted to light, that butterflies are much larger than moths and that flies are, well, boring.

Our stand was constantly busy with families, couples and experts who asked lots of interesting questions about what these insects would have eaten, how old they were and where they might be found today. Many were surprised to hear that Yorkshire hosts species of day-flying moths that can be spotted in gardens and green spaces across the county and were intrigued to find out about the Dark Bordered Beauty that is becoming increasingly more rare and can now only be seen at five sites (one of which happens to be Strensall Common).

I got the chance to have a wander around the other exhibitions on my break. I faced my fears at the spider table and now know how to tell the different between a male and a female (the males have "boxing glove" type features at the front). I also joined the Yorkshire Wildlife Trust; it only costs £2.75 per month and comes with a handbook that details all the nature reserves and wildlife spotting areas across Yorkshire and, importantly, tells you which sites are dogfriendly.

15

The stand next to ours belonged to The Pirbright Institute. Their expertise is on the prevention and control of viral diseases and they had brought with them a selection of adult and larval mosquitoes that you could see in real time on their laptop screen using a hand held camera. I was able to have a chat with one of their staff about my PhD and he was really enthusiastic about using vector manipulation to control the spread of diseases.



The festival is held once every two years and cost £1 per adult to enter. It is such good value for money for how much there is to do and it really appeals to every age group and interest level. There was even the opportunity to eat some bugs, although I didn't take

PIPS Perspectives

Caitlin McQueen, York

Student Bio: I'm a final year student supervised by Betsy Pownall and Bob White at the University of York. I'm investigating the relationship of mRNA and tRNAs in the regulation of muscle development using a *Xenopus* (frog) model. This has involved using CRIS-PR/Cas9 techniques and designing custom microarrays to simultaneously look at the transcription of both mRNA and tRNA populations.

Where did you do your placement?

I carried out my placement at The Company of Biologists which is a not for profit organisation based in Histon, Cambridge. The company publish 5 scientific journals including Development, The Journal of Experimental Biology and The Journal of Cell Science. They award travel grants for students and post-docs, travel scholarships for young researchers to fund collaborative trips and organise society meetings such as yearly conferences.

What did your placement involve?

I was in charge of a data analysis project to predict 2016 journal impact factors for each journal, as well as designing and carrying out analysis looking at the effect of open access on the usage of articles on their company site versus usage on PubMed. This meant that I worked with the managing editors from each journal, tailoring the analysis to give them useful information to use in the upcoming journal strategy meetings. I also worked with people covering most of the roles in the company including marketing managers, managing and commissioning editors, production editors, communication managers and the head publisher.

Why did you choose your placement?

I thought the placement would give me a good insight into the publishing process and would be helpful for when considering publishing my own work. It also would give me a good view of alternative careers for PhD graduates and build useful contacts should I consider a career outside of academia.

What point during your PhD did you do your placement and was this a good time?

I did my placement towards the end of my third year due to the availability of the project at the time. I think it's important to plan early to make sure you can be flexible if there is a particular place you would like to work. It turned out to be a good time for me, but I had planned to carry out my placement a year earlier.

What resources did you find useful when searching for a PIPS placement?

Lorna and Amanda at York were really crucial to helping me make contact with the company and also with arranging the contract with the HR as well as being around for any interview practice I needed.



How did you organise your PIPS placement, was it difficult to get a placement?

I contacted the company myself in February 2016. The company were going through staff changes and so progress was slow at the beginning and the internship I originally applied for was no longer available due to the changes in staff. It took a long time to get sorted but the process was relatively easy as I had plenty of time.

What did you enjoy most about your placement?

I really enjoyed meeting the editors for each journal and feeling like one of the team. They hosted a pot-luck lunch during my first week to give me a chance to get to know people and everyone was friendly and full of advice for my future career.

What skills/ experience have you gained from the placement?

I am now master of Excel and it gave me a great opportunity to become more confident in my presentation skills within a professional setting as I gave regular progress reports, written analysis reports and a presentation to the managing staff in my final week. I feel like I made really useful contacts in the publishing world as well as working with a really friendly set of colleagues!

If you could do anything differently what would you do?

I would not have opted for a commute as it became very draining travelling 4hours+ a day.

Do you have any other advice for students planning their PIPS placement?

Really think about what would be most valuable to your skillset and network before applying for PIPS. Even though my project was data-based, the network I have gained and the skills needed for the project are really valuable for a much wider setting. If you have a career goal outside of academia make sure your placement reflects that.

PIPS Perspectives

Ellie Healicon, Sheffield

Student Bio: I'm a third year PhD student at the University of Sheffield supervised by Professor Andrew Fleming and Professor Julie Gray. I am part of the Sheffield stomata research group, focussing on guard cell wall mechanics and their effects on plant physiology. I also run an outreach project in collaboration with local colleges to encourage children from disadvantaged backgrounds to apply for higher education.

Where did you do your placement?

I did my placement at the Leeds branch of RSK ADAS Limited.

What did your placement involve?

I was working in the policy and economics team, assisting on a wide variety of projects, including questionnaire design, research and data collection, analysis and report writing, and managing a team of over ten people. I worked with a variety of clients, including Defra, Fera, the National Trust and Historic England.

Why did you choose your placement?

I was looking for placements in the plant science area that would let me try something new compared to my PhD and my previous experience, and came across this opportunity at ADAS.

What point during your PhD did you do your placement and was this a good time?

I undertook my placement in January to April of my second year. This was a really good time for me as I had finished my upgrade review in mid-November so wasn't in the middle of any long term experiments, and it was at a point early enough in my PhD where it was less stressful to take time out as my workload will likely increase in later years.

What resources did you find useful when searching for a PIPS placement?

The researcher development team at my university are very good at emailing round internship opportunities – my advice to anyone looking is to actually read these emails and keep an open mind about the types of project you're looking for.

How did you organise your PIPS placement, was it difficult to get a placement?

I applied through email with my CV and a cover letter, then had a phone interview, and was offered the job during the phone interview. I found it easy to get a placement even though I didn't have much relevant experience in this area – a lot of companies are aware of the transferable skills PhD students have and would be happy to take us on.

What did you enjoy most about your placement?

The team and office I was working in were incredibly friendly and supportive, and made me feel like an integral and valuable part of the team. I was given opportunities to take on more responsibility and do interesting and challenging work that was beyond the initial job role. I also enjoyed moving to and living in Leeds and having a break from Sheffield and my PhD in a different environment.

What skills/ experience have you gained from the placement?

I have learned many new skills such as project management, social research methodology, communication skills with both industrial clients and the public and laminating. I also contributed to writing press releases that were published on the ADAS website, and research reports which were well received by our clients. It helped me realise how many valuable skills you obtain during your PhD without noticing.

If you could do anything differently what would you do?

At the start of the placement I came back to Sheffield most weekends, but when my placement ended I realised there was so much of Leeds I hadn't got to see. You rarely get the opportunity to move to a new city when your time isn't taken up with day-to-day administrative tasks, and you should make the most of that.

Do you have any other advice for students planning their PIPS placement?

Remain open minded – just because a job description doesn't look like what you were searching for on paper, doesn't mean it won't be a worthwhile placement. Also, employers don't expect you to already have all the skills required for your placement – you can learn on the job and it's good to choose something where you'll learn new skills. Talking to the employers beforehand is good as it gives you a sense of what kind of environment and training you can expect. You don't have to take the first thing you see if you feel like you won't benefit from the experience.

If you think that your PIPS placement was great and would like to tell us all about it or have words of advice for other students organising their placement please contact the PIPS subsection leader Caroline Pearson (cp751@york.ac.uk).

For more information about PIPS and to find your university PIPS contact, visit the White Rose Mechanistic Biology PhD website www.whiterose-mechanisticbiology-dtp.ac.uk

Old Techniques Breath New Life into Biogas Production

James Robson, York

There is a buffet of fancy new-spangled molecular techniques that many PhD students dream of using on their ultra-pure carefully cultured cell lines. I, however, have spent a lot of time over the last two years breathing (forcing) new life into old school techniques to use on my cultures that most would consider "pure contamination". Techniques that were discovered by the initial pioneers in biological science when all they had were a few lasers, a couple of thousand volts AND A BIG BAG OF CANS.

So a bit of background... I am currently researching the microbial communities of anaerobic sludge (remember the "magic potions" you used to make as a kid in the garden?) and how they can be used to remediate whisky waste water (sadly I have not received any of the good stuff yet). This good stinky soup is about as sterile as it sounds being comprised of over 1000 species all fighting over nutrients before the end products are eventually converted to methane by a group of archaea called methanogens.

To understand who is part of this biological sludgestorm I turned to the usual scapegoat, DNA sequencing. But little fragments of DNA are not enough when you are trying to reconstruct a jigsaw of epic proportion, just like trying to reassemble a frog after blending it. For this masterpiece, we needed HUUUUUGE DNA for massive DNA gainz to achieve the biggest DNA in the department. I was aiming to use these massive DNAs on an emerging sequencing technology from Oxford Nanopore, a membrane that you thread DNA through and it infers the sequence from the electrical conduction across the membrane with theoretically no upper size limit. So instead of blending my frog, I chose to use an oldschool technique called Pulsed Field Gel Electrophoresis (PFGE) which works by oscillating the DNA back and forth and side to side to achieve multidimensional separation, initially used to separate whole yeast chromosomes. By carefully encasing my sludge samples in a solid gel then blasting them with heat, detergents and meanie enzymes I destroyed almost all trace of my subject apart from the threads of it's soul (DNA). This technique worked pretty well, other techniques got ~10-30kb whereas I managed to get between 300-500kb. Unfortunately the sequencing technology at that time started to lose accuracy after ~70kb; were all my gainz for nothing? Euphoriously, there have been multiple improvements since two year ago, so I am going to give it a shot. Hopefully I will have bite sized chunks to re-arrange my frog.

But what is science without lasers? As you might not remember, archaea were only recognised to be distinct from bacteria in the last century. Preliminary investigation into these organisms revealed all sorts of things; novel cell wall composition, sweet thermostable polymerases and methane production. All biotechnologically useful and field changing. BUT THEN ONE DAY, probably at a rave, Cheeseman (1972) discovered that if you blast a methanogen with 420nm light it will glow due to the presence of an almost-exclusive methanogen cofactor involved in the final stages of methane production. I coupled this ancient technique with a recent technique for culturing unculturable organisms (the iCHIP, which also discovered the only new class of antibiotic in 30 years). The iCHIP works by sandwiching a single cell from an environment between two permeable membranes then burying it again to grow them up by allowing metabolite exchange with the environment/ potential friends. The idea was simple; culture cells from a methanogenic community then expose them to 420nm to find the methanogens to a) avoid doing PCR and b) characterise metabolically. After checking the concept with a lab-grown methanogen, initial interviews identified one candidate out of 192 applicants that gave a glowing performance. Time will tell if his talents are truly unique...

So I encourage you to sit down and read some of those papers written on parchment, they were written in different times where smoking and drinking were encouraged allowed in labs and people looked directly at X-ray beams and lasers. So go on, get out there and shine some lasers on stuff, you never know, it might glow. In the almost words of Rihanna "Shine bright like a laser".



Home made methane bioreactors

Beware of the Predatory Publisher!

Okay, so it sounds pretty scary and I hadn't come across the term before I went for my placement in a publishing company, but the term refers to a journal that exploits open access fees to make money whilst not giving the authors the expected editing and peerreview process that should be associated with submitting a manuscript. And there's A LOT of them!

Sadly, there isn't a comprehensive list detailing the "who's who of predatory publishers" therefore it becomes more important to be aware of any tell-tale signs to help you spot a potential problem journal.

- 1. Have they approached you for a primary research paper? Whilst this can be a massive ego stroke, unless you are well established within your field and receive a tailored request or it's mentioned at a conference, chances are an email starting "dear esteemed colleague" or similar is a potential predatory journal.
- 2. The editorial board is not tailored to the field. There have been cases of editorial boards consisting of people who do not know they are listed, fake editors, deceased editors being used as a name and if you see a lot of "Hotmail" or "btinternet" emails, chances are the profile is made up. Some journals have been known to accept fake profiles in research trials, some even accepting someone's dog as an editor!





- The open access fee is requested before submission, and is lower than usual open access fees. Some possible predatory publishers request just £100 for "gold open access", much lower than expected.
- 5. The journal is listed on "Beall's list". Jeffrey Beall wrote an article in Nature during 2012 warning of the corruption of Open Access by predatory journals and has since published a list of journals he deems to be potential "Predatory Publishers".

At present, most supervisors are hands on and therefore this should not be an issue so let's not all start overthinking every open access journal submission! But as a Post-Doc, or if you decide to change fields for example, these tips will help you keep an eye out for anything suspicious.



Student Achievements

- Lewis White published in Animal Behaviour.
- David Farmer won a poster prize for the quantum biology section at the 19th IUPAB conference in Edinburgh.
- Emily Beardon (now submitted) won the best student talk at the world congress on parasitic plants.
- Milena Von Und Zur Muhlengave a talk at the Staphylococcus GBI conference in Swansea.
- Rebecca Hall was awarded third prize in the Young Microbiologist of the Year competition.

Want to Get Involved?

Thanks for reading this issue of the White Rose Mechanistic Biology DTP Newsletter. We're always looking for White Rose PhD student volunteers to join the team. The newsletter is entirely student run and is published every quarter. This is a fantastic opportunity to get some **journalism experience** on your CV!

Wanted: Leeds Editor

Responsibilities: Coordinate volunteers and be the first point of call for new volunteers from your university, put out calls for contributions, find student achievements (academic publications, conference attendance and non-academic sporting achievements) in your institution. Be involved in deciding on content of each issue and signing off on final layout before publication.

Wanted: Casual Contributors

Contributions are accepted on a causal basis so if you've been to an interesting talk/conference/ careers meeting etc. or have found an exciting piece of science news that you'd like to share, feel free to submit your article to the appropriate editor. There is no limit on what you can submit!

Some ideas for inspiration:

- An article about your PhD research, your lab, a brief update from your field or any cool breakthroughs.
- An article about a field of science that you want to get some attention.
- A piece on a particular scientist/journalist/documentary that inspired you.
- A summary of a conference that you have attended or spoken at.
- A comic that you created whilst pulling an all night lab party for one.
- A review of an outreach event that you were involved in or would like to publicise ahead of time.

Wanted: Cover Photo

If you are a budding photographer or just have a great photo of an experiment you carried out that you are super proud of, send it to us for a chance to make the cover photo of the February news-letter which will be titled *Evolution and Extinction*. Thanks to James Robson for his contribution to this issue with his light and heavy isotope DNA image.

DATE FOR YOUR DIARY

White Rose DTP Annual Research Symposium 2017 15th December 2017, Biology Department, University of York

This student-led symposium will showcase the research of students in their third and fourth year and will include a selection of talks from keynote speakers. The one day meeting will provide you with the opportunity to find out more about the DTP and meet other academics involved in the DTP from the universities of Leeds, York and Sheffield for potential cross-institution collaboration.