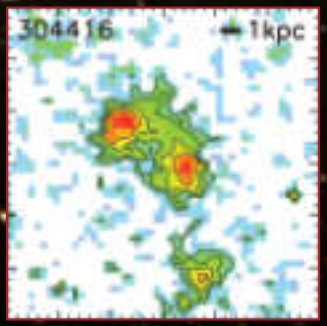
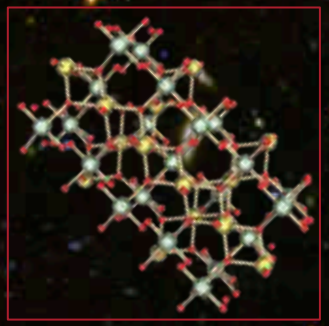
Celebrating Women in STEM at New College





WOMEN IN NEW COLLEGE 1979 40 2019

CELEBRATING WOMEN IN STEM AT NEW COLLEGE

Introduction

Ashleigh Griffin

It took 34 years after the admission of women into the Royal Society, and 15 years after Dorothy Hodgkin became the first British woman to win a Nobel Prize, for New College to accept female undergraduates. 10 out of the 26 women to be admitted in 1979 were science students – breaking new ground, not just for being the first women but also for taking the decision to study subjects that were seen as more suitable for male students.

Whilst the College's first female fellow had arrived in 1974, our first female science undergraduates would have been taught exclusively by men. It is now impossible to study science at New College without being taught by a woman; we have female tutorial fellows in Maths, Engineering, Chemistry, Biology, Physics and Medical Sciences.

One hundred years after women were first allowed to study at Oxford. We celebrate the achievements of women who first came to New College to study science, together with the incredible achievements of our young women scientists today.

Sara Weller joined New College in 1979 to study Chemistry and from this start went on the become one of the highest profile women in the business world. She met with Helen Potts from the MCR and Geena Goodwin from the JCR to share her experiences:

"the thing I learnt in chemistry and science generally is that the way to establish the truth is to develop hypotheses and test them with evidence. And that's always been my approach to business."

Professor E J Milner-Gulland is a New College alumna and Professor of Biodiversity in the Department of Zoology at Oxford. She talks about how the interactions across disciplines during her undergraduate years have shaped her career in the interface between conservation and policy making.

What emerges from both of these interviews is that, despite the challenges facing women in science, then as now, their experience of studying science subjects at New College was empowering and inspiring, and provided a launch pad for their future careers.
That is something we hope to provide for our undergraduates today. One thing that has changed in 40 years is the presence of female scientists in the MCR and the SCR and in this booklet we share some of the world-class research our young female scientists are engaged in.

Dr Tetyana Varysyleva's research helps us understand how chronic viral infections spread and can help development of preventive strategies. Dr Rebecca Bowler's research has helped us understand the most extreme galaxies in the first billion years of the life of the Universe. Helen Potts' research is hoping to reverse the damage done by a heart attack by stimulating the heart to heal itself. We hope you enjoy reading about their ideas and inspirations and reflect on how, until as little as 40 years ago, they would not have been deemed eligible to join us as undergraduates.

Current Fellows in STEM subjects

1 Rebecca Bowler
Glasstone JRF in Physics.

2 Ashleigh Griffin
Tutor in Biological Sciences; Professor of Evolutionary Biology.

3 Bethan Psaila
Fellow in Clinical Medicine.

4 Laura Lauro-Taroni
Stipendiary Lecturer in Physics.

5 Frances Kirwan
Professorial Fellow; Savilian Professor of Geometry, Mathematics.

6 Barbara Rossi
Tutor in Engineering; Associate Professor in Engineering Science.

7 Christiane Timmel
Tutor in Chemistry; Professor of Chemistry.

8 Adrianne Slyz
Tutor in Physics; University Lecturer in Physics.

9 Tetyana Vasylyeva
Matthews Junior Research Fellow in Biological Sciences.

Sara Weller (1979 CHEMISTRY) **Interviewed by Geena Goodwin** (2018 BIOLOGICAL SCIENCES) **and Helen Potts** (2012 CELL AND SYSTEMS BIOLOGY)

H: So why did you pick New College?

Well to be honest, I didn't really, my school did. I went to a state grammar school and I think about four or five people went to Oxford or Cambridge. I [was advised to apply] to the college with which the school had the best connection, which was here. And, fortunately, it was the first year they were going to take any women. I never really thought about which college I was going to come to.

H: Do you think if you could have, you'd have chosen to go to an all-female college?

No. I liked the fact that it was going to go female for the first time. Because I was a woman doing science, and there weren't that many of those at school, there was a bit of me feeling – I want to do something that not many women have done.

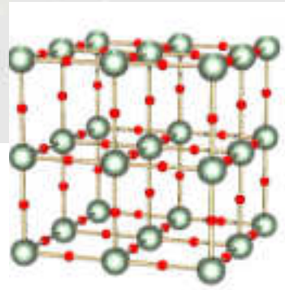
What became quite evident was that the tutors weren't that comfortable with women because they never had women before. I remember going to Peter Dickens for my interview. His room was in the front of Garden Quad where the beautiful wrought iron gates are into the garden and I was overwhelmed by the sense of a place that I'd never seen before. And I was asked – How would I calculate Avogadro's number? And I clearly muddled my way through it adequately to get an offer. I didn't know anything about Oxford and I didn't really realise until I came here how important the college was.

G: I agree completely. I didn't realise how integral it was to your whole experience here.

I count myself very lucky because I loved New College. Steve Davis came as a tutor when I was in my second year. So I baffled my way through my organic chemistry with Gordon Whittam who we had tutorials with in the labs. Lionel Stavely was very much the elder statesman of the tutors, and he said to me: "women make very good crystallographers. They have very delicate fingers." But he was so gloriously courteous you couldn't conceivably take offense.

But you felt so privileged to be here anyway, you weren't in any position to worry about whether they saw you differently. You were just soaking it all in.

That group has just been awarded nobel prizes; they were doing work that preceded the invention of lithium batteries. But at the time you don't know any of that. I was doing my little project on making a new form of uranium trioxide that had never been made before and it was very pretty.



Delta Uranium Trioxide (S.V. Hawke), New College

G: Did you always know you weren't going to go into chemistry and that you were going to go into business?

No. Well, I say no, but when I was at school I was interested in business and politics and the economy. I wanted to be an accountant. But in chemistry I could put things together in test-tubes and they'd change colour, so I thought that was quite fun. I thought I wanted to be [an accountant] until I realised that half the chemistry graduates in Oxford went on to be accountants. It was like a sausage factory! And so two things: one, it didn't feel very pioneering, and secondly, I was fed up by exams by then … because I was diligent and hard-working I put a lot of pressure on myself to do well, and I did do well. But I was just fed-up with them!

So I thought about how else I could use my chemistry degree, and I started to apply to firms like ICI, Shell, BP ESSO, and I also applied to the government, and to the food companies: Unilever, Mars and Proctor & Gamble which had really good training schemes. I discovered that the people I liked were mostly in business, so I decided to join Mars. I was a woman, I wanted to have kids at some point. The problem with going into academic research is that it's a very long journey, whereas if I went into business, I thought six or seven years after I leave here either I'll have decided that business is for me or I'll have flunked it and I'll be fine to go off and have kids. Either way I'll know and have made some progress. So I decided to go on the Mars training scheme which was very popular and for good reason – it was a very good scheme. And I never looked back.

I didn't use my chemistry but my numeracy has always been a real asset in business for sure. And the other thing I learnt in chemistry and science generally is that the way to establish the truth is to develop hypotheses and test them with evidence. And that's always been my approach to business. So, in trying to understand how customers behave and what works in industry, you form a point of view about what might explain the way people are behaving and then you think – well, how would I know that's really what they do? How would I research it? How would I test it? But I loved my chemistry degree. I got the research prize in the fourth year for my inorganic project and I think

you come out with confidence in your intellectual ability and in your ability to stand up for yourself in arguments and to be confident about your rationale. That is definitely helpful when you go out into the bigger world. I certainly never knew when I came up that I would end up doing what I did.

But that's what we always say when we go to career events and students ask us: how did you get to where you are? You say – you just take the first step. Each time you open a door you find a whole load of new doors and you just choose one and you could never plot the path that you end up taking.

G: Business must have been a similarly male-dominated world as chemistry?

It was a bit and there were times where I was the only woman in the room.

I went into generally more socially, more forward-thinking organisations where I would argue being a woman was a good thing, actually. Because if they could establish that you were as good as the men, they were more keen to put you forward.

H: Why do you think that is?

Well, because there was a lot of pressure, a sense that there were not enough women at the top level. And that's partly because the pool wasn't as big. So I always felt I had, maybe not an unfair advantage, but the intrinsic disadvantages were compensated by support and encouragement in these organisations.

The thing was there weren't many role-models; that was probably the biggest problem. You couldn't look 15 years ahead of you and find women you'd aspire to be like. The women who got on in the generation above me generally didn't have families, were in very powerful dual-career partnerships or didn't have a partner at all. And they broadly had to adapt to a man's world in order to get on.

H: As you were going through your career did you have any help with how to have a family? How did you navigate that?

Well, there weren't any paths to follow for sure. I always felt like I was making my own rules. I wanted my job back. So, I decided that the deal I was going to do was to keep my job and the trade is that I'll come back quite soon. And I felt the business was … supportive, but they weren't doing me any favours. But they were happy to have a grown-up debate about what was a mutually acceptable solution.

G: You were almost relying on those businesses working around you and being willing to.

But at the time I didn't feel aggrieved about any of that. If anything I felt they were very helpful because I felt I alighted on a solution that would work for me and they were happy to engage with me on that solution.

I can remember having the conversation with the boss saying – I have two children. I am going to leave work on time because I need to be home. I will work as much as I have to, to make sure I get a great job done. And if you're not happy that I'm doing a great job at any point, you just have to say and I'll go somewhere else. If you're not happy with the quality of the work that I'm producing, that's fine, just tell me. But don't be unhappy because I'm not in the office at half past six. If you want someone who's going to be in the office at half past six, please don't recruit me. So I always say: be honest with people. Be transparent.

We were in that transition period between knowing that they had to do something for women and not quite knowing what they were supposed to do. They wanted to be helpful. It was just all very uncharted territory. And of course now everyone is very focussed on women in senior leadership positions. Everyone is trying to get to 35–40% on boards. It's just become a wholly different kind of conversation.

G: A much more open conversation?

People now recognise that diversity is fundamentally important. That having six white men between 40 and 60 in a room making a decision will give you six voices that are the same; you might as well have one voice, you don't need six. People have to be good obviously, they have to be talented, so I think the whole agenda has shifted, very positively actually.

G: It's very interesting, hearing how everything has changed.

Yes, so some things change and some things don't change.

G: It does feel like this place is steeped in history.

It really is. And you're just passing through. I remember when I left at the end of four years, my overriding feeling was – what a privilege it had been to be living here for four years and to be a tiny little part of the history. So, as I say, things change and at the same time, some stay the same. After all, Steve Davis is still here!

Rebecca in Hawaii using the Gemini Telescope.

Rebecca Bowler

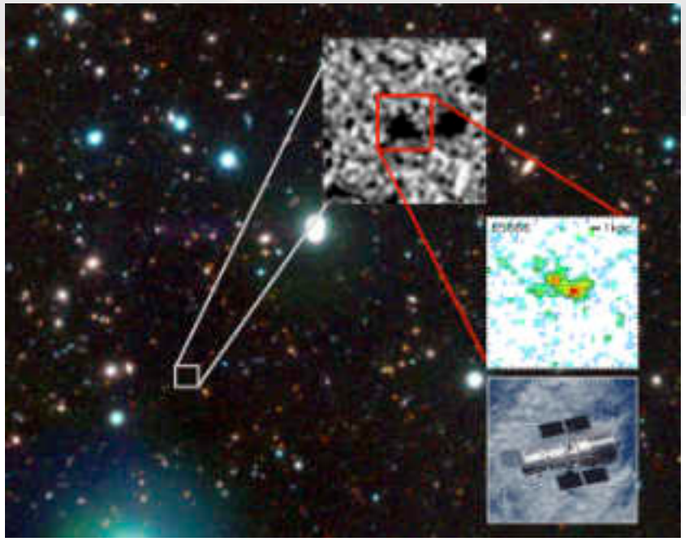
GLASSTONE JRF IN PHYSICS

After the Big Bang, the Universe entered a period known as the dark ages, the time before the first star was ignited. After many million years of darkness, primordial stars and eventually galaxies were formed, changing the Universe forever.

When I was a child we used to go camping on the North Norfolk Coast, and it was on one of these trips that I first saw the Milky Way. The memory is crystal clear. The cold grass under my bare feet, the sound of the waves crashing on the beach below, and the low voices and zipping of tents from all directions. All this framing a sky full to the brim with stars in an arc over my head. If you had told me at that point that years later I would have a PhD in Astronomy and be using the best telescopes to observe some of the most distant galaxies, I would have been sceptical to say the least, but that's exactly what happened. Inspired by the dark skies of Norfolk, and a kind and persistent Physics A-level teacher who made me feel like I belonged despite being the only girl in the class, I continued my studies and ended up today as a research fellow in Astrophysics at New College.

One of the biggest open questions in Astronomy is how and when did the first stars and galaxies form. Remarkably, astronomers are now able to observe some of the earliest galaxies, thanks to exquisite observations from the Hubble Space Telescope and other facilities. Using the trick that the light from the most distant galaxies shows them as they were in the past, not as they are now, because the light has taken billions of years to reach us, astronomers like myself are able to look back in time and understand how the first galaxies came to be. My research has been crucial in understanding some of the most extreme galaxies in the first billion years of the life of the Universe. During my PhD I found some early galaxies that were not expected to be there, they had too many stars, too early on, when compared with the expectation from computer simulations and previous data. This subsequently changed the view of how galaxies grow after the Big Bang, and has opened up a new field of studying these unexpected objects and how they came to be.

There are still many questions to answer. What were these galaxies like? How soon after the excitement of the Big Bang did they form? How many of these primordial galaxies coalesced over time to form the Milky Way? To answer these questions I must peer beyond our own galaxy, far beyond into the distant Universe. In my office in Oxford, far in both time and space from that moment with my feet on the cold grass, I continue to peer upwards and am fascinated by what I see.



The background picture is a false-colour image from the VISTA telescope in Chile. It took over 1000 hours to form the image, and in total it contains hundreds of thousands of galaxies. The zoom in shows one of the distant galaxies I discovered in this data. The light from this galaxy has taken 13 billion years to travel to our telescopes here on Earth. A further zoom in shows what this galaxy looks like with the Hubble Space Telescope. The irregular appearance is what is expected for such a young galaxy, as it is one of the first to form in our Universe.

Tetyana Vasylyeva

MATTHEWS JUNIOR RESEARCH FELLOW IN BIOLOGICAL SCIENCES

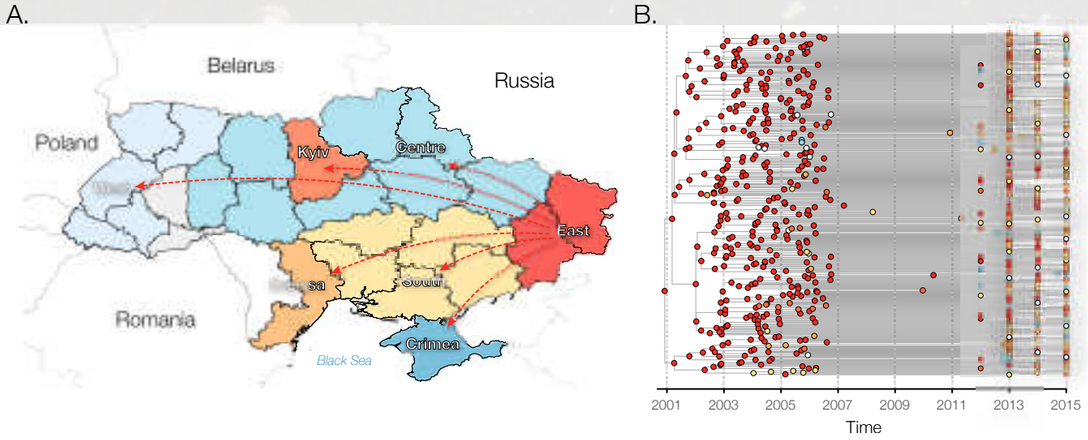
Training in genetic sequencing in Ukraine

I joined New College in October 2018 as Juliana Cuyler Matthews Junior Research Fellow in Biological Sciences. My studies focus on a combination of molecular and behavioural epidemiology, social network analysis, and epidemiological modelling, which I use to describe the spread of chronic viral infectious diseases. Knowing how chronic viral infections spread, including how often and when transmission events happen, can help development and assessment of preventive strategies.

My research mainly relies on a branch of evolutionary biology, which uses viral genetic sequences to study phylogenetic trees and virus transmission dynamics. Analysing data in this framework allows me to estimate changes in viral population size following a certain intervention or a change in policy. For example, I showed how harm-reduction programs (interventions aimed to reduce risky injecting practices among people who inject drugs) slowed the growth of the HIV epidemic in Ukraine and how changes in nationwide drug policy in Portugal were followed by a decline in the HIV effective reproductive number in the country. I can also use this method to detect changes in R0 (familiar to everyone following the covid-19 pandemic), which is defined as the average number of people to whom one infected person transmits the virus.

When studying HIV epidemics I am interested in how major political, social, or economic crises (so-called “big events”) can affect HIV spread worldwide. The war in Ukraine has led to an internal displacement of a large number of people from the eastern, war-affected, regions to the rest of the country. My work helped to define the effect of the ongoing war on the HIV spread in the country. Unfortunately, still little is known about how HIV and other chronic viral infections are transmitted in such displaced populations. Firstly, forced migrants, internal or external, are often omitted from standard surveillance efforts, and secondly, questions of the directionality of virus transmission and timing of infections are not easily answered by traditional epidemiology methods.

My current research project exploits innovative portable genetic sequencing technologies and molecular epidemiology analysis in order to investigate chronic viral infections transmission in such displaced populations. By rapidly producing genetic data sampled from hard-to-reach population and analysing them with phylogenetic tools, it is possible to rapidly characterise patterns in HIV transmission events. My study also focuses on describing the viral exchange between migrant and autochthonous communities, which hopefully can contribute necessary scientific evidence to the debate of public health consequences of increased migration and become a crucial argument against the anti-migration narrative.



(A) A geographical map of Ukraine. Colors indicate the grouping of the sequences in locations used in phylogeographic analysis. The arrows indicate the directionality of virus gene flow movement from the East. (B) Results of the discrete trait phylogeographic analysis based on the Ukrainian dataset (n = 427). Colors indicate the ancestral state locations of the internal nodes reconstructed by robust count phylogeographic method and the sampling locations of the tips.

Interview with EJ Milner-Gulland (1985 BIOLOGICAL SCIENCES)

PROFESSOR OF BIODIVERSITY IN THE DEPARTMENT OF ZOOLOGY AT OXFORD

© John Cairns

Why did you choose New College?

I hate to admit it but I chose it because my Dad went there. We were going through the prospectus together and he made notes on each college. When we got to New College he just ticked it and wrote "Best". What could I do?

By complete coincidence, he was helping me move into my second-year room (top floor of 12NB) and when we walked in he said – but this was my room when I was an undergrad 40 years ago! .... And this was my desk – I remember the ink stain!

But I also chose it because it was big, central, beautiful, and had a laid-back atmosphere, not too academic, not too sporty. I am so glad I did, because my Dad was right!

Were you the only woman in your year group studying biology in New College?

There were only two people studying Biology, both women – me and Michelle Gilders. There were actually quite a few female zoologists around but our degree course, Pure and Applied Biology, was newly introduced. It combined zoology, botany, agriculture, forestry and pest management. In the 1980s, and even more so in the 1990s, applied subjects were frowned upon in British universities. So even though Oxford had a world-renowned Forestry Institute, the applied parts of biology were having a hard time keeping going. This degree was meant to be a way to bring in some income, but it didn't work because it only lasted 5 years before being abolished. But I loved it – I got to study my favourite bits of zoology (like behaviour and evolution) along with economics, development, forestry ... That interface is still what I do today. I do remember a low point when I had to write a tutorial essay entitled "The potato" when all my friends were writing about far more interesting topics.

Did women across subjects hang out together in college or did you spend more time with the other biologists?

I spent lots of time in College and I did rather fall in with a PPE crowd. There wasn't much opportunity to get to know other biologists outside College. I was quite active in women's issues – we had a Women's group which was not particularly mainstream. For example, I invited an outside speaker who was rather eminent; we had 5 people attend and held the event in someone's bedroom! I was Women's Officer on the JCR committee (elected unopposed – or I would never have stood!) and also did some women's/welfare work for OUSU. I wasn't prominent in any of this stuff but I did enjoy feeling useful and part of things, and it enabled to hang out with the PPE-ists (sad I know!). Oxford student politics really is the training ground for national politics though – many of the people who I was aware of then were part of the Blair/Brown/Cameron years in government.

Did you feel conscious of being treated any differently by tutors as a woman?

No. But I did come back to New College in the early 1990s as the Cox Fellow. I arranged lots of social and other events to link the JCR with the SCR, and also did welfare work. It was just when the last cohort of Fellows who had been appointed before women had come to the college were coming towards retirement, and I have to say there were several who just really didn't understand female undergraduates. A couple of times I got rung up by older male tutors who said "I've got a female undergraduate crying in my room, so I'm sending her over for you to deal with". I got a pretty good sense of how deeply pervasive the issues around how women are treated in academia were, and I have seen pretty much the whole gamut of bad behaviour during my academic career. These issues still persist, but I don't think today's younger women would put up with the things we put up with 20 or 30 years ago. I hope not, anyway.

What was your most memorable tutorial?

There was the one-to-one tutorial (on agricultural economics, which I did find interesting!), in which I fell asleep, I had been enjoying myself a bit too much the night before... maybe we've all been there!? I had some very memorable tutorials with Richard Dawkins of course, but there are too many stories about those to be repeated here!

Do you think women studying science subjects felt differently about their future careers?

Not that I'm aware of. We had all worked really hard to get to Oxford and we were ambitious for our futures.

Did you always want to be a biologist?

When I was 13, I was really worried about nuclear war (that was the "climate change"-type existential threat of the late 70s-early 80s) and decided I wanted to be Prime Minister so I could sort the issue out. I even went to our school careers fair and asked for advice as to how to do it. The careers master said I had to join a political party first, which rather put me off. But I'd always loved nature and learnt a lot of natural history from my parents. So biology was a natural fit for me, but I've also always been interested in the applications of science in human societies.

You are now Professor of Biodiversity at Oxford, how do you think our current biology students' experience at Oxford differs from yours?

I don't think it actually differs that much here at Oxford, though I don't really know. As you get older you think you still have your 18-year-old self inside you, and that you understand your students' experiences, but maybe that's a bit of an illusion (and one that makes actual 18-year-olds cringe). I think that the kind of experience students get now is much more structured at the Departmental level, and that the tutors are more focussed on giving students all the different types of support they need to do their best. It was a bit sink-or-swim in my day, especially for DPhil students.

Any other points?

I thought you might like to see this absolutely cringe-making article in our local paper about me getting into Oxford. My school was a very large comprehensive and I was the only person to get into Oxford that year, so the local paper covered it. As you can see, the reporter didn't exactly warm to me (apparently our geese attacked him as he arrived). I particularly like the last line: "her one other interest is horse riding". Not only is that visibly untrue as I was sitting at a piano, but it does make me seem a real saddo. And you can see two guilty secrets; I was known as Jane at the time, and I have straight hair.

Off to Oxford

STEYNING Grammar School pupil Jane Miller Gulland has been accepted for entry to Oxford University to read biology.

Jane, 17, lives in Washington, the daughter of a Sussex University lecturer in Russian. She wants to be a conservationist. With entry to Oxford to take place in October she is already well on the way.

Six years a pupil at Steyning Grammar School, she was previously in school near Haywards Heath. Her one other interest is horse riding.

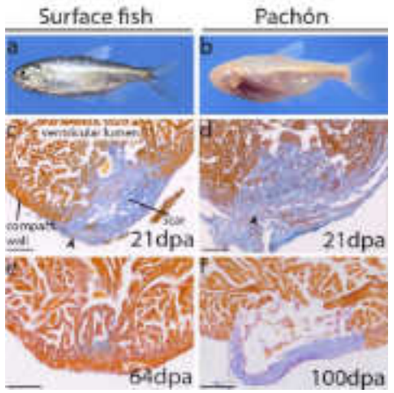
Helen Potts (2012 CELL AND SYSTEMS BIOLOGY)

Helen Potts first started at New College in 2012 as an undergraduate studying Cell and Systems Biology. She has always been fascinated by regenerative medicine and the idea that the body can heal some parts of itself, like the skin and liver, but that other body parts, like the nervous system or heart, are irreparably damaged by injury and disease. After a brief stint in Exeter College studying an MSc in Pharmacology, Helen did her master's research project at the University of Brisbane in Australia in a cardiac regeneration lab and fell in love with the idea that the heart could potentially heal itself after a heart attack. Helen came back to New College in 2017 to start her DPhil in cardiac regeneration in Mathilda Mommersteeg's group where she studies how differences in the immune response to injury can impact regeneration.

What is cardiac regeneration?

During a heart attack, a coronary artery becomes blocked and the downstream tissue is starved of nutrients and oxygen and dies, typically losing about a billion cardiomyocytes (heart muscle cells). Normally the heart can replace about 1% of lost cardiomyocytes and the remaining 99% is filled by a collagenous scar that can't contract. As the heart tries to cope with this massive loss of contractile muscle, it stimulates a whole range of compensatory mechanisms that eventually lead to heart failure which is when the heart can no longer pump blood to sufficiently meet the needs of the body. Heart failure is incurable and requires a transplant so there is a huge clinical need for us to better be able to repair hearts that become damaged by injury. The hope of cardiac regeneration is to improve the heart's innate capacity for repair from a 1% repair rate to 100%.

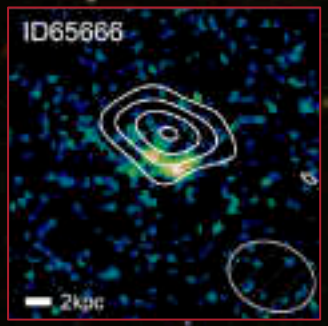
Helen is trying to do this by studying a very special fish known as the *Astyanax mexicanus. The A. mexicanus* are uniquely suited for studying cardiac regeneration as they are comprised of cave-dwelling and surface-dwelling populations that have differential abilities to regenerate their hearts after injury: the surface fish can fully regenerate after ventricular amputation or cryoinjury (freezing part of the heart using liquid nitrogen) whilst the Pachón cave fish cannot regenerate and instead form a scar, much like the human (see diagram). The cave- and surface- dwelling populations of the *A. mexicanus* arose approximately 1.5 million years ago when river levels fell, isolating the rivers on the surface from the lakes in the caves. At this point, the cave- and surface-dwelling populations began to diverge as they adapted to their separate environments. The cave-dwelling fish had to adapt to the lack of light and scarcity of food available in the caves which has resulted in some phenotypic changes: they no longer have eyes or pigment but have developed highly sensitive taste buds and a lateral line system that helps them detect food in the dark as well



The Surface and Pachón fish show different capacity for regenerating their hearts after injury. In panels a) and b), you can see that, morphologically, the surface and Pachon fish look quite different with the Pachon having lost their pigment and eyes. Panels c-f show a histological stain known as AFOG. AFOG stains myocardium in orange and collagen in blue. 3 weeks after an injury, both Surface and Pachon fish form a collagen scar, this stops the heart from rupturing after injury. However, after about 2 months, the Surface fish have completely resorbed their collagen scar and replaced it with healthy new myocardium whereas Pachon fish still have a scar which can still be seen a year later!

as an altered metabolism that can cope with long periods of fasting in the caves. It is during this period of adaptation that the cave-dwelling fish have lost their ability to regenerate their hearts after injury. The Mommersteeg group are trying to pinpoint what abilities the surface fish have that the Pachón have lost that causes their differences in regenerative capacity.

Helen's graduate research focuses on the immune response to cardiac injury. So far she has found that the immune response is very different after injury: the Pachon fish have a much more inflammatory response, with lots of immune cells flooding to the heart and creating more damage. She hopes to transplant the immune cells from the Surface fish into the Pachón to see if this will improve their ability to regenerate after injury.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