BIOSCIENTIST
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For the love of global health: Ongoing UoS microbiology research in Uganda

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In late 2015 I got an email from Louise Ackers, a Professor in the Health School, asking if there were any microbiologists at Salford University. I told her, yes, there were a few, including me and my colleague Dr Chloe James. Looking back, this was yet another moment of serendipity that changed my life – another "bit of luck out of the blue" that serves to remind me that just when you think life is getting predictable, there's always a surprise just around the corner. Louise was looking for some help with a project she was planning in Uganda focused on educating hospital staff to improve antimicrobial stewardship.

Six months later, Chloe and I were in Fort Portal, the biggest town in western Uganda, washing our hands like fury in front of groups of doctors and nurses to illustrate a good way of controlling transmission of Staphylococcus aureus infections. By this point we had learnt a lot about the appalling impact of infection (particularly sepsis) on maternal mortality in Uganda and we wanted to try and do something to help.

We arranged for the regional hospital to collect S. aureus clinical isolates for us and, with the help of a new PhD student, we set about characterising these to see how they were related to one another and the extent of their resistance to antibiotics - hoping to get a better understanding of where mothers pick up infection from and how best to treat infections. This work involved sequencing bacterial genomes and, with the help of my colleague Dr Ian Goodhead, we were able to do this in collaboration with microbiologists at Makerere University in Kampala as a way of transferring expertise in genomic techniques that are well- established in the UK to Uganda.

We used our free time in Fort Portal to explore some other avenues – I'm interested in tick-borne infections of livestock, so we had a day-trip to nearby farms to pull ticks off cows (later tested by an MSc student) and Chloe had us collecting chicken poo as part of a project on the epidemiology of the food-borne zoonotic pathogen Campylobacter jejuni.

Fort Portal is also the "home" of a UK/Uganda charity called Knowledge for Change (K4C). K4C has been offering placements for Salford University nursing and midwifery students for several years and we were very keen that they expand their offering to include Biomed and HBID students. It took a while to get things sorted, but the first group of BMS and HBID students went out to Fort Portal with Chloe in June 2018 and had a wonderful, life-changing month-long experience embedded in local microbiology, parasitology and haematology services. Here's what BMS student Adrian Beck said: "This placement had a very positive impact on my personality. The most important thing I noticed is Ugandans have so little [materially] but are still so happy; I am grateful now that I have roof over my head and my good health!".

Our work on S. aureus as a cause of maternal sepsis and other hospital-acquired infections started to yield results (https://www.biorxiv.org/content/10.1101/2020.11.20.371203v1), and Chloe returned to Fort Portal in January 2020 to share these results with hospital and public health staff. She used virtual reality kits to help her deliver messages about antibiotic resistance and how it develops. Through continuing collaboration with Louise Ackers this work also contributed to improved antimicrobial stewardship both locally and nationally.

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Staff at Fort Portal Regional Referral Hospital use VR developed by Chloe and others at Salford University to learn about antimicrobial stewardship

In late 2017 we were chosen to showcase the work we'd been doing in Fort Portal to a delegation of academics from the University of Gulu who were visiting Salford University. Gulu is in northern Uganda, a region devastated by civil war in the 1990s and 2000s and now accommodating hundreds of thousands of refugees from South Sudan and the Democratic Republic of Congo. The University in Gulu is new and very keen to establish collaborations with Institutions that have strong global health research, thus in January 2018 Chloe, Ian and I made a reciprocal visit to Gulu aiming to develop these collaborations.

We had an amazing, exhausting trip, which included me addressing prisoners in a remote jail about body lice and the infections they transmit, and encounter with children suffering from the terrible "nodding disease", the cause of which remains a mystery. Ian and one of his PhD students were able to carry out field work collecting tsetse flies, Which transmit sleeping sickness. We established links with scientists working on black flies that transmit river blindness and are now working together exploring the microbiomes of black fly guts and their possible impact on Onchocerca volvulus transmission.

The one person we didn't meet in Gulu was Dr Richard Echodu, the Director of Gulu University's new multifunctional research laboratories, who was away in Kampala. However, in early 2020 yet another moment of serendipity led to our working together on the biggest Salford-Uganda collaboration to date. Richard and I were talking about a grant application to support the black fly microbiome work mentioned above, when I mentioned COVID-19.

Richard spoke passionately about how unprepared Uganda was for the pandemic and we both agreed to look out for funding that might give us the opportunity to contribute the country's response to the virus. A week or two later, Ian found a call for the UK Government through its Global Challenges Research Fund that seemed to fit the bill. What followed was pandemonium as Ian, Richard and I raced to submit our application (at the same time as converting all our teaching to online and teaching students as befuddled by all the changes as we were), but submit we did, and a month later we got the surprising news that we'd been funded.

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Chloe's PhD student, Paz, collecting faecal samples from Ugandan chickens to screen for *Campylobacter jejuni* and other zoonotic pathogens.

An infectious control (hand hygiene) class at Kibiito Health Centre.

Me playing a rather passive role in collecting ticks off local cattle. Doing most of the work is my ex-Phd student Jess and Philip (right), a Regional Veterinary Health Officer.

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The project started last August and under the management of the magnificent Dr Judy Mwangi (who just completed her PhD at Salford University) with fantastic support from Louise Ackers and many other people, we are now six months in and still standing. Working in two countries during the pandemic has thrown up many barriers but this week our diagnostic laboratory opened for business with the approval of the Ugandan Ministry of Health. We now aim to test at least 25,000 people for SARS-Cov2 infection in the next few months and to compliment this with genome sequencing by the summer.

We're particularly interested in the impact the virus is having on refugee communities and how the epidemiology of infections might be shaped by risk factors quite different to those recognised in the UK, such as age and obesity. Most Ugandans are young and not fat, but they are far more likely to be carrying parasites or be malnourished than Salford residents. Hopefully, this time next year, we'll have some answers and we'll also have helped Gulu University establish itself on the national stage as a centre of molecular microbiology research excellence because the need for such expertise will not go away with COVID19.

So, as far as this story goes, we're nowhere near the end, but maybe we're at the end of the beginning. There will undoubtedly be many opportunities for oldies like me, Ian, Chloe and Louise, who have loved global health for many years, but there are also opportunities for those just starting out; those who recognise that the relevance of biomedicine and bioscience extends way beyond the boundaries of Salford, or Manchester, or the north-west, or the UK. There's a big world out there waiting!

K4C placements are available (again) from September 2021 and are open to all, regardless of whether you are still a student or not. For more information, check out their website, www.Knowledge4Change.org.

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