

GrahAM Research Group Newsletter



February 2021
Volume 2

Message from Group Leader

Welcome to our second newsletter, which is intended to compliment our research blog at <https://blogs.ncl.ac.uk/grahamr> and provide context to our funders, partners, university colleagues, and alumni.

This past year has seen many changes, both good and not so good, related to Covid-19 pandemic. For example, rather than primarily focusing on antimicrobial resistant (AMR) work, the group has become very involved in wastewater-based epidemiology (WBE) on SARS-CoV-2 (the COVID-19 virus), both performing core WBE research and also govern-

ment advisory work in the UK and around the world. We have had staff turnover in our group, due to student graduations and new projects; nevertheless, I feel we still have a world class team that is performing cutting-edge research.

On a personal note, I finally become a Chartered Engineer in the UK through the Institute of Water, and joined the Executive Advisory Board at *Environmental Science & Technology*, both of which are new demands. If you have any questions or feedback on the newsletter, please contact me directly or us at grahAMR@newcastle.ac.uk.

Staffing Changes

In 2020, the group composition had several changes. Our post-doctoral researcher (PDRA) number went down to three for most of the year: **Dr Marcos Quintela Baluja**, **Dr Myra Giesen**, and **Dr Kelly Jobling**. **Dr Andrew Zealand** was moved to Northumbria University, where he is now working in their Applied Sciences Department. We did have **Dr Carl Samuel** with us for a few months, but he now has moved into research support at Newcastle University.

Our Research Technician, **Adrian Blackburn**, is now in shared position with Dr David Werner's lab, which kept him very busy. **Vincenzo Padricello** joined our group as a Research Assistant to help with SARS-CoV-2 work. He since left in December to join E^xponent, but was replaced by **Dr Panagiota (Pani) Adamou** who was hired as a Senior Technician to work on WBE and a new AMR project in India (see later).

Florence Jong graduated in January 2020 with her PhD and took up a PDRA post at the National Environment Research Institute at the National University of Singapore. Pani Adamou defended her thesis successfully and was awarded her PhD in September. She was hired quickly as a Senior Scientist at Cignpost Diagnostics to manage their screening lab for SARS-CoV-2, but as noted, she has returned to the group to work on new Covid-19 and AMR projects.

We now have two PhD candidates: Amelie Ott and Katie Robins. **Amelie** is in her final stretch, finishing manuscripts for publication and tweaking the penultimate version of her thesis. This past autumn she interrupted her studies for three months to work for the UK Parliament. As part of the Parlia-

mentary Office of Science and Technology (POST) – Nuffield fellowship, Amelie published an impartial briefing (POSTnote) on '[Screen use and health in young people](#)' and a rapid response article on '[Monitoring wastewater for COVID-19](#)' (to which Marcos and David also contributed).

Katie has been struggling with her field work due to the on and off lockdowns, yet she still has been productive. She is about to submit a manuscript on soil metals and AMR. She also is about to start a three-month, part-time placement

Key 2020 Group Impacts

1. The WHO/FAO/OIE used our work to underpin [new guidance](#) for prioritising sanitation interventions to reduce global AMR spread. Our approach, developed by Josh, Myra and myself, suggests incrementally improved Water, Sanitation and Hygiene (WASH) implementation as the best way to reduce AMR spread while simultaneously reducing infectious disease.
2. Our research on understanding and mitigating the global spread of AMR was [short-listed](#) in the STEM (Science, Technology, Engineering and Mathematics) research of the Year category in the UK THE (Times Higher Education) Awards. Although we did not win, this is a great compliment to everyone in our group.
3. Our work on WBE related to the Covid-19 pandemic has been highly influential, including work with Northumbrian Water (who have been brilliant), the Joint Biosecurity Centre (JBC), and Defra. Marcos and Kelly are now UK "methods experts," and Marcos and David are on various government advisory teams. We have two MEng assisting the JBC on data analysis as their dissertation topics.

with Defra working on WBE data from the national surveillance programme. **Rui Xin**, also spent 2020 with us as a highly successful visiting student from University in China (see below).

In 2020, we had four MSc students, including **Matthew O'Donnell**, **Lawrence Adah**, **Palash Singh**, and **Riley Crum**. All were great students with whom we learned a lot.

Highlighted Publications

Of our thirteen 2020 publications, [Impact of redox conditions on antibiotic resistance conjugative gene transfer frequency and plasmid fate in wastewater ecosystems](#) in *Environmental Science & Technology* deserves a special highlight. It was co-authored by **Florence**, Colin Harwood, **Adrian**, Jason Snape, **David**, and reports heroic work by Florence that will be extended in our new UK-India project.

Our SARS-CoV-2 WBE work, also contributed to two highly regarded review publications: [Shedding of SARS-CoV-2 in feces and urine and its potential role in person-to-person transmission and the environment-based spread of COVID-19](#) in *Science of the Total Environment (SOTEN)* and [Making waves: Wastewater-based epidemiology for COVID-19—approaches and challenges for surveillance and prediction](#) in *Water Research*. Both reviews have been cited over 20 times in the few months they have out, with the SOTEN review being described by reviewers as among the most valuable reviews on SARS-CoV-2 in the literature, which is high praise given the many reviews out there.

Accolade



Our research effort [Engineering a halt to the 'superbug'](#) was [short-listed](#) in the STEM Project of the Year category for the [THE Awards](#). This project highlights our research understanding relationships among environmental pollution, inadequate sanitation, and antibiotic resistance around world. Impact story is described [here](#). Although we did not win, we are extremely honoured to make the shortlist. It was too bad that we could not physically attend the black tie award ceremony as it was held online.

Influencing Policy

In June, **David** and Peter Collignon released an *Insights* piece called [Scientists around the world are already fighting the next pandemic](#) in *The Conversation*. A shorter version entitled [Access to clean water may be as vital as cutting antibiotic use in the fight against superbugs](#) also was published in *The Telegraph*. Both articles discuss the importance of environmental factors in the spread of antibiotic resistance, especially in the developing world.

These articles comment on the recently-published [Technical Brief](#) on antimicrobial resistance from the World Health Organization; Food and Agriculture Organization; and World Organization for Animal Health. The Brief provides recommendations on the implementation of WASH, and wastewater management as strategy for preventing infections and reduce the spread of antimicrobial resistance around the world. David is among the lead authors on this Brief.

David also co-authored [Monitoring the presence and infection risk of SARS-CoV-2 in the environment: approaches, limitations and interpretation](#) as part of the Transmission of Covid-19 in the Wider Environment Group (TWEG), reporting to the UK Scientific Advisory Group for Emergencies (SAGE).

SARS-CoV-2 Wastewater Epidemiology

We were among the first research groups to be funded by the Engineering and Physical Sciences Council (EPSRC) to sample and analyse sewage to estimate local concentrations of SARS-CoV-2 in across North East England and in Santiago de Compostela, Spain. The aim being to develop a way to quantify the prevalence of the COVID-19 infected individuals across the regions based on sewage data. The [project](#) is being co-led by **David** and **Marcos**.

This project lead us to the UK-wide team on the new £1M research programme



**National Wastewater
Epidemiological
Surveillance Programme**

seeking to establish an early warning of future outbreaks and reduce reliance on costly testing of large populations. The National Wastewater Epidemiology Surveillance Programme (NWESP) [programme](#) led by the UK Centre for Ecology & Hydrology (UKCEH), also involves researchers from the universities of Bangor, Bath, Edinburgh, Cranfield, Lancaster, Oxford and Sheffield, plus the London School of Hygiene and Tropical Medicine. Read the news releases from [Newcastle University](#) and [UKCEH](#). This work is an extension to our UK and Spanish SARS-CoV-2 Project.



Kelly hard at work.

In April 2020, **David** was asked to join the TWEG, which provides technical guidance to the SAGE. Both **David** and **Marcos** formally and informally advise the JBC on SARS-CoV-2 detection methods in wastewater samples, modelling of Covid-19

spread based on wastewater and other data. This has led to two new projects using SARS-CoV-2 detection in sewage as a health predictor, one related SARS-CoV-2 spread in correctional facilities and the second related to the food production industry. This work has stretched our capacity, but it is also very exciting to be involved in the national fight against the pandemic.

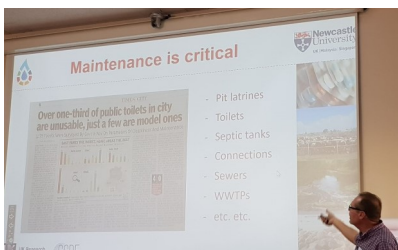
Finally, **David** and **Marcos** are the Scientific Advisors for NE England on the Core Cities project, which is quantifying relationships between sewage SARS-CoV-2 levels and Covid-19 cases major UK cities. This is a massive effort that is simultaneously assessing WBE and case data in Bristol, Leeds, Liverpool, London, Manchester, Newcastle, and Sheffield.

Out and About

Unsurprisingly, travel was at a minimum in 2020 due to pandemic travel restrictions.



In mid-February, **Myra** traveled to New Delhi with Dr Gopal Iyer to train community leads (CL) from the Centre for Urban and Regional Excellence on knowledge, attitudes, and practices (KAP) surveys they were to administer to households and medical professionals in low-income informal Indian communities. They wanted to equip CLs with knowledge and understanding related to technical aspects of the survey (e.g., terminology). Additionally, they wanted to clarify and mitigate misconceptions CLs might have about antibiotic use, drug resistance, and WASH activities. It was important for them to give CLs confidence to roll out the necessary training and instruction to other community team members, who with themselves will perform the surveys. Finally, though field visits, they piloted the surveys in the targeted communities, allowing CLs to put into practice the knowledge and knowhow gained during training. See project details [here](#).



In late February, **David** was back in Addis Ababa, Ethiopia to deliver a two-day workshop lead by Prof Barbara Evan from Leeds University. The workshop entitled on *Sanitation and Water Security – Towards a unified understanding* as part of the Water Security and Sustainable Development

Hub. The workshop was to address the general lack of understanding of the processes and components of effective sanitation, environmental sanitation, solid waste, and water supply systems hampers effective engagement. The aim of the workshop being to address this gap and ensure hub team members are well placed to include sanitation and water services in the wider water resources framework. Thereby, moving towards a hub-wide understanding of how sanitation and water supply fit within our vision of a water secure future.

Conferences, Webinars & Online Talks

In January 2020, all GrahAMRs attended the [Global Water Security Symposium](#), which celebrated 70 years of water and environmental health research at Newcastle University. **Amelie**, **Myra**, and **David** made presentations in the session on *Water, public health and sustainable livelihood*.



In May, **Amelie** was the first of us to attend a virtual conference, the Society of Environmental Toxicology and Chemistry (SETAC) Europe [30th Annual Meeting](#): Open Science for Enhanced Global Environmental Protection, something that has become common place in 2020. Amelie gave two pre-recorded platform presentations at SETAC, one on her PhD [project](#) talking about *Monitoring and modelling antibiotic resistance in a Southeast Asian river catchment* and the other one on a previous research project on *Multi-laboratory validation of a new marine biodegradation test for persistence screening*.

David, in August, joined Professor Dato' Ir Dr Zaini Ujang (Secretary General to the Environment Ministry of Malaysia) and Professor Azmi bin Aris (Director of Centre for Environmental Sustainability and Water Security, Universiti Teknologi Malaysia) as panellists and moderator at the UK-Malaysia Water Expert Forum: *The Linkage between Wastewater, Health and Sustainable Sanitation*. Day two of the webinar is available online [here](#).



In September, **David** spoke at the 2020 Newcastle University Alumni Day. The talk called *Fighting the Next Pandemic: Water quality, antimicrobial resistance and global health* is available [here](#).

In October, the GrahAMRs had a strong presence at the virtual [6th World One Health Congress](#). The group's research



was presented in three talks (**David**, **Marcos**, and **Pani**) and two posters (**Andrew** and **Myra**), with David and Marcos chairing separate sessions.

Visitors

Hosting **Rui Xin**, a PhD student from the School of Marine Science and Technology at Tianjin University (China), was an immense pleasure. She was an extremely valuable member of the research team during her time with us. She proved to be an independent and proactive researcher with a deep understanding of molecular microbiology techniques. She also has an incredibly positive attitude and was a joy to be part of our team.



Her core work was studying the fundamental nature and genetics vancomycin resistance *Enterococcus* in urban wastewater systems, work we expect to be published in 2021. However, she also became an invaluable member of our research team's work on "Wastewater Based Epidemiology" related to SARS-CoV-2 in sewage and its value as an early warning marker of Covid-19 cases in the community. This work enhanced Rui's molecular toolkit to environmental virology, a nearly unique skill for the future.

Ending Projects

Our Innovate UK/Newton Fund project *Improving community health in Malaysia using sustainable decentralised wastewater treatment* came to an end 2020, as did the [DARWIN: Dynamics of antimicrobial resistance in the urban water cycle in Europe](#) project.

Ongoing and New Projects

Our EPSRC funded [Tackling AMR in wastewater systems with Sneaky Bacteria](#) was scheduled to end but has been extended to February 2021.

In addition to the wastewater epidemiology work, NERC funded the [AMRflows: Antimicrobials and resistance from manufacturing flows to people: joined up experiments, mathematical modelling and risk analysis](#). Jan Kreft is the PI, and **David** is one of ten Co-PIs on this large project. This project is just commencing, initially trying to adapt the planned sampling program to pandemic conditions. We also are in the process of the recruiting a new PDRA for the project, which we hope will join our team by April 2021.

In late December, the project: [Identifying Best Practice for Empowerment through Entrepreneurial Freedom: A Project for the Marginalized in Slum areas in Delhi](#) was awarded by the Rising Tide Foundation to start in April 2021 (for 3 years). This is an exciting multidisciplinary project led by Prof Pauline Dixon, it investigates social and technical approaches to improve the quality of life in several slum types in India. **Myra** will move to this project on 1 April 2021 when it starts, and **Kelly** will move part-time to the project later in the year when demands from her WBE work declines.

Hydraulics at Home

With our labs being closed due to Covid in Semester 1, David had to rethink how to deliver laboratory skills for the MSc class *Introduction to Practical Hydraulics*. Many thanks to **Katie**, who came to the rescue, with two "Hydraulics at Home" lab practicals. They were brilliant because they used kitchen sinks to 1) investigate different flow regimes from your tap and 2) measuring open channel flow rate using homemade weirs. We are thinking of making them public on YouTube because they were so successful.

On the Horizon

As previously mentioned, we were just awarded a new project for the Joint Biosecurity Centre called *Wastewater-based epidemiology for Her Majesty's Correctional Service*, which will assess the value of WBE as an early warning of health conditions in several types of prisons. The novelty with this work is that we are expanding wastewater analysis to include viruses other than SARS-CoV-2, enteric pathogens, AMR, and microbomes. The goal being to examine other infectious disease markers that might be responsive to WBE approaches. We also are negotiating another targeted research project on SARS-CoV-2 and Covid-19 at food production facilities, although the work is still being negotiated.

Beyond the above, we have two MEng students, **Savannah Lawrence** and **Matt Day**, performing their dissertation work on WBE data from Defra and the JBC. While **Katie** is starting a part-time internship at Defra to work with their Senior Epidemiologist on merging environmental and human health data to aid in health protection.

Finally, we were just awarded a CDT WIRE PhD studentship, which will study *The future of wastewater-based epidemiology*, sponsored by the EPSRC, Northumbrian Water, and Scottish Water. **David** and Dr Vanessa Speight at the University of Sheffield will supervise the studentship. The announcement will be released soon for applications, so check our blog.

Please email us at grahAMR@newcastle.ac.uk to 1) submit a piece for the next newsletter or blog post and/or 2) request to be placed on the newsletter distribution list.



<https://blogs.ncl.ac.uk/grahamr>



Thank you Vincenzo.