

Welcome to the newsletter of the Quadram Institute.

It is now a year since the COVID-19 pandemic swept across the world. Whilst we are still to see the full global cost to society, the collective contribution of the scientific community to understanding the virus, its transmission and developing vaccines gives us hope that we can find ways to return to more normal life again. There will be lessons to learn about the reaction to the pandemic, but for now we can reflect on the way the scientific community has pulled together. I take immense pride in the way that all Quadram Institute staff and students have adapted under COVID-19. Whether that has been pivoting to new projects that directly address the coronavirus threat, or adapting to continue our important research, the response has been excellent.

The achievements of Justin O'Grady, Andrew Page and the team sequencing COVID-19 genomes are documented later in this newsletter. The capability they have built in a short time, now able to sequence hundreds of viral genomes a week, has provided invaluable information on the virus locally and nationally. I hope, as we move towards the post-COVID era, that the value of this sort of genomic surveillance is recognised so that we can be ready for any future threats.

As we build towards the future, I am pleased that we have secured investment into facilities that will support our future research programmes. Cynthia Whitchurch has secured £1.5 million from BBSRC for highly-advanced microscopy equipment and associated dedicated computing and analysis software that will provide capabilities in super-resolution imaging, which will benefit many areas of our research. BBSRC investment in the NRP

Biorepository is coming to fruition under the project management of Lizzie Meadows, with a new centralised system to store and manage human samples in this Norfolk and Norwich University Hospital facility. This will support collaborative projects across the Norwich Research Park, particularly in cancer and gut health, and is already proving invaluable supporting the COVID-19 genome sequencing. Future deployment of an AI-driven big data extraction tool will further strengthen health research in Norwich.

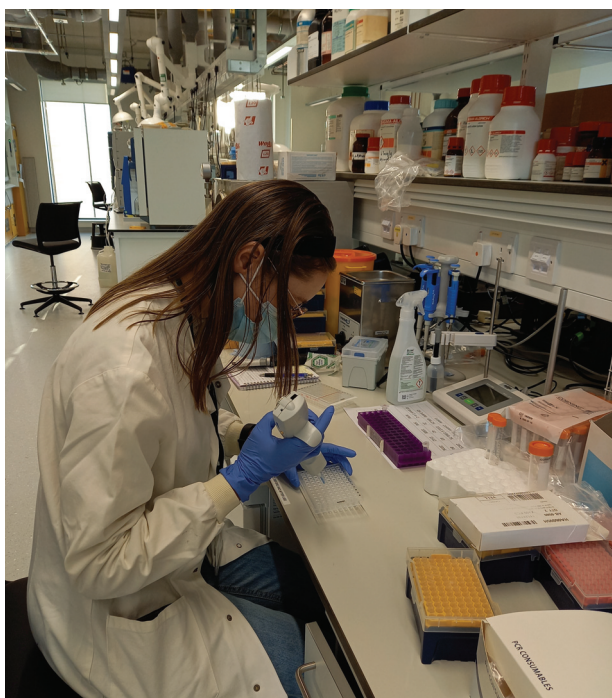
COVID-19 has shown how scientific collaboration can tackle the major issues facing global society; we have seen this across the Norwich Research Park. Our interactions with our NRP partners are crucial to delivering our mission, so I am pleased that the Quadram Institute is involved in two new initiatives that bring together interdisciplinary researchers to tackle grand challenges. The Norwich Institute of Healthy Ageing and the Norwich Institute for Sustainable Development bring together partners to develop solutions in these areas where the Norwich Research Park is a world leader.

We also welcome Ashley Blackshaw and Chris Quince to the institute. Ashley has been working with our Gut Microbes and Health programme for a number of years and will be investigating microbe-gut-brain interactions, and supporting neuroscience research. Chris will be working across Quadram and the Earlham Institute on high-resolution microbiomics and metagenomic profiling of microbial communities.

Ian Charles, Quadram Institute Director

In the 12 months of the COVID-19 pandemic, the Quadram Institute has sequenced over 10,000 positive samples of the SARS-CoV-2 virus. As part of the COVID-19 Genomics UK (COG-UK) consortium, this provides vital public health information by tracking genomic changes in near real-time. The expertise and dedication of the Quadram team, bioinformatic support from CLIMB (Cloud Infrastructure for Microbial Bioinformatics) and easy access to demographic data via the Norwich Research Park Biorepository have combined to achieve this.

bit.ly/QI21A01



By the end of summer, the large-scale genome sequencing and analysis was providing detailed epidemiological information about the spread of SARS-CoV-2, as well as helping local public health authorities identify and control outbreaks.

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The 'genome detectives' work has helped protect the most vulnerable people by understanding transmission in relation to care homes, and by advising the UK Scientific Advisory Group for Emergencies (SAGE) on how to safeguard the most vulnerable.

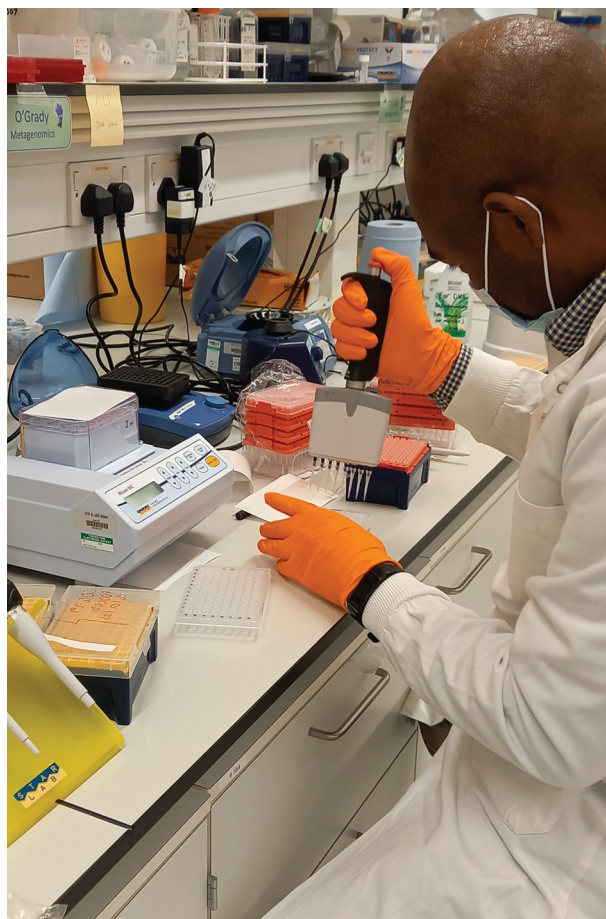
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The importance of this work was recognised by the Department of Health and Social Care who, through their Testing Innovation Fund, provided an additional £12 million to COG-UK to expand their surveillance. This provided extra equipment and staff for Quadram Institute, which was already leading the way in high-throughput genome sequencing.

bit.ly/QI21A04

The value of this genomic surveillance was demonstrated in December when a new Variant of Concern was identified. By identifying changes in the virus in real time, how it is tackled can be adjusted.

bit.ly/QI21A05



The genome sequencing efforts allow us to monitor the spread of these SARS-CoV-2 variants locally and nationally, providing a constantly updated snapshot of the situation.

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Vaccines offer hope for an end to the devastating effects of this pandemic, and the development, trialling and deployment of multiple vaccines within such a short time frame is remarkable. Quadram's Clinical Research Facility has played its part, hosting a Phase III vaccine trial

bit.ly/QI21A07

Vaccines are an important part of the solution but the more we know about the virus, the better we can adapt and control its transmission. To this end, the COPS Study is looking for people within 40 miles of Norwich who have recently tested positive for COVID-19 to take part in research into the virus' prevalence and persistence in the gut.

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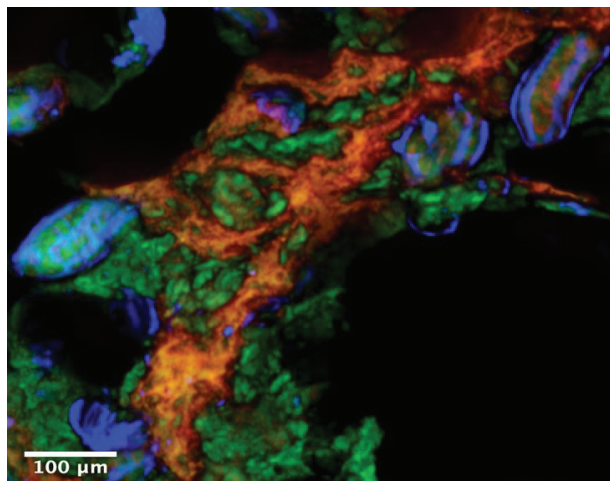
A poster for the COPS Study recruitment. The poster has a green background. At the top, it asks three questions: 'ARE YOU AGED 18 OR OVER?', 'HAVE YOU TESTED POSITIVE FOR COVID-19?', and 'DO YOU LIVE WITHIN A 40-MILE RADIUS OF NORWICH?'. Below these questions is a QR code with the text 'SCAN ME'. A central banner reads 'YOU CAN HELP US WITH COVID-19 RESEARCH IN NORWICH'. The main title 'PARTICIPATE IN THE COPS STUDY' is prominently displayed in the center. At the bottom, there are logos for Quadram Institute, NHS Norfolk and Norwich University Hospitals, and James Paget University Hospitals, along with the website 'WWW.QUADRAM.AC.UK/COPS'.

Quadram's expertise in food structure, digestion and the microbiome is delivering novel foods and ingredients designed to improve health, especially in the area of higherquality carbohydrates. Developing food products with resistant starch can help people control blood glucose levels and reduce the risk of type 2 diabetes

PulseON® is a new ingredient developed by Cat Edwards at the Quadram Institute, with collaborators at King's College London. In human trials PulseON® lowered the blood glucose response to white bread by 40%. A specially developed process preserves cellular structure, making its starch more resistant to digestion.

The PulseON® technology is patent-protected and the group are looking at commercial exploitation and exploring ingredient applications in a broader range of food products.

bit.ly/QI21A09



Wrinkled 'super peas', a natural variant that Mendel studied, produce more resistant starch than normal peas and, in another human study, prevent sugar spikes, and benefit the gut microbiome.

bit.ly/QI21A10



Quercetin, found in onions, apples, tea and other leafy vegetables, interacts with cells lining blood vessels in a way that may protect them from inflammation and damage caused by high glucose spikes, according to a study led by Paul Kroon.

This research provides evidence of a mechanism which may explain why people who consume the highest quantities of quercetin in their diets have lower risk of developing cardiovascular diseases

bit.ly/QI21A11

Mycoprotein is a food ingredient, branded as Quorn, and used in meat replacement products. It reduced the digestion of fat and bound bile salts during simulated digestion, which may explain why consumption of mycoprotein lowered cholesterol in previous clinical trials. Further research at Quadram suggests that mycoprotein could also reduce the digestion of carbohydrates, mediated by the mycoprotein structure and its ability to bind and retain the enzyme alpha amylase within its cell walls.

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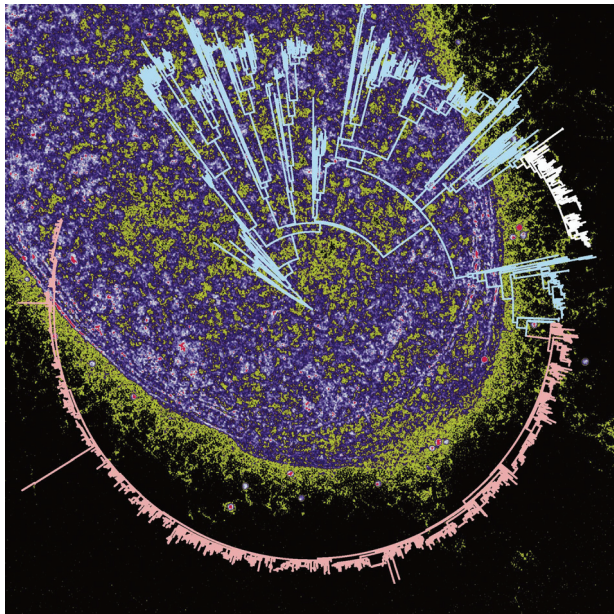
Supplements containing Human Milk Oligosaccharides (HMOs) may help improve the gut health of adults, according to new research carried out at the Quadram Institute.

Using highly advanced 'gut-on-chip' technology, Nathalie Juge and colleagues showed that the fermentation products of HMOs made the gut lining less 'leaky'. This highlights the usefulness of these advanced physiological models in understanding the complexities of gut barrier function.

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Mark Webber and colleagues have shown how the development of antibiotic resistance by bacteria can have unexpected 'side-effects' for those bacteria, including affecting their ability to cause disease. This new research has the potential to help in the development of new treatments and ways to stop antimicrobial resistance developing.

bit.ly/QI21A14



Mark Pallen and Andrea Telatin have developed an automated system for generating new names for bacteria. Based on the system devised by Linnaeus, the 'Great Automatic Nomenclator', is designed to help bacteriologists give well-formed names to the huge numbers of new species that are being discovered through DNA analysis.

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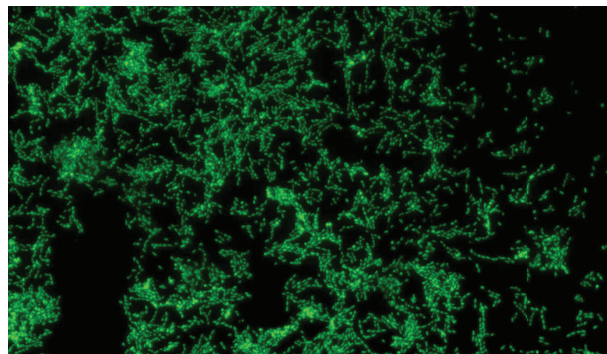
The Cloud Infrastructure for Microbial Bioinformatics (CLIMB) project has been recognised in the annual HPCwire Readers' and Editors' Choice Awards. CLIMB was recognised with the Readers' Best High Performance Computing Collaboration award for its role supporting the COVID-19 Genomics UK (COG-UK) Consortium.

bit.ly/QI21A16

Volunteering can be an incredibly rewarding experience, both personally and professionally. James Lovett and Gabriel Astorga, both UEA undergraduate students, gave us some insights into their experiences

bit.ly/QI21A17

bit.ly/QI21A18



Research from Rob Kingsley's group has implicated a toxin-carrying virus in the emergence of a new strain of *Salmonella* in pigs. Whole-genome epidemiology of a *Salmonella* Typhimurium strain that causes half of the UK's infections indicated that a bacterial virus, or phage, had infected this strain multiple times, conferring a competitive advantage in the form of a toxin gene that helps *Salmonella* infect their animal hosts.

bit.ly/QI21A19



The DIME Study

Dietary Bioactives and Microbiome Diversity

Food and Health researchers at the Quadram Institute are looking for participants aged between 18 and 65 with no known medical conditions to take part in the DIME Study (Dietary Bioactives and Microbiome Diversity), to better understand the relationship between diets rich in plant bioactives and our microbiome, and how this affects metabolic health.

<https://quadram.ac.uk/dimestudy/>

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