# SCIENCE UNDER LOCKDOWN

***"We will be guided by the science"*** **has been a recurring mantra throughout the Covid-19 crisis. But how does science keep going under lockdown? Caroline Wood explores how the measures taken by the Science and Technology Facilities Council (STFC, part of UK Research and Innovation, UKRI) have allowed vital research to continue.**

## THE CENTRAL LASER FACILITY – SHINING A LIGHT ON THE CORONAVIRUS

**Professor John Collier leads the UK's Central Laser Facility (CLF), based at STFC's Rutherford Appleton Laboratory in Harwell, Oxfordshire. The facility has 200 staff and boasts some of the world's most impressive lasers, capable of imaging detail at the single molecule scale.**

Professor John Collier is Director of the Central Laser Facility.

For John, there was never any question of whether CLF should remain open in some capacity when the lockdown was imposed. With their unique facilities, he knew that they could help to discover valuable knowledge about the coronavirus. Within days, CLF issued a Rapid Access Call for research relevant to the SARS-CoV-2 virus and Covid-19, using the facility's high-resolution microscopy suite called Octopus. But this was only possible thanks to advance planning and the fact that much of the facility can operate with a very low level of staff. "The main reason we have been able to keep going is that many of our lasers can be operated by only one or two trained scientists" John says. This means that CLF now has a very different environment to 'business as usual', due to the complete absence of the wider scientific community from the site. "Normally we would have three to four university groups on Octopus at any time, who would participate in the experimental procedures" John says. "We are now having to reconfigure everything so that external users can participate remotely in real time. It's not ideal – we'd rather be helping these groups to design and run their own experiments."

Even so, this has facilitated several clinically-relevant experiments including an investigation into the cellular response to a potential drug treatment designed to reduce the inflammatory response in the lungs (often the cause of death in Covid-19 cases). "With colleagues on the Campus at the Diamond Light Source, the electron Bio-Imaging Centre and the Rosalind Franklin Institute, we have also been working on projects to map in high resolution where the coronavirus goes once it enters a cell and which cellular components it interacts with" John says. A further experiment is exploring whether anti-viral nanoparticles could target reservoirs of coronavirus in brain neural tissue. It is unusual for such a high proportion of CLF's work to have a virology basis, and there have been some challenges in handling the experimental samples. "Normally, users would bring living samples to us, but now we are having to establish delivery chains to make sure cell samples arrive intact" John says.

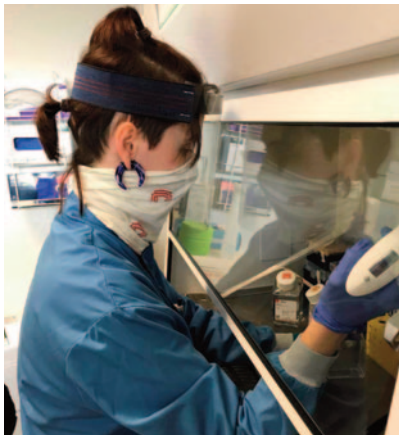
### ADVANCE PLANNING

Since a large part of scientific research involves troubleshooting problems, it is not surprising to learn that John was already convening daily coronavirus-focused business continuity meetings several weeks before the lockdown. It was clear that reducing on-site staff numbers to the bare minimum required to remain operational meant that most would have to work from home. "We realised that half the department was not set up for home working, so we immediately began sourcing laptops, cameras and WiFi dongles. This meant that by the time the lockdown was imposed, our staff could get set up for remote working very quickly." Besides this foresight and preparation, some fortuitous timing also helped the community to adapt. CLF are involved with several projects currently in the design and modelling stage, including the Extreme Photonics Application Centre. "This has given us a lot of computer-based design and modelling work to do, so we are still being productive" says John. "For other researchers, it's been a chance to finally work through a backlog of data – I expect a lot of papers will be written during this time!"

But ultimately, science needs a continual flow of data and John's challenge has been to work out how the rest of the facility can safely reopen. "The larger facilities, such as the Vulcan Laser, will be easier as there is more space for people to move around, and much of it is automated" he says. The smaller laboratories used by multiple groups will be more problematic. Approaches adopted have included assigning individuals or groups specific zones; alternating between different groups each week and introducing a Monday-Thursday working week, to allow any traces of the virus to die off over the weekend should it be present. But even with these measures in place, John worries about the long-term repercussions for early-career researchers, particularly since 50-60% of the facility's users are PhD students at a critical part of their research training.

Elsewhere, other STFC labs and facilities have also been trying to keep work as 'business as usual' as possible and to contribute to the effort against coronavirus. STFC's Scientific Computing Department, for instance, are continuing to develop software for determining the 3D-structure of proteins from crystallography and electron microscopy data. This is now being used to understand how the coronavirus spike protein enables it to gain entry into human cells.

Meanwhile, STFC's ISIS Neutron and Muon Source facility is working to be operational again in the autumn, whilst at the same time continuing to publish numerous new scientific findings and running various online webinars for its large research community. STFC has also run its 3D printing capability 24/7 to produce PPE for local NHS Trusts and hospitals, including face shields and headbands. □



Researchers working under social distancing guidelines at STFC's Central Laser Facility. © Central Laser Facility

## RESEARCH COMPLEX AT HARWELL – BUILDING UP CAPACITY

**Materials chemist Dr David Payne is Interim Director of the Research Complex at Harwell, located on the Harwell Campus. Although the Campus closed when lockdown was introduced, the Research Complex remained open. David and the core team he leads swiftly brought in new measures that allowed them to continue their safe working capacity, whilst launching new projects on tackling Covid-19. At the time of writing, 40 researchers can work in the building at any time.**

Dr David Payne is Interim Director of the Research Complex at Harwell. He is also a Reader of Photoelectron Spectroscopy of Materials at Imperial College London.

"It's been a while since I was a PhD student and spending all my time at the bench" David says. "So my initial action was to 'think' my way through the laboratory buildings and assess, to the highest detail, every possible source of potential infection and the areas where social distancing cannot be easily maintained." According to David, the core team have done "an incredible job" in making the Research Complex Covid-secure. One of their first steps was to get rid of any pen and paper sign-in sheets for out-of-hours working and replace these with a swipe card system, so that the Security Officers would be aware when users left. Using the floor plans, the building was divided into zones which could safely contain researchers, with a variety of different access points. "We had been looking into introducing an online system for hot-desking, so it has been relatively easy to modify this for the labs themselves, so that scientists could 'check in' remotely in advance." says David. "What is important for us is how to find the balance between individual research autonomy against needing to manage occupancy and use of space. Our system allows researchers to plan their work better, and allows others to see this in advance and accommodate their work around others." Using this system, they hope to further increase the number of researchers allowed in the building at any one time.

According to David, sharing best practice has been invaluable, including his work as part of STFC's Bronze Business Continuity team. "This made me aware of what colleagues in other facilities were doing, besides the vital services that support research" he says. "Everyone has stepped up to the challenge and we've all worked hard with a common purpose to come up with solutions." Aware of the need to prioritise PPE, David and his team have been keen to embrace innovative alternatives.

They have installed new door handles that dispense alcohol hand gel besides replacing exit push-buttons with motion activated ones, thereby removing a common touch point. "All these small cumulative changes have enabled our vital research into coronavirus to continue, and now accelerate, with one of our groups at the Research Complex recently submitting a research article on Covid-19 for Peer Review" he says.

"The real challenge though is that science is an inherently social activity. There are certain activities you just can't do in isolation, even with Zoom meetings" David says. One of the things he misses most is the chance to discuss the latest research findings with scientists from across the world. "This must be the first time in many years when I am not flying overseas for a conference, and in many ways that is a good thing. My carbon footprint is much better now, which I'd like to maintain even after things have gone back to normal." Like John, he is also worried about the long-term repercussions on PhD students and other early-career researchers. "How can we safely train the next generation of scientists? At the moment, we are only looking at the immediate crisis in front of us but if this goes on, there will be impacts we won't see until many years down the line." □

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