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Microbiology Society online workshop on SARS-CoV-2 and COVID-19, Wednesday 29 July 2020

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This workshop was fully subscribed and was attended by an audience of approximately 150 people, who listened to 29 short talks given by researchers from the UK and ROI. The intention of the workshop was to act as a showcase for the research on SARS-CoV-2 and COVID-19 currently underway, but also to provide a platform for people to present their future plans and seek input and advice. It was intended therefore to bring together the various researchers and interested parties to promote exchange of ideas; in particular, it sought to highlight opportunities for collaborative work and sharing of reagents. In that regard, as well as presentations on the biology of the virus, Arvind Patel (CVR, Glasgow) and Yann Le Duff (NIBSC) described extensive open resources that are available for researchers. More details can be found at https://mrcppu-covid.bio/ and www.nibsc.org/cfar.

A recurrent theme throughout the day was the challenge encountered by many groups in starting research projects on SARS-CoV-2. These included seeking permission for the work from the Health and Safety Executive, obtaining virus stocks and then establishing safe working practices and robust protocols for propagation and titration of virus, and of course securing funding for the work. To compound these obstacles there was the overarching issue of lab closure following lockdown, although with a few exceptions this restriction was lifted for COVID-related research. The extraordinary progress presented during the workshop is a testament to the dedication and hard work of the virology community.

A second thread that ran through the workshop was that very few labs in the UK/ROI had previous experience in working with coronaviruses. In general groups had rapidly repurposed their activity and applied their skills and expertise to SARS-CoV-2. Again this flexibility and willingness to tackle new challenges reflects well on the community.

The workshop started with a session on the molecular and cellular biology of SARS-CoV-2. The challenge of manipulating the ~30 kb cDNA of the viral genome was highlighted by Andrew Davidson from Bristol who described their approach to this problem and successful generation of cDNA for infectious virus and subgenomic replicons. These reagents were already feeding into collaborative work with, for example, Wendy Barclay (Imperial) to understand the role of proteolytic cleavage of the spike protein by furin in SARS-CoV-2 transmission, and Hazel Stewart (Cambridge) who described the identification of a novel protein ORF3c and initial progress towards its characterization.

Other labs have used virus obtained from clinical samples: Greg Towers (UCL) characterized the innate immune response to virus infection in Calu-3 lung epithelial cells; Zania Stamataki (Birmingham) is investigating aspects of virus infection and transmission; Sharon Brookes (APHA) has established a ferret model to study pathogenesis; lastly, David Matthews (Bristol) described 'omics-based approaches to understanding replication, host-cell interactions and pathogenesis, using Nanopore technology to directly sequence mRNA from infected cells. Connor Bamford (Belfast) described the establishment of a repurposing drug screen to identify small molecule inhibitors of SARS-CoV-2. Other therapeutic approaches included Gemma Swinscoe (Leeds) who has established an assay for viroporin activity of the E protein and Catherine Adamson (St Andrews) who is using a cell-based screen based on the inhibition of virus-induced cytopathic effect.

The latter two talks highlighted the fact that establishing work with SARS-CoV-2 in a BSL3 laboratory is non-trivial and time consuming, so many groups presented data derived from various model systems. These included lentiviruses pseudotyped with the SARS-CoV-2 spike (S) glycoprotein which Dalan Bailey (Pirbright) used to show that S could bind to the receptor ACE2 protein of diverse species. Others expressed individual viral proteins: Gill Elliott (Surrey) looked at translocation of envelope proteins, Rachel Ulferts (Crick) and Helena Maier (Pirbright) were interested in membrane trafficking and structures.

The SARS-CoV-2 genome was a focus for several groups: Emma Thomson (CVR, Glasgow) used state-of-the-art sequencing to track multiple introductions of SARS-CoV-2 into Scotland before travel restrictions were applied. Bioinformatics approaches allowed Peter Simmonds (Oxford) and Colin Sharp (Edinburgh) to analyse the epigenetics of the virus (RNA editing and CpG/UpA frequencies).

Analysis of serological responses was an important theme: Katie Doores (KCL) looked at longitudinal antibody responses showing that disease severity correlated with neutralization

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activity but not the kinetics of the response. Maia Kavanagh Williamson (Bristol) and Alex Tarr (Nottingham) also examined antibody responses, describing evidence for neutralizing and virus entry-enhancing antibodies during severe infection. Suzy Pickering (KCL) and Abbie Bown (PHE) evaluated a range of commercially available serology assays. On a related subject, Nicola Stonehouse (Leeds) described a VLP platform for antigen presentation that was being applied to SARS-CoV-2, and Simon Graham (Pirbright) provided an update on evaluation of candidate vaccines in pigs, highlighting that a prime-boost protocol was more efficacious than a single dose.

Other diverse approaches to understanding SARS-CoV-2 biology or working towards therapies included Stergios Moschos (Northumbria) who described a novel hand-held system to detect viruses (and other pathogens or substances) in exhaled breath or other aerosols, Abeer Shaalan (KCL) who is interested in caspase inhibition as a method to prevent the cytokine storm, and Chris Coleman (Nottingham) who is seeking to extrapolate his work on MERS protein functions to SARS-CoV-2.

A final discussion revealed great enthusiasm to hold further events, perhaps taking place over two half-day sessions to avoid Zoom fatigue. Providing a forum to share ideas, protocols and reagents/systems was seen as a critical outcome and the Microbiology Society was identified as the obvious organization to facilitate this. All agreed that this should be expedited.

Mark Harris, University of Leeds, on behalf of the other members of the organizing committee:

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Lindsay Broadbent, Queens University Belfast

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