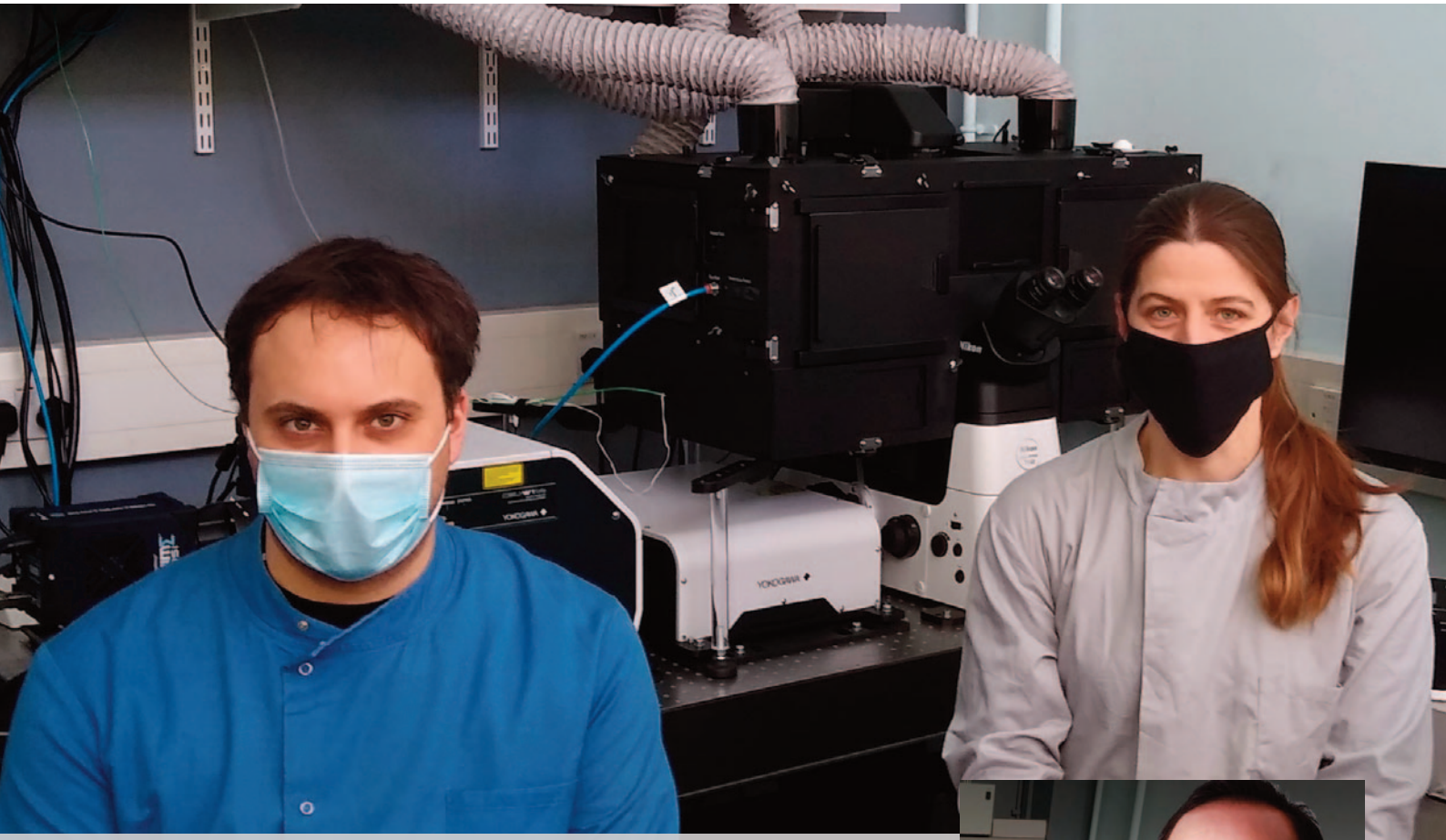
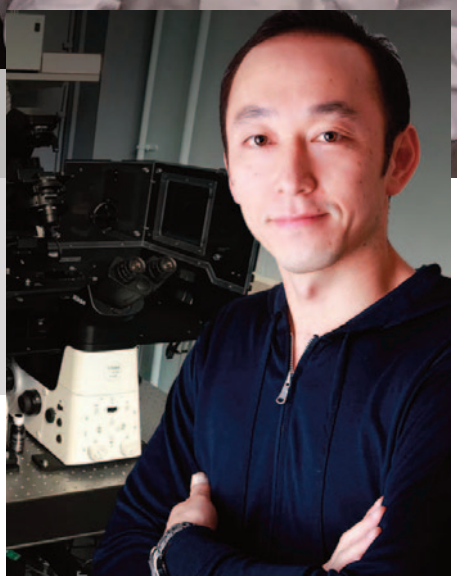
Dr Yohei Yamauchi: How do viruses break into cells?



▲ Dr David Bitto (left) and Dr Katja Klein (right), postdoctoral researchers, School of Cellular and Molecular Medicine, University of Bristol, UK



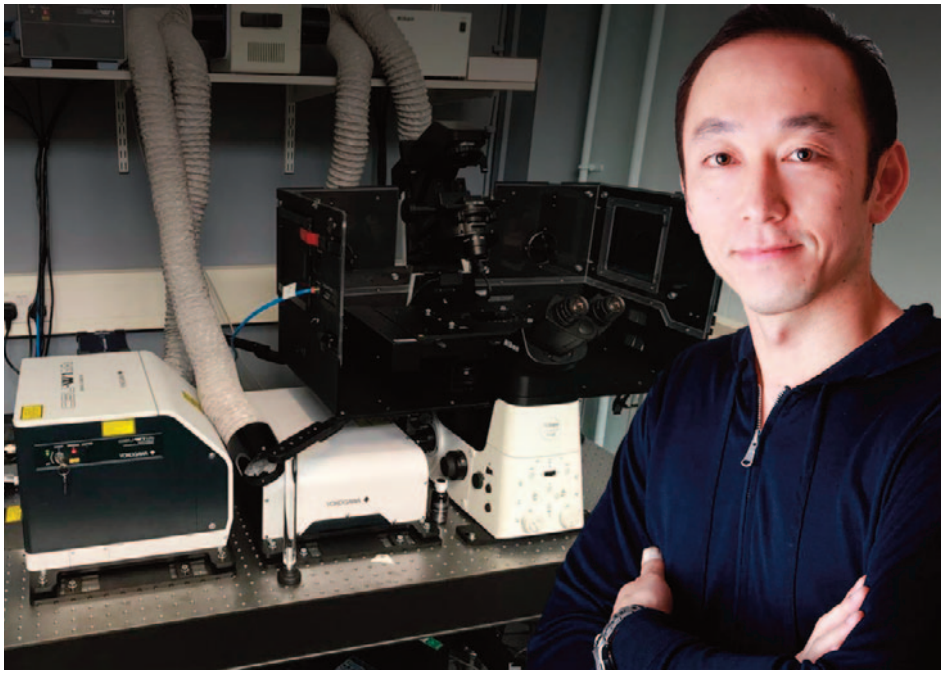
Dr Yohei Yamauchi, Principal Investigator, Cell biologist of viral infections, School of Cellular and Molecular Medicine, University of Bristol, UK ►

Please tell me more about your research

My research group studies how viruses interact with our cells to establish infection. Viruses are so adept at hijacking the cell's biosynthetic machinery to infect and replicate themselves. In our laboratory, we are looking at mechanistic insights of how viruses, such as influenza or SARS-CoV-2 interact with the host cell during the early stages of infection.

Ultimately, our goal is to use the knowledge we gain from our research to design novel therapeutic strategies. We use an established systems biology approach and a variety of techniques that includes imaging, to dissect the host-virus interactions.

Recently, we have been awarded the European Research Council's (ERC) Synergy Grant to pursue our work in identifying host factors for the infection of viruses that could be used as targets for universal anti-viral drugs or vaccines.



What are the challenges of imaging host interactions with viruses?

RNA is much less stable than DNA. For this reason, imaging of RNA viruses, such as influenza and SARS-CoV-2 by labelling their genome is a challenging task.

Another challenge when studying the viral life cycle is the difficulty in imaging movement of the virus during infection in high speed and high resolution.

How do you overcome some of these challenges and how can Nikon help you?

We are working with conventional fluorescent dyes (Alexa Fluor) and in the near future with Quantum dots (QDs) (semi-conducting nanoparticles) that possess optical properties of superbright fluorescence when exposed to light, and excellent photostability.

We plan to use QDs covalently linked to streptavidin that can form a stable molecule with biotin-labelled RNA viruses and be rapidly and continuously imaged for a long time.

Viruses are tiny entities which provide new perspectives for studying cellular processes during infection. Imagine you are looking at your house from a satellite and then being able to see it from the perspective of a person entering the house - that is what it is like to try and track a virus entering a cell. By understanding these processes better, it is thought that antivirals can be developed that could be adapted for more than one target pathogen.

We have purchased a CSU-W1 SoRa dual spinning disc confocal microscope from Nikon to provide us with a high-speed, high-resolution imaging tool. We plan to use the two cameras for imaging influenza viruses and track their live movement across a cell. The field scanners in this system enable low dosage exposure and are gentle on the specimen making them ideal for our research.

Do you have any previous experience with Nikon products?

Yes, I worked with the first Eclipse Ts2 inverted microscope that was sold in the UK and that is how I got to appreciate Nikon's microscopes. I was very satisfied with this configuration. I have also previously worked with Yokogawa Electric Corporation that developed the spinning disc system of the CSU-W1 SoRa microscope and contributed to giving this microscope its catchy name.

What is your impression of Nikon?

I have always enjoyed working with Nikon instruments and their attentive customer service. The Eclipse Ts2 inverted microscope was always easy to work with and had great optical performance.

We purchased the CSU-W1 SoRa microscope as we needed a high-speed, high-resolution imaging tool and we look forward to working closely with the customer service team to install and use it.

What developments would you like to see in the future for imaging viruses?

A system, preferably compact, that enables seamless transition of a specimen from fluorescent light microscopy to electron microscopy for correlative light and electron microscopy (CLEM).

@YamauchiLab

Yohei Yamauchi studied medicine at Nagoya University, Japan. During med school he became fascinated by how viruses hijack cells and spent many hours on the confocal microscope. After graduation and 2 years of clinical residency, he obtained a PhD in Virology at Nagoya in 2008 and moved to ETH Zurich in Switzerland as a postdoc (and later in 2015 to the University of Zurich) to work on the mechanisms of influenza virus entry and uncoating. In 2016, he became Associate Professor at the University of Bristol and focuses on virus-host cell interactions in viral entry, uncoating and infection. Currently, his research team works on the influenza and SARS-CoV-2. Yohei is also a visiting Associate Professor at Nagoya University.