COVID-19 Virology, immunology and diagnostics – a year of achievement

The onset of the COVID-19 pandemic in early 2020 saw the mobilisation of unprecedented collaboration across King’s Health Partners, drawing together infectious disease and critical care physicians, nurses, immunologists, virologists and diagnostic service specialists.

Working together, these teams have made internationally leading contributions informing our understanding of SARS-CoV-2, the disease it causes (COVID-19) and the immune response to infection or vaccination. Leveraging this knowledge has led to treatments to control disease, tailored amendments to vaccination programmes for patients, and the discovery of novel anti-viral drugs.

Rapid and accurate diagnosis is a central pillar of infection control. At the onset of the pandemic and working with our diagnostic laboratory at Viapath, King’s College London pivoted facilities to assist with hospital testing while also trialling alternative methodologies (Martinez-Nunez). This work laid the foundation for saliva-based PCR testing that continues to be employed by KCL-TEST in surveillance testing for King’s College London staff and students. This has played a crucial role in the early identification of infection outbreaks (eg, halls of residence) and in maintaining safe working environments on King’s College London campuses. In the hospital setting, co-development and clinical evaluations of ’point-of-care’ lateral flow immunoassays combined with onsite SARS-CoV-2 genome sequencing enabled their rapid introduction into routine service including for rapid isolation-decisions for Emergency admissions at the peak of the second wave (Neil, Edgeworth).

High throughput immune profiling of severe COVID-19 patients during wave one identified signature patterns of immune dysregulation that predicted disease outcomes, including excessive production of the cytokines IP-10, interleukin-6 and interleukin-10 (Hayday, Edgeworth, Shankar-Hari). This work laid the foundation for a multi-centre trial demonstrating that therapeutic blockade of interleukin-6 reduces the death rate in severe COVID-19, especially when combined with corticosteroids (Shankar-Hari). Related immunological studies with paediatricians at the Evelina London Children’s Hospital helped define a rare

“The integration of clinical teams with researchers that has been fostered by King’s Health Partners was a perfect base for instantly putting into place the collaborations that were essential to understand and manage COVID-19.”

Prof Adrian Hayday

SARS-CoV-2 variant tree off all 1335 sequenced patient isolates at Guy’s and St Thomas’ NHS Foundation Trust since start of the pandemic when our specialised High Consequence Infectious Diseases Unit admitted some of the first UK cases. It demonstrates the explosion of viral genetic diversity due to global connectivity and the need for continued monitoring to detect emerging variants that might evade the immune response to prior infection or vaccination.

Ongoing serological monitoring of COVID-19 patients and health care workers provided detailed insights into antibody responses to natural infection. The initial intense response declines over the first few months, but then flattens out over a longer period, providing some cross-neutralisation (protection) against the main emerging variants of concern such as alpha (Kent) and delta (India) (Doores, Edgeworth). This distinctive ability to link both serological monitoring with on-site daily SARS-CoV-2 sequencing, provides real-time detection of potential vaccine escape mutants that informs a rapid public health response with relevance to future vaccination planning and targeted community follow-up (Snell, Nebbia). By combining different immune analyses, King’s Health Partners scientists are monitoring patient responses to COVID-19 vaccination, and have, for instance, helped inform UK guidance for effective cancer patient vaccination (Irshad, McLornan, de Lavallade).

“The King’s Health Partners response to the pandemic has been inspiring in its breadth, intensity and impact. It has been our privilege to work with so many talented and committed colleagues from across our partner organisations, and we look forward to building on this spirit collaboration in the future.”

Prof Michael Malim, Head of School of Immunology and Microbial Sciences, King’s College London

By the end of the first wave, King’s Health Partners scientists and clinicians had engaged with more than 20 companies and successfully identified three, rapid lateral flow point of care antigen tests, that later went into routine service.

In December 2020, these tests started to be used in the emergency department at St Thomas’ Hospital. This meant more than 90% of Covid-19 patients were diagnosed ahead of admission or discharge.

This is the first British-made and approved test of its kind.

In 2021, the Government announced it had purchased 20 million tests following approval by Public Health England.

The test is being used on approximately 700 patients at St Thomas’ Hospital each week.