Global bioinformatics surveillance drives innovation in SARS-CoV-2 variant detection tests

Market-leading intelligence is the catalyst behind Novacyt's ability to anticipate - and respond - to emerging new SARS-CoV-2 variants. Global tracking of virus mutations enables its R & D division to quickly develop tests that not only identify variants of concern (VOCs) – originally identified in countries such as the UK, Brazil, South Africa etc - in less than two hours but also identify and add mutations that are likely to become biologically relevant. Novacyt's bioinformatics surveillance group has worked with a global network of virologists tracking variants to identify the mutations expected to pose the greatest challenges to healthcare and vaccine efficacy. Such foresight – plus the unique and well-established expertise of its research and development team in designing primers and probes – has positioned the company at the cutting edge of innovation in SARS-CoV-2 identification kits.

Background expertise

It was only just before Christmas 2020, when the UK's COVID-19 pandemic was well into its second wave, that Novacyt was asked if it could use its skills in polymerase chain reaction (PCR) genotyping to develop an assay to identify the then-emerging UK variant (20I/501Y.V1 or B.1.1.7). Two more fast-emerging variants were also tackled – South Africa (20H/501Y.V2 or B.1.351) and Brazil (20J/501Y.V3 or B.1.1.28). Each individual assay enables the identification of the original SARS-CoV-2 virus and the variant in under two hours, as well as whether the variant carries the N501Y mutation, which can lead to <70% increased infectivity. The most recent development has been the introduction of an assay specifically for the E484K 'escape' mutation, which is seen in most current VOCs. It helps the virus slip past the body's immune defences to evade host antibodies and may, as a result, diminish vaccine efficacy. The fast-paced response and development behind new assays prompted Novacyt to set up a specialist assay portfolio in early February 2021, specifically to aid the diagnosis of new variants of SARS-CoV-2.

Specialist focus

This new portfolio of patented assays to identify Single Nucleotide Polymorphisms (SNPs) critical to each variant, is called SNPsig® - one of the first commercially available range of assays for variant detection. The SNPsig® portfolio for detecting variants complements Novacyt's existing range of PCR COVID-19 assays and enables a funnelling of proven expertise into the dynamic world of variant detection. Three weeks after the SNPsig® launch, new assays were developed to identify two further variants of concern, first identified in Bristol (VOC-202102/02) and California (B.1.429/ 20C/S:452R). Today, the SNPsig® portfolio contains assays for eight individual variants, with another two on the way. The rapid evolution of the range means that SNPsig® is the world's most comprehensive portfolio of SARS-CoV-2 variant identification assays. Continuing the innovation and response to the evolving market need, SNPsig® has recently launched a CE-IVD marked test that detects multiple SARS-CoV-2 variants of concern. SNPsig® VariPLEX™ is able to spot six key mutations using PCR genotyping. This single kit fast-tracks identification of the four main SARS-CoV-2 variants of concern (UK, South Africa, Brazil and California) plus the two most biologically significant mutations N501Y and E484K, which are now all prevalent globally. VariPLEX™ can be used on-site to generate results within just two hours - a significant advance on the 1-2 weeks it takes for results through Next Generation Sequencing (NGS). This enables same-day patient and public health decision making, necessarily rapid action to contain the spread of a variant and minimise its impact in the healthcare setting. VariPLEX™ is a fully customisable assay panel and new mutations can be added to the panel within weeks as and when they become relevant. Besides use by governments, healthcare providers and private companies, VariPLEX™ has tremendous scope for pharmaceutical companies to assess the efficacy of their vaccines.

Rapid option

Novacyt's SNPsig® kits use the company's proprietary genotyping method to identify SARS-CoV-2 variants of concern. The assays can be used on Novacyt's selected genesig® family of instruments or on any real-time PCR

machine with the ability to test across fluorescence channels, providing a rapid on-site alternative or complementary ability to next generation sequencing/off-site analysis. SNPsig® assays work with extracted viral RNA from a positive COVID-19 patient sample and use primers and probes, which don't cross-react, to create a fluorescence amplification signal to identify either the original virus or a variant. Because the virus mutates through the spike protein, wherever possible, the team chose a unique identifier in the ORF1 gene region, which is more conservative. Based on initial results, the assays have 100% concordance with NGS findings. SNPsig®'s fast-paced innovation programme is made possible by the company's ability to match the rapid evolution of the virus with real-time bioinformatics surveillance and accelerated product development. The R&D programme can pivot quickly, and tailor assay development to real-world need. All SNPsig® assays are being validated in a variant diagnostics surveillance study, with sites in the UK, US and Latin America. The research enables scientists and healthcare planners to track the incidence of VOCs in their area, to help develop strategies for containment and patient management.

Dynamic agility

With daily meetings and thrice-weekly updates based on global publication tracking, Novacyt's bioinformatics surveillance group remains highly vigilant. As significant new mutations are identified, the dynamic agility behind the SNPsig® innovation programme will develop new assays for the SNPsig® portfolio. Current assays are able to detect more than 853,312 sequences of SARS-CoV-2.