# compass

**spring 2020**

special COVID-19 edition

## our race
to combat a global threat

NSW GOVERNMENT | Health Pathology

for all of us

# Secretary, NSW Health

## Elizabeth Koff

History will show that the decision to create and sustain a statewide public pathology service was critical to managing the 2020 COVID-19 pandemic in NSW.

We are fortunate indeed that NSW Health Pathology was formed and in such a strong position to lead our public health testing response when we needed it most.

We have watched with pride and admiration as this extraordinary workforce has stepped up time and again, pioneering new solutions with an indefatigable appetite to meet almost daily challenges.

Virologists, microbiologists, scientists, couriers, data analysts, information technology engineers and all types of support staff – to acknowledge just a few – have all played a vital role.

From growing the live virus and sequencing its genome, to creating an SMS results service to notify the majority of negative results to patients within 24 to 48 hours, NSW Health Pathology has proved itself essential to protecting the health and safety of the people of NSW.

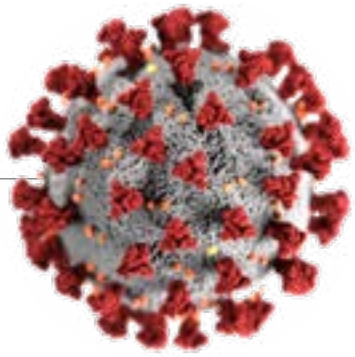
On behalf of all of us within NSW Health, I want to thank everyone at NSW Health Pathology for their phenomenal response to COVID-19 while maintaining a full suite of public pathology and forensic services to people across the state.

Thank you for your ongoing commitment and dedication to serving the people of NSW.

Elizabeth Koff
**Secretary, NSW Health**

# Chief Executive

## Tracey McCosker



I can't think of a year when we have been more tested or that I have felt prouder.

We'd barely made it through the bushfires where our staff distinguished themselves with incredible professional and personal resilience, when we were hit with a global pandemic.

With little to no reprieve, our 5,000-strong NSW Health Pathology team again rose to the occasion, showing the extraordinary capability that exists at every level of our organisation.

The caring, connecting and pioneering spirit on display as we mobilised against this unprecedented threat is something I won't forget. Our people are working tirelessly and under enormous and unrelenting pressure to deliver a response we can all be proud of.

We quickly established COVID-19 specialist diagnostic testing at dedicated laboratories, and evaluated and deployed new rapid testing platforms throughout regional and rural NSW. Our testing rate was quickly among the highest in the world per capita.

Our inspiring scientists and researchers grew the live virus from infected patients' samples in February and developed a game-changing serology test by March. They continue to play a key role in these and other advancements that are helping the public health response.

With around 99 per cent of people tested found to be COVID-19-negative, our ICT team pioneered a solution to automatically deliver negative results direct to patients via SMS. Most results have been delivered within 24 to 48 hours of lab testing to more than 1.5 million people. By September we had recorded the amazing milestone of 1 million registrations with the service.

I thank you all for your incredible work, expertise and care. While our work together is not yet over, as you read on, please take a moment to reflect on all we have achieved so far.

Tracey McCosker PSM
**Chief Executive, NSW Health Pathology**

# genetic detectives
## on the case

When the coronavirus SARS-CoV-2 first landed on Australian shores in January 2020, it carried with it a genetic passport.

Each case of the virus had its own passport with a genetic stamp showing how the nucleotides inside it were ordered.

As with many viruses, as SARS-CoV-2 spread it evolved and mutated, changing the type and ordering of these nucleotides ever so slightly. This may sound sinister, but it is in fact a very useful development.

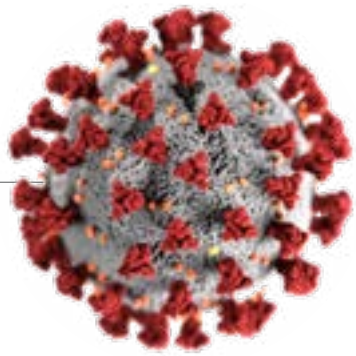
The pandemic continued and additional cases of COVID-19 were diagnosed, with people testing positive after returning from overseas and some becoming infected in the community. Understanding how the virus was spreading was going to be key to its containment.

Professor Vitali Sintchenko, lead pathologist for the Microbial Genomics Laboratory at NSW Health Pathology's ICPMR-Westmead describes nucleotides within an RNA genome as the building blocks of a virus.

"In order to understand transmission pathways of the pathogen, you must first understand the order of these building blocks. You can then identify any presence or absence of changes in the building blocks," Prof Sintchenko said.

Whole genome sequencing is a highly sensitive tool used to figure out the type and order of individual nucleotides in each virus sample.

"With whole genome sequencing we capture the sequence of these building blocks very accurately and we employ complex instruments to do it quickly and in high volumes."



Rapid sequencing techniques allow us to gain a whole genome wide view of the pathogen very quickly and predict or understand behaviours of the virus.

"When we look at nucleotides, we can identify with high accuracy any variance within the virus genetic sequence. We compare viruses from patients at different stages of the disease or with a different history of disease and look for potential relationships between cases.

"From this we can infer, from genomic data, potential transmission patterns or pathways that can help track how it has spread through a community and beyond," Prof Sintchenko said.

Through whole genome sequencing, experts can match new cases to clusters, or identify the origin of, and relationships between COVID-19 cases, providing a deeper understanding of the spread of the disease.

Whole genome sequencing offers another line of evidence to support contact tracing by filling in gaps where people have not or cannot provide all necessary details to help trace the source.

Within two weeks NSW Heath Pathology's Westmead laboratory had developed an in-house whole genome sequencing process for the COVID-19 virus, in collaboration with academics from the University of Sydney, soon followed by NSW Health Pathology's laboratories at Randwick.

Within two months they had learnt a lot about diversity and the slow evolution of the coronavirus.

In eight months, the team at Westmead has successfully sequenced more than 1,000 cases and discovered 51 genomic clusters.

NSW Health Pathology laboratories at Randwick have also sequenced about 350 cases.

Sequences are also uploaded to an international virus sequence database to assist epidemiologists and researchers around the world.

Prof Sintchenko says the application of whole genome sequencing to the investigation of COVID-19 has been transformational and the number of genomes uploaded to the international database has been unprecedented.

## Introduction to Genetics

SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus-2) is the coronavirus that causes COVID-19 disease.

A coronavirus encodes its genetic information using an RNA genome, which then carries the coding for specific proteins in the virus.

RNA is made up of four types of organic molecules called nucleotides, that are like chemical building blocks stacked in a specific formation.

To understand a virus, you must first understand the order of these building blocks.

By using genome sequencing to identify changes or mutations in these building blocks, researchers can construct specific 'fingerprints' for the virus and match new cases to confirmed clusters and identify transmission patterns within a population.

"NSW Health Pathology is a national leader in genome sequencing and we have made a significant contribution to data sharing to international research teams," Prof Sintchenko said.

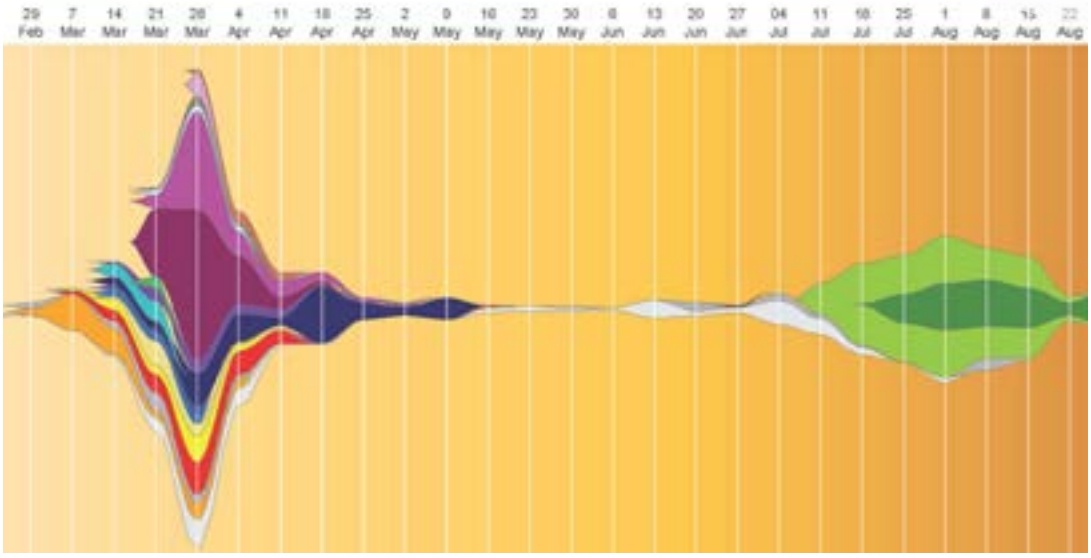
"We have very well developed translational research collaboration between clinicians, scientists and researchers that has enabled us to achieve what we have in a very short timeframe."

NSW Health Pathology continues to work closely with Health Protection NSW, providing whole genome sequencing data and reporting to support their centralised contact tracing and epidemiology teams.

This work is critical to identify people at risk of COVID-19, to manage new clusters of infection and minimise further spread of the virus in the community and among the most vulnerable.

"The evolution and spread of the virus around the globe and in Australia is fascinating but complex," Prof Sintchenko said.

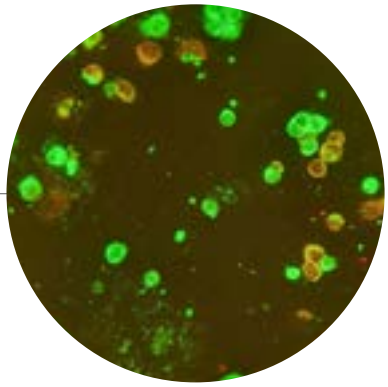
"It is like detective work, and we are part of the NSW Health COVID-19 response team."




Using genomic data, scientists and bioinformaticians can link new cases of COVID-19 to clusters, as shown in this graph depicting Sydney clusters. Each colour represents a different cluster, created based on the genetic code contained within the virus.

# hueston...

## we have a solution



NSW Health Pathology was once described as 'the quiet achievers during the pandemic, working incredibly hard behind the scenes'.

The statement couldn't be more true for Dr Linda Hueston, Principal Hospital Scientist and Chief Serologist at NSW Health Pathology's Westmead laboratory.

When the rest of the country was sweating through the barbeques and backyard cricket games that are synonymous with Australia Day, Dr Hueston spent the long weekend in her laboratory. She was working on developing three assays that could tell whether a person had been infected previously with the COVID-19 virus, based on the antibodies present in their blood. She succeeded.

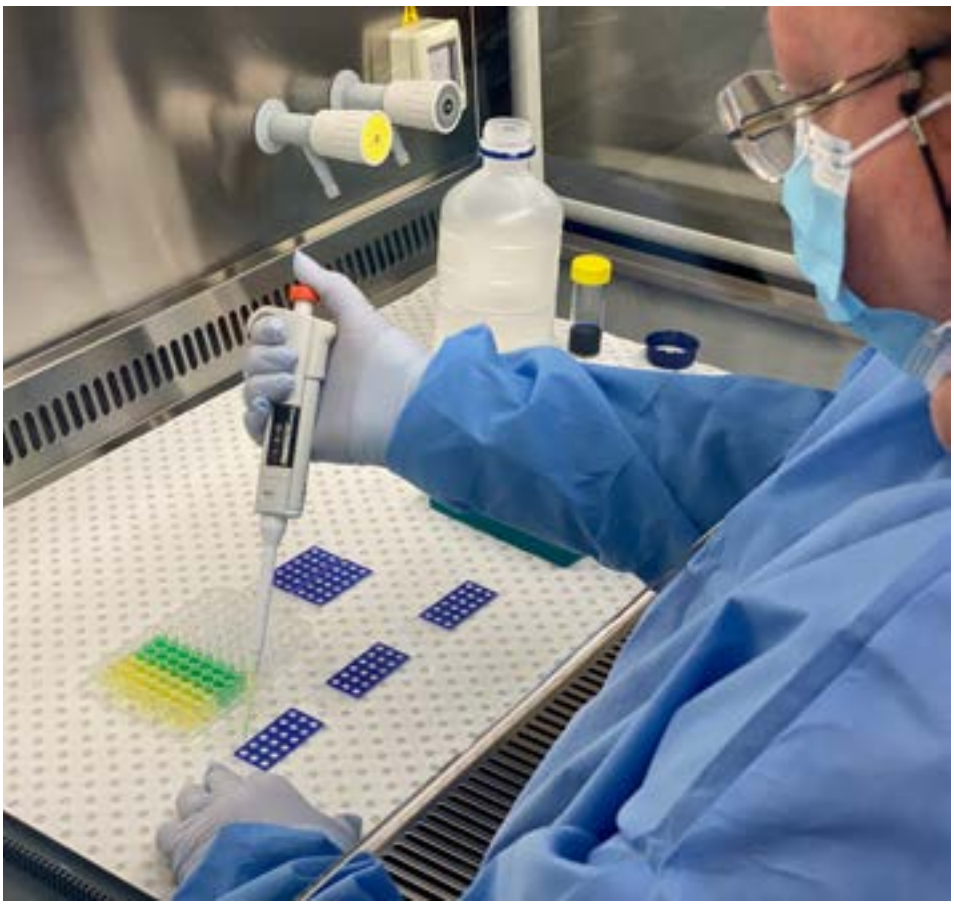
Dr Hueston pioneered the immunofluorescent serology tests used in NSW to detect the specific antibodies the body creates to fight the COVID-19 virus. A positive serology result indicates the person had been infected at one time, which can tell us if someone was recently infected, even if they had recovered without being tested or were infected without exhibiting any symptoms.

Serology not only confirms recent infection, it can be used potentially to determine immunity, to determine community spread and find those people who were asymptomatically infected.

Dr Hueston's team was the first to produce and use the suite of immunofluorescent antibody assays for the diagnosis of COVID-19 and, as of September, they had used these tests for more than 22,000 patients. They have assisted laboratories across Australian and in New Zealand with serologic diagnosis.

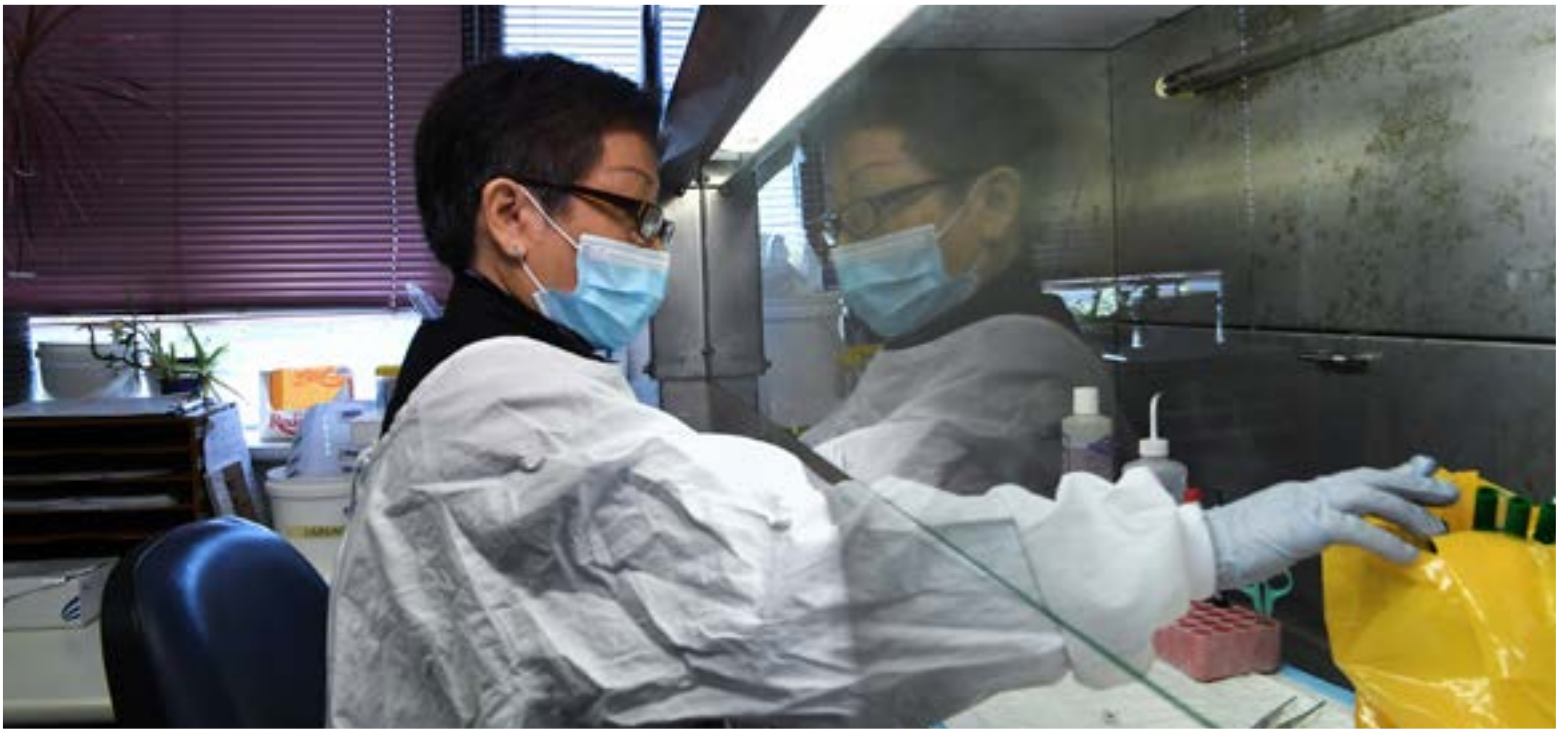
With a strong history of successful test development and its translation into routine diagnostic tests, Dr Hueston was awarded funding under the NSW Health COVID-19 Research Grants to develop a suite of new tests that will improve rapid diagnosis of this newly emerging disease.

The round image above is immunofluorescence under the microscope, where a chemical dye is added to the blood sample, lighting up antibodies as they bind to the virus. This is used in serology testing.

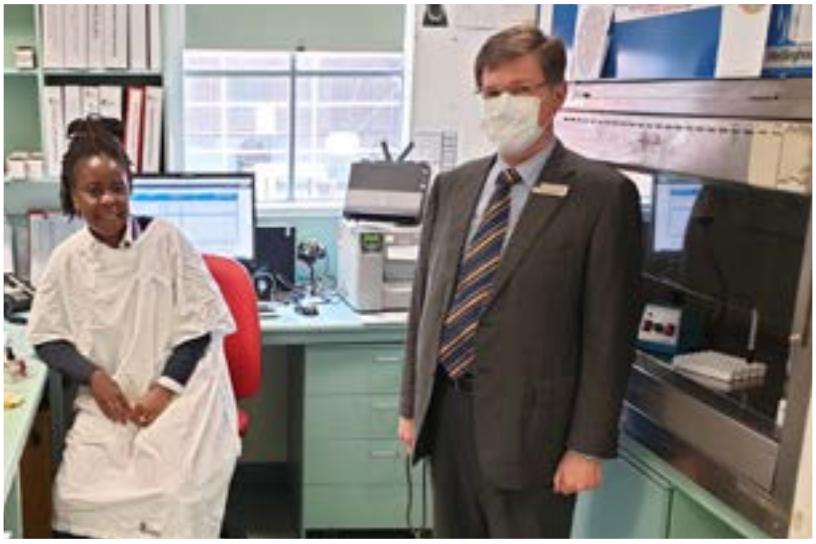


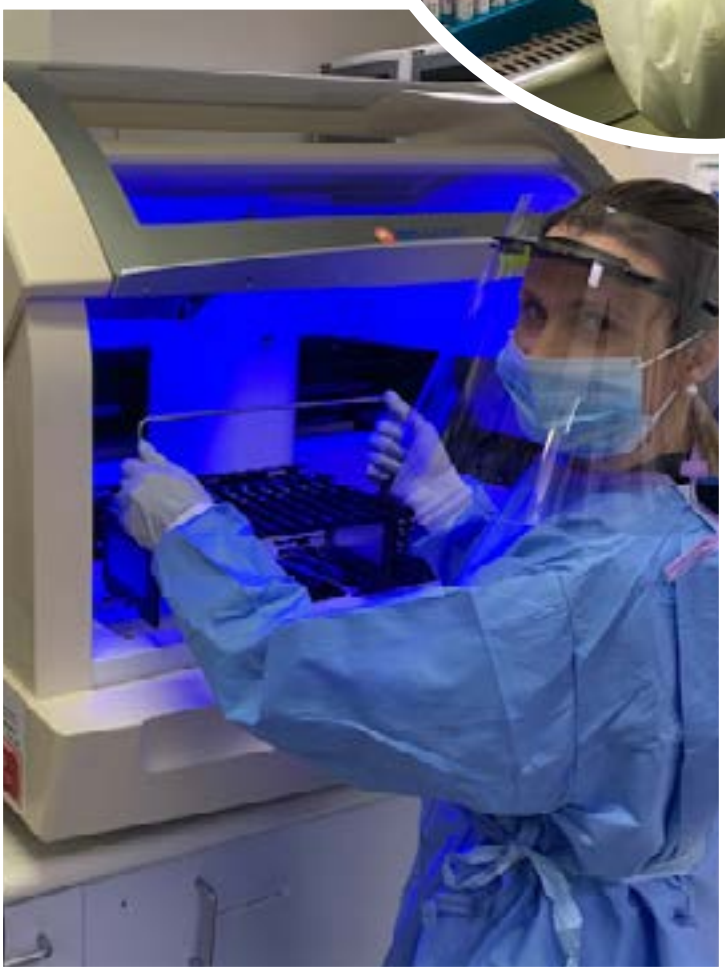

NSW Health Pathology Randwick has continued to work tirelessly throughout the pandemic, testing more than 350,000 COVID-19 samples as of September 2020.
**Pictured:** Anna Condylios, Senior Hospital Scientist in the Virology lab, Randwick.

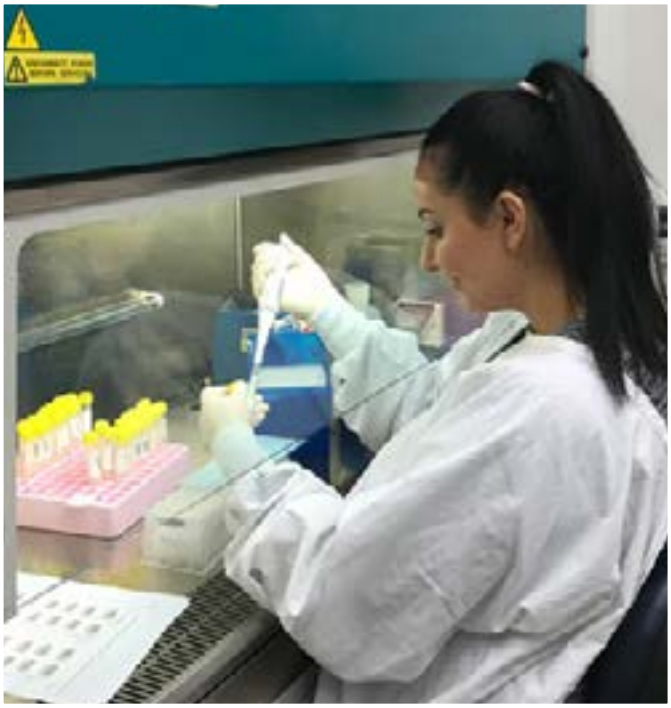
Prof Bill Rawlinson
Director of Virology, Serology and OTDS
Randwick laboratory

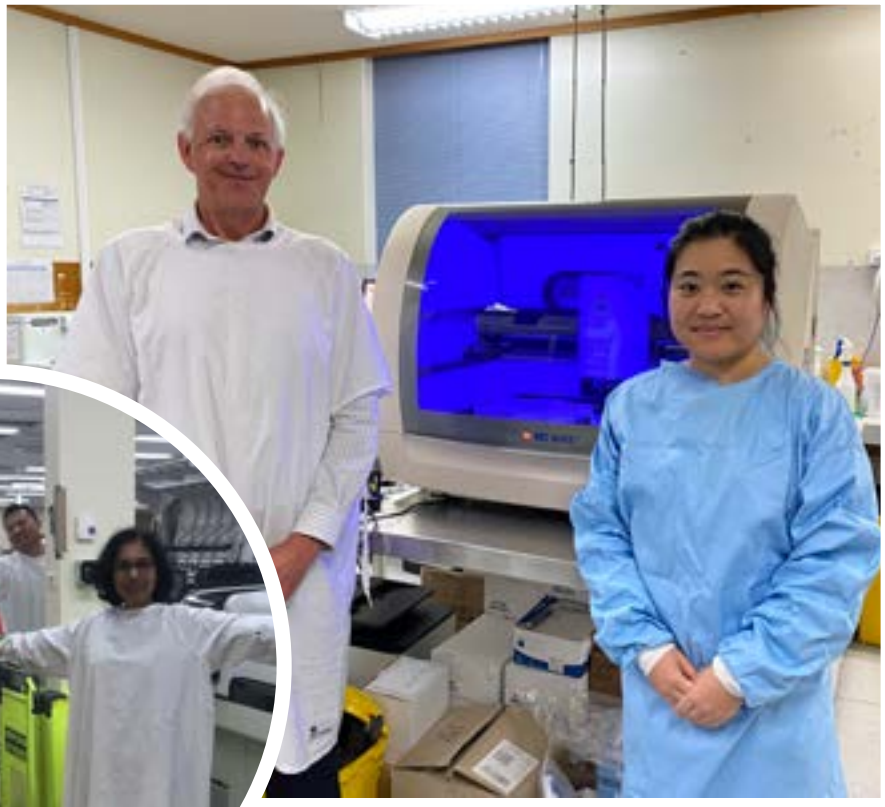


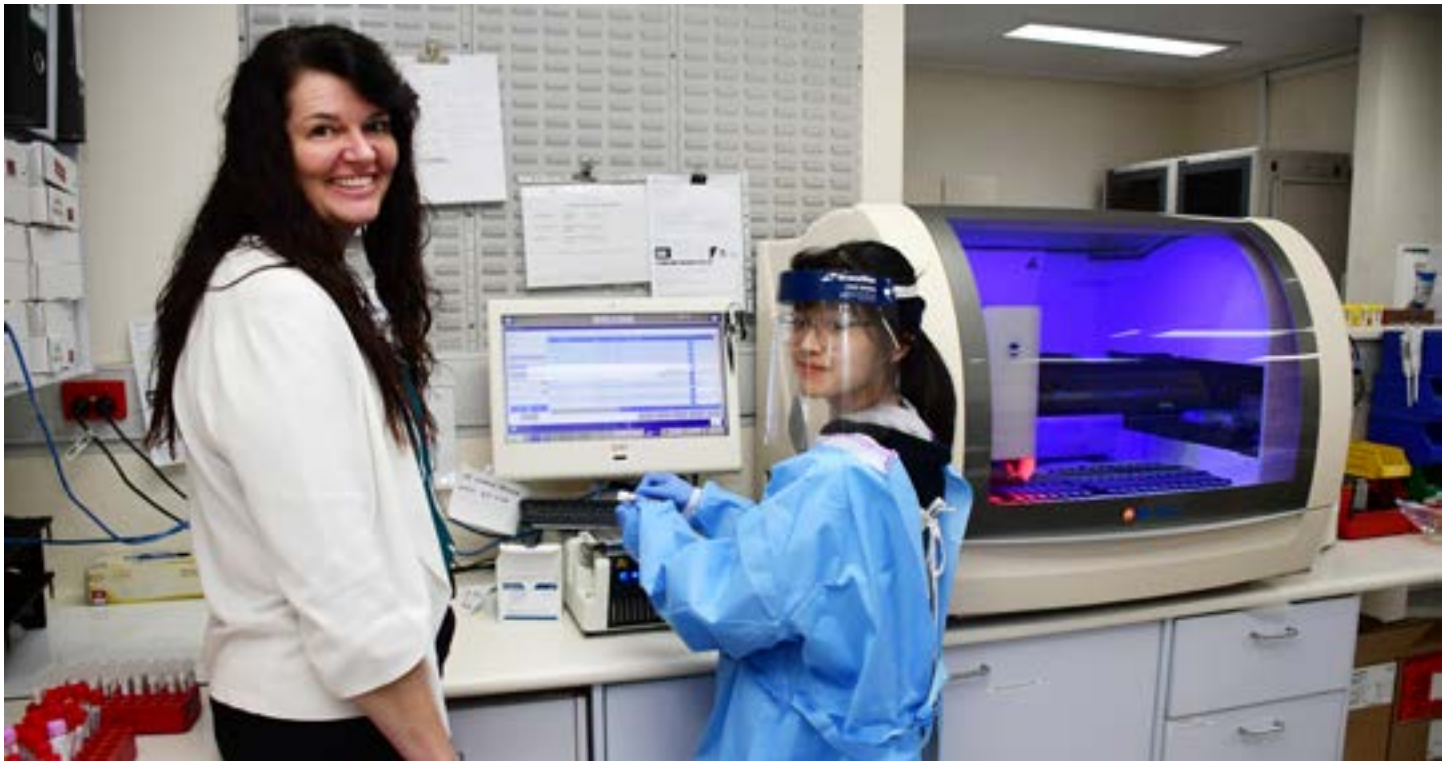
# Statewide...





# Two towns, one goal

They're almost 800 kms apart, but two senior scientists leading NSW Health Pathology regional laboratories are working on the frontline of the COVID-19 pandemic response to help protect the communities they call home.

Situated at the tail end of the Wilsons River in the Northern Rivers region, scientists at NSW Health Pathology's Lismore laboratory are a willful force of testing and analysis.

The lab is testing the highest number of patient swabs outside of its sister laboratories in Sydney, turning over about 300 to 400 COVID-19 diagnostic tests a day.

At the helm is Senior Scientist and Microbiology Lab Manager Glenn Hawkins.

Glenn leads a team of 10, made up of laboratory scientists and technicians, working day and night to deliver timely and accurate COVID-19 test results.

Samples are received from collection centres as far south as Grafton, further inland and also up to Tweed Heads.

With testing numbers on the rise, Glenn supports his team by problem solving any challenges that may arise, remaining hands on to support the analysis of patient swabs, and keeping a happy and unified team working at their peak.

Glenn started his current role at NSW Health Pathology in 2008, and prior to that was a senior scientist at Prince of Wales Laboratory, Randwick where he started his training in 1993.

"I have always enjoyed science and was fortunate to get a start in Microbiology in Sydney after I finished my degree," Glenn said.

"I have loved the job ever since. I see pathology as an integral part of the frontline of the health system, even though it often operates behind the scenes."

Regional hubs will help curb the spread of the coronavirus and protect our vulnerable communities.

"My favourite part of this role as a laboratory manager is seeing the fantastic teamwork and dedication the team has for delivering timely COVID-19 results for the Northern Rivers community," Glenn said.

**Pictured right:** Senior Scientist and Microbiology Laboratory Supervisor Glenn Hawkins uses the molecular testing instrument in the Lismore lab.

**Pictured left:** Dubbo Laboratory Manager Monique Mintern with Technical Officer Alice Woon using the BD-Max molecular testing platform.


Out west on the other side of the Blue Mountains, is the town of Dubbo. It is here that Monique Mintern heads up the local NSW Health Pathology laboratory. Dubbo lab, which is located at the heart of the Central West, is testing COVID-19 samples collected from across a region comparable to the size of some Australian states.

Monique says she was first inspired to pursue science as a career by her Year 8 science teacher who identified her passion and talent for science. This led to a pathway into pathology, and she was first introduced to the field during the early stages of her university study. Her career journey has included her working in Sydney, Darwin and Victoria prior to heading out to Dubbo.

"I am constantly amazed at the vital role pathology plays in the day-to-day lives of so many people," Monique said. "It has evolved into a powerful tool used to determine the health status of patients and is vital in ensuring patients receive the best treatment for their needs.

Lismore lab is testing up to 400 COVID-19 samples a day

"I am exceptionally passionate about high quality healthcare services, particularly in rural and regional communities, as patients in these communities may be far from the facilities of metropolitan sites, but their needs are no different," Monique explained.

"I believe we make a significant difference in the services we provide to our communities and I wouldn't want it any other way".

Monique says having local expertise and capabilities to diagnose COVID-19 cases quickly was vital to protect the community and curb the spread of the virus.

"Having diagnostic testing for COVID-19 available here at Dubbo is a game changer for regional and remote communities," Monique said.

"Local testing capabilities help ensure early diagnosis and management of COVID-19 cases, which is vital for the protection of the community and assists in curbing the spread of the virus."

The Dubbo laboratory tests between 150 to 500 COVID-19 samples each day, and to date almost 10,000 tests have been performed at Dubbo for residents of Western and Far West NSW.

# COVID-19 response timeline

**22 JANUARY**

NSWHP commences COVID-19 molecular testing at Westmead

**25 JANUARY**

Australia confirms its first case of COVID-19

**28 JANUARY**

Molecular testing commences at NSWHP Randwick lab

**4 FEBRUARY**

NSWHP's expert researchers grow the novel coronavirus from patient samples

**6 FEBRUARY**

Westmead-ICPMR maps the virus using whole genome sequencing

**20 FEBRUARY**

NSWHP Westmead develops the serology test to detect COVID-19 antibodies

**6-26 MARCH**

NSWHP Liverpool, Royal Prince Alfred, John Hunter, Royal North Shore labs start testing

**18 MARCH**

NSWHP activates its Emergency Operations Centre (EOC) after pandemic declared

**25 MARCH**

NSWHP's Nepean lab starts molecular testing

**30 MARCH**

NSWHP starts COVID-19 testing at Elizabeth Macarthur Agricultural Institute laboratories

**2 APRIL**

NSWHP Lismore and Concord labs start molecular testing for COVID-19

**13 APRIL**

Rapid testing deployed across the state to deliver results in under 1 hour for urgent cases

**14 APRIL**

NSWHP pioneers automated COVID-19 SMS Service for negative results

**25-28 APRIL**

NSWHP Dubbo and Wagga Wagga labs start molecular testing for COVID-19

**20 JUNE**

NSWHP Bega lab starts molecular testing

**AUGUST**

NSWHP performed more than 1 million COVID-19 molecular tests

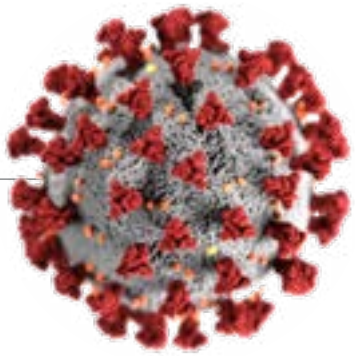
**27 AUGUST**

NSWHP Tamworth lab starts molecular testing

**MID SEPTEMBER**

NSW Health Pathology's SMS Results Service passes milestone of 1 million registrations

# negative results service delivers positive outcomes



In April 2020, NSW Health Pathology rapidly pioneered a solution to automatically deliver negative COVID-19 results directly to patients via SMS.

For the first time in NSW, patients could opt in to get their COVID-19 results sent to them directly via text message.

Since its inception, the SMS Results Service has gone from strength to strength.

More than one million people have used the service to access their results in a secure and timely manner. In doing so, they have helped save laboratory and healthcare workers from spending thousands of hours on calls to patients, freeing them up to focus on vital clinical care.

An estimated 181,000 hours have been saved; that's the equivalent of 22,625 healthworker shifts.

By cutting down the time needed to make notification calls for negative results, the service has helped NSW Health Pathology deliver results in 24 to 48 hours; down from seven days.

Positive results are always reported immediately to the patient's referring doctor and public health unit.

NSW Health Pathology's SMS Results Service Project Team has helped cut negative results notification timeframes by half.

NSW Health Pathology's SMS Results Service Project Manager Liz Geddes said the system has helped patients get faster results and reduce unnecessary time in self-isolation, which is an important factor in keeping testing numbers high.

"In NSW, we are leading the way with testing, and with fast, easy and reliable access to COVID-19 results, people can get tested knowing they will have an answer in good time," Ms Geddes said.

Efficiency around delivery of results is vital given the vast majority of COVID-19 tests come back negative. Furthermore, patient privacy and security is paramount.

A patient must opt in through a registration and identity verification process when they are tested at a NSW public hospital or public COVID-19 clinic.

"Data security is critical to this process and the SMS notification system integrates with existing statewide security and other support infrastructure to ensure patient privacy and data integrity is maintained.

"The project team, our staff across the state and the people of NSW have all played a part in establishing and ensuring the ongoing success of the SMS Results Service," Ms Geddes said. "This one has definitely been a team effort all round."

It was all hands on deck with Aunty Joy and Lynne Coleman joining the ‘Swab Squad’, packing much needed consumables in our Newcastle office.

**Photography credits:**
Front cover: John Janson-Moore
Page 4, 6-7, 13-14, 16: NSWHP Strategic Communications team
Page 8-9: Lisa Maree Williams/Getty Images
Page 10-11: NSWHP staff
Page 12: Belinda Soole/ACM

Compass is produced by NSW Health Pathology’s Strategic Communications team

NSW Health Pathology (NSWHP) acknowledges the Aboriginal and Torres Strait Islander people of New South Wales and their special place as traditional custodians of this land. Through their sacred cultures and customs, they have nurtured and cared for this land for thousands of years and continue to do so today. We would like to pay our respects to the Elders past, present and emerging, for they hold the memories, the traditions, the culture and hopes of Aboriginal and Torres Strait Islander peoples across the state.