Australia's National
Science Agency

CSIRO's Australian Centre for Disease Preparedness

2022 | Year in Review

Citation

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Acknowledgement of Traditional Owners

CSIRO's Australian Centre for Disease Preparedness respectfully acknowledges the Wadawurrung people of the Kulin Nation, the Traditional Owners of the land on which we undertake our science and business today. We pay our respects to their Elders past and present.

We thank the Wadawurrung people for their custodianship of the land and acknowledge their deep connection with this country. We strive to learn from their unique perspective and knowledge.

Important disclaimer

The information included in this document is based on the calendar year from 1 Jan 2022 to 31 Dec 2022.

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Cover image: ACDP on the evening of the lunar eclipse, November 2022.

Contents

From the Director

I'm very pleased to present the 2022 Year in Review for CSIRO's Australian Centre for Disease Preparedness, situated here in the beautiful lands of the Wadawurrung People of the Kulin Nation in Geelong, Victoria and I pay my respects to their Elders past and present.

Australia's wildlife, feral animal populations and systems of domestic animal production present some rather unique challenges, in terms of disease prevention, preparedness, surveillance and response. With the transition to learning to live with COVID-19, increasing numbers of people and products are crossing our borders, with significant emergence of biothreats that are new to our region.

The steady move southwards in Asia of foot-and-mouth disease, lumpy skin disease and African swine fever represent probably the greatest risk of incursion Australia has ever faced. Naturally, mitigation has been a key element of our approach over the last year, with many strands of work being pursued, including predictive modelling; development of more efficient methods of surveillance; vaccine development; and our international program, which aims to assist our neighbours to develop improved capability in diagnosis and response.

We take a One Health approach to our work and the incursion and spread of Japanese encephalitis in many states of Australia in 2022 has posed a threat, both to our pig production and to our people, with several human cases also diagnosed. We have been working to understand more of this particular genotype IV, the wild reservoirs and vectors that play a role in its transmission and the efficacy of existing vaccines to this disease.

Not all viral threats are exotic to Australia. We continue our work to understand more about the novel genotype of Hendra virus detected in a horse for the first time in 2021. Likewise, the perennial challenge of avian influenza has also occupied much of our time, and this Year in Review outlines some insights into the emerging strains that threaten our poultry production, as well as our wildlife.

The COVID-19 pandemic has highlighted the need to understand more of pathogens that exist in wildlife. We are delighted that our application to be a Reference Centre for Zoonotic Coronaviruses with the Food and Agriculture Organization of the United Nations was successful, and we look forward to working within that network in the future.

As an institute, ACDP works closely with scientists across CSIRO, and with academia and industry, to achieve maximum impact. We continue to bolster our animal and zoonotic disease research portfolios and have significantly grown our post-doctoral and PhD student cadres. I hope you will enjoy reading more of the investments we have made in our science, our people and our infrastructure over the last year, and our plans for the future in helping to assure a safe, secure and prosperous Australia and region.

Professor Trevor Drew
Director, CSIRO's Australian Centre for Disease Preparedness

2022 snapshot

3 WOAH Collaborating Centres

3 FAO Designated Reference Centres

10 WOAH Reference Laboratories

83 active research projects

62,663 diagnostic tests performed
– our highest number in 10 years!

5 CSIRO challenges supported

- Food security and quality
- Health and wellbeing
- Resilient and valuable environments
- Future industries
- Secure Australia and region

Partnering in

2 CSIRO Missions

- Infectious Disease Resilience
- Antimicrobial Resistance

Our people

57% female

43% male

7 post-doctoral fellows

4 students

87 research staff

62 engineering and facility operations staff

43% of our leaders are women

9.7 million media audience reach

65 external enquiries regarding ACDP capabilities

76 peer-reviewed publications

Preparing antigens from purified proteins for use in research experiments.

Our capabilities

CSIRO's Australian Centre for Disease Preparedness (ACDP) provides Australia's highest level of biocontainment within a purpose-built biosecurity facility.

CSIRO's expert research and operational staff work together across multiple disciplines at ACDP, adopting a One Health approach that recognises that the health of people, animals and the environment are intricately linked.

ACDP's research helps protect Australia's valuable livestock and aquaculture industries, and the community, from exotic and emerging infectious diseases.

Together, our staff:

- Increase Australia's preparedness and capability to rapidly respond to biosecurity challenges, such as threats to animal and human health
- Conduct fundamental research to increase understanding of infectious agents of significance to human and animal health
- Support development and testing of vaccines and therapeutics for a broad range of human and animal diseases
- Maintain world-class national facility infrastructure and accreditation.

ACDP prides itself on its dedicated and diverse workforce, who apply their skills across scientific and support roles to maintain this world-class facility and deliver impactful science.

Our scientific expertise extends across the disease and science spectrum, from understanding disease pathogenesis and epidemiology, to virus characterisation, diagnostic testing and animal studies to validate new vaccines and therapeutics.

Supporting our scientific research are highly specialised operations teams who maintain facility biocontainment, biosafety, quality assurance, training, site security and monitoring, engineering and infrastructure maintenance.

ACDP operates across two sites: a high containment facility in East Geelong with laboratories at Physical Containment Levels 2, 3 and 4; and a Physical Containment Level 2 animal facility in Werribee, Victoria.

Our modern, high-containment laboratory allows scientists to conduct research requiring the highest levels of biosafety.

ACDP's core activities

We work to protect Australia's livestock and aquaculture industries, wildlife and people from emerging disease threats, and ensure the competitiveness of our agriculture and trade.

Disease identification and characterisation

In addition to housing research projects, as a national facility ACDP is tasked with characterising emergency terrestrial and aquatic animal diseases, so authorities can stay informed on the threats they pose to Australia.

National emergency disease response

ACDP's facilities are purpose-built so we can respond quickly and effectively to disease outbreaks, whilst meeting our quality assurance standards.

Diagnostic services

We provide quality assured diagnostic services for new, emerging and exotic emergency animal diseases, using accredited and validated tests.

Emergency preparedness and response

Our staff undertake regular training to be ready to respond to an emergency animal disease outbreak. New insights are incorporated into emergency animal disease response plans.

Technical advice and support

We provide expert advice on emergency animal diseases, diagnostic policy and biosecurity issues.

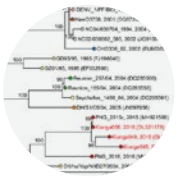
Reagent and specimen supply

We provide specialised reagents for emergency animal diseases for diagnostic activities in Australian state and private laboratories, and for outbreak response in neighbouring countries.

Laboratory diagnostic activities are routinely proficiency tested and reagents must be adequately quality assured.

Molecular epidemiology

We undertake molecular research studies on emergency animal diseases to inform epidemiological investigations, i.e. disease origins, distribution and patterns of infection.



We also contribute to national disease surveillance programs.

Support to international activities

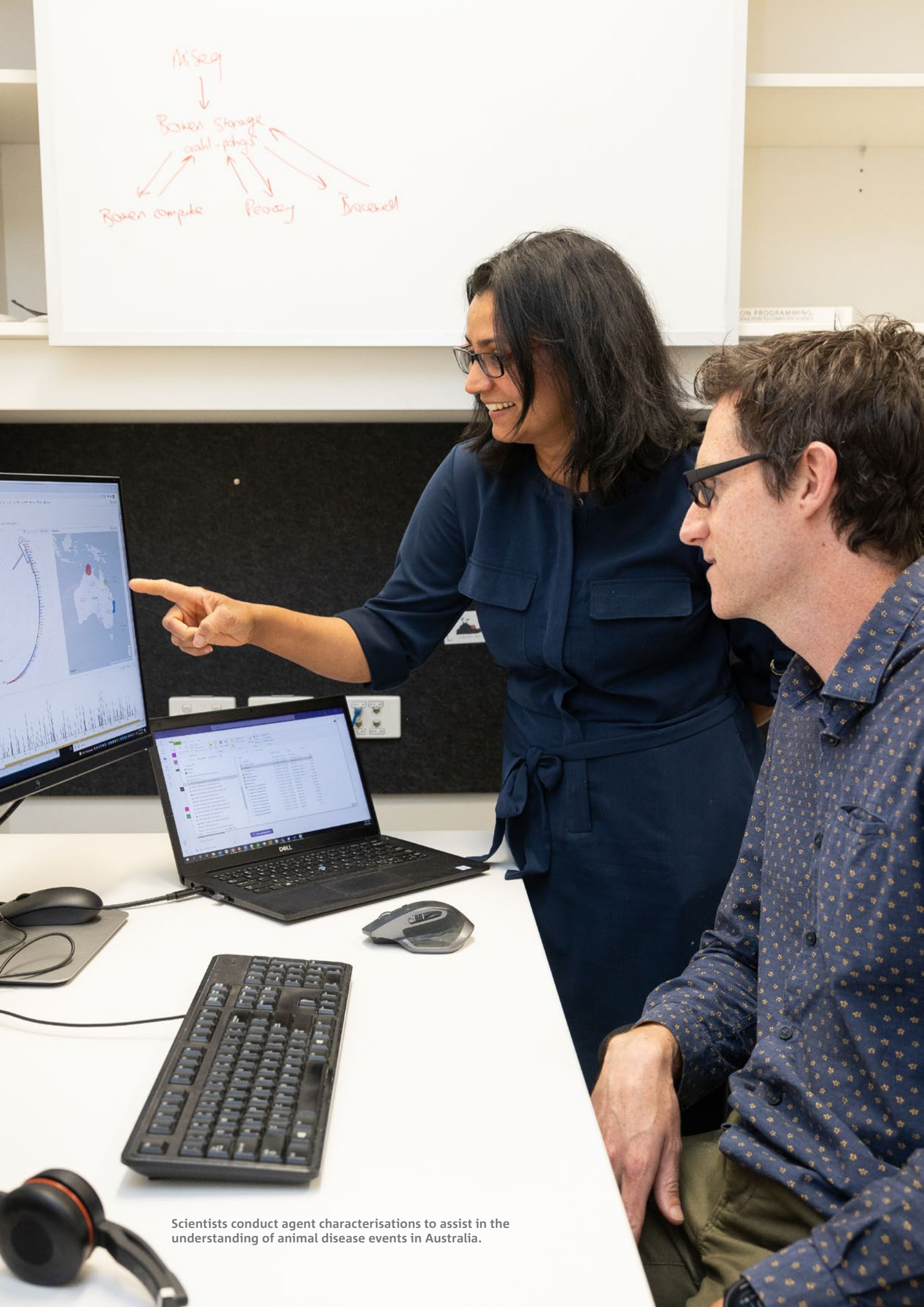
We provide scientific and diagnostic expertise to support Australia's national interests in the region and beyond.

Training

We provide specialised training for Australian veterinarians and diagnosticians in emergency animal disease recognition and diagnosis.

Research and development

We conduct research and development to support ACDP's diagnostic capability in areas such as: assessment of novel technologies for improved diagnostic testing; new diagnostic tests to address identified gaps in capability; and pathogenesis studies to enhance understanding of control strategies for key diseases.



Scientists conduct agent characterisations to assist in the understanding of animal disease events in Australia.

Animal research services

Research projects undertaken at ACDP are supported by a specialised, trained Animal Services Team comprised of veterinarians and animal technicians who are highly experienced in the care and welfare of animals.

An on-site Animal Welfare Officer works alongside the Animal Services Team and is responsible for monitoring the welfare of animals and ensuring current best practice techniques are applied during planning and conduct of research projects involving animals.

All research project proposals involving animals are reviewed by an independent Animal Ethics Committee to ensure they are conducted in compliance with the Australian Code of Practice for the care and use of animals for scientific procedures.

ACDP has capability to conduct research with animals across Physical Containment Levels 2 to 4.

Animal diagnostics for surveillance and emergency response

As Australia's National Reference Laboratory, ACDP provides independent referral and diagnostic capabilities. In this capacity, we maintain laboratory equipment and skills to handle complex identification with rarely utilised tests. We also operate as a regional and international reference laboratory for specific diseases of concern to Australia and our region.

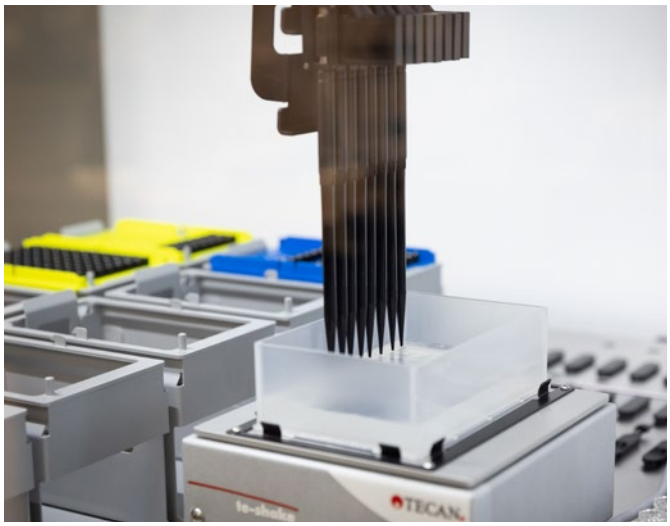
As a high containment facility, ACDP is a vital part of Australia's preparedness for disease outbreaks. The microbiologically and physically secure facilities at the lab allow teams to work safely with animal and zoonotic diseases while keeping them securely contained.

Specialised services delivered by our teams include diagnostic and investigative laboratory techniques on samples sent to ACDP to confirm the index case of an emergency animal disease. In the case of large and ongoing outbreaks, our laboratory has surge testing capabilities to manage the influx of samples sent from across the country.

Our teams also provide technical advice and support for emergency animal disease management activities to Australian Government agencies, state and territory governments, and national animal health bodies and committees such as the Consultative Committee on Emergency Animal Disease. Effective disease control and surveillance systems are not only important for quick diagnosis and response to disease outbreaks, but also for confirming the absence of diseases of interest – which is essential to facilitate export and import trade.

ACDP also supports national disease surveillance programs, such as the National Arbovirus Monitoring Program and the National Avian Influenza Wild Bird Surveillance Program. Some of our key contributions include agent characterisations and molecular epidemiological assessments to assist with the understanding of emergency animal disease events in Australia. Diagnostic teams also perform quarantine testing on samples from cats, dogs, horses, chickens, and other animals being imported into Australia or moved internationally every year (approximately 15,101 tests in 2022). This testing is conducted as part of Australia's strict biosecurity controls to ensure exotic disease outbreaks are prevented.

Involvement in national, international and quarantine disease testing places the diagnosticians and disease experts at ACDP in a unique position. To capitalise on this for the benefit of disease preparedness, ACDP provides education and training to veterinarians and government personnel, ensuring Australia's frontline animal health workers are informed about emergency animal disease identification and management, helping enable rapid detection of possible disease outbreaks.



An automated workstation streamlines handling of multiple samples sent during disease outbreaks.

ACDP is a reference laboratory

As Australia's National Reference Laboratory, ACDP provides independent referral and diagnostic capabilities. In this capacity, ACDP maintains laboratory equipment and skills to handle complex identification with rarely utilised tests. It also operates as a regional and international reference laboratory for specific diseases of concern to Australia and our region on behalf of the Australian Government, the World Organisation for Animal Health, and the United Nations' Food and Agriculture Organization.

ACDP's Reference Laboratory designations

We work closely with veterinary and human health agencies around the world

World Organisation for Animal Health (WOAH)

WOAH Collaborating Centres:

- Laboratory Capacity Building
- New and Emerging Diseases
- Diagnostic Test Validation Science in the Asia-Pacific Region

WOAH Reference Laboratory designations:

- Bluetongue virus
- Hendra and Nipah virus diseases
- Highly pathogenic avian influenza and low pathogenic avian influenza (poultry)
- Newcastle disease
- African swine fever
- Classical swine fever
- Abalone herpesvirus
- Ranavirus
- Yellow head virus genotype 1
- Epizootic haematopoietic necrosis virus

National Reference Laboratory

Terrestrial animals:

- 27 diseases of multiple species
- 2 cattle diseases
- 5 sheep and goat diseases
- 11 equine diseases
- 16 swine diseases
- 10 avian diseases
- 4 diseases of other species

Aquatic species:

- 24 fish diseases
- 13 diseases of molluscs
- 15 diseases of crustaceans
- 3 diseases of amphibians

Proficiency and Innocuity testing:

- Test validation and lab competency
- Screening imported pharmaceuticals

The Food and Agriculture Organization of the United Nations (FAO)

FAO Reference Centre designations:

- Animal Influenza and Newcastle disease
- Laboratory Biorisk Management
- Zoonotic Coronaviruses

The microbiologically and physically secure facilities at the lab allow teams to work safely with animal and zoonotic diseases while keeping them securely contained.

Meet Frank Wong, our avian influenza virus expert

ACDP is a World Organisation for Animal Health (WOAH) designated reference laboratory for high impact animal diseases, and some of our scientists are world reference laboratory experts in those diseases. To find out more about what these designations mean, we spoke to our avian influenza virus expert Frank Wong.

What does it mean that ACDP is a WOAH reference laboratory?

WOAH works to improve animal health and welfare across the globe. To assist with this, collaboration is key. They work to create a network of people around the world to help develop a knowledge base and information on animal diseases that can be shared.

Some diseases have a greater impact on livelihoods than others and WOAH maintains a list of diseases in livestock and wildlife which have a detrimental effect on trade and food security.

Avian influenza is one of these diseases. It can have a devastating effect on domestic poultry, causing high mortalities. In fact, a devastating global epidemic of highly pathogenic avian influenza is happening right now, with reports to the WOAH of over 10 million birds culled due to the disease in just a five-week period from 2 December 2022 to 5 January 2023, in every continent except Australia and Antarctica.

ACDP is a WOAH reference laboratory for this disease, and I am the designated reference expert for avian influenza.

As a reference laboratory, WOAH requires us to act as a focal point to pursue all scientific and technical challenges for that disease.

We are seen as a national and world leader in diagnostic and laboratory knowledge about avian influenza. Part of the role is to provide advice on the disease, and to supply training, support and scientific expertise to other countries that don't have sufficient resources, capacity or reference lab capability.

As an international reference lab, ACDP has a responsibility to stay up to date with diagnostic techniques, and to be able to pursue scientific and technical investigations to help solve problems relating to avian influenza and its control, in particular its impact to poultry production and wildlife health.

What is required of you as the designated expert?

"I need to keep abreast of what is happening around the world regarding our understanding of changes to the epidemiology of avian influenza viruses and the different virus strains circulating in domestic and wild

Frank Wong is a World Organisation for Animal Health reference expert for avian influenza.

bird populations. This is done through gathering disease surveillance information. I also work with my colleagues at ACDP to collate virus information from our diagnostic results and research projects, to share at national and international meetings.

I advise on diagnostic tests and our avian influenza projects, such as advising which relevant strains to use for different experiments and helping analyse the results. I also provide guidance to the team running the laboratory proficiency testing service in our region.

As the designated expert, I am also a member of the Food and Agriculture Organisation (FAO) Technical Working Group on avian influenza in the Asia Pacific region."

What do you enjoy about being a reference expert?

"A really interesting part is being invited as the representative for Australia to national and international meetings attended by other reference experts and researchers contributing to the understanding and control of avian influenza worldwide. At these meetings I hear about the new research happening elsewhere and people's experiences with avian influenza in their countries.

Another very rewarding part of the role is that we can directly assist Australia and other countries by helping control and mitigate risks of disease outbreaks, particularly contributing to our own national livestock and wildlife biosecurity and providing laboratory support to lower-economic countries in the Asia Pacific region which can be greatly impacted by the disease.

Due to its potential for occasional spillover infections of people, impact to wildlife, and recognised pandemic risk, avian influenza is a classic example of a One Health disease problem and has well-established global networks. It has given me the opportunity to be involved in three major international organisations: the World Health Organization (WHO; human health), FAO (global food security) and WOAH (animal health). This has provided opportunities to be part of real-world solutions, including directly contributing to global discussions to a WHO pre-pandemic influenza vaccine composition meeting in Geneva and elsewhere."

All samples received at the lab are labelled and documented at every stage from delivery and through each stage of testing.

Biocontainment management

ACDP provides Australia with the capability to safely hold and conduct work on some of the most dangerous pathogens in the world. Through the expertise and dedication of the Biorisk Management Group, research at ACDP is microbiologically safe and secure, in full compliance with our national and international obligations.

Highly trained staff provide specialised engineering requirements for the day-to-day operation of ACDP. This includes maintaining critical infrastructure, biocontainment, biosecurity and compliance with regulatory frameworks.

Supporting our commitment to best practice, our internal processes of review, evaluation, education and training ensure ACDP operates at or beyond the highest levels of national compliance and safety.

Our expertise in biocontainment management is highly valued and we provide training and technical advice to governments and customers around the world.

Quality and environmental management

Quality and environmental management at ACDP is fundamental to delivering trusted science that protects a healthy, productive, and prosperous future for Australia's animals, people and environment.

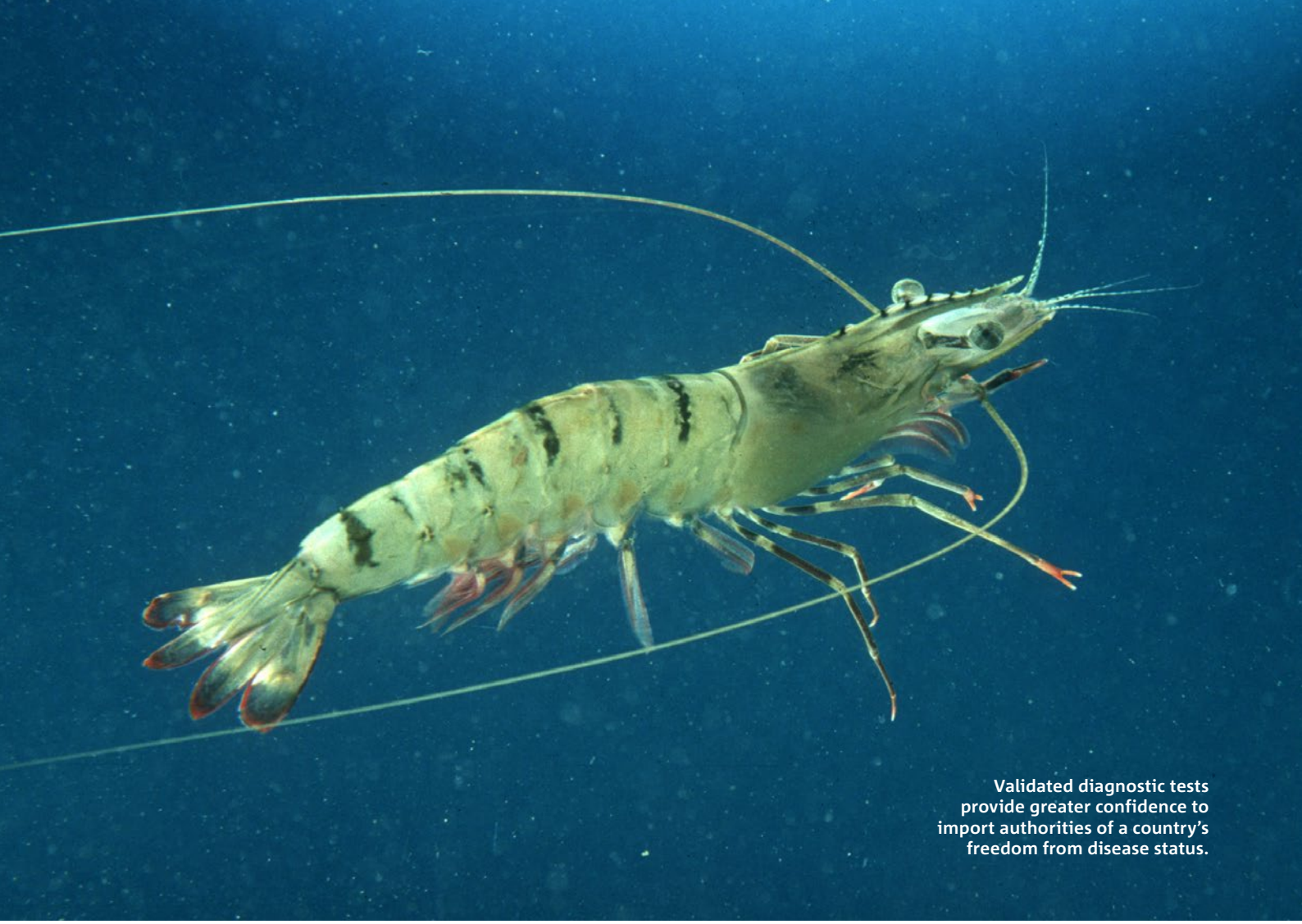
ACDP proudly operates according to several quality standards and maintains the following certifications/accreditations:

- ISO 9001 Quality Management
- ISO 14001 Environmental Management
- ISO/IEC 17025 Testing & Calibration
- ISO/IEC 17043 Proficiency Testing

The Quality Assurance and Compliance Unit are responsible for establishing and maintaining the framework, systems and processes to enable our scientific and support services to meet all applicable regulatory requirements and stakeholder expectations. ACDP is committed to developing a single, site wide Integrated Management System that demonstrates our commitment to quality, the environment and addresses the requirements of all standards we operate under. The Integrated Management System will ensure that ACDP continues to deliver trusted science in a compliant, efficient and environmentally responsible manner.

Read more on our commitment to quality and the environment.

Scanning quality assured samples for PCR proficiency testing.



Validated diagnostic tests provide greater confidence to import authorities of a country's freedom from disease status.

Test validation

ACDP, in partnership with Melbourne University and Massey University, is a World Organisation for Animal Health (WOAH) Collaborating Centre for Diagnostic Test Validation Science in the Asia-Pacific Region.

Part of a collaborating centre's role is to develop or improve diagnostic tests, with the aim of creating tests that meet international standards. WOAH sets international standards for validating tests.

In 2022, researchers from ACDP and the WOAH Collaborating Centre worked with a colleague from Canada's University of Prince Edward Island, to scientifically validate two real-time diagnostic tests used to detect white spot syndrome virus according to international standards. White spot syndrome virus affects prawns and is a contagious viral disease affecting a wide range of decapod crustaceans, especially penaeid prawn species. It is considered a serious threat to prawn farmers.

The entire process of validation has been published in the peer reviewed journal *Diseases of Aquatic Organisms*. The performance characteristics of the tests developed during this work have since been incorporated into the update of the Australian and New Zealand Standard Diagnostic Procedure (ANZSDP) for white spot syndrome virus.

Knowing the tests meet international standards for accuracy and reliability in diagnosing white spot disease benefits the prawn industry, not only for future surveillance, but also to provide greater confidence for import authorities on establishing freedom from disease status in Australia and other countries.

For more information contact Dr Nick Moody: nick.moody@csiro.au

Working with us

As a national facility, ACDP supports collaborations with Australian and international academics, government agencies, research organisations and industry to access our high-containment research infrastructure and capabilities for infectious disease research.
Our national facility role extends Australia's capabilities in research and development and improves pathways for research to translate to applied uses.

To enable this work, our access2ACDP program facilitates requests for information, collaboration or consulting services to ACDP. The program coordinates a review process for all proposed onsite research, ensuring the research:

- will result in high impact science
- is aligned with ACDP's purposes and capabilities
- meets the highest ethical and safety standards
- will benefit the Australian community.

In 2022, ACDP received 65 applications to access laboratory capabilities for research collaborations from Australian and international entities, including universities, private industry, government departments and other research organisations.

National Collaborative Research Infrastructure Strategy

The Australian Government's National Collaborative Research Infrastructure Strategy investment in ACDP has enabled CSIRO to deliver world-class research infrastructure for use by Australian and overseas researchers to benefit Australian's national disease diagnostic capability and strengthen the country's biosecurity framework.

Access to these facilities enabled CSIRO's research on COVID-19 earlier in the pandemic, such as testing of vaccines and antivirals, and research to gain an understanding of the SARS-CoV-2 virus, including genomic sequencing and imaging.

In 2022, following the outbreak of Japanese encephalitis, access to the NCRIS-supported high containment insectary at ACDP provided our scientists with the ability to conduct vector-competence studies, to determine whether a southern subspecies of *Culex annulirostris* could acquire and transmit the virus. This information will help determine the risk of Japanese encephalitis virus establishing in south-eastern Australia.

NCRIS-funded infrastructure at ACDP includes Physical Containment Level 4 laboratories, a Physical Containment Level 3 immunology laboratory, the Physical Containment Level 3 bioimaging suite and the Physical Containment Level 3 insectary.

ACDP's insectary operates at Physical Containment Level 3.

This year saw the start of a project, LabCap PNG, building laboratory diagnostic capability and capacity for field diagnostics in Papua New Guinea.

Securing Australia and the region

ACDP delivers an international program to provide greater stability, prosperity and resilience to Australia and the Asia-Pacific region.

Australian agriculture benefits significantly from the absence of several high-impact diseases which are endemic overseas, including in some of our closest neighbouring countries. Ensuring our regional partners have the capability to detect and control these diseases significantly reduces the risk of these diseases reaching our shores. It also leads to positive impacts on food security in affected countries.

In 2022 there were outbreaks of foot-and-mouth disease and lumpy skin disease in neighbouring countries, leading to significant economic impact on livestock owners. These outbreaks have underscored the importance of Australia's existing animal health status, and the need to continue preventing these exotic animal diseases coming to our shores.

This year, in addition to bolstering our own capabilities to manage potential outbreaks of these diseases here in Australia, we have been working across the region in support of neighbouring countries, to assist them in their own preparedness and response.

Highlights from ACDP's 2022 international work include:

- Supporting Pakistan's response to an outbreak of lumpy skin disease, through a visit as an Australian Government-supported representative, as part of an emergency response field mission undertaken by the Food and Agriculture Organization of the United Nations
- Delivering training in PCR techniques for lumpy skin disease and foot-and-mouth disease diagnostics in Timor-Leste
- Attending an expert workshop in Fiji, organised by the Pacific Community, bringing together relevant experts, government representatives and key stakeholders to strengthen animal health and production and improve veterinary services, which are lacking in the region
- Establishing a project in Papua New Guinea with their National Agriculture Quarantine and Inspection Authority, to provide guidance and training in field disease surveillance and laboratory diagnostics
- Continuing to work on the BICOLLAB project in Indonesia, working with the Disease Investigation Centre at Wates to strengthen their laboratory capacity for avian influenza
- Supporting partners from Indonesia and the Philippines to attend and present at the 7th World One Health Congress in Singapore.

Signing the Letter of Collaboration with PNG's NAQIA for the laboratory capacity building project.

Strengthening PNG against animal diseases, including African swine fever

This year work on the new $3 million laboratory capacity building project (LabCap PNG) began in Papua New Guinea, funded by the Australian Government Department of Foreign Affairs and Trade and CSIRO.

The project, led by our international program, is working with PNG's National Agriculture Quarantine and Inspection Authority (NAQIA) to strengthen and support PNG's ability to detect and control priority animal diseases, using African swine fever as a model.

In recent years, African swine fever virus has spread rapidly throughout much of the Asia-Pacific region and was detected in PNG in early 2020. With much of the region's population reliant on small-scale farming, pigs can often be a mainstay of people's livelihoods. This is the case in PNG, where pigs are raised for food, economic and cultural purposes.

Our researchers had already been working with NAQIA, providing technical advice, training and development activities for field-based and laboratory diagnostic methods for detecting and testing for African swine fever and mosquito-borne diseases.

Following on from this experience, NAQIA was keen to continue the collaboration with ACDP, drawing on our staff's world-class expertise and ACDP's status as a World Organisation for Animal Health reference laboratory for African swine fever, to expand PNG's overall diagnostic capacity and disease preparedness.

The project will link together our scientists, who have decades of experience in infectious animal diseases, with local laboratory staff in PNG. A full-time project manager, Dr Annika Suttie, also based in PNG, will work with staff from NAQIA's National Animal Health and Food Testing Laboratory.

Supporting NAQIA to develop this capacity will assist in control and preparedness for African swine fever along with other priority and emerging animal diseases identified by NAQIA, like highly pathogenic avian influenza, foot-and-mouth disease and lumpy skin disease.

For more information on our international program contact Dr Phoebe Readford: phoebe.readford@csiro.au

Partnering with Indonesia's animal health laboratory

Livestock farming throughout the Asia-Pacific region contributes significantly to the livelihoods of farmers through the provision of food and food products plus as a source of income and, in many locations, is of important cultural significance.

Outbreaks of transboundary and emerging infectious diseases can result in serious hardship for many communities. Timely and reliable disease information is important for early warning and effective response to animal disease outbreaks.

This year saw our continued work on the BICOLLAB project in Indonesia. BICOLLAB is a bilateral collaboration with Indonesia's Disease Investigation Centre in Wates and ACDP, to strengthen their avian influenza diagnostic capacity.

There were 23 training activities over the past year focussed on up-skilling the local workforce, the majority of whom were female, in diagnostic virology, sequencing, bioinformatics, biosafety and poultry housing,

In addition to the laboratory capacity building arrangement with Indonesia, BICOLLAB encompasses two other components: training in biorisk management practices in the Indo-Pacific; and support for the development of sustainable, regionally networked, risk-based targeted emerging infectious diseases surveillance systems in Indonesia and the Philippines. Indonesian and Filipino partners in the emerging infectious diseases surveillance component were supported to attend the 7th World One Health Congress in Singapore in November where the Indonesian partners presented some of their findings from project activities.

In the longer term, BICOLLAB will be continuing its engagement with the Disease Investigation Centre in Wates to strengthen their engagement and contribution to knowledge and understanding of strategic infectious animal diseases in livestock, especially avian influenza in poultry.

The project is supported by the Australian Government's Indo-Pacific Centre for Health Security, via the Department of Foreign Affairs and Trade.

BICOLLAB is a collaboration between ACDP's international team and Indonesia's Disease Investigation Centre in Wates.

CSIRO's investment in proficiency testing

Proficiency testing (PT) is a method of assessing a laboratory's testing capabilities to monitor and improve testing performance. Around the world, PT is conducted independently using interlaboratory test comparisons, and can be complemented by "backstopping", where scientists visit participating laboratories to provide comprehensive support on site.

ACDP has been providing PT and backstopping services in South-East Asian veterinary diagnostic laboratories since 2007.

Our PT allows for vigorous vetting of laboratories specialising in transboundary animal diseases including zoonotic diseases. It aims to improve diagnostic quality and epidemic preparedness, and reduce the risk of disease outbreaks. PT in our region also supports the pre-border protection of Australia's primary producers and our economy against the import of infectious diseases, and cultivates strategic partnerships between laboratories.

What started as specific activities within a broader project to support and develop diagnostic capability for avian influenza evolved in 2009 to a strategic initiative to help strengthen Asia's regional laboratory capabilities to maintain the region's food security and economic viability, and safeguard human health.

An independent review by economic research agency the Centre of International Economics in August 2021 has valued CSIRO's investment in PT and backstopping services in the Asia-Pacific region over the period 2007 to 2017 at $7.06 million (present value), with an estimated positive net benefit of $3.66 million and benefit cost ratio of 2.07.

ACDP is an ISO/IEC 17043-accredited leading PT provider in the region. As laboratories in this region undertake PT programs for external quality assurance, the Centre of International Economics' review considered PT programs as the implementation of standards to increase safety and/or manage risk. It then calculated the economic cost of a potential disease outbreak and attributed a percentage of avoided remediation costs from outbreaks to these standards.

The predicted $7.06 million value was calculated from a conservative 10 per cent of the avoided outbreak remediation costs over the review period of 20 years.

It excludes the valuation of benefits that are difficult to attribute to the ACDP team, such as price premia for Australian animal food exports.

For more information on our PT program contact Dr James Watson: james.watson@csiro.au

ACDP is an ISO/IEC 17043-accredited proficiency testing provider.

Protecting Australia from emergency animal diseases

A significant part of our role is to conduct research to help protect Australia against the most pressing emergency animal and human health disease threats.

Lumpy skin disease

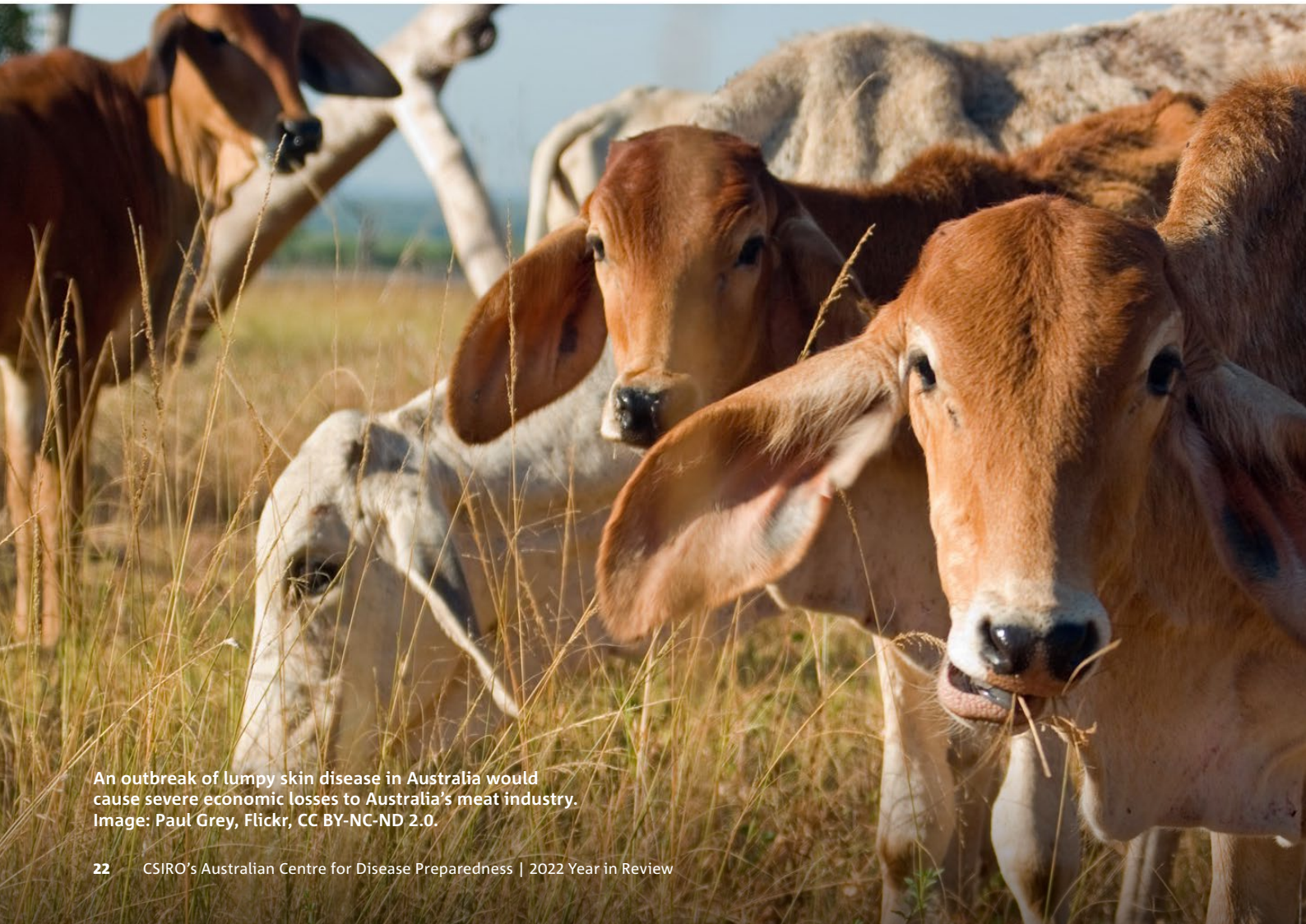
Lumpy skin disease is a highly infectious viral disease of cattle and water buffalo, caused by a capripox virus. It is an arbovirus, spread by biting mosquitoes, ticks, midges and biting flies. It does not affect other livestock or humans.

Spread of the disease in the Asia-Pacific in recent years brings increased risk of further outbreaks in the region and a potential incursion on our shores.

Our scientists are working with government agencies and industry to prepare Australia, and the region, to be ready to respond to potential outbreaks of lumpy skin disease.

To best support our preparations, CSIRO has imported live samples of lumpy skin disease virus into Australia after an extensive risk assessment and Australian Government approval process. We have also formed a new research group to develop new diagnostic tests and conduct studies to increase our understanding of the strains of the virus circulating in our region.

For more information contact Dr Kelly Stanger: kelly.stanger@csiro.au



An outbreak of lumpy skin disease in Australia would cause severe economic losses to Australia's meat industry. Image: Paul Grey, Flickr, CC BY-NC-ND 2.0.

Our FMD scientists were part of a large collaboration working to prepare Australia against the disease.

African swine fever

African swine fever (ASF) is a contagious and often fatal viral disease of domestic and wild pigs.

It's not harmful to humans but the impacts of ASF include economic losses through lost trading markets, the costs associated with outbreak response and eradication measures, and impacts to the pork industries of affected countries and the livelihoods of farmers and small holders.

There is currently no effective vaccine against ASF; however, novel candidate vaccines are currently being trialled in Vietnam, offering a potentially valuable tool to control the virus.

Researchers at ACDP are working on several projects to ensure Australia is prepared with the necessary tools to respond quickly to an ASF outbreak if one should occur.

We are working with colleagues in Canada and America to evaluate and compare commercially available PCR test kits to identify which are the most accurate and reliable. The information gained from this project is expected to benefit ASF testing laboratories around the world.

In another project our scientists are comparing different types of sampling methods from pigs to test for infection. They are specifically looking to test the effect of high temperatures, as experienced in outback Australia, on dry swabs used to collect blood samples. This would be a practical way to potentially test feral pigs in outback Australia for possible infection with ASF virus.

As part of ACDP's WOAH ASF Reference Laboratory role, our scientists have collaborated with colleagues in Timor-Leste, Papua New Guinea and Nepal, to conduct diagnostic testing and whole genome sequencing of strains of ASF virus from Southeast Asia and the Pacific. Understanding where a virus originated and the changes that may have occurred in its genome helps to inform the response strategy.

In addition, our scientists are working with colleagues in China to develop new diagnostic strategies that will help to mitigate and manage further ASF incursions or outbreaks in China. This work is focussed on designing novel pen-side (field) tests that have superior performance to existing tests.

ACDP continues to support state and territory veterinary services by providing laboratory diagnosis for ASF disease exclusion from domestic and wild pigs to support Australia's freedom of disease status.

We have also supported pre-border surveillance for ASF by providing diagnostic testing advice and services to the Australian Department of Agriculture, Fisheries and Forestry.

For more information on our World Organisation for Animal Health reference laboratory for African swine fever contact Dr David Williams: d.williams@csiro.au

Foot-and-mouth disease

In May 2022, an outbreak of foot-and-mouth disease (FMD) was reported in cattle in Indonesia, increasing the risk of the disease's spread to Australia. FMD is a highly contagious viral disease of cloven-hoofed animals. It is the greatest disease threat to Australia's livestock industries and the impacts of an outbreak would be devastating.

While it is vitally important for Australia to be prepared to respond to a FMD outbreak onshore, it is equally important we do all we can to prevent the disease from entering the country.

Our scientists play a critical role in Australia's pre-border biosecurity preparedness – preventing and reducing threats before they get to the border. We have been working with international partners to build laboratory and biosecurity capacity across Southeast Asia for decades, including Indonesia, Vietnam, Thailand, Timor-Leste, and Papua New Guinea.

In addition, we are members of the Vaccine Expert Advisory Group which assesses the global FMD situation to recommend the vaccine strains to be included in the Australian Vaccine Bank.

FMD Ready Project key outcomes

For many years, ACDP has been leading research to ensure Australia is well prepared should we face a FMD outbreak. We first led a research project called the FMD Risk Management Project.

Following on from this, we have been leading the FMD Ready Project. In 2022, the final report of the FMD Ready Project was published, detailing the project's key findings.

The FMD Ready Project focused on ensuring Australia is prepared in the event of an emergency animal disease outbreak, using FMD as a model. It also included helping develop processes and support tools to ensure a rapid return to trade following an outbreak.

This work, which built upon the substantial work of the previous FMD Risk Management Project, has improved Australia's preparedness through:

- improving decision making on which antigens should be included when renewing Australia's FMD vaccine bank
- improving the availability, accuracy, and efficiency of diagnostic tests for use in the detection of a FMD incursion to ensure accurate diagnosis and surveillance
- improving the participation of primary producers in biosecurity and surveillance networks. This in turn increased awareness of how to recognise and report emergency animal diseases, and helped to build trust in local networks between primary producers and government agencies
- increasing collaboration between government agencies and livestock industry networks to improve biosecurity and surveillance outcomes
- developing biosecurity communication tools by producers for producers
- updating and expanding the Australian Animal Disease spread model as a decision support tool and integrating it with improved economic modelling tools to inform disease control strategies, including vaccination and the use of trading zones to support earlier return to trade
- developing an application (SPREAD) to incorporate big data into the real-time modelling of disease spread during an emergency animal disease outbreak.

A significant achievement of this work was the truly transdisciplinary nature of the FMD Ready Project. Using this approach, we were able to demonstrate that collaboration between different research disciplines (e.g., modelling, economics, science) combined with direct interaction and collaboration with livestock industries, governments, Rural Research and Development Corporations and other agencies, can deliver solutions to highly complex problems.

The greatest benefit is that we have developed a suite of tools that will ensure Australia is better prepared for an emergency animal disease incursion. As a result, this will provide better protection to our livestock industries and lessen the potential for disease impact.

The full report is available on the Meat and Livestock Australia website.

For more information contact Dr Wilna Vosloo: Wilna.vosloo@csiro.au

This project was supported by Meat & Livestock Australia (MLA), through funding from the Australian Government Department of Agriculture, Fisheries and Forestry as part of its Rural R&D for Profit program, and by producer levies from Australian FMD-susceptible livestock (cattle, sheep, goats and pigs) industries and Charles Sturt University, leveraging significant in-kind support from the research partners.

The research partners for this project were CSIRO, Charles Sturt University through the Graham Centre for Agricultural Innovation, the Bureau of Meteorology and the Australian Department of Agriculture, Water and the Environment, supported by Animal Health Australia.

Japanese encephalitis

In late February and early March 2022, a widespread outbreak of Japanese encephalitis occurred in piggeries in southern Queensland, New South Wales, Victoria and South Australia. In parallel with these outbreaks, there were also multiple confirmed human cases of the virus.

Our scientists were instrumental in the laboratory diagnosis of the first case of the outbreak in Queensland in late February and additional detections in four more states, alerting authorities to an unprecedented multi-state outbreak in Australia.

ACDP is a nationally recognised reference laboratory for arboviruses such as Japanese encephalitis virus, and its diagnostic and emergency response team conducted 1352 tests for the virus in pigs, horses and other animals within the first month alone.

The strain of the virus that caused the outbreak hadn't been seen in Australia before, and many labs weren't equipped to diagnose it. Our scientists quickly shared test protocols and reagents with

Our scientists were instrumental in the laboratory diagnosis of the first case of the Japanese encephalitis outbreak in Queensland.

veterinary and public health laboratories, as well as the first genome sequence to enable diagnostic laboratories to check the accuracy of their PCR tests.

Our scientists contributed to government committees and advisory groups, providing expert scientific advice for public and animal health purposes to support the outbreak response and management.

The national impact of this work was recognised widely at CSIRO, with the team awarded the Trusted Medal at the 2022 CSIRO Awards.

For more information about Japanese encephalitis diagnostics contact David Williams: d.williams@csiro.au

Transmission of Japanese encephalitis virus

Japanese encephalitis virus is maintained in the environment in a transmission cycle between mosquitoes and animal hosts such as waterbirds and pigs. The main species of mosquito (known as a 'vector') thought to be involved in the transmission of the virus in Australia is *Culex annulirostris*, also known as the common banded mosquito. However, with the latest outbreak occurring in new regions in Australia, it is vital to confirm that mosquitoes from these areas can acquire and transmit the virus.

Working in ACDP's high containment insectary, our vector-borne disease specialists conducted vecto-competence studies, to determine whether a southern subspecies of *Culex annulirostris* can acquire and transmit this virus. The information from this study, which is ongoing, will help determine the risk of Japanese encephalitis virus establishing in south-eastern Australia.

The same team is also collaborating with the University of California San Diego to develop and test the application of next-generation genome engineering techniques to generate mosquitoes that rapidly die when infected with specific viruses, preventing pathogen transmission. Although currently focused on dengue fever, this technology could be adapted for use in reducing Japanese encephalitis spread. Once developed, the field deployment of such mosquitoes has the potential to curb future disease outbreaks.

For more information on Japanese encephalitis vector research contact Dr Prasad Paradkar: prasad.paradkar@csiro.au

Avian influenza

In May, results from a large collaborative study were published in PLOS Pathogens, providing a clearer picture of bird flu dynamics in Australia's wild birds.

Scientists from ACDP contributed to this work by sequencing the largest number of Australian wild bird avian influenza virus genomes since sampling began in 2006.

Until recently, studies of waterbirds in the northern hemisphere provided most of our understanding of the ecology and evolution of avian influenza viruses in the natural wild bird reservoir. But Australia's wild waterfowl, like duck and geese, face different environmental conditions and do not show the same migratory behaviour as their northern hemisphere cousins.

As part of this study, ACDP researchers sequenced and assembled the genomes of more than 300 avian influenza viruses collected by the National Avian Influenza Wild Bird Surveillance program. These virus sequences, along with those generated by our partners, have been added to public sequence data platforms and made accessible to other researchers worldwide.

Results of the collaboration showed avian influenza viruses in Australia's wild waterbird populations aren't closely linked to strains circulating in the northern hemisphere. Australia is not on a migratory pathway for ducks and geese from the northern hemisphere that follow clear seasonal patterns of migration over long distances. Instead, Australian waterfowl are nomadic and mainly stay within the Australo-Papuan region, moving more unpredictably within the Australian continent according to drought, rain and other local ecological cycles.

The study also found low pathogenic avian influenza virus strains can be carried into Australia by small, migratory shorebirds. Australia mostly acts as a dead end for avian influenza virus diversity, where strains may persist for varying lengths of time in isolation within the Australian continent or eventually go extinct. It's uncommon for bird flu viruses from Australia to be introduced by wild birds to other continents.

This study provided the first evidence-based picture of avian influenza dynamics in Australia. It revealed where the viruses fit in with those in other parts of the world.

Scientists in Australia now have greater information available for avian influenza virus risk assessments, evaluation and improvement of diagnostic tests, and early warnings and responses to potential new virus introductions, such as the H5N1 highly pathogenic avian influenza virus that caused devastating outbreaks in poultry and wild bird populations across Europe, Asia, Africa, and North America in 2021–2022.

ACDP is a World Organisation for Animal Health Reference Laboratory for avian influenza, and a Food and Agricultural Organization of the United Nations Reference Centre for animal influenza and Newcastle disease. We play a key role in supporting avian influenza diagnostics, surveillance and control in Australia and country partners in the Asia-Pacific region. ACDP has helped countries including Nepal, the Philippines and Timor-Leste with highly pathogenic avian influenza outbreak investigations over the course of 2022.

The NAIWB project was led by a partnership between CSIRO's ACDP, The University of Sydney, Deakin University, the World Health Organization Collaborating Centre for Reference and Research on Influenza, and the Commonwealth Department of Agriculture, Fisheries and Forestry, in coordination with the National Avian Influenza Wild Bird Surveillance Program of Wildlife Health Australia.

For more information on our animal influenza diagnostics and research capabilities contact Dr Frank Wong, WOAH reference expert on avian influenza: frank.wong@csiro.au

Australian waterbirds, like these Pacific Black Ducks, are not migratory. This has helped minimise bird flu introductions into Australia. Image: Geoff Whalan.

New understanding of avian influenza strain H7N9

The zoonotic H7N9 avian influenza virus first emerged in 2013 as a low pathogenic strain, meaning it did not cause severe disease in chickens. However, it has repeatedly caused human infection resulting in severe respiratory illness and a mortality of ~39% (killing more than 600 people) across five epidemic waves. This virus has circulated in poultry with little to no discernible clinical signs, making detection and control difficult.

Contrary to published data, our researchers observed a subset of chickens infected with the H7N9 virus succumbed to the disease, showing clinical signs consistent with highly pathogenic avian influenza. We were able to demonstrate that a mutation in the nucleoprotein led to the change in disease severity.

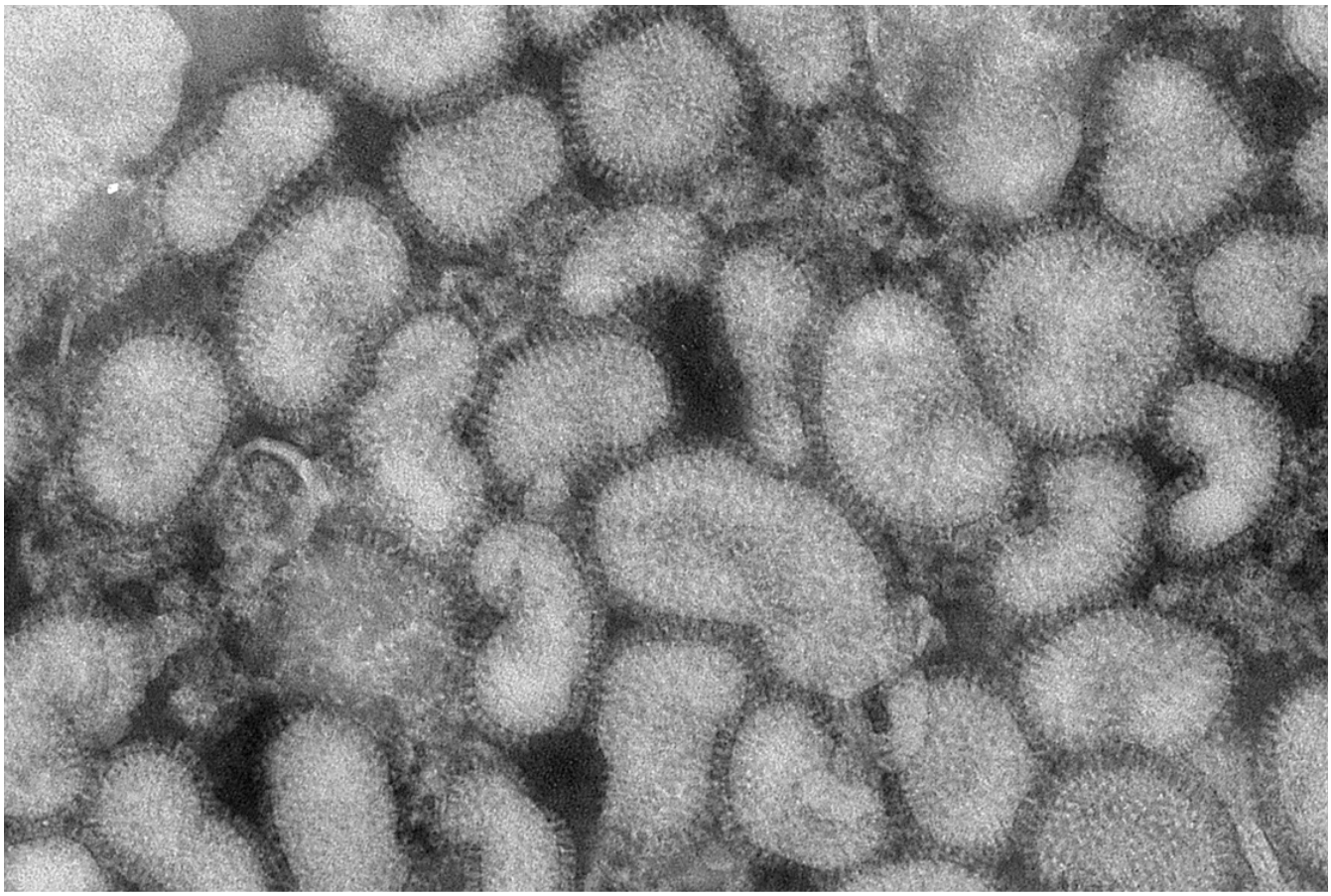
Changes associated with the mutation of the nucleoprotein was a loss of some T cells, specifically those known to fight viral infection, and disruption to a group of proteins known to control many viral infections. These changes suggest the nucleoprotein mutation may play a role in altered T cell activation.

Alternatively, it is possible the mutation altered the ability for the virus to replicate, as the mutation occurred on a section of the nucleoprotein which has previously been shown to be important in RNA binding.

These results have broad ramifications for our understanding of how avian influenza virus causes disease in chickens and humans and provides an excellent model for investigating the role of antiviral genes in a natural host species.

This work was conducted at ACDP and is published in *Frontiers in Immunology*.

For more information contact Dr Daniel Layton: daniel.layton@csiro.au or Dr David Williams: D.williams@csiro.au



Avian influenza virus H7N9 particles under the electron microscope.

Supporting preparedness

Our scientists are testing if Australian species of *Culicoides* can transmit African horse sickness. Credit: Wikimedia CC BY-SA 4.0

Infectious animal diseases and zoonoses program

In 2022, a new infectious animal diseases and zoonoses program was established at ACDP to deliver the research capability to effectively prepare for, detect, diagnose and respond to emerging, exotic and zoonotic diseases.

The long-term goal of this research program is to establish ACDP as a national hub for sovereign vaccine, antiviral and diagnostics innovation, to enable Australia to rapidly develop and deploy vaccines, diagnostic capability and antivirals.

Three areas of research capability have been identified to achieve this goal: investment in disease research, development of vaccine platform capability and knowledge, and delivering novel methods for vaccines and diagnostics.

Since establishing the program, new science teams have been appointed in mammalian, aquatic and avian research to complement existing capabilities. Three new post-doctoral researchers have been recruited to work on understanding:

- how infectious three viruses of concern are in amphibians and finfish: Bohle iridovirus, Mahafee road virus and epizootic haematopoietic necrosis virus
- if Australian species of *Culicoides* can transmit African horse sickness
- pathogenesis and transmission of Japanese encephalitis genotype 4 in the vertebrate host.

Future developments in this program will see growth in areas such as ex-vivo models with a pivot to more sustainable and ethical research methods compatible with vaccine pipelines and the start of vaccine trials.

Immune Resilience Future Science Platform

This year saw the establishment of the new Immune Resilience Future Science Platform.

CSIRO's Future Science Platforms (FSPs) are multi-year, multi-disciplinary investments in science that has the potential to help reinvent and create new industries for Australia.

Spanning three interconnected focus areas – vaccines, resilience technologies, and therapeutics and diagnostics – the Immune Resilience FSP aims to increase our preparedness by enabling more rapid and robust responses to emerging health threats.

The pandemic focussed our attention on the challenge of emerging infectious diseases for human health globally and the need to develop strategies to respond rapidly and effectively.

The Immune Resilience FSP will focus on providing an even deeper understanding of our innate and adaptive immune systems, our strongest defence against disease.

Using new and emerging technologies, we're aiming to develop new systems to stimulate, modulate and harness immune responses, and find new ways to identify, treat and prevent diseases.

In early November, the FSP participants met together for the first time at ACDP to discuss the confirmed research portfolio.

More information is available on the Immune Resilience FSP website.

Immune Resilience FSP workshop participants met for the first time in November.

Meet Dr Kristie Jenkins, Leader of the Immune Resilience Future Science Platform

Dr Kristie Jenkins says her love of science likely began with a Christmas gift she unwrapped as a six-year-old: a microscope. In the years that followed, she says that love only grew and, when the time came, the decision to attend university to study a Bachelor of Science, focussing on Biotechnology, was an easy one for her.

It was at university where Kristie developed a keen interest in immunology and continued this interest during her Honours and PhD based at ACDP looking at chicken cytokines. During her first post-doctoral fellowship position at Monash Institute for Medical Research she worked to characterise regulation of the innate immune response.

It wasn't until she was investigating ways to modulate the immune system during her second post-doctoral fellowship that she first discovered genome engineering.

"Genome engineering gives us a great way to study and change things in a way we never could before, opening up new ways to solve our greatest challenges," Kristie says.

Following her second post-doctoral position she went onto her next role as a research scientist in a team that developed transgenic chickens resilient to avian influenza.

Kristie led the Genome Engineering Team at ACDP between 2014–2022, during which she developed partnerships with global poultry genetics companies to develop disease resilient poultry.

Now, her work in immunology continues in her new role as Leader of CSIRO's Immune Resilience Future Science Platform.

Kristie is looking forward to seeing the first results of the impressive suite of new projects now getting underway.

Our science

Hendra and Nipah virus

Hendra virus and Nipah virus are pathogens of concern because they cause zoonotic disease. CSIRO has been involved in Hendra virus research since the virus' emergence in Australia in 1994, and was also involved with the discovery of the closely related Nipah virus, which emerged in Malaysia in 1998. Our researchers have made a significant contribution to the current understanding of these viruses, and ACDP is the only World Organisation for Animal Health (WOAH) reference laboratory for them.

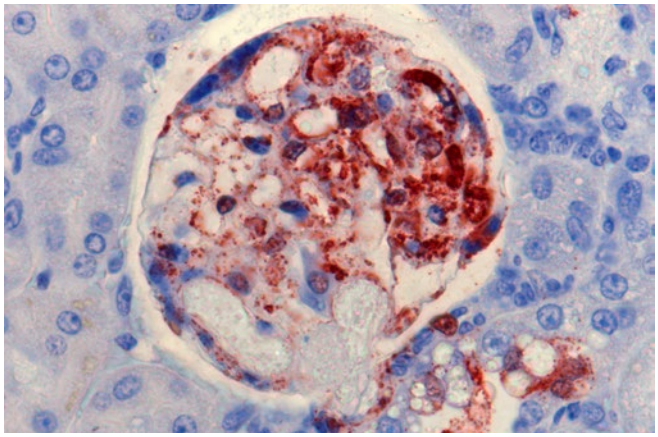
Surveillance study collaborating with veterinarians in Nigeria

As the WOAH reference laboratory, we were approached to collaborate with veterinarians from Nigeria to determine whether there was any evidence of prior infection in horses and pigs with Hendra or Nipah viruses.

This was a large-scale sero-surveillance study targeting seven states in Nigeria, with 1044 animals sampled. Serum from horses and pigs was collected, frozen and sent to ACDP for antibody screening assays and gold standard tests. There was very low reactivity in the antibody screening assays and no positive test results in the gold standard tests, confirming there were no antibodies specific to either virus in the horse and pig sera collected from northern Nigeria in 2018.

These results were expected, especially as there has been no report of Hendra virus or Nipah virus disease in either pigs or horses in Nigeria or in Africa. However, due to the presence of bats, which might be carrying undescribed viruses in parts of Africa, it is pertinent to monitor this situation, and we made recommendations for future surveillance.

There have been no reports of Hendra virus or Nipah virus in pigs in Africa. Credit: Amy the Nurse, Flickr, CC BY NC ND 2.0.



The brown pigment shows the Nipah viral protein in blood vessels in a kidney.

Differences between different genotypes of Hendra virus and Nipah virus

In 1994, the first Hendra virus was identified by our researchers and in 2021, a second Hendra virus genotype was isolated by CSIRO. Meanwhile, there are currently two known Nipah virus genotypes, named after where they were originally found: Nipah virus-Malaysia and Nipah virus-Bangladesh (the more pathogenic genotype).

Identifying and characterising differences between Hendra virus genotypes and Nipah virus genotypes is now the focus of a PhD project.

For more information about Nipah and Hendra virus contact Dr Kim Halpin: kim.halpin@csiro.au

Bats and filoviruses

Filoviruses refer to a family of viruses called *Filoviridae* which can cause severe or fatal disease in people and non-human primates, and includes the ebola virus. Filovirus infections have never been detected in humans or animals in Australia previously, but researchers at ACDP have now discovered filovirus antibodies in Australian bats in a study of more than a decade's worth of samples.

The details of this study were published in the *Journal of General Virology* in 2022 with Murdoch University.

The study tested 190 samples from microbats and megabats across Australia between 2005 to 2017, and found 46 samples reacted to filoviruses, with nine reacting more specifically to the ebola and reston viruses.

While it is believed the bats were most likely exposed to a currently unknown filovirus, more extensive research is needed to better understand the presence of the antibodies. Filovirus antibodies have been found in bats in countries overseas without filovirus spread in the human population.

This study reinforced the importance of national collaborations for preventative wildlife health and public health activities.

For more information about this research contact Dr Prasad Paradkar: prasad.paradkar@csiro.au

Ebola Reston virus, pictured here, is in the family *Filoviridae*. This is a colorised negative contrast image of Ebola Reston virus taken on the electron microscope at ACDP.

Screening for anti-viral treatments for COVID-19

Scientists at ACDP have screened a range of drugs approved by the Therapeutic Goods Administration/US Food and Drug Administration to assess their potential to be re-purposed as treatments for COVID-19.

This project, funded by the Australian Government's Medical Research Future Fund, first used an algorithm to sort and select the approved drugs that matched criteria for being most promising against a respiratory infection such as COVID-19.

The resulting shortlist was then assessed for antiviral capabilities in human lung and heart 3D tissue models.

The large quantity of data collected using an 'omics' approach was analysed to generate biological insights. This analysis generated patterns from within host tissue responses indicating effective and ineffective treatments.

Although none of the drugs tested showed sufficient antiviral efficacy for future use against COVID-19, this work established the usefulness of this rapid screening technology.

For more information about the rapid screening platform contact Dr Alex McAuley: alex.mcauley@csiro.au

Using metal organic frameworks to encapsulate vaccines

Vaccination is undoubtedly one of the most effective medical interventions, saving millions of lives each year. However, delivering vaccines is challenging in some countries that lack the cold storage supply chains required to keep the vaccine viable. The World Health Organization estimates that at least 50 per cent of vaccines are wasted globally each year, mainly due to a lack of facilities and temperature control.

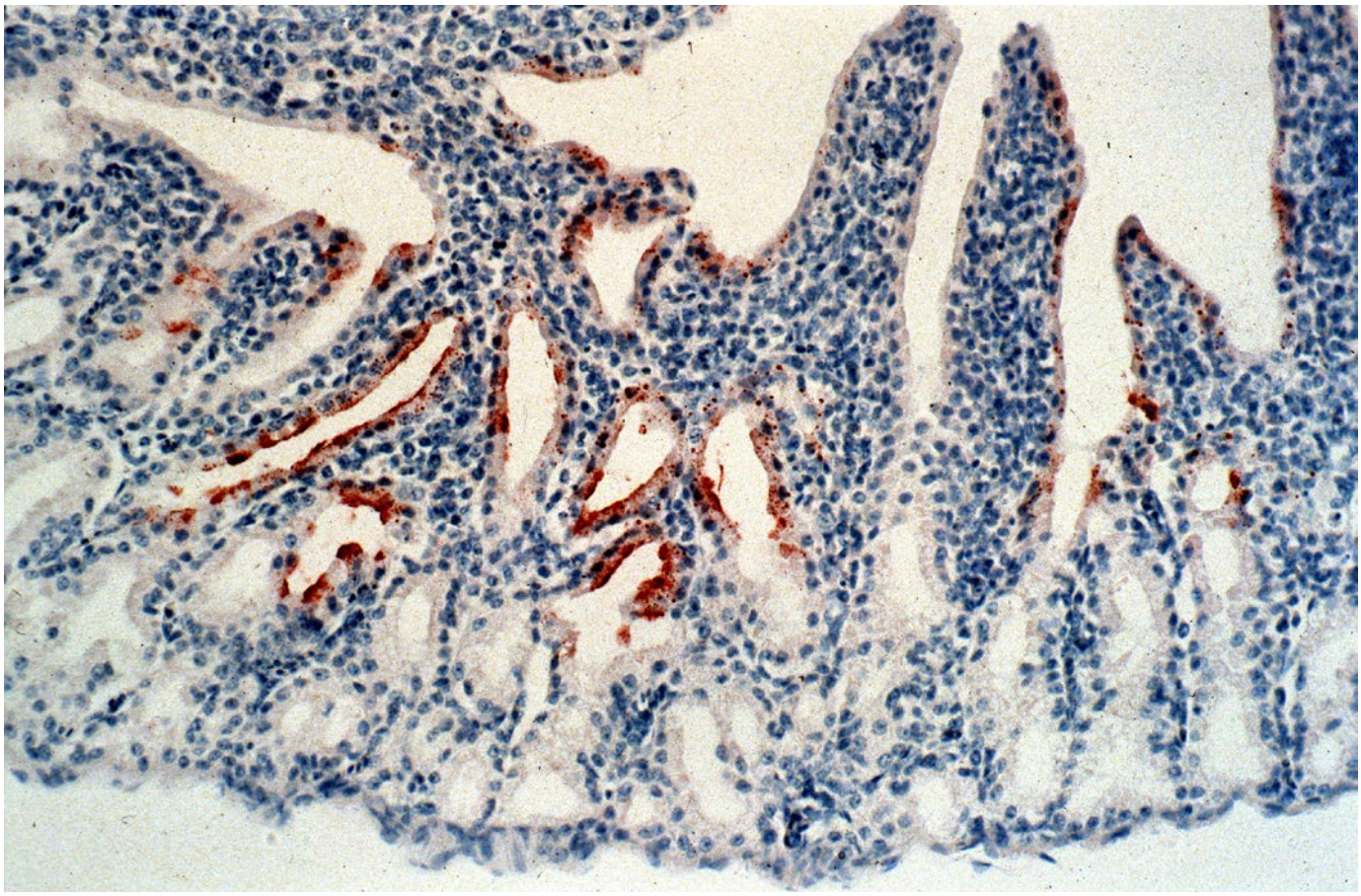
Live virus vaccines are extremely effective, but their complex composition makes them susceptible to high temperatures, and a universal stabilisation technique has not been found.

Recently published in *Acta Biomaterialia*, CSIRO researchers encapsulated live virus vaccines with a dissolvable crystalline material called metal organic frameworks, which protected the integrity of the vaccines for up to 12 weeks and at temperatures as high as 37 degrees Celsius. Without refrigeration the vaccines would otherwise last only a few days.

When metal organic frameworks were formed around the vaccines they helped protect the vaccine molecules from heat stress. A solution was then used that dissolved the metal organic framework for administration of the vaccine. This world-first approach of stabilising a vaccine with metal organic frameworks is simple, rapid, and scalable because it takes one step. The research focused on two different types of live viruses as proofs of concept, a Newcastle Disease vaccine designed to protect poultry and a strain of Influenza A.

The breakthrough science would now focus on proving the approach for other animal and human vaccines, including mRNA COVID-19 vaccines. The team continue to progress this research and are looking to partner with animal and human health companies to commercialise their work. Their study forms part of CSIRO's biomedical research, which is aiming to generate new opportunities for Australian businesses and increase national sovereign capability.

For more information on thermostable vaccines contact Dr Daniel Layton: daniel.layton@csiro.au



The research focused on two different types of live virus, including Newcastle disease virus pictured here.

Mozambique tilapia has established itself in Queensland waters. Credit: By Greg Hume - Own work, CC BY-SA 3.0.

Tilapia biocontrol

Mozambique tilapia (*Oreochromis mossambicus*) is listed as one of the world's top 100 worst invasive alien species, and has severe impacts on freshwater ecosystems primarily through displacement of native species and habitat alteration.

In Australia, both *O. mossambicus* and the lesser-known black spotted tilapia (*Tilapia mariae*) have established significant populations within Queensland waters, and recent incursions into northern New South Wales are of great concern.

Scientists at ACDP are leading a tilapia biocontrol research project, in collaboration with University of the Sunshine Coast, James Cook University, Elizabeth Macarthur Agricultural Institute, and ACRE Economics. The project is funded by the Australian Government via the Centre for Invasive Species Solutions.

Where feasible, biological control can be a cost-effective, safe and practical solution to managing invasive species.

Based on the development of previous viral biocontrol strategies for rabbits and carp, the team used a robust assessment framework to identify potential biocontrol agent candidates. They found tilapia lake virus (*Tilapinevirus tilapiae)* and possibly *tilapia parvovirus* may offer the potential for biocontrol for invasive tilapia in Australia.

This work was published in *Biological Control* in August, and the team presented their findings at two symposia later in the year.

For more information contact Dr Agus Sunarto: agus.sunarto@csiro.au

Researchers at ACDP have developed a gene-marker system to identify eggs containing male embryos before they are incubated and hatched.

Sex sorting for the egg-layer industry

Each year in Australia, around 23 million day-old male chicks are humanely culled in the egg laying industry. As these male chicks are of the layer, rather than broiler, breed of chicken, they do not produce meat sustainably and cannot be grown for this purpose. This culling results in waste as well as representing a serious ethical issue.

The Genome Engineering Team at ACDP has formed a research partnership with Hendrix Genetics to assess the viability of a solution that would enable the egg laying industry to avoid culling male chicks altogether, and in doing so improve its ethics, carbon footprint, and sustainability.

This solution was developed by our researchers; it is a gene-marker system that can identify eggs containing male embryos before they are incubated and hatched, allowing for their removal and, potentially, use in other ways such as for vaccine production. Not only does this solution eliminate stress to both hatched and unhatched male chicks, but also it means producers won't have to incubate and hatch double the number of eggs necessary, thus improving their workflow, sustainability, and profitability.

The partnership between CSIRO and Hendrix Genetics allows for further research into integrating this technology with current industry practice.

In 2022, we have also welcomed Dr Olivier Serralbo from Monash University into the team at ACDP, to expand this research capability and enable new gene technology solutions for the poultry industry.

For more information on sex-sorting technology contact Dr Mark Tizard: mark.tizard@csiro.au or Dr Oliver Serralbo: olivier.serralbo@csiro.au

Johne's disease

Johne's disease is a chronic, incurable infectious disease in ruminant livestock which leads to wasting and eventual death in affected animals. The highly contagious disease is a significant biosecurity risk and welfare concern in Australia and internationally.

To control the spread of Johne's disease in livestock, early detection and quarantine is vital. However, as for many infectious diseases, the current diagnostic tests for Johne's disease are lacking, with poor sensitivity and long turn-around times.

In collaboration with the National Reference Laboratory for Johne's Disease, researchers at ACDP have begun a project investigating microbiome-based biomarkers for the improved detection of Johne's disease. Intestinal inflammation resulting from infection leads to changes to the composition and function of the gut microbiome. These changes have the potential to be used to distinguish healthy and infected animals faster and more accurately than current diagnostics tools.

We are analysing hundreds to thousands of bacteria in the gut microbiome to identify candidate markers to accurately predict disease. This novel approach will give farmers actionable information that they can use to minimise the spread of this devastating disease, improving the health and welfare of their livestock.

For more information on Johne's disease research contact Dr Annaleise Wilson: annaleise.wilson@csiro.au or Dr Cameron Stewart: cameron.stewart@csiro.au

Researchers are investigating microbiome-based biomarkers for the improved detection of Johne's disease, an incurable infectious disease of livestock.

Delivering bioassays for diagnosis, surveillance and response to disease outbreaks

Australia's response to emerging and existing biological threats to animal health requires development of new assays and reagents suitable for detection and identification of disease agents. Diagnosis of disease informs appropriate actions to help mitigate the threat to our animals, industries and people.

The Bioassay Research and Development team at ACDP develop and manufacture novel diagnostic tests and bioreagents suitable for detection of veterinary and zoonotic diseases. In 2022, a lowered priority for SARS-CoV-2 bioassays allowed the team to refocus attention to developing tests for diseases of livestock and zoonoses, including foot-and-mouth disease virus, Hendra and Nipah viruses, and capripox viruses that cause sheep pox, goat pox and lumpy skin disease in cattle.

The assays and reagents developed support ACDP's diagnostic services program and external customers at home and abroad. This important role forms an integral part of ACDP's and Australia's efforts to ensure our nation's biosecurity.

For more information contact Dr Grant Peck: grant.peck@csiro.au

Research has detected potential sources of *Mycobacterium ulcerans*, including the role possums play in circulating the bacteria in the environment.

Buruli ulcer

Mycobacterium ulcerans, the agent of Buruli ulcer, causes severe destructive lesions of skin and soft-tissue in humans, which often result in long-term disability. In Victoria the community is facing a worsening epidemic; cases are rapidly increasing in number, becoming more severe in nature, and occurring in new geographical areas.

Despite this, it is still not clear how people are contracting this disease, preventing the implementation of control measures, and inhibiting the effectiveness of public health policy.

With National Health and Medical Research Council funding and working with numerous Victorian partners, including the University of Melbourne and Barwon Health, ACDP researchers conducted a large-scale case-control study of Buruli ulcer throughout the Victorian endemic area.

Using a questionnaire approach alongside environmental sampling of case and control properties, this research both detected potential sources of *Mycobacterium ulcerans* and identified several risk and protective factors for this disease, including strong support for the role possums play in the environmental circulation of this bacteria. Through publication of the results and provision of this information to the Victorian Department of Health, this research has contributed to improved public education and awareness of Buruli ulcer. These findings will also aid in the development of disease-appropriate intervention strategies to help in the prevention of Buruli ulcer.

For more information contact Dr Kim Blasdell: kim.blasdell@csiro.au

Maintaining our infrastructure

ACDP was constructed in 1985 and has been operating ever since. During this time, there have been upgrades to operational systems and some laboratories, but the facility now needs a refresh to future-proof its extensive high-containment laboratories.

The ACDP Part-Life Refit project aims to extend and refresh the existing facility and infrastructure services to ensure CSIRO can continue to prevent and respond to exotic and emerging animal and zoonotic diseases in Australia for the next 30+ years. The planned works will also ensure CSIRO continues to meet its regulatory compliance requirements of the facility.

The works will involve updating some areas of the existing facility in Geelong to match future research demands. Stages include the construction of a new wing extension, refurbishment of several of the facility's laboratory suites, and replacing end-of-life services and infrastructure.

Due to its national importance as a provider of critical disease testing and animal and zoonotic disease research, ACDP will continue operating throughout the project. This will be achieved by carrying out the work in phases, to ensure full capability is maintained.

CSIRO is currently undertaking design development and is expected to submit project information to the Parliamentary Standing Committee on Public Works for consideration in early 2023.

If approved by the committee, construction works are expected to commence in October 2023. At this stage it is anticipated that these works will continue through to July 2027.

The Operations and Maintenance teams monitor and look after the services required to keep the facility operating safely.

Meet Stuart Lucas, helping to keep ACDP running

Stuart Lucas is the Acting State Manager looking after the operation and maintenance of ACDP. As Australia's largest biocontainment laboratory, there is some very elegant engineering in the building, and it requires a specialised team to keep the facility operating smoothly. We chatted to Stuart to find out what it's like to manage a complex building like ACDP.

What is involved in being State Manager of ACDP?

Stuart hasn't long been in his new role as Acting State Manager for ACDP but is quickly getting up to speed. He manages the team of people who keep the facility running smoothly, allowing our scientists to conduct their important research safely.

As the Acting Manager, Stuart has day-to-day interactions with the team to monitor progress and discuss forward plans. A major project currently underway is the ACDP Part-Life Refit project. The project is now in the design development phase, which requires input from Stuart's team to assist with the technical considerations required for such a complex build.

What is unique about managing a facility like ACDP?

This facility is one of only a few in the world, able to safely store and conduct research on some of the world's most dangerous pathogens. Stuart's team helps make sure that services are maintained around the clock to guarantee the biocontainment is secure, and all regulatory requirements are always met. For this level of biocontainment, the facility is equipped with substantial engineering infrastructure – including pressurised air filtering systems, collection and treatment of all solid and liquid waste plus every containment system is either duplicated or triplicated ensuring containment is never at risk from one computer or power failure – all of which requires significant specialist skills to operate and maintain.

What mix of skills do the team need to run the facility?

Stuart's team consists of engineers, technical trades and those involved in documentation and compliance, including:

- the Operations team, who monitor the services in the facility and ensure they are operating correctly and within specifications
- the Maintenance team who look after the services, plan for updates, prevent issues and respond rapidly to repair any equipment downtime
- the Documentation and Compliance team
- the General Services team who run the stores and manage cleaning and waste and contractors onsite
- a small team of engineers, who provide specialist technical knowledge across the facility and run minor works projects as required.

Engagement and outreach

Australian Society of Immunology Conference

This year was the 50th Annual Scientific Meeting of the Australian and New Zealand Society for Immunology held on 29 November to 2 December 2022 at the Melbourne Convention and Exhibition Centre.

The conference presented an excellent opportunity for CSIRO to network and hear about the latest immunology research.

Several CSIRO scientists and post-docs attended. The Student Networking Forum attracted around 200 participants and the booth was well attended during conference breakouts.

Topics included COVID-19, innate immunity, tumour immunology, systems immunology, autoimmunity and many more.

Cutting Edge Symposium

In late September, CSIRO held a *Joint Cutting-Edge Virtual Symposium on Coronaviruses with 'Disease X' Potential* together with the UK International Coronavirus Network, the US Department of Health and Human Services and the US Food and Drug Administration (FDA) as part of the Biosafety Level 4 Zoonotic Laboratory Network international conference.

Disease X refers to a hypothetical unknown virus that could be of serious threat to human health, with an increasing likelihood of zoonotic origin.

The event brought together early/mid-career researchers and international experts from a diverse range of disciplines who have been working on COVID-19 and SARS-like coronaviruses to develop strategies to facilitate the rapid responses to novel infectious agents.

This symposium was a part of our existing collaboration with the FDA through the Medical Countermeasures Initiative led by CSIRO. A conference hub at ACDP had more than 75 in-person attendees and over 1100 online through the Biosafety Level 4 Zoonotic Laboratory Network international conference, with other hubs in the UK and Canada.

A Women in STEMM networking event was also held at ACDP in conjunction with the symposium. The proceedings of the symposium will be distributed and made available in a special forthcoming edition of the *Journal of General Virology*.

ACDP seminar series

The ACDP seminar series was held online in 2022. It provides a platform for our researchers, students and visiting scientists to present their work to a broader audience onsite and to others in the Geelong research network.

ACDP hosted a conference hub as part of the Cutting Edge Symposium.

About 40 external participants attended the WOAH Reference Laboratory network meeting for avian influenza and Newcastle disease.

International visitors

In 2022, ACDP and the Australian Government Department of Agriculture, Fisheries and Forestry co-hosted two international meetings of the World Organisation for Animal Health Asia Pacific Reference Laboratory networks for avian influenza and Newcastle disease, and African swine fever.

This was the first face-to-face meeting of these group members for three years, and the first time the meetings have been held at ACDP or in Australia.

For both meetings, about 40 external participants attended, including experts from across the Asia-Pacific region and additionally from Europe and USA. Staff from the World Organisation of Animal Health and the UN Food and Agriculture Organisation, and the Australian Chief Veterinary Officer Dr Mark Schipp, were also present.

It presented a fantastic opportunity to engage directly with international experts and discuss the key issues in managing these diseases in the Asia Pacific.

Dr Mark Schipp, Australia's Chief Veterinary Officer, attended the WOAH meetings at ACDP.

Developing our people, culture and workforce

At CSIRO our values underpin not just the work we do, but how we do it, and how we interact with our colleagues and the diverse range of partners we collaborate with every day.

Living these values is central to the work and success of ACDP, and the important outcomes we deliver for the nation.

There are four CSIRO values: People First, Trusted, Further Together and Making it Real.

Our people are highly trained scientific, technical, and professional officers committed to high standards of work, and to ensuring the safety and wellbeing of themselves and each other.

This year has been all about re-connecting again after the disruptions of the COVID-19 pandemic and many initiatives for supporting our people have been started or re-invigorated. The ACDP First Nations Engagement Committee established a dialogue with the Wadawurrung Traditional Owners, which led to opportunities for interaction and presented site-based people with a glimpse into the pre-European settlement culture of the site.

As a national facility, ACDP has a significant responsibility to help Australia, its people and its industries. We consider ACDP's purpose a privilege and work hard to deliver on the trust placed in our staff and in our science. Our workplace is also built on the trust between each other as colleagues, and between ACDP and our partners.

We collaborate widely because we can achieve more together and at ACDP, we work together across teams and across disciplines in a One Health approach, which recognises the health of people, animals and the environment are all connected.

This year we have again delivered real impact, not only in our research results, but in living our values and developing our people. Living true to CSIRO's values helps us to perform our critical function within Australia's biosecurity network, delivering and developing our core diagnostic skills and undertaking research into diseases that pose a real threat to our livestock industry, our wildlife and our people.

First Nations engagement

In 2021, ACDP established a First Nations Engagement Working Group to oversee the development of an action plan for ACDP in meeting its commitments under the CSIRO Reconciliation Action Plan.

This year, ACDP achieved a significant milestone with the establishment of dialogue with the Wadawurrung Traditional Owners for the Geelong ACDP site.

ACDP is about to embark on a major capital works project which will see the refit and extension of the secure laboratories. ACDP and the design team see an opportunity for the physical design of the space to reference Traditional Owner history, culture and values.

To facilitate this opportunity, ACDP hosted a "Walk on Country" in May 2022 – an informal meeting between Wadawurrung Traditional Owners and the designers and architects for the ACDP Part-Life Refit. The walk was to help architects better understand the Indigenous cultural history, stories or outlook that might influence layout or be incorporated into design. As ACDP is a quarantine site and not open to public access, the walk also provided the first look at the ACDP site by the Wadawurrung Traditional Owners in decades.

Also in May, ACDP was fortunate to have a Welcome to Country by the Wadawurrung Traditional Owners to celebrate Reconciliation Week. The event featured a smoking ceremony and official unveiling of an artwork by local Aboriginal artist BJ O'Toole. Around 100 onsite staff and representatives from the Victorian Indigenous Engagement Committee attended the smoking ceremony, hosted by Wadawurrung woman Corrina Eccles and her son BJ O'Toole.

Following the ceremony, BJ O'Toole gave a short talk on a painting that ACDP purchased in 2021. There was a light afternoon tea after the talk. Due to COVID-19, this was the first opportunity ACDP had to unveil the painting which is displayed in the reception area.

We are thrilled to have finally had the opportunity to have BJ and Corrina onsite and BJ's explanation of the painting, recorded beside it with his permission.

BJ O'Toole's artwork and the explanation of the painting.

Matt Bruce reflects on the Wadawurrung Traditional Owners visit on-site

In May, a traditional smoking ceremony was held onsite followed by the official unveiling of BJ O'Toole's artwork. These events were organised through the efforts of the ACDP First Nations Engagement Working Group. Matt Bruce received ACDP's Corporate Citizenship Award in December 2022 in recognition of his role in helping to organise these events, his efforts to raise awareness about CSIRO's RAP and for encouraging our people to consider the role they can play in reconciliation.

"I always felt like this site was so curated, turned over and developed that any Indigenous culture had been scrubbed from it. Seeing how Corrina (in particular) related to what she could hear, see and smell from this site, made me realise that Wadawurrung Culture exists here, way deeper than anyone can dig.

"It includes the sky in every direction and as far as the stars. It includes the view from every corner and bump and hill and tower. A culture that believes the spirit of past ancestors is returned to, and lives on in the environment, in the dirt, rocks, trees and animals. A culture that is acutely aware that we stand on the lives and choices of our ancestors and the ancestors of this land. An ancient and wise culture that surrounds and permeates us on Wadawurrung Country. It has always and will always be here, if we are aware of it or not.' – Matt Bruce, part of ACDP's First Nations Engagement Working Group.

Wadawurrung Country, 2021, Acrylic on canvas

"The first layer represents the ochre which is our earth, it is commonly found exposed along our coastline in the cliffs. Ochre was used in ceremonies and as a traditional paint. The next layer represents the coastline with the traditional Wadawurrung markings sharing the story of the old people who lived, camped, collected food and resources along this coastline for thousands of years. Next is the saltwater which Wadawurrung Country is known for. It is saltwater country. It is followed by the volcanic plains that run through Wadawurrung Country, telling of times long ago. We then have our freshwater, which were our travelling routes across country. Then the mountains our 'Wurdi youang' meaning big hill. You can see our mountains all over Country. Waa the crow is our protector on Wadawurrung Country which is why I have incorporated Waa onto this painting. He will always look over you and protect you while you are on Wadawurrung Country."

(Billy-Jay O'Toole, 31/5/2021)

BJ is a proud Wadawurrung man living on Wadawurrung Country at Mount Duneed. He is a recognised Traditional Owner and Cultural Heritage Representative for Wadawurrung Traditional Owners Aboriginal Corporation.

Representing CSIRO at Mardi Gras

Diversity is important, to foster innovation, creativity and productivity. But diversity is only one part. We need an inclusive culture for all our people to thrive.

Participating in the Sydney Gay and Lesbian Mardi Gras parade is one way CSIRO demonstrates how much we value and celebrate the LGBTQI+ community.

In 2022, 40 of our people powered their way around the Sydney Cricket Ground representing CSIRO and the Pride@CSIRO network.

Mark Woodcock from ACDP was there and brings us his reflections on what it meant for him to be representing CSIRO at Mardi Gras.

Mark Woodcock and Lynda Wright from ACDP at Mardi Gras.

What did it feel like to be marching at Mardi Gras?

"Marching at Mardi Gras, it felt like I was where I was supposed to be, and that I was loved for being my true self and for expressing myself honestly – all throughout the weekend's arrangements, celebrations and dancing. Clear in my memory is the buzzing, whooping and vibrant colours of an entire stadium chanting 'we love science', plus the strong sense of being valued and seen that this experience gave me. The entire weekend was an incredible rush of excitement, belonging and community."

Are you able to bring your true self to work each day?

"For me, Mardi Gras is about inclusion, belonging and the power to be proud and honest about who you are. I work hard to be my true self whenever I'm out in the world, including at work – even if that's sometimes easier said than done. Learning to not hide and to express all pieces of myself – whether that's being ADHD, non-binary, a dyslexic thinker, disabled, queer or another of my qualities that aren't so neatly labelled – takes time and isn't without setbacks. Yet when I can bring my whole self to work, I feel excited to collaborate with others, I'm productive and joyful, and often I surprise myself with the creative solutions my wonderful brain comes up with."

What does it mean for you that CSIRO is working to create a safe, supportive and diverse working environment?

"It means heaps to me that CSIRO is working to create a safe, supportive, and diverse working environment. To me it says that CSIRO understands the value in providing places where people can clearly see they belong, no matter their background, and where they're empowered to speak up and share their ideas. It means that CSIRO wants its people to succeed in all areas of their lives and is willing to give them the means to do so. While there may be a way to go, from tolerance and acceptance to appreciation and admiration of our differences, I'm excited to see what we can learn from each other, and the progress we can make, in an environment that shows folk that they matter because of their diversity and not despite it."

Meet Sinéad Williams, a champion of diversity and inclusion

Sinéad Williams is a research scientist at ACDP and team leader of the Zoonotic Platforms research team.

She and the team have been developing ex-vivo lung models through cell culture to aid research into both viral and bacterial respiratory infections in the normal and diseased lung. These models have been used to test therapeutics against SARS-CoV-2 and are currently being used as a platform to test nebulized antivirals to influenza.

Sinéad was among many CSIRO scientists who contributed to our understanding of COVID-19. But the pandemic also presented another unique challenge for her science career: she was born profoundly deaf, and, in 2020, she lost what little hearing she had. With the introduction of mask mandates and virtual meetings as the new norm through COVID-19, Sinéad found she could no longer rely on facial expressions and lipreading to help her communicate as she used to.

Sinéad's hearing loss was what initially led her to a career in science. Her interest in microbiology emerged with her discovery that Rubella virus, which her mother had contracted while pregnant, had caused her hearing loss. After schooling, Sinéad went into laboratory research and found the conditions of this work suited her well; it required face-to-face interaction with just a small group of colleagues at one time.

When COVID-19 upended these conditions and at the same time Sinéad lost her hearing completely, she became anxious about her ability to work. But CSIRO's Health, Safety and Environment team found a way to help, arranging clear face shields for her team so they could all still communicate.

That same year, Sinéad underwent surgery for a cochlear implant and the sound processor helped her to hear again. A second cochlear sound processor was donated by the company Cochlear who manufactures them, to be kept in the secure laboratory, because the microbiological security procedures required to exit the lab mean the device can't leave the lab without being destroyed.

Sinéad is a member of the CSIRO Disability Working Group, actively supporting CSIRO's diversity and inclusion efforts, even appearing as a guest speaker at an all-staff event. She believes frank discussions about our needs are key to ensuring our workplaces are inclusive. She encourages leaders to have these discussions with their team members, to ask how they can best be of support, and to not assume anything about anyone's abilities.

CSIRO Early Research Career Postdoctoral and Engineering Fellowship

CSIRO Early Research Career Postdoctoral and Engineering Fellows work alongside leading researchers on projects of national and global significance. They undertake independent research and are mentored by senior scientists, while being given access to generous personal development and learning opportunities.

We aim to enhance the research capability of ACDP through the employment of PhD graduates as CSIRO Early Research Career Fellows. Our goal is to offer a range of opportunities to develop successful candidates as future science leaders.

ACDP hosted seven Early Research Career Fellows in 2022.

ACDP Academic Board

ACDP's Academic Board was established in 2021 to support students undertaking formal scientific research in pursuit of postgraduate qualifications, and their supervisory staff.

The overall objective of the Board is to ensure ACDP maintains the highest standards in research training, scholarship opportunities and collegiate culture. This is achieved by ensuring student projects are of high scientific quality, have appropriate financial support, and that students receive high-quality supervision.

The aim is to ensure a positive and rewarding research experience for the student, and the delivery of high-quality and rigorous scientific outcomes from student projects that advance knowledge in the field.

The STEMM engagement program, established in 2022, hosted five high school visits and two high school work experience students. ACDP hosted numerous student placements in 2022, including six veterinary student placements, and five undergraduate and postgraduate student placements. ACDP hosted 13 honours, masters, and PhD students in 2022.

ACDP Social Club

The ACDP Social Club aims to make the workplace an enjoyable and inclusive place for all. Our hard-working committee of 21 staff regularly organises events for people to socialise and make connections with their colleagues, arranges services such as the tea and coffee supply, and holds functions to mark special dates.

In 2022, the Social Club offered important support to our staff to welcome everyone back to site following the COVID-19 pandemic. Events were held online and in person, both indoors and outdoors, to allow people to participate as they felt comfortable. Activities included discounted ticket sales to local events, weekends at the snow, day trips in the local area, fundraising raffles and morning teas, happy hours, lunches and Christmas breakups.

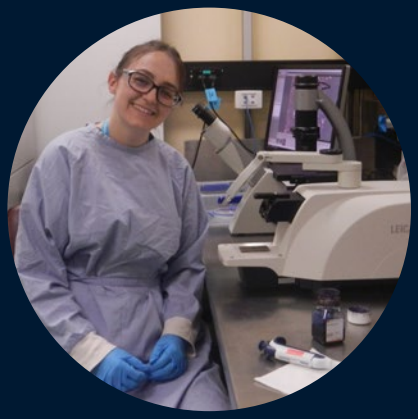
Social connection is more important than ever as we emerge from the last couple of years and reconnect with colleagues and new staff.

Embrace

The "Embrace" group at ACDP, a leadership initiative for women, aims to encourage and raise awareness of key roles women can play in science and leadership positions. They want to provide inspiration and encouragement to women at ACDP, to not only continue in science but to influence the direction of science by pursuing management positions and seeing them as worthwhile and a positive challenge.

This year the group was able to celebrate together at ACDP with only minor restrictions. The theme was #BreakTheBias and Vicky Boyd started the presentation by reflecting on the establishment of International Women's Day and paying homage to the brave women and men that founded the day.

The guest speaker was Dr Danielle Anderson, who completed her PhD research at ACDP then worked in labs around the world. Danielle is now back in Australia working as a research scientist at the Victorian Infectious Diseases Reference Laboratory at the Peter Doherty Institute, and she shared her experiences with the group.



Meet Melanie Tripp, PhD student, studying differences between Hendra and Nipah virus genotypes

A PhD student studying through Monash University, Melanie is based at ACDP and is about to start her second year of study.

Since starting at ACDP, Melanie has embraced many opportunities. She is the student representative on site and co-facilitator of the ACDP Scientific Journal Club, which she says contribute to a supportive student community, enhance learning and help create a friendly working environment. Melanie was also awarded best student seminar in the 2022 ACDP student seminar series awards.

We asked Melanie what got her started in a career in science and what she is working on for her PhD.

How Melanie ended up in science

Melanie says she has always been interested in science and understanding how things work. Once enrolled in her science degree, Melanie found she really enjoyed studying molecular biology and microbiology. She enrolled in an honours year in 2021, looking at inflammasome inhibitors to treat viral respiratory infections at the Hudson Institute which sparked her interest in virology. Melanie is excited to be able to undertake research that no one else has done before and contribute new knowledge to the scientific community.

What Melanie's working on now

In 2022, Melanie moved to Geelong to start her PhD at ACDP. She is researching the genotypes of Hendra and Nipah virus to determine if there are any functional differences between them.

Melanie finds her PhD project very interesting and hopes her research will assist with understanding the risk of outbreaks associated with different Hendra/Nipah genotypes, helping us to be more prepared for future outbreaks. She enjoys the fact there are many possibilities and pathways for the research to take which has allowed her to learn about many different areas and develop lots of new skills including in molecular biology, virology and histopathology.

Meet Marina Alexander, mid-career researcher, working with large biological datasets

Based at ACDP, Marina Alexander is a bioinformatician – a scientist who de-codes large and complex biological datasets – but she wasn't always. We asked Marina about her pathway to science and what she is currently working on.

How Marina became a scientist

At school, Marina discovered she loved solving puzzles. And she found that biology was a very fascinating puzzle. She enjoys understanding the mechanics of living things, and appreciates that they provide us with food, health and wellbeing. It was no surprise that biology and chemistry were her two favourite subjects in high school.

From school Marina went on to complete a Bachelor of Commerce/Science at Melbourne University majoring in microbiology followed by her honours year as a virologist studying the disease, HIV. After graduating from Melbourne University, Marina enrolled in a PhD program at the Peter Doherty Institute and continued to research HIV.

Her first post doctorate position was at the Weill Cornell Medical College in New York where she assisted the HIV vaccine development mission.

After taking a career break and returning to Australia, Marina started work as a molecular biologist at the Australian National Wildlife Collection at CSIRO in Canberra. Here she worked on genomics, the study of genes and how they interact, developing a method for reading the genetic sequence of museum specimens preserved in formalin.

What Marina is researching now

After moving to Melbourne, Marina started a second post-doctoral position at ACDP, again working with viruses, but this time focussed on Hendra and Nipah viruses. It was during this time that Marina moved into bioinformatics, discovering the joy of solving biological and computing problems.

She has now been appointed as a research scientist with ACDP working on lumpy skin disease (LSD) virus. Using her bioinformatics skills, she and the team will look for a biomarker in the LSD virus genome that can be used as an accurate and sensitive diagnostic tool for identifying infection with LSD.

Marina is also leading a project in collaboration with the Australian National Wildlife Collection, to read the genetic sequences of viruses found in bats and rodents preserved in formalin. These specimens have been collected from 10 to 60 years ago from many regions in Australia. By analysing viruses from this group of specimens, we may be able to track the evolution of the viruses that these species carry and possibly define the host range, the term used for the diversity of species the viruses can naturally infect.

CSIRO's Trusted Medal Award

We are pleased to report that the Japanese Encephalitis Virus (JEV) Outbreak Response Team won CSIRO's 2022 Trusted Medal Award.

The Trusted Medal Award recognises and promotes significant contributions to enhancing CSIRO's research and reputation as a trusted advisor, by engaging with and providing benefit to the Australian community.

In 2022, Australia had an unprecedented outbreak of the mosquito-borne Japanese encephalitis virus. ACDP scientists were instrumental in the lab detection of the first cases, alerting authorities to the existence of the virus in Australia, and the start of the outbreak. Our diagnostic and emergency response teams conducted 1352 diagnostic and confirmatory tests on animal samples in the first month alone.

This strain of the virus hadn't been seen in Australia before, and many labs weren't equipped to diagnose it. Our scientists quickly developed and shared test protocols and reagents with veterinary and public health laboratories.

In addition, CSIRO scientists provided advice on disease transmission, vector monitoring and risk assessment in a One Health approach, supporting authorities to understand and manage the outbreak.

CSIRO's communication team worked in tandem with researchers, creating comms to enable accurate media reporting, and supporting researchers to provide expert viewpoints to the public.

Our cross-organisational efforts in the outbreak have been acknowledged by government and industry.

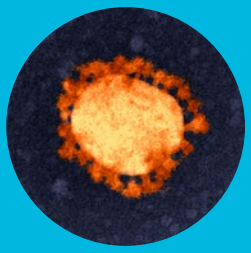
Receiving a sample containing Japanese encephalitis for diagnostic and confirmatory testing at ACDP.

Future focus

As the world learns to live with COVID-19, there is a strong recognition of the importance of scientific research for prevention, preparedness, surveillance, and response against new and emerging infectious diseases. We will continue to strengthen our One Health approach, with the need to investigate more of the pathogens that exist in wildlife. As well as bolstering our animal and zoonotic disease research portfolios, we are focused on enhanced methods of surveillance, predictive modelling and the development of new vaccines. Along with this, we are committed to mitigating the impacts of disease, as we expand our work in the Asia-Pacific to assist them with their preparedness and response, leading to greater security in the region.

One Health

Animal and zoonotic disease preparedness and response



Strengthening biosecurity in our region

Building capability for national and regional biosecurity and resilience


Protecting our way of life

Improved health and wellbeing of all Australians



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