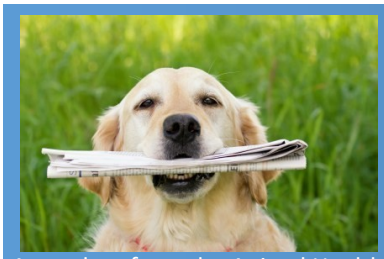


THE SENTINAHL

Issue 1
SPRING 2019
An update from the Animal Health Laboratory, MPI NZ

Kia ora and welcome to the first newsletter from the Animal Health Laboratory (AHL). The AHL is New Zealand's national veterinary laboratory. It plays a vital role in protecting New Zealand from animal diseases that could have serious effects on our animal industries, the health of New Zealanders and our environment.

What do the staff do at AHL?

The staff at the AHL carry out tests for known or suspected infectious diseases that could have a significant effect on New Zealand. The staff at AHL are veterinary and scientific experts in veterinary virology, bacteriology, immunology, pathology and molecular diagnostics.

As experts they play an important role advising government, industry and individuals on animal diseases and tests.

Testing for exotic and emerging diseases

We test animals suspected of carrying exotic or emerging diseases such as bird flu, transmissible spongiform encephalopathies (TSEs) or foot-and-mouth disease. Our highly secure lab (enhanced biocontainment) allows us to safely test for pathogens that would have a serious effect if they entered New Zealand, including animal diseases that can affect people (zoonoses).

Surveillance

MPI regularly checks animals in New Zealand to make sure we don't have exotic diseases like bird flu or TSEs. We also monitor diseases that are already in New Zealand. These surveillance programmes are important to protect our animal industries and reassure our trading partners that New Zealand doesn't have certain diseases.

AHL prepares for African Swine Fever—an emerging disease threat

Skin discolouration

In August 2018 African Swine Fever (ASF) emerged in China with devastating effect. Outbreaks have now occurred in many other countries across Asia accounting for many millions of pig deaths. African swine fever is caused by a virus of the same name (ASFV), and stands apart as the only member of its own viral family, Asfarviridae. The disease originally came from Africa, and as the name suggests is a disease of swine – being transmitted by ticks and direct contact between wild pigs, warthogs or other suids. Domestic pigs are also susceptible and outbreaks have routinely occurred in Europe since it was first reported in Portugal in 1957. Attempts to eradicate the disease have been successful in areas of Europe and Africa in the past. The Americas have reported cases before but are now free from the disease. It is the scale and the speed of recent transmissions in Asia that is unprecedented, and worrying.

ASFV is a fearsome virus with mortality rates as high as 100% for acute infections. Chronic forms of the disease do occur, and can make it hard to track the disease - they still result in mortalities of between 30-70%.

The list of symptoms include:

- Red, blotchy or dark coloured skin
- Pigs reluctance to move, piling or huddling

(continued on page 2)

The SentinAHL is a biannual newsletter produced by the National Animal Health Laboratory, Ministry for Primary Industries New Zealand.

For further information please contact: info@mpi.govt.nz

Biosecurity New Zealand
Ministry for Primary Industries
Manatū Ahu Matua

PEST AND DISEASE HOTLINE

Call to report any exotic pests or diseases of plants or animals

0800 80 99 66

Bee Pathogen Programme

The Bee Pathogen Programme is a three-year research project conducted by Biosecurity New Zealand, which concluded in July 2019. It is the largest and most-detailed study of honey bee health ever undertaken in New Zealand. Over 132,000 bees were collected from all over the country – from Northland to Stewart Island, and out to Great Barrier Island and Chatham Island. Our apiculture inspectors spent 1,693 hours looking in 2,595 beehives, interviewing beekeepers and collecting bee samples. The project has amassed 31,344 pieces of data that add up to more than 180 years of apiary records.

Richard Hall and Hayley Pragert collect honey bee samples on Great Barrier Island—photo courtesy of Jacques Goussard

Many elements of MPI were involved in the planning and execution of the project. Bee samples were sent to the Animal Health Laboratory to test for viral, bacterial and parasitic infections in the honey bees. The list included the endemic pathogens: deformed wing virus, chronic bee paralysis virus, Kashmir bee virus, black queen cell virus, American foulbrood (*P. larvae)*, lotmaria, and nosema bee diseases. Bees were also tested for the exotic pathogens, European foulbrood (*M. plutonius*) and Israeli acute paralysis virus, to provide further evidence that our bees are free from these agents. Enhanced qPCR testing was used, where assays were standardised so that the specific number of viruses, bacteria or parasites, could be reported – not just their presence or absence in a sample. This required extra work to calibrate each qPCR, but it allows the pathogen load of each sample to be compared with other metrics and used to answer big questions about the interrelationships between honey bee pathogens, pests, hive management, hive productivity, colony losses and climate.

Hayley Pragert and Richard Hall working with local beekeepers on Chatham Island

The project also supports a central biosecurity aim for MPI of maintaining freedom-from-disease status for selected pathogens, by doing active surveillance for exotic and unwanted organisms. The collection of 132,000 bees is housed at the Animal Health Laboratory in a dedicated -80°C freezer and provides a resource of national importance – for biosecurity purposes or related-research on New Zealand honey bees. The first results of the study are just being generated and have been shared with beekeepers, the industry and the public, through conferences and magazines. The first scientific paper (of many) is currently being written and will be published in an international peer-reviewed scientific journal by the end of 2019.

Processing honey bee samples in AHL

- Richard Hall and Hayley Pragert

(African Swine Fever—from page 1)

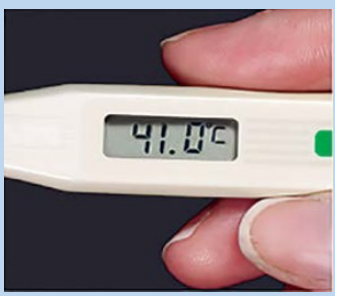
- Loss of appetite
- High fever
- Diarrhoea, vomiting and abdominal pain
- Rapid breathing
- Abortions
- Haemorrhage

Piling or huddling

Transmission occurs by direct contact between pigs (wild or domestic), through biting ticks or by contact with any infected material like bedding, feed or animal waste. Only laboratory testing can truly ascertain if a pig is suffering an ASFV infection – the initial symptoms may look like many other pig diseases.

The seriousness and developing situation in Asia has not gone unnoticed. There has never been a case of ASFV reported in Oceania, and the Ministry for Primary Industries (MPI) and our domestic pork industry are working to ensure New Zealand is prepared to keep it out. The MPI Animal Health Laboratory (AHL) has the diagnostic capability in detecting the virus and its antibodies. This diagnostic capability is being further developed, such as virus isolation. To strengthen our preparedness for ASFV, AHL Virology's staff have participated in training at international laboratories, such as The Pirbright Institute in the United Kingdom, to work with other specialists who have experience in the detection of ASFV. The MPI high-containment (PC3+) laboratory provides a good assurance that testing can be done safely and according to world best-practice.

- Hye Jeong Ha



High temperatures

M. bovis in the lab – exciting and challenging work

As a result of the *Mycoplasma bovis* (*M. bovis*) Programme, we have nearly doubled staff at MPI's Animal Health Laboratory (AHL) to help with testing, research and offer diagnostic advice.

Since the beginning of the response more than two years ago, AHL has reported more than 395,000 tests for *M. bovis,* with our teams processing and testing around 5000 to 7000 samples per week.

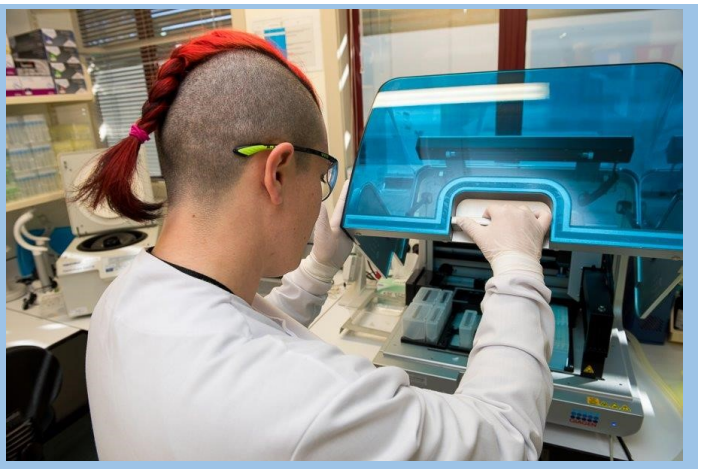
More than 30 AHL staff are currently working for the *M. bovis* Programme. The majority are spread between two dedicated laboratory teams – the *M. bovis* Diagnostic team, comprised of experienced laboratory technicians and scientists; and the *M. bovis* Information Management team, who work across the laboratory with Specimen Reception, Procurement, Liaison and Data Management. There are also a number of

M. bovis team May 2019

bioinformaticians, microbiologists, 'next-generation-sequencing' scientists, veterinarians and principal advisors from the Diagnostic and Surveillance Services Directorate who offer expert advice.

We boast a broad range of expertise from around the world, including Australia, Austria, Brazil, England, Malaysia, Russia, South Africa, South Korea, United States and of course New Zealand.

Dr Andreas Rohringer and Dr Anastasia Chernyavtseva are the Diagnostic team's senior scientists. Through the *M. bovis* Programme, we have also hired Veterinarian Dr Mark Bestbier, an experienced pathologist who undertakes microscopic examinations of tissue samples (known as histopathology) in order to study and understand the manifestation of *M. bovis* in cattle.



Dana Reid operating QIAcube HT Systems

M. bovis samples arrive at the lab from all over New Zealand and are prepared for testing in the specimen reception area. This includes importing digital data from the field into the laboratory information management system and packaging them to be safely transferred into our enhanced physical containment level 3 (PC3+) laboratory.

The high level bio-containment laboratory provides a safe environment to unpack these samples and distribute them for polymerase chain reaction (PCR) and enzyme-linked immunosorbent assay (ELISA) testing.

PCR is looking for evidence of *M. bovis* by amplifying and detecting its DNA; it can be used on a variety of samples including milk, and swabs from sites such as tonsils and tissues.

ELISA is designed to detect pathogen-specific antibodies that may be present in the animal's blood or milk as a result of being exposed to *M. bovis*.

The laboratory is equipped with sophisticated instrumentation that helps support *M. bovis* testing, including robotic workstations that can automatically purify DNA, real-time PCR machines that amplify DNA, and genome-sequencing instruments.

This is exciting and challenging work in a fast-paced environment in our high containment laboratory. Highly trained staff and quality assurance procedures ensure only scientifically correct results are reported back to the Intelligence team in the National Control Centre for the *M. bovis* Programme.

We love working together to provide critical testing that will help lead to the eradication of *M. bovis* from New Zealand's dairy and beef farms.

- M Bovis Team Wallaceville

Our contribution to global control of foot-and-mouth disease virus

For six weeks between May and August, Rudi Bueno of the Animal Health Laboratory and Kelly Buckle of the Surveillance and Incursion Investigation Team (Animal Health) visited Laos and Myanmar. The purpose of the two 3-week visits was to pilot a new tool for surveillance of foot-and-mouth disease (FMD) virus circulation within these countries, as part of a Ministry for Foreign Affairs and Trade (MFAT)-funded and OIE-administered project. This was a great chance for MPI to share its FMD expertise and to work with FMD virus within an endemic setting.

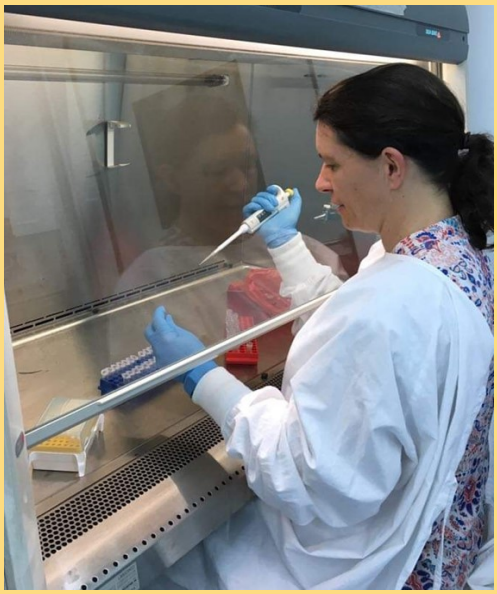
Sampling of FMDV strains from outbreaks is important because it is the major surveillance method (as required by the OIE on the pathway towards freedom). In addition, knowledge of circulating virus allows for targeted vaccination to decrease outbreaks. One of the dilemmas facing countries with endemic FMD infection is the difficulty in obtaining timely, high-quality samples from outbreaks. Outbreaks can often be located several days' drive from the laboratory, and occur more commonly in the monsoon season, when roads can be washed out and travel is dangerous. In some infected animals, a carrier state will occur where virus continues to be present in the throat. Our mission was to assess whether we could find virus in carrier animals at the slaughterhouse, as an alternative way of doing surveillance.

Slaughterhouse sampling was trialled in Vientiane (the capital of Laos) and in Mandalay, Myanmar. In total, we took samples from 262 animals, about half in each country. A cow-side PCR assay that Rudi has developed, as part of an MPI Operational Research project, was used for preliminary screening, although it is a low-throughput device so it was used only on a subset of samples. All samples are also being sent to a reference laboratory for validation and comparison.

Our work was interesting and fun, with challenging logistical hurdles such as sleep deprivation (slaughterhouses in SE Asia only operate in the middle of the night) and translated communication with our local government veterinary colleagues. The heat, mosquitoes, rolling blackouts, and various other logistical issues made for a very good adventure indeed!

Our preliminary results indicate that FMD virus is detectable in a subset of cattle and buffalo, and we are recommending that the OIE continues to support efforts to develop slaughterhouse sampling as a method for surveillance of viral circulation. An unexpected positive outcome was that both countries generously shared their libraries of positive outbreak samples, meaning that Rudi was able to validate his portable PCR machine and assay set-up against actual outbreak samples. It performed promisingly, giving us confidence that it will be a great tool for use in the field during investigations of suspect FMD cases here in NZ.

Rudi Bueno (AHL Scientist) preparing his FMD virus real-time PCR assay on the tailgate of a truck at the Nonduang slaughterhouse, Vientiane, Laos.

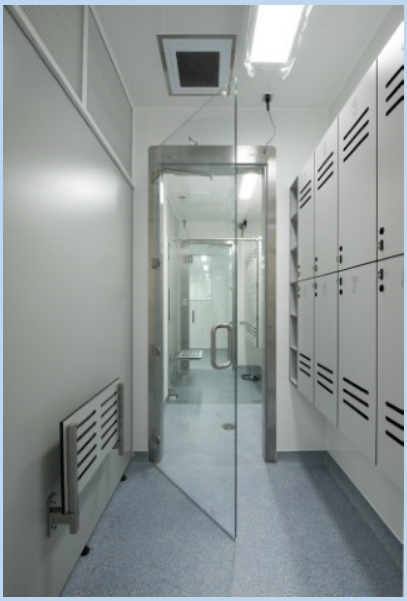


Kelly Buckle (Incursion Investigator, SII Animal Health) pipettes samples with live FMD virus, in the Lao PDR BSL-3 Laboratory.

- Rudi Bueno and Kelly Buckle

National Biocontainment Laboratory (NBL)

The National Biocontainment Laboratory continues more than 100 years of animal disease diagnostics at Wallaceville. The first facility was built in 1905 and was the first veterinary diagnostic lab in the southern hemisphere. The laboratory is staffed by skilled scientists, who have expertise in a wide variety of diseases that affect a range of animals, including cattle, sheep, deer, pigs, birds, horses, bees, and fish. We have strong links to similar centres all over the world.



PC3 Locker room and change area

The NBL will be the only lab of its type in New Zealand. It has a floor area of more than 3,400 square metres and we have used over 440 tonnes of structural steel and 680 cubic metres of concrete. It has 83 kilometres of electrical and data cabling. It will be able to withstand a one in 2,500 year earthquake with the improved earthquake protection.

The design has been led by Merrick & Company, an international company based in North America. Leading New Zealand designers and consultants have supported Merrick, including Dunning Thornton Consultants Ltd, CCM Architects, and BECA. Senior laboratory staff and an international team of engineering and biosafety experts have helped to review and refine the design. The Fletcher Construction Company is building the lab.

We've invested $87 million in this project, covering design, construction, commissioning, and certification.

Building high-containment labs is very specialised in all aspects. The new laboratory has a highly complex air handling system used to keep all the laboratory spaces at negative pressure compared to normal atmospheric pressure. Achieving this is complex, especially when the laboratory has over four kilometres of air handling duct, all of which must be air-tight.

The NBL has been designed to provide the laboratory environment capable of rapidly expanding testing should the situation call for it. Improved features such as new containment boundary equipment, better capacity in the containment showers and more resilient containment systems, such as air handling and effluent decontamination will ensure the laboratory can do the work necessary for a foot and mouth outbreak with up to 100 infected properties.

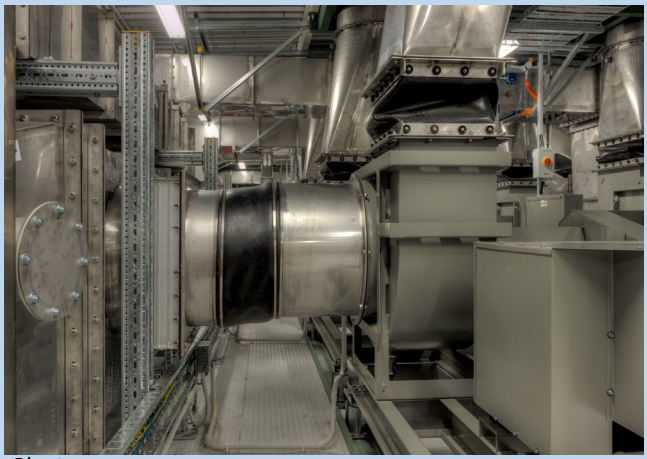
Artist's impression of the lab

Protecting staff and the environment

High-level biocontainment labs use complex systems and technology to protect the scientists who work inside and to make sure organisms aren't released into the environment. They have sensitive air management, fumigation, and heat treatment systems to treat rubbish and waste water, and sophisticated building monitoring systems to quickly identify any faults that might occur.

We've designed the building with duplicated systems and multiple layers of containment so even if there was a failure, the containment systems would keep working properly.

The NBL is fitted with a specialist walling system - Arcoplast. This innovative synthetic resin - which inhibits fungal and microbial growth - has been specially made for the NBL in the US. With the sheets too large to bring in after the rooms have been fabricated sequencing is absolutely critical. The sheets are held in place with a custom adhesive that sets almost immediately, meaning that the expert carpenters only have one chance to get it right,.



Plant room