

Biobanks – serum and cells – human and animals



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The Australian Animal Health Laboratory (AAHL), CSIRO is a high-containment facility and a vital part of Australia's national biosecurity infrastructure. AAHL closely collaborates with veterinary and human health agencies globally, as approximately 70 per cent of emerging infectious diseases in people originate in animals. The facility is designed to allow scientific research into the most dangerous infectious agents in the world and contains a large collection of serum and cell lines.

The National Animal Serum Bank (NASB) is in the care of the Diagnostic, Surveillance and Response Group (DSR) at the CSIRO Australian Animal Health Laboratory, Geelong, Victoria (Figure 1) and an important component of Australia's biosecurity arrangements. It is a catalogued collection of valuable animal sera stored for the primary purpose of retrospective investigations into exotic or newly discovered agents. Availability of these types of sera is important as an integral component of Australia's animal health biosecurity arrangements even though accessions are rare. There is greater than 30 000 different sera in the collection and CSIRO maintains careful control over the serum repository, utilising a scientific review board to determine which requests for serum will be granted.

The NASB was initiated in 1979 to supply a planned and properly catalogued collection of sera, frozen in liquid nitrogen to preserve their biochemical and immunological characteristics. The earliest sera housed in the NASB was collected from a representative sample of animals located throughout Australia, and from animals imported through quarantine stations. Originally each of the Australian states and the Northern Territory collected serum from a minimum of 100 animals annually. In 1994, national annual sampling of cattle was discontinued and since this time the submissions to the NASB consist of quarantine samples from

imported animals¹. The aim is to continue to accumulate these samples indefinitely.

At AAHL, all physical containment systems are duplicated, and all essential systems, such as electricity generators, steam and compressed air plants, are triplicated. Containment and sample integrity of the NASB and cell culture collection would therefore not be at risk from a computer or power failure.

In establishing the serum bank, the most relevant question was to develop effective methods for submission, processing and storage of samples and establishing a database, which would be fit and flexible for such a long-term collection. AAHL staff developed a simple and practical method to effectively store a serum submission in 4–8 semen straws of 0.5 mL to remove the need for freeze/thawing when accessing and risk compromising the samples integrity. Since 2010, each serum submission has been stored in duplicate cryogenic vials.

Originally, sera were stored in liquid nitrogen at -196°C but this was changed to -80°C in the 1990s with the move to mechanical freezers and resulted in simpler management and larger capacities. There have been little changes to the way sera are submitted to DSR since the NASB's inception but accessions are now computer based in a Laboratory Information Management System, which facilitates logistics and retrieval of stored samples.

The public perception about the value of stored sera is often low, but this is a problem of lack of information rather than a reality. The stored sera are largely there as an insurance against an emergency need. Lack of access for this purpose can therefore be interpreted as a positive rather than a negative aspect of the NASB – it indicates that other components of Australia's livestock biosecurity are working effectively.

Some sera has been used on rare occasions, in 1993/94 AAHL scientists used bovine sera from the NASB to validate an ELISA test, samples were retrieved and tested during the Equine influenza outbreak in horses in 2007 to assist with the initial diagnosis at Eastern Creek and some quarantine samples have also been accessed by AAHL scientists to verify earlier findings.

In some instances access may allow a research group to add value to a set of recently collected sera by obtaining extra information from



Figure 1. CSIRO Australian Animal Health Laboratory.

the source properties during epidemiological studies. This may also be a valuable use of sera whose value to biosecurity is waning. Such access to the NASB would be a matter of judgement on a case by case basis.

AAHL also holds a large collection of sera from designed surveys mostly from the northern regions of Australia and bordering countries.

The AAHL Cell Culture Unit has over 350 cell lines stored in liquid nitrogen -196°C cabinets in the same storage area as the National Serum Bank. The Cell Culture Unit is a service provider for the facility and supplies appropriate cell culture to order.

AAHL has both primary and continuous cell lines from a variety of species including, humans, bovine, equine, piscine, mosquito, amphibian, reptile, murine, caprine, feline, canine, porcine, avian, ovine and other species. The collection was started at the CSIRO Division of Animal Health at Parkville and was moved to AAHL in 1984 when the Laboratory opened with some of those cell lines dating back to 1970s. Many of the cell lines have been obtained from commercial organisations or other research Institutions, although a certain proportion have been developed by the staff at the Laboratory.

Production of primary cell cultures requires the use of animals, and to reduce the usage of animals, cells are produced in large quantities and then stored long term in liquid nitrogen. Primary animal cell cultures are used to diagnose many diseases. For example, porcine bone marrow and porcine alveolar macrophages (PAMs) are used for the highly contagious African Swine Fever virus (ASFV) that causes high mortality rates in pigs and is currently causing huge problems in several countries.

Cell lines are required in most instances for the isolation of virus from field samples, for example in Australia they are used for Hendra virus, Australia Bat Lyssa virus and a range of aquatic viruses. Both of these collections have existed at AAHL since its opening in 1984 and have been carefully managed and expanded, and provide a valuable resource to Australian veterinary research and diagnosis into animal diseases in Australia. They will continue to be preserved to play a vital role in maintaining the health of Australia's animals, the international competitiveness of Australian agriculture and trade, the well-being of Australians and the quality of our environment.

Conflicts of interest

The authors declare no conflicts of interest.

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Reference

1. (1995) National Animal Serum Bank working party report to Animal Health Council – September 1995.

Biography

Lynda Wright is an Operations Manager CSIRO Australian Animal Health Laboratory primarily responsible for the Biorisk Management Group and data platform systems. She has previously worked in the mammalian Virology Laboratory, working with viruses exotic to Australia in PC3 and PC4 containment laboratories.