

BIO-CONTAINMENT IMAGING AT THE CSIRO AUSTRALIAN ANIMAL HEALTH LABORATORY.

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Key words: Bio-containment, live cell, virus, stem cells, cell culture models

The CSIRO Australian Animal Health Laboratory (AAHL) in Victoria, Australia, is a high bio-containment laboratory. The Physical Containment (PC) level 3 and 4 laboratories, including the high-containment bio-imaging facility, are a shared resource dedicated to the diagnosis and research of some of the most dangerous infectious agents in the world. Our bio-imaging facility is a specialist microscopy service which provides a real-time interactive platform for research collaboration. Using advanced light microscopy and transmission electron microscopy methods, our team of microscopy specialists carry out research and diagnostic activities to assist our collaborators in the areas of viral identification and diagnosis. In addition, we have the capability to perform live confocal imaging of high containment pathogens for morphogenesis, co-localisation, and cellular trafficking studies. Within the bio-imaging group there are also several ongoing research projects which aim to explore new *in vitro* model systems for the application of modelling high-path diseases affecting humans and animals.

Current research into human and animal pathogen biology, surveillance and rational drug design is intrinsically limited by the available experimental models that represent natural host species and support viral replication for analysis. Unfortunately we still rely heavily on the use of crude tissue culture and sometimes inappropriate cell and/or animal models that may not always give an accurate representation of viral pathology within a whole tissue, organ or in the natural host species. For example, we have recently identified significant differences in the assembly of Hendra Virus virions in commonly used bat, pig and mouse cell line models. So which of these cell lines do we employ as a model to study virus assembly and transmission within human neurons? These preliminary observations highlight the need for tailored model systems in which to study the mechanisms of viral infection, particularly in humans.

At AAHL, we have also found that many newly emerging “street strains” of viral pathogens are derived from wildlife species for which there are no robust culture or animal models available. In many cases species incompatibility between the agent and available cell culture models limits the research or diagnostic tests that can be performed. As such, we are currently investigating how to best apply induced pluripotent stem cells from “unique” species or “hard to obtain” cell types, like human neurons, to develop reproducible, representative *in-vitro* models, tailored to support the study of emerging pathogens. Utilising our specialist bio-containment research and imaging facility to develop and test these novel cell culture models will help provide the requisite insight for the future diagnostic and treatment strategies for some of the world’s most deadly pathogens.