

OIE Collaborating Centres Reports Activities

Activities in 2021

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Title of collaborating centre:	New and Emerging Diseases
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Name of writer:	Dr Debbie Eagles Deputy Director

ToR: To provide services to the OIE, in particular within the region, in the designated specialty, in support of the implementation of OIE policies and, where required, seek for collaboration with OIE Reference Laboratories

ToR: To identify and maintain existing expertise, in particular within its region

1. Activities as a centre of research, expertise, standardisation and dissemination of techniques within the remit of the mandate given by the OIE

Epidemiology, surveillance, risk assessment, modelling	
Title of activity	Scope
Northern Australia Surveillance Strategy and Pre-Border Testing	Testing was conducted on surveillance samples from the Australian mainland, Torres Strait Islands and Papua New Guinea for target diseases - Aujeszky's Disease, Avian Influenza, Bluetongue, CSF, ASF, Ehrlichia, FMD, Japanese Encephalitis, Newcastle Disease, Nipah, PRRS, Rabies, Surra, Brucella, Maedi visna, TGE, Leptospirosis, PEDV, PCV-2
African Horse Sickness - identification of potential vectors	Identification of horse feeding Culicoides in Australia and assessment of competency as vectors for AHS
Enhanced next-generation surveillance of Bluetongue virus	Development of a Nextstrain-based platform for genome tracking of Australian Bluetongue virus gene segments and application of support vector machine technology to whole genome analyses for improved bluetongue virus characterization and disease risk assessment
Zoonoses	
Title of activity	Scope
Research activities on SARS-CoV-2	A suite of activities including pre-clinical vaccine evaluation, assessment of virus survivability on common surfaces, genomics, evaluation of therapeutics and diagnostics, in silico modelling, and diagnostic preparedness
A One Health approach to establish surveillance strategies for Japanese Encephalitis and zoonotic arboviruses in Papua New Guinea	The aim of the project is to establish pilot surveillance activities for JE and other zoonotic arboviruses of public health importance that may affect the predominantly rural population of PNG.
Recombinant tools for investigation of rabies pathogenesis	Produce cell lines and plasmids to generate recombinant rabies virus and proteins suitable to study novel mechanisms associated with rabies pathogenesis in cultures of human and mouse neurons.
Evaluation of effectiveness of Hendra virus vaccine	Sero-Monitoring of horses to determine effectiveness of Equivac ® HeV Hendra Virus Vaccine in Inducing Neutralising Antibody Titres
Development of an IgM ELISA for Hendra virus	Development and validation of an IgM antibody capture ELISA for early detection of Hendra virus
Wildlife	

Title of activity	Scope
Monitoring of avian influenza viruses in Australian avifauna	ACDP functions as the national reference laboratory for the characterization of H5 and H7 avian influenza viruses detected in Australian wild birds by surveillance and tests specimens from unexplained mortalities in wild birds for AI infection. ACDP also performs monitoring and characterization of non-H5/H7 LPAI subtypes from the national avifauna surveillance program.
Detecting pestiviruses of significance to livestock in native and feral Australian wildlife	Investigate diversity of pestiviruses in Australian wildlife using genomics capability, with subsequent development of specific molecular and serological assays
Surveillance for newly detected genotype of Hendra virus in bats	Surveillance in Australian bats for HeV-g2 and publication of results of these detections
Avian diseases	
Title of activity	Scope
Genotyping of Australian influenza viruses (ongoing)	Whole genome sequencing using NGS and genome wide phylogenetic analysis of avian influenza A viruses detected in wild bird samples in Australia
Surveillance and pathotyping of Australian IBDV	Monitor Australian IBDV to confirm that endemic strains remain genetically distinct from overseas strains.
Aquatic animal diseases	
Title of activity	Scope
Evaluation of Point of Care (POC) Tests for White Spot Syndrome Virus (WSSV)	To determine the analytical and diagnostic performance characteristics (analytical sensitivity and specificity, diagnostic sensitivity and specificity, repeatability and applicability) of five commercially available WSSV POC test kits for the detection of WSSV in clinically affected prawns
To determine minimal ineffective dose of gamma irradiation to render white spot syndrome virus non-infectious	To clarify that gamma-irradiation at a dose of 50kGy will render WSSV non-infectious and determine the effect of lower doses of gamma-irradiation the infectivity of WSSV
Determine the susceptibility of <i>P. monodon</i> and <i>P. merguensis</i> to newly identified YHV genotypes	Determine the susceptibility of <i>P. monodon</i> and <i>P. merguensis</i> to newly identified YHV genotypes
Diagnosis, biotechnology and laboratory	
Title of activity	Scope
LSD diagnostic support to Timor-Leste	Provision of diagnostic test kits to Timor-Leste to establish diagnostic capability for lumpy skin disease.
LSD awareness in Indonesia	Contributed to workshops for animal health laboratories in Indonesia, providing an overview of LSD epidemiology and diagnosis. Provided technical support on LSD diagnosis to animal health laboratories in Indonesia.
Support ASF response in Papua New Guinea	Provision of advice and technical support relating to laboratory and field diagnosis of African swine fever to assist PNG's response to the disease incursion.
Evaluation of antibody detection ELISA for LSD in Australian cattle and buffaloes	To determine accuracy of a prototype antibody detection ELISA for LSD in Australian cattle and buffaloes
Identification of host factors associated with African Swine Fever virus replication	CRISPR screening of porcine cells to identify host factors associated with African Swine Fever virus replication

ToR : To propose or develop methods and procedures that facilitate harmonisation of international standards and guidelines applicable to the designated specialty

2. Proposal or development of any procedure that will facilitate harmonisation of international regulations applicable to the surveillance and control of animal diseases, food safety or animal welfare

Proposal title	Scope/Content	Applicable area
Interlaboratory comparability testing for OIE ad hoc Group for Tilapia Lake Virus (TiLV)	Through the OIE ad hoc Group for TiLV, organise an interlaboratory comparability trial to provide information to the OIE AAHSC regarding robust diagnostic tests for the detection of TiLV	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
Diagnostic Validation Science: a key element for effective detection and control of infectious animal diseases.	OIE Scientific and Technical Review, co-edited by and with several publication authors from the Collaborating Centre	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
OIE Manual of Diagnostic Tests for Terrestrial Animals	Review (on OIE request) specific chapters in the Terrestrial Manual to improve consistency among chapters and improve the quality and completeness of information	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
To develop validation templates	Harmonization of validation and approval of diagnostic tests, including POC, based on OIE templates	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare

ToR: To establish and maintain a network with other OIE Collaborating Centres designated for the same specialty, and should the need arise, with Collaborating Centres in other disciplines

ToR: To carry out and/or coordinate scientific and technical studies in collaboration with other centres, laboratories or organisations

3. Did your Collaborating Centre maintain a network with other OIE Collaborating Centres (CC), Reference Laboratories (RL), or organisations designated for the same specialty, to coordinate scientific and technical studies?

Yes

Name of OIE CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose

BSL4ZNet	Global Network	<input type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input type="checkbox"/> Middle East	BSL4ZNet is a network of government mandated organisations with national level responsibility for protecting animal health by working together to enhance knowledge, competency and capacity to meet current and future high containment needs, including for new and emerging diseases
OFFLU	Global Network	<input checked="" type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input checked="" type="checkbox"/> Middle East	Coordination of the science underpinning the management and control of influenza in animals
OIE ad hoc Steering Committee of the Regional Framework on Aquatic Animal Health in the Asia Pacific Region	Asia Pacific	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	Increasing collaboration in the region on investigation of emerging aquatic diseases, improving tests capability and proficiency testing, with the view to improve overall capability
5RD Global Biodefense Network	Global Network	<input type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input type="checkbox"/> Middle East	The Five Research and Development (5RD) Global Biodefense Network (GBDN) is a forum for 5RD members to maintain dialogue on various topics regarding biological hazards, emphasizing hazard assessment, characterization, and biosecurity issues for COVID-19 and other emerging diseases

4. Did your Collaborating Centre maintain a network with other OIE Collaborating Centres, Reference laboratories, or organisations in other disciplines, to coordinate scientific and technical studies?

Yes

Name of OIE CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
Global African Swine Fever Disease Research Alliance	Global Network	<input checked="" type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input checked="" type="checkbox"/> Middle East	To establish and sustain global research partnerships that will generate scientific knowledge and tools to contribute to the successful prevention, control and where feasible eradication of ASF
OIE aquatic Animal Health Standards Commission	Global Network	<input checked="" type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input checked="" type="checkbox"/> Middle East	Collaboration to ensure the Aquatic animal health code and Manual of Diagnostic Tests for Aquatic Animals reflect current scientific information

Global Foot-and Mouth Disease Research Alliance	Global Network	<input checked="" type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input checked="" type="checkbox"/> Middle East	A coordinated global alliance of scientists producing evidence and innovation that enables the progressive control and eradication of FMD
EVAg	Global Network	<input checked="" type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input checked="" type="checkbox"/> Middle East	A coordinated global network that mobilises expertise in virology to amplify, characterize, standardize, authenticate, distribute, track, collect viruses and derived products
VetBioNet	Global Network	<input checked="" type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input checked="" type="checkbox"/> Middle East	A network of facilities researching animal and zoonotic diseases in secure facilities. The network aims to standardize protocols, identify best practice and develop new technologies.
STAR-IDAZ	Global Network	<input checked="" type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input checked="" type="checkbox"/> Middle East	The overall objective of the network is to coordinate research at the international level to contribute to new and improved animal health strategies for at least 30 priority diseases/infectious/issues.

ToR: To place expert consultants at the disposal of the OIE.

5. Did your Collaborating Centre place expert consultants at the disposal of the OIE?

Yes

Name of expert	Kind of consultancy	Subject
Dr Trevor Drew	Invited participant	The 9th Asia-Pacific Workshop on Multisectoral Collaboration at the Animal-Human-Ecosystems Interface
Dr Trevor Drew Dr David Williams	Invited participant/member	ASF Reference Laboratory Network Meetings
Dr Nick Moody	Invited participant	3rd Meeting of Steering Committee of the Regional Collaboration Framework
Dr Trevor Drew	Member	Scientific Committee for Animal Diseases
Dr Trevor Drew Dr David Williams Dr Phoebe Readford (invited participant)	Members	OIE Standing Group of Experts for African swine fever

Dr David Williams	Member	FAO African swine fever Global Pool of Experts for - Laboratory Diagnosis
Dr Kim Halpin	Invited participant	OIE Expert Group drafting case definition for Nipah virus infection (several meetings May - August 2021)
Axel Colling	Chair of OIE ad hoc working group for certification of diagnostic kits.	Assessment of validation extension dossier for OIE certification of diagnostic kit for MERS after 5 years.
John Allen	Chair of OIE ad hoc working group for certification of diagnostic kits.	Assessment of validation dossier for OIE certification of a lateral flow device for WSSV.
Nagendra Singanallur Balasubramanian	Chair of OIE ad hoc working group for certification of diagnostic kits.	Assessment of validation dossier for OIE certification of diagnostic kit of a gamma interferon test for diagnosis of Mycobacterium bovis in cattle.
Nagendra Singanallur Balasubramanian	Chair of OIE ad hoc working group for certification of diagnostic kits.	Assessment of validation dossier for OIE certification of penside tests for FMDV antigen detection.
Trevor Drew, Dwane O'Brien, Debbie Eagles, David Williams, Mark Ford, Kim Halpin, Gemma Clark, John Allen, Wilna Vosloo, Frank Wong	Invited participants and presenters	OIE Regional Reference Centres meeting. 24-25 February 2021
David Williams, Trevor Drew	Invited participants and presenters	OIE-FAO GF-TADs Regional Laboratory Expert Meeting on ASF and other pig diseases in Asia and the Pacific
David Williams, Anthony Keyburn	Invited participant	OIE Pacific Partners Meeting
Frank Wong	Member of the OIE/FAO Network of Expertise on Influenza (OFFLU) Executive Committee	OIE/FAO Network of Expertise on Influenza (OFFLU) Steering & Executive Committee Meetings (virtual) https://www.offlu.org/index.php/offlu-organisation/
Frank Wong	Chair of the OIE/FAO Network of Expertise on Influenza (OFFLU) Avian Influenza Technical Activity	Coordinate and update meetings (virtual) on the OFFLU Avian Influenza activities
Frank Wong	Invited participant and the OIE/FAO Network of Expertise on Influenza (OFFLU) representative	FAO/CDC/USAID virtual consultation on non-avian zoonotic influenza in Asia, FAO-RAP Bangkok, Thailand on 20 January, 26 January, 3 February & 10 February 2021

Frank Wong, Angela Scott	Invited participants and presenters	OIE Regional Expert Network Meeting for Avian Diseases in Asia & the Pacific (virtual), OIE-RRAP Tokyo, Japan on 29-30 February 2021
Frank Wong	Invited participant and the OIE/FAO Network of Expertise on Influenza (OFFLU) representative	OFFLU virtual short call on recent notification of AI in UK - seal, fox and its risk significance on 30 March 2021
Frank Wong	Invited participant and OIE Reference Laboratory for Avian Influenza representative	WHO Tool for Pandemic Influenza Risk Assessment (TIPRA) scoring exercise on H5 clade 2.3.4.4b on 17 June and 9 July 2021

ToR: To provide, within the designated specialty, scientific and technical training to personnel from OIE Member Countries

6. Did your Collaborating Centre provide scientific and technical training, within the remit of the mandate given by the OIE, to personnel from OIE Member Countries?

Yes

- a) Technical visits: 0
- b) Seminars: 4
- c) Hands-on training courses: 3
- d) Internships (>1 month): 0

Type of technical training provided (a, b, c or d)	Content	Country of origin of the expert(s) provided with training	No. participants from the corresponding country
B (remote)	ACDP provided an overview of lumpy skin disease diagnostics and epidemiology to animal health laboratories in Indonesia, funded by the Australia-Indonesia Health Security Partnership. 21 Jan 2021??	Indonesia	30
B (remote)	2 ACDP staff participated as panelists in a lumpy skin disease webinar, funded and arranged by AIHSP, for Indonesian laboratory staff. 29 July, 5-6 August	Indonesia	50
B, C (remote)	CC member from ACDP co-led African Swine Fever Training on Surveillance and Antigen Rapid Test Kit. Organised by Pacific Horticultural & Agricultural Market Access Plus Program (PHAMA Plus) and the Pacific Community (SPC); webinar-based theoretical and practical training for thirteen Pacific island countries, 29th November to 17th December, 2021	Fiji, Federated States of Micronesia, Papua New Guinea, Vanuatu,	14

C (remote)	As part of an ACIAR-funded project, CC members from ACDP provided remote training for the use of antibody ELISA for the detection of Japanese encephalitis virus and related flaviviruses, including provision of reagents, test kits and SOPs and worksheets; took place over the duration of 2021.	Papua New Guinea	4
C (remote)	As part of an ACIAR-funded project, CC members from ACDP provided remote training for African swine fever virus PCR, including the provision of test kits and SOPs and worksheets; Jan - Oct 2021.	Papua New Guinea	5
B (remote)	BSL4ZNet International Conference, Keynote speaker "BSL3 and BSL4 Biosafety & Biosecurity: International Perspectives"	Various	100

ToR: To organise and participate in scientific meetings and other activities on behalf of the OIE

7. Did your Collaborating Centre organise or participate in the organisation of scientific meetings on behalf of the OIE?

No

ToR: To collect, process, analyse, publish and disseminate data and information relevant to the designated specialty

8. Publication and dissemination of any information within the remit of the mandate given by the OIE that may be useful to Member Countries of the OIE

a) Articles published in peer-reviewed journals: 65

1. Bowden, T., Crowther, J. & Wang, J., (2021) "Review of critical factors affecting analytical characteristics of serological and molecular assays.", *Revue Scientifique et Technique*, 40 (1), 53-73.
2. Colling, A. & Gardner, I.A., (eds), (2021) "In Diagnostic test validation science: a key element for effective detection and control of infectious animal diseases.", *Rev. Sci. Tech. Off. Int. Epiz.*, 40 (1).
3. Gardner, I.A., Colling, A., Caraguel, C.G., Crowther, J.R., Jones, G., Firestone, S.M. & Heuer C., (2021) "Introduction - Validation of test for OIE-listed diseases as fit-for-purpose in a world of evolving diagnostic technologies and pathogens. In Diagnostic test validation science: a key element for effective detection and control of infectious animal diseases.", *Rev. Sci. Tech. Off. Int. Epiz.*, 40 (1), 19-28.
4. Colling, A. & Gardner, I.A., (2021) "Conclusions - Validation of test for OIE-listed diseases as fit-for-purpose in a world of evolving diagnostic technologies and pathogens. In Diagnostic test validation science: a key element for effective detection and control of infectious animal diseases.", *Rev. Sci. Tech. Off. Int. Epiz.*, 40 (1).
5. Caraguel, C.G.B. & Colling, A., (2021) "Diagnostic likelihood ratio the next-generation of diagnostic test accuracy measurement. In Diagnostic test validation science: a key element for effective detection and control of infectious animal diseases.", *Rev. Sci. Tech. Off. Int. Epiz.*, 40 (1), 299-309. doi:10.20506/rst.40.1.3226.
6. Gifford, G., Szabó, M., Hibbard, R., Mateo, D., Colling A., Gardner I. & Erlacher-Vindel, E., (2021) "Validation, certification and registration of certified tests and regulatory control of veterinary diagnostic test kits. In Diagnostic test validation science: a key element for effective detection and control of infectious animal diseases.", *Rev. Sci. Tech. Off. Int. Epiz.*, 40 (1), 173-188. doi:10.20506/rst.40.1.3216.
7. Newberry, K. & Colling, A., (2021) "Quality standards and guidelines for test validation for infectious diseases in veterinary laboratories. In Diagnostic test validation science: a key element for effective detection and control of infectious animal diseases.", *Rev. Sci. Tech. Off. Int. Epiz.*, 40 (1), 227-237. doi:10.20506/rst.40.1.3220.
8. Waugh, C., & Clark, G.A., (2021) "Factors affecting test reproducibility among laboratories. In Diagnostic test validation science: a key element for effective detection and control of infectious animal diseases.", *Rev. Sci.*

Tech. Off. Int. Epiz., 40 (1), 131-143.

9. Watson, J.W., Clark, G.A. & Williams D.T., (2021) "The value of virtual biobanks for transparency purposes with respect to reagents and samples used during test development and validation. In Diagnostic test validation science: a key element for effective detection and control of infectious animal diseases.", Rev. Sci. Tech. Off. Int. Epiz., 40 (1), 253-259.

10. Shan, S., Bruce, K., Stevens, V., Wong, F.Y.K., Wang, J., Johnson, D., Middleton, D., O'Riley, K., McCullough, S., Williams, D.T., & Bergfeld, J., (2021) "In Vitro and In Vivo Characterization of a Pigeon Paramyxovirus Type 1 Isolated from Domestic Pigeons in Victoria, Australia 2011.", Viruses, 13, 429.

11. Samsing, F., Hopf, J., Davis, S., Wynne, J.W. & Durr, P.A, (2021) "Will Australia's common carp (*Cyprinus carpio*) populations develop resistance to Cyprinid herpesvirus 3 (CyHV-3) if released as a biocontrol agent? Identification of pathways and knowledge gaps.", Biological Control, 157 104571.

12. Sarker, S., Athukorala, A., Nyandowe, T., Bowden, T.R. & Boyle, D.B., (2021) "Genomic Characterisation of a Novel Avipoxvirus Isolated from an Endangered Northern Royal Albatross (*Diomedea sanfordi*).", Pathogens, 10(5), 575, doi: 10.3390/pathogens10050575.

14. Sarker, S., Athukorala, A., Bowden, T.R. & Boyle, D.B., (2021) "Characterisation of an Australian fowlpox virus carrying a near-full-length provirus of reticuloendotheliosis virus.", Archives of Virology, 166, pages1485-1488

15. Sarker, S., Athukorala, A., Bowden, T.R. & Boyle, D.B., (2021) "Genomic Characterisation of a Novel Avipoxvirus Isolated from an Endangered Yellow-Eyed Penguin (*Megadyptes antipodes*).", Viruses, 13(2), 194.

16. Annand, E., High, H., Wong, F., Phommachanh, P., Chanthavisouk, C., Happold, J., Dhingra, M., Eagles, D., Britton, P & Alders, R., (2021) "Highly pathogenic avian influenza in Sekong province Lao PDR 2018-Potential for improved surveillance and management.", International Journal of Infectious Diseases, 101(S1), 336-383.

17. Barrett, R.S., Wiethoelter, A. & Halpin, K., (2021) "The Hendra virus vaccine: perceptions regarding the role of antibody titre testing." Aust Vet J, Vol 99, 9.

18. Halpin, K., Graham, K. & Durr, P.A., (2021) "Sero-Monitoring of Horses Demonstrates the Equivac((R)) HeV Hendra Virus Vaccine to Be Highly Effective in Inducing Neutralising Antibody Titres.", Vaccines (Basel), 9(7).

20. Riddell, S., Goldie, S., McAuley, A.J., Kuiper, M.J., Durr, P.A., Blasdel, K.R., Tachedjian, M., Druce, J.D., Smith, T.R.F., Broderick, K.E. & Vasan, S.S., (2021) "Live Virus Neutralisation of the 501Y.V1 and 501Y.V2 SARS-CoV-2 Variants following INO-4800 Vaccination of Ferrets.", Front Immunol, 12: 694857.

21. Mileto, P., da Conceicao, F., Stevens, V., Cummins, D., Certoma, A., Neave, M.J., Bendita da Costa Jong, J. & Williams, D.T., (2021) "Complete Genome Sequence of African Swine Fever Virus Isolated from a Domestic Pig in Timor-Leste, 2019.", Microbiol Resour Announc, 10(26): e0026321.

22. Sarker, S., Bowden, T.R. & Boyle, D.B., (2021) "Genomic characterisation of a novel avipoxvirus, magpiepox virus 2, from an Australian magpie (*Gymnorhina tibicen terraereginae*).", Virology, 562, 121-127.

23. Graham, K., Gilligan, D., Brown, P., van Klinken, R.D., McColl, K.A. & Durr, P.A., (2021) "Use of spatio-temporal habitat suitability modelling to prioritise areas for common carp biocontrol in Australia using the virus CyHV-3.", J Environ Manage, 295: 113061.

24. Harrison, A.R., Todd, S., Dearnley, M., David, C.T., Green, D., Rawlinson, S.M., Au, G.G., Marsh, G.A. & Moseley, G.W., (2021). "Antagonism of STAT3 signalling by Ebola virus.", PLoS Pathog, 17(6): e1009636.

25. Hobbs, E.C., Colling, A., Gurung, R.B. & Allen, J., (2021) "The potential of diagnostic point-of-care tests (POCTs) for infectious and zoonotic animal diseases in developing countries: Technical, regulatory and sociocultural considerations.", Transbound Emerg Dis, 68(4): 1835-1849.

26. Hobbs, E.C. & Reid, T.J., (2021) "Animals and SARS-CoV-2: Species susceptibility and viral transmission in experimental and natural conditions, and the potential implications for community transmission.", Transbound Emerg Dis, 68(4): 1850-1867.

27. Horman, W.S.J., Kedzierska, K., Rootes, C.L., Bean, A.G.D., Nguyen, T.H.O. & D. S. Layton (2021). "Ferret Interferon (IFN)-Inducible Transmembrane Proteins Are Upregulated by both IFN-alpha and Influenza Virus Infection." J Virol, 95(14): e0011121.

28. Horman, W.S.J., Kedzierska, K., Rootes, C.L., Bean, A.G.D., Nguyen, T.H.O. & Layton, D.S, (2021) "Upregulated expression of ferret Interferon-Inducible Transmembrane genes by IFN-alpha and influenza virus infection." J Virol, 95(7).

29. Jansen van Vuren, P., Parry, R., Khromykh, A.A. & Paweska, J.T., (2021) "A 1958 Isolate of Kedougou Virus (KEDV) from Ndumu, South Africa, Expands the Geographic and Temporal Range of KEDV in Africa.", Viruses, 13(7).

30. Kuhn, J. H., et al., (2021). "2021 Taxonomic update of phylum Negarnaviricota (Riboviria: Orthornavirae), including the large orders Bunyavirales and Mononegavirales.", Arch Virol, Aug 31.

31. Layton, D., Burkett, K., Marsh, G.A., Singanallur, N.B., Barr, J., Layton, R., Riddell, S.J., Brown, S., Trinidad, L., Au, G.G., McAuley, A.J., Lowther, S., Watson J. & Vasan, S.S., (2021) "Type I Hypersensitivity in Ferrets Following Exposure to SARS-CoV-2 Inoculum: Lessons Learned.", ILAR J, June 23.

32. Malladi, S. K., et al., (2021) "Immunogenicity and Protective Efficacy of a Highly Thermotolerant, Trimeric SARS-CoV-2 Receptor Binding Domain Derivative." ACS Infect Dis, 7(8): 2546-2564.

33. Manning, L. K., Srivastava, M., Bingham, J., Curran, G.C., Westermann T. & Cook, R.W., (2021) "Neuronal inclusions resembling Negri bodies in the thalamus of a red kangaroo (*Macropus rufus*).", Aust Vet J, 99(5):

178-180.

34. Mara, K., Dai, A., Brice, A.M., Alexander, M.R., Tribolet, L., Layton, D.S. & Bean, A.G.D., (2021) "Investigating the Interaction between Negative Strand RNA Viruses and Their Hosts for Enhanced Vaccine Development and Production." *Vaccines (Basel)*, 9(1).
35. Marsh, G. A., et al., (2021) "ChAdOx1 nCoV-19 (AZD1222) vaccine candidate significantly reduces SARS-CoV-2 shedding in ferrets." *NPJ Vaccines*, 6(1): 67.
36. Marsh, G. A., et al., (2021) "In vitro characterisation of SARS-CoV-2 and susceptibility of domestic ferrets (*Mustela putorius furo*).", *Transbound Emerg Dis*.
37. McNabb, L., Andiani, A., Bulavaite, A., Zvirbliene, A., Sasnauskas K. & Lunt, R., (2021) "Development and validation of an IgM antibody capture ELISA for early detection of Hendra virus.", *J Virol Methods*, 298: 114296.
38. Paweska, J. T., Jansen van Vuren, P., Msimang, V., Lo, M.M., Thiongane, Y., Mulumba-Mfumu, L.K., Mansoor, A., Fafetine, J.M., Magona, J.W., Boussini, H., Bazanow, B., Wilson, W.C., Pepin, M., Unger H. & Viljoen, G., (2021) "Large-Scale International Validation of an Indirect ELISA Based on Recombinant Nucleocapsid Protein of Rift Valley Fever Virus for the Detection of IgG Antibody in Domestic Ruminants.", *Viruses*, 13(8).
39. Sarker, S., Athukorala, A., Bowden, T.R. & Boyle, D.B., (2021) "Characterisation of an Australian fowlpox virus carrying a near-full-length provirus of reticuloendotheliosis virus.", *Arch Virol*, 166(5): 1485-1488.
40. Singanallur, N.B., Dekker, A. Eble, P.L., van Hemert-Kluitenberg, F., Weerdmeester, K., Horsington, J.J. & Vosloo, W., (2021) "Emergency FMD Serotype O Vaccines Protect Cattle against Heterologous Challenge with a Variant Foot-and-Mouth Disease Virus from the O/ME-SA/Ind2001 Lineage.", *Vaccines (Basel)*, 9(10).
41. Tong, Z. W. M., Karawita, A.C., Kern, C., Zhou, H., Sinclair, J.E., Yan, L., Chew, K.Y., Lowther, S., Trinidad, L., Challagulla, A., Schat, K.A., Baker M.L. & Short K.R., (2021) "Primary Chicken and Duck Endothelial Cells Display a Differential Response to Infection with Highly Pathogenic Avian Influenza Virus.", *Genes (Basel)*, 12(6).
42. Tribolet, L., Alexander, M.R., Brice, A.M., van Vuren, P.J., Rootes, C.L., Mara, K., McDonald, M., Bruce, K.L., Gough, T.J., Shi, S., Cowled, C., Bean A.G.D. & Stewart C.R., (2021) "ILRUN Downregulates ACE2 Expression and Blocks Infection of Human Cells by SARS-CoV-2.", *J Virol*, 95(15).
43. Walker, P.J., Cowley, J.A., Dong, X., Huang, J., Moody, N., Ziebuhr, J. & Consortium, I.R., (2021) "ICTV Virus Taxonomy Profile: Roniviridae.", *J Gen Virol*, 102(1).
44. Wang, J., Anderson, D.E., Halpin, K., Hong, X., Chen, H., Walker, S., Valdeter, S., van der Heide, B., Neave, M.J., Bingham, J., O'Brien, D., Eagles, D., Wang L.F. & Williams D.T., (2021) "A new Hendra virus genotype found in Australian flying foxes.", *Virol J*, 18(1): 197.
45. White, J. R., Williams, D.T., Davies, K., Wang, J., Chen, H., Certoma, A., Davis, S.S., Weir, R.P., Melville, L.F. & Eagles, D., (2021) "Bluetongue virus serotype 12 enters Australia - a further incursion of novel western lineage genome segments.", *J Gen Virol*, 102(3).
46. Yuen, K. Y., Fraser, N. S., Henning, J., Halpin, K., Gibson, J. S., Betzien, L. & Stewart, A. J., (2021) "Hendra virus: Epidemiology dynamics in relation to climate change, diagnostic tests and control measures.", *One Health*, 12: 100207.
47. Paton, D.J., Di Nardo, A., Knowles, N.J., Wadsworth, J., Pituco, E.M., Cosivi, O., Rivera, A.M., Bakkali Kassimi, L., Brocchi, E., de Clercq, C., Maree, F.F., Singh, R.K., Vosloo, W., P, M-K., Sumption, K.J., Ludi, A.B. & King, D.P., (2021) "The history of foot-and-mouth disease virus serotype C: the first known extinct serotype?", *Virus Evolution*, 7(1): veab009.
49. Challagulla, A., Shi, S., Nair, K., O'Neil, T.E., Morris, K.R., Wise, T.G., Cahill, D.M., Tizard, M.L., Doran, T.J. & Jenkins, K.A., (2021) "Marker counter-selection via CRISPR/Cas9 co-targeting for efficient generation of genome edited avian cell lines and germ cells.", *Animal Biotechnology*, 1-11.
50. Alexander, M.R., Brice, A.M., Jansen van Vuren, P., Rootes, C.L., Tribolet, L., Cowled, C., Bean, A.G.D. & Stewart, C.R., (2021) "Ribosome-profiling reveals restricted post transcriptional expression of antiviral cytokines and transcription factors during SARS-CoV-2 infection.", *Int. J. Mol. Sci.*, 22, 3392.
51. Blasdel, K.R., Wynne, J.W., Perera, D. & Firth, C., "First detection of a novel 'unknown host' flavivirus in a Malaysian rodent.", *Access Microbiology*, 2021;3:000223.
52. Cheung, A., Dufour, S., Jones, G., Kostoulas, P., Stevenson, M.A., Singanallur, N.B. & Firestone, S.M., "Bayesian latent class analysis when there is an imperfect reference test.", *OIE revue scientifique et technique*, 2021; 40(1):271-286.
53. Halpin, K., Singanallur, N.B., Tribolet, L. & Hobbs, E., (2021) "Perspectives and challenges on validating new diagnostic technologies.", *Revue Scientifique et Technique Office International des Epizootic*, 40(1):145-157.
54. Beale, D.J., Shah, R., Karpe, A.V., Hillyer, K.E., McAuley, A.J., Au, G.G., Marsh, G.A. & Vasan, S.S., (2021) "Metabolic profiling from an asymptomatic ferret model of SARS-CoV-2 infection.", *Metabolites*, 11, 327.
55. Ludi, A., Mioulet, V., Vosloo, W. & King, D., (2021) "Selection and use of reference panels: a case study highlighting current gaps in materials available for foot-and-mouth disease.", *OIE Scientific and Technical Review*, 40(1):239-251.
56. Farr, R.J., Rootes, C.L., Rowntree, L.C., Nguyen, T.H.O., Hensen, L., Kedzierski, L., Cheng, A.C., Kedzierski, K., Au, G.G., Marsh, G.A., Vasan, S.S., Hong Foo, C. & Cowled, C., (2021) "Altered microRNA expression in COVID-19 patients enables identification of SARS-CoV-2 infection." *PLOS Pathogens*, 17(7), 1-12.
57. Javed, N., Bhatti, A. & Paradkar, P.N., (2021) "Advances in Understanding Vector Behavioural Traits after

Infection.”, *Pathogens*, 10, 1376.

58. Paweska, J.T., Jansen van Vuren, P., Store, N., Markotter, W. & Kemp, A., (2021) “Vector Competence of *Eucampsipoda Africana* (Diptera: Nycteribiidae) for Marburg Virus Transmission in *Rousettus Aegyptiacus* (Chiroptera: Pteropodidae).”, *Viruses*, 13, 2226.

59. Edwards, S.J., Caruso, S., Suen, W.W., Jackson, S., Rowe, B., Marsh, G.A. (2021) “Evaluation of henipavirus chemical inactivation methods for the safe removal of samples from the high-containment PC4 laboratory.” *J Virol Methods*, 298:114287.

60. Gamble, A., Yeo, Y.Y., Butler, A.A., Tang, H., Snedden, C.E., Mason, C.T., Buchholz, D.W., Bingham, J., Aguilar, H.C., Lloyd-Smith, J.O. (2021) “Drivers and Distribution of Henipavirus-Induced Syncytia: What Do We Know?” *Viruses*. 13(9):1755.

61. Boardman WSJ, Baker ML, Boyd V, Crameri G, Peck GR, Reardon T, Smith IG, Caraguel CGB, Prowse TAA. Serological evidence of exposure to a coronavirus antigenically related to severe acute respiratory syndrome virus (SARS-CoV-1) in the Grey-headed flying fox (*Pteropus poliocephalus*). *Transbound Emerg Dis*. 2021 Jul;68(4):2628-2632. doi: 10.1111/tbed.13908.

62. Cox-Witton K, Baker ML, Edson D, Peel AJ, Welbergen JA, Field H. Risk of SARS-CoV-2 transmission from humans to bats - An Australian assessment. *One Health*. 2021 Dec;13:100247. doi: 10.1016/j.onehlt.2021.100247.

63. Sun H, Niu Q, Yang J, Zhao Y, Tian Z, Fan J, Zhang Z, Wang Y, Geng S, Zhang Y, Guan G, Williams DT, Luo J, Yin H, Liu Z. Transcriptome Profiling Reveals Features of Immune Response and Metabolism of Acutely Infected, Dead and Asymptomatic Infection of African Swine Fever Virus in Pigs. *Front Immunol*. 2021 Dec 15;12:808545.

63. Mulvey P, Duong V, Boyer S, Burgess G, Williams DT, Dussart P, Horwood PF. The Ecology and Evolution of Japanese Encephalitis Virus. *Pathogens*. 2021 Nov 24;10(12):1534.

64. Williams, DT, Paradkar, P, Karl, S. (2021). Chapter 14: Arbovirus Detection in Vectors. In: Genetically Modified and other Innovative Vector Control Technologies: Eco-bio-social Considerations for Safe Application"; Ed. Brij Kishore Tyagi. Springer Nature, Singapore. Published 14th December, 2021.

65. Wille. M., et al., (2021) Australia as a global sink for the genetic diversity of avian influenza A virus. *bioRxiv* 2021.11.30.470533; doi: <https://doi.org/10.1101/2021.11.30.470533>

b) International conferences: 26

1. Williams DT. ‘ASF Diagnostic and Research Support at the Australian Centre for Disease Preparedness’ and ‘ASF Vaccine Update’. Virtual Meeting of the OIE Standing Group of Experts on African Swine Fever for Asia; 5th February 2021. Webinar.

2. Drew T. ‘Implications of use of unauthorised ASF vaccines in the region’. Regional Consultation Workshop on ASF Preparedness and Response, Virtual Workshop based in Bangkok, Thailand; 9-10 March 2021.

3. Colling, A. ‘Validation of diagnostic tests for infectious diseases: challenges and opportunities’. International Symposium on Sustainable Animal Production and Health - Current Status and Way Forward, 28 June to 2 July 2021.

4. Eagles, Debbie; Paradkar, Prasad. Vector-borne diseases - gaps and opportunities. Joint Chinese Academy Agricultural Sciences (CAAS) and CSIRO Animal Sciences and Veterinary Medicine Theme Workshop. CAAS-CSIRO, 07/05/2021 Webinar.

5. Williams, David. ASF research at ACDP. Joint Chinese Academy Agricultural Sciences (CAAS) and CSIRO Animal Sciences and Veterinary Medicine Theme Workshop. CAAS-CSIRO, 07/05/2021 Webinar.

6. Wong, Frank. One Health animal influenza surveillance through the WHO/OIE/FAO tripartite global networked approach. Joint Chinese Academy Agricultural Sciences (CAAS) and CSIRO Animal Sciences and Veterinary Medicine Theme Workshop. CAAS-CSIRO, 07/05/2021 Webinar.

7. Moody, Nick; Sunarto, Agus. The National Carp Control Plan: Essential studies on cyprinid herpesvirus 3 (CyHV-3) prior to release of the virus in Australian waters. In: 18th Australasian Vertebrate Pest Conference; Melbourne, Australia (online). Centre for Invasive Species Solutions; 2021.

8. Beale, David; Shah, Rohan; Karpe, Avinash; Hillyer, Katie; Vasana, Vasana A critical appraisal of the ferret model of SARS-CoV-2 infection from a metabolomics perspective, 9th International Singapore Lipid Symposium 1-5 March 2021

9. Williams DT. ‘ASF Diagnostic and Research Support at the Australian Centre for Disease Preparedness and ASF Vaccine Update’. Virtual Meeting of the OIE Standing Group of Experts on African Swine Fever for Asia, 5th February, 2021.

10. Williams DT. And Drew T. ‘Australian Centre for Disease Preparedness - Introduction as new reference centre for ASF and CSF’. The 3rd OIE Regional Meeting of OIE Reference Centres (RCs) in Asia and the Pacific, 24-25 February 2021.

11. Williams DT. ‘Feedback from the Global network of ASF laboratories & global pool of experts’ and ‘Introduction to ACDP ASF and CSF’. OIE-FAO GF-TADs Regional Laboratory Expert Meeting on ASF and other pig diseases in Asia and the Pacific, 24th June 2021.

12. Williams DT. ‘Available laboratory and field diagnostic tools for ASF diagnosis’. OIE-FAO GF-TADs African swine

fever (ASF) Coordination Virtual meeting: Session III ASF Diagnosis, 25th August 2021.

13. Williams DT. 'ACDP Update'. Virtual Meeting of the OIE Standing Group of Experts on African Swine Fever for Asia, 7th September 2021

14. Williams DT. 'Options for portable and field diagnostics' Virtual Meeting of the OIE Standing Group of Experts on African Swine Fever for Asia, 15th December 2021.

15. Wong FYK. FAO consultation on non-avian zoonotic influenza in Asia (virtual), FAO-RAP Bangkok, Thailand, 20 January, 26 January, 3 February & 10 February 2021.

16. Wong FYK & Scott A. OIE Regional Expert Network Meetings for Avian Diseases in Asia & the Pacific (virtual), OIE-RRAP Tokyo, Japan on 29-30 February & 10 December 2021.

17. Wong FYK. FAO Expert Group Consultation Towards Mitigating Pandemic Influenza Risk (virtual), FAO-RAP Bangkok, Thailand, 30 November-3 December 2021.

18. Wong FYK. Avian Influenza Challenges (Genetic diversity, evolution, vaccine composition) - OFFLU perspectives. FAO-ECTAD Indonesia High Level Avian Influenza Surveillance and Vaccination Policy Consultation Meeting. FAO-ECTAD & Government of Indonesia, Jakarta, Indonesia, 23-24 December 2021.

19. Drew, T. W. 'Classical swine fever - aetiology, diagnosis and control'. Boehringer Ingelheim BaseCamp Asia Regional Training Programme, March 2021

20. Drew, T. W. 'Aujeszky's disease - aetiology, diagnosis and control'. Boehringer Ingelheim BaseCamp Asia Regional Training Programme, March 2021

21. Drew, T. W. 'Foot & mouth disease - aetiology, diagnosis and control'. Boehringer Ingelheim BaseCamp Asia Regional Training Programme, March 2021

22. Drew, T. W. 'Porcine reproductive & respiratory syndrome - aetiology, diagnosis and control'. Boehringer Ingelheim BaseCamp Asia Regional Training Programme, March 2021

23. Drew, T. W. 'Classical swine fever - epidemiology, prevention, diagnosis and control in commercial farms' Boehringer Ingelheim Swine Academy, August 2021

24. Drew, T. W. 'Aujeszky's disease - epidemiology, prevention, diagnosis and control in commercial farms' Boehringer Ingelheim Swine Academy, August 2021

25. Drew, T. W. 'Porcine reproductive & respiratory syndrome - epidemiology, prevention, diagnosis and control in commercial farms' Boehringer Ingelheim Swine Academy, August 2021

26. Eagles, D. "BSL3 and BSL4 Biosafety & Biosecurity: International Perspectives", BSL4ZNet International Conference, Keynote speaker, September 2021

c) National conferences: 0

d) Other

(Provide website address or link to appropriate information): 0

9. Additional comments regarding your report:

Due to COVID-19, ACDP has continued to work with limited operational capacity throughout 2021 (for example, adopting roster arrangements for staff site access, reduced site access to ensure physical distancing, no international travel and visitors unable to attend site for most of the year). This has significantly limited ACDP's capacity to carry out planned research and conduct training and has limited some types of diagnostic submissions to the laboratory. Due to lack of space, the table in question 5 could not be completed. The following are the missing entries: Frank Wong, invited OIE Reference Laboratory for Avian Influenza participant and the OIE/FAO Network of Expertise on Influenza (OFFLU) representative - FAO Regional Expert Group on Avian Influenza Virus (REG-AI) Working Group 2 Meeting (virtual) on Revision of the Regional Testing Algorithm for Avian Influenza on 26 August 2021 Frank Wong, invited OIE Reference Laboratory for Avian Influenza participant and the OIE/FAO Network of Expertise on Influenza (OFFLU) representative - FAO Regional Expert Group on Avian Influenza Virus (REG-AI) Working Group 3 Meeting (virtual) on Integration of Novel Technologies and Protocols for Avian Influenza on 27 August 2021 Frank Wong, Meeting organiser and co-chair, as Chair of the OIE/FAO Network of Expertise on Influenza (OFFLU) Avian Influenza Technical Activity - OFFLU AI situation virtual meeting for updates in poultry and wild birds as response to ongoing H5 HPAI clade 2.3.4.4b epizootic:

<https://www.offlu.org/wp-content/uploads/2021/11/OFFLU-November2021-Final.pdf> Frank Wong, Invited participant and the OIE/FAO Network of Expertise on Influenza (OFFLU) representative - FAO Expert Group Consultation Towards Mitigating Pandemic Influenza Risk, FAO-RAP Bangkok, Thailand on 30 November-3 December 2021 Frank Wong, Invited participant and presenter - OIE Regional Expert Network Meeting for Avian

Diseases in Asia & the Pacific (virtual), OIE-RRAP Tokyo, Japan on 10 December 2021 Dr Nick Moody, Invited participant - OIE ad hoc Group on Tilapia lake virus