

OIE Collaborating Centres Reports Activities

Activities in 2021

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Title of collaborating centre:	Laboratory Capacity Building
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Name of writer:	Dr Dwane O'Brien Research Director - Diagnostics, Surveillance & Response and Dr. Phoebe Readford Group Leader, International Program

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

Training, capacity building	
Title of activity	Scope
Biosafety workshops (supported by Australian Department of Foreign Affairs and Trade [DFAT] and the USA Defense Threat Reduction Agency)	Virtual Biosafety workshops were conducted by ACDP for 13 participants from countries across SE Asia. The attending country participants included laboratory quality assurance personnel, biorisk/biosafety managers and technical laboratory staff.
EID surveillance (supported by Australian Government Department of Foreign Affairs and Trade)	Surveillance of wildlife and livestock in high risk locations (e.g. wet markets) in Indonesia, Philippines, Lao PDR and Cambodia for EIDs such as coronaviruses and influenza A viruses.
Australia Indonesia Health Security Program - Lab strengthening Component (supported by DFAT and managed by Cardno)	Priority laboratory diagnostic capacity building activities for Indonesia including Lumpy Skin Disease, ASF/CSF, FMD exclusion testing, Brucella serology and vaccine updates, Leptospirosis diagnostics (MAT and PCR) and general laboratory QA and biosafety.
Technical support to Indonesia for COVID-19 Vaccine platform development (supported by DFAT and managed by Cardno)	To assist the Eijkman Institute in setting up a vaccine development platform through the establishment of a technical advisory group that includes ACDP and other international experts as required.
Technical support and capacity building for animal health laboratories in Indonesia supported by FAO Indonesia	Provision of technical support and laboratory capacity building to animal health laboratories in Indonesia including supply of influenza reagents, assistance on technical swine and avian influenza assays, bioinformatics capacity building and support for the Indonesia Virus Monitoring (IVM Online) database.
Diagnosis, biotechnology and laboratory	
Title of activity	Scope
Provision of technical support to the Regional Animal Health Office No. 6 (RAHO-6) Laboratory, Ho Chi Minh City, Vietnam under the OIE supported twinning project	ACDP is providing technical support to RAHO-6 under an OIE twinning project. This will support RAHO-6 in its efforts towards an application to be a future OIE Reference Laboratory for selected swine diseases including African Swine Fever (ASF).
Provision of technical support to Disease Investigation Centre Wates (DIC Wates) (Indonesia) as part of a twinning arrangement supported by the Australian Department Foreign Affairs and Trade (DFAT) Centre for Health Security.	ACDP is providing technical support to DIC Wates laboratory (Indonesia) under twinning arrangements.

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
Improved laboratory quality assurance systems	Provide advice and support to laboratories wanting to establish or improve laboratory quality assurance systems such as those provided through AS/NZS ISO 9001:2015 and environmental management systems under AS/NZS ISO 14001:2015.	<input checked="" type="checkbox"/> Surveillance and control of animal diseases <input type="checkbox"/> Food safety <input type="checkbox"/> Animal welfare
Pilot virtual training content and learning management platform	To enable the remote delivery of laboratory capacity building activities using virtual reality, real time remote viewing and other web-based tools	<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
Biosafety Level 4 Zoonotic Laboratory Network (BSL4ZNet)	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	BSL4ZNet is a network of government mandated organisations with national level responsibility for protecting animal health by working together to enhance knowledge, competency and future high containment needs.
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 Asia and the Pacific	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 to investigate emerging diseases, improve test capacity and proficiency testing to improve capability in the region.
FAO Regional Program, Bangkok and FAO Indonesia Country Program	Asia	<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 and improving regional harmonization of diagnostics for TADs
The Fleming Fund	UK	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input type="checkbox"/> Asia and Pacific <input checked="" type="checkbox"/> Europe <input type="checkbox"/> Middle East	To collaborate on Antimicrobial resistance initiatives
Burnet Institute	Australia	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	To collaborate on research projects
Australian Centre for International Agricultural Research (ACIAR)	Australia	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	To collaborate on capacity building initiatives
FAO Indonesia country program	Asia	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	Laboratory technical support in Indonesia.
Mahidol Oxford Tropical Medicine Research Unit (MORU)	Asia	<input type="checkbox"/> Africa <input type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	Collaboration on surveillance of wildlife and livestock in high risk locations (e.g. wet markets) for EIDs such as coronaviruses and influenza A viruses. Collaboration to improve biosafety capacity in Asia-Pacific region.
US Defense Threat Reduction Agency (DTRA)	America	<input type="checkbox"/> Africa <input checked="" type="checkbox"/> Americas <input checked="" type="checkbox"/> Asia and Pacific <input type="checkbox"/> Europe <input type="checkbox"/> Middle East	Maintain communication and collaboration to improve biosafety and biosecurity capacity in the Asia-Pacific region.

GF-TADs Standing Group of Experts for African swine fever in the Asia-Pacific	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	Continued support and technical expertise on strengthening response and control of ASF, including improving diagnostic capability, in the Asia-Pacific region.
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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
The Coalition for Epidemic Preparedness Innovations	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 accelerate the development of vaccines against emerging infectious diseases
Global African Swine Fever 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 successful prevention, control and where feasible eradication of African Swine Fever
Global Foot and Mouth Disease Research Alliance (GRFA)	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
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	The project forms a network of facilities researching animal diseases (including diseases which can spread to humans) in secure facilities. It will develop new technologies for this which go considerably beyond the current state of the art as well as activities such as standardization of protocols and best practices as well as connecting with similar institutes outside Europe. New tools will be developed for remote monitoring of the animals' health and welfare.
European Virus Archive - Global	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 and collect viruses and derived products

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
OIE ad hoc Group on susceptibility of fish species to infection with OIE listed diseases	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	Working group on molecular detection, subtyping and Characterisation of influenza viruses

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 Dr David Williams	Invited participants, presenters	Laboratory Capacity Building Workshop – Experience from Asia Pacific to share with the Americas
Dr Gemma Clark	Member	AHG on Sustainable Laboratories: briefing on PVS Lab data and OIE Equipment Management Survey (26 April 2021: Zoom)
Dr Gemma Clark	Member	3rd Meeting of the OIE Ad Hoc Group on Sustainable Laboratories (1-4 June 2021: Zoom)
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, Anthony Keyburn	Invited participant	OIE Pacific Partners Meeting

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: 5

c) Hands-on training courses: 8

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
C (remote)	ACDP ran Part One of a virtual Biosafety course for participants in the Asia-Pacific region which included support from Mahidol Oxford Tropical Medicine Research Unit and US Defense Threat Reduction Agency. This part covered basic biorisk principles, risk assessment, spill management, chemicals and disinfectants and PPE. 25-27 May and 8 June	Indonesia, Cambodia, Lao PDR, Vietnam, Timor Leste, Thailand and Papua New Guinea	13
C (remote)	ACDP delivered a sequencing workshop, focusing on Avian Influenza, for staff at the Disease Investigation Centre, Wates. 27-30 July.	Indonesia	6
B (remote)	ACDP delivered a mentoring session to DIC Wates, on serological techniques for IBDV antibody production and review of AI serology, Haemagglutination Inhibition assay and antigenic characterisation. 14 September	Indonesia	13
C (remote)	ACDP held a technical seminar with DIC Wates to review AI virology reagent and equipment requirements. 8 October	Indonesia	10
B (remote)	ACDP delivered 4 mentoring sessions between 24 August and 27 September on PT provision and ISO17043 Management for laboratory staff at DIC Wates	Indonesia	13
B (remote)	ACDP delivered a mentoring session to DIC Wates on biosafety management including spills and disinfectants, incidents and reporting, primary containment and management of sample storage. 22 September	Indonesia	5
C (remote)	ACDP delivered a biosafety workshop specific to DIC Wates. 12 October	Indonesia	5
C (remote)	ACDP ran Part Two of a virtual Biosafety course for participants in the Asia-Pacific region which included support from Mahidol Oxford Tropical Medicine Research Unit and US Defense Threat Reduction Agency. This covered biosafety cabinet usage and testing, safe use of autoclaves and centrifuges and animal ethics. 13-16 December	Indonesia, Cambodia, Lao PDR, Vietnam, Timor Leste, Thailand and Papua New Guinea	11
C (remote)	ACDP delivered a biosafety workshop specific to DIC Wates. October 11	Indonesia	5

C (remote)	ACDP deliver a PT workshop specific to DIC Wates, covering assessment of PT participants, review, analysis and meaning of statistical results. 22 & 29 November	Indonesia	9
B (remote)	ACDP provided advice and technical support to Indonesia, via AIHSP, on introduction and application of LAMP technology in Indonesia	Indonesia	20
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

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. Blasdell, 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

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- 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
- 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.
- 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.
- 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. Question 1 - additional information: Prior to the COVID-19 pandemic, the significant majority of ACDP's capacity building activities focused on face-to-face provision of technical support and practical workshops. While laboratory theory can be delivered virtually, the practical benchtop work and troubleshooting is difficult to deliver through virtual workshops. COVID-19 therefore resulted in a significant reduction in ACDP's ability to deliver practical laboratory capacity building work and has seen a significant effort required to trial and operationalise alternate delivery methods. Throughout 2021, ACDP has continued to pivot activities in a number of ways to mitigate the impacts on delivery. These include, · Redesigned course content to make virtual delivery a more engaging experience · Continued to investigate the use of augmented reality technology to facilitate practical benchtop assistance and troubleshooting. · Finalised a project delivery model which will place project managers in-country where it is necessary and when risk can be managed. One project manager ready for deployment in 2022. · Tried ways to improve laboratory networks and collaboration across the region (through combined training) to minimize the ongoing impact of COVID-19 related travel restrictions

