

WOAH Reference Laboratory Reports Activities 2025

This report has been submitted: 20 janvier 2026 19:18

LABORATORY INFORMATION

*Name of disease (or topic) for which you are a designated WOAH Reference Laboratory:	Foot and mouth disease
*Address of laboratory:	The Pirbright Institute, Ash Road, Pirbright, Surrey, GU24 0NF, United Kingdom
*Tel:	+441483231021
*E-mail address:	donald.king@pirbright.ac.uk
Website:	https://www.pirbright.ac.uk/
*Name (including Title) of Head of Laboratory (Responsible Official):	Prof. Bryan Charleston
*Name (including Title and Position) of WOAH Reference Expert:	Dr Donald King
*Which of the following defines your laboratory? Check all that apply:	Governmental Academic institution

TOR1: DIAGNOSTIC METHODS

1. Did your laboratory perform diagnostic tests for the specified disease/topic for purposes such as disease diagnosis, screening of animals for export, surveillance, etc.? (Not for quality control, proficiency testing or staff training)

Yes

Diagnostic Test	Indicated in WOAH Manual (Yes/No)	Total number of test performed last year	
		Nationally	Internationally
Indirect diagnostic tests			
ELISA - NSP	Yes	0	251
ELISA - SP	Yes	0	84
VNT	Yes	0	5726
Vaccine matching	Yes	0	106
Direct diagnostic tests			
Virus isolation	Yes	16	341
Antigen ELISA	Yes	12	297
Real-time RT-PCR	Yes	84	682
VP1 sequencing (with analyses)	Yes	0	119
Phylogenetic analyses of sequences submitted to the Ref. Lab.	Yes	0	32

TOR2: REFERENCE MATERIAL

2. Did your laboratory produce or supply imported standard reference reagents officially recognised by WOAH?

Yes

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Type of reagent available	Related diagnostic testing	Produced/ imported	Quantity supplied nationwide (ml, mg)	Quantity supplied at international level (ml, mg)	Name of beneficiary WOA Member Countries
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3. Did your laboratory supply standard reference reagents (nonWOAH-approved) and/or other diagnostic reagents to WOA Members?

Yes

Type of reagent available	Related diagnostic test	Produced/ provide	Amount supplied nationally (ml, mg)	Amount supplied internationally (ml, mg)	No. of recipient WOA Member Countries	Country of recipients
FMDV antigens, FMDV-specific antisera and serum controls	VNT and ELISA	Produced	19	921.5 ml	6	CHINESE TAIPEI, KOREA (REP. OF), POLAND, UNITED KINGDOM, UNITED STATES OF AMERICA, VIETNAM,
FMDV-specific monoclonal ab	ELISA	Produced	0.5	0	1	UNITED KINGDOM,
FMD virus isolates	Vaccine matching and assay controls	Produced	79.2	23.4	4	ITALY, KOREA (REP. OF), TURKEY, UNITED KINGDOM,

4. Did your laboratory produce vaccines?

No

5. Did your laboratory supply vaccines to WOA Members?

TOR3: NEW PROCEDURES

6. Did your laboratory develop new diagnostic methods for the designated pathogen or disease?

Yes

Name of the new test or diagnostic method developed	Description and References (Publication, website, etc.)
New nanopore sequencing method	Shaw AE, Lebani K, González Gordon L, Ihearahu UE, Wadsworth J, Hicks HM, Polo N, Freimanis G, Muhanguzi D, Tennakoon C, Orton RJ, Knowles NJ, Di Nardo A, Waters RA, Bronsvort BM, King DP. Universal amplification and sequencing of foot-and-mouth disease virus complete genomes using nanopore technology. BMC Genomics. 2025 Aug 22;26(1):770. doi: 10.1186/s12864-025-11938-7.
New reference antigen standards to assess FMD vaccine quality	Paton DJ, Wilsden G, Browning CF, Foglia EA, Di Nardo A, Knowles NJ, Wadsworth J, Gubbins S, Chitsungo E, Boukary CRM, Ayelet G, Bodjo CS, Nwankpa N, Brocchi E, Grazioli S, Ludi A, King DP. An antigen panel to assess the regional relevance of foot and mouth disease vaccines. NPJ Vaccines. 2025 May 26;10(1):106. doi: 10.1038/s41541-025-01128-7.
A new ELISA to directly assess the 146S content of FMD vaccines	Berryman S, Asfor A, Benham E, Howe N, Burman A, Brocchi E, Grazioli S, Tuthill TJ. Foot-and-mouth disease vaccine quality: A universal test for intact viral capsids based on detection of VP4. Vaccine. 2025 Apr 2;51:126845. doi: 10.1016/j.vaccine.2025.126845. Epub 2025 Feb 13.

7. Did your laboratory validate diagnostic methods according to WOA Standards for the designated pathogen or disease?

No

8. Did your laboratory develop new vaccines for the designated pathogen or disease?

9. Did your laboratory validate vaccines according to WOA Standards for the designated pathogen or disease?

TOR4: DIAGNOSTIC TESTING FACILITIES

10. Did your laboratory carry out diagnostic testing for other WOA Members?

Yes

Name of WOA Member Country seeking assistance	Date	Which diagnostic test used	No. samples received for provision of diagnostic support	No. samples received for provision of confirmatory diagnoses
BAHRAIN	2025-01-01	Virus isolation, Ag ELISA, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis, Vaccine	0	58

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		matching		
EGYPT	2025-12-01	Virus isolation, Ag ELISA, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis	0	4
ETHIOPIA	2025-09-01	Virus isolation, Ag ELISA, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis	0	79
GERMANY	2025-02-01	Virus isolation, Ag ELISA, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis, Vaccine matching	0	2
HUNGARY	2025-04-01	Virus isolation, Ag ELISA, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis, Vaccine matching	0	2
IRAQ	2025-03-01	Virus isolation, Ag ELISA, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis, Vaccine matching	0	25
KENYA	2025-11-01	Virus isolation, Ag ELISA, Real-time RT-PCR	0	119
NEPAL	2025-07-01	Virus isolation, Ag ELISA, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis, Vaccine matching	0	33
NIGERIA	2025-06-01	Virus isolation, Ag ELISA, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis, Vaccine matching	0	25
THAILAND	2025-06-01	Virus isolation, Ag ELISA, Real-time RT-PCR, VP1 sequencing, Phylogenetic analysis, Vaccine matching	0	19
ESWATINI	2025-06-01	Phylogenetic analysis	0	1
ISRAEL	2025-04-01	Phylogenetic analysis	0	7
ISRAEL	2025-06-01	Phylogenetic analysis	0	1
KUWAIT	2025-05-01	Phylogenetic analysis	0	1
SYRIA	2025-06-01	Phylogenetic analysis	0	9
TURKEY	2025-06-01	Phylogenetic analysis	0	9
TURKEY	2025-11-01	Phylogenetic analysis	0	1
VANUATU	2025-12-01	NSP testing	0	1

11. Did your laboratory provide expert advice in technical consultancies on the request of an WOA Member?

Yes

Name of the WOA Member Country receiving a technical consultancy	Purpose	How the advice was provided
ARMENIA	Advice on FMD diagnostics	Visit to Pirbright
GEORGIA	Advice on FMD diagnostics	Visit to Pirbright
TUNISIA	Advice on FMD vaccine selection	email
GEORGIA	Advice on FMD vaccine selection	email
SOUTH AFRICA	Advice on FMD vaccine selection	email
ISRAEL	Guidance on circulating FMD strains in the Middle East	email
JORDAN	Advice on FMD vaccine selection	email

TOR5: COLLABORATIVE SCIENTIFIC AND TECHNICAL STUDIES

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12. Did your laboratory participate in international scientific studies in collaboration with WOA Member Countries other than the own?

Yes

Title of the study	Duration	Purpose of the study	Partners (Institutions)	WOAH Member Countries involved other than your country
Evaluation of FMD vaccine quality	5 years (until Dec 2026)	To develop tools and a pipeline to assess FMD vaccine quality	ICAR	INDIA
WOAH Twinning project	3.5 years (until June 2026)	Development of diagnostic capacity for Kenya	Embakasi	KENYA
WOAH Twinning project	2 years (until June 2026)	Development of diagnostic capacity for Jordan	CVL	JORDAN
Partnering project	2 years (until April 2026)	Building diagnostic capacity in Zambia	CVRI	ZAMBIA

13. In exercising your activities, have you identified any regulatory research needs* relevant for WOA Member Countries?

Yes

Research need : 1

Please type the Research need: Reference antigens for FMD

Relevance for WOA Standard Setting,

Relevance for the Code or Manual Manual,

Field Vaccines,

Animal Category Terrestrial,

Disease:

Foot and mouth disease

Kind of disease (Zoonosis, Transboundary diseases) Transboundary diseases,

If any, please specify relevance for Codes or Manual, chapter and title

(e.g. Terrestrial Manual Chapter 2.3.5 - Minimum requirements for aseptic production in vaccine manufacture)

Answer: Scope to include reference FMDV antigens as an approach to demonstrate the regional relevance of FMD vaccines

Notes:

Answer:

TOR6: EPIZOOLOGICAL DATA

14. Did your Laboratory collect epidemiological data relevant to international disease control?

Yes

If the answer is yes, please provide details of the data collected:

Sample reports include associated metadata (i.e., host species, sampling date, location, etc..)

15. Did your laboratory disseminate epidemiological data that had been processed and analysed?

Yes

If the answer is yes, please provide details of the data collected:

Epidemiological data are included in diagnostic reports returned to sender and the appropriate country's WOA representative(s). These reports are also circulated to WOA and FAO.

16. What method of dissemination of information is most often used by your laboratory? (Indicate in the appropriate box the number by category and list the details in the box)

a) Articles published in peer-reviewed journals:

20

1. Berryman, S., A. Asfor, E. Benham, N. Howe, A. Burman, E. Brocchi, S. Grazioli, and T.J. Tuthill (2025). Foot-and-mouth disease vaccine quality: A universal test for intact viral capsids based on detection of VP4. *Vaccine*, 51: 13. DOI: 10.1016/j.vaccine.2025.126845.
2. Berryman, S., F. Feenstra, A. Asfor, J. Coco-Martin, T. Jackson, and T.J. Tuthill (2025). Foot-and-mouth disease vaccines by design; production of capsid-modified foot-and-mouth disease viruses with improved cell culture growth. *Vaccines*, 13(3): 25. DOI: 10.3390/vaccines13030281.
3. Colenutt, C., A. Shaw, S.N. Esemu, A.J. Kfusi, B.W. Ojong, E. Brown, J. Wadsworth, N.J. Knowles, D.P. King, L.M. Ndip, E. Chevanne, F. Rosso, K. Sumption, and S. Gubbins (2025). Detection and genomic characterisation of Foot-and-mouth disease virus serotypes circulating in Cameroon using environmental sampling. *Scientific Reports*, 15(1): 14. DOI: 10.1038/s41598-024-84724-2.
4. Di Nardo, A., A.E. Shaw, M. Gondard, J. Wadsworth, G. Girault, K. Parekh, A. Ludi, V. Mioulet, C. Bernelin-Cottet, H.M. Hicks, N. Polo, A. Bulut, U. Parlak, D. Gizaw, M. Ababneh, M. Al Ameer, L.M.S. Abdulrasool, F.S.A. Saloom, W.A. Al-Rawahi, N.J. Knowles, L. Bakkali-Kassimi, and D.P. King (2025). Eastern Africa origin of SAT2 topotype XIV Foot-and-mouth disease virus outbreaks, western Asia, 2023. *Emerging Infectious Diseases*, 31(2): 368-372. DOI: 10.3201/eid3102.240395.
5. Edwards, N., A.E. Shaw, A. Di Nardo, A. Sowood, H.M. Hicks, J. Wadsworth, K. Parekh, A. McCarron, P.L. Kumarawadu, Y.M. Eltahir, M.S. Mohamed, L.R. Dahal, K.R. Pandey, N. Poudel, E. Taylor, D.L. Horton, V. Mioulet, A. Ludi, N.J. Knowles, D.P. King, and L. Lasecka-Dykes (2025). Foot-and-mouth disease virus O/ME-SA/SA-2018: A new emerging threat posed by viruses circulating in Asia? *Infection Genetics and Evolution*, 132: 5. DOI: 10.1016/j.meegid.2025.105771.
6. Edwards, N., A.E. Shaw, A. Di Nardo, A. Sowood, H.M. Hicks, J. Wadsworth, K. Parekh, A. McCarron, P.L. Kumarawadu, Y.M. Eltahir, M.S. Mohamed, L.R. Dahal, K.R. Pandey, N. Poudel, E. Taylor, D.L. Horton, V. Mioulet, A. Ludi, N.J. Knowles, D.P. King, and L. Lasecka-Dykes (2025). Foot-and-mouth disease virus O/ME-SA/SA-2018: A new emerging threat posed by viruses circulating in Asia? *Infection Genetics and Evolution*, 132. DOI: 10.1016/j.meegid.2025.105771.
7. Foglia, E.A., V. Mioulet, S. Cavalera, J. Baguisi, S.I. Turgut, A. Sangula, S. Khan, S.M. Jamal, H. Bull, S. Rosati, C. Nogarol, G. Pezzoni, A. Bulut, D.P. King, L. Anfossi, F. Rosso, E. Brocchi, and S. Grazioli (2025). Validation of two multiplex lateral flow devices for the rapid detection and typing of Foot-and-mouth disease viruses. *Research in Veterinary Science*, 185: 7. DOI: 10.1016/j.rvsc.2025.105558.
8. Gizaw, D., B. Senbata, A. Fentie, T. Bilata, D. Negessu, A. Muluneh, D. Shegu, H. Ashenafi, N.J. Knowles, J. Wadsworth, V. Mioulet, H.M. Hicks, M. Legesse, T. Kassa, and D.P. King (2025). Serotype diversity and molecular characterization of foot-and-mouth disease viruses from outbreaks in Ethiopia (2019-2023): re-emergence of SAT 2 after 30 years. *Transboundary and Emerging Diseases*, 2025(1): 12. DOI: 10.1155/tbed/6670343.
9. Gubbins, S., E. Brown, Y. Wungak, O. Oyekan, A.J. Adedeji, S.I. Ijoma, R.B. Atai, M.O. Oguche, M. Samson, B.B. Dogonyaro, F. Rosso, H. Hicks, B.A. Wood, J. Wadsworth, N. Knowles, D.P. King, A.B. Ludi, C. Colenutt, A.E. Shaw, G. Limon, and D.O. Ehizibolo (2025). Longitudinal study of Foot-and-mouth disease virus in Northern Nigeria: implications for the roles of small ruminants and environmental contamination in endemic settings. *Veterinary Research*, 56(1): 16. DOI: 10.1186/s13567-025-01502-2.
10. Humphreys, J.M., C. Stenfeldt, D.P. King, T. Knight-Jones, A.M. Perez, K. Vanderwaal, M.W. Sanderson, A. Di Nardo, W.T. Jemberu, N. Pamornchainavakul, and J. Arzt (2025). Epidemiology and economics of foot-and-mouth disease: current understanding and knowledge gaps. *Veterinary Research*, 56(1). DOI: 10.1186/s13567-025-01561-5.
11. Jamal, S.M., S. Khan, H.U. Rahman, S.A.A. Shah, N. Polo, G. Wilsden, K. Parekh, C. Browning, J. Wadsworth, N.J. Knowles, A. Ludi, D.P. King, M. Eschbaumer, and G.J. Belsham (2025). Emergence of new sublineages of serotype O Foot-and-mouth disease viruses circulating in Pakistan during 2012-2021. *Virology*, 605: 14. DOI: 10.1016/j.virol.2025.110455.
12. Jones, R., D.P. King, and V. Busin (2025). Retrospective analysis of submissions to the World Reference Laboratory for foot-and-mouth disease: What can these data tell us about the role of small ruminants in disease epidemiology? *Preventive Veterinary Medicine*, 239: 12. DOI: 10.1016/j.prevetmed.2025.106526.
13. Jones, R., D.P. King, and V. Busin (2025). Retrospective analysis of submissions to the World Reference Laboratory for foot-and-mouth disease: What can these data tell us about the role of small ruminants in disease epidemiology? *Preventive Veterinary Medicine*, 239. DOI: 10.1016/j.prevetmed.2025.106526.
14. Jones, R., D.P. King, and V. Busin (2025). Retrospective analysis of submissions to the World Reference Laboratory for foot-and-mouth disease: What can these data tell us about the role of small ruminants in disease epidemiology? (vol 239, 106526, 2025). *Preventive Veterinary Medicine*, 240. DOI: 10.1016/j.prevetmed.2025.106542.
15. Kerfua, S.D., D.T. Haydon, G. Wilsden, A. Ludi, D.P. King, R.A. Okurut, S. Atim, M.T. Dhikusooka, I. Kyakuwa, P. Motta, and D.J. Paton (2025). Evaluation of commercial quadrivalent Foot-and-mouth disease vaccines against East African virus strains reveals limited immunogenicity and duration of protection (vol 42, 126325, 2024). *Vaccine*, 43: 1. DOI: 10.1016/j.vaccine.2024.126480.
16. King, D.P., M. McLaws, N. Mapitse, and D.J. Paton (2024). Are the knowledge, tools and resources to control Foot-and-mouth-disease available? *Revue Scientifique Et Technique - Office International Des Epizooties*: 24-35. DOI: 10.20506/rst.SE.3555.
17. Neil, C., J. Newman, N.J. Stonehouse, D.J. Rowlands, G.J. Belsham, and T.J. Tuthill (2024). The pseudoknot region and poly-(C) tract comprise an essential RNA packaging signal for assembly of Foot-and-mouth disease virus. *PLoS Pathogens*, 20(12): 26. DOI: 10.1371/journal.ppat.1012283.
18. Paton, D.J., G. Wilsden, C.F. Browning, E.A. Foglia, A. Di Nardo, N.J. Knowles, J. Wadsworth, S. Gubbins, E. Chitsungo, C.R.M. Boukary, G. Ayelet, C.S. Bodjo, N. Nwankpa, E. Brocchi, S. Grazioli, A. Ludi, and D.P. King (2025). An antigen panel to assess the regional relevance of foot-and-mouth disease vaccines. *NPJ Vaccines*, 10(1): 12. DOI: 10.1038/s41541-025-01128-7.
19. Paton, D.J., G. Wilsden, C.F. Browning, E.A. Foglia, A. Di Nardo, N.J. Knowles, J. Wadsworth, S. Gubbins, E. Chitsungo, C.R.M. Boukary, G. Ayelet, C.S. Bodjo, N. Nwankpa, E. Brocchi, S. Grazioli, A. Ludi, and D.P. King (2025). An antigen panel to assess the regional relevance of foot-and-mouth disease vaccines. *NPJ Vaccines*, 10(1). DOI: 10.1038/s41541-025-01128-7.
20. Shaw, A.E., K. Lebani, L.G. Gordon, U.E. Ihearahu, J. Wadsworth, H.M. Hicks, N. Polo, G. Freimanis, D. Muhanguzi, C. Tennakoon, R.J. Orton, N.J. Knowles, A. Di Nardo, R.A. Waters, B.M. Bronsvort, and D.P. King (2025). Universal amplification and sequencing of Foot-and-mouth disease virus complete genomes using nanopore technology. *BMC Genomics*, 26(1). DOI: 10.1186/s12864-025-11938-7.
21. Yassin, A.A., A.B. Ludi, S. Grazioli, E. Brocchi, D. Horton, D.P. King, and A.S. Asfor (2025). Mapping cross-reactive residues in the G-H loop of Foot-and-mouth disease virus: insights for serotype-specific design. *Frontiers in Microbiology*, 16. DOI: 10.3389/fmicb.2025.1631386.

b) International conferences:

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1. Bernelin-Cottet C., Ababneh M., Abdulrasool L. M. S., Al Ameer M., Al Ansari A., Al Mamari W., Al Rashdi Z., Al Rawahi W. A., Al Riyami B., Al Salloom F., Bakkali Kassimi L., Baqir A., Bulut A., Di Nardo A., Elshafie E. I., Girault G., Gizaw D., Gondard M., Hicks H. M., King D. P., Knowles N. J., Ludi A., Mioulet V., Parekh K., Parlak U., Polo N., Sangula A., Shaw R., Wadsworth J. and Zientara S. Foot-and-mouth disease virus circulation in the Sultanate of Oman (2018-2023) and associated risks. *International Symposium of the World Association of Veterinary Laboratory Diagnosticians, Calgary, Canada, June 2025.*
2. Edwards N., Schmidt S., Polo N., Wadsworth J., Mioulet V., Taylor E., King D. P., Horton D., Lasecka-Dykes L. and Shaw A. E. Investigating foot-and-mouth disease virus lineage turnover using integrated in vitro and genomics approaches. *American Society for Virology, Montréal, Canada, July 2025.*
3. Armson B. A., Zaleski T., Browning C., Mioulet V., Shaw A., Ludi A., Wood B., Wilsden G., Parekh K., Edwards N., Di Nardo A., Wadsworth J., Henstock M., Hicks H. M., Paton D., Baguisi J., Bull H., McCarron A., Gray A., Maryan J., Belgrave S., Polo N., Gubbins S., Colenutt C., Nicholls M., Brown E., Nasou E., Drelicuc A., Pittalis L., Jorge D., Wilson C., Taylor S., Bis J., Nfon C., Williamson S. and King D. P. Seneca Valley virus: the cause of vesicular disease in pigs in England in 2022. *13th International Congress for Veterinary Virology, Portorož, Slovenia, September 2025.*
4. Zaleski T., Armson B., Browning C., Darpel K., Frossard J.-P., King D. P., Tucker D. and Williamson S. Serological and molecular surveillance for Seneca Valley virus in England. *13th International Congress for Veterinary Virology, Portorož, Slovenia, September 2025.*
5. Armson B., Zaleski T., Morant N., Howson E. L. A., Edwards N., Williamson S., King D. P. and Shaw A. E. A simple approach for pen-side testing, to rapidly detect foot-and-mouth disease virus and Seneca Valley virus. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
6. Sowood A., Wood B., Bull H., Chantler V., McCarron A., Baguisi J., Hicks H., Wadsworth J., Mioulet V., King D. P. and Shaw A. E. Development and evaluation of lineage-specific assays to detect emerging lineages of concern. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
7. Shaw A. E., Sowood A., Wadsworth J., González Gordon L., Bronsvort M., Wee B., Odoom T., Orton R. J., Abualghusein I. H., Al-Zghoul M. D. B., Ababneh M. and King D. P. Lyophilised PCR reagents to simplify nanopore sequencing of foot-and-mouth disease virus. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
8. Lyimo M. T., Njau E. P., Kandusi S., Di Nardo A., Juma R., Mpete H., Mkama M., Knowles N. J., King D. P. and Kasanga C. J. Foot-and-mouth disease outbreak investigation in cattle: insights for viral evolution in the southern highlands of Tanzania. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
9. Di Nardo A., Shaw A. E., Girault G., Wadsworth J., Hick H. M., Polo N., Ludi A., Parekh K., Mioulet V., Gonard M., Bernelin-Cottet C., Bulut N., Parlak U., Gizaw D., Ababneh M., Al Ameer M., Abdulrasool L. M. S., Al Saloom F. S., Al-Rawahi W. A., Knowles N. J., Bakkali-Kassimi L. and King D. P. "out-of Africa" – incursions of exotic foot-and-mouth disease viruses into Western Asia. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
10. Al-Rashed A., Wadsworth J., Shaw A., Hicks H., Bulut A., Knowles N., King D. P. and Di Nardo A. Evolutionary emergence of the A/ASIA/G-VII FMDV lineage in Western Asia. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
11. Eschbaumer M., Staubach C., Schulz K., Pfaff F., Calvelage S., Höper D., Breithaupt A., Deutschmann P., Knowles N., Girault G., Bakkali Kassimi L., King D. P., Sauter-Louis C. and Beer M. Germany's first FMD outbreak in 37 years: detection, recovery and lessons learned. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
12. Bonnet-Di Placido M., Duyvesteyn H. M. E., Steyn A., Hay A. L., Porta C., Valdez K. R., Lohman E., Crossley S., Hanson K., Mwangi W., Munir D., Perez-Martin E., Knowles N. J., Burman A., Yasson A. A., Asfor A., Faralla C., Lam K. J., McComb R., Leifeld C., Pietersz K., King D. P., van den Born E., Duncan S. K., Charleston B., Fry E. E., Ren J., Stuart D. I. and Hammond J. A. Cattle antibodies identify a cross-serotype broadly neutralising foot-and-mouth virus epitope. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
13. Yasmin A., Grant C., Burman A., Perez-Martin E., Bugatti M., Grazioli S., Bentham A., Mitchell K., Ribeiro C., Wakeman A., King D. P., Ludi A., Berryman S. and Tuthill T. Development of in vitro tests for FMD vaccine quality using ELISA and lateral-flow devices. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
14. Ludi A., Paton D. J., Wilsden G., Di Nardo A., Knowles N. J., Wadsworth J., Gubbins S., Chistungo E., Boukary C. R. M., Ayelet G., Bodjo C. S., Nwankpa N., Brocchi E., Foglia E. A., Grazioli S. and King D. P. Assing FMD vaccine quality – moving beyond vaccine matching. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
15. Titus E., Saxena V. K., Krishnaswamy N., Krishnappa S., Shetty C. J., Sreenivasa B. P., Chaudhuri P., Sanyal A., King D. P., Selvan T. and Periyasamy R. A novel approach to titrating serum antibodies against foot-and-mouth virus: solid phase competitive ELISA using purified mammalian cell line integrin receptors. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
16. Maccabiani G., Burman A., Mioulet V., Foglia E. A., Scaramuzza M., Soldati R., Trogu T., Ludi A., King D. P. and Grazioli S. Monoclonal antibodies against FMDV type SAT 3: preliminary characterization and potential use in diagnostic assays. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
17. Trogu T., Di Nardo A., King D. P., Eldaghayes I., Krim A., Abosrer F., Rosso F., Baiomy S., Grazioli S., Maccabiani G. and Pezzoni G. Recent incursions of FMDV topotype O/EA-3 in Libya (2019-2025). *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*
18. Tamil Selvan R. P., Ludi A. B., King D. P., Paton D. J., Gubbins S., Patel B. H. M., Narayanan K., Sumana K., Sandra B., Ramakrishnan M. A., Gnanavel V., saravanan P., Goovaerts D., Bhanuprakash V., Dechamma H. J., Nihar M. N., Singh G. V., Chaudhuri P., Singh S. K., Sanyal A., Malik P., Hemadri D. and Dutt T. Initial validation of a small animal model for potency assessment of FMD vaccines for batch release. *Scientific meeting of the Global Foot-and-mouth Disease Research Alliance, Istanbul, Türkiye, October 2025.*

c) National conferences:

1

1. Edwards N., Schmidt S., Polo N., Wadsworth J., Mioulet V., Taylor E., King D. P., Horton D. L., Lasecka-Dykes L. and Shaw A. E. Integrating molecular assays with viral genomics to identify fitness factors driving lineage turnover of foot-and-mouth disease virus. *Mico Soc, Liverpool, March 2025.*

d) Other (Provide website address or link to appropriate information):

4

<https://www.wrlfmd.org/>

<https://www.foot-and-mouth.org/>

<https://www.fmdbase.org/>

<https://www.openfmd.org/>

TOR7: SCIENTIFIC AND TECHNICAL TRAINING

17. Did your laboratory provide scientific and technical training to laboratory personnel from other WOA Members?

Yes

a) Technical visit : 6

b) Seminars : 0

c) Hands-on training courses: 10

d) Internships (>1 month) 1

Type of technical training provided (a, b, c or d)	Country of origin of the expert(s) provided with training	No. participants from the corresponding country
D	KOREA (REP. OF)	1
C	KENYA	7
C	INDONESIA	1
C	SPAIN	1
C	SINGAPORE	1
A	ZAMBIA	3
A	JORDAN	3

TOR8: QUALITY ASSURANCE

18. Does your laboratory have a Quality Management System?

Yes

Quality management system adopted	Certificate scan (PDF, JPG, PNG format)	
ISO 17025	.pdf	UKAS 4025 16June2025.pdf

19. Is your quality management system accredited?

Yes

Test for which your laboratory is accredited	Accreditation body
Virus isolation	United Kingdom Accreditation Service
Real-time RT-PCR	United Kingdom Accreditation Service
Antigen ELISA	United Kingdom Accreditation Service
VNT	United Kingdom Accreditation Service
NSP ELISA	United Kingdom Accreditation Service
SP-ELISA	United Kingdom Accreditation Service
Disinfectant testing	United Kingdom Accreditation Service

20. Does your laboratory maintain a "biorisk management system" for the pathogen and the disease concerned?

Yes

FMDV infectious material is handled within high-containment facilities at The Pirbright Institute which are licensed by the UK Health and Safety Executive (HSE) under level 4 of the Specific Animal Pathogens Order (UK).

TOR9: SCIENTIFIC MEETINGS

21. Did your laboratory organise scientific meetings related to the pathogen in question on behalf of WOA?H?

Yes

National/ International	Title of event	Co-organiser	Date	location	No. Participants
International	Annual Meeting of the WOA/FAO Reference Laboratory Network	Şap Institute, Türkiye	2025-10-19	Istanbul, Türkiye	45

22. Did your laboratory participate in scientific meetings related to the pathogen in question on behalf of WOA?H?

Yes

Title of event	Date	location	Role (speaker, presenting poster, short communications)	Title of the work presented
Special meeting of SEACFMD	2025-09-14	Virtual	Speaker	Foot-and-mouth Disease Global and regional risks
SEACFMD National Coordinators meeting	2025-08-18	Luang Prabang, Laos	Speaker	Foot and mouth Disease: Global risks and vaccine selection
WOAH Disease Networks meeting	2025-05-06	WOAH HQ, Paris	Speaker	Talks on the FMD Network, Open FMD and the impacts of the Nagoya Protocol
WOAH Seminar	2025-01-27	Online	Speaker	New FMD outbreaks: SAT2/XIV risks in the Middle East
GFTADs FMD Regional Roadmap for the Middle East	2025-04-15	Online	Speaker	FMD Regional risks
GFTADS FMD Regional Roadmap meeting for West Eurasia	2025-11-11	online	Speaker	FMD situation with emphasis on West Eurasia
Training workshop on FMD epidemiology, diagnostics, and surveillance	2025-10-20	Mombasa, Kenya	Speaker and trainer	Presentations on PCP, effective control of FMD via vaccination
Regional Training on Official Status RWOAH Procedures for Official Status Recognition, Endorsement of Official Control Programmes, and Maintenance	2025-02-25	Issyk-Kul, Kyrgyzstan	Speaker and trainer	Vaccination in support of official FMD-freedom

TOR10: NETWORK WITH WOA?H REFERENCE LABORATORIES

23. Did your laboratory exchange information with other WOA?H Reference Laboratories designated for the same pathogen or disease?

Yes

24. Are you a member of a network of WOA?H Reference Laboratories designated for the same pathogen?

Yes

NETWORK/DISEASE	ROLE OF YOUR LABORATORY (PARTICIPANT, ORGANISER, ETC)	NO. PARTICIPANTS	PARTICIPATING WOA?H REF. LABS
WOAH/FAO Network for FMD Reference Laboratories	Secretariat and organiser	21	Argentina, Belgium, Botswana, Brazil (Panaftosa), Canada, China, France, Italy, Japan, South Korea, Russia, South Africa, UK and USA

25. Did you organise or participate in inter-laboratory proficiency tests with WOA?H Reference Laboratories designated for the same pathogen during the past 2 years?

Yes

Purpose of the proficiency test:	Role of your Reference Laboratory (organiser/ participant)	No. participating Laboratories	Participating WOA?H Ref. Labs/ organising WOA?H Ref Lab
			SENASA, Argentina; Sciensano, Belgium; BVI, Botswana; PANAF?TOSA, Brazil; NCFAD, Canada; LVRI, China; ANSES,

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Virology and Serology tests for FMD	Organiser	12	France; IZSLER, Italy; OVI, South Africa; APQA, South Korea; USDA, USA, Pirbright UK
FMD/SVD Diagnostic methods	Participant	>30	ANSES, France

26. Did your laboratory collaborate with other WOA Reference Laboratories for the same disease on scientific research projects for the diagnosis or control of the pathogen of interest?

Yes

Title of the project or contract	Scope	Name(s) of relevant WOA Reference Laboratories
SAT2/XIV in Western Asia	Phylogenetic analyses of SAT 2 viruses from Middle East countries	ANSES, France
Molecular epidemiology of FMD in Asia	Development of genome sequencing technologies	APQA, Republic of Korea
IZSLER/Pirbright collaboration	Development of immunoassays for vesicular diseases	IZSLER, Italy

TOR11: OTHER INTERLABORATORY PROFICIENCY TESTING

27. Did your laboratory organise or participate in inter-laboratory proficiency tests with laboratories other than WOA Reference Laboratories for the same pathogen during the past 2 years?

Yes

Purpose for inter-laboratory test comparisons ¹	Role of your reference laboratory (organizer/participant)	No. participating laboratories	Name of the test	WOAH Member Countries
Virology and serology tests for FMDV	Organiser	34	All virology and serology tests	ARMENIA, AUSTRALIA, AZERBAIJAN, BRAZIL, BURKINA FASO, CHINESE TAIPEI, EGYPT, ETHIOPIA, HONG KONG, INDIA, INDONESIA, IRAN, IRAQ, ISRAEL, JORDAN, KENYA, MOROCCO, NAMIBIA, NEPAL, NEW ZEALAND, NIGERIA, PERU, PHILIPPINES, SENEGAL, SINGAPORE, THAILAND, UNITED ARAB EMIRATES, UNITED KINGDOM, UNITED STATES OF AMERICA, ZAMBIA,

TOR12: EXPERT CONSULTANTS

28. Did your laboratory place expert consultants at the disposal of WOA?

Yes

Kind of consultancy	Location	Subject (facultative)
Review of official texts	via email	Review and updating the Terrestrial Manual Chapter for FMD
Presentation at WOA GS (92GS)	Paris	Provided short talk in the Animal Health Forum 'Veterinary Vaccines and vaccination: from science to action – reflections for change'
Member of WOA BSC	Paris	Attendance at Commission meetings in February and September
Presentation to WOA SCAD	on-line	Update on global FMD outbreaks
Review of texts	on-line meetings	Update and review of SEACFMD workplan (as core group members)
Member of WOA ad-hoc group	Paris	on Evaluation of foot and mouth disease Status of Members
Expert opinion	on-line	Import of breeding and fattening animals from an FMD-infected zone to an FMD-free zone where vaccination is practised
Expert opinion	on-line	Risk mitigation for FMD contamination of foetal claf serum
		Co-authorship of WOA Guidelines for surveillance to

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Preparation of WOAHA texts	on-line	substantiate foot and mouth disease (FMD) freedom when vaccinated livestock are present
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29. Additional comments regarding your report: