



# Support from WOA Reference Laboratories

**David Paton**

**Acknowledgements:** Don King and the team at the FAO World Reference Laboratory for FMD and WOA Reference Laboratories for FMD and SVD  
[donald.king@pirbright.ac.uk](mailto:donald.king@pirbright.ac.uk)

Workshop on WOA Procedures for official status recognition, Issyk Kul  
Kyrgyzstan  
25-27<sup>th</sup> February 2025



Pirbright receives strategic funding from BBSRC UKRI



Department  
for Environment  
Food & Rural Affairs



OIE/FAO  
Foot-and-Mouth Disease  
Reference Laboratories  
Network



[www.pirbright.ac.uk](http://www.pirbright.ac.uk)

# WOAH/FAO FMD Laboratory Network

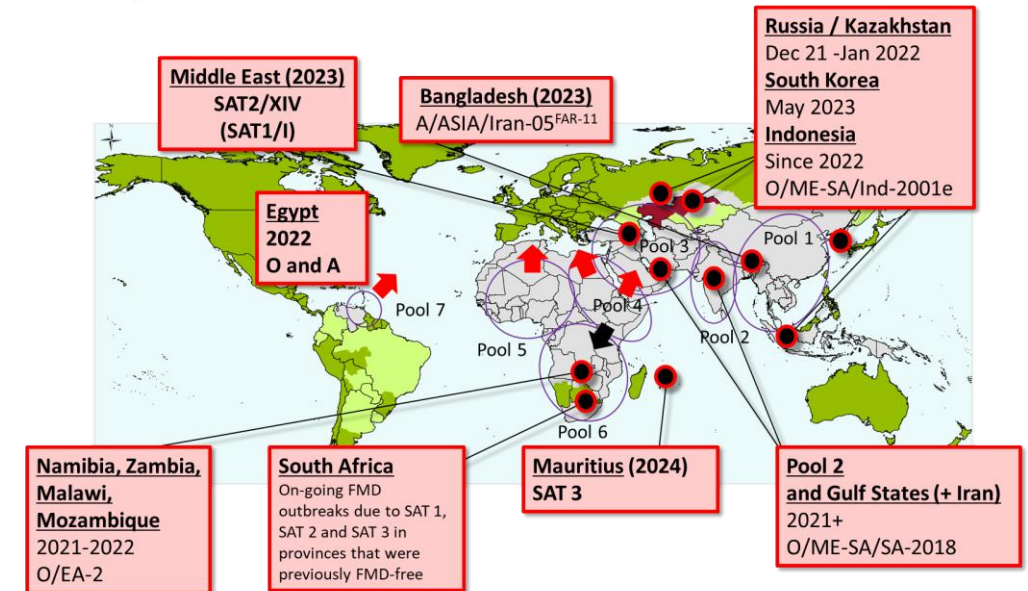
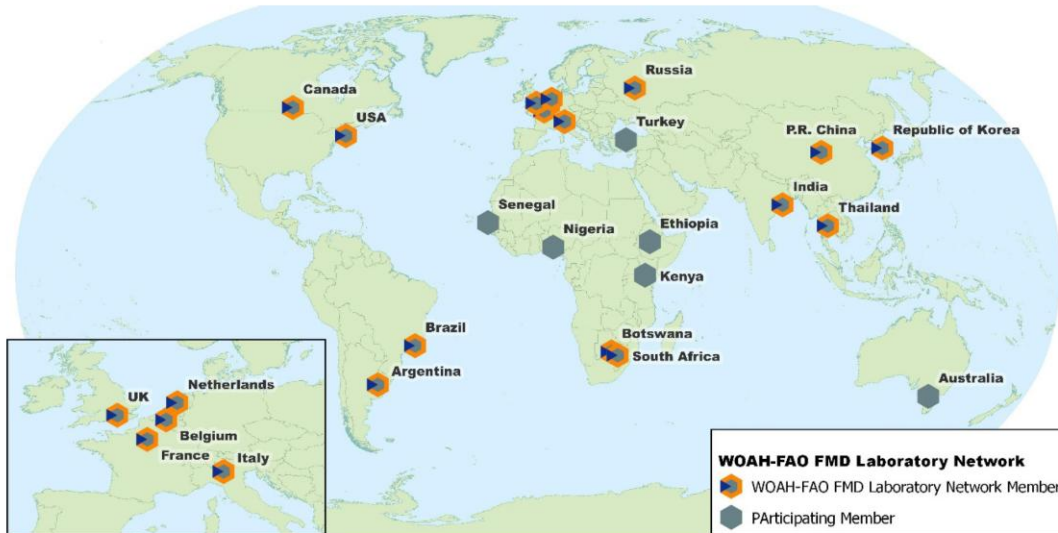


[www.foot-and-mouth.org](http://www.foot-and-mouth.org)

- Reviewing the global circulation of FMD viruses and the suitability of vaccines.
- A forum for laboratory issues such as biosafety, performance and standardization of tests, reagent supply, material transfers, and sharing of information.
- Providing support to regional roadmaps of GF-TAFDS

Network Members and affiliates:

Analysing and sharing pooled information:



International partnerships are essential to collate, share and analyse data

[www.pirbright.ac.uk](http://www.pirbright.ac.uk)

# What is available from WRLFMD



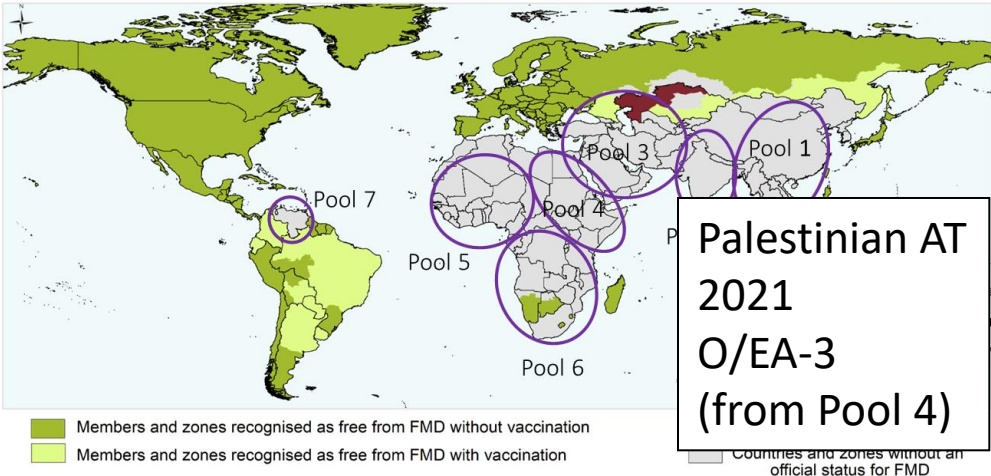
- Referral diagnosis
- Vaccine quality control
- Training and proficiency tests
- Informatics
- Collaboration and twinning
- Get in touch!

Head of the WRLFMD: [donald.king@pirbright.ac.uk](mailto:donald.king@pirbright.ac.uk); Website: [wrlfmd.org](http://wrlfmd.org)



# Recent introductions of exotic viruses into Pool 3

WOAH Members' official FMD status  
Last update June 2024



Iraq, Jordan, Türkiye, Oman, Bahrain  
2023  
**SAT2/XIV**  
(from Pool 4)

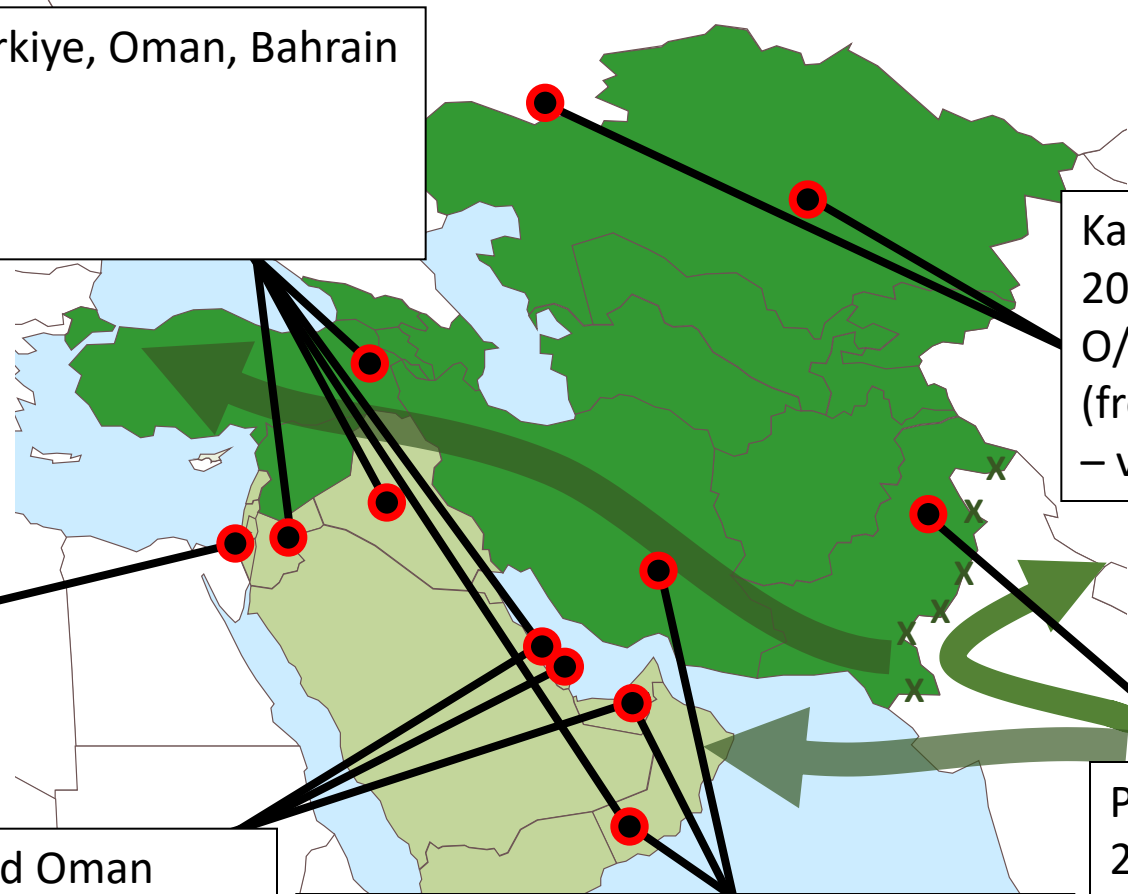
Palestinian AT  
2021  
O/EA-3  
(from Pool 4)

Bahrain and Oman  
O/EA-3 (2020-21)  
A/AFRICA/G-I (2018-21)  
Qatar  
SAT1/I (2023)  
(from Pool 4)

UAE and Oman  
2021  
Iran (2023), Palestine/Türkiye (2024)  
**O/ME-SA/SA-2018**  
(from Pool 2)

Kazakhstan and Russia  
2021-22  
O/ME-SA/Ind-2001e  
(from Pool 1  
– via Mongolia?)

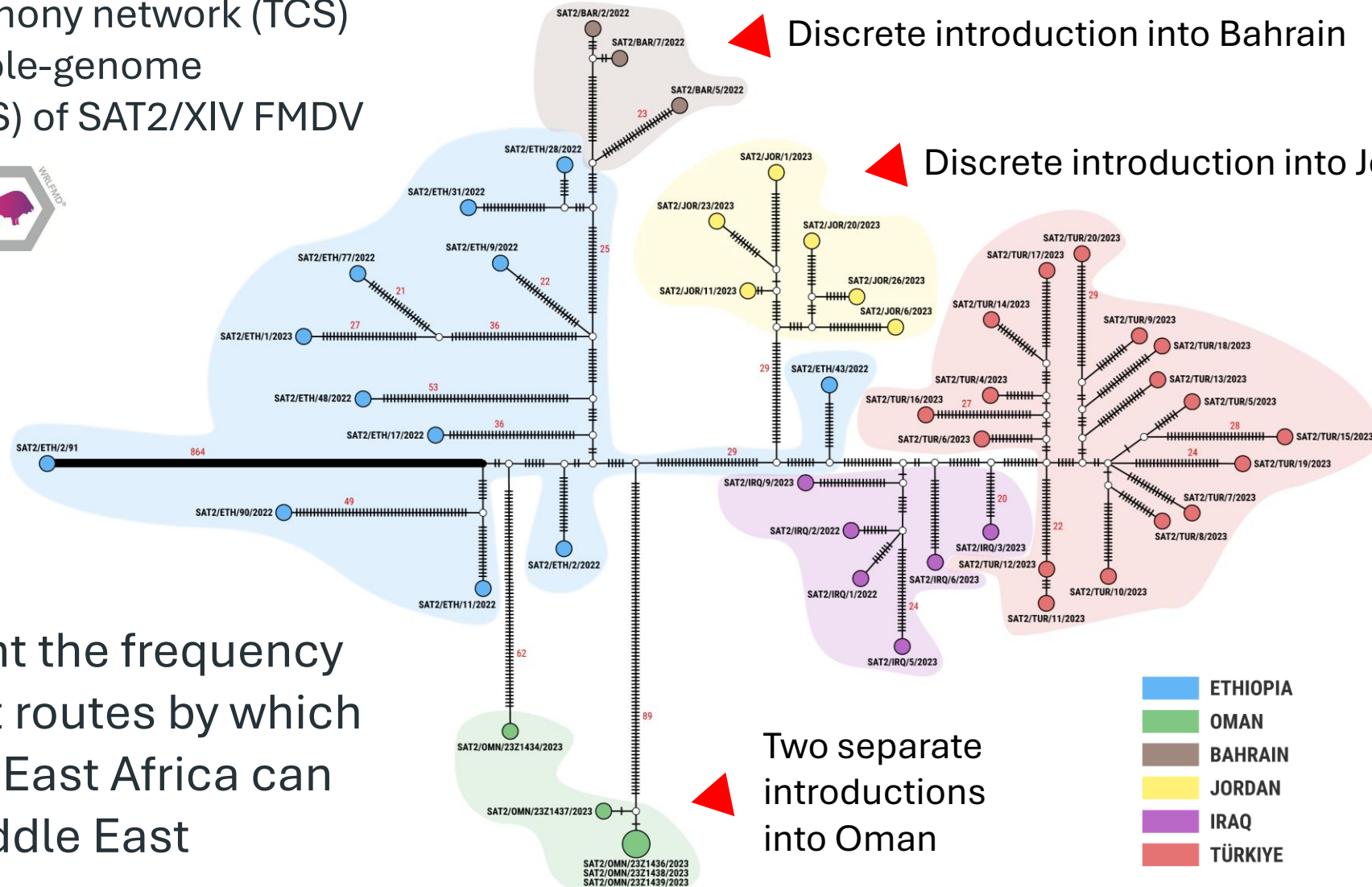
Pakistan  
2019-20  
O/ME-SA/Ind-2001e  
(from Pool 2)



# Network of Genetic Diversity

evidence for 5 introductions of the SAT2/XIV topotype

Statistical parsimony network (TCS) based on 51 whole-genome sequences (WGS) of SAT2/XIV FMDV isolates:



Data highlight the frequency and different routes by which FMDVs from East Africa can enter the Middle East

Common pathway for Iraq and Türkiye

- ETHIOPIA
- OMAN
- BAHRAIN
- JORDAN
- IRAQ
- TÜRKIYE

# What FMDV lineages are circulating?

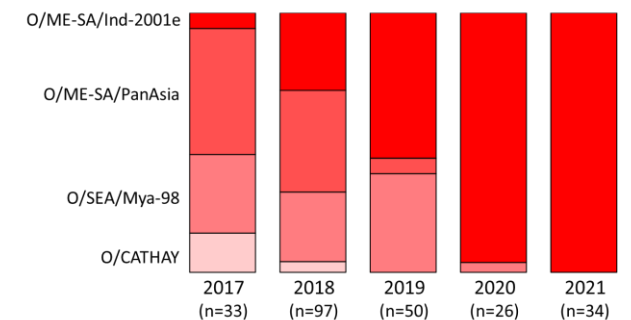
Conjectured status and anticipated risks that need to be covered by vaccines:

- O/ME-SA/PanAsia-2
  - ANT-10
  - QOM-15
- O/ME-SA/SA-2018 (UAE and Oman - 2021-22, Iran 2023 [GenBank seq])
- A/ASIA/Iran-05
  - FAR-11 (first cases in Türkiye in six years [09/24])
  - SIS-13
- A/ASIA/G-VII (reducing risk?)
- Asia 1
- SAT2/XIV (Oman, Bahrain, Jordan, Iraq and Türkiye)

Other risks:

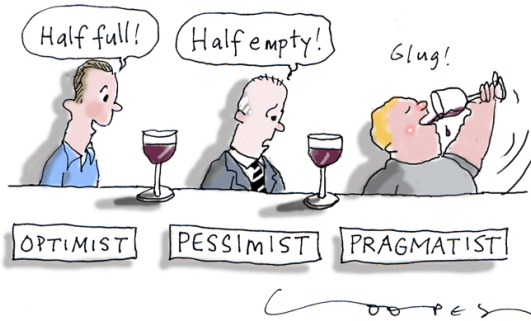
- O/ME-SA/Ind-2001e (Pakistan - 2019)
- SAT1/I (Bahrain)

Recent serotype O data from Pool 1:



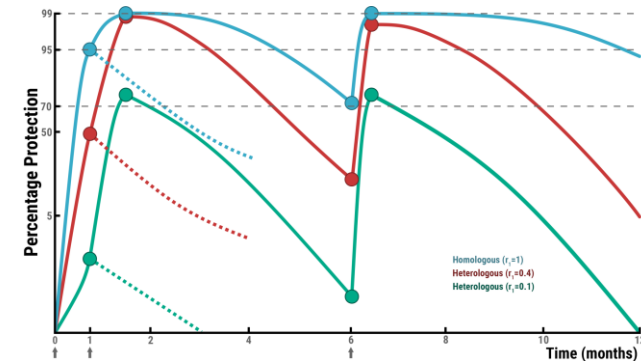
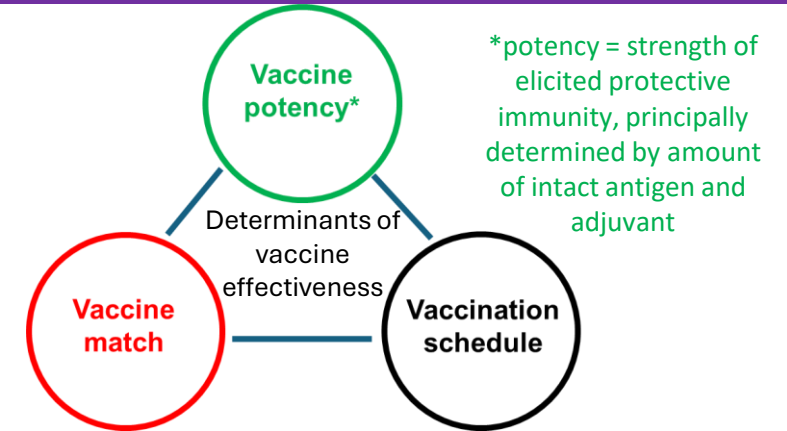
# Vaccine Quality Control

- The quality and performance of FMDV vaccines cannot be easily assessed through direct testing – immunisation of animals usually needed



Experience tells us that neutralising antibodies are correlated to protection, but .....how much FMD-specific antibody is enough?

- Pre-selection: tests by producer and reference labs on homologous/monovalent QA/QC (WOAH Manual)
  - All manufacturers should do immunity threshold tests on all batches
  - Vaccine matching by RLs but only performed on a limited number of vaccines
  - Vaccine selection based on knowledge of regional threats and vaccine matches and assurance of vaccine quality  
<https://pubmed.ncbi.nlm.nih.gov/36590816/>
- Vaccine performance in the field with multivalent products
  - Testing antisera from vaccinated animals for ability to neutralize regionally circulating viruses
- Value of batch release sera



Waxing and waning of post-vaccination immunity



Vet World. 2022 Feb 28;15(2):524–530. doi: 10.14202/vetworld.2022.524-530

Toward the calibration of serological assays using sera collected from cattle and sheep following a single dose of foot-and-mouth disease vaccine

Aiken S Karabassova<sup>1,✉</sup>, Akhmetzhan A Sultanov<sup>1</sup>, Meruyert A Saduakassova<sup>1</sup>, Donald P King<sup>2</sup>, Anna B Ludi<sup>2</sup>, Clare F J Browning<sup>2</sup>, Ginette Wijsden<sup>2</sup>

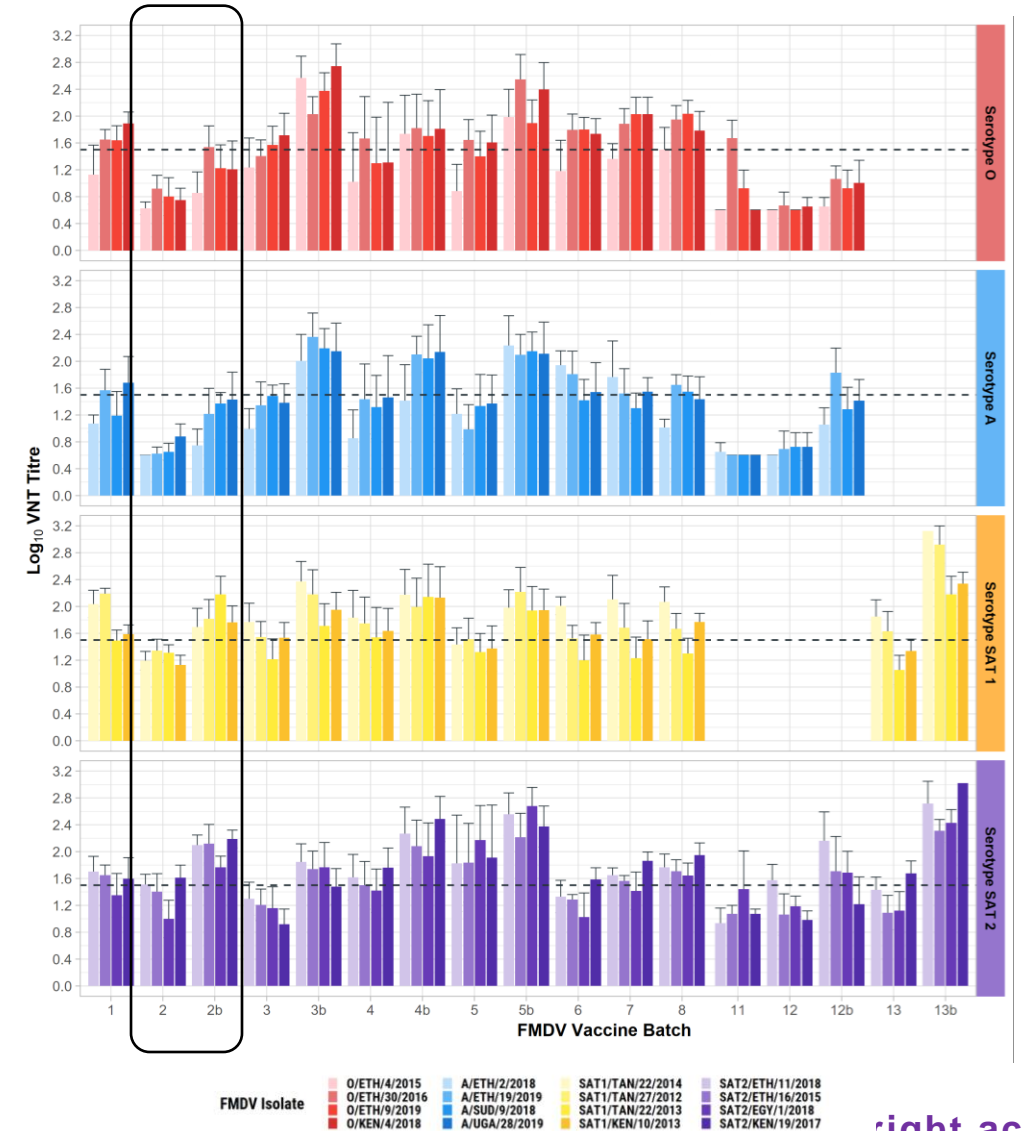
Example of collaboration with WRLFMD



# The need to closely monitor vaccine suitability:

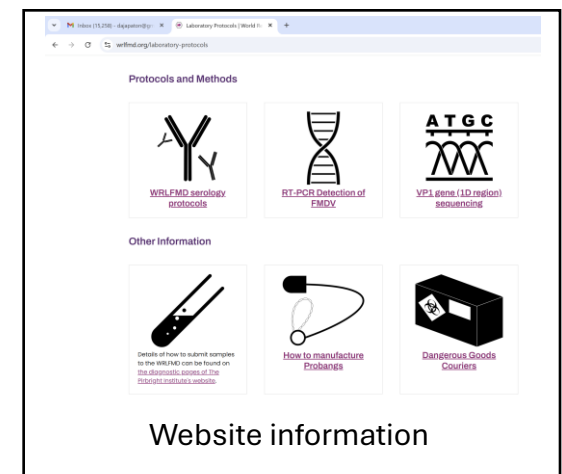
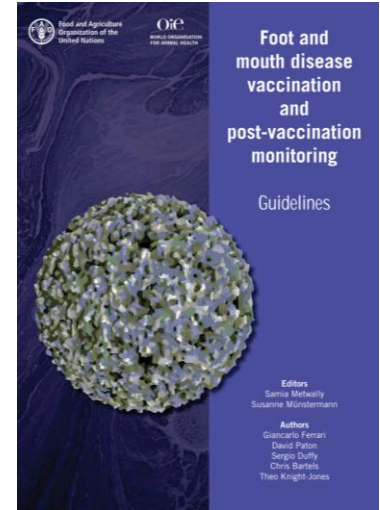
Example of testing commercial vaccine batches in E Africa

- Part of a WOAHA Twinning Project between WRLFMD and AU-PANVAC and in support of the FMD AgResults initiative
- Evaluated batches of multivalent commercial vaccines used in region
- Vaccinated small groups of naïve cattle and tested responses
- Used VNT with a reference panel of locally representative viruses
- Few vaccines met the acceptance criteria for all 4 serotypes without boosting

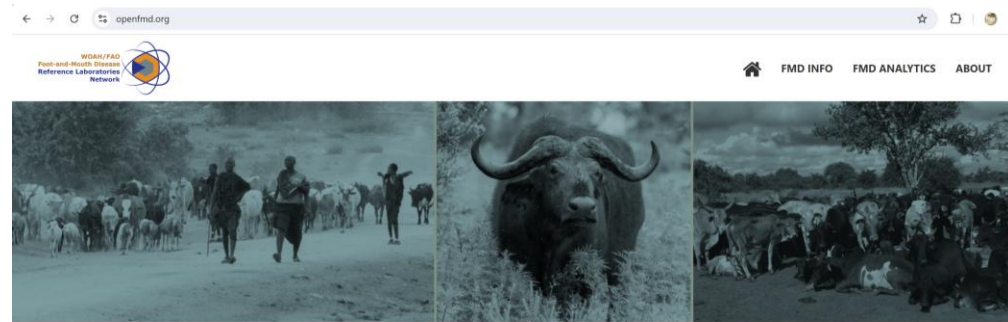


# Training and information

- Annual hands-on training course at WRLFMD  
reflabsevents@pirbright.ac.uk
- Online training courses with EuFMD for FMD laboratory diagnosticians <https://eufmdlearning.works/>
- Provide experts for specific/local training
  - This course
  - FMD Outbreak investigation courses
  - Twinning projects
- Contribution to standards and manuals



# New FMD Dashboard – <https://www.openfmd.org/>



## openFMD

openFMD provides a platform to promote sharing of Foot-and-Mouth Disease (FMD) information and open collaborations for FMD research, by addressing data gaps and improving transparency, in order to gain a better understanding of the epidemiology and evolution of globally circulating FMD virus lineages

### FMD Tools

openFMD maintains a comprehensive range of open-access and up-to-date analytical resources for FMD

### FMD Info



### About



Designed and developed by Epi-interactive

## FMD Analytics

openFMD facilitates the retrieval, analysis and dissemination of FMD surveillance data, including global epidemic intelligence, genome sequences and disease determinants

openFMD provides a portfolio of analytical resources for FMD with optimised workflows to reduce analysis time and user-friendly interfaces to effectively navigate through the applications.

These tools make use of both genetic sequence and epidemiological data, along with associated geographical as well as species-specific data, to help researchers understand how FMD viruses evolve and spread, and facilitate data interaction and exploration through customizable filters, sophisticated queries and intuitive visualisation further enabling download of data.

### Genomics

use tools to explore FMDV evolution and retrieve FMDV sequence data



### Surveillance

explore historical and current epidemiological trends of FMDV



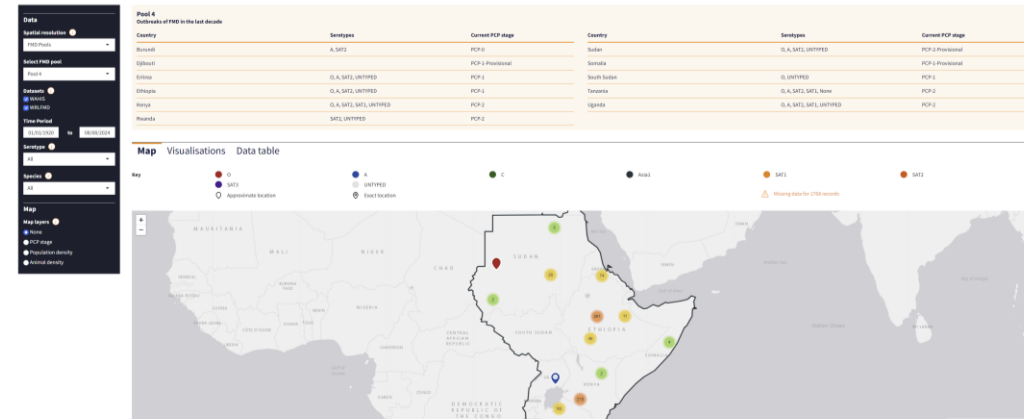
### Vaccine antigen prioritisation

select FMDV vaccines based on current epidemiological risks



## FMDwatch

FMD epidemiological intelligence for digital surveillance, exchange and communication of new disease threats.



# Proficiency testing

Aim to test a laboratory's response to an outbreak within their country

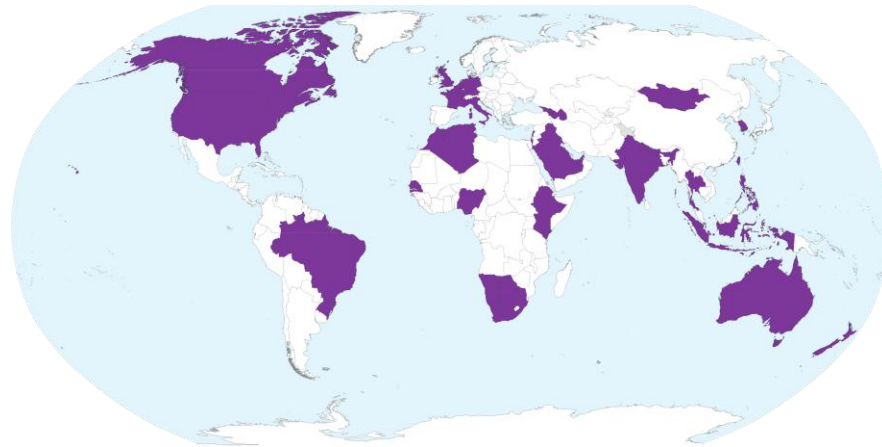
Reagents are not supplied, and tests to be used are not prescribed - labs select based on their own procedures/contingency plans.

Two panels:

- Virus Detection
- Serological Testing

Feedback based on:

- Capability
- Performance



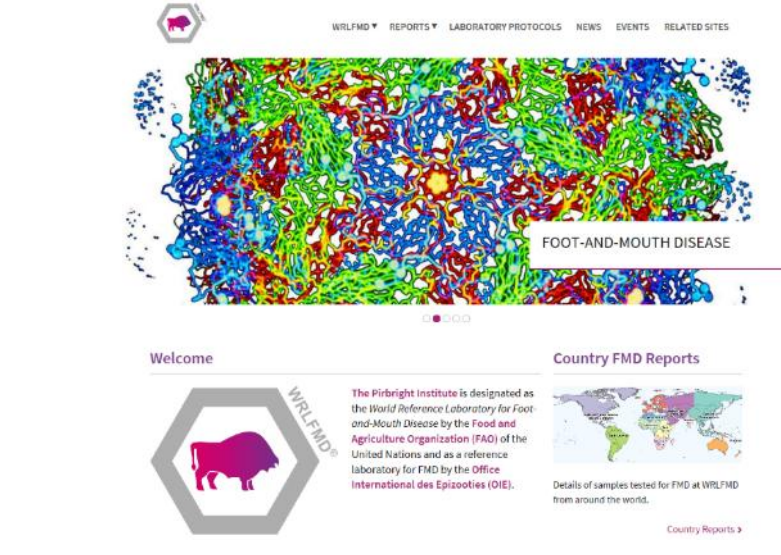
Capability Level	Relevant for FMD status	VIROLOGY (Panel 1)		SEROLOGY (Panel 2)	
		Minimum test requirements	Expected lab capability	Minimum test requirements	Expected lab capability
0	PCP 0	n/a	n/a	NSP ELISA	Define infection history (FMDV+/-)
1	PCP 1	either AgELISA or RT-PCR	FMD virus present +/- FMDV serotype	NSP ELISA	Define infection history (FMDV+/-)
2	PCP 2	either AgELISA or RT-PCR	FMD virus present FMDV serotype	NSP ELISA SP ELISA	Define infectious status Vaccination status Serotype Expectation of working towards establish relevant PVM
3	PCP 3	AgELISA rRT-PCR (pan-serotype +/- lineage/serotype-specific RT-PCRs) +/- sequencing +/- VI*	FMD virus present FMDV serotype, topotype, lineage	NSP ELISA SP ELISA +/- VNT	Define infectious status Vaccination status Serotype Expectation of working towards establish relevant PVM
4	PCP 4	AgELISA rRT-PCR (pan-serotype +/- lineage/serotype-specific RT-PCRs) sequencing +/- VI*	FMD virus present FMDV serotype topotype, lineage	NSP ELISA SP ELISA +/- VNT	Define infectious status Vaccination status Serotype PVM
5	WOAH/FAO Reference Laboratories (PCP 5)	Enhanced genome sequencing	FMD virus present FMDV serotype topotype, lineage, and relationship between FMDV positive samples in panel	NSP ELISA SP ELISA VNT	Define infectious status Vaccination status Serotype PVM Identify cross-reactivity

# What should be available in your own country?

- Biosecure facilities, trained staff and suitable systems for sample management, sample reporting and quality control (including PTS/QA)
- Network of local laboratories with appropriate coordination and quality control
- Capacity to detect and serotype FMDV
  - RT-PCR, Ag-ELISA, (Virus Isolation, pen-side tests, sequencing, vaccine matching)
- NSP serology (ELISA) to detect and confirm infection (in the past)
- SP serology (ELISA) for population immunity surveys and other immunogenicity studies
- Links to field service, epidemiological expertise and one or more reference laboratories

# Further information.....

- FMD reports and lab testing (<https://www.wrlfmd.org/ref-lab-reports>)
  - *Genotyping reports, Vaccine matching and Serotyping reports*
- Other data sources:
  - Quarterly WRLFMD/EuFMD report (<https://www.wrlfmd.org/ref-lab-reports>)
  - Annual report of the WOA/FAO FMD Laboratory Network (<http://foot-and-mouth.org/>)
  - [Opendfmd.org](http://opendfmd.org)



The screenshot shows the WRLFMD website interface. At the top, there is a navigation menu with links for WRLFMD, REPORTS, LABORATORY PROTOCOLS, NEWS, EVENTS, and RELATED SITES. Below the menu is a large, colorful world map with a legend for FOOT-AND-MOUTH DISEASE. The map shows various colored regions representing different FMD reports. Below the map, there is a 'Welcome' section with the WRLFMD logo and a text box stating: 'The Pirbright Institute is designated as the World Reference Laboratory for Foot-and-Mouth Disease by the Food and Agriculture Organization (FAO) of the United Nations and as a reference laboratory for FMD by the Office International des Epizooties (OIE)'. To the right of the welcome message is a 'Country FMD Reports' section with a world map and a link to 'Country Reports >'. Below the screenshot are two overlapping document covers. The left cover is the 'WRLFMD Quarterly Report April to June 2018' and the right cover is the 'OIE/FAO Foot-and-Mouth Disease Reference Laboratory Network Annual Report 2021'. The right cover lists the editors: Dr Donald King, Dr Antonello Di Nardo, and Dr Mark Henstock, The Pirbright Institute, UK. At the bottom of the right cover, there are logos for BBSRC, Department for Environment Food & Rural Affairs, and eofmd.

# Acknowledgements

- Collaborating FMD Reference Laboratories and field teams
- Partners within the WOA/FAO FMD Lab Network
- Support for the WRLFMD and research projects



Department  
for Environment  
Food & Rural Affairs

