



# Activities at the Australian Centre for Disease Preparedness to assist with FMD preparedness and response

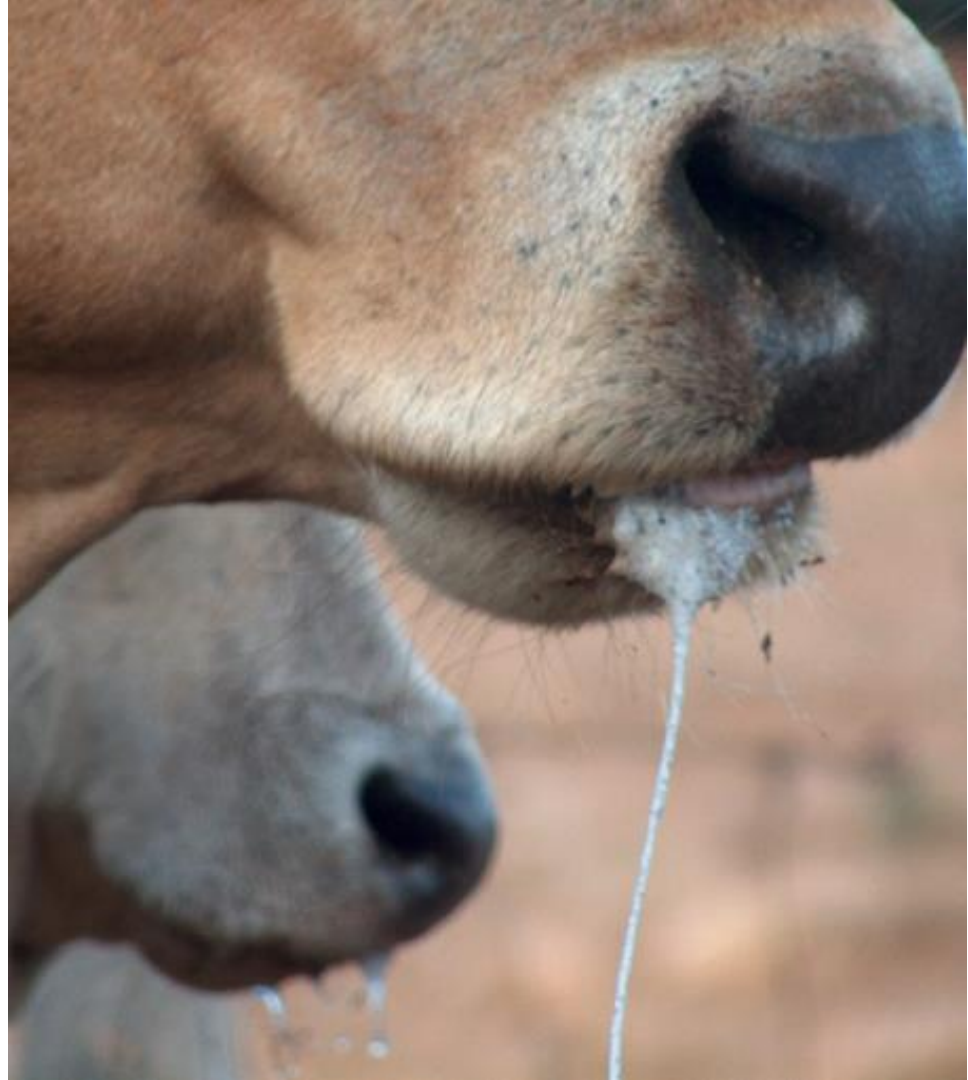
Wilna Vosloo | 23 August 2023





# FMD preparedness

- Tools to assist with
  - Surveillance
  - Diagnostics
  - Control





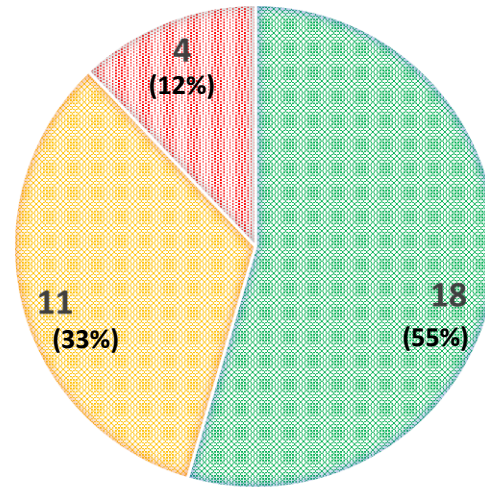
# Laboratory predictions of vaccine efficacy

- *In vitro* screening allows investigations into a large number of isolates
- Vaccine matching using VNT and ELISA (AVB vaccine strains)
- Up to 2018
  - Serotype O: no clear trend in antigenic drift
  - Serotype A: new viral clusters constantly evolving

	Serotype O		Serotype A	
Vaccine strain	O1 Manisa	O3039	A22/IRQ	A/MAY/97
No of isolates	166	169	60	130
Homologous	32%	72%	28%	75%
Intermediate	13%	12%	25%	8%
Heterologous	21%	1%	42%	15%
Poor binding*	34%	15%	5%	2%

## VACCINE MATCHING WITH A MALAYSIA 97 THAILAND FMD A VIRUSES n=33

■ Homologous ( $r1 > 0.40$ )   ■ Intermediary ( $r1 = 0.19-0.39$ )   ■ Heterologous ( $r1 < 0.20$ )

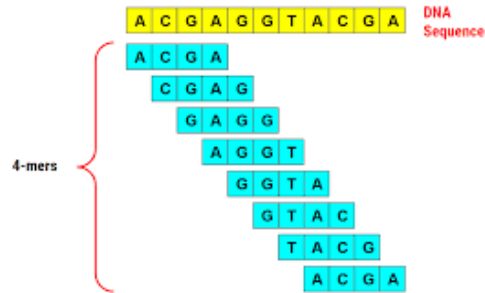


2017-2022

Acknowledgement: Pakchong laboratory in Thailand

# Novel way of phylogenetic analysis

- Most phylogenetic comparisons require sequence alignment
  - Prior knowledge on sequence – indels
  - Can be computationally demanding
- K-mer analysis requires no sequence alignment – therefore no prior knowledge





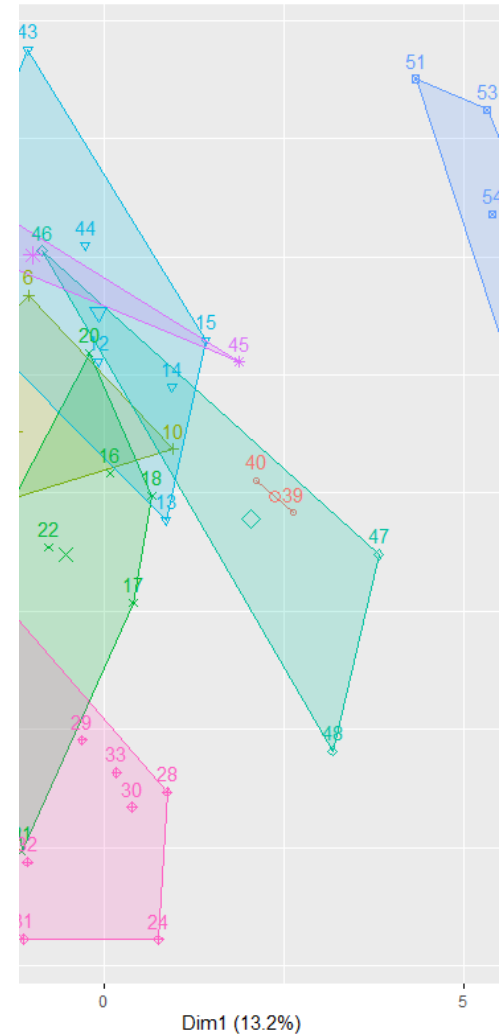
# Approach

Downloaded a large number of sequences + internally generated

Focused on serotype O and A

Determined the optimal k-mer frequency

Compared tree topologies generated by Neighbour-Joining, General Time Reversible (GTR) model, and k-mer



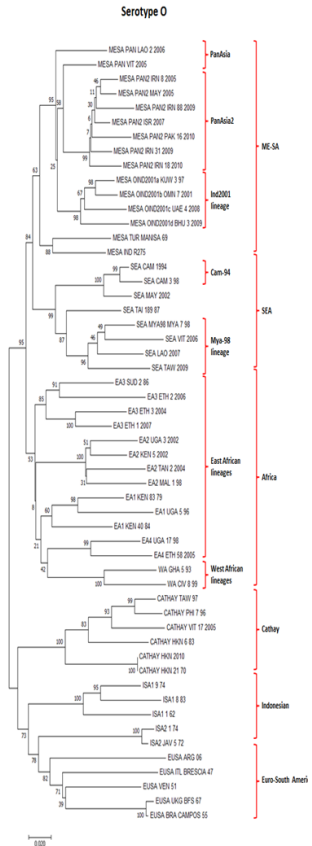


# Results

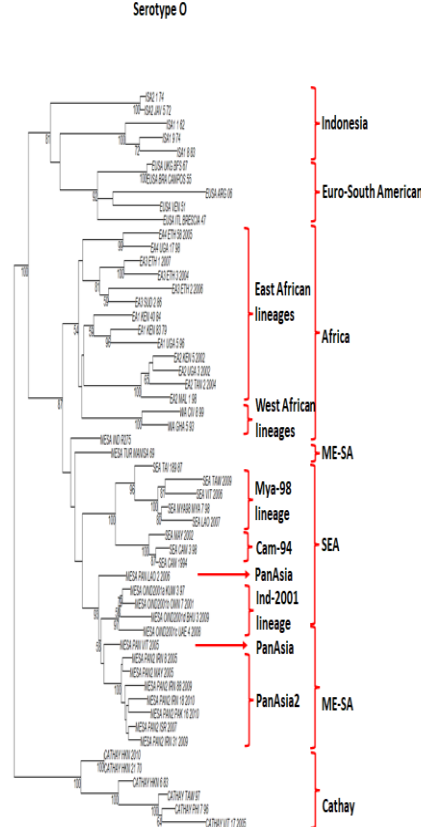
- Genetic groupings were similar between all 3 methods for both serotypes
- However, k-mer analysis was computationally intense and needed high-performance computing systems when large numbers of isolates were compared
- Could improve scripts to circumvent this
- Reference sequences were very useful where alignment is required

# Dendrogram comparisons for serotype O

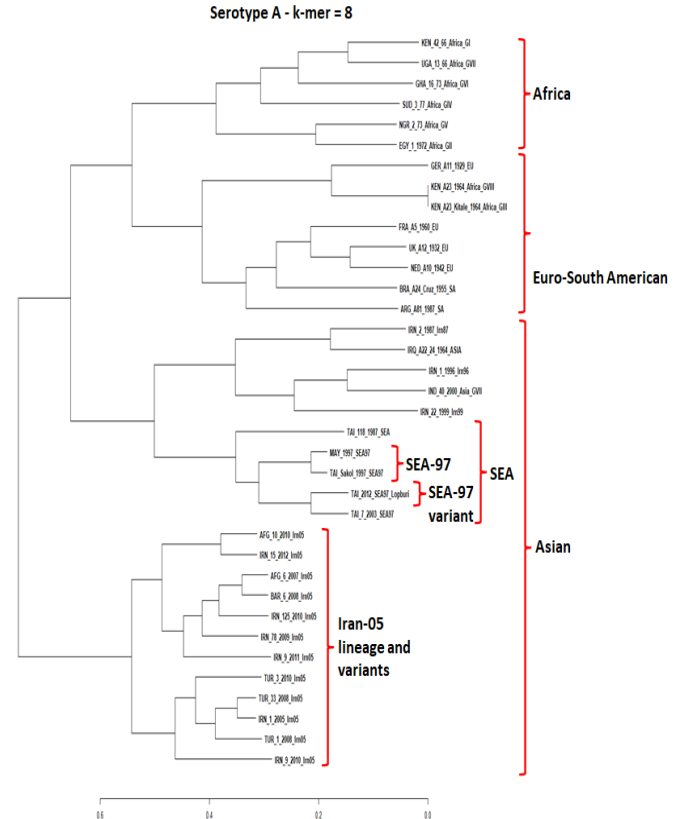
Neighbour-joining



General Time Reversible



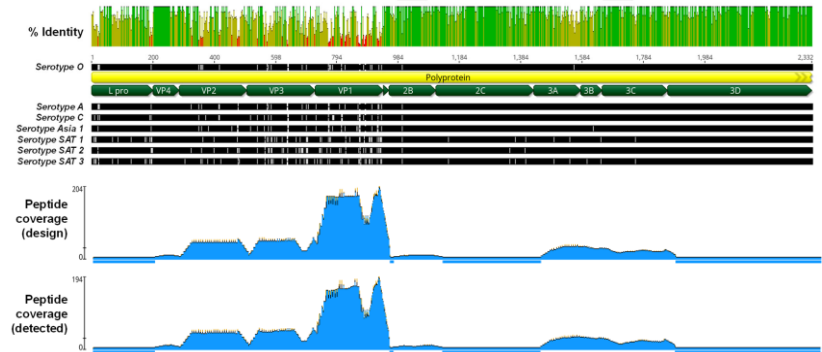
K-mer





# Multiplexed profiling of serological responses

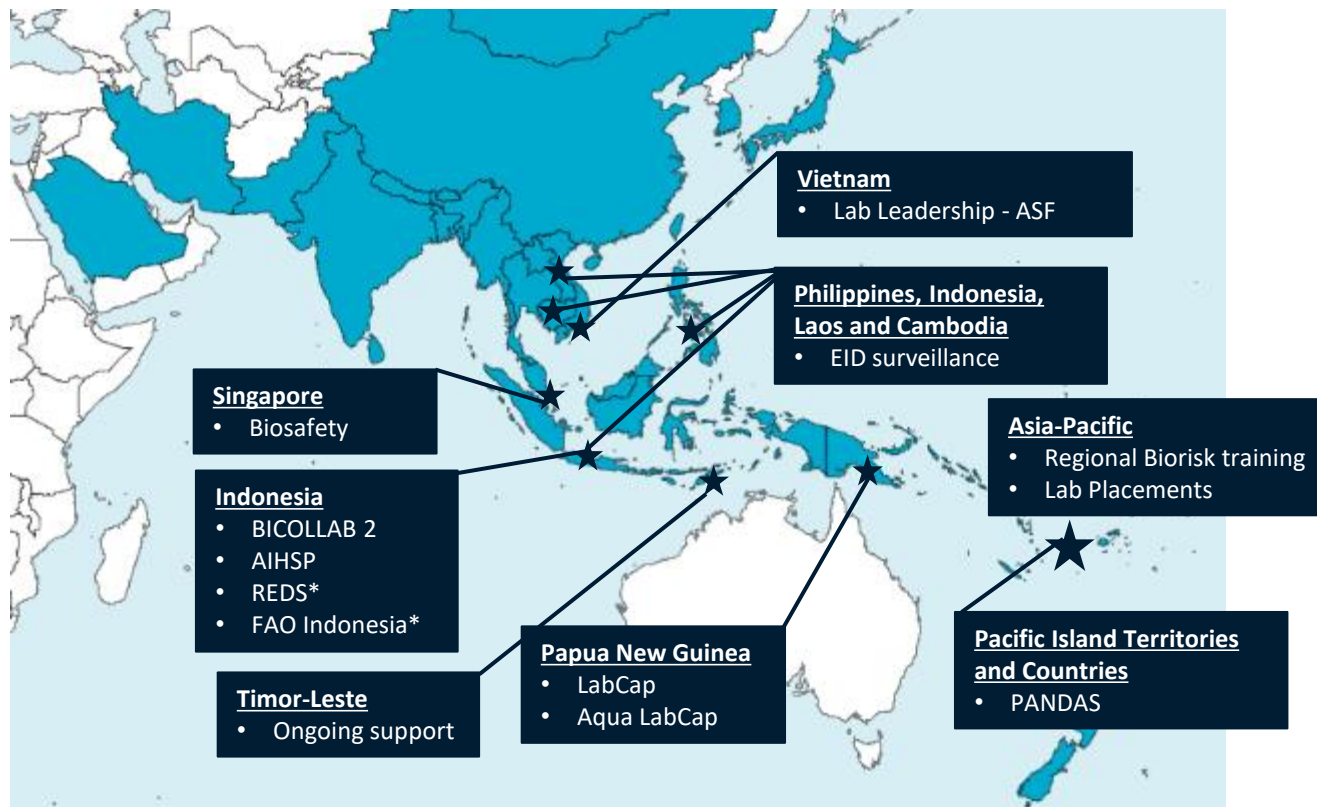
- Phage Immunoprecipitation Sequencing (PhIP-Seq)
  - Based on peptide phage display
  - Attractive for high-throughput serological profiling and epitope discovery
  - Sero-epidemiology, risk factor analysis and association, vaccinology and pandemic preparedness efforts
- We investigated if we can distinguish between 5 serotypes and vaccinated animals
  - Pool of 1663 peptides
- Promise for epitope mapping
- Differences between vaccinated and unvaccinated animals
- More value in highly multiplexed assay design





# Support for the region through the International Program at ACDP

# ACDP-IP Regional footprint 2024



# Achievements: Regional Emerging Disease Support REDS

- DAFF funded project to strengthen technical capability in FMD and LSD
- Assisting lead Indonesian laboratories to develop external quality assurance(EQA) programs for the Indonesian veterinary laboratory network
  - PUSVETMA for FMD
  - DIC Wates for LSD
- EQA consisting of network quality controls and proficiency testing programs for serology and PCR





## Achievements: BICOLLAB

- CSIRO ACDP supports the delivery of a targeted laboratory capacity building project in Indonesia: BICOLLAB
- This project is funded by DFAT's Global Health Division (GHD).
- Sub-project to Evaluate the performance characteristics of LFDs for FMD detection in field conditions was proposed.
- Sub-project objectives
  1. Identify LFDs suitable for antigen detection in FMD outbreaks
  2. Evaluate the LFDs for their performance characteristics
  3. Standardize methods to recover the FMDV genome from LFDs

## Achievements: LabCap PNG

- Laboratory capacity building project in Papua New Guinea
- Funded by the Australian High Commission in Port Moresby
- Strengthening laboratory and field diagnostic capability for priority diseases, including FMD.
- For detection of FMD we have implemented:
  - Real time PCR testing
  - Lateral flow devices
  - ELISA testing (set-up in progress)





# Thank you

## **Health & Biosecurity**

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Australia's National Science Agency



## Acknowledgment

International Program – AAHL

Immunomics team – H&B (ACDP)

