

BBSRC  
University of Glasgow

## Can next generation sequencing be used to unravel fine scale FMDV population dynamics?

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### Summary and conclusions

- First time next generation sequencing (NGS) has been used to investigate within-host FMDV population diversity
- NGS demonstrates a 'step-change' improvement in the depth of detection of FMDV population diversity present within-host
- Intermediate stages in the evolution of a cell culture to host adapted virus revealed for the first time
- Such data leads to an improved understanding of FMDV evolution and the more accurate reconstruction of transmission events

FMDV and the 'virus swarm'

- Small genome ~ 8500 nt long
- Rapid replication rate
- Large population sizes
- High error rate of viral polymerase – *virus swarm*

The consensus and beyond

Full genome sequencing has proven to be a powerful tool for epidemiological tracing of FMD during outbreaks (UK '07)

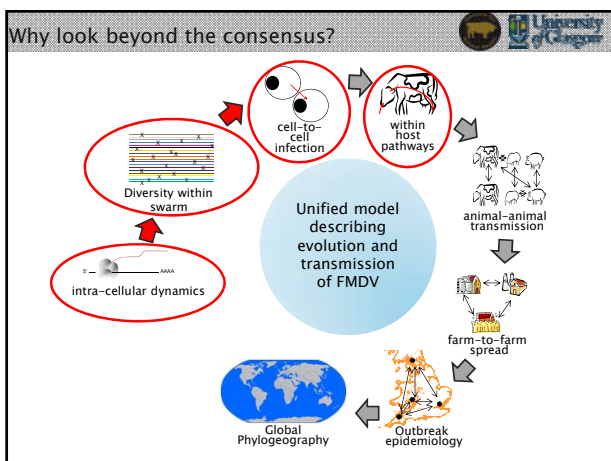
20% 15% 10% 5% ...1%... and beyond

Consensus (≥50%)

Limitations to date

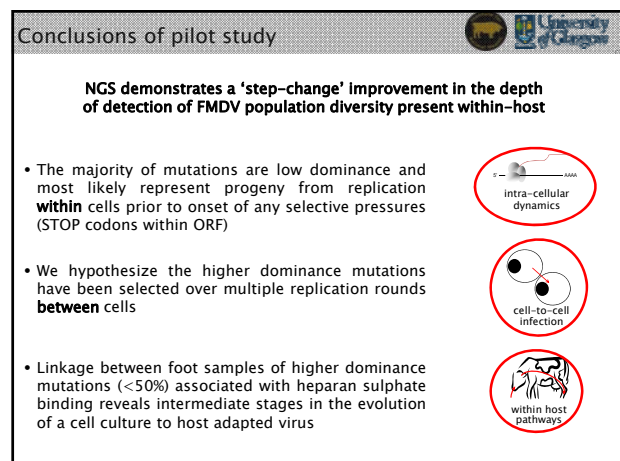
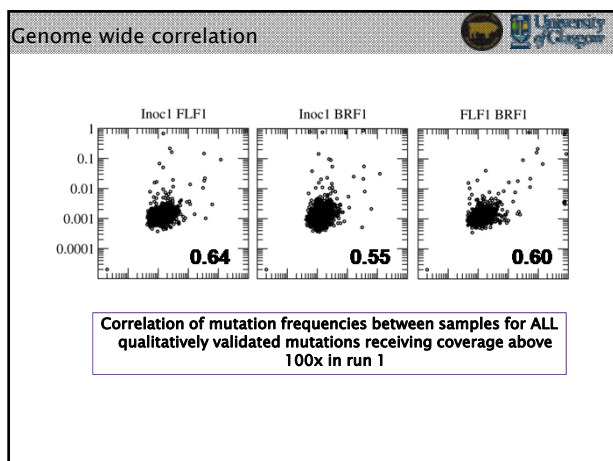
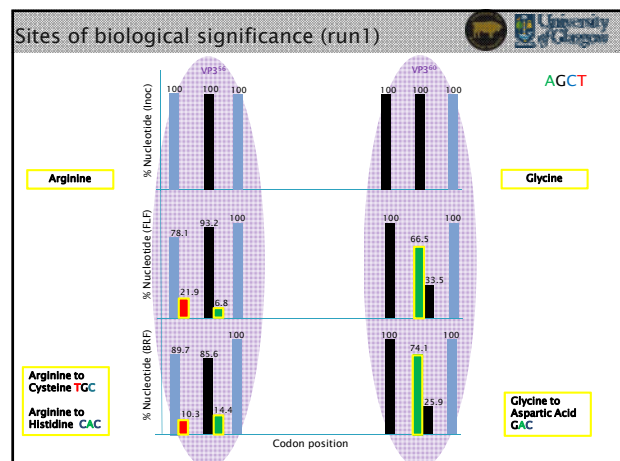
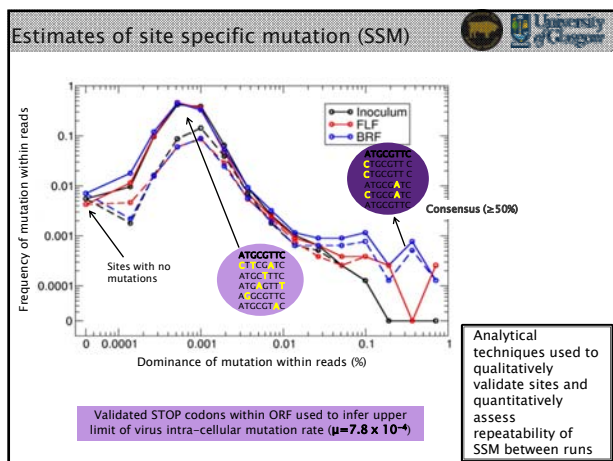
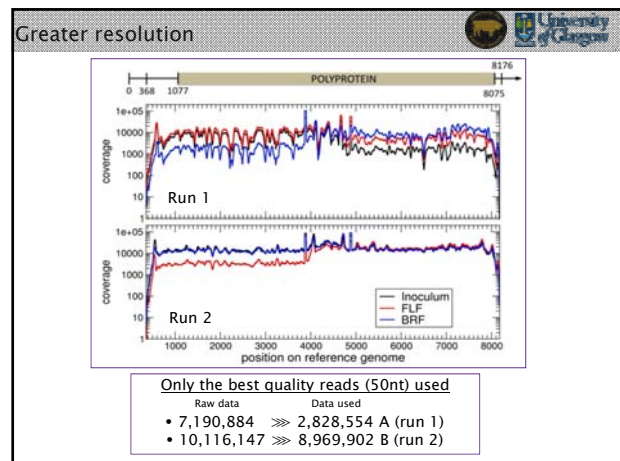
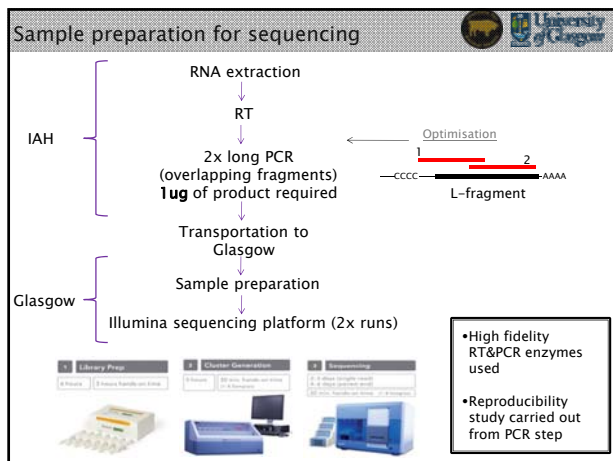
- Consensus (Sanger) sequences average the sequence at any one nucleotide position
- Limited resolution achieved by cloning approaches

Problem distinguishing the genuine mutations from experiment introduced error



Pilot study utilising NGS

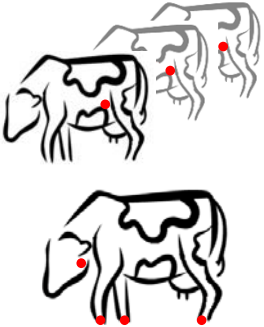
- 1 O<sub>1</sub>BFS1860 (inoculum)
- 2 Front left foot lesion (FLF) – 2dpi
- 3 Back right foot lesion (BRF) – 2dpi



Future work

1. How does the viral swarm vary over time within a naturally infected host?

2. How does the viral swarm vary between different locations within a naturally infected host?



The diagram shows two cows. The top cow is shown in profile, with red dots on its head, neck, and back. The bottom cow is shown from a side-on perspective, with red dots on its head, neck, and legs. These dots represent the locations of the viral swarm within the host.

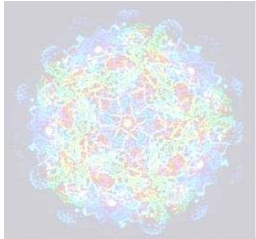



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The viral swarm visualization is a complex, multi-colored network of nodes and edges, representing the interactions within the viral swarm. The BBSRC logo is a blue circle with a white sun-like symbol. The Institute for Animal Health logo is a black circle with a white cow silhouette. The University of Glasgow logo is a blue shield with a white cross.