



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



# Preparedness and response: a laboratory perspective

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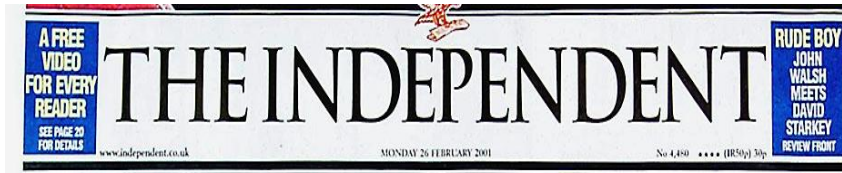


World Organisation  
for Animal Health  
Founded as OIE

FMD Reference Laboratory



# Impact of foot-and-mouth disease



## The cull widens as the contagion grows

By MICHAEL McCARTHY, NIGEL MARSH AND THOMAS FINNY

THE FOOT-AND-MOUTH DISEASE that has brought British farming to a virtual standstill had spread right across the country yesterday and could soon have reached mainland Europe, as desperate efforts to contain the virus appeared to have failed. Despite mass slaughter of infected animals, the West Country, Britain's highest livestock region, joined Northumberland and Essex as a centre of infection, and the situation grew grimmer still when it was learnt that the Devon farmer concerned was a regular exporter of beef to the Europe. Five farms and abattoirs were yesterday put on hold, and the Ministry of Agriculture, Fisheries and Food (MAFF), including the first reported case in Wales. A sheep farmer in the Devon district, and a pig-breeder in Essex, were also reported to be infected. The outbreak in Devon was the first since the outbreak in Essex in 1997, in which nearly 500,000 animals were slaughtered.



A giant bonfire of dead pigs and cattle in Northumberland, entered by the virus. The bonfire was lit yesterday to destroy the virus. The bonfire was lit yesterday to destroy the virus. The bonfire was lit yesterday to destroy the virus.

# DEADLY VIRUS THAT HAS SHUT DOWN THE COUNTRYSIDE

THIS IS THE VIRUS WHICH HAS PARALYSED THE COUNTRYSIDE AND LEFT FARMERS IN FEAR OF FINANCIAL DESTRUCTION. HUNTING WAS BANNED, POSTMEN WERE ORDERED TO LEAVE DELIVERIES AT FARM GATES AND RAMBLERS WERE WARNED TO KEEP AWAY FROM GRASS CONTAINING THE VIRUS. THE VIRUS IS A HIGHLY CONTAGIOUS AND DEADLY DISEASE WHICH CAN BE TRANSMITTED BY CONTACT WITH INFECTED ANIMALS OR THROUGH THE AIR. IT CAN ALSO BE TRANSMITTED BY INSECTS AND WIND-BLOWN PARTICLES. THE VIRUS IS A HIGHLY CONTAGIOUS AND DEADLY DISEASE WHICH CAN BE TRANSMITTED BY CONTACT WITH INFECTED ANIMALS OR THROUGH THE AIR. IT CAN ALSO BE TRANSMITTED BY INSECTS AND WIND-BLOWN PARTICLES.

# FARMERS WEEKLY

Mar 2 - Mar 8 2001 £1.50 www.fwi.co.uk

**FREE INSIDE: GUIDE TO GRASSLAND NUTRITION**

**ARABLE ADVICE: PUTTING CROPS BACK ON TRACK FOR TOP YIELDS**

**TRACTOR TESTS ON TRANSMISSIONS** page 90

## Foot-and-mouth crisis: The tragedy unfolds

pages 6, 19, 35, 39, 106

Press cuttings from the FMD epidemic in 2001 in the United Kingdom

# Rapid confirmation of suspect cases is critical

## Key diagnostic questions

- Is the suspect case FMD?
- If positive,
- What is the viral serotype?
- How does this new positive case connect to other cases that might have been detected?
- Are we missing any cases? (evidence for un-disclosed infection)

## Delays allowed foot-and-mouth epidemic to sweep across Britain

Jim Giles, London

Early delays in tackling foot-and-mouth disease undermined the British government's attempts to control the outbreak, according to three epidemiological studies. All of the studies find that the epidemic is now out of control in the United Kingdom.

Animals at a farm near Newcastle in the north of England were almost certainly infected with the disease in early February, but the outbreak was not detected until sheep were moved over 400 kilometres to an abattoir in Essex. By the time full restrictions on the movement of animals were imposed on 23 February, transport of animals infected at the farm and abattoir had spread the disease across the country.

Teams from Imperial College, London, the University of Edinburgh and the government's Veterinary Laboratories Agency (VLA) in Surrey conducted separate studies on the basis of available government data.

"We're still in the exponential stage of the outbreak," says Mark Woolhouse, an epidemiologist at the University of Edinburgh



Out of control: culling is on the increase as foot-and-mouth spreads out across Britain — and Europe.

tions for the epidemic's development in the medium term. The VLA offers the most pessimistic scenario, projecting 4,411 cases by the end of June. At the other end of scale, the

confirmed by 27 March. Neither team was able to say when they thought the disease would be wiped out.

The government is now trying to limit the of the disease by culling all animals kilometres of infected premises in here the virus is widespread — a at may result in the slaughter of some

Giles J. (2001) *Nature*: 410:501



### INFECTIOUS DISEASES

## Rapid Response Could Have Curbed Foot-and-Mouth Epidemic

To stop a catastrophic outbreak of foot-and-mouth disease (FMD), the British government has so far destroyed almost 4 million pigs, sheep, and cattle—a strategy that has been criticized as overly zealous and draconian by some farmers and animal-welfare activists. But new studies from two teams of British veterinary epidemiologists show that, if anything, the measures haven't been strict enough. If the government had implemented a more rigorous culling policy in the first phase of the epidemic, the total burden would have been much smaller, the researchers say—and millions of animals would have been saved.

Neither of the studies, however, exam-

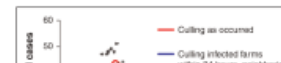
ined before authorities started clamping down in earnest. One of the papers, by Roy Anderson and his colleagues at Imperial College in London, is published in this week's issue of *Nature*; the other, from Bryan Grenfell and colleagues at the University of Cambridge and the University of Edinburgh, is published online by *Science* this week at [www.sciencexpress.org](http://www.sciencexpress.org).

FMD is one of the most contagious diseases known; infected animals shed large amounts of the virus before they become sick, and viral particles can survive on clothes, shoes, or vehicle tires. Even the wind can carry the virus to farms dozens of kilometers away. The disease can affect all cloven-hoofed animals, including pigs, cattle, and sheep. Although it usually doesn't kill adult animals, infected animals

Rural Affairs (DEFRA), says Imperial College's Neil Ferguson, says led the government to adopt the massive culling that eventually helped reduce the number of cases (*Science*, 20 April, p. 410).

Now, both teams have produced much more detailed models of the epidemic. They take into account things such as the location of every farm and the estimated number of pigs, cattle, and sheep each farm contained, as well as exhaustive data about the spread of the disease and the culling process, provided by DEFRA scientists on the ground. The groups also calculated a number of what-if scenarios to show how different measures could have diverted the epidemic's course. For instance, if the government had succeeded in culling every infected farm within 24 hours and every adjacent farm within 48 hours, the number of cases would have been cut by 66% and the number of farms culled by 62%, according to the Imperial College model (see graph); the other team puts those numbers at 43% and 46%, respectively.

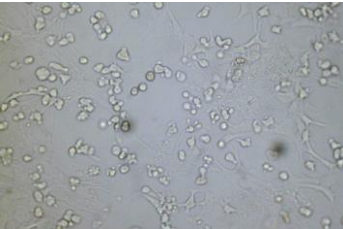
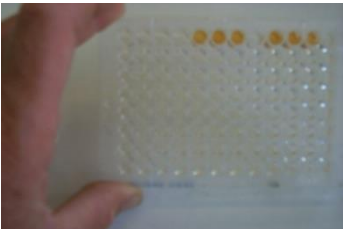
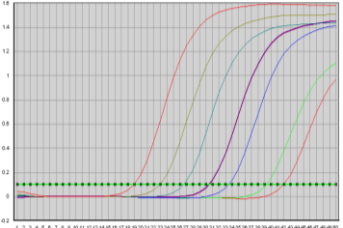
Other veterinary epidemiologists praise the models' accuracy in describing the epidemic. At the same time, some wish the studies would have offered more clues into case spreads. For in-



Enserink M. (2001) *Science* 294: 26

# Frontline “virology” tests in the OIE/WOAH Manual

- It is recommended that National Reference Laboratories maintain redundant systems with different technologies

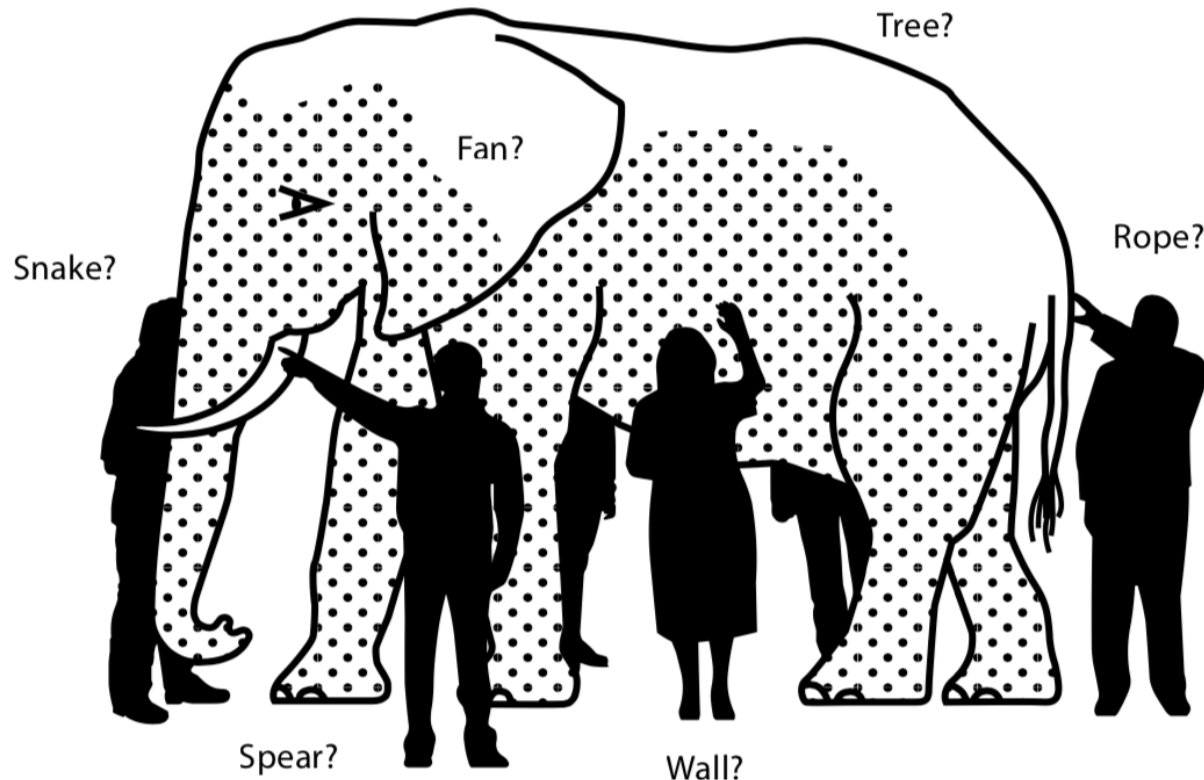
	<p>Virus isolation</p>	<p>1-4 days</p>	<p>- Sensitive but slow and needs confirmation</p>
	<p>Ag ELISA Lateral-flow devices are very rapid and can be used in the field</p>	<p>~4 hours</p>	<p>- Rapid but not very analytically sensitive - Only suitable for certain sample types</p>
	<p>TaqMan® RT-PCR</p>	<p>~3-5 hours</p>	<p>- Rapid test with high diagnostic and analytical sensitivity - Suitable for a wide range of clinical (and other) sample types</p>

ELISA	Advantages	Disadvantages
NSP	<ul style="list-style-type: none"> <li>Fast &amp; easy to perform</li> <li>Detects infected animals regardless of vaccination</li> <li>One test for all serotypes</li> <li>Can be performed out of containment</li> <li>Commercially available</li> </ul>	<ul style="list-style-type: none"> <li>Sensitivity less if low virus replication and for early infection</li> </ul>
LPBE	<ul style="list-style-type: none"> <li>Serotype specific</li> <li>Can be performed out of containment</li> <li>Correlated to immunity via potency tests</li> </ul>	<ul style="list-style-type: none"> <li>Low Specificity (~96%) for infection</li> <li>Limited availability of reagents</li> <li>Not always a homologous system</li> <li>Complicated to perform</li> </ul>
SPCE	<ul style="list-style-type: none"> <li>Fast &amp; easy to perform</li> <li>Serotype specific</li> <li>Can be performed out of containment</li> <li>Commercially available alternatives</li> </ul>	<ul style="list-style-type: none"> <li>Not always a homologous system</li> </ul>
VNT	<ul style="list-style-type: none"> <li>Gold standard-OIE manual</li> <li>Serotype specific</li> <li>Easy to change virus strains</li> <li>Correlated to immunity from potency tests</li> </ul>	<ul style="list-style-type: none"> <li><b>Containment facilities required</b></li> <li>Slow and laborious</li> <li>Cell-culture dependent</li> <li>Variability of results</li> </ul>

# Purpose of Laboratory Contingency Plans

- Learning from experiences gained from previous FMD outbreaks in the UK (2001 and 2007)
- Planning **prior** to an outbreak
- Aide-memoire for those involved in the laboratory response
- Identify laboratory functions
  - Documents and SOPs
  - Maintenance of QA systems (ISO/IEC 17025)
  - Testing capacity (initial and surge)
  - Key personnel and responsibilities
  - Anticipated staff requirements (during the outbreak phases)
- **Documents lines of communication (internal and external)**
- Generating empirical data to support FMD vaccination policy
- Reviewed every 2-years (<)
- Links to other aspects of exotic livestock outbreaks and control are covered by other national contingency plans

# Understanding FMD outbreaks



- Real-time data exchange between different actors is critical (incl. government, laboratory, field teams and international partners)

# How can OIE/FAO FMD Reference Labs help you?

- Technical support to characterise of samples from field outbreaks
  - **Sample submissions are critical**
  - Please contact [donald.king@pirbright.ac.uk](mailto:donald.king@pirbright.ac.uk) for help or assistance to send samples to an OIE/FAO Reference Laboratory
- Vaccine matching
  - Define antigenic match of vaccines to field strains
  - Helps to identify candidate vaccines that can be used in the field
- Post-vaccination monitoring
  - Testing of sera from vaccinated animals
  - Measure heterologous responses against representative virus risks
  - To demonstrate adequate responses in the target species



# Acknowledgements

- Support for the WRLFMD and research projects
- Collaborating FMD Reference Laboratories in Europe
- Partners within the OIE/FAO FMD Lab Network



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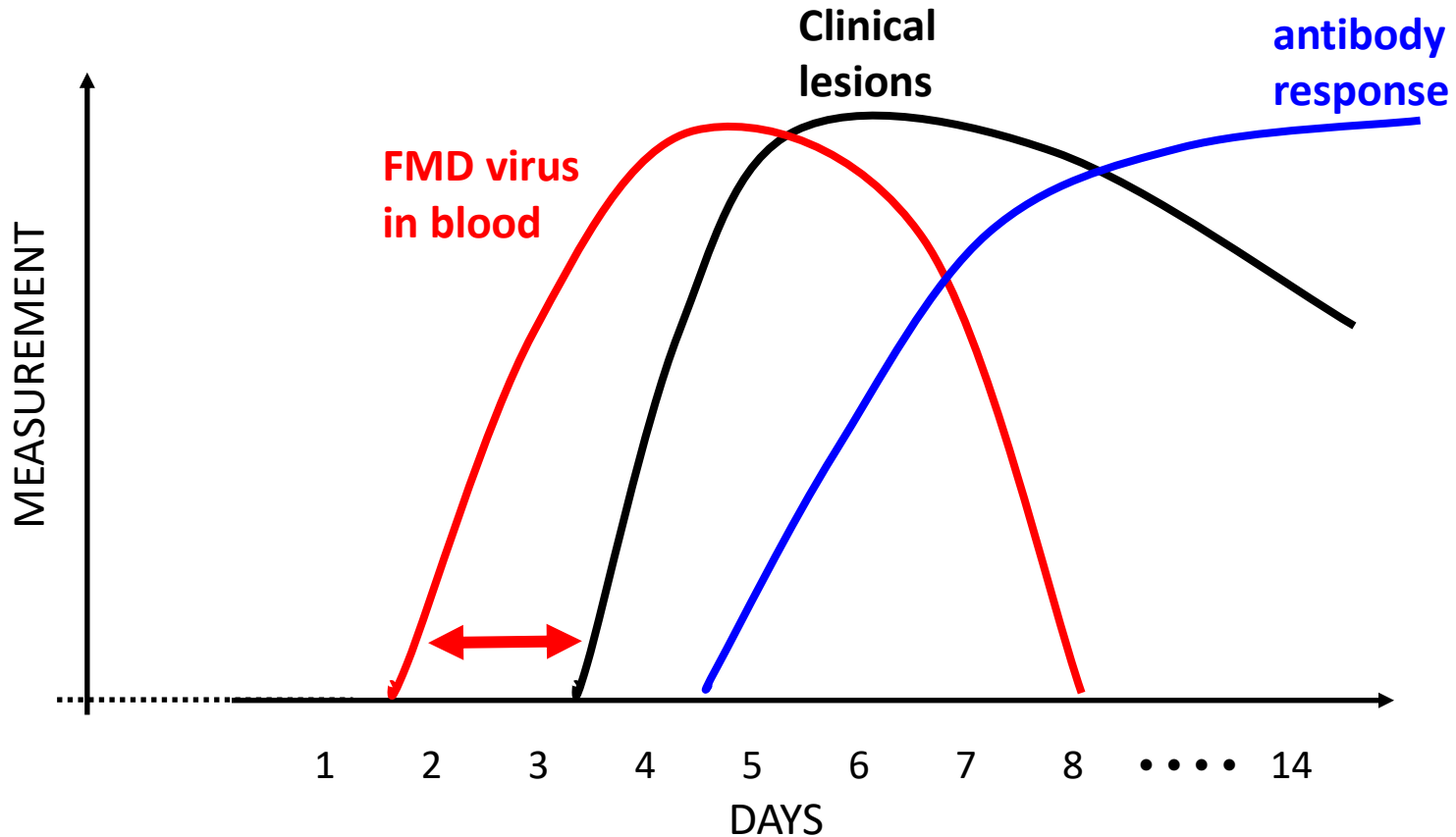
# FMD Diagnostic windows

What are we trying to do?

2 Active surveillance for infected animals (including pre-clinical cases)

1 Rapid confirmation of clinical signs

3 sero-surveillance for FMDV exposed animals



Representative “in contact” cattle data from Alexandersen et al., 2003 and unpublished data from Pirbright