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Paul qualified from Liverpool University in 1978. From 1989 until his retirement in March 2017 he was a director in the mixed, mainly farm animal practice of Allen and Partners Veterinary Services, conducting about 25,000 cattle bTB skin tests annually. He is currently one of the directors and deputy senior official veterinarian for Iechyd da (Gwledig) the delivery partner for TB testing for South Wales.

In 2011, Paul was part of a working group updating the Official Veterinary TB Testing Instructions. He is an adviser to the BCVA, has presented at its annual conference and contributed to Cattle Practice. *Paul chairs the XLVet bTB focus group, is a trained trainer and regularly conducts courses, including TB Test Quality Assurance and Cymorth TB (WG bTB biosecurity project).*

**Suggested Personal & Professional Development (PPD)*

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GOATS

An overview and update on bovine TB

Bovine tuberculosis (bTB) is a chronic, infectious, primarily respiratory disease caused by the slow-growing bacterium, *Mycobacterium bovis* (*M. bovis*). It is mainly a disease of cattle and other bovines, but can affect a wide range of mammalian species (including deer, pigs, camelids, cats). Until milk pasteurisation, better meat inspection and bTB testing in the 1930s, bTB was a common cause of human disease and death in the UK.

Disease status in the UK

Control of bTB has cost £500m in the last 10 years (Defra, 2014) and the average cost of an outbreak is £34,000 (£20K Government; £14K farmer). Links to the current Defra bTB statistics are available from www.tbhub.co.uk and an interactive mapping site for England and Wales can be found at www.ibtb.co.uk.

bTB control in other countries

Australia declared official freedom from bTB in 1997, having started in 1970, by:

- whole-herd test and slaughter, including complete de-stocking
- movement controls, quarantine and 'trace-back'
- no bTB reservoirs in wildlife – including feral cattle and buffalo removal.

> "Control of bTB has cost £500m in the last 10 years (Defra 2014) and the average cost of an outbreak is £34,000..."

Although New Zealand (NZ) is a world leader in bTB control in the face of an extensive wildlife reservoir, their target for freedom from bTB in herds is not until 2026. The lesson from NZ is not just the control of possums – an ecologically damaging non-native mammal – but their 'adequately funded, long-term control programme which cannot be changed at the whim of politicians' (Livingston, 2012).

Three-legged stool

There is an analogy for bTB control based upon the structure of a three-legged stool:

- testing of cattle (deer and camelids) and slaughter of infected animals
- restriction of movement from infected herds and infected areas (including local contact between herds)
- control of wildlife vectors.

For successful control of bTB, all of these three legs need to be in place. The steady increase in bTB incidence in some parts of the UK since the 1980s suggests this is not the case.

Cattle testing

In the UK, the two main diagnostic tests for bTB

Figure 1. *Diagram of the Bovine Immune Response to Diagnostic Tests. The time-line is variable depending on factors, such as animal age.*

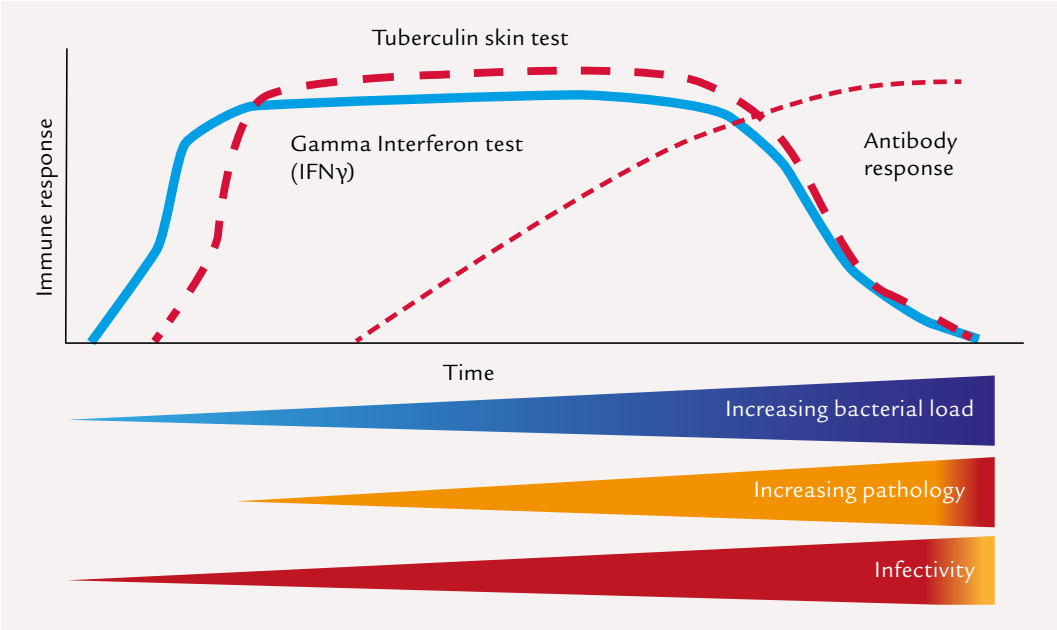

Figure 2. *Poor cattle handling.*

Figure 3. *The consequence of poor cattle handling.*

are the single intradermal comparative cervical tuberculin (SICCT) test and the interferon gamma test (IFNγ), with disease being 'confirmed' by post-mortem examination (PM).

In 1890, Koch demonstrated the action of a purified protein derivative (PPD or tuberculin) using a subcutaneous test. Moussu and Mantoux developed a caudal fold intradermal test in 1908 with a sensitivity of 88.5 per cent and specificity of 96.12 per cent. From 1935, the Ministry of Agriculture & Fisheries developed the comparative test, the procedure for which is essentially the same today (Patterson, 1959).

The SICCT test as described in Council Directive 64/432/EEC is the officially recognised test and is the internationally accepted standard for detecting *M. bovis* in cattle. Official veterinarians (OVs) are contractually obliged to follow the 'OV Instruction' and must sign a TB52, which is a veterinary certificate. However, this test is based on 1930s technology and husbandry.

In the author's opinion, the OV Instruction is excessively prescriptive – and, if cattle handling is less than ideal, the test can be impractical and dangerous to deliver.

The IFNγ test is carried out on live blood cells, usually taken by Animal Plant Health Agency (APHA) staff. Immune cells from infected cattle, stimulated with bovine and avian tuberculins (same as used in the SICCT) respond by releasing IFNγ, which is measured.

Diagnostic tests are judged by parameters including:

- sensitivity (Se) – proportion of truly diseased animals detected as positive in the diagnostic assay
- specificity (Sp) – proportion of truly non-diseased animals that are correctly identified as negative by a diagnostic test.

"In the authors' opinion, the economic and social harm from bTB justifies humane badger culling – within the constraints of the Bern Convention – as part of the control programme"

The SICCT (standard interpretation) is, at best, 80 per cent sensitive and 99.98 per cent specific (Strain et al, 2016); but sensitivity is higher at the herd level. The IFNγ test has higher Se (90%) but lower Sp (99.5%). The principle that a higher Se gives a lower Sp is also true for the SICCT severe interpretation. If the two tests are run in parallel, in the absence of an external source of re-infection, the likelihood of recurrent bTB breakdown should be reduced (de la Rua-Domenech et al, 2006).

Post-mortem sensitivity is at best 50 per cent, but much lower when testing frequently. Contrary to farmer belief, post-mortem examination is not considered the Gold Standard. This is illustrated by **Figure 1,** along with the importance of early detection of infected animals before they become anergic (de la Rua-Domenech et al, 2006).

For the SICCT, it is better to use Test Performance, which takes into account practical delivery of the test. The quality of bTB testing is not only affected by the attitude, knowledge or ability of the OV performing the test; but can also be influenced by other factors (Rodgers, 2015), especially cattle handling facilities (**Figures 2** & **3**).

It is worth noting that in areas where there is no infected wildlife, these tests have successfully eradicated bTB.

Cattle movement

Translocation of disease by cattle movement and local spread to other herds and wildlife has contributed to the increase in bTB since the 1980s. Many farmers do not consider bTB when purchasing cattle. A truly closed herd is the only way to eliminate this risk.

The area of the vendor and recent test history should be considered; and Risk-based Trading and the recent Bovine TB Herd Accreditation under CHeCS (www.checs.co.uk/bovine-tb-herd-accreditation) can further inform decisions. A pre-movement test is no guarantee that an animal is uninfected (**Figure 1**) and 60-day isolation, followed by a post-movement test, should be used.

Rules for the devolved governments can be found on the TB Hub.

Wildlife

The only wildlife control measure that has evidence for its efficacy in reducing bTB in cattle is badger culling, including that from the Randomised Badger Cull Trial

(Jenkins et al, 2010). There is no evidence that vaccination of badgers has reduced cattle bTB incidence; and badger vaccination requires 10 times the human doses of BCG, so supply and cost may be limiting factors.

In the authors' opinion, the economic and social harm from bTB justifies humane badger culling – within the constraints of the Bern Convention – as part of the control programme. Badger vaccine could be used as a secondary measure. It is important that preventive biosecurity measures are also employed.

Biosecurity visits

There have been government biosecurity projects in Wales since 2009 (Rodgers, 2015). These projects have shown that private veterinary surgeons have the best chance of getting changes in farming practice to reduce the risk from the biosecurity hazards identified at their visit. Adequate time should be spent looking round the farm and farm buildings – it is surprising what will be identified.

It should be remembered during the visit that the farmers involved may be suffering from stress – it is known that of farmers referring themselves to the Farming Community Network Helpline (03000 111 999), 31 per cent include bTB as one of their problems. With this in mind, the farmer should have equal 'ownership' of any veterinary recommendations, which must be realistic, achievable and timely, with proper follow up. ■

There is a detailed section on biosecurity in the TB Hub, www.tbhub.co.uk.

> "The only wildlife control measure that has evidence for its efficacy in reducing bTB in cattle is badger culling..."

Badger foot print with characteristic large kidney shaped pad.

PPD Questions

1. For your county, how many new bTB Incidents were there and how many animals were slaughtered?

2. A client complains, "The Ministry has taken 10 of my best animals and none of them had anything". How would you explain this?

3. What is the maximum gap under a door to prevent badger access?
   A. 15cm
   B. 10cm
   C. 7.5cm

Answers
1. use the links from the TB Hub to look at the dataset spreadsheet for your county
2. use easily understood language – e.g. "The chances of your animal not having bTB was 1 in 5000"; "post-mortem examination is like looking for a grain of salt in a pile of sand"; refer to Figure 1
3. 7.5cm – this and other biosecurity information is on the TB Hub, www.tbhub.co.uk

References

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