

PROGRESS IN CONTROL OF BOVINE TUBERCULOSIS

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Bovine tuberculosis



Major economic problem in many countries (50 million cattle infected)

Significant public health risk in others
 - unpasteurised milk, shared dwellings

Traditional control - "test and slaughter"
 - less effective - wildlife reservoirs of infection
 Possums (New Zealand)
 Badgers (UK, Ireland)
 White-tailed deer (USA)

- developing countries - unacceptable

Need for improved diagnostic tests and vaccines

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Transmission of bovine TB from possums to cattle



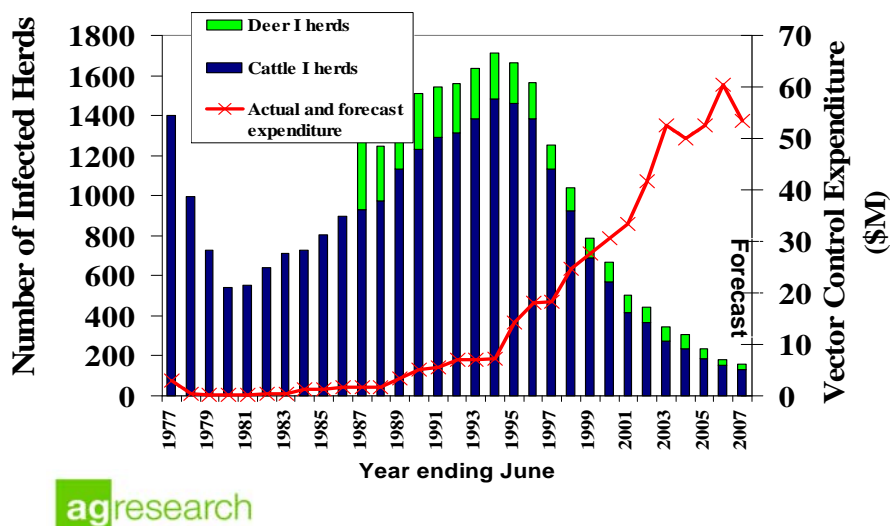
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Culling of possum to control wildlife reservoir of bovine TB



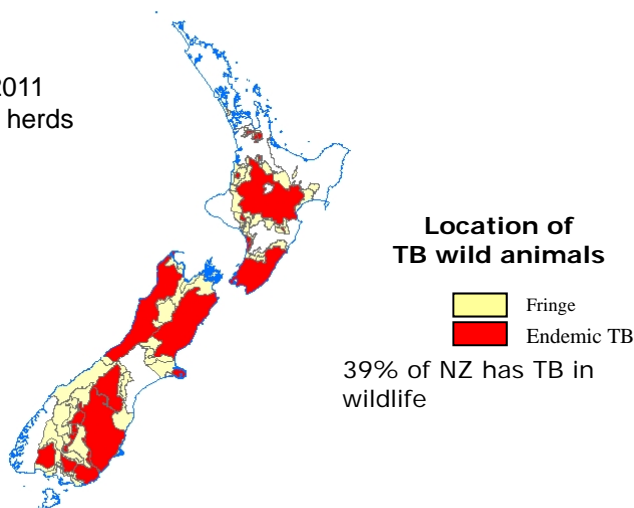
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Number of infected cattle and deer herds and expenditure on vector control 1977 - 2007



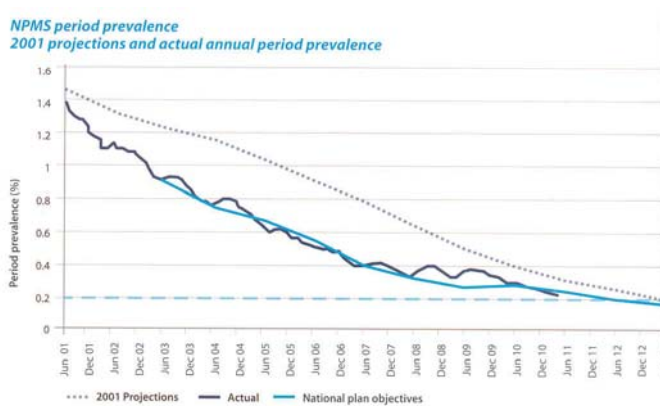
TB control in New Zealand

TB status - June 2011
79 cattle and deer herds infected



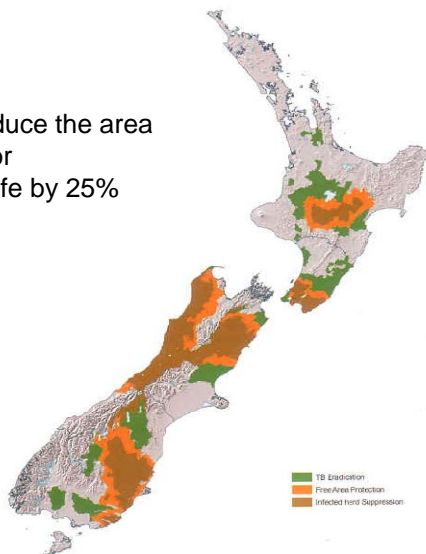
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Period prevalence of bovine TB in cattle and deer herds



New Pest Management Strategy for bovine TB

2025 - Reduce the area endemic for TB in wildlife by 25%



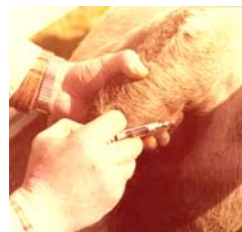
Need for improved tests for the diagnosis TB in cattle

Caudal fold skin test – primary screening

Proportion of false positives rising with the
decrease in the incidence of TB in cattle

Farmers are demanding

- improvements in specificity
- faster removal of confirmed infected cattle
- use of alternative tests to clear infected herds
and to allow movement of stock



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Introduced two new blood tests: BOVIGAM

Standard BOVIGAM test

- Confirmation of TB, retest skin test reactors
- Reduce false positives & faster removal of infected animals
- Use for pre-movement testing

Special antigen BOVIGAM test (2 proteins from *M. bovis*)

- Use for re-testing skin test reactors from TB-free areas
- Markedly reduce the number of false positives

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Current research

1) Pooled milk ELISA test

Less frequent skin testing, need for ancillary tests

Collect milk samples in association with herd testing

Test pooled milk samples, if positive re-test individual milk samples and possibly skin test herd



Current research (continued)

2) Differential skin test using selected mycobacterial proteins

Use *M. bovis*-specific proteins (collaboration DEFRA, UK)

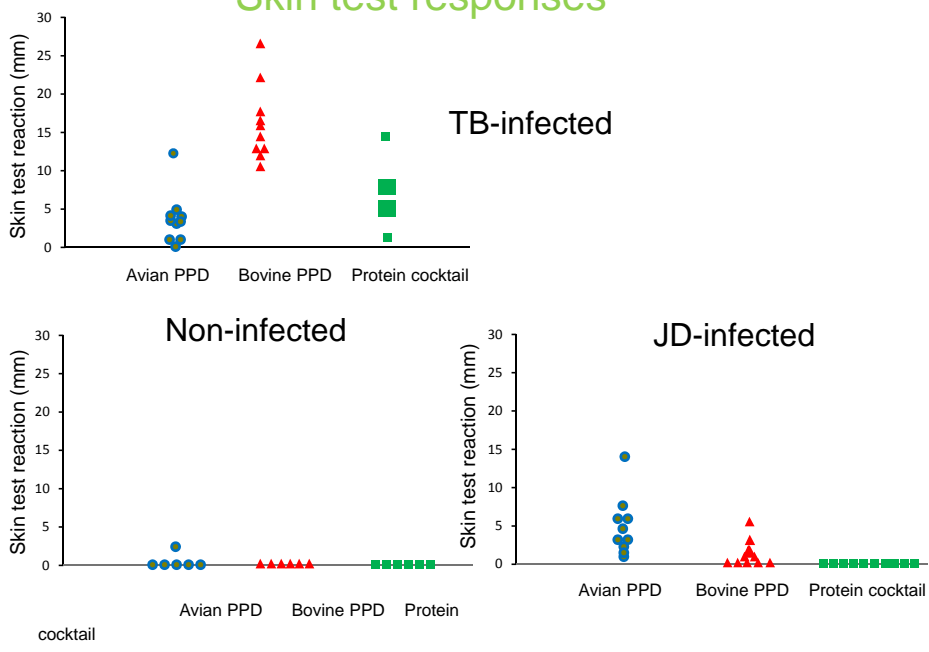
Proteins not present in BCG and other mycobacteria



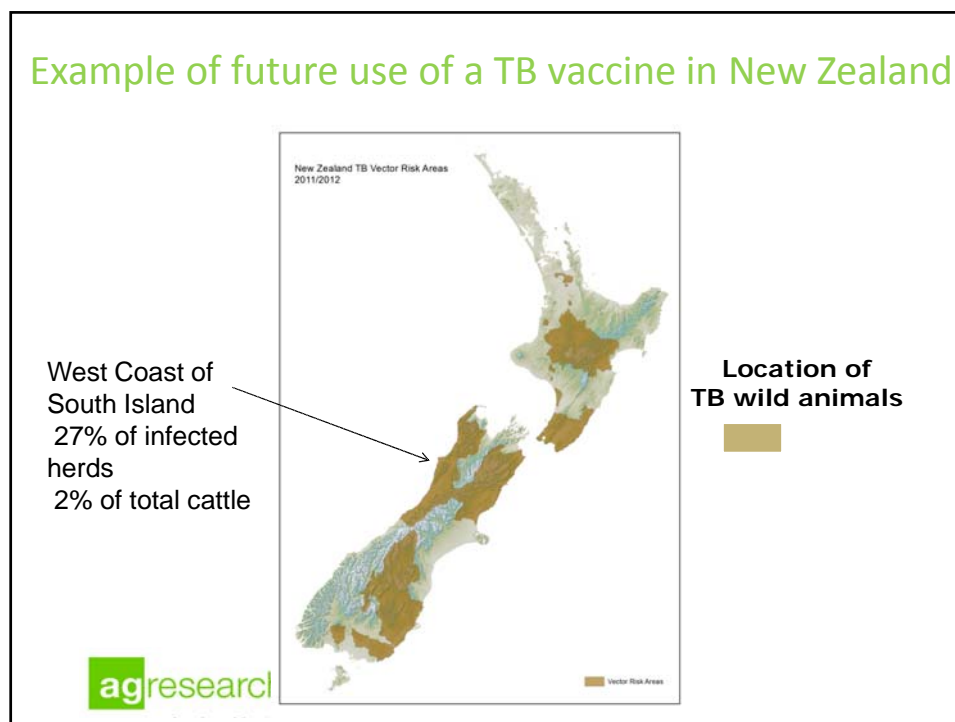
Specific tuberculin skin test



Skin test responses



Example of future use of a TB vaccine in New Zealand



TB vaccine for cattle

- Questions
 - Can BCG be used and still retain the use of the existing or modified skin test
 - How long does BCG vaccine protection last and can immunity be boosted by revaccination
 - Can we develop an effective protein vaccine which does not induce a skin test response

Long term effects of BCG vaccination and can immunity be boosted

Vaccine groups (total 82 calves)

1. Non-vaccinated
2. Subcut BCG
3. Subcut BCG, revaccinate subcut BCG
4. Subcut BCG, revaccinate oral BCG
5. Subcut BCG, revaccinate with TB protein vaccine

Vaccinate calves at 2-5 weeks of age

Revaccinate some groups at 2 years of age

Challenged with TB at 2 ½ years of age and slaughter 4 months later

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Experimental TB challenge of calves

- Challenged with *M. bovis*

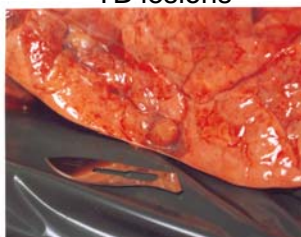


TB containment facility at Kaitoke



- Necropsy at 16 weeks after challenge

TB lesions

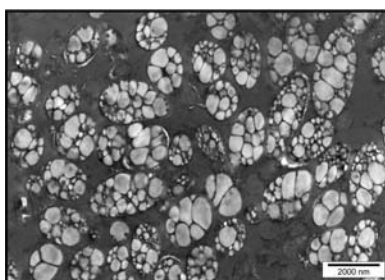


Develop a novel TB protein vaccine

TB protein vaccines do not induce a skin test response

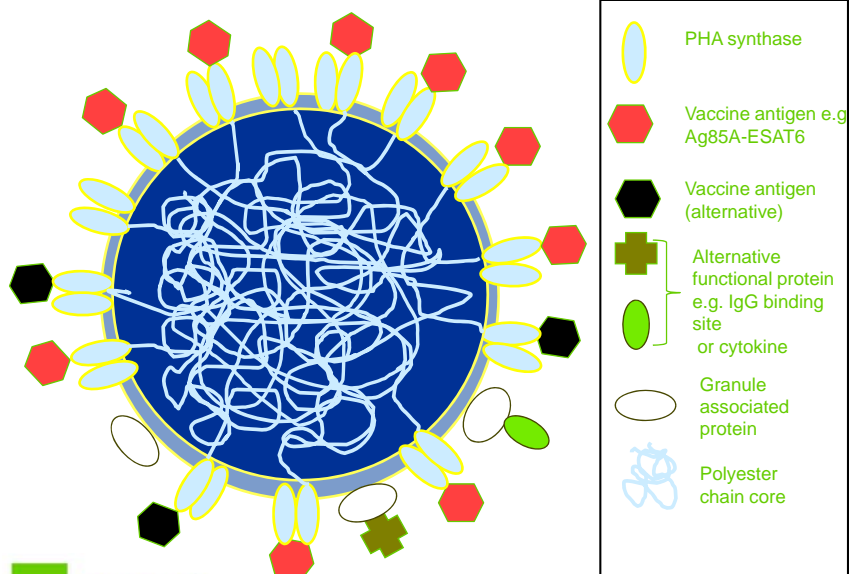
Produce a novel vaccine with TB proteins displayed on nanoparticles produced in bacteria (bionanoparticles, BNPs)

BNPs produced in *E. coli* host

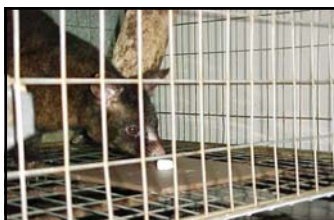


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Functionalised BNP



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Oral BCG vaccine for possums

- Encapsulation of BCG vaccine in a lipid matrix
- Protect against experimental aerosol challenge with *M. bovis*
 - Decrease severity of disease
- Stable for 3-5 wks field conditions
- 85 and 100% of field possums accessed baits at bait densities 40-80 sachets/ha

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Protection against natural exposure to *M. bovis* in possums (Tompkins et al., 2009)

- Approx. 50% of possums orally vaccinated with BCG
- Non-vaccinated matched controls (age, sex, body condition and location)
- Trap every 2 mths and check for TB lesions
- After 2 years, kill all possums in the grid and surrounding area and detailed necropsy undertaken





Protection against natural exposure to *M. bovis* in possums

(Tompkins et al., 2009)

Proportion with TB lesions of infected

12/71 control v. 1/51 vaccinated

($P < 0.05$)



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