Transmission of tuberculosis (*Mycobacterium bovis*) by possums

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CHAPTER 3

Page 73, 3rd and 4th sentences should read: Efferent vessels from the tonsil pass directly to the deep cervical lymph node which is drained by the tracheal trunk. The mandibular and parotid lymph nodes drain independently to the superficial cervical lymph node.

Page 75, paragraph 4. Add: For those lymph node measurements not clearly defined in the text, average sizes were calculated from diameters measured at the widest point of the lymph node.

Page 78, last paragraph should read: *Efferent vessels.* On each side, a large vessel, the tracheal trunk, passed along the ventral surface of the longus colli muscle to a lymphaticovenous connection at the base of each external jugular vein.

CHAPTER 4.

Page 89, 2nd sentence should read: *Mycobacterium bovis* was not re-isolated from ribbons placed on pasture after 4 days.

Page 96. Add:

Survival on control ribbons

The results of cultures of a control ribbon kept in the laboratory at room temperature in the autumn and of four control ribbons kept at 5 °C are shown in Table 4.1a.

Table 4.1a. Culture test results from control ribbons maintained at room temperature or at 5 °C in the laboratory

	2 days	4 days	7 days	14 days	28 days
Control (room temp, autumn)	nt	tnc	tnc	67 cfu	-
Control 5 °C autumn	nt	tnc	tnc	tnc	tnc
Control 5 °C winter	nt	tnc	tnc	tnc	tnc
Control 5 °C spring	nt	tnc	tnc	tnc	tnc
Control 5 °C summer	nt	nt	tnc	tnc	+

nt = not tested; tnc = too numerous to count; - = *M. bovis* not cultured; + = *M. bovis* cultured; cfu = colony forming units

CHAPTER 5.

Page 115 paragraph 2. The reference, Tyndale-Biscoe (1955), applies to the statement in the first sentence.

Page 133, paragraph 2. The reference, Kent PT, Kubica GP. Public Health Mycobacteriology. A Guide for the Level III laboratory. US Department of Health Education and Welfare, Atlanta, USA 1985, applies to the statement about losses during decontamination in the 4th sentence.

CHAPTER 6.

Page 145, paragraph 2. The 4th sentence should read: During postmortem examinations in the studies detailed in Table 6.1, urine, faeces and tracheal washings were collected from randomly selected tuberculous possums with gross lesions of tuberculosis, from which tissues were also taken for bacteriological and/or histopathological examinations.

CHAPTER 8.

Page 204, 2nd last line: "trapping" should read "tracking".

Abstract

Tuberculosis caused by *Mycobacterium bovis* was diagnosed in 59 of 632 possums (*Trichosurus vulpecula*) individually identified over a 52 month period, during a longitudinal study of the naturally occurring disease in possums at a 21 hectare bush pasture location on a farm at Castlepoint in the Wairarapa. The disease exhibited marked spatial and temporal clustering and was continuously present in the population for the whole period.

The disease had a relatively long duration of up to 22 months and four distinct stages were demonstrated in cross-sectional studies. Among tuberculous possums, prevalences of up to 0.15 (±0.11) were recorded in the first stage prior to development of gross lesions. After dissemination started, the disease showed rapid generalisation to multiple sites by haematogenous and/or lymphatic spread to the next stage when gross lesions were evident, particularly in lung, axillary and inguinal lymphocentres. In the third stage, lesions were disseminated through almost all lung lobes, discharging fistulae were common and kidney, intestine and mammary gland were commonly affected by both gross and microscopic lesions. Behaviour and outward signs of health were unaffected prior to the terminally-ill stage, lasting for up to 2 months.

In common with other marsupials studied to date and in contrast with most eutherians, there are no popliteal lymph nodes and efferent drainage from the inguinal lymphocentre passes directly to the deep axillary group of lymph nodes via an inguinoaxillary trunk. All subcutaneous lymph drainage passes through either the superficial cervical or the axillary lymphocentres before entering the venous system.

Studies of survival of *Mycobacterium bovis* organisms in different natural habitats showed a relatively short period of survival of *M. bovis* outside hosts and support a conclusion that environmental contamination of pasture, particularly in summer months, may be relatively unimportant in the epidemiology of tuberculosis in cattle, deer and possums.

The weight of evidence favours transmission of infection by the respiratory route and it would seem that transmission of tuberculosis between possums occurs through two major and one minor pathway. The first major pathway is pseudo-vertical transmission from mother to joey during the rearing process. The second major transmission mechanism is direct horizontal transmission

among adult possums with available evidence suggesting that this takes place around the locality where a possum dens, probably during competition and threat/agonistic behaviour and during courting and mating activity. The third and probably least important pathway is indirect transmission among mature possums.

None of three ELISA assays reliably detected possums infected with tuberculosis and poor test performance was exacerbated by inconsistency between results from serially collected samples from known tuberculous possums.

Acknowledgements

I undertook this postgraduate training mainly to better equip me for solving problems in a logical and systematic manner, and to help me make sense of complex issues. I was very fortunate to be given an opportunity to work on a high profile project by my chief supervisor, Professor Roger Morris, who was willing to take on a "bush vet" who scarcely knew the difference between a mean and a median. I am very grateful to him, not just for that opportunity, but also for his generous assistance and responsiveness to needs throughout the study period and for his counsel through my transition from practice to research.

My other supervisors, Dr. Geoff de Lisle and Associate Professor Roger Marshall have constantly encouraged me and given of their time and expertise willingly and I am grateful to them both.

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Within the group, Dr. Dirk Pfeiffer has guided me over and around many of the "brick walls" thrown up by analytical techniques and I have particularly enjoyed our many discussions about epidemiological issues.

The long term nature of longitudinal studies makes them more prone to problems than short term studies. We had our share of problems at Castlepoint, but none became serious, and a large part of the smooth running of the study was due to the good sense and friendly cooperation of my good friends Ron Goile, manager of Waio and his partner, Donna Lewis, both of whom have made an outstanding contribution to the longitudinal study. Thanks are also due to Bill Maunsell, the owner of Waio, who has made a quiet but considerable contribution by making his property available for the work.

The use of the library at Massey University has given me much pleasure over the past five years, but the greatest pleasure came from the human resource within the Faculty of Veterinary Science,

which shared its talents and knowledge willingly. Fiona Dickinson, secretary to Professor Morris, is a great exponent of all things pertaining to word processing and document layout, and she in particular has answered numerous requests for help and guidance in the preparation of this thesis and other reports.

The nature of my studies carried with it a high ethical cost in terms of use of animals. I trust that I used them wisely and was not wasteful in the extraction and use of information from them.

I am unable to adequately express my feelings for the most outstanding person of all. June and I have now been married for 37 years and her loyalty and support for me have been remarkable. It can't have been much fun helping me go round the trap lines on occasions in foul weather, or scribing for me in a cold shelter and then facing a waist deep evening return through Flagstaff Creek in mid-winter in Westland. Such is the mettle and loyalty of June, which she constantly has demonstrated throughout our life together. Our children too have been highly supportive of us in this venture and I am grateful to them for that. We miss our friends from Alexandra very much and thank them for continuing their friendship with us over time and distance.

Ron Jackson,
Department of Veterinary Clinical Sciences,
Massey University,
New Zealand.

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