

**DETECTION AND CHARACTERIZATION OF  
PAPILLOMAVIRUS IN ZEBRA (*Equus zebra*) AND OTHER  
SOUTH AFRICAN WILDLIFE SPECIES**

By

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Submitted in fulfilment of the requirements for the degree

**Philosophiae Doctor (PhD)  
(Veterinary Tropical Diseases)**

In the

Faculty of Veterinary Science, University of Pretoria

November 2010



Dedicated to my sons Wim and Gerhard

# ACKNOWLEDGEMENTS

I wish to express my sincere appreciation and gratitude to:

Estelle Venter and Marinda Oosthuizen, supervisor and co-supervisor, for support and editorial comment.

Ernie Bailey, co-supervisor, for the privilege to visit Gluck Research Centre and work in his research laboratory, genial hospitality, guidance, support, and valuable editorial comment.

All the friends in the laboratories: In South Africa: Anna-Mari Bosman, Kgomotso Sibeko and Rhaksha Bhoora. Thank you for your friendship, assistance and advice.

In Kentucky, at Gluck: Teri Lear, Samantha Brooks, Barbara Murphy, Stephen Coleman, Jamie McCleod and Stephanie Reedy - thank you for your friendship and making my stay in Lexington an unforgettable experience.

Dr Oliver Ryder from San Diego Zoo / CRES for supplying DNA samples.

Lana Botha, Estelle Mayhew, Antoinette Lourens, Rina Serfontein, Petro Bester and Esther Visser for numerous inputs.

Nacho Bravo, for enthusiasm, interest and support.

The veterinarians concerned with the two affected parks; David Zimmerman (Bontebok National Park), and Pierre Nel (Gariiep Dam Nature Reserve), great admiration for your exceptional marksmanship darting the zebra and thank you for having me with you for sample collections. A big thank you to Cathy Dreyer from the Veterinary Wildlife Services for the professional assistance in collection of samples and data and Lucia Lange, the pathologist, who was involved in the sarcoid problem from day one, for answering numerous questions and providing information. Roy Bengis, SANParks veterinarian for supplying the giraffe samples.

SANParks, for allowing the study to be conducted in the sarcoid-affected herds.

The Faculty of Veterinary Science, University of Pretoria, the Department of Veterinary Tropical Diseases, the Department of Tourism, Environmental and Economic Affairs of the Free State, and the South African Veterinary Foundation as well as the Clay Foundation - a big thank you for the financial support.

Lastly my two professors: Roy Tustin for critical reading of the manuscript, interest and encouragement and Dieter Osterhoff for constant interest and encouragement throughout the study.

# SUMMARY

## DETECTION AND CHARACTERIZATION OF PAPILLOMAVIRUS IN ZEBRA (*Equus zebra*) AND OTHER SOUTH AFRICAN WILDLIFE SPECIES

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### For the **PhD degree**

Sarcoid-like tumours have been reported in Cape mountain zebra (*Equus zebra zebra*) in two South African game parks recently. These tumours caused severe distress to the animals and also made them unsightly for tourists visiting the parks.

The aim of this investigation was to identify and characterize the infectious agent considered to be involved in the aetiology of sarcoid in the Cape mountain zebra. Bovine papillomaviruses (BPV) -1 and -2 deoxyribonucleic acid (DNA) were detected by the polymerase chain reaction (PCR) in sarcoid tumour tissue, but not from blood specimens or unaffected skin. Differentiation between BPV-1 and -2 was made by using the restriction endonuclease *Bst*XI on PCR products of the E5 open reading frame (ORF).

A hybridization probe real-time assay was developed for the specific and sensitive detection and differentiation of BPV-1 and -2 DNA in blood, skin and sarcoid tumour samples. For the specific detection of BPV-1, an increase in fluorescence was detected at 640 nm and of BPV-2 at 705 nm. The test is extremely sensitive and able to detect 1.5 genome copies/reaction.

The presence of BPV-1 and -2 DNA could be demonstrated in the blood of sarcoid-affected and -unaffected zebras even in the blood of zebras from parks where sarcoids have never been observed.

The phylogenetic relationships of the papillomaviruses detected in tumours in the Cape mountain zebra in comparison with a broad selection of papillomavirus sequences available in GenBank were compiled. The papillomavirus sequences retrieved from the zebras were identified as variants of either BPV-1 or BPV-2. The age of the most recent common ancestor for BPV-1 variants is estimated to be 1.40 million years (Mya) and for BPV-2 variants, 0.55 Mya. The age of the most recent common ancestor of BPV-1 and BPV-2 is estimated to be 5.34 Mya.

Certain major histocompatibility (MHC) haplotypes are associated with increased risk of sarcoid tumours in horses. The zebras in these parks may have become inbred for the MHC region with increased prevalence for a haplotype, conferring increased risk for sarcoid tumours. Therefore typing system was developed to determine whether or not a high prevalence of sarcoids among zebras is associated with a MHC haplotype. Single strand conformational polymorphism was used to assess the genetic variation in MHC class II genes. The use of DQB and DRB genes demonstrated that genetic variation and sarcoids in the zebras could not be attributed to a specific haplotype.

The developed real-time PCR technique was also applied in the detection of cutaneous papillomavirus in two giraffes (*Giraffa camelopardalis*) which were manifesting cutaneous papillomatosis, in the Kruger National Park and in a fibropapilloma in a sable antelope (*Hippotragus niger*), on a game farm in the Kimberley district, South Africa.

In conclusion, this was the first study to confirm the presence of BPV-1 and -2 DNA in the sarcoid tumours, healthy skin and blood of sarcoid-affected and healthy free-roaming zebras from sarcoid-affected parks. The presence of BPV-1 and -2 DNA in the blood of zebras from parks where sarcoids have not been previously observed was a significant finding.

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