

Disease in Wild Koalas (*Phascolarctos cinereus*) with Possible Koala Retrovirus Involvement

JON J. HANGER* AND JO LOADER

Endeavour Veterinary Ecology Pty Ltd, Toorbul Queensland 4510, Australia

ABSTRACT. A wide range of serious, and oftentimes fatal, conditions has been observed in both free-living and captive populations of koalas (*Phascolarctos cinereus*) and are attributed, perhaps prematurely, to the koala retrovirus (KoRV). These maladies include lymphoma, leukaemia, and other bone marrow conditions, and the so-called koala AIDS. A variety of other conditions that involve disordered growth of cells and tissues, altered or inappropriate immune responses, and degenerative conditions may also be consequences of insertional mutagenesis, or other pathogenic mechanisms associated with KoRV infection. The list of potential KoRV-associated pathologies continues to grow, as more thorough and consistent approaches to clinical assessment and diagnosis are applied to wild and captive koalas.

HANGER, JON J., AND JO LOADER. 2014. Disease in wild koalas (*Phascolarctos cinereus*) with possible koala retrovirus involvement. In *The Koala and its Retroviruses: Implications for Sustainability and Survival*, ed. Geoffrey W. Pye, Rebecca N. Johnson and Alex D. Greenwood. *Technical Reports of the Australian Museum, Online* 24: 19–29.

This paper aims to briefly describe a selection of well-recognized and newly-observed conditions that may have KoRV as a contributing factor. For most, however, the link with KoRV is evidentially non-existent, and its role in those diseases purely speculative. However, they are listed here to give KoRV researchers, particularly those based in laboratories, a fuller picture of the clinical spectrum of disorders afflicting koalas, and perhaps some guidance on future research directions. Some of these conditions, in the fullness of time, may have their definitive aetiologies and pathogenesis better illuminated as a result.

The evidence for the involvement of a retrovirus in leukaemia in koalas began building with the discovery and reporting of virus particles in the bone marrow of a leukaemic koala in 1988 (Canfield *et al.*, 1988), and the recognition of a spectrum of conditions in koalas similar to that observed in FeLV-infected cats (Hanger, 2009). A full-length KoRV genome sequence was reported in 2000 (Hanger *et al.*, 2000). While it is tempting to conclude that KoRV is responsible for leukaemia, lymphoma, and

related diseases in koalas, causation has not yet been proven. Certainly KoRV has characteristics found in pathogenic gammaretroviruses, including the immunosuppressive domain of the transmembrane portion of the envelope protein (Fiebig *et al.*, 2006). The evidence for KoRV pathogenicity in koalas is building, but not unequivocal.

This paper describes a wide range of diseases and syndromes observed in wild koalas, mainly in Queensland, which may be caused by disruption of normal cellular function and regulation by KoRV. It is important to remember that none has been conclusively causally linked to KoRV infection. These diseases have been included because they represent disordered growth of tissues, either as neoplasia, or benign conditions, or they are associated with putative disruption to normal cellular function, for example, the koala “AIDS” condition. Also included are some immune-mediated conditions, which may be associated with immune dysfunction or dysregulation by KoRV, or perhaps other factors.

* author for correspondence