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## **Chronic neurophysiological and anatomical changes associated with infra-red beak treatment and their implications for laying hen welfare**

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### **Abstract**

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The long-term effects of infra-red beak treatment (IRBT) in laying hens were investigated by examining beak-nerve function and anatomy over a range of ages. In IRBT and control (intact) birds that were ten, 30 or 50 weeks old, the responses of single sensory nerve fibres were recorded from the intramandibular nerve, which provides sensation to the lower beak. The beaks were also measured and subject to microscopic and radiographic examination. The responses of 386 nerve fibres were recorded including mechanoreceptors, thermoreceptors and nociceptors. Receptive field positions indicated that the entire lower beak was sensitive to thermal and mechanical stimuli, regardless of age or treatment. There was no evidence of a treatment effect on nociceptive thresholds at any age. Beak measurements demonstrated that application of IRBT at day-old affected, on average, 36% of beak area, and resulted in a 44% reduction in beak length by four weeks of age. Radiographs produced no evidence of adverse or pathological change in relation to IRBT. Microscopic evaluation of beak-tip anatomy revealed evidence of healing including re-epithelialisation, fibrovascular hyperplasia and bone remodelling. By four weeks of age there was limited nerve regeneration in IRBT beaks, including re-population of mechanoreceptors in some birds. In older birds, re-innervation and scarring was visible, but no neuromas or abnormal proliferations of nerve fibres were observed at any age. Collectively, the results suggest that IRBT does not result in chronic pain or other adverse consequences for sensory function.

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**Keywords:** animal welfare, beak trimming, infra-red beak treatment, laying hen, pain, nociceptors