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Morphological correlates of improved hearing after kanamycin in Belgian Waterslager canaries

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Belgian Waterslager canaries (BWS) show a low level of continuous supporting cell proliferation and hair cell (hc) differentiation in the absence of external trauma. Despite on-going proliferation, hc number and hearing sensitivity remains reduced. We recently reported (Dooling, et al 1998) improved hearing sensitivity in BWS following kanamycin ototoxicity. We determined that hearing sensitivity, while initially decreased during kanamycin injection (200mg/kg, IM for 9 days) returned to pre-injection levels at all frequencies within 2-8 weeks of recovery. Thresholds continued to improve and were stabilized by 10-12 weeks. Improvement in thresholds over baseline values was app. 5-10 dB. The purpose of the present study was to determine whether quantitative measures of basilar papilla (bp) morphology might provide information relating structural changes to functional changes in hearing sensitivity.

Eighteen weeks after kanamycin injections, the three behaviorally tested BWS were sacrificed and one bp from each prepared for scanning electron microscopy. Six adult canaries (3 bp in BWS; 3 bp in 3 non-BWS) received no kanamycin injections and served as controls. Hair cells were counted at 20% intervals of length from the basal tip of the papilla and from neural to abneural edge from 800x montages. No differences in hc number across the bp were seen for either the kanamycin treated BWS or non-treated BWS ($p > 0.05$) . Total hc number was also determined in 25% intervals of length from the proximal tip. Total hc number was slightly, but not significantly ($p < 0.05$), higher in BWS treated with kanamycin. Number of stereovilli (stv) per hair cell was recorded at 20%, 50%, and 80% of length from 4000x SEM montages (n= 70 hc in non-BWS; 88 hc BWS; 55 hc kanamycin BWS). Preliminary results indicate that the average number of stv/hc was greater along the neural edge of the bp in kanamycin treated birds (74 stv/hc in kanamycin treated BWS; 63 stv/hc in control BWS). Our results suggest that hc in BWS following kanamycin ototoxicity may have more stereovilli than usual. This increased number of stv/hc may be related to improved auditory sensitivity.

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