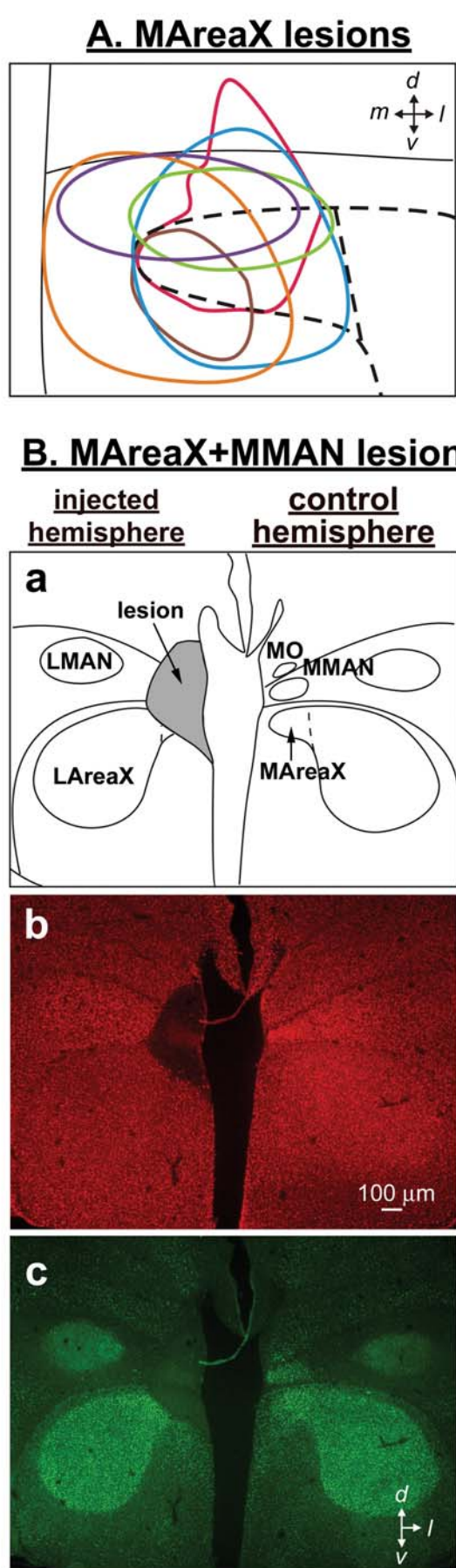
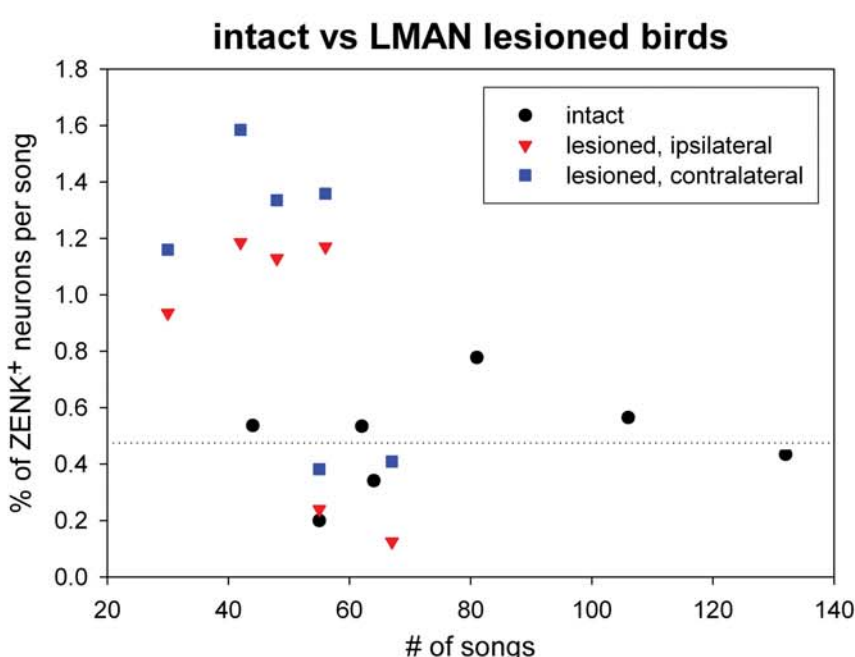


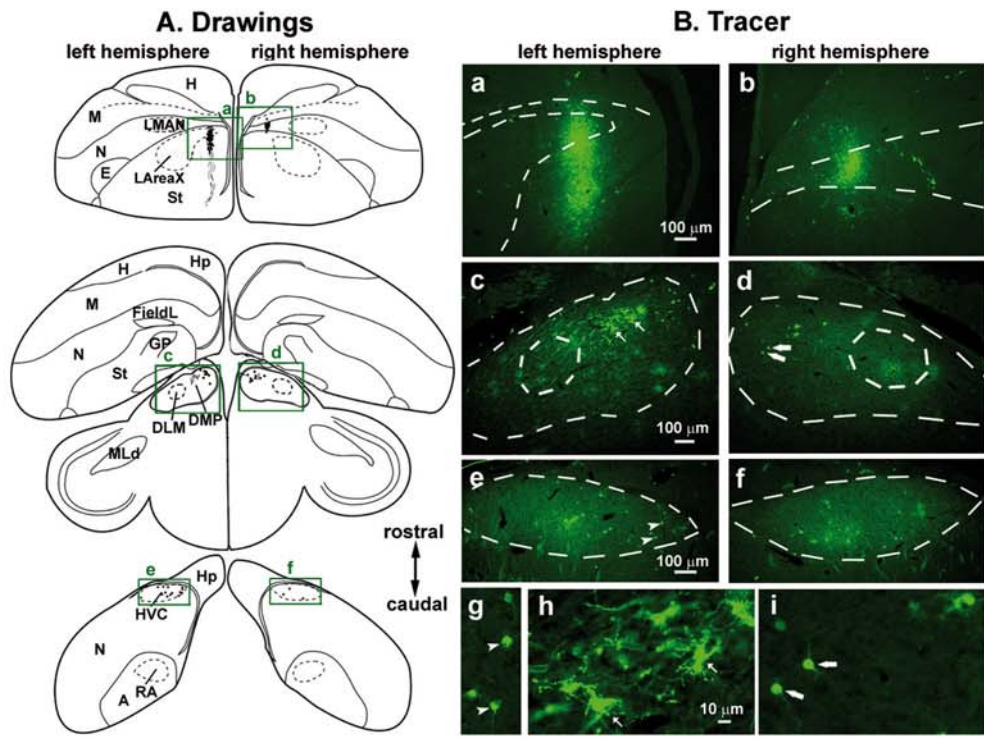
Supplementary Figure 1. Detailed camera lucida drawing (A) and photomicrograph (B) of MAreaX/LAreaX boundary in the directed singing bird shown in Fig. 2.



Supplementary Figure 2. Lesions to the medial part of the pallial basal ganglia loop. (A) Locations of damaged regions in the six birds reported in this study with lesions targeted to MAreaX. Each representation is one animal. Drawings are based on Hu immuno neural marker images. (B) Example of a combined MAreaX+MMAN lesion. Red is Hu neuronal staining; green is ZENK staining in the same section. This bird sang 51 undirected songs.



Supplementary Figure 3. ZENK induction in the vocal motor nucleus RA in intact (black circles) and LMAN lesioned birds (red triangles for ipsilateral hemisphere, blue squares for contralateral hemisphere). In intact birds the ZENK expression per song did not vary with the singing amount and was 0.48 ± 0.07 (mean \pm SEM; dotted horizontal line represents the mean). Birds with LMAN lesions are split to two clusters: two birds with intact-like ZENK expression (0.18 and 0.4 mean values for ipsilateral and contralateral RA, respectively) and four birds with increased ZENK expression (1.11 ± 0.06 and 1.36 ± 0.09 mean \pm SEM for ipsilateral and contralateral RA, respectively). This increase was highly significant even with a conservative comparison when the expression levels of the 4 LMAN lesioned birds were compared with only the 4 intact birds singing similar amounts of songs ($p < 0.001$; t-test).



Supplementary Figure 4. A possible medial anterior vocal pathway loop. Green fluorescent tracer dextran amine (anterograde and retrograde tracer) was targeted bilaterally to MAreaX ($n=8$ male birds; 16 injections) and singing-driven ZENK expression of MAreaX used to verify the injection location. (A) Drawings of coronal sections from which the photomicrographs in (B) were taken. Dots in the drawings represent backfilled cells, wavy lines represent fibers, and straight lines represent terminal fields. Left hemisphere injection is in MAreaX and surrounding caudum (ventrally); right is in MAreaX with some leakage to MAreaX and surrounding lateral striatum onto DLM neurons (Iyengar et al., 1999; Luo et al., 1997). When the injections were mostly restricted to the overlying MMAN (Ab, Bb) and nidopallium ($n=2$), or they were both in the nidopallium and striatum ($n=6$), labeled cell somata were seen bilaterally in DMP (Ac, d, Bc, d, i), confirming that the medial dorsal thalamus projects to the nidopallium and MMAN, and does so bilaterally (Vates et al., 1997). No labeled terminations or somata were seen in DLM (Ac, d, Bc, d). (Be) and (Bf) show retrogradely labeled neurons in HVC, with a detailed view in (Bg) for (Be), confirming that we injected into MAreaX (Foster et al., 1997). Some labels in (Bf) are terminations (not shown at high power), presumably from the striatum (Bc, Bd, Be) show cells or terminals at higher magnification in (Bh, Bi, Bg), respectively. DLM was located by its denser fiber autofluorescence in darkfield (not shown).