



Supplementary Figure S1. Hodological and morphological aspects of LMAN shell

circuits. (A) The complete axonal projections of LMAN_{shell} (blue); Ad projects to a dorsal thalamic zone (DTZ) that includes not only DLM, which makes feedback connections to LMAN, but also DMP, which makes feedforward connections to HVC (via MMAN). In addition, Ad projects to the lateral hypothalamus (LH, which projects in turn to DTZ) and to the ventral tegmental area (VTA) that sends a dopaminergic projection to Area X. The projection of Ad to lateral hypothalamus as well as brainstem regions that produce biogenic amines suggests an involvement with neuromodulatory inputs to the song system that could contribute to mediating motivational aspects of song and changes in song that are known to occur as a function of different behavioral states and social contexts (Hessler and Doupe 1999; Jarvis et al. 1998; Kao and Brainard 2006; Kao et al. 2005). Major connections of LMAN_{core} are shown in light gray. See (Bottjer et al. 2000; Foster et al. 1997; Iyengar et al. 1999; Person et al. 2008) for additional details. (B) The connections of LMAN shell (blue) and core (gray) pathways may integrate information between them through several points of overlap, including DLM which receives a strong projection from Ad and a modest projection from the dorsal region of RA, as well as parallel projections from Area X and medial striatum (MSt)(Bottjer 2004; Foster et al. 1997; Vates et al. 1997; Wild 1993). Because Ad appears to project throughout DLM (as well as to DMP), information processed in both core and shell pathways may converge in this dorsal thalamic complex (Bottjer et al. 2000; Iyengar et al. 1999; Person et al. 2008). An interesting contrast is that HVC sends separate projections to RA and X, whereas core and shell each send single (collateral) projections to RA/X and Ad/MSt, respectively. Not shown here (for clarity) is the direct projection from LMAN_{shell} to dNCL and from DMP→MMAN→HVC. The pathway from RA to DLM is not a major projection in adult birds, but has not been examined in juveniles.

Abbreviations: LMAN (lateral magnocellular nucleus of the anterior nidopallium; c = core region; s = shell region), MMAN (medial magnocellular nucleus of the anterior nidopallium), Area X (Area X of the medial striatum), HVC (high vocal center), RA (robust nucleus of the arcopallium), Ad (dorsal arcopallium), DTZ [dorsal thalamic zone; includes both DMP (the dorsomedial nucleus of the posterior thalamus) and DLM (medial dorsolateral nucleus of the thalamus; DL contains neurons in the dorsolateral portion of DLM that project to LMAN_{core} whereas VM contains neurons in the ventromedial portion of DLM that project to LMAN_{shell})], dNCL (dorsal region of the caudolateral nidopallium), LH (lateral hypothalamus), MSt (medial striatum), VTA (ventral tegmental area). (See Reiner et al. 2004.)