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Anatomical organization of pathways in the locomotor command system of the lamprey

In vertebrates, locomotor behaviors are initiated by groups of neurons in the brain, called locomotor command systems, that project to neural networks in the spinal cord, called central pattern generators (CPGs). The output neural elements of the command system are reticulospinal (RS) neurons. The lamprey, a lower vertebrate, is an excellent model for studying locomotion because its swimming behavior is relatively simple and its nervous system is easier to analyze than those of more complex animals. Recent studies using larval sea lamprey (P. marinus) have hypothesized that RS neurons receive inputs from neurons in higher brain areas in the ventromedial diencephalon (VMD) and dorsolateral mesencephalon (DLM) (Paggett et al., in press). For example, VMD- or DLM-initiated locomotor activity is abolished when RS neurons activity is blocked. In addition, injection of horseradish peroxidase (HRP), an anatomical tracer, in the vicinity of RS neurons retrogradely labels a few neurons in the VMD and DLM. However, the numbers of labeled neurons in the VMD and DLM are lower than we would expect. Therefore, the above model would be significantly strengthened if better anatomical data could be obtained. In the present study, a different anatomical tracer, called biocytin, was injected into reticular nuclei in an attempt to retrogradely label larger numbers of neurons in the VMD and DLM. At present, we have shown that biocytin is an effective retrograde tracer, and we are determining if this technique can be used to support our model of the locomotor command system.