Continuing characterization of GABAergic neurons in spinal cord lamina I of GAD67-EGFP expressing transgenic mice.

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Lamina I neurons receive thermal & nociceptive stimuli in relation to their morphology & firing. Characterizing GABAergic neurons by these variables would provide information on the lamina I inhibitory apparatus. Here, transgenic mice containing EGFP under the control of a GAD67 regulatory element (Oliva, et al., 2000) were used to identify then characterize lamina I GABAergic neurons.

Lamina I neurons form distinct classes based on their firing properties (Prescott & DeKoninck, 2002; Ruscheweyh & Sandkuhler, 2002). Recordings were obtained from $EGFP^+$ cells (P4-19). In response to current steps, 47 cells fired tonically, 45 with single spikes, & 17 with an initial burst. Cells with single spikes had higher rheobase, lower resistance, & shorter time constant than tonic & initial burst cells. Application of neuromodulators (5-HT, DA, & NE) had no effect on these properties. To identify possible neuromodulatory phenotypes, GAD67-EGFP lamina I cells were compared with the immunolabeling of various peptides in colchicines- treated P14 mice. Most $EGFP^+$ cells did not express any peptides tested, but some co-expressed bombesin, CCK, NPY, VIP, or enkephalin. Somatostatin & dynorphin were not found in these cells.

Lamina I EGFP+ cells had 4 morphologies – multipolar (65%), large fusiform (26%), small fusiform (7%), & pyramidal (1%). Large fusiform & multipolar cells respond to nociceptive-specific & nociceptive/polymodal stimuli, respectively (Han, et al. 1998). Here large fusiform EGFP+ neurons were mostly tonic (n=19) with few firing an initial burst (5) or single spike (4). Most multipolar EGFP+ cells fired a single spike (n=21) & the others fired tonically (11), consistent with the correlated morphology & firing properties for all of lamina I cells (Prescott & DeKoninck, 2002). This suggests that GABAergic neurons receive nociceptive-specific & nociceptive/polymodal stimuli. Multipolar cells have a higher resistance, lower capacitance, shorter time constant & smaller outward current than fusiform cells.

We conclude that lamina I GABAergic neurons are heterogeneous morphologically, physiologically and with respect to peptide transmitter co-expression.

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