

PROPERTIES OF GABAERGIC NEURONS IN SPINAL CORD LAMINA I OF GAD67-EGFP EXPRESSING TRANSGENIC MICE.

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Lamina I spinal neurons are involved in nociceptive signaling and respond to sensory stimuli in relation to their morphology and firing. Characterizing GABAergic neurons by these variables would provide information on the lamina I inhibitory apparatus. Glutamic acid decarboxylase (GAD) is the rate-limiting enzyme in GABA synthesis. A neuron is GABAergic if it contains either isoform of GAD (GAD65 or GAD67). Presently, 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.

First, GAD67-EGFP⁺ cells were compared to the number of immunolabeled GABA⁺ neurons in lumbar cord at postnatal days (P) 0, 7, 14 and adult. We observed a decrease in total number of lamina I GAD67-EGFP⁺ cells per spinal segment with age: P0 - 3150; P7 - 2300; P14 - 1833; adult - 647. At all ages ~70% of lamina I EGFP⁺ neurons were also GABA⁺. Lamina I EGFP⁺/GABA⁺ cells were divided into 4 categories by morphological type: small fusiform, large fusiform, multipolar and pyramidal. Percentage of morphological type were similar at all ages with overall mean percentages being; 7% small fusiform, 26% large fusiform, 65% multipolar, 1% pyramidal. These values support the earlier data that all multipolar and most fusiform cells in lamina I are GABAergic (Lima, et al., 1993).

Lamina I neurons can be separated into subtypes based on their firing properties (tonic, phasic, delayed onset, single spike). Whole-cell recordings were obtained from visually-identified EGFP⁺ cells (P6-8). In response to current steps, of 16 cells, 10 fired single spikes and 5 fired tonically. This is consistent with properties of cells having multipolar and fusiform morphology respectively (Prescott and De Koninck 2002). We conclude that GAD67-EGFP⁺ mice can be used to identify and characterize lamina I GABAergic neurons. Supported by NIH grants NS40893 and NS045248.