# ErbB4 labels a novel group of excitatory interneurons in dorsal spinal cord and mediates thermal pain sensation

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Sensory signals from primary afferent neurons are usually processed by interneurons in dorsal horns of spinal cords (abbreviated as DH), integrated by projection neurons and transmitted to the supraspinal regions. Processing of sensory information is cell-type specific; each type of DH interneurons is believed to selectively involved in a specific sensory modality (or modalities). These interneurons are distinct in locations, morphologies, firing patterns, and expression of biochemical markers including palvulbumin (PV), somatostatin and PKCγ. ErbB4 is expressed in a large number of interneurons in the brain and plays critical roles in GABAergic circuit assembly, GABA transmission and E/I balance. In preliminary studies, we found ErbB4 is expressed in laminae I-IV in the DH. Staining of cellular markers showed that they did not appear to be GABAergic, while anterograde and retrograde tracing studies suggest they are not brain-projecting neurons. Lesion or activating of ErbB4-positive (ErbB4+) neurons with neurotoxin or chemogenetics attenuated or promoted the behavioral response to thermal pain but not mechanical pain or itch. AAV virus-mediated spinal cord-specific knockout or pharmacological inhibition of ErbB4 also blunted the response to thermal pain. Based on these results, we propose that ErbB4 is a functional marker of a novel group of excitatory interneurons in DH mediating thermal pain transmission.