

The chemical sensitivities and expression of cold-sensitive ion channels in sensory neurons of the persistently inflamed rat

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Cold sensitivity of animals is augmented in pathological conditions, like inflammation. We have reported that behavioral hypersensitivity to cold was observed under the persistently inflamed condition in rats 2 weeks after unilateral injection of complete Freund's adjuvant (CFA) to tibio-tarsal joint. In the animals, nocifensive behaviors on the cold plate at 5 or -3°C have been increased in the inflamed hind paw, suggesting cold allodynia and hyperalgesia.

To elucidate the molecular basis of these cold hypersensitivities, here, we examined the functional and quantitative differences of cold-sensitive ion channels in sensory dorsal root ganglion (DRG) neurons of the persistently inflamed rats, using calcium-imaging technique for cultured DRG neurons and semi-quantitative RT-PCR of cold-sensitive ion channels, TRPM8 and TRPA1. Incidence of the cells sensitive to a TRPA1-agonist, mustard oil or a TRPM8-agonist, menthol, was significantly increased in the cultured DRG neurons from the ipsilateral side of CFA-injection. However, no clear difference was observed in mRNA expression of the channels through the development of inflammation. These results suggest that the higher incidence of mustard oil-sensitive DRG neurons might be associated with cold hypersensitivity in persistent inflammation, and mediated by modulation of channel or neuronal activities, not by increased expression of these channels.