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Touch Cell Proteins Needed for the Formation of Amiloride-sensitive Ion Channels

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Touch sensation along the body of *C. elegans* depends on six specialized sensory neurons called touch cells (ALM, AVM, PVM, PLM). Genetic screens for touch insensitive mutants identified twelve *mec* (*mec*hanosensory abnormal) genes needed for the activity, but not the development, of the touch cells. Most of these genes have been cloned. Except for *mec*-5, all of the cloned genes are expressed in the touch cells. The protein encoded by *mec*-4 is touch-cell specific and belongs to the DEG/ENaC superfamily of proteins that form amiloride-sensitive ion channels. The *mec*-10 gene encodes another DEG/ENaC channel subunit expressed in touch cells and four other mechanosensory neurons. These channel subunits are hypothesized to be the core of a mechanotransduction complex.

A long-standing question is whether the putative ion channel subunits, MEC-4 and MEC-10, form channels similar to other DEG/ENaC channels. To address this question we measured whole cell currents in Xenopus oocytes injected with cRNAs encoding the channel subunits. We found that heterologous expression of MEC-4 and MEC-10 bearing activating mutations that cause degeneration *in vivo* fails to produce any current. However, robust amiloride-sensitive currents are observed when either MEC-2 (a protein related to human stomatin) or MEC-6 (a protein related to human paraoxonase) is added. MEC-4, but not MEC-10, is required to produce amiloride-sensitive currents. These currents were Na^+-selective, inwardly-rectified, effectively time-independent, and exquisitely sensitive to amiloride. The largest currents were observed when both MEC-2 and MEC-6 were present together with the channel subunits; MEC-2 and MEC-10 altered affinity for amiloride. The expression pattern data, genetic interaction data, and now these oocyte expression data suggest that all four of these proteins (and possibly others) are needed for the formation of a mechanotransduction complex *in vivo*.