Supplementary Figure legends

**Supplementary Figure 1.** A normal expression of *TrkA, alpha-CGRP,* and *Ret* in IB4+ neurons in 446/446 mice. Double staining of IB4 (green) and the mRNAs (red) of *TrkA, alpha-CGRP* and *Ret* on sections through thoracic DRG of P30 wild type and 446/446 mice. Note that expression of *TrkA* was virtually not expressed in IB4+ neurons in both wild-type and 446/446 mice (A, B). Similarly, only a very small fraction of IB4+ neurons showed an elevated expression of *alpha-CGRP* in both wild-type and 446/446 mice (C, D, arrows). Finally, quantitative analysis showed that over 90% of IB4+ neurons expressed Ret in both wild-type and 446/446 mice (E, F, arrows). Therefore, deletion of the C-terminal repression domain does not affect the expression of *TrkA, alpha-CGRP,* and Ret.

**Supplementary Figure 2.** Normal expression of nociceptive ion channels and receptors in 446/446 mice. In situ hybridizations were performed on sections through thoracic DRG of P30 wild-type and 446/446 mice. Note that expression of nociceptive ion channels and receptors did not exhibit obvious changes between wild-type and 446/446 mice, including *TRPA1, TRPM8, TRPC3, Nav1.9* and *P2X3*. Therefore, Runx1 C-terminal repression domain is not required for Runx1-mediated activation of these sensory channels/receptors.

**Supplementary Figure 3.** Expansion of *MrgA3* and *MrgB4* expression in L4/L5 lumbar IB4+ neurons in 446/446 mice. (A-D) Double staining of IB4 (A-D, green) and *MrgA3* mRNA (A, B, red) or *MrgB4* mRNA (C, D, red) on sections through L4/L5 lumbar DRG of P30 wild-type and 446/446 mice. Note that in wild type mice, *MrgA3* was expressed
in both IB4+ (A, arrow) and IB4- (A, arrowhead) neurons, whereas MrgB4 was expressed only in IB4+ neurons (C, arrow), as the case seen in thoracic DRG in Fig. 7. In 446/446 mice, expression of both MrgA3 and MrgB4 was markedly expanded in IB4+ neurons (B, D, arrows). (E) shows the quantitative data. The percentage of IB4+ neurons in L4/L5 lumbar DRG that express MrgA3 increased from 8.0 ± 2.5% in wild type mice to 46.1 ± 4.7% in 446/446 mice (*, p < 0.006), and MrgB4+ neurons increased from 9.1 ± 1.6% to 40.0 ± 10.2% (**, p < 0.02). The net increase of MrgA3 expression in the IB4+ neurons in lumbar DRG (by 46.1-8.0=38.1%) is considerably smaller than that in thoracic DRG (by 74.7-8.2=65.5%, see Fig. 7). In contrast, the net increase of MrgB4 expression within IB4+ neurons is comparable between lumbar DRG (by 40.0-9.1=30.9%) and thoracic DRG (by 37.4-6.9=30.5%), reinforcing the idea that expression of MrgA3 and MrgB4 is independently controlled.

**Supplementary Figure 4.** Smad4-mediated signaling is required for the expression of MrgB4. Mice that carried a Smad4 conditional null allele or Smad4F/F were crossed with SNS-Cre mice, in which the Cre gene is expressed in most small diameter sensory neurons, where Mrg gene expression is detected, and Cre activity is detected around E17 (Agarwal et al., 2004). We found that in Smad4F/F; SNS-Cre conditional null mice, expression of MrgB4 is absent in T12 thoracic DRG at P4 and P30 (A-D), suggesting that Smad4 is required for the establishment of MrgB4 expression or for the survival of prospective MrgB4+ neurons. Expression of MrgA3, MrgC11, MrgD, and other Runx1-dependent nociceptive ion channels/receptors was not affected in Smad4F/F;SNS-Cre conditional null mice (E-J; data not shown), implying a quite specific role of Smad4-mediated signaling in controlling MrgB4 expression.