**Supplemental Figure 1.** Experimental setup for T-to-S pairing experiment. (A) Two-ganglion preparation used for each LTP or LTD experiment. Each ganglion has 3 pairs of T-cells that innervate a discrete region of the skin; the lateral (blue), ventral (green) and dorsal (red) T-cells. T-to-S synaptic transmission is tested in the anterior ganglion (top) using intracellular electrodes (not shown) in the S-cell and either the lateral or ventral T-cell. During LTP or LTD training, the anterior nerve on one side is stimulated, activating the T-cells that have afferent input onto the S interneuron. This anterior nerve stimulation is paired with stimulation of the connective nerve posterior of the posterior ganglion using a suction electrode, which activates the S-cell. (B) Protocol for inducing LTP and LTD. During the pre-test, an initial measurement of the T-to-S EPSP is made. This is followed by 10 pairings of T- and S-cell activity at 2 min intertrial interval (ITI). Post-tests of the T-to-S EPSP are made 60 min after the last pairing. For LTP experiments, pairing consisted of 5 presynaptic stimuli (10 Hz) delivered prior to 20 postsynaptic stimuli (25 Hz). For LTD experiments the order was reversed.

**Supplemental Figure 2.** (A) There was no change in the electrical component of the T-to-S EPSP following pairing at any of the T-S intervals in normal saline or in AP5. (B) No changes in electrical EPSP amplitude were observed following -0.65 or -10 s pairing in the DMSO vehicle, AM251, RHC80267, or capsazepine.