

**Supplemental Movie 1. Semirestrained worm in a spatial temperature gradient.** The intracellular calcium dynamics of the AFD neuron were quantified in this semirestrained worm, also shown in Figure 2A. On the left, the pair of images shows the simultaneous recordings of CFP and YFP fluorescence emission. On the right, a position-color map shows the ratiometric emission signal as it varies over time. The tail of the worm is glued outside the field of view. The gradient is  $1.2\text{ }^{\circ}\text{C}/\text{mm}$  in the direction indicated by the arrow at the left, and the red circle shows the region of interest used to locate the AFD soma in each video frame. The ratiometric emission signal is not normalized by  $R_0$ .

**Supplemental Movie 2. Freely moving worm in a spatial temperature gradient in the vicinity of  $T^*_{AFD}$ .** The intracellular calcium dynamics of the AFD neuron were quantified in this freely moving worm, also shown in Figure 3A. On the left, the pair of images show the simultaneous recordings of CFP and YFP emission. On the right, a position-color map shows the ratiometric emission signal as it varies over time. The gradient is  $0.3\text{ }^{\circ}\text{C}/\text{mm}$  in the direction indicated by the arrow at the left, and the red circle shows the region of interest used to locate the AFD soma in each video frame. On the right, a box outlines the field of view; the motorized microscope stage is moved to follow the freely moving worm. The ratiometric emission signal is not normalized by  $R_0$ .