Supplemental Figure 1. ***A,*** Grid format mainly used in this study. 1 μl each of 200 mM NaCl is spotted on 12 grid points with a spacing of 2 cm. One hour later, a single adult worm was placed at the center. Data were processed only when the animal stayed within the dotted region. ***B,*** Radial gradient chemotaxis assay. 5 μl each of 0.5 M NaCl was spotted 19 hrs and 4 hrs before the assay. A single adult animal was placed 2.2 cm away from the peak. ***C,*** Definition of a sharp turn. For each time point (circled in this example), two points, behind or ahead by 0.3 mm are selected and the angle formed by these three points are measured. If the angle is less than 80°, a sharp turn is assigned to the circled point. ***D,*** Determination of curving rate. Curving rate at the data point marked by the diamond is defined as the angle formed by the two regression lines. To draw the regression lines, two points (circled), 0.5 mm behind or ahead the point of interest (diamond), were chosen and data points within 0.3 mm from the circled points were subjected to major axis regression to draw lines that fit best the data points in the rectangles. ***E,*** Relationship between NaCl concentration and speed of locomotion in wild type N2. ***F,*** Distribution of the duration of migration bordered by sharp turns defined as in *C*. The distribution is fit by two exponential curves (dotted lines). Sum of the two exponentials is shown by a solid line. ***G,*** Relationship of bearing of NaCl peak before and after pirouette. The bearing of the NaCl peak is defined as in Fig. 1*F*. Δθ is the angle made by the direction of movement before pirouette and that after pirouette. On the oblique dotted line, bearing after pirouette is 0, meaning that animals move towards the peak. ***H,*** Relationship between dC/dT and pirouette probability. The same data as Figure 1*C* were processed differently. In this case, all data points were divided in three groups based on dC/dT values and pirouette probability was calculated in each group. Horizontal lines indicate the span of dC/dT for each group. This analysis was used for calculation of pirouette index and basal pirouette frequency (see Materials and Methods).

Supplemental Figure 2. ***A,*** Correlation over time of curving rate. For each bin of curving rate at time 0, curving rates of the same animal after intervals were determined and the average values were plotted. Effect of the original value is persistent for about 10 seconds. ***B, C,*** Relationship between curving rate at a time point and curving rate after 6 seconds (***B***) or 12 seconds (***C***) is plotted for all data points in runs. ***D***, Results from radial gradient assays as in supplemental Fig. 1*B*. The relationship between dC/dT and probability of pirouette, showing the pirouette mechanism. ***E,*** Results from radial gradient assays as in supplemental Fig. 1*B*. Relationship between NaCl gradient in normal direction and the curving rate showing the presence of weathervane mechanism. The slope is shallower compared to the data from grid format for unknown reasons.

Supplemental Figure 3. Efficiency of chemotaxis in cell ablated and control animals. Time spent at each position as fraction of total time is indicated by the darkness of that position. The numbers of animals tested for each test and average chemotaxis indices are shown for each panel.

Supplemental Figure 4. The weathervane response of cell ablated and control animals. Relationships between NaCl gradient in normal direction and average curving rate are shown for each panel.

Supplemental Figure 5. The pirouette response of cell ablated and control animals. Relationship between temporal change of NaCl concentration (dC/dT) and probability of pirouette is shown.