

## Supplemental Movie Legends

Supplemental Movie S1. CXCR4b is evenly distributed on PGC plasma membrane when cells migrate towards their target.

PGCs expressing CXCR4b-EGFP migrate towards a transplanted group of cells expressing physiological levels of SDF-1a (60 pg of injected RNA) and labelled in red with Dextran Alexa Fluor 568. Imaging was initiated immediately following the transplantation. The stamped time on the movie refers to minutes and seconds.

Supplemental Movie S2. CXCR4b-EGFP internalization immediately following introduction of a source of SDF-1a (the cluster of cells labelled in red).

Cells expressing SDF-1a and labelled in red with Dextran Alexa Fluor 568 were transplanted into an embryo whose PGCs expressed CXCR4b-EGFP. Imaging was initiated immediately following the transplantation. The cells that are exposed to very high SDF-1a levels (300pg of injected RNA) do not migrate towards the chemoattractant source, presumably due to their inability to detect the gradient under these conditions. The stamped time on the movie refers to minutes and seconds.

Supplemental Movie S3. Normal run and tumbling phases performed by an *ody* cell that expresses the wild-type CXCR4b.

An *ody* PGC expressing wild-type CXCR4b was labelled with GFP and tracked during the course of its migration. The stamped time on the movie refers to hours and minutes. The cell performed tumbling during frames 12-19, 24-27, 30-36.

Supplemental Movie S4. An example for an exceptionally long run phase performed by an *ody* cell expressing the mutant CXCR4b that can not internalize.

An *ody* PGC expressing mutant CXCR4b (construct 6 in Figure 1F) was labelled with GFP and tracked during the course of its migration. The stamped time on the movie refers to hours and minutes. The migration of this cell is not interrupted by tumbling throughout the movie.