Supporting Information

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SI Materials and Methods

***C. elegans* Strains and Genetics.** *C. elegans* strains were raised on NGM (Nematode Growth Medium) plate seeded with the *Escherichia coli* strain OP50 at 20 °C using standard methods. Wild-type animals were of the Bristol variety, strain N2. Strains are listed in Table S1. Integrated P*mec-4::gfp* (*zdIs5*), P*gcy-32::mCherry* (*casIs35*), and P*gcy-32::gfp* (*casIs35*) transgenes were used to visualize Q-neuroblast progenies, AVM/PVM and AQR/PQR. Ethyl methane sulfonate mutagenesis was carried out, with either a single transgenic marker or both, to identify Q-cell migration mutations. Four mutations affecting AQR and AVM migration were isolated and mapped with snip-SNP techniques and complementation testing. The candidate genes in these regions were sequenced to identify mutations. The data showed that these four alleles caused point mutations in or deletion of the *mig-13* gene.

Molecular Biology and Transgenesis. We used PCR fusion and molecular cloning techniques to generate fluorescence reporters in Q cells. All of the PCRs were performed with Phusion DNA polymerase (New England Biolabs). The PCR templates and primers are listed Table S2 and the plasmid constructs are listed in Table S3. Transgenic *C. elegans* were created by germ-line transformation. The PCR products and DNA plasmids at 10–30 ng/μL were injected into N2 hermaphrodites with a selection marker pRF4 or *unc-76 (e911)* with WT *unc-76* gene.

Live-Cell Imaging. *C. elegans* L1 larva were anesthetized with 0.1 mmol/L levamisole in M9 buffer, and then mounted on 2% (wt/vol) agar pads and maintained at room temperature (20 °C). Our imaging system includes an Axio Observer Z1 microscope (Carl Zeiss MicroImaging) equipped with a 100×, 1.45 N.A. objective, an EM CCD camera (Andor iXon+ DU-897D-C00-#BV-500), and the 405-, 488-, and 568-nm lines of a Sapphire CW CDRH USB Laser System attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). Time-lapse images were acquired with exposure time of 300 ms at every 40–60 s with μManager (www.micro-manager.org) or Focus Image software (developed by Xiang Zhang at the Institute of Biophysics, Chinese Academy of Sciences, Beijing, China). ImageJ software (http://rsbweb.nih.gov/ij/) was used to process the images.

Statistical Analysis. The Student *t* test was used to examine significant differences in Q-cell migration between WT and migration mutants as indicated in the figure legends.

Quantification of Relative Position of Q Cells. The positions of the Q-cell progenies in adult *C. elegans* reflect the outcomes of Q-cell migration. We thus quantified the final positions of Q-cell progenies in the adult stage. We chose three nonmotile cells, URX, PLM, and PVM, which can be labeled by either P*mec-4::gfp* or P*gcy-32::mCherry*, as fiduciary markers (Fig. S3*A*). For example, the relative position of AQR is calculated as the distance between URX and AQR divided by the distance between URX and PLM (Fig. S3*A*).

LIN-39 and MAB-5 Binding Peaks Display. IGB (Integrated Genome Browser 6.7.3) was used to analyze LIN-39 and MAB-5 binding peaks to *mig-13* or *lin-39* promoters. The ChIP-Seq data were downloaded from the modENCODE Consortium (www.modencode.org).

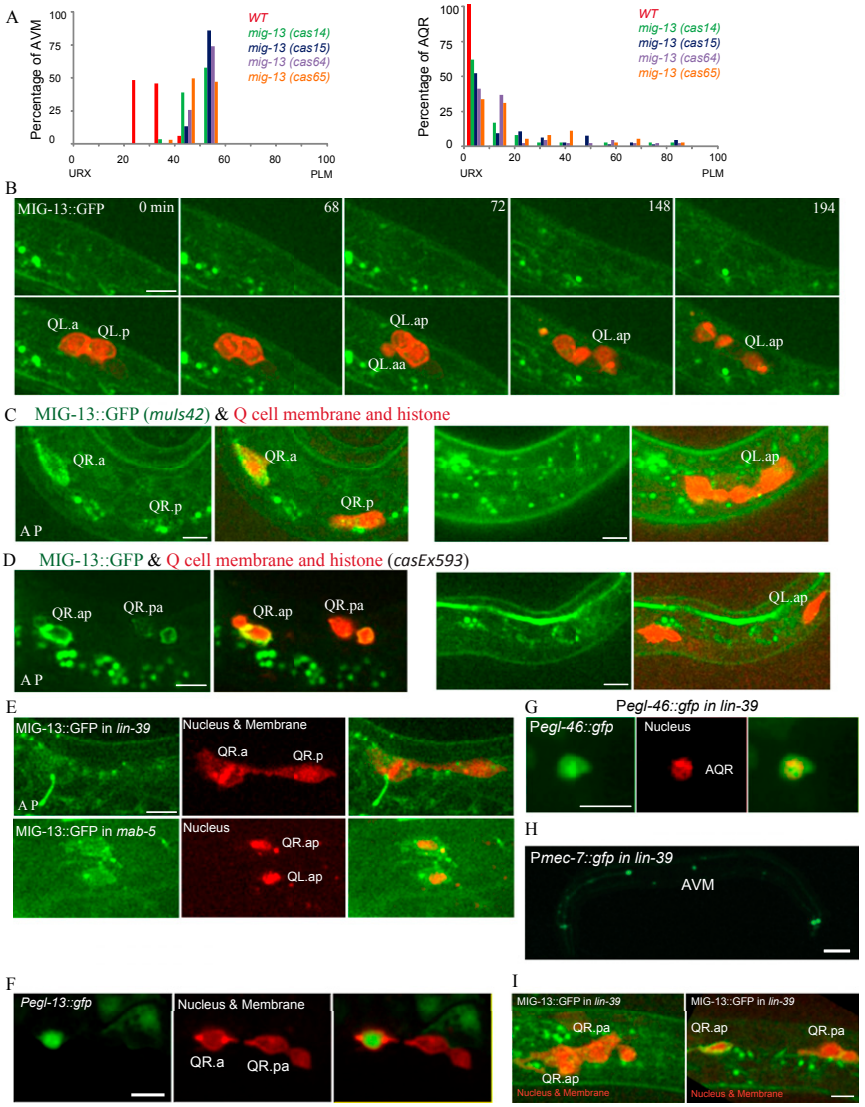


Fig. S1. MIG-13 and LIN-39 expression and localization in Q-cell lineage. (*A*) AVM (*Left*) and AQR (*Right*) migration defects in four new alleles of *mig-13*. n = 23–47. Quantifications are described in Fig. S3*A* and *Materials and Methods*. (*B–D*) Still images of MIG-13::GFP in Q cells using different strains: *muIs62* (*B*), *muIs42* (*C*), and *casEx593* (*D*). Time on the *Right* top is in minutes. (*E*) MIG-13::GFP expression in *lin-39* (*n1760*, *Upper*) and *mab-5* (*e2088*, *Lower*) mutants. (*F*) P*egl-13::gfp* expression pattern (green) in the Q-cell (mCherry, red) lineages. (Scale bar, 5 μm.) (*G* and *H*) The expression of P*egl-46* (*G*) and P*mec-7* (*H*) in *lin-39 (n1760)* mutants. (Scale bars: in *B–G*, 5 μm; in *H*, 50 μm.) (*I*) MIG-13::GFP in *lin-39* (*n1760*) mutants. In QR.ap (AQR) without MIG-13::GFP, QR.ap stayed close to QR.pa (mother cell of AVM) (*Left*), whereas QR.ap with MIG-13::GFP was more anterior than QR.pa (*Right*).

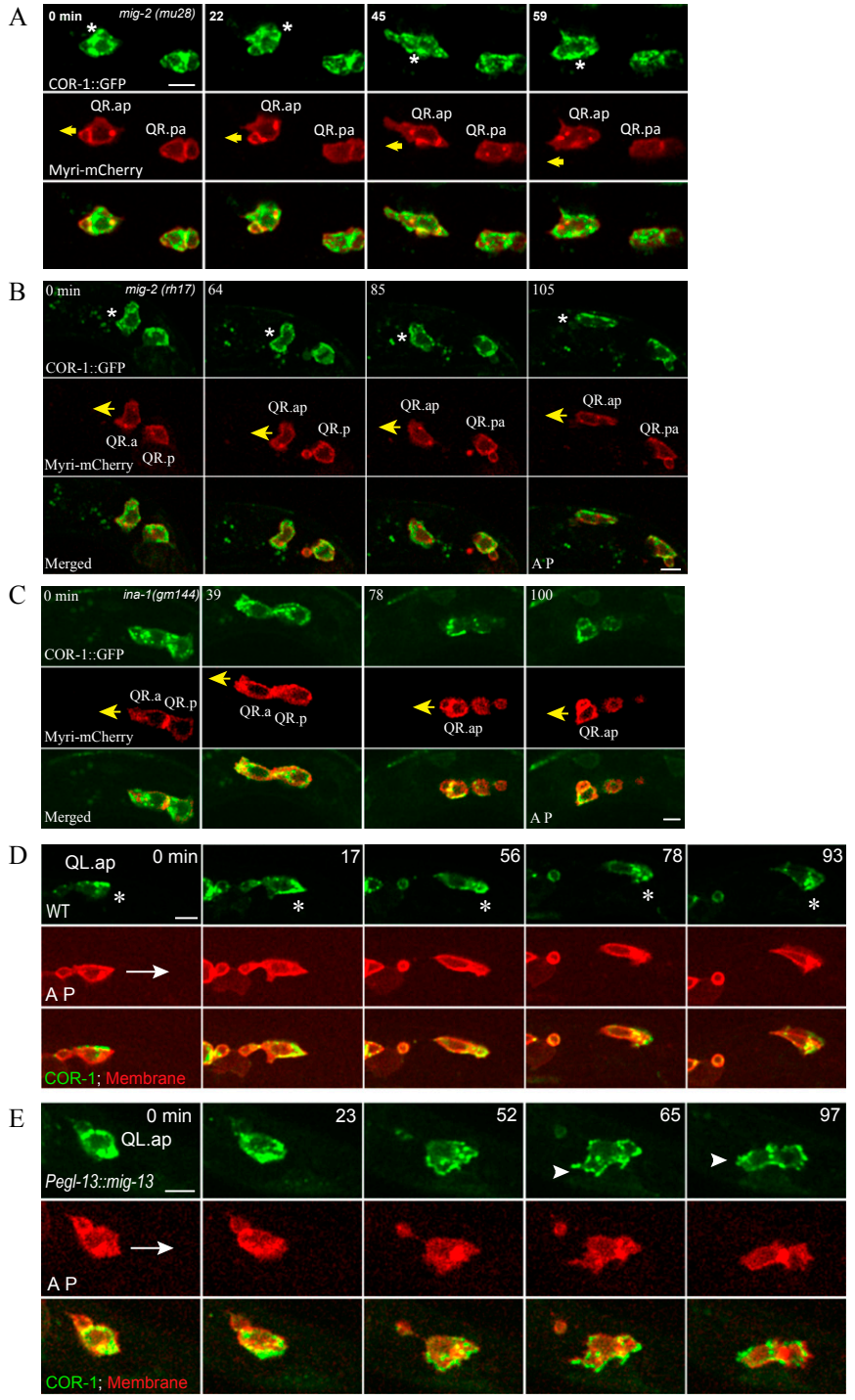


Fig. S2. COR-1::GFP localization in *mig-2 (mu28* null allele*), mig-2 (rh17* gain of function allele*),* or *ina-1 (gm144)* mutants or *mig-13* ectopic expression animals (P*egl-13::mig-13*). (*A* and *B*) COR-1::GFP localization in QR descendants of *mig-2 (mu28* null*)* (*A*), *mig-2 (rh17 gf)* (*B*), and *ina-1 (gm144)* (*C*) mutants. The yellow arrows in *A*–*C* show the anterior direction in which QR.ap normally polarizes. The white asters in *A* show the abnormal distribution of COR-1::GFP in QR.x. (*D* and *E*) Still images show the localization of *casIs49* [COR-1::GFP] during QL.ap migration in WT (*D*) or with *mig-13* ectopic expression (P*egl-13::mig-13*) (*E*). COR-1::GFP is labeled by GFP (*Top*). Q-cell plasma membrane and chromosomes are visualized with mCherry (*Middle*). The merged images are at *Bottom*. The white arrows in *D* and *E* show that the posterior direction that QL.ap normally migrates. The white asters in *D* show the asymmetric distribution of COR-1::GFP in the leading edge of migrating QL.ap. The white arrowhead in *E* indicates the mislocalization of COR-1::GFP opposite to the direction of QL.ap. The cell name is adjacent. The anterior of the cell is on the *Left*. Time is in minutes. (Scale bar, 5 μm.)

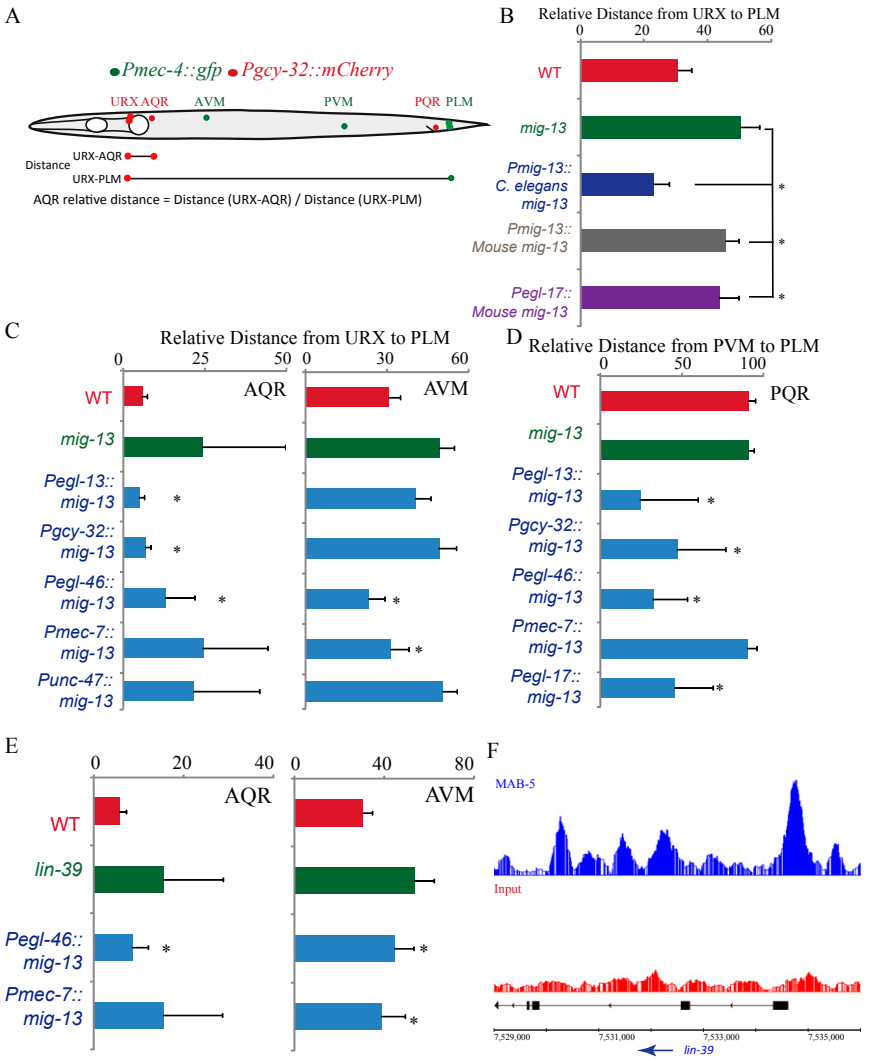


Fig. S3. Statistical analysis of Q-cell migration in WT and mutants. (*A*) Schematics of quantifications of the position of Q-cell descendants in adult *Caenorhabditis elegans* (see *Materials and Methods* for details). AQR position is illustrated as an example. (*B*) AVM position in WT, *mig-13(mu225)*, and *mig-13* rescue experiments with *C. elegans* or *Mus musculus mig-13*. (*C*) AQR (*Left*) and AVM (*Right*) and (*D*) PQR position in *mig-13* cell type-specific rescue animals. (*E*) AQR (*Left*) and AVM (*Right*) position in *lin-39* mutants and the cell type-specific expression of *mig-13* in *lin-39 (n1760)* animals. Data in *B*, *C* and *D*, and *E* are the same as the data in Figs. 1*E*, 2 *B–D*, and 4*D*. Data shown are the mean ± SD, $n = 20–100$ per group in a single experiment. *$P < 0.01$ by Student *t* test. (*F*) ChIP-seq data of MAB-5 binding site in the *lin-39* promoter (*Top*, blue). The input is in the *Middle*, red; the *lin-39* gene model on the *Bottom*, black.

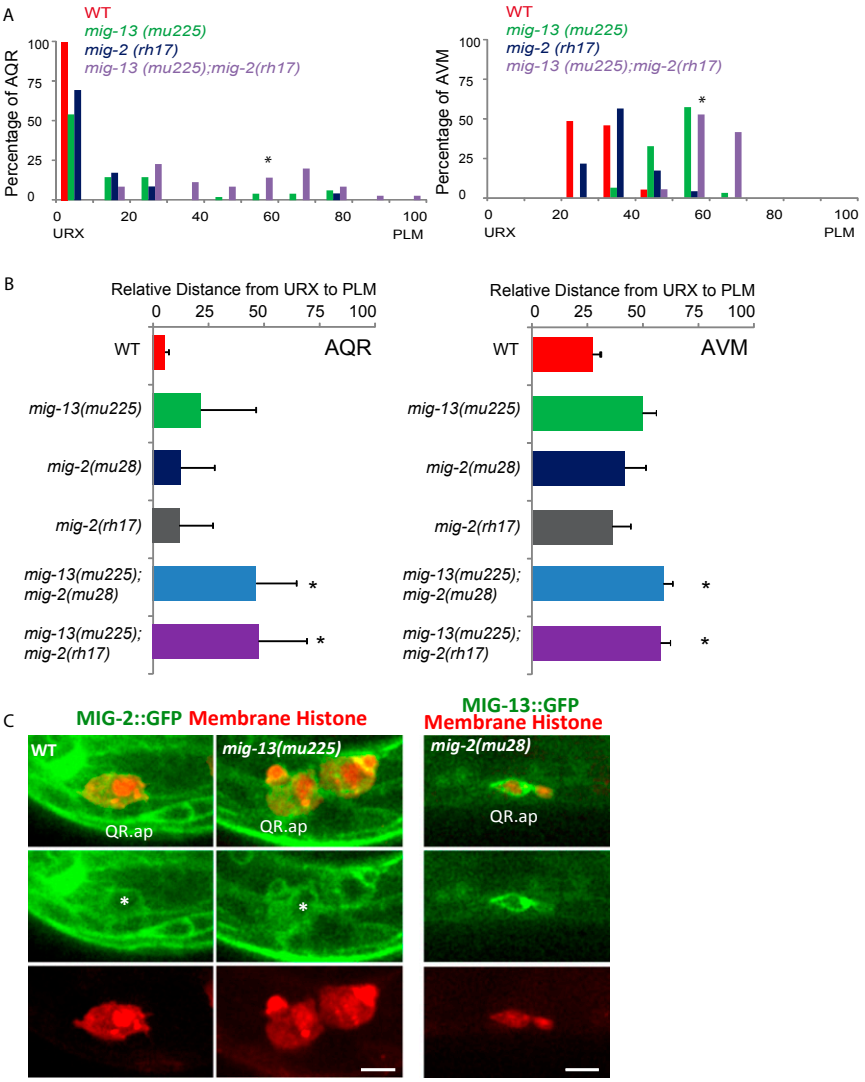


Fig. S4. Genetic interactions between *mig-2* and *mig-13*. (*A*) Quantifications of AQR and AVM positions in *mig-13* and *mig-2*-related genetic backgrounds (indicated on *Top Right*). (*B*) Statistical analysis of AQR and AVM positions in the single or double mutants of *mig-13* or *mig-2*. (*C*) The expression of P*mig-2::mig-2::gfp* in WT and *mig-13* mutants (*Left*) or P*mig-13::mig-13::gfp* in *mig-2* mutants (*Right*). (Scale bar, 5 μm.)

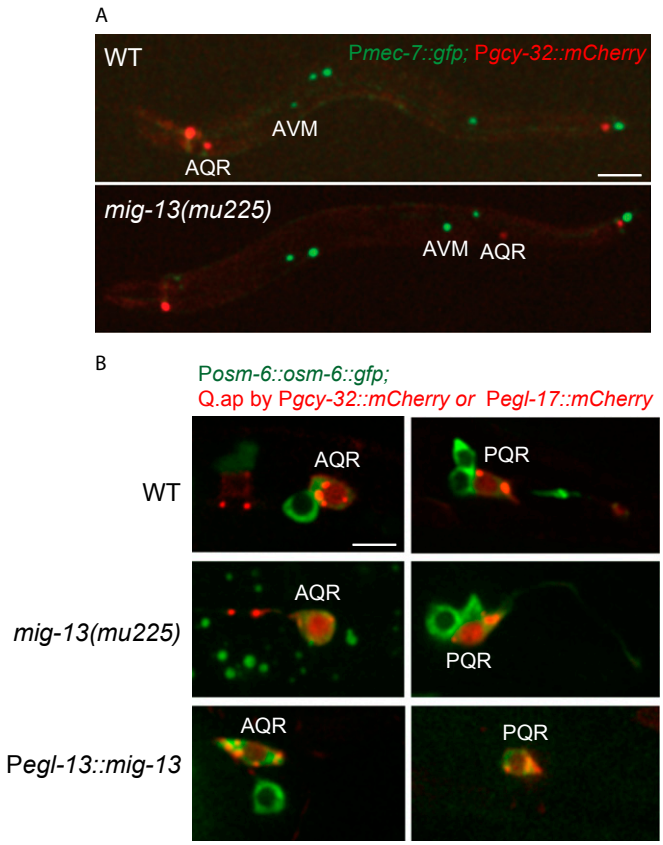


Fig. S5. Q-cell fate in WT and *mig-13*-related mutants. (*A*) The expression of P*mec-7::gfp* and *Pgcy-32::mCherry* in WT and *mig-13* mutants (*Left*). (Scale bar, 50 μm.) (*B*) The expression of P*osm-6::osm-6::gfp* in WT and *mig-13* loss or gain-of function mutants (*Left*). (Scale bar, 5 μm.)

Table S1. *C. elegans* strains used in this study

Strain name	Genotype	Method	Resource	Reference
GOU246	*zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry];*him-5*(*e1490*)	Injection and cross	CGC and this study	Fig. 1*C*
GOU191	*mig-13*(*cas14*); *zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]	EMS	This study	Fig. 1*D* and Fig. S1*A*
GOU192	*mig-13*(*cas15*); *zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]	EMS	This study	Fig. 1*D* and Fig. S1A
GOU655	*mig-13*(*cas64*); *zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]	EMS	This study	Fig. 1*D* and Fig. S1*A*
GOU656	*mig-13*(*cas65*); *zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]	EMS	This study	Fig. 1*D* and Fig. S1*A*
CF726	*mig-13*(*mu225*)		CGC	Fig. 1*E*
CF1295	*mig-13*(*mu225*);*lin-15B(n765)*;*muIs62*[*MIG-13::GFP + lin-15(+)*]		CGC	Fig. 1*F*
GOU649	*casEx593*[*Pmig-13::MIG-13::TEV-S::GFP::mig-13_3′UTR+unc-76(+);* P*egl-17::Myri-mcherry::pie-1 3′UTR;Pegl-17::mcherry-TEV-S::his-24*]; *unc-76*(*e911*)	Injection	This study	Fig. S1*D* and Movie S2
GOU648	*casEx790[Pmig-13::mouse_MIG-13::GFP,pRF4];mig-13(mu225); zdIs5[Pmec-4::GFP]*	Injection	CGC and this study	Fig. 1*E* and Fig. S3*B*
GOU646	*casEx788[Pegl-17::mouse_MIG-13::GFP,pRF4];mig-13(mu225); zdIs5[Pmec-4::GFP]*	Injection	CGC and this study	Fig. 1*E* and Fig. S3*B*
GOU263	*muIs62*[*MIG-13::GFP + lin-15(+)*]; *rdvIs1[*P*egl-17::Myri-mcherry::pie-13′UTR,* P*egl-17::mig-10::YFP::unc-543′UTR, Pegl-17::mcherry-TEV-S::his-24,pRF4]*	Cross	CGC and this study	Fig. 1 *F* and *G*, Fig. S1*B*, and Movie S1
GOU560	*muIs42*[*MIG-13::GFP + lin-15(+)*]; *rdvIs1[*P*egl-17::Myri-mcherry::pie-13′UTR,* P*egl-17::mig-10::YFP::unc-543′UTR, Pegl-17::mcherry-TEV-S::his-24,pRF4]*	Cross	CGC and this study	Fig. S1*C*
GOU644	*lin-39(n1760);zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]	Cross	CGC and this study	Fig. 4*D* and Fig. S3*E*
GOU652	*lin-39(n1760);zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]; *casEx600*[*Pegl-46::mig-13*]	Injection and cross	CGC and this study	Fig. 4*D* and Fig. S3*E*
GOU653	*lin-39(n1760);zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]; *casEx1129*[*Pmec-7::mig-13::GFP*]	Injection and cross	CGC and this study	Fig. 4*D* and Fig. S3*E*
GOU536	*lin-39(n1760); rdvIs1[Pegl-17::Myri-mcherry::pie-1 3′UTR, Pegl-17::mig-10::YFP::unc-54 3′UTR,Pegl-17::mcherry-TEV-S::his-24, pRF4]; muIs62*[*MIG-13::GFP + lin-15(+)*]	Cross	CGC and this study	Fig. 1*G* and Fig. S1*E*
GOU680	*mab-5(e2088); muIs62[MIG-13::GFP]; casIs131[Pegl-17::mcherry::zen-4]*	Injection and cross	CGC and this study	Fig. 1*G* and Fig. S1*E*
GOU745	*mig-14(mu71); muIs62[MIG-13::GFP]; casIs131[Pegl-17::mcherry::zen-4]*	Injection and cross	CGC and this study	Fig. 1*G*
GOU650	*casEx779*[P*egl-13::mig-13*];*mig-13(cas15);zdIs5*[P*mec-4*::GFP]; *casIs35*[P*gcy-32*::mCherry]	Injection	This study	Fig. 2 *B–D* and Fig. S3 *C* and *D*
GOU551	*casEx596*[*Pgcy-32::mig-13*];*mig-13(cas15);zdIs5*[P*mec-4*::GFP]; *casIs35*[P*gcy-32*::mCherry]	Injection	This study	Fig. 2 *B–D* and Fig. S3 *C* and *D*
GOU544	*casEx600*[*Pegl-46::mig-13*];*mig-13(cas15);zdIs5*[P*mec-4*::GFP]; *casIs35*[P*gcy-32*::mCherry]	Injection	This study	Fig. 2 *B–D* and Fig. S3 *C* and *D*
GOU651	*casEx1129*[*Pmec-7::MIG-13::GFP*];*mig-13(cas15);zdIs5*[P*mec-4*::GFP]; *casIs35*[P*gcy-32*::mCherry]	Injection	This study	Fig. 2 *B–D* and Fig. S3 *C* and *D*
GOU347	*casIs49[Pegl-17::Myri-mcherry::pie-1 3′UTR, Pegl-17:: COR-1::GFP::unc-54 3′UTR, Pegl-17::mcherry-TEV-S:: his-24]*	Injection and integration	This study	Fig. 3 *A*, *D*, and *E*, and Movies S3 and S8
GOU422	*mig-13(cas15);casIs49[Pegl-17::Myri-mcherry::pie-1 3′UTR, Pegl-17::COR-1::GFP::unc-54 3′UTR,Pegl-17::mcherry-TEV-S:: his-24]*	Cross	This study	Fig. 3 *B*, *D*, and *E*, and Movie S7
GOU482	*casIs126[Pegl-13::mig-13]; casIs49[Pegl-17::Myri-mcherry::pie-1 3′UTR, Pegl-17::COR-1::GFP::unc-54 3′UTR,Pegl-17::mcherry-TEV-S::his-24]*	Cross	This study	Fig. 3 *C–E*, Fig. S2*E*, and Movie S9
GOU785	*casIs131[Pegl-17::mcherry::zen-4]; wgIs18[*LIN-39::GFP*]*	Injection and cross	CGC and this study	Fig. 5 *A* and *B*, Movies S11 and S12
GOU855	*casEx831[Pmec-7::lin-39::GFP]; zdIs5*[P*mec-4*::GFP];*casIs35* [P*gcy-32*::mCherry]	Injection and cross	This study	Fig. 5 *C* and *D*
GOU856	*casEx832[Pgcy-32::lin-39::GFP]; zdIs5*[P*mec-4*::GFP];*casIs35* [P*gcy-32*::mCherry]	Injection and cross	This study	Fig. 5 *C* and *D*
GOU857	*casEx833[Pegl-13::lin-39::GFP] zdIs5*[P*mec-4*::GFP];*casIs35* [P*gcy-32*::mCherry]	Injection and cross	This study	Fig. 5 *C* and *D*
GOU802	*casEx816[dePmig-13A::mig-13::GFP]; mig-13(mu225); zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]	Injection and cross	This study	Fig. 4*C*

Table S1. Cont.

Strain name	Genotype	Method	Resource	Reference
GOU800	*casEx813[dePmig-13B::MIG-13::GFP]; mig-13(mu225); zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]	Injection and cross	This study	Fig. 4*C*
GOU801	*casEx814[dePmig-13C::mig-13::GFP]; mig-13(mu225); zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]	Injection and cross	This study	Fig. 4*C*
GOU854	*casEx828[Del_motif::MIG-13::GFP]; mig-13(mu225); zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]	Injection and cross	This study	Fig. 4*C*
GOU783	*mab-5(e2088); casIs131[Pegl-17::mcherry::zen-4]; wgIs18[LIN-39::GFP]*	Injection and cross	CGC and this study	Fig. 5*B*
GOU786	*mig-14(mu71); casIs131[Pegl-17::mcherry::zen-4]; wgIs18[LIN-39::GFP]*	Injection and cross	CGC and this study	Fig. 5*B*
GOU350	*mig-2(rh17);casIs49[Pegl-17::Myri-mcherry::pie-1 3′UTR, Pegl-17::COR-1::GFP::unc-54 3′UTR, Pegl-17::mcherry-TEV-S::his-24]*	Injection and integration	CGC and this study	Fig. S2*B* and Movie S5
GOU420	*ina-1(gm144),casIs48[Pegl-17::Myri-mcherry::pie-1 3′UTR, Pegl-17::COR-1::GFP::unc-54 3′UTR, Pegl-17::mcherry-TEV-S::his-24]*	Injection and integration	CGC and this study	Fig. S2C and Movie S6
GOU746	*casEx788*[P*egl-17::mig-13::GFP*];*mig-13(mu225)*; *zdIs5*[P*mec-4*::GFP];*casIs35*[P*gcy-32*::mCherry]	Injection and cross	This study	Fig. S3*D*
GOU944	*casEx5002[Punc-47::MIG-13::GFP]; zdIs5*[P*mec-4*::GFP]; *mig-13(mu225) casIs35*[P*gcy-32*::mCherry]	Injection and cross	CGC and this study	Fig. 2 *B* and *C*, and Fig. S3*C*
GOU945	*casEx5003[Punc-47::MIG-13::GFP]; zdIs5*[P*mec-4*::GFP]; *mig-13(mu225) casIs35*[P*gcy-32*::mCherry]	Injection and cross	CGC and this study	Fig. 2 *B* and *C*, and Fig. S3*C*
GOU890	*mig-2(mu28);casIs49[Pegl-17::Myri-mcherry::pie-1 3′UTR, Pegl-17:: COR-1::GFP::unc-54 3′UTR, Pegl-17::mcherry-TEV-S:: his-24]*	Injection and cross	CGC and this study	Fig. S2*A* and Movie S4
GOU971	*mig-2(mu28) casIs35*[P*gcy-32*::mCherry]; *zdIs5*[P*mec-4*::GFP]	Cross	CGC and this study	Fig. 3*F* and Fig. S4 *A* and *B*
GOU976	*mig-2(mu28) mig-13(mu225) casIs35*[P*gcy-32*::mCherry]; *zdIs5*[P*mec-4*::GFP]	Cross	CGC and this study	Fig. 3*F* and Fig. S4*B*
GOU1004	*mig-2(rh17) casIs35*[P*gcy-32*::mCherry]; *zdIs5*[P*mec-4*::GFP]	Cross	CGC and this study	Fig. S4 *A* and *B*
GOU1005	*mig-2(rh17) mig-13(mu225) casIs35*[P*gcy-32*::mCherry]; *zdIs5*[P*mec-4*::GFP]	Cross	CGC and this study	Fig. S4 *A* and *B*
GOU1006	*mig-2(mu28) casIs35*[P*gcy-32*::mCherry]*; casIs222[Pmig-13:: MIG-13::MYC::GFP Pegl-17 > Myri-mcherry > pie-1 3′UTR, Pegl-17 > mcherry-TEV-S::his-24]*	Injection, integration, and cross	CGC and this study	Fig. S4*C*
GOU963	*mig-13(mu225) casIs35*[P*gcy-32*::mCherry]*; muIs28[MIG-2::GFP];*	Cross	CGC and this study	Fig. S4*C*
GOU988	*lin-39(n1760); casIs48[Pegl-17::Myri-mcherry::pie-1 3′UTR, Pegl-17:: COR-1::GFP::unc-54 3′UTR, Pegl-17::mcherry-TEV-S:: his-24]; rdvIs1*[P*egl-17::Myri-mcherry::pie-13′UTR,*P*egl-17::mig-10:: YFP::unc-54 3′UTR, Pegl-17::mcherry-TEV-S::his-24,pRF4]*	Cross	CGC and this study	Fig. 4*A* and Movie S10
GOU953	*lin-39(n1760); muIs32[Pmec-7::GFP];*	Cross	CGC and this study	Fig. S1*H*
GOU954	*lin-39(n1760); casEx1115[Pegl-46::GFP]*	Cross	CGC and this study	Fig. S1*G*
GOU949	*mig-13(mu225) casIs35*[P*gcy-32*::mCherry]*; muIs32[Pmec-7::GFP];*	Cross	CGC and this study	Fig. S5*A*
GOU955	*mig-13(mu225) casIs35*[P*gcy-32*::mCherry]*; mnIs17[osm-6::GFP unc-36(+)]*	Cross	CGC and this study	Fig. S5*B*
GOU978	*casIs179[Pegl-46::MIG-13, Pegl-17::Myri-mcherry::pie-1 3′UTR, Pegl-17::mcherry-TEV-S:: his-24]; mnIs17[osm-6::GFP unc-36(+)]*	Injection and cross	CGC and this study	Fig. S5*B*

Strains carrying extrachromosome arrays were exposed to gamma-ray irradiation for integration and were backcrossed with wild-type N2 animals at least three times. *rdvIs1* (Q cell membrane and nuclei marked with mCherry) was constructed previously (1). CGC, *Caenorhabditis* Genetics Center; EMS, ethyl methanesulfonate.

1. Ou G, Stuurman N, D'Ambrosio M, Vale RD (2010) Polarized myosin produces unequal-size daughters during asymmetric cell division. *Science* 330(6004):677–680.

Table S2. PCR products for *C. elegans* transgenesis

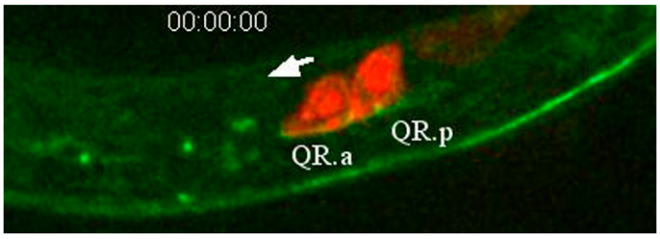
PCR product	Primer 5′	Primer 3′	Template	Reference
egl-17 promoter	cagatggatg tttactgcca actgg	agctcacatt tcgggcacct gaa	N2 genomic DNA	
myr-mCherry	caggtgcccgaaatgtgagct atgggttcct gtattggaaa agtctc	ctaaagggaa caaaagctgg agc	pJWZ50.3	
P_{egl-17} *myr-mCherry*	cttccgttct atggaacact c	gaatcatcgt tcacttttca cgg	*egl-17* promoter and MYR-mCherry	Fig. 3 *A* and *D*, and Figs. S1*D* and S2*C*
P_{egl-17} *mCherry::his-24*	cttccgttct atggaacact c	gaagacgttg aacgtcaaat tatc	*egl-17* promoter and mCherry + his-24	Fig. 3 *A* and *D*, and Figs. S1*D* and S2*C*
P_{gcy-32}	cacattatatacgatcgaggcatg	caccctttgagaccattctat aatacaatcgtgatcttcg	N2 genomic DNA	
mCherry	atggtctcaaagggtgaagaagataac	AAGGGCCCGTACGGCCGACTAGTAGG	pPD49.26-mCherry	
mig-13+3′UTR	CCAGCATGAGCCGTAGACGAA tgactaaactactcatagc	ataaacgaattcaatgcgac	N2 genomic DNA	
P_{egl-13}	TCACCTGCCCCGACATTA	TCGTCTACGGCTCATGCTGG	N2 genomic DNA	
P_{egl-13}*::mig-13*	GAGTGTGTGACACCTTGAG	ataaacgaattcaatgcgac	*mig-13+3′UTR* and P_{egl-13}	Fig. 2 *B–D* and Fig. S3 *C* and *D*
cor-1+3′UTR	ACATGGACAGCGGAGGTGGAGGTACTAT GGCGCAAATCGTCCGGCAGAG	CCATTTATTAGGTTGCAATAC	N2 genomic DNA	
P_{egl-17}*::cor-1*	CTTCCGTTCTATGGAACACTC	GGTTGCAATACAATACAACACAC	*cor-1+3′UTR and* P_{egl-17}	Fig. 3 *A–E* and Fig. S2 *A–D* and Movies S3 and S7
P_{mec-7}	ggtggagaacgtcatgaaattacg	gttgcttgaaatttggaccc	N2 genomic DNA	
P_{mig-13}	tctctgcagtgttacacg	ttcctactgtccaaaccg	N2 genomic DNA	
P_{unc-47}	CGCGGTTTTGGCGCG gtttcccggagtctacgc	gagtagtttagtcatctgt aatgaaataaatgtgacgc	N2 genomic DNA	

Table S3. Plasmids constructed for *C. elegans* transgenesis

Plasmid name	Primer 5′	Primer 3′	Notes	Reference
pPD95.77-P*egl-17*::GFP	TTTTTCTACCGGTACC CTCAAGGG	AGACCCAAGCTTGGTACCAT GAGTAAAGGAGAAGAACTTTTCAC	P*egl-17* sequence was amplified from N2 genomic DNA and inserted into pPD95.77 plasmid via In-fusion advantage PCR cloning kit	
pPD95.77-P*egl-17*:: mouse_*mig-13*_cDNA1::GFP	ccagcgacgggccatagctca catttcgggcacctgaa	taagaacaaccgctgATGA GTAAAGGAGAAGAAC	Mouse_*mig-13* cDNA1 was amplified from mouse cDNA library and inserted into pPD95.77-P*egl-17*::GFP via In-fusion advantage PCR cloning kit	
pPD95.77-P*egl-17*:: mouse_*mig-13*_cDNA::GFP	ccactgtaagaacaaccgctg	gctttgctgctgtgtATG AGTAAAGGAGAAGAAC	Mouse_*mig-13* cDNA2 was amplified from mouse cDNA library and inserted into pPD95.77-P*egl-17*:: mouse_*mig-13*_cDNA1:: GFP via In-fusion advantage PCR cloning kit	Fig. 1*E* and Fig. S3*B*
pCF95-P*mig-13*:: mouse_*mig-13*_cDNA::GFP	ccagcgacgggccattacct gaaattctgaattaaatg	GTACCGGTAGAAAAA ccctgacactaagtt	Mouse_*mig-13* cDNA was amplified from pPD95.77-P*egl-17*:: mouse_*mig-13*_cDNA::GFP and inserted into pCF95 via In-fusion advantage PCR cloning kit	Fig. 1*E* and Fig. S3*B*
pPD49.26-P*mig-13*::mig-13	cgtgtaacactgcagaga TGCAAGCTTGGCGTAATC	gtcgcattgaattcgtttat GACGGTACCATGGTATTG	*Pmig-13::mig-13* sequence was amplified from N2 genomic DNA and inserted into pPD49.26 plasmid via In-fusion advantage PCR cloning kit	
pPD49.26-P*gcy-32*::mig-13	cgattgtattatagaat gactaaactactcatagc	atcgtatataatgtg TGCAAGCTTGGCGTAATC	P*gcy-32* sequence was amplified from N2 genomic DNA and inserted into pPD49.26-P*mig-13*:: mig-13 plasmid via In-fusion advantage PCR cloning kit	Fig. 2 *B–D* and Fig. S3 *C* and *D*
pPD49.26-P*egl-46*::mig-13	ggaaaacatctggaa TGCAAGCTTGGCGTAATC	tgatttcagaaggccA tgactaaactactcatagc	P*egl-46* sequence was amplified from N2 genomic DNA and inserted into pPD49.26-P*mig-13*::mig-13 plasmid via In-fusion advantage PCR cloning kit	Figs. 2 *B–D* and 4*D*, and Fig. S3 *C* and *D*
pPD49.26-P*mig-13*::mig-13:: TEV-S::GFP_mig-13_3′UTR	gagtagattacgatgtacatc	GATGAACTATACAAAtaaaat ctgttctttaattttc	TEV-S::GFP was amplified by soeing PCR and inserted into pPD49.26-P*mig-13*:: mig-13 via In-fusion advantage PCR cloning kit	Fig. S1*D*
pPD49.26-P*mec-7*::mig-13:: TEV-S::GFP_mig-13_3′UTR	atgacgttctccacc TGCAAGCTTGGCGTAATC	caaatttcaagcaacAt gactaaactactcatagc	P*mec-7* sequence was amplified from N2 genomic DNA and inserted into pPD49.26-P*mig-13*::mig-13::TEV-S:: GFP_mig-13_3′UTR	Fig. 2 *B–D* and 4*D*, and Fig. S3 *C* and *D*
pPD95.77-*DePmig-13A*:: mig-13::GFP	AGGTGACCACCACAAACACC GTTTCTTTTTGTTCAAC	TTGTGGTGGTCACCTGTCGA	pCF95(MIG-13::GFP) plasmid was used to amplify sequence deleting Pmig-13A. then it was circled by In-fusion advantage PCR cloning kit	Fig. 4*C*

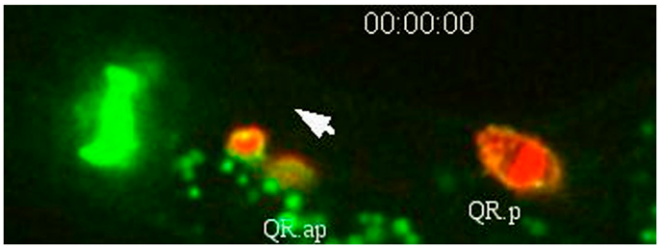
Table S3. Cont.

Plasmid name	Primer 5′	Primer 3′	Notes	Reference
pPD95.77-*DePmig-13B*:: mig-13::GFP	TAGTGTGGTGATAACGAAG AAGGGGGGGGGGTCTA	GTTATCACCACACTAGAAG	pCF95(MIG-13::GFP) plasmid was used to amplify sequence deleting P*mig-13B*. then it was circled by In-fusion advantage PCR cloning kit	Fig. 4*C*
pPD95.77-*DePmig-13C*:: mig-13::GFP	CCTCTCCCTTGTTAGTCATA ATTCCTAGGCCAGGG	CTAACAAGGGAGAGGTCTATG	pCF95(MIG-13::GFP) plasmid was used to amplify sequence deleting P*mig-13C*. then it was circled by In-fusion advantage PCR cloning kit	Fig. 4*C*
pPD95.77-*DePmig-13 motif*:: mig-13::GFP	ATCGTATAGTCAATTAATT AGGCCGACTGTCG	AATTGACTATACGATTGA GTGTTAATGTGCCG	pCF95(MIG-13::GFP) plasmid was used to amplify sequence deleting P*mig-13 motif*. then it was circled by In-fusion advantage PCR cloning kit	Fig. 4*C*
pPD95.77-*lin-39*::GFP	ATGACCACATCAACATCACCG	TTCTCCTTTACTCATGAATTGA TTGAAAAGTGGGAACC	*lin-39* cDNA was amplified and inserted into pPD95.77	
pPD95.77-P*mec-7*:: *lin-39*::GFP	GTACCGGTAGAAAAA ttccagatgttttccttccg	TGTTGATGTGGTCATggcct tctgaaatcaaaacg	P*mec-7* was amplified and inserted into pPD95.77-*lin-39*::GFP	Fig. 5 *C* and *D*
pPD95.77-P*gcy-32*:: *lin-39*::GFP	GTACCGGTAGAAAAAcacat tatatacgatcgaggc	TGTTGATGTGGTCAtctata atacaatcgtgatcttcgc	P*gcy-32* was amplified and inserted into pPD95.77-*lin-39*::GFP	Fig. 5 *C* and *D*
pPD95.77-P*egl-13*:: *lin-39*::GFP	GTACCGGTAGAAAAATCA CCTGCCCCGACATTA	TGTTGATGTGGTCATTCGTC TACGGCTCATGCTGG	P*egl-13* was amplified and inserted into pPD95.77-*lin-39*::GFP	Fig. 5 *C* and *D*
pCF95-P*unc-47*:: *MIG-13*::GFP	CGCGCCAAAACCGCG GTCTAGAG	atgactaaactactc atagctctcatcc	P*unc-47* was amplified from N2 genomic DNA and inserted into pCF95	Fig. 2 *B* and *C*, and Fig. S3C



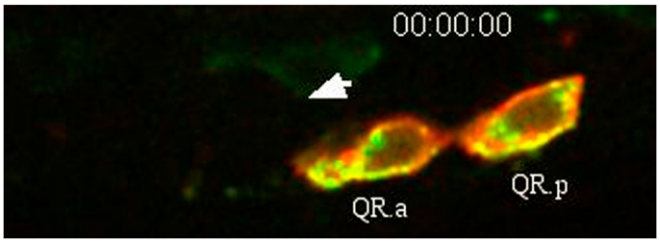
Movie S1. MIG-13::GFP in QR.x migration. Transgenic *C. elegans* strain (GOU263) expressing GFP-tagged MIG-13 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 40 s for 194 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes:seconds.

Movie S1



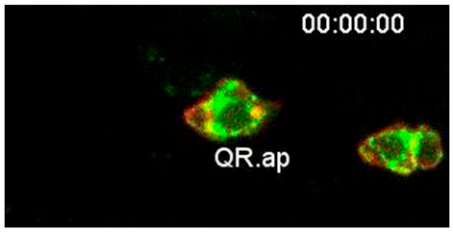
Movie S2. MIG-13::GFP in QR.x migration. Transgenic *C. elegans* strain (GOU649) expressing GFP-tagged MIG-13 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 40 s for 72 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes:seconds.

Movie S2



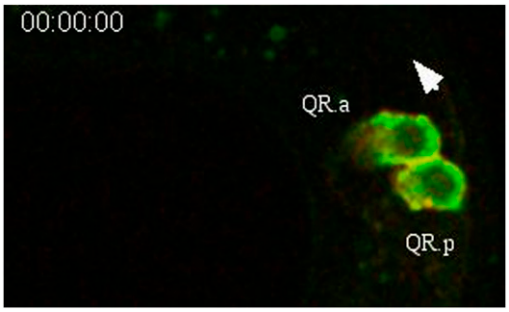
Movie S3. COR-1::GFP in QR.x migration. Transgenic *C. elegans* strain (GOU347) expressing GFP-tagged COR-1 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 60 s for 65 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes:seconds.

Movie S3



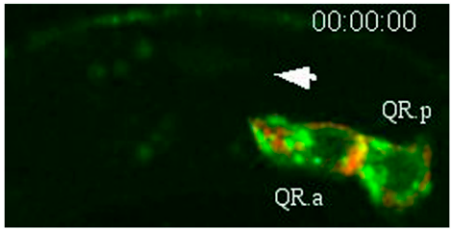
Movie S4. COR-1::GFP in QR.x migration of *mig-2(mu28)* mutant. Transgenic *C. elegans* strain (GOU890) expressing GFP-tagged COR-1 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 60 s for 111 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes:seconds.

Movie S4



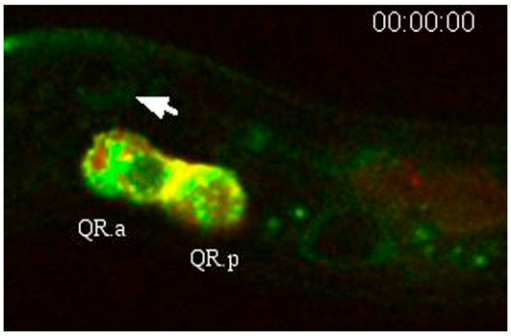
Movie S5. COR-1::GFP in QR.x migration of *mig-2(rh17)* mutant. Transgenic *C. elegans* strain (GOU350) expressing GFP-tagged COR-1 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 40 s for 186 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes: seconds.

Movie S5



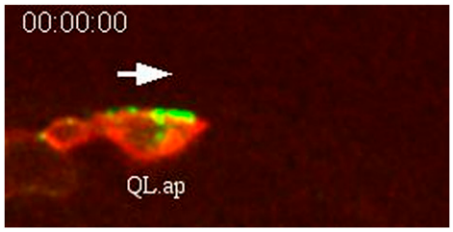
Movie S6. COR-1::GFP in QR.x migration of *ina-1(gm144)* mutant. Transgenic *C. elegans* strain (GOU420) expressing GFP-tagged COR-1 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 60 s for 102 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes: seconds.

Movie S6



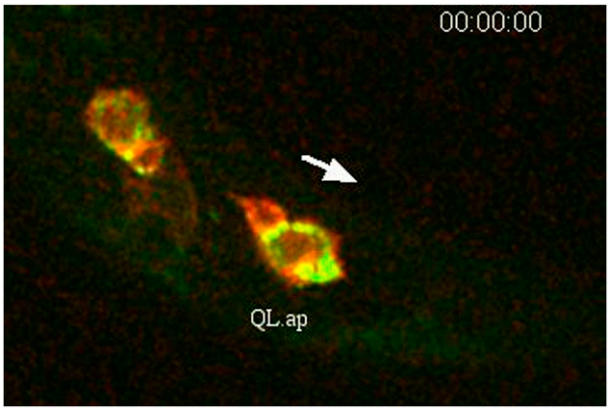
Movie S7. COR-1::GFP in QR.x migration of *mig-13(cas15)* mutant. Transgenic *C. elegans* strain (GOU422) expressing GFP-tagged COR-1 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 60 s for 151 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours: minutes:seconds.

Movie S7



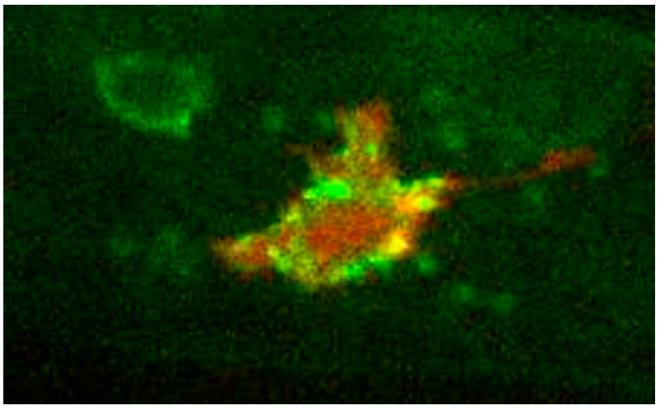
Movie S8. COR-1::GFP in QL.ap migration. Transgenic *C. elegans* strain (GOU347) expressing GFP-tagged COR-1 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 60 s for 90 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes:seconds.

Movie S8



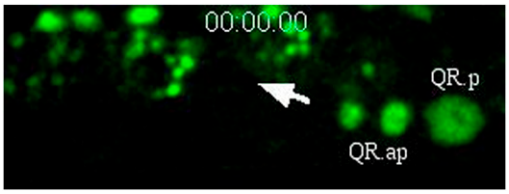
Movie S9. COR-1::GFP in QL.ap migration with *mig-13* ectopic expression. Transgenic *C. elegans* strain (GOU482) expressing GFP-tagged COR-1 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 60 s for 121 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes:seconds.

Movie S9



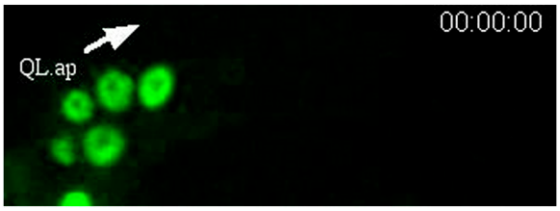
Movie S10. COR-1::GFP during QR.x migration of *lin-39(n1760)* mutant. Transgenic *C. elegans* strain (GOU988) expressing mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 60 s for 61 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes:seconds.

Movie S10



Movie S11. LIN-39::GFP in QR.x migration. Transgenic *C. elegans* strain (GOU785) expressing GFP-tagged LIN-39 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 60 s for 99 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes:seconds.

Movie S11



Movie S12. LIN-39::GFP in QL.x migration. Transgenic *C. elegans* strain (GOU785) expressing GFP-tagged LIN-39 (green) and mCherry in Q cells (red). Images were taken by time-lapse fluorescence microscope (Axio Observer Z1 microscope; Carl Zeiss) attached to a spinning disk confocal scan head (Yokogawa CSU-X1 Spinning Disk Unit). The arrow in the first frame shows the WT migration direction. Cell names are adjacent. The anterior of the animal is toward the *Left*. Frames were taken every 60 s for 135 min. The display rate is 7 frames per second. The time stamp on the movie indicates hours:minutes:seconds.

Movie S12