

Table S1. *C. elegans* and bacterial strains, cell lines and antibodies used in the current study.

REAGENT or RESOURCE	SOURCE	IDENTIFIER
Bacterial Strains		
<i>E. coli</i> : Strain OP50	<i>Caenorhabditis Genetics Center (CGC)</i>	WormBase: OP50
Chemicals and Antibodies		
Antibody: anti-HA	Abcam	Abcam ab71113 (Duval et al., 2014)
Antibody: anti-FLAG	Sigma	Sigma F7425 (Lee et al., 2014)
Antibody: anti- β -actin	Santa Cruz	Santa Cruz sc- 47778 (Moloughney et al., 2018)
Experimental Models: Cell Lines		
HEK293	ATCC	ATCC: CRL-1573
Experimental Models: Organisms/Strains		
<i>C. elegans</i> : Strain N2: wild isolate	CGC	WormBase: N2
<i>C. elegans</i> : Strain CB3303: <i>mig-1(e1787) I</i>	CGC	WormBase: CB3303
<i>C. elegans</i> : Strain MT1306: <i>lin-17(n671) I</i>	CGC	WormBase: MT1306
<i>C. elegans</i> : Strain <i>mom-5(ne12) I</i>	lab of Craig Mello	N/A
<i>C. elegans</i> : Strain EW12: <i>mig-14(ga62) II</i>	CGC	WormBase: EW12
<i>C. elegans</i> : Strain RB763: <i>cwn-1(ok546) II</i>	CGC	WormBase: RB763
<i>C. elegans</i> : Strain SU352: <i>mig-5(rh147) II</i>	CGC	WormBase: SU352
<i>C. elegans</i> : Strain MT1215: <i>egl-20(n585) IV</i>	CGC	WormBase: MT1215

<i>C. elegans</i> : Strain <i>vang-1(tm1422)X</i>	Gian Garriga	N/A
<i>C. elegans</i> : Strain <i>vang-1(twn3)X</i>	This paper	N/A
<i>C. elegans</i> : Strain RB1125: <i>vang-1(ok1142) X</i>	CGC	WormBase:RB1125
<i>C. elegans</i> : Strain EW15: <i>bar-1(ga80) X</i>	CGC	WormBase:EW15
<i>C. elegans</i> : Strain RB660: <i>arr-1(ok401) X</i>	CGC	WormBase:RB660
<i>C. elegans</i> : Strain SK1006: <i>zdl5[Pmec-4::GFP] I</i>	CGC	WormBase:SK1006
<i>C. elegans</i> : Strain CF453: <i>mul5[mab-5::GFP + dpy-20(+)]II; dpy-20(e1282)IV</i>	CGC	WormBase:CF453
<i>C. elegans</i> : Strain RDV55: <i>rdv51v [Pegl-17::Myr-mCherry::pie-1 3'UTR + Pegl-17::mig-10::YFP::unc-54 3'UTR + Pegl-17::mCherry-TEV-S::his-24 + rol-6(su1006)]III</i>	CGC	WormBase:RDV55
<i>C. elegans</i> : Strain GR1366: <i>mgl542[Ptph-1::GFP + pRF4(rol-6(su1006))]</i>	CGC	WormBase:GR1366
<i>C. elegans</i> : Strain JJ1992: <i>zul5145[unc-119(+)+Pnmy-2::MOM-5::GFP]</i>	CGC	WormBase:JJ1992
<i>C. elegans</i> : Strain NG4978: <i>zdl5; vang-1(tm1422)</i>	Gian Garriga	N/A
<i>C. elegans</i> : Strain NG6175: <i>zdl5; arr-1(ok401)</i>	Gian Garriga/Jerome	N/A
<i>C. elegans</i> : Strain NG6407: <i>zdl5 mig-1(e1787); arr-1(ok401)</i>	Gian Garriga/Jerome	N/A
<i>C. elegans</i> : Strain CLP293: <i>mul516; rdv51</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP392: <i>zdl5; mig-5(rh147)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP463: <i>zdl5; egl-20(n585); vang-1(tm1422)</i>	This paper	N/A

<i>C. elegans</i> : Strain CLP475: <i>zdis5</i> ; <i>bar-1(ga80)</i> <i>vang-1(tm1422)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP504: <i>zdis5</i> ; <i>cwn-1(ok546)</i> ; <i>rdvIs1</i> ; <i>vang-1(tm1422)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP540: <i>mulIs16</i> ; <i>rdvIs1</i> ; <i>vang-1(tm1422)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP570: <i>mig-1(e1787)</i> ; <i>mulIs16</i> ; <i>rdvIs1</i> ; <i>vang-1(tm1422)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP571: <i>mulIs16</i> ; <i>rdvIs1</i> ; <i>egl-20(n585)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP580: <i>mulIs16</i> ; <i>rdvIs1</i> ; <i>egl-20(n585)</i> ; <i>vang-1(tm1422)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP598: <i>zdis5 mom-5(ne12)/hT2</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP605: <i>zdis5 mom-5(ne12)/hT2</i> ; <i>vang-1(tm1422)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP607: <i>zdis5</i> ; <i>bar-1(ga80)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP652: <i>zdis5</i> ; <i>twnEx230[Pmec-7::gfp::vang-1, Pdpi-30::NLS::DsRed]</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP702: <i>zdis5 mom-5(ne12)/hT2</i> ; <i>zuIs145</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP721: <i>vang-1(tm1422)</i> ; <i>mgIs42</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP734: <i>zdis5 mom-5(ne12)/hT2</i> ; <i>rdvIs1</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP737: <i>zdis5 mom-5(ne12)/hT2</i> ; <i>rdvIs1</i> ; <i>vang-1(tm1422)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP853: <i>zdis5 mig-1(e1787) mom-5(ne12)</i> ; <i>twnEx199[Punc-86::gfp, Pttx-3::gfp]</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP863: <i>zdis5</i> ; <i>mig-5(rh147)/mInI</i> ; <i>vang-1(tm1422)</i>	This paper	N/A

<i>C. elegans</i> : Strain CLP867: <i>zdis5 mig-1(e1787); vang-1(ok1142)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP870: <i>zdis5 mig-1(e1787); twnEx173[Pegl-17::gfp::vang-1, Pgcy-8::mcherry]</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP871: <i>zdis5; twnEx173[Pegl-17::gfp::vang-1, Pgcy-8::mcherry]</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP872: <i>zdis5; arr-1(ok401); twnEx173[Pegl-17::gfp::vang-1, Pgcy-8::mcherry]</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP874: <i>zdis5; mig-14(ga62); vang-1(tm1422); mgIs42</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP875: <i>zdis5 mig-1(e1787) mom-5(ne12); vang-1(tm1422); twnEx199[Punc-86::gfp, Pttx-3::gfp]</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP876: <i>arr-1(ok401); mgIs42</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP877: <i>egl-20(n585); vang-1(tm1422); mgIs42; twnEX340[Punc-86::gfp::vang-1]</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP878: <i>zdis5; twnEx341[Pmec-7::gfp, Pdpi-30::NLS::dsRed](10ng)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP879: <i>zdis5; twnEx342[Pmec-7::gfp, Pdpi-30::NLS::dsRed]</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP930: <i>zdis5; cwn-1(ok546)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP996: <i>egl-20(n585); mgIs42</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP999: <i>mig-1(e1787); vang-1(tm1422); mgIs42</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1000: <i>mig-1(e1787); mgIs42</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1004: <i>egl-20(n585); arr-1(ok401) vang-1(tm1422); mgIs42</i>	This paper	N/A

<i>C. elegans</i> : Strain CLP1005: <i>egl-20(n585); arr-1(ok401); mglIs42</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1018: <i>cwn-1(ok546); egl-20(n585); vang-1(tm1422); mglIs42</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1021: <i>zdlIs5 mig-1(e1787); arr-1(ok401) vang-1(tm1422)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1025: <i>zdlIs5; egl-20(n585); arr-1(ok401); mglIs42</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1041: <i>rdvIs1; zuIs145</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1043: <i>cwn-1(ok546); egl-20(n585); mglIs42</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1063: <i>zdlIs5 mig-1(e1787) lin-17(n671)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1064: <i>zdlIs5 mom-5(ne12)/hT2; arr-1(ok401)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1065: <i>mig-1(e1787); mulIs16; rdvIs1</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1079: <i>zdlIs5 mig-1(e1787) lin-17(n671); vang-1(tm1422)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1081: <i>zdlIs5 mig-1(e1787); twnEx464[Pegl-17::Cas9, Pu6::vang-1(sgRNA)]</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1082: <i>zdlIs5 lin-17(n671)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1089: <i>zdlIs5 lin-17(n671); vang-1(tm1422)</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1096: <i>zdlIs5 mig-1(e1787); rdvIs1; vang-1(twn3) zuIs145</i>	This paper	N/A

<i>C. elegans</i> : Strain CLP1100: <i>rdvIs1</i> ; <i>zuIs145</i> ; <i>tnwEX482[Pegl-17::HA::VANG-1::SL2::BFP]</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1120: <i>rdvIs1</i> ; <i>vang-1(twn3)</i> <i>zuIs145</i>	This paper	N/A
<i>C. elegans</i> : Strain CLP1163: <i>rdvIs1</i> ; <i>arr-1(twn10)</i> <i>zuIs145</i>	This paper	N/A

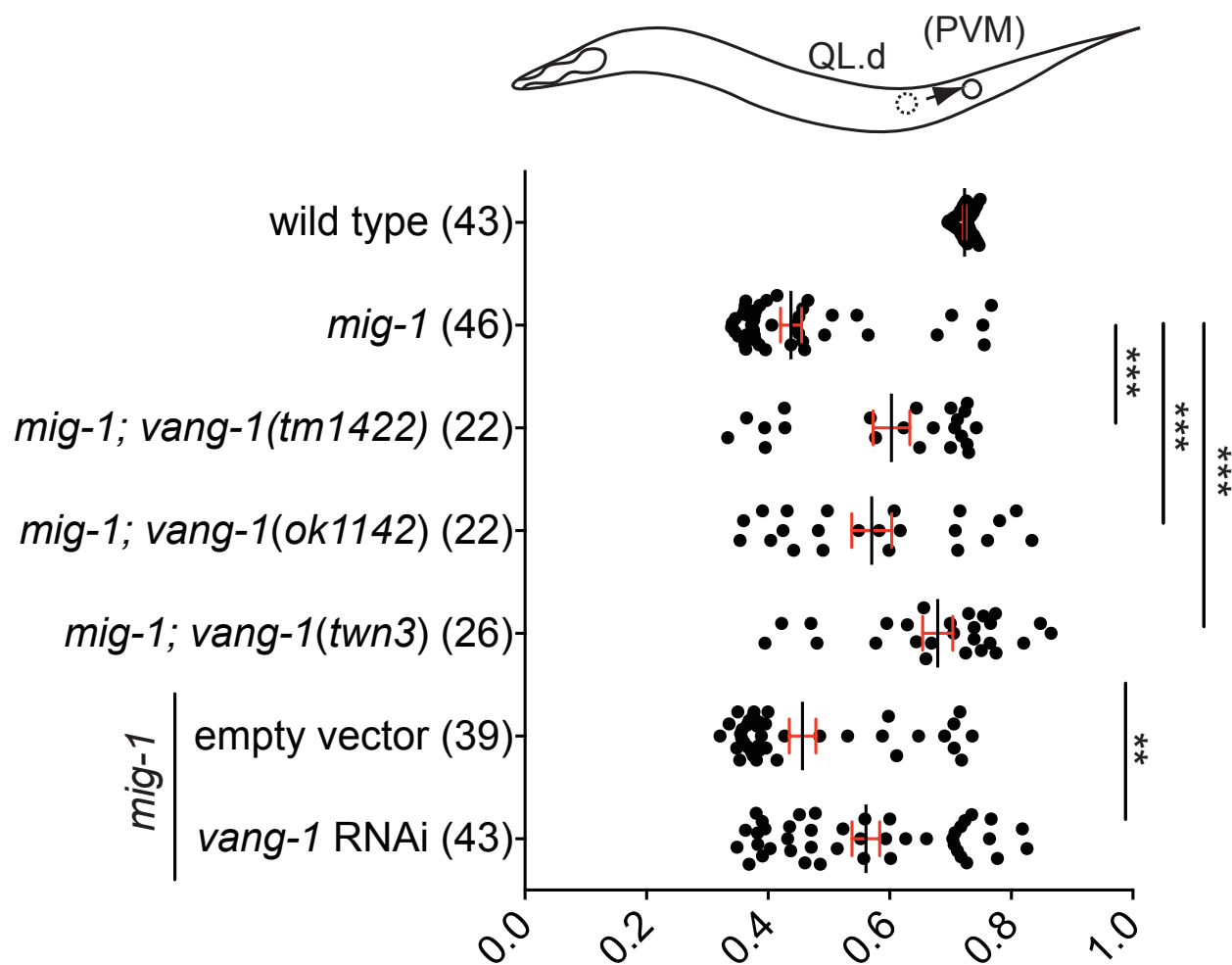
Reference

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Table S2. Sequences of primers used in the cloning of *vang-1*, *mig-1* and *mom-5*.

Primer names	Sequences
pcDNA HA vang-1 KpnI F	GGTACCATGTACCCATACGATGTTCCAGATTAC
pcDNA HA vang-1 Age I R	ACCGGTTCAAACCTGCCGACTCATTGC
kpnI mig-1CRDF	GCTAGCATGAATGAGCAAGGAGCAATTCAAGA
mig-1CRDMF	AATGAGCAAGGAGCAATTCAAGA
mig-1CRDMR	TCTTGAATTGCTCCTTGCTCATT
CRDmig-1MR2	CTGCCCCGTCCACACCAATC
CRDmig-1MF2	ATTGGTGTGGACGGGCAGAATGAGCAAGGAGCAATTCAAGATG
mig-1DeleteCF	CTACGCGTCGACGTTTCGATAGTAAAATAT GATTTTACCGGTACCA G
mig-1DeleteCR	CTGGTACCGGTAAAATCATATTTTACTATCGAAACGTCGACGCGTA G
pcDNA mig-1 BamHI F	GGATCCATGGGACCATTTCGTGGTTACCTCG
mig-1C kpnI FLAG R	GGTACCTTACTTGTCGTCATCGTCTTTGTAGTCTCGAAACGTCGACG CGTAGGTG
pcDNA mig-1 FLAG KpnI F	GGTACCATGGGACCATTTCGTGGTTACC
pcDNA mig-1 FLAG AgeI R	ACCGGT TTA CTTGTCGTCATCGTCTTTGTAGTCAATCATATTATTAG TTCGAAACGTC
Sall MOM-5 R	GTCGACCCTCATATTAACCTGATCAAC
smaI MOM-5 F	CCCGGGATGCATCGACATATTCTGATAT
SallMOM-5 RR	GTCGACGGAGTATAATTGGACTAGTTGTACTC
MOM-5 CRD MR	AGTTGCTCGACTCGCTTCGAGTTGTTGAGAAT
MOM-5 MF	AGCGAGTCGAGCAACTCTAA

A



B

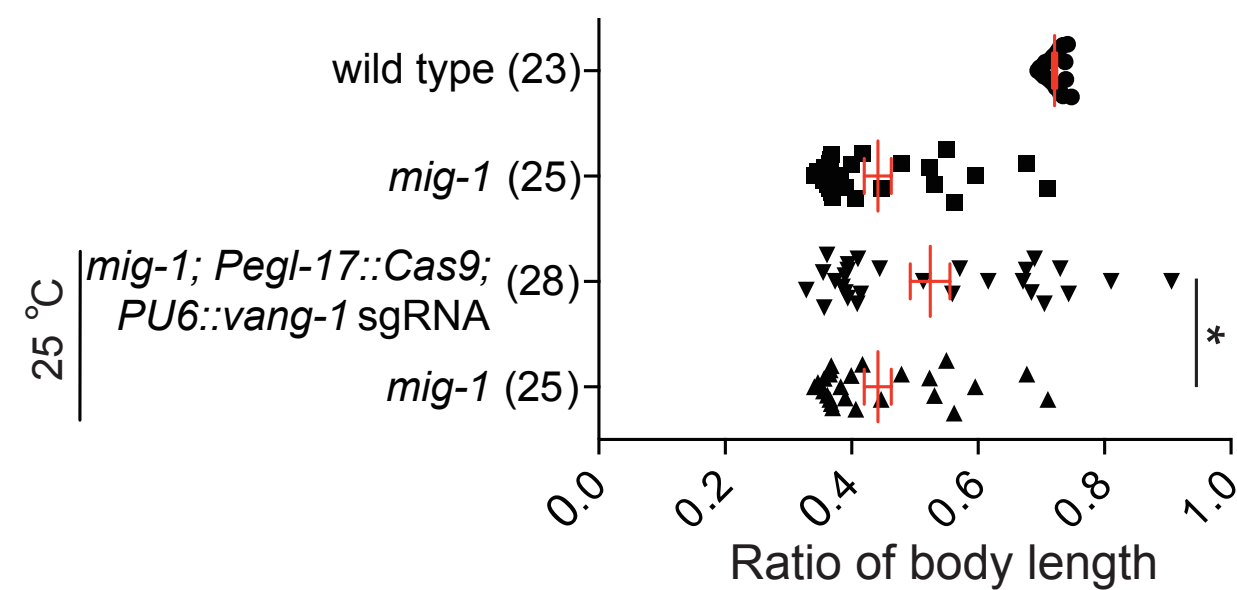


Fig. S1. *vang-1* antagonizes *mig-1* signaling in the migration of QL.d in *C. elegans*.

(A, B) Quantification of PVM positions along the anterior-posterior axis of the worm body. Each dot represents a single PVM neuron, with mean and standard errors of mean (S.E.M.) indicated. N = neurons scored. *, $p < 0.05$, **, $p < 0.01$, ***, $p < 0.001$; one-way ANOVA followed by Bonferroni's multiple comparison test.

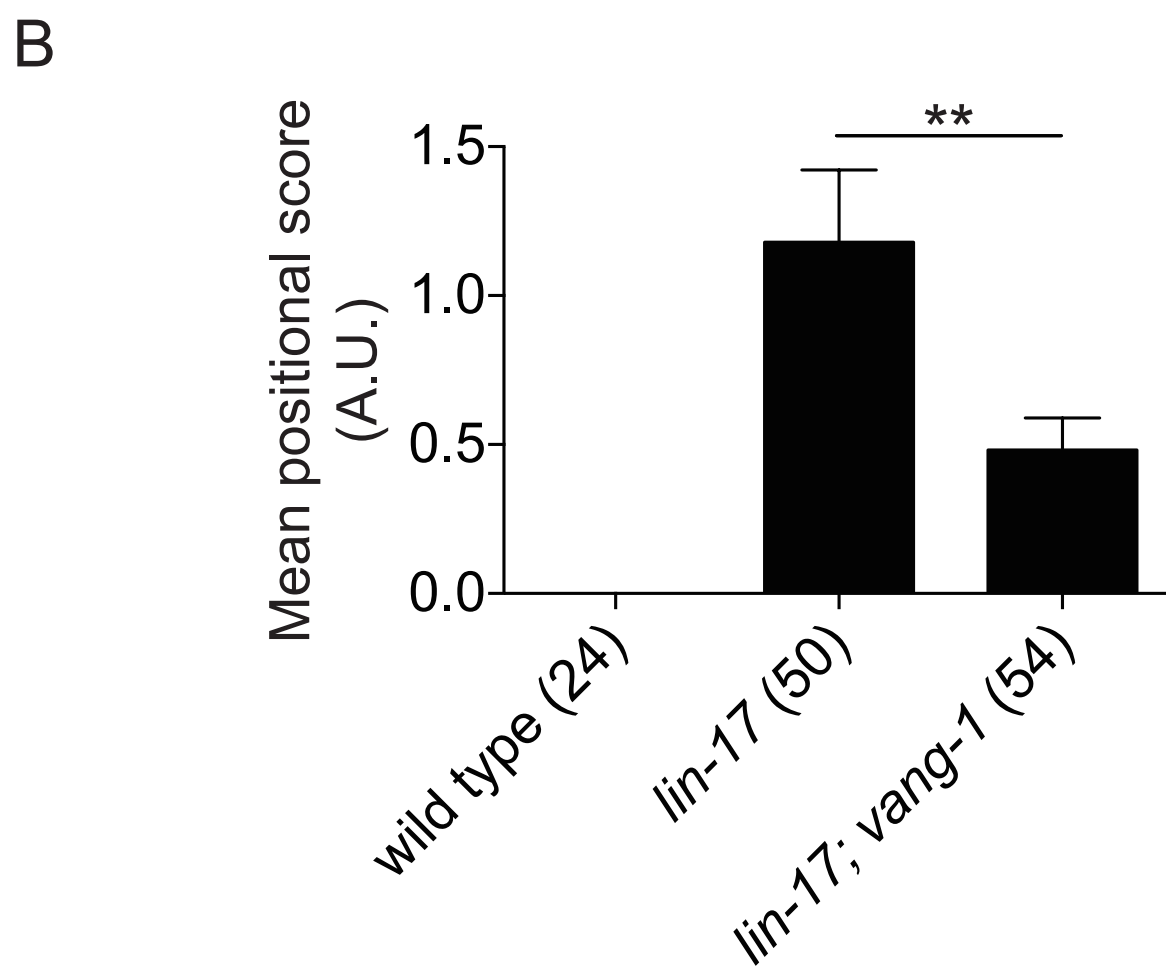
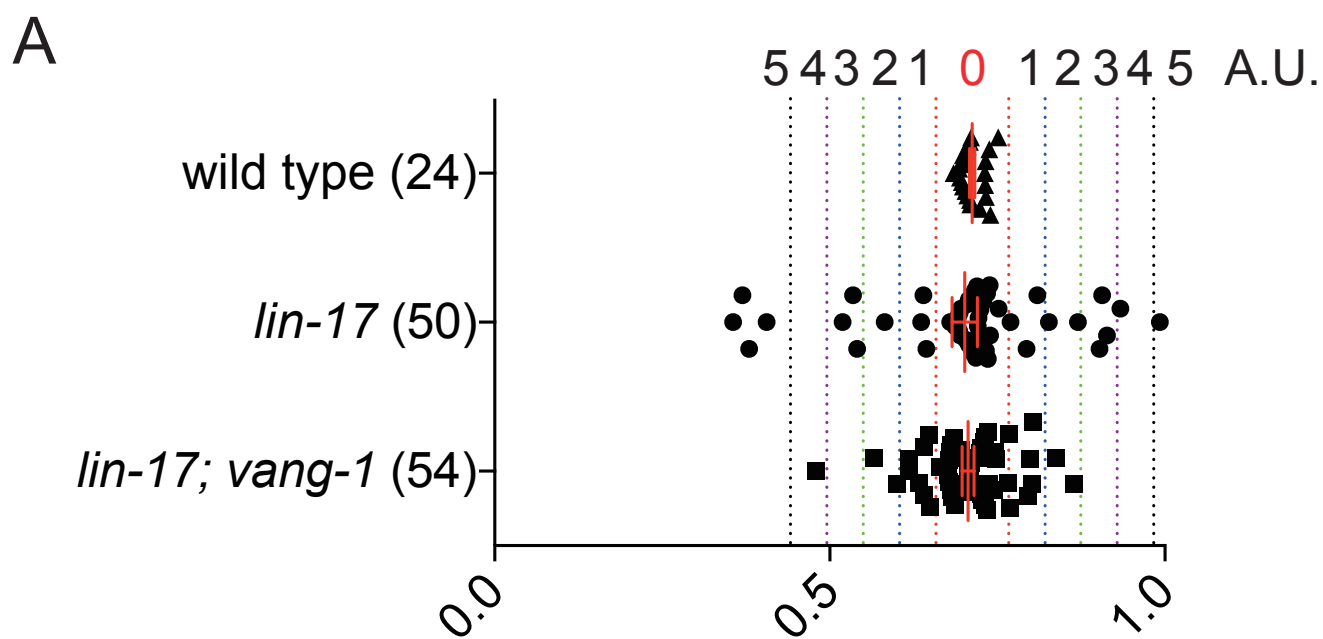


Fig. S2. *vang-1* antagonizes *lin-17* signaling in the migration of QL.d in *C.*

elegans. (A) Quantification of PVM positions along the anterior-posterior axis of the worm body. Each dot represents a single PVM neuron, with mean and standard errors of mean (S.E.M.) indicated. N = neurons scored. PVM positions are quantified based on their deviation from the wild-type zone (defined by the red dotted lines, mean \pm 3 S.D.) Each zone represents a distance of 3-S.D. further away from the wild-type zone, coded by numbers above respective zones. Weighted positional scores are derived using this paradigm and presented in (B), with mean \pm S.E.M. **, $p < 0.01$; one-way ANOVA followed by Bonferroni's multiple comparison test.

A

ALM polarity

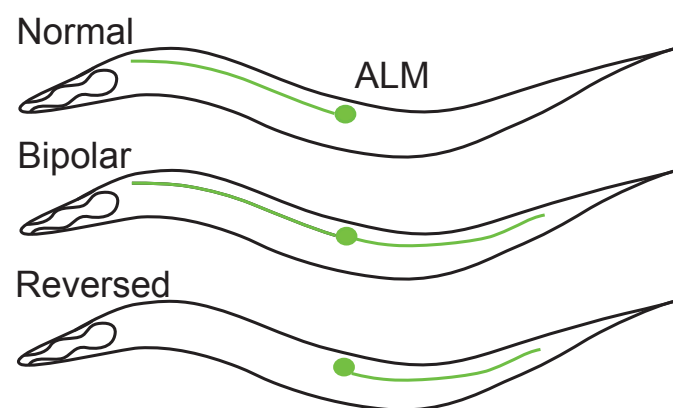
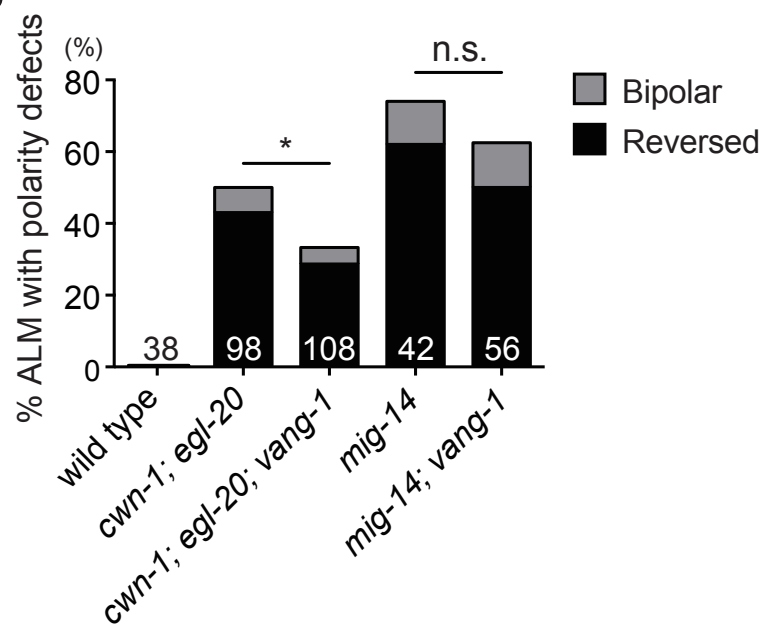
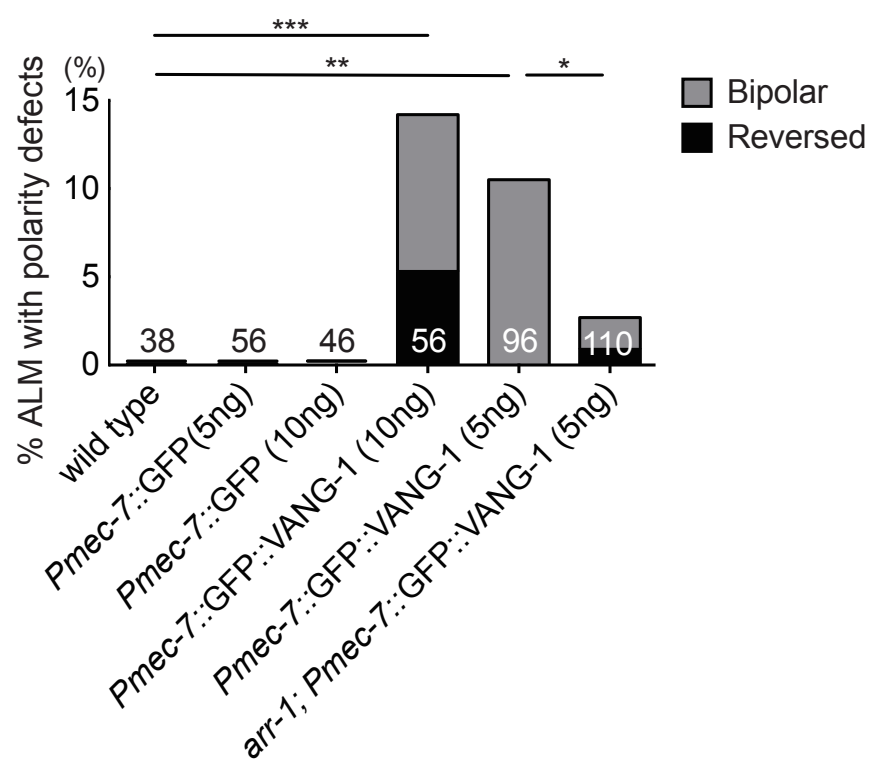
**B****C**

Fig. S3. *vang-1* antagonizes Wnt-Frizzled signaling in the polarization of the ALM neurons. (A) Schematic diagrams of wild-type and mutant ALM polarity. (B,C) Quantification of ALM polarity defects. N = neurons scored. *, $p < 0.05$, **, $p < 0.01$, ***, $p < 0.001$, n.s., not significant; two-proportion z test with Bonferroni corrections.

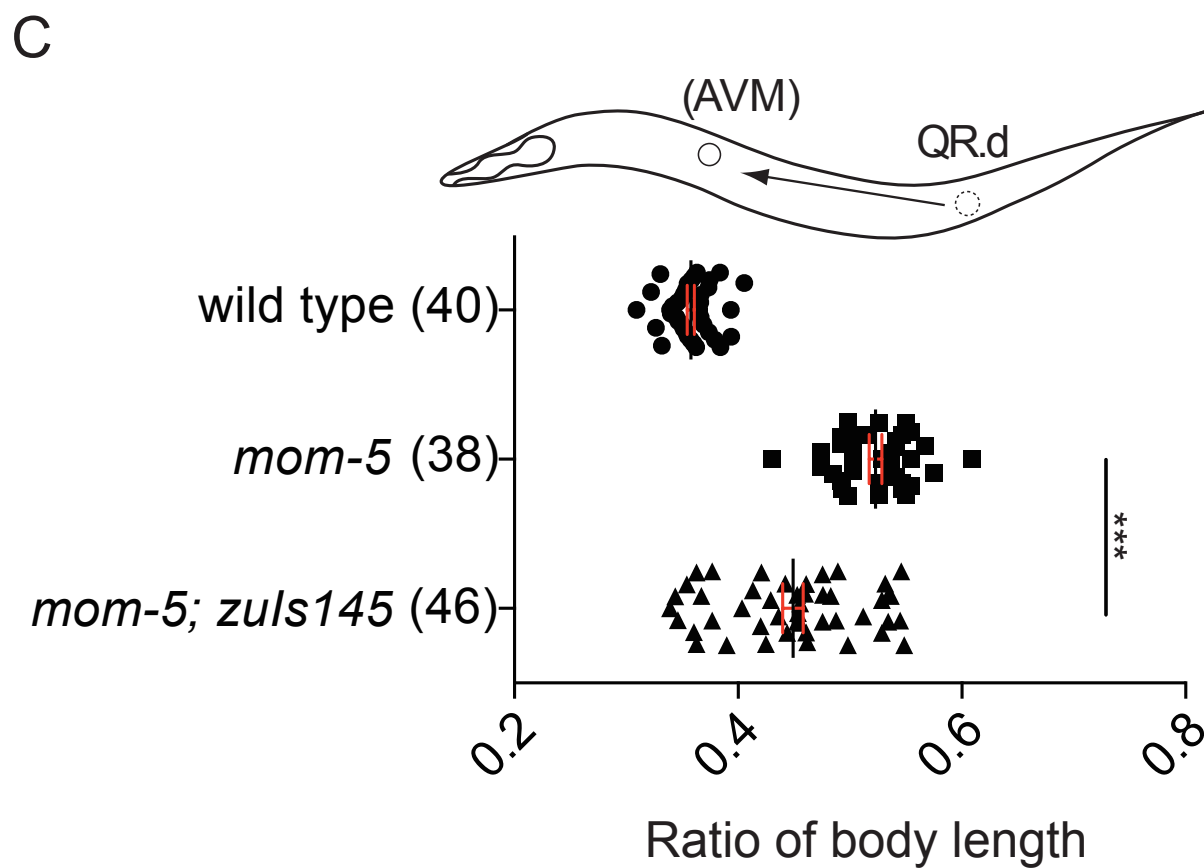
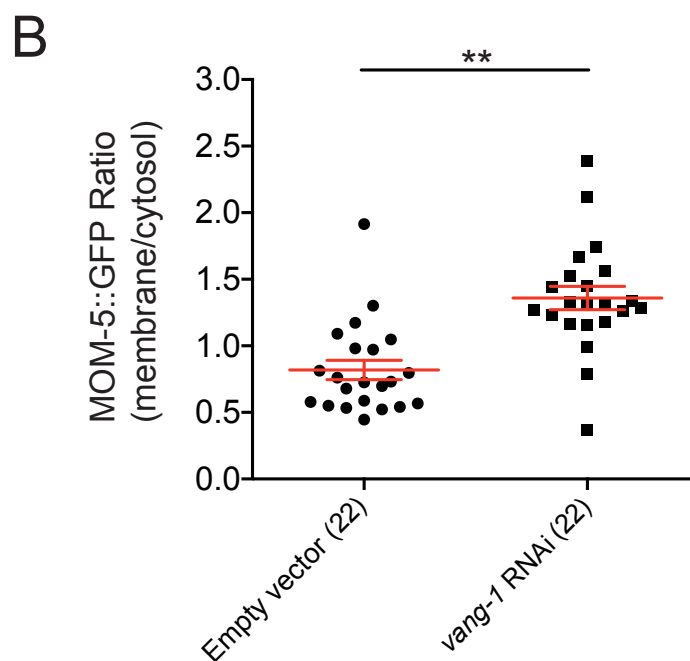
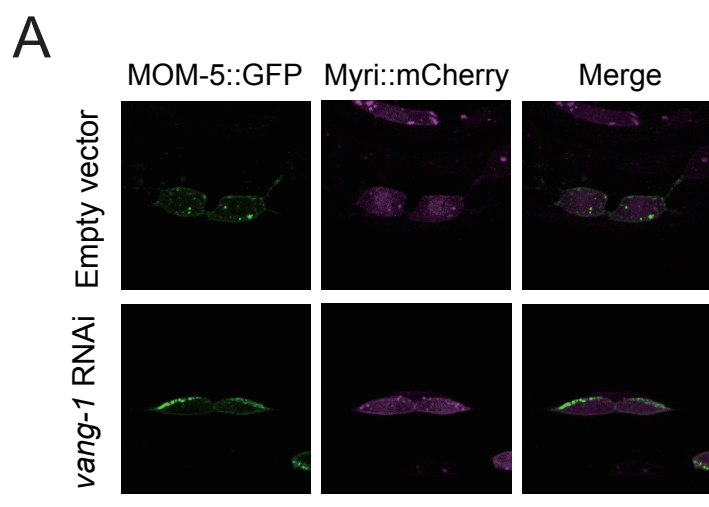


Fig. S4. *vang-1* regulates the distribution of functional MOM-5::GFP in QR.d. (A, B) Confocal projection images (A) and quantification of MOM-5::GFP distribution (B) in QR.d. MOM-5::GFP is from *zuIs145(Pnmy-2::MOM-5::GFP)* and the QR.d membrane marker is *rdvIs1(Pegl-17::Myri::mCherry)* with mCherry pseudocolored in magenta. Scale bar = 10 μ m. Each dot represents a single neuron, with mean and S.E.M. indicated. N = neurons scored. **, $p < 0.01$; one-way ANOVA followed by Bonferroni's multiple comparison test. (C) Quantification of AVM positions along the anterior-posterior axis of the worm body. Each dot represents a single AVM neuron, with mean and S.E.M. indicated. N = neurons scored. ***, $p < 0.001$, one-way ANOVA followed by Bonferroni's multiple comparison test.

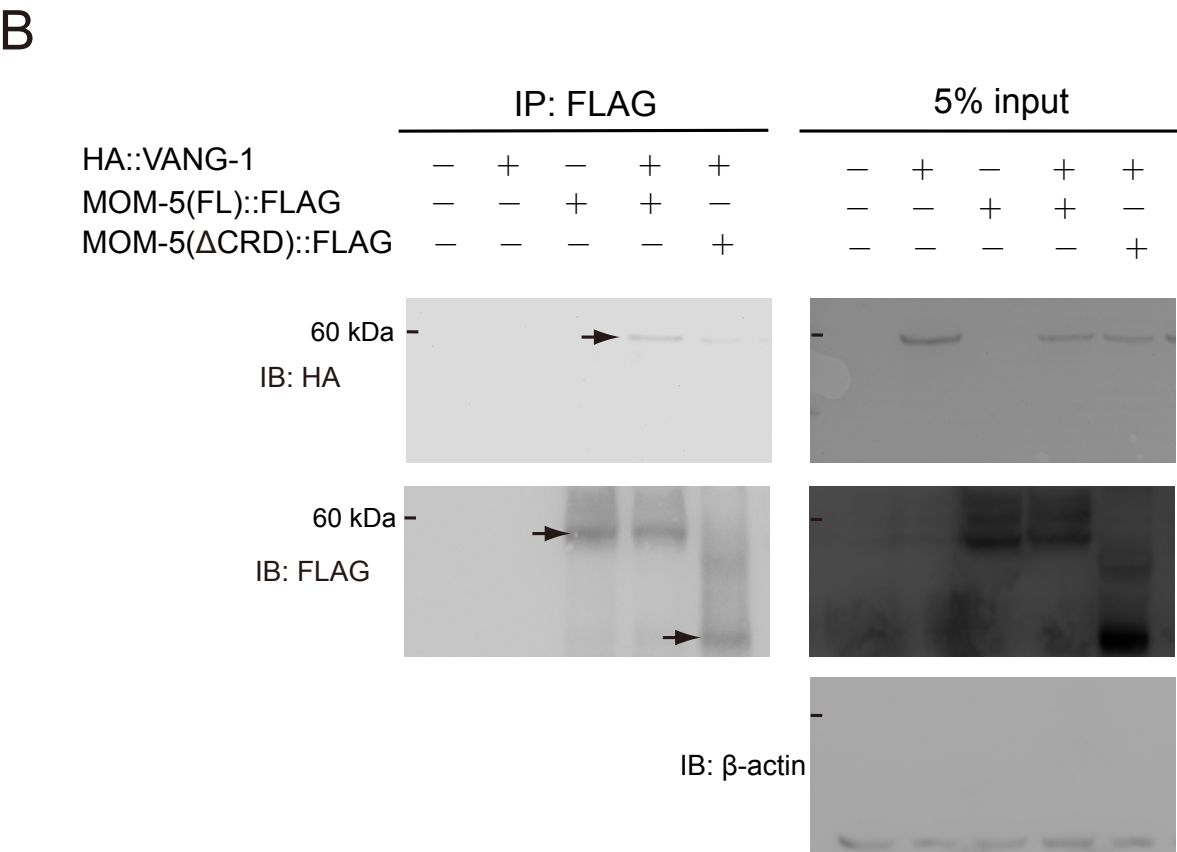
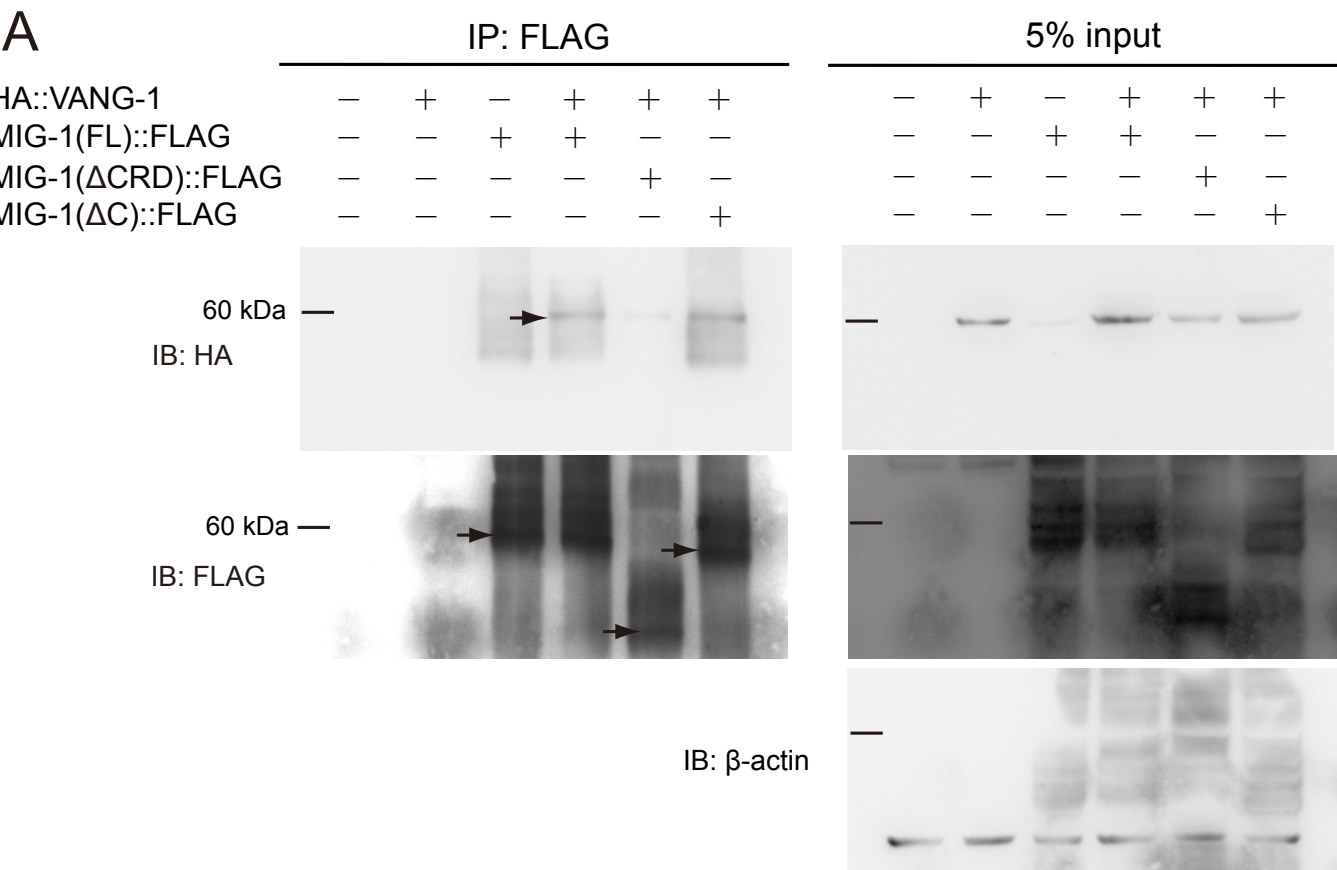


Fig. S5. Original western blotting membrane in co-immunoprecipitation

experiments. The original, uncropped western blotting membranes for MIG-1 (A) and MOM-5 (B) co-immunoprecipitation experiments in Fig. 6B and 6C, respectively. FL, full-length. Arrows indicate MIG-1 and MOM-5 signals in respective immunoblots.