AWBL*	AWCL	AWBR*	AWCR
AFDL	ASHL*	AFDR	ASHR*
ASKL	ASIL*	ASIR*	AIMR
ADFL	PVQL	ASKR	AIYR
ADLL	AIML	ADLR	RICR
BAGL	AIYL	PVQR	PHAR
BAGR	AIZL	ADFR	PVCR
	ADAL	AIZR	
	RICL	ADAR	
	PHAL	PHBR	
	PHBL		
	PVCL		

Fig. S1. Lineage groups in the NSY-5 gap junction-dependent neural network. *nsy-5* is expressed in both AWC neurons and at least 17 pairs of other sensory neurons and interneurons in the head and tail (Chuang et al., 2007). AWBL, AWCL, AWBR and AWCR cells represent four lineage groups within the NSY-5 network and express the co-injection mosaic marker *odr-1p::DsRed*. Fifteen out of the 34 non-AWC cells expressing *nsy-5* are closely related to either AWB by lineage. Asterisks indicate cells analyzed for generation of AWC^{ON} side biases.

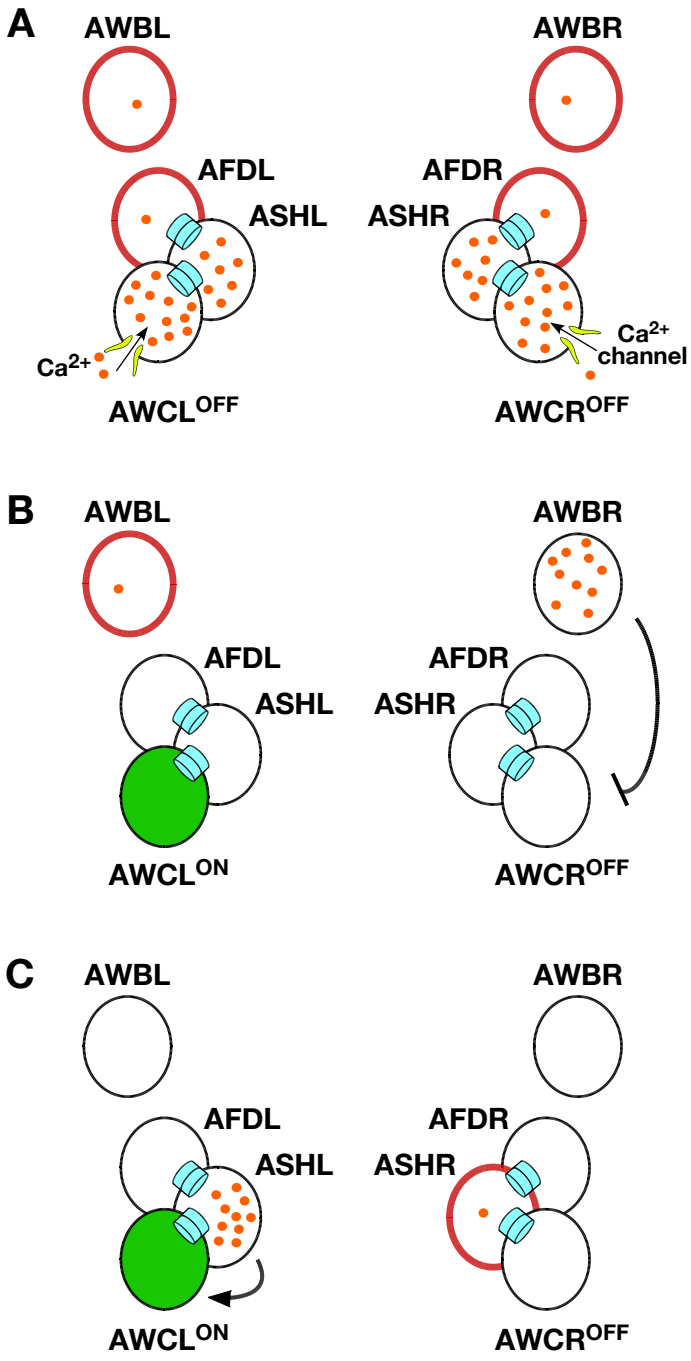

Fig. S2. Schematic of key mosaic results. (**A**) Intracellular calcium in non-AWCs of the NSY-5 network is required for AWC^{ON} induction. Mosaic animals that retain the *nsy-5p::calbindin D28K* array in both AWB lineages but neither AWC lineage have buffered calcium in about half of the population of non-AWCs in the NSY-5 network, leading to defective intercellular calcium signaling within the network required for AWC^{ON} induction. In the absence of proper calcium-based intercellular communication in the NSY-5 network, both AWC cells maintain endogenous high calcium levels via calcium influx through voltage-gated calcium channels and thus stay as the default AWC^{OFF} fate (see Table 1, row c). (**B**,**C**) Intracellular calcium levels in non-AWCs of the NSY-5 network generate side biases of AWC^{ON} induction by communicating with AWC via NSY-5 gap junctions. (B) Mosaic animals that retain the *str-1p::calbindin D28K* array in AWBL have higher calcium in AWBR, which inhibits AWCR from becoming AWC^{ON} (see Table 1, row o). (C) Mosaic animals that retain the *sra-6p::calbindin D28K::SL2::mCherry* array in ASHR have higher calcium in ASHL, which promotes AWCL to become AWC^{ON} (see Table 1, row v). AWB cells express *nsy-5*, but do not directly contact AWC. The influence from AWBR on AWCR may go through other cells in the NSY-5 network. Red cells indicate retention of calcium buffer transgenes. Blue cylinders indicate NSY-5 gap junctions.

Table S1. Effects of mutants and transgenes on Ca^{2+} level/signaling and AWC terminal fate

Genetic background	Transgene	Cells expressing transgene	Effect on Ca^{2+} level (signaling)	Effect on AWC terminal fate
Wild type	None			1 AWC^{ON}
	odr-3p::calbindin D28K	AWC	–	2 AWC^{ON}
	odr-3p::parvalbumin	AWC	–	2 AWC^{ON}
	odr-3p::calbindin D9K	AWC	–	2 AWC^{ON}
	nsy-5p::calbindin D28K	AWC, non-AWCs*	–	2 AWC^{ON}, low 2 AWC^{OFF}
	nsy-5p::parvalbumin	AWC, non-AWCs*	–	2 AWC^{ON}, low 2 AWC^{OFF}
	odr-3p::cmd-1	AWC	(+)	1 AWC^{ON}
	str-1p::calbindin D28K	AWB	–	1 AWC^{ON}, bias AWC^{ON} side in mosaic
	sra-6p::calbindin D28K	ASH, ASI	–	1 AWC^{ON}, bias AWC^{ON} side in mosaic
unc-36(e251)	None		–	2 AWC^{ON}
unc-2(e55)	None		–	2 AWC^{ON}, low 2 AWC^{OFF}
unc-2(zf35gf)	None		+	1 AWC^{ON}
	odr-3p::cmd-1	AWC	+(+)	2 AWC^{OFF}
	odr-3p::calbindin D28K	AWC	+ –	2 AWC^{ON}
unc-43(n498gf)	None		+	2 AWC^{OFF}

+, positive effect; –, negative effect.
*Non-AWCs are other 34 neurons that express *nsy-5* as listed in supplementary material Fig. S1.

Table S2. mCherry expression in AWB and ASH does not affect AWC asymmetry

	mCherry cells		*str-2p::GFP* phenotype (%)				
Transgene	AWBL	AWBR	$2AWC^{OFF}$	$AWCL^{ON}$	$AWCR^{ON}$	$2AWC^{ON}$	*n*
str-1p::mCherry	+	+	1	44	55	0	446
	+	–	0	47	53	0	77
	–	+	0	47	53	0	57
	ASHL	ASHR					
sra-6p::SL2::mCherry	+	+	1	39	60	0	293
	+	–	0	41	59	0	34
	–	+	0	32	68	0	31

Table S3. IP3 and serotonin signaling mutants have wild-type AWC asymmetry

Genetic background	2 AWC^{OFF} (%)	1 AWC^{OFF}/ 1 AWC^{ON} (%)	2 AWC^{ON} (%)	*n*
Wild type	1	99	0	110
IP3 signaling mutants				
IP3 receptor / *itr-1(sy331lf)**	0	100	0	127
IP3 kinase / *lfe-2(sy326lf)*	0	100	0	143
5-phosphatase / *ipp-5(sy605lf)*	1	99	0	139
phospholipase C / *plc-3(tm1340lf)*	1	99	0	117
Serotonin mutants				
tph-1(mg280lf)	1	99	0	244

*Like *itr-1(sy331)* mutants, *itr-1(sy290)*, *itr-1(sy291)*, *itr-1(sy327)* and *itr-1(sy328)* mutants had wild-type AWC asymmetry.