Table S1. Summary of Aer heterodimer results

Aer mutant[a]		Heterodimer phenotype[b]
pACYC-derived construct (M1)	**pTrc99A-derived construct (M2)**	
N34D	V230D	Aerotactic
N34D	D237G	Aerotactic
N34D	G240R	Aerotactic
N34D	Q248R	Aerotactic
N34D	L251P	Aerotactic
N34D	C253R	Partially aerotactic
N34D	L256R	Aerotactic
N34D	D259H	Aerotactic
N34D	N34D	Non-aerotactic
G42C	V230D	Aerotactic
G42C	D237G	Aerotactic
G42C	G240R	Aerotactic
G42C	Q248R	Aerotactic
G42C	L251P	Partially aerotactic
G42C	C253R	Partially aerotactic
G42C	L256R	Non-aerotactic
G42C	D259H	Non-aerotactic
G42C	N34D	Non-aerotactic
D68C	V230D	Aerotactic
D68C	D237G	Aerotactic
D68C	G240R	Aerotactic
D68C	Q248R	Aerotactic
D68C	L251P	Non-aerotactic
D68C	C253R	Partially aerotactic
D68C	L256R	Non-aerotactic
D68C	D259H	Non-aerotactic
D68C	N34D	Non-aerotactic
Y93H	V230D	Aerotactic
Y93H	D237G	Aerotactic
Y93H	G240R	Aerotactic
Y93H	Q248R	Aerotactic
Y93H	L251P	Partially aerotactic
Y93H	C253R	Partially aerotactic
Y93H	L256R	Non-aerotactic
Y93H	D259H	Partially aerotactic
Y93H	N34D	Non-aerotactic
M21D	V230D	Aerotactic
M21D	D237G	Partially aerotactic
M21D	G240R	Aerotactic
M21D	Q248R	Aerotactic
M21D	L251P	Non-aerotactic
M21D	C253R	Partially aerotactic
M21D	L256R	Non-aerotactic
M21D	D259H	Partially aerotactic
M21D	N34D	Non-aerotactic
N34D	V230D/D237G	Partially aerotactic
N34D	V230D/G240R	Aerotactic
N34D	V230D/Q248R	Partially aerotactic
N34D/M341T	Q248R	Aerotactic
N34D	Q248R/M341T	Non-aerotactic
Q248R	M341T	Aerotactic
Q248R	Aer[1-490]	Aerotactic
Q248R	Aer[1-285]	Aerotactic
Q248R	Aer[1-260]	Partially aerotactic
Q248R	Aer[1-256]	Non-aerotactic
Q248R	Aer[1-253]	Non-aerotactic
Q248R	Aer[1-250]	Non-aerotactic
N34D	Aer[1-490]	Non-aerotactic
N34D	Aer[1-285]	Non-aerotactic
N34D	Aer[1-260]	Non-aerotactic
N34D	Aer[1-256]	Non-aerotactic
N34D	Aer[1-253]	Non-aerotactic
Q248R	Aer[120-506]	Aerotactic
Q248R	Aer[165-506]	Non-aerotactic
Q248R	Aer[120-490]	Aerotactic
Q248R	Aer[120-285]^{His6x}	Non-aerotactic

a. Full-length Aer[1-506] unless indicated

b. Heterodimer results in BT3400 based on 30 mM succinate swarm plate analysis

Table S2. Strains, plasmids and primers

Strain, plasmid or primer	Relevant properties or primer sequence (5′ to 3′)	Reference
Strains		
BT3312	Δ*aer-1* Δ*tsr-7028*	(Repik *et al.*, 2000)
BW10724	λ *recA*$^+$*/recA::cat-aadA* Δ*lac-169 pho-510 thi*	(Metcalf and Wanner, 1993; Wanner and Boline, 1990)
BT3400	Δ*aer-1* Δ*tsr-7028 recA::cat*	This study
Plasmids		
pTrc99A	p_{trc} expression vector, *ColE1 lacI*^{q}	Pharmacia
pProEX™HTa	p_{trc} expression vector with an N-terminal His_{6x} tag, *ColE1 lacI*^{q}	Invitrogen
pACYC184	*p15A*	(Chang and Cohen, 1978)
pGH1	pTrc99A Aer$^+$ [1-506]	(Repik *et al.*, 2000)
pQH16	pGH1 Aer-Δ HAMP (204-281), BstBI and SacI sites	(Ma *et al.*, 2005)
pKW1	pQH16 Aer-WT HAMP$^+$ (204-281), NheI site	(Watts *et al.*, 2004)
pKW6	pKW1 Aer[V230D]	(Watts *et al.*, 2004)
pKW2	pKW1 Aer[D237G]	(Watts *et al.*, 2004)
pKW3	pKW1 Aer[G240R]	(Watts *et al.*, 2004)
pKW11	pKW1 Aer[Q248R]	(Watts *et al.*, 2004)
pKW4	pKW1 Aer[L251P]	(Watts *et al.*, 2004)
pKW5	pKW1 Aer[C253R]	(Watts *et al.*, 2004)
pKW80	pKW1 Aer[L256R]	This study
pKW13	pKW1 Aer[D259H]	(Watts *et al.*, 2004)
pKW82	pKW2 Aer[V230D/D237G]	This study
pKW83	pKW3 Aer[V230D/G240R]	This study
pKW84	pKW11 Aer[V230D/Q248R]	This study
pKW81	pKW1 Aer[M341T]	This study
pKW85	pKW11 Aer[Q248R/M341T]	This study
pKW74	pKW1 Aer[N34D]	(Watts *et al.*, 2004)
pKW86	pKW1 Aer[D68C]	This study
pKW87	pKW1 Aer[G42C]	This study
pKW88	pKW1 Aer[Y93H]	This study
pKS1	pGH1 Aer[M21D]	K. Sommer
pKW89	pACYC184 p_{trc} *lacI*^{q} Aer[N34D]	This study
pKW90	pACYC184 p_{trc} *lacI*^{q} Aer[D68C]	This study
pKW91	pACYC184 p_{trc} *lacI*^{q} Aer[G42C]	This study
pKW92	pACYC184 p_{trc} *lacI*^{q} Aer[Y93H]	This study
pKW93	pACYC184 p_{trc} *lacI*^{q} Aer[M21D]	This study
pKW94	pACYC184 p_{trc} *lacI*^{q} Aer[Q248R]	This study
pKW95	pACYC184 p_{trc} *lacI*^{q} Aer[N34D/M341T]	This study
pAJC1	pTrc99A Aer[1-490], Δ491-506	A. Campbell
pKW96	pTrc99A Aer[1-285], Δ286-506	This study
pKW97	pTrc99A Aer[1-260], Δ261-506	This study
pKW98	pTrc99A Aer[1-256], Δ257-506	This study
pKW99	pTrc99A Aer[1-253], Δ254-506	This study
pKW100	pTrc99A Aer[1-250], Δ251-506	This study
pKW101	pTrc99A Aer[120-506], Δ1-119	This study
pKW102	pTrc99A Aer[165-506], Δ1-164	This study
pKW103	pTrc99A Aer[120-490], Δ[1-119/491-506]	This study
pKW104	pProEX™HTa Aer[120-285], Δ[1-119/286-506]	This study
pKG117	p_{nahG} expression vector, *p15A*, Aer$^+$ [1-506]	K. Gosink
pDS7	pKG117, tet	D. Salcedo
Primers[a]		
pTrcSphIF	GAAGCGGCATGCATTTACGTTGACACCATCG	This study
Aer490SphIR	TTAATGCATGC**TTA**CATCGCCGACACCTGCGCACTCTC	This study
Aer285SphIR	CGACATGCATGC**TTA**GGTATGTTCGTTGAGCTCATCGGTGCC	This study
Aer260SphIR	CGACATGCATGC**TTA**GACATCGTTAATTAGCCAACGGCACATC	This study
Aer256SphIR	CGACATGCATGC**TTA**TAGCCAACGGCACATCAGGCCAAGTTG	This study
Aer253SphIR	CGACATGCATGC**TTA**GCACATCAGGCCAAGTTGCCCTAC	This study
Aer250SphIR	CGACATGCATGC**TTA**GCCAAGTTGCCCTACCGCACGTAATGTC	This study
Aer120NcoIF	GACATGCC**ATGG**ATGAAGAGATCGCGGCGGTGGAG	This study
Aer165NcoIF	GACATGCC**ATGG**CGCGTGGAGTGATGACCCTGATG	This study
Aer506SalIR	CGAGGTGTCGACTTAATGCAGTACCGTCACCGCGTC	This study
Aer490SalIR	CGAGGTGTCGAC**TTA**CATCGCCGACACCTGCGCACTCTC	This study
Aer285SalIR	CGAGGTGTCGAC**TTA**GGTATGTTCGTTCAGTTCATCGGTG	This study

a. Restriction endonuclease recognition sites are underlined. Engineered start and stop codons are in bold.

REFERENCES FOR TABLE S2

Chang, A.C., and Cohen, S.N. (1978) Construction and characterization of amplifiable multicopy DNA cloning vehicles derived from the P15A cryptic miniplasmid. *J Bacteriol* **134**: 1141-1156.

Ma, Q., Johnson, M.S., and Taylor, B.L. (2005) Genetic analysis of the HAMP domain of the Aer aerotaxis sensor localizes flavin adenine dinucleotide-binding determinants to the AS-2 helix. *J Bacteriol* **187**: 193-201.

Metcalf, W.W., and Wanner, B.L. (1993) Evidence for a fourteen-gene, phnC to phnP locus for phosphonate metabolism in *Escherichia coli*. *Gene* **129**: 27-32.

Repik, A., Rebbapragada, A., Johnson, M.S., Haznedar, J.O., Zhulin, I.B., and Taylor, B.L. (2000) PAS domain residues involved in signal transduction by the Aer redox sensor of *Escherichia coli*. *Mol Microbiol* **36**: 806-816.

Wanner, B.L., and Boline, J.A. (1990) Mapping and molecular cloning of the phn (psiD) locus for phosphonate utilization in *Escherichia coli*. *J Bacteriol* **172**: 1186-1196.

Watts, K.J., Ma, Q., Johnson, M.S., and Taylor, B.L. (2004) Interactions between the PAS and HAMP domains of the *Escherichia coli* aerotaxis receptor Aer. *J Bacteriol* **186**: 7440-7449.