Table S1. Determination of intracellular iron and manganese content of *B. japonicum* wild type, *fur*$^+$, and *mur* strains. Data are expressed as average nmol metal per mg protein ±standard deviation of triplicate samples.

Medium (μM)		Cellular Iron Content		
		Wild type	***fur*$^+$**	***mur***
Mn	**Fe**	**nmol Fe/ mg protein**	**nmol Fe/ mg protein**	**nmol Fe/ mg protein**
0	0	0.96 ±0.01	1.05 ±0.04	1.13 ±0.06
0	20	46 ±3	46 ±4	42 ±0.1
0	100	307 ±5	306±10	306 ±12
20	0	0.96 ±0.02	0.93 ±0.01	0.96 ±0.02
20	20	48 ±3	48 ±3	46 ±1
20	100	307 ±8	308 ±9	308 ±12
100	0	0.95 ±0.00	0.98 ±0.02	0.94 ±0.02
100	20	47 ±1	48 ±1	47 ±1
100	100	307 ±7	307 ±6	302 ±5

Medium (μM)		Cellular Manganese Content		
		Wild type	***fur*$^+$**	***mur***
Mn	**Fe**	**nmol Mn/ mg protein**	**nmol Mn/ mg protein**	**nmol Mn/ mg protein**
0	0	0.92 ±0.01	0.87 ±0.04	0.90 ±0.04
0	20	1.15 ±0.01	1.37 ±0.01	1.36 ±0.02
0	100	1.10 ±0.04	1.20 ±0.07	1.27 ±0.08
20	0	8.6 ±0.3	9.6 ±0.1	9.4 ±0.2
20	20	9.6 ±0.3	9.3 ±0.3	9.8 ±0.1
20	100	9.8 ±0.2	9.5 ±0.2	9.6 ±0.1
100	0	13.2 ±0.3	12.9 ±0.4	13.0 ±0.1
100	20	13.6 ±0.1	13.4 ±0.3	13.2 ±0.2
100	100	13.3 ±0.3	12.8 ±0.1	14.0 ±0.1

Table S2. Determination of intracellular iron and manganese content of *E. coli* wild type, *mur*$^+$, and *fur* cells. Data are expressed as average nmol metal per mg protein ±standard deviation of triplicate samples.

Medium (μM)		Cellular Iron Content		
		Wild type	*mur*$^+$	*fur*
Mn	Fe	nmol Fe/ mg protein	nmol Fe/ mg protein	nmol Fe/ mg protein
0	0	2.02 ±0.02	2.22 ±0.06	2.02 ±0.08
0	20	214 ±4	216 ±7	238 ±1
0	100	1054 ±0	1150 ±9	1013 ±7
20	0	2.18 ±0.09	2.27 ±0.11	2.34 ±0.05
20	20	228 ±3	225 ±1	233 ±4
20	100	1268 ±52	1258 ±42	1226 ±42
100	0	2.09 ±0.01	2.07 ±0.05	2.09 ±0.14
100	20	274 ±2	267 ±5	272 ±12
100	100	1259 ±45	1246 ±4	1247 ±34

Medium (μM)		Cellular Manganese Content		
		Wild type	*mur*$^+$	*fur*
Mn	Fe	nmol Mn/ mg protein	nmol Mn/ mg protein	nmol Mn/ mg protein
0	0	0.14 ±0.01	0.15 ±0.00	0.09 ±0.02
0	20	0.39 ±0.00	0.45 ±0.00	0.19 ±0.00
0	100	0.96 ±0.04	0.92 ±0.02	0.62 ±0.03
20	0	4.5 ±0.2	7.7 ±0.3	2.6 ±0.2
20	20	31 ±3	27 ±2	22 ±2
20	100	82 ±2	87 ±2	80 ±8
100	0	69 ±3	74 ±1	20 ±1
100	20	237 ±5	241 ±13	165 ±2
100	100	276 ±6	263 ±1	181 ±6

Fig S1. Metal binding residues of Mur and Fur are conserved.

Amino acid sequences and alignment of *E. coli* Fur (EcFur), *Magnetospirillum. gryphiswaldense* Fur (MgFur), and B. *japonicum* Mur (BjMur). Metal binding site 1 (bold) and metal binding site 2 (underlined) are shown as determined by crystal structure of *M. gryphiswaldense* Fur.

Fig S2. Western blot analysis of Mur or Fur expression in *B. japonicum* and *E. coli*.

15 μg of *B. japonicum* whole cell lysates or 5 μg of *E. coli* whole cell lysates were loaded per lane of a 15% SDS-PAGE gel and analyzed using either anti-Mur antibodies (Mur) or anti-Fur antibodies (Fur). (A) Metal dependent expression of Fur in Wt *E. coli*, Mur in ecMur, Fur in bjFur, or Mur in Wt *B. japonicum*. Cells were grown in the presence (+) or absence (-) of 20 μM $MnCl_2$ and $FeCl_3$. (B) Fur and Mur expression in Wt *E. coli*, ecMur (*mur*$^+$), JW0669 (*fur*$^-$) Wt *B. japonicum*, bjFur (*fur*$^+$), and GEM4 (*mur*$^-$) strains.

Fig S3. Metal dependent gene expression of *mnoP* and *fiu* in *B. japonicum* and *E. coli* cells.

(A) Analysis of *mnoP* mRNA by qPCR in *B. japonicum* wild type (Wt) or *mur* cells grown in the presence or absence of 20 μM $MnCl_2$ or 20 μM $FeCl_3$. (B) Analysis of *fiu* mRNA by qPCR in *B. japonicum* wild type (Wt) or *mur* cells grown as described above. (C) Analysis of *fiu* mRNA by qPCR in *E. coli* parent strain (Wt) or *fur* cells grown as described above. (D) Analysis of *mnoP* mRNA by qPCR in *E. coli* strain expressing Mur (mur$^+$) or *fur* cells grown as describe above. The data are expressed as the relative starting quantity (SQ) of *mntH* mRNA normalized to the housekeeping gene *gapA*, and are presented as the average of triplicate samples with the error bars representing the standard deviation.

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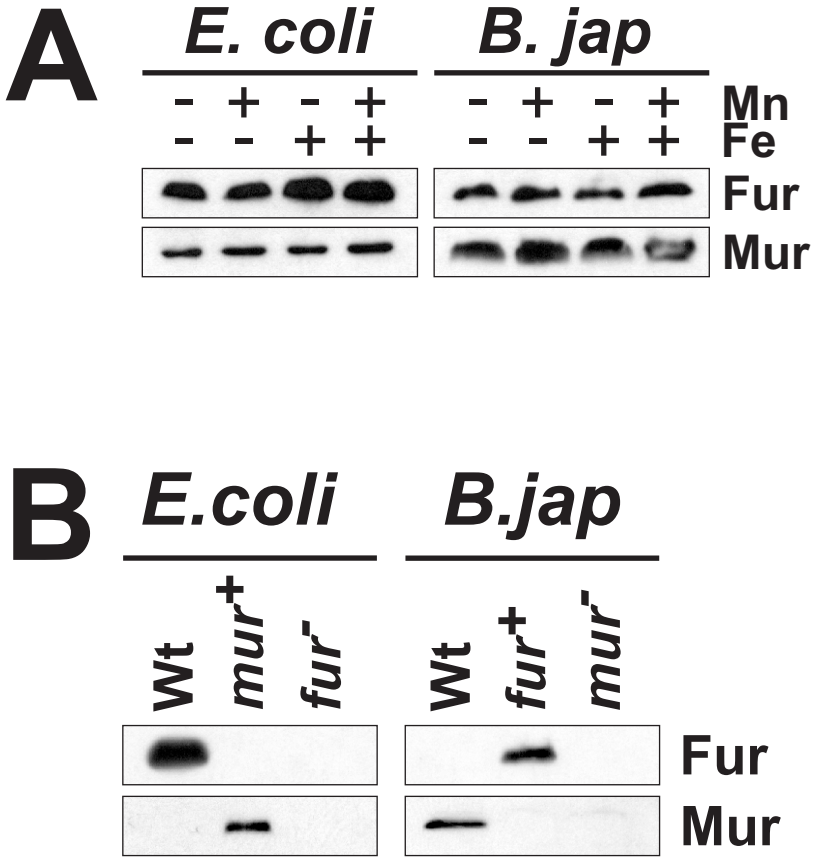
EcFur      -----------MTDNNTALKKAGLKVTLPRLKILEVLQEPDNHHVSAEDLYKRLIDMGEE    49
MgFur      ----------MVSRIEQRCIDKGMKMTDQRRVIAQVLSDS-ADHPDVEEVYRRATAKDPR    49
BjMur      MTALKPSSASKASGIEARCAATGMRMTEQRRVIARVLAEA-VDHPDVEELYRRCVAVDDK    59

EcFur      IGLATVYRVLNQFDDAGIVTRHNFEGGKSVFELTQQHHHDDHLICLDCGKVIEFSDDSIEA    109
MgFur      ISIATVYRTVRLFEEESILERHDFGDGRARYEEAPSEHHDDHLIDVNSARVIEFTSPEIEA    109
BjMur      ISISTVYRTVKLFEDAGIIERHDFREGRARYETMRDSHHDDHLINLRDGKVIEFTSEEIEK    119

EcFur      RQREIAAKHGIRLTNHSLYLYGHCAEGDCREDEHAHEGK        148
MgFur      LQREIARKHGFRLVGHRLELYGVPLTSGGDSDDK-----        143
BjMur      LQAEIARKLGYKLVDHRLELYCVPLDDDKPTS-------        151
```

Figure S1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B. jap
- + - + - + - + Mn
- - + + - - + + Fe
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Mur
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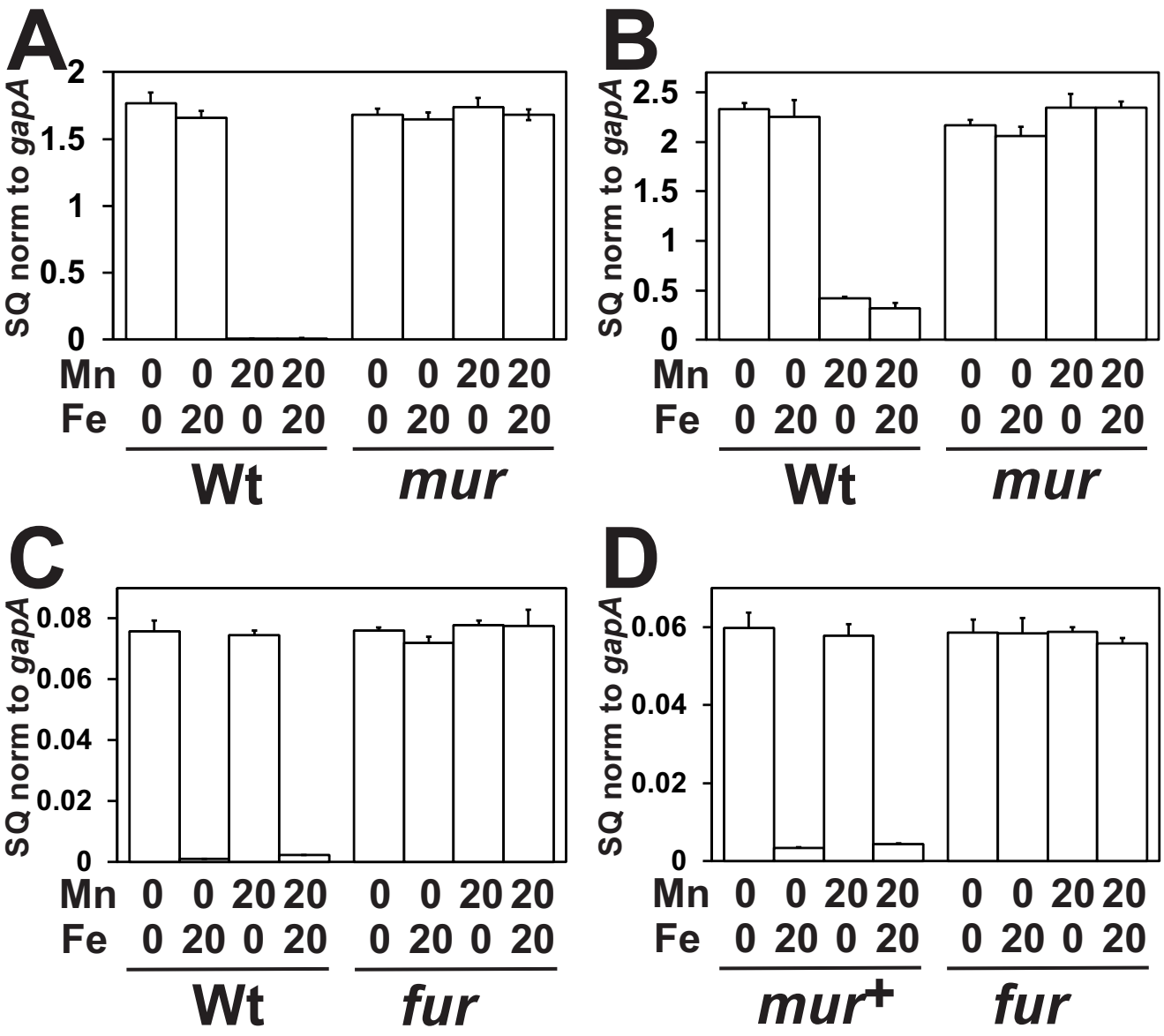
E.coli
B.jap
Wt
mur+
fur-
Wt
fur+
mur-
Fur
Mur

Figure S2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B
C
D
SQ norm to gapA
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Fe 0 20 0 20 0 20 0 20
Wt
mur
fur
mur+

FigureS3