

Online Table S1 | Data on transcription-factor interactions in *Escherichia coli**

Transcription factor	Regulator TU(s)	Effector TU(s)	Coupling	Signal	Refs
AraC	<i>araC</i> (-)	<i>araBAD</i> (dual -/+) [‡] <i>araE</i> (+) <i>araFGH</i> (+) <i>araJ</i> (+)	I [‡]	L-arabinose (Ind) D-fucose (AntiInd)	1–7
CpxR	<i>cpxRA</i> (+)	<i>cpxP</i> (+) Others (- and +)	D	Phosphorylation of CpxR (Ind)	8–11
CynR	<i>cynR</i> (-)	<i>cynTSX</i> (+)	U	Cyanate (Ind)	12–14
CysB	<i>cysB</i> (-)	<i>cysJIH</i> (+) <i>cysK</i> (+) <i>cysPTWA(M?)</i> (+) Others (- and +)	D	<i>N</i> -acetyl-L-serine (Ind) Sulphide (AntiInd) Thiosulphate (AntiInd)	15–20
DsdC	<i>dsdC</i> (-)	<i>dsdXA</i> (+)	D	D-serine (Ind)	21–24
IdnR	<i>idnDOTR</i> (+)	<i>gntKU</i> (-) <i>gntT</i> (-) <i>idnDOTR</i> (+) <i>idnK</i> (+)	D for positively regulated genes, I for negatively regulated genes	L-idonate (Ind for positively regulated genes, CoR for negatively regulated genes) and/or 5-ketogluconate (Ind)	25–27
IlvY	<i>ilvY</i> (-)	<i>ilvC</i> (+)	I [§]	α -acetolactate (Ind) α -acetohydroxybutyrate (Ind)	28–30
MalT	<i>malT</i> (0)	<i>malPQ</i> (+) Others (+)	U(0)	ATP + maltotriose (Ind) Aes (AntiInd) MalK (CoR) MalY (AntiInd)	31–38
MarA	<i>marRAB</i> (+)	<i>acrAB</i> (+) <i>micF</i> (+) Others (+)	D	None (see MarR entry)	39,40
MelR	<i>melR</i> (-)	<i>melAB</i> (+)	D	Melibiose (Ind)	41–43

MetR	<i>metR</i> (-)	<i>glyA</i> (dual +/-) <i>metA</i> (+) <i>metE</i> (+) <i>metF</i> (+) <i>metH</i> (+)	I for <i>metE</i>	Homocysteine (Ind, but CoR of <i>metA</i> and <i>metH</i>)	44–51
MhpR	<i>mhpR</i> (0)	<i>mhpABCDEF-mhpT</i> (+)	U(0)	3HPP [†] (Ind)	52,53
RhaR	<i>rhaSR</i> (+)	<i>rhaSR</i> (+)	D	L-lyxose (Ind) L-mannose (Ind) L-rhamnose (Ind)	54–58
RhaS	<i>rhaSR</i> (-)	<i>rhaBAD</i> (+) <i>rhaT</i> (+)	D	L-rhamnose (Ind) L-lyxose (Ind) L-mannose (Ind)	58,59
Rob	<i>rob</i> (0)	<i>acrAB</i> (+) <i>inaA</i> (+) <i>galT</i> (-) Others (+)	U(0)	Decanoate (Ind) Dipyridyl (Ind)	60–62
SoxR	<i>soxR</i> (-)	<i>soxS</i> (+)	U	Oxidation of SoxR-bound [2Fe-2S] (Ind)	63,64
SoxS	<i>soxS</i> (-)	<i>sodA</i> (+) Others (+)	I	None (oxidizing-agent inducible; see SoxR entry)	65,66
TorR [#]	<i>torR</i> (-)	<i>torCAD</i> (+) Others (+ and -)	U	Phosphorylation of TorR (Ind)	67–69
XapR	<i>xapR</i> (0)	<i>xapAB</i> (+)	U(0)	Xanthosine (Ind)	70,71
XylR	<i>xylFGHR</i> (+), <i>xylR</i> (0)	<i>xylAB</i> (+) <i>xylFGHR</i> (+)	D	D-xylose (Ind)	72,73
BetI	<i>betIBA</i> (-)	<i>betIBA</i> (-) <i>betT</i> (-)	D	Choline (Ind)	74,75
CytR**	<i>cytR</i> (-)	<i>udp</i> (-) Others (- and dual +/-)	D	Cytidine (Ind)	76–78

EmrR	<i>emrRAB</i> (-)	<i>emrRAB</i> (-)	D	2,4-dinitrophenol (Ind) Others (Ind)	79–81
GalR	<i>galR</i> (0)	<i>galETKM</i> (-) <i>galP</i> (-) <i>galS</i> (-)	U(0)	β -D-galactose (Ind) D-fucose (Ind)	82–85
GalS	<i>galS</i> (-)	<i>mglBAC</i> (-) <i>galETKM</i> (-)	D	β -D-galactose (Ind) D-fucose (Ind)	83,84, 86,87
GlpR	<i>glpEGR</i> (0) <i>glpGR</i> (0) <i>glpR</i> (0)	<i>glpACB</i> (-) <i>glpTQ</i> (-) Others (-)	U(0)	<i>sn</i> -glycerol 3-phosphate (Ind) D-galactose 1-phosphate (AntiInd)	88–93
LacI	<i>lacI</i> (0)	<i>lacZYA</i> (-)	U(0)	Allolactose (Ind) IPTG (Ind)	94–96
MarR	<i>marRAB</i> (-)	<i>marRAB</i> (-)	D	Salicylate (Ind) Other phenolic compounds (Ind)	97–100
NagC	<i>nagBACD</i> (-) <i>nagC</i> (0)	<i>glmUS</i> (dual +/-) <i>manXYZ</i> (-) <i>nagBACD</i> (-) <i>nagE</i> (-)	D	GlcNAc-6-P ⁺⁺ (Ind)	101,102
PdhR	<i>pdhR-aceEF-lpdA</i> (-)	<i>pdhR-aceEF-lpdA</i> (-)	D	Pyruvate (Ind)	103,104
PutA	<i>putA</i> (-)	<i>putA</i> (-) <i>putP</i> (-)	D	Proline (Ind)	105
RbsR	<i>rbsKR</i> ? ^{ss} (0) <i>rbsDACBK</i> (R?) ^{ss} (-)	<i>rbsDACBK</i> (R?) ^{ss} (-)	U(0) or D ^{ss}	D-ribose (Ind)	106,107
TreR	<i>treR</i> (?)	<i>treBC</i> (-)	?	Trehalose 6-phosphate (Ind) Trehalose (AntiInd)	108,109
UxuR ^{IIII}	<i>uxuR</i> (-)	<i>uxuAB</i> (-)	D	D-fructuronate (Ind)	110–114

AsnC	<i>asnC</i> (-)	<i>asnA</i> (+)	U	Asparagine (CoR)	115–117
FadR	<i>fadR</i> (0)	<i>fabA</i> (+) Others (- and +)	U(0)	Long-chain acyl-CoA (CoR of positively regulated genes, Ind of negatively regulated genes)	118–124
FruR ^{¶¶}	<i>fruR</i> (0)	<i>ppsA</i> (+) Others (-, + and dual -/+)	U(0)	D-fructose-1-phosphate (CoR of positively regulated genes, Ind of negatively regulated genes) fructose-1,6-biphosphate (same as above)	125–128
GcvA	<i>gcvA</i> (-)	<i>gcvTHP</i> (dual +/-) ^{##}	U	Glycine-free GcvR (CoR) (glycine inducible)	129–135
PspF	<i>pspF</i> (-)	<i>pspABCDE</i> (+)	U	PspA (CoR)	136,137
ArgR	<i>argR</i> (-)	<i>argF</i> (-) Others (-)	D	L-arginine (CoR)	138–141
DnaA	<i>dnaA</i> (-)	<i>dnaA</i> (-) Others (- and +)	D	ATP (CoR)	142,143
Fur	<i>fldA-fur</i> (?) <i>fur</i> (-)	Iron transport genes Others (- and +)	D	Fe ²⁺ (CoR)	144–149
H-NS	<i>hns</i> (-)	<i>hns</i> (-) Others (- and +)	D	DNA curvature (CoR)	150,151
IscR	<i>iscRSUA</i> (-)	<i>iscRSUA</i> (-)	D	[2Fe-2S] (CoR)	152
MazEF	<i>mazEF</i> (-) <i>relA-mazEF</i> (0)	<i>mazEF</i> (-)	D	ppGpp*** (CoR)	153,154
MetJ	<i>metJ</i> (-)	<i>metBL</i> (-) Others (-)	D	S-adenosyl-L-methionine (CoR)	155–159
ModE	<i>modEF</i> (0)	<i>dmsABC</i> (-) <i>modABCD</i> (-) <i>moaABCDE</i> (+) Others (+)	U(0)	Molybdate (CoR of <i>dmsABC</i> and <i>modABCD</i> , Ind of <i>moaABCDE</i>) Tungstate (same as above)	160–162

PurR	<i>purR</i> (-)	<i>purB</i> (-) Others (-)	D	Hypoxanthine (CoR), guanine (CoR) and analogues	163–168
TrpR	<i>trpR</i> (-)	<i>trpLEDCBA</i> (-) Others (-)	D	L-tryptophan (CoR)	169,170
TyrR	<i>tyrR</i> (-)	<i>aroF-tyrA</i> (-) <i>mtr</i> (+) Others (-)	U	ATP + L-tyrosine ^{***} (CoR, but Ind of <i>mtr</i>)	171–173

*The first 34 systems are inducible, and the following 16 systems are repressible. Activator-controlled systems are listed with a grey background, and repressor-controlled systems are listed with a white background. The signal molecule in a repressor-controlled repressible system is called a 'corepressor'. We also use the term 'corepressor' for the signal molecule in an activator-controlled repressible system. An alternative term is 'deactivator'. For some inducible systems, an anti-inducer signal molecule can competitively bind at the inducer binding site, preventing induction. References are provided for regulation of the regulator TU and for documentation of the effect of signal. Other sources of information include EcoCyc (<http://ecocyc.org>), EcoGene (<http://bmb.med.miami.edu/EcoGene/EcoWeb>), RegulonDB (http://www.cifn.unam.mx/Computational_Genomics/regulondb) and a list of *E. coli* transcription-factor interactions compiled in Uri Alon's laboratory (<http://www.weizmann.ac.il/mcb/UriAlon>). [‡]AraC acts as a repressor of effector expression in the absence of signal and as an activator in the presence of signal. During induction, *araC* is transiently induced; expression then falls below the background level⁵. [§]A small decrease (a less than twofold change) in expression of *ilvY* has been observed in the presence of inducer²⁹. ^{||}Although *malT* expression is not autoregulated by MalT, *malT* expression does decrease slightly (up to a twofold change) in the presence of inducer (because of cAMP-CRP). [¶]3-(3-hydroxyphenyl) propionic acid (3HPP). [#]Two-component system. TorS is the sensor; it detects trimethylamine *N*-oxide (TMAO). ^{**}The nucleoprotein complex of CytR and DNA-bound cAMP-CRP negatively regulates promoters⁷⁸. The inducer, cytidine, does not affect the CytR-DNA interaction but interferes with protein-protein interactions of CytR and CRP. ^{**}*N*-acetylglucosamine 6-phosphate (GlcNAc-6-P). ^{§§}A coupling type cannot be assigned unambiguously given uncertainties about transcription of *rbsR*. It is possible that *rbsKR* is expressed from a constitutive promoter upstream of *rbsK* and/or that *rbsDACBKR* is an operon^{106,107}. ^{||||}UxuR cooperates with ExuR (the two transcription factors form hetero-oligomers) to repress expression of *uxuR* and *uxuAB*^{112,113}. ^{¶¶}FruR is also called Cra. ^{##}GcvA acts as an activator of effector expression in the absence of signal and acts as a repressor in the presence of signal. ^{***}Guanosine-3',5'-bispyrophosphate (ppGpp). ^{***} The primary signal that is recognized by TyrR is L-tyrosine, but L-phenylalanine and L-tryptophan also affect the activity of TyrR. AntiInd, anti-inducer signal molecule; CoR, corepressor; D, direct coupling; Ind, inducer; I, indirect coupling; TU, transcriptional unit; U, uncoupling with self-regulation; U(0), uncoupling without self-regulation, a special case of uncoupling.

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