Table S1. Response regulators with rare output domains and domain combinations

Domain organization	Output domain			Example			
	Pfam	COG	Function	Organism, gene name	RefSeq accession	CDD entry	Pfam entry
REC-REC-REC	—	—	—	*Desulfatibacillum alkenivorans* Dalk_5088	YP_002434227	CDD	Pfam
REC-HTH							
REC-HTH_XRE	—	1426	DNA binding	*Herpetosiphon aurantiacus* Haur_0584	YP_001543360	CDD	Pfam
REC-HTH_ArsR	PF01047	1846	DNA binding	*Xanthobacter autotrophicus* Xaut_1114	YP_001416020	CDD	Pfam
REC-HTH_10	PF04967	3413	DNA binding	*Halorubrum lacusprofundi* Hlac_3274	YP_002567397	CDD	Pfam
REC-HTH-REC	PF00196	2197	DNA binding	*Chloroflexus aurantiacus* Caur_1927	YP_001635531	CDD	Pfam
HTH-REC							
wHTH-REC	PF00072	—	DNA binding	*Shewanella halifaxensis* Shal_0757	YP_001672991	CDD	Pfam
BetR-REC	PF08667	—	DNA binding	*Chromobacterium violaceum* CV_0537	NP_900207	CDD	Pfam
AlpA-REC	PF05930	3311	DNA binding	*Dehalococcoides ethenogenes* DET1294*s*	YP_182006	CDD	Pfam
HlxR-REC	PF01638	1733	DNA binding	Haloquadratum walsbyi HQ1946A	YP_138172	CDD	Pfam
LysR-REC	PF00126	0583	DNA binding	*Ruegeria pomeroyi* SPO3037	YP_168241	CDD	Pfam
MerR-REC	PF00376	0789	DNA binding	*Desulfatibacillum alkenivorans* Dalk_2555	YP_002431716	CDD	Pfam
Enzymatic output domain							
REC-HATPase	PF02518	2172	ATPase	*Leptospira biflexa* LBF_3089	YP_001964136	CDD	Pfam
HATPase-REC	PF02518	2172	ATPase	*Chloroflexus aurantiacus* Caur_0465	YP_001634103	CDD	Pfam
REC-CheC	PF04509	1406	Asp~P phosphatase	*Shewanella halifaxensis* Shal_3795	YP_001675994	CDD	Pfam
CheC-REC	PF04509	1406	Asp~P phosphatase	*Desulfococcus oleovorans* Dole_0913	YP_001528800	CDD	Pfam
REC-S_TKc	PF00069	0515	S/T protein kinase	*Rhodopirellula baltica* RB10329	NP_869369	CDD	Pfam
S_TKc-REC	PF00069	0515	S/T protein kinase	*Sorangium cellulosum* sce2313	YP_001612952	CDD	Pfam
REC-REC-HDGYP	—	2206	c-di-GMP-specific phosphodiesterase	*Desulfococcus oleovorans* Dole_2174	YP_001530055	CDD	Pfam

REC-HDOD	PF08668	1639	Phosphodiesterase	*Vibrio cholerae* VC_1081	NP_230726	CDD	Pfam
REC-CpaE	PF01656	4963	Pilus assembly ATPase	*Roseiflexus castenholzii* Rcas_1683	YP_001431793	CDD	Pfam
REC-PulE	PF00437	2804	ParA family ATPase	*Desulfatibacillum alkenivorans* Dalk_0300	YP_002429477	CDD	Pfam
BchE-REC	PF02310 +PF04055	1032	Mg-protoporphyrin IX monomethyl ester cyclase	*Cyanothece* sp. PCC 7425	YP_002485444	CDD	Pfam
REC-DPM1	PF00535	1216	DPG synthase	*Flavobacterium psychrophilum* FP0935	YP_001295843	CDD	Pfam
REC-ElaC	PF00753	1234	Metal-dependent hydrolase	*Desulfatibacillum alkenivorans* Dalk_4072	YP_002433225	CDD	Pfam
REC-GdhA	PF00208	0334	NAD(P)-dependent Glu dehydrogenase	*Beijerinckia indica* Bind_1961	YP_001833073	CDD	Pfam
REC-LmbE	PF02585	2120	Poly-N-acetylglucos-amine deacetylase	*Beutenbergia cavernae* Bcav_0338	YP_002880364	CDD	Pfam
REC-PglZ	PF08665	—	Predicted phosphatase	*Chloroherpeton thalassium* Ctha_1348	YP_001996258	CDD	Pfam
REC-PNPase	PF01048	0775	Nucleoside phosphorylase	*Sinorhizobium medicae* Smed_6520	YP_001315001	CDD	Pfam
REC-TrxB	PF00070	2345	NAD(P)H:disulfide oxidoreductase	*Nocardia farcinica* Nfa52850	YP_121501	CDD	Pfam
REC-WcaA	PF00535	1215	Glycosyltransferase	*Methanobacterium thermoautotr.* MTH548	NP_275691	CDD	Pfam
REC-WcaJ	PF02397	2148	Sugar transferase	*Chloroherpeton thalassium* Ctha_0391	YP_001995309	CDD	Pfam
PHP-REC	PF02811	1387	PHP family hydrolase	*Desulfatibacillum alkenivorans* Dalk_2412	YP_002431573	CDD	Pfam
ThrC-REC	PF00291	0498	Threonine synthase	*Herpetosiphon aurantiacus* Haur_1218	YP_001543994	CDD	Pfam
Ligand-binding output domain							
REC-PBPb	—	0715	Nitrate/sulfonate/ bicarbonate binding protein	*Desulfobacterium autotrophicum* HRM2_31060	YP_002605048	CDD	Pfam
REC-CBS	PF00571	0517	AMP, ATP binding	*Desulfococcus oleovorans* Dole_1341	YP_001529222	CDD	Pfam

REC-PilZ	PF07238	3215	c-di-GMP binding	*Geobacter sulfurreducens* GSU0877	NP_951934	CDD	Pfam
REC-PAS	PF01627	2202	Heme, flavin binding	*Haloarcula marismortui* rrnAC0674	YP_135382	CDD	Pfam
REC-GAF	PF01590	2203	cGMP binding	*Geobacter sulfurreducens* GSU1316	NP_952369	CDD	Pfam
REC-cNMPbind	PF00027	0664	cAMP, cGMP binding	*Bdellovibrio bacteriovorus* Bd3065	NP_969828	CDD	Pfam
REC-USP-USP	PF00582	0589	Nucleotide binding	*Herpetosiphon aurantiacus* Haur_1083	YP_001543859	CDD	Pfam
Transporter output domain							
REC-FocA	PF01226	2116	Formate/nitrate transporter	*Desulfococcus oleovorans* Dole_0884	YP_001528771	CDD	Pfam
REC-CitT	PF00939	0471	Dicarboxylate transporter	*Desulfococcus oleovorans* Dole_1347	YP_001529228	CDD	Pfam
REC-SUL1	PF00916	0659	Sulfate transporter	*Desulfatibacillum alkenivorans* Dalk_2931	YP_002432089	CDD	Pfam
REC-UgpE	PF00528	0395	Sugar transporter	*Caldicellulosiruptor saccharolyticus* Csac_1104	YP_001179907	CDD	Pfam
REC-CorA	Pf-B_90381	0598	Mg^{2+} transporter	*Marinobacter aquaeolei* Maqu_1888	YP_959157	CDD	Pfam
ATM1-REC	PF00664 +PF00005	5265	Fe/S cluster transport and assembly	*Cupriavidus taiwanensis* RALTA_A0579	YP_002004631	CDD	Pfam
Protein-protein interaction output domain							
REC-Hnr	—	—	RpoS-interacting	*Escherichia coli* Hnr	NP_415751	CDD	Pfam
REC-GAF-STAS	PF01740	1366	Anti-anti-sigma	*Sorangium cellulosum* sce1938	YP_001612577	CDD	Pfam
REC-PAS-MCP	PF00015	0840	Methyl-accepting chemotaxis protein	*Methanosphaerula palustris* Mpal_1772	YP_002466802	CDD	Pfam
REC-HPt	PF01627	2198	Phosphocarrier	*Stenotrophomonas maltophilia* Smlt3542	YP_001973253	CDD	Pfam
REC-REC-HPT	PF01627	2198	Phosphocarrier	*Janthinobacterium* sp. mma_0858	YP_001352548	CDD	Pfam
REC-TPR-TPR	PF00515	0457	Protein-protein interaction	*Desulfatibacillum alkenivorans* Dalk_2142	YP_002431304	CDD	Pfam