

Amino acid sequences of the 17 two-component (histidine kinase-response regulator) signal transduction systems and one orphan response regulator identified on the genome of *Enterococcus faecalis* strain V583 (www.tigr.org). The classification of the histidine kinases is as proposed by Fabret et al. (J. Bacteriol., 1999, **181**:1975-1983).

- Highlighted in yellow are the regions surrounding the phosphorylated histidine residues.
- Highlighted in green are the transmembrane domains.
- Highlighted in purple is a GAF domain.
- Highlighted in blue is a PAS domain.

#### EF2218 Response Regulator (Others B)

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1 MYRVMFVDDE YMILEGLKWI IPWQELGFEI VKTARSAQEA
41 LAFLETESID VLLTDITMPE MSGIELIEQA KKKGHQFISL
81 ILSGYQEFDY VKKGMALQVQ DYLLKPVNKQ ELLANIQRIK
121 IELDQQKKSH ARVRLYLENG LMRWLNDEIS EGEYEELMQQ
161 FATIKPGDFT VLLVEAEMSF LETIKELFMK KGQLLFIESW
201 MSTYHQLLLI YKGARQEAFI FIREIEAILA GQGQIFVGES
241 VNEWETVYES YEKVKQLQAI ETFYQEFLPN NQKEQMNRSA
281 EDFTFILAFNQ ALMIGDMQTI QRELDALFNQ LSQQHATPEY
321 VRYVVFLLFS DISRQYPTVL EENYEKIVEE IRASNNTLNTL
361 YALMQQVLAE VKNKPKIKKY SESVSQAVER IEQGYLEELN
401 LKTVADELHL NPSYLGQIFK KETKRSFSQY LNQVRTKHAQ
441 KLLLYTDDTI NEISEKVGFN NTNYFSKMFK KLNGITPKEF
481 REQYQSNYAG VEE

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#### EF2219 Histidine Kinase (Group I)

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1 MKRIFKKLFK KKYLLNRLVQ KYSLLLTSII LLTVAALCVY
41 VTYTINLSID SQKNNAVSQI DSYVTNKNNA ATNMINELAG
81 SASKIENMRK YMELSPPEYF DYTYSQWSED RVSTHFGNNL
121 STLFSTFPDL EEVIIRLDEF DQVLFANRTA TNGKKMDMSS
161 IKKHGFQLMR IISDPYTGQP LGELYTVFSS QELIGNQADL
201 LKKSGINAFI YDSAGNQIFS EKAQFTKEEE RQLDKRMHTD
241 SDIQQVFHNR YDITEIESSG RSTILLTSTR RVLFQQLFMN
281 YAAILGIGLL LIVILLVGLN RLFKRYSQQV QLILEATRAI
321 GDGNLKERID TNQVQEELND IASAINFMVD SLDQYIHDIY
361 TLEIKQRDAH MRALQSQINP HFLYNTLEYI RMYALSRQQE
401 ELADVYAFS TLLRNNINQE KTTTLAEEIS FCEKYVYLYQ
441 MRYPDQFAYK FEIEETIADV EIPKFIIQPL VENYFVHGID
481 YQRQDNAIKV HAYREGEKII VAVVDNGKGI TANRLEEIRE
521 RLNQTEIDTE QSIGLRNVHE RLQRFFGESY GLTIEGKEGE
561 GTTIRLSFVA

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**EF3196 Response Regulator (Others B)**

1 MHVLIIVDDEP LAREELSYLV SQHPQVTSVA EADSVAEAME  
41 EMMDQKPDLL FLDIHLTDES GFDLAEKLTH LKKAPYLVFA  
81 TAYDQYALKA FQVNAKDYIL KPFEEEKITQ VIEKASKEMG  
121 QAVPENTAEEK GPKSEAPIQ GEDRIYLVAP EDIYLVSVVEE  
161 RQLSIFVDQQ VYKMTGTLNS IEQKLPATLF IKTHRSFILN  
201 RTKIQEIQPW FNNTLQVILT NGSKVPVSRV YVKEFKEKLG  
241 LS

**EF3197 Histidine Kinase (Group I)**

1 VVELFILMME RVGLIILLAF LLVNVPYFKR VLLSREKMSS  
41 KVQLILIFGL FAIISNFTGI EIAKNQIVPN NLLTYLSSNA  
81 SIANTRTLVI GVSGLVGGPI VGSVAVGLIAG FHRVIQGGGH  
121 SFFYVPASLI VGLIAGFLGS RMAKQTVFPS AGFSAIVGAC  
161 MEMIQMIFIF FESGDLSDGA TLVRFIALPM ILLNSVGTFI  
201 FMSILTTTLK QEEQAKAVQT HDVLELAAET LPYFREGLNK  
241 NSSKKVAEII KHYTKVSAIS MTNSHQILAH VGAGSDHHIP  
281 ELEVITELSR EVLRTGRMTI AHAKKEEVGCS DPNCPLQAAI  
321 VIPLFSHQOI VGTLKMYFTD PAQLTHVEEQ LAEGLGTIFS  
361 SQIELGEAEV QSKLLKEAEI KSLQAQVNPV FFFNAINTIS  
401 ALMRKDSEKA RKLLLQLSKY FRGNLQGAVQ TTIPVSQELE  
441 QVKAYLSLEQ ARFPNRYQVT FDVEEAVASE KVPPYAIQVL  
481 VENTIKHAFG SRKENNQVRV VVKAKQHKLH VDVYDNGQGI  
521 PEERRLLL GK TTVTSEKGTG TALENLSRRM ANLYGSEGCF  
561 LIENLETGGS HVHLEIPMEQ EELDARINR

**EF2911 Response Regulator (NarL family) YvqC**

1 VIKVMLVDDH EMVRLGVSSY LSIQEDIEVV GEAENGKIGY  
41 EKALELRPDV ILMDLVMEEM DGIDSTKAIL KDWPEAKIII  
81 VTSFIDDEKV YPAIEAGAAG YLLKTSTAHE IADAIRATYR  
121 GERVLEPEVT HKMMERLTKK QEPVLHEDLT NREHEILMLI  
161 AQGKSNQEIA DELFITLKT V KTHVSNILAK LDVDDRTQAA  
201 IYAFQHGLAK

**EF2912 Histidine Kinase (Group II) YvqE**

1 MTDRIARRMI SLYASLSTFI VILITLFSYF HSIKQNRWLL  
41 ELLQRKVFYL PLIVHIVLIS LLIGLLTFLI ISLVQKGQYG  
81 RIEEKLRLLA NGNYESPVLN KPTTSENQDH YLTEVEQDIW  
121 SIKNKLLEMS KELQLLNSRP QLMGQTKEE ILENERHRLA  
161 RELHDSVSQQ LFAAMMLSA LNEQAQRTET PEPYRKQLAM  
201 VAEIINASQS EMRALLLHLR PISLEGKSLR KGIEQLLCEL  
241 QTKIKIELIW DVEDVHLNNS IEDHLFRIVQ ELLSNTLRHA  
281 KAKELEVYLH QVDKNVLLRI VDDGVGFDMK EQSNKAGSYG  
321 LNNIRERVVG MGGTVKIISF KGQGTSVEIK VPVIKEETAS  
361 DQSNVSG

**EF1703 Response Regulator (OmpR family) PhoP**

1 MKKVLVVDDE PSILTLLTFN LEKEGYQVTT SEDGKNGFEL  
41 ALSNQYDFII LDVMLPGMDG LEITKALRRE KIDTPILILT  
81 AKDEQVDKII GLEIGADDYL TKPFSPREVL ARMKAIFRRL  
121 KPTTTETLQE DTPKAPLVIG EIRVDEQNYE VFVRNQPIEL  
161 TPKEFELLYV FMKRKDRVIN RETLLERIWQ YDFAGQSRIW  
201 DVHISHLRDK IEPDPKRPVY LVTVRGFGYR FQEPKR

**EF1704 Histidine Kinase (Group IIIA) PhoR**

1 MKKRLR IEYF LVAAVMLLLF VGSIAATNFF FQKEMVAQQE  
41 TYLRRKNTLL TDQLPPSVFE KGQLTNQQQL LVTHALDDAE  
81 ERVTLLQKNG TVFFDSSQNE PLESHKKRPE IAAVLSGATY  
121 GSALRKSRTL NKELLYVATP VLKSGEIVGI IRISEQTALF  
161 SKNIQSFRRY IIFTFGILFL LITLFIPLLL RQKNQPLVTV  
201 LPILKRMLKH PDENRSIIQQ SSEWNELYET INLLSQQVSQ  
241 TYKAYTSADE QFHELLDELM IGVFIIDTQG RLRLLNPKMQ  
281 EMLGLSAKNM QSNYLEVIQD ADLIHLIHQV VAEKNSLHQE  
321 ITVTQGPTPL RLDLSLRYLD DQSANDYQVL GIAYDLTRVR  
361 QLEKMQKDFV SNVSHELKTP VTSLLGFTET LIDGAKEDPE  
401 VLNQFLHIMQ KDAQRLQQLI QEILELSRGS ATIPYAEQEI  
441 TLEKFITEIL GSYQQQLAAK QLKTVVHGLP ESQFFTKYEL  
481 FYPIVKNLIE NAIQYSQENG QITISYAIEN QQLRLSVQDT  
521 GIGISQKDQE RIFERFYRVD KARSRHSGGT GLGLAIVQNY  
561 TELLGGKIAI DSHLGLGTTF TITLTLTKKE A

**EF3289 Response Regulator (OmpR family)**

1 MKILVADDDK EIVELLSIYI HNEGVEVVK YDGKEALSKL  
41 HTTPDIDLLI LDIMMPIMDG MEVVKELRKE SQIPIIMLTA  
81 KTTDMDKIKG LVAGADDYVT KPFNPLEVMA RVKSILRRSQ  
121 MQLTKKEEPDE LEVGPLMINK DSHEVKTIEG KEIQLTALEF  
161 GILYLLASHP NRVFSADEIF ERVWQQESIV SAKTVMVHVS  
201 HLRDKIEEAT GGEKVIQTVW GVGKIDAR

**EF3290 Histidine Kinase (Group IIIA)**

1 VTIVLLLLLN VSIMFLGQL LSENSPLAGV IWATKDAVAK  
41 ELNTDLFWSW NKFVLPFFL VDAAVLYWRL IRRYHQMLR  
81 HIISELHYIA DGNYNHRIPF ELSGDLAKVV TSINGLVDST  
121 VAAIEDERRI EKSKDELITN VSHDIRTPLT SIIGYLGLIE  
161 DRQFHSQEDL LKYTHTAYVK AKQMKLLVDD LFEYTKVRQP  
201 SVPIHTTTTFD MAQLIEQLAA DFELEAKKIN MQIQVKANPA  
241 SLMMEGDTEK LVRVFNLLS NALKYKGGH HIVMEVDKVG  
281 TEAIIAVRND GPAIPKHS LDQLFDRFYRVE ESRSQETGGT  
321 GLGLAIAQSI VALHGGYIYA KSDQKWTSFI IHLPLQRTNK  
361 KSES

**EF1260 Response Regulator (OmpR)**

1 MNILMIEDNE SVSEMMQMPFF LNEGWEATFK DDGKEGLATF  
41 LASPEKWDMI TLDLNLPSMD GMAVCREIRK VSANVPIIML  
81 TARDSESDQV IGLEMGADDY VTKPFSPLTL IARMKALHRR  
121 AEVAEAAHDT SENTDETFDV ITDHFKMNTK TRETYLDNQL  
161 IEGLTPKEFD LLYTLAKKPR QVFSREQLLE LVWDYQYFGD  
201 ERTVDAHIKK LRQKIEKVG P QVIQTVWVG YKFDDSGVA

**EF1261 Histidine Kinase (Group IIIA)**

1 MKYLYQQLLA FIGVIALIIL IVGTSFTQLT KRTMQENNYE  
41 QLYGYAESAL ETRDFFINVA GVSDRDVLSY SFQLTERVLQ  
81 KQDVQVFIN KDREVQYPPV DSTKKLDFSL IDKNWDQIMK  
121 GNRVYATENI DIYGARTSS YVMLPVYASN QSSDKKVIIG  
161 SLVITQPAKN VDRSVQSVTQ NLIKGFIFSG VIALLLSYLE  
201 ATFQVKRINR MRKATKEITS GNFDIQLPVH DKDEFDDLAE  
241 DFNKMAASLK ESQEEINRQE ERRRQFMADA SHEMRTPLTT  
281 INGLLEGLQY NAIPENQKEN AIKLMQNETA RLIRLVNENL  
321 DYEKIRTNQI QIVVKKFNGT EALENIQTQL TAKAEAAGNQ  
361 LYLDTTPEPID VYADYDRFVQ VVVNIVQNAI QFTENGEIHI  
401 ALEKGYLETI VRISDTGIGM TEEQILNIWD RYYKVDPSRK  
441 NTKYGESGLG LPIVQQLVRL HKGKINVESE LGKGTTFIIS  
481 FPDVEITEN

**EF1193 Response Regulator (OmpR family) VicR, YycF**

1 VKKILVVDDDE KPISEIVKYN LVKEGYEVFT AYDGEEALEK  
41 VEEVEPDLII LDLMLPKMDG LEVAREVRKT HDMPIIMVTA  
81 KDSEIDKVLG LELGADDYVT KPFSNRELVA RVKANLRRGA  
121 TNAKEAEVTT QSELTIGDLT IHPDAYMVSK RGEKIELTHR  
161 EFELLYYLAK HIGQVMTREH LLQTVWGYDY FGDVRTVDVT  
201 VRRLREKIED SPSHPTYLVT RRGVGYLRLN PEQE

**EF1194 Histidine Kinase (Group IIIA) VicK, YycG**

1 MKKKVHFFQS VNFKIALSFI LLLLIAIQII GGYFI RELEA  
41 TTISDFKKNM DSQVVQLSNT LSTQMSNKDL ERSDVDANLK  
81 KALSDFSAD ISEARIVDDK GIIRATNDLN QQNIIGKKND  
121 YRDLNDFTSK KYQALDNDKR VYVNVQPIQS PTGETVIGVL  
161 YVKSNNLENKY QEITNTASIF FTASIAAAI SIIVTLLIAR  
201 SITKPIGEMR EQAIRIARGD YAGKVEVHGK DELGQLAETF  
241 NQLSERIEEA QETMEAERNR LDSVLTHMTD GVIATDRRGK  
281 VITINEMALS LLNVKNENVI GTSLLELLDI EEDYTLRKLK  
321 EEPDELLIDR STSDREEDQM IIRVDFTMIR RESGFITGLV  
361 CVLHDVTEQE KNERERREFV SNVSHEL RTP LTSMRSYIEA  
401 LSEGAWENPE IAPNFLKVTL EETDRMIRMI NDLLNLSRMD  
441 SGNTHLQLEY VNFNELLINFV LDRFDMMIEN EQKNYKICRE  
481 FTKRDLWVEL DTDKVIQVLD NILNNAIKYS PDGGVITCRL  
521 VETHNNVVS ISDQGLGIPK KDLGKVFERF YRVDKARARA  
561 QGGTGLGLAI SKEVIRAHNG SIWVSTEGER GSTFYISLPY  
601 EPYEEDWWE

**EF1864 Response Regulator (OmpR family) VncR(S.pneumo)**

1 MKILTVEDDN MIREGISEYL SEFGYTVIQA KDGREALSKF  
41 NSDINLVILD IQIPFINGLE VLKEIRKKS N LPILILTAFS  
81 DEEYKIDAF T NLVDGYVEKP FSLPVLKARI DSLIKKNYGH  
121 LEKFEYKDLS VNFNSYTAKI NGEEDVNAK ELEV LKCLLD  
161 NNGQVLTRMQ IIDYVWKDSE ETPYDRVIDV YIKELRKKLQ  
201 LDCITTIRNV GYKLERK

**EF1863 Histidine Kinase (Group IIIA) VncS(S.pneumo)**

1 MKKLLKIFPKM FIOIFSVLGI IILVHSLVF FIFPKTYLET  
41 RKEKIHNMNAN EISSNMNGKE IKYIEQTLEF YKSSEIKVF  
81 IKEKNNKNEI QIKDNINVNL ESDSNLIIE EKEIKLNDGK  
121 KTNLQFVSTA DMQKDAKDLS LKFLPYSLLI SILFSATISL  
161 IYAKSIKNNI QEIKIVTDKM MKLDDKMSLK VSSNDEVGEL  
201 KQQINDLYST LLRTIDDLEF KNKEILKLEK LKYDFFKGAS  
241 HELKTPLASL KIILENMKYN IGKYKERDIY INECIEIVDS  
281 LTKNISQILS VHSIENLNND EEYLKINDTL EDILKKYEIL  
321 ANQKKITVNN YILDENVYIG KTALKIILSN LISNAVKYTD  
361 VNGVINIGIV NDWLYIENSY GNNKISNMDK IFDVKFDLTK  
401 ENSNGLGLYI VSNILNNYNI EYKVLQDEEF FIFKIKIFS

**EF0926 Response Regulator (OmpR Family)**

1 MAKIMIVEDE TTIRELISEE LQKWQFETIG TTDFNDVLDD  
41 FQENPQLVL MDINLPVYDG YYWCQKIREV SKVPIIFISS  
81 RSTNMDMIMA MNMGADDFVT KPFQIDVLIA KINALLRRSY  
121 NYSDTDSEVL SHNGITLNV D NGRMEIRGEM IDLSKNEYRL  
161 LYLLMKKHGK ILTREKLLRA LWDDERFVDD NTLTVNINRL  
201 RKKIEQAGIA GYIETKVGVG YMVP

**EF0927 Histidine Kinase (Group IIIA)**

1 MTILKYLKDR WLLIGWLF LFLTCLWL APNVRLDWT  
41 VGYIFLLQSV FLSLFLTI DY YLKRKWWSL ATEKEPPSLQ  
81 EYLNTAEKEE ELLVQTYING LLQEHQQTMO QAINNQDQK  
121 DYIDSWVHEI KVPLAAITLL VQSVEDDIPE KKYYLLENEL  
161 GKIDEYVEQV LYYARLDSFS RDYLLQEYSL KEIVQSVVRT  
201 QANYFIQKRL QFSIEGEDEA VLTDRKWVIF IFRQLLSNAV  
241 KYTPEGGTIT VLISKNKQGI YLSLKDSGIG IPTQDQRRIF  
281 DKGFTGENGR KSEQHSTGIG LYLAHSLAKK LGHDLTVEST  
321 EGQGTMTLF FPSLSYNEV K

**EF1050 Response Regulator (OmpR Family)**

1 MSNILIIEDE KNLARFVELE LKHEGYTTEV HYNGRTGLEA  
41 ALNNEWDAIL LDLMLPELNG LEVCRRVRQV KNTPIIMMTA  
81 RDSVIDRVSG LDHGADDYIV KPFAIEELLA RLRALLRRID  
121 IEGDKNVAKQ TTITYRDLTI EKENRVVRRN SEMIELTKRE  
161 YELLLTLMEN VNVVLARDVL LNKVWGYETE VETNVVDVYI  
201 RYLNRNKIDVP GEESYIQTVR GTGYVMRS

**EF1051 Histidine Kinase (Group IIIA)**

1 MKRTIKKELE GPSLTIK **WAF ASSFFIFVVF TIFAVITY**KS  
41 SVSLIVAKEK ENVEATIAEV TNRLANANEN LTVTDVFDYL  
81 KTPSERDENY YNKHTAVEGS FMEMDSFISE LGQPELYLSV  
121 YDTNQKLVFK TQNEYDKLLQ LDRQLPVVRT VFDKTGFYSV  
161 EPIFSKETRE KIGYIQAFYE LSSFYEIRNH **LLLTLVVLEV**  
201 **ISLIVSSVLG FILSSYFL**KP LKVLRDTMDT IRKDPQSDVH  
241 MPEINTRDEL ADISEIFNEM LDRMRRYIEQ **QEQFVEDVSH**  
281 **ELRTPVAIME** **G**HNLNLRWG KDDPEILDES LKASLQEISR  
321 MKSLVQEMLD LSRAEQVDTQ YANERTDAKQ VVYQVFNNFQ  
361 LVYPEFHITL DDDLPTLEVEL KIYRNHFQEL LIILLDNAIK  
401 YSTDRKEVHI SISRTMNEFE IAVQDFGEGI TEEDLEKIFD  
441 RFYRVDKARA RNKGGNGLGL SIAKQLVENY KGRIDAESVL  
481 HQGTIFRIFI PIAGIKEESN VQ

**EF2299 Response Regulator (OmpR Family) VanR<sub>s</sub>**

1 MSIRILLVED DDHICNTVRA FLAEARYEVD ACTDGNEAHT  
41 KFYENTYQLV ILDIMLPGMN GHELLREFRA QNDTPILMMT  
81 ALSDDENQIR AFDAEADDYV TKPFKMRILL KRVEALLRRS  
121 GALAKEFRVG RLTLLEPEDFR VLCDGTELPL TRKEFEILLL  
161 LVQNKGRTLT HEIILSRIWG YDFDGDGSTV HTHIKNLRAK  
201 LPENIIKTIR GVGYRLEESL

**EF2298 Histidine Kinase (Group IIIA) VanS<sub>s</sub>**

1 MERKGIFIK **V** **FSYTIIVLLL LVGVTATLFA** QQFVSYFRAM  
41 EAQQTVKSYQ PLVELIQNSD RLDMQEVAGL FHYNNSFEF  
81 YIEDKEGSVL YATPNADTSN SVRPDFLYVV HRDDNISIVA  
121 QSKAGVGLLY QGLTIR **GIVM IAIMVVFSL** **CAYIFA**RQMT  
161 TPIKALADSA NKMANLKEVP PPLERKDELG ALAHDMHSMY  
201 IRLKETIARL EDEIAREHEL EETQR **YFFAA** **ASHELKTPIA**  
241 **AVSVL**LEGML ENIGDYKDHS KYLRECIKMM DRQGKTISEI  
281 LELVSLNDGR IVPIAEPLDI GRTVAELLPD FQTLAEANNQ  
321 RFVTDIPAGQ IVLSDPKLIQ KALS NVILNA VQNT PQGGEV  
361 RIWSEPGA EK YRLSVLNMGV HIDD TALS KL FIPFYRIDQA  
401 RSRKSGRSGL GLAIVQKTL D AMSLQYALEN TSDGVLFWLD  
441 LPPTSTL

**EF0571 Response Regulator (OmpR Family)**

1 MKQSILLIED DPNITDFMEV VLGQERYQLT IASTGMEALT  
41 AFQTTSFDLV LLDLGLPDID GIDLLKILRK RMHLPPIIIS  
81 ARNNEEEKVK ALDLGADDYV TKPFGTNELL ARIRTALRHQ  
121 NVQTESLTVV ENKDLKIDFE KQLVYKKGQE IHLTKNEYRI  
161 LALMFRQLGK VVAYQTLMTK VWGPYSNDSQ TLRVNMSNIR  
201 KKIESNTLKP EYLITEIGVG YRLRDHRLE

**EF0570 Histidine Kinase (Group IIIA) KdpD**

1 MQTTEEMQSG DGRRGR LRIF FGFAAGVGKT YGML TEAHEL  
41 LMMGKHVVVG YIEPHDRPDT NRLLEGLPQI PPKNIFYKQM  
81 VLTEPDIDQI IQQKPEIVLI DELAHSNAEG SRNRKRYQDI  
121 DELLNAGIDV FTTVNVQHIE SLNDIVEEVT GIEVKETVPD  
161 TFLRQATIRV IDVEPDELIE RLEQGKIYAN ENAKRALKNF  
201 FIPQKLDQLR GLAIQRASDH INRISGKTIG IQSKLLTVVN  
241 DAFPKMTEKC IRWTARLAQG LVVDWTVIQV RTQENTPTNI  
281 PLADKLGAEV ISIEEDDSFE TIVEFAKMTG VTDI IMGKNL  
321 RQPWYEKIFI EAFDDRLLKR LKDTELHLIP FNEEKRSLFF  
361 KTRKVIIEGGG KDLVIAIGGV FLATVVTELM QYIHVGDQNL  
401 MLIYISFVLL VARTTSGYFW SSLSSILSVL SFNWWFFVEPL  
441 YSLTVYKQGY PFTLLLMLVV ALMSSNLMIR LKKQADTSMK  
481 KEHQMEILYE LNKRYVLVES RKQILDISAT YLSRLLEREV  
521 IIFDRQVKTE SVHCINEKKS ILNNEDEAAV AFWAAKNQKE  
561 AGNGTDTLNG AKGFYLPAAA GRKTLAVLGI ERNADLDLEN  
601 DQLNYLKLVL TQIAVILEQT ELKDEKEQVE LENEREKVRS  
641 NLLRAVSHDL RTPLTVISGI AETLGIGNDL KEETQRKLLK  
681 DIQEESQWLI RMVENLLSIT RINMDTMKVN KTAEPVEEVI  
721 EAVYKHLRKV YPDGQVDIHL PEEVIFIQAD PILIEQALFN  
761 LIENAFRHGE NDLPVKLVNY QEKEQTVFEI ENHGEIPLKQ  
801 FQKIQSNLSG TNEVPVDSKN GLGIGLSIVK TIVHAHNGKM  
841 EMTIGRGKTL VRIYLK

**EF0372 Response Regulator (OmpR Family)**

1 MKPHVLIIED DPSIADLQKD YLEINDMTVT IEHDGKKGLE  
41 AALNEPFDLI ILDVMLPTMD GFEICRAIRK KKQTPIMIVS  
81 AKKEDIDKIR GLGLGADDYI IKPFSPNELV ARAKAHMNRY  
121 QLLSKAEQPP QLLKINEIAV DTAAHKVFVL ENEVIFTSKE  
161 YKLLVFLMEH PNRVWNKEEL FESVWGF DAL DTEVSTVVVH  
201 IKRIREKLLK ANLSDSPIET LWGSGYRFNR

### EF0373 Histidine Kinase (Group IIIA)

1 LTIKRRFFIS YISAIITLA SVLAVLSLAS YITLGTVPSL  
41 PQAYRMMNKQ RPLTANEEES YLALDQLLKK SPKLLDTPLS  
81 KELKETIQTI EAKGLSVIIR KNARFPYYS NLVEKSLSVH  
121 IPNYEMNNIM PTGTLDNAGR LYHYVKSDFH YLDGSNGSFI  
161 VLKRESSLFE FFTRWIIWMI LLIILVAIAA AWLINKRLTK  
201 TTIEPLEALE KATKTLGKDA QKENPFTPTS HQTVSTEVKQ  
241 LQLSFEQMWQ DLEEANAERE KYEANRKELI ANISHDLKTP  
281 ITSIIGYVEG LMDGVANTEE KKQRYLTVIH EKSLGLNDLI  
321 EELFLYSKLD LDRAVFTMEK TNFTRFIAHI LEEYRLEQEL  
361 VITSVLPTEA LYVQMDPTQM NRVITNLIQN SIKFADPTKE  
401 QLAFTISLTH NQTDLVLTIT DNGIGIDKKE LPYLFERFYR  
441 VDKSRTPTVK GSGLGLSIVK QIIDYHQGTI TVTSKKGDGT  
481 NVIITLPLLE DEK

### EF1210 Response Regulator (Others A Family)

1 MNLLIIEDDP MVAYIHQKYL EKLIHQPTIF TVATIAEGLL  
41 LTKEKQPALV LLDVHLKDG N GLTYLATIRD EKIDTEVILI  
81 TAANELENVK RSLHLGVL DY LVKPF S FERF QQSIENYQKK  
121 TAQFTLETKE LSQTKVDQLF HYSQTNARKN EQALQNSLE  
161 KGLTQATLQL LLKKIDEFTD YFTIQELSEA SQLSHVSVRK  
201 YVLFLEKNNL LESKNSYLVK GRPYQSYRRI

### EF1209 Histidine Kinase (Group IV)

1 LSVSQGSLGE SLRGFVPVYD QGKQIGVVAM GIKMTSLSQL  
41 IERTKNDYTV SVLLSVGFGF ILAIVVSYYL KKQLHDLEPR  
81 EIARLLEERN AMLEETKDAI LVIDTDQNIL LANIEATKMY  
121 HNITNSEENL LGKKLSALVL SPEKLVVHSK TEQFYRQNGQ  
161 DYFVSIAPIN VRKKTIGHVI FLKNATETFI VAEQLVSTTT  
201 YASALQSQSH EFMNKMHVYI GLVDLEDYEA LKHYLADLLK  
241 PEKEFAQRLA ILVRNPILAG FLSGERIKFA EIKTQLAIEI  
281 YPEIPP NKRD EDTQNLI AIY RYIHRFLMEQ TLPEEIIETI  
321 DYQPGSLTTT YSFAYPKEQL ERFEQEFTS YLARLLENAE  
361 ATLTWENQQN NWLVLRIN VH YEGAEENEPI DY

**EF1822 Response Regulator (AgrA Family) FsrA**

1 MAIYILEDQI IQAKALEVLL TNILHSRNIY NETIHLFSRS  
41 DELLQVAHQD AQLNIFFLDI QMNNHIQAGF EVAKEIRKTD  
81 SESLIVFIST HTELVLTSYK YMVSAQFIQ KNVDFLDFQK  
121 EVETCVDAYI QQKENIKTKS EYIIINLKAS SIKMDINDIY  
161 FFQTEYDHRV SMVGKNFKRE FYGTLSKIEQ LHPDLIRVHQ  
201 SIIINKKYAS KLNKTHLLT MRDGTEVPVS RRYYTQVKAL  
241 FLT

**EF1820 Histidine Kinase (AgrC Group) FsrC**

1 MILSLLATNV LLVSSFIVFV FLRVTLIKIE CKIPLLSLLI  
41 VINLCSFAAL MLGYSWLIYA LTVVIFTGFL LIHKKRFSIF  
81 KAIFLSVFTL LMVSFINYTE QTILSVFFQQ IYQNKLLWIA  
121 SNVLLLLINI WIALKIPNSV FLRLNRVLEN SRIFFGCLLL  
161 LLLLLLLVFV LISPEISPDF MRGFVTVNSS KLELLISVGL  
201 FLILIGLVIE AYLEEQRINT QLLNNLTIYT EKIESINEEL  
241 AMFRHDYKNL LYSLQIAISY EDILEIKRIY EETIAPTCKI  
281 IDNEEFELMK LNRLKNMELK ALISMKINTA KQAKLKVIVD  
321 VPEVFILDTS IDLVVVIRLL AILLDNAIEN SAKSELKMFA  
361 ISIFNKNETQ EFVITNSVQA EFDKVMKKT KFSSKSNPEE  
401 HGWGLLYVKE IVDFSDQFDL QTSFNEGAVT QHLIIKHNH  
441 SKKVVNE

**EF1336 Response Regulator**

1 LKVAICDDNP TLTEKINTML FNYNPNIFET YTYYNPLKLV  
41 NQLDQENFDF FILDIEMSEM SGIDLAKKIR ERDILSPIVF  
81 LTSYKEYMEE VFQVQTFDYL LKPPTEDRLH QVLEKLRQQL  
121 EKKNRYFVFS SNKVTYKIPT KDIIYFEKDK RQVLIHTVGE  
161 IYKPYMSTNQ INEQLDTNFV QVHSSFIINC AYIKELGKNF  
201 LLMDSKEKCI EIPISRRFKA AAHKSIVMSM RGKI

**EF1335 Histidine Kinase**

1 MLDITLRSL S LLVYLF LISY FFSNWSTAIK NHREFYNVIW  
41 IVIIISAMVT IILSNAYIPN IYLPYLNLLL SFILTYTIAM  
81 LHSVPYLD SA VWTMTLISIN LICEVLSLHF TKIILNAELT  
121 SYGSPTFFIT SITITTLIGV AWIVILKFSI VKEAKSELST  
161 NLSFIVILLP IPILSIIILF GLLIGNNNDK ISEITITISV  
201 IFLNICVIFL YKITIEYQKN QYNLTLRKKK IEVEYRILNE  
241 IKRNRTNVLK LKHDLKNQYL TILGLIENEE VNEAIDYIKS  
281 SFDILEPPTK TYAADGVLNY LLNEKLAEAR KNQINVDHQI  
321 FVSKNIKINN DVLTIVIGNI IDNAIQASKR IKPIDRYVNI  
361 IIKQVNNDLF IEVSNNYNSE EIFTRKHRKN KGLGMKNIDD  
401 LLQQLGGIQR HWTKERRYFV TIVIFNVYKG NKCGDN

**EF1633 Response Regulator**

1 MDGRIVIVDD EPITRLDIRD IVIEAGYEVV GEAADGF EAI  
41 EVCKKTQ PDL VLMDIQMPIL DGLKAGKKIV QDQLASSIVF  
81 LSAYS DVQNT DKAKKLGALG YLVKPLDEKS LIPTIEMSIE  
121 RGKQTQL LLS QIDKLSL KLE ERKII EKAKG ILVKENHISE  
161 EEAYQMLRTL SMNKRARMSE IAELIVMDDE

**EF1632 Histidine Kinase (no transmembrane domains)**

1 MKRLEQLCHQ YTNLSESDIK ELQRTARYLS STTLYQSADV  
41 FIDVYKEMSQ QALVVYHKPP AKTTSLYSGD VVGMEALLKN  
81 EPGVLRMTQT SLNSIGLLAV TQENRLIKQN IYPIRNEHRT  
121 IGVIIVEIAA DEEIQADLQK EELNNCQLAK VAKSTSQVDA  
161 LFIDQLAEAV LIFDAAGHLL ITNHNAQELY RKLGYRDNII  
201 GMSYDNL SID YTTFEYVLYQ MKYKMSNQPI ESKTTYLNYY  
241 FKVRK VWLAS EEQLIMIIQD NTEFKEKEAE IISK SVAIRE  
281 IHHRVKNNLQ SVVSLLR IQE RRTQSPEAKK VLHESVNRIM  
321 AIAATHELLS KQVKDDVALR QTLEAVMYNF RHLFQGAQPI  
361 EMMMDVDP AI MVSSEQMVTI SLVVNELLQN IFDHAFEPQT  
401 SGVVKLSGTL DNKMITITVT DNGKGYDVHQ SNETSLGLMI  
441 VKSYVKDKLK GKITIESNKQ GTKTCFYFEQ NTSDVVH

**EF3329 Response Regulator (Orphan)**

1 MRTEKILVVD DDAAVRRLIW KALQSTGILI YQSESIEKTK  
41 DIVSRVTFDL FILDDNLEHD SDGYLVQMI REKYPLVPII  
81 FFSSKKEEED IIAALEMGVD SYITKPFSLN VFKAQVIASL  
121 NRARMIRKQL NVYKKEELQV GDFRFDYGRY QLFKKDLPIS  
161 LSSKEVQLIQ FFLENPEQVF SKEQIYSSVW GTGDVDANTI  
201 MVFINRLRSK LEENPKEPCY LRTVWGIGYT FTPDGCVQKK