

QacE *Archaeoglobus fulgidus* NP_070524
 QacE *Syntrophomonas wolfei* YP_752855
 QacE *Streptococcus thermophilus* YP_140506
 QacE *Streptococcus agalactiae* ZP_00785182
 EmrE *Mannheimia haemolytica* EDN74853
 EmrE *Haemophilus ducreyi* NP_874231
 EmrE *Stenotrophomonas maltophilia* ZP_01643607
 EmrE *Pseudomonas syringae* YP_233649
 EmrE *Pseudomonas aeruginosa* NP_253677
 EmrE *Ralstonia eutropha* YP_727122
 EmrE *Serratia proteamaculans* ZP_01534598
 EmrE *Yersinia intermedia* ZP_00834935
 EmrE *Photobacterium luminescens* NP_929802
 EmrE *Escherichia coli* P23895
 EmrE *Shigella flexneri* YP_689427
 EmrE *Erwinia carotovora* YP_051073
 QacF plasmid pB8 YP_358817
 Qac class 3 integron ia-3 ABR28416
 EmrE *Rhodobacter sphaeroides* YP_353626
 EmrE *Sulfitobacter* sp. EE36 ZP_00954674
 QacE *Roseobacter denitrificans* YP_682931
 EmrE *Roseovarius nubinhibens* ZP_00960756
 EmrE *Magnetospirillum magnetotacticum* ZP_00051262
 EmrE *Methylobacterium chloromethanicum* ZP_020E
 EmrE *Bradyrhizobium japonicum* NP_770868
 EmrE *Psychrobacter cryohalolentis* YP_580136
 EmrE *Psychrobacter arcticus* YP_264019
 EmrE *Paracoccus denitrificans* YP_917819
 EmrE *Rhizobium leguminosarum* YP_769266
 EmrE *Sinorhizobium meliloti* NP_386521
 EmrE *Bordetella pertussis* NP_881103
 EmrE *Stappia aggregata* ZP_01546857
 EmrE *Salmonella enterica* sbsp. *enterica* YP_216634
 EmrE *Salmonella enterica* sbsp. *enterica* YP_216634
 EmrE *Marinomonas* sp. MWYL1 ZP_01598495
 EmrE *Flavobacterium johnsoniae* YP_001193927
 EmrE *Pseudoalteromonas atlantica* YP_660021
 EmrE *Acinetobacter baumannii* YP_001085323
 EmrE *Pelobacter propionicus* ABL00914
 EmrE *Stigmatella aurantiaca* ZP_01461726
 EmrE *Desulfobacterium autotrophicum* YP_388842
 EmrE *Photobacterium profundum* ZP_01218031
 EmrE *Vibrio harveyi* YP_001445675
 EmrE *Xanthobacter autotrophicus* YP_001417989
 EmrE *Sphingomonas wittichii* YP_001263498
 EmrE *Acidovorax avenae* subsp. *citrulli* YP_973010
 EmrE *Delftia acidovorans* ZP_01577698
 EmrE *Myxococcus xanthus* YP_633339
 EmrE *Dechloromonas aromatica* YP_283677
 QacE *Xanthomonas campestris* NP_637776
 EmrE *Burkholderia cepacia* YP_773352
 Qac int11 (*Serratia marcescens*) AAK40353
 QacF intl (*Achromobacter denitrificans*) AAZ14837
 QacF plasmid pIP833 (*E. aerogenes*) AAD22143
 QacH plasmid p3iANG (*Vibrio cholerae*) AAZ42322
 QacF plasmid pSC138 (*S. enterica*) AAX56371
 QacE2 Int Class1 (*A. salmonicida*) AAK53557
 QacG class I intergen (*A. baumannii*) AAL38576
 QacG integron (*P. aeruginosa*) AAS79147
 QacE plasmid R751 (*E. aerogenes*) NP_044260
 QacEA1 class 2 integron (*P. aeruginosa*) AAV32841

EmrE *Marinobacter aquaeolei* YP_958340
Smr *Chloroflexus aurantiacus* ZP_00766077
EmrE *Shewanella frigidimarina* YP_748773
EmrE *Chromobacterium violaceum* NP_902350
EmrE *Methylobacillus flagellatus* YP_544992
EmrE *Methylococcus capsulatus* YP_115175
EmrE *Coxiella burnetii* ZP_01299513
QacH *Brucella melitensis* YP_414370
QacE *Brucella melitensis* AAL52226
EmrE *Ochrobactrum anthropi* YP_001370804
EmrE *Marinobacter algicola* ZP_01894487
EmrE *Nitrosococcus oceani* YP_342650
EmrE *Reinekea* sp. ED297 ZP_01116498
EmrE *Geobacter sulfurreducens* NP_951765
EmrE *Chlorobium limicola* EAM42528
EmrE *Alcanivorax borkumensis* YP_693512
EmrE *Jannaschia* sp. CCS1 YP_511013
EmrE *Chromohalobacter salexigens*
QacH *Pelagibacter ubique* ZP_01264056
QacH2 *Pelagibacter ubique* YP_266208
EmrE *Pseudoalteromonas atlantica* YP_661014
QacF *Pseudoalteromonas haloplanktis* CAI87270
Qac megaplasmid (*S. oneidensis*) NP_720475
YvaE *Shewanella frigidimarina* YP_752098
EmrE *Shewanella pealeana* YP_001500134
EmrE *Vibrio harveyi* YP_001449011
EmrE *Photobacterium profundum* ZP_01219483
EbrB *Pseudomonas syringae* YP_235623
EmrE *Wigglesworthia glossinidia* NP_871589
EmrE *Aeromonas hydrophila* YP_855864
EmrE *Erwinia carotovora* YP_051860
EmrE *Aeromonas hydrophila* YP_855865
QacE integron (*Escherichia coli*) YP_672432
QacH *Erwinia carotovora* YP_051859
EmrE *Nitrobacter winogradskyi* YP_319204
EmrE *Synechococcus* sp. RS9917 ZP_01081426
EbrB *Mannheimia haemolytica* EDN74090
EmrE *Neisseria meningitidis* NP_284788
EbrB *Listeria monocytogenes* EAL09800
EbrA *Paenibacillus larvae* ZP_02326984
EbrB *Bacillus subtilis* CAB13613
EbrB *Paenibacillus larvae* ZP_02326985
EbrA *Bacillus subtilis* CAB13614
QacG plasmid pST94 O87866
QacJ plasmid pNVH01 (*S. aureus*) CAD55144
QacH plasmid pST2H6 (*S. saprophyticus*) CAA76544P
Smr *Staphylococcus aureus* AAM94142
EbrA *Desulfotomaculum reducens* YP_001114614
Ebr *Pediococcus pentosaceus* YP_804449
Ebr1 *Synechococcus* sp. RS9917 ZP_01080450
EbrA *Listeria monocytogenes* EAL09801
Smr *Roseiflexus castenholzii* ZP_01530339
EbrA *Roseiflexus* sp. RS-1 YP_001278866
EbrA *Gloeobacter violaceus* NP_927270
EbrB *Thermus thermophilus* YP_004540
EbrB *Halobacterium* sp. NRC1 NP_444228
EmrE *Zymomonas mobilis* sbssp. *mobilis* YP_161843
Smr2 *Mycobacterium vanbaalenii* YP_954149
Smr2 *Mycobacterium gilvum* YP_001134816

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      10      20      30      40      50
KSWLLGLAIVAEVIATSALKSSSEGFTRLPLPSI-VVVIGYSVAFYFLALA-
KYWLYLMLAILTEVVATSALKASAGFSRPLPSL-IVVAGYAISFYAMSLA-
KSWIFLSVAILTEVVATSALKASDGFSLTPSI-VVIVGVVLSFYFLSLA-
KVWFLFMGAILSEVVATSALKASDGFTRLWPSSL-LTAGGYVLAIFYLLSQT-
QHWIYFLGIAITAEVVATSALKASDGFTRLPLST-LVIVGYATAFYFLALT-
MPWIHLMIAIIGEVVGTSAKSTDGFSRFWPSV-TVIAAYAVAFYFLSLT-
MKWLYLLIAIVAEVIGTSAKASDGFSTKFGAST-LVIIGYGAIFYFLSLT-
PVYTFLLAIAIFSEVIGTSLKASEGFSRLGPSI-VVVVAYGLAFYFLSLT-
PVYTFLLAIAIFSEVIGTSLKASEGFSRLGPSI-VVVVAYGLAFYFLSLT-
PVYAIIAIAIVSEVIGTSLKASEGFSRLGPSL-IVVVAYGLAFYFLSMT-
IQWVYLSVAIVAEVIGTSFLKSSEGFTRLGPSL-VVVVSYILAFYFLALT-
MQWIFLSLAIAEVIATSSLKAAAGFTRLGPSL-AVILGYGAIFYFLSLT-
N-WLYLLIAIVAEVIATSSLKPAEGFTKLWPSV-VVVIGYAVAFFFLSLT-
HKWLYLLVAIISEVAGTTALKSAEGFTRLWPSC-VVVAGYASAFYFLSLT-
H-WFYLLITAIISEVVATTALKATDSFTRLWPSSL-LVVAGYSSSFYFLSLT-
MGYLYLSLAIVAEVVATSALNASQGFTRLWPSV-TTVVGYTIAFYALSLAL-
MAWLYLVFAILAIEVIATSALKASEGFTQGPAAA-MTVVGYAVSFYFLGLAF-
- -YVFLAIAIAIEVVATSALKASQEFTRLWPSV-TVVVGYALAFYMLTLAL-
TSYFLFALAVVLGVASNSF-KSAEGFTLLVPSI-ITAITIVLCMYALSMVM-
GGYIFLVLAIIILGISSNGF-KATDGFNTIYPTI-FCIITIVACIFCLSKAM-
MSWVFLMLGVVAEAMSHVA-KETDGFTKPLPSV-LVLLGHVAAFMFLGQAM-
MSWVFLFLGVIAEAMSHVA-KQTDGFTRLPLSI-VVLLGHLAFAFVFLGQAM-
MSWIFLLLGVMAEALSHVA-KATDGFTRPIPAV-MVILGHHTAFIFLGQAM-
MSWIFLLLGVMAEALSHVA-KATDGFTRPLPAV-MVILGHHTAFIFLGQAM-
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MSWVFLLLLGVGAELSHVA-KATDGFSKPLPAT-LVLLGHLAFAFVFLGQAM-
MGWVFLLLLGVLAELATSHVA-KATNGFTNPLPSA-IVILGHHTAFIFLGQAM-
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ICYIYFLIAIAEVIATSTSL-KISEGFTKIFPSI-LIILGYIVSSFLLSLAL-
FGFLWLALSIGSEITGTS-KKTNGFSRLGPSI-LVVCAYSLCYFALTRAM-
NGFLWLALSIGSEITGTS-KKTDGFKKRTPSI-IVILAYCLCYFSLTRAM-
KCWLWMMLLVIVSETSATSTLGSSEGTKMLLLG-LLVLLYCTCYYSLSRAV-
KCWLWMMLLVILSETSATSTLDNSEGMKTLLLA-LIVVLYCICYYSLSRAV-
QSWLWMMLLVILSETSATSTLDNSQGMKAALLA-IIILLYCVCYYSLSKAV-
NAWGLLAISIVAEVTATLLTKSEGFSGKPVYGV-AALAIFAGCFWALSQVL-
SPWVLLGFAIAAEVVGTSCLKLSEGFSRPLPTL-LVLAAYATSMALMSRVV-
HWSVLLGFAIAVSEVFGSTMLKLSEGFTKLPLSI-GVVLGFLAFYLLSLA-
HW-LFLTVAIILSEVCGSSMLKLSEGFSKLWPSI-GVIVSFSVCFWALSMT-
KGYVALGIAIIGEIFGTSMKLKLSEGFTNIYPTI-GVAIGFFIAFYTSLSL-
- -YLFLTCSIISEVFGTTMLKFSDFGVFLPTL-GIIAGFSIAFYCLSLC-
RGLLYLALAIVSEVFGSTMLKLSEGFTQAWPIA-GVIVGFLSAFTFLSFS-
- -YLTLAVSLTLEMFGATMLKLSEGFTKWLPAP-LVVFGYGSFAFYFSSKS-
IGYIFLTIACSESIGAAMLKVSDGFKKWKPSA-LVVIGYSFAFYMLSLT-
H-YLYLFIISIATEIIGTSFLKTSEGFTKLWPTL-GTLLSFGICFYFLSLT-
P-YLYLVIAITEIIGTSFLKTAEGFTKLWPTL-GTLLSFGICFYFLSVT-
P-YLYLLLSIVSEVIGSAFLKSSDGFSLKYPTI-TTIIISFLICFYFLSKT-
P-YIYLIIAISTEVIGSAFLKSSEGFSSKFIPSL-GTIIISFGICFYFLSKT-
A-YLYLILAILCELIGTSLKASAGFSKLFPTL-GLLVSFSLAFFFLSLS-
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LGYAVLIAAIIIFENIGTTALKGSNGFKRPVLGS-VAVLGYILSFAFMGQA-
NPYVLLIGAIIIFEVFGSSMMKASNGFKKLVPTV-GLVIGMGSAFYLLSKA-
RGMMLLFGAIVCELIGTNALKAADGFTRLMPTL-LVIAGYGASFYLLMSLS-
RGLALLFGAIVCELIGTSALKATDGFTRLPTL-LVIAGYGASFYLLMSLS-
HPLILLVAIAASEVIGSSALKKLSEGFSRPLPSL-LVVLGYGAIFYLLGLT-
SGWTYLFLAILSEVLASSALKASQGFSSRLPLPSL-VVVGGYGLAFYFLSLA-
HPYAYLAAAIAAEVAGTTALKKLSEGFSNPAPSV-VVLGVYVSSFYFLGLVL-
TGWTGLAIAVFFFEVAATTALRLANGIDKPLWLI-TACIGYFICFTIISFVF-
MTWLYLMLAICTEVAATLSLKGGLA-TVPALYI-VVVLGYVASFVFLALVL-
-MWVFLILAISSEVAATLSLKGSE-TVPALYA-VVVLGYLASFVFLALVL
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EbrB <i>Clavibacter michiganensis</i> YP_001220961	MAWLLLGIAIVTEVAATISLKLATD	GRKRWYA	VVA	VGYVTA	FMSMLAGAL
Smr <i>Nocardia farcinica</i> YP_118186	MTLLLLALAIASEVTATVSLKLSEGF	TKLTPSI	VVV	VGYCAAF	YFLSQAL
Smr <i>Saccharopolyspora erythraea</i> YP_001109297	- - YLLLA	VAAILSEVTATVSLKLSEGF	SKPVPSV	MVV	VGYLAFAALGAVL
Smr <i>Thermobifida fusca</i> YP_289048	MQWLLLLIGAILTEVTGTISLRLSDGF	TRLVPSL	I	ALTSY	GIAFTLLAQVL
Smr <i>Saccharopolyspora erythraea</i> YP_001103712	MAYLLLLGAVASEVVAALATRF	SAGFTKLVP	SA	V	AITGVVGAYYLLSLAL
Smr <i>Nocardioides</i> sp. JS614 YP_921842	VTYLLLLGLAIAVEVMATLSLRASEGF	SRPLPSL	I	VVSGY	GLSFFLLSVVL
Smr <i>Nocardioides</i> sp. JS614 YP_921842	VAVTLLGGAILAEVIATSM	LKSTEGFTRLWPTL	ACLL	LYGA	AFMMLLAQSI
Smr <i>Mycobacterium tuberculosis</i> P95094	MIYLYLLCAIFA	EVVATSLLKSTEGFTRLWPTV	GCL	VGYGIA	FALLALS
NepA plasmid pAO1 (<i>A. nicoitinovorans</i>) CAD47919	TIWPLLLLLAIAAEVAATSLLPQTNGF	RKLKPTV	AVAC	LYTV	AFALLAQIL
EmrE <i>Candidatus Pelagibacter ubique</i> ZP_01264207	KTYLFLTITAI	IFCEVGGTMLLPV	SQNF	TKI	IPTT
QacH <i>Lactobacillus plantarum</i> NP_786542	MAYGLLF	GGIFMEVLG	SFFLKRANGF	RNL	IPTI
YdgF <i>Escherichia coli</i> ABE07266	IYWIILLGLAIA	TEITGTLSM	WASVSE	- - -	NGGFILMLVMISLSYIFLSFAV
YdgF <i>Shigella flexneri</i> YP_689093	IYWIILLGLAIA	TEITGTLSM	WASVSE	- - -	NGGFILMLVMISLSYIFLSFAV
YdgF <i>Salmonella enterica</i> sbsp. <i>enterica</i> YP_216487	FYWIILLALAI	ATEITGTLSM	WASVGN	- - -	NAGFILMLVMITLSYIFLSFAV
YdgF <i>Yersinia intermedia</i> ZP_00833156	IYWIFLGLAIA	VAEII	IGTLSM	YASVSG	- - -
YdgF <i>Photobacterium luminescens</i> NP_929383	IYWFLFLAMAI	ITEVIGTLSM	HASVSG	- - -	VVGMAVMI
YdgF <i>Pseudomonas aeruginosa</i> NP_250232	RSWIYLLLLA	IGA	EVIGTTS	MLAATHA	- - -
YdgF <i>Sinorhizobium meliloti</i> NP_385720	LAWFLFLVLA	IA	TEVVG	LTVMAASG	S
YdgF <i>Aeromonas hydrophila</i> YP_857997	LARIFLTGA	ILTEVAGT	SSMMIP	ENEG	- - -
YdgF <i>Vibrio harveyi</i>	- - -	LFLLLA	IAVAE	VAGTSTMF	IGESN
YdgF <i>Chromobacterium violaceum</i> NP_900949	VAVLVLLAA	IVCEIVG	TSFMVA	ARS	G
YdgF <i>Campylobacter jejuni</i> YP_179294	VAVFFLIA	IAIVFEV	LGTSFL	KM	ENQ
YdgF <i>Desulfovibrio desulfuricans</i> YP_388898	-	HWLCL	TGAVFF	EVAGTTL	MSQSWSMFGAEAGV
YdgF <i>Lawsonia intracellularis</i> CAJ54979	KHWIYLI	IA	AILLE	EVIGTS	VMSQLGTWFEPNIGYLLMLICIGLSYYMLALAA
YdgF <i>Deinococcus geothermalis</i> YP_605419	-	AWIAL	FSAI	ACEVTG	TALLGLHTP
YdgF <i>Pseudoalteromonas haloplanktis</i> YP_340952	MHWIYLI	IA	AVTLE	EVIGTT	VMWLVNED
YdgF <i>Acidovorax avenae</i> sbsp. <i>citulli</i> YP_969092	QPWFLFLAA	VA	SEVVG	VTTMLVA	QEH
YdgF <i>Helicobacter hepaticus</i> NP_860040	-	SYLFL	MF	AILTEV	LAVNLMKASEGE
EmrE <i>Alteromonas macleodii</i> ZP_01110205	MTYLLLA	IA	IVTEVT	ATLL	LKMSNGW
YvaE <i>Bacillus subtilis</i> CAB15362	MNVVFL	C	LAILFE	VAGTV	SMKLS
YvaE <i>Blastopirellula marina</i> ZP_01094237	QPWVFL	LAGA	ILLEVAG	TTS	SMKMS
YvaE <i>Desulfitobacterium hafniense</i> YP_517233	MQWVYLA	LA	ILLEIL	GTTL	MKMSEGLTKMLPTL
YvaE <i>Rhodospirillum rubrum</i> YP_428434	MTWLT	LTGA	ILFELAG	TTAM	KLSEGF
YvaE <i>Bdellovibrio bacteriovorus</i> NP_968626	MAYVYLA	AA	II	FEVFG	ITIMKYSEGF
Smr <i>Streptomyces coelicolor</i> AAK95484	MGYLLLAGA	IA	AEVAG	TAM	KYSEGF
YvaE <i>Acidobacteria bacterium</i> YP_593828	MCWLWL	FLA	IA	ELVA	ATILMKYS
EbrB <i>Rubrobacter xylanophilus</i> YP_644095	MSWL	LL	LLGA	IAAEVAG	TFSKLSDGLSRAGPTL
YvaE <i>Desulfovibrio vulgaris</i> YP_966624	ESWI	IL	FLS	IFCEVTG	TSCLKLS
YvaE <i>Pelodictyon phaeoclastriforme</i> ZP_00590439	MHWIYLI	MA	ILFEV	SGTTC	CMKIS
YvaE <i>Chlorobium tepidum</i> NP_662342	MPWLYLI	LA	IAE	VS	GTTS
YvaE <i>Prosthecochloris vibrioformis</i> YP_001130806	MHWIAL	FMA	IA	TEVIG	TTFLKLS
YvaE <i>Anabaena variabilis</i> YP_323581	TSLVYLL	MA	II	FEVSG	TTCMKLS
YvaE <i>Nostoc</i> sp. PCC 7120 NP_484329	TSLVYLL	IA	II	FEVSG	TTCMKLS
EbrA <i>Methanosarcina acetivorans</i> NP_616284	NYYYLL	LLLA	IA	FEVCG	TTCMKLS
YvaE <i>Methanococcoides burtonii</i> YP_566929	MSYSLL	LA	IS	IFFE	ICGT
YvaE <i>Clostridium beijerinckii</i> YP_001307448	ISWIYLI	FA	II	FEVSG	TISMKLS
YvaE <i>Marinomonas</i> sp. MED121 ZP_01075592	SGWTL	LL	II	IGIA	FEVAGSL
QacC <i>Lactobacillus plantarum</i> NP_786541	RAWIQL	VIA	IGVE	IVG	TSLLKLS
NepB plasmid pAO1 (<i>A. nicoitinovorans</i>) CAD47918	HAWLYL	LG	SAIT	TEVTG	TVILDF
YvaE <i>Burkholderia cenocepacia</i> YP_839289	FAWFVL	GL	SVIA	EVFG	TIGLKF
EmrE <i>Escherichia coli</i> RS9917 ZP_01080451	GALFE	FLA	IA	AEQIG	TSAMKASNGFT
SugE <i>Escherichia coli</i> AAC46453	-	WI	IL	LVIA	GLLEVVWAVGLKYTHGFSRLTPSV
SugE <i>Shigella flexneri</i> YP_691592	-	WI	IL	LVIA	GLLEVVWAVGLKYTHGFSRLTPSV
SugE <i>Salmonella enterica</i> sbsp. <i>enterica</i> YP_219204	-	WI	IL	LLIA	GLLEVVWAVGLKYTHGFSRLTPSI
SugE plasmid/ <i>Citrobacter freundii</i> AAC46457	-	WI	IV	LLIA	GLLEVVWAVGLKYTHGFSRLTPSI
SugE <i>Serratia proteamaculans</i> ZP_01538212	-	WI	IL	LLIA	GLLEVVWAVGLKYTHGFSRLTPSL
SugE <i>Yersinia intermedia</i> ZP_00832613	-	WI	IL	LVIA	GLLEVIWAIGLKYSHGFSRLTPSV
SugE <i>Photobacterium luminescens</i> NP_931319	-	WF	V	LVIA	GLLEVVWAVGLKYTHGFSRLTPSL
SugE <i>Proteus vulgaris</i> P20928	-	WI	IL	LVIA	GLLEVVWAVGLKYTHGFSRLTPSI

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SugE <i>Pseudoalteromonas atlantica</i> YP_660982	- - W I I L I I A G L F E V V W A I G L K Y S D G F S K L W P S I - F T L V A M A I S F G L L S I A M				
SugE <i>Limnobacter</i> sp. MED105 ZP_01915318	- - W L I L F V A G L F E I V W A I G L K Y T D G F T R L V P S A - I T L I A A A I S F G L L G L A M				
SugE <i>Shewanella oneidensis</i> NP_717508	- - W L L L I L A G L F E I G W A I G L K Y T D G F T R L W P S V - F T V L S M A L S V L L L G L A V				
SugE <i>Methylobacillus flagellatus</i> YP_545743	- - W L T L F V A G L F E I V W A V G L K Y S H G F T R F W P S L - G T I V A M A L S V V L L S L A M				
SugE <i>Bradyrhizobium japonicum</i> NP_770684	- - W S I L F V A G L L E I T W A I G L K Y T E G F T R L V P S V - I T L A A M A G S V I L L G L A L				
SugE <i>Ralstonia eutropha</i> YP_727054	- - W T L L A L A G L F E V V W A I G L K Y T E G F T R L V P S V - I T L I G M A I S V L L L A L A L				
SugE <i>Dechloromonas aromatica</i> YP_287101	- - W S I L F I A G L C E V G W A V G M K Y T E G F S R L W P S V - W T V L G M A A S V I L L A W S L				
SugE <i>Mesorhizobium loti</i> NP_105639	- - W T F L F F A G L F E I G W A I G L K Y T D G F T R L V P T V - L T V A S M I V S L T L L G L A L				
SugE <i>Rhizobium leguminosarum</i> YP_768145	- - W F L L F L A G L F E C G W A I G L K Y T E G F T R P M P T A - M T V I S M V I S I V L L G L A V				
SugE <i>Sinorhizobium meliloti</i> NP_385492	- - W F T L L L A G I L E I G W A I G L K Y T D G F T R L T P T V - L T V G S M I L S V V L L G I A V				
SugE <i>Herminiimonas arsenicoxydans</i> YP_001098437	- - W L I L V I A G L F E I G W A I G L K Y T D G F T R L W P T V - G T L G A M L I S V V L L G L A M				
SugE <i>Gloeobacter violaceus</i> NP_925933	- - W V A L I S A G L L E I G W A V G L K Y S E G F T R F L P S V - L T G L S M V L S L G L L G Y A L				
SugE <i>Syntrophus aciditrophicus</i> YP_462525	- - W I I I V L A G L F E T G W A I G L K Y T D G F T R L W P T V - G T V F S M V I S L A L L G I A M				
SugE <i>Geobacter sulfurreducens</i> NP_951764	- - W G I L V L A G L F E V G W A I G L K F T E G F T R L W P T V - L T V L A M I A S F W L L E I A M				
SugE <i>Pseudomonas aeruginosa</i> NP_251955	- - W I I L F F A G L F E V G W A V G L K Y T E G F S K P L P T V - L T A L A M L V S L G L L G L A M				
SugE <i>Aeromonas hydrophila</i> sp. <i>hydrophila</i> YP_856475	- - W L L L L A L A G L F E V A W A I G L K Y T D G F S R P L P T L - L T L I A M G V S V L L L A M A V				
SugE <i>Bdellovibrio bacteriovorus</i> NP_969313	- - W I I L A I A G L L E V G W A I G L K Y T E G F T K L V P S V - L T L V A L A G S M F L L A R A A				
SugE <i>Myxococcus xanthus</i> YP_631852	- - W I L L V I A G L L E V G W A I G L K Y T E G F T R L V P S V - L T G G A I V A S M V L L G I A T				
SugE <i>Deinococcus geothermalis</i> YP_605633	- - W I L L V I A G L L E V G W A I G L K Y T E G F T R P F P T V - L T L V S M V A S M G L L G L A A				
SugE <i>Streptomyces coelicolor</i> NP_627124	- - W V L L F V A G L L E V G W S I G M K Y T D G F T R L W P S V - F T G A G I V A S M M L L S Y A A				
SugE <i>Anaeromyxobacter dehalogenans</i> YP_467455	- - W I Y L V V A G L L E T G W A I G L K Y T D G F R R P L P S V - L T A L A I V A S M W L L G L A A				
SugE <i>Blastopirellula marina</i> ZP_01088886	- - W I I L I V A G L L E I G W A I G L K Y T E G F T K P L P S V - L T A A A I V T S M F L L S V S A				
SugE <i>Myxococcus xanthus</i> YP_628656	- - W L L V L V A G L L E T C W A V G L K Y T Q G F T R P W P S L - F V A V T L I S S L A L L S I A M				
SugE <i>Legionella pneumophila</i> YP_122951	- - W L Y L I I A G L L E I C W A V G L K Y T D G F S K W Q P S L - F T V T T L I I S M F L L A K A A I				
SugE <i>Marinomonas</i> sp. MWYL1 ZP_01596466	- - W F I L V I A G L L E V S W A I G L K Y T E G F T K L W P S I - G T I L S L V V S F V L L G L A M				
SugE <i>Vibrio harveyi</i> YP_001448000	- - W A I L F L A G L C E V A W A V G L K Y T E G F S K L A P S A - F T I G F M G L S F W L L G I A L				
SugE <i>Rhodospirillum rubrum</i> YP_425364	- - W V F L V L A G L C E V G W A V G L K M T E G F T R L V P S L - L T A L A M I A S L G L L G L A L				
SugE <i>Pelodictyon phaeoclastratiforme</i> ZP_00588597	- - W I F L I I A G C L E C G W A V G I K Y T E G F S R P I P S L - L T A S A M I A S F W L L S L A M				
SugE <i>Chlorobium limicola</i> EAM42493	- - W F A L V V A G S L E C V W A V G L K Y T E G F S K P I P S L - I T L I A M I C S F W L L S F A M				
SugE <i>Prosthecochloris aestuarii</i> EAN23020	- - W V Y L F V G G L F E C V W A V S M K Y S E G F T K L W P S I - V T V L S M I A S L W L L S L A M				
SugE <i>Chlorobium tepidum</i> NP_661278	- - W V M L F V A G L F E C A W A V G L K Y S E G F T R P V P S V - L T I A A M L V S F W L L S V A M				
SugE <i>Geobacillus thermodenitrificans</i> YP_001124648	- - W V Y L V V A G I F E V V W A I S L K Y T D G F T R L W P S V - M T V A G M A A S F Y F L S M A I				
SugE <i>Desulfotomaculum reducens</i> YP_001114341	- - W V Y L V I A G L F E V I W A I G L K Y T N G F T K L P S L - I T L A G M A I S F G L L S M A I				
SugE <i>Methanosarcina barkeri</i> AAZ72469	- - W V F L F I A G L F E A W A I G L K Y T E G F T K L Y P S V - L T I V C M F L S F Y F L S Q S L				
SugE <i>Clostridium beijerinckii</i> YP_001310526	- - W L M L I V A G L F E T G W A I G L K Y S E G F T R L I P S V - F T I I G M I A S F Y F L S L A L				
SugE <i>Nitrobacter winogradskyi</i> YP_318926	- - W L Y L F L A G L A E T G W A I G L K Y T D G F T R L W P S V - F T G L G M A L S F M L L S I A I				
SugE <i>Rhodopirellula baltica</i> NP_869718	- - W G Y L L I A G L L E I G W A V G L K Y T D G F S R P V P T V - I T I V I M I A S F F T L S L A L				
SugE <i>Nitrosococcus oceani</i> YP_344225	- - W T H L V V A G L L E I V W A I G L K Y T M G F T K F W P S V - F T V I A M I A S F Y F L S Q A L				
SugE <i>Roseovarius nubinhibens</i> ZP_00959799	- - W I I L C F A G L L E I G W A M G L K L S D G F T R L V P T V - L T L A L A V F S I Y L V G L S A				
SugE <i>Rhodobacter sphaeroides</i> YP_351822	- - W L L V L V A G L M E T G W A L G L K Y S D G F T R P V P S V - L T L V G A V A S F W L L S L A M				
SugE <i>Stenotrophomonas maltophilia</i> ZP_01645236	- - W I Y L L L A G L F E I G A L G M K Y S E G F S K P L P T A - A T V S A L I S L Y L M S Q A M				
SugE <i>Xanthomonas campestris</i> NP_635868	- - W I Y L V L A G L F E I G F A L G L K Y S D G F S R L W P S V - L T I G L A G V S L W F L T Q A L				
SugE <i>Symbiobacterium thermophilum</i> YP_074555	- - W L Y L F V A G A M E I A W S T A M K Y S E G F T R F W P S V - A T I V L S L T S F V L L S Q A M				
SugE <i>Xanthobacter autotrophicus</i> YP_001419080	- - W I Y L F V A G V M E I A W A I G M K Q S E G F T R L W P S V - F T L S A I A V S L F L L S L A L				
SugE <i>Brucella melitensis</i> biovar <i>abortus</i> YP_414234	- - W I Y L V F A G I L E V V W A F F M K K S E G F S L L T P T I - I T F V T M M G S F L L L A I A M				
SugE <i>Ochrobactrum anthropi</i> YP_001371057	- - W I Y L G L A G I L E V I W A Y F M K K S E G F S L L T P S A - I T I V T M I G S F I L L S I A M				
SugE <i>Burkholderia cepacia</i> YP_774210	- - W V L L L I A G L L E V A W A A G M K S E G F T K L W P S V - F T I V T S L A S F G L L A V A M				
SugE <i>Zymomonas mobilis</i> sp. <i>mobilis</i> YP_162432	- - W L V I T I A G L F E V I W A Y F M K Q S E G F T R I P T I - I M F V T M F T S F G L L S W S M				
SugE <i>Stenotrophomonas maltophilia</i> ZP_01643044	- - W I Y L L F A G L L E I V W A V S M K Q S E G F T K L T P T V - V T I I G M I A S F W L L A V A M				
SugE <i>Delftia acidovorans</i> ZP_01582139	- - W V Y L L V A G L L E V V W A F S M K Q S H G F T R L V P S A - I T I V T M I A S F G L L A V A M				
SugE <i>Magnetospirillum magnetotacticum</i> ZP_00208705	- - W I V L I I A G L L E V V W A F A M K Q S E G F S R L W P T V - I T F V T M G L S F A C L A W S M				
SugE <i>Methylobacterium</i> sp. 4-46 ZP_01845840	- - W V Y L I T A G I L E V V W A Y A M K Q S H G F T R L W P T A - I M I A T M L G S F G L L A L A M				
SugE <i>Nitrosomonas europaea</i> NP_842203	- - W M M L I F A G L L E V G W A F T M K L S N G F T N P V Y S I - I T I A G V I A S F V L L S L S M				
SugE <i>Acinetobacter baumannii</i> YP_001083756	- - W L I L I L A G M F E V I W A Y S M K M S E G F T R L T P S I - I T V V F M I L S V V L L S I S M				
SugE <i>Paracoccus denitrificans</i> YP_917710	- - W I Y L G V A G L Y E V I W A F A M K Q S D G F T R P W A T A - T T L V A M A A S V W F L S L S M				
SugE <i>Pseudomonas aeruginosa</i> NP_250573	- - W I Y L L A G V F E I V W A T A M K S A G F T R L W P S L - V T L L F M I L S F G L L A V S M				
SocA2 <i>Myxococcus xanthus</i> YP_633361	- - W I V L I L A G C L E I A W A L A L K R A D G L T R F W P S V - I G I G L A M S L V L L L A L A L				
SugE <i>Bordetella parapertussis</i> NP_883309	- - W M L L A L A G A L E I V W A L A L K Q A D G L T R L W P S L - I G I S V A M L S L V L L A L A L				
SugE <i>Ralstonia eutropha</i> YP_726368	- - W M L L V L A G L I E I V M A L A L K H T D G W T R P G P T A - L G I G A A L A S I F L L S A A L				

	10	20	30	40	50
SugE2 <i>Mycobacterium gilvum</i> YP_001136522	- - W L I L V A S G F L E A V W A T A L G M S N G F R R R R P T V - V F A V A M P A S L A G L A Y A M				
SugE <i>Clavibacter michiganensis</i> YP_001223477	- - W I V L I V S G V L E A V W A T A L G K S A G F T K A G P S I - V F G V T V V L S M V G L A Y A M				
SugE1 <i>Arthrobacter aurescens</i> YP_949237	- - W L I L I L S G A L E A V W A A L H R S K G F R K P V P T V - V F L V S V I A S M G G L A I A M				
SugE <i>Arthrobacter aurescens</i> YP_949238	- - W V I L L A S A L L E A V W A T A L G L S N G F T Q L I P T V - V F A I T A V L S M L G L G I A V				
SugE1 <i>Mycobacterium gilvum</i> YP_001136521	- - W F V L I V S A V L E A V W A T A L G R A D G F T A P G P T V - V F L V A M L A S L G G L G W A T				
SugE <i>Kineococcus radiotolerans</i> ZP_00617403	- - W F V L V V S G V L E A V W A T A L S R T E G F T R L G P S L - V F A L A L V A S M L G L A F A M				
SugE <i>Nocardia farcinica</i> YP_116350	- - W L L L V I S G V L E A V W A T A L G R S E G F T R L V P S V - V F F V A L A G S M A G L A W A M				
SugE <i>Thermobifida fusca</i> YP_289322	- - W L L L I L S G L L E T V W A I A L D A S R G F T R L W P S V - I F L V A M V L S M V G L S L A L				
SugE <i>Stigmatella aurantiaca</i> ZP_01464276	- - W F V L I V S G V L E S G W A I A L K K S E G F T R L G P S V - T F G V L A M V S F G G L A W A M				
SugE <i>Saccharopolyspora erythraea</i> YP_001109242	- - W V V L M L S G M L E A G W A I A L K M S D G F S R L W P T V - W F A V L A T G S F A G L A W A M				
SugE <i>Streptomyces coelicolor</i> NP_629357	- - W L L V I V A G V L E T G F A V C L K L S H G F T R L W P T I - A F C A F A L G S F G L L T M S L				
SugE1 <i>Listeria monocytogenes</i> YP_013473	- - W F Y L I M A G L S E I V W A F G L K E S H G F T M L G W S L - L T I A F L I V S F G L F S I S M				
SugE <i>Bradyrhizobium japonicum</i> NP_770973	L A W L M L V I A G V L D V G W A I S M K Y A E G Y T R P G W S I - A S L A L L A A F V F L L G R A L				
SugE <i>Burkholderia cepacia</i> YP_776179	V A W S I V V A S G V L E V V F S V T M K L S D S Y T K V L P G G - I S I V A A V L S V W L M S L T L				
SugE <i>Sphingopyxis alaskensis</i> YP_615530	- - W I I L A I A V F T E I C W A L S L K W A A T L G T W Q A S I - V P I A L S F L N M A L L A L A M				
SugE <i>Alcanivorax borkumensis</i> YP_694264	- - W V V L L L A V I V E I A W A M S L K W I Q - L S P G V L S I G T S L V L T G L N M L M L S Y A M				
SugE <i>Nocardia farcinica</i> YP_120693	- - W L L L A F A G L V E I A W S Q S I K P T Q N F T R P L P T L - L C F A L A A T A V Y L L S L A M				
SugE <i>Protochlamydia amoebophila</i> YP_007714	- - W I Y L L I A G L F E I G F T T F L K L S N N F T R L W P T A - I F F I F S V C S F L A L S L S L				
SugE <i>Leptospira borgpetersenii</i> YP_801667	- - W I Y L I I A S T F E I G F T T C L K L S D N F T K P T M V G - G F V V S A V F S L A F L N K A V I				
SugE <i>Rickettsia bellii</i> YP_537322	- - W L L L I L A G L F E I A F V I S L R Y S D G L T K L K P T V - A F I F F G A L S F T C L A K T L				
SugE <i>Bacteroides ovatus</i> ZP_0206060	- - W I I L I I A G L F E V G F T F C L K G A T G T D F Y L W G A - G F V I S V I L S M F L L A K A A I				
SugE <i>Flavobacterium johnsoniae</i> YP_001195630	- - W I I L I I A G L F E V A F A T C L K E T A G M E M Y Y W Y I - G F F A S L T I S M L L I K A T				
SugE <i>Rickettsiella grylli</i> ZP_01300129	- - W L I L I I A G L F E V G F T T C M K L S E G F T Q L K Y T L - G F L L F A T L S L F C L N K A I				
SugE <i>Sphingomonas wittichii</i> YP_001262619	- A W I W L I V G G C F E V G F T T C L R F V D G F R N I P W T L - G F L A S V T L S M G L L E V A S				
SugE2 <i>Deinococcus radiodurans</i> AAF10580	A A W G W V L L A G L F E V G F T Y A L K M S Q - - D G K Y L G - - L F L L C A I V S F E C L A Q A L				
SugE1 <i>Deinococcus radiodurans</i> AAF10579	- A W T A L V L A G L F E V G F T T A L K L E Q - - Q N K N W G W - A F I V C A W I S F G F L A Q A I				
SugE <i>Rubrobacter xylanophilus</i> YP_643069	- - W L A L F V A G L F E A G M V V G L K L S E G F T R L W P G L - L V L V S G G L S F F L L S L A M				
SugE2 <i>Listeria monocytogenes</i> YP_013474	M D W I F L L V A G L C E M V F V M L K L S D G F K K V G Y A I - L T I I F M S A S F F L L S L A L				
SugE <i>Pediococcus pentosaceus</i> YP_803585	M T W F Y L V L A G I F E V V W A T T M K L S E G F S V L T Y G I - A T A V G M I M S F V F L S L A I				
SugE <i>Lactobacillus plantarum</i> NP_784622	M T W I Y L I I A G L F E V V W A T M M K L S N G F S H F G Y A A - A T V V G M V L S F G F L A L A T				
SugE <i>Enterococcus faecium</i> ZP_00603219	M A W M E L I I A G I L E V F W S T M M K W S D G F S K I N Y S F - Y T V I G M I A S F Y F L S K A I				
SugE <i>Jannaschia</i> sp. CCS1 YP_509232	- - W V Y L F I A G A L E V A W A T G L K L G I G - F S W T L G V - L T L I A M I A S I I A L Y A A M				
YkkD <i>Bacillus subtilis</i> CAB13167	- - W I S L L C A G C L E M A G V A L M Q Y A K E - - K S V K W V L L I I V G F A A S F S L L S Y A M				
YkkD <i>Staphylococcus saprophyticus</i> YP_300697	- - W I I L L I A G L L E V V G V V I L E I S R T - - K K K W L V I L L A V A F I C S F S T L K L A M				
YkkD <i>Helicobacter hepaticus</i> NP_860983	- - W V Y L I M A G C M E I I G V I T M K Y S L S - - G R K I F L L G L L V C F M L S F A L L S M A M I				
YkkD <i>Campylobacter jejuni</i> YP_178373	- - W F Y L F L A T A C E I F G V V I M E L V N T - - K N K Y F L A L I V C F G S F T F L S L S M I				
YkkD <i>Desulfitobacterium hafniense</i> YP_520482	- - W F I L C L A G L L E A F G V A M I Q L Q I S - - R T W K T V G L L I M G F G A S L A L L G Y S L				
YkkD <i>Lactobacillus brevis</i> YP_796249	- - W L F L I G A G L S E M L G V T L M W A L H R - - K T W W L W V L M I L A F T L S F G G L E L A L				
YkkD <i>Enterococcus faecalis</i> NP_814152	- - W L Y L V I A G C F E I F G V G S I L F T T K - - K D L R S L L I L I L A F S G S F L F L Y L G M				
YvdR <i>Oceanobacillus theyensis</i> NP_694185	- - W I I L I L A G L S E V V G V N G I K V S A G - - K K K S G F A F L I I G F A V S L T L L S I A M				
YkkD <i>Chromohalobacter salexigens</i> YP_572171	- - W L A L L G A G I F E V L G V V G F R V S R G - - R A L A G G L L M T L G F G T A L G F L A L A M				
YkkC <i>Actinobacillus succinogenes</i> YP_001344921	- - F I T L I I A G L F E V A G V S T L S T A R T T Q R K T A F L L A T I V L F A A S L S S L S L A M				
Sug2 <i>Wolbachia pipientis</i> NP_965923	M N W I Y L L L S S L I E V F W V I T L K H S Y G F T H L V P S I - I S I L S M A L S T Y L L S L A T				
Sug1 <i>Wolbachia pipientis</i> NP_965922	M C W Y L L L S S I L E I L W A V T L K F S N S F T K V V P S I - A T L V I M I I S I Y F L S L A A				
YvdR <i>Bacillus subtilis</i> CAB15455	M A W F L L V I A G I E E I I A A I A M K Y I D G T R K K W P I I - V M T V G F G L S F Y C L S Q A M				
SugE <i>Anaeromyxobacter dehalogenans</i> YP_467311	M S W I H L G V A V I F E I A V A I S A G N A R G F T R P W W T T - A T L V S G A I G T F F L S L A L				
SugE <i>Pseudomonas aeruginosa</i> NP_249477	M A W F H L L V A A F E V A F A M G M K F S N G F G R L W P S L - L T V V A A I G G I Y F L T L A L				
YdgE <i>Escherichia coli</i> YP_540796	V H A A W L A L A I V L E I V A N V F L - F S D G F R R K I F G L L - S L A A V L A A F S A L S Q A V				
YdgE <i>Shigella flexneri</i> YP_689092	V H A A W L A L A I V L E I V A N V F L - F S D G F R R K I F G L L - S L A A V L A A F S A L S Q A V				
YdgE <i>Salmonella enterica</i> YP_216488	I H G A W L G L A I M L E I A A N V L L - F S D G F R R K C Y G I L - S L A A V L A A F S A L S Q A V				
YdgE <i>Yersinia intermedia</i> ZP_00833155	Y H I A F L I L A V I L E I I A N I L L - M S D G F R R V W L G I L - S L L S V L G A F S A L A Q A V				
YdgE <i>Photobacterium luminescens</i> NP_929384	W H A A F L F L A V V L D I L A N I L L - L S N G F R R P W M G I L - S L I A V L G A F S A L A Q A V				
YdgE <i>Pseudomonas aeruginosa</i> NP_250231	I P F A W L G L A I A L E V V A N L L L - Y S D G F R R R G L G I A - S I L C V M A A F T A L A Q A V				
YdgE <i>Acidovorax avenae</i> subsp. <i>citrulli</i> YP_969095	 M L - S - - - - R R V P G I I - G I F C I L A S F T A L A Q A V				
YdgE <i>Burkholderia dolosa</i> ZP_00983437	S A I V F V A V S A A I D I A A N M M L - K S D G F R R R A W G A G - A I V L L W I A F A L L G Q A V				
YdgE <i>Chromobacterium violaceum</i> NP_900948	V Y L L F V L A S A L I E V G A N L M L - K S D G F R R R A W G V G - A I L L V W L A F A L L G Q A V				
YdgE <i>Stenotrophomonas maltophilia</i> ZP_01645705	L A L F F V I C S A L I D V A A N M M V - K S E G F R R W R W G V A - A I V L V W I A F A L L G Q A V				
YdgE <i>Aeromonas hydrophila</i> YP_857998	V L G - - - - A A L L D I G A N M A I - R S V G F R H K G W G F L - G I L L V L C A F T L L S E A V				

		10	20	30	40	50
YdgE <i>Vibrio harveyi</i> ZP_01986465	SFG - FVVM	AALVDIMANMAL - RSKGFKHKGWGIT - AIVLVMAAFTLLAQAV				
YdgE <i>Sinorhizobium meliloti</i> NP_385721	LSFAFAIAAGVLDVAANLAS - KSN	GFARRGWGAL - SIVLVLA	AFALLAEAI			
YdgE <i>Desulfotomobacterium</i> YP_388897	AGLLVMLAAALDVAANLLL - KSR	GFTVRRYGVM - ALAAVGLAFVCL	SFAV			
YdgE <i>Deinococcus geothermalis</i> YP_605420	LALLCLAGAAAGLDLFANLLL - ASD	GFRRLPGLA - ALT	VLCAFGLLGLSL			
YdgE <i>Helicobacter hepaticus</i> NP_860039	LAFIYVVISAILDVIANLFL - KSN	VFTHKGYTIG - CILMVWAAFSV	LVLA			
YdgE <i>Campylobacter jejuni</i> YP_179295	MYIFIIVLSALLDIVANLLL - KSD	GFKHKIWGLA - AIVNA	ILAFFLLSFSL			
YdgE <i>Pseudoalteromonas haloplanktis</i> YP_340953	VYWLYILG	SVIFDIAANVFL - MSHGFKHKRFGIL - AIVF	IMAAFALLT	LA		
YvaD <i>Anabaena variabilis</i> YP_323732	-PIIFALLILTTVGLNTLAQLLKL	G - QNPLNLYLGGICCYGLSTIFYVL	VL			
YvaD <i>Nostoc sp.</i> PCC NP_487548	-PIIFALLILTTVGLNTLAQLLKL	G - QNPLNLYLGGICCYGLSTIFYVL	VL			
YvaD <i>Chloroflexus aurantiacus</i> YP_00765654	- - - - - MLKQGMGAMGPLALLETAPGRIVTSPMVGGLLVYIGTFFFWLVTL					
YvaD <i>Brucella melitensis</i> AAL53681	- AAAQLMLKYGMITLGPISFADTLIQQIVFN	PNWVAGLFTFVISMASHLYVL				
YkkC <i>Bacillus subtilis</i> CAB13166	- - WGLVVLAAVFEVWVWVIGLKHADSA -	LTWSG - TAIGIIFSFYLLMKAT				
YkkC <i>Desulfotomobacterium hafniense</i> YP_520483	- - WYKVFVA	AFLEVFVWVIGLAHSHDV - WTW	TG - TVIALIVSNYLMITAG			
YkkC <i>Enterococcus faecalis</i> NP_814151	- - WLKVIFGAFCEVIVWVIGMKHSTTW -	WEILG - TVIAIFISFYALIKAG				
YkkC <i>Lactobacillus brevis</i> YP_796248	- - WLTVVLGAVFEVSWVVGFKHATTP -	WEWLA - TGIAIYLSFYFLIRAS				
YvdS <i>Oceanobacillus iheyensis</i> NP_694186	- - WFLVVI	IAIFEVGWASGLKYANDG - LTW	TL - TIIAIIVSFGTLIVSS			
YkkC <i>Staphylococcus saprophyticus</i> YP_300698	- - WFKVILAGLIEIVWVTGLNTADSL -	LSWTG - TFIVIIISFFLVISAC				
YkkC <i>Helicobacter hepaticus</i> NP_860982	- - WGLVLF	GGIVECFWASGLKYSNLL - FFY	TL - TGIGILISFVSMILAI			
YkkC <i>Campylobacter jejuni</i> YP_178374	- - WFLIILGGIIECFWVSGLKYSTEI -	WHYIL - TAIGVCISFTCLKAC				
YvdS <i>Bacillus subtilis</i> CAB15454	- - WVLVFI	AGLLEVVWASSLKHADSL - LDW	II - IFILIAVSFILLIRSY			
YkkC <i>Chromohalobacter salexigens</i> YP_572170	- - WLLILPLAALAEV	GWATGLKLASSP - LEW	LA - TVIVAAMSLLLAVRAV			
SugE <i>Alteromonas macleodii</i> ZP_01108532	- - WIYILITAGLLEIGWPVGLKMSQEA -	ETRV	MGILAIGFMAASGFC	WMAQ		
SugE <i>Campylobacter curvus</i> ZP_01806950	- - WIYILICAGLMEMGW	VPVGLKMAQQE - GSRVL	GVVAIAFMAASGFL	WLAQ		
SugE integrin (<i>S. maltophilia</i>) AAL07365	- - WIYILILAGVFEV	GWVPVGLKMAQTP - ETRW	SGIVAVAFMTVSGFLL	WLAQ		
Smr-2 / SugE plasmid (<i>P. aeruginosa</i>) AAZ04369	- - WIYILILAGLFEIGWPVGLKMAQVP -	ETRW	SGVIAVAFMAVSGFLL	WLAQ		
SugE <i>Pseudoalteromonas haloplanktis</i> YP_338634	- - MYLII	AGLLEIGWPIGLKISQQS - DSR	WLGIIAVAFM	VVSGF	MLWLAQ	
SugE <i>Methylococcus capsulatus</i> YP_113261	- - WAYLILAGCLEIGWPLGFKLSQTE -	GTRL	AGLLAVLCMVLSGIF	LLWLAQ		
Qac "orfO" class 2 integron AAL51022	- - MDLIL	LAGLFEIGWPVGLKMAQVP - ETR	WSGVIAVAFMAVSGFLL	WLAQ		
EmrE <i>Acinetobacter baumannii</i> YP_001085323	PGAWWLIFAIATDVLSTFYSAKGNL -	VNKTAQIALVLYIISFACAAIAL				
YvaD <i>Geobacillus thermodenitrificans</i> YP_00112717	SNWLLWIGLNTVLLVTGQFLWMTRQKFELL	LLSPWILGLVVGAA	TI	LLWLFIL		
YvaD <i>Pseudomonas syringae</i> YP_235771	- - - - - MLASACLLTCLGQIAQYAVQGWFAAL	RSLWLALACLGSGLLI	WLLVL			
QacE <i>Pyrococcus furiosus</i> AAL81899	LEVFM	SLIPTFEGRYAVVY - IQR	GYESIMAAILVILSLVLPYALPYIDK			
YdgE <i>Lyngbya sp.</i> PCC 8106 ZP_01619571	SGWAFVLI	IAAINNSMGSLLL - KSRLD	SSLLGLLSPWFLAGLG	VYGINVIL		
YvaD <i>Herminiimonas arsenicoxydans</i> YP_001101331	MLKMGMSAPA	IQQAMSNGMRSVYWL - ALT	SPLIGGMVCFGASAGL	WLLVL		
YvaE <i>Azoarcus sp.</i> BH72 YP_935092	MKWLILVLGLSNASASV	LVLP	PPRRF - ALSN	WPFLGLALYGGAFLLYAAAL		
SugE <i>Verminephrobacter eiseniae</i> YP_999455	QGCARCLQGLRRGVRRRPEKAQATGRSRL	PAGVARLPLRHRHALSMRTLSM				
YkkD <i>Actinobacillus succinogenes</i> YP_001344922	- - LTYIIIGASLECAWAYGLHAADG -	LEWAV - TIFCIVASFVVF	TKAF			
EmrE <i>Trichodesmium erythraeum</i> YP_720225	MLLMPLVATFLYP	AVWSDIEIKSKNF - L	WVKVI - SAFFL	FLSQVLIYISI		
YvaD <i>Bacillus subtilis</i> CAB15361	MKLFFLVTDIGFILIY	WLSAGLIPESWFKHHDHP - F	MIAWNWSFFPLDILI			
YvaD bacteriophage 82 (<i>N. gonorrhoeae</i>) YP_208183	- - - - - MSSAIRKAAKGQCTPNIA	GV	DNPETVVLFPGETH	GAGLKSGGLGA		
		60	70	80	90	
QacE <i>Archaeoglobus fulgidus</i> NP_070524	RIAKVELLLGLTIFVAIPLPVTGAWTGTLLAF	LLLKAFLFISAGVCIA				
QacE <i>Syntrophomonas wolfei</i> YP_752855	NEIKIPRLGLMIFVAIPLPGTGAWTGALAAS	FLWPSLLAIVGGV	LIA			
QacE <i>Streptococcus thermophilus</i> YP_140506	KWGD	KPLIWALLLFVGIPLPGTGAWTGTLAAS	ILKRSVLAVMLGVILA			
QacE <i>Streptococcus agalactiae</i> ZP_00785182	EWGD	KPYTIALLLFVGIPLPGTGAWTGTLAAS	LLKHSVIAVMLGVILA			
EmrE <i>Mannheimia haemolytica</i> EDN74853	FRT - LPV	GIVYAIWSGVGIVL	TALVAYFAFG - QKID	LAGLIGISLIA		
EmrE <i>Haemophilus ducreyi</i> NP_874231	TKI - LPL	GIVYAVWSGVGIVL	TSLVAYFAFG - QKLD	LAGGIGITLILL		
EmrE <i>Stenotrophomonas maltophilia</i> ZP_01643607	MKS - IPT	GIAYAIWSGVGIVL	SLIGLVVFK - QRLD	APALIGIGLICA		
EmrE <i>Pseudomonas syringae</i> YP_233649	MRT - IPV	GITYAIWSGMGIVM	VSIAAFFIYG - QKLD	LPALLGMGMIVA		
EmrE <i>Pseudomonas aeruginosa</i> NP_253677	MRT - LPV	GVVYAIWSGLGIVL	VSLVAMFVYG - QRLD	PAALLGIGLIA		
EmrE <i>Ralstonia eutropha</i> YP_727122	MRT - VPV	GIAYAIWSGAGIVL	VSLIAVVLYR - QVPD	LAACAGIGLIA		
EmrE <i>Serratia proteamaculans</i> ZP_01534598	VKT - MPL	GIVYAIWSGMGIVL	VSLIAAVFVYQ - QKLD	LPALVLMGLIA		
EmrE <i>Yersinia intermedia</i> ZP_00834935	VKT - MPL	GIAIYAIWSGLGIVL	VSVAA	TFMYQ - QKLD	WAAIAGMTLIA	
EmrE <i>Photobacterium luminescens</i> NP_929802	VKV - VPL	GIAIYAIWSGLGIVL	VSLIAAIFLYQ - QKLD	WAAI	IGMALIVA	
EmrE <i>Escherichia coli</i> P23895	LAY - IPT	GIAIYAIWSGVGIVL	ISLLSWGFFG - QRLD	LP	AIIGMMLICA	
EmrE <i>Shigella flexneri</i> YP_689427	LAY - IPT	GIAIYAIWSGVGIVL	ISLLSWGFFG - QRLD	LP	AIIGMMLICA	

	60	70	80	90
EmrE <i>Erwinia carotovora</i> YP_051073	LAH - I P T G I A Y A I W S G A G I V L I S L L G W L V S G	- Q K L D L P A I L G M G L I C A		
QacF plasmid pB8 YP_358817	F K F - I P T G I A Y A I W A G A G I V L I T L M G W I V H K	- Q T L D L A A M L G M G L I V S		
Qac class 3 integron ia-3 ABR28416	L R T - L P T G I A Y A I W A G A G I V L I T L V G W I I H K	- Q T L D L P A L L G M S L I V S		
EmrE <i>Rhodobacter sphaeroides</i> YP_353626	L K V - M P V G I V Y A V W S G L G I V F I A A I G W I V Y G	- E R L D L P A I L G L G L I L L		
EmrE <i>Sulfitobacter</i> sp. EE36 ZP_00954674	L K V - M P V G I V Y A I W S G L G I V C I A G I G Y I V F G	- Q K L D L A A V V G L S M I I G		
QacE <i>Roseobacter denitrificans</i> YP_682931	L K Y - M P V G V V Y A I W S G L G I V F I A C I G F V V F G	- Q R L D L P A I I G L G L I L S		
EmrE <i>Roseovarius nubinhibens</i> ZP_00960756	L K V - M P L G V T Y A L W S G L G I C L T V F L G W L V F N	- Q K V D L P A F L G L S M I V G		
EmrE <i>Magnetospirillum magnetotacticum</i> ZP_00051262	L K A - M P L G V V Y A I W S G V G I V L T A V V G V L V S K	- Q S L D G P A M V G M A M I V G		
EmrE <i>Methylobacterium chloromethanicum</i> ZP_02058088	L K A - M P L G V V Y A I W S G V G I V L T A V V G V L V F K	- Q S L D G P A M F G M A M I V C		
EmrE <i>Bradyrhizobium japonicum</i> NP_770868	I R V - I P L S I A Y A I W G G V G I I L T A T V S F V L F R	- Q M L D A A A F V G I G L I V S		
EmrE <i>Psychrobacter cryohalolentis</i> YP_580136	I K T - I P L G I A Y A L W A G L G I V L T S L V G L V F F K	- Q T L D T A A V S G I A M I V G		
EmrE <i>Psychrobacter arcticus</i> YP_264019	L K T - L P L G I A Y A M W G L G I V L T S V I G L V M F K	- Q H L D T A A V S G I T M I V G		
EmrE <i>Paracoccus denitrificans</i> YP_917819	L R A - M P L G I A Y A I W S G L G I V L V S L I G L F L F G	- Q R L D F A A V I G L T M I V A		
EmrE <i>Rhizobium leguminosarum</i> YP_769266	L K S - I P V G I A Y A I W S A L G I V L I S S V G L V F F K	- Q R L D L P A I V G L G L I I S		
EmrE <i>Sinorhizobium meliloti</i> NP_386521	L R Y - I P V G I A Y A L W S G L G I V L I S I A G Y V V F G	- Q K L D L P A I L G L A L I I A		
EmrE <i>Bordetella pertussis</i> NP_881103	L R V - I P V G V A Y A I W S G V G I V L I S L V G A L L F K H Q H L D L P A I I G I A L I L A			
EmrE <i>Stappia aggregata</i> ZP_01546857	I R V - L P T G I V Y A I W S G A G I V L I T M V A W L V F D	- Q K L D L P A L I G L G L I L A		
EmrE <i>Salmonella enterica</i> sbsp. <i>enterica</i> YP_216634	M R T - I P A G I I Y A I W S G V G I V L I G L I G W L F L G	- Q K L D M P A I I G M L L I I C		
EmrE <i>Salmonella enterica</i> sbsp. <i>enterica</i> YP_216634	M R T - I P A G I I Y A I W S G V G I V L I G L I G W L F L G	- Q K L D M P A I I G M L L I I C		
EmrE <i>Marinomonas</i> sp. MWYL1 ZP_01598495	M R S - M P T G V T Y A I W S G L G I V L I S V F G Y L F N S	- E K L D L A A C I G M S L I V A		
EmrE <i>Flavobacterium johnsoniae</i> YP_001193927	I R T - I P V G F A Y A I W S G V G I V L I T A I G A I F F K	- E I P D L P A I I G L S L I I L		
EmrE <i>Pseudoalteromonas atlantica</i> YP_660021	L K T - V P V G I A Y A I W A G M G I V L I A L F S A I F Y K	- E L P D L A A I A G M S L I L S		
EmrE <i>Acinetobacter baumannii</i> YP_001085323	L K T - I P M G I A Y A I W S G A G I I L I S A I G W I F Y K	- Q H L D V A A C I G L T L M I A		
EmrE <i>Pelobacter propionicus</i> ABL00914	L R S - I P I G I S Y A I W S G V G T V L I A G I A A I L H R	- Q L L D I P A L V G I G L I V S		
EmrE <i>Stigmatella aurantiaca</i> ZP_01461726	L R S - I P I G I A Y A L W S G V G I I L V A I A G Y V L Y Q	- Q K L D P A A I A G I A M I L G		
EmrE <i>Desulfovibrio desulfuricans</i> YP_388842	T R A - V P I G I A Y A L W S G F G I V L I A A V N W L I F R	- Q R L D T P A I I G L G L L I S		
EmrE <i>Photobacterium profundum</i> YP_01218031	V K V - V P I G I A Y A I W C G A G I V L V S M V S W L W H G	- Q Q L D M F A V L G I S L I L A		
EmrE <i>Vibrio harveyi</i> YP_001445675	V K S - M P V G I V Y A I W S G A G I V L V A A V G Y F L Y G	- Q K L D L A A L V G I G F I L T		
EmrE <i>Xanthobacter autotrophicus</i> YP_001417989	L K T - M P V G I A Y A I W S G V G I V L V T A I A W L W Y G	- Q R L D L P A I I G L G L I I A		
EmrE <i>Sphingomonas wittichii</i> YP_001263498	L R T - M P T G V A Y A I W S G V G L V L I T T V A W L F Q G	- Q K L D I A A L I G M A L I V A		
EmrE <i>Acidovorax avenae</i> subsp. <i>citulli</i> YP_973010	L Q A - I P T G I A Y A I W S G V G I V L V S T V G W L V Y G	- Q R L D G P A L A G M G L I L A		
EmrE <i>Delftia acidovorans</i> ZP_01577698	L R T - V P T G V A Y A I W S G A G I V L I S L V G W L W Q G	- Q T L D L P A L A G M G L I V A		
EmrE <i>Myxococcus xanthus</i> YP_633339	L R T - I P T G I A Y A I W S G A G I V L V S G V A W L L H G	- Q R L D V P A L V G I G L I L A		
EmrE <i>Dechloromonas aromatica</i> YP_283677	Q N L - M P V G I I Y A I W S G V G I V L V S L V A V F V Y G	- Q V L D L A A M L G I A L I V A		
QacE <i>Xanthomonas campestris</i> NP_637776	L R V - I P V G I A Y A L C S G A G I V L I S L V A W L V H G	- Q R L D P A M L G R A L I V A		
EmrE <i>Burkholderia cepacia</i> YP_773352	L R T - M P V G I I Y A V W S G A G I V L I T L V A M L L Y R	- Q V P D V P A V I G L G L I V A		
Qac int1 (<i>Serratia marcescens</i>) AAK40353	L K S - I P V G I A Y A V W A G L G I V L V A A I A W I F H G	- Q K L D F W A F I G I G L I V S		
QacF int1 (<i>Achromobacter denitrificans</i>) AAZ14837	L K S - I P V G I A Y A V W A G L G I V L V A A I A W I F H G	- Q K L D F W A F I G I G L I V S		
QacF plasmid pIP833 (<i>E. aerogenes</i>) AAD22143	L K S - I P V G I A Y A V W A G L G I V L V A A I A W I F H G	- Q K L D F W A F I G M G L I V S		
QacH plasmid p3iANG (<i>Vibrio cholerae</i>) AAZ42322	L K S - I P V G I A Y A V W A G L G I V L V A A I A W I F H G	- Q K L D F W A F I G M G L I V S		
QacE plasmid pSC138 (<i>S. enterica</i>) AAX56371	L K S - I P V G I A Y A V W A G L G I V L V A A I A W I F H G	- Q K L D L W A F V G M G L I V S		
QacE2 Int Class1 (<i>A. salmonicida</i>) AAK53557	L K S - I P V A I A Y A V W S G L G I V L V T A I A W V L H G	- Q K L D M W G F V G V G F I I S		
QacG class I intergon (<i>A. baumannii</i>) AAL38576	L K S - I P V G I A Y A V W S G L G I V L V T A I A W V L H G	- Q K L D M W G F V G V G F I I S		
QacG integron (<i>P. aeruginosa</i>) AAS79147	L K S - I P V G I A Y A V W S G L G I V L V T A I A W V L H G	- Q K L D M W G F V G V G F I I S		
QacE plasmid R751 (<i>E. aerogenes</i>) NP_044260	L K S - I P V G V A Y A V W S G L G V V I I T A I A W L L H G	- Q K L D A W G F V G M G L I V S		
QacEA1 class 2 integron (<i>P. aeruginosa</i>) AAV32841	L K S - I P V G V A Y A V W S G L G V V I I T A I A W L L H G	- Q K L D A W G F V G M G L I I A		
EmrE <i>Marinobacter aquaeolei</i> YP_958340	I K V - I P V G I A Y A V W A G L G I V L I S L I G W L L L G	- Q K L D F P A V V G M L L I V A		
Smr <i>Chloroflexus aurantiacus</i> ZP_00766077	L E A - I P V G I A Y A V W S G I G I V L I T V A A W F L Y G	- Q R L D V W A L I G I G F I I V		
EmrE <i>Shewanella frigidimarina</i> YP_748773	L K G - I P V G I A Y A T W A G L G I V L I T A I A W V M Y G	- Q K L D L G A L V G M T F I L V		
EmrE <i>Chromobacterium violaceum</i> NP_902350	L R H - I P V G I A Y A L W S G I G I V L V S L I A W L L Y G	- Q K L D L A A V A G M G L I I A		
EmrE <i>Methylobacillus flagellatus</i> YP_544992	L R S - I P V G V A Y A V W S G L G I V L V S V I A S L L Y G	- Q K L D L P A V I G M A L I I A		
EmrE <i>Methylococcus capsulatus</i> YP_115175	V D K - I P V G I S Y A I W S A L G I V L V S L I A W I L H G	- Q A L D R P A I A G M G L I I A		
EmrE <i>Coxiella burnetii</i> YP_01299513	L K S - I P V G L A Y A I W A G L G I V L I S I I G W V V F H	- Q H L D I A A I V G L V L I I S		
QacH <i>Brucella melitensis</i> YP_414370	L K T - I P V G V A Y A I W S G V G T L V A L I G W L V F G	- Q K L D L P A I V G M G L I I A		
QacE <i>Brucella melitensis</i> AAL52226	L K T - I P V G V A Y A I W S G V G T L V A L I G W L V F G	- Q K L D L P A I V G M G L I I A		
EmrE <i>Ochrobactrum anthropi</i> YP_001370804	L K S - I P V G I A Y A V W S G I G V T L V A L I G W L V F G	- Q K L D L A A V L G M G L I I A		
EmrE <i>Marinobacter algicola</i> ZP_01894487	L K T - L P V G V A Y A V W A G A G V A L I A L A G Y L F F G	- Q T L D L P A I L G I G L I V A		
EmrE <i>Nitrosococcus oceanii</i> YP_342650	L R T - L P V G V A Y A V W S G V G V A L I T L V A W L F Y G	- Q T L D T P A L L G L A L I I A		
EmrE <i>Reinekea</i> sp. MED297 ZP_01116498	L K T - I P V G V A Y A I W S G L G V A L V A L L S W W F Y G	- Q A F D L A G V I G V C L I V S		

EmrE *Marinobacter algicola* ZP_01894487
 EmrE *Nitrosococcus oceani* YP_342650
 EmrE *Reinekea* sp. MED297 ZP_01116498
 EmrE *Geobacter sulfurreducens* NP_951765
 EmrE *Chlorobium limicola* EAM42528
 EmrE *Alcanivorax borkumensis* YP_693512
 EmrE *Jannaschia* sp. CCS1 YP_511013
 EmrE *Chromohalobacter salexigens*
 QacH *Pelagibacter ubique* ZP_01264056
 QacH2 *Pelagibacter ubique* YP_266208
 EmrE *Pseudoalteromonas atlantica* YP_661014
 QacF *Pseudoalteromonas haloplanktis* CAI87270
Qac megaplasmid (*S. oneidensis*) NP_720475
 YvaE *Shewanella frigidimarina* YP_752098
 EmrE *Shewanella pealeana* YP_001500134
 EmrE *Vibrio harveyi* YP_001449011
 EmrE *Photobacterium profundum* ZP_01219483
 EbrB *Pseudomonas syringae* YP_235623
 EmrE *Wigglesworthia glossinidia* NP_871589
 EmrE *Aeromonas hydrophila* YP_855864
 EmrE *Erwinia carotovora* YP_051860
 EmrE *Aeromonas hydrophila* YP_855865
 QacE integrin (*Escherichia coli*) YP_672432
 QacH *Erwinia carotovora* YP_051859
 EmrE *Nitrobacter winogradskyi* YP_319204
 EmrE *Synechococcus* sp. RS9917 ZP_01081426
 EbrB *Mannheimia haemolytica* EDN74090
 EmrE *Neisseria meningitidis* NP_284788
 EbrB *Listeria monocytogenes* EAL09800
 EbrA *Paenibacillus larvae* ZP_02326984
 EbrB *Bacillus subtilis* CAB13613
 EbrB *Paenibacillus larvae* ZP_02326985
 EbrA *Bacillus subtilis* CAB13614
 QacG plasmid pST94 O87866
 QacJ plasmid pNVH01 (*S. aureus*) CAD55144
 QacH plasmid pST2H6 (*S. saprophyticus*) CAA76544
Smr *Staphylococcus aureus* AAM94142
 EbrA *Desulfotomaculum reducens* YP_001114614
 Ebr *Pediococcus pentosaceus* YP_804449
 Ebr1 *Synechococcus* sp. RS9917 ZP_01080450
 EbrA *Listeria monocytogenes* EAL09801
 Smr *Roseiflexus castenholzii* ZP_01530339
 EbrA *Roseiflexus* sp. RS-1 YP_001278866
 EbrA *Gloeobacter violaceus* NP_927270
 EbrB *Thermus thermophilus* YP_004540
 EbrB *Halobacterium* sp. NRC1 NP_444228
 EmrE *Zymomonas mobilis* sbsp. *mobilis* YP_161843
 Smr2 *Mycobacterium vanbaalenii* YP_954149
 Smr2 *Mycobacterium gilvum* YP_001134816
 EbrB *Clavibacter michiganensis* YP_001220961
 Smr *Nocardia farcinica* YP_118186
 Smr *Saccharopolyspora erythraea* YP_001109297
 Smr *Thermobifida fusca* YP_289048
 Smr *Saccharopolyspora erythraea* YP_001103712
 Smr *Nocardioides* sp. JS614 YP_921842
 Smr *Nocardioides* sp. JS614 YP_921842
 Smr *Mycobacterium tuberculosis* P95094
NepA plasmid pAO1 (*A. nicotinovorans*) CAD47919

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      60      70      80      90
LKA - I P V G I A Y A I W S G L G T A L V A V V A W V F M G - Q R L D L P A V F G I L L I I A
LRY - F P V G I V Y A I W S G V G V A L V T L A G W F F Y H - Q G L D A G A I A G I V L I V I
RT - - I P M G I A Y A V W A G V G I V L I A L V G A V F F K - Q L P D V P A M V G M G C I I T
R - - T I P L G V A Y A V W A G V G I V T V T L I G V Y W F N Q P I - G A G Q A A G I A M I L G
RD - - L P V G I A Y A F W A G L G I V L V T L I G I V V Y G - E K P D L P A L L G L G L I I A
KN - - I P M G I T Y A S F A G L A I I S T V G V G I I K Y N Q V P - N L Y S I V G L C F I I V
TI - - I P V G F T Y A T Y G G L T I T A V T I F G V V K Y N Q T P - N L Y A V L G I S L I I I
KG - - M P I G I V H A L W A G L A I V T V T L L S T V I Y R Q H L - D L T T W V G M A F V A V
KG - - M P V G I V H A M W A G L A I V T V T L L S T L V Y K Q H L - D L S T W L G M A L V A I
KG - - M P V G V V H A L W A G M A I V T V T L L S A L F Y R Q H L - D M T A W I G M L L V A L
KG - - M P V G V V H A L W A G M A I V T V T L L S A L F Y R Q H L - D M T A W I G M L L V A L
KG - - M P V G V V H A L W A G L A I V S V T L I S A L F Y R E H L - D M T A W I G M V L V A A
KG - G M P V G I V H A L W A G L A I V S V T L I S Q L V Y R Q H M - D T S L W I G M A L I A A
KN - - L P V G I V H A S W A G L A I V L V T L M S N I I Y K Q H L - D A K V W L G M V V I G I
RD - - L P M S L I T S M W S G L G I T L I T V I A A F R Y Q Q V P - T L M A I G G I S L I I A
KD - - I P I G I A Y S S W S G F G I V F V T I S G Y F L Y N Q K I - N L I E I F G I I L I I T
ST - - I P V G V A Y S L W C G F G I V G V T I C S M I L Y K Q K P - D L P A I L A M A L I I S
GY - - L P V G I A Y S L W C G F G I G V T F I S M L L Y K Q K P - D L P A V F S M V L I I S
KD - - I P V G L A Y A T W S G T G I L V V S T L G M A F Y G Q H P - D T A A M I G M A V I A S
KD - - I P V G L A Y A T W S G T G I L M V S T L G I L F Y G Q H P - D T A A I G M V I I A S
RH - - L P V G L A Y A T W S G T G I L L V S T L S I I F Y G Q H P - D I P A I V G M I V I A T
TR - - I P V G V A Y A I W S G A G V V L I S L I G A I F L R - Q S P S M I Q I L F I S L I V V
QS - - I P L G L T Y A L W S G I G I V A I V L V G V L A Y R - Q V P S S G Q L I G M G L I A A
LKS - I P L G M A Y A I W S G V G L V L T A I V G V V V F G - E K V D F W G I A S I G L I L A
LKT - M P L A T A Y A I W A G V G L V L T A L V S V V F F G - E K A D F I G I V S I G L I L L
LKT - L P L S L A Y A I W S G V G T A L T A L I G V L V W N - E P F N I L T F I G L V M I V G
LRY - L S M S L A Y A T W A G A G T A L T A L I S V V V F R - E S L N V I A V F G L L F I I G
LKT - I D L S S A Y A T W S G V G T A L T A I V G F L L F G - E T I S L K G V F G L T L V I A
LTY - L P L N L A Y A T W A G L G T S L T V L V D Y F F F K - E S L T K R S L L G L V L I V C
LNH - I P L S L S Y A T W S G A G T V L T T V I G V K W F K - E D L N A K G L I G I L L L L S
IKF - L P L N I T Y A T W A G L G L V L T T I S V I V F K - E N V N L I S I I S I G L I V I
MKY - L P L N V S Y A T W A G L G L V L T T I V S V V I F K - E S V N L I S I F S I I L I I I
MQH - L P L N I T Y A S W A G L G L V L T T I V S V L I F K - E Q I N L I S I I S I I L I I F
MQH - L P L N I T Y A T W A G L G L V L T T V V S I I I F K - E Q I N L I T I V S I V L I V
LKT - I P L N L A Y A I W S G L G T I A T V I S I L I W Q - E R V N I A S I T G I S L I I V
VKN - I P I N I A Y A I W S G V G I I L M T V I S V F V F H - N P I N V P T V L G I L F I T L
LAR - L P L A I A Y S I W C G L G M S V V T L T G I L V Y K - E K F G W K V A L G L L L I F S
LEH - I P L G T A Y A I W S G G G T A L T A I V G I L V W K - E K F N L K I L L G L L I I I A
LRT - I P L G V A Y A I W S G L G T A A I A V I G V L V W R - E Q L N I T G V I G I V L I I A
LRT - I P L G I A Y A I W S G L G T A A I A V I G V I V W R - E Q L N T A G V I G I V L I I I
LKA - M P L S V V Y A I W S G V G T A A T A F I G V V L F R - E V L D A P R L I G I A L I I V
LKT - V P L S L A Y A V W A G V G T A A I A L I G A F F F G - E A I S P K G W L G I A L V A V
EE - - L P V G V V Y G T W A A V G I A T A L V G V V V F E - E S V D V A G V G L A L I V A
KT - - L P L G I V Y A V W A G G L A I M T I V S Q W I F N - E T L D L R Q I G C I A L I L I
KR - G M G L G V A Y G I W G A T G V A L T A V L S S V M F G - E A L T A V M G V G L S C I I A
RR - G M G L G V A Y G I W G A S G V A M T A L L S A V L F G - E E L T A L M I A G L G C I I A
KA - G M A V G V A Y G I W G A S G V A L T A V G A T V L F G - Q P L T G L M I L G L V L I V A
RQ - G M P L G I A Y G I W A A A G V A L T A L A S H V L F A - E P L T R R M V G G I A L I A A
RH - G M P L G V A Y G I W A A A G V A L T A A F S R L L F D - E P L T R K M L G G I A L I M V
SL - G L P I G V A Y G I W A A T G V A L T A I L G R V L F R - D P L T R T M L A G I A L I G
KR - G M A I G V A Y G I W S A V G V A A I A L I G V L F L N - E R L T L V Q V G G I G L V I L
KL - G L P V G V V Y A I W A G A G V A L V A V I G A V F L G - E T I T P V Q I G G V V L I V G
KL - G M G V G V A Y G I W S A L G V T L V A V I G A V F L G - D T L T W V Q I V G I V L V I A
KQ - G M D M G V A Y G I W A A L G V T A V A L V G A A F L G - D T L T W A Q M I G I V L V I G
QR - G L N V A I V Y A L W S A T G I V A I A V I G A T F L G - E R L T S A Q V L G M G L I V S
SHG - M Q V G I A Y A L W S A I G T T V I V A V G V T F L G - E P I S T L K V I G V A L V V S
SHG - M Q T D V A Y A L W S A I G T A A I V L V A V L F L G - S P I S V M K V V G V G L I V V
KF - - T D I G I A Y A L W A G L G T A S V A V I G V L F R N - E R F S W K H A I G L A L V V T

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	60	70	80	90
EmrE <i>Candidatus Pelagibacter ubique</i> ZP_01264207	DK -	LPIAIVYATWSGLGIFTIAILGYIFFK	QSLSWQAVLGLFFIVT	
QacH <i>Lactobacillus plantarum</i> NP_786542	QR -	LPLGVTYAMWAGLGTFATVILAVVVYR	ERLSLSRLSGLIAIVV	
YdgF <i>Escherichia coli</i> ABE07266	K -	KIALGVAYALWEGIGILFITLFSVLLF	DESL - SLMKIAGLTTTLVA	
YdgF <i>Shigella flexneri</i> YP_689093	K -	KIALGVAYALWEGIGILFITLFSVLLF	DESL - SLMKIAGLTTTLVA	
YdgF <i>Salmonella enterica</i> sbsp. <i>enterica</i> YP_216487	K -	KIALGVAYALWEGIGILFITLFSVLLF	DEAL - STMKIAGLTTTLVA	
YdgF <i>Yersinia intermedia</i> ZP_00833156	K -	KVALGVAYALWEGIGILITVFSVLWF	DESL - SPLKIAGLVTLIG	
YdgF <i>Photobacterium luminescens</i> NP_929383	K -	KVALGVAYALWEGVGLFITVFSVMWF	DESL - SLMKVGGLALLIT	
YdgF <i>Pseudomonas aeruginosa</i> NP_250232	K -	RVPVGVAYALWEGIGIVLITAVSVAWL	GESI - GLYKAVGLGVMI	
YdgF <i>Sinorhizobium meliloti</i> NP_385720	K -	TIPVGVAYAVWEGSGVAVITLVSVFVFG	HAL - SGREMLGLAMAVA	
YdgF <i>Aeromonas hydrophila</i> YP_857997	K -	TISIGIYAFALWEGIGIALITVSVLFL	DYHL - NAQELIGLALAI	
YdgF <i>Vibrio harveyi</i>	K -	KISIGVAYATWEGIGIALITLVSVLFL	DANL - STQQLLGLALAVV	
YdgF <i>Chromobacterium violaceum</i> NP_900949	R -	AISVGVAYAVWEGGLVLGLTAVSVLLF	GKEL - VPQEIYVGLGLALL	
YdgF <i>Campylobacter jejuni</i> YP_179294	K -	KIQVGIYAVWELLGILILLVSFIVF	KESL - TLTQILGILISIV	
YdgF <i>Desulfovibrio desulfuricans</i> YP_388898	T -	ALPVGVAFVWEGVGLAFITLASVFI	LGEM - SLLRFAALCAVLG	
YdgF <i>Lawsonia intracellularis</i> CAJ54979	T -	GLPIGVAYAFWEGGLLILITLVSVFV	IDEKM - TITRLISLFAALLS	
YdgF <i>Deinococcus geothermalis</i> YP_605419	R -	RIPVAVAFVWWEAVGLAAVTLLSVWLL	GDHL - TQLQLLALGGLLL	
YdgF <i>Pseudoalteromonas haloplanktis</i> YP_340952	S -	KIPIALANAFWEGGLMILIASVSFVFL	GEL - SIGQMFALLLAI	
YdgF <i>Acidovorax avenae</i> subsp. <i>citrulli</i> YP_969092	K -	QIPMAVAYATWETLGLLAIYAFIGYR	YFGE - SM - SAGKLLGMSVLIV	
YdgF <i>Helicobacter hepaticus</i> NP_860040	K -	RISVGVAYAIWVEVLGAICVVCISVF	YFGE - E - SFIQKIGIVLSIS	
EmrE <i>Alteromonas macleodii</i> ZP_01110205	K -	NMGIGVAYAIWWSGMGIALITAASV	VFWK - QTF - DIYAVLGIMLIIS	
YvaE <i>Bacillus subtilis</i> CAB15362	KS -	IDVSVAYAVWWSGMGIVLITVVGFL	FFQ - EHVSVMKVISIGLIA	
YvaE <i>Blastopirellula marina</i> ZP_01094237	NK -	IDVSHAYAVWWSGVGTALIAVIGIC	FFR - ETFSPVKLISILLIA	
YvaE <i>Desulfitobacterium hafniense</i> YP_517233	KK -	IPVSVAYAVWWSGVIVVISAIGIAV	FK - ETVTTLKVSVIVLIVA	
YvaE <i>Rhodospirillum rubrum</i> YP_428434	KK -	MDVSIAYAIWWSGAGTVLITVIGIL	VFK - EPATLLKVLICIALIVA	
YvaE <i>Bdellovibrio bacteriovorus</i> NP_968626	KY -	LPVSNVYAIWAGVGTALMAFLGLVIF	N - EPLPLQKVVAATLLIA	
Smr <i>Streptomyces coelicolor</i> AAK95484	KI -	LAVGTAYAIWAGVGTAAIATIGVAF	MG - EGMTLTKAAGIALIII	
YvaE <i>Acidobacteria bacterium</i> YP_593828	KE -	LEVGAUYAIWSALGTVAVALLGMLVF	H - EPANALKVFSIVLIV	
EbrB <i>Rubrobacter xylanophilus</i> YP_644095	RR -	MDVGVAYAVWWSGLGTALVAIVGIAL	FG - EEMTAARALALALIA	
YvaE <i>Desulfovibrio vulgaris</i> YP_966624	KK -	MDVSIAYAVWWSGVGTATVAMIGIC	IFG - ERAT - VKICSLLLIII	
YvaE <i>Pelodictyon phaeocyclathratiforme</i> ZP_00590439	KV -	LPIALTYAIWWSGIGTAAITVIGVIF	WG - EGINAIKLASLILLII	
YvaE <i>Chlorobium tepidum</i> NP_662342	RT -	LPVGMSTAIWSALGTALITAGVVLWF	FG - EGLNALKIIISLILIA	
YvaE <i>Prosthecochloris vibrioformis</i> YP_001130806	KV -	LPIGMTYAIWAGLGTAVVSMIGVIF	WFA - ETLTPVKLFSALIII	
YvaE <i>Anabaena variabilis</i> YP_323581	KN -	IDISIAYSVWAGLGTALIAGVGLIWF	R - ESMTLVKFIISMTLIV	
YvaE <i>Nostoc</i> sp. PCC 7120 NP_484329	KN -	IDISIAYSVWAGLGTALIAGVGLIWF	R - ESMTMVKFIISMTLIV	
EbrA <i>Methanosarcina acetivorans</i> NP_616284	KG -	IDVSVAYAIWAGLGTALITIVGILWF	R - EPATALKMISLIVVIT	
YvaE <i>Methanococcoides burtonii</i> YP_566929	KN -	IDVSLAYAIWWSGVGTASMTLIGV	YFK - EPATTIKMVSIFIVMA	
YvaE <i>Clostridium beijerinckii</i> YP_001307448	KK -	VQIGVAYATWWSGIGILLSAIGIVFF	K - ESINLQKTVFIGLIII	
YvaE <i>Marinomonas</i> sp. MED121 ZP_01075592	KT -	LEISIAVAVWWSGAGIVITFTIGTI	WFA - EQFSLAKFAFISILII	
QacC <i>Lactobacillus plantarum</i> NP_786541	SK -	IPLSVGYAIWAGVGTAAATGLIGIWF	AG - EILTGLKTLGFMALIT	
<u>NeuB</u> plasmid pAO1 (a. <i>nicotinovorans</i>) CAD47918	RA -	VPLSVAYATWSGLGTVAVAFAGAIHG	- EAVTLGRITAITAVIG	
YvaE <i>Burkholderia cenocepacia</i> YP_839289	L -	NVEVGLAYAAWAGASTAITAGLGILL	FGESV - SVSKLCGLAMAAG	
EmrE <i>Synechococcus</i> sp. RS9917 ZP_01080451	R -	VLPMGFAYALWVGVMVVASVSGVFL	SEAL - TPSVFLGLMFVVF	
SugE <i>Escherichia coli</i> AAC46453	KS -	LPVGTAYAVWWTGIGAVGAAITGIV	LLGES - NPMRLASLALIVL	
SugE <i>Shigella flexneri</i> YP_691592	KS -	LPVGTAYAVWWTGIGAVGAAITGIV	LLGES - NPMRLASLALIVL	
SugE <i>Salmonella enterica</i> sbsp. <i>enterica</i> YP_219204	KT -	LPVGTAYAIWWTGIGAVGAAITGILL	GES - SPARLLSLGLIVA	
<u>SugE</u> plasmid/ <i>Citrobacter freundii</i> AAC46457	RT -	LPVGTAYAVWWTGIGAVGAAITGILL	GES - SPARLLSLGLIVA	
SugE <i>Serratia proteamaculans</i> ZP_01538212	KT -	LPAGTAYAVWWTGIGAVGAAIMGMV	LLGEST - NIARILSLCLIVV	
SugE <i>Yersinia intermedia</i> ZP_00832613	KT -	LPAGTAYAVWWTGIGAIGTAILGIAL	LLGES - SLARVLSLGLILA	
SugE <i>Photobacterium luminescens</i> NP_931319	KG -	LPIGTAYAVWWTGIGAVGTAIFGIIV	FGES - SFARILSFALIIA	
SugE <i>Proteus vulgaris</i> P20928	KG -	LPAGTAYAIWWTGIGAVGTAIFGIIV	FGES - NIYRLLSLAMIVF	
SugE <i>Pseudoalteromonas atlantica</i> YP_660982	KS -	LPAGTAYAVWVVIIGLIGTAIVGIV	MLNEPL - NFWRVVSLLITIV	
SugE <i>Limnobacter</i> sp. MED105 ZP_01915318	KT -	LPVGTAYSVMVVGIGAAGTVLMGV	VLFNEPV - NALRIGSVVLLIVL	
SugE <i>Shewanella oneidensis</i> NP_717508	KQ -	LPIGTAYGVVVGIGAMGTAIAGILL	EGV - SLLKIASLLILL	
SugE <i>Methylobacillus flagellatus</i> YP_545743	RS -	LPMTAYAIWVGIGAVGTVIMGIFL	FNEPT - SLVRLFSVALIV	
SugE <i>Bradyrhizobium japonicum</i> NP_770684	KS -	LPVGTAYAVWWTGIGAVGTATLGIL	LFGEPA - TALRLASIGLIVA	
SugE <i>Ralstonia eutropha</i> YP_727054	RH -	IPVGTGYAVWWTGIGAVGTAILGIL	LFNEPA - TAARLACIGLIVC	
SugE <i>Dechloromonas aromatica</i> YP_287101	KT -	LPLGTAYAVWWTGIGAVGTAILGIY	LFDES - EVLRFVCIGLIVA	
SugE <i>Mesorhizobium loti</i> NP_105639	KA -	LPVGTAYAVWWTGIGTVGTALLGIW	LLGEPA - TAILRLACIALIVC	

SugE *Rhizobium leguminosarum* YP_768145
 SugE *Sinorhizobium meliloti* NP_385492
 SugE *Hermiinimonas arsenicoxydans* YP_001098437
 SugE *Gloeobacter violaceus* NP_925933
 SugE *Syntrophus aciditrophicus* YP_462525
 SugE *Geobacter sulfurreducens* NP_951764
 SugE *Pseudomonas aeruginosa* NP_251955
 SugE *Aeromonas hydrophila* sp. *hydrophila* YP_856475
 SugE *Bdellovibrio bacteriovorus* NP_969313
 SugE *Myxococcus xanthus* YP_631852
 SugE *Deinococcus geothermalis* YP_605633
 SugE *Streptomyces coelicolor* NP_627124
 SugE *Anaeromyxobacter dehalogenans* YP_467455
 SugE *Blastopirellula marina* ZP_01088886
 SugE *Myxococcus xanthus* YP_628656
 SugE *Legionella pneumophila* YP_122951
 SugE *Marinomonas* sp. MWYL1 ZP_01596466
 SugE *Vibrio harveyi* YP_001448000
 SugE *Rhodospirillum rubrum* YP_425364
 SugE *Pelodictyon phaeoclathratifforme* ZP_00588597
 SugE *Chlorobium limicola* EAM42493
 SugE *Prosthecochloris aestuarii* EAN23020
 SugE *Chlorobium tepidum* NP_661278
 SugE *Geobacillus thermodenitrificans* YP_001124648
 SugE *Desulfotomaculum reducens* YP_001114341
 SugE *Methanosarcina barkeri* AAZ72469
 SugE *Clostridium beijerinckii* YP_001310526
 SugE *Nitrobacter winogradskyi* YP_318926
 SugE *Rhodopirellula baltica* NP_869718
 SugE *Nitrosococcus oceani* YP_344225
 SugE *Roseovarius nubinihibens* ZP_00959799
 SugE *Rhodobacter sphaeroides* YP_351822
 SugE *Stenotrophomonas maltophilia* ZP_01645236
 SugE *Xanthomonas campestris* NP_635868
 SugE *Symbiobacterium thermophilum* YP_074555
 SugE *Xanthobacter autotrophicus* YP_001419080
 SugE *Brucella melitensis* biovar *abortus* YP_414234
 SugE *Ochrobactrum anthropi* YP_001371057
 SugE *Burkholderia cepacia* YP_774210
 SugE *Zymomonas mobilis* sp. *mobilis* YP_162432
 SugE *Stenotrophomonas maltophilia* ZP_01643044
 SugE *Delftia acidovorans* ZP_01582139
 SugE *Magnetospirillum magnetotacticum* ZP_00208705
 SugE *Methylobacterium* sp. 4-46 ZP_01845840
 SugE *Nitrosomonas europaea* NP_842203
 SugE *Acinetobacter baumannii* YP_001083756
 SugE *Paracoccus denitrificans* YP_917710
 SugE *Pseudomonas aeruginosa* NP_250573
 SocA2 *Myxococcus xanthus* YP_633361
 SugE *Bordetella parapertussis* NP_883309
 SugE *Ralstonia eutropha* YP_726368
 SugE2 *Mycobacterium gilvum* YP_001136522
 SugE *Clavibacter michiganensis* YP_001223477
 SugE1 *Arthrobacter aurescens* YP_949237
 SugE *Arthrobacter aurescens* YP_949238
 SugE1 *Mycobacterium gilvum* YP_001136521
 SugE *Kineococcus radiotolerans* ZP_00617403
 SugE *Nocardia farcinica* YP_116350
 SugE *Thermobifida fusca* YP_289322

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      60      70      80      90
KH - - LPIGTAYAVWVGIGTVGTVFLGIWLLGDEA - SVSRLACISLIVA
RS - - LPLGTAYAVWVGIGTVGTVILGIILFAEPA - TAMRLGCIGLIVA
KS - - LPVGTAYAVWVGIGTVGTVILGMVLLGEAA - SAVRVVCIMLIVA
KS - - LPIGTAYAVWVGIGTVGTALLGIWLFGESE - SALRLACIGLIVA
KS - - IPVGTAYAVWVGIGAVGTAMLGIVLLGEPV - NSGRILSLALIA
RT - - LPVGTAYSVWVGIGAVGTVLLGIVLFGEP - NPARLISVALIVA
KH - - LPLGTAYAVWVGIGAVGTVIAIGIVLFGESM - ALLRLASVALIVC
KQ - - LPLGTAYAVWVGIGAVGTVLMGIWLFNEPA - TLARVLCLLIIG
TV - - LPIGTAYGVWVGIGALGAAILGIFLFNEAA - TPARVFFLALLLI
KN - - LPIGTAYGVWVGIGAVGAAIMGIVLFNEPA - TPARVFFLVLLLT
KT - - LPIGTAYGVWVGIGAVGAAILGIVLFKEPA - TPARLVFLGMMIV
RT - - LPIGTAYGVWVGIGAGAAVLMGMVLLGEPA - TAARIFFICLLLV
RD - - LPIGTAYAVWVGIGAGAAVLMGMVLLGEPL - SLARAAFLGLLVV
RT - - IPIGSAYAIWVGIGASGAALLGVWLFGESL - SPARGFFLLLVG
RT - - LPAGTAYAVWVGIGALGAALVGIVLFFREPA - TLGRFFFLGLMVV
QT - - LPIGTAYAVWVGIGSLGTAIMGILLFQEH - SVFRLLYLVMLI
KT - - LPVGVAYAVWVGIGLVGTAIILGILLFDESA - QTLKLSLGLICA
RT - - LLLGVAYGVWVGIGAIGTAIASIILFNEPA - TLIKLISLLIVA
RS - - LPLGVGYGIWVGIGTVGAAGVAGMALFGEAV - SVVKLASLGLIV
KT - - IPVGTAYAVWVGIGATGVAIVGMLFLDEPR - DIARILCLLILS
KT - - IPAGTAYAVWVGIGAGVAVAGIMLFDES - DTARLICLLIVA
KS - - LPAGTAYAVWVGIGAVGVAVAGMFLFDEPR - ELIRILSILLIVA
KI - - VPVGTAYAVWVGIGAGVAVAGILLFNEPR - DLARVFCIFLIA
KT - - LPIGTAYAVWVGIGAFGAVVIGMLFLNEPV - NAPRIVFLFLIV
KT - - LPIGTAYAVWVGIGALGTVLVGMFLFGEP - DIVRVIFILQIVG
KT - - LPIGTSYAVWVGIGIIGTTILGFLLFNEPM - DFARGFCIILIFS
KS - - LPLGTAYAIWVGIGTVGTVALGILFKEPV - DIIRLICIGFIVI
RT - - LPVGTAYAIWVGIGATGTALLGMWLFSEPA - TIARFACGLIII
RE - - IPLGTGYAVWVGIGAVGTAIAGMILFGESK - DAIRLACIAVIVA
KV - - IPIGTGYAMWVGIGVAGTAVLGIIILFSESA - ALPRLACIALIVA
RS - - IPVGTAYAVWVGIGAVGTVIFGIVIFAEPV - SLMRMACVGLIVA
KS - - LPVGTAYAVWVGIGAVGTALLAMALFGEPA - SPLRIAGIGLILA
KS - - IPVGTAYAIWVGIGAMGVAVLGIIYLFNDSA - SPARLACVGLIVA
KT - - IPVGTGYAIWVGIGALGVTAIAGIALFGDSA - SVSRLACVGLIVA
KT - - LPLGTAYGVWVGIGALGSALVGVFLGEP - EPLRLLCIFLIFA
RG - - IPIGTAYAVWVGIGTVGTALVGILFFSEST - DLLRLASIGLIGA
RS - - LPLGTAYAIWVGIGAVGASIVGIFLLGEAA - TFFRVASVALILA
RS - - LPLGTAYAIWVGIGAVGAFLVGIFILGEAA - TFFRVASVTLILA
RQ - - LPLGTAYAVWVGIGAVGAFIFGIVMMGEAL - TVARVASASIVL
KF - - LPLGSAYAVWVGIGIIGSFIVGIVFLKEPA - NFIRILAVSLIA
RS - - LPLGTAYTIWVGIGAVGAFFVGVFLGQV - SPMRIGAALLIVS
RS - - LPLGTAYTIWVGIGAVGAFLVGIVTLGQV - SAMRIGAALLIVS
RS - - LPLGTAYTIWVGIGAVGAFLVGIAFLGEAM - NATRLLAAGLIVS
RS - - LPLGTAYTIWVGIGAVGAFLVGILVLGEQA - SVTRLVAAGLIVS
KI - - LPLGTAYTIWVGIGAIGAFMVGIFVLGESV - TPLRLLAALIIIS
KT - - LPLGTAYTVWVGIGAIGSFLVGIFFLHEPI - GAMRMIAAVLIVS
KV - - LPLGTAYVIWVGIGAVGTFLVGLVLLGESE - DSLRLLAAVLIVA
KT - - LPLGTAYTIWVGIGAVGAFLGILLFGESP - SPLRLLAVGLIVA
KQ - - LPVGTAYDVWVGIGMCGVAVFGMLFLGQV - SAPRIFFLVMIIGI
RH - - LPVGTAYAIWVGIGAFGVAVFGTLVLGEP - SWAKLLFLALIGI
RH - - LPVGTAYAIWVGIGAIGVTVVGILFLGESE - APMRLVLIGLIFVI
TE - - VPTGTAYAVWVGIGATLTVVWAIVTKKEAA - TTARVLLLCLLVG
RE - - ISTGTAYAVWVGIGAALTVTYAVTGSEPA - SVVKVLLLLGLVG
QS - - IPTGTAYAVWVGIGVVLATYAMVTKVERA - TTARLLLLLAGIGA
KR - - IPLGTAYAVWVGIGAALTVGWAMITGVESA - SPLKLLFIAGIVG
KH - - IPIGTAYAVWVGILGAALTVGYAMLSGDEHA - SLGKAVFLTGIIA
RD - - LPVGTAYAVWVGIGAVLTVVHAMATGAEP - SALRILFLAMIVG
RD - - LPVGTAYAVWVGIGAVGTAVYAMATGTEPI - AWTKILFLTMIGI
KS - - IPVGTGYAVWVGIGAVGTATVGMVWLGEAV - SVAKICCLLLIIS
  
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	60	70	80	90
SugE <i>Stigmatella aurantiaca</i> ZP_01464276	KT - L P A G P S Y A V W T G	I G A A L T A T L G I L L F N E A V	- S A V K L V S I G L I I A	
SugE <i>Saccharopolyspora erythraea</i> YP_001109242	RT - L P V G P A Y A V W V G	I G A A L T A V I G M V W L G D P V	- S V L K V V S I V L I A A	
SugE <i>Streptomyces coelicolor</i> NP_629357	KK - L D V G P A Y A V W T G	I G A A G T A I Y G M I F L G D L V	- S T L K I V S I S F V I I	
SugE1 <i>Listeria monocytogenes</i> YP_013473	KS - I P I G T A Y A V F T G	I G A A G T A I I G M I F L S E G V	- S F W K I V S L I V L L T	
SugE <i>Bradyrhizobium japonicum</i> NP_770973	KV - L E V G V A Y S V W T G	I G A A G T F V M G V V L F G E T L	- S A M K I A G I V L V L T	
SugE <i>Burkholderia cepacia</i> YP_776179	TV - L P L G D A Y A V W A G	I G A A G T A L V G I V W F H E P A	- V L G R L V C M A L V V V	
SugE <i>Sphingopyxis alaskensis</i> YP_615530	RE - I S A G T A Y A I W T G	L G A V G V I I G G T I L F G E K I	- S P M Q A G F M V L I V V	
SugE <i>Alcanivorax borkumensis</i> YP_694264	RQ - I P V G T A Y A I W T G	L G A V G I T L I G I V F F K D P A	- N A S R L A F M A L I V V	
SugE <i>Nocardia farcinica</i> YP_120693	RT - L P V G T A Y A V F T G	I G A V G A V G L G V V V H K D P L	- S A G R M M A L A L I V G	
SugE <i>Protochlamydia amoebophila</i> YP_007714	KT - I P L G T A Y A I W T G	M G A V G T A V I G I L Y F G E S I	- D F W R L F F L V C L I I	
SugE <i>Leptospira borgpetersenii</i> YP_801667	QT - I P M G T A Y A I W T G	L G A A G T I L V G I F H G E P I	- D F W R G F F L S T L I L	
SugE <i>Rickettsia bellii</i> YP_537322	GK - I P M G T A Y A V W T G	I G A A G T V I L G I L V F N E P V	- S I L R L F F V T T L I V	
SugE <i>Bacteroides ovatus</i> ZP_02066060	QT - L P I G T A Y P V W T G	I G A V G T V L I G I L F F H E P A	- T L G R L F F M T T L I I	
SugE <i>Flavobacterium johnsoniae</i> YP_001195630	ET - L P M G T A Y A V W T G	I G A V G T V L M G I F V F K E P A	- T F W R L F F L V T L V S	
SugE <i>Rickettsiella grylli</i> ZP_01300129	EQ - I P L G T A Y A V W T G	V G A F G T A L V G I F Y F K D P L	- T C L R L F F L I L L V S	
SugE <i>Sphingomonas wittichii</i> YP_001262619	RS - I P M G T A Y A V W G G	I G A I G T V I V G M A W F G E P A	- T P L R I V L I F A I V A	
SugE2 <i>Deinococcus radiodurans</i> AAF10580	KT - L P V G L A Y A V W T G	I G S V G T I L V G L V L F G D S L	- S A L R L G L L T V L I G	
SugE1 <i>Deinococcus radiodurans</i> AAF10579	ET - I P L G T A Y A V W T G	I G A V G T V L V G R V F F G E Q L	- G G R K L A L L A V M V A	
SugE <i>Rubrobacter xylanophilus</i> YP_643069	RT - I S A G T A Y A I W T A	G A S G A V L G I L V F G E P A	- D L L R L G G I A F V L V	
SugE2 <i>Listeria monocytogenes</i> YP_013474	K - T I P I G T G Y A I W T G	I G A V G S V T L G M I V F K E R K	- S V G K L L F I T M I I A	
SugE <i>Pediococcus pentosaceus</i> YP_803585	K - Q M P L S L A Y P I W T G	I G A V G S I I V G V I L F H D Q I	- P N I T W V F I I M L I V	
SugE <i>Lactobacillus plantarum</i> NP_784622	K - H L P L S I A Y P I W T G	I G A V G A I I V G L V F F K D T I	- A P I T W I F I A M L V I	
SugE <i>Enterococcus faecium</i> ZP_00603219	K - S L P M S L S Y P I W T G	I G A V G S V I I G V V L F H D K L	- N L S T W F F V G M L L I	
SugE <i>Jannaschia</i> sp. CCS1 YP_509232	TR - L P L G I A Y P I W T G	I G S V G S V L V G V L A F N Q N	- - - L S W S G I A G L A L	
YkkD <i>Bacillus subtilis</i> CAB13167	ET - T P M G T A Y A V W T G	I G T A G G A L I G - I L F Y K E Q K D A K R I F F I A L I L C		
YkkD <i>Staphylococcus saprophyticus</i> YP_300697	ND - I P M G T A Y A T W S G	I G T G G G T L V G - M F L Y N E S K N A K R I F F I A L I I L		
YkkD <i>Helicobacter hepaticus</i> NP_860983	QG - I A M A T A Y A I W T G	I G A A G G V L V G - V V F F K E S K S A K K L F F I A L I I I		
YkkD <i>Campylobacter jejuni</i> YP_178373	QN - I A M S V A Y A I W T G	A G T A G G V M I G - V L F Y K E S K S F L K F L I T V I I A		
YkkD <i>Desulfotobacterium hafniense</i> YP_520482	RF - L P M G T A Y A V W T G	I G V V G G T L I G - M I R Y H E S K D W R R V V F I T M I L G		
YkkD <i>Lactobacillus brevis</i> YP_796249	KT - L P M G T A Y A I W T G	I G A A G G V L T G - M L F F G E S K D W R K L V W V A V I L S		
YkkD <i>Enterococcus faecalis</i> NP_814152	RQ - L P M G V S Y A V W T G	I G T A G G A I L G - M L L G - E S K D L R R I F F I F L I I V		
YvdR <i>Oceanobacillus iheyensis</i> NP_694185	ST - I P L G V A Y A V W T G	M G T V G S V V I G - M I F Y N D S A D R K R I F F L S L I V V		
YkkD <i>Chromohalobacter salexigens</i> YP_572171	RG - I D L G I A Y A V F T G	I G T V C G T L L G - M L Y W G E S R H P L R I A F T A L I V L		
YkkC <i>Actinobacillus succinogenes</i> YP_001344921	QD - I L L S I A Y A V W T G	I G A A G A V A V G - V W I S K D K I T L Q K A A G L V L T I T		
Sug2 <i>Wolbachia pipientis</i> NP_965923	R - S I P I G V C Y A I W T G	V A I G A S I L G V Y L F D E P V - N L F E V I C F I L V T F		
Sug1 <i>Wolbachia pipientis</i> NP_965922	C - F L P I R L C Y A V S S G	I C T I G I T I G A T T F T E N I - N L S Q V L C I V L I V I		
YvdR <i>Bacillus subtilis</i> CAB15455	I - V L P A G V A Y A V W T G	I G S I G V S A V G L I W F K E R F - Q L S Q V I S L C L I L A		
SugE <i>Anaeromyxobacter dehalogenans</i> YP_467311L	- T F D V G V G Y A I W T S	V A G V G V V V L G A M F L G Q R L - G W Q K L L G I L L V I G		
SugE <i>Pseudomonas aeruginosa</i> NP_249477	R - E L P V S V A Y P I W T A	I G S L G T V F L G V L L L G E S L - T A V K L V S V G L I V A		
YdgE <i>Escherichia coli</i> YP_540796	K - G I D L S V A Y A L W G G F	G I A A T L A A G W I L F G Q R L - N R K G W I G L V L L L A		
YdgE <i>Shigella flexneri</i> YP_689092	K - G I D L S V A Y A L W G G F	G I A A T L A A G W I L F G Q R L - N R K G W I G L V L L L A		
YdgE <i>Salmonella enterica</i> YP_216488	K - G I D L S V A Y A L W G G F	G I A A T L A A G W V L F G Q R L - N P K G W V G V I L L L A		
YdgE <i>Yersinia intermedia</i> ZP_00833155	K - G I E L S V A Y A L W G G F	G I A A T V A A G W I L F N Q R L - N Y K G W V G L I L L L A		
YdgE <i>Photobacterium luminescens</i> NP_929384	K - G I E L S I A Y A L W G A F	G I A T V A A G W I M F N Q R L - N Y K G W G G I A L L L L		
YdgE <i>Pseudomonas aeruginosa</i> NP_250231	K - D I E L S L A Y A I W G G F	G I L A T V A M G W A L F G Q R L - A W R G W L G L L L L A		
YdgE <i>Acidovorax avenae</i> subsp. <i>citrulli</i> YP_969095	K - G I D L S I A Y A L W G G T	G I V L T S M A G W A L F R Q R L - G R Q A F A G I L L I V A		
YdgE <i>Burkholderia dolosa</i> ZP_00983437	K - S I D L P T A Y A M W G G	I G I L G T A L C A K V L Y R Q H L - K P I G W V G I V L V I V		
YdgE <i>Chromobacterium violaceum</i> NP_900948	K - G M D L A I A Y A L W G S	I G I L G T A I G R L L Y K Q K L - K P I G W A G I G I V A A		
YdgE <i>Stenotrophomonas maltophilia</i> ZP_01645705	R - Y M D L A T A Y A M W G A	I G V I G T A T C R L L F G N R L - R P I G W V G I G L V T V		
YdgE <i>Aeromonas hydrophila</i> YP_857998	STG K I D L A V A Y A T W G A	I G I L G T A L G G L L L F G E R L - K P I G W V G M L V M A V		
YdgE <i>Vibrio harveyi</i> ZP_01986465	K - E I D L A I A Y A S W G A	I G I L G T A I G G A L L F K Q K L - K P I G W F G I F V V I A		
YdgE <i>Sinorhizobium meliloti</i> NP_385721	R - D M D L A V A Y A L L G A	T G I F G T A I C R L F F G Q R L - K P V G W L G L S L I F G		
YdgE <i>Desulfotomobium desulfuricans</i> YP_388897	K - S M D L A V A Y A M W G G	F G I L G T S L G G W V L F G Q K M - A P S A W A G I A L L T C		
YdgE <i>Deinococcus geothermalis</i> YP_605420	H - T V P L S V A Y A V W G G	L G I I G A A L L S R R L E G V R F - T P R A W L G L A L I L G		
YdgE <i>Helicobacter hepaticus</i> NP_860039	E - S M P L S V A Y S T W G A	I G I I G T I F G G Y V F F K E K L - D F L G Y I G V A M V V C		
YdgE <i>Campylobacter jejuni</i> YP_179295	K - Y V P L S I A Y S T W G A	I G I I G T C L G G W I L Y K E K L - N K I G I L G I I I V I I		
YdgE <i>Pseudoalteromonas haloplanktis</i> YP_340953	Q - G I P L F I A Y A T W G A	L S I S G T A L A T W L L F G H K L - N W V V C F G L A V L I L		
YvaD <i>Anabaena variabilis</i> YP_323732	GK - L N L S I A Y P L V I G	L T I V L T T I A G A V V L R E K V - L V S Q W I G I G L L L S		
YvaD <i>Nostoc</i> sp. PCC NP_487548	GK - L N L S I A Y P L V I G	L T I V L T T I A G A V V L R E K V - L V S Q W I G I G L L L S		
YvaD <i>Chloroflexus aurantiacus</i> ZP_00765654	SR - I D L S V A Y P F V S	- L N H I I I F L L A W L V L H E Q V - N P L R A A G V I V I C A		

	60	70	80	90
YvaD <i>Brucella melitensis</i> AAL53681	SK	-VDLSFAYPFLS	-LAYVAVALCAWLLFKEEL	-GAYKIAAGIAFIC
YkkC <i>Bacillus subtilis</i> CAB13166	HS	-LPVGTVYAVFTGL	GTAGTVLSEIVLFHEP	-VGWPKLLLIGVLLI
YkkC <i>Desulfitobacterium hafniense</i> YP_520483	Q	-VLPAGTVYAVFVGL	TTGTVISEIFFFEHP	-FQWAKVLLILILLT
YkkC <i>Enterococcus faecalis</i> NP_814151	E	-ELPVGTAAYAVFVGL	SSAGTIVTDHFLFHTP	-LGIGKVLFLLLILLI
YkkC <i>Lactobacillus brevis</i> YP_796248	R	-ILPAGTAAYAVFVGL	TLGTTSIGMFIFGEP	-ISWLKIALILLLLLV
YvdS <i>Oceanobacillus iheyensis</i> NP_694186	T	-RLPTATVYAVFVGL	TLGTVTVDIFFFGAA	-VNVGVILFVVLLLV
YkkC <i>Staphylococcus saprophyticus</i> YP_300698	KY	-LPVGTVYAVFVGL	GAAGTVLVDMIFFGDP	-FDLVKISLIILILLI
YkkC <i>Helicobacter hepaticus</i> NP_860982	KV	-LEIGIAYSVFVGL	GTAGITLAEILIFGEP	-FSPLKILFIATLLL
YkkC <i>Campylobacter jejuni</i> YP_178374	ER	-LEVSITYSVFVGL	GTIGVVNLNEMFIFNEA	-VSIKLVLIAILLL
YvdS <i>Bacillus subtilis</i> CAB15454	QK	-IPMAAAYTVFVGL	GTVGTYLTGIVLGES	-FSAAQMFFLALLLA
YkkC <i>Chromohalobacter salexigens</i> YP_572170	RF	-LPASTVYTVFVGL	GAAGTVVADAWLFGTR	-FSWPSLACIGLILV
SugE <i>Alteromonas macleodii</i> ZP_01108532	KQ	-IPIGTAYAVWVTG	GAAGTFLVG-VVFYGD	PASLARYFGVALIVA
SugE <i>Campylobacter curvus</i> ZP_01806950	RE	-IPIGTYSYAVWTS	GAAGTFLVG-VWFFYG	DAASLWKYFGVLLILS
<u>SugE</u> integrin (<i>S. maltophilia</i>) AAL07365	RQ	-IPIGTAYAVWVTG	GAAGTFFVG-VLYYGD	PTSFFRYMGVALIIA
<u>Smr-2</u> / <u>SugE</u> plasmid (<i>P. aeruginosa</i>) AAZ04369	RH	-IPIGTAYAVWVTG	GAAGTFLVG-VLYYGD	PTSVARYFGVALIVA
SugE <i>Pseudoalteromonas haloplanktis</i> YP_338634	RD	-IPMGTSYAVWVTG	GAAGTFLVG-ILFYGD	AATFGRIAGVLMIIIC
SugE <i>Methylococcus capsulatus</i> YP_113261	R	-EIPMGTAAYAVWVTG	GAAGTFFVG-VWFFYG	DAATPGRYLGAALIVA
<u>Qac</u> "orfO" class 2 integrin AAL51022	AA	-TFPSVLPNAVWVTG	IRCGWHLPRRRSLLRRS	NI SCAVLWRGAHCCR
EmrE <i>Acinetobacter baumannii</i> YP_001085323	KY	-MQAGILYVLWSGVG	VLATAFLAKIFLGQNI	-DVAGWIGIGFITV
YvaD <i>Geobacillus thermodenitrificans</i> YP_00112717	SR	-VPLSVAYPLQS	-FAYVLAVFGAYAFFHEPL	-SVPKII GVILIML
YvaD <i>Pseudomonas syringae</i> YP_235771	QR	-LDVGIAYP	-MLGVNFVLITLAGRYVF	NEPV-DVRHWLGIALILV
QacE <i>Pyrococcus furiosus</i> AAL81899	IME	-TPLGKKWGFGLGLV	VFAIPLPGTG	IWTGSLLGIDKKSTIPALLI
YdgE <i>Lyngbya</i> sp. PCC 8106 ZP_01619571	F	AKKLPSVSAYPVFA	IGFSLIAVAGGWFFGERL	-EINQWIGLGMILA
YvaD <i>Herminiimonas arsenicoxydans</i> YP_001101331	G	-KLEVSMAYPLIS	-LGVVLTTLAGIFILGESV	-SIYKVLGVSLVIA
YvaE <i>Azoarcus</i> sp. BH72 YP_935092	AR	-LPLNVAHPVLTSG	AVATVALFSVVLFS	SEPF-HWTTAAGVVLVIA
SugE <i>Verminephrobacter eiseniae</i> YP_999455	RT	-LPMGTGYAVWVTG	GAAGTAIVGMVVP	GD SA-APMRLPCIALIPA
YkkD <i>Actinobacillus succinogenes</i> YP_001344922	KY	-MGASIAVVLTYTGL	TLFVVLLDMVTTVQAG	IDFVKLFFVVTLMSS
EmrE <i>Trichodesmium erythraeum</i> YP_720225	GN	-IPTGIIAMTIFY	-IYPIITVLLSWGLF	GDSP-SVLRICAMVILGL
YvaD <i>Bacillus subtilis</i> CAB15361	SV	TSLYLQADWKLMA	LISLVTCCSGLQALS	FDWTFDLVWVWLFNGYLLI
YvaD bacteriophage 82 (<i>N. gonorrhoeae</i>) YP_208183	G	-FGCGCRRGAIDGR	AGLSREDKEFYMRRS	QRTIRRLLEALG-VV
100				
QacE <i>Archaeoglobus fulgidus</i> NP_070524	.	GVVVLLASIGII		
QacE <i>Syntrophomonas wolfei</i> YP_752855	.	GLLVLTGASLGVI		
QacE <i>Streptococcus thermophilus</i> YP_140506	.	GIIMGTLSLL-F		
QacE <i>Streptococcus agalactiae</i> ZP_00785182	.	GCIMGTLSIIIGF		
EmrE <i>Mannheimia haemolytica</i> EDN74853	.	GVLVINLFSK--		
EmrE <i>Haemophilus ducreyi</i> NP_874231	.	GVLVINLFSQHS		
EmrE <i>Stenotrophomonas maltophilia</i> ZP_01643607	.	GVLVINLFSHSS		
EmrE <i>Pseudomonas syringae</i> YP_233649	.	GVAVIQLFSKTA		
EmrE <i>Pseudomonas aeruginosa</i> NP_253677	.	GVLV IQLFSRAS		
EmrE <i>Ralstonia eutropha</i> YP_727122	.	GVAVIQLFSKTS		
EmrE <i>Serratia proteamaculans</i> ZP_01534598	.	GVLVINLLSKTA		
EmrE <i>Yersinia intermedia</i> ZP_00834935	.	GVVMVINLLSKTP		
EmrE <i>Photobacterium luminescens</i> NP_929802	.	GVVMVINLLSNS		
EmrE <i>Escherichia coli</i> P23895	.	GVLIINLLSRST		
EmrE <i>Shigella flexneri</i> YP_689427	.	GVLVINLLSRSA		
EmrE <i>Erwinia carotovora</i> YP_051073	.	GVLVINIFSKVA		
<u>QacF</u> plasmid pB8 YP_358817	.	GVLVINIFSKSG		
<u>Qac</u> class 3 integrin ia-3 ABR28416	.	GVLVINIFSKSG		
EmrE <i>Rhodobacter sphaeroides</i> YP_353626	.	GVLVVNLFSKTI		
EmrE <i>Sulfitobacter</i> sp. EE36 ZP_00954674	.	GVLV IHLFSHSA		
QacE <i>Roseobacter denitrificans</i> YP_682931	.	GILVIHLLSNTT		
EmrE <i>Roseovarius nubinhibens</i> ZP_00960756	.	GIVVINLFSSTA		
EmrE <i>Magnetospirillum magnetotacticum</i> ZP_00051262	.	GVVVMQAFSATT		
EmrE <i>Methylobacterium chloromethanicum</i> ZP_02058088	.	GVVVMQAFSATT		
EmrE <i>Bradyrhizobium japonicum</i> NP_770868	.	GVVIINLFSSETT		
EmrE <i>Psychrobacter cryohalolentis</i> YP_580136	.	GVVVMNLLSNSV		
EmrE <i>Psychrobacter arcticus</i> YP_264019	.	GVVVMNIFSNSV		
EmrE <i>Paracoccus denitrificans</i> YP_917819	.	GVVIINLFSSTSV		

100

EmrE *Desulfovibrio desulfuricans* YP_388842 G I V V I N V F S K T V
EmrE *Photobacterium profundum* ZP_01218031 G T V I I N V F S N T T
EmrE *Vibrio harveyi* YP_001445675 G V M I V N L L S K T V
EmrE *Xanthobacter autotrophicus* YP_001417989 G V M V I N L L S K S V
EmrE *Sphingomonas wittichii* YP_001263498 G V A V L N L F S T S I
EmrE *Acidovorax avenae* subsp. *citrulli* YP_973010 G V L V I N L F S S T A
EmrE *Delftia acidovorans* ZP_01577698 G V L V I Q L F S K T A
EmrE *Myxococcus xanthus* YP_633339 G V I V I N T F S R S A
EmrE *Dechloromonas aromatica* YP_283677 G V V V L N V F S K T V
QacE *Xanthomonas campestris* NP_637776 G A V V I N V F S K M A
EmrE *Burkholderia cepacia* YP_773352 G V V V L N L F S K M Q
QacE int1 (*Serratia marcescens*) AAK40353 G V A V L N P L S K V S
QacF int1 (*Achromobacter denitrificans*) AAZ14837 G V A V L N L L S K V S
QacF plasmid pIP833 (*E. aerogenes*) AAD22143 G V A V L N L L S K V S
QacH plasmid p3iANG (*Vibrio cholerae*) AAZ42322 G V A V L N L L S K V S
QacF plasmid pSC138 (*S. enterica*) AAX56371 G V A V L N L L S K V S
QacE2 Int Class1 (*A. salmonicida*) AAK53557 G V A V L N L L S K A S
QacG class I intergen (*A. baumannii*) AAL38576 G V A V L N L L S K A S
QacG integron (*P. aeruginosa*) AAS79147 G V A V L N L L S K A S
QacE plasmid R751(*E. aerogenes*) NP_044260 G V V V L N L L S K A S
QacEA1 class 2 integron (*P. aeruginosa*) AAV32841 A F L L A R S P S W K S
EmrE *Marinobacter aquaeolei* YP_958340 G V L V I N L L S N T G
Smr *Chloroflexus aurantiacus* ZP_00766077 G V V I L N L L S K V E
EmrE *Shewanella frigidimarina* YP_748773 G V V V M N L F S N V T
EmrE *Chromobacterium violaceum* NP_902350 G V A V I N L F S H S A
EmrE *Methylobacillus flagellatus* YP_544992 G V V V M Q L F S R T T
EmrE *Methylococcus capsulatus* YP_115175 G V L V C T L W S K S A
EmrE *Coxiella burnetii* ZP_01299513 G V L V I N L L S K S I
QacH *Brucella melitensis* YP_414370 G V I V L N L L S N T A
QacE *Brucella melitensis* AAL52226 G V I V L N L L S N T A
EmrE *Ochrobactrum anthropi* YP_001370804 G V I V L N L F S N T A
EmrE *Marinobacter algicola* ZP_01894487 G V M V I N V F S G S I
EmrE *Nitrosococcus oceani* YP_342650 G V V V L N V F S K S I
EmrE *Reinekea* sp. MED297 ZP_01116498 G V V V L N L F S N V G
EmrE *Geobacter sulfurreducens* NP_951765 G V L V L N L C S T S A
EmrE *Chlorobium limicola* EAM42528 G V L V L N L F S K T V
EmrE *Alcanivorax borkumensis* YP_693512 G V V L V T L V S N T A
EmrE *Jannaschia* sp. CCS1 YP_511013 G V L I L R L M T T T A
EmrE *Chromohalobacter salexigens* G V V I I Q A F S R M S
QacH *Pelagibacter ubique* ZP_01264056 G V L M V N L L G N N -
QacH2 *Pelagibacter ubique* YP_266208 G V I L L N T M G K T N
EmrE *Pseudoalteromonas atlantica* YP_661014 G V A M I N L S Q G H S
QacF *Pseudoalteromonas haloplanktis* CAI87270 G I A M I N L S Q G H S
Qac megaplasmid (*S. oneidensis*) NP_720475 G V I M I N L S Q G H S
YvaE *Shewanella frigidimarina* YP_752098 G V V M I N L S Q G H S
EmrE *Shewanella pealeana* YP_001500134 G V M M I N F S Q G H A
EmrE *Vibrio harveyi* YP_001449011 G V M V I N F S H G H A
EmrE *Photobacterium profundum* ZP_01219483 G I A I I N L S S V P H
EbrB *Pseudomonas syringae* YP_235623 G I I L V N L A K E Q A
EmrE *Wigglesworthia glossinidia* NP_871589 G V L I I N I Y - - - -
EmrE *Aeromonas hydrophila* YP_855864 G G V I M N V F S S M -
EmrE *Erwinia carotovora* YP_051860 G G V I M N L Y S S M -
EmrE *Aeromonas hydrophila* YP_855865 G I V I M N L F S - - -
QacE integron (*Escherichia coli*) YP_672432 G I I I M N L F S K M G
QacH *Erwinia carotovora* YP_051859 G I M I M N L F S K - -
EmrE *Nitrobacter winogradskyi* YP_319204 G A V G L N L T T S V S
EmrE *Synechococcus* sp. RS9917 ZP_01081426 G V V I V N L T G S L E
EbrB *Mannheimia haemolytica* EDN74090 G V I M M N T L S K M G
EmrE *Neisseria meningitidis* NP_284788 G V V L L N T M S H M S

EbrB *Listeria monocytogenes* EAL09800
 EbrA *Paenibacillus larvae* ZP_02326984
 EbrB *Bacillus subtilis* CAB13613
 EbrB *Paenibacillus larvae* ZP_02326985
 EbrA *Bacillus subtilis* CAB13614
 QacG plasmid pST94 O87866
 QacJ plasmid pNVH01 (*S. aureus*) CAD55144
 QacH plasmid pST2H6 (*S. saprophyticus*) CAA76544
 Smr *Staphylococcus aureus* AAM94142
 EbrA *Desulfotomaculum reducens* YP_001114614
 Ebr *Pediococcus pentosaceus* YP_804449
 Ebr1 *Synechococcus* sp. RS9917 ZP_01080450
 EbrA *Listeria monocytogenes* EAL09801
 Smr *Roseiflexus castenholzii* ZP_01530339
 EbrA *Roseiflexus* sp. RS-1 YP_001278866
 EbrA *Gloeobacter violaceus* NP_927270
 EbrB *Thermus thermophilus* YP_004540
 EbrB *Halobacterium* sp. NRC1 NP_444228
 EmrE *Zymomonas mobilis* sbsp. *mobilis* YP_161843
 Smr2 *Mycobacterium vanbaalenii* YP_954149
 Smr2 *Mycobacterium gilvum* YP_001134816
 EbrB *Clavibacter michiganensis* YP_001220961
 Smr *Nocardia farcinica* YP_118186
 Smr *Saccharopolyspora erythraea* YP_001109297
 Smr *Thermobifida fusca* YP_289048
 Smr *Saccharopolyspora erythraea* YP_001103712
 Smr *Nocardioides* sp. JS614 YP_921842
 Smr *Nocardioides* sp. JS614 YP_921842
 Smr *Mycobacterium tuberculosis* P95094
 NepA plasmid pAO1 (*A. nicotinovorans*) CAD47919
 EmrE *Candidatus Pelagibacter ubique* ZP_01264207
 QacH *Lactobacillus plantarum* NP_786542
 YdgF *Escherichia coli* ABE07266
 YdgF *Shigella flexneri* YP_689093
 YdgF *Salmonella enterica* sbsp. *enterica* YP_216487
 YdgF *Yersinia intermedia* ZP_00833156
 YdgF *Photobacterium luminescens* NP_929383
 YdgF *Pseudomonas aeruginosa* NP_250232
 YdgF *Sinorhizobium meliloti* NP_385720
 YdgF *Aeromonas hydrophila* YP_857997
 YdgF *Vibrio harveyi*
 YdgF *Chromobacterium violaceum* NP_900949
 YdgF *Campylobacter jejuni* YP_179294
 YdgF *Desulfovibrio desulfuricans* YP_388898
 YdgF *Lawsonia intracellularis* CAJ54979
 YdgF *Deinococcus geothermalis* YP_605419
 YdgF *Pseudoalteromonas haloplanktis* YP_340952
 YdgF *Acidovorax avenae* sbsp. *citrulli* YP_969092
 YdgF *Helicobacter hepaticus* NP_860040
 EmrE *Alteromonas macleodii* ZP_01110205
 YvaE *Bacillus subtilis* CAB15362
 YvaE *Blastopirellula marina* ZP_01094237
 YvaE *Desulfitobacterium hafniense* YP_517233
 YvaE *Rhodospirillum rubrum* YP_428434
 YvaE *Bdellovibrio bacteriovorus* NP_968626
 Smr *Streptomyces coelicolor* AAK95484
 YvaE *Acidobacteria bacterium* YP_593828
 EbrB *Rubrobacter xylanophilus* YP_644095
 YvaE *Desulfovibrio vulgaris* YP_966624
 YvaE *Pelodictyon phaeoclathratiforme* ZP_00590439
 YvaE *Chlorobium tepidum* NP_662342

G V I I L N Q R S A D T
 G V F F L N K S K E K G
 G V V V L N Q S K A H A
 G V F I L N L - - - -
 G V V L L N W P - - - -
 G V V L L N V F G E S H
 G V V L L N V F G S S H
 G V V L L N T F G S S H
 G V V S L N I F G T S H
 G V I I L N L - - - -
 G V I L V N L F G V S -
 G V M I S N Y H G L V E
 G V V V L K L - - - -
 G V V L L N M F G G S E
 G V I L L N M F G G E -
 G V L V L N L S G G G R
 G V V L I R L A D - - -
 G V V V L N V A S D A Y
 G V I G L N L I S P A -
 G V V L V E S G S H Q E
 G V A L V E T G S R V D
 G V L L I E L G H - - -
 G V L A L E L G G A H -
 G V L A L E M - - - -
 G V A A L E L G A A R -
 G V L S L E L G G Q H -
 G V L A L E L G A R H G
 G V V T L Q L D G H Q A
 G V V T L N L A G A H -
 G V V T L N L Q A G Q -
 G V V L V N S F T I K T
 G A I L L N - - - I - -
 G I V L I K S G T R K A
 G I V L I K S G T R K A
 G I V L I K S G T R K P
 G I M L V K S G T R K P
 G I M L I K S G T R K A
 G I L L I K S G T R N A
 G I L L L N A G R S D A
 G I V L V T M G E T H D
 G I V C V T L - - - -
 G L V C V T M G E T H D
 G I I M I N I G E V K E
 G V L L V H - - - - -
 G A I L I H H G T V N I
 G A R L L H G G T R A R
 G I V I I N S G H A M Q
 G V V L V N A D G A H A
 G I A L I N Y A E I K R
 G T L L I T S K S A V V
 G V V S L N L I E H V A
 G V V G L N A C S - - -
 G V V G L N L G G T A -
 G V V G L N L L S K Q -
 G V V I L N L - - - -
 G V V V L N L G G - - -
 G V V G L N L S G R S -
 G V M L L N L S G - - -
 G V V G L N Y T S S G E
 G V A G L H F S Q E V H
 G I A G L H F S Q E H M

100

YvaE *Prosthecochloris vibrioformis* YP_001130806 GVVGLQLSQHTA
YvaE *Anabaena variabilis* YP_323581 GVVGIN-SGK--
YvaE *Nostoc* sp. PCC 7120 NP_484329 GVVGIN-SGK--
EbrA *Methanosarcina acetivorans* NP_616284 GVIGLHLSDKVT
YvaE *Methanococcoides burtonii* YP_566929 GVLGLNLSDKLA
YvaE *Clostridium beijerinckii* YP_001307448 GVIGLNLSTST--
YvaE *Marinomonas* sp. MED121 ZP_01075592 GVFGLHQVSTKT
QacC *Lactobacillus plantarum* NP_786541 GVILLNMPAKTT
NepB plasmid pAO1 (*A. nicotinovorans*) CAD47918 GIVILNLATTRQ
YvaE *Burkholderia cenocepacia* YP_839289 SLVLLNLSDGPT
EmrE *Synechococcus* sp. RS9917 ZP_01080451 GILVLNLSQQEA
SugE *Escherichia coli* AAC46453 GIIGLKLSTH--
SugE *Shigella flexneri* YP_691592 GIIGLKLSTH--
SugE *Salmonella enterica* sbsp. *enterica* YP_219204 GIIGLKLSAH--
SugE plasmid/ *Citrobacter freundii* AAC46457 GIIGLKLSTH--
SugE *Serratia proteamaculans* ZP_01538212 GILGLKFSSH--
SugE *Yersinia intermedia* ZP_00832613 GIIGLKLAS---
SugE *Photorhabdus luminescens* NP_931319 GIIGLKLSS---
SugE *Proteus vulgaris* P20928 GIIGLKLAS---
SugE *Pseudoalteromonas atlantica* YP_660982 GVIGLKLSS---
SugE *Limnobacter* sp. MED105 ZP_01915318 GVLGLKLS----
SugE *Shewanella oneidensis* NP_717508 GVLGLKLAAH---
SugE *Methylobacillus flagellatus* YP_545743 GIIGLKLATP--
SugE *Bradyrhizobium japonicum* NP_770684 GIIGLKLVT---
SugE *Ralstonia eutropha* YP_727054 GIAGLKLVGSA-
SugE *Dechloromonas aromatica* YP_287101 GIIGLKLVT PDT
SugE *Mesorhizobium loti* NP_105639 GIMGLKFAA--
SugE *Rhizobium leguminosarum* YP_768145 GIAGLKLTA---
SugE *Sinorhizobium meliloti* NP_385492 GIAGLKLVG---
SugE *Herminiimonas arsenicoxydans* YP_001098437 GIIGLKVFSPT-
SugE *Gloeobacter violaceus* NP_925933 GIVGLKVVAPH-
SugE *Syntrophus aciditrophicus* YP_462525 GIVGLKLTTQS-
SugE *Geobacter sulfurreducens* NP_951764 GIIGLKLSSPA-
SugE *Pseudomonas aeruginosa* NP_251955 GLVGLKLSSH--
SugE *Aeromonas hydrophila* sp. *hydrophila* YP_856475 GILGLKFIG---
SugE *Bdellovibrio bacteriovorus* NP_969313 SIIGLKATAGGH
SugE *Myxococcus xanthus* YP_631852 SIVGLKVTSGR-
SugE *Deinococcus geothermalis* YP_605633 AIIGLKATSGH-
SugE *Streptomyces coelicolor* NP_627124 AVVGLKATSGH-
SugE *Anaeromyxobacter dehalogenans* YP_467455 SILGLKLTAAS-
SugE *Blastopirellula marina* ZP_01088886 SIIGLKLTS GH-
SugE *Myxococcus xanthus* YP_628656 SVIGLKFTSGGD
SugE *Legionella pneumophila* YP_122951 SIFGLKYTA---
SugE *Marinomonas* sp. MWYL1 ZP_01596466 GIVGLKLTS--
SugE *Vibrio harveyi* YP_001448000 GI-----
SugE *Rhodospirillum rubrum* YP_425364 GLIGLKIG----
SugE *Pelodictyon phaeoclathratiforme* ZP_00588597 GVIGLKIFSGGM
SugE *Chlorobium limicola* EAM42493 GVAGLR LFSR--
SugE *Prosthecochloris aestuarii* EAN23020 GVLGLRLL----
SugE *Chlorobium tepidum* NP_661278 GVAGLRVL AGK-
SugE *Geobacillus thermodenitrificans* YP_001124648 GIIGLKFTAGQ-
SugE *Desulfotomaculum reducens* YP_001114341 GMIGLKITS GH-
SugE *Methanosarcina barkeri* AAZ72469 GILGLRIISL--
SugE *Clostridium beijerinckii* YP_001310526 GIVGLKIVSSH-
SugE *Nitrobacter winogradskyi* YP_318926 G MVGLKVVS PA-
SugE *Rhodopirellula baltica* NP_869718 GIVGLKLASSS-
SugE *Nitrosococcus oceani* YP_344225 GIIGLKLTS SD-
SugE *Roseovarius nubinhibens* ZP_00959799 GIVGLKLVDGSA
SugE *Rhodobacter sphaeroides* YP_351822 GIALKLA----

SugE <i>Stenotrophomonas maltophilia</i> ZP_01645236	G V I G L K L V S P N .
SugE <i>Xanthomonas campestris</i> NP_635868	G V I G L K L V S . . .
SugE <i>Symbiobacterium thermophilum</i> YP_074555	G I V G L K L T S R S .
SugE <i>Xanthobacter autotrophicus</i> YP_001419080	G I V G L K L V T P . .
SugE <i>Brucella melitensis</i> biovar abortus YP_414234	G I I G L K L S S T . .
SugE <i>Ochrobactrum anthropi</i> YP_001371057	G I I G L K L S S S . .
SugE <i>Burkholderia cepacia</i> YP_774210	G L V G L K L S S S A .
SugE <i>Zymomonas mobilis</i> sp. <i>mobilis</i> YP_162432	G I I L M K L S N K N V
SugE <i>Stenotrophomonas maltophilia</i> ZP_01643044	G L V L M K L S S S . .
SugE <i>Delftia acidovorans</i> ZP_01582139	G L V L M K L S S D . .
SugE <i>Magnetospirillum magnetotacticum</i> ZP_00208705	G L V L M K L S S P A .
SugE <i>Methylobacterium</i> sp. 4-46 ZP_01845840	G L V T M K L A S T S .
SugE <i>Nitrosomonas europaea</i> NP_842203	G L V L M K L S S . . .
SugE <i>Acinetobacter baumannii</i> YP_001083756	G L V L M K I S S P S .
SugE <i>Paracoccus denitrificans</i> YP_917710	G L V L M K I A S P H .
SugE <i>Pseudomonas aeruginosa</i> NP_250573	G I V I L K L A T R Q G
SocA2 <i>Myxococcus xanthus</i> YP_633361	G V A G L R A I E R . .
SugE <i>Bordetella parapertussis</i> NP_883309	G V A G L R M I E P . .
SugE <i>Ralstonia eutropha</i> YP_726368	G I G G L K L L P A . .
SugE2 <i>Mycobacterium gilvum</i> YP_001136522	S V V G L K A V S . . .
SugE <i>Clavibacter michiganensis</i> YP_001223477	Q V V G L K V V D T G H
SugE1 <i>Arthrobacter aureescens</i> YP_949237	C V V G L K V V A . . .
SugE <i>Arthrobacter aureescens</i> YP_949238	C A A G L K A L P A E K
SugE1 <i>Mycobacterium gilvum</i> YP_001136521	A V A G L K V L P S S T
SugE <i>Kineococcus radiotolerans</i> ZP_00617403	G V V G L K F T H . . .
SugE <i>Nocardia farcinica</i> YP_116350	G V V G L K M V G . . .
SugE <i>Thermobifida fusca</i> YP_289322	G I V G L R V L E . . .
SugE <i>Stigmatella aurantiaca</i> ZP_01464276	G V T G L A L T G G G H
SugE <i>Saccharopolyspora erythraea</i> YP_001109242	G V I G L N L S G A A H
SugE <i>Streptomyces coelicolor</i> NP_629357	G V I G L Q L S G S A H
SugE1 <i>Listeria monocytogenes</i> YP_013473	G I I G L K L V D G N E
SugE <i>Bradyrhizobium japonicum</i> NP_770973	G I A A L K L A
SugE <i>Burkholderia cepacia</i> YP_776179	G I V G L Q L Q E G V .
SugE <i>Sphingopyxis alaskensis</i> YP_615530	G V A G T K L F A A N .
SugE <i>Alcanivorax borkumensis</i> YP_694264	G I V G L K L T S G P A
SugE <i>Nocardia farcinica</i> YP_120693	G I V L A R L T N P E .
SugE <i>Protochlamydia amoebophila</i> YP_007714	S I I G L K I S S A . .
SugE <i>Leptospira borgpetersenii</i> YP_801667	S V L G L K F L V S E .
SugE <i>Rickettsia bellii</i> YP_537322	S I I G L K F S
SugE <i>Bacteroides ovatus</i> ZP_02066060	S I V G L K L
SugE <i>Flavobacterium johnsoniae</i> YP_001195630	S I V G L K A V S H . .
SugE <i>Rickettsiella grylli</i> ZP_01300129	S I F G L K L V S S R .
SugE <i>Sphingomonas wittichii</i> YP_001262619	C I A G L K L T A H . .
SugE2 <i>Deinococcus radiodurans</i> AAF10580	S I A G L K I V D R . .
SugE1 <i>Deinococcus radiodurans</i> AAF10579	A I L G L K V T A . . .
SugE <i>Rubrobacter xylanophilus</i> YP_643069	G V L M L R F A E A . .
SugE2 <i>Listeria monocytogenes</i> YP_013474	G V V G L K L T S G V .
SugE <i>Pediococcus pentosaceus</i> YP_803585	G I I G I K M T A G H .
SugE <i>Lactobacillus plantarum</i> NP_784622	G I I G I K V T S . . .
SugE <i>Enterococcus faecium</i> ZP_00603219	S I I G I K I T S G H .
SugE <i>Jannaschia</i> sp. CCS1 YP_509232	L I A G M F L L G S D A
YkkD <i>Bacillus subtilis</i> CAB13167	S A V G L K I L S . . .
YkkD <i>Staphylococcus saprophyticus</i> YP_300697	S I V G L K I V S . . .
YkkD <i>Helicobacter hepaticus</i> NP_860983	S V V G L K A L S . . .
YkkD <i>Campylobacter jejuni</i> YP_178373	C T F L S . . .
YkkD <i>Desulfotobacterium hafniense</i> YP_520482	S V I G L K L I S . . .
YkkD <i>Lactobacillus brevis</i> YP_796249	A T L G L K L I S . . .
YkkD <i>Enterococcus faecalis</i> NP_814152	S V I G L K L I G . . .
YvdR <i>Oceanobacillus iheyensis</i> NP_694185	A V I G L R I V S N . .
YkkD <i>Chromohalobacter salexigens</i> YP_572171	G V V G L K L L A . . .
YkkC <i>Actinobacillus succinogenes</i> YP_001344921	S A I A L K V M

100

Sug2 *Wolbachia pipientis* NP_965923
 Sug1 *Wolbachia pipientis* NP_965922
 YvdR *Bacillus subtilis* CAB15455
 SugE *Anaeromyxobacter dehalogenans* YP_467311
 SugE *Pseudomonas aeruginosa* NP_249477
 YdgE *Escherichia coli* YP_540796
 YdgE *Shigella flexneri* YP_689092
 YdgE *Salmonella enterica* YP_216488
 YdgE *Yersinia intermedia* ZP_00833155
 YdgE *Photorhabdus luminescens* NP_929384
 YdgE *Pseudomonas aeruginosa* NP_250231
 YdgE *Acidovorax avenae subsp. citrulli* YP_969095
 YdgE *Burkholderia dolosa* ZP_00983437
 YdgE *Chromobacterium violaceum* NP_900948
 YdgE *Stenotrophomonas maltophilia* ZP_01645705
 YdgE *Aeromonas hydrophila* YP_857998
 YdgE *Vibrio harveyi* ZP_01986465
 YdgE *Sinorhizobium meliloti* NP_385721
 YdgE *Desulfovibrio desulfuricans* YP_388897
 YdgE *Deinococcus geothermalis* YP_605420
 YdgE *Helicobacter hepaticus* NP_860039
 YdgE *Campylobacter jejuni* YP_179295
 YdgE *Pseudoalteromonas haloplanktis* YP_340953
 YvaD *Anabaena variabilis* YP_323732
 YvaD *Nostoc sp. PCC* NP_487548
 YvaD *Chloroflexus aurantiacus* ZP_00765654
 YvaD *Brucella melitensis* AAL53681
 YkkC *Bacillus subtilis* CAB13166
 YkkC *Desulfitobacterium hafniense* YP_520483
 YkkC *Enterococcus faecalis* NP_814151
 YkkC *Lactobacillus brevis* YP_796248
 YvdS *Oceanobacillus iheyensis* NP_694186
 YkkC *Staphylococcus saprophyticus* YP_300698
 YkkC *Helicobacter hepaticus* NP_860982
 YkkC *Campylobacter jejuni* YP_178374
 YvdS *Bacillus subtilis* CAB15454
 YkkC *Chromohalobacter salexigens* YP_572170
 SugE *Alteromonas macleodii* ZP_01108532
 SugE *Campylobacter curvus* ZP_01806950
 SugE integron (*S. maltophilia*) AAL07365
 Smr-2 / SugE plasmid (*P. aeruginosa*) AAZ04369
 SugE *Pseudoalteromonas haloplanktis* YP_338634
 SugE *Methylococcus capsulatus* YP_113261
 Qac "orfO" class 2 integron AAL51022
 EmrE *Acinetobacter baumannii* YP_001085323
 YvaD *Geobacillus thermodenitrificans* YP_00112717
 YvaD *Pseudomonas syringae* YP_235771
 QacE *Pyrococcus furiosus* AAL81899
 YdgE *Lyngbya sp.* PCC 8106 ZP_01619571
 YvaD *Hermiiniomonas arsenicoxydans* YP_001101331
 YvaE *Azoarcus sp. BH72* YP_935092
 SugE *Verminephrobacter eiseniae* YP_999455
 YkkD *Actinobacillus succinogenes* YP_001344922
 EmrE *Trichodesmium erythraeum* YP_720225
 YvaD *Bacillus subtilis* CAB15361
 YvaD bacteriophage 82 (*N. gonorrhoeae*) YP_208183

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 · G V I G L R L T S S S -
 · G V V G L R L S G A A -
 · G V A G L K - - - - -
 · G M I M V K L A - - - -
 · G M I M V K L A - - - -
 · G M V M I K F A - - - -
 · G M V M I K L S - - - -
 · G M V M I K M A - - - -
 · G M S L L K L A - - - -
 · G I S L L K L S - - - -
 · A V V L L S T A E - - -
 · A V V T L S T V - - - -
 · A V L L L S T A K - - -
 · A V V V M - - - - - -
 · A V T L L T T A - - - -
 · A V L V L H T A - - - -
 · G L A M L H I S - - - -
 · S V A V L H L A E G S Q
 · G V I L L H W E S - - - -
 · A V F L L N Y - - - - -
 · S I V T M Q L V G P A -
 · G I S A I A L A K P S -
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 · G M L M V A R S - - - -
 · G T I L I A Q S G K V R
 · G V I G L K L V T Q D E
 · G V F G L K A V T G E R
 · G I I G L K M V T G N K
 · G I G G L Q W T T T K E
 · G V L G L K S V T G - -
 · G I I G L K L T T E E A
 · G V V G L K L S A D K T
 · S I I A L K W V S - - -
 · G I L G M K L F T K E S
 · G V I G L H Q F S G K P
 · G V V V L K L A H - - -
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 · G L M I I A Q Y Y - - -
 · G V S F I G F S A N G S
 · G V F Q L G R Q A - - -
 · G L L S L A I T T L P T
 · G I I I M S R - - - - -
 · G V L V L S V K S - - -
 · G V F L I T F R V A - -
 · G V I G F K R V T S D G
 · G V I V I K S A K - - -
 · G I L V I P G G V G N -
 · Y L F F I H L L L K E G
 · G V K - - R L K - - - -