



STRUCTURAL BIOLOGY
COMMUNICATIONS

Volume 75 (2019)

Supporting information for article:

Crystal structure of phosphoribulokinase from *Synechococcus sp.* strain PCC 6301

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βA → *ll*

1	Syn_PCC6301	1	MS KPD R V V L I G V A G D S G C G K S T F
	Syn_PCC6803	1	MT T Q L D R V V L I G V A G D S G C G K S T F
	T_elongatus_BP1	1	MS . . . . .	. . . . . S K P D R V V L I G V A G D S G C G K S T F
	Nostoc_PCC7524	1	MT . . . . .	. . . . . S K P E R V V L I G V A G D S G C G K S T F
	S_oleracea	1	T . . . . .	. . . . . C S Q Q Q T I V I G I L A A D S G C G K S T F
	O_sativa	1	S . . . . .	. . . . . C S V D K P V V I G I L A A D S G C G K S T F
	S_moellendorffii	1	· · · · ·	. . . . . K T I V I G I L A A D S G C G K S T F
	C_reinhardtii	1	· · · · ·	. . . . . D K D K T V V I G I L A A D S G C G K S T F
	V_carteri	1	LV . . . . .	. . . . . V K A Q K D K T V V I G I L A A D S G C G K S T F
	B_prasinos	1	· · · · ·	. . . . . K A D G P V I I G I L A A D S G C G K S T F
	P_umbilicalis	1	MA . . . . .	. . . . . S . S N I E K P M I I G V A A D S G C G K S T F
	G_sulfuraria	1	LR . . . . .	. . . . . N . K G I E R P V I I G V A A D S G C G K S T F
	B_natans	1	MA . . . . .	. . . . . Q . K N I Q R P V I F G V A A D S G C G K S T F
	C_merolae	1	QR . . . . .	. . . . . K N I Q R P V M V G V A A D S G A G K S T F
	G_chorda	1	MD . . . . .	. . . . . V . K R I T R P V I I G V A A D S G C G K S T F
	P_purpureum	1	MK . . . . .	. . . . . Q . K G I E R P V I I G V A A D S G C G K S T F
2	L_chlorophorum	1	A . . . . .	. . . . . L . G K D E P V V V I G V A A D S G C G K S T F
	E_gracilis	1	MR . . . . .	. . . . . P K V D P K K T V L I G V A A D S G C G K S T F
	P_tricornutum	1	MA . . . . .	. . . . . L . K E G Q T P I I I G V A A D S G C G K S T F
	T_pseudonana	1	A . . . . .	. . . . . L . K D G E V P I I G I L A A D S G C G K S T F
	G_theta	1	A . . . . .	. . . . . S . G Q K P V V I G I L A A D S G C G K S T F
	L_polyedra	1	PA . . . . .	. . . . . T . K E G V S P V V I G V A A D S G C G K S T F
	E_huxleyi	1	M . . . . .	. . . . . D A S N P V V I G I L A A D S G C G K S T F
3	A_profundus	1	ML . . . . .	. . . . . K E K L . I K S G K V F I I G I A G D S G S G K T T F
	H_hungatei	1	MGLVPRGSHMSQPE . . . . .	. . . . . N F R E V I . R H S P L V Y L I G V A G D S G S G K S T F
	M_paulustris	1	MM . . . . .	. . . . . Q T E G K T G E K P D L C P G T G G L N F K D R I . A S S P C V F T I G V A G D S G S G K T T F
	M_thermophilus	1	MP PS . . . . .	. . . . . D F K R V I . A E S P Y V F I I G V A G D S G T C G K T T F
4	R_sphaerooides	1	MS . . . . .	. . . . . K K H P I I S V T G S S G A G T S T V
	R_rubrum	1	MS . . . . .	. . . . . V K H P I I A I T G S S G A G T T T T
	P_luminescens	1	MS . . . . .	. . . . . A K H P I I A I T G S S G A G T S T V
	Syn_WH7803	1	MS . . . . .	. . . . . K R H P V V A V T G S S G A G T S T V
	P_chromatophora	1	MS . . . . .	. . . . . K R H P V V A V T G S S G A G T S T V
	H_crunogenus	1	MS . . . . .	. . . . . V E H P I V T V T G S S G A C T S F V
5	D_swuensis	1	MT . . . . .	. . . . . S P F V I G V A G G S G S G K T T V
	E_coli	1	MT . . . . .	. . . . . D Q S H Q C V I I G I A G A S A S C K S L I
	H_volcanii	1	MT . . . . .	. . . . . I . . P S F V I G I A G G S G A G K T T V
	T_thermophilus	1	MS . . . . .	. . . . . A . . P K P F V I G I A G G T A S G K T T V

1

α1 ← → *βB* → *η1* ← → *ll*

1	Syn_PCC6301	24	L N R L A D L F G T E	L M T V I C L D D Y H S L D R K G R
	Syn_PCC6803	25	L R R L T D L F G E E	F M T V I C L D D Y H S L D R Q G R
	T_elongatus_BP1	25	L R R L A D L F G E D	F M T V I C L D D Y H S L D R K Q R
	Nostoc_PCC7524	25	L R R L T D L F G E E	L M T V I C L D D Y H C L D R K Q R
	S_oleracea	24	M R R L T S V F G G A A E P . P K	G G N P D S N T L I S D T T T V I C L D D F H S L D R N G R
	O_sativa	24	M R R L T S V F G G A A E P . P K	G G N P D S N T L I S D T T T V I C L D D Y H S L D R T G R
	S_moellendorffii	19	M R R L T S V F G G A A S P . P K	G G N P D S N T L I S D T T T V I C L D D Y H S L D R T G R
	C_reinhardtii	22	M R R R M T S I F G G V P K P . P A	G G N P D S N T L I S D M T T V I C L D D Y H C L D R N G R
	V_carteri	27	M R R R M T S I F G G V P K P . P A	G G N P D S N T L I S D M T T V I C L D D Y H C L D R N G R
	B_prasinos	22	M R R R M T S I F G G K A S P . P E	G G N P D S N T L I S D T T T V I C L D D Y H L N D R Q G R
	P_umbilicalis	26	L R R V S G I F G T K V S Q	G H T P Q G D F M T V I C L D D F H T Q D R K G R
	G_sulfuraria	26	L R R V N E I F G T K V S Q	S H T P Q G E L V T V I C L D D F H T L D R K G R
	B_natans	26	L R R V N A I F G T T T S K	A H T P T G D L I T T I C L D D F H T L D R T G R
	C_merolae	25	L R R V R M R M F G S D I P K	G H T P Q G E L I T V I C L D D W H N R D R Q G R
	G_chorda	26	L R R V T S I F G T E V S K	S H T P V G E F I T V I C L D D Y H T H D R M G R
	P_purpureum	26	L R R V N L I F G A Q V S K	A H T P Q G D F I T V I C L D D Y H Y H D R K G R
2	L_chlorophorum	25	M R R L T N V F G G E Q V G . P L G G G F G G G G W E T N T L V S D Q T	T V I C L D D Y H L L D R Q G R
	E_gracilis	27	M R R L T G I F G G G K P T . P L G G G F G T G G W E T N T L V S D K T	T V M C L D D Y H L N D R A G R
	P_tricornutum	26	M R R L T N I F G G D V V G . P L G G G F D K G S W E T N T L V S D L T	T V I C L D D Y H L N D R E G R
	T_pseudonana	25	M R R V T S T F G G E T C G . P L G G G F G N G G W E T N T L V S D M A	T V I C L D D Y H L N D R E G R
	G_theta	23	M R R V T A C F G G A S K L N P	I G R E T N T L I S D M T T V I C L D D Y H L N D R Q G R
	L_polyedra	26	L R R I L T G A L G T E V T P	G H T A I G D M M T V I C L D D Y H T N D R A G R
	E_huxleyi	23	M R R V T G I F G E C K L N D	I G R E T N T L V S D M T T V I C L D D Y H K W D R T G R
3	A_profundus	29	A N G I K R M F G D D	I V S H I T L D D Y H V Y D R E M R
	H_hungatei	43	T R A I S D I F G E E	L V S S I T V D D Y H L Y D R K T R
	M_paulustris	50	T Q S I R D I F G E D	L V T T I T L D D Y H L Y D R E E R
	M_thermophilus	33	T R A I R E I F G K D	L I S T I T D D Y H R Y D R E E R
4	R_sphaerooides	22	K H T F D Q I F R R E	G V K A V S I E G D A F H R F N R A D M
	R_rubrum	22	T R T F E Q I F R R E	G V N A A V V E G D S F H R N D R K A M
	P_luminescens	22	S S A F R K I F Q Q L	N I S A A Q I E G D S F H R Y T R P E M
	Syn_WH7803	22	K R A F E H I F A R E	S I T P A V V E G D S Y H R F E R M E M
	P_chromatophora	22	K R A F E Y I F I R E	G I Q P A V V E G D S Y H R Y E R T E M
	H_crunogenus	22	K R A V E K I F D R E	N L N V A I V E G D S Y H K Y N R A E M
5	D_swuensis	21	T R R V M E T V G A Q	G V A V L A Q D N Y Y R S Q D E I P F E
	E_coli	25	A S T L Y R E L R E Q V G D E	H I G V I P E D C Y Y K D Q S H L S M E
	H_volcanii	22	A R L I T E N V G E S	V T R I P I D N Y Y K D Q S H L D M A
	T_thermophilus	23	Q A L A R T L G E R	V A L L P M D H Y Y K D L G H L P L E

1

		α2	β	η2	ε	α3	βC
1	Syn_PCC6301	53	KE	...	A	...	GVTALDP[RANNFDLMYEQVKALKNGETIMKPIYNH]
Syn_PCC6803	54	KA	...	A	...	GVTALDP[RANNFDLMYEQIKTLKGQSIMKPIYNH]	
T_elongatus_BP1	54	KE	...	M	...	GITALDP[RANNFDLMYEQIKALKNGESIMKPIYNH]	
Nostoc_PCC7524	54	KE	...	T	...	GITALDP[RANNFDLMYEQIKALKLEGQAIINKPIYNH]	
S_oleracea	70	KV	...	E	...	KVTALDP[KANDFDLMYEQVKALKLEGKAVDKPIYNH]	
O_sativa	70	KE	...	K	...	GVTALDP[RANDFDLMYEQVKAIKEGKAIIEKPIYNH]	
S_moellendorffii	65	KE	...	K	...	GVTALDP[KANNFDLMYEQVKALKLEGKAVQKPIYNH]	
C_reinhardtii	68	KV	...	K	...	GVTALAP[EAQNFDLMYEQVKALKLEGKSVDKPIYNH]	
V_carteri	73	KV	...	K	...	GVTALAP[EAQNFDLMYEQVKALKLEGKAVDKPIYNH]	
B_prasinos	68	KE	...	S	...	GLTALNL[KEQNFDLMHEQVKALKLEGKTVQKPIYNH]	
P_umbilicalis	65	AA	...	A	...	KVTALDP[VANNFELMYEQVKALKLEGKSVMKPIYNH]	
G_sulfuraria	65	AE	...	K	...	KVTALNP[EANNFELMYQQIAALKEGYDIMKPIYNH]	
B_natans	65	AD	...	T	...	GISALDV[RANNFALMADQLKALKQGRAIKKPIYNH]	
C_merolae	64	KE	...	D	...	NITALDENCNQFDLMAEQLEALKNGFDIMKPIYNH	
G_chorda	65	RE	...	A	...	KVTALDERANNFDLMASQIQLAKEGKSIIMKPIYNH	
P_purpureum	65	KV	...	A	...	NVTALDE[KANNFTLMAAQVKALKLEGKAIYKPIYNH]	
2	L_chlorophorum	76	KV	...	S	...	KRTALDTAEQKFDLMYEQIAALKRGETIKKPIYNH
E_gracilis	78	KV	...	T	...	GITALDQE[NNFDFLMFQMSSLKRGETIAKPIYNH]	
P_tricornutum	77	KV	...	T	...	MRTALDPEENNFDFLMYEQVKALKDGKTVEKPIYNH	
T_pseudonana	76	KV	...	S	...	GITALNTAEQKFDLMFEHVKALKEGKTIIMKPIYNH	
G_theta	68	KK	...	T	...	GITALDPRENNFDLMYEQVKALKEGKKIMKPIYNH	
L_polyedra	65	KA	...	T	...	GTALDAKENFDALMGVQIEALKQGKAVYKPIYNH	
E_huxleyi	68	KSNPEWPD	...	...	GTALHEACQNWDKMAADVTDLKAGKAVEKPIYNH	
3	A_profundus	58	ER	...	L	...	ITPLHP[SANNLKLVE]THLYLLKGEKI[KKPT]YNH
H_hungatei	72	SE	...	M	...	ITPLLHTANNLKLLEENLMDL[KAGRTI]QKPVYLH	
M_paulustris	79	KV	...	R	...	ITPLNPEANRLDQLEHD[LVE]TEGRTIIDKPVYNH	
M_thermophilus	62	RK	...	L	...	ITPLAPEANRFD[LLE]HLAAALKEGKTIQKPVYNH	
4	R_sphaerooides	53	KA	...	ELDRYYAAGDATFSHFSYANEELKEERV[FREYGETGQGRTRTYVHDDAEAR		
R_rubrum	53	KI	...	AMAEAQKAGNANFSHFGPEEANLFEETLFR[YGETGGGRRI]YLNHND[EEAAP			
P_luminescens	53	DA	...	AIRKAKEQG.RHISYFGPEEANDFGMLEKT[MIDYGETGEGRRKYLNHTYDDAVP			
Syn_WH7803	53	KK	...	AMAEALSKG.ENFSHFGPEEANLFDKLEELFRVYGETGGQKRYYLHSPEEAAE			
P_chromatophora	53	KQ	...	AMEKALSIG.NNFSHFGPEEANLFDKLEELFKVYGETGGGEKRYYLHSLDEAAD			
H_crunogenus	53	KE	...	KVAASKANGGPVLTHFSEKANEFGE[ELFK]YKE[YKENG]GKQRYYIH[HSDE]EEAAE			
5	D_swuensis	52	TR	...	KTNYDHPAAFDWELLRAHLDALLAGVPIDMPEYDF...		
E_coli	60	ER	...	V	...	KTNYDHPSAMDHSLLLHLQALKRGLAIIDL[PV]YSY...	
H_volcanii	52	ER	...	E	...	QVNYPDHPSAFEWDLLYEQLSELMEGR[AVEM]PQYDF...	
T_thermophilus	53	ER	...	L	...	RVNYDHPD[AF]D[LA]LYL[EHAQALI]RGLPVEMPQYDF...	

		βD	βE	α4	βF
1	Syn_PCC6301	91	ETG[L.IDPPEK[I.	EPNR[IVIVIEGLHPLYDE...	RVRELLDF[SVY
Syn_PCC6803	92	ETG[L.LDPPEKV.	EPNK[VVVIIEGLHPLYDE...	RVRELVD[FGVY	
T_elongatus_BP1	92	ETG[T.IDPPEK[V.	DPNHVIVIEGLHPLYDE...	RVRSLIDEFSVY	
Nostoc_PCC7524	92	ETG[M.IDPPEIV.	EPNH[IVIVEGLHPLYDE...	RVRSLLLDFSVY	
S_oleracea	108	VSG[L.LDPPELI.	QPPK[IVVIIEGLHPMYDA...	RVRELLDFSIY	
O_sativa	108	VTG[L.LDPPELI.	QPPK[IVFIIEGLHPMFDE...	RVRDLLLDFSIY	
S_moellendorffii	103	VSG[L.LDPPELI.	QPPK[IVVIIEGLHPMFDS...	RVRELLDFSIY	
C_reinhardtii	106	VSG[L.IDAPEK[I.	ESPP[ILVIECLHPFYDK...	RVAEELLDFK[IY	
V_carteri	111	VTG[L.IDAPEK[I.	DSPN[ILVIEGLHPFFDK...	RVADLLDFK[IY	
B_prasinos	106	VTG[V.FDPAEE[I.	VSPK[VILEGLHPFADD...	RVRNFYDFK[IY	
P_umbilicalis	103	ETG[K.IDPPELI.	NPNHVIVIEGLHPMYDA...	RMKELLDFTVY	
G_sulfuraria	103	QTG[L.IDPPELI.	QPNH[IVIEGLHPWYDA...	RMKQLLDFTVY	
B_natans	103	DTG[A.IDPVETI.	HPNH[IVIEGLHPMLDK...	DVIESLDFTFY	
C_merolae	102	ETG[R.IDPPELV.	SPNH[IVVIEGLHPMYDE...	RVRKLLDF[SVY	
G_chorda	103	ETG[E.IDPPELV.	EPNH[LVVIEGLHPMYDE...	RVRDVLDFTVY	
P_purpureum	103	DTG[E.HDPSELI.	EPNH[LVVIEGLHPMYDP...	RVAEELLDDLSVY	
2	L_chlorophorum	114	VNG[T.LDEPETI.	KPTPIVIIIEGLHPFVDE...	RVRKLIDF[SIY
E_gracilis	116	VNG[T.LDTPEEI.	APASIMIIEGLHPLLDD...	RVAGLLDF[SIY	
P_tricornutum	115	VNG[T.LDTPETI.	EPTPIVIIIEGLHPFMHDK...	RVLDDLDF[SIY	
T_pseudonana	114	VNG[T.LDTPEEI.	EPTPIVIIIEGLHPFVDE...	RVRELIDF[SIY	
G_theta	106	VNG[T.LDEPEEI.	TPTPIVIIIEGLHPFYDK...	RVEELMDF[KIY	
L_polyedra	103	DTGN[KDPPELI.	EPKVNVMVFEGLHP[PIYDK...	KARDQLDLGIY	
E_huxleyi	111	ITGE[L.DPDEPV.	QPTPIVIIIEGLHPMHDE...	RVNEALDL[TIY	
3	A_profundus	96	KTGT[FGEWEF.	ESTPIVIVIEGLHTLYD...	GIRDYIDF[KIY
H_hungatei	110	DHGT[FGEPEL.	SPTKFIIIEGLHPYATK...	SLRALYDYTIF	
M_paulustris	117	ANGR[FAPPICR.	TPGK[ILIIEGLHTFFTP...	ALREHLDFTLF	
M_thermophilus	100	NTGR[FDPPV.	SPTK[ILIIEGLHPFITP...	RLRGLIDF[KLY	
4	R_sphaerooides	108	TGVAP[GN.FTDWRD.	FDSDSHLLFYEGLHGAVVNS...	EVNIAGLADLKIG
R_rubrum	108	FAQEP[GTF.	FTPWE[L.PESDLLFYEG...	TVDAQHADLKIG	
P_luminescens	107	YNQLPGT[FTPWE.	SLPKQTD[VLFYEGLHGGVVTP...	QHNVASHVDDLVG	
Syn_WH7803	107	HNARLGVELDPGQ.	IPTSGTD[LFLYEGLHGGVQGE...	SYDVAALADLVG	
P_chromatophora	107	HNARLSTNLKPQGQ.	FTPWEAISKNTD[LFLYEGLHGGVESK...	NHDVSNYVDDLVG	
H_crunogenus	108	HNARLGTNFSSGE.	FTPWEPIPEGTD[VLFYEGLHGMVKRMDHGPKEGMHNVAQYVDDLGIG		
5	D_swuensis	90	TQHTRSARTTTV.	LPGS[VVVLLEGFFALYDE...	ELRARMMHLKVF
E_coli	98	VEHTRMKETVT.	EPKKVIIILEGILLLTDA...	RLRDELNFISIF	
H_volcanii	90	EIHNRKSERETV.	EP[TDVIIILEGILALYDE...	DVNEMLDLRLY	
T_thermophilus	91	RAYTRSPRRTPV.	R[PAP[VVILEGILVLYPK...	ELRDLMDLKVF	

		α5	α6	η3	βG
1	Syn_PCC6301	130 LDIDDEVKIAWKIQRDMAERGHSYEDVLASI.EARRPDFKAYIEPQRGHADIVIRVMPTQ			
Syn_PCC6803	131 LDISEVKINWKIQRDMAERGHTYEDILASI.NARKPDFTAYIEPQKQYADVVIQLPQT				
T_elongatus_BP1	131 LDISDDVKIAWKIQRDMAERGHSYEDVIASI.NARRPDFMAYIDPQKQYADVVLQILPSQ				
Nostoc_PCC7524	131 FDISDEVKIAWKIQRDMAERGHRYEDVLAASI.NSRKPDFQKYIEPQREFADVVLQVLPTN				
S_oleracea	147 LDISNEVKFAWKIQRDMAERGHSLESIKASI.ESRKPDFDAYSIDPQKQYADVVIEVLPTE				
O_sativa	147 LDISDEVKFAWKIQRDMAERGHSLESIKASI.EARKPDFDAFIIDPQKQYADAVIEVLPTQ				
S_moellendorffii	142 LDISDAVKFAWKIQRDMAERGHSLESIKASI.AARKPDFDAYIDTQKQYADVVIQLPQT				
C_reinhardtii	145 LDISDDIKFAWKIQRDMAERGHSLESIKSSSI.AARKPDFDAYIDPQKKDADMIIQLVLPQT				
V_carteri	150 LDISDDIKFAWKIQRDMAERGHSLQAIKSSSI.EARKPDFDAYIDPQKKDADMIIQLVLPQT				
B_prasinos	145 LDISDDVKFAWKIQRDMAERGHSLESIKASI.EARKPDFDAFVDPQKKFADVVIQLPQT				
P_umbilicalis	142 LDISLDEVKIAWKIQRDMAERGHLDNLASIESRRPDFEAYVDPQKRDVDMVMOILPTN				
G_sulfuraria	142 LDISDEVKVAWKIQRDMAERGHKLENILASIESRKPDFQQYIDPQKKDAVAVIQLPTR				
B_natans	142 IDVSDPVKKCAWKEERDMVERGHKEDIIASIESRKPDFEKFVIEPKKANADVIIISIEPTK				
C_merolae	141 LDLDDDEVKIAWKIQRDMAERGHTEAILEASIESRKPDFERFPLPQRQYADAVIQLVPTE				
G_chorda	142 LDLADEVKIAWKIQRDMAERGHLDNLASIESRKPDFEKFVDPQKKNCDVVMEILVPTE				
P_purpureum	142 MDVSDEVKLSWKVQRDMAERGHLENILASIESRKPDFAQFVDPQKKKADIVLNILVLPQT				
2	L_chlorophorum	153 LDITDDVKFAWKRDRMQRERGHSLESIKASI.EARKPDFDAYVAPQRANSDLVIQLVLPTE			
E_gracilis	155 LDISDRVKFAWKRDRMAREGRWALEDIKKDI.ERKPDFDKVYAPQRAKADMIEVLPSR				
P_tricornutum	154 LDISDDVKLNWKVQRDMEEERGHSMESILASIESRKPDFDAYIDPQKQLADLIIIEVLPTR				
T_pseudonana	153 LDISPDVKLNWKVQRDMEEERGHSMESILASIESRKPDFDAFIEPQKKFADYVIEVLPTE				
G_theta	145 VDITPEVKFNWKVQRDHEERGHSESIKQKI.EARKPDFDAYIDPQKRNKADCVIQLVLPQT				
L_polyedra	142 IDIVNDVKFAWKRDRDAAERGWITEEQREDIEEKRLPDFSAVYDPQKAADVILRYEPSE				
E_huxleyi	150 LDITDDVKFAWKAORDIAERGATPEEVQAAI.DGRKPDFFAAYVEPKQKAADIIQLVLPDS				
3	A_profundus	134 VDPARYIKRLWKIKRDRVEERGYDRDKVIREI.IRREPDYKRYIDFQKITYADVVIKILPSS			
H Hungatei	149 VDPERDVKYDWKIKRDRMKKRNYYDKNEVLRREI.LQREPDYFQYVFQPREVADAVIQISYSS				
M_paulustris	156 VEPDPEVKIEWKMRDRDINNRGYTREQVMAEL.EPRERDYQRFIAPQKQYADVVRVRFSK				
M_thermophilus	139 VDPDPDVKRAWKIKRDRVERRGYTTPDAVQVQEM.AERKRDYEAYVAPQCQFADAVIKIAFSK				
4	R_sphaerooides	154 VVPVINLEWIQKIHDRDRAARTGYSTEAVTDVILRRMHAYVHCIVPQFSQLTDINFQRPVVF			
R_rubrum	153 VVPVINVEWIQKIHDRDRAARGYSTEAVTDVILRRMPDYVHYICPQFTRTDVNFQRPVLF				
P_luminescens	153 VVPIVNLEWIQKILIRDGERGHQSQEAVMDSV.VRSMDDINYITPQFSRTHINFQRPVTF				
Syn_WH7803	159 VVPITNLEWIQKIHDRNAERGYSAAEIVDTI.LRRMPDYINHICPQFSRTDINFQRPVTV				
P_chromatophora	159 VVPITNLEWIQKIQORDNAERGYSAAEIVDTI.LRRMPDYINHICPQFSRTDINFQRPVTV				
H_crunogenus	167 VAPSINIEWMQKIFYRDTSERPYSVEQVRDVI.LERMPDFYIETIVPQFHRTHINFHRVPLI				
5	D_swuensis	130 VDADADVRFIRRLIKRDTGERGRTPEPSVISQYLEFVRPMHLSFVEPTKRYADVIIIPHGGMN			
E_coli	138 VDTPLDICLMRRRIKRDVNERNGRSMDSVMAQYQKTRPMFLQIEEPSKQYADIIIVPRGGKN				
H_volcanii	130 VETADADVRILRRRIORDAIDRGRDLOGVIDQYLSTVKPMHEQFIEPTKKHADLIIPEEGAN				
T_thermophilus	131 VDADADERFIRRLKRDVLERGRSLEGVVAQYLEQVKPMHLHFVEPTKRYADVIVPREGGQN				

		BH	BI
1	Syn_PCC6301	189 LIPN.DT.....ER..KVLRVQLIQR....EGRDGFEPAYLFD.EGSTIQW	
Syn_PCC6803	190 LIED..K.....ES..KLRVRLVQK....EGVKFFEPAYLFD.EGSTIDW		
T_elongatus_BP1	190 LAKE.EK.....VG..NILRVRMLQR....EGIPGFEPVYLF.DEGSTIWT		
Nostoc_PCC7524	190 LIKN.DT.....DR..KVLRVVRMLQR....EGKEGFEPAYLFD.EGSTIQW		
S_oleracea	206 LI PD..DD.....EG..KVLRVVRMIIQK....EGVKFFNPVYLF.DEGSISWT		
O_sativa	206 LI PD..DN.....EG..KVLRVVRMIIQK....EGVKFFNPVYLF.DEGSISWT		
S_moellendorffii	201 LI PD..DN.....EG..KVLRVVRMIMK....EGVDNFEPVYLF.DEGSTISW		
C_reinhardtii	204 LVPD.DK.....G..QYLRVRLIMK....EGSKMFDPVYLF.DEGSTISW		
V_carteri	209 LVPD.DK.....G..QYLRVRLIQQK....EGSKMFDPVYLF.DEGSTISW		
B_prasinos	204 LI PD..DN.....EG..KILRVRMIMK....EGVKFFDTPTYLF.DEGSTISW		
P_umbilicalis	201 LI PD..DT.....EK..KVLRVRLLQK....EDT.DVDAVLYD.EGSTIDW		
G_sulfuraria	201 LI PD..DT.....EK..KVLRVRLIQR....EGIQGQFSVYLYD.EGSTIDW		
B_natans	201 LDVAPGE.....ET..KYLNTRLIQR....ENQHGIRPVYMFEEEGSTVDW		
C_merolae	200 LI PE..DK.....ER..KILKVRLLQR....EGVQGFKTAYLF.DEGSTIEW		
G_chorda	201 LI PD..DT.....EK..KVLRVRLLQD....ENCTHLEPVFLYD.EGSTIDW		
P_purpureum	201 LVPD.DK.....EN..KYLVRQMIQR....EAATNFAKVSIFD.EGSTIDW		
2	L_chlorophorum	212 LTND.D.....TG..KLLKVRLLIEA....AGKEKYSPSYLF.DEGSTISW	
E_gracilis	214 LAPP.KD.....ETAPLEYLVRVLIQK....TTKHFDPVYLINE.KGSVTW		
P_tricornutum	213 LDQD..D.....K..KTLRVRCLIQK....EGVENFDPCFLD.EGSIEW		
T_pseudonana	212 LDKE..D.....K..KTLRVRALIQK....KGVADFTPTYLF.DEGSEIEW		
G_theta	204 LAAN.D.....K..THLNVKLIIQK....KDVDHFAPTYLWD.EGSDIEW		
L_polyedra	201 QG.....L..PYLKVKLIIQK....KGG.AFPPISSLKK.D.....		
E_huxleyi	209 LI ED..P.....TG..KFLKVKYIQQK....KSVCACETPYLF.DEGSELTW		
3	A_profundus	193 IQST..ERIKY.....LVDS.RE..EYVYKVRILIKL..KTDIPLESVSLN.....IDI	
H Hungatei	208 YGKE..EG.....E..KR..NVYRVMLSMP....AQEYCFEDIEN..IDL		
M_paulustris	215 YGRE..RG.....I..RE..KIVQVSLSQN....RITKSIEDVDSL..IDL		
M_thermophilus	198 YGRE..IS.....E..ER..NVYHVTLQCS....KLERSIRDVDSL..IDL		
4	R_sphaerooides	213 DTSN..PFIAR.....WIPTADE..SVVVIRFRNP..RG..IDFPYL.....	
R_rubrum	212 DTSN..PFVAR.....HVPSADE..SFVVIIRFRDP..KG..IDFPYL.....		
P_luminescens	212 DTSN..PFSAK.....AIPSLEDE..SFIVIRFRDL..TQ..IDFPYL.....		
Syn_WH7803	218 DTSN..PFICR.....NIPTPDE..SFVIIHFRKGAREKWG..IDFSYL.....		
P_chromatophora	218 DTSN..PFICR.....NIPTPDE..SFIIIVHFRKGAREKWG..IDFPYL.....		
H_crunogenus	226 DTSD..PFSTMSPDAPMGPAPED..SLLICHVRH..QD..IDLEAV.....		
5	D_swuensis	190 .....EPALDMLAA..RIRT.....	
E_coli	198 .....RIAIDILKA..KISQ.....		
H_volcanii	189 .....SVAVTLEE..KVQAEEVE.....		
T_thermophilus	191 .....PVALLEMMLAA..KALARL.....		

			βJ	βK	α7
1	Syn_PCC6301	227	TPCGR . KLTCSYPGIR . LAYGPDTYVGHEVSVLEVDG . QFE . . . NLE . EMIYVEGH		
	Syn_PCC6803	227	RPCGR . KLTCTYPGIK . MYYGPDNFMGNEVSLEVDG . RFE . . . NLE . EMVYVENH		
	T_elongatus_BP1	228	IPCGR . KLTCSYPGIR . LSYGPDEYYGHPVSVLEVDG . RFE . . . KLD . ELIYIESH		
	Nostoc_PCC7524	228	TPCGR . KLTCSYPGMQ . MYYGSDVYGRYVSVLEVDG . QFD . . . NLE . EVIYIETH		
	S_oleracea	244	IPCGR . KLTCSYPGIK . FSYGPDTYFGNEVTVLEMVG . MFD . . . RLD . ELIYVESH		
	O_sativa	244	VPCGR . KLTCSYPGIK . FAYGPDTYFGHEVSVLEMVG . QFD . . . RLD . ELIYVESH		
	S_moellendorffii	239	IPCGR . KLTCSYPGIK . FFYGPDTYDNEVSVLEMVG . QFD . . . KLD . ELIYVESH		
	C_reinhardtii	241	IPCGR . KLTCSFPGIK . MFYGPDTWYGQEVSVLEMVG . QFD . . . KLE . ELIYVESH		
	V_carteri	246	IPCGR . KLTCSFPGIK . MFYGPDTWYGQEVSVLEMVG . QFD . . . KLE . ELIYVESH		
	B_prasinos	242	IPCGR . KLTCSYPGIK . FFYGPDTYFGEEVSVLEMVG . QFD . . . KLE . ELIYVESL		
	P_umbilicalis	238	VPCGR . KLTGYPGIK . FHYGPDTYDNEVSVLEMVG . NFA . . . KLE . EMIVYETH		
	G_sulfuraria	239	IPCGR . KLTCSYPGIK . FHYGPDNWNHDVSVLEMVG . NFE . . . KLE . ELIYIESH		
	B_natans	241	DPCAGPAMACPYPGTR . VRYYNEMSGEKHAAHVLEVGD . VFG . . . ETE . ELFFIEER		
	C_merolae	238	IPCGR . RLTCSYPGIK . FHYGPESFYGADFSTIEVDG . EFA . . . KLE . ELVYIESH		
	G_chorda	239	VPCGR . KLTCSYPGIK . FHYGPDTYDCKPVSFVEVDG . GFE . . . KLE . EMVYVETH		
	P_purpureum	239	VPCGR . KLSCSYPGIK . FHYGPDSYFGEDVTVLEMVG . VVE . . . KLD . EMIVYVESH		
2	L_chlorophorum	249	IPCGT . KLTCSYPGVK . LGYGTTEEMFGKEVSVLEMVG . EF		
	E_gracilis	255	KPCGD . NLQCEYPGLQ . LAYYTEREYGMHGPAAEVLEMVG . VIH . . . NLK . EGLYVEKF		
	P_tricornutum	249	TPAPT . KLSSPAPGIK . LAYYPEEEFKDKAQVLEMDG . NFD . . . NIQ . ELVYVESA		
	T_pseudonana	248	APSAD . KLSSPAPGIK . LSYKQEQQYFGADVAVVEMDG . TFD . . . NIQ . ELVYVESP		
	G_theta	240	VPPRS . KLASAAGPGVGMKIYQKNEKWAGKAADVIGMDG . KYD . . . KID . EMMYVEKQ		
	L_polyedra	227	. . . L . TLTGSKPGAT . LKMYDDDWFGNAATVIVEMDG . EIDMD . . . NMEAQLKEIEDN		
	E_huxleyi	246	VPNGD . KLTTSPPGVV . IKSYDDEWFEGAPVSVLEMVG . KVD . . . VLD . ELVYVESA		
3	A_profundus	233	SD . . . LVKASERDFS . IGFSDYYYYAEKASFIDIDG . FLNVDIFKSLF . DSLRKEIG		
	H_hungatei	242	CD . . . LFKKSSHDFS . LSCISHTPDSRNMRALVVGD . ELMPTDIHKIE . RQIEFQTG		
	M_paulustris	249	FS . . . LLSLSDRNFL . IEFHSQRNDERTGELILDG . ELSRMVKRLE . TSIEEQTO		
	M_thermophilus	232	FP . . . LLSLSERNFM . VEFTIEEIGGRAMGALTFDG . ELYNAVVRLE . KNIEIQTQ		
4	R_sphaerooides	247	. . . . . TSMIHGSWMSRANSIVVPGN . KLD . . . LAM . QLI . . .		
	R_rubrum	246	. . . . . LNMLNDSFMSRPNTIVVPGG . KME . . . LSM . QLI . . .		
	P_luminescens	246	. . . . . LAMLQGSFVSSLNTIVVPGG . KMG . . . LAM . ELI . . .		
	Syn_WH7803	256	. . . . . LSMIHDSFMSSPTSIVVNNGG . KMG . . . FAM . ELI . . .		
	P_chromatophora	256	. . . . . LEMIHDSFMSSPTSIVVNNGG . KMG . . . FAM . ELI . . .		
	H_crunogenus	264	. . . . . KAKIPGAFLQNEETLVCGG . HMV . . . EAM . DLM . . .		
5	D_swuensis				
	E_coli				
	H_volcanii	205			GDETRTWERDAIE . . .
	T_thermophilus				
		2	2		

			α8		α9	
1	Syn_PCC6301	276	LSKTDTQYYGELTHLLLQHKDYPGSNNGTGLFQVLTKLKMRAA . . Y . . . ER . . . L.			
	Syn_PCC6803	276	LSKTGTKYGGEMTELLLKHKKDYPGTDNGTGLFQVLVGLKMREV . . Y . . . EQ . . . L.			
	T_elongatus_BP1	277	LSNTSTKHYGEVTLELLKHHRDYPGSDNGSGLQFQVLTKLKMRA . . Y . . . ER . . . L.			
	Nostoc_PCC7524	277	LSNTSTKHYGEVTLELLKHHRDYPGSDNGSGLQFQVLTKLKMRA . . Y . . . ER . . . L.			
	S_oleracea	293	LSNLSTKFYGEVTQQMLKHQNPFPGSNNGTGFQTTIIGLKIRDL . . F . . . EQ . . . L.			
	O_sativa	293	LSNLSTKFYGEVTQQMLKHADFPGSNNNGTGFQTTIIGLKIRDL . . F . . . EQ . . . I.			
	S_moellendorffii	288	LSNISTRFYGEITQQMLKHADFPGSNNNGTGFQTTIIGLKIRDL . . F . . . EQ . . . I.			
	C_reinhardtii	290	LSNTSAKFYGEITQQMLKNNSGFPGSNNGTGLFQTTIIGLKIRDL . . F . . . ER . . . I.			
	V_carteri	295	LSNTSAKFYGEITQQMLKNNSGFPGSNNGTGLFQTTIIGLKIRDL . . F . . . ER . . . I.			
	B_prasinos	291	LSNSTKFYGEITQQMLKYQNGPGSNNGTGFQTTLIGLKIREL . . Y . . . EK . . . I.			
	P_umbilicalis	287	LNNTSTKFYGEMTQQLLKNPNAPGSSNNGTGLCQVILALKMREM . . Y . . . EK . . . I.			
	G_sulfuraria	288	LNNTSTKFYGEITQQLLRNSAAPGSNNNGTGLFQVLTAALKMRQL . . Y . . . EE . . . L.			
	B_natans	292	LSNTNTKVFGEITQMLKNAAPGSGDGSGLIQALVALKMRES . . Y . . . ER . . . F.			
	C_merolae	287	LSNTGTYKYYGELTQLMLAAQNTPGAYNGTALFQTIALKIREI . . Y . . . EQ . . . L.			
	G_chorda	288	IERSGTFKFFGEITQSLLRNPTAPGSKNGTGLVQVLMMAMMRNV . . Y . . . EK . . . V.			
	P_purpureum	288	LNNTETKFYGEMTQQLLKNPATPGTFNGTGLFQVLIAALKMREV . . Y . . . EK . . . C.			
2	L_chlorophorum					
	E_gracilis	304	LHNTGAKEFGELETQELLKGQNSPGGGDNGTGFMQTLAAALKIREI . . Y . . . ER . . . A.			
	P_tricornutum	298	LSNTKTFYGEMTQAMLALATAPGSNNNGTGLMQTLAAFAIRDI . . Y . . . EK . . . K.			
	T_pseudonana	297	LGNTNSKFYGEVTQAMLSSLADSPGSNNNGTGLMQTLAAFAIREL . . Y . . . NK . . . K.			
	G_theta	291	FASTGSKFVGEVTKKMLEYEGQPGSGNDGTGFLQTITALKVREI . . Y . . . EG . . . I.			
	L_polyedra	275	LEGLPSKTPGELTEAMVKLSSPGSGNQGTGMLQTVIAMKFREV . . Y . . . EK . . . L.			
	E_huxleyi	295	ISATGTFKYGELTEQMIKMKDAPGSENGTGLFQSVLCAFKIREA . . Y . . . ES . . . L.			
3	A_profundus	284	DGEIK . . . V . . . ESEYVNAIEFSKLIVCWKLVEV . . L . . . KH . . . S.			
	H_hungatei	293	ISPINI . . . FR . . . GQEHTITGTDLVRILSWQIINGRIAL . . SN . . . H.			
	M_paulustris	300	VRPISD . . . FH . . . DHDYMTATEVQQLILAWRIIHQRVFL . . ER . . . CL.			
	M_thermophilus	283	VQPIDL . . . VQ . . . SGGYLTAGDV AQLAWRIINRRIFI . . ES . . . SP.			
4	R_sphaerooides	276	. . . . . LTPLIDRVV . . . R . . . E . . . S . . .			
	R_rubrum	275	. . . . . FTPFIIWRPFM . . . D . . . KRAR . . . A.			
	P_luminescens	275	. . . . . MTPLVQRLL . . . E . . . G . . . G.			
	Syn_WH7803	285	. . . . . LTPPIIHRMI . . . E . . . EK . . . K.			
	P_chromatophora	285	. . . . . LAPPIIHRMI . . . E . . . EK . . . K.			
	H_crunogenus	293	. . . . . MTPPIIQNLI . . . A . . . KKRDAMAK.			
5	D_swuensis					
	E_coli					
	H_volcanii	218			REV . . . QERASSR . . . G.	
	T_thermophilus	206			AR . . . M.	

		.. .	
1	<i>Syn_PCC6301</i>	323	. TSQ . A A . P VA . ASV
	<i>Syn_PCC6803</i>	323	. TAE . A K VP . ASV
	<i>T_elongatus_BP1</i>	324	. TSR . D A . A TV . TNR
	<i>Nostoc_PCC7524</i>	324	. TAK . E A . K LA . VQV
	<i>S_oleracea</i>	340	. VAS . R STATATA . AKA
	<i>O_sativa</i>	340	. IAE . R AGAPTEA . AKV
	<i>S_moellendorffii</i>	335	. TSK . Q GSP . . VGAAAAT . SKV
	<i>C_reinhardtii</i>	337	. VKK . D V . VPV
	<i>V_carteri</i>	342	. VKK . D V . VPA
	<i>B_prasinos</i>	338	. SET . E V . VAK
	<i>P_umbilicalis</i>	334	. TGR . K V . L P . RAA
	<i>G_sulfuraria</i>	335	. TGK . S I . A P . VLV
	<i>B_natans</i>	339	. TGR . T I . Q . . . IPKWGLFLDY
	<i>C_merolae</i>	334	. TGR . K V . D PVRS
	<i>G_chorda</i>	335	. TGK . K V . S V . SSS
	<i>P_purpureum</i>	335	. TGR . K L SVN
2	<i>L_chlorophorum</i>		.
	<i>E_gracilis</i>	351	. TG EKA
	<i>P_tricornutum</i>	345	. TAA . AKAKAGV SA . AAA
	<i>T_pseudonana</i>	344	. SAAAKLAATKE TA . ASA
	<i>G_theta</i>	338	. AKV . K V PA . QAN
	<i>L_polyedra</i>	322	. TG GK
	<i>E_huxleyi</i>	342	. . . . . . . . . RK
3	<i>A_profundus</i>	316	. . . . . . . . . LRL
	<i>H_hungatei</i>	330	. . . . . . . . . LDQ
	<i>M_paulultris</i>	338	HQ D . HNK
	<i>M_thermophilus</i>	321	ESTGR . K V . TAAASGGCGCG . DRR
4	<i>R_sphaerooides</i>	288	. . . . . . . . . KVA
	<i>R_rubrum</i>	290	. . . . . . . . . LGR
	<i>P_luminescens</i>	287	. . . . . . . . . KIS
	<i>Syn_WH7803</i>	298	. . . . . . . . . KLG
	<i>P_chromatophora</i>	298	. . . . . . . . . RQF
	<i>H_crunogenus</i>	311	. . . . . . . . . LNG
5	<i>D_swuensis</i>	203	. . . . . . . . . TI
	<i>E_coli</i>	211	. . . . . . . . . FFE
	<i>H_volcanii</i>	229	. . . . . . . . . SGN
	<i>T_thermophilus</i>	209	. . . . . . . . . GAA

Figure S1 Sequence alignment for the classification of PRK sequences. The amino acid alignment of PRK and uridine kinases from Fig. 1 was rendered using ESPript (Gouet *et al.*, 1999). Similar residues are shown in red and identical residues in white on a red background. Blue frames indicate homologous regions. Species abbreviations and NCBI sequence identifier information are as follows: abbreviation, species genus (NCBI code). Uridine kinase: *E. coli*, *Escherichia coli* (WP_097516444.1); *H. volcanii*, *Haloferax volcanii* (WP_004043040.1); *T. thermophilus*, *Thermus thermophilus* (WP_011172663.1); *D. swuensis*, *Deinococcus swuensis* (WP_039685329.1). Phosphoribulokinase: *H. crunogenus*, *Hydrogenovibrio crunogenus* (WP_011369436.1); *P. chromatophora*, *Paulinella chromatophora* (YP_002048771.1); *Syn sp. WH 7803*, *Synechococcus* sp. WH 7803 (WP_011933059.1); *P. luminescens*, *Photorhabdus luminescens* (WP_036780244.1); *R. rubrum*, *Rhodospirillum rubrum* (WP_011390157.1); *R. sphaeroides*, *Rhodobacter sphaeroides* (P12033.2); *M. thermophilus*, *Methanoculleus thermophilus* (WP_066956607.1); *M. palustris*, *Methanospaerula palustris* (WP_012617646.1); *M. hungatei*, *Methanospirillum hungatei* (WP_011447825.1); *A. profundus*, *Archaeoglobus profundus* (WP_012940929.1); *L. polyedra*, *Lingulodinium polyedra* (AAX13961.1); *E. huxleyi*, *Emiliania huxleyi* CCMP1516 (XP_005767208.1); *G. theta*, *Guillardia theta* CCMP2712 (XP_005827680.1); *T. pseudonana*, *Thalassiosira pseudonana* CCMP1335 (XP_002289281.1); *P. tricornutum*, *Phaeodactylum tricornutum* CCAP 1055/1 (XP_002186456.1); *E. gracilis*, *Euglena gracilis* (AAX13964.1); *L. chlorophorum*, *Lepidodinium chlorophorum* (CCC15103.1); *S. oleracea*, *Spinacia oleracea* (XP_021851648.1); *O. sativa*, *Oryza sativa* Japonica Group (XP_015625719.1); *S. moellendorffii*, *Selaginella moellendorffii* (XP_002986864.1); *V. carteri*, *Volvox carteri* f. *nagariensis* (XP_002949322.1); *C. reinhardtii*, *Chlamydomonas reinhardtii* (XP_001694038.1); *B. prasinos*, *Bathycoccus prasinos* (XP_007512393.1); *Syn sp. PCC 6301*, *Synechococcus elongatus* sp. PCC 6301 (WP_011242879.1); *Syn sp. PCC 6803*, *Synechocystis* sp. PCC 6803 (WP_010873078.1); *T. elongatus* BP-1, *Thermosynechococcus elongatus* BP-1 (WP_011057751.1); *Nostoc* sp. PCC 7524 (WP_015137356.1); *P. umbilicalis*, *Porphyra umbilicalis* (OSX70232.1); *G. sulphuraria*, *Galdieria sulphuraria* (XP_005707300.1); *B. natans*, *Bigelowiella natans* (AAP79209.1); *C. merolae*, *Cyanidioschyzon merolae* strain 10D (XP_005535773.1); *G. chorda*, *Gracilariaopsis chorda* (PXF44800.1); *P. purpureum*, *Porphyridium purpureum* (extracted from genome).

Synechococcus_PCC6301	.
Nostoc_PCC7120	.
Thermosynechococcus_elongatus	.
Zea_mays	.
Arabidopsis_thaliana	.
Selaginella_moellendorffii	.
Physcomitrella_patens	.
Tetraselmis_GSL018	.
Auxenochlorella_protothecoides	.
Volvox_carteri	.
Chlamydomonas_reinhardtii	.
Micromonas_pusilla	.
Ostreococcus_tauri	.
Ostreococcus_lucimarinus	.
Ectocarpus_siliculosus	.
Galdieria_sulphuraria	.
1	MMAICSAH.....TTTISLRSPCTTVS.NA.....AAGLV.....QKQV.
1	.MAVSTIY.....ST.QALNSTHFLT.....SSSS.....SKQ..
1	.MAAACSS.....SGS....SSRIGWFQ.ASSSSSNIGILQHHPWRGSHASS.
1	....MACTT.....AAASTVSTPRLGAVS.GVKTSAA.....AARSVQLTS..
1	.....MSA.
1	.....M.
1	.....M.
1	.....MSA.
1	.....MAS.
1	MMKTC AFL.....AV.....AAGVATGSPWAGQASKSA
1	.MGFVLPS TTS YV VY KSS STIKSKK YNKR NY SS VS RV QV GG SKI SS WL SN RL ..

Synechococcus_PCC6301	.
Nostoc_PCC7120	.
Thermosynechococcus_elongatus	.
Zea_mays	.
Arabidopsis_thaliana	.
Selaginella_moellendorffii	.
Physcomitrella_patens	.
Tetraselmis_GSL018	.
Auxenochlorella_protothecoides	.
Volvox_carteri	.
Chlamydomonas_reinhardtii	.
Micromonas_pusilla	.
Ostreococcus_tauri	.
Ostreococcus_lucimarinus	.
Ectocarpus_siliculosus	.
Galdieria_sulphuraria	.
35	IF.....LTSINRRSGSR.....RR..GGGV SRTLLQVS
27	VF.....LY.....R.....RQ..PQTNR RFTNLIT
42	LFSF.....PK...LGARI GSS...SGGS GSS..GT..SSSNRVRV LVC C
37	AFHG.....QS VSS VSHVAALK..AA.V.....TS..KRSGRRAV VV..
4	SLKM.....NTSQLASRN SG F S..AAGR I QARAP R..ATCAARRVV VV..
1	.....MLVI..
2	AFTM.....RAP.....A..PRATAQSR..VT..ASRASRRVL V..
2	AFTM.....RAP.....A..PRATAQSR..VT..ANRAR.RSLV..
1	..M.....ATM.....TM..SATCAQPLAAR..KVRAAKRN VV..
4	SLGF.....STS.....VR..AAPVRATR DAV..KPRATRARVV..
4	ALGF.....ATA.....VR..ARPVA A QKRAT..APKARSARVV..
29	AFVGAPVGR.....SAPWGLGTRWASS..TPTSTKARP GTMSRSAR ARLEALSM
52	LFQGKEINTTRKTT KYWI ITVSS QT ALEEV FVNCGSK .GVHESAGISRSKSKV L

beta1 → **alpha1**

beta2 → **alpha2**
alpha3
beta3

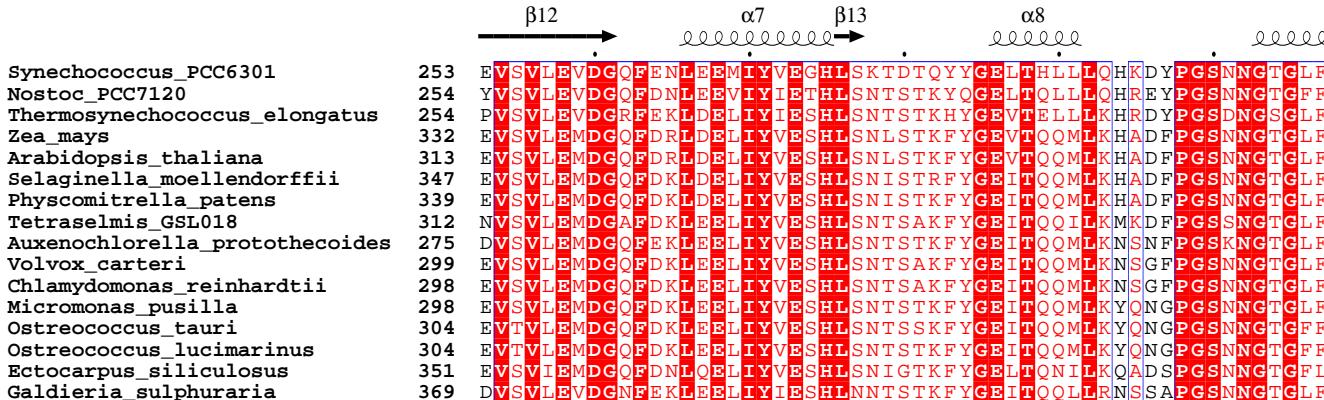
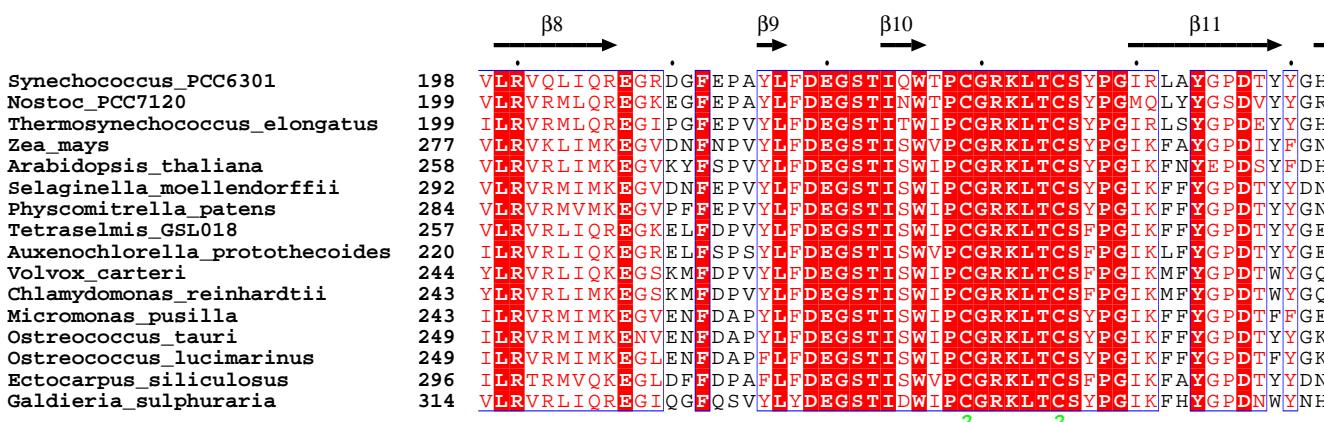
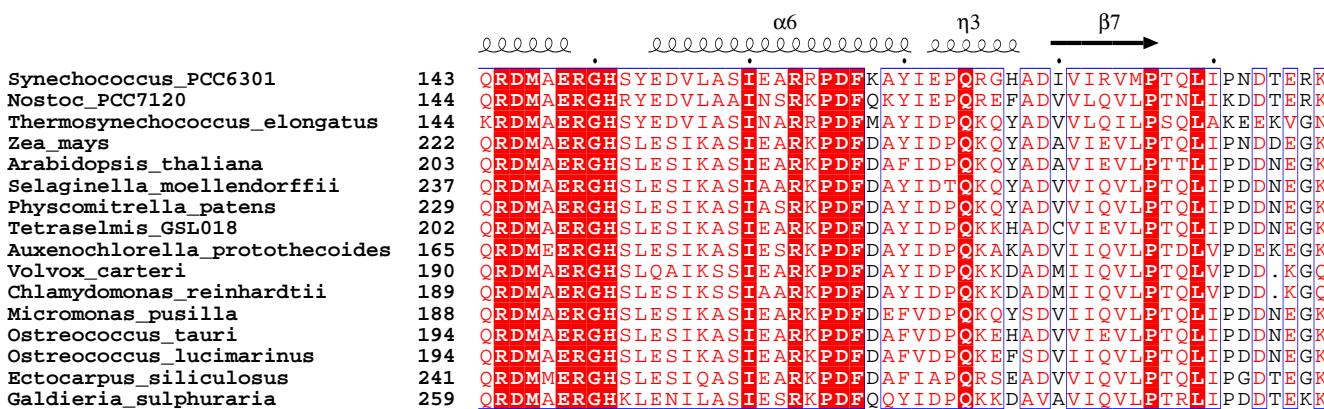
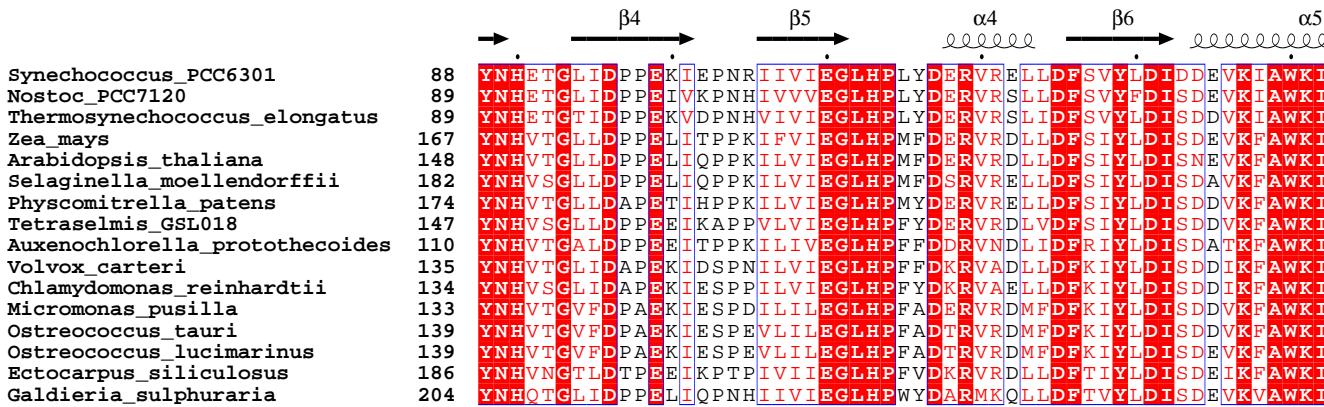
Synechococcus_PCC6301	.
Nostoc_PCC7120	.
Thermosynechococcus_elongatus	.
Zea_mays	.
Arabidopsis_thaliana	.
Selaginella_moellendorffii	.
Physcomitrella_patens	.
Tetraselmis_GSL018	.
Auxenochlorella_protothecoides	.
Volvox_carteri	.
Chlamydomonas_reinhardtii	.
Micromonas_pusilla	.
Ostreococcus_tauri	.
Ostreococcus_lucimarinus	.
Ectocarpus_siliculosus	.
Galdieria_sulphuraria	.
1	.MSKPDRV V I IGVAGDSGCGKSTF LNR LAD D LF GT .
1	MTTK PERV V I IGVAGDSGCGKSTF LRR LID D LF GE .
1	MSSKPDRV V I IGVAGDSGCGKSTF LRR LAD D LF GE .
62	CSADGNKP V I IGLAADSGCGKSTF MRR L TS V F GG AA E PPRGGNP DSNT LI
46	C . . AQ ET I V I IGLAADSGCGKSTF MRR L TS V F GG AA K PPKGG NP DSNT LI
77	AAGGDGKT I V IGLAADSGCGKSTF MRR L TS V F GG AA S PPKGG NP DSNT LI
69	CKAADGQT V V IGLAADSGCGKSTF MRR L TS V F GG AA T PPKGG NP DSNT LI
42	VRADQKT V V IGLAADSGCGKSTF MRR M TS V F GG SPK PAG GN P DSNT LI
5	RAAGPGQT V V IGLAADSGCGKSTF MRR V T G V FG GVP K P P SGG NP DSNT LI
30	VKAQDKT V V IGLAADSGCGKSTF MRR M TS I F GG V GP K P P A GG NP DSNT LI
29	VRADKD T V V IGLAADSGCGKSTF MRR M TS I F GG V GP K P P A GG NP DSNT LI
28	TRAARDGP V I IGLAADSGCGKSTF MRR M TS I F GG K AT P PEG GN P DSNT LI
34	TTAKRDGP V I IGLAADSGCGKSTF MRR M TS I F GG K AT P PEG GN P DSNT LI
34	TQAKRDGP V I IGLAADSGCGKSTF MRR M TS I F GG K AT P PEG GN P DSNT LI
76	KLGEDEKV V I IGVAA DSGCGKSTF MRR L TS I F GG DT V GP L GGG FD NGG WET NS LV
106	RNK GIERP V I IGVAA DSGCGKSTF LRR V N E I F GT KV S Q SHT PQ

1

beta2 → **eta1**
alpha2
eta2
alpha3
beta3

Synechococcus_PCC6301	.
Nostoc_PCC7120	.
Thermosynechococcus_elongatus	.
Zea_mays	.
Arabidopsis_thaliana	.
Selaginella_moellendorffii	.
Physcomitrella_patens	.
Tetraselmis_GSL018	.
Auxenochlorella_protothecoides	.
Volvox_carteri	.
Chlamydomonas_reinhardtii	.
Micromonas_pusilla	.
Ostreococcus_tauri	.
Ostreococcus_lucimarinus	.
Ectocarpus_siliculosus	.
Galdieria_sulphuraria	.
34	.E L M TV I CLDD YHS LDR K G R KE A G V T AL D P R AN NFD L MY E Q V K AL K N GET I M KPI
35	.E F M TV I CLDD YHS LDR K Q R KE T G I T AL D P R AN NFD L MY E Q I K AL K E G QT I N KPI
35	.D F M TV I CLDD YHS LDR K Q R KE M G I T AL D P R AN NFD L MY E Q V K AL K N GES I M KPI
112	S D T T TV I CLDD YHS LDR T Q R KE K G V T AL D P R AN NFD L MY E Q V K AL K N G QAV Q KPI
93	S D T T TV I CLDD YHS LDR Y Q R KE Q K V T AL D P R AN D F D L MY E Q V K AL K N G I AV E KPI
127	S D T T TV I CLDD YHS LDR T Q R KE K G V T AL D P R AN N FD L MY E Q V K AL K E G K A V Q KPI
119	S D T T TV I CLDD YHS LDR Y Q R KE K A V T AL D P R AN N FD L MY E Q V K AL K E G K S V E KPI
92	S D M T TV I CLDD YH C LDR Y Q R KE K G V T AL A P E A Q D F D L MY E Q V K AL K E G K P V Q KPI
55	S D M T TV I CLDD YH C LDR N Q R K V E K V T AL H P R A Q N F D L MY E Q V K AL K N G Q S V Q KPI
79	S D M T TV I CLDD YH C LDR N Q R K V K G V T AL A P E A Q N F D L MY E Q V K AL K E G K S V D K P I
80	S D M T TV I CLDD YH C LDR N Q R K V K G V T AL A P E A Q N F D L MY N O Q V K AL K E G K A V D K P I
78	S D T T TV L CLDD YH L NDR N Q R K E S G L T A L N L K E Q N F D L MY D Q V K AL K E G K S V E K P I
84	S E T T TV L CLDD YH L NDR A Q R K T S G L T A L N L K E Q N F D L MY D Q V K AL K E G K S V D K P I
84	S D T T TV L CLDD YH L NDR Q Q R K D S G L T A L N L K E Q N F D L MY E Q V K AL K E G K S V D K P I
131	S D L T TV L CLDD YH L NDR G Q R K V S G R T A L H T E E Q K F D L MY E O L N D L K N G K S V M K P I
149	G E L V T I CLDD F H T L D R K G R A E K K V T A L N P E A N N F E L L MY Q O I A A L K E G Y D I M KPI

1



		α 9
		e e e e e e e e e e e e e e e e
Synechococcus_PCC6301	308	QVLT ₁ GLKMRAAYE ₂ RLT ₃ SQA ₄ A ₅ PVAASV.....
Nostoc_PCC7120	309	QVLT ₁ GLKMRAAYE ₂ RLT ₃ TKE ₄ A ₅ KLAVQV.....
Thermosynechococcus_elongatus	309	QVLT ₁ GLKMRAAYE ₂ RLT ₃ S ₄ RD ₅ A ₆ ATVTNR.....
Zea_mays	387	QTIV ₁ GLKIRDLYE ₂ QIV ₃ A ₄ E ₅ R ₆ A ₇ GAPAEAAKV...
Arabidopsis_thaliana	368	QTIV ₁ GLKIRDLYE ₂ QLI ₃ A ₄ N ₅ K ₆ A ₇ TARAEEAKA...
Selaginella_moellendorffii	402	QTIV ₁ GLKIRDLV ₂ FERIT ₃ SKQG ₄ SPVGAAAATSKV.....
Physcomitrella_patens	394	QTIC ₁ GLKIREVYERIL ₂ E ₃ KQK ₄ NAVSLEGAKS..
Tetraselmis_GSL018	367	QTIV ₁ GLKIREVYERLT ₂ A ₃ K ₄ E ₅ V ₆ AKTA.....
Auxenochlorella_protothecoides	330	QVIT ₁ GLKVREVYEQLT ₂ Q ₃ RE ₄ V ₅ ARV.....
Volvox_carteri	354	QTIV ₁ GLKVREVYERIV ₂ K ₃ KD ₄ V ₅ VPA.....
Chlamydomonas_reinhardtii	353	QTIV ₁ GLKVREVYERIV ₂ K ₃ KD ₄ V ₅ VPV.....
Micromonas_pusilla	353	QTL ₁ CGLKVREL ₂ LYERIS ₃ E ₄ K ₅ E ₆ V ₇ VAAA.....
Ostreococcus_tauri	359	QTIV ₁ GLKVREVYERIS ₂ G ₃ K ₄ E ₅ V ₆ VAKA.....
Ostreococcus_lucimarinus	359	QTIV ₁ GLKVREVYERIA ₂ E ₃ K ₄ E ₅ V ₆ VVK.....
Ectocarpus_siliculosus	406	QTL ₁ VALKLREVYERIT ₂ K ₃ K ₄ T ₅ V ₆ SVKLPE ₇ SVAQ..
Galdieria_sulphuraria	424	QVLT ₁ ALKMRQLYE ₂ ELT ₃ GKS ₄ I ₅ APVLV.....

Figure S2 Alignment of group IA PRK sequences for calculation of similarity scores. Amino acid sequences of a representative set of group IA PRK homologs were aligned using the EBI Clustal-O server (<https://www.ebi.ac.uk/Tools/msa/clustalo/>). The similarity scores were calculated with ESPript (Gouet *et al.*, 1999). Secondary structure elements for PRK from *Synechococcus* sp. PCC6301 are indicated above the sequences. Similar residues are shown in red and identical residues in white on a red background. Blue frames indicate homologous regions. The Uniprot accession codes for the sequences are: A0A0H3K6J7, *Synechococcus* sp. PCC6301; Q8YPR9, *Nostoc* sp. PCC7120; Q8DHN2, *Thermosynechococcus elongatus* BP-1; B6TYM1, *Zea mays*; P25697, *Arabidopsis thaliana*; D8SU48, *Selaginella moellendorffii*; A9RPJ4, *Physcomitrella patens*; A0A061S214, *Tetraselmis* GSL018; A0A087SM57, *Auxenochlorella protothecoides*; D8TRR7, *Volvox carteri*; A8IYP4, *Chlamydomonas reinhardtii*; C1MQ62, *Micromonas pusilla*; A0A090N369, *Ostreococcus tauri*; A4RW43, *Ostreococcus lucimarinus*; D8LBI0, *Ectocarpus siliculosus*; Q8GUE1, *Galdieria sulphuraria*.