

Sustainable production of photosynthetic isobutanol and 3-methyl-1-butanol in the cyanobacterium *Synechocystis* PCC 6803

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Additional file 1

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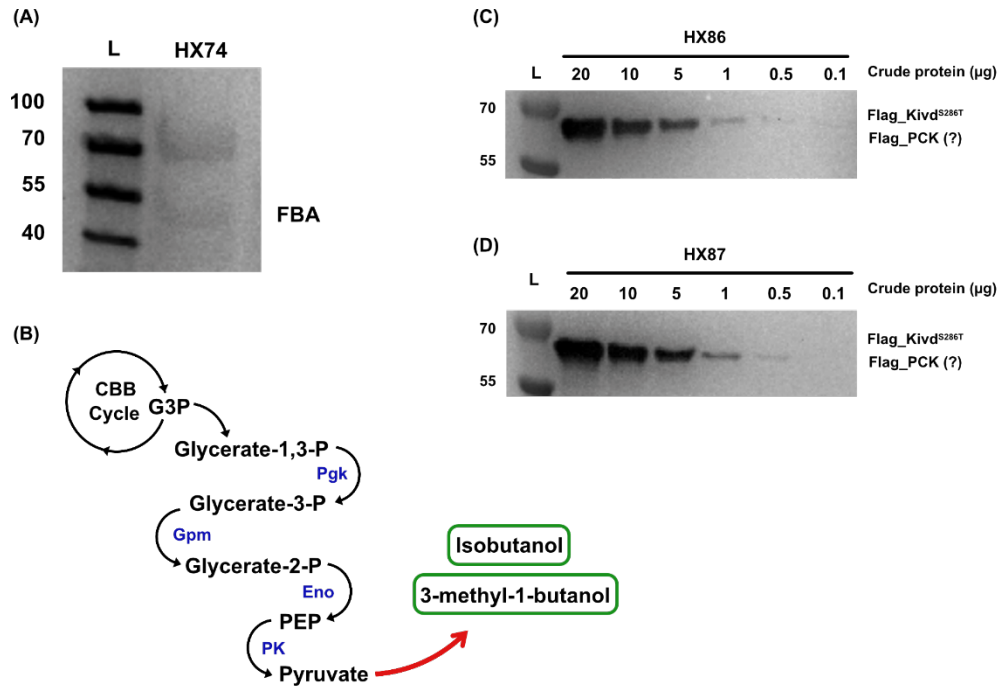


Figure S1 Western-immunoblot analysis of selected strains and central carbon metabolic pathway with selected reactions. (A) Western-immunoblot analysis of His-tagged FBA expression in *Synechocystis* PCC 6803 strain HX74. L, ladder (in kDa). 162 μ g of total soluble proteins were loaded for detection. Protein size: FBA, 39 kDa. (B) Simplified pathway between metabolites G3P and pyruvate. G3P is an intermediate metabolite of Calvin-Benson-Bassham (CBB) cycle, and pyruvate is a starting metabolite for isobutanol and 3-methyl-1-butanol biosynthesis through 2-keto acid pathway. Endogenous pathways are written in black; heterologous pathways are written in red. Abbreviations of enzymes: P_{gk}, phosphoglycerate kinase; G_{pm}, 2,3-bisphosphoglycerate-independent phosphoglycerate mutase; E_{no}, enolase; P_K, pyruvate kinase. Abbreviations of intermediates: G3P, glyceraldehyde-3-phosphate; glycerate-1,3-P, glycerate-1,3-bisphosphate; glycerate-3-P, glycerate-3-phosphate; glycerate-2-P, glycerate-2-phosphate; PEP, phosphoenolpyruvate. (C) Western-immunoblot analysis of Flag-tagged Kivd^{S286T} and PCK expression in engineered *Synechocystis* strain HX 86. Crude proteins were loaded in a series of dilutions (20 μ g, 10 μ g, 5 μ g, 1 μ g, 0.5 μ g, and 0.1 μ g). L, ladder (in kDa). Protein size: Kivd^{S286T}, 61 kDa; PCK, 60 kDa. (D) Western-immunoblot analysis of Flag-tagged Kivd^{S286T} and PCK expression in engineered *Synechocystis* strain HX 87. Crude proteins were loaded in a series of dilutions (20 μ g, 10 μ g, 5 μ g, 1 μ g, 0.5 μ g, and 0.1 μ g). L, ladder (in kDa). Protein size: Kivd^{S286T}, 61 kDa; PCK, 60 kDa.

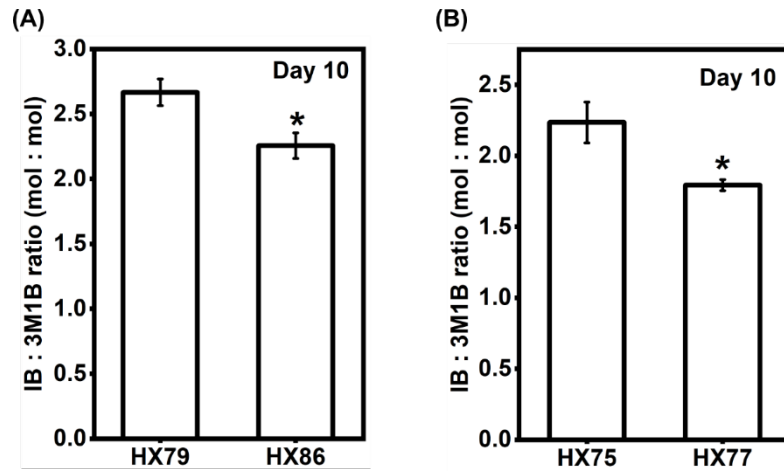


Figure S2 Molar ratio of isobutanol (IB) and 3-methyl-1-butanol (3M1B) in engineered *Synechocystis* PCC 6803 strains HX75, HX77, HX79 and HX86. (A) IB:3M1B molar ratio of strains HX79 and HX86 on day 10. (B) IB:3M1B molar ratio of strains HX75 and HX77 on day 10. Results are the mean of three biological replicates, each with three technical replicates. Error bars represent standard deviation. Asterisk represents significant difference between different strains (one-way ANOVA, * $p < 0.05$).

Table S1 Plasmids used in this study. Expressed genes in bold

Plasmid	Relevant characteristics ^a	Reference
P1	pDdh-(PtrcBCD- <i>slr1192</i> ^{OP} - <i>slI0065</i> -T)-Cm ^R	This study
P2	pDdh-(PtrcBCD- <i>slr1192</i> ^{OP} - <i>slr2088</i> - <i>slI0065</i> -T)-Cm ^R	This study
P3	pSlr0168-(PtrcBCD- <i>slI1363</i> - <i>slr0452</i> -T)-Sp ^R	This study
P4	pSlr0168-(PpsbA2- <i>slI1363</i> - <i>slr0452</i> -T)-Sp ^R	This study
P5	pEEK2-(PtrcBCD- <i>kivd</i> ^{S286T} -T)-Km ^R	(Miao et al., 2018)
P6	pDdh-(PtrcBCD- <i>kivd</i> ^{S286T} -T)-Cm ^R	(Xie and Lindblad, 2022)
P7	pSlI1564-(PtrcBCD- <i>kivd</i> ^{S286T} -T)-Sp ^R	(Xie and Lindblad, 2022)
P8	pSlr0186-(PtrcBCD- <i>kivd</i> ^{S286T} -T)-Sp ^R	(Xie and Lindblad, 2022)
P9	pPEPc-(PtrcBCD- <i>kivd</i> ^{S286T} -T)-Sp ^R	(Xie and Lindblad, 2022)
P10	pSlr1934-(PtrcBCD- <i>kivd</i> ^{S286T} -T)-Sp ^R	(Xie and Lindblad, 2022)
P11	pSlI1721-(PtrcBCD- <i>kivd</i> ^{S286T} -T)-Sp ^R	(Xie and Lindblad, 2022)
P12	pSlr0168-(PtrcBCD- <i>kivd</i> ^{S286T} -T)-Em ^R	This study
P13	pSlr0168-(PpsbA2-T)-Em ^R	This study
P14	pDdh-(PtrcBCD- <i>slr1192</i> ^{OP} - <i>alsS</i> -T)-Cm ^R	(Xie and Lindblad, 2022)
P15	pSlr0168-(PtrcBCD- <i>kivd</i> ^{S286T} -T)-Sp ^R	(Xie and Lindblad, 2022)
P16	pSlr0168-(PtrcBCD- <i>kivd</i> ^{S286T} -T)-Sp ^R	(Xie and Lindblad, 2022)
P17	pSlr0168-(PtrcBCD- <i>ilvC</i> - <i>ilvD</i> -T)-Sp ^R	(Xie and Lindblad, 2022)
P18	pNSII-(PnrsB-T)-Em ^R	This study
P19	pNSII-(PtrcBCD- <i>fbaA</i> - <i>tklA</i> -T)-Em ^R	This study
P20	pNSII-(PtrcBCD- <i>pckA</i> - <i>tpiA</i> -T)-Em ^R	This study
P21	pNSII-(PtrcBCD- <i>pyk1</i> - <i>pckA</i> -T)-Em ^R	This study

^a NSII, neutral site II, a region between *slr2030* and *slr2031*; Km^R, kanamycin resistance cassette; Sp^R, spectinomycin resistance cassette; Cm^R, chloramphenicol resistance cassette; Em^R, erythromycin resistance cassette; T, Terminator Bba_B0015. The difference between P15 and P16 is different tags linked to *kivd*^{S286T}: P15, His tag; P16, Flag tag.

Table S2 Oligonucleotides used in this study

Primer name	Oligonucleotides sequence
A. Primers for PCR amplification of homologous recombination regions	
ddh_US_BglII_F	TATAAGATCTAAACCACTGGGCCAGTAGTTC
ddh_US_Ter_EcoRI_R	TATAGAATTCAAAAAAAGGATCTCAAGAAGATCCTTTGATTTTGACGATTATGGGAAGTAGTTTAG
ddh_DS_BamHI_F	TATAGGATCCGGTTAGAAAATATCAATGTTAAC
ddh_DS_Sall_R	TATAGTCGACCGGACTATTTGGTAGAACATAAAATC
slr0168_US_BglII_F	TATAAGATCTAATGTGGAACGGGGCCTAGACAC
slr0168_US_Ter_EcoRI_R	TATAGAATTCAAAAAAAGGATCTCAAGAAGATCCTTTGATTTTAGATTAATTCAACAGTAATATTTTC
slr0168_DS_BamHI_F	TATAGGATCCCTCAGGGGCATTATCGGAGCAAG
slr0168_DS_XhoI_R	TATACTCGAGGATCGCCAAAGATGTTGGCCGTCGGG
NSII_US_BglII_F	TATAAGATCTTTGTAAAAAATCATCGGGCCGGTC
NSII_US_Ter_EcoRI_R	TATAGAATTCAAAAAAAGGATCTCAAGAAGATCCTTTGATTTTCCAAATGGTTTGAGCAAAGTTATTC
NSII_DS_BamHI_F	TATAGGATCCGTGGTCATTCTCAAGGAGTTGGTGGCTAAGTTG
NSII_DS_Sall_R	TATAGTCGACCGGCCCGCCACAATAGGGGAG
B. Primers for <i>Synechocystis</i> colony PCR to verify genomic integration	
ddh_UUS_F	CAGCCGTACCACTTCTTCTAC
slr0168_UUS_F	ATGTGGAGTTTGTGGGTATTG
NSII_UUS_F	GCTTTCTCCCCTCTACGTTTCCATCCATG
slr1192 ^{OP} _SR	AGTTACTAATACCCCATTCGTTG
slr1363_SR	TTTACTCCCGGAATATAAACCC
kivd ^{S286T} _SR	TTGGCATTACCCACCCATTTC
EmR_SR	CGGTACCAATTTCATAAACGGTGTC
fbaA_SR	TACCGTAACCGTTTTTCGGCAG
pckA_SR	GTTCTTGCGGGGTCAAACCATTC
pyk1_SR	ATAAATTTACGGGGTTAATCAG
C. Primers for PCR with <i>Synechocystis</i> genomic DNA to examine fully segregation	
ddh_SF	AGTCCATGTACCATCCTATTCTC
ddh_SR	GCTCTTCCTCTTCTTCGTAAAC
slr0168_SF	CGGCAATGATCCAGAGAATG
slr0168_SR	CTATCTGCCAAAGCTGCTTC
NSII_SF	ACCCCGGCAATTTTGTGAA
NSII_SR	AGTAACTTACGACGGGTGGG

D. Primers for <i>Synechocystis</i> colony PCR to verify self-replicating plasmid conjugation	
VF2	TGCCACCTGACGTCTAAGAA
kivd ^{S286T} _SR	TTGGCATTACCCACCCATTTC
E. Primers for PCR amplification of genes	
kivd ^{S286T} _BgIII_F	TATAAGATCTATGTACACCGTGGGAGATTAC
SpeI_PstI_R	CTGCAGCGGCCGCTACTAG
slr1192 ^{OP} _BgIII_F	TATAAGATCTATTAAAGCCTACGCCGCCTTG
slI1363_BgIII_F	TATAAGATCTCAAACTTGATTTTACAACATTTC
slI1363_His_XbaI_F	TATATCTAGAATGCATCATCACCATCACCACGGTAGCGGAAGTGGATCTCAAAAC
XbaI_F	TATATCTAGATAGTGGAGGTACTAGAATG
fbaA_BgIII_F	TATAAGATCTGCCTTAGTGCCCATGC
tktA_RBS_Strep_XbaI_F	TATATCTAGATAGTGGAGGTACTAGAATGTGGAGTCATCCTCAGTTCGAGAAGGGTAGCGGAAGTG GATCTGTTGTTGCTAC
pckA_BgIII_F	TATAAGATCTCGCGTTAACAATGGTTTGACCCC
pckA_Spe_Pst_R	TATACTGCAGCGGCCGCTACTAGTTTACAGTTTCGGACCAGCCGCTAC
tpiA_RBS_Flag_F	TATATCTAGATAGTGGAGGTACTAGAATGGACTACAAGGATGACGATGACAAGGGTAGCGGAAGTG GATCTCGACATCCTTTAGTGATGGGTAAC
tpiA_Spe_Pst_R	TATACTGCAGCGGCCGCTACTAGTTTAAGCCTGTTTAGCCGCTTC
pyk1_BgIII_F	TATAAGATCTCCCGCCCTGATTAACC
pckA_RBS_Flag_XbaI_F	TATATCTAGATAGTGGAGGTACTAGAATGGACTACAAGGATGACGATGACAAGGGTAGCGGAAGTG GATCTCGCGTTAACAATGGTTTGACCCC

Table S3 Sequences of all genes used in this study

Gene	Nucleotide sequence (5'-3')
<i>kivd</i> ^{S286T}	ATGTACACCGTGGGAGATTACTTACTGGACCGCTTACATGAACTGGGTATTGAA GAAATTTTTGGCGTGCCCGGAGATTACAACCTTACAATTTTTAGATCAAATTATTA GTCATAAAGACATGAAATGGGTGGGTAATGCCAACGAACTGAATGCCTCCTATA TGGCTGATGGGTACGCCCGTACCAAAAAAGCCGCTGCCTTTTTGACCACTTTT GGCGTGGGTGAACTGTCCGCCGTTAATGGCTTGGCTGGTAGTTATGCCGAAAA CTTACCCGTGGTTGAAATTGTGGGGTCCCCACCTCCAAAGTTCAAACGAAG GAAATTTGTGCATCACACCTTGGCCGATGGCGACTTTAAACATTTTATGAAAT GCACGAACCCGTGACTGCTGCCCGGACCTTGTTAACTGCCGAAAATGCTACCG TGGAAATTGATCGTGTTCTGAGTGCTCTGTTGAAAGAACGGAAACCCGTGTACA TAACTTGCCCGTGGACGTTGCTGCCGCTAAAGCCGAAAAACCTCCTTACCC CTGAAAAAAGAAAATTCCACCAGTAACACTTCTGATCAAGAAATTTTAAACAAAA TTCAGGAATCCCTGAAAAACGCCAAAAAACCCATTGTTATTACTGGCCACGAAA TTATTAGTTTTGTTTTGAAAAAACCGTGACTCAATTTATTTCCAAACCAAATT GCCCATTAACACTCTGAATTTTGGGAAATCCAGTGTGGATGAAGCCCTGCCCT CCTTTTTGGGCATTTATAATGGCACCTTGAGTGAACCCAACCTGAAAGAATTTG TTGAAAGCGCTGATTTTATTTTGATGCTGGGGGTGAAATTGACCGACACCTCTA CTGGAGCCTTTACCCATCACCTGAACGAAAAACAAATGATTAGTCTGAACATTG ATGAAGGTAAAATCTTTAACGAACGGATTCAAACTTTGATTTTGAATCCTTGAT TTCCAGTTTACTGGACTTATCTGAAATTGAATACAAAGGGAAATACATTGATAAA AAACAGGAAGACTTTGTGCCCAGCAATGCTTTGTTATCTCAAGATCGCCTGTGG CAGGCCGTTGAAAATTTGACTCAAAGTAACGAAACCATTGTGGCTGAACAGGG CACCTCCTTTTTCGGAGCCAGCTCTATTTTTCTGAAAAGCAAATCTCATTTTATT GGACAACCCTTATGGGGGAGTATTGGATATACCTTTCCCGCCGCTTTGGGCAG CCAGATTGCCGATAAAGAATCTCGCCACCTGTTGTTTATTGGGGACGGCTCCTT GCAATTGACCGTTCAGGAATTAGGCCTGGCCATTTCGCGAAAAAATTAACCCCAT TTGTTTTATTATTAACAACGATGGCTACACCGTGGAACGTGAAATTCATGGTCC CAATCAATCCTATAACGACATTCCCATGTGGAATTACTCCAAATTGCCCGAAAG TTTTGGTGCCACTGAAGATCGGGTGGTTTTCTAAAATTGTGCGCACCGAAAATGA ATTTGTGAGCGTTATGAAAGAAGCCCAGGCTGACCCCAACCGTATGTACTGGA TTGAATTGATTCTGGCCAAAGAAGGTGCCCCCAAAGTGCTGAAGAAAATGGGA AAACTGTTTGCTGAACAGAATAAAAGCTAA
<i>alsS</i>	ATGTTGACCAAAGCCACTAAAGAACAAAAATCCTTAGTGAAAAACCGCGGTGCC GAATTGGTGGTTGATTGTTTAGTGGAACAGGGGGTGACCCATGTTTTTGGGATT CCCGGAGCCAAAATTGATGCTGTGTTTGACGCCTTGCAAGATAAAGGTCCCGA AATTATTGTGGCCCGCCACGAACAAAACGCTGCTTTTATGGCCAGGCTGTGG GGCGTTTAACCGGCAAACCCGCTGTGTTTCTGGTTACTAGCGGCCCCCGGTGC TTCTAATTTAGCCACCGGGTTGTTAACCGCCAACACTGAAGGAGATCCCGTGG TTGCCCTGGCTGGCAATGTGATTGCGGGCCGACCGCTTGAAACGTACCCATCAA TCCCTGGATAACGCCGCTTTGTTTCAGCCATTACTAAATATAGTGTGGAAGTT CAAGATGTGAAAAATATTCCCGAAGCTGTTACCAACGCCTTTTCGTATTGCCTCC GCTGGGCAAGCCGGAGCCGCTTTTGTGAGTTTTCCCAGGATGTGGTTAACGA AGTTACCAACACTAAAAACGTGCGGGCCGTTGCCGCTCCCAAATTGGGACCCG CCGCTGATGACGCCATTAGCGCCGCTATTGCTAAAATTCAAACCGCCAAATTGC CCGTGGTTCTGGTGGGGATGAAAGGCGGTGCCCCGAAGCCATTAAAGCTGT GCGTAAACTGTTGAAAAAAGTGCAATTACCCTTTGTTGAAACCTATCAGGCCGC TGGTACTTTGAGTCGGGATTTAGAAGACCAATACTTTGGCCGTATTGGTTTATTT CGGAATCAACCCGGAGACTTACTGTTGGAACAGGCCGATGTGGTTCTGACCAT TGGCTATGACCCCATTAACATACGATCCCAAATTTTGAACATTAAACGGCGACCG CACTATTATTCATTTGGATGAAATTATTGCTGATATTGACCACGCCTATCAACCC

	GACTTAGAACTGATTGGTGATATTCCAGTACCATTAATCATATTGAACACGATG CTGTGAAAGTTGAATTTGCCGAACGTGAACAGAAAATTCTGAGCGATTTGAAAC AATACATGCATGAAGGGGAACAGGTGCCCGCTGACTGGAAATCTGATCGGGCC CACCCCTTGGAAATTGTGAAAGAATTACGCAATGCCGTTGATGACCATGTGACC GTTACTTGCATATTGGCTCCACGCCATTTGGATGTCCCGGTATTTTCGCAGT TACGAACCCTTGACCTTAATGATTAGCAACGGCATGCAAACCTTTAGGCGTGGCT TTGCCCTGGGCTATTGGAGCTTCTTTAGTGAAACCCGGTGAAAAAGTGTTTCC GTTAGTGGTGATGGGGGATTTCTGTTTAGTGCTATGGAATTGGAAACCGCTGT GCGGTTAAAGCCCCCATTGTGCATATTGTTTGAATGACTCCACCTATGATAT GGTGGCCTTTCAACAGTTGAAAAAATACAATCGCACCTCCGCCGTGGATTTTG CAACATTGATATTGTTAAATACGCTGAATCCTTTGGGGCCACCGGATTACGTGT GGAATCTCCCGACCAATTAGCTGATGTTCTGCGGCAGGGGATGAATGCCGAAG GACCCGTGATTATTGATGTGCCCGTTGATTACAGCGACAATATTAACCTTAGCCT CTGATAAACTGCCCAAAGAATTTGGCGAACTGATGAAAACCAAAGCCTTGTA
slI0065	ATGGAATTTTATCCCAATGGTCATCGGCGCTCCCCCTCCTTGCCTCCCATGAAA CATACCTTGTCCGTGTTAGTGGAAGATGAAGCCGGCGTGTTGACCCGCATTGC CGGTTTATTTGCCCGTCGGGGGTTTAATATTGAATCCTTGGCCGTGGGGAGTG CCGAACAAGGCGATGTGAGTCGTATTACTATGGTGGTGCCCGGCGATGAAAAT ACCATTGAACAATTAACCAACAATTGTACAAATTAGTGAATGTGATTAAAGTGC AAGATATTACCGAAACCCCTGTGTGGAACGTGAATTGATGTTAGTGAAAGTGT CCGCCAATGCCCCCAATCGGGCCGAAGTGATTGAATTGGCCCAAGTGTTTCGC GCCCGTATTGTGGATATTAGTGAAGATACCGTGACCATTGAAGTGGTGGGCGA TCCCGGTAAAATGGTGGCCATTTTGC AAATGTTAGCCAAATTTGGCATTAAAGA AGTGGCCCGGACCGGTAAAATTGCCTTAGTGCGCGAATCCGGCGTGAACACC GAATATTTGAAATCCTTAGAAAGTAAATTTTAA
slr2088	ATGGTGGCCTCCATTCCCAATCCCAAACCAATTTTCTGAAAACCGTGCCCTCC CAACGTCAAACCGGTGCCTACATTTTGATGGATAGTTTGAAACGGCATGGCGT GAAACATATTTTGGTTATCCCGGCGGTGCCATTTTACCCATTTATGATGAATTG TATCGCTTTGAAGCCGCGGTGAAATTGAACATATTTTGGTGCATGAACAA GGTGCCTCCCATGCCGCCGATGGTTATGCCCGTGCCACCGGTAAAGTGGGCG TGTGTTTTGGGACCAGTGGTCCCGGCGCCACCAATTTAGTGACCGGCATTGCC AATGCCCATTTGGATTCCGTGCCTATGGTGGTGATTACCGGTCAAGTGGGGCG GGCCATGATTGGTAGTGATGCCTTTCAAGAAATTGATATTTTGGGATTACCTTA CCCATTGTGAAACATTCTATGTGGTGCGGAGTGCCGCCGATATGGCTCGTAT TGTGACCGAAGCCTTTTATTAGCCTCCACCGGCCGGCCCGGTCCCGTGTTAA TTGATATTTCCAAAGATGTGGGCTTGGAAGAATGTGAATATATTCCCTTAGATC CCGGCGATGTGAATTTGCCCGGCTATCGTCCCACCGTGAAAGGTAATCCCCGG CAAATTAATGCCGCCTTACAATTGTTAGAACAAGCCCGGAATCCCTTGTTATAT GTGGGCGGCGGCCGCAATTGCTGCTAATGCTCATGCCCAAGTGCAAGAATTTGC CGAACGCTTTCAATTACCCGTGACCACCACCTTGATGGGTATTGGGGCCTTTG ATGAAAATCATCCCTTATCCGTGGGGATGTTGGGCATGCATGGCACCGCCTAT GCCAATTTTGCCGTGAGTGAATGTGATTTGTTAATTGCCGTGGGTGCCCGGTTT GATGATCGCGTGACCGGCCAAATTGGATGAATTTGCCAGTCGCGCCAAAGTGAT TCATATTGATATTGATCCCGCCGAAGTGGGCAAAAATCGTGCCCCCGATGTGC CCATTGTGGGTGATGTGCGCCATGTGTTAGAACAATTGTTACAACGGGCCCCGC GAATTGGATTATCCCACCCATCCCCATACCACCAAGCCTGGTTAAATCGTATT GATCATTGGCGGACCGATTATCCCTTGCAAGTGCCCCATTATGAAGATACCATT GCTCCCCAAGAAGTGGTGCATGAAATTGGCCGTCAAGCCCCCGATGCCTATTA TACCACCGATGTGGGTCAACATCAAATGTGGGCCGCCCAATTTTAAATAATGG TCCCGTTCGGTGGATTTCCAGTGCCGGCTTAGGCACTATGGGCTTTGGTTTGC CCGCCGTATGGGCGCCAAAGTGGGTGTGGGGGATGAAGCCGTGATTTGTAT TTCCGGTGATGCCAGTTTTCAAATGAATTTGCAAGAATTAGGGACCTTGGCCCA

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<i>ilvC</i>	ATGGCCAACCTATTTTAACACCCTGAACTTACGCCAACAACTGGCTCAACTGGGG AAATGCCGCTTTATGGGCCGTGACGAATTTGCTGACGGAGCCAGTTATTTGCA AGGCAAAAAAGTGGTTATTGTGGGCTGTGGTGCCCAAGGGCTGAATCAGGGAT TGAACATGCGCGATTCCGGTCTGGACATTAGTTATGCCTTGCGTAAAGAAGCTA TTGCCGAAAAACGTGCCTCCTGGCGGAAAGCTACCGAAAACGGCTTTAAAGTG GGTACTTACGAAGAATTAATTCCCCAAGCCGATTTAGTTATTAATCTGACCCCC GATAAACACATAGCGACGTGGTTCGGACTGTGCAGCCCTTAATGAAAGATGG GGCCGCTCTGGGATATTCTCACGGCTTTAATATTGTGGAAGTTGGGGAACAAAT TCGCAAAGACATTACCGTGGTTATGGTGGCCCCCAAATGCCCCGGCACTGAAG TTCGCGAAGAATACAAACGTGGGTTTGGAGTGCCACCTTGATTGCCGTTTCAT CCCGAAAATGATCCCAAAGGCGAGGGTATGGCTATTGCCAAAGCCTGGGCCG CTGCCACCGGCGGTACCGTGCTGGCGTGCTGGAATCCAGTTTTGTGGCTGA AGTTAAATCCGATTTGATGGGTGAACAAACCATTTTGTGTGGCATGTTACAGGC CGGGAGTTTGCTGTGCTTTGATAAATTAAGTGGAAGAAGGAACCGACCCCGCCT ATGCTGAAAAATTGATTCAATTTGGGTGGGAAACCATTACTGAAGCCCTGAAAC AAGGCGGCATTACCTTAATGATGGATCGTCTGTCCAACCCCGCCAACTGCGG GCCTACGCTCTGAGTGAACAATTGAAAGAAATTATGGCCCCCTTATTTAGAAA CACATGGATGACATTATTTCCGGAGAATTTAGCTCTGGCATGATGGCCGATTGG GCTAATGATGACAAAAAACTGTTGACCTGGCGGAAGAAACCGGCAAACTGC CTTTGAAACTGCTCCCCAATATGAAGGGAAAATTGGAGAACAGGAATACTTTGA TAAGGGTGTGTTGATGATTGCTATGGTGAAAGCTGGGGTTGAATTAGCCTTTGA AACTATGGTGGATAGTGGTATTATTGAAGAAAGCGCCTATTACGAATCTTTGCA TGAATTGCCCTTAATTGCCAATACCATTGCTCGGAAACGCTTATATGAAATGAA CGTGGTTATTAGCGATACTGCCGAATATGGCAATTACTTGTTTTCTTACGCTTGT GTGCCCTTACTGAAACCCTTTATGGCCGAATTGCAACCCGGCGACTTAGGCAA AGCCATTCCCGAAGGTGCTGTGGATAATGGGCAGTTACGGGACGTTAACGAAG CCATTCGCTCCACGCTATTGAACAGGTTGGGAAAAAATTGCGTGGATACATGA CCGATATGAAACGGATTGCTGTGGCTGGTTAA
<i>sII1363</i>	ATGCAAAACTTGATTTTACAACATTTGCAAGATCGTATTAGTCGGCCCCGCCTTT GCCATGATTAAAAGTTTACAATCCACCATTCAAAGTCAACAGGGTGATTCTCTATA TGGCCCGTATGTATTATGATCAAGATGCCAATTTGGATTTGTTAGCCGGGAAAA CCGTGGCCATTATTGGCTATGGTAGTCAAGGGCATGCCCATGCCTTGAATTTAA AAGATTCCGGCGTGAATGTGGTGGTGGGTTTATATTCCGGGAGTAAATCCGTG GCCAAAGCCGAAGGGGCCGCTTGAAGTGTTATCCGTGGCCGAAGCCGCCA AAGCCGCCGATTTGATTATGATTTTGTACCCGATGAAGTGCAAAAAACCGTGT ATGAAGCCGAAATTGCCCCCAATTTAGTGGCCGGTAATGTGTTGTTGTTTGGCC ACGGCTTTAACATTAACCTTTGCCCAAATTGTGCCTCCCGCCGATGTGGATGTGG TGATGGCTGCTCCCAAAGGTCCCGGCCATTTGGTGCGTCGGACCTATGAACAA GGCCAAGGTGTGCCCGCCTTATTTGCCGTGTATCAAGATGCCAGTGGGCAAGC CCGCGATTATGCTATGGCCTATGCCAAAGGTATTGGCGGCACCCGCGCCGGC ATTTTGGAAACCACCTTTGCGGAAGAAACCGAAACCGATTGTTTGGTGAACAA GTGGTGTATGTGGTGGCTTGACCGCCTTGATTAAAGCCGGCTTTGATACCTTA GTGGAAGCCGGTTATCAACCCGAATTGGCCTACTTTGAATGTTTGCATGAAGTG AAATTGATTGTGGATTTAATTGTGGAAGGTGGGTTGGCCAAAATGCGCGATAGT ATTTCCAATACCGCCGAATATGGCGATTAAACCCGCGGTCCCGTATTGTGACC

	GAAGAAACCAAAGCCGAAATGCGCCAAATTTTGGATGAAATTCATCCGGCCAA TTTGCCCGTGAATTTGTGTTAGAAAATCAAGCCGGGAAACCCGGTTTTACCGCC ATGCGTCGGCGCGAAAGTGAAGAATTGATTGAAGAAGTGGGTAAAGATTTGCG TGCCATGTTTTCTGGTTAAAAGATCGGTAA
<i>ilvD</i>	ATGCCCAAATATCGTAGTGCCACCACTACCCACGGCCGTAATATGGCTGGTG CCGCGCTTTGTGGCGTGCTACTGGAATGACCGACGCTGATTTTGGTAAACCA TTATTGCCGTGGTTAACTCCTTTACCCAATTTGTGCCCCGGCCATGTGCACCTGC GGGATTTGGGAAAATTAGTGGCCGAACAGATTGAAGCCGCTGGCGGTGTTGCT AAAGAATTTAATACCATTGCCGTGGATGACGGGATTGCTATGGGACATGGGGG AATGCTGTATAGTTTGCCAGCCGTGAATTAATTGCCGATTCTGTTGAATACAT GGTGAATGCTCACTGCGCCGACGCTATGGTGTGCATTAGCAACTGTGATAAAA TTACTCCCGGCATGTTGATGGCCTCTTTGCGCTTAAATATTCCCGTTATTTTTGT GTCCGGCGGTCTATGGAAGCCGGTAAAACCAAATTGAGTGACCAAATTATTAA ACTGGACTTGGTGGATGCCATGATTGAGGGGGCTGATCCCAAAGTTTCCGACA GTCAAAGCGATCAGGTGGAACGCAGTGCTGTCCACCTGCGGCTCTTGTTCC GGCATGTTTACTGCCAATAGCATGAACTGTTTGACCGAAGCCTTGGGGCTGTC TCAACCCGGTAATGGCTCCTTGTTAGCCACTCATGCTGATCGCAAACAGTTGTT TTTAAACGCCGGCAAACGCATTGTGGAATTGACCAAACGTTACTACGAACAAAA CGATGAAAGTGCCCTTACCCCGTAACATTGCTAGCAAAGCCGCTTTTGAAAATGC CATGACCCTGGATATTGCTATGGGCGGCTCCACCAACACCGTGTTGCACCTGT TGGCCGCTGCCAAGAAGCCGAAATTGATTTTACTATGATGAGTGACATTGATA AACTGAGCCGTAAAGTTCCCAATTGTGTAAAGTGGCCCCCTCCACCCAGAAA TATCATATGGAAGATGTTACCCGGGCCGGCGGTGTGATTGGGATTTTAGGAGA ACTGGACCGGGCCGGGTACTGAATCGCGATGTTAAAAACGTGCTGGGCTTGA CTTTACCCCAAACCTTAGAACAGTACGATGTTATGCTGACCCAAGATGACGCCG TGAAAAATATGTTTCGTGCTGGACCCGCTGGTATTGCACTACCCAAGCCTTTA GTCAGGACTGCCGGTGGGATACCTTAGATGACGATCGTGCCAACGGCTGTATT CGGTCTCTGGAACATGCTTATTCCAAAGATGGGGGATTGGCCGTGTTATACGG CAATTTTGCTGAAAACGGTTGCATTGTTAAACTGCCGGCGTGACGATTCTAT TTTGAAATTTACCGGTCCCGCCAAAGTTTATGAATCCCAAGACGATGCCGTGGA AGCTATTTTAGGCGGTAAAGTGGTTGCCGGTGATGTGGTTGTGATTCCGTATG AAGGGCCCAAAGGGGGACCCGGAATGCAAGAAATGTTGTACCCACCTCTTTT CTGAAAAGTATGGGCTTGGGTAAAGCCTGTGCTCTGATTACTGATGGACGTTTT TCCGGCGGCACCTCCGGATTATCCATTGGACACGTGAGCCCCGAAGCTGCCA GTGGGGGAAGCATTGGGTTAATTGAAGACGGCGATTTGATTGCCATTGACATT CCCAATCGGGGCATTCAATTGCAGGTGTCCGATGCCGAATTAGCTGCTCGTCG GGAAGCTCAAGATGCTCGCGGTGATAAAGCCTGGACTCCCAAAAATCGTGAAC GGCAAGTTAGTTTTGCCTTGCGCGCCTACGCTAGTTTAGCCACCAGCGCTGAC AAAGGTGCCGTGCGTGATAAATCCAAATTAGGCGGTAA
<i>slr0452</i>	ATGTCCAATAATCCCCGCAGTCAAGTGATTACCCAAGGCACCCAACGCAGTCC CAATCGTGCCATGTTACGGGCCGTGGGTTTTGGGGATGATGATTTTACCAAAC CCATTGTGGGTATTGCCAATGGGTATTCCACCATTACCCCCTGTAATATGGGCA TTAATGATTTGGCCTTGCGGGCTGAAGCTGGTTTACGTACCGCCGGTGCTATG CCCCAATTGTTTGGGACCATTACCATTCCGATGGCATTAGTATGGGGACCGAA GGCATGAAATATTCCTTGGTGAGTCGTGAAGTGATTGCCGATAGTATTGAAACC GTGTGTAATGGGCAACGGATGGATGGCGTGTTAGCCATTGGCGGTTGTGATAA AAATATGCCCGGTGCCATGATTGCTATGGCCCGTTTGAATATTCCCTCCATTTT TGTGTATGGGGGCACCATTAACCCCGGTCATTATGCCGGTGAAGATTTAACCG TGGTGTCCGCCTTTGAAGCCGTGGGTCAATATAGTGCCGGGAAAATTGATGAA GAAACCTTGTATGGCATTGAACGGAATGCTTGTCCCGGCGCTGGTAGTTGTGG TGGGATGTTTACCGCCAATACCATGTCCAGTGCCCTTTGAAGCTATGGGCATGTC CTTACCCTATTCTCCACTATGGCCGCGGTGGATGGCGAAAAAGCCGATTCCA

	CCGAAGAAAGTGCCAAAGTGTTGGTGGAAGCCATCAAAAAACAAATTTTGCCCA GTCAAATTTTAACCCGGAAAGCCTTTGAAAATGCCATTGCCGTGATTATGGCCG TGGGCGGTAGTACCAATGCCGTGTTACATTTGTTAGCCATTGCCAATACCATTG GGGTGCCCTTGTCCTTAGATGATTTTGAACCAATTCGCCATAAAGTGCCCGTGT TGTGTGATTTAAACCCTCCGGCAAATATGTGACCACCAATTTGCATGCCGCCG GGGGCATTCCCCAAGTGATGAAAATTTGTTAGTGAACGGGATTTTGCATGGC GATGCCTTAACCATTACCGGCCAAACCATTGCCGAAGTGTTAGCCGATATTCCC GATCAACCTCCCGCCGGCCAAGATGTGATTCATAGTTGGGATGATCCCGTGTA TCAAGAAGGGCATTGCGCGTGTTAAAGGGTAATTTGGCCACCGAAGGGTCCG TGGCCAAAATTAGTGGTGTGAAAAACCCGTGATTACCGGGCCCGCCAAAGTG TTTGAATCCGAAGAAGATTGTTTGAAGCCATTTTAGCCGGCAAATTCAGCC GGTGATGTGGTGGTGGTGCGGTATGAAGGCCCAAGGTGGGCCCGGTATGC GCGAAATGTTAGCTCCACCTCCGCTATTATTGGTGCTGGTTTGGGTGATAGTG TGGGGTTAATTACCGATGGCCGCTTTTCCGGCGGCACCTATGGCTTGGTGGTG GGTCATGTGGCTCCCGAAGCCTATGTGGGCGGCGCCATTGCCTTGGTGCAAG AAGGCGATCAAATTACCATTGATGCCGGTAAACGTTTGTACAATTAAACATTAG TGAAGAAGAATTGGCTCAACGGCGCGCCCAATGGACCCCTCCCCAACCCCGG TATCCCCGCGGCATTTTGGCCAAATATGCCAAATTAGTGTCCAGTTCAGTTTG GGTGCCGTGACCGATATTGATTTGTTTTAA
<i>slr1192^{OP}</i>	ATGATTAAAGCCTACGCCGCCTTGGAAGCCAATGGAAAATTACAGCCCTTTGAA TACGATCCCGGTGCCCTGGGTGCTAACGAAGTTGAAATTGAAGTGCAATATTGT GGCGTGTGTCATAGTGATTTGTCCATGATTAAACAACGAATGGGGTATTAGTAAC TATCCCTTAGTGCCCGGTCATGAAGTGGTGGGGACCGTGGCTGCTATGGGCG AAGGTGTGAATCATGTGGAAGTGGGGGATTTAGTGGGGTTGGGCTGGCATAGT GGCTATTGTATGACCTGTCATAGTTGTTTGTCCGTTATCATAACTTGTGTGCC ACCGCCGAATCCACCATTGTGGGGCATTATGGCGGTTTTGGCGATCGGGTGC GCGCCAAAGGGGTGAGTGTGGTGAAATTGCCCAAAGGCATTGATTTGGCCTCC GCCGGTCCCTTATTTTGTGGTGGCATTACCGTGTTTAGTCCTATGGTGGAAATTG TCCTTAAACCCACCGCCAAAGTGGCCGTGATTGGCATTGGTGGGTAGGTCA TTTGGCCGTGCAATTTTTGCGTGCCTGGGGCTGTGAAGTGACCGCCTTTACCA GTTCCGCCCGGAAACAAACCGAAGTGTTGGAATTAGGGGCCCATCATATTTTA GATAGTACCAATCCCGAAGCCATTGCCTCCGCCGAAGGCAAATTTGATTACATT ATTAGTACCGTGAACCTTGAATTTGGATTGGAACCTGTACATTTCCACCTTGGCT CCCCAAGGTCATTTTCATTTTGTGGGCGTGGTGTGGAACCCTTGGATTTAAAT TTGTTTCCCTTGTGATGGGTCAACGCTCCGTGAGTGCTTCCCCCGTGGGGAG TCCCGCCACCATTGCCACCATTGTAGATTTTGGCGTGCATGATATTAACC CGTGGTGGAAACAATTTTCTTTGATCAAATTAACGAAGCCATTGCTCATTTGGA AAGTGGTAAAGCCCATTATCGGGTGGTGTGTCCATTCTAAAACTAA
<i>fbaA</i>	ATGGCCTTAGTGCCCATGCGCCTGCTGCTGGACCACGCTGCCGAAAACGGTTA CGGTATTCCCGCCTTTAATGTGAATAATATGGAACAGATTATTTCTATTATGCAA GCCGCTGATGAAACCGACTCCCCCGTGATTTTGCAAGCCAGTCGGGGCGCCC GGTCCTATGCCGGAGAAAATTTCTGCGTCATTTAGTGCTGGGTGCTGTTGAAA CCTACCCCCACATTCCCATTGCCATGCATCAAGATCATGGCAATTCCCCCGCTA CCTGTTATTCCGCCATTCGGAACGGATTTACCTCCGTGATGATGGATGGCAGC TTAGAAGCTGACGCCAAAACCCCGCTAGTTTTGAATACAATGTGAACGTTACT GCCGAAGTGGTTAAAGTGGCTCATTCTGTTGGTGCCTCCGTGGAAGGGGAACT GGGATGCTTGGGCTCTTTAGAAACCGGGCAAGGAGAAGCCGAAGATGGTCAT GGCTTTGAAGGGAAACTGGATCACAGTCAATTGTAACTGACCCCGAAGAAGC CGTGGAATTTGTTAATAAAACCCAGGTTGACGCTTTGGCCGTGGCTATTGGCAC CAGTCATGGCGCCTATAAATTTACCCGCAAACCCACTGGAGAAGTGTTAGCCAT TAGCCGTATTGAAGAAATTCACCGGCTGTTGCCCAATACCCATCTGGTTATGCA CGGGTCCAGTAGCGTGCCCCAAGAATGGATTGATATGATTAAACGAATTTGGCG

	GTGCCATTCCCGAAACCTACGGCGTGCCCGTTGAAGAAATTCAGAAAGGAATT AAATCCGGCGTGCGTAAAGTTAATATTGATACCGACAACCGCTTGGCCATTACT GCCGCTTTTCGTGAAGCCGCTGCCAAAGATCCCAAAATTTTGACCCCGGCA TTTTCTGAAACCCAGCATTAAATACATGAAACAAGTGTGTGCCGATCGCTACCA ACAGTTTTTGGACCGCCGGCAACGCTTCCAAAATTAACAGTTGACTTTAGATGA CTATGCTGCCAAATACGCCAAAGGGGAACTGACTGCCACTTCTCGCACTTCTG TTGCTGTTTAA
<i>tktA</i>	ATGGTTGTTGCTACCCAAAGTCTGGACGAACGTGTCTATTAACGCCATTTCGGTTT CTGGCTGTTGACGCCATTGAAAAAGCTAAAAGCGGCCATCCCGGCTTGCCTAT GGGCGCCGCTCCTATGGCCTTTACCCTGTGGAACAAATTTATGAAATTTAATCC CAAAAACCCCAAATGGTTTAACCGGGATCGCTTTGTGTTGTCCGCCGGTCATG GCTCCATGTTACAATATGCCTTGTATACCTGTTGGGGTATGATTCCGTGACCA TTGAAGACATTAAACAATTTGCGCAGTGGAATCCAGTACCCCGGCCACCCC GAAAATTTTCTGACTGCCGGGGTGGAAGTTACCACTGGACCCTTGGGGCAGGG AATTGCCAATGGCGTGGGTCTGGCCTTGGCTGAAGCCCATTTAGCCGCTACCT ATAACAAACCCGATGCCACCATTGTGGACCACTATACTTACGTTATTTTGGGGG ATGGATGTAATATGGAAGGGATTAGCGGAGAAGCCGCTTCTATTGCCGGCCAT TGGGGCTTGGGTAAATTGATTGCCCTGTACGATGACAACCACATTAGCATTGAT GGTTCTACCGACGTGGCCTTTACTGAAGATGTTTCCAAACGTTTTGAAGCCTAT GGCTGGCATGTGCTGCACGTTGAAGATGGTAATACCGACTTGGCCGCTATTGC TAAAGCCATTGAAGAAGCTAAAGCCGTGACCGATAAACCCCTCCATGATTAAAGT TACCACTATTATTGGGTACGGAGCCCCCAATAAAAGTGATACCGCTGGCATTCA TGGTGCCGCTTTAGGCACCGACGAAGTGGCCGCTACTCGGAAAAACCTGGGTT GGGATTATGCCCCCTTTGAAGTGCCCCAAGAAGTTTTAGACTACACCCGCAAA GCCATTGAACGTGGTGCCAGTTATGAAGCTGAATGGAATCAAGCCTTTGCCCA GTACAAAACCAAATATCCCACTGAAGCCGCTGCCTTTGAACGCCAATTAAGCG GGGCCCTGCCCGAAGGATGGGATAAAACCTTAGCCTCTTTTACTCCCGACCAG AAAGGCCTGGCCACCCGTAAATACAGTGAAGAATGCTTGAATGCTTTAGCCCC CGTGCTGCCCGAATTGATTGGCGGTTCCGCCGATTTGACCCATAGTAACTTAA CTGAACTGCACTGTAGCGGCGACTTTCAAAAAGGTGCCTATCAGAATCGGAAC GTGCATTTTGGTGTTTCGCGAACACGCTATGGGCGCTATTTGCAATGGAATTGC CTTACATGGCTCCGGTTTACTGCCCTTTGGCGCCACCTTTTTGATTTTACTGAT TACATGCGTGCTGCCATTTCGGTTGAGCGCCTTATCTGAAGCTGGGGTGATTTG GGTTATGACCCATGATAGCATTGGGCAAGGAGAAGACGGCCCCACCCACCAG CCCATTGAAGTGCTGGCCTCTTTGCGTGCTATTCCCAATTTAACCGTTATTTCGG CCCGCCGATGGCAACGAAACCTCCGGTGCTTACAAAGTGGCTATTGCCAAAGC TAAAGAAAATGCCCCACCTTGTTATCCCTGACTCGTCAAGCCGTGCCCAACTT GCCCGGCACCTCCATTGATGCCGTTGCTAAAGGAGCCTATACTATTGTGGACA GCGAAGGGGTTCCCGAATTAATTCTGATTGGCACCGGTTCTGAAGTGCAATTAT GTGTTGCTGCCGCTGAAAACTGGCCGCTCAGGGTAAAAAAGTGCGGGTGTTT TCCATGCCCAGTTGGGAATTGTTTGAAACCCAAGATGCCGCTTACAAAGAATCC GTGTTGCCCAAAGCCGTTACCAAACGCTTAAGTGTGGAAGCCGCTACTAATTTT GGTTGGCATAAATATGTGGGGACCGAAGGAGATACTGTTAGCATTGAAACCTTT GGGGCCTCTGCCCCCGCGGCGTGTGCCTGGAAAAATTTGGATTTAGTGTTGA TAATGTGTTAGCCAAAGCCAAACCTTGTTGTCCTAA
<i>pckA</i>	CGCGTTAACAATGGTTTGACCCCGCAAGAACTCGAGGCTTATGGTATCAGTGA CGTACATGATATCGTTTACAACCCAAGCTACGACCTGCTGTATCAGGAAGAGCT CGATCCGAGCCTGACAGGTTATGAGCGCGGGGTGTTAACTAATCTGGGTGCC GTTGCCGTCGATACCGGGATCTTCACCGGTCTGTTACCAAAAAGATAAGTATATC GTCCGTGACGATACCACTCGCGATACTTTCTGGTGGGCAGACAAAGGCCAAAGG TAAGAACGACAACAAACCTCTCTCTCCGGAAACCTGGCAGCATCTGAAAGGCC TGGTGACCAGGCAGCTTTCCGGCAAACGTCTGTTTCGTTGTCGACGCTTTCTGT

	GGTGCGAACCCGGATACTCGTCTTTCCGTCCGTTTCATCACCGAAGTGGCCTG GCAGGCGCATTTTGTCAAAAACATGTTTATTCGCCCGAGCGATGAAGAACTGG CAGGTTTCAAACCAGACTTTATCGTTATGAACGGCGCGAAGTGCCTAACCCG CAGTGGAAGAAGAGGGTCTCAACTCCGAAAACCTTCGTGGCGTTTAACTGAC CGAGCGCATGCAGCTGATTGGCGGCACCTGGTACGGCGGCGAAATGAAGAAA GGGATGTTCTCGATGATGAACTACCTGCTGCCGCTGAAAGGTATCGCTTCTAT GCACTGCTCCGCCAACGTTGGTGAGAAAGGCGATGTTGCGGTGTTCTTCGGCC TTTCCGGCACCGGTAAAACCACCCTTTCCACCGACCCGAAACGTCGCCTGATT GGCGATGACGAACACGGCTGGGACGATGACGGCGTGTTTAACTTCGAAGGCG GCTGCTACGCAAAAACCTATCAAGCTGTCGAAAGAAGCGGAACCTGAAATCTAC AACGCTATCCGTCGTGATGCGTTGCTGGAAAACGTCACCGTGCGTGAAGATGG CACTATCGACTTTGATGATGGTTCAAAAACCGAGAACACCCGCGTTTCTTATCC GATCTATCACATCGATAACATTGTTAAGCCGGTTTCAAAGCGGGCCACGCGA CTAAGGTTATCTTCCTGACTGCTGATGCTTTCCGGCGTGTTGCCGCCGGTTTCTC GCCTGACTGCCGATCAAACCCAGTATCACTTCCTCTCTGGCTTCACCGCCAAA CTGGCCGGTACTGAGCGTGGCATCACCGAACCGACGCCAACCTTCTCCGCTT GCTTCGGCGCGGCATTCTCTGCTGCACCCGACTCAGTACGCAGAAGTGCT GGTGAACGTATGCAGGCGGCGGGCGCGCAGGCTTATCTGGTTAACTGGC TGGAACGGCACTGGCAAACGTATCTCGATTAAAGATACCCGCGCCATTATCGA CGCCATCCTCAACGGTTCGCTGGATAATGCAGAAACCTTCACTCTGCCGATGTT TAACCTGGCGATCCCAACCGAACTGCCGGGCGTAGACACGAAGATTCTCGATC CGCGTAACACCTACGCTTCTCCGGAACAGTGGCAGGAAAAAGCCGAAACCTG GCGAACTGTTTATCGACAACTTCGATAAATACACCGACACCCCTGCGGGTGC CGCGCTGGTAGCGGCTGGTCCGAAACTGTAA
<i>tpiA</i>	ATGCGACATCCTTTAGTGATGGGTAACTGGAAACTGAACGGCAGCCGCCACAT GGTTCACGAGCTGGTTTCTAACCTGCGTAAAGAGCTGGCAGGTGTTGCTGGCT GTGCGGTTGCAATCGCACCACCGGAAATGTATATCGATATGGCGAAGCGCGAA GCTGAAGGCAGCCACATCATGCTGGGTGCGCAAAACGTGGACCTGAACCTGT CCGGCGCATTACCGGTGAAACCTCTGCTGCTATGCTGAAAGACATCGGCGCA CAGTACATCATCATCGGTCACTCTGAACGTCGTACTTACCACAAAGAATCTGAC GAACTGATCGCGAAAAAATTCGCGGTGCTGAAAGAGCAGGGCCTGACTCCGGT TCTGTGCATCGGTGAAACCGAAGCTGAAAATGAAGCGGGCAAACTGAAGAAG TTTGCGCACGTCAGATCGACGCGGTACTGAAAACCTCAGGGTGCTGCGGCATT GAAGGTGCGGTTATCGCTTACGAACCTGTATGGGCAATCGGTACTGGCAAATC TGCAACTCCGGCTCAGGCACAGGCTGTTCAAAAATTCATCCGTGACCACATCG CTAAAGTTGACGCTAACATCGCTGAACAAGTGATCATTACGTACGGCGGCTCT GTAAACGCGTCTAACGCTGCAGAACTGTTTGCTCAGCCGGATATCGACGGCGC GCTGTTGGTGGTGTCTCTGAAAGCTGACGCCTTCGCAGTAATCGTTAAAG CTGCAGAAGCGGCTAAACAGGCTTAA
<i>pyk1</i>	ATGCCCCGCCCTGATTAACCCCGTGAAATTTATGCGCCCCTTATCTCATCGGACT AAAATTGTTGCTACTATTGGACCCGCCTCCTCCTCCGTGGAAGTTATTCGTCAA ATGGTGATGCCGGGATGAATGTTGCTCGGTTAACTTTAGTCATGGCTCCTAT GAAGATCACGCCACTATGGTGCGCTTGTTACGTTCCGTTGAACAGGAAATGGA TACCCCATTAATCTGTTGCAAGACTTGACGGGGCCCAAAATTCGCATTGGACA ACTGCCCGGCGGTGAAAAACAGTTGCGTGAAGGCGAAAAAGTGAGTTTGTG CCGTTGAAATTGGTGATCGCCATCCCGGCGCCGTGGGTATTGACTACCCCCAC TTGGCCACCGAAGCTAAAGTGGGCGAACGTATTTTACTGGATGACGGTTTGTTA GAAATGAAAGTGGTTTCTATTCAAGATCCCGAAGTGATTTGTGAAGTGGTTACC GGGGGAATTTTAAATCCCGTAAAGGGGTGAATCTGCCCGGACTGGTTTTGAC TTTACCCAGTATGACCACTAAAGATAAACAAGACCTGGAATTTGGCTTGAGCCA GGGTATTGATTGGGTGTCCTTGAGTTTTGTTTCGTAAGGGGAAGACATTATAC CTTAAACAATTTCTGGCCGAACGGGGACACCCCGATTTACCCGTGATTGCCA

	AAATTGAAAAACCCCAGGCTATTGACAATTTGGAAGAAATTGTGGCCGTTTCCA ACGGCATTATGGTGGCTCGCGGGGATTTAGGAGTGGAAGTTAATCCCGAAAAA GTGCCCCGGCTGCAAAAAGAAATTATTCGTCCGTGCAACGTGCGCGCCATTCC CGTTATTACCGCTACTCAAATGCTGGATAGTATGATTCAGAATAGCCGGCCAC CCGCGCCGAAGCTAGTGATGTGGCCAACGCTATTTTGGATGGGACTGACGCC GTGATGTTATCCGGCGAAAGTGCTGTTGGTCAATATCCCGTGAAAAGCGTTCA GATGTTGCGGAAAATTGCCGAAGAAACCGAAGTGGGCCTGCATTTGGTTAACA ATCCTCCCATTGAAAACACCGAAACTCACGCCTTGAGTGAAGCCTTGGTGGTTA TTGATGGCATTTTAGACCTGAAATACATTGTGACCTTTACCACTAGCGGTTTTAC TTCTCTGTTGGCCTCCAATCAACGCCCTCCGTGCCCGTTATTGCCTTTACCC CTCTGAAAAAGTGTAACCTTGAACCTGGTTTGGGGTATTATTCCCTTTCTG ATTAACGAAGAATTTGATACCTTTGAAGACTTGATTCAACAGGCCGAAGTGTTA CTGCGTGATCGGAAAATGGTGAAAAAGGGGACCAATTGTTAATTATGGCTGG CATTCCCACCAAAATCCCCGTGGCACCAACTTTCTGAAAATTCATCGTATTAG C
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