

**Supplemental data S1.** The protein sequences of Put in arabidopsis, rice and tomato, respectively.

>At1G31820(AtPut1)

MGDYNMNEFAYGNLYDDDDGDVGGSSKEGNNSIQKVSMLPLVFLIFYEVSGGPFGAEGS  
VNAAGPLLALLGFVIFPFIWCIPEALITAEMSTMFPINGGFVWVSSALGTFWGFQVGWM  
KWLCGVIDNALYPVLFLDYLSAVPALATGLPRVASILITLLTYLNYRGLTIVGWTAVFM  
GVFSMLPFAVMSLVSIQLEPSRWLVMDLGNVNWNLNTLLWNLNYWDSVSTLAGEVA  
NPKKTLPKALCYGVIFVALSNFLPLSGTGAIPLDRELWTDGYLAEVAKAIGGGWLQLWV  
QAAAATSNMGMFLAEMSSDSFQLLGMAELGILPEIFAQRSRYGTPLLILFSASGVLLLSG  
LSFQEIIAAENLLYCGGMILEFIAFVRLRKKHPAASRPYKIPVGTGVSILICVPIVLICLVIVL  
STIKVALVSFVMVVGIFLMKPCLNHMDGKKWVKFVCSDLAEFQKENLDCEESLLR

>At1G31830(AtPut2)

MQKRRIITVNPSASIEMSQYENNEVPYSSVGADEVSSPPKATDKIRKVSMLPLVFLIFYEV  
SGGPFGVEDSVNAAGPLLALLGFVIFPFIWSIPEALITAEMGMTMYPENGGYVWVSSALGP  
FWGFQQGWMKWLSGVIDNALYPVLFLDYLSGV PALGSGLP RVASILVLTILLTYLNYRGL  
TIVGWVAVLMGVFSILPFAVMGLISIPQLEPSRWLVMDLGNVNWNLNTLFWNLNYWDS  
ISTLAGEVENPNHTLPKALFYGVILVACSYIFPLLAGIGAIPLEREKWTGDGYFSDVAKALGG  
AWLRWWVQAAAATSNMGMFIAEMSSDSFQLLGMAERGMLPEFFAKRSRYGTPLLILFS  
ASGVLLSWLSFQEIVAAENLLYCVGMILEFIAFVRMRMKHPAASRPYKIPIGTTGSILMCI  
PPTILICAVVALSSLKVAASIVMMIIGFLIHPLLNHMDRKRWVKFSSISDLPDLQQQTREYE  
ETLIR

>At5G05630(AtPut3)

MTELSSPNLDSASQKPRISTENPPPPPHISIGVTTGDPATSPARTVNQIKKITVLPLVFLIFYE  
VSGGPFGIEDSVKAAGPLLAIVGFIVPFIWSIPEALITAEMGMTMFPENGGYVWVTLAMG  
PYWGFQQGWVKWLSGVIDNALYPILFLDYLSGIPILGSGIPRVAAILVLTVALTYLNYRGL  
SIVGVAAVLLGVFSILPFVVMFSIPKLKPSRWLVVSKMKGVNWSLYLNTLFWNLNY  
WDSVSTLTGEVENPSKTLPRALFYALLLVFSYIFPVLGTGAIALDQKLWTDGYFADIGK  
VIGGVWLGWVIQAAAATSNMGMFLAEMSSDSFQLLGMAERGMLPEVFAKRSRYRTPWV  
GILFSASGVILSWLSFQEIVAAENLLYCFGMVLEFITFVRLRMKYPAASRPFKIPVGVLGVS  
LMCIPPTVLIGVIMAFNLKVALVSLAAIVIGLVLPCLKQVEKKGWLKFSTSSHLPNLME

>At3G13620(AtPut4)

MAISEASKSSHELPVTTAESSGKKATAKKLTLIPLVFLIFYEVAGGPFGEEP AVQAAGPLLAI  
LGFLIFPFIWSIPEALITAELSTAFPGNGGFVIWAHRAFGSFVGSMMGSLKFLSGVINVASFP  
VLCVTYLDKLPVLESGWPRNVCIFASTVVL SFLNYTGLAIVGYAAVVLGLVSLSPFLVMS  
AMAIPKIKPHRWGSLGTTKKKDNLYFNLT LFWNLNFWDNVSTLAGEVDEPQKTFPLALLI  
AVIFTCVAYLIPLFAVTGAVSVDQSRWENG FHAEAAEMIAGKWLKIWIEIGAVLSSIGLFEA  
QLSSSAYQLEGMAELGFLPKFFGVRSKWENTPWWGILISALMSLGLSYMNFDTIISANFL  
YTLGMFLEFASFIWLRRKLPQLKRPYRVPLKIPGLVVMCLIPSAFLVLILVFATKIVYLICGV  
MTIGAIGWYFLINYFRKTKIFEFEVIDDLN NVNGEHPKVDDHNS

>At3G19553(AtPut5)

MGEEETIVNDENSSKPKPSPKLTLLPLVFLIFYEVSGGPFGVEDSVKSGGGPLLALLGFLIFP  
LIWSIPEALVTAELATSFPENGGYVWVWISSAFGPFWGFQEGFWKWFSGVMDNALYPVLFL  
DYLKHSFPVLHDHVAARVPALLVITFSLTYLNYRGLHIVGFSAVVLAVFSLCPFVVMALLAVP

NIRPKRWLFVDTQKINWRGYFNTMFWNLNYWDKASTLAGEVDRPGKTFPKALFGAVLL  
VMGSYLIPLMAGTGALSSSTSGEWSGDYFAEVGMLIGGVWLKGWIQAAAAMSNLGLFE  
AEMSSDAFQLLGMSEIGMLPAFFAQRSKYGTPTISILCSATGVIFLSWMSFQEIEFLNFLYA  
LGMLLEFAAFVKLRIKKPDLHRPYRVPLNTFGVSMLCLPPSLLVILVMVLAAPKTF LISGVI  
IVLGFCLYPFLTLVKEKQWARFIPEETRPVSGVSSESQLDEEHGDESAASLLP

>Solyc08g078100(SIPut1)

MGEFDDGEYAGINEVTSPRENNARKVSVLPLLFLIFYEVSGGPFGVEDTVRAAGPLLALL  
GFLVFPFIWSVPEALITAEMGTMFPENGGYVVWVSSALGPYWGFQLGWMKWLSGVIDN  
ALYPVLFLDYLKSAIPALGGGLPRVLAVLVLTVVLTVMNYRGLTIVGWVAVSLGILSILPFV  
VMGLISIPKL RPSRWLVVDVQSVDWNLYLNTLFWNLNYWDSISTLAGEVHNPKKTLPKA  
LFYAVILVVLSYFFPLLIGTGAIPLEHDLWTDGYFS DIAKILGGVWLRVWIQGAAAASNMG  
MFVAEMSSDSFQLLGMAERG LLEFFSKRSRYGTPLFGILFSASGVILLSWLSFQEIVAAEN  
FLYCFGMILEFIAFVLLRMKYPHAPRPFKIHGGTVGAILLCIPPTILICVVLALSSFKVMVVS  
LAAVAIGLVMQPCKLIENKRWLKFSISSDLPDDITTHEPLLR\*

>Solyc08g005540(SIPut2)

MTVKSETKSSIEVPNAQQQVAVAEKKTSALSSPTTAQNDKFVQNGDDQKVRDLPQKEAAI  
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VGFLVFPFIWSVPEALITAE LGTMFPENSGYVVWVSSALGPYWGFQQGWVKWLSGVIDN  
ALYPVLFLDYLKSGVPALGGGLPRVLAVIGITLVLTVMNYRGLTIVGWVAVLLGVLSILPFV  
VMGLISIPKLKPTRWLATDVHSVDWNLYLNTLFWNLNYWDSISTLVGEVRNPKKTLPKAL  
FYAVILVVLSYFFPLLVG TGAVPLERDLWTDGYFS DIAKILGGVWLRWWIQGAAALSNMG  
TFVAEMSSDSFQLLGMAERGMLPEFFAKRSRHGTPLVGILLSASGVLLLSWMSFQEIVAAE  
NFLYCFGMILEFIAFVRLRIKFPNASRPFKIPGGTVGAIVLCIPPTILVGIVLAFSTVKVMIISL  
AAIAIGLVMQPCKLHIEKKKWLKFSISPDLPIHRDNGTLVH\*

>Solyc08g075710(SIPut3)

MVPTTTTTSSSETLQNSSISVADKKTSQQNGDNNNQVLRGVNVGT FKIELHFFMKLRVSA  
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PLFALLGFLIFPLIWSVPEALITAEMGTMFPENGGYVVWVSSALGPYWGFQQGWMKWLS  
GVIDNALYPVMFLDYLKSAIPALGGGLPRIVAVLALTVVLTVMNYRGLTIVGWVAVSLGIL  
SMLPFVVMGLISIPKIRPERWL VADVHSIDWNLYLNTLFWNLNYWDSISTLAGEVRNPKKT  
LPKALFYAVLLVVLSYLFPLLIGTGAVPLERELWTDGYFS DIAKILGGVWLRFWLQGAAAV  
SNMGMFVAEMSSDSFQLLGMAERGMLPEFFAKRSRHGT PILGIIFSASGVLLLSWLSFQEIV  
AAENFLYCFGMILEFIAFVWLRIKYPNAPRPFKIPGGIIGAILLCVPPAILGIVVLAFASTIKIMI  
VSLAAVAIGMVLQPCIKLIERKRWLKFSSTSSDLPDITAHGPLIR\*

>Solyc01g034080(SIPut4)

MAEEKQTPVSTMAENSEEIPITTAKTVEKSKKLSLIPLIFLIYFEVAGGPYGE E PAVQSAGPL  
FAILGFLIFPFIWSVPEALITAE LSTTFPGNGGFVTWAYTAFGPFWGSLMGTWKFLSGVINIA  
SFPVLCISYMDKLFPIFSSWVPRYMAILVSTLLSFLNYTG LAIVGYVAVVLGIVSLAPFIVM  
SLIAIPKIQPHRWISLGQKGVKKDWNMFFNSLFWNLNFWDNVSTLVGEVENPKRTFPKAL  
FSSVILT CFGYLIPLMAVTGAVSVDQREWETGFMANAADMISGKWLKFWIEIGAILSSIGLF  
EAQLSTCAFQLLGMAELAF LPKFFALRSKWFNTPWVGILLSTVISSSMSYMNFTDISSANF  
LYSLGMFLELASFLWLRRKYPLINRPYKVPMKMPGLVVMCLIPSVFLAFIMAIATKVVF LIS  
GLMTVGGIGWYFFMKLCKTKKWLKFYDDMEEMTIT\*

>Solyc10g049640(SIPut5)

MVNDIKKNPKLTLLPLIALIFYDVSGGPFGIEDSVKAGGGPLLSLLGFLIFPLFWSIPEALITA  
ELSTSFPQNGGYVIWISSAFGPFWGFQQGFWKWFSGVMDDTTLYPFLFDYDKHSLPIFTHL  
IARIPALLTITVSLTYLNYRGLHIVGFSSVLLASFSLLPFLVMGILSIPRINTRKWFVVFNEKV  
EWRGYFNNMFWNLYWDKASTVAGEVDDPSRTFPKALLGAVVLVVLSYIIPLLAGTGAL  
DSDSSEWSDGYFAEVGTLIGGLWLKWWIQAAAAMSNMGLFEAEMSSDAYQLLGMSEIG  
MLPSVFSSRSKYGTPTISILCSATGTIFLSWMTFQEILEFLNFLYSVGMLLEFAAFINLRIKKP  
NLHRPYKVPLQTVGAMLLCLPPSLLLLFVMYLASLKTIVSGSVIIVGLFLYPVAMYAKEK  
QWCHFNTSEQLGLSNDLEDRSSPTELDQIVADDASLSLLGHSKTLRDSKTSSQEISSVD\*

>Solyc01g005920(SIPut6)

MGSWKFLTGVINIASFPVLCISYLEEIFPVLD SGVPRKLAILGSTLFLSLVNYTGLTIVGYVA  
VALGVISLAPFIIMSLIAIPKIHPRWLSLGQKGVKKDOWNLFFNTLFWNLNFDNVSTMA  
GEVENPRKTFPLALFSSVVFCLGYIIPLMAVTGAVDQDQDWDGTGFMANAAEMISGKW  
LKFWIEIGAVLSTIGLFEAQLSSSAFQILGMAEIAFLPKFFGLRSKWENTPWVGIVLSTTISL  
GMSYMDFQDISSANFLYSLGMLLEFASFLWLRKFPLIKRPYRVPMLPLLVIMCLIPCGF  
LVFIMAIATKLVYLISGLMTIGGIGWYFLMNFCKSKKLLKFNDKVDDTYIE\*

>Solyc01g111800(SIPut7)

MEAEKYSSLRSGANFTKLSFVPLTFLIFYGVSGGPFVEDTVRAAGPFLALVGYLIFPIVWS  
IPESLITAELSTMFPENGGYVWVWSKSFPGPYWGFQLGWVKWMSGVVDNALYPVLFLDYI  
KSSVPALANGLPRTIVIVALVIALTYLNYRGLTIVAWVATVLAIFTLLPFLIMGVIALPKLEPS  
RWFVMDLENVQWGLYLNTLFWNLNYWDSVSTMAGEVEDPGKTIPKALFYALPLVVS VY  
FFPLLFGTGAVPLHRDLWSDGYFS DIAKIIGGVWLRWWVQGASAVSNMGMFLAEMSGDS  
YQLLGMAERGMLPEFFAKRSHYGT PFIISILFSASGVVLLSCLSFQEIVAAENFMNCFGMILE  
FLCFVKLRIKYPAASRPYRIPLGTIGSILICLPPTLFLLVIALCSFKVMIVSFLAILVGLIMQP  
CLIYCDKKKWL SFSVSSDLVELQTN YHQVVEA\*

>Solyc09g092420(SIPut8)

MALPSSLFLSTFKSFPLEKQPLEIFNVLRYYLRVTIISKFMLVCSVLTNDTSKRPLIMFFLYI  
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ALPKLEPSRWVVDLENVQWGLYLNTLFWNLNYWDSVSTMAGEVEDPGKTIPKALFYAL  
PLVVSGYFLPLLFGTGAVPLHRDLWSDGYFS DIAKIIGGVWLRRLWVQGASAVSNMGMFLA  
EMSGDSYQLLGMAERGMLPDFFAKRWRYGTPFIISILFSASGVVLLSCLGFQEIVAAENFM  
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>Os02g0700500(OsPUT1)

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PVIWSIPEALITAELGAMFPENGGYVWVVASALGPYWGFQQGWMKWLSGVIDNALYPVL  
FLDYLKSGVPALGGGAPRAFAVVGLTAVLTLLNYRGLTVVGWVAICLGVSLLPFFVMGLI  
ALPKLRPARWLVIDLHNVDWNLYLNTLFWNLNYWDSISTLAGEVKNP GKTLPKALFYAVI  
FVVVAYLYPLLAGTGAVPLDRGQWTDGYFADIAKLLGGAWLMWVWQSAAALSNMGMF  
VAEMSSDSYQLLGMAERGMLPSFFAARSRYGTPLAGILFSASGVLLLSMMSFQEIVAAENF  
LYCFGMLLEFVAFILHRVRRPDAARPYRVPLGTAGCVAMLPPTALIAVVLALSTLKVAVV  
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>Os12g0580400(OsPut2)

MTGACEAAPARRRGLTVLPLVALIFYDVSGGPGFIEDSVRAGGGALLPILGFLVLPVLWSLP  
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GGLVLSPPARSLAVLALTAALTYLNFRGLHLVGLSALALTAFLSLSPFVALAVLAAPKIRPSR  
WLAVNVAAVEPRAYFNSMFWNLYWDKASTLAGEVEEPRKTFPKAVFGAVGLVVGAYLI  
PLLAGTGALPSETAGEWTDGFFSVVGDRIGGPWLRVWIQAAAAMSNMGLFEAEMSGDSF  
QLLGMAEMGMIPAIFARRSRHGTPYISILCSATGVVILSFMSFQEIVEFLNFLYGLGMLAVF  
AAFVKLRVKDPDLPRPYRIPVGAAGAAAMCVPPVVLITVMCLASARTLVVSAAVAVAGV  
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HAGEGVSVSKENY

>Os03g0576900(OsPut3)

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WSVPEALITAEMGTMFPENGGYVWVWSSALGPFWGFQQGWAKWLSGVIDNALYPVLFL  
DYVKSSIPALGGGLPRTLAVLILTVALTYMNYRGLTIVGWVAVFLGVFSLLPFFVMGLIAIPR  
IEPSRWLEMDLGNVNWGLYLNTLFWNLNYWDSISTLAGEVENPKRTLPRALSYALVLVV  
GGYLYPLITCTAAVPVREFWTDGYFSDVARILGGFWLHSLWLQAAAALSNMGNFVTEMS  
SDSYQLLGMAERGMLPEFFAKRSRYGTPLIGIMFSAFGVVLLSWMSFQEIIAAENYLYCFG  
MILEFIAFIKLRVVHPNASRPYKIPLGTIGAVLMIIPPTILIVVVMMLASFVKVMVVSIMAMLV  
GFVLQPALVYVEKRRWLKFSISAELPDLPYSNVEEDSTIPLVC

>Os03g0375900(OsPut4)

MAAEEAHLRADASATAPPKNAAAVDGVAVAAPAAGGGHGRAPGNKLSLVPLIFLIFFEVA  
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AGGLSIVGWTAVALGVASLSPFALMFGAALPKIRPRRWRATAADKDWKLFFNTLFWNLNY  
WDSASTMAGEVERPGRTPRALLSAVAMTTLGYYLLPLLAATGAIDAAPEDWGNNGFFADA  
AGMIAGGWLYWIEVGAVLSTIGLYSATLSSAAFQLLGMAIDLGLLPRAFALRAPVFDTPW  
VGILATAAITLAMSFTSFDITIVASANFLYSLGMLLEFAAFVRLRARLPAMPRPYAVPLRGLP  
AAAALCAVPSAFLVFVMAIAGWKVYIAISAVFTAAGVAVYYLMDLCKARGWLTFSAAAD  
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