

The amino acid sequences of the ZIP proteins

>AtGUFA

MDSQMLVALGLSLVGGGLSTSLGALFVVLSETPNMKMLGLLQGFASGLMLSISF
LDLAHNAINSIGFFKANLWFFGGVIFACITKFIPEPTLGPSTDGKRRKKNNGDE
GGKDDMMKKHRKQVLYSGLITAIGISLHNFPEGMAVFLGSIKGMRVGVNLALA
IALHNIPEGVAVALPIYFATESKWQAFKLATLSGLAEPLGVIIIVAYLFPRSLSPEIL
EGLLGAVGGIMAFLLTHEMLPLAFDYAGQKQAVKAVFFGMACMSASLYFLEL
SLPETMSL

>AtIAR1

MSFSLRKLLVPILVLVFLDLCVESGFSQSTPARDDHVHHHGGGCSHSHDHDH
DHDHDHHVKKTTAKVEMKLPEELAEEDMRLCGFGPCLHDHDHSSSTLTGF
ALWLNALGCSLLVSLASLICLVLLPIMFVQGKPSKWFVDSLALFGAGAMLGD
AFLHQLPHAFGGGGHSHSNDHHENHDHHDHSHSDSPSHSHSIQDLSVGLSVLA
GIVVFLLEKLVRYVEENSSGSNTWGHHHHHHHAGSKKLKDEGDHNNLDQQ
SSSDAIVNSSEKVS GGSTD KSLRKRKTSASDATDKSDSGTEITSDGKSDKPEQV
ETRSSSLVFGYLNLFSDGVHNFTDGMALGSAFLIYGSVGGWSRTMFLLAHELP
QEIGDFGILVRSGFTVT KALFFNFLSALVALAGTALVLVWGNPEGQSSLIEGFTA
GGFIYIAGVLAEMNNSGKSTLKNSACHLISLILGMSVALCISLIE

>AtIRT1

MASNSALLMKTIFLVLFVSFAISPATSTAPEECGSESANPCVNKAKALPLKVIA
IFVILIASMIGVGAPLFSRNVSFLQPDGNIFTIICKFASGIILGTGFMHVL PDSFEM
LSSICLEENPWHKFPFSGFLAMLSGLITLAIDSMATSLYTSKNAV GIMPHGHGH
GHGPANDVTLP IKEDDSSNAQLLRVRIAMVLELGIIVHSV VIGLSLGATSDTC
TIKGLIAALCFHQMFEGMGLGGCILQA EYTNMKKFVMAFFFAVTT PFGIALGI
ALSTVYQDNSPKALITVGLLNAC SAGLLIYMALVDLLAAEFMGPKLQGSIKM
QFKCLIAALLGCGGMSIIAKWA

>AtIRT2

MATTKLVYILLILFTFTVSPAISTAPEHCDSGFDNPCINKAKALPLKIVAIVAILTT
SLIGVTSPLFSRYISFLRPDGNNGFMIVKCFSSGIILGTGFMHVL PDSFEM LSSKC
LSDNPWHKFPFAGFVAMMSGLVTLAIDSITTSLYTGKNSVGPVPDEEY GIDQE
KA IHMVGHNHSHGHGVVLATKDDGQLLR YQVIAMVLEV GILFHSV VIGLSLG
ATNDSCTIKGLIIALCFHHLFEGIGLGGCILQADFTNVKKFLMAFFFTGTTPCGI
FLGIALSSIIYRDN SPTALITIGLLNAC SAGMLIYMALVDLLATEFMGSMLQGSIK
LQIKCFTAALLGCAVMSVAVWA

>AtIRT3

MFFVDVLWKLVPYLYFGSETKSLSATESILQIVPEAMAATSSNVLCNASESDLC
RDDSA AFLK FVAIASILLAGAAGVTIPLIGNRRFLQTDGNLFVTAKAFAAGV
ILATGFVHMLAGGTEALKNPCLPDFPWSKFPFPGFFAMIAALITLFVDFMGTQ
YYERKQEREASESVEPFGREQSPGIVVPMIGEGTNDGKVFGCEEDSGGIHIVGIH
AHAAHHRHSHPPGHDSCEGH SKIDIGHAHAHGHGHGHGHGHVHGGLDAVN
GARHIVVSQVLELGIVSHSIIIGLSLGVSQSPCTIRPLIAALS FHFQFFEGFALGGCI
SQAQFRNKSATIMACFFALTPIGIGIGTAVASSFN SHSVGALVTEGILDSLSAGI
LVYMALVDLIAADFLSTKMRCNFRLQIVSYV MLFLGAGLMSSLA IWA

>AtZIP1

MSECGCFSATTMLRICVVLIICLHMCCASSDCTSHDDPVSQDEAEKATKLKLG
SIALLLVAGGVGVSLPLIGKRIPALQPENDIFFMVKAFAAGVILCTGFVHILPDA
FERLSSPCLEDTTAGKFPFAGFVAMLSAMGTLMDTFATGYYSKRQHFSNNHGS
KQVNVVVDEEEHAGHVHIIHTHASHGHTHGSTELIRRRIVSQVLEIGIVVHSVII
GISLGASQSIDTIKPLMAALSFFHQFFEGGLGCGCISLADMKSKSTVLMATFFSV
TAPLGIGIGLGMSSGLGYRKESKEAIMVEGMLNAASAGILIYMSLVDLLATDF
MNPRLQSNLWLHLAAYLSVLGAGSMSLLAIWA

>AtZIP2

MALSSKTLKSTLFFLSIIFLCFSLILAHGGIDDGDEEEETNQPPPATGTTTVVNL
RSKSLVLVKIYCIILFFSTFLAGVSPYFYRWNESFLLLGTQFSGGIFLATALIHFL
SDANETFRGLKHKEYPYAFMLAAAGYCLTMLADVAVAFVAAGSNNNHVGAS
VGESREDDDDVAVKEEGRREIKSGVDVSQALIRTSGFGDTALLIFALCFHSIFEGI
AIGLSDTKSDAWRNLTISLHKVFAAVAMGIALLLKIPKRPFFLTVVYSFAFGIS
SPIGVGIGIGINATSQGAGGDWTYAISMGLACGVFVYVAVNHLISKGYKPREEC
YFDKPIYKFIAVFLGVALLSVVMIWD

>AtZIP3

MKTKNVKLLFFFFSVSLLLIADVNAAEHSHGGPKCECSHEDDHENKAGARK
YKIAAIPTVLIAGIIGVLFPLLKGVPFSLRPETCFFFVTKAFAAGVILATGFMHV
LPEAYEMLNSPCLTSEAWFEPFTGFIAMIAAILTSLVDTFATSSFYKSHCKASKR
VSDGETGESSVDSEKVQILRTRVIAQVLELGIIVHSVVIGISLGASQSPDAKAL
FIALMFHQCFEGLGCGCIAQGKFKCLSVTIMSTFFAITTPIGIVVGMGIANSYD
ESSPTALIVQGVNAASAGILIYMSLVDLLAADFTHPKMQSNTGLQIMAHIAL
LGAGLMSLLAKWA

>AtZIP4

MASSTTKILCDAGESDLCRDDSAFLLKFVAIASILLAGAAGVAIPLIGNRRF
LQTEGNLFVAAKAFAAGVILATGFVHMLAGGTEALSNPCLPDFPWSKFPFPGF
FAMVAALATLLVDFMGTQYYERKQERNQAATEAAAGSEEIAVVPVVGERTD
NKVFGEEDGGGIHIVGIRAHAAHHRHSHSNHGTCDGHAHGHSHGHMHGNS
DVENGARHVVVSQILELGIVSHSIIIGLSLGVVSQSPCTIRPLIAALSFFHQFFEGFA
LGGCISQAQFRNKSATIMACFFALTTPLGIGIGTAVASSFNHSPGALVTEGILDS
LSAGILVYMALVDLIAADFLSKRMSCNLRLQVVSYVMLFLGAGLMSALAIWA

>AtZIP5

MRITQNVKLLFFFFFISFLFIAVSAGESKCECSHEDDEANKAGAKKYKIAAIPS
VLAAGVIGVMFPLLKGFFPSLKPETTTFFVTKAFAAGVILATGFMHVLPEGYE
KLTSPCLKGEAWFEPFTGFIAMVAAILTSLVDSFATSYFHKAHFKTSKRIGDGE
EQDAGGGGGGGDELGLHVHAHGHTHGIVGVESGESQVQLHRTRVVAQVLEV
GIIVHSVVIGISLGASQSPDTAKALFAALMFHQCFEGLGCGCIAQGNFNCMSI
TIMSIFFSVTTPVGIAVGMAISSSYDDSSPTALIVQGVNAASAGILIYMSLVDL
AADFMHPKMQSNTRLQIMAHISLLVGAGVMSLLAKWA

>AtZIP6

MASCVTGTEAAIRAAACRDGEEASHLKIVAVFAIFLTSVFGVWGPVLLAKYFH
GKPLYDKAILVIKCFAAGVILSTSLVHVLPEAFESLADCQVSSRHPWKDFPFAG
LVTMIGAITALLVDLTASEHMGHGGGGGGDGGMEYMPVGKAVGGLEMKEG
KCGADLEIQENSEEEIVKMKQRLVSQVLEIGIIFHSVIIIGVTMGMSQNKCTIRPL

IAALSFHQIFEGLGLGGCIAQAGFKAGTVVYMCLMFAVTTPLGIVLGMVIFAA
TGYDDQNPNALIMEGLLGSFSSGILIYMALVDLIAIDFFHNKMLTTCGESGSRL
KKLCFV

>AtZIP7

MAYSKACYKLTTITILLLSFTLPSLAGNAENADVSECKAESGDLSCHNNKEAQ
KLKIIAIPSILVASMIGVSLPLFSRSIPALGPDREMSVIVKTLASGVILATGFMHV
LPDSFDDLTSKCLPEDPWQKFPFATFITMISALLVLMIESFAMCAYARRTSKREG
EVVPLENGSNSVDTONDIQTLENGSSYVEKQEKVNEDKTSELLRNKVIAQILE
LGIVVHSVIGLAMGASDNKCTVQSLIAALCFHQLFEGMGLGGSILQAQFKS
KTNWTMVFFFSVTPFGIVLGMAIQKIYDETSPTALIVVGVLNACSAGLLIYM
ALVNLLAHEFFGPKIQGNIKLHVLGYVATFTGAAGMSLMAKWA

>AtZIP8

MATTTQHMNQIFLVLLISFAISPAISTVPKECETDSTDSCIDKTKALPLKIVAIV
AILVTSMIGVAAPLFSRYVTFLHPDGKIFMIKCFASGIILGTGFMHVLPSDFEM
LSSPCLEDNPWHKFPFTGFVAMLSGLVTLAIDSIATSLYTKKAVADDSEERTTP
MIIQIDHLPLTTKERSSTCSKQLLRVIATV

>AtZIP9

SILISGAAGVSIPLVGTLPLNGGLMRGAKAFAAGVILATGFVHMLSGGSKALS
DPCLPEFPWKMFPPPEFFAMVAALLTLLADFMITGYPERKQEKMMNQSVESL
GTQVSVMSDPGLESGFLRDQEDGGALHIVGMRAHAHHRHSLSMGAEGFEA
LSKRSGVSGHGHGHSHGHGDVGLDSGVRHVVSQILEMGIVSHSIIIGISLGVS
HSPCTIRPLLLALSFHQFFEGFALGGCVAEARLTPRGSAMMAFFFAITTPIGVAV
GTAIASSYNSYSVAALVAEGVLDLSAGILVYMALVDLIAADFLSKKMSVDFR
VQVVSYCFLFLGAGMMSALAIWA

>AtZIP10

MTKSHVIFSASIALFLLLSISHFPGALSQSNKDCQSKSNYSCIDKNKALDLKLL
SIFSILITSLIGVCLPFFARSIPAFQPEKSHFLIVKSFASGIILSTGFMHVLPSDFEM
LSSPCLNDNPWHKFPFAGFVAMMSAVFTLMVDSITTSVFTKSGRKDLRADVAS
VETPDQEIGHVQVHGHVHSHTLPHNLHGENDKELGSYLQLLRYLILAIVLELG
IVVQSIIVIGLSVGDTNNTCTIKGLVAALCFHQMFEGMGLGGCILQAIEYGVVK
KAVMAFFFAVTPFGVVLGMALSKTYKENSPELITVGLLNASSAGLLIYMAL
VDLLAADFMGQKMQRSIKLQLKSYAAVLLGAGGMSVMAKWA

>AtZIP11

MSRSLVFFFLFLVLVVPCLSHGTGGDHDDDEASHVKSSDLKSKSLISVKIACLV
IIFVLTFISGVSPYFLKWSQGFLVLGTQFAGGVFLATALMHFLSDADETFRGLLT
AEGESEPSPAYPFAYMLACAGFMLTMLADSVIAHIYSKTQNDLELQGEDKSNQ
RSATTETSIGDSILLIVALCFHSVFEGIAIGISETKSDAWRALWTITLHKIFAAIAM
GIALLRMIPDRPLFSSITYSFAFAISSPIGVAIGIVIDATTQGSIAWIFALSMSLAC
GVFVYVSVNHLLAKGYRPNKKVHVDEPRYKFLAVLFGVVVIAIVMIWDT

>AtZIP12

MSRFRKTLVSAFVLCLVIFPLLVSAAEEENQCGGSKGGSAAEKASALKYKIIAF
FSILIAGVFGVCLPIFGLKTESNFFMYVKAFAAGVILATGFVHILPDATESLTSSC
LGEEPPWGDFFPMTGLVAMAASILTMLIESFASGYLNRSRLAKEGKTLPVSTGG
EEEHAHTGSAHTHASQGHSHGSLIPQDDDHIDMRKKIVTQILELGIVVHSVII

GISLGASPSVSTIKPLIAAITFHQLFEGFGLGGCISEAKFRVKKIWVMLMFFALT
APIGIGIGIGVAEIYNENSPMALKVSGFLNATASGILIYMALVDLVAPLFMNQKT
QSSMKIQVACSVSLVVGAGLMSLLAIWA

>AtZIP13

MFVRSNILRALIFTVLEKTCLEIKMMHSSCKGLVLLLFLFVVVFIGNTDANAQ
WEVSHKVRASPHENMGRNVIDGSGVEKTLHDIGMGEKRGTHNKVSVSTVAL
FTLAMAAATGLGAVPFFFVELDPQWAGICNGMAAGVMLAASF DLVKEGQEH
GSGNWVVTGILAGALFIWLCKQILEQYGEVSMLDIKGADATKVVLVIGIMTL
HSFGE GSGVGVSFAGSKGFSQGLLVTLAIAVHNIPEGLAVSMVLASRGVSPQN
AMLWSIITSLPQPLVAVPAFLCADAFSKFLPFCTGFAAGCMIWMVIAEVL PDAF
KEASPSQVASAATISVASMEALSTLFDASGFFVSLLFGLGPLLGGVFLVASAVTF
RLQHALLMGVASGIAFVLGLWESFTHDYNS EDASGFFVSLLFGLGPLLGGVFL
VASAVTFRLQHALLMGVARPLQLLSAKMGLIPLVSLLAIGAGLSHFTSSTILN
VTGRKKS RAGSLINS GIAFVLGLWPVTNFPTSVITLQSLACGAVGFHALAEGL
ALGVAAPNAYGLGRH MVLPVSLHGLPRGTAVASCVFGATDSWHAALAAAALI
GFVGPISAIGSILAGIDYSGLDHVMV VACGGLLPSFWQVIKRAVRLERRKGSV
GMVLGLACAVVCLTFTRLVCLHTPYCNSAPEAVR

>CmZIP1

MLRFLFLLLLLLLLLSSAAAHSGHSD EDAAPEDGPSPPNLRSKPLILVKIACLILI
FFGT FIPGISPCFFK WNDGFLLLGTQFAGGVFFGTAMMHFLSDANETFRDLTD
NDYPFAFMLASSGFLMTMAADCVISYLYRKPTADSSTDVELGGAATSPSKFQV
QNGSNGHHPHPHQALT TMGSFGDSILLIVALCFHSVFEGIAIGVAETEADAWK
ALWTISLHKVFAAIAMGIALLRMIPNRLLSSAAYSFAFAISSPIGIAIGIVIDATT
QGAVADWIFAISMGLACGVFIYVSINHLLSKGYTPRDSVVVDNPNYKFLAVLL
GIGVIAILANGIADG

>CmZIP2

MSKFFFLFLALFLPALVSGGGVSCSCDESDGGA AVSAKEAMKYKVG SIGSVLV
AGAAGVSLPLVGKKIRCLRPENDIFFMIKAFAAGVILSTGFIHILPDAFQDLTSP
CLGQNPWGDFPFAGFIAMAASIATLMVDTFATSFYQRRHFSKTKQVIADQETG
NDHAGHVHVHTHATHGHAHGSAPTPTGELSLADLIRYRIISQVLELGIVVHSV
IGISLGASLSPATIKPLLVALSFHQFFEGMGLGGCISQAQFRWQSAAAMATFFSL
TAPVGIAVGIGISGVYRDN SRTALIVEGSMNSASAGILIYMALVDLLAADFMNP
RMQNNLGLQLGANISLLLGAACMSVLAKWA

>CmZIP3

MFFFEDLLQVLCIRGFQDKTRLLSESFIRT VSESMTNSACGVSEVELCRNDSAA
LHFKLIAIASILTAGVIGIAIPLFGKQRRFLKTDGNLFVAAKAFAAGVILATAFVH
MLPDGSKALSDPCLPEFPWSKFPGFFAMMASLLTLLVDFVGTQYYERKQG
MIRSKEEANRVGSLVDTGLESGIVPAGELNVKVFG EEDGGGMHIVGMHAHAA
HHRHNHPQGKEACDGHVAVHDHGHGHAHGHGHS HGLDVDDDES GVRHV
VSQILELGIVSHSVIIGLSLGVSHSPCTIRPLIAALS FHQFFEGFALGGCISQAQFN
TLSTSLMAVFFAITTPLGIAVGAAVASTYNPNST GALVAEGILDSLSAGILVYMA
LVDLIAADFLSKRMSCNFRLQLVSYCTLFLGAGLMSSLALWA

>CmZIP4

MASQVLVALALSLVGGFSTSLGALFVVL SGAPNLKMLGLLQGFAAGLMLSISF

LDLAHNAINSIGFLKGNLWFFAGVIFFAFVAHFIPEPTLGPVSDTKRRKDKDEG
GKDLMKKHRRQVLYSGIITAIGISLHNFPEGMAVFLGSIKGLRVGLNLALAIAL
HNIPEGVAVALPVYFATQSKWQAFKLATLSGFAEPLGVVIVAYLFPSSLSPEILE
GLLGSVGGVMAFLTLEMLPLAFDYAGQKQAVKVVFLGMACMSASLYFLEIS
LPEDLSL

>CmZIP5

MPMPMPDFKLHSLLSFFFLFLLLIPSVIAAADQCPCPEDSEEDGGKRDDTLALK
YKIVAIATILLAGIIGVVIPLLGKVIPALSPEKDIFFVIKAFAGVILATGFIHVLPD
AYEKLTSKLNHPWGKFPFTGLVAMVAAIGTLMMDAGASSYYTRIHLNKAQ
PELNGDDEMRRGGGGHGHVHVHHTHGHGHAHGSADVGGSTEILRHRVISQ
VLELGIVVHSIIIGIGLVSETPKTIRPLVAAITFHQLFEGMGLGGCIAQAKFKN
RATILMGLFFCLTTPLGIAIGIAVTKGYDEDSPKALIVEGILNAASSGILIYMALV
DLAADFMMNPRMQSNGKLQLLANVSLILGAALMSLLAIWA

>CmZIP6

MARNLIFLLLLFSFSSPSLSASIPSPNSECEAQLQQGCHDRAESLKLKLIATIL
VASMIGVSLPLFSRAMPVLQPEGKTFIVKAFASGVILATGYMHVLPDSFNFLT
SPCLPENPWRKFPFPTFIAMLSAIMTLMDSFTLSHYNKQSVQDQLSEEEEIKN
ENRKEMSENLGKEEGTGKKLDSQLLRHRVIAQLLEAGILVHSVIGLSLGASE
NPCTIRPLIAALCFHQLFEGMGLGGCILQAEYRIKMKAIMVFFFSVTPFGIGL
GIGLSNVYSENSPTALIVVGILNALSAGLLNYMALVDLLAHDFMGPQLQANL
KLHIWAYVAVLLGVGGMSLLAKWA

>CmZIP7

MTVDFKRVLLFSLLFLLFCGRAIAEFEHGN SQKIISAPDKSGIKVIDGSGTENLI
GFEDTNYLLHERKGGSRVSVSTVAVFTLAMAAATGLGAVPFFFVELDPQWAG
LCNGMASGVMLAASFDLIQEGQEHGAGNWVIGILAGGIFIWLCKKFLEQYG
EVSMLDIKGADATKVVLIIIGIMTLHSFGEGSGVGVSFAGSKGFSQGLLVTLAIA
VHNIPEGLAVSMVLASRGVSPQNALLWSVITSLPQPIVAVPSFICADAFNKFLPF
CTGFAAGCMIWMVVAEVLPAFKEASPSQVASAATLSVAFMEALSTLFQSFTH
EYNSGDVSGFFVSLLFGVGPLLGGVLVVFHAHAFHLQHALLMG TASGIAFILG
AWRPLQLLFSSKMDFIPLTTLTLGAAFIHFSSSSLLKLAGQKKASVNDLAAS
NFSVSVHTLQSFLSCGAIAFHALAEGLALGVAAPKAYGFGRHIVLPVSLHGLP
RGA AVASCIFGATDSWHGSLMSAALIGFVGPIAIGAILAGIDYSGLDHVMVLA
CGGLLPSFGSIIKRAMRLDTQKSSSGLVIGLGFAILCLMCTKLVCLHTPYCNSA
PEAVR

>CmZIP8

MPNSCFFPFIFASALVFSFLDLSFAHGS LGHHQCSHSHGHHQHAAHHRHDDD
LSVTSKLLPEELAEEDMRLYGFGRPYVEHDHESVGSSDLSGLGLWIRALGCS
LLISMASLICLILLPVIFVRGKPSKAVVDSLALFGAGAMLGDAFLHQLPHAFFG
GKHSHSHADHHGHSHSEDEHSHSHAHTLEDLSVGMSVLAGIVLFLVEKIVR
YVEDNSEGGNDWSHGHHHHHKNNKKLKDDSDSPDTTDKKGRAKLLDGV PND
SKEDQGTPQKSVPRKRNGKSASRDDKEDLVAANGLTADVNSSQEFPKTPSNL
VFGYLNLFSDGVHNFTDGMALGSAFLLYGSVGGWSRTVFLLAHELPQEIGDF
GILVRSGFSVAKALFFNFLSALVALAGTAIALLMGTDPGHSSLIEGFTAGGFIYA
VAGVLAEMNSSSKSTIRTTVFQLTSLVLGMAVALGISLIE

>CmZIP9

MAAACPTDFTHDSACRDGRAAAHLKLISIFLIFITSVIGVSSPVLLTRFFH GKPL
YDKAILTVKSFAAGVILSTSLVHVLPDAFDALSDCRVASQHPWRDFPFSGLVT
MIGALVALFVDVTATSHVEHDQYNPVEVKGGEDSGGEIGLLVAGERKSEETGE
GIGEEELVKMKQKLVSKEIGIIFHSVIIGVTMGMSQNNQCTIKPLVAALAFHQI
FEGMGLGGCIAQAGFSFTTTAYMCLMFSVTTPMGHILGMILFSLTGYDDSNPK
ALIMEGLLGSFSSGILIYMALVDLIAALDFFHNKLMTSNQWLKKICFIALLLGST
SMSILALWA

>CmZIP10

MASFTKLISIFLFLCFLSIQAVSQSDECETT VNSCTNKGKALRLKIIAIFSILIAS
VIGVGSPLVTRSIPMLHPDRNMFVILKAFAAGIILATGFMHVLPDSFDMLWSNC
LKENPWHKFPFSGFVAMMSAIVTLMVDSMATS LYTKKHNEVMPENSPRGGD
DHESPVVSGGHFHHGHHMDAKETNAGSQLLR YRVVAMVLEMGIVVHVS VVIG
LSLGATNDTCTIKGLVAALCFHQMFEGMGLGGC ILQAEYKWMKKAIMVFFFS
VTPFGIALGIGLSKTYKENSPIALITVGLLNASSAGLLIYMALVDLLSADFMG
PKLQGSIKLQVKSYIAVLLGAGAMSLMAKWA

>CsZIP1

MASFTKPFSIFLFLICFFSIQAVSQSDECETT ANSCTNKHKALRLKIIAIFSILIAS
VIGVGSPLVTRSIPMLHPDRNMFVILKAFAAGI ILATGFMHVLPDSFDMLWSNC
LKENPWHKFPFSGFVAMMSAIVTLMVDSMATS LYTKKHNEVMPENSPRGGD
DHELPVVSGGHFHHGHHMDTKETNAGSQLLR YRVVAMVLELGIVVHVS VVIG
LSLGATNDTCTIKGLVAALCFHQMFEGMGLGGC ILQ

>CsZIP2

MFFFEDLLQMLCIRGFQDKTRLLSESFIRT VSESMANSACGVSELELCRND SA
ALHFKLIAIASILTAGVIGIALPLFGKQRRFLK TDGNLFVAAKAFAAGVILATAF
VHMLPDGSKALSDPCLPEFPWSKFPFSGFFAM MASLLTLLVDFVGTQYYERK
QGIIRSKEEANRVGSLMDTGLESGIVPAGDLN VKVFGEEEGGGMHIVGMHAH
AAHHRHNHPQGKEACDGHMGVHDHGHGHAHGH GHSHGLDGDDESGVRH
VVVSQILELGIVSHSVIIGLSLGVSHSPCTIR PLIAALS FHQFFEGFALGGCISQA
QFNTLSTSLMAVFFAITTPLGIAVGA AVASTYNPNSTGALVAEGILDSLSAGILV
YMALVDLIAADFLSKRMSCNFRLQLVSYCTL FLGAGLMSSLALWA

>CsZIP3

MLSISFLDLAHNAINSIGFLKGNLWFFAGV IFFAFIAHFIPEPSLGPVSDTKRRK
DKDEGGKDIMKKHRRQVLYSGIITAIGISLHN FPEGMAVFLGSVKGLRVGLNL
ALAIALHNIPEGVAVALPVYFATQSKWQAFKL ATLSGFAEPLGVVIVAYLFPSSL
SPEILEGLLGSVGGVMAFLTLHEMLPLAFDYAG QKQAVKVVFLGMACMSASL
YFLEISLPEDLSL

>CsZIP4

MTVSFKQVLLFSLFLFCGGAIAEIEHENSQ KIISAPDKNGIKVIDGSGTENLI
GFEDTNYLLHERKGGSRVSVSTVAVFTLAMAA ATGLGAVPFFFVELDPQWAG
LCNGMASGVMLAASFDLIQEGQEHGAGNWV VIGILAGGIFIWLCKKFLEQYG
EVSMLDIKGADATKVVLVIGIMTLHSFGEGSG VGVVSFAGSKGFSQGLLVTLAIA
VHNIPEGLAVSMVLASRGVSPQNALLWSVITSL PQPIVAVPSFICADAFNKFLPF
CTGFAAGCMIWMVVAEVLPAFKEASPSQVASA ATLSVAFMEALSTLFQSFTH

EYNSGDVSGFFVSLLFGVGPLLGGVVLVAFAHAFHLQHALLMG TASGIAFILG
AWRPLQLLFSSKMDFIPLTTLLSLGAAFIHFSSSSLLKLAGQKRASVNDLTTST
NFSVSVHTLQSFLSCGAIAFHALAEG LALGVAAPKAYGFGRHIVLPVSLHGLP
RGA AVASCIFGATDSWHGSLMSAALVG FVGPISAIGAILAGIDYSGLDHVMVL
ACGGLLP SFGSIIKRAMRLDTQKSSSGLVIGLGFAILCLMCTKLVCLHTPYCNS
APEAVR

>CsZIP5

MPMPMPHFNPSSL SLFFLLFLLLIPSVLAAPDCQCPEDSEDDGKRDETLALK
YKVVAIATILVAGIIGVVIPLLGLKIPALSPEKDIFFIIKAFAAGVILATGFIHVLPD
AYGNLTSSKLNEHPWGKFPFTGLVAMVAAIGTLMVDAGASSYYTRIHLNKAQ
PELNGDDEMRRGGGCGAHDGHVHVHHTHGHGHAHGSADVGGSSTEILRHRVI
SQVLELGIVVHSVIIIGLGVSESPETIRPLVAAITFHQLFEGMGLGGCIAQAKF
KNRATILMGLFFCLTTPIGIAIGIAVTKTYDEDESPKALIVEGILNAASSGILIYMA
LVDLLAADFMNPRMQSNGKLQLLANVSLILGAALMSLLAIWA

>CsZIP6

MPNSCFFPFIFASALVFSFLDLSFAHGS LGHHQCTHSHGHQHHAHHHHHDDD
VSVTSKLLPEELAEEDMRLYGFGRPYVEHDHESVGSSDLSGLGLWIRALGCS
LLISMASLICLILLPVIFVRGKPSKAVVDSLALFGAGAMLGDAFLHQLPHAFGG
GKHS SHSHADHHGHSHSEDEHSHSHAHTLEDLSVGISVLAGIVLFLVEKIVRY
VEDNSEGGNDWSHSHHHHHKKNKKLKDDSDSHDTTDKKGRAKLLDGVPNDS
KEDQGTPQKSVPRKRNANSSSRDDKEDLVAANGPTADVNSSQEPPAKTPSNLV
FGYLNLFSDGVHNFTDGMALGSAFLLYGSVGGWSRTVFLLAHELPQEIGDFGI
LVRSGFSVAKALFFNFLSALVALAGTAIALLMGTDPGHSSLIEGFTAGGFIYIAV
AGVLAEMNSSSKSTIKTTVFQLTSLVLGMAVALGISLFE

>CsZIP7

MAAACPTDFTHDSACRDGRAAAHLKLISIFLIFITSVIGVSSPVLLTRFFH GKPL
YDKAILTVKSFAAGVILSTSLVHVLPDAFDALSDCRIASQHPWRDFPFSGLV TM
VGALVALFVDVTATSHVGH DQYNPVEEKGGEE SGGEIGLLVAGERKSEETGG
GGIIGEEESVKMKQKLVSKVLEIGIIFHSV IIGVTMGMSQNQCTIKPLVAALAFH
QIFEGMGLGGCIAQAGFSFTTTAYMCFMFSVTTPMGIILGMILFSLTGYDDSNP
KALIMEGLLGSSGILIYMALVDLIALDFFHNKLMTSNHCLKNICFIALLLGST
SMSILALWA

>CsZIP8

MARNLIFLLLLLSFISLSFSDSIPSPDSECEAQLQQDCHDRAESLKLKLISIATILV
ASMIGISLPLFSRAIPVLHPDGQTFAIVKAFASGVILATGYMHVLPDSYDFLTSP
CLPENPWRKFPFPTFIAMLSAIMTLM LDSFSLSHFNKQSMQDQLSEEEEEINNE
DRKEMSEN LGKEEGTGEKLGSQLLRHRVIAQILEAGIVVHSV VIGLSLGASEN
PCTIRPLIAALCFHQLFEGMGLGGCILQAQYRIKMKAIMVFFFSVTTPFGIGLGI
VLSNVYSENSPTALIVVGILNALSAGLLNYMALVNLLAHDFKGPKLQANLKL
HIWAYVAVLMGVGGMSLLATWA

>CsZIP9

MLRFLFLLLSSAAAHSGHSDDDDSAAGDSLSPSPNLRSKPLILVKITCLILIFFG
TFIPGISPCFFKWNDGFLLLGTQFAGGVFFGTAMMHFLSDANETFRDLTDNAY
PFAFMLACLGLMTMAADCVISYLYRKPTADSS TDVELRGAATSPSKFQVQN

GSNGHHTHPHQALTMTMGSGDSILLIVALCFHVSFEGIAIGVAETKADAWKAL
WTISLHKVFAAIAMGIALLRMIPNRPLLSSAAYSFAFAISSPIGIAIGIIIDATTQG
AVADWIFAISMGLACGVFIYVSINHLLSKGYTPRDSVLVDNPNYKFLAVLLGIG
VIAIVMIWDT

>CsZIP10

MSKFFFLFTLFLPALVSGVGASCSCDKSDGGGAVATKEAMKYKVGSIGSVLV
AGAAGVSLPLVGKKIRCLRPENDIFFMIKAFAAGVILSTGFIHILPDAFQDLTSP
CLGQNPWGDFFPAGFIAMAASIATLMVDTFATSFYQRRHFSKTKQVIADQETG
NDHAGHVHVHTHATHGHAHGSAPTPTGELSLADLIRYRIISQVLELGIVVHSV
IGISLGASVSPATIKPLLVALSFHQFFEGMGLGGCISQAQFRWRSAAAMATFFSL
TAPVGIAVGIGISGAYRDNRTALIVEGSMNSASAGILIYMALVDLLAADFMNP
RMQNNLGLQLGANISLLLGAACMSVLAKWA

>OsZIP1

MARTMTMRVSSLLVAVVLLAALSFAQACSGHGGINDGDGQVDAPATPASSSGV
RSKGLIAVKVWCLVILLVFTFAGGVSPYFYRWNESFLLLGTQFAAGVFLGTAL
MHFLADSTSTFKGLTTNQYPFSFMLTCVGFLTMLS DLVIAAVARRSAAAGVS
DNQVSEQQQRQQAEGAVMSRKEEEAAVAHPAMLVRTSSFEDAVLLIVALCF
HSVFEGIAIGVSASKSEAWRNLTIGLHKIFAAMGIALLRMIPKRPFLMTVV
YSLAFVSSPVGVGIGIAIDATSQGRAADWTYAISMGLATGVFIYVAINHIAK
GYRPHHTAADKPLFKFLAVLLGVAVMAVVMWDT

>OsZIP2

MAGGRGARASLHLHLAWLCAFATTAWAHGGGGGGGSDADADGGGEGKPD
LRARGLVAAKLWCLAVVFAGTLAGGVSPYFMRWDAFLALGTQFAGGVFLG
TAMMHFLADANETFADLLPGTAYPFAFMLACAGYVLTMLADCAISFVVARGG
GRTEPAAAAGAGLEEGKLSSTNGNASDPPAADAAAQDHSVASMLRNASTLG
DSVLLIAALCFHVSFEGIAIGVAETKADAWKALWTISLHKIFAAMGIALLRM
LPDRPFLSCFGYAFVAVSSPVGVGIGIVIDATTQGRVADWIFAVSMGLATGIFIY
VSINHLLSKGYTPLRPVAADTPAGRLLAVVLGVAVIAVVMWDT

>OsZIP3

MGAKKHTLQVLPWLLLFAQHTAASACDCANTTDGADRQGAMKCLKLIAIASI
LAAGAAGVLVPVIGRSMAALRPDGDIFFAVKAFAGVILATGMVHILPAAFDA
LTSPCLKRGGGDRNPFPFAGLVSMSAAVSTMVVDSLAAGYYHRSQFRKARPV
DNINVHKHAGDERAEHAQHINAHTHGGHTHSHGDIVVCGSPEEGSVAESIRH
KVVSQVLELGILVHSVIGVSLGASVRPSTIRPLVGALSFHQFFEGVGLGGCIVQ
ANFKVRATVIMAIFFSLTAPVGIVLGIAISSSYNVHSSTAFVVEGVFNSASAGILI
YMSLVDLLATDFNNPKLQINTKLQLMAYLALFLGAGLMSMLAIWA

>OsZIP4

MDAMRQSTPRAMLLLCVLMLAVAPPGAATAAAVAGCECGNAAAAAVAGED
ARGALRLKLVAIASILAAGAAGVLVPVLGRSFAALRPDGDVFFAVKAFAGVI
LATGMVHILPAAFDALASPCGGGRGGGGGFPFAGLVAMAAAMATMMIDSVA
AGYYRRSHFKKPRPVDDPADAARAAGVEEGGAEHAGHVHVHTHATHGHAH
GHVHSHGHGHGHSHGSAPAAATSPEDASVAETIRHRVVSQVLELGILVHSVIG
VSLGASLRPSSIRPLVGALSFHQFFEGIGLGGCIVQANFKAKATVIMATFFSLTA
PVGIALGIAISSYSKHSSTALVVEGVFNSAAAGILIYMSLVDLLAADFNNPKL

QTNTKLQLAVYLALFLGAGMMSLLAIWA

>OsZIP5

MATAAMTKVFVLLFLVAACYLPAHAAAAECDCATDTAGRDKAQALRLKVIAI
FCILAGSTVGAALPSLGGRFPAIQPETDVFLSVKAFAGGVILATGLVHILPAAFE
ALSSPCLVGGPWKRFPFAGMVAMVSAIGTLIVDTVATGYFHRTDAKRKAAAV
ADEPADDLEASDEHSHGHAGHGMMSVMSVAPAGEEDLVRHRVISQVLELGVVV
HSLIIGMSLGASDFPSTVRPLVPALTFHQFFEGIGLGGCIVQAKFRVRSVVTMA
LFFSLTTPAGIVVGIGISSVYDANSPTALVVQGLLEAAAAGILVYMALVDILAE
DFMKTQVQRRGRLQLAMNVALLLGAGLMSMIAIWA

>OsZIP6

MSGTGCFPAGEMAAVARVCRDGAARLKTGSLLAILVASAVGICLPVALTGA
FRGKAGYARGLLLKCYAAGVILSTSLVHVLPDAHAALADCAVATRRPWRDF
PFAGLFSLVGALLALLVDLSASSHLEAHGHHQHAEEGESPPPPPPHQPYPAPIPT
TKKSPVFELSGEMSPKKRAHSDDTDRDDVALFGAKSAVRSDEVVVAPRVGCH
GHHDVVEVGEEGGGGGEEEEARRKQKMVSKVLEIGIVFHSVIIGVTMGMSQD
VCAIRPLVVALSFHQVFEGMGLGGCIAQAGFGIATVGYMCVMFSVTTPLGILL
GMAIFHMTGYDDSSPNALHIEGLLGSLSGILVYMALVDLISLDFHNMMSSS
NKLKKVSYVALVLGSASMSILALWA

>OsZIP7

MERFVQFLRRGNGLMAASLAAGSCAEVAKAEGAGCRDDAAALRLKGVAM
ATILVAGVVGVGLPLAGRKRRALRTDSAAFVAAKAFAGVILATGFVHMLHD
AEHALSSPCLPAHPWRSFPFPGFVAMSAALATLVLDLAFRYEGKHRAETER
VKAAAAAALAASSASDDDDITVTVTEDDNDNKAPLLQPHSHSHSHPHGHGH
GHELAQPEGSGGEGEVPAQVRSVVVSQILEMGIVSHSVIIGLSLGVSRSPCTIRP
LVAALSFHQFFEGFALGGCIAQAQFKTLSAAIMACFFAITTPAGIAAGAGVASF
YNANSPRALVVEGILDSVSAGILIYMSLVDLIAADFLGGKMTGSTRQQVMAYI
ALFLGALSMSSLAIWA

>OsZIP8

MRTNTTATVLLAAAVALLATAARGDGGDGGCGKEDAAAGRDRARARGLKI
AAFFSILVCGALGCGLPSLGRHVPALRPDGDVFFLVKAFAAGVILATGFIHILPD
AFDNLTDCLPAGGPWKEFPFAGFGAMVGAIGTLVVDTLATGYFTRALSCKD
AATAAAVADEEKQSAAATQQHNHHHNHHVVGDGGGGGEEHEGQVHVHHTHA
THGHAHGSSALVAAGEDDKETTLRHRVISQVLELIGIVVHSVIIGISLGASQNP
ETIKPLVVALSFHQMFEGMGLGGCIVQAKFKVRSIVTMVLFFCLTTPVGIAVG
VGISSVYNESPTALVVEGILNSVAAGILIYMALVDLLAEDFMNPRVQSKGKLQ
LGINLAMLAGAGLMSMLAKWA

>OsZIP9

MAFDLKLTAACLLAVFSLAAAADCECQPSDEGHDAAKSRTLKVIAIFCILVGSS
AGCAIPSLGRRFPALRPDTSLFFALKAFAGVILATAFVHILPVSFDKLGSPCLV
DGPWRKYPTGLVAMLA AVATLLLDTIATGYFLQRAQDSRGAVA AVAACGGD
ASSSHDHERGNAHGVSASIASATMPNDAADDCDDAEDRAKLVRHRVISQVF
ELGIIVHSIIIIGISLGASESPSTIRPLVAALTFHQFFEGIGLGGCIVQARFHLKSAVT
MAIFFSLTTPVGIMIGIGISSAYNENSPTALIVEGILDAAAAGILNYMALVDLLA
EDFMNPRVRKSGRLQLIISILLVGIALMSLLGIWA

>OsZIP10

MESSSSSSYIPFIRQIAASVSAASCDVVGGGGDKDEECRDEAAALRLKMOVAV
AAILIAGAAGVAIPLVGRRRRRGGGGGGGGGASSGGLFVLAKAFAAGVILATGF
VHMLHDAEHALSNPCLPHSPWRRFPFPGFVAMLAALATLVVDFVGTHTFYERK
HRQEEAAAAAEEAAAALLEDGGALPVGDGEGRDGRGGKRDAMHIVGIHAH
AAAHRHSHAHVHGACHGGAVNDAHAHGHGHGHGHEEGPSARHVVVVSQILELGI
VSHSVIIGLSLGVVSQSPCTIKPLVAALSFHQFFEGFALGGCISEAQLKNFSAFLM
AFFFAITTPAGITVGA AVASFYNPNSPRALVVEGILDSMSAGILIYMALVDLIAA
DFLSRKMSCNPRLQVGSYIALFLGAMAMAAALALWA

>OsZIP11

MDPKVVVALALSLIGGLSTSLGALLAILNCAPNNKTLGMLQGFIATGLMLSMS
FFDLAYDAVNAIGFLKGNLWFFAGALLFSTIAEVFPEPDCNLADENDKHLENK
TGNNNIAGKELMMRHRRRRVIFS VVVTAIVAGVSLQNFVPVGTAAFLGTTKGFRV
GLNLSLAIALHYIPEGISVALPAYFATCSKWQAFKLATLSGFAEPLGVIIIVAYLFP
SNLNPEILEGLLGLVGGVMAFLTLYEMLPIAFEYAGRKDAVKAVFVGMAFMS
MSLHFLDISLPKEMGA*

>OsZIP12

MAFDLKLTAACLLAVFSLAAAADCECQPSDEGHDAAKSRTLKVIAIFCIVLGSS
AGCAIPSLGRRFPALRPDTSLFFALKAFAAGVILATAFVHILPVSFDKLGSPCLV
DGPWRKYPTGLVAMLA AVATLLLDTIATGYFLQRAQDSRGAVA AVAACGGD
ASSSHDHERGNAHGVSSAVIASATMPNDAADDCDDAEDRAKLVRHRVISQVF
ELGIIVHSIIIGISLGASESPSTIRPLVAALTFHQFFEGIGLGGCIVQARFHLKSAVT
MAIFFSLTTPVGIMIGIGISSAYNENSPTALIVEGILDAAAAGILNYMALVDLLA
EDFMNPRVRKSGRLQLIISILLVGIALMSLLGIWA*

>OsZIP13

MDSRVGVVLFLLFVLVRDVS AVAETE VGVVRVVQEAPDRKLEGAGGQDGF
KSGKVPVSTVAWSTLAMAAATGLGALPFFLELEAQWAGLCNGLAAGVMLA
ASFDLVQEGQMYGSGSWVVFILSGGFFIWLCKKFLEQYGEVSMLDIKGADA
SKVILVVGIMTLHSFGE GSGVGVSFAGSKGFSQGLLV TIAIAVHNIPEGLAVSM
LLSSRGVSPQKAMIWSIITSLPQPIVAVPAFLCADAFQKVLPFCTGFAAGCMIWI
VIAEVLPAFKEAAPSQVASAGTLAVAFMETLGTVLQGFTDGHNS EDTAGFLV
SLVFGLGPLFGGIVLVAFSLTFSMPHPLLTGVASGIAFRLAAWRPLQLLMSSKM
GLFTTLFLLIGGSLIYHVATSNILQLVNRKKSSVNVITSSSGLSLSVLTLQSLAC
GSVFLHAYA EQLGVAARKAYGLGRYMVLPVSLHGLPRGA AVASCIYGATD
SWRAALAAAALTGFAGPSAAISAILAKIDYSGLDYWMVIACGALIPSFGRVFK
RSLRLDMRKSICGLLIGFAFASVCLMSTRFICLHTPYCNSAPEAVT*

>OsZIP14

MRGGLLVLLLLTA AVAGGGGHEGSSSCPFHAHDKPHDDHHHGHGHGHGHSC
GGGGDDSHHVHHHHHHGHGHGHGHDGGIQRRLPEELAE EADLELDSFGDHHHH
HHHHHEHHHHHDHHHGHGDFQAELSPLGMWLSAMGCSLLVSMASLVCLVLL
PVIFFQGKPSKTMVDCLAIFGAGAMLGDSFLHQLPHAFGGGHSHTHDHQNHN
HSHEHSHAHSLEDLSIGLSVLFGIVFFFIVEKIVRYVEDNSQKGAHGMGHHHH
HHKRHDRSDKAKLNHAEKDHDKG V NQAEKEPSHDGAIEKTDGVTRADSKS
AIRKRLSSGSNSADREPVNSESDPAPNKALSSSEDSSVSNSNMVFGYLNLFSD

GVHNFTDGMALGSAFLLHGSVGGWSRTLFLLAHELPQEVDGFGILVRSRGFTV
TKALFFNFLSALVALAGTALALSLGKDPGHSSLIEGFTAGGFIYIAVAGVLP
NDQKTTVKSSMIQLVSLTMGMLVALGISLVE*

>OsIRT1

MATPRTLVPILPPVAALLLLLVAASSIPILAAQPADACGGAPDQAAADGACHD
VPRALRLKLIAIPTILVSSVVGVCPLLSRSVPALRPDGGGLFAVVKAFA
SGVILATGYMHVLPDAFNLTSPCLPRKPWSEFPFAAFVAMLA
AVSTLMADSLMLTYYNRSKPRPSSGGDVA
AVADHGESPDQGHRHGHGHGHGHGM
AVAKPDDVEATQVQLRRNRVVVQV
LEIGIVVHSVVI
GLGMGASQNVCTIRPLVAAMCFHQM
FEGMGLGGCILQAEYGRRMRSVLV
FFFSTTT
PFGIALGLALTRVYRDNSPTALIVVG
LLNAASAGLLHYMALVELLAADFMGPKLQGNVRLQLAAFLAVLLGAGGMS
VMAKWA*

>OsIRT2

MLAAVFTLMVDSLMLTFHTRGSKGRASSAVAHHGDHGHCHAHALGQADVA
ALSTTEAADQGS
GDVEAGNTTKAQLLRNRVIVQVLEM
GIVVHSVVI
GLGMGASQNVCTIRPLVAALCFHQM
FEGMGLGGCILQAGYGGRTSALV
FFFSTTT
PFGIALGLALTRVYSDSSPTALVVVGLLNAASAGLLHYMALVELLAADFMGPKL
QGNVRLQLAASLAILLGAGGMSVMAKWA*