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Sphingolipids containing very-long-chain fatty acids define a secretory pathway for specific polar plasma membrane protein targeting in Arabidopsis.

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HAL Authorization

Sequences (p. 1-5) and alignment (p. 6-10) used for phylogenetic analysis in Supplemental Figure 1B (FASTA format)

>SlAsc-2

```
MDSIWANNGAPAVSHLFYAIFFAFGFVIVRFLDRFIFRRLAVLLLRLGTTHLRNDEATR GKIVKCESESMWK
FAYYATIEFCVLKVAYHEPWFLDVKGYFSGWPNQELTAGIKLIYMCQCGFYLYSIAALVWETR RKDFAVMM
SHHIVTVFLISSYILSFFRIGIVILALHDGSDVFLEAAKVKYSEKELGASVLF GCFAVSWFPLRLVFFPF
WWIRSSSYLCEVLKLSesydtmiyyffntmlltllvfhiywwiliysmimkqlrnrqvgedirsdseddd
```

>PtLOH2

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MDPILTFNGSANPSHFLPIYFAFGFFLARFILD RFI FRKLAIWLLYSKAKAISSRIDEATIVKCESESMWKL
TYYATVEICVLKITCNEPWFRDTKEYFRGWPHQELGFPIMLFYMCQCGFYIYSIAALLIWETR RKDFSVMMMS
HHVITVILIGYSYSTSFFRIGTIICAVHDASDV FLEAAKVKYSGKEL SASILFGLFAISWVILRLVFFPFW
IIKATSYELVEFLDLSLAYDKLLYYVFN TMLLMLLVFHIYWWILIYSMIMRQLRNRGRVGEDIRSDSEDE
```

>AtLOH2

```
MESVSSRGGDPVVKPSMEVWHFQIAVYFAFGFFLRLVLD RYVFQRIALWLLSTGSAPIKL NDAATRAKIVK
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KDFAVMMSHHVITIIILLSY SYLTSFFRIGAIILALHDASDV METAKIFKYSEKEFGASVCFALFAVSWLLL
RLIYFPFWIIRATSIELLDYLDMTSAEGTLMYYSFN TMLLMLLVFHIYWWYLICAMIVRLLKNRGKVGEDIR
SDSEDDDD
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>SbLOH2

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VQAWVLMIIKQEPWSLDMMQYFDGWPNQPIASSLMLFYMCQCGFYIYSIGALVAWETR RKDFAVMMSHHVIT
STLIGVSYLTGFFRIGTIILALHDASDV FLETAKLCKYTEKELGASLFFGLFAISWLLLRLIYFPFWI IKAS
SYHSIAFLRKLDEFPTALYYILNTMLL TLLVFHMYWKLICLMIMRQLNNGQVTDDVRSDEDE
```

>SlAsc-1

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LYWETRRYDFAAQIIHHVTTVSLIVLSYVYGFARIGSVLALHDGSDVFMEIAKMSKYS GFDLIADIFFSLF
ALVFTSLRIICYPFWIIRSTCYELLYVLDIQKERTTGIILYFVFNALLICLLVLHLFWFKIILRMVKNQILS
RGHITDDVRESESDDDHKD
```

>SlAsc-3

```
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FAAHMIHHITSVSLILLSYIFGMARAGSMAALIHGSDVLM EIAKMSLYSGFHSVADISFALFALS WLLLRL
IYFPFFIYSTSYEVLFIVDKEKQ QNINGIILYFVINSMLICLLLLHIYWWTLICRVIINILKKGQFDDVRS
DSESEDEDEHKQS
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>PtLOH1a

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IFWETRSDFGVSMHHVATVILIVLSYILRFGRVGSVLAIH DASDV FLEV GKMSKYSGAEGVASFAF ILF
VLSWILLRLIYYPFWLWSTSYEVLLILDKEKHPVDGPIYYVFN TLLYCLLFLHVYWWLIYQMLAKQIQ A
RGHLSDDVRSDEGEDEHED
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>PtLOH1b

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IFWETRSDFGVSMHHVATVILIVLSYILRFGRAGSIVLAIHDASDVFLEVGKMSKYSGAEGIASFAFILF
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>VvLOH1

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IFWETRSDFGVSMGHHVATFILIVLSYIFRFARVGSVVLALHDASDVFLEVGKMSKYKGAETTASISFILF
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RGQLSDDVRSDESEDEDEHED

>BrLOH1

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TRSDFGVSMGHHITTVILIVLSYICRFSRAGSVLALHDASDVFLEVGKMSKYSGFEGIAAFSFLFALS
VLLRLIYYPFWILWSTSYQIIMTVDKKHPIEGPIYYYMFNTLLFCLLVLHIFWVWLIYRMLVKVQVQDRGK
LSEDVRSDESDEDEHED

>AtLOH1

MGLFESVKSIDWEQESFPTYQDLGFLPLFAVFFPTIRFLLDRFVFEKLASLVIYGRMSTNKSDNIKDRKKN
PKVRKFKESAWKCIYYLSAELLALSVTYNEPWFSNTLYFWIGPDQIWPDPQMKMLKFLYMFAGFYYSI
FALVWETRSDFGVSMGHHITTVLIVLSYICRLTRAGSVILALHDASDVFLEIGKMSKYCGAESLASISF
VLFALSWWVRLIYYPFWILWSTSYQIIMTVDKKHPNGPIIYYMFNTLLYFLLVLHIFWVWLIYRMLVKV
QDRGKLSDEVRSDESDEDEHED

>AtLOH3

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VFWETRSDFGVSMGHHIATLILIVLSYVCSFSRVGSVVLALHDASDVFLEVGKMSKYSGAERIASFSFILF
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RGKLSDEVRSDEGEDEHED

>AlLOH3

MGLLESVKSINWEHESSPVYQDFRVLPLFAVFFPTIRFLLDRFVFEKLAKHLIYKHRQDMGDDTTERNKKI
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RGKLSDEVRSDEGEDEHED

>OcLOH1

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>OcLOH3

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IFWETRSDFGVSMGHHVASSVLIVLSYVFGSVLALHDATDVFLEVGKMSKYSGAETLASCFSVLFVSWV
ILRLIYYPFWILWSTSCIEIPFLDKDTHKVDGPIYYYIFNTLLFSLLVLHIYWFVLMFRMLVDQIKAGGQVS
GDVRSDESDEETQDD

>GmLOH1

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LIFWETRRSDFGVSMHHVATVILIVLSYIFRFARVGSVVLALHDASDVFLIEIGKMSKYSGAETMASFAMIL
FVLSWIVLRLIYYPFWILWSTSYEVLLTLDKEKHRVDGPIYYYYVFNSLLYCLLMHIYWWVLIYRMLVKQIQ
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>GmLOH3

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ILALVFWETKRSDFFVSMGHHVITVILIVLSYIFRFVRVGSVVLALHDASDVFIETGKMSKYSGAETTASIA
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QEKGVSEDIRSDESEDEDEHKHEE

>RcLOH3

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RGKVSDDVRSDESEGEDEHDD

>PtLOH3

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VFWETRSDFGVSMGHHIVTVFLIVLSYILRFGRVGVAVLALHDATDVFMETAKMSKYSGYELMASVFFLLF
VLFWTILRIIYYPFWILRSTSYEIVSALNKEKQMVGDGSIYYLNFNTLLFSLVLHIYWWILMVGVMMAQIQIA
GGQVSDDVRSDESEGEDDHDD

>AtLOH4

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TRRSDFKVMLVHHIVTSFLIILSYVFRFARIGSVILALHEISDVFLIEIGMKCKYSGAETMSTSVSVLFFLSW
TTLRLIYYPFWILWSTSYESIKVKTEYWDKHLMETGPPLILFYVFNNTLLYCLQILHIYWWILYRVLISQ
IRAKGVAKDIRSDSEGEDDEHQD

>AlLOH4

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TALRLIYYPFWILWSTSYESIKVMEYWDKKNLMEGPNLMVFYYVFNNTLLYCLQILHIYWWILYRVLISQ
IRAKGVAKDIRSDSEGEDDEHDD

>HsCerS2

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KTRLRAPPNATLEHFYLTSGKQPKQVEVELLSRQSGLSGRQVERWFRRRRNQDRPSLLKKFREASWRFTFYL
IAFIAGMAVIVDKPWFDYDMKKVWEGYPIQSTIPSQYWYMIELSFYWSLLFSIASDVKRKDFKEQIIHHVAT
IILISFSWFANYIRAGTLIMALHDSSDYLLSAKMFNYAGWKNTCENNIFIVFAIVFIITRLVILPFWILHCT
LVYPLELYPAFFGYFFNSMMGVLQLLHIFWAYLILRMAHKFITGKLVEDERSDREETESSE
GEEAAAGGAKSRPLANGHPILNNHRKND

>HsCerS3

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>HsCerS4

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>HsCerS5

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>HsCerS6

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VFTYGVRFLLKTPWLWNTRHCWYNYPYQPLTTDLHYIILELSFYWSLMFSQFTDIKRKDFGIMFLHHLVSI
FLITFSYVNMARVGTLLVCLHDSADALLEAAKMANYAKFQKMCDDL FVMFAVVFITTRLGIFPLWVLTTL
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>HsCerS1

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>ScLAG1

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FLREFLMDVVIRPFTVYLNVTSEHRQKRMLEQMYAIFYCGVSGPFGLYIMYHSDLWLFKTKPMYRTYPVITN
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>ScLAC1

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LSFSKTLNYLDSGLAFFSFAIFVWAWIYLRHYINLKILWSVLTQFRTEGNYVLNFATQQYKCWISLPIVFVL
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Alignment used for phylogenetic analysis in Supplemental Figure 1B

```

SlAsc-2 -----
PtLOH2 -----
AtLOH2 -----
SbLOH2 -----
SlAsc-1 -----
SlAsc-3 -----
PtLOH1a -----
PtLOH1b -----
VvLOH1 -----
BrLOH1 -----
AtLOH1 -----
AtLOH3 -----
AlLOH3 -----
OcLOH1 -----
OcLOH3 -----
GmLOH1 -----
GmLOH3 -----
RcLOH3 -----
PtLOH3 -----
AtLOH4 -----
AlLOH4 -----
HsCerS2 -----MLQTLYDYFWWERLWLP
HsCerS3 -----MFWTFKEFWLRFWLP
HsCerS4 -----MLSSFNEWFWQDRFWLP
HsCerS5 -----MATAAQGPLSLLWGWLWSERFWLP
HsCerS6 -----MAGILAWFWRERFWLP
HsCerS1 -----
ScLAG1 -MTSATDKSIDRLVVNAKTRRRNSSVGKIDLGDTPVGFAAMPESAASKNEAKKRMKALTG
ScLAC1 MSTIKPSPSNNLKVRSRPRRK-SSIGKIDLGDTPVSLGTMFETKESKTAAKRRMQRLSE

SlAsc-2 -----MDSIWANNGAP
PtLOH2 -----MDPILTFNGSA
AtLOH2 -----MESVSSRGGDPVVKPSM
SbLOH2 -----MAAVR
SlAsc-1 -----MKNLDHIAASVDWEKESLP
SlAsc-3 -----MDWDTESYR
PtLOH1a -----MGFMEYVKSIWEHESYP
PtLOH1b -----MGFMEYAKSIQWEHESYP
VvLOH1 -----MGLLESAASINWEHESFP
BrLOH1 -----MGFFESVKSINWEHESFP
AtLOH1 -----MGLFESVKSIDWEQESFP
AtLOH3 -----MGLLESVKINWEHESFP
AlLOH3 -----MGLLESVKINWEHESFP
OcLOH1 -----MGFLDLMNPIDWEYESYP
OcLOH3 -----MGFLEMVKSVDWEQESYS
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GmLOH3 -----MGTWVLQQVTSIDWNWNHESYP
RcLOH3 -----MGVVGTNGFINWESESY
PtLOH3 -----MGVLGINNIDWESESY
AtLOH4 -----MDLKLLSRPDWDQESYP
AlLOH4 -----MDLKLLSR- DWDHESYP
HsCerS2 VNLTWADLED-RDGRVYAKASDLYITLPLALLFLIVRYFFELYVATPLAALLNIKEKTRL

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HsCerS3 PTIKWSDLED-HDGLVFKPSHLYVTIPYAFLLLIIRRVFEKFFVASPLAKSFGIKETVRK
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 HsCerS5 ENVSWADLEGPADGYGYPRGRHILSVFPLAAGIFFVRLLEFERFIAKPCALCIGIEDSGPY
 HsCerS6 HNVTWADLKN-TEEATFPQAEDLYLAFPLAFCIFMVRLIFERFVAKPCAIALNIQANGPQ
 HsCerS1 -----MAAAGPAAGPTGPEPMPSYAQLVQRGWSALAAARGCTDCGW
 ScLAG1 DSKKSDLLWKVWFSYREMNYSRHSWLPFFILVVCVYSAYFLSGNRTESNPLHMFVAISYQ
 ScLAC1 ATKNDSDLVKKIWFWSFREISYRHAWIAPLMILIAVYSAYFTSGNTTKTNVLRHFVAVSYQ

SlAsc-2 AVSHLFYAIFFAFGFVIVRFLDRFIFRRLAVLLLRLGTTHLRNDEATR-----KIVKC
 PtLOH2 NPSHFLLPYAFGFLLARFILDRIFRKLAIWLLYSKAKAISSRIDEAT-----IVKC
 AtLOH2 EVWHFQIAVYFAFGFFLRLVLDRIYVQRIALWLLSTGSAPIKLNDAATRA-----KIVKC
 SbLOH2 GGEAVSVALLFSLAFFCARLLLDRLVYKPLAVYLFNTKASKLMNDEARQA-----KIVKF
 SlAsc-1 EYQDLIFLLFFALFFPVLRFILDRFVFEALAKRMIFGKKTVVNINGREERK-----KINKF
 SlAsc-3 EYKDLIFIPFFALFFPILRFILDRLVFEALAKRMICGKDAKVIKNGSSIKRK---KMNKF
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 PtLOH1b AYEDYIVLPLFSLFFTFVRFFLDRFVQKLAQRLIFGKEHQMMLDQPDERRK---KIGKF
 VvLOH1 EYGDFVALPVFAFFFSVRFFLDRFVQKLGRIIFGKGGQQLDVGVDKRRK---KLRKF
 BrLOH1 TYQDFVCLPLFAVFFPSIRFLLDRFVFEKVGRLLIYGKQSPKKNKKT-----KIRKF
 AtLOH1 TYQDLGFLPLFAVFFPTIRFLLDRFVFEKLASLVIYGRMSTNKSNIKDRKKNSPKVRKF
 AtLOH3 VYQDFRVLPLFAVFFPSIRFLLDRFVFEKLAKYLIYGKHRQDMGDDTTERKK---KIRKF
 AllOH3 VYQDFRVLPLFAVFFPTIRFLLDRFVFEKLAKHLIYGKHRQDMGDDTTERNK---KIRKF
 OcLOH1 QYEDFLVPLFALFFPTVRFFLDRFVFEKVGRRLIYRKGVEVENETYEQKK---KIRKF
 OcLOH3 QYEDFIVLLFFVLFFPTVRFFLDIFVFEKVSRRLMFGKGMQVVAESEERKK---KIRKF
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 RcLOH3 EAIDFSAVPFFALFFPSVRLFDITYVFEKLARRLIFGKASTSTDVATHENRK---KINKF
 PtLOH3 VATDFIAIPLFAVFFSVRFVLDKYVFECSARRFIFGKGHVTVDVGKHGHRK---KVNKF
 AtLOH4 DSSDFLVLIFFAPFFLRLILDRCIFERVARRLVVPKGLCA---DSNERRK---KVKKF
 AllOH4 AFSDLWLIFFAPFFLRLILDRCIFERVARRLVVPRGHY---DSNERRK---KIVKF
 HsCerS2 RAPPNATLEKHFYLTSGKQPKQVEVELLSRQSGLSGRQVERWFRRRRNQDRPS---LLKKF
 HsCerS3 VTP-NTVLENFFKHSTRQPLQTDIYGLAKKCNLTERQVERWFRSRRNQERPS---RLKKF
 HsCerS4 QVKPNATLEKHFLTEGHRPKEPQLSLLAAQCGLTLQQTQRWFRRRRNQDRPQ---LTKKF
 HsCerS5 QAQPNAILEKVVISITKYPDKKRLEGLSKQLDWNVRKIQCWFRHRRNQDKPP---TLTKF
 HsCerS6 IAPPNAILEKVFTAITKHPDEKRLEGLSKQLDWDVRSIQRWFRQRRNQEKPS---TLTRF
 HsCerS1 GLARRGLAEHAHLAPPELLLLALGALGWTALRSAATARLFRPLAKRCCLQPR---DAAKM
 ScLAG1 VDGTDYAKGKIDLSFVFFYMIFFTFLEFLMDVIRPFTVYLVNVTSEHRQK-----RM
 ScLAC1 IGDTNAYGKGINDLFCVFFYMIFFTFLEFLMDVIRPFAIRLHVTSKHKRIK-----RI

SlAsc-2 SESMWKFAYYATIEFCVLKVAYHEPWFLDVKGYFSG-----WPNQELTAGIKLIYMCQCG
 PtLOH2 SESMWKLTYYATVEICVLKITCNEPWRDTEKEYFRG-----WPHQELGFPIMLFYMCQCG
 AtLOH2 KESLWKLLEYAACDFVLQVIYHEPWARDIKLYFHG-----WPNQELKLSIKLYYMCQCG
 SbLOH2 SESSWKLTYYASVQAWVLMIIKQEPWSLDMMQYFDG-----WPNQPIASSLMLFYMCQCG
 SlAsc-1 KESAWKFVYFLSAELLALSVCNEPWFTDSRYFWAGPGDVVWPNLKMMLKLLKLLYMYAGG
 SlAsc-3 KESAWKFMVFLSAEIFALYVTYNPWFNTNTRYWTGPGDQVWPDQKMKLKLKGLWMTMYAGG
 PtLOH1a KESAWKCIYFLSSEILVLCVYDEPWLVTNTKYFWVGPQVWPDQKMKLKLKAVYMYAAG
 PtLOH1b KESAWKCIYFLSAEILVLYVYDEPWFNTKYFWVGPQVWPDQKMKLKLKAVYMYAAG
 VvLOH1 KESAWKCVYFLSAELLALSVCNEPWFTNTKYFWVGPQVWPDQKMKLKLKGLYMYCGG
 BrLOH1 KESAWKCIYFLSAEVLALSVCNEPWFTDTLYFWIGPGDIWPNQMKIKLKLFLYMYTAG
 AtLOH1 KESAWKCIYFLSAELLALSVCNEPWFNTLYFWIGPGDIWPDQPMKMKLKLFLYMYFAAG
 AtLOH3 KESAWKCVYFLSAEILALSVCNEPWFMTKYFWVGPQVWPDQKMKLKLKLLYMYFVAG
 AllOH3 KESAWKCVYFLSAEILALSVCNEPWFMTKYFWVGPQVWPDQKMKLKLKLLYMYFVAG
 OcLOH1 KESAWKCVYFLSAEILALAVTYNEPWFTTKTYFWLGPQVWPDQAYKMKLKLKGLYMYFVGG
 OcLOH3 KESAWKCVYFLSADFFALAATYKESWFTNTKHFWEVGPQVWPDQKYNLKLKGLYMYTGG
 GmLOH1 KESAWKCVYFLSAEILALSVCNEPWFTNTINFVGPQVWPDQKMKLKLKAVYMYAAG
 GmLOH3 MESAWKCVYFLSAEILALAVTYNEPWFTDTRYFWVGPQVWPDQKMKLKLKGLYMYAAG
 RcLOH3 KESAWKYIYFSSAEILALSVCNEPWFNTKYFWVGPQVWPDQKMKLKLKGLYMYFVAG
 PtLOH3 KESAWKCVYFLCAEILALVSYDEPWFTNTKYFWVGPQVWPDQKMKLKLKGLYMYAAG

AtLOH4 KESAWKCLCSFSVEAFALYVTYKEPWFKDTRSFWLGGDQVWPDQKIKLKMKGMYMFVGG
 AllOH4 KESAWKCLCSFSVEALALYVTYKEPWFKDTRCFWLGGDQIWPDQKIKRLKMKGMYMFVGG
 HsCerS2 REASWRFTFYLIAFIAGMAVIVDKPWFYDMKKVWEG-----YPIQSTIPSQYWYYMIELS
 HsCerS3 QEACWRFAFYLMITVAGIAFLYDKPWLIDLWEVWNG-----YPKQPLPSQYWYYILEMS
 HsCerS4 CEASWRFLFYLSSFVGGSLVLYHESWLWAPVMCWD-----YPNQTLKPSLYWYYLLELG
 HsCerS5 CESMWRFTFYLCIFCYGIRFLWSSPWFWDIRQCWHN-----YPFQPLSSGLYHYIIMELA
 HsCerS6 CESMWRFSFYLYVFTYGVRFLLKTPWLWNTRHCWYN-----YPPYPLTTDLHYIILELS
 HsCerS1 PESAWKFLFYLGWSYSAYLLFGTDYPPFFHPPSVFYD--WTPGMVPRDIAAAYLLQGS
 ScLAG1 LEQMYAIFYCGVSGPFGLYIMYHSDLWLFKTKPMYRT----YPVITNPFLLKIFYLQQA
 ScLAC1 MEQMYAIFYTGVSGPFGIYCMYHSDLWFFNTKAMYRT----YPDFTNPFLLKVFYLGQA

SlAsc-2 FYL-YSIAALVWETRRKDFAVMMSHHIVTVFLISSYILSFFRIGIVILALHDGSDVFL
 PtLOH2 FYI-YSIAALLIWETRRKDFSVMMSHHIVITVILIGYSYSTSFFRIGTIICAVHDASDVFL
 AtLOH2 FYV-YGVAALLAWETRRKDFAVMMSHHIVITIIILLSYSYLTSSFFRIGAIILALHDASDVFM
 SbLOH2 FYI-YSIGALVAWETRRKDFAVMMSHHIVITSTLIGVSYLTGFFRIGTIILALHDASDVFL
 SlAsc-1 FYF-YSIFATLYWETRRYDFAAQIIHHVTTVSLIVLSYVYGFARIGSVLALHDGSDVFM
 SlAsc-3 FYL-YSIFALIYWETRRSDFAAHMIHHITSVSLILLSYIFGMARAGSMAALIHGSDVLM
 PtLOH1a FYT-YSIFALIFWETRRSDFGVSMHHVATVILIVLSYILRFGRVGSVLAIHGSDVFL
 PtLOH1b FYT-YSIFALIFWETRRSDFGVSMHHVATVILIVLSYILRFGRAGSIVLAIHDGSDVFL
 VvLOH1 FYT-YSIFALIFWETRRSDFGVSMGHHVATFILIVLSYIFRFARVGSVLAHDGSDVFL
 BrLOH1 FYT-YSIFALIFWETRRSDFGVSMGHHITTVILIVLSYICRFSRAGSVLALHDGSDVFL
 AtLOH1 FYT-YSIFALVFWETRRSDFGVSMGHHITTLVILIVLSYICRLTRAGSVILALHDGSDVFL
 AtLOH3 FYT-YSIFALVFWETRRSDFGVSMGHHIATLILIVLSYVCSFSRVGSVLAHDGSDVFL
 AllOH3 FYT-YSIFALIFWETRRSDFGVSMGHHIATLILIVLSYVCSFSRVGSVLAHDGSDVFL
 OcLOH1 FYT-YSIFALIFWETRRSDFGVSMHHVATFILIVLSYVLRFARAGSVLALHDGSDVFL
 OcLOH3 FYT-YSIFALIFWETRRSDFGVSMGHHVASSVILIVLSYVF-----GSVLAHDATDVFL
 GmLOH1 FYS-YSIFALIFWETRRSDFGVSMHHVATVILIVLSYIFRFARVGSVLAHDGSDVFL
 GmLOH3 FYT-YSILALVFWETKRSDFFVSMGHHVITVILIVLSYIFRFVVRVGSVLAHDGSDVFI
 RcLOH3 FYI-YSIFALIFWETRRSDFAVSMAHHVATVILLVMSYILRFARVGSIVLALHDVCDGFL
 PtLOH3 FYT-YSIFALVFWETRRSDFGVSMGHHIVTVFLIVLSYILRFGRVAVLALHDATDVFM
 AtLOH4 LNV-YAFFALFFWETRRSDFKVMLVHHIVTSFLIILSYVFRFARIGSVILALHEISDVFL
 AllOH4 GLNVYAFFALFFWETRRSDFKVMLVHHIVTSFLIILSYVFRFARIGSVILALHEISDVFL
 HsCerS2 FY--WSSLFSIASDVKRKDFKEQIIHHVATIILISFSWFANYIRAGTLIMALHDSSDYLL
 HsCerS3 FY--WSSLFRLGFDVKKRDFLAHIIHHLAAISLMSFSWCANYIRSGTLVMIVHDVADIWL
 HsCerS4 FY--LSLLIRLPFDVKKRDFKEQVIHFFVAVILMTFSYSANLLRIGSLVLLLDSSDYLL
 HsCerS5 FY--WSLMFSQFTDIKRKDFLIMFVHHLVTIGLISFSYINMVRVGTLMCLHDVSDFLL
 HsCerS6 FY--WSLMFSQFTDIKRKDFGIMFLHHLVSIFLITFSYVNNMARVGTLLVCLHDSADALL
 HsCerS1 FYG-HSIYATLYMDTWRKDSVVMLLHHVVTLLILIVSSYAFRYHNVGILVFLHDISDVQL
 ScLAG1 FWAQQACVLVLQLEKPRKDYKELVFHHIVTLLLIIWSSYVFHFTKMGLAIYITMDVSDFFL
 ScLAC1 FWAQQACILVLQLEKPRKDHNELTFHHIVTLLLIIWSSYVFHFTKMGLPIYITMDVSDFLL

SlAsc-2 EAAKVKYSEKELGASVLFGCFAVSWFPLRLVFFPFWIRSSSYLCEVLKLSSEYD---
 PtLOH2 EAAKVKYSGKELASILFGLFAISWILRLVFFPFWIIKATSVELVEFLDLSLAYDK--
 AtLOH2 ETAKIFKYSEKEFGASVCFALFAVSWLLLRLLIYFPFWIIRATSIELLDYLDMTSA-----
 SbLOH2 ETAKLCKYTEKELGASLFFGLFAISWLLLRLLIYFPFWIIRKASSYHSIAFLRKLDEF-----
 SlAsc-1 EIAKMSKYSGFDLIADIFFSLFALVFTSLRIICYPFWIIIRSTCYELLYVLDIQKER-----
 SlAsc-3 EIAKMSLYSGFHSVADISFALFALSLLRLIYFPFFIIYSTSYEVLFIVDKEKQ-----
 PtLOH1a EVGKMSKYSGAEGVASFAFILFVLSWILLRLIYYPFWLWSTSYEVLLILDKEK-----
 PtLOH1b EVGKMSKYSGAEGIASFAFILFVLSWILLRLIYYPFWLWSTSYEVLLNLDKEK-----
 VvLOH1 EVGKMSKYKGAETTASISFILFVLSWIVLRLIYYPFWILRSTSYEVILTLDKEK-----
 BrLOH1 EVGKMSKYSGFEGIAAFSFLFALSLLRLIYYPFWILWSTSYQIIMTVDKK-----
 AtLOH1 EIGKMSKYCGAESLASISFVLFALSLLRLIYYPFWILWSTSYQIIMTVDKK-----
 AtLOH3 EVGKMSKYSGAERIASFSFILFVLSWILLRLIYYPFWILWSTSYEVVLELDKDK-----
 AllOH3 EVGKMSKYSGAERIASFSFILFVMSWILLRLIYYPFWILWSTSYEVVLELDKDK-----
 OcLOH1 EVGKMSKYSGAEIASISFVLFVLSWVLLRLIYYPFWILWSTSYEVIQTVDKK-----
 OcLOH3 EVGKMSKYSGAETLASCFSVLFVSWVILRLIYYPFWILWSTSCIEIIPFLDKDT-----
 GmLOH1 EIGKMSKYSGAETMASFAFILFVLSWIVLRLIYYPFWILWSTSYEVLLTLDKEK-----

GmLOH3 ETGKMSKYSGAETTASIAFILFVLCFTVTRIIYYPFWILRSTSYEVVHALKMD-----
 RcLOH3 EIAKMSRYSYGEWISSIFFVLFVLSWTIFRIIYYPFWILRSTSYEVVLTLDMMK-----
 PtLOH3 EIAKMSKYSYELMASVFFLLFVLFWTILRIIYYPFWILRSTSYEIVSALNKEK-----
 AtLOH4 EIGKMCKYSGAETMTSVSFVLFLLSWTTLRLIYYPFWILWSTSYESIKVKTEYWDKHLM
 ALLOH4 EIGKMCKYSGAEAMTSVSVFVLFLLSWTALRLIYYPFWILWSTSYESIKVKMEYWDKKNLM
 HsCerS2 ESAKMFNYAGWKNTCNNIFIVFAIVFIITRLVILPFWILHCTLVYPLELYPAFFG-----
 HsCerS3 ESAKMFNYAGWTQTCNTLFFIFSTIFFISRLIVFPFWILYCTLILPMYHLEPFFS-----
 HsCerS4 EACKMVNYMQYQQVCDALFLIFSFVFFYTRLVLFPTQILYTTYYESISNRGPPFFG-----
 HsCerS5 EAAKLANYAKYQRLCDTLFVIFSAVFMVTRLGIYYPFWILNTTLFESWEIIGPYAS-----
 HsCerS6 EAAKMANYAKFKQKMDLLFVMFAVVFITTRLGIFPLWVNTTLFESWEIVGPYPS-----
 HsCerS1 EFTKLNIIYFKSRGGSYHRLHALAADLGCLSFSGFSWFWRLYWFLKVLATSHCSLRTVP
 ScLAG1 SLSKTLNLYNSVFTPFVFGFLFVFWIYLRHVNIIRILWSVLTEFRHEGNYVLFNATQQYK
 ScLAC1 SFSKTLNLYLDSGLAFFSFAIFVVAWIYLRHYINLKILWSVLTQFRTEGNYVLFNATQQYK

SlAsc-2 -----TMIYFFNTMLLTLVLFHIYWWILYISMIMKQLRNRGQVGEDIRSDSEDDDD---
 PtLOH2 -----LLYYVFNTMLLMLLVFHIYWWILYISMIMRQLRNRGRVGEDIRSDSEDDDE---
 AtLOH2 ----EGTLMYYSFNTMLLMLLVFHIYWWYLICAMIVRLLKNRGKVGEDIRSDSEDDDD---
 SbLOH2 -----PTALYYILNTMLLTLVLFHMYWVKLICLMIMRQLNKGQVTDVRSDEDDDE---
 SlAsc-1 ---TTGIILYFVNALLICLLVLFHFKIILRMVKNQILSRGHITDDVREDSSEDDDD-H
 SlAsc-3 -QNINGIILYFVINSMLICLLLLHIYWWTLICRVIINIL-KKGQF-DDVRSDESESEDED
 PtLOH1a -HPVDGPIYYYYVFNTLLYCLLFLHVIYWWVLIYQMLAKQIQARGHLSDDVRSDEGEDE-H
 PtLOH1b -HAVDGPYYYYVFNTLLYGLLVLHIYWWVLMYRMLVKQIQARGQLSDDVRSDEGEDE-H
 VvLOH1 -HAVEGPIYYYYLFNTLLFCLLVLHIYWWVLMYRMLVKQVQARGQLSDDVRSDESEDE-H
 BrLOH1 -HPIEGPIYYMFNTLLFCLLVLHIFWVLIYRMLVKQVQDRGKLSDDVRSDESDDDE-H
 AtLOH1 -HP-NGPILYYMFNTLLYFLLVLFHIFWVLIYRMLVKQVQDRGKLSDDVRSDESDDDE-H
 AtLOH3 -HPIEGPIYYMFNTLLYCLLVLHIYWWVLMYRMLVKQIQDRGKLSDDVRSDEGEDE-H
 ALLOH3 -HPIEGPIYYMFNTLLYCLLVLHIYWWVLMYRMLVKQIQDRGKLSDDVRSDEGEDE-H
 OcLOH1 -HRADGPIYYYYFNSLLFSLLVLHIYWWVLMYRMLVKQIQARGVSEDVRSDESEDE-H
 OcLOH3 -HKVDGPIYYYYFNTLLFSLLVLHIYWWVLMFRMLVDQIKAGGQVSGDVRSDESEDE-Q
 GmLOH1 -HRVDGPIYYYYFNSLLYCLLVLMHIYWWVLIYRMLVKQIQARGKVSDDVRSDESEDE-H
 GmLOH3 --LVDGPLYYYYYFNSLLYFLQVLHIYWWVLMRMLVKQIQEKGVSEDIRSDSEDEDE-H
 RcLOH3 -HMVDGPNYYLFNTLLFCILVFNIIYWWILMVRMVVEQIKARGKVSDDVRSDEGEDE-H
 PtLOH3 -QMVDGSIYYYYLFNTLLFSLLVLHIYWWILMVGVMVAQIQAGGQVSDVRSDEGEDD-H
 AtLOH4 ETGPPLILFYFVFNTLLYCLQILHIYWWILYRVLISQIRAKGKVAKDIRSDSEGEDDEH
 ALLOH4 ETGPNLMVFFYFVFNTLLYCLQILHIYWWILYRVLISQIRAKGKVAKDIRSDSEGEDDEH
 HsCerS2 -----YFFNSMMGVLQLLHIFWAYLILRMAHKFIT--GKLVEDERSDREETESSE
 HsCerS3 -----YIFLNLQMLILQVLHLYWGYIILKMLNRCIF--MKSIQDVRSDDDEDYEEEE
 HsCerS4 -----YFFNGLLMLLQLLHVFWSCILRMLYSFMK-KGQMEKDIRSDVEESDSSE
 HsCerS5 -----WLLNGLLLTLQLLHVIWSYLIARIALKALI-RGKVSDDRSDVESSESEEE
 HsCerS6 -----WVFNLLLLLVQGLNCFWSYLIVKIACKAVS-RGKVSDDRSDIESSSDEE
 HsCerS1 D-----IPFYFFFNALLLLLTLMNLYWFLYIVAFAAKVLTGQVHELKDLREYDTAEAQSL
 ScLAG1 C-----WISLPIVFLVIAALQLVNLVWFLFILRILYRLIW-QG-IQKDRSDSDSDESAE
 ScLAC1 C-----WISLPIVFLVIGALQLVNLVWFLFIFRVLRYRILW-RG-ILKDRSDSESEDEESD

SlAsc-2 -----
 PtLOH2 -----
 AtLOH2 -----
 SbLOH2 -----
 SlAsc-1 KD-----
 SlAsc-3 EHKQS-----
 PtLOH1a ED-----
 PtLOH1b ED-----
 VvLOH1 ED-----
 BrLOH1 ED-----
 AtLOH1 ED-----
 AtLOH3 ED-----
 ALLOH3 ED-----

OcLOH1 ED-----
OcLOH3 DD-----
GmLOH1 EHED-----
GmLOH3 KHEE-----
RcLOH3 DD-----
PtLOH3 DD-----
AtLOH4 QD-----
AlLOH4 HD
HsCerS2 GEEAAAGGGAKSRPLANGHPILNNNHRKND-----
HsCerS3 EEEEEATKGKEMDCLKNGLRAERHLIPNGQHG-----
HsCerS4 EAAAAQEPLQLKNGAAGGPRPAPT DGPRSRVAGRLTNRHTTAT
HsCerS5 DVTTCTKSPCDSSSSNGANRVNGHMG-GSYWAE-----
HsCerS6 DSEPPGKNPHTATTTNGTSGTNGYLLTGSCSMDD-----
HsCerS1 KPSKAEKPLRNGLVKDKRF-----
ScLAG1 NEESKEKCE-----
ScLAC1 ESSTTPTDSTPTKKDI-----