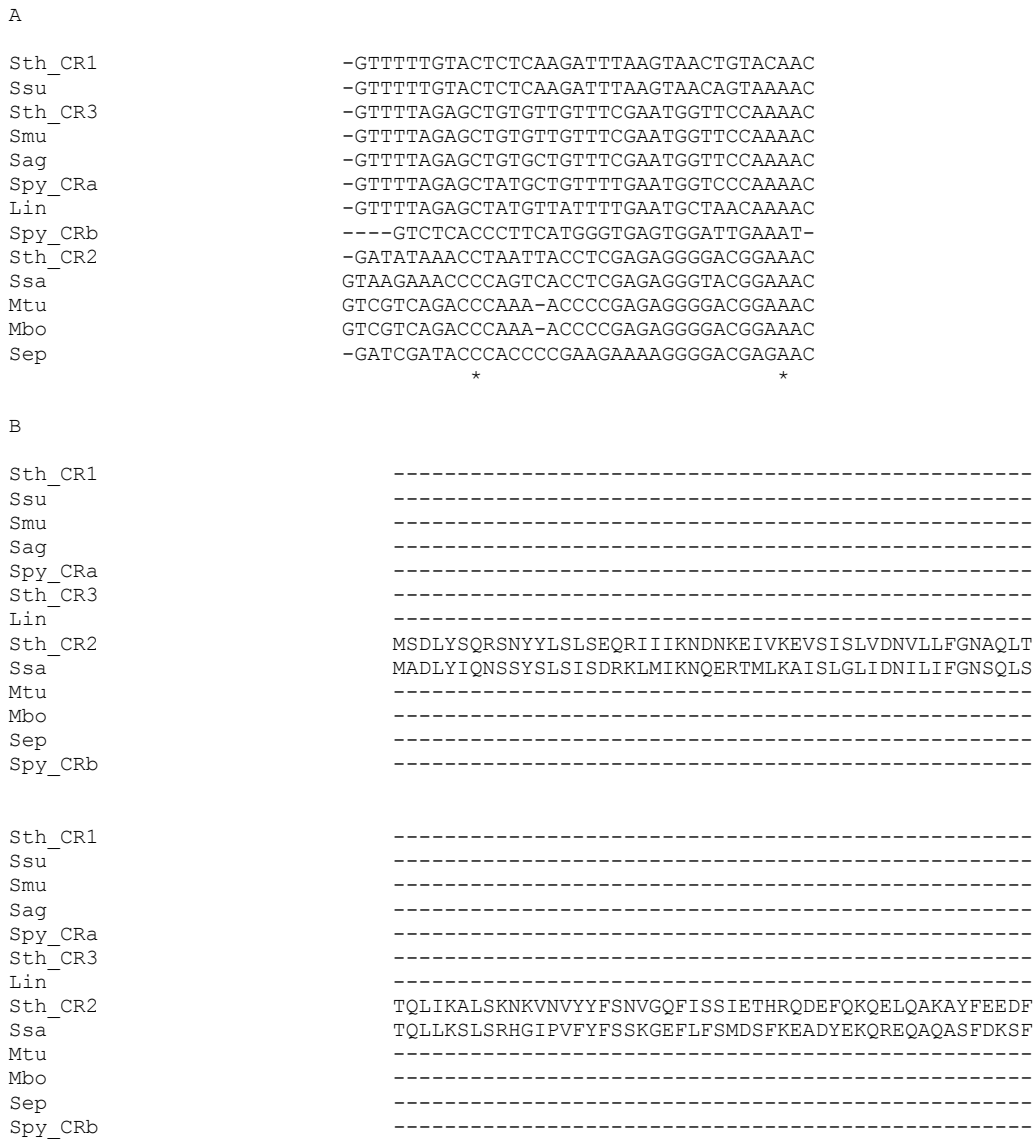


Figure S1. Multiple sequence alignments. (A) CRISPR repeats; (B) concatenated Cas protein sequences; (C) Cas1 sequences. Lin, *Listeria innocua* Clip11262 (AL592022); Mbo, *Mycobacterium bovis* BCG Pasteur 1173P2 (AM408590); Mtu, *Mycobacterium tuberculosis* F11 (CP000717); Sag, *Streptococcus agalactiae* A909 (CP000114); Sep, *Staphylococcus epidermidis* RP62A (CP000029); Smu, *Streptococcus mutans* UA159 (AE014133); Spy, *Streptococcus pyogenes* MGAS5005 (CP000017); Ssa, *Streptococcus sanguinis* SK36 (CP000387); *Streptococcus suis* 89/1591 (AAFA00000000); Sth, *Streptococcus thermophilus* LMD-9 (CP000419). CR1, CRISPR1; CR2, CRISPR2; CR3, CRISPR3; CRa, CRb, two CRISPR loci in *S. pyogenes*.



Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 RLEVARSIATTKVRHQIALLREFDTDGLLDTSDYSRFEDSVNDIQKAYSI
Ssa CLKMSKRIASAKIMNQLNLLKAYDEQGLFDEEDFKRFSACESLESAKSI
Mtu -----
Mbo -----
Sep -----
Spy_CRb -----MILAHYDCKKDKKQSLDEHLWHVACSS

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 TEIMGYEGRLAKSYFYLNLLVPDDFHFNGRSRRTAEDCFNSALNFGYSI
Ssa SEIMGIEGRIAKSYFYLNLLVEEDFQFYSRNRSPSLDRFNALLNFGYSI
Mtu -----
Mbo -----
Sep ----MKDVIYVENHYFVTAKENSIKFRNVIDKSEKFYLFEEIEAIIFDH
Spy_CRb RQEASIIIGQGDVLFLLIGLYHDLGKADRTFQDKLLNPNRHVDHSYAGAKY

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 LYSCLMGLIKKNGLSLGFGVIHKKHQHATLASDLMEWRPIIVDNTLME
Ssa LYSCFIGLIRKNGLSAGFGVTHQPHTHHAVLASDLMEWRPVIIVDDTVMS
Mtu -----
Mbo -----
Sep YKSYFSHKLVIKCIENDIAIIFCDKKHSP-----
Spy_CRb LCSIIIGPHLKNRGVDKNERMTFN-----

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 LIRNG-----KLLLS--HFENKDQDFILTDEGREIFAWALRSRILEVH
Ssa LIKHGDIRGGAFMVLGGEHFEKMGDEMHLTSEGIEVFSRAMRERILEIH
Mtu -----
Mbo -----
Sep -----VTQLISSYGMVNRKRIQSQ
Spy_CRb -----EMVGYVISAHHGMYDLCYFDDAE

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 RYIELDKKRYSFLYTADRQIKSLIRAFRELDPSLYETSYTGGHMGLYFNL
Ssa HYVELDKNRYTFLYMADQQVKS LIRCFKSRNADDYISSYTGEVKMTFYNL
Mtu -----
Mbo -----

Sep FQLSGRTKDRIVKWKIVNKKIFNQTRCLENNLHNENVKMLG-----FAKE
Spy_CRb YYGFNKFKNRINRDLDDGYHYHEDIKGYALKLEKLCYGYKDLRELIDKA

Sth_CR1 -----MSD-LVLGLDIGIGSVGVGI
Ssu -----MSNGKILGLDIGIASVGVGV
Smu -----MKKPYSIGLDIGTNSVGWAV
Sag -----MNKPYSIGLDIGTNSVGSWI
Spy_CRa -----MDKKYSIGLDIGTNSVGWAV
Sth_CR3 -----MTKPYSIGLDIGTNSVGWAV
Lin -----MKKPYTIGLDIGTNSVGWAV
Sth_CR2 SEEEREFKQKTMFCLIIYDIRSNKRRLKLSKLLLEGYGVVRQKSCFEVNL
Ssa DSVSKEFARKKTKFCLVIYDIVSNKRRLKLALELEGYGTRVQRSCFEVDI
Mtu -----LAARRGGIRRTDLLRRSQPRGRHRASAAE
Mbo -----LAARRGGIRRTDLLRRSQPRGRHRASAAE
Sep VSSGDKSNKEAHATRIYFKDLFGKQFKRGRYNDVINSGLNYGYSILRSFI
Spy_CRb FDNYQQAMSSLNWQDKSEWYYQSCMVRLYLSLLKNADILDTVNAYGLKI

Sth_CR1 LN-----KVTGE-----
Ssu ID-----AQTGE-----
Smu VTDDYKVPAKMKVVLGNTDKSH-----
Sag ITDDYKVPAKMVRVLGNTDKEY-----
Spy_CRa ITDDYKVPSSKFKVVLGNTDRHS-----
Sth_CR3 TTDNYKVPSSKMKVVLGNTSKKY-----
Lin LTDQYDLVKKMKIAGDSEKKQ-----
Sth_CR2 SRNDYQSLKLDIEGFYKADEEDSIIVYVTTKEEVTFSFPHYSAEKLDDIL
Ssa EKLNFELLIKDIRDFYQADEGDNIIVYVGHK-----
Mtu SGLTWISPTLILVGFSHRGDRRMTEHLSRLT-----
Mbo SGLTWISPTLILVGFSHRGDRRMTEHLSRLT-----
Sep NKELAIHGFEMSLGIKHQSKEN-----
Spy_CRb SPMDKTERSFLKHSYLAIEQKYASFGQP-----

Sth_CR1 --I IHKNSRI FPAQAENNLVRRTNRQGRRLARRKKHRRVRLNRLFEESE
Ssu --I HASRI FPSANAANNAERTRFRGSRRLIRRKKHRIKRLDDLFN--D
Smu --IEKNLLGALLFDSGNTAEDRRLKRTARRRYTRRRNRILYLQEIFSEEM
Sag --IKKNLIGALLFDGGNTAADRRLKRTARRRYTRRRNRILYLQEIFAEEM
Spy_CRa --IKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEM
Sth_CR3 --IKKNLLGVLLFDSGITAEGRLKRTARRRYTRRRNRILYLQEIFSTEM
Lin --IKKNFWGVRLFDEGQTAADRRMARTARRRIERRNRISYLGQIFAEEM
Sth_CR2 FFMKKLVFTFKRIDHPAQDLAVKFHGFLEQLDSYVDYLHQQTNPYAT
Ssa --VKKIRLHLSKVSLKDDDLVCKLQGFLEKLSDDFASFLHQQTNPYSM
Mtu --LTLEVDAPLERARVATLGPHLHGVLMESIPADYVQTLHTVFPVNPYSQ
Mbo --LTLEVDAPLERARVATLGPHLHGVLMESIPADYVQTLHTVFPVNPYSQ
Sep ----PFNLADDIEVFRPFVDNIVYEIVFKKNI DTFDINEKKLLLNVLVE
Spy_CRb --NNQLNTRTEIAERVKERGRDSDKGIYRLDLPTGAGKTNLSMRYAFHQ

Sth_CR1 LITDFTKISINLNYPQLRVKGLTDELSNEELFIALKNMVKGHRGISYLD
Ssu FHINLDGEMSTDNYPVLRVKGSLQKLTVEELYISIKNIMKRRGISYLD
Smu GKVDDSFHRLLEDVFLVTEDKRGERHPIFGNLEEEVKYHENFPTIYHLRQ
Sag SKVDDSFHRLLEDVFLVEEDKRGSKYPIFATLQEEKDYHEKFSSTIYHLRK
Spy_CRa AKVDDSFHRLLEDVFLVEEDKHERHPIFGNIVDEVAYHEKYPTIYHLRK
Sth_CR3 ATLDDAFFQRLDDVFLVDDKRDVSKYPIFGNIVVEEKAYHDEFPTIYHLRK
Lin SKTDANFFCRLSDSFYVNEKRNRSRHPFATIEEEVEYHKNYPTIYHLRE
Sth_CR2 KVIQ-GKENTQWVHLLTDDIEDKVFMFL--LQIKEVSLN-DLPKLSVEK
Ssa NLRS-ERESIWTVNLLSEEAEQQILPQL--LSLEMIKLETYSEEILVKN
Mtu YALARSTTSLEWKISTLTNEARQQIVGPIINDAAFAGFRLRASGIATQVTS
Mbo YALARSTTSLEWKISTLTNEARQQIVGPIINDAAFAGFRLRASGIATQVTS
Sep RCIIDKKVVRLLDSVKIYIQLIRCYEENTPTYLLLPKMIENSDVVKLF
Spy_CRb LVHHDKSRFFYITPFLSVLEQNASEIRKVTGDLGVLEHHSNVVKQANEDD

Sth_CR1 SDDGNSSVGDYAIQVKNESK----QLETKTPGQIQLERYQT-----Y
Ssu ESDNEAGRSDYAKAIERNRQ----LLTSKTPGEIQLEK-----Y
Smu YLADNPEKVDLRLVYLALAH----IKFRGHFLIEG-KFDTRNNDVQRLF
Sag ELADKKEKADLRLIYIALAH----IKFRGHFLIEDDSFDVRNTDISKQY
Spy_CRa KLVDDSTDKADLRLIYIALAH----MIKFRGHFLIEG-DLNPDSNDVVKLF
Sth_CR3 YLADSTKKADLRLVYLALAH----MIKYRGHFLIEG-EFNSKNNDIQKNF
Lin ELVNSSEKADLRLVYLALAH----IKYRGNFLIEG-ALDTQNTSVDGII

Sth_CR2 VEIQELGTDKLLLEIFNSEENQTYFSIIIFETPTGFKSQGSYVIFPSMRLIF
Ssa IEIQSLSSQSLLLEVFQGDASHLISLNFYPTPTFKRQQFVLFPPDTRLIF
Mtu RSLEQNPLSQFARIFYARPETRKFRVEFLTPTAFKQSGEYVFWPDPRLV
Mbo RSLEQNPLSQFARIFYARPETRKFRVEFLTPTAFKQSGEYVFWPDPRLV
Sep FDLPRDTKLERRIASKYRLR-----LIELGFSMKQFSLYERVSVNQKK
Spy_CRb DDKDSLLSAYLSDSWDSQVVLTT--SMVQFFQTLFKTKSANLRRFSSLINS

::

Sth_CR1 GQLRGDFTVE-KDGKK-----HRLINVFPTSAYRSEALRILQTOQ
Ssu GQLRGNFTIIDEEQS-----QQIINVFSTSDYVKEVEKILDCQK
Smu QEFLAVYDNTFENSS-----LQEQNVQVEEILTDKISKSAKKDRVLK
Sag QDFLEIFNFTFENND-----LLSQNVQVEEILTDKISKSAKKDRILA
Spy_CRa IQLVQTYNQLFEEENP-----INASGVDAKAILSARLSKSRRLLENLIA
Sth_CR3 QDFLDITYNAIFESDL-----SLENSKQLEEVKDKISKLEKKDRILK
Lin KQFIQTYNQVFASGIEDGS--LKKLEDNKDVAKILVEKVTRKEKLERILK
Sth_CR2 QSLMQKYGRLEVENQPEIEEDTLDYLSHSTITNYRLETSYFRVHRQRI
Ssa QSLMQKYSRLVEGKAEIEEETLEFLAEHSQISSYRLKSHYFPIHGRKYP
Mtu QSLAQKYGAIVDGE-EPDPGLIAEFGQSVRLSAFRVASAPFAVGAARVPG
Mbo QSLAQKYGAIVDGE-EPDPGLIAEFGQSVRLSAFRVASAPFAVGAARVPG
Sep DKILEILKQEIPTDGSITLYILPDEVNSNQITILGKEVKLAVNKEPKLIF
Spy_CRb VVILDEVQSLPIEVTTLFNLTMNFLNKVMDTTIVLCTATQPAYDSSEIDH

:

Sth_CR1 EFNQITDEFINRYLEILTGKRKYHGPNEKSRDY-----
Ssu MYHKFISDEFCDKLIELREKRKYVGPNEKSRDY-----
Smu LFPNEKSNGRFAEFLKLI VGNQADFKKHFELEEKAPL-----
Sag QYPNQKSTGIFAELFLKLI VGNQADFKKYFNLEDKTPLE-----
Spy_CRa QLPGEKKNLFGNLIASLGLTPNFKSNFDLAEDAKL-----
Sth_CR3 LFPGEKNSGIFSEFLKLI VGNQADFRKCFNLDEKASL-----
Lin LYPGKESAGMFAQFISLIVGSKGNFQKPFDLIEKSDI-----
Sth_CR2 FRGKLTFKVQGAKTLLKAYVKMLLTFGEYSGLGMKTSGLMGGIKLE----
Ssa FEGRVTIRIQGASTLKAYAQMMLRFGYSGVGAKCSLGMGGMRIE----
Mtu FTGSATFTVRGVDTFASYIAALLWFGEFSGCGIKASMGMAIRVQPLAPR
Mbo FTGSATFTVRGVDTFASYIAALLWFGEFSGCGIKASMGMAIRVQPLAPR
Sep IMNKNILMYGSLLDHIGKIIYRSGDHTFSRGTSHSKLGHQFLS-----
Spy_CRb RICYGGNLGELAEIVELTIEEKQIFSRTELKRFDDSD-----

Sth_CR1 --GRYR-TSGETLDNIFGILIGKC-----
Ssu --GIYR-TDGTTLLENLFGILIGKC-----
Smu --QFSKDTYEEELVLLAQIG-----
Sag --QFAKDSYDEDLENLLGQIG-----
Spy_CRa --QLSKDTYDDDLNLLAQIG-----
Sth_CR3 --HFSKESYDEDELTLGIG-----
Lin --ECAKDSYEEDESLLALIG-----
Sth_CR2 ---ERKDLKKEKIDLFYGALLHDIGKVIQ-RATGERKKHALVGADWFEI
Ssa ---ERKTLKKEKIDLIYQALFYNLGRVVS-RSDGQ-SDDIDLKAWLKKQ
Mtu EKCVPKMNPQLIEAIIIGCLLHDIGKPVQRAALGYPGRHSAIGRAFMKKV
Mbo EKCVPKMNPQLIEAIIIGCLLHDIGKPVQRAALGYPGRHSAIGRAFMKKV
Sep --QFSEFKDNEVLNDVAYHHYKELAKAN-----
Spy_CRb ---QKVHLTDVINLILGEENSVLAI FN-----

::

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 ADNQ-----VISDQIRYHMANYSNKLGN
Ssa LP-----QLDFGGN
Mtu WLRDSRNPQSFTDEVDEADIGVSDRRILDAYSYHHSSALRTAAENGRILAA
Mbo WLRDSRNPQSFTDEVDEADIGVSDRRILDAYSYHHSSALRTAAENGRILAA
Sep -----LDN
Spy_CRb -----

Sth_CR1 -----TFYPDEFRAAKASYTAQEFN-LLNDLNNL--TVPTETKKLSKEQ
Ssu -----TFYPDQYRSSRASYTAQEFN-FLNDLNNL--TVPTETKKLSQEQ
Smu -----DNYAELFLSAKKLYDSILLSGILTVTDVG--TKAPLSASMIQRY

Sag -----DEFADLFSAAKKLYDSVLLSGILTVIDL--TKAPLSASMIQRY
Spy_CRa -----DQYADLFLAAKNLSDAILLSDILRVNTEI--TKAPLSASMIKRY
Sth_CR3 -----DQYSDVFLKAKKLYDAILLSGFLTVDNE--TEAPLSASMIKRY
Lin -----DEYAEFLVAAKNAYSAVVLSIITVAETE--TNAKLSASMIERF
Sth_CR2 DHLAYITYIADNIAAGVDRRQSNESDEEDASAKIW--DTYTNQADIFNIF
Ssa CRAEKI IALANNIASGS--LDENEVSKE-----QLFKPLADIFNFAF
Mtu DAPAYIAYIADNIAAGTDRRKAD--SDDGHGASTW--DPDTPLYSMFNRF
Mbo DAPAYIAYIADNIAAGTDRRKAD--SDDGHGASTW--DPDTPLYSMFNRF
Sep DNTAYITYIADNIAAGIDRRDIIEEGDEEYEQQLFNFDKYTPLYSVFNIV
Spy_CRb --TKKTVHNCYTMLKDMTDRPVYQLSTNMCAQHRLD-LIAKIKTELQNNI

: :

Sth_CR1 KNQIINYVKNEKAMG-----PAKLFKYIAKLLSCDVADIKG-Y
Ssu KEFLVNYAKETSVLG-----AGKILQQIAKLADCKVEDIRG-Y
Smu NEHQMDLAQLKQFIR-----QKLSDKYNEVFSVSKDGYAG-Y
Sag DEHREDLKQLKQFVK-----ASLPEKYQEIFADSSKDNGELAG-Y
Spy_CRa DEHHQDLTLLKALVR-----QQLPEKYKEIFDQSKNGYAG-Y
Sth_CR3 NEHKEDLALLKEYIR-----NISLKYNEVFKDDTPKNGYAG-Y
Lin DTHEEDLGELKAFIK-----LHLPKHYYEIEFSNTEKHGYAG-Y
Sth_CR2 GAQTDKRYFKPTVNLKSKPNFASATYEPFSKGDYAAIATRIKNEELAE-F
Ssa KKKEESRYQKFEVLTDEIELNIAAGHEAVDISQDCYEELNLVNEKLQ-L
Mtu GSGTANLAFAPMLDDRKPINIPSPRRIEFDKDRYAAIVNKLKAILVD-L
Mbo GSGTANLAFAPMLDDRKPINIPSPRRIEFDKDRYAAIVNKLKAILVD-L
Sep NSEKLLQNTNGKFKFSNESNIEYPKTENIQYSSGNYTTMLKMDMSHDLHL
Spy_CRb PICISTQLIEAGVDVDFHRVIRSYSGIDSIVQAAGRCNREGKRDKGQVT

Sth_CR1 RIDKSGKAEIHTFEAYRKM-K-TLETLDIEQMDRETLDKLAYVLTNTERE
Ssu RLDNKDKPELHTFETYRAMKGLVPLVDIGVLSREQLDILADILTLNTDFE
Smu IDGKTNQEAIFYKYLKGLLNKIEGSGYFLDKIERE-----DFLRKQRTFD
Sag IEGKTNQEAIFYKYLKGLLNKIEGSGYFLDKIERE-----DFLRKQRTFD
Spy_CRa IDGGASQEEFYKFIKPILEKMDGTEELLVKNRE-----DILLRQRTFD
Sth_CR3 IDGKTNQEDFYVYLKLLAEFEGADYFLEKIDRE-----DFLRKQRTFD
Lin IDGKTKQADFYKYMKMTLENIEGADYFIAKIEKE-----NFLRQRTFD
Sth_CR2 EFNQAQIDSLNLFPEATLSFVPSSTNTKEIADIS----LSEHSRLTAafa
Ssa SLEESLPSFFNLWRTLFSKVPLLPGDKELGDLS----LAEHSRLTVafa
Mtu ERSPTYLASLLNVLEATLSFVPSSTDASEVVDVS----LFDHLKLTGALG
Mbo ERSPTYLASLLNVLEATLSFVPSSTDASEVVDVS----LFDHLKLTGALG
Sep SIKEGTFPSLLQWTESLWQYVPSSTNKNQLIDIS----LYDHSRITCAIA
Spy_CRb LVNLTNEENISRLTEIKTKKEATESILHKIGSP-----IDISTLNRDFF

Sth_CR1 GIQEALEHEFADGFSFSQKQVDELV---QFRKANSSIFGKGWHNFSVKLMM
Ssu GIREALKKQLPN-VFDEKQVKGLA---SFRKSKSQLFAGKWHNLSQKIML
Smu NGSIPHQIHLQEMRAIIRRQAEFY---PFLADNQDRIEK-----LLTFRI
Sag NGSIPHQVHLTELKAIIRRQSEYY---PFLKENQDRIEK-----ILTFRI
Spy_CRa NGSIPHQIHLGELHAILRRQEDFY---PFLKDNREKIEK-----ILTFRI
Sth_CR3 NGSIPYQIHLQEMRAILDQAKFY---PFLAKNKERIEK-----ILTFRI
Lin NGAIIPHQLHLELEAILHQQAKY---PFLKENYDKIKS-----LVTFRI
Sth_CR2 LAIYDYLEDKGRHNYKEDLFTKAS---AFYEEEAFLLAS-----FDLSGI
Ssa TAIYDYLENQG---QDSSLDDDES---KFYRESAFLLAS-----FDLSGI
Mtu ACIWHYLQATGQSDFKSALFDKQD---TFYNEKAFLLTT-----FDVSGI
Mbo ACIWHYLQATGQSDFKSALFDKQD---TFYNEKAFLLTT-----FDVSGI
Sep SCIFDYLNENNIHNYKDELFSKYENTKSFYQKEAFLLS-----MDMSGI
Spy_CRb EYYYANNQGLMDYPLEDNLSIYDYLSLNIYQTANKKFKGKQLQAFKTAGA

: :

Sth_CR1 EL-----IPELYETSEEQMTILTRLGKQKTSSSNKTKYIDEKLLT
Ssu EV-----IPELYATSDEQMTILTRLGKFEKSSVAEYPPSSINVDEIT
Smu PY-----YVGPLARGKSDFAWLSRKSADKITPWNFDEIVDKESSA
Sag PY-----YIGPLAREKSDFAWMTRKTD-DSIRPWNFEDLVDKESSA
Spy_CRa PY-----YVGPLARGNSRFAMWTRKSE-ETITPWNFEEVVDKGASA
Sth_CR3 PY-----YVGPLARGNSDFAWSIRKRN-EKITPWNFEDVIDKESSA
Lin PY-----FVGPLANGQSEFAWLTRKAD-GEIRPWNIEEKVDFGKSA
Sth_CR2 QD-----FIYNIATSGAAKQLKARSLYLDFMSEYIADSLDKLGLN
Ssa QD-----FIYNIASKGAAKQLKARSLYLEFMSENIIVDSLLEKLALS
Mtu QD-----FIYTIHSSGAAKMLRARSFYLEMLTEHLIDELLARVGLS
Mbo QD-----FIYTIHSSGAAKMLRARSFYLEMLTEHLIDELLARVGLS
Sep QD-----FIYNISSGALKSLRSRFSYLEMLLEIVDQLLERLELA
Spy_CRb KMNLINNDMIGILVYPYGAEKKLAYLEELGVSHFLSAKDYQTIKSLKEL

Sth_CR1 EEIYNPVVAKSVRQAIIKIVNAAIKEYGDFDNIVIEMARETNEDEKKAIQ
Ssu DEIYNPVVAKSIRQTIKLIINASIKKWGEFDQIVIEMPRDRNEDEEKKRIA
Smu EAFINRMTNYDLYLPNQKVLPHKSLLYEKFTVYNELTKVKYKTE--QGKTA
Sag EAFIHRMTNDFYLPPEEKVLPKHSLIYEKFTVYNELTKVRYKNE--QGKTY
Spy_CRa QSFIERMTNFDKLNLPNEKVLPHKSLLYEYFTVYNELTKVKYVTEGMRKPA
Sth_CR3 EAFINRMTSFDLYLPPEEKVLPKHSLLYEYFTVYNELTKVRFIAESMRDYQ
Lin VDFIEKMTNKDTYLPKENVLPKHSLCYQKYLIVYNELTKVRYIND--QGKTS
Sth_CR2 RANLLYVSGGHAYFVLANTTEKTVE TLVQFEKDFNQFLLANFQTRLYVAFG
Ssa RANVLYVGGGHAYFVLPNTEVTVAVLEQFEMEFNSFLLKHFQTGLYVAFG
Mtu RANLNYSGGGHAYLLLNPNTESARKSVEQFEREANDWLENFATRLFIATG
Mbo RANLNYSGGGHAYLLLNPNTESARKSVEQFEREANDWLENFATRLFIATG
Sep RANLLYTGGGHAYLLVSNNTDKVKKKITQFNNELKKWFMSEFTTDLSLSMA
Spy_CRb QPFTVNVRENDPLFETTKSYLNGQILVLTSEYYDTERGVKYDSASFYFLY

Sth_CR1 KIQKANKDEKDA-----MLKAANQYNGKAELPHSVFHGHKQL
Ssu DGQKANAKEKADS-----ILRAAELYCAGKVLDPVYVYNGHNQL
Smu FFDANMKQEIFDG-----VFKVYRKVTKDKLMDFLKFEKDFEFR
Sag FFDNLIKQEIFDG-----VFKHRKVSKKLLDFLAKEYBEFR
Spy_CRa FLSGEQKKAIVDL-----LFKTRNKVTVKQLKEDYFKKIECFD
Sth_CR3 FLDKSKQKDIVRL-----YFKDKRKVTDKDIIEYLHAIYG--YD
Lin YFSGQEKEQIFND-----LFKQKRKVK--KKDLELFLRNMSHVE
Sth_CR2 WGSFAAKDIMFELNSSES-----YRQVYQKASRMISEKKSQGMIIKP
Ssa WAPFAAEQIMKYRYGSVASYL---QHYREIYQETS RMISEKKISRYDATT
Mtu SVPLAANDLMRRPNESASQASNRALRYSGLYRELSEQLSAKKLARYSADQ
Mbo SVPLAANDLMRRPNESASQASNRALRYSGLYRELSEQLSAKKLARYSADQ
Sep FEKCSGDDLMNTSG-----NYRTIWRNVSSKLSDIKAKHYS AED
Spy_CRb RSRDFYVRVSGQRALFTNPATKGGSSERSYSVPTRQALNGIVDAIYYKPT

Sth_CR1 ATKIR-----LWHQQGERCLYTGKTI SIHD-----
Ssu ATKIR-----LWYQQGERCIYTGQPI SIHD-----
Smu IVDLTGLDKENKVFNASYGTYHDLCKIL--DKD-----
Sag IVDVIGLDKENKAFNASLGTYHDLKIL--DKD-----
Spy_CRa SVEISGVEDR---FNASLGTYHDLKIIKDKD-----
Sth_CR3 GIELKGIEKQ---FNSSLSTYHDLNIIINDKE-----
Lin SPTIEGLEDS---FNSSYSTYHDLKVGIKQE-----
Sth_CR2 LCCM--LLNRGGKSSERECEI CHSVENLVSYHD----QKVCDCIRGLYQF
Ssa LR---ELNKGKQSERECEI CHAVGDIKELRIGGEDVQNLCPICREL RGF
Mtu LRELNSRDHDGQKGDRECSVCHTVNRTVSADD----EPKCSLCQAL TAA
Mbo LRELNSRDHDGQKGDRECSVCHTVNRTVSADD----EPKCSLCQAL TAA
Sep I LKLNHFHSYG---DRECKECLRSIDIDINDG-----LCSICEGINI
Spy_CRb FTNIVTEVKVINQIQTE LQGV RALLHDYSADLS-----

Sth_CR1 -----LINNSNQFEVDHILPLSITFDD-----
Ssu -----LIHNQNYEIDHILPLSLTFDD-----
Smu -----FLDNSKNEKILEDIVLTLTLFE-----
Sag -----FLDNPDNESI LEDIVQTLTLFE-----
Spy_CRa -----FLDNEENEDI LEDIVLTLTLFE-----
Sth_CR3 -----FLDSSNEAIEEIIHTLTIFE-----
Lin -----ILDNPVNTEMLENIVKILTVFE-----
Sth_CR2 SKETIAHD-----HFIIIE--NEGLPIGPNACLK GVA----FEKL
Ssa AAKIHTFNNDTENPEREDY YFQIVEGEEGLPIGPGAVLLAVD----GDDI
Mtu SSQIQSESRR-----FLLISDGATKGLPLPFGATLTFCSRADADKAL
Mbo SSQIQSESRR-----FLLISDGATKGLPLPFGATLTFCSRADADKAL
Sep SNDLRDKS-----FFVLSETGKLMKPFNKFISVIDYEEAEMLV
Spy_CRb -----YVSYLSDVVYLIKHFVWNE DRKDLNSDR LPA

Sth_CR1 SLANKVLVYATANQEKGQRTPYQALDSMDDAWSFRELKAFVRESKT----
Ssu SLSNKVLVLATANQEKAQRTPYNYLKSATSAWSYREFKDYVTKRKG----
Smu DREMIRKRLLENYSDLLTKEQVKKLERRHYTGWGRLSAELIHGIRNK----
Sag DREMIKKRLENYKDLFTESQLKKLYRRHYTGWGRLSAKLINGIRDK----
Spy_CRa DREMIEERLKYTAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDK----
Sth_CR3 DREMIKQRLSKFENIFDKSVLKKLSRRHYTGWGRLSAKLINGIRDK----
Lin DKRMIKEQLQQFSDVLDGVVLLKLERHYTGWGRLSAKLLMGI RDK----
Sth_CR2 SQEAFSRVYVKNYKAGTVKATHVFGDYQCD EIIYNYAALS KNENG----
Ssa PTSG--RLYVKNKFST--NNAAIHVYIGDRQAANIEDYAGLSQKEIEGNEG
Mtu QQPQTRRRYAKNKFFAGECLGTGLWVG DYVAQMEFGDYVKR-----

Mbo QQPQTRRRYAKNKFFAGECLGTGLWVG DYVAQMEFGDYVKR-----
Sep QNNQVRIYSKNKPYIGIGISTNLWMC DYDASQNQDMREKIGISYVD--
Spy_CRb KHEAIMERSIRKGGRRDVFLGTRECLGLVDDISQEEYETT VSYNGVNI

Sth_CR1 --LSNKKKEYLLTEEDISKFDVRKKFIERNLVDTRYASRVV LNALQEHFR
Ssu --IGKKKCEYLTFEEDINGFEVRSKFIQRNLVDTRYASKVILNALQDYFK
Smu --ESRKTILDYLI DDGNSNRNFMQLINDDALSFKEEI IAKAQVIGETD--N
Sag --ESQKTILDYLI DDGRSNRNFMQLINDDGLSFKSII SKAQAGSHSD--N
Spy_CRa --QSGKTI LDFLKS DGFANRNF MQLIHDDSLTFKEDI QKAQVSGQGD--S
Sth_CR3 --KSGNTILDYLI DDGINSNRNFMQLIHDDALSFKKKIQKAQIIGDEDKGN
Lin --QSHLTI LDYLMNDDGLNRNLMQLINDSNLSFKSII EKEQVTTADK--D
Sth_CR2 --LGIKRLAVVRLD VDDLGA AFMAGFSQQGNGQYSTLSRSATFSRSMSLF
Ssa ETRGIKRLAVLRLD VDNLGA AFMAGFSQAAGSYNTLARS AVFSQQMSLF
Mtu -ASGIARLGVLR LRDV DNLGQA FTHGFMEQNGKFNTI SR TAAF SRMLS L
Mbo -ASGIARLGVLR LRDV DNLGQA FTHGFMEQNGKFNTI SR TAAF SRMLS L
Sep REEGVKRLGVVRADIDNLGATFISGIPEK----YNSISRTATLSRQLSLF
Spy_CRb LGIMFHSFAYPKDKKTP LKSYFTKTVMKNGVITFKAQSECDIVNTLSSYA

Sth_CR1 AHKIDTKVSV-----VRGQFTS QLRHHWGIEKTRD TYHHHA
Ssu ISGIQTKVSV-----VRGQFTS QLRHKWGIEKTR ETYHHHA
Smu LNQVVS DIAG-----SPA I KKGILQSLKIVDEL VKIMG-HQ
Sag LKEVVGELAG-----SPA I KKGILQSLKIVDEL VKVMG-YE
Spy_CRa LHEHIANLAG-----SPA I KKGILQTVKVVDEL VKVMGRHK
Sth_CR3 IKEVVKSLPG-----SPA I KKGILQSLKIVDEL VKVMGGRK
Lin IQSIVADLAG-----SPA I KKGILQSLKIVDEL VSVMG-YP
Sth_CR2 FKVYINQFAS-----DKKLSII YAGGDDVFAIGSWQD
Ssa FKFHINHFAE-----GKNLTII YAGGDDVFAIGSWQD
Mtu FRQHINYVLARPKLRPITGD----DPA RPREATII YSGGDDV FVVGAWDD
Mbo FRQHINYVLARPKLRPITGD----DPA RPREATII YSGGDDV FVVGAWDD
Sep FKYELNHLEN-----YQITAI YSGGDDLFLIGAWDD
Spy_CRb FKAPEEIKSVNDECM EYDAMEKGENMDFFTSLKTYEKAELADLV DHQKR

Sth_CR1 VDALIIAASSQLNLWKKQKNTLVS-YSEDQLLDIETGE-----LIS---
Ssu VDALIIAASSQLRLWKKQESPLVVDYQEGRQVDLETGE-----ILELT-
Smu PENIVVEMARENQFTNQGRRNSQORL KGLTDSIKEFGS----QILKEHP-
Sag PEQIVVEMARENQFTNQGRRNSRQRYKLLDDGVKNLADLNGN ILKEYP-
Spy_CRa PENIVVEMARENQFTNQGKNSRERMKRIE EGIKELGS----QILKEHP-
Sth_CR3 PESIVVEMARENQFTNQGKNSQORLKRLEKSLKELGS----KILKENIP
Lin PQTIVVEMARENQFTGKGNNSRPRYKSLEKAIKEFGS----QILKEHP-
Sth_CR2 IIAFTVELRENFIKWTNGKLTLSAGIGLFADKTPIRLMAHQ TGELEEA
Ssa VIDFAVDIRQKFI AFTNGKLTLSAGVGLYPDKTPIHLMALDAGQLEEA
Mtu VIEFGIELRERFHEFTQGKLTVSAGIGMFPDKYPI SVMAREVGDLEDA
Mbo VIEFGIELRERFHEFTQGKLTVSAGIGMFPDKYPI SVMAREVGDLEDA
Sep IIEASIIYINDKFKEFTLDKLTLSAGVGMFSGKYPVSKMAFETGRLEEA
Spy_CRb NNEPVLPIYHTSLKSNKNIISVKLDKDGQFHKAEFMADKQMIIFPVTA

Sth_CR1 -----DDEYKESVFKAPYQH FVDTLKSKEFEDSILFSYQVDSKFN RKI
Ssu -----DEQYKELVYQPPYQGFVNTISSAFDNEILFSYQVDSKVN RKI
Smu -----VENSQ LQNDRLFLY YLQNGRDMYTGEELDI DLSQYDIDHII
Sag -----TDNQALQNERLFLY YLQNGRDMYTGEALDIDNLSQYDIDHII
Spy_CRa -----VENTQLQNEKLYLY YLQNGRDMYVDQELDINRLSDYDVHIV
Sth_CR3 AKLS---KIDNNALQNDRLYLY YLQNGKDMYTGDLDIDRLSNYDIDHII
Lin -----TDNQELRNNRLYLY YLQNGKDMYTGDLDIHNL SNYDIDHIV
Sth_CR2 GN-----EKDSISLFS SDYTFKFRFITNVYDDKLEQIRYFFNHQDERGK
Ssa SN-----GKDSISL FNERYTF SFDDFIDEIYKGLKDIRRYFSGQKERGI
Mtu SLP-----GKNVALFDREFTFGWDELLSKVIEEKYRHIADYFSGNEERGM
Mbo SLP-----GKNVALFDREFTFGWDELLSKVIEEKYRHIADYFSGNEERGM
Sep TG-----EKNQISLWLQEKVYNWDEFKKNILEEKLLVLQGFQSTDEHGK
Spy_CRb DSVARS GSHPAHPPLVDFAYYSAEMGQIQYDSFHKQLNNWIDYCEE G DV

Sth_CR1 SDATIYATRQAKVGK-----DKADETYVLGKIKD
Ssu SDATIYATR NAQLGK-----DKTEGIYVLGKIKD
Smu PQA--FIKDNSIDNR-----VLTSSKENRGKSDD
Sag PQA--FIKDNSIDNR-----VLTSSAKNRGKSDD
Spy_CRa PQS--FLKDDSIDNK-----VLT RSDKNRGKSDN
Sth_CR3 PQA--FLKDNSIDNK-----VLTSSASNRGKSDD

Lin PQS--FITDNSIDNL-----VLTSSAGNREKGGD
Sth_CR2 NFIYKLIPELLRNYDR-----MNMARLAYYLTRLEELTRETDR
Ssa NFLYRLVELLQLNDKTMKYGYGPEDDRRMNVARLAYLLARMEDEAGKEGK
Mtu AFYKLELLAERDD-----RITKARWVYFLTRMRNPTG--DT
Mbo AFYKLELLAERDD-----RITKARWVYFLTRMRNPTG--DT
Sep AFYKMLALLRNNEA-----INARLAYLLARS
Spy_CRb KKFLTFVQQFILKPEFLTLILDLSLIG-----PDYQHNQLKVTFCDA

Sth_CR1 IYTDQGYDAFMKIYK-----DKSKFLMYRHDPQT-----
Ssu IYQAGYEAFMKRYTK-----DKTSFLMYHKDLDT-----
Smu VPSKDVVVRKMSYWSK-----LLSAKLITQRKFDN-----
Sag VPSLEIVKDCVKVFWKK-----LLDAKLMSQRKYDN-----
Spy_CRa VPSEEVVKKMKNYWRQ-----LLNAKLITQRKFDN-----
Sth_CR3 VPSLEVVKRKRFTWYQ-----LLKSKLISQRKFDN-----
Lin VPPLEIVRKRKVFWEK-----LYQGNLMSKRKFDY-----
Sth_CR2 DKFKTFKNLFYSWYTNKDDKDRKEAELALLLYIYEIRKDMTILTD----
Ssa EHFREFKNAFWNWYKS--SSKTQREAEFALIYYLYEIRKAMKLERHKMMAP
Mtu APFQQFANRLHQWFQD--PTDAKQLKTALHLYIYRTRKEE-----
Mbo APFQQFANRLHQWFQD--PTDAKQLKTALHLYIYRTRKEE-----
Sep KMNEDFTSKI FNWAQN--DKDKNQLITALEYYYIQIREADLT-----
Spy_CRb TGKEKLIDLSACFLEFSIDQFQGFKNESVSTFKALHQSYIS-----

..

Sth_CR1 -----FEKVI
Ssu -----WEKVI
Smu -----LTKAE
Sag -----LTKAE
Spy_CRa -----LTKAE
Sth_CR3 -----LTKAE
Lin -----LTKAE
Sth_CR2 -----ENYVDIAE
Ssa YEKNRNRNRTNGRNQFQNNRSKGSYSSQSNKQKFFKLDPPILTDYVVKAD
Mtu -----SEMSVIQ
Mbo -----SEMSVIQ
Sep -----FAHEVV
Spy_CRb -----FVEAN

Sth_CR1 EPILENYPNKQINEKGKEVPCNPFLKYKEEHGYIRKYSKKGNGPE-----
Ssu EIIIRDY--REYDEKGEIG--NPFERYRRENGYVKKYSRKGNGTA-----
Smu RGGLTDDDKAGFIKRQLVETRQITKHVARILDERFNTEEDENNKK-----
Sag RGGLTSDDKARFIQRQLVETRQITKHVARILDERFNNELDSKGR-----
Spy_CRa RGGLSELDKAGFIKRQLVETRQITKHVAQILD SRMNTKYDENDKL-----
Sth_CR3 RGGLSPEDKAGFIQRQLVETRQITKHVARLLDEKFNKKDENNRA-----
Lin RGGLTEADKARFIHRQLVETRQITKNVANILHQRFNYEKDDHGNT-----
Sth_CR2 KAILKLERNTRNRKN--PDAFFLTTSKLRNLLSTLSTLFDESKVK---EY
Ssa LVIHTLSDDKQLNNGKIKFKLTSTQIRNLAALTSNLFDESKTKN---DI
Mtu DDYVKQAEVIRGLPKKNGFELTTQLRVLLSLTAQLFDEAQQSANPTLP
Mbo DDYVKQAEVIRGLPKKNGFELTTQLRVLLSLTAQLFDEAQQSANPTLP
Sep KSNVKNVKDRKGEKQVLFNGLTTSKLRNLMQVNRLYTIAFNSNEDQLN
Spy_CRb RENLGICNISGREQLTDKHRGLMGNAKII SVSNKREAYKGRFREREDVF

Sth_CR1 -IKSLKYYSKLGNHIDITPKDSNNKVVLSVSPWRADVYFNK--TTGKY
Ssu -IKSLKYDNLGNHIDITPENSNAVVLQSLKFWRTDVYFNK--ETGKY
Smu -IRQVKIVTLKSNLVSFRKEFELYKVREINDYHHAHDAYLNA--VIGKA
Sag -IRKVKIVTLKSNLVSFRKEFGFYKIREVNNYHHAHDAYLNA--VVAKA
Spy_CRa -IREVKVITLKSCLVDFRKFDFQFYKIREVNNYHHAHDAYLNA--VVGTA
Sth_CR3 -VRTVKIITLKSTLVSQFRKDFELYKVREINDYHHAHDAYLNA--VVASA
Lin -MKQVRIVTLKSALVSQFRKQFQLYKVRDVNDYHHAHDAYLNG--VVANT
Sth_CR2 DDLDRIAYLVRVQFVYQAGREIAVKDLIEKAQILEALKEIKD---RETLO
Ssa EELREKISYLRIFVYQSGREPAVEDFVKKAGLLEALTEIQD---IPSLQ
Mtu RQLKEKVQYLRVRFVYQSGREDAVKT FVRNAKLEALEGIGDS--RDGLL
Mbo RQLKEKVQYLRVRFVYQSGREDAVKT FVRNAKLEALEGIGDS--RDGLL
Sep EEFIDELEYLKI FYEAGREKSVDEFLLKKTLMFPPIIDRVIKKESKFFL
Spy_CRb SVGYETSEKIHMLKYLLENKNTSTWLGSSQYLINWFSDDLTN--DSRLD

..

Sth_CR1 EILGLKYADLQFEKGTGYKISQEKYNDIKKKEGVDSDFEKFPLYKNDL
Ssu EFLGIKYSDLSEFEKGTGEYGISQEKYDSIKIAEGVAKKSIFKFTLYKQDL

Smu LLG--VYPQLEPEFVYGDYPHFH-GHKENK-----ATAKFFYSNIM
Sag ILT--KYPQLEPEFVYGDYPKYN-SYKTRKS-----ATEKLFYYSNIM
Spy_CRa LIK--KYPKLESEFVYGDYKVD--VRKMIKSEQEIGKATAKYFFYSNIM
Sth_CR3 LLK--KYPKLEPEFVYGDYPKYN-SFRERKS-----ATEKVYFYSNIM
Lin LLK--VYPQLEPEFVYGDYHQFD-WFKANK-----ATAKQFYTNIM
Sth_CR2 RFCRYMEALVAYFKFYG--GKD-MTFAKIKFSAQIRLETGLHIGGSDAFA
Ssa RFCRYMEALVAYFKFYG--GRDQMTYSKVKISGIELKSGLHIGTSNAFA
Mtu RFCRYMEALVAYFKFYG--GRDQMTYSKVKISGIELKSGLHIGGAGDGF
Mbo RFCRYMEALVAYFKFYG--GRDQMTYSKVKISGIELKSGLHIGGAGDGF
Sep DYCKYFEALVAYAKYYQ---KEDMYSKIKISGTIEVVTGLHIGGGESS
Spy_CRb IVSFI FDDGLEEDDDDDT P P VITLATEDNKRIGKSF IKGQKLFANDATYY

Sth_CR1 LLVKDTETKEQQLF RFLSRTMPKQKHVELKPYDKQKFE GGEALIKVLGN
Ssu LFIKDIENNFGLLRFTSKND-TSKHYVELKPYDKNKFGTEEP LLPVLGN
Smu NFFK-----KDDVRTD-KNGEIIWKKDEHISNKKKQVQV
Sag NFFKTKVT LADGT VVVKDDIEVNNDTGEIVWDK KKH FAVR KVL SYPQNN
Spy_CRa NFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK VLSMPQVN
Sth_CR3 NIFKKSISLADGRVIERPLIEVNEETGESVWNKESDLATVRRVLSYPQVN
Lin LFFAQK-----DRIIDENGEILWDK-KYLDTVKVMYSYRQMN
Sth_CR2 AIGAIDSPVIKDPITNIP IIPGSS LKGMRTLLAK---VYNEKVAEKPSD
Ssa AIGATNNPI IKDPLTNLPYIPGSTLKGKMRSLLYRT--DYN SNTTEKLSK
Mtu AIGAVDKPVVRDPLSRLPMIPGTS LKGVRTLLSRQYGADTETFYRKPNE
Mbo AIGAVDKPVVRDPLSRLPMIPGTS LKGVRTLLSRQYGADTETFYRKPNE
Sep MIGAIDSPVVRDLQTKLP IIPGSS IKGMRNLLAKHFLKMKQESHNQDD
Spy_CRb VAILNKTSNGRIALKYFRQLQASQLLTNLNKWQETYSWESRSKFGKSRRL

Sth_CR1 VANSQCCKKG-LGK-----SNIS IYKVRTDVLGNQHI-----
Ssu VAKSGQCIKG-LNK-----SNIS IYKVRTDILGYRHF-----
Smu IVKKVEEQTGGFSK-----ESILPKGNSDKLI PRKTKKFY---
Sag IVKKTEIQTGGFSK-----ESILAHGNSDKLI PRKTKDIY--
Spy_CRa IVKKTEVQTGGFSK-----ESILPKRNSDKLI ARKKD-----
Sth_CR3 VVKKVEEQNHGLDRG-----KPKGLFNANLSSKPKPNSNENLVG-
Lin IVKKTEIQKGEFSK-----ATIKPKGNSSKLI PRKTN-----
Sth_CR2 DSDILSRLFGNSKDK-----RFKMGRLIFRDAFLSNADELDSL G-
Ssa DSLEISRLFGNSE-----TYKIGRLVFRDAFLNNKEELGKR--
Mtu DHAHIRRLFGDTE-----EYMTGRLVFRDTKLTNKKDLEARG-
Mbo DHAHIRRLFGDTE-----EYMTGRLVFRDTKLTNKKDLEARG-
Sep E--RVLRFLFGSSEK G-----NIQRARLQISDAFFSEKTEKHFQON
Spy_CRb TPTFFHDILNVS YGVD RDRFLELDNDNFKSDQIQKLVASLIDGK PMPQSIV

Sth_CR1 -----IKNEGDKPKLDF--MTWRVVHVSQSEKMR LKLDNLLVQ-----
Ssu -----IKQEGEHPQLKFKMTWRIVHIHQSEKMR LKLDNLLVIK-----
Smu -----WDTKKYGGFDSPIVAYSILVIADIEKGKSKKLTVKALVG-----
Sag -----LDPKKYGGFDSPIVAYSVLVADIKKGAQKLTVTTELLG-----
Spy_CRa -----WDPKKYGGFDSPTVAYSVLVAVKVEKSKKLSVKELLG-----
Sth_CR3 AKEYLDPKKYGGYAGISNSFTVLVKGTEIEGAKKKITNVLEFQG-----
Lin -----WPMKYGGLDSPNMAYAVVIEYAKGK---NKL VFEKKIIR-----
Sth_CR2 VRSYTEVKFENTIDRI TAEANPRQIERAIRNSTFD FELIYEITD-----
Ssa VSTYTEVKFENTINRITAEATPRQVERAIRESEFAFELIYSIQE-----
Mtu AKTLTEVKFENAINRVTAKANLRQMERVIPGSEFAFSLVYEVSGFTPGEE
Mbo AKTLTEVKFENAINRVTAKANLRQMERVIPGSEFAFSLVYEVSGFTPGEE
Sep DIAYTETKFENTINRLTAVANPRQIERVTRGSEFDFVFIYNVDE-----
Spy_CRb KKLGNVVKERHRYRKHVYQVEQVCLAILHKQNGEEFSPMLDHTN-----

:

Sth_CR1 -----KMQEFTVPLSDISIIVAEGGDTVVTLRLLSALS
Ssu -----KQGEFTIPLSDISIIVAEGGDTVVTLRLLSALS
Smu -----VTIMEKMTFERDFVAFLEKGYRNVQEEENIKLP
Sag -----ITIMERSRFEKNPSAFLESKGYLNIRADKLIILP
Spy_CRa -----ITIMERSRFEKNPIDFLEAKGYKEVKKDLIKLP
Sth_CR3 -----ISILDRINRYRDKLNFLEKGYKDI--ELIIELP
Lin -----VTIMERKAFKDEKAFLEEQYRQP--KVLAKLP
Sth_CR2 -----ENENQVEEDFKVIRDGLKLELDYLGSGSRGYGKVAFEKLLKATT
Ssa -----KELTEVEKDMEILKAGFELLEWDYIGSGSRGYGKVCFKNFVKT
Mtu QKASLPSSDEI IEDFNAIARGLKLELDYLGSGSTRGYGQVKF SNLKARA
Mbo QKASLPSSDEI IEDFNAIARGLKLELDYLGSGSTRGYGQVKF SNLKARA
Sep -----ESQVEDDFENIEKAIHLLENDYLGSGSTRGNRIQFKDNTNIET
Spy_CRb -----QNRSYLFGRLLAIFELIETLRYGLDGNNDRITNAERYWTAY

Sth_CR1 KYNIALVVCNEHLPTG-----IYHSQNGHFRAYKRLKEQ-L
Ssu KYNIALIVCDNHHLPTG-----IYHSQNGHFRAYKRLQEQ-L
Smu KYSLFKLENGRKRLLAS-----ARELQKGNELVLPNHLGT-L
Sag KYSLFELENGRRRLLAS-----AGELQKGNELALPTQFMK-F
Spy_CRa KYSLFELENGRRRLLAS-----AGELQKGNELALPSKYVN-F
Sth_CR3 KYSLFELENGRRRLLAS-----AGELQKGNELALPSKYVN-F
Lin KYTLYECEEGRRRLLAS-----ANEAQKGNQOVLPHLVT-L
Sth_CR2 VFGNYDVKTLNELLT-----AEVMTYKLYIMTFQN-A
Ssa VFGFDEYRIKALKPFTNDES DGGGSTE SPDSEIKMAYQLYKLDKFS-A
Mtu AVGALDGSLLLEKLNH-----ELAAVMNSRLFRFDFDR-T
Mbo AVGALDGSLLLEKLNH-----ELAAVMNSRLFRFDFDR-T
Sep VVGEYDSTNLK-----IKMTLATKVKFLSFKTPV
Spy_CRb TGQPTKLMMLLENKIKPYEPLKLNRRGSWMKLEKEKEEILELLNPLET

Sth_CR1 DWSQKQKD-----KAWQIVTYKINNQEDV--LAMFEKSLDNIRLL
Ssu SWAPLQKD-----KLWQIIIFKITNQQDV--LAMQEKSLSTIQLL
Smu LYHAKNIHKVDE-----PKHLDYVDKHKDEFKEL--LDVVSFNFKYTLA
Sag LYLASRYNESKGPKEIEKKQEFVNQHVSYFDDI--LQLINDFSKRVLILA
Spy_CRa LYLASHYEKLLKSPEDNEQKQLFVEQHKHYLDEI--IEQISEFSKRVLILA
Sth_CR3 LYHAKRISNTIN-----ENHRKYVENHKKFEEL--FYIILEFNENYVGA
Lin LHHAANCEVSDG-----KSLDYIESNREMFael--LAHVSEFAKYTLA
Sth_CR2 HFGSGTLDSSKLTFSADRIFSA LVLES LKMGKLD--AFLAEANQDKFTLT
Ssa HFGEGHLDSDVMTFTAARLYSALVLEAIKAGVLD--EFENLSRQDEFVLT
Mtu HFGDHGLESSTISCPADTLYSALCVEALRMGGQQ--LLGELVACSTLRLT
Mbo HFGDHGLESSTISCPADTLYSALCVEALRMGGQQ--LLGELVACSTLRLT
Sep HFGKRLSDGEMTITADTLFSALFIETLQLGKTDWLLNDLIISDTFPYE
Spy_CRb ETMEKPLDYRFIFGYAENKYYTKQNTTEVTESEEMLEHKIDFMVTLEVK

Sth_CR1 SDYKEQIEPGDRTNREGHAAKVYFNELEFG-----KQFVRVTQ
Ssu SDYREHIELGDRTNREGHAAKVYFNELEFG-----KQFVRLTQ
Smu EGNLEKIKELYAQQN-GEDLKE LASSFIN-----LFTFTA
Sag DANLEKINKLYQDNKENISVDELANNIIN-----LFTPTS
Spy_CRa DANLDKVL SAYNKHR-DKPIREQAENIIH-----LFTLTN
Sth_CR3 KKNKGLLNSAFQSWQ-NHSIDELCSSF IGPTG-----SERKGLFELTS
Lin EANLNKINQLFEQNK-EGDIKAI AQSFVD-----LMAFNA
Sth_CR2 DAFPPQFGFFLP-KPIGYPKHDQIDQSV DVKEVRRQAKLSKQLFLALEN
Ssa DAFPPMGAPYLP-KPIGYPLLDKVNREDIIKQREEAKKAKKLAFLIKLGD
Mtu DLLPYPVGPDYLYPKPLHSVRS DGS SMQKLAKKIGFLPAAQLGSFLDGT
Mbo DLLPYPVGPDYLYPKPLHSVRS DGS SMQKLAKKIGFLPAAQLGSFLDGT
Sep NELYYLPKPLIKLDSKEDNHKAFKLLKYVPVHHYNYLNGELSAEDATD
Spy_CRb EANANGDPLNGNMPRTDAKGYGVMSDVS IKRKRIRNRLQDMGKISFVQANE

Sth_CR1 KEADVINA GLNYGYAIMR--AQMARIVAGYGLNGLLGI FHKNEYNQFNLV
Ssu QETDAVNAGLNYGYTIFR--AQMARI IAGYGLNALIGIFHKNEYNQFNLA
Smu IGAPATFKFFDKNIDRKR-YTSTTEILNATLIHQ SITGLYETRIDLNLKLG
Sag LGAPAAFKFFDKIVDRKR-YTSTKEVLNSTLIHQ SITGLYETRIDLGLKLG
Spy_CRa LGAPAAFKYFDTTIDRKR-YTSTKEVL DATLIHQ SITGLYETRIDLSQLG
Sth_CR3 RGSAADFEFLGKIPRYRDYTPSSLLKDATLIHQSVTGLYETRIDLAKLG
Lin MGAPASFKFFETTIERKR-YNNLKELLNSTIIYQSITGLYESRKRLLDDMG
Sth_CR2 VDDYLNGLFENEHVAIDTVTKNQPHKDG NLYQVATFRFSNDTSLYVIA
Ssa FDCFLSGNSIVGESLATSINTKNQPFQDGNLYQVAVHFD-KSSLYFIA
Mtu DLKELAAQTKIGVHAVSAKAAIHNGKADADPYRVGYFRFELDAGLWLLA
Mbo DLKELAAQTKIGVHAVSAKAAIHNGKADADPYRVGYFRFELDAGLWLLA
Sep LNDIFNIGYFSLQT-KVSLIAQETDSSADSEPY SVGTFTFPEAGLYFIA
Spy_CRb RIEDDFRSLEKRF SQHFTAKTPDKEIEEKANALWFDVRAFGQVFTYLKKS

Sth_CR1 DDLMEPFRQIVDVVV-----YDNLRDQEFK---YEYRLGLTDLNNAKIK
Ssu DDLMEPFRQIVDVVV-----YMNLRADFLT---YQHRLELTNLLNAKIR
Smu GDMG-WRTVVVNTHS-----KLSYKNNHLIFKDAYQTEMIHLSEIDILL
Sag EDMAGWRTVVVNTHS-----KLSYKNNHLIFKDSYQTEMIHLSEIDILIM
Spy_CRa GDMAGWRTVVVNTHS-----KLSYKNNHLIFKDAYKTEMIHLSEIDILL
Sth_CR3 EGMAGWRTVVVNTHS-----KLSYKNNHLIFRNSYKTEMIHLSEIDILL
Lin -----WRTVVVNTHS-----KLSYKNNHLIFKDAYQTEMIHLSEIDVLL
Sth_CR2 NESDLLNELMSSIQY---SGLGGKRSSGFRFELD-IQNIPELSDRLT
Ssa NQSDLLDRLLESIQF---SGIGGKRSSGYGGFTLDKTVQQPLDFFKRLT

Mtu TGSESELGLLTRLLKGI--SALGGERTSGFGAFNLTESEAP----AALTP
Mbo TGSESELGLLTRLLKGI--SALGGERTSGFGAFNLTESEAP----AALTP
Sep KGSEETLDHLNNTALQYSGLGGRNAGYQGFEYEIINNQQ--LSKLL
Spy_CRb IGVIRGPVSI SAKSLEPIVISSLQITRSTNGMEAKNNSGRSSDTMGTKHF

Sth_CR1 YGKETCSVTVMADKYVKGFYKIKYISEKDS-----SKFHCPVVSSLEWRK
Ssu YGKENCSTVMADKFKVGFIRCIEDKDT-----NQFFCPVVSSLEMEK
Smu ETTDIVLSTMLIKRLVDENILVIFCDDKRLPTAMLMPYARHDSLSLQLSH
Sag ETTDIVLSTMLIKRLVDENILVIFCDDKRLPTAMLMPYARHDSLSLQLSR
Spy_CRa ETTDIVLSTMLVKRLVDENVLVI FCDDKRLPTAMLMPYGRHDSLSLQLGK
Sth_CR3 ETTDIVLSTMLVKRLVDENILVIFCDDKRLPTAFLTPYARHDSLSLQIAR
Lin ETTDITLSTMLINCLVAENILILFCDDKRLPIGKVLPHYGRHDSLSLQLS-
Sth_CR2 KNHSDKVMSLTALPVADLEEAMEDGHYLLTKSSGFAF'SHATNEN-YRK
Ssa VKYTGKVMALTTSLPVSELKVAMNEGRYLLKKSSGFAFSEETESN-YRK
Mtu TVDAASLMTLTTSLPTDDELEAALAGATYRLVKRSGFVASSTYADMPLRK
Mbo TVDAASLMTLTTSLPTDDELEAALAGATYRLVKRSGFVASSTYADMPLRK
Sep NQNGKHSILLSTAMAKKEEIESALKEARYILTKRSGFVQSTNYSEMVLVK
Spy_CRb VDYGVYVLKGSINAYFAEKTGFSQEDAEAIKEVLVSLFENDASSARPEGS

Sth_CR1 -MRYEALR-----LLCFFDLPMESKDEKRIYRNF
Ssu LMRYDAMR-----LLCFFDLPMETTQEKQRYLRF
Smu QISWTEEVKCDVWTTIIAQKILNQSCYLGECFYFEKSQSIMDLYHDLPEFF
Sag QMSWIEDVKADVWTSIIAQKILNQSFYLGECSEFEKSQSIMNLYHDLPEFF
Spy_CRa QMSWSETVKSQVWTTIIAQKILNQSCYLGACSYFEKSQSIMDLYHGLENF
Sth_CR3 QIAWKENVKCEVWTAIIAQKILNQSYLLGECSEFEKSQSIMELYHGLERF
Lin -----
Sth_CR2 QDLYKFASGSTFSKTFEGQIVDVRPLD-FPHAVLNYAKPLFFKLEV--MK
Ssa QNLYTFKAGSTFSKTYNGQICDVKPSDEFPHSVWHYAKPLFYILEESKMK
Mtu RDIYKFAAGSVFSRPFQGGILDVSLGG--NHPVYSYARPLFLALPESAA
Mbo RDIYKFAAGSVFSRPFQGGILDVSLGG--NHPVYSYARPLFLALPESAA
Sep SDFYSFSSGVSFKNIFNGDIFNVGHNG--KHPVYRYAKPLWLEVMTIKN-
Spy_CRb MRVCEVFWFTHSSKLGNVSSARVFDLLEYHQSIEEKSTYDAYQIHLNQEK

Sth_CR1 RKELISNGFEMLQFSVYVRTCPNRSFANKFYKCLK--MSNLPAGNVRLLA
Ssu RKELIANGFEMLQFSVYVRTCPNRSFATKFKYKCLK--QSHLPAGNVRLLA
Smu DPSNREGHSARIYFNTLFGNVFSREQDNDINAGLD--YGYTLLLSMFARE
Sag DPSNREGHAARIYFNTLFGNDFSREQDNPINAGLD--YGSLLLSMFARE
Spy_CRa DPSNREGHAARIYFNTLFGNDFSRLDLEHPINAGLD--YGYTLLLSMFARE
Sth_CR3 DPSNREGHSARIYFNTLFGNDFTRSDNDINAALD--YGYTLLLSMFARE
Lin -----
Sth_CR2 NDYRT-FKLSLLTLAPIHIGNGEKYTSREFIYENK--KFYFPDMGKIFYNK
Ssa TKYRK-FKLTWLTLGPVHIGSGQLHTAREYILEGD--EYFFPDMTLLYDE
Mtu NTYLKPFELTLRCLGPVFIGSGEKRTSKEYHVVEGD--RVYFPDMELLYAD
Mbo NTYLKPFELTLRCLGPVFIGSGEKRTSKEYHVVEGD--RVYFPDMELLYAD
Sep -----YEVVIKTLGPIHIGSGQVMKKQDYIYDFYNSKVYMINTKLVKF
Spy_CRb LAKYEAKGLTLEILEGLMVYAEDDYLMLSGIQHFQFCKRQWALIHIEQQW

Sth_CR1 VTEKQFSEMTEIIGGKTKQEEIVSDNKLVAIMKF----FVRHPYKDRIEL
Ssu VTEKQFSEMVLIVGGKTRQEEAISDRKLVIMKW----LITHVVLNPIPI
Smu VVVGCMQTQFGLKHANQFNQFNASDIMEPFRPI----VDRIYVENRNNS
Sag VVKCGCMTQFGLKHANQFNQFNASDIMEPFRPI----VDRIYENRQSD
Spy_CRa VVVGCMQTQFGLKHANQFNQFNASDIMEPFRPL----VDKIYVENRNQP
Sth_CR3 VVVGCMQTQIGLKHANQFNQFNASDIMEPFRPI----IDRIYQNRHNN
Lin -----KIRPY----LQVRVFAN----
Sth_CR2 MVEKRLAEKFEAFLIQTRPNARNNRLISFLNDNR----IAER--SFGGYS
Ssa LIKRGIDEKFKQFLIDS--DNKTNRISDFLAEHG----ITKR--NFGGYR
Mtu IPAH-KRKSFEAFVMNTDGAQATAPLKEWVEPNA----VKLDPAKHRYE
Mbo IPAH-KRKSFEAFVMNTDGAQATAPLKEWVEPNA----VKLDPAKHRYE
Sep LKRKNLLYTYQNFLRYPKPNPRENGLKDYLDQON----VKQSEWEAFVSY
Spy_CRb LDNEATAHGQVHLTKADNPYIKEKRKELLVSRAMPISAEGLGSGIMDVV

Sth_CR1 NIGAITQIVGQNNELKYYILQILSWYFGGKYSREDSLIFDYEEPTILDE
Ssu HVGQFTQIVGQNYELKYYIWQILIWYFGGKYSSEDLILFNQEEPVISQD
Smu FIKIKRELFSMFSDTYLYNNKEMYLNTNIVSDYTKKVIKALNNDGKGVPEF
Sag FVKMKRELFSMFSSETYSYNGKEMYLNTNIVSDYTKKVIKALNSDNGNGIPEF
Spy_CRa FPKIKRELFTLFSDTFSYNGKEMYLNTNIVSDYTKKVIKALNNEGKGVPEF

Sth_CR3 FVKIKKELFSIFSETYLYNGKEMYSNIVSDYTKKVIKALNQLGEEIPEF
Lin -----
Sth_CR2 ISETGLES DRPNPS-----AGAINVKNKFI RDAFGNPIY PGSSSLKGA
Ssa LKATGLEKPKGENVPRNQETTDPEINGVHQFMRDCYGNPYVPGSSSLKGA
Mtu VKIGSIEPRRASRGRGGRMTRKKLTLNEIHAFIKDPLGRPYVPGSTVKGM
Mbo VKIGSIEPRRASRGRGGRMTRKKLTLNEIHAFIKDPLGRPYVPGSTVKGM
Sep SEKVNQGGKYGNTN-----PKPLNDLHLMVRDQGNKVYLPGSSIKGA
Spy_CRb EFYKDDQGVSLRGRKRWLPKVVEYKRKPKKDRDITVQLVAQTMCLEET

Sth_CR1 AREIVKRSSYHYIDISTFKDLLEQMEYKKGTLAHGYLRKIVNQVDIVGH-
Ssu S-EAIKRNAFKIIISIAEVDILEQISYKKGTTIGFSYLSLKMQNIIEIIEE-
Smu RIM-----RMILMFDMPDTAEERKAYRKRFRKFLLESGFIMHQFSVYSK-
Sag RIMSRYRMRMILMFDMPDTAEERKAYRKRFRKFLLESGFIMHQFSVYSK-
Spy_CRa RIMSRYRMRMILMFDMPDTAEERKAYRKRFRKFLLESGFIMHQFSVYSK-
Sth_CR3 RIMSRYRMRMILMFDMPDTAEERKAYRKRFRKFLLESGFIMHQFSVYSK-
Lin -----
Sth_CR2 IRTILMNTTPKWNENAVNDFGRFPKENKNLIPWGPCKG-----
Ssa IRTILMNTHHWSTDFKQENKKGKIVE-NKKAIPWGPTRRQRHE-----
Mtu LRSIYQLQSLVHKRTAQPVVRVPGHQTRHRQYGERFERKELRKSGRPNTR-
Mbo LRSIYQLQSLVHKRTAQPVVRVPGHQTRHRQYGERFERKELRKSGRPNTR-
Sep IKTTLVSKYNNENKNDIYSKIKVSDSKPIDESNLAIYQKIDINKSEKSM
Spy_CRb LDCDINEGCLLYHSVNQRVIVPMTSALRQEVKELAAEMHEVYQSOMLPKA

Sth_CR1 LEKINEQVELIEEAMNRHINLNCGQVEYHLENLPLTLDQLLT-----
Ssu LEILNYHLHKIAQKVNSSISLINDEIEYEVGTTDLLPEQILT-----
Smu LLLNNSANTAMIARLKENNPKKGNITLLTVTEKQFARMYILNGERDTSIA
Sag LLLNNTANNAMIGRLKVNPNKGNITLLTVTEKQFARMVYLHGERNTSVA
Spy_CRa LLLNNTANNAMIGRLREHNPKNITLLTVTEKQFARMYILHGERNNCIA
Sth_CR3 LLLNNTANKAMIGRLKANNPKKGNITLLTVTEKQFARMYILYGDKNTSIA
Lin -----
Sth_CR2 --KEYDDLFNAI RVS DSKPFDNKSLILVQKWDYSAKTNKAKPLPLYRESI
Ssa KIKPFDDIFNEIRVSDSQPLTNDLILVQKWDFTPDDTKPHLSIYREAL
Mtu PQDAVNDFLQAI RVTDS PALRTSDLLICQKMDMNVHG-KPDGLPLFRECL
Mbo PQDAVNDFLQAI RVTDS PALRTSDLLICQKMDMNVHG-KPDGLPLFRECL
Sep LYRECIDVNTIEIKFKLTIEDEIYSINEIEQSIQDFYKNYDKWLVGFKET
Spy_CRb AYFKNCQLCSLVDICKPRLSKKTRSVSRVINEAMTSEEMDLMKLLNTLY

Sth_CR1 -----KN
Ssu -----KQ
Smu NSDSRLVFLGEAFPD-----ETMVR
Sag NSDSRLVFLGDSYDQDMIKINFPILDEPLVLSNATILTIEDVSVYSSLVK
Spy_CRa NSDERLVFLGEAFDES MN-LNFSLLDEPIPLRGGTILVLEDVCVFSKIVQ
Sth_CR3 NSDERLVFLGENYCDEHMNINFSLLDEPLEINQGTVLVIEDVSVFAQLVK
Lin -----VTK
Sth_CR2 SPLTKIEFEITTTT-----DEAGR-----LIEELGK
Ssa RPKGKMEFEIITALGFKG----GRAGE-----LVASLGE
Mtu APGTSISHRVVDTSP TARGGWREGER-----FLETIAE
Mbo APGTSISHRVVDTSP TARGGWREGER-----FLETIAE
Sep KGGRRFALEGGIPDVLNQNILFLGAGTG-----FVSKTTH
Spy_CRb LTQEDFYVTKEGDNIVIKQEGKVLKRF-----FRIID

Sth_CR1 FSPFFTI-----ENKNLSFEWVSNIDKLSLFLLEMLDHLHLQTTTE
Ssu LTPHFKK-----SRDEIAIEFISNEKKLCFLQLMLNAIMQEQTK
Smu NLYQYDE-----DSELKFFNRKFKSLKPSSEMLVTDILGYDVNA
Sag HFYQYDV-----DEHLKLFDDKQKSLKATEMLVTDILGYDVNS
Spy_CRa YCYQYEE-----DSELKFFDHKMKTIKESSEIMLVTDILGFDVNS
Sth_CR3 EFYQYDE-----QSNLTI FDSKIRSRSELLELITDILGFDINT
Lin WLYQYDE-----TEELTIFGAKQQPLKSSELMLITDVLGHDINS
Sth_CR2 RAQAFYK-----DYKAFFLSEFPDDKI QANLQYPIYL GAGSGA
Ssa YAQKFYFGVTEDEGYEGYEGYKDFFLKFPNHLIQNNLSYPLYLGGGSGA
Mtu TAASVNQ-----ARYAEYRAMYPG--VNAIVGPIVYLGGGGAGY
Mbo TAASVNQ-----ARYAEYRAMYPG--VNAIVGPIVYLGGGGAGY
Sep YQLKNRKQAKQ-----DSFEILT KFRGTYGKMKI P SNVVALKGT
Spy_CRb GIVCFSYLG-----VSSALVKLCTENQINLSFHTPQGRFCGRYIGS

Sth_CR1 KYLIVLKNIDGFI SEESYTI-----FYRQICHLVKYPNL

Ssu PILLVLKLNDDYLTYSFVR-----IAQYLEELS NKYPYF
Smu PSLKLVHADLENQFNEKPE-----VKSMVEKLAN TIT--
Sag APILKLIHGDLENQFNEKPE-----VKSMVEKLAATIT--
Spy_CRa STILKLIHADLESQFNEKPE-----VKS MIDKL VATIT--
Sth_CR3 SQVLKLLHTDIVSQLNDKPE-----VRSEIDSLVSLIT--
Lin LATLKLTYADLEQQLNKPE-----VKS MIDKLTATIS--
Sth_CR2 WTKTLFKQADGILQRRYSRM-----KTKMVKKGVLKLT KAPL
Ssa WTKTVFRQADGEVQKRHK-----KMSER GALKLT KAPF
Mtu RSKTFVTDQDDMAKVLD AQFGKVVK-----HVDKTREL RVSP LVKRTKI
Mbo RSKTFVTDQDDMAKVLD AQFGKVVK-----HVDKTREL RVSP LVKRTKI
Sep NQSRHTSYQQGMCKV SFQELN-----NEVLMKILFSPIGNS
Spy_CRb TNGNVLLRREHYRLSDREESLEYAKRFILAKISNSRKYLLRFRKDRHQI

:

Sth_CR1 TFI LFP SQGYL KIDEENS R FVNILSDQ-VEHLYDVEFMYERVMKYPS-
Ssu NTILFP SQEGYLYL TEATLET VNI VSDR-IEHYPAFTFLYTRYQQSYPS-
Smu ELIAYECL ENELD LEYDEITILEL IKALGVKIETQSDTIFEKMF EVLQV-
Sag ELIAYECL ENELD LEYDEITILEL IKALGVKIETQSDTIFEKCFEIIQV-
Spy_CRa ELIVFECL ENELD LEYDEITILEL IKSLGVK VETQSDTIFEKCLEILQI-
Sth_CR3 DI IMAECIENELDI EYDEITLLEL IKALGVRIETK SCTVFEKIFDILQI-
Lin ELIGYELLEHELDLE EDEITVIELFKALGIK IETKSDTVFEKLEIIVQV-
Sth_CR2 KTVKIPSGNHSLVKNHESFYEMGKANFMKEID-KMRVLISAVGDTDFP-
Ssa LTV---DGEIELINNAENFYEMGKTCFTITEVATRMKTLITFISQYDPIG
Mtu DNICYEMGQCELSIRRAEMILFSPIGTADPITALGDGPMLHIVRHYRPV
Mbo DNICYEMGQCELSIRRAEMILFSPIGTADPITALGDGPMLHIVRHYRPV
Sep DPWRNDRD GAMLHIVRHYNLDKV VLYFTRTIWEGNENRKGHKIYEWEKII
Spy_CRb DTKLFEAVNDEL IWALEMVQAADNKDSL RGI EGQAANQYFRIFNDLV LTD

*

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----
Ssa VKFKHPTKKDETGREKTDNFRRALSIGDIHTYEHDGYQ-----
Mtu VVLFLSAEIAAFENADRRYSAAITRLAPETDVRIVTYTNPSVHRFDL FVP
Mbo VVLFLSAEIAAFENADRRYSAAITRLAPETDVRIVTYTNPSVHRFDL FVP
Sep QTVSPNTEVEII IENVDNAQDYDV FKEKFHKYLKIIEDS-----
Spy_CRb KKT-----

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----RNFHDG-ALIH IKQEY-----RSLK
Ssa -----QEISDGPALVIKDEL PDKLIVISDEMVKVQENFERTVK
Mtu VFRNHLVELSAEFPDR TILLNTSSGTPAMQAALVAINVFGIPRTTAVQVS
Mbo VFRNHLVELSAEFPDR TILLNTSSGTPAMQAALVAINVFGIPRTTAVQVS
Sep -----YEDCEIILNVTSGTPQME STLCL EYIVYPENK KCVQVS
Spy_CRb -----

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 KTAR-----
Ssa TVYR-----
Mtu TPARALSKPGDRESPDAYDLELMWDANDDNQPGAPNRCFEATS AALGALL
Mbo TPARALSKPGDRESPDAYDLELMWDANDDNQPGAPNRCFEATS AALGALL
Sep TPTK-----

Spy_CRb -----

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----
Ssa -----DFIEKFDYKAALDILDQLSDFPN--LKSLREEIRD---
Mtu -----KKAVQIPVIQNEYVTEGVHEFEA--MYKFVEKILDRED
Mbo ERANLKQLIVSYDYSAAVTIAADSRLPDQVSNLIRGAMHRSRLEHLVAPK
Sep ERANLKQLIVSYDYSAAVTIAADSRLPDQVSNLIRGAMHRSRLEHLVAPK
Spy_CRb -----DSNAGIEYSNPKDKVEFEIVNEVEKKSEKRCKEINIL-----

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----
Ssa -----MSGNDYILNITSGTAQCQAAMYFINFIKDYHTRLARVDSPNGKKTNRSNQ
Mtu -----FFKDTAFTYDPANKVAEYISALALLAKREQWAEFARSATPAITIVLRAAV
Mbo -----FFKDTAFTYDPANKVAEYISALALLAKREQWAEFARSATPAITIVLRAAV
Sep -----SFREAMIRSQILGLIDNYDYEGALNLVSNQ-----
Spy_CRb -----

Sth_CR1 -----NDFPTREGFRMSLET-----
Ssu -----TSPLGEKEFLNSLRK-----
Smu -----YKYLNKKKLLVFIN-----
Sag -----YHYLTKKNLLVFN-----
Spy_CRa -----FKYLTKKKLLIFVN-----
Sth_CR3 -----FKYLVKKRILVFN-----
Lin -----YKYLKSKKLLVFIN-----
Sth_CR2 -----VVNCLSKKKIAYIREK-----
Ssa -----GAPYFEEVVLDDLLKKQTAEKEDERKPEIETGEKLNLLQRTYKDFILK
Mtu -----AKHLPEDRYLDDMGRVDRRKLEREPEIRCALKHPPKSPNAEWYLYTKDWL
Mbo -----AKHLPEDRYLDDMGRVDRRKLEREPEIRCALKHPPKSPNAEWYLYTKDWL
Sep -----KSFNRGKLLRKKLLSLTKQIKTHEVFPEINEKYRDDALKKSLFHY
Spy_CRb -----FYFQGRSKRPLDCVNALLSFG-----

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----
Ssa -----YEYK-----
Mtu -----ALLRQFAPDRVGALEVLGRFESRVRNTAAHEIVSISEDRIKDGGLPEQ
Mbo -----ALLR-----
Sep -----LLLN-----
Spy_CRb -----

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----

Ssa -----AALDILK
Mtu LLKILARETGADLTLYDRLNDEIRQIDMAPLGMVQLYVSDSVSRISFAD
Mbo -----MVQLYVSDSVSRISFAD
Sep -----MRYNRLDVAETLIRVKS
Spy_CRb -----

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----LYDFSRVFKNQSIKSDILS-----
Ssa ANPDIISNKDDQEKSKKALENMISSVFQKQKVLKELAADSK-----
Mtu GRVIVWSEELGESQYPIETLDGITLFGFRPTMTTFFIVEMLKRELDIQLFT
Mbo GRVIVWSEELGESQYPIETLDGITLFGFRPTMTTFFIVEMLKRELDIQLFT
Sep IAEFILKTYIEIHWPTLIEKDGKPYLNDEDNLSFVYKYN-----
Spy_CRb -----

Sth_CR1 -----VTPYLLT-KMLRQPS
Ssu -----ISSYLFSSDINRVVS
Smu -----TLSYFKREEIAQILE
Sag -----SGAYLTKDEVIKLCE
Spy_CRa -----SGAFLTKDEVASIQE
Sth_CR3 -----SLSYFSKDEIYQILE
Lin -----VCAYLTEDELLELRR
Sth_CR2 -----FPLDDS--QEKALNYYL
Ssa -----LKYNDTGEFQKVLNYYL
Mtu TDGHYQGRISTPDVSYAPRLRQQVHRTDDPAFCLSLSKRIVSRKILNQQA
Mbo TDGHYQGRISTPDVSYAPRLRQQVHRTDDPAFCLSLSKRIVSRKILNQQA
Sep -----LLEKRRQNFDVSRILGLPA
Spy_CRb -----YSLLTFFECQSALEAVGLDSYVG

Sth_CR1 LSLVDSVILNINLQLFHFSYRIRYLQK-SDEKLLQKFLESKD-----
Ssu LADIDLVTLKIVNSLYQYDIKVMYMK-GISKLEENYLS-----
Smu YIHLSDMVVFLEPRKIDGFAQYILDE-DYFLITESNN-----
Sag YINLMQKSVLFLEPRRLYDLPQYVIDK-DYFLIGENMV-----
Spy_CRa YISLTNLTVLFLEPRELYDFPQYILDE-DYFLITKNMV-----
Sth_CR3 YTKLSQADVLFLEPRQIEGIIQQFILDK-DYIILMPYNN-----
Lin YVSLNQVKVLFVEPRKTEGFSQVILDS-DYFLQVEKGM-----
Sth_CR2 MIDVLKEREHIADVLIKAKSLAEFVIE-ETIKKDHEGLIVFDGN-----
Ssa MIDILNRRGQVTDVLVKAKSFAEFVIG-NYLFRKYERYVKTTSKGFKLNL
Mtu LIRAHTSGQDVAESIRTMKHS LAWVDR-SGSLAELNGFEGNAAKAYFTAL
Mbo LIRAHTSGQDVAESIRTMKHS LAWVDR-SGSLAELNGFEGNAAKAYFTAL
Sep FIDILTILEPNSQLLKEVNAVNDINGLRNSIAHNLDTLNLDKNKNYKIM
Spy_CRb FFHTDRPGRASLALDLVEEFRSYIVDRFVFSLINKGQLQKKHFVVKENG

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----LPKLNPF-----
Ssa ESLNNDIEISEICDYITQEIKKVNPKGSGFRKSDLM-----
Mtu GHLVPQEFQGRSTRPPLDAFNSMVSLGYSLLYKNIIGAIERHSLNAYI
Mbo GHLVPQEFQGRSTRPPLDAFNSMVSLGYSLLYKNIIGAIERHSLNAYI
Sep LSVEAIKNMLHISFPEIEEEDYNYFEEKNKEFKELLMINKITVELDLP--
Spy_CRb ILLTENGRAIFIDLWQKRKHTEVEHPFTKEKVKMLMLLPYVQAQLLAKAIR

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----

Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----SFPDKVAHGLSEI
Ssa -----IHSFRHLVIFLEGRSAIVTSTQKVTELNSKRNNVAHGLAEI
Mtu GFLHQDSRGHATLASDLMEVWRAPIIDDTVLRLIADGVVDTRAFSKNSDT
Mbo GFLHQDSRGHATLASDLMEVWRAPIIDDTVLRLIADGVVDTRAFSKNSDT
Sep --ESIRFQYLGSVLHGVLMDYLSDDIADQLHHEFAYSPLKQRIYHKNKKI
Spy_CRb GDLESYPPFMVMMVLVTYDVNTEETPAGRKRLRHVAKLCVDYQGRVQNSVF

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----DTRLLSRKK--LKQLSENQLLLVDCLG-----IDSSYFNY-YDKQNKEL
Ssa S---VLQEE--LNELVKGLKLVIAAYSDDKKVYLYQEYFDY-YDQKNQDL
Mtu GAVFATREA--TRSIARAFGNRIARTATYIKGDPHRYTFQYALDLQLQSL
Mbo GAVFATREA--TRSIARAFGNRIARTATYIKGDPHRYTFQYALDLQLQSL
Sep IWEIVCMSDNLFKEVVKLFSSKNSLLKYYQTNIDIQSFQIEKINVQNM
Spy_CRb ECSVTPAEFVDIKHRLTQIIDEKTD SIRFYLLGKNWQRRVETLGRSDSYD

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----TKMLE-----
Ssa ISCLK-----
Mtu VRVIEAGHPSRLVDIDITSEPSGAMP---TRSREEYFNLPLKVDDESSGTI
Mbo VRVIEAGHPSRLVDIDITSEPSGAMP---TRSREEYFNLPLKVDDESSGTI
Sep NQLLQVEDLSRYVRLNIQTPMSFKYQNSYMI FPDVKRFRS IMIQFDAFF
Spy_CRb PDKGVLLL-----

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----
Ssa -----
Mtu GKMFVLVIYDISDNRRRASLAKILAGFGYRVQESAFEAMLTKGQLAKLVA
Mbo GKMFVLVIYDISDNRRRASLAKILAGFGYRVQESAFEAMLTKGQLAKLVA
Sep EEYRMYDKETLNFLEKNVNIVDYKLLKSTRFNLEKVKIPSFTEIVFKIKG
Spy_CRb -----

Sth_CR1 -----
Ssu -----
Smu -----
Sag -----
Spy_CRa -----
Sth_CR3 -----
Lin -----
Sth_CR2 -----
Ssa -----
Mtu RIDRFAIDCDNIRIYKIRGVAAVTFYGRGRLVSAEEFVFF
Mbo RIDRFAIDCDNIRIYKIRGVAAVTFYGRGRLVSAEEFVFF
Sep PLPFLQLTHFLLKFGFESGSGIKTSLGMGKYSII-----
Spy_CRb -----

C

```

Sth_CR1 ---MTWRVVHVQSSEKMRLLKLDNLLVQKMG---QEFTVPLSDISIIVAEGGDTVVTLLRLLS
Ssu ---MTWRIVVHIHQSEKMRLLKLDNLVKKQG---DEFTIPLSDISIIVAEGGDTVVTLLRLLS
Smu ---MGWRTVVVNTHSKLSYKNNHLIFKDAY---QTEMIHLSEIDILLETDDIVLSTMLIK
Spy_CRa ---MAGWRTVVVNTHSKLSYKNNHLIFKDAY---KTEMIHLSEIDILLETDDIVLSTMLVK
Sth_CR3 ---MAGWRTVVVNIHSHKLSYKNNHLIFRNSY---KTEMIHLSEIDILLETDDIVLSTMLVK
Sag ---MAGWRTVVVNTHSKLSYKNNHLIFKDSY---QTEMIHLSEIDILIMETDDIVLSTMLIK
Lin ---MGWRTVVVNSHSHKLSYKNNHLVFKSAY---QTEMIHLSEIDVLIETDDITLSTMLIN
Sth_CR2 ----MSDLYSQRSNYYLSLSEQR I I I KNDNKEIVKEVSI SLVDNVLLFG-NAQLTTQLIK
Ssa ----MADLYIQNSSYSLSISDRKLMIKNQERTMLKAI SLGLIDNILIFG-NSQLSTQLLK
Mtu ----MVQLYVSDSVSRISFADGRVIVWSEELGES-QYPIETLDGITLFG-RPTMTTFFIV
Mbo ----MVQLYVSDSVSRISFADGRVIVWSEELGES-QYPIETLDGITLFG-RPTMTTFFIV
Sep ----MKDVIYVENHYFVTAKENS IKFRNVIDKSEK FYLFEEIEA I I F D H Y K S Y F S H K L V I
Spy_CRb MKKLLNTLYLTQEDFVYVTKEGDNIVIKQEGK-VLKRFPFR I I D G I V C F S -Y L G V S S A L V K

```

: . . . : . . . : . . .

```

Sth_CR1 ALSKYNIALVVCNEHLPTGIYHSQNGHFRAYKRLKEQLDWSQKQKDKAWQIVTYKINN
Ssu ALSKYNIALIVCDNHHLPTGIYHSQNGHFRAYKRLQQLSWAPLQDKLWQII I YFKITN
Smu RLVDENILVIFCDDKRLPTAMLMPPYARHDSLQLSHQISWTEEVKCDVWTTIIAQKILN
Spy_CRa RLVDENVLFVIFCDDKRLPTAMLMPPYGRHDSLQLGKQMSWSETVKSQVWTTIIAQKILN
Sth_CR3 RLVDENILVIFCDDKRLPTAFILTPPYARHDSLQIARQIAWKENVKCEVWTAIIAQKILN
Sag RLVDENILVIFCDDKRLPTAMLMPPYARHDSLQLSRQMSWIEDVKADVWTSIIAQKILN
Lin CLVAENILVIFCDDKRLPIGKVLFPFYGRHDSLQLSKIRPYLQ-----
Sth_CR2 ALSKNKVNYYFYSNVGQFISSIETHRQDEFQKQELQAKAYFEEDFRLEVARSIATTKVRH
Ssa SLSRHGIPVFYFSSKGEFLFSMDSFKADYEQREQAQASFDKSFCLKMSKR IASAKIMN
Mtu EMLKREEDIQLFTTDGHYQGRISTPDVSYAPRLRQQVHRTDDPAFCLSLSKRIVSRKILN
Mbo EMLKREEDIQLFTTDGHYQGRISTPDVSYAPRLRQQVHRTDDPAFCLSLSKRIVSRKILN
Sep KCIENDIAIIFCDKHSFVPTQLISSYGMVNRKRIQSQFQLSGRTKDRIWKKIVINKIFN
Spy_CRb LCTENQINLSFHTPQGRFCGRIGSTNGNVLLRREHYRLSDREE-SLEYAKRIFILAKISN

```

: . . .

```

Sth_CR1 QEDVLAMFEK-----SLDNIRLLSDYKEQIEPGDRTNREGHAAKVYFN---
Ssu QQDVLAMQEK-----SLSTIQLLSDYREHIELGDRTNREGHAAKVYFN---
Smu QSCYLGEFCF-----YFEKSQSIMDLYHDLEPFDPNSREGHSARIYFN---
Spy_CRa QSCYLGACS-----YFEKSQSIMDLYHGLENFDPNSREGHAARIYFN---
Sth_CR3 QSYYLGECS-----FFEKSQSIMELYHGLERFDPNSREGHSARIYFN---
Sag QSFYLGACS-----FFEKSQSIMNLYHDLEPFDPNSREGHAARIYFN---
Lin -----
Sth_CR2 QIALLREFDTDG-----LLDTSYSRFEDSVNDIQKAYSITEIMGYEGR LAKSYFYLLN
Ssa QLNLLKAYDEQG-----LFDEEDFKRFSACESLESAKSISEIMGIEGRIAKSYFYLLN
Mtu QQALIRAHTS-G-----QDVAESIRTMKHS LAWVDRSGSLAELNGFEGNAAKAYFTALG
Mbo QQALIRAHTS-G-----QDVAESIRTMKHS LAWVDRSGSLAELNGFEGNAAKAYFTALG
Sep QTRCLENLH-----NENVKMLGFAKEVSSGDKSNKEAHATRIYFK---
Spy_CRb SRKYLRLFRKDRHQQIDTKLFEAVNDELIWALEMVQAADNKDSLRLGIEGQAANQYFRIFN

```

```

Sth_CR1 ELFGK---QFVR---VTQKEADV INAGLNYGYAIMRAQMARI VAGYGLNGLLGI FHKNEY
Ssu ELFGK---QFVR---LTQQUETDAVNAGLNYGYTI FRAQMARI IAGYGLNALIGI FHKNEY
Smu TLFGN---VFS-----REQDNDINAGLDYGYTL LLSMFAREV VVSGCMTQFGLKHANQF
Spy_CRa TLFGN---DFS-----RDLEHPINAGLDYGYTL LLSMFAREV VVSGCMTQFGLKHANQF
Sth_CR3 TLFGN---DFT-----RESNDINAALDYGYTL LLSMFAREV VVSGCMTQI GLKHANQF
Sag TLFGN---DFS-----REQDNPINAGLDYGYSL LLSMFAREV VVKGCMTQFGLKHANQF
Lin -----
Sth_CR2 LLVPD---DFHFNGRSRRTAEDCFNSALNFGYSILYSCLMGLIKKNGLSLGFVVIKHHQ
Ssa LLVEE---DFQFYSRNRSPLDRFNALNFGYSILYSCFIGLIRKNGLSAGFGVTHQPHT
Mtu HLV PQ---EFAFQGRSTRPPLDAFNSMVS LGYSLLYKNI IGAIERHSLNAYIGFLHQDSR
Mbo HLV PQ---EFAFQGRSTRPPLDAFNSMVS LGYSLLYKNI IGAIERHSLNAYIGFLHQDSR
Sep DLF GK---QFKR-----GRYNDVINSGLNYGYSILRSFINKELAIHGFEMLGKIKHSKE
Spy_CRb DLVLTDKKTFYFQGRSKRPP LDCVNALLSFGYSL LTFECQSALEAVGLDSYVGFHFTDRP

```

```

Sth_CR1 NQFNLVDDLMEPFRQ-IVDVVYDNLRDQEF LKYEYR-----L
Ssu NQFNLADDLMEPFRQ-IVDVVYVMNLRADFLTYQHR-----L
Smu NQFNFASDIMEPFRP-IVDRIVYENRNS---FIKIK-----R
Spy_CRa NQFNFASDIMEPFRP-LVDKIVYENRNQP---FPKIK-----R
Sth_CR3 NQFNLASDIMEPFRP-IIDRIVYQNRHNN---FVKIK-----K
Sag NQFNLASDIMEPFRP-IVDRIIYENRQSD---FVKMK-----R
Lin -----
Sth_CR2 HHATLASDLMEWRPIIVDNTLMELIRNGKLLLSHFENKQD--FILTDEGREIFAWALR
Ssa HHAVALASDLMEWRPIVDDTVMSLIKHGDIRGGAF-----

```

Mtu GHATLASDLMEVWRAPIIDDTVLRLIADGVVDTRAFSKNSDTGAVFATREATRSIARAFG
Mbo GHATLASDLMEVWRAPIIDDTVLRLIADGVVDTRAFSKNSDTGAVFATREATRSIARAFG
Sep NPFNLADDIEVFRP-FVDNIVYEIVFKKNIDTFDINEK-----K
Spy_CRb GRASLALDLVEEFRSYIVDRFVFLINKQLQKKHFEVKENG-----SILLTEN

Sth_CR1 GLTDLLNAKIKYGKETSVTVAMDKYVKGFIKYISEKDSSKFHCPVVSLEWRK-
Ssu ELTNLLNAKIRYKENCSTVAMDKFVKGFIKRCIEDKDTNQFFCPVVSLEMEKL
Smu ELFSMFSDTYLYNNKEMYL TNIVSDYTKKVIKALNNDGKGVPEFRI-----
Spy_CRa ELFTLFSDTFSYNGKEMYL TNISDYTKKVVKALNNEGKGVPEFRI-----
Sth_CR3 ELFSIFSETYLYNGKEMYL SNIVSDYTKKVIKALNQLGEEIPEFRI-----
Sag ELFSMFSETYSYNGKEMYL SNIVSDYTKKVIKSLNSDNGIPEFRI-----
Lin -----
Sth_CR2 SRILEVHRYIELDKKRYSFLYTADRQIKSLIRAFRELDPSLYETSYTGGH-----
Ssa -----
Mtu NRIARTATYIKGDPHRYTFQYALDLQLQSLVRVIEAGHPSRLVDIDITSEPSGA-
Mbo NRIARTATYIKGDPHRYTFQYALDLQLQSLVRVIEAGHPSRLVDIDITSEPSGA-
Sep LLLNVLYERCIIDKKVRLLDVSVKIVIQSLIRCYEENTPTYLLLPKMIEVGN---
Spy_CRb GRAIFIDLWQKRKHTEVEHPFTKEKVKMLLLPYVQAQLLAKAIRGDLESYPPFMV