```
Bovine_respirat MSKINKYGLELHWAPEFPWMFEDAEEKLDNPSSSEVDIVCSTTAQKLETGGICPENHVMV
Bovine_enteric_ MSKINKYGLELHWAPEFPWMFEDAEEKLDNPSSSEVDIVCSTTAQKLETGGICPENHVMV
Bovine_CoV      MSKINKYGLELHWAPEFPWMFEDAEEKLDNPSSSEVDIVCSTTAQKLETGGICPENHVMV
Murine_HepV     MAKMGKYGLGFKWAPEFPWMLPNASEKLGNPERSEEDGFCPSAAQEPKVKGKTLVNHVRV
SARS_CoV        ------------MESLVLGVNEKTHVQLSLPVLQVRDVLVRGFGDSVEEALSEAREHLKN
Human_CoV       -------------------MACNRVTLAVASDSEISANGCSTIAQAVRRYSEAASNGFRA
Porcine_epidemi -------------------MASNHVTLAFANDAEISAFGFCTASEAVSYYSEAAASGFMQ
Porcine_transmi -------------------MSSKQFKILVNEDYQVNVP-SLPIRDVLQEIKYCYRNGFEG
Feline_infectio ------------------------------------------------------------
consensus       -------------------m-------l-np-----d--c-t-aq-l--------nhv--

Bovine_respirat DCRRLLKQECCVQSSLIREIVMNTRPYDLEVLLQDALQSREAVLVTPPLGMSLEACYVRG
Bovine_enteric_ DCRRLLKQECCVQSSLIREIVMNTRPYDLEVLLQDALQSREAVLVTPPLGMSLEACYVRG
Bovine_CoV      DCRRLLKQECCVQSSLIREIVMNTRPYDLEVLLQDALQSREAVLVTPPLGMSLEACYVRG
Murine_HepV     DCSRLPALECCVQSAIIRDIFVDEDPQKVEASTMMALQFGSAVLVKPSKRLSVQAWAKLG
SARS_CoV        GTCGLVELEKGVLPQLEQPYVFIKRSD--ALSTNHGHKVVELVAEMDGIQYGRSGITLGV
Human_CoV       CRFVSLDLQDCIVGIADDTYVMGLHG--------------NQTLFCNIMKFSDRPFMLHG
Porcine_epidemi CRFVSLDLADTVEGLLPEDYVMVVIG--------------TTKLSAYVDTFGSRPRNICG
Porcine_transmi YVFVPEYCRDLVDCDRKDHYVIGVLG--------------NGVSDLKPVLLTEPSVMLQG
Feline_infectio ------------------------------------------------------------
consensus       ----ll--e-cv---l--e-vm-------------a-----avl----l-ms--a--v-g

Bovine_respirat CNPNGWTMGLFRRRSVCNTGRCAVNKHVAYQLYMIDPAGVCFGAGQFVGWVIPLAFMPVQ
Bovine_enteric_ CNPNGWTMGLFRRRSVCNTGRCAVNKHVAYQLYMIDPAGVCFGAGQFVGWVIPLAFMPVQ
Bovine_CoV      CNPNGWTMGLFRRRSVCNTGRCAVNKHVAYQLYMIDPAGVCFGAGQFVGWVIPLAFMPVQ
Murine_HepV     VLPKTPAMGLFKRFCLCNTRECVCDAHVAFQLFTVQPDGVCLGNGRFIGWFVPVTAIPEY
SARS_CoV        LVPHVGETPIAYRNVLLRK---NGNKGAGGHSYGIDLKSYDLG--DELGTDPIEDYEQNW
Human_CoV       WLVFSNSNYLLEEFDVVFGKRGGGNVTYTDQYLCGADGKPVM---SEDLWQFVDHFGENE
Porcine_epidemi WLLFSNCNYFLEELELTFGRRGG-NIVPVDQYMCGADGKPVL---QESEWEYTDFFADSE
Porcine_transmi FIVRANCNGVLEDFDLKIARTGR-GAIYVDQYMCGADGKPVI---EG---DFKDYFGDED
Feline_infectio ------------------------------------------------------------
consensus       -lp-----gl--r--v----r-a-n---a-q-y-i--a---lg----vgw-----f----

Bovine_respirat SRKFIVPWVMYLRKCGEKGAYNKDHKRGGFEH-VYNFKVEDAYDLVHDEPKGKFSKKAYA
Bovine_enteric_ SRKFIVPWVMYLRKCGEKGAYNKDHKRGGFEH-VYNFKVEDAYDLVHDEPKGKFSKKAYA
Bovine_CoV      SRKFIAPWVMYLRKCGEKGAYIKDYKRGGFEH-VYNFKVEDAYDLVHDEPKGKFSKKAYA
Murine_HepV     AKQWLQPWSILLRKGGNKGSVTSGHFRRAVTMPVYDFNVEDACEEVHLNPRGKYSCKAYA
SARS_CoV        NTKHGSGALRELTRELNGGAVTRYVDNNFCGPDGYPLDCIKDFLARAGKSMCTLS-EQLD
Human_CoV       E--IIINGHTYVCAWLTKRKPLDYKRQNNLAIEEIEYVHGDALHTLRNGSVLEMAKEVKT
Porcine_epidemi DGQLNIAGITYVKAWIVERSDVSYASQNLTSIKSITYCS-TYEHTFLDGTAMKVARTPKI
Porcine_transmi --IIEFEGEEYHCAWTTVRDEKPLNQQTLFTIQEIQYNL-DIPHKLPNCATRHVAPPVKK
Feline_infectio ------------------------------------------------------------
consensus       ----i---v-ylrk---kg---------------y-f-v-da---v------k-sk----

Bovine_respirat LIRGYRGVKPLLYVDQYGCDYTGGLADGLEAYADKTLQEMKALFPIWSQELPFDVTVAWH
Bovine_enteric_ LIRGYRGVKPLLYVDQYGCDYTGGLADGLEAYADKTLQEMKALFPIWSQELPFDVTVAWH
Bovine_CoV      LIRGYRGVKPLLYVDQYGCDYTGGLADGLEAYADKTLQEMKALFPIWSQELPFDVTVAWH
Murine_HepV     LLRGYRGVKPILFVDQYGCDYTGCLAKGLEDYGDLTLSEMKELSPVWRDSLDNEVVVAWH
SARS_CoV        YIESKRGVYCCRDHEHEIAWFTERSDKSYEHQTPFEIKSAKKFDTFKGECPKFVFPLNSK
Human_CoV       SSKVVLSDALDKLYKVFGSPVMTNGSNILEAFTKPVFISALVQCTCGTKSWSVGDWTGFK
Porcine_epidemi KKNVVLSEPLATIYREIGSPFVDNGSDARSIIRRPVFLHAFVKCKCGSYHWTVGDWTSYV
Porcine_transmi NSKIVLSEDYKKLYDIFGSPFMGNGDCLSKCFDTLHFIAATLRCPCGSESSGVGDWTGFK
Feline_infectio ------------------------------------------------------------
consensus       -ir--rgv------d-yg--ytg----gle-y----l---k---p--s--------vaw-

Bovine_respirat VVRDPRYVMRLQSASTIRSVAYVANPTEDLCDGSVVIKEPVHVYADDSIILRQHNLVDIM
Bovine_enteric_ VVRDPRYVMRLQSASTIRSVAYVANPTEDLCDGSVVIKEPVHVYADDSIILRQHNLVDIM
Bovine_CoV      VVRDPRYVMRLQSASTIRSVAYVANPTEDLCDGSVVIKEPVHVYADDSIILRQHNLVDIM
Murine_HepV     VDRDPRAVMRLQTLATVRSIEYVGQPIEDMVDGDVVMREPAHLLAPNAIVKRLPRLVETM
SARS_CoV        VKVIQPRVEKKKTEGFMGRIRSVYPVASPQECNNMHLSTLMKCNHCDEVSWQTCDFLKAT
Human_CoV       SSCCNVISNKLCVVPGNVKPGDAVITTQQAGAGIKYFCGMTLKFVANIEGVSVWRVIALQ
Porcine_epidemi STCCGFKCKPVLVASCSAMPGSVVVTRAGAGTGVKYYNNMFLRHVADIDGLAFWRILKVQ
Porcine_transmi TACCGLSGKVKGVTLGDIKPGDAVVTSMSAGKGVKFFANCVLQYAGDVEGVSIWKVIKTF
Feline_infectio ------------------------------------------------------------
consensus       v------v-rl-s---i--va-v---t-----g-v-i---v--ya-d-i-l----lv-i-
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Bovine_respirat SCFYMEADAVVNAFYGVDLKDCGFVMQFGYIDCEQDLCDFKGWVPGNMIDG---FACTTC
Bovine_enteric_ SCFYMEADAVVNAFYGVDLKDCGFVMQFGYIDCEQDLCDFKGWVPGNMIDG---FACTTC
Bovine_CoV      SCFYMEADAVVNAFYGVDLKDCGFVMQFGYIDCEQDLCDFKGWVPGNMIDG---FACTTC
Murine_HepV     ---LYTDSSVTEFCYKTKLCDCGFITQFGYVDCCGDTCGFRGWVPGNMMDG---FPCPGC
SARS_CoV        CEHCGTENLVIEGPTTCGYLPTNAVVKMPCPACQDPEIGPEHSVADYHNHSNIETRLRKG
Human_CoV       SVDCFVASSTFVEEEHVNRMDTFCFNVRNSVTDECRLAMLGAEMTSNVRRQ------VAS
Porcine_epidemi SKDDLACSGKFLEHHEEGFTDPCYFLNDSSLATKLKFDILSGKFSDEVKQA------IIA
Porcine_transmi TVDETVCTPGFEGELND----FIKPESKSLVACSVKRAFITGDIDDAVHDC------IIT
Feline_infectio ------------------------------------------------------------
consensus       s--------v--a-------d--fvmq---i-c--------g-v--nm-dg---------

Bovine_respirat GHVYETGDLLAQSSGVLPVNPVLHTKSAAGYGGFGCKDSFTLYGQTVVYFGGCVYWSPAR
Bovine_enteric_ GHVYETGDLLAQSSGVLPVNPVLHTKSAAGYGGFGCKDSFTLYGQTVVYFGGCVYWSPAR
Bovine_CoV      GHVYETGDLLAQSSGVLPVNPVLHTKSAAGYGGFGCKDSFTLYGQTVVYFGGCVYWSPAR
Murine_HepV     CKSYMPWELEAQSSGVIPEGGVLFTQSTDTVN----RESFKLYGHAVVPFGGAAYWSPYP
SARS_CoV        GRTRCFGGCVFAYVGCYNKRAYWVPRASADIG----SGHTGITGDNVETLNEDLLEILSR
Human_CoV       GVIDISTGWFDVYDDIFAESKPWFVRKAEDIFGPCWSALASALKQLKVTTGELVRFVKSI
Porcine_epidemi GHVVVGSALVDIVDDALG--QPWFIRKLGDLASAPWEQLKAVVRGLGLLSDEVVLFGKRL
Porcine_transmi GKLDLSTNLFGNVGLLFKK-TPWFVQKCGALFVDAWKVVEELCGSLTLTYKQIYEVVASL
Feline_infectio ------------------------------------------------------------
consensus       g-v--t--llaq--gvl--------k--a-vg----k----l-g--vv-fg--v-w----

Bovine_respirat NIWIPILKSSVKSYDGLVYTGVVGCKAIVKETNLICKALYLDYVQHKCGNLHQRELLGVS
Bovine_enteric_ NIWIPILKSSVKSYDGLVYTGVVGCKAIVKETNLICKALYLDYVQHKCGNLHQRELLGVS
Bovine_CoV      NIWIPILKSSVKSYDGLVYTGVVGCKAIVKETNLICKALYLDYVQHKCGNLHQRELLGVS
Murine_HepV     GMWLPVIWSSVKSYSYLTYTGVVGCKAIVQETDAICRFLYMDYVQHKCGNLEQRAILGLD
SARS_CoV        ---ERVNINIVGDFHLNEEVAIILASFSASTSAFIDTIKSLDYKSFKT-IVESCGNYKVT
Human_CoV       CNSAVAVVG--GTIQILASVPEKFLNAFDVFVTAIQTVFDCAVETCTIAGKAFDKVFDYV
Porcine_epidemi SCATLSIVN--GVFEFLADVPEKLAAAVTVFVNFLNEFFESACDCLKVGGKTFNKVGSYV
Porcine_transmi CTSAFTIVNYKPTFVVPDNRVKDLVDKCVKVLVKAFDVFTQIITIAGIEAKCFVLGAKYL
Feline_infectio ------------------------------------------------------------
consensus       -----il---v-sy--l---gvv---aiv--t--i-----ldy---k-g-l----l--v-

Bovine_respirat DVWHKQLLLNRGVYKPLLENIDYFNMRRAKFSLETFT---VCADGFMPFLLDDLVPRAYY
Bovine_enteric_ DVWHKQLLLNRGVYKPLLENIDYFNMRRAKFSLETFT---VCADGFMPFLLDDLVPRAYY
Bovine_CoV      DVWHKQLLLNRGVYKPLLENIDYFNMRRAKFSLETFT---VCADGFMPFLLDDLVPRAYY
Murine_HepV     DVYHRQLLVNRGDYSLLLENVDLFVKRRAEFACK-FA---TCGDGLVPLLLDGLVPRSYY
SARS_CoV        KGKPVKGAWNIGQQRSVLTPLCGFPSQAAGVIRSIFARTLDAANHSIPDLQRAAVTILDG
Human_CoV       LLDNALVKLVTTKLKGVRERGLNKVKYATVVVGSTEEVKSSRVERSTAVLTIANNYSKLF
Porcine_epidemi LFDNALVKLVKAKARGPRQAGICEVRYTSLVVGSTTKVVSKRVENANVNLVVVDEDVTLN
Porcine_transmi LFNNALVKLVSVKILGKKQKGLECAFFATSLVGATVNVTPKRTETATISLNKVDD-VVAP
Feline_infectio ------------------------------------------------------------
consensus       -v----l-lnrg--k-lle-i--f----a-----tf------ad--mp-ll---v----y

Bovine_respirat LAVSGQAFCDYADKICHAVVSKSKELLDVSLDSLSAAIHYLN-SKIVDLAQHFSDFGTSF
Bovine_enteric_ LAVSGQAFCDYADKICHAVVSKSKELLDVSLDSLSAAIHYLN-SKIVDLAQHFSDFGTSF
Bovine_CoV      LAVSGQAFCDYAGKICHAVVSKSKELLDVSVDSLGAAIHYLN-SKIVDLAQHFSDFGTSF
Murine_HepV     LIKSGQAFTSLMVNFSREVVDMCMDMALLFMHDVKVATKYVK-KVTGKVAVRFKALGIAV
SARS_CoV        ISEQSLRLVDAMVYTSDLLTNSVIIMAYVTGGLVQQTSQWLS-NLLGTTVEKLRPIFEWI
Human_CoV       DEGYTVVIGDVAYFVSDGYFRLMASPNSVLTTAVYKPLFAFNVNVMGTRPEKFPTTVTCE
Porcine_epidemi TTGRTVVVDGLAFFESDGFYRHLADADVVIEHPVYKSACELKPVFECDPIPDFPLPVAAS
Porcine_transmi GEGYIVIVGDMAFYKSGEYYFMMSSPNFVLTNNVFKAVKVPSYDIVYDVDNDTKSKMIAK
Feline_infectio ------------------------------------------------------------
consensus       l--------d-a---s-av-----el--v----v--ai-yl----i-dl---f-------

Bovine_respirat VSKIVHFFKTFTTSTALAFAWVLFHVLHGAYIVVESDIYFVKN-IPRYASAVAQAFRSVA
Bovine_enteric_ VSKIVHFFKTFTTSTALAFAWVLFHVLHGAYIVVESDIYFVKN-IPRYASAVAQAFRSVA
Bovine_CoV      VSKIVHFFKTFTTSTALAFAWVLFHVLHGAYIVVESDIYFGKN-IPRYASAVAQAFRSGA
Murine_HepV     VRKITEWFDLAVDTAASAAGWLCYQLVNGLFAVANGVITFIQE-VPELVKNFVDKFKTFF
SARS_CoV        EAKLSAGVEFLKD-----AWEILKFLITGVFDIVKGQIQVASDNIKDCVKCFIDVVNKAL
Human_CoV       NLESAVL--FVNDKITEFQLDYSIDVIDNEIIVKPNISLCVPLYVRDYVDKWDDFCRQYS
Porcine_epidemi VAELCVQTDLLLKNYNTPYKTYSCVVRGDKCCITCTLQFKAPSYVEDAVN-FVDLCTKNI
Porcine_transmi LGSSFEYDGDIDAAIVKVNELLIEFRQQSLCFRAFKDDKSIFVEAYFKKYKMPACLAKHI
Feline_infectio ------------------------------------------------------------
consensus       v-ki--f--------------vl--vl-g-y-v----i--v---i-----------r---
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Bovine_respirat KVVLDSLRVTFIDGLSCFKIGRRRICLSGSKIYEVERG-LLHSSQLPLDVYDLTMPSQVQ
Bovine_enteric_ KVVLDSLRVTFIDGLSCFKIGRRRICLSGSKIYEVERG-LLHSSQLPLDVYDLTMPSQVQ
Bovine_CoV      KVGLDSLRVTFIDGLSCFKIGRRRICLSGSKIYEVERG-LLHSSQLPLDVYDLTMPSQVQ
Murine_HepV     KVLIDSMSVSILSGLTVVKTASNRVCLAGSKVYEVVQK-SLPAYIMPVGCSEATC-----
SARS_CoV        EMCIDQVTIAGAK-LRSLNLGEVFIAQSKGLYRQCIRGKEQLQLLMPLKAPKEVT-----
Human_CoV       NESWFEDDYRAFISVLDITDAAVKAAESKAFVDTI--VPPCPSILKVIDGGKIWN-----
Porcine_epidemi GTAGFHEFYITAHEQQDLQGFLTTCCTMSGFECFMPTIPQCPAVLEEIDGGSIWR-----
Porcine_transmi GLWNIIKKDSCKRGFLNLFNHLNELEDIKETNIQAIKNILCPDPLLDLDYGAIWY-----
Feline_infectio ------------------------------------------------------------
consensus       -v-ld-l-vt---gl--v--g--ric-s---i--v-r-------ilpld---l-------

Bovine_respirat KAKQKPIYLKGSGSDFSLADSVVEVVTTSLTPCG-----YSEPPKVADKICIVDNVYMAK
Bovine_enteric_ KAKQKPIYLKGSGSDFSLADSVVEVVTTSLTPCG-----YSEPPKVADKICIVDNVYMAK
Bovine_CoV      KTKQKGIYLKGSGSDFSLADSVVEVVTTSLTPCG-----YSEPPKVADKICIVDNVYMAK
Murine_HepV     --------LVGEIEPAVFEDDVVDVVKAPLTYQG-----CCKPPSSFEKICIVDKLYMAK
SARS_CoV        -------FLEGDSHDTVLTSEEVVLKNGELEALETPVDSFTNGAIVGTPVCVNGLMLLEI
Human_CoV       ----------GVIKNVNSVRDWLKSLKLNLTQQG--------LLGTCAKRFKRWLGILLE
Porcine_epidemi ----------SFITGLNTMWDFCKRLKVSFGLDG--------IVVTVARKFKRLGALLAE
Porcine_transmi ----------NCMPGCSDPSVLGS---VQLLIGN--------GVKVVCDGCKGFANQLSK
Feline_infectio ------------------------------------------------------------
consensus       --------l-g---------vv-vv---lt--g----------v--kici---v-mak

Bovine_respirat AGDKYYPVVVDG-HVGLLDQAWRVPCAG--RRVTFKEQPTVNEIASTPKTIKVFYELDKD
Bovine_enteric_ AGDKYYPVVVDG-HVGLLDQAWRVPCAG--RRVTFKEQPTVNEIASTPKTIKVFYELDKD
Bovine_CoV      AGDKYYPVVVDG-HVGLLDQAWRVPCAG--RCVTFKEQPTVNEIASTPKTIKVFYELDKD
Murine_HepV     CGDQFYPVVVDNDTVGVLDQCWRFPCAG--KKVVFNDKPKVKEVPST-RKIKIIFALDAT
SARS_CoV        KDKEQYCALSPG--LLATNNVFRLKGGAPIKGVTFG-EDTVWEVQG-YKNVRITFELDER
Human_CoV       AYNAFLDTVVST----------VKIGGLTFKTYAFDKPYIVIRDIVCKVENKTEAEWIEL
Porcine_epidemi MYNTYLSTVVEN----------LVLAGVSFKYYATSVPKIVLG--GCFHSVKSVFASVFQ
Porcine_transmi GYNKLCNAARND----------IEIGGIPFSTFKTPTNTFIEMTDAIYSVIEQGKALSFR
Feline_infectio ------------------------------------------------------------
consensus       a---yy--vvd---v----q-wrv--ag--r-v-f-----v-ei----k-ikv-yeld--

Bovine_respirat FNTILNTACGVFEVDDTVDMEEFYAVVVDAIEEKLSPCKELEGVGAKVSAFLQKLEDNSL
Bovine_enteric_ FNTILNTACGVFEVDDTVDMEEFYAVVIDAIEEKLSPCKELEGVGAKVSAFLQKLEDNSL
Bovine_CoV      FNTILNTACGEFEVDDTVDMEEFYAVVIDAIEEKLSPCKELEGVGAKVSAFLQKLEDNSL
Murine_HepV     FDSVLSKACSEFEVDKDVTLDELLDVVLDAVESTLSPCKEHGVIGTKVCALLERLVDDYV
SARS_CoV        VDKVLNEKCSVYTVESGTEVTEFACVVAEAVVKTLQPVSDLLTN---MGIDLDEWSVATF
Human_CoV       FPHNDRIKSFSTFESAYMPIADPTHFDIEEVELLDAEFVEPGCGGILAVIDEHVFYKK-D
Porcine_epidemi IPVQAGIEKFKVFLNCVHPVVP-RVIETSFVELEETTFKPPALNGGIAIVDGFAFYYD-G
Porcine_transmi DADVPVVDNGTISTADWS----------EPILLEPAEYVKPKNNGNVIVIAGYTFYKDED
Feline_infectio ------------------------------------------------------------
consensus       f--il---c--f-vd--v-m-e---vvvdaie--lsp-ke----g--v---l--------

Bovine_respirat FLFDEAGEEVLASKLYCAFTAPEDD------------------------DFLEESGVEE
Bovine_enteric_ FLFDEAGEEVLASKLYCAFTAPEDD------------------------DFLEESGVEE
Bovine_CoV      FLFDEAGEEVLAPKLYCAFTAPEDD------------------------DFLEESGVEE
Murine_HepV     YLFDEGGEEVIASRMYCSFSAPDEDCVATDVVYADENQDDDADDPVVLVADTQEEDGVAR
SARS_CoV        YLFDDAGEENFSSRMYCSFYPPDEE------------------------EEDDAECEEE
Human_CoV       GVYYPSNGTNILPVAFTKAAGGK----------------------------VSFSDD
Porcine_epidemi TLYYPTDGNSVVPICFKKKGGGD----------------------------VKFSDE
Porcine_transmi EHFYPYGFGKIVQRMYNKMGGGDKT--------------------------VSFSEE
Feline_infectio ------------------------------------------------------------
consensus       flfdeagee-l--klyc-f-apedd------------------------d--e-s--ee

Bovine_respirat DDVEGEETDLTVTSAG-----EPCVASEQ-------------------EESSEILEDT
Bovine_enteric_ DDVEGEETDLTVTSAG-----EPCVASEQ-------------------EESSEILEDT
Bovine_CoV      DDVEGEETDLTVTSAG-----EPCVASEQ-------------------EESSEILEDT
Murine_HepV     EQVDSADSEICVAHTGGQEMTEPDVVGSQTPIASAEETEVGEACDREGIAEVKATVCADA
SARS_CoV        EIDETCEHEYGTEDDYQGLPLEFGASAET------------------VRVEEEEEEDW
Human_CoV       VEVKDIEPVYRVKLCF-----------------------------EFEDEKLVDV
Porcine_epidemi VSVKTIDPVYKVSLEF-----------------------------EFESETIMAV
Porcine_transmi VDVQEIAPVTRVKLEF-----------------------------EFDNEIVTGV
Feline_infectio ------------------------------------------------------------
consensus       ddve--e-d--v--------e---------------------------e---eil-d-
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Bovine_respirat  LDDGP-CVETS-DSQVEEDVEMSDFADLESVIQD------------YENVCFEFYTT--E
Bovine_enteric_  LDDGP-CVETS-DSQVEEDVEMSDFADLESVIQD------------YENVCFEFYTT--E
Bovine_CoV       LDDGP-CVETS-DSQVEEDVQMSDFGDLESVIQD------------YENVCFEFYTT--E
Murine_HepV      LDACPDQVEAF-DIEKVEDSILSELQTELNAPADKTYEDVLAFDAIYSETLSAFYAVPSD
SARS_CoV         LDDTTEQSEIEPEPEPTPEEPVNQFTGYLKLTDN------------VAIKCVDIVKEAQS
Human_CoV        CEKAIG------KKIKHEG-DWDSFCKTIQSALS-------------------VVS----
Porcine_epidemi  LNKAVG------NRIKVTG-GWDDVVEYINVAIE-------------------VLK----
Porcine_transmi  LERAIG------TRYKFTGTTWEEFEESISEELD-------------------AIFDTLA
Feline_infectio  ------------------------------------------------------------
consensus        ld-g----e---d----ed--m-df-d-l-v--d--------------------------

Bovine_respirat  PEFVKVLDLYVPKATRNNCWLRSVLAVMQKLPCQFKDKNLQDLWVLYKQQYSQLFVDTLV
Bovine_enteric_  PEFVKVLDLYVPKATRNNCWLRSVLAVMQKLPCQFKDKNLQDLWVLYKQQYSQLFVDTLV
Bovine_CoV       PEFVKVLDLYVPKATRNNCWLRSVLAVMQKLPCQFKDKNLQDLWVLYKQQYSQLFVDTLV
Murine_HepV      ETHFKVCGFYSPAIERTNCWLRSTLIVMQSLPLEFKDLGMQKLWLSYKAGYDQCFVDKLV
SARS_CoV         ANPMVIVNAANIHLKHG-GGVAGALNKATNGAMQKESDDYIKLNGPLTVGGSCLLSGHNL
Human_CoV        -CYVNLPTYYIYDEEGGNDLSLP--VMISEWPLS--------------------VQQAQQ
Porcine_epidemi  -DHVEVPKYYIYDEEGGTDPNLP--VMVSQWPLNDDTISQDLLDVEVVTDAPIDSEGDEV
Porcine_transmi  NQGVELEGYFIYDTCGGFDIKNPDGIMISQYDIN--------ITADEKSEVSASSEEEEV
Feline_infectio  ------------------------------------------------------------
consensus        ---v-v---yv------n--l---l-vm---plq--------l-v--k---s----d--v

Bovine_respirat  NKIPANIVVPQGGYVADFAYWFLTLCDWQCVAYWKC-IKCDLALKLKGLDAMFFYGDVVS
Bovine_enteric_  NKIPANIVVPQGGYVADFAYWFLTLCDWQCVAYWKC-IKCDLALKLKGLDAMFFYGDVVS
Bovine_CoV       NKIPANIVVPQGGYVADFAYWFLTLCDWQCVAYWKC-IKCDLALKLKGLDAMFFYGDVVS
Murine_HepV      KSAPKSIILPQGGYVADFAYFFLSQCSFKVHANWRC-LKCGMELKLQGLDAVFFYGDVVS
SARS_CoV         AKKCLHVVGPNLNAGEDIQLLKAAYENFNSQDILLAPLLSAGIFGAKPLQSLQVCVQTVR
Human_CoV        EATLPDIAEDVVD-------------------------------QVEEVNSIFD-IETVD
Porcine_epidemi  DSSAPEKVADVANSEPGDDGLPVAPETNVES-------------EVEEVAATLSFIKDTP
Porcine_transmi  ESVEEDPENEIVEASEGAEG-TSSQEEVETV-------------EVADITSTEEDVDIVE
Feline_infectio  ------------------------------------------------------------
consensus        ------iv-pqg----d-----lt---w---------i-------l--l-amf-y-dvv-

Bovine_respirat  HVCKCGESMVLIDVDVPFTAHFALKDKLFCAFITKRSVYKAACVVDVNDSHSMAVVDGKQ
Bovine_enteric_  HVCKCGESMVLIDVDVPFTAHFALKDKLFCAFITKRSVYKAACVVDVNDSHSMAVVDGKQ
Bovine_CoV       HVCKCGESMVLIDVDVPFTAHFALKDKLFCAFITKRSVYKAACVVDVNDSHSMAVVDGKQ
Murine_HepV      HMCKCGNSMTLLSADIPYTFDFGVRDDKFCAFYTPRKVFRAACAVDVNDCHSMAVVDGKQ
SARS_CoV         TQVYIAVNDKALYEQVVMDYLDNLKPRVEAPKQEEPPNTEDSKTEEKSVVQKPVDVKPKI
Human_CoV        VKHDVSPFEMP-----------------FEELNGLKILKQLDNNCWVNSVMLQIQLTGIL
Porcine_epidemi  STVTKDPFAFD-----------------FVSYGGLKVLRQSHNNCWVTSTLVQLQLLGIV
Porcine_transmi  VSAKDDPWAAAVDVQEAEQFNPSLPPFKTTNLNGKIILKQGDNNCWINACCYQLQAFDFF
Feline_infectio  ------------------------------------------------------------
consensus        ---k-g-----i---v-------lk---f--f---r-v--a----dvn-------v-gk-

Bovine_respirat  IDDHRVTSITSDKFDFIIGHGMSFSMTTFEIAQLYGSCITP-NVCFVKGDIIKVSKRVKA
Bovine_enteric_  IDDHRVTSITSDKFDFIIGHGMSFSMTTFEIAQLYGSCITP-NVCFVKGDIIKVSKRVKA
Bovine_CoV       IDDHRITSITSDKFDFIIGHGTSFSMTTFEIAQLYGSCITP-NVCFVKGDIIKVSKRVKA
Murine_HepV      IDGKVVTKFNGDKFDFMVGHGMTFSMSPFEIAQLYGSCITP-NVCFVKGDVIKVLRRVGA
SARS_CoV         KACIDEVTTTLEETKFLTNKLLLFADINGKLYHDSQNMLRGEDMSFLEKDAPYMVGDVIT
Human_CoV        DGDYAMQFFKMGRVAKMIERCYTAEQCIRGAMGDVGLCMYRLLKDLHTGFMVMDYKCSCT
Porcine_epidemi  D-DPAMELFSAGRVGPMVRKCYESQKAILGSLGDVSACLESLTKDLHTLKITCSVVCGCG
Porcine_transmi  N-NEAWEKFKKGDVMDFVNLCYAATTLARGHSGDAEYLLELMLNDYSTAKIVLAAKCGCG
Feline_infectio  ------------------------------------------------------------
consensus        --d--v---t-dk--fii----sfs-----i----g-ci----v-fv-gdii-v-k-v-a

Bovine_respirat  EVVVNPANGHMAHGGGVAKAIAVAAGQQFVKETTDMVKSKGVCATGDCYVSTGGKLCKTV
Bovine_enteric_  EVVVNPANGHMAHGGGVAKAIAVAAGQQFVKETTDMVKSKGVCATGDCYVSTGGKLCKTV
Bovine_CoV       EVVVNPANGHMAHGGGVAKAIAVAAGQQFVKETTDMVKSKGVCATGDCYVSTGGKLCKTV
Murine_HepV      EVIVNPANGRMAHGAGVAGAIAKAAGKAFINETADMVKAQGVCQVGGCYESTGGKLCKKV
SARS_CoV         SGDITCVVIPSKKAGGTTEMLSRALKKVPVDEYITTYPGQGCAGYTLEEAKTALKKCKSA
Human_CoV        SGRLEESGAVLFCTPTKKAFPYGTCLNCNAPRMCTIRQLQGTIIFVQQKPEPVNPVS-FV
Porcine_epidemi  TGERIYEGCAFRMTPTLEPFPYGACAQCAQVLMHTFKSIVGTGIFCR-DTTALSLDS-LV
Porcine_transmi  EKEIVLERAVFKLTPLKESFNYGVCGDCMQVNTCRFLSVEGSGVFVHDILSKQTPEAMFV
Feline_infectio  ------------------------------------------------------------
consensus        e--v----g-m--gggv---i--a-gq--v-et--mv---g---------stg-klck-v
```

```
Bovine_respirat  LNVVGPDARTQGKQSYALLERVYKHLNKYDCVVTTLISAGIFSVPSDVSLTYLLGTAEKQ
Bovine_enteric_  LNVVGPDARTQGKQSYALLERVYKHLNKYDCVVTTLISAGIFSVPSDVSLTYLLGTAEKQ
Bovine_CoV       LNVVGPDARTQGKQSYALLERVYKHLNKYDCVVTTLISAGIFSVPSDVSLTYLLGTAKKQ
Murine_HepV      LNIVGPDARGHGNECYSLLERAYQHINKCDNVVTTLISAGIFSVPTDVSLTYLLGVVTKN
SARS_CoV         FYVLPSEAPNAKEEILGTVSWNLREMLAHAEETRKLMPICMDVRAIMATIQRKYKGIKIQ
Human_CoV        VKPVCSSIFRGAVSCGHYQTNIYSQNLCVDGFGVNKIQPWTNDALNTICIKDADYNAKVE
Porcine_epidemi  VKPLCAAAFIGKDS-GHYVTNFYDAAMAIDGYGRHQIK---YDTLNTICVKDVNW-----
Porcine_transmi  VKPVMHAVYTGTTQNGHYMVDDIEHGYCVDGMGIKPLKKRCYTSTLFINANVMTRAEKPK
Feline_infectio  ------------------------------------------------------------
consensus        l-vv--da---g------l---y-hl---d-v---li---ifs----vsl--l------q

Bovine_respirat  VVLVSNNQEDFDLISKCQITAVEG-TKKLAERLSFN------VGRSIVYETDANKLILSN
Bovine_enteric_  VVLVSNNQEDFDLISKCQITAVEG-TKKLAERLSFN------VGRSIVYETDANKLILSN
Bovine_CoV       VVLVSNNQEDFDLISKCQITAVEG-TKKLAERLSFN------VGRSIVYETDANKLILSN
Murine_HepV      VILVSNNQDDFDVIEKCQVTSVAG-TKALSFQLAKN------LCRDVKFVTNACSSLFS-
SARS_CoV         EGIVDYGVRFFFYTSKEPVASIITKLNSLNEPLVTMPIGYVTHGFNLEEAARCMRSLKAP
Human_CoV        ISV-----------TPIKNTVDTTPKEEFVVKEKLN------AFLVHDNVAFYQGDVDTV
Porcine_epidemi  -------------------TAPLVPAVDSVVEPVVK------PFYSYKNVDFYQGDFSDL
Porcine_transmi  QEFKVEKVEQQPIVEENKSSIEKEEIQSPKNDDLIL------PFYKAGKLSFYQGALDVL
Feline_infectio  ------------------------------------------------------------
consensus        v-lv----e-f-lisk--it-v------l---l--n----------i---t--n--i-s-

Bovine_respirat  DVAFVSTFNVLQDVLSLRHDIALDDDARTFVQSNVDVVPEGWRVVNKFYQINGVRTVKYF
Bovine_enteric_  DVAFVSTFNVLQDVLSLRHDIALDDDARTFVQSNVDVVPEGWRVVNKFYQINGVRTVKYF
Bovine_CoV       DVAFVSTFNVLQDVLSLRHDIALDDDARTFVQSNVDVVPEGWRVVNKFYQINGVRPVKYF
Murine_HepV      ESSFVSSYDVLQEVEALRHDIQLDDDARVFVQANMDCLPTDWRLVNKFDSVDGVRTIKYF
SARS_CoV         AVVSVSSPDAVTTYNGYLTSSSKTSEEHFVETVSLAGSYRDWSYSGQRTELG----VEFL
Human_CoV        VNGVDFDFIVNAANENLAHGGGLAKALDVYTKGKLQRLSKEHIGLAGKVKVGTGVMVECD
Porcine_epidemi  VK-LPCDFVVNAANEKLSHGGGIAKAIDVYTKGMLQKCSNDYIKAHGPIKVGRGVMLEAL
Porcine_transmi  INFLEPDVIVNAANGDLKHMGGVARAIDVFTGGKLTERSKDYLKKNKSIAPGNAVFFENV
Feline_infectio  ------------------------------------------------------------
consensus        ----vstf-vl-----lrh--al--d---f----v--v--dw--vnk---i-----v-y-

Bovine_respirat  ECPGGIDICSQDKVFGYVQQGSFNKATVAQIKALF----LDKVDILLTVDGVNFTNRFVP
Bovine_enteric_  ECPGGIDICSQDKVFGYVQQGSFNKATVAQIKALF----LDKVDILLTVDGVNFTNRFVP
Bovine_CoV       ECPGGIDICSQDKVFGYVQQGSFNKATVAQIKALF----LDKVDILLTVDGVNFTNRFVP
Murine_HepV      ECPGEVFVSSQGKKFGYVQNGSFKEASVSQIRALL----ANKVDVLCTVDGVNFRSCCVA
SARS_CoV         KRGDKIVYHTLESPVEFHLDG--EVLSLDKLKSLLSLREVKTIKVFTTVDNTNLHTQLVD
Human_CoV        S--LRIFNVVGPRKG-KHERDLLIKAYNTINNEQG---TPLTPILSCGIFGIKLETSLEV
Porcine_epidemi  G--LKVFNVVGPRKG-KHAPELLVKAYKSVFANSG---VALTPLISVGIFSVPLEESLSA
Porcine_transmi  IEHLSVLNAVGPRNGDSRVEAKLCNVYKAIAKCEG---KILTPLISVGIFNVRLETSLQC
Feline_infectio  ------------------------------------------------------------
consensus        -----i---s--k---y---g---katv--ik-l-----l--v-i-ltvdgvn-----v-

Bovine_respirat  VGENFGKSLGNVFCDGVNVTKHKCDINYKGKVFFQFDNLSSEDLKAVRSSFNFDQKELLA
Bovine_enteric_  VGESFGKSLGNVFCDGVNVTKHKCDINYKGKVFFQFDNLSSEDLKAVRSSFNFDQKELLA
Bovine_CoV       VGESFGKSLGNVFCDGVNVTKHKCDINYKGKVFFQFDNLSSEDLKAVRSSFNFDQKELLA
Murine_HepV      EGEVFGKTLGSVFCDGINVTKVRCSAIHKGKVFFQYSGLSAADLAAVKDAFGFDEPQLLQ
SARS_CoV         MSMTYGQQFGPTYLDGADVTKIKPHVNHEGKTFFVLPSDDTLRSEAFEYYHTLDESFLGR
Human_CoV        LLDVCNTKEVKVFVY-TDTEVCKVKDFVSGLVN-VQKVEQPKIEPKPVSVIKVAPK----
Porcine_epidemi  FLACVGDRHCKCFCY-GDKEREAIIKYMDGLVDAIFKEALVDTTPVQEDVQQVSQKPVLP
Porcine_transmi  LLKTVNDRGLNVFVY-TDQERQTIENFFS-------------------------------
Feline_infectio  ------------------------------------------------------------
consensus        v-e-fg---g-vfcdg--vtk-k------gkvff-f---------a-------d-k-ll-

Bovine_respirat  YYNMLVNCSKWQVVFNGKYFTFKQANNNCFVNVSCLMLQSLNLKFKIVQWQEAWLEFRSG
Bovine_enteric_  YYNMLVNCSKWQVVFNGKYFTFKQANNNCFVNVSCLMLQSLNLKFKIVQWQEAWLEFRSG
Bovine_CoV       YYNMLVNCSKWQVVFNGKYFTFKQANNNCFVNVSCLMLQSLNLKFKIVQWQEAWLEFRSG
Murine_HepV      YYSMLG-MCKWPVVVCGNYFAFKQSNNNCYINVACLMLQHLSLKFPKWQWRRPGNEFRSG
SARS_CoV         YMSALNHTKKWKFPQVGGLTSIKWADNNCYLSSVLLALQQLEVKFNAPALQEAYYRARAG
Human_CoV        ---PYRVDGKFSYFT---EDLLCVADDKPIVLFTDSMLTLDDRGLALDNALSGVLSAAIK
Porcine_epidemi  NFEPFRIEGAHAFYECNPEGLMSLGADK-LVLFTNSNLDFCSVGKCLNDVTSGALLEAIN
Porcine_transmi  ------------------------------------------------------------
Feline_infectio  ------------------------------------------------------------
consensus        yy--l----kw-----g-----k-a-nncfv--s-lmlq-l-lkf-i-q---a-l--r-g
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Bovine_respirat RPARFVSLVLAKGGFKFGDPADSRDFLRVVFSQVDLTGAICDFEIACK-CGVKQEQRTGV
Bovine_enteric_ RPARFVSLVLAKGGFKFGDPADSRDFLRVVFSQVDLTGAICDFEIACK-CGVKQEQRTGV
Bovine_CoV      RPARFVSLVLAKGGFKFGDPADSRDFLRVVFSQVDLTGAICDFEIACK-CGVKQEQRTGV
Murine_HepV     KPLRFVSLVLAKGSFKFNEPSDSTDFIRVELREADLSGATCDLEFICK-CGVKQEQRKGV
SARS_CoV        DAANFCALILAYSNKTVGELGDVRETMTHLLQHANLESAKRVLNVVCKHCGQKTTTLTGV
Human_CoV       DCVDINKAIPSGNLIKFDIG-SVVVYMCVVPSEKDKHLDNNVQRCTRKLNRLMCDIVCTI
Porcine_epidemi VFKKSNKTVPAGNCVTLDCANMISITMVVLPFDGDANYDKNYARAVVKVSKLKGKLVLAV
Porcine_transmi ------------------------------------------------------------
Feline_infectio ------------------------------------------------------------
consensus       ---rf--lvla----kf-d--d--dfl-vv----dl--a-------ck-cgvk-e---gv

Bovine_respirat DAVMHFGTLSREDLEIGYTVDCSCG-KKLIHCVRFDVPFLICSNTPASVKLPKG-VGSAN
Bovine_enteric_ DAVMHFGTLSREDLEIGYTVDCSCG-KKLIHCVRFDVPFLICSNTPASVKLPKG-VGSAN
Bovine_CoV      DAVMHFGTLSREDLEIGYTVDCSCG-KKLIHCVRFDVPFLICSNTPASVKLPKG-VGSAN
Murine_HepV     DAVMHFGTLDKSGLVKGYNIACTCG-DKLVHCTQFNVPFLICSNTPEGKKLPDD-VVAAN
SARS_CoV        EAVMYMGTLSYDNLKTGVSIPCVCGRDATQYLVQQESSFVMMSAPPAEYKLQQGTFLCAN
Human_CoV       P-ADYILPLVLSSLTCNVSFVGELKAAEA-KVITIKVTEDGVNVHDVTVTTDKS----FE
Porcine_epidemi DDATLYSKLSHLSVLGFVSTPDDVERFYANKSVVIKVTEDTRSVKAVKVESTAT----YG
Porcine_transmi ------------------------------CSIPVNVTEDNVNHERVSVSFDKT----YG
Feline_infectio ------------------------------------------------------------
consensus       davm-fgtls---l--g-tv-c-cg------v---v-fli-s--p-svkl-k-----an

Bovine_respirat IFKG-DKVGHYVHVKCEQSYQLYDASNVKKVTDVTGNLSDCLYLKNLKQTFKSVLTTYYL
Bovine_enteric_ IFKG-DKVGHYVHVKCEQSYQLYDASNVKKVTDVTGNLSDCLYLKNLKQTFKSVLTTYYL
Bovine_CoV      IFKG-DKVGHYVHVKCEQSYQLYDASNVKKVTDVTGNLSDCLYLKNLKQTFKSVLTTYYL
Murine_HepV     IFTG-GSVGHYTHVKCKPKYQLYDACNVSKVSEAKGNFTDCLYLKNLKQTFSSVLTTYYL
SARS_CoV        EYTGNYQCGHYTHITAKETLYRIDGAHLTKMSEYKGPVTDVFYKETSYTTTIKPVS-YKL
Human_CoV       QQVG-VIADKDKDLSGAVPSDLNTSELLTKAIDVDWVEFYGFKDAVTFATVDHSAFAYES
Porcine_epidemi QQIG-PCLVNDTVVTDNKP--VVADVVAKVVPNANWDSHYGFDKAGEFHMLDHTGFTFPS
Porcine_transmi EQLKGTVVIKDKDVTNQLPSAFDVGQKVIKAIDIDWQAHYGFRDAAAFSASSHDAYKFEV
Feline_infectio ------------------------------------------------------------
consensus       -f-g---vghy-hv-------l-da--v-kvtdv-gn-sd--y------t----ltty-l

Bovine_respirat DDVKKIEYKPDLSQYYCDGGKYYTQRIIKAQFKTFEKVDGVYTNFKLIG--HTICDILNA
Bovine_enteric_ DDVKKIEYNPDLSQYYCDGGKYYTQRIIKAQFKTFEKVDGVYTNFKLIG--HTICDILNA
Bovine_CoV      DDVKKIEYKPDLSQYYCDGGKYYTQRIIKAQFKTFEKVDGVYTNFKLIG--HTVCDILNA
Murine_HepV     DDVKCVAYKPDLSQYYCESGKYYTKPIIKAQFRTFEKVEGVYTNFKLVG--HDIAEKLNA
SARS_CoV        DGVTYTEIEPKLDGYYKKDNAYYTEQPIDLVP-TQPLPNASFDNFKLTCSNTKFADDLNQ
Human_CoV       AVVNGIRVLKTSDNNCWVNAVCIALQYSKPHFISQG-LDAAWNKFVLGDVEIFVAFVYYV
Porcine_epidemi EVVNGRRVIKTTDNNCWVNVTCLQLQFARFRFKSAG-LQAMWESYCTGDVAMFVHWLYWL
Porcine_transmi VTHSNFIVHKQTDNNCWINAICLALQRLKPQWKFPG-VRGLWNEFLERKTQGFVHMLYHI
Feline_infectio ------------------------------------------------------------
consensus       d-v--i---p-l-qyy---g-yyt---ik-qfkt---vdgvy-nfkl------i-diln-

Bovine_respirat KLGFDSSKEFVEYKVTEWPTATGDVVLATDDLYVKRYERGCITFGKPVIWLSHEQASLNS
Bovine_enteric_ KLGFDSSKEFVEYKVTEWPTATGDVVLATDDLYVKRYERGCITFGKPVIWLSHEQASLNS
Bovine_CoV      KLGFDSSKEFVEYKVTEWPTATGDVVLATDDLYVKRYERGCITFGKPVIWLSHEQASLNS
Murine_HepV     KLGFDCNSPFMEYKITEWPTATGDVVLASDDLYVSRYSGGCVTFGKPVIWRGHEEASLKS
SARS_CoV        MTGFTKP-ASRELSVTFFPDLNGDVVAIDYRHYSASFKKGAKLLHKPIVWHINQATTKTT
Human_CoV       ARLMKGDKGDAEDTLTKLSKYLANEAQVQLEHYSSCVECDAKFKNSVASINSAIVCASVK
Porcine_epidemi TGVDKGQPSDSENALNMLSKYIVPAGSVTIERVTHDGCCCSKR-----VVTAPVVNASVL
Porcine_transmi SGVKKGEPGDAELMLHKLGDLMDNDCEIIVTHTTACDKCAKVEK-----FVGPVVAAPLA
Feline_infectio ------------------------------------------------------------
consensus       --gf-------e--vt-wp---gdvv--t-d-y---y--g-i---kpviw-----as--s

Bovine_respirat LT--------YFNRPLLVDENKFDVLKVDDVD--------------------DGGDISES
Bovine_enteric_ LT--------YFNRPLLVDENKFDVLKVDDVD--------------------DGGDISES
Bovine_CoV      LT--------YFNRPLLVDENKFDVLKVDDVD--------------------DGGDISES
Murine_HepV     LT--------YFNRPSVVCENKFNVLPVDVSEPTDRRPVPSAVLVTGAASGADASAISTE
SARS_CoV        FKPNTWCLRCLWSTKPVDTSNSFEVLAVEDTQG------------------MDNLACESQ
Human_CoV       RD--------GVQVGYCVHGIKYYSRVRSVRG----------------------------
Porcine_epidemi KL--------GVEDGLCPHGLNYIGKVVVVKG----------------------------
Porcine_transmi IH--------GTDE-TCVHGVSVNVKVTQIKG----------------------------
Feline_infectio ------------------------------------------------------------
consensus       l----------fn---lv--nkf-vl-vd-----------------------d-------
```

```
Bovine_respirat D--AKESKE------------------------INIIKLSGVKKPFKVEDSVIVNDDTSE
Bovine_enteric_ D--AKESKE------------------------INIIKLSGVKKPFKVEDSVIVNDDTSE
Bovine_CoV      D--AKEPKE------------------------INIIKLSGVKKPFKVEDSVIVNDDTSE
Murine_HepV     PGTAKEQKACASDSVEDQIVMEAQKKSSVTTVAVKEVKLNGVKKPVKWNCSVVVNDPTSE
SARS_CoV        QPTSEEVVEN---------------------PTIQKEVIECDVKTTEVVGNVILKPSDEG
Human_CoV       -----------------------------------RAIIVSVEQLEPCAQSRLLSGVAYT
Porcine_epidemi -----------------------------------TTIVVNVGKPVVAPSHLFLKGVSYT
Porcine_transmi -----------------------------------TVAITSLIGPIIG---EVLEATGYI
Feline_infectio ------------------------------------------------------------
consensus       -----e---------------------------i--i-l--v-kp-----sviv---t--

Bovine_respirat IKYVKSLSIVDVYDMWLTGCRYVVRTANDLSMAVNVPTIRKFIKFG--------------
Bovine_enteric_ IKYVKSLSIVDVYDMWLTGCRYVVRTANALSMAVNVPTIRKFIKFG--------------
Bovine_CoV      IKYVKSLSIVDVYDMWLTGCRCVVRTANALSRAVNVPTIRKFIKFG--------------
Murine_HepV     TKVVKSLSIVDVYDMFLTGCRYVVWTANELSRLINSPTVREYVKWG--------------
SARS_CoV        VKVTQELGHEDLMAAYVENTSITIKKPNELSLALGLKTIATHGIAA--------------
Human_CoV       AFS--GPVDKGHYTVYDTAKKSMYDGDRFVKHDLSLLSVTSVVMV---------------
Porcine_epidemi TFLDNGNGVVGHYTVFDHGTGMVHDGDAFVPGDLNVSPVTNVVVS---------------
Porcine_transmi CYS--GSNRNGHYTYYDNRNGLVVDAEKAYHFNRDLLQVTTAIASNFVVKKPQAEERPKN
Feline_infectio ------------------------------------------------------------
consensus       -k----l-ivdvy-mwltg-r-vv---n-ls--vnv-ti---i--g--------------

Bovine_respirat ------MTLVSIPIDLLNLREIKPVFNVVKAVRNKISACFNFIKWLFVLLFGWIKISADN
Bovine_enteric_ ------MTLVSIPIDLLNLREIKPVFNVVKAVRNKISACFNFIKWLFVLLFGWIKISADN
Bovine_CoV      ------MTLVSIPIDLLNLREIKPVFNVVKAVRNKISACFNFIKWLFVLLFGWIKISADN
Murine_HepV     ------MSKLIIPANLLLLRDEKQEFVAPKVVKAKAIACYGAVKWFLLYCFSWIKFNTDN
SARS_CoV        ------INSVPWSKILAYVKPFLG-----QAAITTSNCAKRLAQRVFNNYMPYVFTLLFQ
Human_CoV       -------GGYVAPVN------TVKPKPVINQLDEKAQKFFDFGDFLIHNFVIFFTWLLSM
Porcine_epidemi -------EQTAVVIKDPVKKAELDATKLLDTMNYASERFFSFGDFMSRNLITVFLYILSI
Porcine_transmi CAFNKVAASPKIVQEQKLLAIESGANYALTEFGRYADMFFMAGDKILRLLLEVFKYLLVL
Feline_infectio ------------------------------------------------------------
consensus       ------m--v-ipi-l--lr-------vv--v--k----f-f--wl---l--wik----n

Bovine_respirat KVIYTTEVASKLTCKLVALAFKNAFLTFKWSVVARGACIIATIFLLWFNFIYANVIFSDF
Bovine_enteric_ KVIYTTEVASKLTCKLVALAFKNAFLTFKWSVVARGACIIATIFLLWFNFIYANVIFSDF
Bovine_CoV      KVIYTTEVASKLTCKLVALAFKNAFLTFKWSVVARGACIIATIFLLWFNFIYANVIFSDF
Murine_HepV     KVIYTTEVASKLTFKLCCLAFKNALQTFNWSVVSRGFFLVATVFLLWFNFLYANVILSDF
SARS_CoV        LCTFTKSTNSRIRASLPTTIAKNSVKSVAKLCLDAGINYVKSPKFSKLFTIAMWLLLLSI
Human_CoV       FTLCKTAVTTGDVKIMAKAPQRTGVVLKRSLKYNLKASAAVLKSKWWLLAKFTKLLLLIY
Porcine_epidemi LGLCFRAFRKRDVKVLAGVPQRTGIILRKSMRYNAKALGVFFKLKLYWFKVLGKFSLGIY
Porcine_transmi F-MCLRSTKMPKVKVKPPLAFKDFGAKVRTLNY-------MRQLNKPSVWRYAKLVLLLI
Feline_infectio ------------------------------------------------------------
consensus       --iytt-v-skl---l--lafkna-lt-k---v--ga--i-t---lwf-fiya-vil--f

Bovine_respirat YLPKIGFLPTFVGKIAQWIKSTFSLVTICDLYSIQDVGFKNQYCNGSIACQFCLAGFDML
Bovine_enteric_ YLPKIGFLPTFVGKIAQWIKSTFSLVTICDLYSIQDVGFKNQYCNGSIACQFCLAGFDML
Bovine_CoV      YLPKIGFLPTFVGKIVQWIKNTFSLVTICDLYSIQDVGFKNQYCNGSIACQFCLAGFDML
Murine_HepV     YLPNIGPLPMFVGQIVAWVKTTFGVLTICDFYQVTDLGYRSSFCNGSMVCELCFSGFDML
SARS_CoV        CLGSLICVTAAFGVLLSNFGAPSYCNGVRELYLNSSNVTTMDFCEGSFPCSICLSGLDSL
Human_CoV       TLYSVVLLCVRFGPFN--FCSETVNG------YAKSNFVKDDYCDGSLGCKMCLFGYQEL
Porcine_epidemi ALYALLFMTIRFTPIGSPVCDDVVAG------YANSSFDKNEYCN-SVICKVCLYGYQEL
Porcine_transmi AIYNFFYLFVSIPVVHKLTCNGAVQA------YKNSSFIKSAVCGNSILCKACLASYDEL
Feline_infectio ------------------------------------------------------------
consensus       -l--i-fl---vg-i---i--------i-d-y--q----k--ycngsi-c--cl-gfd-l

Bovine_respirat DNYKAIDVVQYEADRRAFVDYTGVLKIVIELIVSYALYTAWFYPLFALISIQILTTWLPE
Bovine_enteric_ DNYKAIDVVQYEADRRAFVDYTGVLKIVIELIVSYALYTAWFYPLFALISIQILTTWLPE
Bovine_CoV      DNYKAIDVVQYEADRRAFVDYTGVLKIVIELIVSYALYTAWFYPLFALISIQILTTWLPE
Murine_HepV     DNYESINVVQHVVDRRVSFDYISLFKLVVELVIGYSLYTVCFYPLFVLVGMQLLTTWLPE
SARS_CoV        DSYPALETIQVTIS--SYKLDLTILGLAAEWVLAYMLFTKFFYLLGLSAIMQVFFGYFAS
Human_CoV       SQFSHLDVVWKHITDPLFSNMQPFIVMVLLLIFG-DNYLRCFLLYFVAQMISTVGVFLGY
Porcine_epidemi SDFSHTQVVWQHLRDPLIGNVMPFFYLAFLAIFG-GVYVKAITLYFIFQYLNSLGVFLGL
Porcine_transmi ADFQHLQVTWDFKSDPLWNRLVQLSYFAFLAVFG-NNYVRCFLMYFVSQYLNLWLSYFGY
Feline_infectio ------------------------------------------------------------
consensus       dny--idvvq-------f-----vl-ivielivgy-lyt--fy-lfv---iqil-twl--
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Bovine_respirat LFMLSTLHWSVRLLVSLANMLPAHVFMRFYIIIASFIKLFSLFRHVAYGCSKPGCLFCYK
Bovine_enteric_ LFMLSTLHWSVRLLVSLANMLPAHVFMRFYIIIASFIKLFILFRHVAYGCSKPGCLFCYK
Bovine_CoV      LLMLSTLHWSVRLLVSLANMLPAHVFMRFYIIIASFIKLFSLFRHVAYGCSKSGCLFCYK
Murine_HepV     FFMLGTMHWSARLFVFVANMLPAFTLLRFYIVVTAMYKVYCLCRHVMYGCSKPGCLFCYK
SARS_CoV        HFISN--SWLMWFIISIVQMAPVSAMVRMYIFFASFYYIWKSYVHIMDGCTSSTCMMCYK
Human_CoV       KETN-----------WFLHFIPFDVICDELLVTVIVIKVISFVRHVLFGCENPDCIACSK
Porcine_epidemi QQSI-----------WFLQLVPFDVFGDEIVVFFIVTRVLMFIKHVCLGCDKASCVACSK
Porcine_transmi VEYS-----------WFLHVVNFESISAEFVIVVIVVKAVLALKHIVFACSNPSCKTCSR
Feline_infectio ------------------------------------------------------------
consensus       --ml----w-----v-l-nmlp--v-mr-yiii---iklf---rhv-ygcskp-cl-cyk

Bovine_respirat RNRSLRVKCSTIVGGMIRYYDVMANGGTGFCSKHQWNCIDCDSYKPGNTFITVEAALDLS
Bovine_enteric_ RNRSLRVKCSTIVGGMIRYYDVMANGGTGFCSKHQWNCIDCDSYKPGNTFITVEAALDLS
Bovine_CoV      RNRSLRVKCSTIVGGMIRYYDVMANGGTGFCSKHQWNCIDCDSYKPGNTFITVEAALDLS
Murine_HepV     RNRSVRVKCSTVVGGSLRYYDVMANGGTGFCTKHQWNCLNCNSWKPGNTFITHEAAADLS
SARS_CoV        RNRATRVECTTIVNGMKRSFYVYANGGRGFCKTHNWNCLNCDTFCTGSTFISDEVARDLS
Human_CoV       SARLKRFPVNTIVNGVQRSFYVNANGGSKFCKKHRFFCVDCDSYGYGSTFITPEVSRELG
Porcine_epidemi SARLKRVPVQTIFQGTSKSFYVHANGGSKFCKKHNFFCLNCDSYGPGCTFINDVIATEVG
Porcine_transmi TARQTRIPIQVVVNGSMKTVYVHANGTGKFCKKHNFYCKNCDSYGFENTFICDEIVRDLS
Feline_infectio ------------------------------------------------------------
consensus       rnr--rv-cstiv-gmir-y-v-anggtgfc-khqwnci-cdsy-pgntfit-e-a-dls

Bovine_respirat KELKRPIQPTDVAYHTVTDVKQVGCYMRLFYERDGQRTYDDVNASLFVDYSNLLHSKVKG
Bovine_enteric_ KELKRPIQPTDVAYHTVTDVKQVGCYMRLFYERDGQRTYDDVNASLFVDYSNLLHSKVKG
Bovine_CoV      KELKRPIQPTDVAYHTVTDVKQVGCYMRLFYDRDGQRTYDDVNASLFVDYSNLLHSKVKS
Murine_HepV     KELKRPVNPTDSAYYSVIEVKQVGCSMRLFYERDGQRVYDDVSASLFVDMNGLLHSKVKG
SARS_CoV        LQFKRPINPTDQSSYIVDSVAVKNGALHLYFDKAGQKTYERHPLSHFVNLDNLRANNTKG
Human_CoV       NITKTNVQPTGPAYVMIDKVEFENGFYRLYSCETFWRYNFDITESKYSCKEVFKN----C
Porcine_epidemi NVVKLNVQPTGPATILIDKVEFSNGFYYLYSGDTFWKYNFDITDSKYTCKEALKN----C
Porcine_transmi NSVKQTVYATDRSHQEVTKVECSDGFYRFYVGDEFTSYDYDVKHKKYSSQEVLKS----M
Feline_infectio ------------------------------------------------------------
consensus       --lkrpiqptd-ay--v--v-----ymrlfyerdgqr-yddv--s-fv----l-----k-

Bovine_respirat VPNMHVVVVEN--DADKANFLNAAVFYAQSLFRPILMVDKNLITTANTGTSVTETMFDVY
Bovine_enteric_ VPNMHVVVVEN--DADKANFLNAAVFYAQSLFRPILMVDKNLITTANTGTSVTETMFDVY
Bovine_CoV      VPNMHVVVVEN--DADKANFLNAAVFYAQSLFRPILMVDKILITTANTGTSVTETMFDVY
Murine_HepV     VPETHVVVVEN--EADKAGFLNAAVFYAQSLYRPMLMVEKKLITTANTGLSVSRTMFDLY
SARS_CoV        SLPINVIVFDGKSKCDESASKSASVYYSQLMCQPILLLDQALVSDVGDSTEVSVKMFDAY
Human_CoV       NVLDDFIVFNN-NGTNVTQVKNASVYFSQLLCRPIKLVDSELLSTL--SVDFNGVLHKAY
Porcine_epidemi SIITDFIVFNN-NGSNVNQVKNACVYFSQMLCKPVKLVDSALLASL--SVDFGASLHSAF
Porcine_transmi LLLDDFIVYSP-SGSALANVRNACVYFSQLIGKPIKIVNSDLLEDL--SVDFKGALFNAK
Feline_infectio ------------------------------------------------------------
consensus       v----vvv-en----d-an--na-vfy-q-l-rpilmvd--litt------vt-tmfd-y

Bovine_respirat VDTFLSMFDVDKKSLNALIATAHSSIKQGTQICKVLDTFLSCARKSCSIDSDVDTKCLAD
Bovine_enteric_ VDTFLSMFDVDKKSLNALIATAHSSIKQGTQICKVLDTFLSCARKSCSIDSDVDTKCLAD
Bovine_CoV      VDTFLSMFDVDKKSLNALIATAHSSIKQGTQICKVLDTFLSCARKSCSIDSDVDTKCLAD
Murine_HepV     VYSLLRHLDVDRKSLTSFVNAAHNSLKEGVQLEQVMDTFVGCARRKCAIDSDVETKSITK
SARS_CoV        VDTFSATFSVPMEKLKALVATAHSELAKGVALDGVLSTFVSAARQG-VVDTDVDTKDVIE
Human_CoV       IDVLRNSFGKDLNANMSLAECKRALGLS------------------------ISDHEFTS
Porcine_epidemi VSVLSNSFGKDLSSCNDMQDCKSTLGFD-----------------------DVPLDTFNA
Porcine_transmi KNVIKNSFNVDVSECKNLDECYRACNLN------------------------VSFSTFEM
Feline_infectio ------------------------------------------------------------
consensus       vdt----f-vd--sl--li--ahs-i--g--i--vl-tfl--ar----idsdvdtk-l--

Bovine_respirat SVMSAVSAGLELTDESCNNLVPTYLKGDN--IVAADLGVLIQNSAKHVQGNVAKIAGVSC
Bovine_enteric_ SVMSAVSAGLELTDESCNNLVPTYLKGDN--IVAADLGVLIQNSAKHVQGNVAKIAGVSC
Bovine_CoV      SVMSAVSAGLELTDESCNNLVPTYLKGDN--IVAADLGVLIQNSAKHVQGNVAKIAGVSC
Murine_HepV     SVMAAVNAGVEVTDESCNNLVPTYVKSDT--IVAADLGVLIQNNAKHVQSNVAKAANVAC
SARS_CoV        CLKLSHHSDLEVTGDSCNNFMLTYNKVEN--MTPRDLGACIDCNARHINAQVAKSHNVSL
Human_CoV       AISNAHRCDVLLSDLSFNNFVSSYAKPEEK-LSAYDLACCMRAGAKVVNANVLTKDQTPI
Porcine_epidemi AVAEAHRYDVLLTDMSFNNFTTSYAKPEEK-FPVHDIATCMRVGAKIVNHNVLVKDSIPV
Porcine_transmi AVNNAHRFGILITDRSFNNFWPSKVKPGSSGVSAMDIGKCMTSDAKIVNAKVLTQRGKSV
Feline_infectio ------------------------------------------------------------
consensus       -v--a---gleltdescnn-vptylk-d---i-a-dlg--i---akhvqgnvak---vs-
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Bovine_respirat IWSVDAFNQLSSDFQHKLKKACCKTGLKLKLTYNKQMANVSVL----TTPFSLKGGAVFS
Bovine_enteric_ IWSVDAFNQLSSDFQHKLKKACCKTGLKLKLTYNKQMANVSVL----TTPFSLKGGAVFS
Bovine_CoV      IWSVDAFNQLSSDFQHKLKKACCKTGLKLELTYNKQMANVSVL----TTPFSLKGGAVFS
Murine_HepV     IWSVDAFNQLSADLQHRLRKACVKTGLKIKLTYNKQEANVPIL----TTPFSLKGGAVFS
SARS_CoV        IWNVKDYMSLSEQLRKQIRSAAKKNNIPFRLTCATTRQVVNVI----TTKISLKGGKIVS
Human_CoV       VWHAKDFNSLSAEGRKYIVKTSKAKGLTFLLTINENQAVTQIP----ATSIVAKQGAGDA
Porcine_epidemi VWLVRDFIALSEETRKYIIRTTKVKGITFMLTFNDCRMHTTIP----TVCIANKKGAGLP
Porcine_transmi VWLSQDFAALSSTAQKVLVKTFVEEGVNFSLTFNAVGSDDDLPYERFTESVSPKSGSGFF
Feline_infectio ------------------------------------------------------------
consensus       iw-v--fn-ls-d-q--lkka--k-gl---ltyn-q-a-v-vl----tt--slkggavfs

Bovine_respirat YFVYVCFLLSLVCFIG---LWCLMPTYTVHKSDFQLP-VYTSYKVLDNGVIRDVSVEDVC
Bovine_enteric_ YFVYVCFLLSLVCFIG---LWCLMPTYTVHKSDFQLP-VYASYKVLDNGVIRDVSVEDVC
Bovine_CoV      YFVYVCFVLSLVCFIG---LWCLMPTYTVHKSDFQLP-VYASYKVLDNGVIRDVSVEDVC
Murine_HepV     RVLQWLFVANLICFIV---LWALMPTYAVHKSDMQLP-LYASFKVIDNGVLRDVSVTDAC
SARS_CoV        TCFKLMLKATLLCVLAALVCYIVMPVHTLSIHDGYTN-EIIGYKAIQDGVTRDIISTDDC
Human_CoV       GHS--LTWLWLLCGLVCLIQFYLCFFMPYFMYDIVSSFEGYDFKYIENGQLKNFEAPLKC
Porcine_epidemi SFSKVKKFFWFLCLFIVAAFFALSFLD---FSTQVSSDSDYDFKYIESGQLKTFDNPLSC
Porcine_transmi DVITQLKQIVILV-FVFIFICGLCSVYSVATQSYIESAEGYDYMVIKNGIVQPFDDTISC
Feline_infectio ------------------------------------------------------------
consensus       --v-v---l-lvc-i----lw-lmp-ytv--sd--------ykvidngvirdv---d-c

Bovine_respirat FANKFEQFDQWYESTFGLSYYSNSMACPIVVAVVDQDLGSTVFNVPTKVLRYG-YHVLHF
Bovine_enteric_ FANKFEQFDQWYESTFGLSYYSNSMACPIVVAVVDQDLGSTVFNVPTKVLRYG-YHVLHF
Bovine_CoV      FANKFEQFDQWYESTFGLSYYSNSMACPIVVAVVDQDFGSTVFNVPTKVLRYG-YHVLHF
Murine_HepV     FANKFNQFDQWYESTFGLVYYRNSKACPVVVAVIDQDIGHTLFNVPTKVLRYG-FHVLHF
SARS_CoV        FANKHAGFDAWFSQRGGS--YKNDKSCPVVAAIITREIGFIVPGLPGTVLRAINGDFLHF
Human_CoV       VRNVFENFEDWHYAKFGFTPLNKQSCPIVVG---VSEIVNTVAGIPSNVYLVG--KTLIF
Porcine_epidemi VHNVFINFDQWHDAKFGFTPVNNPSCPIVVG---VSDEARTVPGIPAGVYLAG--KTLVF
Porcine_transmi VHNTYKGFGDWFKAKYGFIPTFGKSCPIVVGTVFDLENMRPIPDVPAYVSIVG--RSLVF
Feline_infectio ------------------------------------------------------------
consensus       fankf-qfdqwye--fg-s-y-n---cpvv-avvd-dlg-tv--vpt-vlr-g----lhf

Bovine_respirat ITHALSADGVQCYTPHSQISYSNFYASGCVLSSACTMFAMADGSPQPYCYTEGLMQNASL
Bovine_enteric_ ITHALSADGVQCYTPHSQISYSNFYASGCVLSSACTMFAMADGSPQPYCYTEGLMQNASL
Bovine_CoV      ITHALSADGVQCYTPHSQISYSNFYASGCVLSSACTMFAMADGSPQPYCYTDGLMQNASL
Murine_HepV     ITHAFATDRVQCYTPHMQIPYDNFYASGCVLSSLCTMLAHADGTPHPYCYTEGVMHNASL
SARS_CoV        LPRVFSAVGNICYTPSKLIEYSDFATSACVLAAECTIFKDAMGKPVPYCYDTNLLEGSIS
Human_CoV       TLQAAFGNAGVCYDIFG-----VTTPEKCIFTSACTRLEGLGGN-NVYCYNTALMEGSLP
Porcine_epidemi AINTIFGTSGLCFDASG-----VADKGACIFNSACTTLSGLGGT-AVYCYKNGLVEGAKL
Porcine_transmi AINAAFGVTNMCYDHTGNAVSKDSYFDTCVFNTACTTLTGLGGT-IVYCAKQGLVEGAKL
Feline_infectio ------------------------------------------------------------
consensus       i--a--a-g--cytp--qi-y--fy-sgcvlssactm---a-gsp-pycy--glm--a-l

Bovine_respirat YSSLVPHVRYNLANAKGFIRFPEVLREGL-VRIVRTRSMSYCRVGLCEEADEGICFNFNG
Bovine_enteric_ YSSLVPHVRYNLANAKGFIRFPEVLREGL-VRIVRTRSMSYCRVGLCEEADEGICFNFNG
Bovine_CoV      YSSLVPHVRYNLANAKGFIRLPEVLREGL-VRIVRTRSMSYCRVGLCEEADEGICFNFNG
Murine_HepV     YSSLVPHVRYNLASSNGYIRFPEVVSEGI-VRVVRTRSMTYCRVGLCEEAEEGICFNFNS
SARS_CoV        YSELRPDTRYVLMDG-SIIQFPNTYLEGS-VRVVTTFDAEYCRHGTCERSEVGICLSTSG
Human_CoV       YSSIQANAYYKYDNGN-FIKLPEVIAQGFGFRTVRTIATKYCRVGECVESNAGVCFGFDK
Porcine_epidemi YSELAPHSYYKMVDGN-AVSLPEIISRGFGIRTIRTKAMTYCRVGQCVQSAEGVCFGADR
Porcine_transmi YSDLMPDYYYEHASGN-MVKLPAIIRG-LGLRFVKTQATTYCRVGECIDSKAGFCFGGDN
Feline_infectio ------------------------------------------------------------
consensus       ysslvph-ry-la-a--fir-pevl-egl-vrivrtr-msycrvg-cee-degicf-f--

Bovine_respirat SWVLNNDYYRSLPGTFCGRDVFDLIYQLFKGLAQPVDFLALTASSIAGAILAVIVVLVFY
Bovine_enteric_ SWVLNNDYYRSLPGTFCGRDVFDLIYQLFKGLAQPVDFLALTASSIAGAILAVIVVLVFY
Bovine_CoV      SWVLNNDYYRSLPGTFCGRDVFDLIYQLFKGLAQPVDFLALTASSIAGAILAVIVVLGFY
Murine_HepV     SWVLNNPYYRAMPGTFCGRNAFDLIHQVLGGLVQPIDFFALTASSVAGAILAIIVVLAFY
SARS_CoV        RWVLNNEHYRALSGVFCGVDAMNLIANIFTPLVQPVGALDVSASVVAGGIIAILVTCAAY
Human_CoV       WFVNDGRVA---NGYVCGTGLWNLVFNILSMFSSSFSVAAMSGQILLNCALGAFAIFCCF
Porcine_epidemi FFVYNAESG---SDFVCGTGLFTLLMNVISVFSKTVPVTVLSGQILFNCIIAFVAVAVCF
Porcine_transmi WFVYDNEFG---NGYICGNSVLGFFKNVFKLFNSNMSVVATSGAMLVNIIIACLAIAMCY
Feline_infectio ------------------------------------------------------------
consensus       -wvlnndyyr-l-g-fcg--vf-li-qlf--l-qpv--laltas-iagailavivv---y
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Bovine_respirat YLIKLKRAFGDYTSIVFVNVIVWCVNFMMLFVFQVYPTLSCVYAICYFYATLYFPSEISV
Bovine_enteric_ YLIKLKRAFGDYTSIVFVNVIVWCVNFMMLFVFQVYPTLSCVYAICYFYATLYFPSEISV
Bovine_CoV      YLIKLKRAFGDYTSIVFVNVIVWCVNFMMLFVFQVYPTLSCVYAICYFYATLYFPSEISV
Murine_HepV     YLIKLKRAFGDYTSVVVINVIVWCINFLMLFVFQVYPTLSCLYACFYFYTTLYFPSEISV
SARS_CoV        YFMKFRRVFGEYNHVVAANALLFLMSFTILCLVPAYSFLPGVYSVFYLYLTFYFTNDVSF
Human_CoV       LVTKFRRMFGDLSVGVCTVVVAVLLNNVSYIVTQN-LVTMIAYAILYFFATRSLR--YAW
Porcine_epidemi LFTKFKRMFGDMSVGVFTVGACTLLNNVSYIVTQN-TLGMLGYATLYFLCTKGVR--YMW
Porcine_transmi GVLKFKKIFGDCTFLIVMIIVTLVVNNVSYFVTQN-TFFMIIYAIVYYFITRKLA--YPG
Feline_infectio ------------------------------------------------------------
consensus       ylik-kr-fgdyt-iv-vnvivw-vnfmmlfv-q-y--l--vyai-yfy-t-yf--eis-

Bovine_respirat IMHLQWLVMYGTIMPLWFCLLYISVVVSNHAFWVFAYCRRLGTSVR--SDGTFEEMALTT
Bovine_enteric_ IMHLQWLVMYGTIMPLWFCLLYISVVVSNHAFWVFAYCRRLGTSVR--SDGTFEEMALTT
Bovine_CoV      IMHLQWLVMYGTIMPLWFCLLYISVVVSNHAFWVFSYCRQLGTSVR--SDGTFEEMALTT
Murine_HepV     VMHLQWLVMYGAIMPLWFCITYVAVVVSNHALWLFSYCRKIGTDVR--SDGTFEEMALTT
SARS_CoV        LAHLQWFAMFSPIVPFWITAIYVFCISLKHCHWFFNNYLRKRVMFNGVTFSTFEEAALCT
Human_CoV       IWCAAYLIAYISFAPWWLCAWYFLAMLTGLLPSLLKLKVSTNLFEGDKFVGTFESAAAGT
Porcine_epidemi IWHLGFLISYILIAPWWVLMVYAFSAIFEFMPNLFKLKVSTQLFEGDKFVGSFENAAAGT
Porcine_transmi ILDAGFIIAYINMAPWYVITAYILVFLYDSLPSLFKLKVSTNLFEGDKFVGNFESAAMGT
Feline_infectio ------------------------------------------------------------
consensus       imhlqwlvmy--imp-w-cllyi-vvvs-h--wvf------------s-gtfee-al-t

Bovine_respirat FMITKDSYCKLKNS--LSDVAFNRYLSLYNKYRYYSGKMDTAAYREAACSQLAKAMDTFT
Bovine_enteric_ FMITKDSYCKLKNS--LSDVAFNRYLSLYNKYRYYSGKMDTAAYREAACSQLAKAMDTFT
Bovine_CoV      FMITKDSYCKLKNS--LSDVAFNRYLSLYNKYRYYSGKMDTAAYREAACSQLAKAMDTFT
Murine_HepV     FMITKESYCKLKNS--VSDVAFNRYLSLYNKYRYFSGKMDTATYREAACSQLAKAMETFN
SARS_CoV        FLLNKEMYLKLRSETLLPLTQYNRYLALYNKYKYFSGALDTTSYREAACCHLAKALNDFS
Human_CoV       FVIDMRSYEKLANS--ISPEKLKSYAASYNRYKYYSGNANEADYRCACYAYLAKAMLDFS
Porcine_epidemi FVLDMHAYERLANS--ISTEKLRQYASTYNKYKYYSGSASEADYRLACFAHLAKAMMDYA
Porcine_transmi FVIDMRSYETIVNS--TSIARIKSYANSFNKYKYYTGSMGEADYRMACYAHLGKALMDYS
Feline_infectio ------------------------------------------------------------
consensus       fmi-kdsy-klkns--ls---fnrylslynkyryysg-mdta-yreaac--lakam--ft

Bovine_respirat NNNGSDVLYQPPTASVSTSFLQSGIVKMVNPTSKVEPCIVSVTYGNMTLNGLWLDDKVYC
Bovine_enteric_ NNNGSDVLYQPPTASVSTSFLQSGIVKMVNPTSKVEPCIVSVTYGNMTLNGLWLDDKVYC
Bovine_CoV      NNNGSDVLYQPPTASVSTSFLQSGIVKMVNPTSKVEPCIVSVTYGNMTLNGLWLDDKVYC
Murine_HepV     HNNGNDVLYQPPTASVTTSFLQSGIVKMVSPTSKVEPCVVSVTYGNMTLNGLWLDDKVYC
SARS_CoV        -NSGADVLYQPPQTSITSAVLQSGFRKMAFPSGKVEGCMVQVTCGTTTLNGLWLDDTVYC
Human_CoV       RDHN-DILYTPPTVSYG-STLQAGLRKMAQPSGFVEKCVVRVCYGNTVLNGLWLGDIVYC
Porcine_epidemi SNHN-DTLYTPPTVSYN-STLQAGLRKMAQPSGVVEKCIVRVCYGNMALNGLWLGDIVMC
Porcine_transmi VNRT-DMLYTPPTVSVN-STLQSGLRKMAQPSGLVEPCIVRVSYGNNVLNGLWLGDEVIC
Feline_infectio -----------PTVSVN-STLQSGLRKMAQPSGVVEPCIVRVAYGNNVLNGLWLGDEVIC
consensus       -n-g-dvlyqpPt-Svsts-LQsGirKManPsgkVEpCiV-VtyGnmtLNGLWLdD-VyC

Bovine_respirat PRHVICSASDMTNPDYTNLLCRVTSSDFTVLFDRLSLTVMSYQMQGCMLVLTVTLQNSRT
Bovine_enteric_ PRHVICSASDMTNPDYTNLLCRVTSSDFTVLFDRLSLTVMSYQMQGCMLVLTVTLQNSRT
Bovine_CoV      PRHVICSASDMTNPDYTNLLCRVTSSDFTVLFDRLSLTVMSYQMQGCMLVLTVTLQNSRT
Murine_HepV     PRHVICSSADMTDPDYPNLLCRVTSSDFCVMSDRMSLTVMSYQMQGSLLVLTVTLQNPNT
SARS_CoV        PRHVICTAEDMLNPNYEDLLIRKSNHSFLVQAGNVQLRVIGHSMQNCLLRLKVDTSNPKT
Human_CoV       PRHVIASNTTSA-IDYDHEYSIMRLHNFSIISGTAFLGVVGATMHGVTLKIKVSQTNMHT
Porcine_epidemi PRHVIASSTTST-IDYDYALSVLRLHNFSISSGNVFLGVVSATMRGALLQIKVNQNNVHT
Porcine_transmi PRHVIASDTTRV-INYENEMSSVRLHNFSVSKNNVFLGVVSARYKGVNLVLKVNQVNPNT
Feline_infectio PRHVIASDTSRV-INYENELSSVRLHNFSIAKNNAFLGVVSAKYKGVNLVLKVNQVNPNT
consensus       PRHVIcs-sdmt-pdYenll-rvt-h-Ftvl---l-L-Vms--mqg-mLvlkVt-qN--T

Bovine_respirat PKYTFGVVKPGETFTVLAAYNGKPQGAFHVTMRSSYTIKGSFLCGSCGSVGYVLMGDCVK
Bovine_enteric_ PKYTFGVVKPGETFTVLAAYNGKPQGAFHVTMRSSYTIKGSFLCGSCGSVGYVLMGDCVK
Bovine_CoV      PKYTFGVVKPGETFTVLAAYNGKPQGAFHVTMRSSYTIKGSFLCGSCGSVGYVIMGDCVK
Murine_HepV     PKYSFGVVKPGETFTVLAAYNGRPQGAFHVVMRSSHTIKGSFLCGSCGSVGYVLTGDSVR
SARS_CoV        PKYKFVRIQPGQTFSVLACYNGSPSGVYQCAMRPNHTIKGSFLNGSCGSVGFNIDYDCVS
Human_CoV       PRHSFRTLKSGEGFNILACYDGCAQGVFGVNMRTNWTIRGSFINGACGSPGYNLKNGEVE
Porcine_epidemi PKYTYRTVRPGESFNILACYDGAAAGVYGVNMRSNYTIRGSFINGACGSPGYNINNGTVE
Porcine_transmi PEHKFKSIKAGESFNILACYEGCPGSVYGVNMRSQGTIKGSFIAGTCGSVGYVLENGILY
Feline_infectio PEHKFKSVRPGESFNILACYEGCPGSVYGVNMRSQGTIKGSFIAGTCGSVGYVLENGTLY
consensus       Pkytf--vkpGetFtvLAcYnG-pqgvf-v-MRsnyTIkGSFl-GsCGSvGyvl--d-v-
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Bovine_respirat FVYMHQLELSTGCHTGTDFNGDFYGPYKDAQVVQLPVQDYIQSVNFVAWLYAAILNNCNW
Bovine_enteric_ FVYMHQLELSTGCHTGTDFNGDFYGPYKDAQVVQLPVQDYIQSVNFVAWLYAAILNNCNW
Bovine_CoV      FVYMHQLELSTGCHTGTDFNGDFYGPYKDAQVVQLPVQDYIQSVNFVAWLYAAILNNCNW
Murine_HepV     FVYMHQLELSTGCHTGTDFSGNFYGPYRDAQVVQLPVQDYTQTVNVVAWLYAAILNRCNW
SARS_CoV        FCYMHHMELPTGVHAGTDLEGKFYGPFVDRQTAQAAGTDTTITLNVLAWLYAAVINGDRW
Human_CoV       FVYMHQIELGSGSHVGSSFDGVMYGGFEDQPNLQVESANQMLTVNVVAFLYAAILNGCTW
Porcine_epidemi FCYLHQLELGSGCHVGSDLDGVMYGGYEDQPTLQVEGASSLFTENVLAFLYAALINGSTW
Porcine_transmi FVYMHHLELGNGSHVGSNFEGEMYGGYEDQPSMQLEGTNVMSSDNVVAFLYAALINGERW
Feline_infectio FVYMHHLELGNGSHVGSNLEGEMYGGYEDQPSMQLEGTNVMSSDNVVAFLYAALINGERW
consensus       FvYmHqlEL-tGcH-GtdfeGdfYGpy-D-q-vQl---d-i-svNvvAwLYAAilNgc-W

Bovine_respirat FVQSDKCSVEDFNVWALSNGFSQVKSDLV--IDALASMTGVSLETLLAAIKRLKN-GFQG
Bovine_enteric_ FVQSDKCSVEDFNVWALSNGFSQVKSDLV--IDALASMTGVSLETLLAAIKRLKN-GFQG
Bovine_CoV      FVQSDKCSVEDFNVWALSNGFSQVKSDLV--IDALASMTGVSLETLLAAIKRLKN-GFQG
Murine_HepV     FVQSDSCSLEEFNVWAMTNGFSSIKADLV--LDALASMTGVTVEQVLAAIKRLHS-GFQG
SARS_CoV        FLNRFTTTLNDFNLVAMKYNYEPLTQDHVDILGPLSAQTGIAVLDMCAALKELLQNGMNG
Human_CoV       WLKGEKLFVEHYNEWAQANGFTAMNGEDA--FSILAAKTGVCVERLLHAIQVLNN-GFGG
Porcine_epidemi WLSSSRIAVDRFNEWAVHNGMTTVGNTDC--FSILAAKTGVDVQRLLASIQSLHK-NFGG
Porcine_transmi FVTNTSMSLESYNTWAKTNSFTELSSTDA--FSMLAAKTGQSVEKLLDSIVRLNK-GFGG
Feline_infectio FVTNTSMTLESYNAWAKTNSFTEIVSTDA--FNMLAAKTGYSVEKLLECIVRLNK-GFGG
consensus       fvqsdk-svedfNvwAlsngfs-v-sd-v--i--Laa-TGvsve-llaaikrL-n-gfqG

Bovine_respirat RQIMGSCSFEDELTPSDVYQQLAGIKLQSKRTRLVKGIVCWIMASTFLFSCIITAFVKWT
Bovine_enteric_ RQIMGSCSFEDELTPSDVYQQLAGIKLQSKRTRLVKGIVCWIMASTFLFSCIITAFVKWT
Bovine_CoV      RQIMGSCSFEDELTPSDVYQQLAGIKLQSKRTRLVKGIVCWIMASTFLFSCIITAFVKWT
Murine_HepV     KQILGSCVLEDELTPSDVYQQLAGVKLQSKRTRVIKGTCCWILASTFLFCSIISAFVKWT
SARS_CoV        RTILGSTILEDEFTPFDVVRQCSGVTFQGKFKKIVKGTHHWMLLTFLTSLLILVQSTQWS
Human_CoV       KQILGYSSLNDEFSINEVVKQMFGVNLQS---GKTTSMFKSISLFAGFFVMFWAELFVYT
Porcine_epidemi KQILGHTSLTDEFTTGEVVRQMYGVNLQG---GYVSRACRNVLLVGSFLTFFWSELVSYT
Porcine_transmi RTILSYGSLCDEFTPTEVIRQMYGVNLQA---GKVKSFFYPIMTAMTILFAFWLEFFMYT
Feline_infectio RTILSYGSLCDEFTPTEVIRQMYGVNLQS---GKVKSIFYP-------------------
consensus       rqIlgs-sleDEftpsdVvrQl-Gv-lQsk--rlvkgi--wim-s--lf--iit-fv-wt

Bovine_respirat MFMYVTTN-MLSITFCALCVISLAMLLVKHKHLYLTMYIIPVLFTLLYNNYLVV-YKQTF
Bovine_enteric_ MFMYVTTN-MLSITFCALCVISLAMLLVKHKHLYLTMYIIPVLFTLLYNNYLVV-YKQTF
Bovine_CoV      MFMYVTTN-MLSITFCALCVISLAMLLVKHKHLYLTMYIIPVLFTLLYNNYLVV-YKQTF
Murine_HepV     MFMYVTTH-MLGVTLCALCFVIFAMLLIKHKHLYLTMYIMPVLCTLFYTNYLVVGYKQSF
SARS_CoV        LFFFVYENAFLPFTLGIMAIAACAMLLVKHKHAFLCLFLLPSLATVAYFNMVYMPASWVM
Human_CoV       TTIWVNPGFLTPFMILLVALSLCLTFVVKHKVLFLQVFLLPSIIVAAIQNCAWDYHVTKV
Porcine_epidemi KFFWVNPGYVTPMFACLSLLSSLLMFTLKHKTLFFQVFLIPALIVTSCINLAFDVEVYNY
Porcine_transmi PFTWINPTFVSIVLAVTTLISTVFVSGIKHKMLFFMSFVLPSVILVTAHNLFWDFSYYES
Feline_infectio ------------------------------------------------------------
consensus       mfmyv----ml-it-c-l-v-slamllvkhkhlyl-myiip-l-tl-y-n-l-v-----f

Bovine_respirat RGYVYAWLSYYVPSVEYTYTDEVIYGMLLLIGMVFVTLRSINHDLFSFIMFVGRVISVVS
Bovine_enteric_ RGYVYAWLSYYVPSVEYTYTDEVIYGMLLLIGMVFVTLRSINHDLFSFIMFVGRVISVVS
Bovine_CoV      RGYVYAWLSYYVPSVEYTYTDEVIYGMLLLIGMVFVTLRSINHDLFSFIMFVGRVISVVS
Murine_HepV     RGLAYAWLSYFVPAVDYTYMDEVLYGVVLLVAMVFVTMRSINHDVFSTMFLVGRLVSLVS
SARS_CoV        R--IMTWLELADTSLSGYRLKDCVMYASALVLLILMTARTVYDDAARRVWTLMNVITLVY
Human_CoV       LAEKFDYN-VSVMQMDIQGFVNIFICLFVALLH---TWRFAKERCTHWCTYLFSLIAVLY
Porcine_epidemi LAEHFDYH-VSLMGFNAQGLVNIFVCFVVTILHGTYTWRFFNTPAS-SVTYVVALLTAAY
Porcine_transmi LQSIVENTNTMFLPVDMQGVMLTVFCFIVFVTYSVRFFTCKQSWFSLAVTTILVIFNMVK
Feline_infectio ------------------------------------------------------------
consensus       rg-vy-wl---v--ve-----eviy-mllli-mv-vt-rsin-d----i-fv--visvv-

Bovine_respirat LWYMG------SNLEEEILLMLASLFGTYTWT---TALSMAAAKVIAKWVAVNVLYFTDI
Bovine_enteric_ LWYMG------SNLEEEILLMLASLFGTYTWT---TALSMAAAKVIAKWVAVNVLYFTDI
Bovine_CoV      LWYMG------SNLEEEILLMLASLFGTYTWT---TALSMAAAKVIAKWVAVNVLYFTDI
Murine_HepV     MWYFG------ANLEEEVLLFLTSLFGTYTWT---TMLSLATAKVIAKWLAVNVLYFTDI
SARS_CoV        KVYYG------NALDQAISMWALVISVTSNYSGVVTTIMFLARAIVFVCVEYYPLLFITG
Human_CoV       TA----------LYSYDYVSLLVMLLCAISNEWYIGAIIFRICRFG-VAFLP-VEYVSYF
Porcine_epidemi NY----------FYASDILSCAMTLFASVTGNWFVGAVCYKVAVY--MALRF-PTFVAIF
Porcine_transmi IFGTSDEPWTENQIAFCFVNMLTMIVSLTTKDWMVVIASYRIAYYIVVCVMP-SAFVSDF
Feline_infectio ------------------------------------------------------------
consensus       lwy-g-------nle-eillml-slfgt-twt---tals---akvi---v---vlyftd-
```

```
Bovine_respirat  PQIKIVLVCYLFIGYIISCYWGLFSLMNSLFRMPLGVYNYKISVQELRYMNANGLRPPKN
Bovine_enteric_  PQIKIVLVCYLFIGYIISCYWGLFSLMNSLFRMPLGVYNYKISVQELRYMNANGLRPPKN
Bovine_CoV       PQIKIVLVCYLFIGYIISCYWGLFSLMNSLFRMPLGVYNYKISVQELRYMNANGLRPPKN
Murine_HepV      PQIKLVLLSYLCIGYVCCCYWGVLSLLNSIFRMPLGVYNYKISVQELRYMNANGLRPPRN
SARS_CoV         NTLQCIMLVYCFLGYCCCCYFGLFCLLNRYFRLTLGVYDYLVSTQEFRYMNSQGLLPPKS
Human_CoV        DGVKTVLLFYMLLGFVSCMYYGLLYWINRFCKCTLGVYDFCVSPAEFKYMVANGLNAPNG
Porcine_epidemi  GDIKSVMFCYLVLGYFTCCFYGILYWFNRFFKVSVGVYDYTVSAAEFKYMVANGLRAPTG
Porcine_transmi  GFMKCISIVYMACGYLFCCYYGILYWVNRFTCMTCGVYQFTVSAAELKYMTANNLSAPKN
Feline_infectio  ------------------------------------------------------------
consensus        --ik-vlv-yl-igyi-ccywgl--lmn--frm-lgvyny-is-qelrymnanglrppkn

Bovine_respirat  SFEALMLNFKLLGIGGVPIIEVSQFQSKLTDVKCANVVLLNCLQHLHVASNSKLWQYCST
Bovine_enteric_  SFEALMLNFKLLGIGGVPIIEVSQFQSKLTDVKCANVVLLNCLQHLHVASNSKLWQYCST
Bovine_CoV       SFEALMLNFKLLGIGGVPIIEVSQFQSKLTDVKCANGGLLNCLQHLHVASNSKLWQYCST
Murine_HepV      SFEALMLNFKLLGIGGVPVIEVSQIQSRLTDVKCANVVLLNCLQHLHIASNSKLWQYCST
SARS_CoV         SIDAFKLNIKLLGIGGKPCIKVATVQSKMSDVKCTSVVLLSVLQQLRVESSSKLWAQCVQ
Human_CoV        PFDALFLSFKLMGIGGPRTIKVSTVQSKLTDLKCTNVVLMGILSNMNIASNSKEWAYCVE
Porcine_epidemi  TLDSLLLSAKLIGIGGERNIKISSVQSKLTDIKCSNVVLLGCLSSMNVSANSTEWAYCVD
Porcine_transmi  AYDAMILSAKLIGVGGKRNIKISTVQSKLTEMKCTNVVLLGLLSKMHVESNSKEWNYCVG
Feline_infectio  ------------------------------------------------------------
consensus        sfealmlnfkllgigg-p-i-vs-iqskltdvkc-nvvll-clq-lhvasnsklwqyc--

Bovine_respirat  LHNEILATSDLGVAFEKLAQLLIVLFANPAAVDSKCLTSIEEVCDDYAKDNTVLQALQSE
Bovine_enteric_  LHNEILATSDLGVAFEKLAQLLIVLFANPAAVDSKCLTSIEEVCDDYAKDNTVLQALQSE
Bovine_CoV       LHNEILATSDLGVAFEKLAQLLIVLFANPAAVDSKCLTSIEEVCDDYAKDNTVLQALQSE
Murine_HepV      LHNEILATSDLSVAFDKLAQLLVVLFANPAAVDSKCLASIEEVSDDYVRDNTVLQALQSE
SARS_CoV         LHNDILLAKDTTEAFEKMVSLLSVLLSMQGAVD------INRLCEEMLDNRATLQAIASE
Human_CoV        MHNKINLCDDPETAQELLLALLAFFLSKHSDFG------LGDLVDSYFENDSILQSVASS
Porcine_epidemi  LHNKINLCNDPEKAQEMLLALLAFFLSKNSAFG------LDDLLESYFNDNSMLQSVAST
Porcine_transmi  LHNEINLCDDPEIVLEKLLALIAFFLSKHNTCD------LSELIESYFENTTILQSVASA
Feline_infectio  ------------------------------------------------------------
consensus        lhneil---d--vafekl--ll-vl----aavd------ieev-ddy--dntvlqal-se

Bovine_respirat  FVNMASFVEYEVAKKNLDEARSSGSANQQQLKQLEKACNIAKSAYERDRAVARKLERMAD
Bovine_enteric_  FVNMASFVEYEVAKKNLDEARSSGSANQQQLKQLEKACNIAKSAYERDRAVARKLERMAD
Bovine_CoV       FVNMASFVEYEVAKKNLDEACSSGSANQQQLKQLEKACNIAKSAYERDRAVARKLERMAD
Murine_HepV      FVNMASFVEYELAKKNLDEAKASGSANQQQIKQLEKACNIAKSAYERDRAVARKLERMAD
SARS_CoV         FSSLPSYAAYATAQEAYEQAVANGDS-EVVLKKLKKSLNVAKSEFDRDAAMQRKLEKMAD
Human_CoV        FVGMPSFVAYETARQEYENAVANGSSPQ-IIKQLKKAMNVAKAEFDRESSVQKKINRMAE
Porcine_epidemi  YVGLPSYVIYENARQQYEDAVNNGSPPQ-LVKQLRHAMNVAKSEFDREASTQRKLDRMAE
Porcine_transmi  YAALPSWIALEKARADLEEAKKNDVSPQ-ILKQLTKAFNIAKSDFEREASVQKKLDKMAE
Feline_infectio  ------------------------------------------------------------
consensus        fv-m-sfv-ye-ak-nldea---gs--q--lkql-ka-niaks-yerd-av-rklermad

Bovine_respirat  LALTNMYKEARINDKKSKVVSALQTMLFSMVRKLDNQALNSILDNAVKGCVPLNAIPSLA
Bovine_enteric_  LALTNMYKEARINDKKSKVVSALQTMLFSMVRKLDNQALNSILDNAVKGCVPLNAIPSLA
Bovine_CoV       LALTNMYKEARINDKKSKVVSALQTMLFSMVRKLDNQALNSILDNAVKGCVPLNAIPSLA
Murine_HepV      LALTNMYKEARINDKKSKVVSALQTMLFSMVRKLDNQALNSILDNAVKGCVPLNAIPPLT
SARS_CoV         QAMTQMYKQARSEDKRAKVTSAMQTMLFTMLRKLDNDALNNIINNARDGCVPLNIIPLTT
Human_CoV        QAAAAMYKEARAVNRKSKVVSAMHSLLFGMLRRLDMSSVDTILNMARNGVVPLSVIPATS
Porcine_epidemi  QAAAQMYKEARAVNRKSKVVSAMHSLLFGMLRRLDMSSVDTILNLAKDGVVPLSVIPAVS
Porcine_transmi  QAAASMYKEARAVDRKSKIVSAMHSLLFGMLKKLDMSSVNTIIDQARNGVLPLSIIPAAS
Feline_infectio  ------------------------------------------------------------
consensus        -altnmykear--dkkskvvsalqtmlfsmvrkldn-alnsildna--gcvpln-ip-lt

Bovine_respirat  ANTLTIIVPDKSVYDQVVDNVYVTYAGNVWQIQTIQDSDGTNKQLNEISDDCN----WPL
Bovine_enteric_  ANTLTIIVPDKSVYDQVVDNVYVTYAGNVWQIQTIQDSDGTNKQLNEISDDCN----WPL
Bovine_CoV       ANTLTIIVPDKSVYDQVVDNVYVTYAGNVWQIQTIQDSDGTNKQLHEISDDCN----WPL
Murine_HepV      SNTLTIIVPDKQVFDQVVDNVYVTYAPNVWHIQSIQDADGAVKQLNEIDVNST----WPL
SARS_CoV         AAKLMVVVPDYGTYKNTCDGNTFTYASALWEIQQVVDADSKIVQLSEINMDNSPNLAWPL
Human_CoV        AARLVVVVPDHDSFVKMMVDGFVHYAGVVWTLQEVKDNDGKNVHLKDVTKENQEILVWPL
Porcine_epidemi  ATKLNIVTSDIDSYNRIQREGCVHYAGTIWNIIDIKDNDGKVVHVKEVTAQNAESLSWPL
Porcine_transmi  ATRLVVITPSLEVFSKIRQENNVHYAGAIWTIVEVKDANGSHVHLKEVTAANELNLTWPL
Feline_infectio  ------------------------------------------------------------
consensus        a--l-iivpd--vy-qvvd--yvtyag-vw-iq-i-d-dg---ql-eis-d------wpl
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Bovine_respirat  VIIANRHNEVSATVLQNNELMPAKLKTQVVNSGPDQTCNTPT--QCYYNNSNNGKIVYAI
Bovine_enteric_  VIIANRHNEVSATVLQNNELMPAKLKTQVVNSGPDQTCNTPT--QCYYNNSNNGKIVYAI
Bovine_CoV       VIIANRHNEVSATVLQNNELMPAKLKTQVVNSGPDQTCNTPT--QCYYNNSYNGKIVYAI
Murine_HepV      VISANRHNEVSTVVLQNNELMPQKLRTQVVNSGSDMNCNIPT--QCYYNTTGTGKIVYAI
SARS_CoV         IVTALRAN--SAVKLQNNELSPVALRQMSCAAGTTQTACTDDNALAYYNNSKGGRFVLAL
Human_CoV        ILTCER-----VVKLQNNEIMPGKMKVKATKGEG--DGGITSEGNALYNNEGGRAFMYAY
Porcine_epidemi  VLGCER-----IVKLQNNEIIPGKLKQRSIKAEG--DG-IVGEGKALYNNEGGRTFMYAF
Porcine_transmi  SITCER-----TTKLQNNEIMPGKLKERAVRASATLDGEAFGSGKALMASESGKSFMYAF
Feline_infectio  ------------------------------------------------------------
consensus        vi-a-r-n--s---lqnnelmpaklk---v--g--------t--q-yynns--gk-vyai

Bovine_respirat  LSDVDGLKYTKILKDDGN-FVVLELDPPCKFTVQDVKGLKIKYLYFVKGCNTLARGWVVG
Bovine_enteric_  LSDVDGLKYTKILKDDGN-FVVLELDPPCKFTVQDVKGLKIKYLYFVKGCNTLARGWVVG
Bovine_CoV       LSDVDGLKYTKILKDDGN-FVVLELDPPCKFTVQDVKGLKIKYLYFVKGCNTLARGWVVG
Murine_HepV      LSDCDGLKYTKIVKEDGN-CVVLELDPPCKFSVQDVKGLKIKYLYFVKGCNTLARGWVVG
SARS_CoV         LSDHQDLKWARFPKSDGTGTIYTELEPPCRFVTDTPKGPKVKYLYFIKGLNNLNRGMVLG
Human_CoV        VTTKPGMKYVKWEHDSG--VVTVELEPPCRFVIDTPTGPQIKYLYFVKNLNNLRRGAVLG
Porcine_epidemi  ISDKPDLRVVKWEFDGG--CNTIELEPPRKFLVDSPNGAQIKYLYFVRNLNTLRRGAVLG
Porcine_transmi  IASDNNLKYVKWESNND--IIPIELEAPLRFYVDGANGPEVKYLYFVKNLNTLRRGAVLG
Feline_infectio  ------------------------------------------------------------
consensus        lsd--glky-k--kddg---v-leldppckf-v---kg-kikylyfvkg-ntl-rg-vvg

Bovine_respirat  TISSTVRLQAGTATEYASNSSILSLCAFSVDPKKTYLDFIQQGGTPIANCVKMLCDHAGT
Bovine_enteric_  TISSTVRLQAGTATEYASNSSILSLCAFSVDPKKTYLDFIQQGGTPIANCVKMLCDHAGT
Bovine_CoV       TISSTVRLQAGTATEYASNSSILSLCAFSVDPKKTYLDFIQQGGTPIANCVKMLCDHAGT
Murine_HepV      TLSSTVRLQAGTATEYASNSAILSLCAFSVDPKKTYLDYIQQGGVPVTNCVKMLCDHAGT
SARS_CoV         SLAATVRLQAGNATEVPANSTVLSFCAFAVDPAKAYKDYLASGGQPITNCVKMLCTHTGT
Human_CoV        YIGATVRLQAGKQTEFVSNSHLLTHCSFAVDPAAAYLDAVKQGAKPVGNCVKMLTNGSGS
Porcine_epidemi  YIGATVRLQAGKQTEQAINSSLLTLCAFAVDPAKTYIDAVKSGHKPVGNCVKMLANGSGN
Porcine_transmi  YIGATVRLQAGKPTEHPSNSSLLTLCAFSPDPAKAYVDAVKRGMQPVNNCVKMLSNGAGN
Feline_infectio  ------------------------------------------------------------
consensus        ti--tvrlqag-ateyasnssilslcafsvdp-ktyldfi-qgg-piancvkmlc-hagt

Bovine_respirat  GMAITVKPDATTNQDSYGGASVCIYCRARVEHPDVDGLCKLRGKFVQVP-VGIKDPVSYV
Bovine_enteric_  GMAITVKPDATTNQDSYGGASVCIYCRARVEHPDVDGLCKLRGKFVQVP-VGIKDPVSYV
Bovine_CoV       GMAITVKPDATTSQDSYGGASVCIYCRARVEHPDVDGLCKLRGKFVQVP-VGIKDPVSYV
Murine_HepV      GMAITIKPEATTNQDSYGGASVCIYCRSRVEHPDVDGLCKLRGKFVQVP-LGIKDPVSYV
SARS_CoV         GQAITVTPEANMDQESFGGASCCLYCRCHIDHPNPKGFCDLKGKYVQIPTTCANDPVGFT
Human_CoV        GQAITCTIDSNTTQDTYGGASVCIYCRAHVAHPTMDGFCQYKGKWVQVP-IGTNDPIRFC
Porcine_epidemi  GQAVTNGVEASTNQDSYGGASVCLYCRAHVEHPSMDGFCRLKGKYVQVP-LGTVDPIRFV
Porcine_transmi  GMAVTNGVEANTQQDSYGGASVCIYCRCHVEHPAIDGLCRYKGKFVQIP-TGTQDPIRFC
Feline_infectio  ------------------------------------------------------------
consensus        gmaitv-pdattnqdsyggasvciycra-vehp-vdglcklrgkfvqvp-vg--dpv-yv

Bovine_respirat  LTHDVCQVCGFWRDGSCSCVST-DTTVQSKDTN--FLNRVRGTSVDARLVPCASGLSTDV
Bovine_enteric_  LTHDVCQVCGFWRDGSCSCVST-DTTVQSKDTN--FLNRVRGTSVDARLVPCASGLSTDV
Bovine_CoV       LTHDVCQVCGFWRDGSCSCVST-DTTVQSKDTN--FLNRVRGTSVDARLVPCASGLSTDV
Murine_HepV      LTHDVCQVCGFWRDGSCSCVGT-GSQFQSKDTN--FLNRVRGTSVNARLVPCASGLDTDV
SARS_CoV         LRNTVCTVCGMWKGYGCSCDQLREPLMQSADAST-FLNRVCGVSA-ARLTPCGTGTSTDV
Human_CoV        LENTVCKVCGCWLNHGCTCDRT---AIQS--FDNSYLNRVRGSSA-ARLEPCN-GTDIDY
Porcine_epidemi  LENDVCKVCGCWLSNGCTCDRS---IMQS--TDMAYLNRVRGSSA-ARLEPCN-GTDTQH
Porcine_transmi  IENEVCVVCGCWLNNGCMCDRT---SMQSFTVDQSYLNRVRGSSA-ARLEPCN-GTDPDH
Feline_infectio  ------------------------------------------------------------
consensus        l--dvc-vcg-wr---csc--t----vqs-dt---flnrvrgts--arl-pcasg--tdv

Bovine_respirat  QLRAFDICNASVAGIGLHLKVNCCRFQRVDENGDKLDQFFVVKRTDLTIYNREMECYERV
Bovine_enteric_  QLRAFDICNASVAGIGLHLKVNCCRFQRVDENGDKLDQFFVVKRTDLTIYNREMECYERV
Bovine_CoV       QLRAFDICNASVAGIGLHLKVNCCRFQRVDENGDKLDQFFVVKRTDLTIYNREMECYERV
Murine_HepV      QLRAFDICNANRAGIGLYYKVNCFRFQRVDEEGNKLDKFFVVKRTNLEVYNKEKECYELT
SARS_CoV         VYRAFDIYNEKVAGFAKFLKTNCCRFQEKDEEGNLLDSYFVVKRHTMSNYQHEETIYNLV
Human_CoV        CVRAFDVYNKDASFIGKNLKSNCVRFKNVDKD----DAFYIVKRCIKSVMDHEQSMYNLL
Porcine_epidemi  VYRAFDIYNKDVACLGKFLKVNCVRLKNLDKH----DAFYVVKRCTKSAMEHEQSIYSRL
Porcine_transmi  VSRAFDIYNKDVACIGKFLKTNCSRFRNLDKH----DAYYIVKRCTKTVMDHEQVCYNDL
Feline_infectio  ------------------------------------------------------------
consensus        -lrafdi-n--vagig--lkvnc-rfq-vde-g--ld-ffvvkr--ltiyn-e--cy--v
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Bovine_respirat  KDCKFVAEHDFFTFDVEGSRVPHIVRKDLTKYTMLDLCYALRHFDRNDCMLLCDILSIYA
Bovine_enteric_  KDCKFVAEHDFFTFDVEGSRVPHIVRKDLTKYTMLDLCYALRHFDRNDCMLLCDILSIYA
Bovine_CoV       KDCKFVAEHDFFTFDVEGSRVPHIVRKDLTKYTMLDLCYALRHFDRNDCMLLCDILSIYA
Murine_HepV      KDCGVVAEHEFFTFDVEGSRVPHIVRKDLSKFTMLDLCYALRHFDRNDCSTLKEILLTYA
SARS_CoV         KDCPAVAVHDFFKFRVDGDMVPHISRQRLTKYTMADLVYALRHFDEGNCDTLKEILVTYN
Human_CoV        KGCNAVAKHDFFTWHEGRTIYGNVSRQDLTKYTMMDLCFALRNFDEKDCEVFKEILVLTG
Porcine_epidemi  EKCGAIAEHDFFTWKDGRAIYGNVCRKDLTEYTMMDLCYALRNFDENNCDVLKSILIKVG
Porcine_transmi  KDSGAVAEHDFFTYKEGRCEFGNVARRNLTKYTMMDLCYAIRNFDEKNCEVLKEILVTVG
Feline_infectio  ------------------------------------------------------------
consensus        kdc--vaehdfftf-vegs-vphi-rkdltkytmldlcyalrhfd-ndc-llkdill-ya

Bovine_respirat  GCEQSYFTKKDWYDFVENPDIINVYKKLGPIFNRALVSATEFADKLVEVGLVGILTLDNQ
Bovine_enteric_  GCEQSYFTKKDWYDFVENPDIINVYKKLGPIFNRALVSATEFADKLVEVGLVGILTLDNQ
Bovine_CoV       GCEQSYFTKKDWYDFVENPDIINVYKKLGPIFNRALVSATEFADKLVEVGLVGILTLDNQ
Murine_HepV      ECDESYFQKKDWYDFVENPDIINVYKKLGPIFNRALLNTANFADTLVEAGLVGVLTLDNQ
SARS_CoV         CCDDDYFNKKDWYDFVENPDILRVYANLGERVRQSLLKTVQFCDAMRDAGIVGVLTLDNQ
Human_CoV        CCSTDYFEMKNWFDPIENEDIHRVYAALGKVVANAMLKCVAFCDEMVLKGVVGVLTLDNQ
Porcine_epidemi  ACEESYFNNKVWFDPVENEDIHRVYALLGTIVARAMLKCVKFCDAMVEQGIVGVVTLDNQ
Porcine_transmi  ACTEEFFENKDWFDPVENEAIHEVYAKLGPIVANAMLKCVAFCDAIVEKGYIGVITLDNQ
Feline_infectio  ------------------------------------------------------------
consensus        gce-syf-kkdwydfvenpdii-vy-klgpi--rall----f-d-lve-glvgvltldnq

Bovine_respirat  DLNGKWYDFGDYVIAAPGCGVAIADSYYSYMMPMLTMCHALDCELYVNN-----AYRLFD
Bovine_enteric_  DLNGKWYDFGDYVIAAPGCGVAIADSYYSYMMPMLTMCHALDCELYVNN-----AYRLFD
Bovine_CoV       DLNGKWYDFGDYVIAAPGCGVAIADSYYSYMMPMLTMCHALDCELYVNN-----AYRLFD
Murine_HepV      DLYGQWYDFGDFVKTVPCCGVAVADSYYSYMMPMLTMCHALDSELFVNG-----TYREFD
SARS_CoV         DLNGNWYDFGDFVQVAPGCGVPIVDSYYSLLMPILTLTRALAAESHMDADLA-KPLIKWD
Human_CoV        DLNGNFYDFGDFVLCPPGMGIPYCTSYYSYMMPVMGMTNCLASECFMKSDIFGQDFKTFD
Porcine_epidemi  DLNGDFYDFGDFTCSIKGMGVPICTSYYSYMMPVMGMTNCLASECFVKSDIFGEDFKSYD
Porcine_transmi  DLNGNFYDFGDFVKTAPGFGCACVTSYYSYMMPLMGMTSCLESENFVKSDIYGSDYKQYD
Feline_infectio  ------------------------------------------------------------
consensus        dlng-wydfgdfv--apgcgvai-dsyysymmpmltm--ald-e-yv--------yr-fd

Bovine_respirat  LVQYDFTDYKLELFNKYFKHWSMPYHPNTVDCQDDRCIIHCANFNILFSMVLPNTCFGPL
Bovine_enteric_  LVQYDFTDYKLELFNKYFKHWSMPYHPNTVDCQDDRCIIHCANFNILFSMVLPNTCFGPL
Bovine_CoV       LVQYDFTDYKLELFNKYFKHWSMPYHPNTVDCQDDRCIIHCANFNILFSMVLPNTCFGPL
Murine_HepV      LVQYDFTDFKLELFNKYFKHWSMTYHPNTSECEDDRCIIHCANFNILFSMVLPKTCFGPL
SARS_CoV         LLKYDFTEERLCLFDRYFKYWDQTYHPNCINCLDDRCILHCANFNVLFSTVFPPTSFGPL
Human_CoV        LLKYDFTEHKEVLFNKYFKYWGQDYHPDCVDCHDEMCILHCSNFNTLFATTIPNTAFGPL
Porcine_epidemi  LLEYDFTEHKTALFNKYFKYWGLQYHPNCVDCSDEQCIVHCANFNTLFSTTIPITAFGPL
Porcine_transmi  LLAYDFTEHKEYLFQKYFKYWDRTYHPNCSDCTSDECIIHCANFNTLFSMTIPMTAFGPL
Feline_infectio  ------------------------------------------------------------
consensus        lv-ydftd-kl-lfnkyfk-w-m-yhpn-vdc-ddrciihcanfnilfsmvlp-t-fgpl

Bovine_respirat  VRQIFVDGVPFVVSIGYHYKELGIVMNMDVDTHRYRLSLKDLLLYAADPALHVASASALY
Bovine_enteric_  VRQIFVDGVPFVVSIGYHYKELGIVMNMDVDTHRYRLSLKDLLLYAADPALHVASASALY
Bovine_CoV       VRQIFVDGVPFVVSIGYHYKELGIVMNMDVDTHRYRLSLKDLLLYAADPALHVASASALY
Murine_HepV      VRQIFVDGVPFVVSIGYHYKELGVVMNMDVDTHRYRLSLKDLLLYAADPALHVASASALL
SARS_CoV         VRKIFVDGVPFVVSTGYHFRELGVVHNQDVNLHSSRLSFKELLVYAADPAMHAASGNLLL
Human_CoV        CRKVFIDGVPVVATAGYHFKQLGLVWNKDVNTHSTRLTITELLQFVTDPTLIVASSPALV
Porcine_epidemi  CRKCWIDGVPLVTTAGYHFKQLGIVWNNDLNLHSSRLSINELLQFCSDPALLIASSPALV
Porcine_transmi  VRKVHIDGVPVVVTAGYHFKQLGIVWNLDVKLDTMKLSMTDLLRFVTDPTLLVASSPALL
Feline_infectio  ------------------------------------------------------------
consensus        vr-ifvdgvpfvvs-gyhykelgiv-nmdv-th--rlslkdlllyaadpalhvasa-all

Bovine_respirat  DLRTCCFSVAAITSGVKFQTVKPGNFNQDFYDFILSKGLLKEGSSVDLKHFFFTQDGNAA
Bovine_enteric_  DLRTCCFSVAAITSGVKFQTVKPGNFNQDFYDFILSKGLLKEGSSVDLKHFFFTQDGNAA
Bovine_CoV       DLRTCCFSVAAITSGVKFQTVKPGNFNQDFYDFILSKGLLKEGSSVDLKHFFFTQDGNAA
Murine_HepV      DLRTCCFSVAAITSGVKFQTVKPGNFNQDFYEFILSKGLLKEGSSVDLKHFFFTQDGNAA
SARS_CoV         DKRTTCFSVAALTNNVAFQTVKPGNFNKDFYDFAVSKGFFKEGSSVELKHFFFAQDGNAA
Human_CoV        DKRTVCFSVAALSTGLTSQTVKPGHFNKEFYDFLRSQGFFDEGSELTLKHFFFTQKGDAA
Porcine_epidemi  DQRTVCFSVAALGTGMTNQTVKPGHFNKEFYDFLLEQGFFSEGSELTLKHFFFAQKVDAA
Porcine_transmi  DQRTVCFSIAALSTGITYQTVKPGHFNKDFYDFITERGFFEEGSELTLKHFFFAQGGEAA
Feline_infectio  ------------------------------------------------------------
consensus        d-rt-cfsvaaitsgv-fqtvkpgnfn-dfydfilskg--kegssvdlkhffftqdgnaa
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Bovine_respirat ITDYNYYKYNLPTMVDIKQLLFVLEVVYKYFEIYDGGCIPASQVIVNNYDKSAGYPFNKF
Bovine_enteric_ ITDYNYYKYNLPTMVDIKQLLFVLEVVYKYFEIYDGGCIPASQVIVNNYDKSAGYPFNKF
Bovine_CoV      ITDYNYYKYNLPTMVDIKQLLFVLEVVYKYFEIYDGGCIPAAQVIVNNYDKSAGYPFNKF
Murine_HepV     ITDYNYYKYNLPTMVDIKQLLFVVEVVNKYFEIYEGGCIPATQVIVNNYDKSAGYPFNKF
SARS_CoV        ISDYDYYRYNLPTMCDIRQLLFVVEVVDKYFDCYDGGCINANQVIVNNLDKSAGFPFNKW
Human_CoV       IKDFDYYRYNRPTMLDIGQARVAYQVAARYFDCYEGGCITSREVVVTNLNKSAGWPLNKF
Porcine_epidemi VKDFDYYRYNRPTVLDICQARVVYQIVQRYFDIYEGGCITAKEVVVTNLNKSAGYPLNKF
Porcine_transmi MTDFNYYRYNRVTVLDICQAQFVYKIVGKYFECYDGGCINAREVVVTNYDKSAGYPLNKF
Feline_infectio ------------------------------------------------------------
consensus       itdynyykynlptmvdikqllfvlevv-kyfeiydggci-a-qvivnnydksagypfnkf

Bovine_respirat GKARLYYEALSFEEQDEIYAYTKRNVLPTLTQMNLKYAISAKNRARTVAGVSILSTMTGR
Bovine_enteric_ GKARLYYEALSFEEQDEIYAYTKRNVLPTLTQMNLKYAISAKNRARTVAGVSILSTMTGR
Bovine_CoV      GKARLYYEALSFEEQDEIYAYTKRNVLPTLTQMNLKYAISAKNRARTVAGVSILSTMTGR
Murine_HepV     GKARLYYEALSFEEQDEIYAYTKRNVLPTLTQMNLKYAISAKNRARTVAGVSILSTMTGR
SARS_CoV        GKARLYYDSMSYEDQDALFAYTKRNVIPTITQMNLKYAISAKNRARTVAGVSICSTMTNR
Human_CoV       GKAGLYYESISYEEQDAIFSLTKRNILPTMTQLNLKYAISGKERARTVGGVSLLATMTTR
Porcine_epidemi GKAGLYYESLSYEEQDELYAYTKRNILPTMTQLNLKYAISGKERARTVGGVSLLSTMTTR
Porcine_transmi GKARLYYETLSYEEQDALFALTKRNVLPTMTQMNLKYAISGKARARTVGGVSLLSTMTTR
Feline_infectio ------------------------------------------------------------
consensus       gkarlyye-lsfeeqdeiyaytkrnvlptltqmnlkyaisaknrartvagvsilstmt-r

Bovine_respirat MFHQKCLKSIAATRGVPVVIGTTKFYGGWDDMLRRLIKDVDNPVLMGWDYPKCDRAMPNI
Bovine_enteric_ MFHQKCLKSIAATRGVPVVIGTTKFYGGWDDMLRRLIKDVDNPVLMGWDYPKCDRAMPNI
Bovine_CoV      MFHQKCLKSIAATRGVPVVIGTTKFYGGWDDMLRRLIKDVDNPVLMGWDYPKCDRAMPNI
Murine_HepV     MFHQKCLKSIAATRGVPVVIGTTKFYGGWDDMLRRLIKDVDSPVLMGWDYPKCDRAMPNI
SARS_CoV        QFHQKLLKSIAATRGATVVIGTSKFYGGWHNMLKTVYSDVETPHLMGWDYPKCDRAMPNM
Human_CoV       QFHQKCLKSIVATRNATVVIGTTKFYGGWDNMLKNLMADVDDPKLMGWDYPKCDRAMPSM
Porcine_epidemi QYHQKHLKSIVNTRGASVVIGTTKFYGGWDNMLKNLIDGVENPCLMGWDYPKCDRALPNM
Porcine_transmi QYHQKHLKSIAATRNATVVIGSTKFYGGWDNMLKNLMRDVDNGCLMGWDYPKCDRALPNM
Feline_infectio ------------------------------------------------------------
consensus       -fhqkclksiaatrg--vvigttkfyggwd-mlr-likdvdnp-lmgwdypkcdrampni

Bovine_respirat LRIVSSLVLARKHEACCSQSDRFYRLANECAQVLSEIVMCGGCYYVKPGGTSSGDATTAF
Bovine_enteric_ LRIVSSLVLARKHEACCSQSDRFYRLANECAQVLSEIVMCGGCYYVKPGGTSSGDATTAF
Bovine_CoV      LRIVSSLVLARKHEACCSQSDRFYRLANECAQVLSEIVMCGGCYYVKPGGTSSGDATTAF
Murine_HepV     LRIVSSLVLARKHDSCCSHTDRFYRLANECAQVLGEIVMCGGCYYVKPGGTSSGDATTAF
SARS_CoV        LRIMASLVLARKHNTCCNLSHRFYRLANECAQVLSEMVMCGGSLYVKPGGTSSGDATTAY
Human_CoV       IRMLSAMILGSKHVTCCTASDKFYRLSNELAQVLTEVVYSNGGFYFKPGGTTSGDATTAY
Porcine_epidemi IRMISAMILGSKHTTCCSSTDRFFRLCNELAQVLTEVVYSNGGFYLKPGGTTSGDATTAY
Porcine_transmi IRMASAMILGSKHVGCCTHNDRFYRLSNELAQVLTEVVHCTGGFYFKPGGTTSGDGTTAY
Feline_infectio ------------------------------------------------------------
consensus       lrivsslvlarkh--ccs-sdrfyrlanecaqvlseivmcgg-yyvkpggtssgdattaf

Bovine_respirat ANSVFNICQAVSANVCALMSCNGNKIEDLSIRALQKRLYSHVYRSDMVDSTFVTEYYEFL
Bovine_enteric_ ANSVFNICQAVSANVCALMSCNGNKIEDLSIRALQKRLYSHVYRSDMVDSTFVTEYYEFL
Bovine_CoV      ANSVFNICQAVSANVCALMSCNGNKIEDLSIRALQKRLYSHVYRSDMVDSTFVTEYYEFL
Murine_HepV     ANSVFNICQAVSANVCSLMACNGHKIEDLSIRELQKRLYSNVYRADHVDPAFVSEYYEFL
SARS_CoV        ANSVFNICQAVTANVNALLSTDGNKIADKYVRNLQHRLYECLYRNRDVDHEFVDEFYAYL
Human_CoV       ANSVFNIFQAVSSNINCVLSVNSSNCNNFNVKKLQRQLYDNCYRNSNVDESFVDDFYGYL
Porcine_epidemi ANSVFNIFQAVSANVNKLLSVDSNVCHNLEVKQLQRKLYECCYRSTIVDDQFVVEYYGYL
Porcine_transmi ANSAFNIFQAVSANVNKLLGVDSNACNNVTVKSIQRKIYDNCYRSSSIDEEFVVEYFSYL
Feline_infectio ------------------------------------------------------------
consensus       ansvfnicqavsanv--lms-ngnki-dlsir-lqkrly--vyrs--vd--fv-eyy-fl

Bovine_respirat NKHFSMMILSDDGVVCYNSDYASKGYIANISAFQQVLYYQNNVFMSESKCWVENDINNGP
Bovine_enteric_ NKHFSMMILSDDGVVCYNSDYASKGYIANISAFQQVLYYQNNVFMSESKCWVENDINNGP
Bovine_CoV      NKHFSMMILSDDGVVCYNSDYASKGYIANISAFQQVLYYQNNVFMSESKCWVENDINNGP
Murine_HepV     NKHFSMIILSDDGVVCYNSEFASKGYIANISDFQQVLYYQNNVFMSEAKCWVETDIEKGP
SARS_CoV        RKHFSMMILSDDAVVCYNSNYAAQGLVASIKNFKAVLYYQNNVFMSEAKCWTETDLTKGP
Human_CoV       QKHFSMMILSDDSVVCYNKTYAGLGYIADISAFKATLYYQNGVFMSTAKCWTEEDLSIGP
Porcine_epidemi RKHFSMMILSDDGVVCYNNDYASLGYVADLNAFKAVLYYQNNVFMSASKCWIEPDINKGP
Porcine_transmi RKHFSMMILSDDGVVCYNKDYADLGYVADINAFKATLYYQNNVFMSTSKCWVEPDLSVGP
Feline_infectio ------------------------------------------------------------
consensus       nkhfsmmilsddgvvcynsdyas-gyia-isaf--vlyyqnnvfmseskcwve-di--gp
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Bovine_respirat HEFCSQHTMLVKMDGDDVYLPYPDPSRILGAGCFVDDLLKTDSVLLIERFVSLAIDAYPL
Bovine_enteric_ HEFCSQHTMLVKMDGDDVYLPYPDPSRILGAGCFVDDLLKTDSVLLIERFVSLAIDAYPL
Bovine_CoV      HEFCSQHTMLVKMDGDDVYLPYPVPSRILGAGCFVDDLLKTDSVLLIERFVSLAIDAYPL
Murine_HepV     HEFCSQHTMLVKMDGDEVYLPYPDPSRILGAGCFVDDLLKTDSVLLIERFVSLAIDAYPL
SARS_CoV        HEFCSQHTMLVKQGDDYVYLPYPDPSRILGAGCFVDDIVKTDGTLMIERFVSLAIDAYPL
Human_CoV       HEFCSQHTMQIVDENGKYYLPYPDPSRIISAGVFVDDITKTDAVILLERYVSLAIDAYPL
Porcine_epidemi HEFCSQHTMQIVDKEGTYYLPYPDPSRILSAGVFVDDVVKTDAVVLLERYVSLAIDAYPL
Porcine_transmi HEFCSQHTLQIVGPDGDYYLPYPDPSRILSAGVFVDDIVKTDNVIMLERYVSLAIDAYPL
Feline_infectio ------------------------------------------------------------
consensus       hefcsqhtmlvk-d-ddvylpypdpsrilgagcfvddllktd-vllierfvslaidaypl

Bovine_respirat VYHENEEYQKVFRVYLEYIKKLYNDLGNQILDSYSVILSTCDGQKFTDESFYKNMYLRSA
Bovine_enteric_ VYHENEEYQKVFRVYLEYIKKLYNDLGNQILDSYSVILSTCDGQKFTDESFYKNMYLRSA
Bovine_CoV      VYHENEEYQKVFRVYLEYIKKLYNELGNQILDSYSVILSTCDGQKFTDESFYKNMYLRSA
Murine_HepV     VYHENPEYQNVFRVYLEYIKKLYNDLGNQILDSISVILSTCDGQKFTDETFYKNMYLRSA
SARS_CoV        TKHPNQEYADVFHLYLQYIRKLHDELTGHMLDMYSVMLTNDNTSRYWEPEFYEAMYTPHT
Human_CoV       SKHPKPEYRKVFYALLDWVKHLNKTLNEGVLESFSVTLLDEHESKFWDESFYASMYEKST
Porcine_epidemi SKHENPEYKKVFYVLLDWVKHLYKTLNAGVLESFSVTLLEDSTAKFWDESFYANMYEKSA
Porcine_transmi TKHPKPAYQKVFYTLLDWVKHLQKNLNAGVLDSFSVTMLEEGQDKFWSEEFYASLYEKST
Feline_infectio ------------------------------------------------------------
consensus       --hen-eyqkvf-vyleyikkly-dl---ildsysvils-----kf-desfy-nmy-rsa

Bovine_respirat VMQSVGACVVCSSQTSLRCGSCIRKPLLCCKCCYDHVMATDHKYVLSVSPYVCNAPGCDV
Bovine_enteric_ VMQSVGACVVCSSQTSLRCGSCIRKPLLCCKCCYDHVMATDHKYVLSVSPYVCNAPGCDV
Bovine_CoV      VMQSVGACVVCSSQTSLRCGSCIRKPLLCCKCCYDHVMATDHKYVLSVSPYVCNAPGCDV
Murine_HepV     VMQSVGACVVCSSQTSLRCGSCIRKPLLCCKCAYDHVMSTDHKYVLSVSPYVCNSPGCDV
SARS_CoV        VLQAVGACVLCNSQTSLRCGACIRRPFLCCKCCYDHVISTSHKLVLSVNPYVCNAPGCDV
Human_CoV       VLQAAGLCVVCGSQTVLRCGDCLRRPMLCTKCAYDHVFGTDHKFILAITPYVCNTSGCNV
Porcine_epidemi VLQSAGLCVVCGSQTVLRCGDCLRRPMLCTKCAYDHVIGTTHKFILAITPYVCCASDCGV
Porcine_transmi VLQAAGMCVVCGSQTVLRCGDCLRRPLLCTKCAYDHVMGTKHKFIMSITPYVCSFNGCNV
Feline_infectio ------------------------------------------------------------
consensus       vmqsvgacvvc-sqtslrcg-cirkpllcckc-ydhvmatdhkyvlsvspyvcnapgcdv

Bovine_respirat NDVTKLYLGGMSYYCEDHKPQYSFKLVMNGMVFGLYKQSCTGSPYIDDFNRIASCKWTDV
Bovine_enteric_ NDVTKLYLGGMSYYCEDHKPQYSFKLVMNGMVFGLYKQSCTGSPYIDDFNRIASCKWTDV
Bovine_CoV      NDVTKLYLGGMSYYCEDHKPQYSFKLVMNGMVFGLYKQSCTGSPYIDDFNRIASCKWTDV
Murine_HepV     NDVTKLYLGGMSYYCEAHKPQYSFKLVMNGMVFGLYKQSCTGSPYIEDFNKIASCKWTEV
SARS_CoV        TDVTQLYLGGMSYYCKSHKPPISFPLCANGQVFGLYKNTCVGSDNVTDFNAIATCDWTNA
Human_CoV       NDVTKLYLGGLNYYCVDHKPHLSFPLCSAGNVFGLYKSSALGSMDIDVFNKLSTSDWSDI
Porcine_epidemi NDVTKLYLGGLSYWCHEHKPRLAFPLCSAGNVFGLYKNSATGSPDVEDFNRIATSDWTDV
Porcine_transmi NDVTKLFLGGLSYYCMNHKPQLSFPLCANGNVFGLYKSSAVGSEAVEDFNKLAVSDWTNV
Feline_infectio ------------------------------------------------------------
consensus       ndvtklylggmsyyc-dhkpq-sf-l--ng-vfglykqsctgsp-iddfnriasc-wtdv

Bovine_respirat DDYILANECTERLKLFAAETQKATEEAFKQSYASATIQEIVSERELILSWEIGKVKPPLN
Bovine_enteric_ DDYILANECTERLKLFAAETQKATEEAFKQSYASATIQEIVSERELILSWEIGKVKPPLN
Bovine_CoV      DDYILANECTERLKLFAAETQKATEEAFKQSYASATIQEIVSERELILSWEIGKVKPPLN
Murine_HepV     DDYVLANECTERLKLFAAETQKATEEAFKQCYASATIREIVSDRELILSWEIGKVRPPLN
SARS_CoV        GDYILANTCTERLKLFAAETLKATEETFKLSYGIATVREVLSDRELHLSWEVGKPRPPLN
Human_CoV       RDYKLANDAKESLRLFAAETVKAKEESVKSSYAYATLKEIVGPKELLLLWESGKAKPPLN
Porcine_epidemi SDYRLANDVKDSLRLFAAETIKAKEESVKSSYACATLHEVVGPKELLLKWEVGRPKPPLN
Porcine_transmi EDYKLANNVKESLKIFAAETVKAKEESVKSEYAYAVLKEVIGPKEIVLQWEASKTKPPLN
Feline_infectio ------------------------------------------------------------
consensus       ddyilanecterlklfaaet-katee-fk-sya-ati-eivserelilsweigk-kppln

Bovine_respirat KNYVFTGYHFTKNGKTVLGEYVFDKSELTN-GVYYRATTTYKLSVGDVFVLTSHSVANLS
Bovine_enteric_ KNYVFTGYHFTKNGKTVLGEYVFDKSELTN-GVYYRATTTYKLSVGDVFVLTSHSVANLS
Bovine_CoV      KNYVFTGYHFTKNGKTVLGEYVFDKSELTN-GVYYRATTTYKLSVGDVFVLTSHSVANLS
Murine_HepV     KNYVFTGYHFTNNGKTVLGEYVFDKSELTN-GVYYRATTTYKLSVGDVFILTSHAVSSLS
SARS_CoV        RNYVFTGYRVTKNSKVQIGEYTFEKGDYGD-AVVYRGTTTYKLNVGDYFVLTSHTVMPLS
Human_CoV       RNSVFTCFQITKDSKFQVGEFVFEKVDYGSDTVTYKSTATTKLVPGMLFILTSHNVAPLR
Porcine_epidemi RNSVFTCYHITKNTKFQIGEFVFEKAEYDNDAVTYKTTATTKLVPGMVFVLTSHNVQPLR
Porcine_transmi RNSVFTCFQISKDTKIQLGEFVFEQSEYGSDSVYYKSTSTYKLTPGMIFVLTSHNVSPLK
Feline_infectio ------------------------------------------------------------
consensus       knyvftgyh-tkn-k--lgeyvfdkse--n-gvyyratttyklsvgdvfvltsh-v--ls
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Bovine_respirat  APTLVPQENYSSIR-FASVYSVLETFQNNVVNYQHIGMKRYCTVQGPPGTGKSHLAIGLA
Bovine_enteric_  APTLVPQENYSSIR-FASVYSVLETFQNNVVNYQHIGMKRYCTVQGPPGTGKSHLAIGLA
Bovine_CoV       APTLVPQENYSSIR-FASVYSVLETFQNNVVNYQHIGMKRYCTVQGPPGTGKSHLAIGLA
Murine_HepV      APTLVPQENYTSVR-FASAYSVPETFQNNVPNYQHIGIKRYCTVQGPPGTGKSHLAIGHA
SARS_CoV         APTLVPQEHYVRITGLYPTLNISDEFSSNVANYQKVGMQKYSTLQGPPGTGKSHFAIGLA
Human_CoV        APTMANQEKYSTIYKLHPSFNVSDAYANLVPYYQLIGKQRITTIQGPPGSGKSHCSIGIG
Porcine_epidemi  APTIANQERYSTIHKLHPAFNIPEAYSSLVPYYQLIGKQKITTIQGPPGSGKSHCVIGLG
Porcine_transmi  APILVNQEKYNTISKLYPVFNIAEAYNTLVPYYQMIGKQKFTTIQGPPGSGKSHCVIGLG
Feline_infectio  ------------------------------------------------------------
consensus        aptlvpqe-yssi------y-v-e-fqnnv-nyq-igm-ry-tvqgppgtgksh-aigla

Bovine_respirat  VYYCTARVVYTAASHAAVDALCEKAYKFLNINDCTRIVPAKVRVECYDKFKINDTTRKYV
Bovine_enteric_  VYYCTARVVYTAASHAAVDALCEKAYKFLNINDCTRIVPAKVRVECYDKFKINDTTRKYV
Bovine_CoV       VYYCTARVVYTAASHAAVDALCEKAYKFLNINDCTRIVPAKVRVECYDKFKINDTTRKYV
Murine_HepV      VYYCTARVVYTAASHAAVDALCEKAHKFLNINDCARIVPAKLRVDCYDKFNVNDTTRKYV
SARS_CoV         LYYPSARIVYTACSHAAVDALCEKALKYLPIDKCSRIIPARARVECFDKFKVNSTLEQYV
Human_CoV        VYYPGARIVFTACSHAAVDSLCAKAVTAYSVDKCTRIIPARARVECYSGFKPNNNSAQYV
Porcine_epidemi  LYYPGARIVFTACSHAAVDSLCVKASTAYSNDKCSRIIPQRARVECYDGFKSNNTSAQYL
Porcine_transmi  LYYPQARIVYTACSHAAVDALCEKAAKNFNVDRCSRIIPQRIRVDCYTGFKPNNTNAQYL
Feline_infectio  ------------------------------------------------------------
consensus        vyy-tarvvyta-shaavdalceka-kflni--ctrivpakvrvecydkfkin-tt--yv

Bovine_respirat  FTTINALPEMVTDIVVVDEVSMLTNYELSVINARIRAKHYVYIGDPAQLPAPRVLLSKGT
Bovine_enteric_  FTTINALPEMVTDIVVVDEVSMLTNYELSVINARIRAKHYVYIGDPAQLPAPRVLLSKGT
Bovine_CoV       FTTINALPEMVTDIVVVDEVSMLTNYELSVINARIRAKHYVYIGDPAQLPAPRVLLSKGT
Murine_HepV      FTTINALPELVTDIIVVDEVSMLTNYELSVINSRVRAKHYVYIGDPAQLPAPRVLLNKGT
SARS_CoV         FCTVNALPETTADIVVFDEISMATNYDLSVVNARLRAKHYVYIGDPAQLPAPRTLLTKGT
Human_CoV        FSTVNALPEVNADIVVVDEVSMCTNYDLSVINQRISYKHIVYVGDPQQLPAPRVLISKGV
Porcine_epidemi  FSTVNALPECNADIVVVDEVSMCTNYDLSVINQRISYRHVVYVGDPQQLPAPRVMISRGT
Porcine_transmi  FCTVNALPEASCDIVVVDEVSMCTNYDLSVINSRLSYKHIVYVGDPQQLPAPRTLINKGV
Feline_infectio  ------------------------------------------------------------
consensus        fttinalpem--divvvdevsm-tnyelsvin-rirakhyvyigdpaqlpaprvllskgt

Bovine_respirat  LEPKYFNTVTKLMCCLGPDIFLGTCYRCPKEIVDTVSALVYENKLKAKNESSSLCFKVYY
Bovine_enteric_  LEPKYFNTVTKLMCCLGPDIFLGTCYRCPKEIVDTVSALVYENKLKAKNESSSLCFKVYY
Bovine_CoV       LEPKYFNTVTKLMCCLGPDIFLGTCYRCPKEIVDTVSALVYENKLKAKNESSSLCFKVYY
Murine_HepV      LEPRYFNSVTKLMCCLGPDIFLGTCYRCPKEIVDTVSALVYNNKLKAKNDNSAMCFKVYY
SARS_CoV         LEPEYFNSVCRLMKTIGPDMFLGTCRRCPAEIVDTVSALVYDNKLKAHKDKSAQCFKMFY
Human_CoV        MEPIDYNVVTQRMCAIGPDVFLHKCYRCPAEIVNTVSELVYENKFVPVKEASKQCFKIFE
Porcine_epidemi  LEPKDYNVVTQRMCALKPDVFLHKCYRCPAEIVRTVSEMVYENQFIPVHPDSKQCFKIFC
Porcine_transmi  LQPQDYNVVTKRMCTLGPDVFLHKCYRCPAEIVKTVSALVYENKFVPVNPESKQCFKMFV
Feline_infectio  ------------------------------------------------------------
consensus        lepkyfntvtklmc-lgpdiflgtcyrcp-eivdtvsalvyenklka-ne-s--cfkvyy

Bovine_respirat  KGVTTHESSSAVNMQQIYLINKFLKANPLWHKAVFISPYNSQNFAAKRVLGLQTQTVDSA
Bovine_enteric_  KGVTTHESSSAVNMQQIYLINKFLKANPLWHKAVFISPYNSQNFAAKRVLGLQTQTVDSA
Bovine_CoV       KGVTTHESSSAVNMQQIYLINKFLKANPLWHKAVFISPYNSQNFAAKRVLGLQTQTVDSA
Murine_HepV      KGQTTHESSSAVNMQQIHLISKLLKANPSWSNAVFISPYNSQNYVAKRVLGLQTQTADSA
SARS_CoV         KGVITHDVSSAINRPQIGVVREFLTRNPAWRKAVFISPYNSQNAVASKILGLPTQTVDSS
Human_CoV        RGSVQVDNGSSINRRQLDVVKRFIHKNSTWSKAVFISPYNSQNYVAARLLGLQTQTVDSA
Porcine_epidemi  KGNVQVDNGSSINRRQLDVVRMFLAKNPRWSKAVFISPYNSQNYVASRLLGLQIQTVDSS
Porcine_transmi  KGQVQIESNSSINNKQLEVVKAFLAHNPKWRKAVFISPYNSQNYVARRLLGLQTQTVDSA
Feline_infectio  ------------------------------------------------------------
consensus        kg--thesssavn--qi-li-kfl--np-w-kavfispynsqnfvakrvlglqtqtvdsa

Bovine_respirat  QGSEYDYVIYSQTAETAHSVNVNRFNVAITRAKKGILCVMSNMQLFEALQFTTLTLDKVP
Bovine_enteric_  QGSEYDYVIYSQTAETAHSVNVNRFNVAITRAKKGILCVMSNMQLFEALQFTTLTLDKVP
Bovine_CoV       QGSEYDYVIYSQTAETAHSVNVNRFNVAITRAKKGILCVMSNMQLFEALQFTTLTVDKVP
Murine_HepV      QGSAYDFVIYSQTAQTAHSVNVNRFNVAITRAKKGILCVMSSMQLIGVFNFTTLTLDKIN
SARS_CoV         QGSEYDYVIFTQTTETAHSCNVNRFNVAITRAKIGILCIMSDRDLYDKLQFTSLEIPRRN
Human_CoV        QGSEYDYVIFAQTSDTAHACNANRFNVAITRAKKGIFCIMSDRTLFDALKFFEITMTDLQ
Porcine_epidemi  QGSEYDYVIYAQTSDTAHASNVNRFNVAITRAKKGILCIMCDRSLFDLLKFFELKLSDLQ
Porcine_transmi  QGSEYDYVIYTQTSDTQHATNVNRFNVAITRAKVGILCIMCDRTMYENLDFYELKDSKIG
Feline_infectio  ------------------------------------------------------------
consensus        qgseydyviysqt-etahs-nvnrfnvaitrakkgilcvms---lfe-lqftttltl-kv-
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Bovine_respirat QAVETRVQCSTNLFKDCSKSYSGYHPAHAPSFLAVDDKYKATGDLAVCLGIGDSAVTYSR
Bovine_enteric_ QAVETRVQCSTNLFKDCSKSYSGYHPAHAPSFLAVDDKYKATGDLAVCLGIGDSAVTYSR
Bovine_CoV      QAVETRVQCSTNLFKDCSKSYSGYHPAHAPSFLAVDDKYKATGDLAVCLGIGDSAVTYSR
Murine_HepV     ---NPRLQCTTNLFKDCSKSYVGIPP--CAFLLAVDDKYKVSGNLAVCLNVADSAVTYSR
SARS_CoV        -VATLQAENVTGLFKDCSKIITGLHPTQAPTHLSVDIKFKTEG-LCVDIPGIPKDMTYRR
Human_CoV       ---SESS---CGLFKDCARNPIDLPPSHATTYLSLSDRFKTSGDLAVQIGNNN-VCTYEH
Porcine_epidemi ---ANEG---CGLFKDCSRGDDLLPPSHANTFMSLADNFKTDQYLAVQIGVNG-PIKYEH
Porcine_transmi ---LQAKPETCGLFKDCSKSEQYIPPAYATTYMSLSDNFKTSDGLAVNIG-TK-DVKYAN
Feline_infectio ------------------------------------------------------------
consensus       ---------st-lfkdcsks--gi-p-ha-sfl-vddkyk-tg-lav-lgi----vty-r

Bovine_respirat LISLMGFKLDVTLDGYCKLFITKEEAVKRVRAWVGFDAEGAHATRDSIGTNFPLQLGFST
Bovine_enteric_ LISLMGFKLDVTLDGYCKLFITKEEAVKRVRAWVGFDAEGAHATRDSIGTNFPLQLGFST
Bovine_CoV      LISLMGFKLDVTLDGYCKLFITKEEAVKRVRAWVGFDAEGAHATRDSIGTNFPLQLGFST
Murine_HepV     LISLMGFKLDLTLDGYCKLFITRDEAIKRVRAWVGFDAEGAHATRDSIGTNFPLQLGFST
SARS_CoV        LISMMGFKMNYQVNGYPNMFITREEAIRHVRAWIGFDVEGCHATRDAVGTNLPLQLGFST
Human_CoV       VISYMGFRFDVSMPGSHSLFCTRDFAMRHVRGWLGMDVEGAHVTGDNVGTNVPLQVGFSN
Porcine_epidemi VISFMGFRFDINIPNHHTLFCTRDFAMRNVRGWLGFDVEGAHVVGSNVGTNVPLQLGFSN
Porcine_transmi VISYMGFRFEANIPGYHTLFCTRDFAMRNVRAWLGFDVEGAHVCGDNVGTNVPLQLGFSN
Feline_infectio ------------------------------------------------------------
consensus       lislmgfkldvtl-gy--lfitreeavk-vrawvgfd-egahatrd-igtn-plqlgfst

Bovine_respirat GIDFVVEATGLFADRDGYSFKKAVAKAPPGEQFKHLIPLMTRGQRWDVVRPRIVQMFADH
Bovine_enteric_ GIDFVVEATGLFADRDGYSFKKAVAKAPPGEQFKHLIPLMTRGQRWDVVRPRIVQMFADH
Bovine_CoV      GIDFVVEATGLFADRDGYSFKKAVAKAPPGEQFKHLIPLMTRGQRWDVVRPRIVQMFADH
Murine_HepV     GIDFVVEATGMFAERDGYVFKKAAARAPPGEQFKHLVPLMSRGQKWDVVRIRIVQMLSDH
SARS_CoV        GVNLVAVPTGYVDTENNTEFTRVNAKPPPGDQFKHLIPLMYKGLPWNVVRIKIVQMLSDT
Human_CoV       GVDFVAQPEGCVLTNTGSVVKPVRARAPPGEQFTHIVPLLRKGQPWSVLRKRIVQMIADF
Porcine_epidemi GVDFVVRPEGCVVTESGDYIKPVRARAPPGEQFAHLLPLLKRGQPWDVVRKRIVQMCSDY
Porcine_transmi GVDFVVQTEGCVITEKGNSIEVVKARAPPGEQFAHLIPLMRKGQPWHIVRRRIVQMVCDY
Feline_infectio ------------------------------------------------------------
consensus       gidfvv--tg------g--fkk--akappgeqfkhliplm-rgq-wdvvr-rivqm--d-

Bovine_respirat LIDLSDCVVLVTWAANFELTCLRYFAKVGREISCNVCTKRATAYNSRTGYYGCWRHSVTC
Bovine_enteric_ LIDLSDCVVLVTWAANFELTCLRYFAKVGREISCNVCTKRATAYNSRTGYYGCWRHSVTC
Bovine_CoV      LIDLSDCVVLVTWAANFELTCLRYFAKVGREISCNVSTKRATAYNSRTGYYGCWRHSVTC
Murine_HepV     LVDLADSVVLVTWAASFELTCLRYFAKVGKEVVCSVCNKRATCFNSRTGYYGCWRHSYSC
SARS_CoV        LKGLSDRVVFVLWAHGFELTSMKYFVKIGPERTCCLCDKRATCFSTSSDTYACWNHSVGF
Human_CoV       LAGSSDVLVFVLWAGGLELTTMRYFVKIGAVKHC-QCGTVATCYNSVSNDYCCFKHALGC
Porcine_epidemi LANLSDILIFVLWAGGLELTTMRYFVKIGPSKSC-DCGKVATCYNSALHTYCCFKHALGC
Porcine_transmi FDGLSDILIFVLWAGGLELTTMRYFVKIGRPQKC-ECGKSATCYSSSQSVYACFKHALGC
Feline_infectio ------------------------------------------------------------
consensus       l--lsd-vv-v-waa-felt-lryf-kvgre-sc-vc-kratcyns-t--ygcwrhsv-c

Bovine_respirat DYLYNPLIVDIQQWGYIGSLSSNHDLYCSVHKGAHVASSDAIMTRCLAVYDCFCNNINWN
Bovine_enteric_ DYLYNPLIVDIQQWGYIGSLSSNHDLYCSVHKGAHVASSDAIMTRCLAVYDCFCNNINWN
Bovine_CoV      DYLYNPLIVDIQQWGYIGSLSSNHDLYCSVHKGAHVASSDAIMTRCLAVYDCFCNNINWN
Murine_HepV     DYLYNPLIVDIQQWGYTGSLTSNHDPICSVHKGAHVASSDAIMTRCLAVHDCFCKSVNWN
SARS_CoV        DYVYNPFMIDVQQWGFTGNLQSNHDQHCQVHGNAHVASCDAIMTRCLAVHECFVKRVDWS
Human_CoV       DYVYNPYVIDIQQWGYVGSLSTNHHAICNVHRNEHVASGDAIMTRCLAVYDCFVKNVDWS
Porcine_epidemi DYLYNPYCIDIQQWGYKGSLSLNHHEHCNVHRNEHVASGDAIMTRCLAIHDCFVKNVDWS
Porcine_transmi DYLYNPYCIDIQQWGYTGSLSMNHHEVCNIHRNEHVASGDAIMTRCLAIHDCFVKRVDWS
Feline_infectio ------------------------------------------------------------
consensus       dylynp-ivdiqqwgy-gslssnhd--c-vhk-ahvas-daimtrclav-dcf-knv-w-

Bovine_respirat VEYPIISNELSINTSCRVLQRVMLKAAMLCNRYTLCYDIGNPKAIACV--KDFDFKFYDA
Bovine_enteric_ VEYPIISNELSINTSCRVLQRVMLKAAMLCNRYTLCYDIGNPKAIACV--KDFDFKFYDA
Bovine_CoV      VEYPIISNELSINTSCRVLQRVMLKAAMLCNRYTLCYDIGNPKAIACV--KDFDFKFYDA
Murine_HepV     LEYPIISNEVSVNTSCRLLQRVMFRAAMLCNRYDVCYDIGNPKGLACV--KGYDFKFYDA
SARS_CoV        VEYPIIGDELRVNSACRKVQHMVVKSALLADKFPVLHDIGNPKAIKCVPQAEVEWKFYDA
Human_CoV       ITYPMIANENAINKGGRTVQSHIMRAAIKLYNPKAIHDIGNPKGIRCA-VTDAKWYCYDK
Porcine_epidemi ITYPFIGNEAVINKSGRIVQSHTMRSVLKLYNPKAIYDIGNPKGIRCA-VTDAKWFCFDK
Porcine_transmi IVYPFIDNEEKINKAGRIVQSHVMKAALKIFNPAAIHDVGNPKGIRCA-TTPIPWFCYDR
Feline_infectio ------------------------------------------------------------
consensus       veypii-nel-intscrvlq-vmlkaaml--ry-l-ydignpkai-cv---d-dfkfyda
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Bovine_respirat  QPIVKS---VKTLLYSFEAHKDSFKDGLCMFWNCNVDKYPPNAVVCRFDTRVLNNLNLPG
Bovine_enteric_  QPIVKS---VKTLLYSFEAHKDSFKDGLCMFWNCNVDKYPPNAVVCRFDTRVLNNLNLPG
Bovine_CoV       QPIVKS---VKTLLYFFEAHKDSFKDGLCMFWNCNVDKYPPNAVVCRFDTRVLNNLNLPG
Murine_HepV      SPVVKS---VKQFVYKYEAHKDQFLDGLCMFWNCNVDKYPANAVVCRFDTRVLSKLNLPG
SARS_CoV         QPCSDKAYKIEELFYSYATHHDKFTDGVCLFWNCNVDRYPANAIVCRFDTRVLSNLNLPG
Human_CoV        NPINSN---VKTLEYDYMTHG--QMDGLCLFWNCNVDMYPEFSIVCRFDTRTRSTLNLEG
Porcine_epidemi  NPTNSN---VKTLEYDYITHG--QFDGLCLFWNCNVDMYPEFSVVCRFDTRCRSPLNLEG
Porcine_transmi  DPINNN---VRCLDYDYMVHG--QMNGLMLFWNCNVDMYPEFSIVCRFDTRTRSKLSLEG
Feline_infectio  ------------------------------------------------------------
consensus        qpi------vktl-y-y--h-d-f-dglcmfwncnvdkyp-navvcrfdtrvls-lnlpg

Bovine_respirat  CNGGSLYVNKHAFHTKPFSRAAFEHLKPMPFFYYSDTPCVYMDGMDAKQVDYVPLKSATC
Bovine_enteric_  CNGGSLYVNKHAFHTKPFSRAAFEHLKPMPFFYYSDTPCVYMDGMDAKQVDYVPLKSATC
Bovine_CoV       CNGGSLYVNKHAFHTKPFSRAAFEHLKPMPFFYYSDTPCVYMDGMDAKQVDYVPLKSATC
Murine_HepV      CNGGSLYVNKHAFHTNPFTRAAFENLKPMPFFYYSDTPCVYMEGMESKQVDYVPLRSATC
SARS_CoV         CDGGSLYVNKHAFHTPAFDKSAFTNLKQLPFFYYSDSPCESHGKQVVSDIDYVPLKSATC
Human_CoV        VNGGSLYVNNHAFHTPAYDKRAMAKLKPAPFFYYDDGSCEVVH----DQVNYVPLRATNC
Porcine_epidemi  CNGGSLYVNNHAFHTPAFDKRAFAKLKPMPFFFYDDTECDKLQ----DSINYVPLRASNC
Porcine_transmi  CNGGALYVNNHAFHTPAYDRRAFAKLKPMPFFYYDDSNCELVD----GQPNYVPLKSNVC
Feline_infectio  ------------------------------------------------------------
consensus        cnggslyvnkhafht--f-r-af--lkpmpffyysdtpc--md-----qvdyvplksatc

Bovine_respirat  ITRCNLGGAVCLKHAEEYREYLESYNTATTAGFTFWVYKTFDFYNLWNTFTK---LQSLE
Bovine_enteric_  ITRCNLGGAVCLKHAEEYREYLESYNTATTAGFTFWVYKTFDFYNLWNTFTK---LQSLE
Bovine_CoV       ITRCNLGGAVCLKHAEEYREYLESYNTATTAGFTFWVYKTFDFYNLWNTFTK---LQSLE
Murine_HepV      ITRCNLGGAVCLKHAEEYREYLESYNTATTAGFTFWVYKTFDFYNLWNTFTR---LQSLE
SARS_CoV         ITRCNLGGAVCRHHANEYRQYLDAYNMMISAGFSLWIYKQFDTYNLWNTFTR---LQSLE
Human_CoV        ITKCNIGGAVCSKHANLYRAYVESYNIFTQAGFNIWVPTTFDCYNLWQTFTEVN-LQGLE
Porcine_epidemi  ITKCNVGGAVCSKHCAMYHSYVNAYNTFTSAGFTIWVPTSFDTYNLWQTFSN-N-LQGLE
Porcine_transmi  ITKCNIGGAVCKKHAALYRAYVEDYNIFMQAGFTIWCPQNFDTYMLWHGFVNSKALQSLE
Feline_infectio  ------------------------------------------------------------
consensus        itrcnlggavc-kha-eyr-ylesynt-ttagft-wvyktfd-ynlwntftk---lqsle

Bovine_respirat  NVVYNLVKTGHYTGQAGEMPCAIINDKVVAKIDKEDVVIFINNTTYPTNVAVELFAKRSI
Bovine_enteric_  NVVYNLVKTGHYTGQAGEMPCAIINDKVVAKIDKEDVVIFINNTTYPTNVAVELFAKRSI
Bovine_CoV       NVVYNLVKTGHYTGQAGEMPCAIINDKVVAKIDKEDVVIFINNTTYPTNVAVELFAKRSI
Murine_HepV      NVVYNLVNAGHFDGRAGELPCAVIGEKVIAKIQNEDVVVFKNNTPFPTNVAVELFAERSI
SARS_CoV         NVAYNVVNKGHFDGHAGEAPVSIINNAVYTKVDGIDVEIFENKTTLPVNVAFELWAKRNI
Human_CoV        NIAFNVVNKGSFVGADGELPVAISGDKVFVRDGNTDNLVFVNKTSLPTNIAFELFAKRKV
Porcine_epidemi  NIAFNVLKKGSFVGDEGELPVAVVNDKVLVRDGTVDTLVFTNKTSLPTNVAFELYAKRKV
Porcine_transmi  NVAFNVVKKGAFTGLKGDLPTAVIADKIMVRDGPTDKCIFTNKTSLPTNVAFELYAKRKL
Feline_infectio  ------------------------------------------------------------
consensus        nv-ynlvk-ghf-g-agemp-aiindkvv-ki---dvvif-n-tt-ptnva-elfakr-i

Bovine_respirat  RHHPELKLFRNLNIDVCWKHVIWDYARESIFCSNTYGVCMYTDLK------FIDKLNVLF
Bovine_enteric_  RHHPELKLFRNLNIDVCWKHVIWDYARESIFCSNTYGVCMYTDLK------FIDKLNVLF
Bovine_CoV       RHHPELKLFRNLNIDVCWKHVIWDYARESIFCSNTYGVCMYTDLK------LIDKLNVLF
Murine_HepV      RPHPELKLFRSSNIHVCWNHVLWDYAKDSVFCSSTYKVCKYTDLQ------CIESLNVLF
SARS_CoV         KPVPEIKILNNLGVDIAANTVIWDYKREAPAHVSTIGVCTMTDIAKKPTESACSSLTVLF
Human_CoV        GLTPPLSILKNLGVVATYKFVLWDYEAERPLTSFTKSVCGYTDFA--------EDVCTCY
Porcine_epidemi  GLTPPITILRNLGVVCTSKCVIWDYEAERPLTTFTKDVCKYTDFE--------GDVCTLF
Porcine_transmi  GLTPPLTILRNLGVVATYKFVLWDYEAERPFSNFTKQVCSYTDLD--------SEVVTCF
Feline_infectio  ------------------------------------------------------------
consensus        r--pelkl-rnl-i-v-wk-viwdy-re--f-s-t--vc-ytdl--------d-l-vlf

Bovine_respirat  DGRDNGALEAFKRSNNGVYISTTKVKS----LSMIKGPPRAELNGVVVDKVGDT-----D
Bovine_enteric_  DGRDNGALEAFKRSNNGVYISTTKVKS----LSMIKGPPRAELNGVVVDKVGDT-----D
Bovine_CoV       DGRDNGALEAFKRSNNGVYISTTKVKS----LSMIRGPPRAELNGVVVDKVGDT-----D
Murine_HepV      DGRDNGALEAFKKCRNGVYINTTKIKS----LSMIKGPQRADLNGVVVEKVGDS-----D
SARS_CoV         DGRVEGQVDLFRNARNGVLITEGSVKG----LTPSKGPAQASVNGVTLIGES-V-----K
Human_CoV        DNSIQGSYERFTLSTNAVLFSATAVKTGGKSLPAIK-LNFGMLNGNAIATVKSEDGNIKN
Porcine_epidemi  DNSIVGSLERFSMTQNAVLMSLTAVKK----LTGIK-LTYGYLNGVPVNTHED-----KP
Porcine_transmi  DNSIAGSFERFTTTRDAVLISNNAVKG----LSAIK-LQYGLLNDLPVSTVGN-----KP
Feline_infectio  ------------------------------------------------------------
consensus        dgr-ng-le-fk-s-ngv-is-t-vks----ls-ikgp--a-lngv-v--vgd-------
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Bovine_respirat CVFYFAVRKEGQDVIFSQFDSLRVSSNQSPQGNLGSNEPGNVGGNDALATSTIFTQSRVI
Bovine_enteric_ CVFYFAVRKEGQDVIFSQFDSLRVSSNQSPQGNLGSNEPGNVGGNDALATSTIFTQSRVI
Bovine_CoV      CVFYFAVRKEGQDVIFSQFDSLRVSSNQSPQGNLGSNEPGNVGGNDALATSTIFTQSRVI
Murine_HepV     VEFWFAMRRDGDDVIFSRTGSLEPSHYRSPQGNPGGNRVGDLSGNEALARGTIFTQSRFL
SARS_CoV        TQFNYFKKVDG---IIQQLP------------------------------ETYFTQSRDL
Human_CoV       INWFVYVRKDGKPVDHYDG---------------------------------FYTQGRNL
Porcine_epidemi FTWYIYTRKNGKFEDYPDG---------------------------------YFTQGRTT
Porcine_transmi VTWYIYVRKNGEYVEQIDS---------------------------------YYTQGRTF
Feline_infectio ------------------------------------------------------------
consensus       --fyf-vrkeg--vif-----------------------------------t-ftqsr-i

Bovine_respirat SSFTCRTDMEKDFIALDQDLFIQKYGLEDYAFEHIVYGNFNQKIIGGLHLLIGLYRRQQT
Bovine_enteric_ SSFTCRTDMEKDFIALDQDLFIQKYGLEDYAFEHIVYGNFNQKIIGGLHLLIGLYRRQQT
Bovine_CoV      SSFTCRTDMEKDFIALDQDVFIQKYGLEDYAFEHIVYGNFNQKIIGGLHLLIGLYRRQQT
Murine_HepV     SSFSPRSEMEKDFMDLDEDVFIAKYSLQDYAFEHVVYGSFNQKIIGGLHLLIGLARRPKK
SARS_CoV        EDFKPRSQMETDFLELAMDEFIQRYKLEGYAFEHIVYGDFSHGQLGGLHLMIGLAKRSQD
Human_CoV       QDFLPRSTMEEDFLNMDIGVFIQKYGLEDFNFEHVVYGDVSKTTLGGLHLLISQVRLSKM
Porcine_epidemi ADFSPRSDMEKDFLSMDMGLFINKYGLEDYGFEHVVYGDVSKTTLGGLHLLISQVRLACM
Porcine_transmi ETFKPRSTMEEDFLSMDTTLFIQKYGLEDYGFEHVVFGDVSKTTIGGMHLLISQVRLAKM
Feline_infectio ------------------------------------------------------------
consensus       -sftprsdmekdfi-ld-dlfiqkygledyafehivyg-f----igglhlligl-rr---

Bovine_respirat SNLVIQEFVS-YDSSIHSYFITDEKSGGSKSVCTVIDILLDDFVALVKSLNLNCVSKVVN
Bovine_enteric_ SNLVIQEFVS-YDSSIHSYFITDEKSGGSKSVCTVIDILLDDFVALVKSLNLNCVSKVVN
Bovine_CoV      SNLVIQEFVS-YDSSIHSYFITDEKSGGSKSVCTVIDILLDDFVALVKSLNLNCVSKVVN
Murine_HepV     SNLVIQEFVP-YDSSIHSYFITDENSGSSESVCTVIDLLLDDFVDIVKSLNLKCVSKVVN
SARS_CoV        SPLKLEDFIP-MDSTVKNYFITDAQTGSSKCVCSVIDLLLDDFVEIIKSQDLSVISKVVK
Human_CoV       GILKAEEFVAASDITLKCCTVTYLNDPSSKTVCTYMDLLLDDFVSVLKSLDLTVVSKVHE
Porcine_epidemi GVLKIDEFVSSNDSTLKSCTVTYADNPSSKMVCTYMDLLLDDFVSILKSLDLSVVSKVHE
Porcine_transmi GLFSVQEFMNNSDSTLKSCCITYADDPSSKNVCTYMDILLDDFVTIIKSLDLNVVSKVVD
Feline_infectio ------------------------------------------------------------
consensus       s-l-iqefv---dssi-syfitd--sgssksvctvidilllddfv-lvksl-l--vskvv-

Bovine_respirat VNVDFKDFQFMLWCNDEKVMTFYPRLQAASDWKPGYSMPVLYKYLNSPMERVSLWNYGKP
Bovine_enteric_ VNVDFKDFQFMLWCNDEKVMTFYPRLQAASDWKPGYSMPVLYKYLNSPMERVSLWNYGKP
Bovine_CoV      VNVDFKDFQFMLWCNDEKVMTFYPRLQAASDWKPGYSMPVLYKYLNSPMERVSLWNYGKP
Murine_HepV     VNVDFKDFQFMLWCNEEKVMTFYPRLQAAADWKPGYVMPVLYKYLESPMERVNLWNYGKP
SARS_CoV        VTIDYAEISFMLWCKDGHVETFYPKLQASQAWQPGVAMPNLYKMQRMLLEKCDLQNYGEN
Human_CoV       VIIDNKPWRWMLWCKDNAVATFYPQLQSA-EWKCGYSMPGIYKTQRMCLEPCNLYNYGAG
Porcine_epidemi VMVDCKMWRWMLWCKDHKLQTFYPQLQAS-EWKCGYSMPSIYKIQRMCLEPCNLYNYGAG
Porcine_transmi VIVDCKAWRWMLWCENSHIKTFYPQLQSA-EWNPGYSMPTLYKIQRMCLERCNLYNYGAQ
Feline_infectio ------------------------------------------------------------
consensus       v-vdfkdf-fmlwc-d-kv-tfyprlqaa-dwkpgysmp-lyk-----mer--lwnyg--

Bovine_respirat VTLPTGCMMNVAKYTQLCQYLNTTTLAVPVNMRVLHLGAGSEKGVAPGSAVLRQWLPAG-
Bovine_enteric_ VTLPTGCMMNVAKYTQLCQYLNTTTLAVPVNMRVLHLGAGSEKGVAPGSAVLRQWLPAG-
Bovine_CoV      VTLPTGCMMNVAKYTQLCQYLNTTTLAVPVNTRVLHLGAGSEKGVAPGSAVLRQWLPAGT
Murine_HepV     ITLPTGCMMNVAKYTQLCQYLSTTTLAVPANMRVLHLGAGSDKGVAPGSAVLRQWLPSG-
SARS_CoV        AVIPKGIMMNVAKYTQLCQYLNTLTLAVPYNMRVIHFGAGSDKGVAPGTAVLRQWLPTG-
Human_CoV       LKLPSGIMFNVVKYTQLCQYFNSTTLCVPHNMRVLHLGAGSDYGVAPGTAVLKRWLPHD-
Porcine_epidemi VKLPDGIMFNVVKYTQLCQYLNSTTMCVPHHMRVLHLGAGSDKGVAPGTAVLRRWLPLD-
Porcine_transmi VKLPDGITTNVVKYTQLCQYLNTTTLCVPHKMRVLHLGAAGASGVAPGSTVLRRWLPDD-
Feline_infectio ------------------------------------------------------------
consensus       v-lptg-mmnvakytqlcqylntttlavp-nmrvlhlgagsekgvapgsavlrqwlp-g-

Bovine_respirat ---------TILVDNDLYPFVSDSVATYFGDCITLPFDCQWDLIISDMYDPITKNIGEYN
Bovine_enteric_ ---------TILVDNDLYPFVSDSVATYFGDCITLPFDCQWDLIISDMYDPITKNIGEYN
Bovine_CoV      ILRQWLPAGTILVHNDLYPFVSDSVATYFGDCITLPFDCQWDLIISDMYD-LLLDIGVHV
Murine_HepV     ---------SILVDNDMNPFVSDSVASYYGNCITLPFDCQWDLIISDMYDPLTKNIGEYN
SARS_CoV        ---------TLLVDSDLNDFVSDADSTLIGDCATVHTANKWDLIISDMYDPRTKHVTKEN
Human_CoV       ---------AIVVDNDVVDYVSDADFSVTGDCATVYLEDKFDLLISDMYDGRTKAIDGEN
Porcine_epidemi ---------AIIVDNDSVDYVSDADYSVTGDCSTLYLSDKFDLVISDMYDGKIKSCDGEN
Porcine_transmi ---------AILVDNDLRDYVSDADFSVTGDCTSLYIEDKFDLLVSDLYDGSTKSIDGEN
Feline_infectio ------------------------------------------------------------
consensus       ---------tilvdndl--fvsd---t--gdc-tl--d--wdliisdmyd--tk-i---n
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Bovine_respirat VSKDGFFTYICHMIRDKLALGGSVAIKITEFSWNAELYKLMGYFAFWTVFCTNANASSSE
Bovine_enteric_ VSKDGFFTYICHMIRDKLALGGSVAIKITEFSWNAELYKLMGYFAFWTVFCTNANASSSE
Bovine_CoV      VRCS---YIHCHMIRDKLALGGSVAIKITEFSWNAELYKLMGYFAFWTVFCTNANASSSE
Murine_HepV     VSKDGFFTYLCHLIRDKLALGGSVAIKITEFSWNAELYSLMGKFAFWTIFCTNVNASSSE
SARS_CoV        DSKEGFFTYLCGFIKQKLALGGSIAVKITEHSWNADLYKLMGHFSWWTAFVTNVNASSSE
Human_CoV       VSKEGFFTYINGFICEKLAIGGSIAIKVTEYSWNKKLYELVQRFSFWTMFCTSVNTSSSE
Porcine_epidemi VSKEGFFPYINGVITEKLALGGTVAIKVTEFSWNKKLYELIQKFEYWTMFCTSVNTSSSE
Porcine_transmi TSKDGFFTYINGFIKEKLSLGGSVAIKITEFSWNKDLYELIQRFEYWTVFCTSVNTSSSE
Feline_infectio ------------------------------------------------------------
consensus       vskdgfftyic-mirdklalggsvaikitefswnaely-lmg-f-fwtvfctnvnassse

Bovine_respirat GFLIGINYLG--KPKVEIDGNVMHANYLFWRNSTVWNGGAYSLFDMAKFPLKLAGTAVIN
Bovine_enteric_ GFLIGINYLG--KPKVEIDGNVMHANYLFWRNSTVWNGGAYSLFDMAKFPLKLAGTAVIN
Bovine_CoV      GFLIGINYLG--KPKVEIDGNVMHAIICFG-------------------EIPQFGTGVLI
Murine_HepV     GFLIGINWLN--RTRNEIDGKTMHANYLFWRNSTMWNGGAYSLFDMTKFPLKAAGTAVVS
SARS_CoV        AFLIGANYLG--KPKEQIDGYTMHANYIFWRNTNPIQLSSYSLFDMSKFPLKLRGTAVMS
Human_CoV       AFVVGINYLGDFAQGPFIDGNIIHANYVFWRNSTVMSLSYNSVLDLSKFNCKHKATVVVQ
Porcine_epidemi AFLIGVHYLGDFASGAVIDGNTMHANYIFWRNSTIMTMSYNSVLDLSKFNCKHKATVVVN
Porcine_transmi GFLIGINYLGPYCDKAIVDGNIMHANYIFWRNSTIMALSHNSVLDTPKFKCRCNNALIVN
Feline_infectio ------------------------------------------------------------
consensus       gfliginylg--k-k--idgnvmhanylfwrnstv------sl-dm-kf-lk--gtavin

Bovine_respirat LRADQINDMVYSLLEKGKLLVRDTNKEVFVGDSLVNVI-
Bovine_enteric_ LRADQINDMVYSLLEKGKLLVRDTNKEVFVGDSLVNVI-
Bovine_CoV      ACLIWLNSRLSWLVMP-----------------------
Murine_HepV     LKPDQINDLVLSLIEKGKLLVRDTRKEVFVGDSLVNVK-
SARS_CoV        LKENQINDMIYSLLEKGRLIIRENNRVVVSSDILVNN--
Human_CoV       LKDSDINEMVLSLVRSGKLLVRGNGKCLSFSNHLVSTK-
Porcine_epidemi LKDSSISDVVLGLLKNGKLLVRNNDAICGFSNHLVNVNK
Porcine_transmi LKEKELNEMVIGLLRKGKLLIRNNGKLLNFGNHFVNTP-
Feline_infectio ---------------------------------------
consensus       lk---indmv-sll-kgkllvr---k-v-----lvn---
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