Extended data

Sequence alignments of SARS-CoV-2 ORF1ab and N proteins with their counterparts in the common human coronaviruses

(A) (pages 2-23) Multiple sequence alignment by CLUSTALW software (https://www.genome.jp/tools-bin/clustalw) of the ORF1ab polyprotein sequences of SARS-CoV-2 (GenBank accession QHD43415), HCoV-OC43 (NP_937947), HCoV-HKU1 (YP_173236), HCoV-229E (NP_073549), and HCoV-NL63 (YP_003766). Consecutive 9 aa stretches that are identical between SARS-CoV-2 and at least one of the other viruses are highlighted in yellow, with numbers indicating the N-terminal position of regions with such stretches.

(B) (pages 24-25) Multiple sequence alignment by CLUSTALW software of the nucleocapsid protein N sequences of SARS-CoV-2 (QHD43423), HCoV-OC43 (NP_937954), HCoV-HKU1 (YP_173242), HCoV-229E (NP_073556), and HCoV-NL63 (YP_003771). Highlighting as in (A).

(A) Alignment of ORF1ab polyprotein sequences

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229E_ORF1ab           --------------------MACNRVTLAVASDSEISANGCSTIAQAVRRYSEAASNGFR
NL63_ORF1ab           --------------------MFYNQVTLAVASDSEISGFGFAIPSVAVRTYSEAAAQGFQ
OC43_ORF1ab           MSKINKYGLELHWAPEFPWMFEDAEEKLDNPSSSEVDMICSTTAQKLETDGICPENHVMV
HKU1_ORF1ab           MIKTSKYGLGFKWAPEFRWLLPDAAEELASPMKSDEGGLCPSTGQAMESVGFVYDNHVKI
SARS-CoV-2_ORF1ab     ------------MESLVPGFNEKTHVQLSLPVLQVRDVLVRGFGDSVEEVLSEARQHLKD

229E_ORF1ab           ACRFVSLDLQDCIVGIADDTYVMGLHGNQTLFCNIMKFS----------------------
NL63_ORF1ab           ACRFVAFGLQDCVTGINDDDYVIALTGTNQLCAKILPFS----------------------
OC43_ORF1ab           DCRRLLKQECCVQSSLIREIVMNASPYDLEVLLQDALQSREAVLVTTPLGMSLEAC----
HKU1_ORF1ab           DCRCILGQEWHVQSNLIRDIFVHEDLHVVEVLTKTAVKSGTAILIKSPLHS---------
SARS-CoV-2_ORF1ab     GTCGLVEVEKGVLPQLEQPYVFIKRSDARTAPHGHVMVELVAELEGIQYGRSGETLGVLV

229E_ORF1ab           ----------------------------DRPFMLHGWLVFSNSNYLLEEFDVVFGKRGGG
NL63_ORF1ab           ----------------------------DRPLNLRGWLIFSNSNYVLQDFDVVFG-HGAG
OC43_ORF1ab           YVRGCNPKGWTMGLFRRRSVCNTGRCTVNKHVAYQLYMIDPAGVCLGAGQFVGWVIPLAF
HKU1_ORF1ab           --LGGFPKGYVMGLFR----------SYKTKRYVVHHLSMTTSTTNFGEDFLGWIVPFGF
SARS-CoV-2_ORF1ab     PHVGEIPVAYRKVLLR-----------KNGNKGAGGHSYGADLKSFDLGDELGTDPYEDF

229E_ORF1ab           NVTYTDQYLCGADGKPVMSEDLWQFVDHFGENEEIIING-HTYVCAWLTKRKPLDYKRQN
NL63_ORF1ab           SVVFVDKYMCGFDGKPVLPKNMWEFRDYFNNNTDSIVIGGVTYQLAWDVIRKDLSYEQQN
OC43_ORF1ab           MPVQSRKFIVPWVMYLRKRGEKGAYNKDHGRGGFGHVYDFKVEDAYDQVHDEPKGKFSKK
HKU1_ORF1ab           MPSYVHKWFQFCRLYIEESDLIISN-------FKFDDYDFSVEDAYAEVHAEPKGKYSQK
SARS-CoV-2_ORF1ab     QENWNTKHSSGVTRELMRELNGGAYTRYVDNNFCGPDGYPLECIKDLLARAGKASCTLSE

229E_ORF1ab           NLAIEEIEYVHGDALHTLRNGSVLEMAKEVKTSSKVVLSDALDKLYKVFGSPVMTNGSNI
NL63_ORF1ab           VLAIESIHYLG-TTGHTLKSGCKLTNAKPPKYSSKVVLSGEWNAVYRAFGSPFITNGMSL
OC43_ORF1ab           AYALIRGYRGVKPLLYVDQYGCDYTGSLADGLEAYADKTLQEMKALFPTWSQELLFDVIV
HKU1_ORF1ab           AYALLRQYRGIKPVLFVDQYGCDYSGKLADCLQAYGHYSLQDMRQKQSVWLANCDFDIVV
SARS-CoV-2_ORF1ab     QLDFIDTKRGVYCCREHEHEIAWYTERSEKSYELQTPFEIKLAKKFDTFNGECPNFVFPL

229E_ORF1ab           LEAFTKPVFISALVQCTCGTKSWSVGDWTGFKSSCCNVISNKLCVVPGNVKPGDAVITTQ
NL63_ORF1ab           LDIIVKPVFFNAFVKCNCGSESWSVGAWDGYLSSCCGTPAKKLCVVPGNVVPGDVIITST
OC43_ORF1ab           AWHVVRDPRYVMRLQSAATIRSVAYVANPTEDLCDGSVVIKEPVHVYADDSIILRQYNLV
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HKU1_ORF1ab           AWHVVRDSRFVMRLQTIATICGIKYVAQPTEDVVDGDVVIREPVHLLSADAIVLKLPSLM
SARS-CoV-2_ORF1ab     NSIIKTIQPRVEKKKLDGFMGRIRSVYPVASPNECNQMCLSTLMKCDHCGETSWQTGDFV

229E_ORF1ab           QAGAGIKYFCGMTLKFVANIEGVSVWRVIALQSVDCFVASSTFVEEEHVNRMDTFCFNVR
NL63_ORF1ab           SAGCGVKYYAGLVVKHITNITGVSLWRVTAVHSDGMFVASSSYDALLHRNSLDPFCFDVN
OC43_ORF1ab           DIMSHFYMEADTVVNAFYGVALKDCGFVMQFGYIDCEQDSCDFKGWIPGNMIDGFACTTC
HKU1_ORF1ab           KVMTHMDDFS---IKSIYNVDLCDCGFVMQYGYVDCFNDNCDFYGWVSGNMMDGFSCPLC
SARS-CoV-2_ORF1ab     KATCEFCGTEN-----LTKEGATTCGYLPQNAVVKIYCPACHNSEVGPEHSLAEYHNESG

229E_ORF1ab           NSVTDECRLAMLG------AEMTSNVRRQVASGVIDISTGWFDVYDDIFAESKPWFVRKA
NL63_ORF1ab           TLLSNQLRLAFLG------ASVTEDVKFAASTGVIDISAGMFGLYDDILTNNKPWFVRKA
OC43_ORF1ab           GHVYEVGDLIAQSSGVLPVNPVLHTKSAAGYGGFGCKDSFTLYGQTVVYFGGCVYWSPAR
HKU1_ORF1ab           CTVYDSSEVKAQSSGVIPENPVLFTNSTDTVN----HDSFNLYGYSVTPFGSCIYWSPRP
SARS-CoV-2_ORF1ab     LKTILRKGGRTIAFGGCVFSYVGCHNKCAYWVPRASANIGCNHTGVVGEGSEGLNDNLLE

229E_ORF1ab           EDIFGPCWSALASALKQLKVTTGELVRFVKSICNSAVAVVGGTIQILASVPEKFLNAFDV
NL63_ORF1ab           SGLFDAIWDAFVAAIKLVPTTTGVLVRFVKSIASTVLTVSNGVIIMCADVPDAFQSVYRT
OC43_ORF1ab           NIWIPILKSSVKSYDSLVYTGVLGCKAIVKETNLICKALYLDYVQHKCGNLHQRELLGVS
HKU1_ORF1ab           GLWIPIIKSSVKSYDDLVYSGVVGCKSIVKETALITHALYLDYVQCKCGNLEQNHILGVN
SARS-CoV-2_ORF1ab     ILQKEKVNINIVGDFKLNEEIAIILASFSASTSAFVETVKGLDYKAFKQIVESCGNFKVT

229E_ORF1ab           FVTAIQTVFDCAVETCTIAGKAFDKVFDYVLLDNALVKLVTTKLKGVRERGLNKVKYATV
NL63_ORF1ab           FTQAICAAFDFSLDVFKIGDVKFKRLGDYVLTENALVRLTTEVVRGVRDARIKKAMFTKV
OC43_ORF1ab           DVWHKQLLLNRGVYKPLLENIDYFNMRRAKFSLETFTVCADGFMPFLLDDLVPRAYYLAV
HKU1_ORF1ab           NSWCRQLLLNRGDYNMLLKNIDLFVKRRADFACK-FAVCGDGFVPFLLDGLIPRSYYLIQ
SARS-CoV-2_ORF1ab     KGKAKKGAWNIGEQKSILSPLYAFASEAARVVRS--------IFSRTLETAQNSVRVLQK

229E_ORF1ab           VVGSTEEVKSSRVERSTAVLTIANNYSKLFDEGYTVVIGDVAYFVSDGYFRLMASPNSVL
NL63_ORF1ab           VVGPTTEVKFSVIELATVNLRLVDCAPVVCPKGKIVVIAGQAFFYSGGFYRFMVDPTTVL
OC43_ORF1ab           SGQAFCDYADKLCHAVVSKSKELLDVSLDSLGAAIHYLNSKIVDLAQHFSDFGTSFVSKI
HKU1_ORF1ab           SGIFFTSLMSQFSQEVSDMCLKMCILFMDRVSVATFYIEHYVNRLVTQFKLLGTTLVNKM
SARS-CoV-2_ORF1ab     AAITILDGISQYSLRLIDAMMFTSDLATNNLVVMAYITGGVVQLTSQWLTNIFGTVYEKL

229E_ORF1ab           TTAVYKPLFAFNVNVMGTRPE----KFPTTVTCENLESAVLFVNDKITEFQLDYSIDVID
NL63_ORF1ab           NDPVFTGDLFYTIKFSGFKLDGFNHQFVTASSATDAIIAVELLLLDFKTAVFVYTCVVDG
OC43_ORF1ab           VHFFKTFTTSTALAFAWVLFHVLHGAYIVVESDIYFVKNIPRYASAVAQAFQSVAKVVLD
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HKU1_ORF1ab           VNWFNTMLDASAPATGWLLYQLLNGLFVVSQANFNFVALIPDYAKILVNKFYTFFKLLLE
SARS-CoV-2_ORF1ab     KPVLDWLEEKFKEGVEFLRDGWEIVKFISTCACEIVGGQIVTCAKEIKESVQTFFKLVNK

229E_ORF1ab           NEIIVKPNISLCVPLYVRDYVDKWDDFCRQYS-------------------------NES
NL63_ORF1ab           CSVIVRRDATFATHVCFKDCYNVWEQFCIDNC-------------------------GEP
OC43_ORF1ab           SLRVTFIDGLSCFKIGRRRICLSGRKIYEVERGLLHSSQLPLDVYDLTMPSQVQKAKQKP
HKU1_ORF1ab           CVTVDVLKDMPVLKTINGLVCIVGNKFYNVSTGLIPGFVLPCNAQ-----------EQQI
SARS-CoV-2_ORF1ab     FLALCADS--IIIGGAKLKALNLGETFVTHSKGLYRKCVKSREETGLLMP---LKAPKEI

229E_ORF1ab           WFEDDYRAFISVLDITDAAVKAAES-----------KAFVDTIVPPCPSILKVIDGGKIW
NL63_ORF1ab           WFLTDYNAILQSNNPQCAIVQASES-----------KVLLERFLPKCPEILLSIDDGHLW
OC43_ORF1ab           IYLKGSGSDFSLADSVVEVVTTSLTPCGYS-----EPPKVADKICIVDNVYMAKAGDKYY
HKU1_ORF1ab           YFFEGVAESVIVEDDVIENVKSSLSSYEYC-----QPPKSVEKICIIDNMYMGKCGDKFF
SARS-CoV-2_ORF1ab     IFLEGETLPTEVLTEEVVLKTGDLQPLEQPTSEAVEAPLVGTPVCINGLMLLEIKDTEKY

229E_ORF1ab           NGVIKNVNSVRDWLKSLKLNLTQQGLLGTCAKRFKRWLGILLEAYNAFLDTVVSTVKIGG
NL63_ORF1ab           NLFVEKFNFVTDWLKTLKLTLTSNGLLGNCAKRFRRVLVKLLDVYNGFLETVCSVAYTAG
OC43_ORF1ab           PVVVDD-HVGLLDQAWRVPCAGRRVTFKEQPTVKEIISMPKIIKVFYELDNDFNTILNTA
HKU1_ORF1ab           PIVMNDKNICLLDQAWRFPCAGRKVNFNEKPVVMEIP-SLMTVKVMFDLDSTFDDILGKV
SARS-CoV-2_ORF1ab     CALAPN-MMVTNNTFTLKGGAPTKVTFGDDTVIEVQG--YKSVNITFELDERIDKVLNEK

229E_ORF1ab           LTFKTYAFDKPYIVIRDIVCKVENKTEAEWIELFPHNDRIKSFSTFESAYMPIADPTHFD
NL63_ORF1ab           VCIKYYAVNVPYVVISGFVSRVIRR--ERCDMTFPCVSCVTFFYEFLDTCFGVSKPNAID
OC43_ORF1ab           CGVFEVDDTVDMEEFYAVVIDAIEEKLSPCKELEGVGAKVSAFLQKLEDNPLFLFDEAGE
HKU1_ORF1ab           CSEFEVEKGVTVDDFVAVVCDAIENALNSCKEHPVVGYQVRAFLNKLNENVVYLFDEAGD
SARS-CoV-2_ORF1ab     CSAYTVELGTEVNEFACVVADAVIKTLQPVSELLTP---LGIDLDEWSMATYYLFDESGE

229E_ORF1ab           IEEVELLDAEFVEPGCGGILAVID-----------------------------------
NL63_ORF1ab           VEHLELKETVFVEPKDGGQFFVSG-----------------------------------
OC43_ORF1ab           EVLAPKLYCAFTAPEDDDFLE----ESDVE-------------------------------
HKU1_ORF1ab           EAMASRMYCTFAIEDVEDVIS----SEAVEDTIDGVVEDTINDDEDVVTGDNDDEDVVTG
SARS-CoV-2_ORF1ab     FKLASHMYCSFYPPDEDEEEGDCEEEE---------------------------------

229E_ORF1ab           ------------------------------------------------------------
NL63_ORF1ab           ------------------------------------------------------------
OC43_ORF1ab           ------------------------------------------------------------
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HKU1_ORF1ab           DNDDEDVVTGDNDDEDVVTGDNDDEDVVTGDNDDEDVVTGDNDDEDVVTGDNDDEDVVTG
SARS-CoV-2_ORF1ab     ------------------------------------------------------------


229E_ORF1ab           -----EHVFYKKDGVYYPSNGTNILPVAFTKAAGGKVSFSDDVEVKDIEPVYRVKLCFEF
NL63_ORF1ab           -----DYLWYVVDDIYYPASCNGVLPVAFTKLAGGKISFSDDVIVHDVEPTHKVKLIFEF
OC43_ORF1ab           ----EDDVEGEETDLTVTSAGQPCVASEQEESSEVLEDTLDDGPSVETSDSQVEEDVEMS
HKU1_ORF1ab           DNDDEDVVTGDNDDEDVVTGDNDDEDVVTGDNDDEDVVTGDNDDEDVVTGDNDDEDVVTG
SARS-CoV-2_ORF1ab     FEPSTQYEYGTEDDYQGKPLEFGATSAALQPEEEQEEDWLDDDSQQTVGQQDGSEDNQTT

229E_ORF1ab           EDEKLVDVCEKAIG----------------------------------------------K
NL63_ORF1ab           EDDVVTSLCKKSFG----------------------------------------------K
OC43_ORF1ab           DFVDLESVIQDYEN-----------------------------------VCFEFYTTEP
HKU1_ORF1ab           DNNDEEIVTGDNDDQIVVTGDDVDDIESIYDFDTYKALLVFNDVYNDALFVSYGSSVETE
SARS-CoV-2_ORF1ab     TIQTIVEVQPQLEMELTPVVQTIEVNSFSG-----------YLKLTDNVYIKNADIVEEA

229E_ORF1ab           KIKHEGDWDSFCKTIQSALSVVSCYVNLPTYYIYDEEGGNDLSLPVMISEWPLS------
NL63_ORF1ab           SIIYTGDWEGLHEVLTSAMNVIGQHIKLPQFYIYDEEGGYDVSKPVMISQWPISNDSNGC
OC43_ORF1ab           EFVKVLGLYVPKATRNNCWLRSVLAVMQKLPCQFKDKNLQDLWVLYKQQYSQLFVDTLVN
HKU1_ORF1ab           TYFKVNGLWSPTITHTNCWLRSVLLVMQKLPFKFKDLAIENMWLSYKVGYNQSFVDYLLT
SARS-CoV-2_ORF1ab     KKVKPTVVVNAANVYLKHGGGVAGALNKATNNAMQVESDDYIATNGPLKVGGSCVLSGHN

229E_ORF1ab           -VQQAQQEATLPDIAEDVVDQVEEVNSIFDIETVDVKHDVSPFEMPFEELNGLKILKQLD
NL63_ORF1ab           VVEASTDFHQLECIVDDSVREEVDIIEQPFEEVEHVLSIKQPFSFSFRDELGVRVLDQSD
OC43_ORF1ab           KIPANIVLPQGGYVADFAYWFLTLCDWQCVAYWKCIKCDLALKLKGLDAMFFYGDVVSHI
HKU1_ORF1ab           TIPKAIVLPQGGFVADFAYWFLNQFDINAYANWCCLKCGFSFDLNGLDALFFYGDIVSHV
SARS-CoV-2_ORF1ab     LAKHCLHVVGPNVNKGEDIQLLKSAYENFNQHEVLLAPLLSAGIFGADPIHSLRVCVDTV

229E_ORF1ab           NNCWVNSVMLQIQLTGILDGDYAMQFFKMGRVAKMIERCYTAEQCIRGAMGDVGLCMYRL
NL63_ORF1ab           NNCWISTTLVQLQLTKLLDDSIEMQLFKVGKVDSIVQKCYELSHLISGSLGDSGKLLSEL
OC43_ORF1ab           CKCGESMVLIDVDVPFTAHFALKDKLFCAFITKRIVYKAACVVDVNDSHSMAVVDGKQID
HKU1_ORF1ab           CKCGHNMTLIAADLPCTLHFSLFDDNFCAFCTPKKIFIAACAVDVNVCHSVAVIGDEQID
SARS-CoV-2_ORF1ab     RTN-VYLAVFDKNLYDKLVSSFLEMKSEKQVEQKIAEIPKEEVKPFITESKPSVEQRKQD

229E_ORF1ab           LKDLHTGFMVMDYKCSCTSGRLEESGAVLFCTPTKKAFPYGTCLNCNAPRMCTIRQLQGT
NL63_ORF1ab           LKEKYTCSITFEMSCDCGKKFDDQVGCLFWIMPYTKLFQKGECCICHKMQTYKLVSMKGT
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OC43_ORF1ab           D-------HRITSITSDKFDFIIGHGMSFSMTTFEIAQLYGSCITPNVCFVKGDIIKVSK
HKU1_ORF1ab           G-------KFVTKFSGDKFDFIVGYGMSFSMSSFELPQLYGLCITPNVCFVKGDIINVAR
SARS-CoV-2_ORF1ab     DKKIKACVEEVTTTLEETKFLTENLLLYIDINGNLHPDSATLVSDIDITFLKKDAPYIVG
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229E_ORF1ab           IIFVQQKPEPVNPVSFVVKPVCSSIFRGAVSCGHYQTNIYSQNLCVDGFGVNKIQPWTND
NL63_ORF1ab           GVFVQD-PAPIDIDAFPVKPICSSVYLGVKGSGHYQTNLYSFNKAIDGFGVFDIK---NS
OC43_ORF1ab           LVKAEVVVNPANGHMAHGGGVAKAIAVAAGQQFVKETTDMVKSKGVCATGDCYVSTGGKL
HKU1_ORF1ab           LVKADVIVNPANGHMLHGGGVAKAIAVAAGKKFSKETAAMVKSKGVCQVGDCYVSTGGKL
SARS-CoV-2_ORF1ab     DVVQEGVLTAVVIPTKKAGGTTEMLAKALRKVPTDNYITTYPGQGLNGYTVEEAKTVLKK

229E_ORF1ab           ALNTICIKDADYNAKVEISVTPIKNTVDTTPKEEFVVKEKLNAFLVHDNVAFYQGDVDTV
NL63_ORF1ab           SVNTVCFVDVDFHSVEIEAG-------------------EVKPFAVYKNVKFYLGDISHL
OC43_ORF1ab           CKTVLNVVGPDARTQGKQSYVLLERVYKHLNNYDCVVTTLISAGIFSVPSDVSLTYLLGT
HKU1_ORF1ab           CKTILNIVGPDARQDGRQSYVLLARAYKHLNNYDCCLSTLISAGIFSVPADVSLTYLLGV
SARS-CoV-2_ORF1ab     CKSAFYILPSIISNEKQEILGTVSWNLREMLAHAEETRKLMPVCVETKAIVSTIQRKYKG

229E_ORF1ab           VNGVDFDFIVNAANENLAHGGGLAKALDVYTKG----------------KLQRLSKEHIG
NL63_ORF1ab           VNCVSFDFVVNAANENLLHGGGVARAIDILTEG----------------QLQSLSKDYIS
OC43_ORF1ab           AKKQVVLVSNNQEDFDLISKCQITAVEGTK----KLAARLSFNVGRSIVYETDANKLILI
HKU1_ORF1ab           VDKQVILVSNNKEDFDIIQKCQITSVVGTK----ALAVRLTANVGRVIKFETDAYKLFLS
SARS-CoV-2_ORF1ab     IKIQEGVVDYGARFYFYTSKTTVASLINTLNDLNETLVTMPLGYVTHGLNLEEAARYMRS

229E_ORF1ab           LAGKVKVGTGVMVECDSLRIFNVVGPRKGKHERDLLIKAYNTINNEQGTPLTPILSCGIF
NL63_ORF1ab           SNGPLKVGAGVMLECEKFNVFNVVGPRTGKHEHSLLVEAYNSILFENGIPLMPLLSCGIF
OC43_ORF1ab           NDVAFVSTFNVLQDVLSLRHDIALDDDARTFVQSNVDVVPEGWRVVNKFYQINGVRTVKY
HKU1_ORF1ab           GDDCFVSNSSVIQEVLLLRHDIQLNNDVRDYLLSKMTSLPKDWRLINKFDVINGVKTVKY
SARS-CoV-2_ORF1ab     LKVPATVSVSSPDAVTAYNGYLTSSSKTPEEHFIETISLAGSYKDWSYSGQSTQLGIEFL

229E_ORF1ab           GIKLETSLEVLLDVCNTKEVKVFVYTDTEVCKVKDFVSGLVNVQKVEQPKIEPKPVSVIK
NL63_ORF1ab           GVRIENSLKALFSCDINKPLQVFVYSSNEEQAVLKFLDGLD-----------LTPVIDDV
OC43_ORF1ab           FECTGGIDICSQDKVFGYVQQGIFNKATVAQIKALFLDKVDILLTVDGVNFTNRFVPVGE
HKU1_ORF1ab           FECPNSIYICSQGKDFGYVCDGSFYKATVNQVCVLLAKKIDVLLTVDGVNFKSISLTVGE
SARS-CoV-2_ORF1ab     KRGDKSVYYTSNPTTFHLDGEVITFDNLKTLLSLREVRTIKVFTTVDNINLHTQVVDMSM

229E_ORF1ab           VAPKPYR-VDGKFSYFTEDLLCVADDKPIVLFTDSMLTLDDRGLALDNALSGVLSAAIKD
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NL63_ORF1ab           DVVKPFR-VEGNFSFFDCGVNALDG-DIYLLFTNSILMLDKQGQLLDTKLNGILQQAALD
OC43_ORF1ab           SFGKSLGNVFCDGVNVTKHKCDINYKGKVFFQFDNLSSEDLKAVRSSFNFDQKELLAYYN
HKU1_ORF1ab           VFGKILGNVFCDGIDVTKLKCSDFYADKILYQYENLSLADISAVQSSFGFDQQQLLAYYN
SARS-CoV-2_ORF1ab     TYGQQFGPTYLDGADVTKIKPHNSHEGKTFYVLPNDDTLRVEAFEYYHTTDPSFLGRYMS

229E_ORF1ab           CVDINKAIPSGNLIKFDIGSVVVYMCVVPSEKDKHLDNNVQRCTRKLNRLMCDIVCTIPA
NL63_ORF1ab           YLATVKTVPAGNLVKLFVESCTIYMCVVPSINDLSFDKNLGRCVRKLNRLKTCVIANVPA
OC43_ORF1ab           MLVNCFKWQVVVVNGKYFTFKQANNNCFVNVSCLMLQSLHLTFKIVQWQEAWLEFRSGRPA
HKU1_ORF1ab           FLT-VCKWSVVVVNGPFFSFEQSHNNCYVNVACLMLQHINLKFNKWQWQEAWYEFRAGRPH
SARS-CoV-2_ORF1ab     ALNHTKKWKYPQVNGLTSIKWADNNCYLATALLTLQQIELKFNPPALQDAYYRARAGEAA

229E_ORF1ab           DYILPLVLSSLTCNVSFVGELKAAEA------KVITIKVTEDGVNVHDVTVTTDKSFEQQ
NL63_ORF1ab           IDVLKKLLSSLTLTVKFVVESNVMDVNDCFKNDNVVLKITEDGINVKDVVVESSKSLGKQ
OC43_ORF1ab           RFVALVLAKGGFKFGDPADSRDFLRVVFSQVDLTGAICDFEIACK-CGVKQEQRTGLDAV
HKU1_ORF1ab           RLVALVLAKGHFKFDEPSDATDFIRVVLKQADLSGAICELELICD-CGIKQESRVGVDAV
SARS-CoV-2_ORF1ab     NFCALILAYCNKTVGELGDVRETMSYLFQHANLDSCKRVLNVVCKTCGQQQTTLKGVEAV

229E_ORF1ab           VGVIADKDKDLSGAVPSDLNTSELLTKAIDVDWVEFYGFKDAVTFATVDHSAFAYESAVV
NL63_ORF1ab           LGVVSDGVDSFEGVLP--INTDTVLSVAPEVDWVAFYGFEKAALFASLDVKPYGYPNDFV
OC43_ORF1ab           MHFGTLSREDLEIGYTVDCSCGKKLIHCVRFD-VPFLICSNTPASVKLPKGVGSANIFIG
HKU1_ORF1ab           MHFGTLAKTDLFNGYKIGCNCAGRIVHCTKLN-VPFLICSNTPLSKDLPDDVVAANMFMG
SARS-CoV-2_ORF1ab     MYMGTLSYEQFKKGVQIPCTCGKQATKYLVQQESPFVMMSAPPAQYELKHGTFTCASEYT

229E_ORF1ab           NGIRVLKTSDNNCWVNAVCIALQYSKPHFISQ----------------------------
NL63_ORF1ab           GGFRVLGTTDNNCWVNATCIILQYLKPTFKSK----------------------------
OC43_ORF1ab           --DKVGHYVHVKCEQSYQLYDASNVKKVTDVTGKLSDCLYLKNLKQTFKSVLTTYYLDDV
HKU1_ORF1ab           --VGVGHYTHLKCGSPYQHYDACSVKKYTGVSGCLTDCLYLKNLTQTFTSMLTNYFLDDV
SARS-CoV-2_ORF1ab     GNYQCGHYKHITSKETLYCIDGALLTKSSEYKGPITDVFYKE-NSYTTTIKPVTYKLDGV

229E_ORF1ab           ---------------------------------GLDAAWNKFVLGDVEIFVAFVYYVARL
NL63_ORF1ab           ---------------------------------GLNVLWNKFVTGDVGPFVSFIYFITMS
OC43_ORF1ab           KKIEYKPDLSQYYCDGGKYYTQRIIKAQFKTFEKVDGVYTNFKLIGHTVCDSLNAKLGFD
HKU1_ORF1ab           EMVAYNPDLSQYYCDNGKYYTKPIIKAQFKPFAKVDGVYTNFKLVGHDICAQLNDKLGFN
SARS-CoV-2_ORF1ab     VCTEIDPKLDNYYKKDNSYFTEQPIDLVPNQPYPNASFDNFKFVCDNIKFADDLNQLTGY

229E_ORF1ab           MKGDKGDAEDTLTKLSKYLANEAQVQLEHYSSCVECDAKFKNSVASINSAIVCASVK---
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NL63_ORF1ab           SKGQKGDAEEALSKLSEYLISDSIVTLEQYSTCDICKS----TVVEVKSAIVCASVL---
OC43_ORF1ab           SSKEFVEYKITEWPTATGDVVLATDDLYVKRYERGCITFGKPVIWLSHEKASLNSLT---
HKU1_ORF1ab           VDLPFVEYKVTVWPVATGDVVLASDDLYVKRYFKGCETFGKPVIWFCHDEASLNSLT---
SARS-CoV-2_ORF1ab     KKPASRELKVTFFPDLNGDVVAIDYKHYTPSFKKGAKLLHKPIVWHVNNATNKATYKPNT

229E_ORF1ab           ----------------------------------------RDGVQVGYCVHGIKYYSRVR
NL63_ORF1ab           ----------------------------------------KDGCDVGFCPHRHKLRSRVK
OC43_ORF1ab           -----YFNRPSLVDDNKFDVLKVDDVDDG-------GDSSESGAKETKEINIIKLSGVKK
HKU1_ORF1ab           -----YFNKPSFKSENRYSVLSVDSVSEES-----QGNVVTSVMESQISTKEVKLKGVRK
SARS-CoV-2_ORF1ab     WCIRCLWSTKPVETSNSFDVLKSEDAQGMDNLACEDLKPVSEEVVENPTIQKDVLECNVK

229E_ORF1ab           SVRGRAIIVSVEQLEPCAQSRLLSGVAYTAFSGPVDKGHYTVYDTAKKSMYDGDRFVKHD
NL63_ORF1ab           FVNGRVVITNVGEPIISQPSKLLNGIAYTTFSGSFDNGHYVVYDAANNAVYDGARLFSSD
OC43_ORF1ab           PFKVEDSVIVNDDTSETKYVKSLSIVDVYDMWLTGCKYVVRTANALSRAVNVPTIRKFIK
HKU1_ORF1ab           TVKIEDAIIVNDENSSIKVVKSLSLVDVWDMYLTGCDYVVWVANELSRLVKSPTVREYIR
SARS-CoV-2_ORF1ab     TTEVVGDIILKPANNSLKITEEVGHTDLMAAYVDNSSLTIKKPNELSRVLGLKTLATHGL

229E_ORF1ab           LSLLSVTSVVMVGGYVAP---VNTVKPKPVINQLDEKAQKFFDFGDFLIHNFVIFFTWLL
NL63_ORF1ab           LSTLAVTAIVVVGGCVTSNVPTIVSEKISVMDKLDTGAQKFFQFGDFVMNNIVLFLTWLL
OC43_ORF1ab           FGMTLVSIPIDLLNLREIKPAVNVVKAVRNKISVCFNFIKWLFVLLFGWIKISADNKVIY
HKU1_ORF1ab           YGIKPITIPIDLLCLRDDNQTLLVPKIFKARAIEFYGFLKWLFIYVFSLLHFTNDKTIFY
SARS-CoV-2_ORF1ab     AAVNSVPWDTIANYAKP-----FLNKVVSTTTNIVTRCLNRVCTNYMPYFFTLLLQLCTF

229E_ORF1ab           SMFTLCKTAVTTGDVKIMAKAPQRTGVVLKRSLKYNLKASAAVLKSKWWLLAKFTKLLLL
NL63_ORF1ab           SMFSLLRTSIMKHDIKVIAKAPKRTGVILTRSFKYNIRSALFVIKQKWCVIVTLFKFLLL
OC43_ORF1ab           TTEIASKLTCKLVALAFKNAFLTFKWSMVARGACIIATIFLLWFNFIYANVIFSDFYLPK
HKU1_ORF1ab           TTEIASKFTFNLFCLALKNAFQTFRWSIFIKGFLVVATVFLFWFNFLYINVIFSDFYLPN
SARS-CoV-2_ORF1ab     TRSTNSRIKASMPTTIAKNTVKSVGKFCLEASFNYLKSPNFSKLINIIIWFLLLSVCLGS

229E_ORF1ab           IYTLYSVVLLCVRFGPFN--FCSETVNGYAKSNFVKDDYCDGSLGCKMCLFGYQELSQFS
NL63_ORF1ab           LYAIYALVFMIVQFSPFNSLLCGDIVSGYEKSTFNKDIYCGNSMVCKMCLFSYQEFNDLD
OC43_ORF1ab           IGFLPTFVGKIAQWIKNTFSLVTICDLYSMQDVGFKNQYCNGSIACQFCLAGFDMLDNYK
HKU1_ORF1ab           ISVFPIFVGRIVMWIKATFGLVTICDFYSKLGVGFTSHFCNGSFICELCHSGFDMLDTYA
SARS-CoV-2_ORF1ab     LIYSTAALGVLMSNLGMPSYCTGYREGYLNSTNVTIATYCTGSIPCSVCLSGLDSLDTYP

229E_ORF1ab           HLDVVWKHITDPLFSNMQPFIVMVLLLIFGDNYLRCFLLYFVAQMISTVGVFLG------
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NL63_ORF1ab           HTSLVWKHIRDPILISLQPFVILVILLIFGNMYLRFGLLYFVAQFISTFGSFLG------
OC43_ORF1ab           AIDVVQYEADRRAFVDYTGVLKIVIELIVSYALYTAWFYPLFALISIQILTTWLPELFML
HKU1_ORF1ab           AIDFVQYEVDRRVLFDYVSLVKLIVELVIGYSLYTVWFYPLFCLIGLQLFTTWLPDLFML
SARS-CoV-2_ORF1ab     SLETIQITIS--SFKWDLTAFGLVAEWFLAYILFTRFFYVLGLAAIMQLFFSYFAVHFIS

229E_ORF1ab           ------YKETNWFLHFIPFDVICDELLVTVIVIKVISFVRHVLFGCENPDCIACSKSARL
NL63_ORF1ab           ------FHQKQWFLHFVPFDVLCNEFLATFIVCKIVLFVRHIIVGCNNADCVACSKSARL
OC43_ORF1ab           STLHWSFRLLVALANMLPAHVFMRFYIIIASFIKLFSLFRHVAYGCSKSGCLFCYKRNRS
HKU1_ORF1ab           ETMHWLIRFIVFVANMLPAFVLLRFYIVVTAMYKVVGFIRHIVYGCNKAGCLFCYKRNCS
SARS-CoV-2_ORF1ab     N--SWLMWLIINLVQMAPISAMVRMYIFFASFYYVWKSYVHVVDGCNSSTCMMCYKRNRA

229E_ORF1ab           KRFPVNTIVNGVQRSFYVNANGGSKFCKKHRFFCVDCDSYGYGSTFITPEVSRELGNITK
NL63_ORF1ab           KRVPLQTIINGMHKSFYVNANGGTCFCNKHNFFCVNCDSFGPGNTFINGDIARELGNVVK
OC43_ORF1ab           LRVKCSTIVGGMIRYYDVMANGGTGFCSKHQWNCIDCDSYKPGNTFITVEAALDLSKELK
HKU1_ORF1ab           VRVKCSTIVGGVIRYYDITANGGTGFCVKHQWNCFNCHSFKPGNTFITVEAAIELSKELK
SARS-CoV-2_ORF1ab     TRVECTTIVNGVRRSFYVYANGGKGFCKLHNWNCVNCDTFCAGSTFISDEVARDLSLQFK

229E_ORF1ab           TNVQPTGPAYVMIDKVEFENGFYRLYSCETFWRYNFDITESKYSCKEVFKNCNVLDDFIV
NL63_ORF1ab           TAVQPTAPAYVIIDKVDFVNGFYRLYSGDTFWRYDFDITESKYSCKEVLKNCNVLENFIV
OC43_ORF1ab           RPIQPTDVAYHTVTDVKQVGCSMRLFYDRDGQRTYDDVNASLFVDYSNLLHSKVKSVPNM
HKU1_ORF1ab           RPVNPTDASHYVVTDIKQVGCMMRLFYDRDGQRVYDDVDASLFVDINNLLHSKVKVVPNL
SARS-CoV-2_ORF1ab     RPINPTDQSSYIVDSVTVKNGSIHLYFDKAGQKTYERHSLSHFVNLDNLRANNTKGSLPI

229E_ORF1ab           FNNNGTN-----VTQVKNASVYFSQLLCRPIKLVDSELLSTLS--VDFNGVLHKAYIDVL
NL63_ORF1ab           YNNSGSN-----ITQIKNACVYFSQLLCEPIKLVNSELLSTLS--VDFNGVLHKAYVDVL
OC43_ORF1ab           HVVVVEN--DADKANFLNAAVFYAQSLFRPILMVDKNLITTANTGTSVTETMFDVYVDTF
HKU1_ORF1ab           YVVVVES--DADRANFLNAVVFYAQSLYRPILLVDKKLITTACNGISVTQTMFDVYVDTF
SARS-CoV-2_ORF1ab     NVIVFDGKSKCEESSAKSASVYYSQLMCQPILLLDQALVSDVGDSAEVAVKMFDAYVNTF

229E_ORF1ab           RNSFGKDLNAN-----------------------MSLAECKRALGLSISDHEFTSAISN
NL63_ORF1ab           CNSFFKELTAN-----------------------MSMAECKATLGLTVSDDDFVSAVAN
OC43_ORF1ab           LSMFDVDKKSLNALIATAHSSIKQGTQIYKVLDTFLSCARKSCSIDSDVDTKCLADSVMS
HKU1_ORF1ab           MSHFDVDRKSFNNFVNIAHASLREGVQLEKVLDTFVGCVRKCCSIDSDVETRFITKSMIS
SARS-CoV-2_ORF1ab     SSTFNVPMEKLKTLVATAEAELAKNVSLDNVLSTFISAARQG-FVDSDVETKDVVECLKL

229E_ORF1ab           AHRCDVLLSDLSFNNFVSSYAKPEEKLSAYDLACCMRAGAKVVNANVLTKDQTPIVWHAK
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NL63_ORF1ab           AHRYDVLLSDLSFNNFFISYAKPEDKLSVYDIACCMRAGSKVVNHNVLIKESIPIVWGVK
OC43_ORF1ab           AVSAGLELTDESCNNLVPTYLKSDN-IVAADLGVLIQNSAKHVQGNVAKIAGVSCIWSVD
HKU1_ORF1ab           AVAAGLEFTDENYNNLVPTYLKSDN-IVAADLGVLIQNGAKHVQGNVAKAANISCIWFID
SARS-CoV-2_ORF1ab     SHQSDIEVTGDSCNNYMLTYNKVEN-MTPRDLGACIDCSARHINAQVAKSHNIALIWNVK

229E_ORF1ab           DFNSLSAEGRKYIVKTSKAKGLTFLLTINENQAVTQIPATSIVAKQGAGDAGHSLTWLWL
NL63_ORF1ab           DFNTLSQEGKKYLVKTTKAKGLTFLLTFNDNQAITQVPATSIVAKQGAG-FKRTYNFLWY
OC43_ORF1ab           AFNQFSSDFQHKLKKACCKTGLKLKLTYNKQMANVSVLTTPFSLKGGAVFS---YFVYVC
HKU1_ORF1ab           AFNQLTADLQHKLKKACVKTGLKLKLTFNKQEASVPILTTPFSLKGGVVLS---NLLYIL
SARS-CoV-2_ORF1ab     DFMSLSEQLRKQIRSAAKKNNLPFKLTCATTRQVVNVVTTKIALKGGKIVNNWLKQLIKV

229E_ORF1ab           LCGLVCLIQFYLCFFMPYFMYDIVSSFEGYD-FKYIENGQLKNFEAPLKCVRNVFENFED
NL63_ORF1ab           VCLFVVALFIGVSFID---YTTTVTSFHGYD-FKYIENGQLKVFEAPLHCVRNVFDNFNQ
OC43_ORF1ab           FVLSLVCFIGLWCLMPTYTVHKSDFQLPVYASYKVLDNGVIRDVSVEDVCFANKFEQFDQ
HKU1_ORF1ab           FFVSLICFILLWALLPTYSVYKSDIHLPAYASFKVIDNGVVRDISVNDLCFANKFFQFDQ
SARS-CoV-2_ORF1ab     TLVFLFVAAIFYLITPVHVMSKHTDFSSEIIGYKAIDGGVTRDIASTDTCFANKHADFDT

229E_ORF1ab           WHYAKFGFT-PLNKQSCPIVVGVSEIVN--TVAGIPSNVYLVG-------KTLIFTLQAA
NL63_ORF1ab           WHEAKFGVV-TTNSDKCPIVVGVSERIN--VVPGVPTNVYLVG-------KTLVFTLQAA
OC43_ORF1ab           WYESTFGLSYYSNSMACPIVVAVIDQDFGSTVFNVPTKVLRYG-YHVLHFITHALSADGV
HKU1_ORF1ab           WYESTFGSVYYHNSMDCPIVVAVMDEDIGSTMFNVPTKVLRHG-FHVLHFLTYAFASDSV
SARS-CoV-2_ORF1ab     WFSQRGGS--YTNDKACPLIAAVITREVGFVVPGLPGTILRTTNGDFLHFLPRVFSAVGN

229E_ORF1ab           FGNAGVCYDIFGVTTPEKCIFTSACTRLEGLGGN-NVYCYNTALMEGSLPYSSIQANAYY
NL63_ORF1ab           FGNTGVCYDFDGVTTSDKCIFNSACTRLEGLGGD-NVYCYNTDLIEGSKPYSTLQPNAYY
OC43_ORF1ab           QCYTPHSQISYSNFYASGCVLSSACTMFTMADGSPQPYCYTEGLMQNASLYSSLVPHVRY
HKU1_ORF1ab           QCYTPHIQISYNDFYASGCVLSSLCTMFKRGDGTPHPYCYSDGVMKNASLYTSLVPHTRY
SARS-CoV-2_ORF1ab     ICYTPSKLIEYTDFATSACVLAAECTIFKDASGKPVPYCYDTNVLEGSVAYESLRPDTRY

229E_ORF1ab           KYDNGNFIKLPEVIAQGFGFRTVRTIATKYCRVGECVESNAGVCFGFDKWFVND---GRV
NL63_ORF1ab           KYDAKNYVRFPEILARGFGLRTIRTLATRYCRVGECRDSHKGVCFGFDKWYVND---GRV
OC43_ORF1ab           NLANAKGFIRFPEVLREGLVRIVRTRSMSYCRVGLCEEADEGICFNFNGSWVLNNDYYRS
HKU1_ORF1ab           SLANSNGFIRFPDVISEGIVRIVRTRSMTYCRVGACEYAEEGICFNFNSSWVLNNDYYRS
SARS-CoV-2_ORF1ab     VLMDG-SIIQFPNTYLEGSVRVVTTFDSEYCRHGTCERSEAGVCVSTSGRWVLNNDYYRS
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229E_ORF1ab           ANGYVCGTGLWNLVFNILSMFSSSFSVAAMSGQILLNCALGAFAIFCCFLVTKFRRMFGD
NL63_ORF1ab           DDGYICGDGLIDLLVNVLSIFSSSFSVVAMSGHMLFNFLFAAFITFLCFLVTKFKRVFGD
OC43_ORF1ab           LPGTFCGRDVFDLIYQLFKGLAQPVDFLALTASSIAGAILAVIVVLVFYYLIKLKRAFGD
HKU1_ORF1ab           MPGTFCGRDLFDLFYQFFSSLIRPIDFFSLTASSIFGAILAIVVVLVFYYLIKLKRAFGD
SARS-CoV-2_ORF1ab     LPGVFCGVDAVNLLTNMFTPLIQPIGALDISASIVAGGIVAIVVTCLAYYFMRFRRAFGE

229E_ORF1ab           LSVGVCTVVVAVLLNNVSYIVTQN---LVTMIAYAILYFFATRSLRYAWIWCAAYLIAYI
NL63_ORF1ab           LSYGVFTVVCATLINNISYVVTQN---LFFMLLYAILYFVFTRTVRYAWIWHIAYIVAYF
OC43_ORF1ab           YTSVVFVNVIVWCVNFMMLFVFQVYPILSCVYAICYFYATLYFPSEISVIMHLQWLVMYG
HKU1_ORF1ab           YTSVVVINVVVWCINFLMLFVFQVYPICACVYACFYFYVTLYFPSEISVIMHLQWIVMYG
SARS-CoV-2_ORF1ab     YSHVVAFNTLLFLMSFTVLCLTPVYSFLPGVYSVIYLYLTFYLTNDVSFLAHIQWMVMFT

229E_ORF1ab           SFAPWWLCAWYFLAMLTGLLPSLLKLKVSTNLFEGDKFVGTFESAAAGTFVIDMRSYEKL
NL63_ORF1ab           LLIPWWLLTWFSFAAFLELLPNVFKLKISTQLFEGDKFIGTFESAAAGTFVLDMRSYERL
OC43_ORF1ab           TIMPLWFCLLYIAVVVSNHAFWVFS--YCRKLGTSVRSDGTFEEMALTTFMITKDSYCKL
HKU1_ORF1ab           AIMPFWFCVTYVAMVIANHVLWLFS--YCRKIGVNVCSDSTFEETSLTTFMITKDSYCRL
SARS-CoV-2_ORF1ab     PLVPFWITIAYIICISTKHFYWFFSNYLKRRVVFNGVSFSTFEEAALCTFLLNKEMYLKL

229E_ORF1ab           AN--SISPEKLKSYAASYNRYKYYSGNANEADYRCACYAYLAKAMLDFS-RDHNDILYTP
NL63_ORF1ab           IN--TISPEKLKNYAASYNKYKYYSGSASEADYRCACYAHLAKAMLDYA-KDHNDMLYSP
OC43_ORF1ab           KN--SLSDVAFNRYLSLYNKYRYYSGKMDTAAYREAACSQLAKAMDTFTNNNGSDVLYQP
HKU1_ORF1ab           KN--SVSDVAYNRYLSLYNKYRYYSGKMDTAAYREAACSQLAKAMETFNHNNGNDVLYQP
SARS-CoV-2_ORF1ab     RSDVLLPLTQYNRYLALYNKYKYFSGAMDTTSYREAACCHLAKALNDFS-NSGSDVLYQP

229E_ORF1ab           PTVSYG-STLQAGLRKMAQPSGFVEKCVVRVCYGNTVLNGLWLGDIVYCPRHVIASN-TT
NL63_ORF1ab           PTISYN-STLQSGLKKMAQPSGCVERCVVRVCYGSTVLNGVWLGDTVTCPRHVIAPS-TT
OC43_ORF1ab           PTASVSTSFLQSGIVKMVNPTSKVEPCVVSVTYGNMTLNGLWLDDKVYCPRHVICSASDM
HKU1_ORF1ab           PTASVSTSFLQSGIVKMVSPTSKIEPCIVSVTYGSMTLNGLWLDDKVYCPRHVICSSSNM
SARS-CoV-2_ORF1ab     PQTSITSAVLQSGFRKMAFPSGKVEGCMVQVTCGTTTLNGLWLDDVVYCPRHVICTSEDM
                                                      3289      3299

229E_ORF1ab           SAIDYDHEYSIMRLHNFSIISGTAFLGVVGATMHGVTLKIKVSQTNMHTPRHSFRTLKSG
NL63_ORF1ab           VLIDYDHAYSTMRLHNFSVSHNGVFLGVVGVTMHGSVLRIKVSQSNVHTPKHVFKTLKPG
OC43_ORF1ab           TNPDYTNLLCRVTSSDFTVLFDRLSLTVMSYQMRGCMLVLTVTLQNSRTPKYTFGVVKPG
HKU1_ORF1ab           NEPDYSALLCRVTLGDFTIMSGRMSLTVVSYQMQGCQLVLTVSLQNPYTPKYTFGNVKPG
SARS-CoV-2_ORF1ab     LNPNYEDLLIRKSNHNFLVQAGNVQLRVIGHSMQNCVLKLKVDTANPKTPKYKFVRIQPG
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229E_ORF1ab           EGFNILACYDGCAQGVFGVNMRTNWTIRGSFINGACGSPGYNLKN-GEVEFVYMHQIELG
NL63_ORF1ab           DSFNILACYEGIASGVFGVNLRTNFTIKGSFINGACGSPGYNVRNDGTVEFCYLHQIELG
OC43_ORF1ab           ETFTVLAAYNGKPQGAFHVTMRSSYTIKGSFLCGSCGSVGYVIMG-DCVKFVYMHQLELS
HKU1_ORF1ab           ETFTVLAAYNGRPQGAFHVTMRSSYTIKGSFLCGSCGSVGYVLTG-DSVKFVYMHQLELS
SARS-CoV-2_ORF1ab     QTFSVLACYNGSPSGVYQCAMRPNFTIKGSFLNGSCGSVGFNIDY-DCVSFCYMHHMELP

229E_ORF1ab           SGSHVGSSFDGVMYGGFEDQPNLQVESANQMLTVNVVAFLYAAILNGCTWWLKGEKLFVE
NL63_ORF1ab           SGAHVGSDFTGSVYGNFDDQPSLQVESANLMLSDNVVAFLYAALLNGCRWWLCSTRVNVD
OC43_ORF1ab           TGCHTGTDFNGDFYGPYKDAQVVQLLIQDYIQSVNFVAWLYAAILNNCNWFVQSDKCSVE
HKU1_ORF1ab           TGCHTGTDFTGNFYGPYRDAQVVQLPVKDYVQTVNVIAWLYAAILNNCAWFVQNDVCSTE
SARS-CoV-2_ORF1ab     TGVHAGTDLEGNFYGPFVDRQTAQAAGTDTTITVNVLAWLYAAVINGDRWFLNRFTTTLN

229E_ORF1ab           HYNEWAQAN---GFTAMNGEDAFSILAAKTGVCVERLLHAIQVLNNGFGGKQILGYSSLN
NL63_ORF1ab           GFNEWAMAN---GYTSVSSVECYSILAAKTGVSVEQLLASIQHLHEGFGGKNILGYSSLC
OC43_ORF1ab           DFNVWALSN---GFSQVKSDLVIDALASMTGVSLETLLAAIKRLKNGFQGRQIMGSCSFE
HKU1_ORF1ab           DFNVWAMAN---GFSQVKADLVLDALASMTGVSIETLLAAIKRLYMGFQGRQILGSCTFE
SARS-CoV-2_ORF1ab     DFNLVAMKYNYEPLTQDHVDILGPLSAQTGIAVLDMCASLKELLQNGMNGRTILGSALLE

229E_ORF1ab           DEFSINEVVKQMFGVNLQSG---KTTSMFKSISLFAGFFVMFWAELFVYTTTIWVNPGFL
NL63_ORF1ab           DEFTLAEVVKQMYGVNLQSG---KVIFGLKTMFLFSVFFTMFWAELFIYTNTIWINPVIL
OC43_ORF1ab           DELTPSDVYQQLAGIKLQSKRTRLFKGTVCWIMASTFLFSCIITAFVKWTMFMYVTTNMF
HKU1_ORF1ab           DELAPSDVYQQLAGVKLQSKTKRFIKETIYWILISTFLFSCIISAFVKWTIFMYINTHMI
SARS-CoV-2_ORF1ab     DEFTPFDVVRQCSGVTFQSAVKRTIKGTHHWLLLTILTSLLVLVQSTQWSLFFFLYENAF

229E_ORF1ab           TPFMILLVALSLCLTFVVKHKVLFLQVFLLPSIIVAAIQN---CAWDYHVTKVLAEKFDY
NL63_ORF1ab           TPIFCLLLFLSLVLTMFLKHKFLFLQVFLLPTVIATALYN---CVLDYYIVKFLADHFNY
OC43_ORF1ab           S-ITFCALCVISLAMLLVKHKHLYLTMYITPVLFTLLYNNYLVVYKHTFRGYVYAWLSYY
HKU1_ORF1ab           G-VTLCVLCFVSFMMLLVKHKHFYLTMYIIPVLCTLFYVNYLVVYKEGFRGFTYVWLSYF
SARS-CoV-2_ORF1ab     LPFAMGIIAMSAFAMMFVKHKHAFLCLFLLPSLATVAYFN-MVYMPASWVMRIMTWLDMV

229E_ORF1ab           NVSVMQMDIQGFVNIFICLFVALLHTWRFAKERCTHWCTYLFSLIAVLYTALYSYDYVSL
NL63_ORF1ab           NVSVLQMDVQGLVNVLVCLFVVFLHTWRFSKERFTHWFTYVCSLIAVAYTYFYSGDFLSL
OC43_ORF1ab           VPSVEYTYTDEVIYGMLLLVGMVFVTLRSINHDLFSFIMFVGRLISVFSLWYKGSNLEEE
HKU1_ORF1ab           VPAVNFTYVYEVFYGCILCVFAIFITMHSINHDIFSLMFLVGRIVTLISMWYFGSNLEED
SARS-CoV-2_ORF1ab     DTSLSGFKLKDCVMYASAVVLLILMTARTVYDDGARRVWTLMNVLTLVYKVYYGNALDQA
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229E_ORF1ab           LVMLLCAISNEWYIG------AIIFRICRFGVAFLPVEYVSYFDGVKTVLLFYMLLGFVS
NL63_ORF1ab           LVMFLCAISSDWYIG------AIVFRLSRLIVFFSPESVFSVFGDVKLTLVVYLICGYLV
OC43_ORF1ab           ILLMLASLFGTYTWT---TVLSMAVAKVIAKWVAVNVLYFTDIPQIKIVLLCYLFIGYII
HKU1_ORF1ab           VLLFITAFLGTYTWT---TILSLAIAKIVANWLSVNIFYFTDVPYIKLILLSYLFIGYIL
SARS-CoV-2_ORF1ab     ISMWALIISVTSNYSGVVTTVMFLARGIVFMCVEYCPIFFITGNTLQCIMLVYCFLGYFC

229E_ORF1ab           CMYYGLLYWINRFCKCTLGVYDFCVSPAEFKYMVANGLNAPNGPFDALFLSFKLMGIGGP
NL63_ORF1ab           CTYWGILYWFNRFFKCTMGVYDFKVSAAEFKYMVANGLHAPHGPFDALWLSFKLLGIGGD
OC43_ORF1ab           SCYWGLFSLMNSLFRMPLGVYNYKISVQELRYMNANGLRPPKNSFEALMLNFKLLGIGGV
HKU1_ORF1ab           SCYWGFFSLLNSVFRMPMGVYNYKISVQELRYMNANGLRPPRNSFEAILLNLKLLGIGGV
SARS-CoV-2_ORF1ab     TCYFGLFCLLNRYFRLTLGVYDYLVSTQEFRYMNSQGLLPPKNSIDAFKLNIKLLGVGGK

229E_ORF1ab           RTIKVSTVQSKLTDLKCTNVVLMGILSNMNIASNSKEWAYCVEMHNKINLCDDPETAQEL
NL63_ORF1ab           RCIKISTVQSKLTDLKCTNVVLLGCLSSMNIAANSSEWAYCVDLHNKINLCDDPEKAQSM
OC43_ORF1ab           PIIEVSQFQSKLTDVKCANVVLLNCLQHLHVASNSKLWHYCSTLHNEILATSDLSVAFEK
HKU1_ORF1ab           PVIEVSQIQSKLTDVKCANVVLLNCLQHLHVASNSKLWQYCSVLHNEILSTSDLSVAFDK
SARS-CoV-2_ORF1ab     PCIKVATVQSKMSDVKCTSVVLLSVLQQLRVESSSKLWAQCVQLHNDILLAKDTTEAFEK

229E_ORF1ab           LLALLAFFLSKHSDFG----------LGDLVDSYFENDSILQSVASSFVGMPSFVAYETAR
NL63_ORF1ab           LLALLAFFLSKHSDFG----------LDGLIDSYFDNSSTLQSVASSFVSMPSYIAYENAR
OC43_ORF1ab           LAQLLIVLFANP---AAVDSKCLTSIEEVCDDYAKDNTVLQALQSEFVNMASFVEYEVAK
HKU1_ORF1ab           LAQLLIVLFANP---AAVDTKCLASIDEVSDDYVQDSTVLQALQSEFVNMASFVEYEVAK
SARS-CoV-2_ORF1ab     MVSLLSVLLSMQ---GAVD------INKLCEEMLDNRATLQAIASEFSSLPSYAAFATAQ

229E_ORF1ab           QEYENAVANGSS-PQIIKQLKKAMNVAKAEFDRESSVQKKINRMAEQAAAAMYKEARAVN
NL63_ORF1ab           QAYEDAIANGSS-SQLIKQLKRAMNIAKSEFDHEISVQKKINRMAEQAATQMYKEARSVN
OC43_ORF1ab           KNLDEARFSGSANQQQLKQLEKACNIAKSAYERDRAVAKKLERMADLALTNMYKEARIND
HKU1_ORF1ab           KNLADAKNSGSVNQQQIKQLEKACNIAKSVYERDKAVARKLERMADLALTNMYKEARIND
SARS-CoV-2_ORF1ab     EAYEQAVANGDS-EVVLKKLKKSLNVAKSEFDRDAAMQRKLEKMADQAMTQMYKQARSED

229E_ORF1ab           RKSKVVSAMHSLLFGMLRRLDMSSVDTILNMARNGVVPLSVIPATSAARLVVVVPDHDSF
NL63_ORF1ab           RKSKVISAMHSLLFGMLRRLDMSSVETVLNLARDGVVPLSVIPATSASKLTIVSPDLESY
OC43_ORF1ab           KKSKVVSALQTMLFSMVRKLDNQALNSILDNAVKGCVPLNAIPSLAANTLNIIVPDKSVY
HKU1_ORF1ab           KKSKVVSALQTMLFSMVRKLDNQALNSILDNAVKGCVPLSAIPALAANTLTIVIPDKQVF
SARS-CoV-2_ORF1ab     KRAKVTSAMQTMLFTMLRKLDNDALNNIINNARDGCVPLNIIPLTTAAKLMVVIPDYNTY
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229E_ORF1ab           VKMMVDGFVHYAGVVWTLQEVKDNDGKNVHLKDVTKENQEILVWPLILTCERVVK-----
NL63_ORF1ab           SKIVCDGSVHYAGVVWTLNDVKDNDGRPVHVKEITKENVETLTWPLILNCERVVK-----
OC43_ORF1ab           DQVVDNVYVTYAGNVWQIQTIQDSDGTNKQLNEISDDCN----WPLVIIANRYNEVSATV
HKU1_ORF1ab           DKVVDNVYVTYAGSVWHIQTVQDADGINKQLTDISVDSN----WPLVIIANRYNEVANAV
SARS-CoV-2_ORF1ab     KNTCDGTTFTYASALWEIQQVVDADSKIVQLSEISMDNSPNLAWPLIVTALRAN--SAVK

229E_ORF1ab           LQNNEIMPGKMKVKATKGEGDGGITSEG--NALYNNEGGRAFMYAYVTTKPGMKYVKWEH
NL63_ORF1ab           LQNNEIMPGKLKQKPMKAEGDGGVLGDG--NALYNTEGGKTFMYAYISNKADLKFVKWEY
OC43_ORF1ab           LQNNELMPAKLKIQVVNSGPDQTCNTPT--QCYYNNSNNGKIVYAILSDVDGLKYTKILK
HKU1_ORF1ab           MQNNELMPHKLKIQVVNSGSDMNCNIPT--QCYYNNGSSGRIVYAVLSDVDGLKYTKIMK
SARS-CoV-2_ORF1ab     LQNNELSPVALRQMSCAAGTTQTACTDDNALAYYNTTKGGRFVLALLSDLQDLKWARFPK

229E_ORF1ab           DSGV--VTVELEPPCRFVIDTPTGPQIKYLYFVKNLNNLRRGAVLGYIGATVRLQAGKQT
NL63_ORF1ab           EGGC--NTIELDSPCRFMVETPNGPQVKYLYFVKNLNTLRRGAVLGFIGATIRLQAGKQT
OC43_ORF1ab           DDGN-FVVLELDPPCKFTVQDAKGLKIKYLYFVKGCNTLARGWVVGTISSTVRLQAGTAT
HKU1_ORF1ab           DDGN-CVVLELDPPCKFSIQDVKGLKIKYLYFIKGCNTLARGWVVGTLSSTIRLQAGVAT
SARS-CoV-2_ORF1ab     SDGTGTIYTELEPPCRFVTDTPKGPKVKYLYFIKGLNNLNRGMVLGSLAATVRLQAGNAT
                                4208

229E_ORF1ab           EFVSNSHLLTHCSFAVDPAAAYLDAVKQGAKPVGNCVKMLTNGSGSGQAITCTIDSNTTQ
NL63_ORF1ab           ELAVNSGLLTACAFSVDPATTYLEAVKHGAKPVSNCIKMLSNGAGNGQAITTSVDANTNQ
OC43_ORF1ab           EYASNSSILSLCAFSVDPKKTYLDFIQQGGTPIANCVKMLCDHAGTGMAITVKPDATTSQ
HKU1_ORF1ab           EYAANSSILSLCAFSVDPKKTYLDYIQQGGVPIINCVKMLCDHAGTGMAITIKPEATINQ
SARS-CoV-2_ORF1ab     EVPANSTVLSFCAFAVDAAKAYKDYLASGGQPITNCVKMLCTHTGTGQAITVTPEANMDQ

229E_ORF1ab           DTYGGASVCIYCRAHVAHPTMDGFCQYKGKWVQVP-IGTNDPIRFCLENTVCKVCGCWLN
NL63_ORF1ab           DSYGGASICLYCRAHVPHPSMDGYCKFKGKCVQVP-IGCLDPIRFCLENNVCNVCGCWLG
OC43_ORF1ab           DSYGGASVCIYCRARVEHPDVDGLCKLRGKFVQVP-VGIKDPVSYVLTHDVCRVCGFWRD
HKU1_ORF1ab           DSYGGASVCIYCRARVEHPDVDGICKLRGKFVQVP-LGIKDPILYVLTHDVCQVCGFWRD
SARS-CoV-2_ORF1ab     ESFGGASCCLYCRCHIDHPNPKGFCDLKGKYVQIPTTCANDPVGFTLKNTVCTVCGMWKG

229E_ORF1ab           HGCTCDRT---AIQSFDNSYLNRVRG-SSAARLEPCN-GTDIDYCVRAFDVYNKDASFIG
NL63_ORF1ab           HGCACDRT---TIQSVDISYLNRARG-SSAARLEPCN-GTDIDKCVRAFDIYNKNVSFLG
OC43_ORF1ab           GSCSCVST-DTTVQSKDTNFLNRVRGTSVDARLVPCASGLSTDVQLRAFDIYNASVAGIG
HKU1_ORF1ab           GSCSCVGS-SVAVQSKDLNFLNRVRGTSVNARLVPCASGLSTDVQLRAFDICNTNRAGIG
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SARS-CoV-2_ORF1ab      YGCSCDQLREPMLQSADAQSFLNRVCGVSAARLTPCGTGTSTDVVYRAFDIYNDKVAGFA

229E_ORF1ab            KNLKSNCVRFKNVDKD----DAFYIVKRCIKSVMDHEQSMYNLLKGCNAVAKHDFFTWHE
NL63_ORF1ab            KCLKMNCVRFKNADLK----DGYFVIKRCTKSVMEHEQSMYNLLNFSGALAEHDFFTWKD
OC43_ORF1ab            LHLKVNCCRFQRVDENGDKLDQFFVVKRTDLTIYNREMKCYERVKDCKFVAEHDFFTFDV
HKU1_ORF1ab            LYYKVNCCRFQRIDDDGNKLDKFFVVKRTNLEVYNKEKTYYELTKSCGVVAEHDFFTFDI
SARS-CoV-2_ORF1ab      KFLKTNCCRFQEKDEDDNLIDSYFVVKRHTFSNYQHEETIYNLLKDCPAVAKHDFFKFRI

229E_ORF1ab            GRTIYGNVSRQDLTKYTMMDLCFALRNFDEKDCEVFKEILVLTGCCSTDYFEMKNWFDPI
NL63_ORF1ab            GRVIYGNVSRHNLTKYTMMDLVYAMRNFDEQNCDVLKEVLVLTGCCDNSYFDSKGWYDPV
OC43_ORF1ab            EGSRVPHIVRKDLTKYTMLDLCYALRHFDRNDCMLLCDILSIYAGCEQSYFTKKDWYDFV
HKU1_ORF1ab            DGSRVPHIVRRNLSKYTMLDLCYALRHFDRNDCSILCEILCEYADCKESYFSKKDWYDFV
SARS-CoV-2_ORF1ab      DGDMVPHISRQRLTKYTMADLVYALRHFDEGNCDTLKEILVTYNCCDDDYFNKKDWYDFV
                                                                      4551

229E_ORF1ab            ENEDIHRVYAALGKVVANAMLKCVAFCDEMVLKGVVGVLTLDNQDLNGNFYDFGDFVLCP
NL63_ORF1ab            ENEDIHRVYASLGKIVARAMLKCVALCDAMVAKGVVGVLTLDNQDLNGNFYDFGDFVVSL
OC43_ORF1ab            ENPDIINVYKKLGPIFNRALVSATEFADKLVEVGLVGVLTLDNQDLNGKWYDFGDYVIAA
HKU1_ORF1ab            ENPDIINIYKKLGPIFNRALLNTVIFADTLVEVGLVGVLTLDNQDLYGQWYDFGDFIQTA
SARS-CoV-2_ORF1ab      ENPDILRVYANLGERVRQALLKTVQFCDAMRNAGIVGVLTLDNQDLNGNWYDFGDFIQTT
                                                  4594          4608

229E_ORF1ab            PGMGIPYCTSYYSYMMPVMGMTNCLASECFMKSDIFGQDFKTFDLLKYDFTEHKEVLFNK
NL63_ORF1ab            PNMGVPCCTSYYSYMMPIMGLTNCLASECFVKSDIFGSDFKTFDLLKYDFTEHKENLFNK
OC43_ORF1ab            PGCGVAIADSYYSYIMPMLTMCHALDCELYVN-----NAYRLFDLVQYDFTDYKLELFNK
HKU1_ORF1ab            PGFGVAVADSYYSYMMPMLTMCHVLDCELFVN-----DSYRQFDLVQYDFTDYKLELFNK
SARS-CoV-2_ORF1ab      PGSGVPVVDSYYSLLMPILTLTRALTAESHVDTDLT-KPYIKWDLLKYDFTEERLKLFDR
                                                        4661

229E_ORF1ab            YFKYWGQDYHPDCVDCHDEMCILHCSNFNTLFATTIPNTAFGPLCRKVFIDGVPVVATAG
NL63_ORF1ab            YFKHWSFDYHPNCSDCYDDMCVIHCANFNTLFATTIPGTAFGPLCRKVFIDGVPLVTTAG
OC43_ORF1ab            YFKHWSMPYHPNTVDCQDDRCIIHCANFNILFSMVLPNTCFGPLVRQIFVDGVPFVVSIG
HKU1_ORF1ab            YFKYWGMKYHPNTVDCDNDRCIIHCANFNILFSMVLPNTCFGPLVRQIFVDGVPFVVSIG
SARS-CoV-2_ORF1ab      YFKYWDQTYHPNCVNCLDDRCILHCANFNVLFSTVFPPTSFGPLVRKIFVDGVPFVVSTG
                                                          4725
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229E_ORF1ab           YHFKQLGLVWNKDVNTHSTRLTITELLQFVTDPTLIVASSPALVDKRTVCFSVAALSTGL
NL63_ORF1ab           YHFKQLGLVWNKDVNTHSVRLTITELLQFVTDPSLIIASSPALVDQRTICFSVAALSTGL
OC43_ORF1ab           YHYKELGIVMNMDVDTHRYRLSLKDLLLYAADPALHVASASALYDLRTCCFSVAAITSGV
HKU1_ORF1ab           YHYKELGVVMNLDVDTHRYRLSLKDLLLYAADPAMHVASASALLDLRTCCFSVAAITSGI
SARS-CoV-2_ORF1ab     YHFRELGVVHNQDVNLHSSRLSFKELLVYAADPAMHAASGNLLLDKRTTCFSVAALTNNV

229E_ORF1ab           TSQTVKPGHFNKEFYDFLRSQGFFDEGSELTLKHFFFTQKGDAAIKDFDYYRYNRPTMLD
NL63_ORF1ab           TNQVVKPGHFNEEFYNFLRLRGFFDEGSELTLKHFFFAQNGDAAVKDFDFYRYNKPTILD
OC43_ORF1ab           KFQTVKPGNFNQDFYDFVLSKGLLKEGSSVDLKHFFFTQDGNAAITDYNYYKYNLPTMVD
HKU1_ORF1ab           KFQTVKPGNFNQDFYEFVKSKGLFKEGSTVDLKHFFFTQDGNAAITDYNYYKYNLPTMVD
SARS-CoV-2_ORF1ab     AFQTVKPGNFNKDFYDFAVSKGFFKEGSSVELKHFFFAQDGNAAISDYDYYRYNLPTMCD
                       4799

229E_ORF1ab           IGQARVAYQVAARYFDCYEGGCITSREVVVTNLNKSAGWPLNKFGKAGLYYESISYEEQD
NL63_ORF1ab           ICQARVTYKIVSRYFDIYEGGCIKACEVVVTNLNKSAGWPLNKFGKASLYYESISYEEQD
OC43_ORF1ab           IKQLLFVLEVVYKYFEIYDGGCIPASQVIVNNYDKSAGYPFNKFGKARLYYEALSFEEQD
HKU1_ORF1ab           IKQLLFVLEVVYKYFEIYDGGCIPASQVIVNNYDKSAGYPFNKFGKARLYYEALSFEEQN
SARS-CoV-2_ORF1ab     IRQLLFVVEVVDKYFDCYDGGCINANQVIVNNLDKSAGFPFNKWGKARLYYDSMSYEDQD

229E_ORF1ab           AIFSLTKRNILPTMTQLNLKYAISGKERARTVGGVSLLATMTTRQFHQKCLKSIVATRNA
NL63_ORF1ab           ALFALTKRNVLPTMTQLNLKYAISGKERARTVGGVSLLSTMTTRQYHQKHLKSIVNTRNA
OC43_ORF1ab           EIYAYTKRNVLPTLTQMNLKYAISAKNRARTVAGVSILSTMTGRMFHQKCLKSIAATRGV
HKU1_ORF1ab           EIYAYTKRNVLPTLTQMNLKYAISAKNRARTVAGVSILSTMTGRMFHQKCLKSIAATRGV
SARS-CoV-2_ORF1ab     ALFAYTKRNVIPTITQMNLKYAISAKNRARTVAGVSICSTMTNRQFHQKLLKSIAATRGA
                                  4931

229E_ORF1ab           TVVIGTTKFYGGWDNMLKNLMADVDDPKLMGWDYPKCDRAMPSMIRMLSAMILGSKHVTC
NL63_ORF1ab           TVVIGTTKFYGGWNNMLRTLIDGVENPMLMGWDYPKCDRALPNMIRMISAMVLGSKHVNC
OC43_ORF1ab           PVVIGTTKFYGGWDDMLRRLIKDVDNPVLMGWDYPKCDRAMPNLLRIVSSLVLARKHETC
HKU1_ORF1ab           PVVIGTTKFYGGWDDMLRHLIKDVDNPVLMGWDYPKCDRAMPNILRIVSSLVLARKHEFC
SARS-CoV-2_ORF1ab     TVVIGTSKFYGGWHNMLKTVYSDVENPHLMGWDYPKCDRAMPNMLRIMASLVLARKHTTC
                                             5006

229E_ORF1ab           CTASDKFYRLSNELAQVLTEVVYSNGGFYFKPGGTTSGDATTAYANSVFNIFQAVSSNIN
NL63_ORF1ab           CTATDRFYRLGNELAQVLTEVVYSNGGFYFKPGGTTSGDASTAYANSIFNIFQAVSSNIN
OC43_ORF1ab           CSQSDRFYRLANECAQVLSEIVMCGGCYYVKPGGTSSGDATTAFANSVFNICQAVSANVC
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HKU1_ORF1ab           CSHGDRFYRLANECAQVLSEIVMCGGCYYVKPGGTSSGDATTAFANSVFNICQAVTANVC
SARS-CoV-2_ORF1ab     CSLSHRFYRLANECAQVLSEMVMCGGSLYVKPGGTSSGDATTAYANSVFNICQAVTANVN
                           5043                  5066           5082

229E_ORF1ab           CVLSVNSSNCNNFNVKKLQRQLYDNCYRNSNVDESFVDDFYGYLQKHFSMMILSDDSVVC
NL63_ORF1ab           RLLSVPSDSCNNVNVRDLQRRLYDNCYRLTSVEESFIDDYYGYLRKHFSMMILSDDGVVC
OC43_ORF1ab           ALMSCNGNKIEDLSIRALQKRLYSHVYRSDKVDSTFVTEYYEFLNKHFSMMILSDDGVVC
HKU1_ORF1ab           SLMACNGHKIEDLSIRNLQKRLYSNVYRTDYVDYTFVNEYYEFLCKHFSMMILSDDGVVC
SARS-CoV-2_ORF1ab     ALLSTDGNKIADKYVRNLQHRLYECLYRNRDVDTDFVNEFYAYLRKHFSMMILSDDAVVC

229E_ORF1ab           YNKTYAGLGYIADISAFKATLYYQNGVFMSTAKCWTEEDLSIGPHEFCSQHTMQIVDENG
NL63_ORF1ab           YNKDYAELGYIADISAFKATLYYQNNVFMSTSKCWVEEDLTKGPHEFCSQHTMQIVDKDG
OC43_ORF1ab           YNSDYASKGYIANISAFQQVLYYQNNVFMSESKCWVEHDINNGPHEFCSQHTMLVKMDGD
HKU1_ORF1ab           YNSDYASKGYIANISVFQQVLYYQNNVFMSESKCWVENDITNGPHEFCSQHTMLVKIDGD
SARS-CoV-2_ORF1ab     FNSTYASQGLVASIKNFKSVLYYQNNVFMSEAKCWTETDLTKGPHEFCSQHTMLVKQGDD
                                        5177          5196           5217

229E_ORF1ab           KYYLPYPDPSRIISAGVFVDDITKTDAVILLERYVSLAIDAYPLSKHPKPEYRKVFYALL
NL63_ORF1ab           TYYLPYPDPSRILSAGVFVDDVVKTDAVVLLERYVSLAIDAYPLSKHPNSEYRKVFYVLL
OC43_ORF1ab           DVYLPYPNPSRILGAGCFVDDLLKTDSVLLIERFVSLAIDAYPLVYHENEEYQKVFRVYL
HKU1_ORF1ab           YVYLPYPDPSRILGAGCFVDDLLKTDSVLLIERFVSLAIDAYPLVHHENEEYQKVFRVYL
SARS-CoV-2_ORF1ab     YVYLPYPDPSRILGAGCFVDDIVKTDGTLMIERFVSLAIDAYPLTKHPNQEYADVFHLYL
                                              5248

229E_ORF1ab           DWVKHLNKTLNEGVLESFSVTLLDEHESKFWDESFYASMYEKSTVLQAAGLCVVCGSQTV
NL63_ORF1ab           DWVKHLNKNLNEGVLESFSVTLLDNQEDKFWCEDFYASMYENSTILQAAGLCVVCGSQTV
OC43_ORF1ab           AYIKKLYNDLGNQILDSYSVILSTCDGQKFTDESFYKNMYLRSAVMQSVGACVVCSSQTS
HKU1_ORF1ab           EYIKKLYNDLGTQILDSYSVILSTCDGLKFTEESFYKNMYLKSAVMQSVGACVVCSSQTS
SARS-CoV-2_ORF1ab     QYIRKLHDELTGHMLDMYSVMLTNDNTSRYWEPEFYEAMYTPHTVLQAVGACVLCNSQTS

229E_ORF1ab           LRCGDCLRRPMLCTKCAYDHVFGTDHKFILAITPYVCNTSGCNVNDVTKLYLGGLNYYCV
NL63_ORF1ab           LRCGDCLRKPMLCTKCAYDHVFGTDHKFILAITPYVCNASGCGVSDVKKLYLGGLNYYCT
OC43_ORF1ab           LRCGSCIRKPLLCCKCCYDHVMATDHKYVLSVSPYVCNAPGCDVNDVTKLYLGGMSYYCE
HKU1_ORF1ab           LRCGSCIRKPLLCCKCCYDHVMATNHKYVLSVSPYVCNAPNCDVSDVTKLYLGGMSYYCE
SARS-CoV-2_ORF1ab     LRCGACIRRPFLCCKCCYDHVISTSHKLVLSVNPYVCNAPGCDVTDVTQLYLGGMSYYCK
                                5349                  5372           5388
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229E_ORF1ab           DHKPHLSFPLCSAGNVFGLYKSSALGSMDIDVFNKLSTSDWSDIRDYKLANDAKESLRLF
NL63_ORF1ab           NHKPQLSFPLCSAGNIFGLYKNSATGSLDVEVFNRLATSDWTDVRDYKLANDVKDTLRLF
OC43_ORF1ab           DHKPQYSFKLVMNGLVFGLYKQSCTGSPYIDDFNRIASCKWTDVDDYILANECTERLKLF
HKU1_ORF1ab           NHKPHYSFKLVMNGMVFGLYKQSCTGSPYIDDFNKIASCKWTEVDDYVLANECIERLKLF
SARS-CoV-2_ORF1ab     SHKPPISFPLCANGQVFGLYKNTCVGSDNVTDFNAIATCDWTNAGDYILANTCTERLKLF
                                                                      5450

229E_ORF1ab           AAETVKAKEESVKSSYAYATLKEIVGPKELLLLWESGKAKPPLNRNSVFTCFQITKDSKF
NL63_ORF1ab           AAETIKAKEESVKSSYAFATLKEVVGPKELLLSWESGKVKPPLNRNSVFTCFQISKDSKF
OC43_ORF1ab           AAETQKATEEAFKQSYASATIQEIVSERELILSWEIGKVKPPLNKNYVFTGYHFTKNGKT
HKU1_ORF1ab           AAETQKATEEAFKQSYASATIQEIVSDREVILCWETGKVKPPLNKNYVFTGYHFTSTGKT
SARS-CoV-2_ORF1ab     AAETLKATEETFKLSYGIATVREVLSDRELHLSWEVGKPRPPLNRNYVFTGYRVTKNSKV

229E_ORF1ab           QVGEFVFEKVDYGSDTVTYKSTATTKLVPGMLFILTSHNVAPLRAPTMANQEKYSTIYKL
NL63_ORF1ab           QIGEFIFEKVEYGSDTVTYKSTVTTKLVPGMIFVLTSHNVQPLRAPTIANQEKYSSIYKL
OC43_ORF1ab           VLGEYVFDKSELT-NGVYYRATTTYKLSVGDVFVLTSHSVANLSAPTLVPQENYSSIR-F
HKU1_ORF1ab           VLGEYVFDKSELT-NGVYYRATTTYKLSIGDVFVLTSHSVASLSAPTLVPQENYASIR-F
SARS-CoV-2_ORF1ab     QIGEYTFEKGDYG-DAVVYRGTTTYKLNVGDYFVLTSHTVMPLSAPTLVPQEHYVRITGL
                                                        5559

229E_ORF1ab           HPSFNVSDAYANLVPYYQLIGKQRITTIQGPPGSGKSHCSIGIGVYYPGARIVFTACSHA
NL63_ORF1ab           HPAFNVSDAYANLVPYYQLIGKQKITTIQGPPGSGKSHCSIGLGLYYPGARIVFVACAHA
OC43_ORF1ab           ASVYSVLETFQNNVVNYQHIGMKRYCTVQGPPGTGKSHLAIGLAVFYCTARVVYTAASHA
HKU1_ORF1ab           SSVYSVPLVFQNNVANYQHIGMKRYCTVQGPPGTGKSHLAIGLAVYYYTARVVYTAASHA
SARS-CoV-2_ORF1ab     YPTLNISDEFSSNVANYQKVGMQKYSTLQGPPGTGKSHFAIGLALYYPSARIVYTACSHA
                                          5605                        5634

229E_ORF1ab           AVDSLCAKAVTAYSVDKCTRIIPARARVECYSGFKPNNNSAQYVFSTVNALPEVNADIVV
NL63_ORF1ab           AVDSLCAKAMTVYSIDKCTRIIPARARVECYSGFKPNNTSAQYIFSTVNALPECNADIVV
OC43_ORF1ab           AVDALCEKAYKFLNINDCTRIVPAKVRVECYDKFKINDTTRKYVFTTINALPEMVTDIVV
HKU1_ORF1ab           AVDALCEKAYKFLNINDCTRIIPAKVRVDCYDKFKINDTTCKYVFTTINALPELVTDIVV
SARS-CoV-2_ORF1ab     AVDALCEKALKYLPIDKCSRIIPARARVECFDKFKVNSTLEQYVFCTVNALPETTADIVV
                                    5656

229E_ORF1ab           VDEVSMCTNYDLSVINQRISYKHIVYVGDPQQLPAPRVLISKGVMEPIDYNVVTQRMCAI
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NL63_ORF1ab           VDEVSMCTNYDLSVINQRLSYKHIVYVGDPQQLPAPRVMITKGVMEPVDYNVVTQRMCAI
OC43_ORF1ab           VDEVSMLTNYELSVINARIRAKHYVYIGDPAQLPAPRVLLSKGTLEPKYFNTVTKLMCCL
HKU1_ORF1ab           VDEVSMLTNYELSVINARIKAKHYVYIGDPAQLPAPRVLLSKGSLEPRHFNSITKIMCCL
SARS-CoV-2_ORF1ab     FDEISMATNYDLSVVNARLRAKHYVYIGDPAQLPAPRTLLTKGTLEPEYFNSVCRLMKTI
                                          5716

229E_ORF1ab           GPDVFLHKCYRCPAEIVNTVSELVYENKFVPVKEASKQCFKIFERGSVQVDNGSSINRRQ
NL63_ORF1ab           GPDVFLHKCYRCPAEIVNTVSELVYENKFVPVKPASKQCFKVFFKGNVQVDNGSSINRKQ
OC43_ORF1ab           GPDIFLGTCYRCPKEIVDTVSALVYENKLKAKNESSSLCFKVYYKGVTTHESSSAVNMQQ
HKU1_ORF1ab           GPDIFLGNCYRCPKEIVETVSALVYDNKLKAKNDNSSLCFKVYFKGQTTHESSSAVNIQQ
SARS-CoV-2_ORF1ab     GPDMFLGTCRRCPAEIVDTVSALVYDNKLKAHKDKSAQCFKMFYKGVITHDVSSAINRPQ
                                  5771

229E_ORF1ab           LDVVKRFIHKNSTWSKAVFISPYNSQNYVAARLLGLQTQTVDSAQGSEYDYVIFAQTSDT
NL63_ORF1ab           LEIVKLFLVKNPSWSKAVFISPYNSQNYVASRFLGLQIQTVDSSQGSEYDYVIYAQTSDT
OC43_ORF1ab           IYLINKFLKANPLWHKAVFISPYNSQNFAAKRVLGLQTQTVDSAQGSEYDYVIYSQTAET
HKU1_ORF1ab           IYLISKFLKANPVWNSAVFISPYNSQNYVAKRVLGVQTQTVDSAQGSEYDYVIYSQTAET
SARS-CoV-2_ORF1ab     IGVVREFLTRNPAWRKAVFISPYNSQNAVASKILGLPTQTVDSSQGSEYDYVIFTQTTET
                                      5832                  5855

229E_ORF1ab           AHACNANRFNVAITRAKKGIFCIMSDRTLFDALKFFEITMTDLQSESS------CGLFKD
NL63_ORF1ab           AHACNVNRFNVAITRAKKGIFCVMCDKTLFDSLKFFEIKHADLHSSQV------CGLFKN
OC43_ORF1ab           AHSVNVNRFNVAITRAKKGILCVMSNMQLFEALQFTTLTLDKVPQAVETKVQCSTNLFKD
HKU1_ORF1ab           AHSVNVNRFNVAITRAKKGIFCVMSNMQLFESLNFITLPLDKIQNQTLPRLHCTTNLFKD
SARS-CoV-2_ORF1ab     AHSCNVNRFNVAITRAKVGILCIMSDRDLYDKLQFTSLEIPRRNVATLQAENVTG-LFKD
                         5880

229E_ORF1ab           CARNPIDLPPSHATTYLSLSDRFKTSGDLAVQIGNNN-VCTYEHVISYMGFRFDVSMPGS
NL63_ORF1ab           CTRTPLNLPPTHAHTFLSLSDQFKTTGDLAVQIGSNN-VCTYEHVISFMGFRFDISIPGS
OC43_ORF1ab           CSKSYSGYHPAHAPSFLAVDDKYKATGDLAVCLGIGDSAVTYSRLISLMGFKLDVTLDGY
HKU1_ORF1ab           CSKSCLGYHPAHAPSFLAVDDKYKVNENLAVNLNICEPVLTYSRLISLMGFKLDLTLDGY
SARS-CoV-2_ORF1ab     CSKVITGLHPTQAPTHLSVDTKFKTEG-LCVDIPGIPKDMTYRRLISMMGFKMNYQVNGY

229E_ORF1ab           HSLFCTRDFAMRHVRGWLGMDVEGAHVTGDNVGTNVPLQVGFSNGVDFVAQPEGCVLTNT
NL63_ORF1ab           HSLFCTRDFAIRNVRGWLGMDVESAHVCGDNIGTNVPLQVGFSNGVNFVVQTEGCVSTNF
OC43_ORF1ab           CKLFITKEEAVKRVRAWVGFDAEGAHATRDSIGTNFPLQLGFSTGIDFVVEATGLFADRD
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HKU1_ORF1ab           SKLFITKDEAIKRVRGWVGFDVEGAHATRENIGTNFPLQIGFSTGVDFVVEATGLFAERD
SARS-CoV-2_ORF1ab     PNMFITREEAIRHVRAWIGFDVEGCHATREAVGTNLPLQLGFSTGVNLVAVPTGYVDTPN
                                                      6031

229E_ORF1ab           GSVVKPVRARAPPGEQFTHIVPLLRKGQPWSVLRKRIVQMIADFLAGSSDVLVFVLWAGG
NL63_ORF1ab           GDVIKPVCAKSPPGEQFRHLIPLLRKGQPWLIVRRRIVQMISDYLSNLSDILVFVLWAGS
OC43_ORF1ab           GYSFKKAVAKAPPGEQFKHLIPLMTRGHRWDVVRPRIVQMFADHLIDLSDCVVLVTWAAN
HKU1_ORF1ab           CYTFKKTVAKAPPGEKFKHLIPLMSKGQKWDIVRIRIVQMLSDYLLDLSDSVVFITWSAS
SARS-CoV-2_ORF1ab     NTDFSRVSAKPPPGDQFKHLIPLMYKGLPWNVVRIKIVQMLSDTLKNLSDRVVFVLWAHG

229E_ORF1ab           LELTTMRYFVKIG-AVKHCQCGTVATCYNSVSNDYCCFKHALGCDYVYNPYVIDIQQWGY
NL63_ORF1ab           LELTTMRYFVKIG-PIKYCYCGNSATCYNSVSNEYCCFKHALGCDYVYNPYAFDIQQWGY
OC43_ORF1ab           FELTCLRYFAKVGREISCNVCTKRATVYNSRTGYYGCWRHSVTCDYLYNPLIVDIQQWGY
HKU1_ORF1ab           FELTCLRYFAKLGRELNCNVCSNRATCYNSRTGYYGCWRHSYTCDYVYNPLIVDIQQWGY
SARS-CoV-2_ORF1ab     FELTSMKYFVKIGPERTCCLCDRRATCFSTASDTYACWHHSIGFDYVYNPFMIDVQQWGF

229E_ORF1ab           VGSLSTNHHAICNVHRNEHVASGDAIMTRCLAVYDCFVKNVDWSITYPMIANENAINKGG
NL63_ORF1ab           VGSLSQNHHTFCNIHRNEHDASGDAVMTRCLAVHDCFVKNVDWTVTYPFIANEKFINGCG
OC43_ORF1ab           IGSLSSNHDLYCSVHKGAHVASSDAIMTRCLAVYDCFCNNINWNVEYPIISNELSINTSC
HKU1_ORF1ab           TGSLTSNHDIICNVHKGAHVASADAIMTRCLAIYDCFCKSVNWNLEYPIISNEVSINTSC
SARS-CoV-2_ORF1ab     TGNLQSNHDLYCQVHGNAHVASCDAIMTRCLAVHECFVKRVDWTIEYPIIGDELKINAAC
                                          6198

229E_ORF1ab           RTVQSHIMRAAIKLYNPKAIHDIGNPKGIRCA-VTDAKWYCYDKNP-----INSNVKTLE
NL63_ORF1ab           RNVQGHVVRAALKLYKPSVIHDIGNPKGVRCA-VTDAKWYCYDKQP-----VNSNVKLLD
OC43_ORF1ab           RVLQRVILKAAMLCNRYTLCYDIGNPKAIACV--KDFDFKFYDAQP---IVKSVKTLLYS
HKU1_ORF1ab           RLLQRVMLKAAMLCNRYNLCYDIGNPKGLACV--KDYEFKFYDAFP---VAKSVKQLFYV
SARS-CoV-2_ORF1ab     RKVQHMVVKAALLADKFPVLHDIGNPKAIKCVPQADVEWKFYDAQPCSDKAYKIEELFYS

229E_ORF1ab           YDYMTHGQMDGLCLFWNCNVDMYPEFSIVCRFDTRTRSTLNLEGVNGGSLYVNNHAFHTP
NL63_ORF1ab           YDYATHGQLDGLCLFWNCNVDMYPEFSIVCRFDTRTRSVFNLEGVNGGSLYVNKHAFHTP
OC43_ORF1ab           FEAHKDSFKDGLCMFWNCNVDKYPPNAVVCRFDTRVLNNLNLPGCNGGSLYVNKHAFHTK
HKU1_ORF1ab           YDVHKDNFKDGLCMFWNCNVDKYPSNSIVCRFDTRVLNKLNLPGCNGGSLYVNKHAFHTN
SARS-CoV-2_ORF1ab     YATHSDKFTDGVCLFWNCNVDRYPANSIVCRFDTRVLSNLNLPGCDGGSLYVNKHAFHTP
                                6307        6320                6341
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229E_ORF1ab           AYDKRAMAKLKPAPFFYYDDGSCEVVHDQVN----YVPLRATNCITKCNIGGAVCSKHAN
NL63_ORF1ab           AYDKRAFVKLKPMPFFYFDDSDCDVVQEQVN----YVPLRASSCVTRCNIGGAVCSKHAN
OC43_ORF1ab           PFARAAFEHLKPMPFFYYSDTPCVYMDGMDAKQVDYVPLKSATCITRCNLGGAVCLKHAE
HKU1_ORF1ab           PFTRTVFENLKPMPFFYYSDTPCVYVDGLESKQVDYVPLRSATCITRCNLGGAVCSKHAE
SARS-CoV-2_ORF1ab     AFDKSAFVNLKQLPFFYYSDSPCESHGKQVVSDIDYVPLKSATCITRCNLGGAVCRHHAN
                                                        6389

229E_ORF1ab           LYRAYVESYNIFTQAGFNIWVPTTFDCYNLWQTFTEVNLQGLENIAFNVVNKGSFVGADG
NL63_ORF1ab           LYQKYVEAYNTFTQAGFNIWVPHSFDVYNLWQIFIETNLQSLENIAFNVVKKGCFTGVDG
OC43_ORF1ab           EYREYLESYNTATTAGFTFWVYKTFDFYNLWNTFTK--LQSLENVVYNLVKTGHYTGQAG
HKU1_ORF1ab           EYCNYLESYNIVTTAGFTFWVYKNFDFYNLWNTFTT--LQSLENVIYNLVNVGHYDGRTG
SARS-CoV-2_ORF1ab     EYRLYLDAYNMMISAGFSLWVYKQFDTYNLWNTFTR--LQSLENVAFNVVNKGHFDGQQG

229E_ORF1ab           ELPVAISGDKVFVRDGNTDNLVFVNKTSLPTNIAFELFAKRKVGLTPPLSILKNLGVVAT
NL63_ORF1ab           ELPVAVVNDKVFVRYGDVDNLVFTNKTTLPTNVAFELFAKRKMGLTPPLSILKNLGVVAT
OC43_ORF1ab           EMPCAIINDKVVAKIDKEDVVIFINNTTYPTNVAVELFAKRSVRHHPELKLFRNLNIDVC
HKU1_ORF1ab           ELPCAIMNDKVVVKINNVDTVIFKNNTSFPTNIAVELFTKRSIRHHPELKILRNLNIDIC
SARS-CoV-2_ORF1ab     EVPVSIINNTVYTKVDGVDVELFENKTTLPVNVAFELWAKRNIKPVPEVKILNNLGVDIA

229E_ORF1ab           YKFVLWDYEAERPLTSFTKSVCGYTDFA--------EDVCTCYDNSIQGSYERFTLSTNA
NL63_ORF1ab           YKFVLWDYEAERPFTSYTKSVCKYTDFN--------EDVCVCFDNSIQGSYERFTLTTNA
OC43_ORF1ab           WKHVIWDYARESIFCSNTYGVCMYTDLK------FIDKLNVLFDGRDNGALEAFKRSNNG
HKU1_ORF1ab           WKHVLWDYVKDSLFCSSTYGVCKYTDLK------FIENLNILFDGRDTGALEAFRKARNG
SARS-CoV-2_ORF1ab     ANTVIWDYKRDAPAHISTIGVCSMTDIAKKPTETICAPLTVFFDGRVDGQVDLFRNARNG

229E_ORF1ab           VLFSATAVKTGGKSLPAIKLNFGMLNGNAIATVKSEDGNIKNINWFVYVR----------
NL63_ORF1ab           VLFSTVVIKN----LTPIKLNFGMLNGMPVSSIKGDKGVEKLVNWYIYVR----------
OC43_ORF1ab           VYISTTKVKSLSMIRGPPRAELNGVVVDKVGDTDCVFYFAVRKEGQDVIFSQFDSLGVSS
HKU1_ORF1ab           VFISTEKLSRLSMIKGPQRADLNGVIVDKVGELKVEFWFAMRKDGDDVIFSRTDSLCSSH
SARS-CoV-2_ORF1ab     VLITEGSVKGLQPSVGPKQASLNGVTLIGEAVKTQFNYYKK----------------

229E_ORF1ab           ----------------KDGKPVDHYDGFYTQGRNLQDFLPRSTMEEDFLNMDIGVFIQKY
NL63_ORF1ab           ----------------KNGQFQDHYDGFYTQGRNLSDFTPRSDMEYDFLNMDMGVFINKY
OC43_ORF1ab           NQSPQGNLGSNGKPGNVGGNDALSISTIFTQSRVISSFTCRTDMEKDFIALDQDVFIQKY
HKU1_ORF1ab           YWSPQGNLGGN-CAGNVIGNDALTRFTIFTQSRVLSSFEPRSDLERDFIDMDDNLFIAKY
SARS-CoV-2_ORF1ab     ----------------VDGVVQQLPETYFTQSRNLQEFKPRSQMEIDFLELAMDEFIERY
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229E_ORF1ab           GLEDFNFEHVVYGDVSKTTLGGLHLLISQVRLSKMGILKAEEFVAASDITLKCCTVTYLN
NL63_ORF1ab           GLEDFNFEHVVYGDVSKTTLGGLHLLISQFRLSKMGVLKADDFVTASDTTLRCCTVTYLN
OC43_ORF1ab           GLEDYAFEHIVYGNFNQKIIGGLHLLIGLYRRQQTSNLVVQEFVSY-DSSIHSYFITDEK
HKU1_ORF1ab           GLEDYAFDHIVYGSFNHKVIGGLHLLIGLFRRKKKSNLLIQEFLQY-DSSIHSYFITDQE
SARS-CoV-2_ORF1ab     KLEGYAFEHIVYGDFSHSQLGGLHLLIGLAKRFKESPFELEDFIPM-DSTVKNYFITDAQ
                           6682           6698

229E_ORF1ab           DPSSKTVCTYMDLLLDDFVSVLKSLDLTVVSKVHEVIIDNKPWRWMLWCKDNAVATFYPQ
NL63_ORF1ab           ELSSKVVCTYMDLLLDDFVTILKSLDLGVISKVHEVIIDNKPYRWMLWCKDNHLSTFYPQ
OC43_ORF1ab           SGGSKSVCTVIDILLDDFVALVKSLNLNCVSKVVNVNVDFKDFQFMLWCNDEKVMTFYPR
HKU1_ORF1ab           CGSSKSVCTVIDLLLDDFVSIVKSLNLSCVSKVVNINVDFKDFQFMLWCNDNKIMTFYPK
SARS-CoV-2_ORF1ab     TGSSKCVCSVIDLLLDDFVEIIKSQDLSVVSKVVKVTIDYTEISFMLWCKDGHVETFYPK
                            6746

229E_ORF1ab           LQS-AEWKCGYSMPGIYKTQRMCLEPCNLYNYGAGLKLPSGIMFNVVKYTQLCQYFNSTT
NL63_ORF1ab           LQS-AEWKCGYAMPQIYKLQRMCLEPCNLYNYGAGIKLPSGIMLNVVKYTQLCQYLNSTT
OC43_ORF1ab           LQAASDWKPGYSMPVLYKYLNSPMERVSLWNYGKPVTLPTGCMMNVAKYTQLCQYLNTTT
HKU1_ORF1ab           MQATNDWKPGYSMPVLYKYLNVPLERVSLWNYGKPINLPTGCMMNVAKYTQLCQYLNTTT
SARS-CoV-2_ORF1ab     LQSSQAWQPGVAMPNLYKMQRMLLEKCDLQNYGDSATLPKGIMMNVAKYTQLCQYLNTLT
                                                        6839

229E_ORF1ab           LCVPHNMRVLHLGAGSDYGVAPGTAVLKRWLPHDAIVVDNDVVDYVSDADFSVTGDCATV
NL63_ORF1ab           MCVPHNMRVLHYGAGSDKGVAPGTTVLKRWLPPDAIIIDNDINDYVSDADFSITGDCATV
OC43_ORF1ab           LAVPVNMRVLHLGAGSEKGVAPGSAVLRQWLPAGTILVDNDLYPFVSDSVATYFGDCITL
HKU1_ORF1ab           LAVPVNMRVLHLGAGSDKEVAPGSAVLRQWLPSGSILVDNDLNPFVSDSLVTYFGDCMTL
SARS-CoV-2_ORF1ab     LAVPYNMRVIHFGAGSDKGVAPGTAVLRQWLPTGTLLVDSDLNDFVSDADSTLIGDCATV
                                 6869

229E_ORF1ab           YLEDKFDLLISDMYDGRTKAIDGENVSKEGFFTYINGFICEKLAIGGSIAIKVTEYSWNK
NL63_ORF1ab           YLEDKFDLLISDMYDGRIKFCDGENVSKDGFFTYLNGVIREKLAIGGSVAIKITEYSWNK
OC43_ORF1ab           PFDCQWDLIISDMYDPITKNIGEYNVSKDGFFTYICHMIRDKLALGGSVAIKITEFSWNA
HKU1_ORF1ab           PFDCHWDLIISDMYDPLTKNIGDYNVSKDGFFTYICHLIRDKLSLGGSVAIKITEFSWNA
SARS-CoV-2_ORF1ab     HTANKWDLIISDMYDPKTKNVTKENDSKEGFFTYICGFIQQKLALGGSVAIKITEHSWNA
                           6922           6943      6958      6973
```

```
229E_ORF1ab           KLYELVQRFSFWTMFCTSVNTSSSEAFVVGINYLGDFAQGPFIDGNIIHANYVFWRNSTV
NL63_ORF1ab           YLYELIQRFAFWTLFCTSVNTSSSEAFLIGINYLGDFIQGPFIAGNTVHANYIFWRNSTI
OC43_ORF1ab           ELYKLMGYFAFWTVFCTNANASSSEGFLIGINYLCKPKV--EIDGNVMHANYLFWRNSTV
HKU1_ORF1ab           DLYKLMSCFAFWTVFCTNVNASSSEGFLIGINYLGKSSF--EIDGNVMHANYLFWRNSTT
SARS-CoV-2_ORF1ab     DLYKLMGHFAWWTAFVTNVNASSSEAFLIGCNYLGKPRE--QIDGYVMHANYIFWRNTNP
                                        6993                          7024

229E_ORF1ab           MSLSYNSVLDLSKFNCKHKATVVVQLKDSDINEMVLSLVRSGKLLVRGNGKCLSFSNHLV
NL63_ORF1ab           MSLSYNSVLDLSKFECKHKATVVVTLKDSDVNDMVLSLIKSGRLLLRNNGRFGGFSNHLV
OC43_ORF1ab           WNGGAYSLFDMAKFPLKLAGTAVINLRADQINDMVYSLLEKGKLLIRDTNKEVFVGDSLV
HKU1_ORF1ab           WNGGAYSLFDMTKFSLKLAGTAVVNLRPDQLNDLVYSLIERGKLLVRDTRKEIFVGDSLV
SARS-CoV-2_ORF1ab     IQLSSYSLFDMSKFPLKLRGTAVMSLKEGQINDMILSLLSKGRLIIRENNRVVISSDVLV

229E_ORF1ab           STK
NL63_ORF1ab           STK
OC43_ORF1ab           NVI
HKU1_ORF1ab           NTC
SARS-CoV-2_ORF1ab     NN-
```

(B) Alignment of nucleocapsid protein N sequences

```
229E_N          ---------------------MATVKWADASEPQRGRQGR--------------------
NL63_N          ---------------------MASVNWADDR---AARKKF--------------------
OC43_N          MSFTPGKQSSSRASSGNRSGNG-ILKWADQSDQFRNVQTRGRRAQPKQTATSQQPSGGNV
HKU1_N          MSYTPGHYAGSRSSSGNRSGILKKTSWADQSERNYQTFNRGRKTQPKFTVSTQPQ--GNT
SARS-CoV-2_N    --MSDNGPQNQRNAPRITFGGPSDSTGSNQNGERSGARSKQRRPQ------------GLP

229E_N          -IPYSLYSPLLVDSE-QPWKVIPRNLVPINKKDK-NKLIGYWNVQKR--FRTRKGKRVDL
NL63_N          -PPPSFYMPLLVSSDKAPYRVIPRNLVPIGKGNK-DEQIGYWNVQER--WRMRRGQRVDL
OC43_N          VPYYSWFSGITQFQKGKEFEFVEGQGVPIAPGVPATEAKGYWYRHNRRSFKTADGNQRQL
HKU1_N          IPHYSWFSGITQFQKGRDFKFSDGQGVPIAFGVPPSEAKGYWYRHSRRSFKTADGQQKQL
SARS-CoV-2_N    NNTASWFTALTQHGK-EDLKFPRGQGVPINTNSSPDDQIGYYRRATRR-IRGGDGKMKDL

229E_N          SPKLHFYYLGTGPHKDAKFRERVEGVVWVAVDGAKTEPTGYGVRRKNSEPEIPHFNQKLP
NL63_N          PPKVHFYYLGTGPHKDLKFRQRSDGVVWVAKEGAKTVNTSLGNRKRNQKPLEPKFSIALP
OC43_N          LPRWYFYYLGTGPHAKDQYGTDIDGVYWVASNQADVN-TPADIVDRDPSSDEAIPTRFPP
HKU1_N          LPRWYFYYLGTGPYANASYGESLEGVFWVANHQADTS-TPSDVSSRDPTTQEAIPTRFPP
SARS-CoV-2_N    SPRWYFYYLGTGPEAGLPYGANKDGIIWVATEGALNT-PKDHIGTRNPANNAAIVLQLPQ
                 106

229E_N          NGVTVVEEPD-----SRAPSRSQSRSQSRGRGESKPQSRNPSSDRNHNSQDDIMKAVAAA
NL63_N          PELSVVEFEDRSNNSSRASSRSSTRNNSRDSSRSTSRQQSRTRSDSNQSSSDLVAAVTLA
OC43_N          GTVLPQGYYIEGSGRSAPNSRSTSRTSSRASSAGSRSRANSGNRTPTSGVTPDMADQIAS
HKU1_N          GTILPQGYYVEGSGRSASNSRPGSRSQSRGPNNRSLSRSNSNFRHSDSIVKPDMADEIAN
SARS-CoV-2_N    GTTLPKGFYAEG---SRGGSQASSRSSSRSRNSSRNSTPGSSRGTSPARMAGNGGDAALA

229E_N          LKSLGFDKPQEKDKKSAKTGTPKPSRNQSPASSQTSAKSLARSQSSETKEQKHEMQKPRW
NL63_N          LKNLGFDNQSKSPSSSGTSTPKKPNK----------------PLSQPRADKPSQLKKPRW
OC43_N          LVLAKLGKDATKPQQVTKHT--------------------------AKEVRQKILNKPRQ
HKU1_N          LVLAKLGKDS-KPQQVTKQN--------------------------AKEIRHKILTKPRQ
SARS-CoV-2_N    LLLLDRLNQLESKMSGKGQQQQ--------------------GQTVTKKSAAEASKKPRQ

229E_N          KRQPNDDVTSNVTQCFGPRDLDH---NFGSAGVVANGVKAKGYPQFAELVPSTAAMLFDS
NL63_N          KRVPTR--EENVIQCFGPRDFNH---NMGDSDLVQNGVDAKGFPQLAELIPNQAALFFDS
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```
OC43_N           KRSPNK--QCTVQQCFGKRGPNQ---NFGGGEMLKLGTSDPQFPILAELAPTAGAFFFGS
HKU1_N           KRTPNK--HCNVQQCFGKRGPSQ---NFGNAEMLKLGTNDPQFPILAELAPTPGAFFFGS
SARS-CoV-2_N     KRTATK--AYNVTQAFGRRGPEQTQGNFGDQELIRQGTDYKHWPQIAQFAPSASAFFGMS

229E_N           HIVSKESGN---------------TVVLTFTTRVTVPKDHPHLGKFLEELNAFTR--EMQ
NL63_N           EVSTDEVGD---------------NVQITYTYKMLVAKDNKNLPKFIEQISAFTKPSSIK
OC43_N           RLELAKVQNLSGNPDEPQKDVYELRYNGAIRFDSTLSGFETIMKVLNENLNAYQ---QQD
HKU1_N           KLDLVKRD---SEADSPVKDVFELHYSGSIRFDSTLPGFETIMKVLEENLNAYVNSNQNT
SARS-CoV-2_N     RIGMEVTPSG-----------TWLTYTGAIKLDDKDPNFKDQVILLNKHIDAYKTFPPTE

229E_N           QHPLLNPSALEFNPSQTSPAT-----------------AEPVRDEVSIETDIIDEVN---
NL63_N           EMQSQSSHVAQNTVLNASIPE-----------------SKPLADDDSAIIEIVNEVLH--
OC43_N           GMMNMSPKPQRQRGHKNGQGENDNISVAVPKSRVQQNKSRELTAEDISLLKKMDEPYTED
HKU1_N           DSDSLSSKPQRKRGVKQLPEQFDSLNLSAG----TQHISNDFTPEDHSLLATLDDPYVED
SARS-CoV-2_N     PKKDKKKKADETQALPQRQKKQQTVTLLP---------AADLDDFSKQLQQSMSSADSTQ

229E_N           ----
NL63_N           ----
OC43_N           TSEI
HKU1_N           SVA-
SARS-CoV-2_N     A---
```