

Figure S1:

Nucleoprotein

MSDNGPQNRNAPRITFGGSPDSTGSNQNGERSGARSQRRPQGLPNNTASWFTALTQHGKEDLKFPRGQVPINT
NSSPDDQIGYRRATRRIRGGDGKMKDLSPRWYFYLLGTGPEAGLPYGANKDGIIWVATEGALNTPKDHIGTRNPAN
NAAIVLQLPQGTTLPKGFYAEGRGGSQASSRSSRSRNRSSRNSTPGSSRGTSPARMAGNGGDAALALLLDRLNQL
KMSGKGQQQQGQTVTKKSAEASKKPRQKRTATKAYNVTQAFGRRGPEQTQGNFGDQELIRQGTDYKHWPQIAQF
APSASAFFGMSRIGMEVTPSGTWLTYTGAIKLDDKDPNFKDQVILLNKHIDAYKTFPTEPKDKKKKADETQALPQRQ
KKQQTVTLPAADLDDFSKQLQQSMSSADSTQA

ORF7a

MKIILFLALITLATCELYHYQECVRGTTVLLKEPCSSGTYEGNPFPHLADNKFALTCFSTQFAFACPDGVKHVYQLRARSV
SPKLFIRQEEVQELYSPIFLVAAIVFITLCFTLKRKTE

ORF3a

MDLFMRIFTIGTVTLKQGEIKDATPSDFVRATATIPIQASLPFGWLIVGVALLAVFSASKIITLKRWQLALSKGVHFC
NLLLLFVTYSHLLVAAGLEAPFLYLYALVYFQSINFRIMRLWLCWKCRSKNPLLYDANYFLCWHTNCYDYCIPYNSV
TSSIVITSGDGTTSPISEHDYQIGGYTEKWESGVKDCVVLHSYFTSDYYQLYSTQLSTDTGVEHVTFIYNKIVDEPEEHVQ
IHTIDGSSGVVNPVMEPIYDEPTTTTSVPL

ORF1ab

MESLVPGFNEKTHVQLSLPVLQVRDVLVRGFGDSVEEVLSEARQHLDGTCGLVEVEKGVLPQLEQPYVFIKRS DARTAPHGHVMV
ELVAELEGIQYGRSGETLGVLPVHVGEIPVAYRKVLLRKNNGKAGGHSYGADLKSFDLGDDELGTDPEYEDFQENWNTKHSSGVREL
MRELNGGAYTRYVDNFCGPDGYPLECIKDLLARAGKASCTLSEQLDFIDTKRGVYCCREHEHEIAWYTERSEKSYELQTPFEIKLAKK
FDTFNGECPNFVPLNSIITIQPRVEKPKLDGFMGRIRSVYPVASPNECNQMCLSTLMKCDHCGETSWQTGDFVKATCEFCGTENL
TKEGATTCGYLPQNAVVKIYCPACHNSEVGPHEHSLAEYHNESGLKTLRKGRTIAFGGCVFSYVGCHNKAYWVPRASANIGCNHT
GVVGESEGLNDNLLEILQKEKNINIVGDFKLNIEAIIILASFSASTSAFVETVKGLDYKAFKQIVESCGNFVKTKGAKKGAWNIGE
KSILSPLYAFASEARVRSIFSRTLETAQNSVRVLQKAAITLDGISQYSLRLIDAMMFTSDLATNNLVVMAYITGGVVQLTSQWL
TNI FGTVYEKLPVLDWLEEKFEKGEVFLRDGWEIVKFISTCACEIVGGQIVTCAKEIKESVQTFKLVNKFALCADSIIIGGAKL
KALNLGE TFWTHSKGLYRKCVRKREETGLLMPLKAPKEIIFLEGETLPTTEVVLTKGDLQPLEQPTSEAVEAPLVGTPVCINGLM
LLEIKDTEK YCALAPNMMVTNNTFTLKGGAAPTQVTFGDDTVIEVQGYKSVNITFELDERIDKVLNEKCSAYTVELGTEVNEFACV
VADAVIKTLQP VSELLTPLGIDLDEWSMATYYLFDSEGEFKLASHMYCSFYPPDEDEEGDCEEEEFEPSTQYEGTEDDYQ
GKPLEFGATSAAALQPEE EQEEDWLDLDDSDQQTGQDGSQDSEDNQTITQITIVEVQPQLEMELTPVVQTEIVNSFSGY
LKLTDNVYIKNADIVEEAKVKPTVVVN AANVYLKHGGGVAGALNKATNNAMQVESDDYIATNGPLKVGSCVLSGHNLAKH
CHLVVGPVNVKGEDIQLLKSAYENFNQHEV LLAPLLSAGIFGADPIHSLRVCVDTVRTNVYLAVFDKNLYDKLV
SSFLEMKSEKQVEQKIAEIPKEEVKPFITESKPSVEQRKQDDKKIKA CVEEVTTTLEETKFLTENLLYIDINGNL
HPDSATLVSDDITFLKADAPYIVGDVVQEGVLTAVVIPTKKAGGTTEMLAKALRVPPTDN YITTYPGQGLNGY
TVEEAKTVLKKCKSAFYILPSIISNEKQEILGTVSWNLREMLAHAEETRKLMPVCVETKAIVSTIQRKYKGIKIQEGV
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PEEHFIEIT SLAGSYKDWYSYGQSTQLGIEFLKRGDKSVYYSNPTTFHLDGEVITFDNLKTLLSREVRTIKVFTTVDNINLHT
QVVDMSMTYGGQ FGPTYLDGADVTKIPHNSHEGKTFYVLPNDDTLRVEAFEYHTTDPSTLGRYMSALNHTKWKYPQV
NGLTSIKWADNNCYLATA LTLTQQIELKFNPPALQDAYRRARAGEAANFCALILAYCNKTVGELGDVRETM
SYLFQHANLDSCKRVLNVVCKTCGQQQTTLKQVE AVMYMGTLSYEQFKGVQIPCTCGKQATKYL
VQQESPVMMSAPPAQYELKHGFTFCASEYTGNYQCCHYKITSKETLYCIDGAL LTKSSEYKGPITDV
FYKENSYTTTIKPVTYKLDGVVCTEIDPKLDNYKKNDSYFTEQPIDLVPNQYPNASFDNFKVC
DNIFADDLNLQTGYKPPASRELKVTFFPDNGDVVAIDYKHYTPSFKKAGALLHKPIVWHVNNATNKATYK
PNTWCIRCLWSTKPVETSNSFDVLK SEDAQGMNDLACEDLKPVSEEVVENPTIQKDVLECNVKT
TEVVGDIILKPANNSLKITEEVGHTDLMAAYVDNSSLTIKPNELSRVL GLKTLATHGLAAVNSV
PVDTIANYAKPFLNKVVSTTNIIVTRCLNRVCTNYMPYFFTLQLLCTFTRSTNSRIKASMP
TTIAKNVKSV GKFCLEASFNYLKSPNFSKLINIIWFLLSVCLGSLIYSTAALGVLSNLGMP
SYCTGYREGYLNSTNVTIATYCTGSIPCSVCLSGLDSL DTPYSLETIQTISSFKWDLTAFGLVA
EWFAYILFRFFYVGLAAIMQLFFSYFAVHFISNSWLMWLIINLVQMAPISAMV RMYIFFA

SFYVWKSYPVHVVDGCSNSTCMMCYKRNRATRVECTIVNGVRRSFYVYANGGKGFCKLHNWNCVNCDFCAGSTFISDEVARDL
SLQFKRPINPTDQSSYIVDSVTVKNGSIHLYFDKAGQKTYERHLSHFVNLNLRANNTKGSPLINVIVFDGKSKCEESSAKSASVYYSQ
LMCQPILLDDQALVSDVGDSEAVAVKMFDAYVNTFSSTFNVPMEKLTLVATAEAEELAKNVSLDNVLFSTFISAARQGFVDSVETKD
VVECLKLSHQSDIEVTGDCSCNNYMLTYNKVENMTPRDLGACIDCSARHINAQVAKSHNIALIWNVKDFMSLSEQLRKQIRSAAKKN
NLPFKLTCATTRQVNVVTTKIALKGGKIVNWNKQLIKVTLVFLVAAIFLITPVHVMKHTDFSSEIIGYKAIDGGVTRDIASDTDCF
ANKHADFDTWFSQRGGSYTNDAKCLIAAVITREVGFFVPLPGTILRTTNGDFLHFLPRVFSAVGNICYTPSKLIEYDFATSACVLA
AECTIFKDASGKPVPCYDNTNVEGVSAYESLRPDTRYVLM DGSIIQFPNTYLEGSRVVTTFDSEYCRHGTCERSEAGVCVSTSGRW
VLNNDYYRSLPGVFCGVDVAVNLLTNMFTPLIQIPIGALDISASIVAGGIVAVVTCLAYYFMRFRRAFGEYSHVAVFNTLLFLMSFTVLC
LTPVYSFLPGVYSVIYLYLTFYLTNDVSLAHIQWMVMFTPLVPFWITAIYIICISTKHFWFFSNYLKRRVVFNGVFSSTFEAALCTFLL
NKEMYLKLRSDVLLPTQYNRYLALYNKYKFSGAMDTTSYREAACCHLAKALNDFSNVSGSDVLYQPPQTSITSAVLQSGFRKMAFP
SGKVEGCMVQVTCGTTTLNGLWLDVVYCPRHVICSEDMLNPNYEDLLIRKSNHNFVQAGNVQLRVIGHSMQNCVLKLVDT
ANPKTPKYKRVRIQPGQTFSVLACYNGSPSGVYQCAMPNFTIKGSFLNGSCGSGVFNIDYDCVFCYMHMELPTGVHAGTDLEG
NFY GPFVDRQTAQAAGTDDTTITVNLAWLYAAVINGDRWFLNRFTTTLNDFNLVAMKYNIEPLTQDHVDILGPLSAQTGIAVLDL
CASLKELLQNGMNGRTILGSALLEDEFTPFVVRQCSGVTFQSAVKRTIKGTHHWLLLTLTSLLVQSTQWSLFFFLYENAFLPFAM
GIIAMSAFAMMFVKHKHAFCLFLLPLATVAYFNMVMPASWVMRIMTWLDMVDTSLSGFKLKDVCMYASAVLLILMTARTV
YDDGARRVWTLMNVLTLVYKVVYGNALDQAISMWALIISVTSNYSVGVVTTVMFLARGIVFMCVEYCPFIITGNTLQCIMLVYCFGL
YFCTCYFGLFCLLNRYFRLTLGVYDYLSTQEFYRMSQGLLPPKNSIDAFKLNILKLVGGKPCIKVATVQSKMSDVKCTSVLLSVL
QQLRVESSSKLWAQCVLHNDILLAKDTTEAFEKMSVLLSVMQGAVDINKLCEEMLDNRATLQAIASEFSSLPYAAAFATAQEA
YEQAVANGDSEVLLKLLKSLNVAKSEFDRDAAMQRKLEKMAQAMTQMYKQARSEDKRAKVTSAMQTMFLTMLRKLDNDAL
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NSAVKLQNNELSPVALRQMCAAGTTQACTDDNALAYYNTTKGGRFVLLSDDLQDLKWARFPKSDGTGTIYTELEPPCRFVDT
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QAITVTPEANMDQESFGGASCCLYCRCHIDHPNPKGFCDLKGKYVQIPTTCANDPVGFTLKNVCTVCGMWKGYGCSCDQLREP
MLQSADAQSFLNRVCGVSAARLTPCGTGTSTDVYRAFDIYNDKVAGFAKFLKTNCCRFEKDEDDNLIDSYFVVKRHTFSNYQHE
ETIYNLLKDCPAVAKHDFKFRIDGDMVPHISRQLTKYTMADLVYALRHFDGNCDDLKEILVTYNCCDDDFYNNKDWYDFVENPD
ILRVYANLGERVRQALLKTVOFCDAMRNAGIVGLTLDNQLNGNWYDFGDFIQTPGSGVPPVDSYSLMLPILTRALTAESHV
DIDLTKPIYKWDLLKYDFTEERLKLFDRYFKYWDQTYHPNCVCLDDRCILHCANFNVLSTVFPPTSGFPLVRKIFVDGVPFVSTG
YHFRELGVVHNQDVLNHSRSLFKELLVYAADPAMHAASGNLLLDKRTTCFVAALTNNAFQTVKPGFNKDFYDFAVSKGFFKE
GSSVELKHFFFAQDGNAAISDYRYRNLPMTCDIRQLLFFVEVDKYFDCYDGGCINANQVIVNNDKSAAGFPFNKVGKARLYD
SMSYEDQDALFAYTKRNVIPTITQMNLYAISAKNRARTVAGVSICSTMTNRQFHQKLLKSIAATRATVIGTSKYGGWHNMLK
TVYSDVENPHLMGWDYPKCDRAMPNMLRIMASLVLARKHTCCSLSHRFYRLANECAQVLESEMVMCGGSLYVKGPGTSSGDATT
AYANSVFNICQAVTANVNALLSTDGNKIADKYVRNLQHRLYECLYRNRDVTDFVNEFYAYLRKHFSMMLSDDAVVCFNSTYASQ
GLVASIKNFKSVLYQNNVFMSEAKCWTTETDLTKGPHFECQHTMLVKQGGDYVYLPYDPSRILGAGCFVDDIVKTDGTLMIERFV
SLAIDAYPLTKHPNQEYADVHLYLQYIRKLHDELTHMLDMYSVMLTNDNTSRYWEPEFYEAMYTPHTVLQAVGACVLCNSQTSL
RCGACIRRPFLCCKCCYDHVISTSHKLVLSVNPYVCNAPGCDVTDVTLQYLGGMSSYCKSHKPPISFPLCANGQVFLYKNTCVGSD
NVTDFNAIATCDWTNAGDYILANTCTERLKLFAAETLKATEETFKLSYGIATVREVLSRELHLSWEVKGPRPPLNRNYVFTGYRVTK
NSKVQIGEYTFEKGDYGDAVVYRGTTTYKLVNGDYFVLTSHTVMPLSAPTLPVQEHYVRITGLYPTLNISDEFSSNVANYQKVMQK
YSTLQGPPTGKSHFAIGLALYPSARIVYTACSHAAVDALCEKALKYLPIDKCSRIIPARARVCFDKFKVNSTLEQYVFTVNALPETT
ADIVVFEISMATNYDLSVNNARLRAKHYYVIGDPAQLPAPRLLTKGTLEPEYFNSVCRMKTIGPDMFLGTCRRCPAEIVDVSAL
VYDNKLAHKDKSAQCFKMFYKGVITHDVSSAINRPQIGVVREFLTRNPAPWRKAVFISPYNSQNAVASKILGLPTQTVDSQSGSEYD
YVIFTQTTEHAHSCNVNRFNVAITRAKVGILCIMSDDRDLQFTSLIPRRNVATLQAENVTLGFKDCSKVITGLHPTQAPTHLSVD
TKFKTEGLCVDIPGPKDMTYRRLISMMGFKMNYQVNGYPNMFITREEAIRHVRAWIGFDVEGCHATREAVGTNLPLQLGFSTGV
NLVAVPTGYVDTPNNTDFSRVSAKPPPGDQFKHLIPLMYKGLPWNVVRIKIVQMLSDTLKNSDRVVFVLAHGFELTSMKYFVKI
GPERTCCLDRRATCFSTASDTYACWHHS GFDYVYNPFMIDVQQWGFTGNLQSNHDLYCQVHGNNAHVASCDAIMTRCLAVHEC
FVKRVDWTIEYPIIGDELKINAACRQVHMVKAALLADKFPVLHDIGNPKAIKCVQADVEWKFYDAQPCSDKAYKIEELFYSYATH
SDKFTDGVCLFWNCNVDROPANSIVCRFDTRVLSNLLPGCDGGSLYVKNHAFHTPAFDKSAFVNLKQLPFFYYSDSPCESHGKQV
VSDIDYVPLKSATCITRNLGGAVCRHHANEYRLYLDAYNMMISAGFSLVWVYQFDTYNLWNTFTRLQSLNFAFNVVKNKGFHDG
QQGEVPSIINNTVYTKVDGVDVELFENKTLPVNVAFELWAKRNKIPVEVKILNNGVDIAANTVIWYDKRDAPAHISTIGVCSMT
DIAKKTETICAPLTVFFDGRVDGQVDFRNARNGLITEGSKGLQPSVGPQASLNGVTLIGEAVKTFNYKVDGQVQQLPET
YFTQSRNLQEFKPRSQMEIDFLELAMDEFIERYKLEGYAFEHIVYGDGFSHSQLGGLHLLIGLAKRFKESPFLEDFIPMDSTVKNYFITD
AQTGSSKCVCSVIDLLDDFVEIISQDLSVSVKVVKTIDYTEISFMLWCKDGHVETFPKQSSQAWQPGVAMPNLYKMQRMILLE
KCDLQNYGDSATLPKIMMNVAKYTQLCQYLNTLTLAVPYNMRVIHFGAGSDKGVAPGTAVLRQWLPTGTLVDSLDNDFVSDA
DSTLIGDCATVHTANKWDLIISDMYDPKTKNVTKENDSKEGFFTYICGFIQKALALGGSVAIKITEHSWNADLYKLMGHFAWWTAF

VTNVNASSEAFILGICNYLGKPREQIDGYVMHANYIFWRNTNPIQLSSYSFLDMSKFPLKLRGTAVMSLKEGQINDMILSLLSKGRLII
RENNRVVISDVLVNN

Figure S1: SARS-CoV-2 Wuhan variant protein amino acid sequence with CD8+ T cell epitopes highlighted and all mutations, insertions (box) and deletions (slash) sites indicated in bold orange (non-overlapping).