

Supplementary material

The highest percentage in each row was shown in bold.

Table S1: Accession number of CoV genomes used for the construction of prototype aa sequences

Accession	SARS-CoV-2	Bat-CoV	Bat-SL-CoV	Pan-CoV	SARS-CoV
GenBank/GISAID	MN985325.1	MN996532.1	MG772933.1	EPI_ISL_410538	NC_004718.3
GenBank/GISAID	MT106052.1	MK211376.1	MG772934.1	EPI_ISL_410539	AY274119.3
GenBank/GISAID	MT019532.1	MK211377.1	GQ153543.1	EPI_ISL_410540	AY323977.2
GenBank/GISAID	MN996528.1	MK211378.1	GQ153542.1	EPI_ISL_410541	DQ898174.1
GenBank/GISAID	MN997409.1	KJ473813.1	DQ084199.1	EPI_ISL_410542	AY864805.1
GenBank/GISAID	MN988668.1	DQ648857.1	GQ153540.1	EPI_ISL_410543	AY282752.2
GenBank/GISAID	MT118835.1	KJ473811.1	GQ153539.1	EPI_ISL_410544	AY350750.1
GenBank	MT106053.1	KJ473815.1	DQ022305.2		AY345986.1
GenBank	MT049951.1	DQ648856.1	DQ084200.1		AY291451.1
GenBank	MT019533.1	KJ473813.1	GQ153546.1		AY357075.1
GenBank	MT019531.1				

Table S2: The size of the 14 different ORFs of the CoVs represented as a number of aas

Gene	SARS-CoV-2 (aa #)	Bat-CoV (aa #)	Bat-SL-CoV (aa #)	Pan-CoV (aa #)	SARS-CoV (aa #)
ORF1a	4,405	4,404	4,402	4,397	4,382
ORF1ab	7,096	7,095	7,093	7,082	7,073
Spike (S)	1,273	1,269	1,246	1,269	1,255
3a	275	275	275	275	274
3b	22	22	22	22	154
Envelope (E)	75	75	75	75	76
Membrane (M)	222	221	222	222	221
6	61	61	61	61	63
7a	121	121	122	121	122
7b	43	43	43	43	44
8	121	121	121	121	8a:39; 8b:84
Nucleocapsid (N)	419	419	419	419	422
9b	97	97	97	97	98
14	73	73	70	73	70

Table S3: Position and numbers of non-structural proteins aa in pp1ab region of CoVs

Non-structural proteins	SARS-CoV-2 (aa #)	Bat-CoV (aa #)	Bat-SL-CoV (aa #)	Pan-CoV (aa #)	SARS-CoV (aa #)
nsp1 (Leader protein)	p (1–180) 180	p (1–180) 180	p (1–180) 180	p (1–180) 180	p (1–180) 180
nsp2	p (181–818) 638	p (181–818) 638	p (181–818) 638	p (181–818) 638	p (181–818) 638
nsp3	p (819–2,763) 1,945	p (819–2,762) 1,944	p (819–2,760) 1,942	p (819–2,755) 1,937	p (819–2,740) 1,922
nsp4	p (2,764–3,263) 500	p (2,763–3,262) 500	p (2,761–3,260) 500	p (2,756–3,253) 500	p (2,741–3,240) 500
nsp5 (3C-like proteinase)	p (3,264–3,569) 306	p (3,263–3,568) 306	p (3,261–3,566) 306	p (3,256–3,561) 306	p (3,241–3,546) 306
nsp6	p (3,570–3,859) 290	p (3,569–3,858) 290	p (3,567–3,856) 290	p (3,562–3,851) 290	p (3,547–3,836) 290
nsp7	p (3,860–3,942) 83	p (3,859–3,941) 83	p (3,857–3,939) 83	p (3,852–3,934) 83	p (3,837–3,919) 83
nsp8	p (3,943–4,140) 198	p (3,942–4,139) 198	p (3,940–4,137) 198	p (3,935–4,132) 198	p (3,920–4,117) 198
nsp9	p (4,141–4,253) 113	p (4,140–4,252) 113	p (4,138–4,250) 113	p (4,133–4,245) 113	p (4,118–4,230) 113
nsp10 (Growth factor-like protein)	p (4,254–4,392) 139	p (4,253–4,391) 139	p (4,251–4,389) 139	p (4,246–4,384) 139	p (4,231–4,369) 139
nsp12 (RNA-dependent RNA polymerase)	p (4,393–5,324) 932	p (4,392–5,323) 932	p (4,390–5,321) 932	p (4,385–5,310) 926	p (4,370–5,301) 932
nsp13 (RNA 5'-triphosphatase)	p (5,325–5,925) 601	p (5,324–5,924) 601	p (5,322–5,922) 601	p (5,311–5,911) 601	p (5,302–5,902) 601
nsp14 (3'-5' exonuclease)	p (5,926–6,452) 527	p (5,925–6,451) 527	p (5,923–6,449) 527	p (5,912–6,438) 527	p (5,903–6,429) 527
nsp15 (endoRNase)	p (6,453–6,798) 346	p (6,452–6,797) 346	p (6,450–6,795) 346	p (6,439–6,784) 346	p (6,430–6,775) 346
nsp16 (2'-O-ribose methyltransferase)	p (6,799–7,096) 298	p (6,798–7,095) 298	p (6,796–7,093) 298	p (6,785–7,082) 298	p (6,776–7,073) 298

Table S4: Amino acid sequence similarities among the 14 different ORFs of SARS-CoV-2 with Bat-CoV, Bat-SL-CoV, Pan-CoV and SARS-CoVs

Gene	Bat-CoV (%)	Bat-SL-CoV (%)	Pan-CoV (%)	SARS-CoV (%)
Whole genome	98.67	94.35	94.51	82.93
ORF1a	98.62	96.94	92.90	80.44
ORF1ab	99	96.73	94.87	86.19
Spike (S)	98.04	83.52	93.87	75.96
3a	98.91	95.27	95.64	72.36
3b	77.27	81.82	90.91	61.11
Envelope (E)	100	100	100	94.74
Membrane (M)	99.52	99.05	98.57	91.43
6	100	93.44	96.72	68.85
7a	99.17	88.52	94.21	85.25
7b	97.67	93.02	90.70	85.37
8	95.87	29.73	95.87	8a: 31.71; 8b: 40.48
Nucleocapsid (N)	99.28	95.70	97.85	90.52
9b	92.78	76.29	93.81	72.45
14	90.41	92.98	96.49	84.21

>Bat-CoV:

MESLVPGFNEKTHVQLSLFVLQVRDVLVRGFGDSVEEALSEARQHCLKDGTCLGVEVEKGVLPQLEQPYVFIKRSDARTAPHGHVMVELVAELNGIQYGRSGETGLVLVPHVGETPVAYRK
VLLRKNGNGKAGGHSYGADLKSFDLGDDELGTDPYEDFQENWNWTKHSSGVTRRLMRELNGGAYTRYVDNNFCGPDGYPLECIKDLARAGKASCTLSEQLDFIDTKRGVYCCREHEHEIAW
YTERSEKSYELQTPFEIKLAKKFDTFNGECPNFVFLPNSTIKTIQPRVEKKLDGFMGRIRSVYPVASPNECNQMCMLSTLMKCDHCGETSWQGTDFVKATCEFCGTENLTKEGATTCGYL
PQNAVVKIYCPACHNPEVGPPEHSLAEYHNESGLKTILRKGGRTIAFGGCVFSYVGCNKCAYWVPASANIICGNHTGVVGESEGLNDNLEIIQKEKVINIIVGDFKNEEIAIILASF
SASTSAFVETVKGLDYKTFKQIIVESCNGFKVTKGAKKGAWNIGEQKSLISPLFYAFSEAAARVRSIFSRTLETAQNSVRAQLKAAIITILDGISQYSLRLIDAMMFTSLDVLNVLVMAY
ITGGVQLTSQWLNTIFGTVYEKLPVLDWLEEKFKEGVEFLRDGWEIVKFIITSTACBIIEVGGQIVTCAKIKESVQTFFKLVNKFALCADIISIIIGAKLALNMGTFVTHSKGLYRKC
VKPKEETGLMLPKAPKEIIFLEGETLPTPEVLTEEVVLKTGDLQPLEQPTSEAEAPLVGTPVCINGMLMLEIKDTEKYCALAPNMMVTNNFTFLKGGAPTQVTFGDDTVIEVQGYKSVN
ITFELDERIDKVLNEKCSITYVELGTEVNEFACVADAVIKTLQPVSELLTPLGIDLDEWGMATYYLFDSEGEFKLASHMYCSFYPPDEDEEGDCEEEFEPSTQYEGTEDDYQGKPL
EFGATSVTPQPEEELEEDWLDDDSQQTVVQEDDSEVNQTTITQSIAEVQPOLEMEPTPVVQTEVNSFSGYLKLTDNVYIKNADIVEAAKKVKPTVVVNAANVYLKHGGGVAGALNKATNN
AMQVESDDYIATNGPLKVGCGCVLSGHNLAKNCLHVVGPNNVRGEDIQLLKSAYENFNQHDVLLAPLLSAGIFGADPVHSLRVCVDTVRTNVYLAVFDDKNLYDKLVSSFLEMKSEKQVEQ
KTAEIKPEEVKSSITESKLSVEQRKQVDKKIKACVEEVTTLTEETKFLTENLLYIDINGNLHPDSATLVNDIDITFLKKDAPYIVGDVVGEGVLTAVVIPTKKAGGTTEMLAKALRKVP
TDNYITTPYGGQLNGYTVEEAKTVLKKCKSAFYILPSIIISNEKEILGTVSNLREMLAHAEETRKMLPVCMETKAIIVSTIQRKYKGIQIEGVVDYGARFYFTSKTTVASLINTLNDL
NETLVMPGLVYTHGLNLEEAARYMSRLKVPATVSVSSPDAVTAYNGYLTSSSKTPEEHFIETISLAGSYKDWYSYGQSTQLGIEFLKRGDKSVYYTNSNPTFHLDEGVEITFDNLKILLS
LKEVRTIKVFTTVDNINLHTQVDMSTMTYGQGFPTYLDGADVTKIKPHNSHEGKTFYVLPNDDTLRAEAFFEYHYHTDPSFLGRYMSALNHTKKWYQVNGVLTSIKWADNNCYLATALL
TLQQIELKFNPALQDAYYRARAGEAANFICALILAYCNKTVGELGDVRETMNYLFQHANLDSCKRVLNVVCKTCGQQQTTTLKGVEAVMYMGTLSEYQLKKGQVQIPCTCGKQATQYLVQQE
SPFVMSAPPAQYELKHGTFICASEYTGNYQCCHYKHITSKETLYCIDGALLTKSSEYKGPITDVFYKENSYITTIKPIVYKLDGVVCTEIDPKLDNYKKDINSYFTEQPIDLVNPQYP
NASFDNFKFVCDNIKVFQSDMKSDVKTSSVLLSVLQQLRVESKSLWALQCVLHNDILAKDTTEAFKEMKSLVLLSVLQSMQADINKLCEMLDNKATQILASSEFSSLPYAAFAATQ
EDLKPVSSEEVENPTIQKDVLECNVKTTEVVGDILILKPANDGLKITEEVGHDTLMAAAYDNSSITIKKPNELSRVLGLKTLATHGLAAVNSVPWDTIANYAKPFLNKVSTTTNIVTRCL
NRVCTNMYPFYFTLLQLCTFTRSTNSRIKASMPTTIAKNTVKSVGKFCLEASFNYLKSPNFSTLINIIWFLLSVCLGSLIYSTAALGLVMSNLGMPSYCTGYREGYLNSTNVTTAIY
CTGSI PCSVCLSGDLSLDTYPSLETIQITISSFKWDLTAFGLVAEWFVLAIFLTFRTFVVLGLAAIMQLFFSYFAVHFISNSWLMWLIINLQVMAPISAMVRMYIFASFYVWVKSYYHV
DGTSTSCMMCYKRNARTRVECTTIVNGVRRSFYVYANGGKGFCKLHNWNCVNDTCFAGSTFISDEAVRDLQSFQKRPINPTDQSSYIVDSVTVKNGSIHLFYDQAGQGTVERHSLSHF
VNDLNRANNTKGSPLINIVFDGKSKCESSAKSASVYYSQMLQCPILLLDQALVSDVDGSTEAVAKMFDAYVNTFSSFTNVPMEKLTLSVATAEAELKANVSLDNVLSTFISAAQGF
VDSVDVETKDVVECLKLSHQSDIEVTGDSNNYMLTYNKVENMTPRDLGACIDCSARHINAQVAKSHNIALIWNVKDFMSLSEQLRQKIRSAAKNNLPFKLTCAATRVQNVVTTKIALK
GGKIVNNWKLQKILKVTFLVFAAIFYLITPVHVMSKHTDFSSEIIIGYKADIGGVTRDIASDTFCFANKHADPDTWFSQRGGSYTNDAKAPLIAAIVITREGVGVFVGLPGLTILRTNGD
LHFLPRFVSAGNICYVTPSKLIEYTFDATSACVLAABCTIFKDSAGKPPVPCYCDTNVLEGSVAYESLRPDTRFVLMDSGIIQFPNTYLGESVRYVNTFDSYECRHGTGTCERSEAGVCVST
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FLAHIQMVMFTPLVPFWTIIYVICISTKHFWFFSNYLKRRVFNNGVSFSTFEEAALCTFLLNKEMYKLRSDVLLPLTQYNNRYLALYKXYFSGAMDTSYREAAACCHLAKALND
SNSGSDVLYQPPQTSITSAILQSGFRKMAFPSPGKVEGCMVQVTCGTTLNGWLDVYVCPRHVITKEMLPNNVDELLIRKSNHNPVLQAGNVQLRVIRGHSNMCVLKLKVDNTPKT
PKYKFVRIPQGTFSVLACYNSSPGSVYQCAMRPNFTIKGSLFNGSCSGSVGNIDYDCVSCFYMHMELPTGVHAGTDLEGTFFYGFFVDRQTAQAAGQDITITVNVLAWLYAAVINGDRW
FLNRFTTTLNDFNLVAMKYNIEPLTDHVDILGLPSAQTGIAVLDMCASLQVHNGMGRITLGSALDEBETFPDQVVRQCSGVTFQSAVKRTIKGTHWLLTILTSLLVLQVSTQ
LFFFVYENAFPLFAMGIIAMSAFAMMFVKHKAFLCLFLPLSLATVAYFNMVMPASWVMRIMTWLDMVDTSLSGFKLDCVMYASAVVLIILMTARTVYDGGARVMTLMNVLTLYVK
YYGNALDQAIISWALLISVTSNYSNGVVTVMFLARGIVFMCVEYCPIFFITGNTLQCILMYCYFLGFCYCTCYFGLFCLLNRVFRILTGVYDYLVSTQEFYRMYNSQGLLPKNSIDAFKLN
IKLLVGKGKPCIKVATQVQSKMSDVKTSSVLLSVLQQLRVESKSLWALQCVLHNDILAKDTTEAFKEMKSLVLLSVLQSMQADINKLCEMLDNKATQILASSEFSSLPYAAFAATQ
EAYEQAVANGDSEVVLKLLKLSLVAKSEFDRDAAMQRKLEKMAQDQMTQMYKQARSEDKRAKVTSAMQTMFLTMLRKLDNDALNNIINNARDGCVPLNIIPLTAAKLMVVIDPYNTYK
NTCDGTFTFYASALWEIQQVVDADSKIVQLSIESMDNSPNLAWPLIVTALRANSAPVQLQNNELSPVALRQMSCAAGTTQACTDDNALAYNTTKGGRFVLAALLSDQLDKWARFPKSGD
TGTIYFTELEPPCRFVYTDTPKPGKPVYLYLFIKGLNNLNRGMVLGSLAATVRLQAGNATEVVPANSTVLSQCAFAYDAAKAYKDYLASGGQPICTNCVKMLCTHTGTGQKAIITVTPPEANMDQESF
GGASCCLYCRCHIDHFNPKGFCDLKGKVVQIPTTCANDPVGFTLKMTVCTVCGMMWKGSGCSDQLREBMLQSDAQSLNRCVCGVSAARLTPCGTGTSTDVVYRAFDIYNDKVAGFAKFL
KTNCCRFQEKDEDDNLDISYFVVKRHTFSNYQHEETIYNLLKDCPAVAKHDFKFRIDGMVPHISRQRLTKMPTMADLVYALRHDFDEGNCDLTKEILVTYNCCDDYFNKKWDYDFVENP
DILRVYANLGERVRQALLTKVQFCDAMRDAGIVGTLTDNQDLNGWYDFDGIITTPGSGVPVIVDSYSLTLYMPTILTLTRALTAEHVSDTLTKPPIKWDLLYDFTTEERKLDFRKYFY
WDQTYHFNVCNCLDDRCILHCAENFVLFSTVFPPTSGFPLVRKIFVDGVFPVSVTGYHFRELGVHNNQDVNLHSSRLSFKELLVYAADPAMHAASGNLLDKRKTFCFSAALTNNAVFTA
VKPGNFNDPFDYFAVSKGFEKGGSSDKVCTSSVLLSVLQQLRVESKSLWALQCVLHNDILAKDTTEAFKEMKSLVLLSVLQSMQADINKLCEMLDNKATQILASSEFSSLPYAAFAATQ
YTKRNVIPITITQMNKLKYAISAKNRARTVAGVSICTMTNRQFHQKLLKSIATARGATTVIGTSKFYGGWHNMLKTVYSDVENPHLMGWDPKCDRAMPNMLRIMASLVLARKHHTCCSL
HRFYRLANECQVLSSEMVMCGGSLYVVKPGTSSGDDATYANVSFNICQAVTANVALLSTDGNIKADKHVRNLQHRLYECLYRNRDVTDFVNEFYAYLRKHFMSMIISDDAVFCNST
YASQGLVASIKNFKSVLYYQNNVFMSEAKWTEEDTLTKGHEFCQSHTMLVKQGDYVLYLPDPBSRILGAGCFVDDIVKTGDTLMIERFVSLAIDAYPLTKHNPGEYADVDFHLYLQYIR
KLHDELTGHMLDMYSVMLTNDNTSRWEPEFEAMYTPHTVLQVAGACVLCNSQTSLRCAICIRRPFLCKCCYDHHVISTSHKLVLSVNPVYCNAPGCDNRDVTQYLYLGGMSSYCKSHKP
PISFPLCANGQVFGYKNTCVGSDNVDTFNAIATKWTNAGDYIANTCTERLKLFAETLIKATEETFKLSYGIATVREVLSDRELHLSWEVGKFRPPLNRVYTVGTGRVTKNSKQIGE
YTFEKGDYGDADVYKGTTTYKLNVGDYFVLTSHTVPLSAPTLVPQEHYVRTITGLYPTPLNLSDEFSSNNVANYQKVGMMQKYSITLQGGPPTGKSHAIFALAIYPSARIYVTCASHAAVDAL
CEKALKYLPIDKCSRIIPARARVECKDFKFNVTLEQYVFCTVNALPETTADIVFDEISMATNLDLSVNARLAKHXYVIGDPAQLAPARTLTLTKGTLEPEYFNSVCRMLKGTIPGDMF
LGTCCRCPAEIVDSRTSALIVYDNKLKAHKDKSAQCCKMYKGVITHDVPASINRQPIGVREFLTRNPAWRKAVIISPYNSQAWQPGVAMPNLYKMLGLLEKCDLQVNGDSATLPTQTTETAHSCN
VNRFNVAITRAKVGILCIMSDDRLDYDKLQFTSLEIPRRNVATLQAEVNTGLFKDCSKVITGLHPTQAPTHLSVDTKFKTEGLCVDIPGPKDMTYRRLISMMGFKMNYQVNGYPNMFITR
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VKAALLDAKFYPLVLDIGNPKAIFKVPQADVEWKFYDAQPCSDKAYKIEELFYSYATHSDKFTDGVCLFWMNCVNDRYPANSIVCRFDTRVLNLSNLPGCDGGSLYVNKHAFTPAFDKSAF
VNLKQLPFFYYSDPSCSEHGKQVSDIDYVPLKSACTIRCNLGGAVCRHHAENYRLIYLDAYNMMISAGFSLVWYKQFDPTYNLWNTFTRLQSLLENVAFNNGKHFDGQGGVEPVPSIINN
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GLQPSVGPQASLQNTLILGAEAVTQFNYYKVDGVVQQLPETYFTQTSRNLKEFKFRPSQMEIDFLELAMDEFIERYKLEGYAFHEHIVGDFSHRQLQGLHLLIIGLAKRSKESPLEDEDFI
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EFGATSVTPQPEEELEEDWLDDDSQQTVVQEDDSEVNQTTITQSIAEVQPOLEMEPTPVVQTEVNSFSGYLKLTDNVYIKNADIVEAAKKVKPTVVVNAANVYLKHGGGVAGALNKATNN
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KTAEIKPEEVKSSITESKLSVEQRKQVDKKIKACVEEVTTLTEETKFLTENLLYIDINGNLHPDSATLVNDIDITFLKKDAPYIVGDVVGEGVLTAVVIPTKKAGGTTEMLAKALRKVP
TDNYITTPYGGQLNGYTVEEAKTVLKKCKSAFYILPSIIISNEKEILGTVSNLREMLAHAEETRKMLPVCMETKAIIVSTIQRKYKGIQIEGVVDYGARFYFTSKTTVASLINTLNDL
NETLVMPGLVYTHGLNLEEAARYMSRLKVPATVSVSSPDAVTAYNGYLTSSSKTPEEHFIETISLAGSYKDWYSYGQSTQLGIEFLKRGDKSVYYTNSNPTFHLDEGVEITFDNLKILLS
LKEVRTIKVFTTVDNINLHTQVDMSTMTYGQGFPTYLDGADVTKIKPHNSHEGKTFYVLPNDDTLRAEAFFEYHYHTDPSFLGRYMSALNHTKKWYQVNGVLTSIKWADNNCYLATALL
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SPFVMSAPPAQYELKHGTFICASEYTGNYQCCHYKHITSKETLYCIDGALLTKSSEYKGPITDVFYKENSYITTIKPIVYKLDGVVCTEIDPKLDNYKKDINSYFTEQPIDLVNPQYP
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VDSVDVETKDVVECLKLSHQSDIEVTGDSNNYMLTYNKVENMTPRDLGACIDCSARHINAQVAKSHNIALIWNVKDFMSLSEQLRQKIRSAAKNNLPFKLTCAATRVQNVVTTKIALK
GGKIVNNWKLQKILKVTFLVFAAIFYLITPVHVMSKHTDFSSEIIIGYKADIGGVTRDIASDTFCFANKHADPDTWFSQRGGSYTNDAKAPLIAAIVITREGVGVFVGLPGLTILRTNGD
LHFLPRFVSAGNICYVTPSKLIEYTFDATSACVLAABCTIFKDSAGKPPVPCYCDTNVLEGSVAYESLRPDTRFVLMDSGIIQFPNTYLGESVRYVNTFDSYECRHGTGTCERSEAGVCVST
GRWVLNNDYYRSLPGVFCGVDAVNLLTNMFTPLIQPIGALDISASIVAGGIVAIIVVTCLAYYFMRFRRAFGEYSHVVAFTNLLFLMSFTVLCCLTPVYSFPLPGVYSVIYLYLTFYLTNDVS
FLAHIQMVMFTPLVPFWTIIYVICISTKHFWFFSNYLKRRVFNNGVSFSTFEEAALCTFLLNKEMYKLRSDVLLPLTQYNNRYLALYKXYFSGAMDTSYREAAACCHLAKALND
SNSGSDVLYQPPQTSITSAILQSGFRKMAFPSPGKVEGCMVQVTCGTTLNGWLDVYVCPRHVITKEMLPNNVDELLIRKSNHNPVLQAGNVQLRVIRGHSNMCVLKLKVDNTPKT
PKYKFVRIPQGTFSVLACYNSSPGSVYQCAMRPNFTIKGSLFNGSCSGSVGNIDYDCVSCFYMHMELPTGVHAGTDLEGTFFYGFFVDRQTAQAAGQDITITVNVLAWLYAAVINGDRW
FLNRFTTTLNDFNLVAMKYNIEPLTDHVDILGLPSAQTGIAVLDMCASLQVHNGMGRITLGSALDEBETFPDQVVRQCSGVTFQSAVKRTIKGTHWLLTILTSLLVLQVSTQ
LFFFVYENAFPLFAMGIIAMSAFAMMFVKHKAFLCLFLPLSLATVAYFNMVMPASWVMRIMTWLDMVDTSLSGFKLDCVMYASAVVLIILMTARTVYDGGARVMTLMNVLTLYVK
YYGNALDQAIISWALLISVTSNYSNGVVTVMFLARGIVFMCVEYCPIFFITGNTLQCILMYCYFLGFCYCTCYFGLFCLLNRVFRILTGVYDYLVSTQEFYRMYNSQGLLPKNSIDAFKLN
IKLLVGKGKPCIKVATQVQSKMSDVKTSSVLLSVLQQLRVESKSLWALQCVLHNDILAKDTTEAFKEMKSLVLLSVLQSMQADINKLCEMLDNKATQILASSEFSSLPYAAFAATQ
EAYEQAVANGDSEVVLKLLKLSLVAKSEFDRDAAMQRKLEKMAQDQMTQMYKQARSEDKRAKVTSAMQTMFLTMLRKLDNDALNNIINNARDGCVPLNIIPLTAAKLMVVIDPYNTYK
NTCDGTFTFYASALWEIQQVVDADSKIVQLSIESMDNSPNLAWPLIVTALRANSAPVQLQNNELSPVALRQMSCAAGTTQACTDDNALAYNTTKGGRFVLAALLSDQLDKWARFPKSGD
TGTIYFTELEPPCRFVYTDTPKPGKPVYLYLFIKGLNNLNRGMVLGSLAATVRLQAGNATEVVPANSTVLSQCAFAYDAAKAYKDYLASGGQPICTNCVKMLCTHTGTGQKAIITVTPPEANMDQESF
GGASCCLYCRCHIDHFNPKGFCDLKGKVVQIPTTCANDPVGFTLKMTVCTVCGMMWKGSGCSDQLREBMLQSDAQSLNRCVCGVSAARLTPCGTGTSTDVVYRAFDIYNDKVAGFAKFL
KTNCCRFQEKDEDDNLDISYFVVKRHTFSNYQHEETIYNLLKDCPAVAKHDFKFRIDGMVPHISRQRLTKMPTMADLVYALRHDFDEGNCDLTKEILVTYNCCDDYFNKKWDYDFVENP
DILRVYANLGERVRQALLTKVQFCDAMRDAGIVGTLTDNQDLNGWYDFDGIITTPGSGVPVIVDSYSLTLYMPTILTLTRALTAEHVSDTLTKPPIKWDLLYDFTTEERKLDFRKYFY
WDQTYHFNVCNCLDDRCILHCAENFVLFSTVFPPTSGFPLVRKIFVDGVFPVSVTGYHFRELGVHNNQDVNLHSSRLSFKELLVYAADPAMHAASGNLLDKRKTFCFSAALTNNAVFTA
VKPGNFNDPFDYFAVSKGFEKGGSSDKVCTSSVLLSVLQQLRVESKSLWALQCVLHNDILAKDTTEAFKEMKSLVLLSVLQSMQADINKLCEMLDNKATQILASSEFSSLPYAAFAATQ
YTKRNVIPITITQMNKLKYAISAKNRARTVAGVSICTMTNRQFHQKLLKSIATARGATTVIGTSKFYGGWHNMLKTVYSDVENPHLMGWDPKCDRAMPNMLRIMASLVLARKHHTCCSL
HRFYRLANECQVLSSEMVMCGGSLYVVKPGTSSGDDATYANVSFNICQAVTANVALLSTDGNIKADKHVRNLQHRLYECLYRNRDVTDFVNEFYAYLRKHFMSMIISDDAVFCNST
YASQGLVASIKNFKSVLYYQNNVFMSEAKWTEEDTLTKGHEFCQSHTMLVKQGDYVLYLPDPBSRILGAGCFVDDIVKTGDTLMIERFVSLAIDAYPLTKHNPGEYADVDFHLYLQYIR
KLHDELTGHMLDMYSVMLTNDNTSRWEPEFEAMYTPHTVLQVAGACVLCNSQTSLRCAICIRRPFLCKCCYDHHVISTSHKLVLSVNPVYCNAPGCDNRDVTQYLYLGGMSSYCKSHKP
PISFPLCANGQVFGYKNTCVGSDNVDTFNAIATKWTNAGDYIANTCTERLKLFAETLIKATEETFKLSYGIATVREVLSDRELHLSWEVGKFRPPLNRVYTVGTGRVTKNSKQIGE
YTFEKGDYGDADVYKGTTTYKLNVGDYFVLTSHTVPLSAPTLVPQEHYVRTITGLYPTPLNLSDEFSSNNVANYQKVGMMQKYSITLQGGPPTGKSHAIFALAIYPSARIYVTCASHAAVDAL
CEKALKYLPIDKCSRIIPARARVECKDFKFNVTLEQYVFCTVNALPETTADIVFDEISMATNLDLSVNARLAKHXYVIGDPAQLAPARTLTLTKGTLEPEYFNSVCRMLKGTIPGDMF
LGTCCRCPAEIVDSRTSALIVYDNKLKAHKDKSAQCCKMYKGVITHDVPASINRQPIGVREFLTRNPAWRKAVIISPYNSQAWQPGVAMPNLYKMLGLLEKCDLQVNGDSATLPTQTTETAHSCN
VNRFNVAITRAKVGILCIMSDDRLDYDKLQFTSLEIPRRNVATLQAEVNTGLFKDCSKVITGLHPTQAPTHLSVDTKFKTEGLCVDIPGPKDMTYRRLISMMGFKMNYQVNGYPNMFITR
EEAIRHVRWAIIGFVDEGGHATREASTVNTLPLQLGFGSTGVNLVAFPTGYVDTPNNTDFSRSVSAKPPGQGFKHLIPMYKGLPWNVVRKIIVQMLSDTLKNSDRVFLVWAGHFELTSMK
YFVKIGPERTCCLDRRATCFSTAGTYACWHHSIGFDVYNPFMDIVDQVQGTGNLQSNHGRYCVQGHNAVASCDAMTRCLAVHECFVYKRVDMTIEYPIIGDELKINAAKRCVQHMV
VKAALLDAKFYPLVLDIGNPKAIFKVPQADVEWKFYDAQPCSDKAYKIEELFYSYATHSDKFTDGVCLFWMNCVNDRYPANSIVCRFDTRVLNLSNLPGCDGGSLYVNKHAFTPAFDKSAF
VNLKQLPFFYYSDPSCSEHGKQVSDIDYVPLKSACTIRCNLGGAVCRHHAENYRLIYLDAYNMMISAGFSLVWYKQFDPTYNLWNTFTRLQSLLENVAFNNGKHFDGQGGVEPVPSIINN
TVTYKVDGVDVLEFNKTTLPVNAFELWAKRNIIPVEVKILNNLNGDIAAANTYIDWYKRDAPAHISTIGVCSMTDIAKKPTENICAPLTVPFDRGVNQQVLDFFNRANRGVLIITEGSVK
GLQPSVGPQASLQNTLILGAEAVTQFNYYKVDGVVQQLPETYFTQTSRNLKEFKFRPSQMEIDFLELAMDEFIERYKLEGYAFHEHIVGDFSHRQLQGLHLLIIGLAKRSKESPLEDEDFI
PMDSTVKNYFITDAQVTGSSKCAVSTLDLLDFVEIISQSDLSVSKVNVKVTIDYTESFMLWCKDGHVETFFYPKLQSQAWQPGVAMPNLYKMLGLLEKCDLQVNGDSATLPTQTTETAHSCN
VAKYTQLCQYLNLTLLAVPYNMRVHIFGAGSDKGAVPGTAVLRQWLPTGTLTLLVSDSLNDFVSDADSTLIGDCATVHTANKWDLIISDMYDPKTKNVTKENDSKEGFFTYICGFIQKQKAL
GGSVAKIKIETHSWNADLYLKGHFAWMTAVFTNVNASSEAFILICGNYLKGPREQIDGYVMHNYEIFWRNTNPIQLSSYSLFDMSKFPLKLRGTAVMSLEKQGINDMIISLSLKGRLIIR
ENNRVVISDVLVNNMESLVLPGNEKHTHVQLSLPVLVLRGFGDSVEEALSEARQHCLKDGTCLGVEVEKGVLPQLEQPYVFIKRSDARTAPHGHVMVELVAELNGIQYGRSGETGLVLVPHVGETPVAYRK
VLYPHVGETPVAYRKVLLRKNGNGKAGGHSYGADLKSFDLGDDELGTDPYEDFQENWNWTKHSSGVTRRLMRELNGGAYTRYVDNNFCGPDGYPLECIKDLARAGKASCTLSEQLDFIDTK
RGVYCCREHEHEIAWYTERSEKSYELQTPFEIKLAKKFDTFNGECPNFVFLPNSTIKTIQPRVEKKLDGFMGRIRSVYPVASPNECNQMCMLSTLMKCDHCGETSWQGTDFVKATCEFCG
TENLTKEGATTCGYLPQNAVVKIYCPACHNPEVGPPEHSLAEYHNESGLKTILRKGGRTIAFGGCVFSYVGCNKCAYWVPASANIICGNHTGVVGESEGLNDNLEIIQKEKVINIIVGDFKNEEIAIILASF
DFKLNEEIAIILASFSASTSAFVETVKGLDYKTFKQIIVESCNGFKVTKGAKKGAWNIGEQKSLISPLFYAFSEAAARVRSIFSRTLETAQNSVRAQLKAAIITILDGISQYSLRLIDAMM
FTSDLVNINLVMAYITGGVQLTSQWLNTIFGTVYEKLPVLDWLEEKFKEGVEFLRDGWEIVKFIITSTACBIIEVGGQIVTCAKIKESVQTFFKLVNKFALCADIISIIIGAKLALNMGTFVTHSKGLYRKC
VKPKEETGLMLPKAPKEIIFLEGETLPTPEVLTEEVVLKTGDLQPLEQPTSEAEAPLVGTPVCINGMLMLEIKDTEKYCALAPNMMVTNNFTFLKGGAPTQVTFGDDTVIEVQGYKSVN
ITFELDERIDKVLNEKCSITYVELGTEVNEFACVADAVIKTLQPVSELLTPLGIDLDEWGMATYYLFDSEGEFKLASHMYCSFYPPDEDEEGDCEEEFEPSTQYEGTEDDYQGKPL
EFGATSVTPQPEEELEEDWLDDDSQQTVVQEDDSEVNQTTITQSIAEVQPOLEMEPTPVVQTEVNSFSGYLKLTDNVYIKNADIVEAAKKVKPTVVVNAANVYLKHGGGVAGALNKATNN
AMQVESDDYIATNGPLKVGCGCVLSGHNLAKNCLHVVGPNNVRGEDIQLLKSAYENFNQHDVLLAPLLSAGIFGADPVHSLRVCVDTVRTNVYLAVFDDKNLYDKLVSSFLEMKSEKQVEQ
KTAEIKPEEVKSSITESKLSVEQRKQVDKKIKACVEEVTTLTEETKFLTENLLYIDINGNLHPDSATLVNDIDITFLKKDAPYIVGDVVGEGVLTAVVIPTKKAGGTTEMLAKALRKVP
TDNYITTPYGGQLNGYTVEEAKTVLKKCKSAFYILPSIIISNEKEILGTVSNLREMLAHAEETRKMLPVCMETKAIIVSTIQRKYKGIQIEGVVDYGARFYFTSKTTVASLINTLNDL
NETLVMPGLVYTHGLNLEEAARYMSRLKVPATVSVSSPDAVTAYNGYLTSSSKTPEEHFIETISLAGSYKDWYSYGQSTQLGIEFLKRGDKSVYYTNSNPTFHLDEGVEITFDNLKILLS
LKEVRTIKVFTTVDNINLHTQVDMSTMTYGQGFPTYLDGADVTKIKPHNSHEGKTFYVLPNDDTLRAEAFFEYHYHTDPSFLGRYMSALNHTKKWYQVNGVLTSIKWADNNCYLATALL
TLQQIELKFNPALQDAYYRARAGEAANFICALILAYCNKTVGELGDVRETMNYLFQHANLDSCKRVLNVVCKTCGQQQTTTLKGVEAVMYMGTLSEYQLKKGQVQIPCTCGKQATQYLVQQE
SPFVMSAPPAQYELKHGTFICASEYTGNYQCCHYKHITSKETLYCIDGALLTKSSEYKGPITDVFYKENSYITTIKPIVYKLDGVVCTEIDPKLDNYKKDINSYFTEQPIDLVNPQYP
NASFDNFKFVCDNIKVFQSDMKSDVKTSSVLLSVLQQLRVESKSLWALQCVLHNDILAKDTTEAFKEMKSLVLLSVLQSMQADINKLCEMLDNKATQILASSEFSSLPYAAFAATQ
EDLKPVSSEEVENPTIQKDVLECNVKTTEVVGDILILKPANDGLKITEEVGHDTLMAAAYDNSSITIKKPNELSRVLGLKTLATHGLAAVNSVPWDTIANYAKPFLNKVSTTTNIVTRCL
NRVCTNMYPFYFTLLQLCTFTRSTNSRIKASMPTTIAKNTVKSVGKFCLEASFNYLKSPNFSTLINIIWFLLSVCLGSLIYSTAALGLVMSNLGMPSYCTGYREGYLNSTNVTTAIY
CTGSI PCSVCLSGDLSLDTYPSLETIQITISSFKWDLTAFGLVAEWFVLAIFLTFRTFVVLGLAAIMQLFFSYFAVHFISNSWLMWLIINLQVMAPISAMVRMYIFASFYVWVKSYYHV
DGTSTSCMMCYKRNARTRVECTTIVNGVRRSFYVYANGGKGFCKLHNWNCVNDTCFAGSTFISDEAVRDLQSFQKRPINPTDQSSYIVDSVTVKNGSIHLFYDQAGQGTVERHSLSHF
VNDLNRANNTKGSPLINIVFDGKSKCESSAKSASVYYSQMLQCPILLLDQALVSDVDGSTEAVAKMFDAYVNTFSSFTNVPMEKLTLSVATAEAELKANVSLDNVLSTFISAAQGF
VDSVDVETKDVVECLKLSHQSDIEVTGDSNNYMLTYNKVENMTPRDLGACIDCSARHINAQVAKSHNIALIWNVKDFMSLSEQLRQKIRSAAKNNLPFKLTCAATRVQNVVTTKIALK
GGKIVNNWKLQKILKVTFLVFAAIFYLITPVHVMSKHTDFSSEIIIGYKADIGGVTRDIASDTFCFANKHADPDTWFSQRGGSYTNDAKAPLIAAIVITREGVGVFVGLPGLTILRTNGD
LHFLPRFVSAGNICYVTPSKLIEYTFDATSACVLAABCTIFKDSAGKPPVPCYCDTNVLEGSVAYESLRPDTRFVLMDSGIIQFPNTYLGESVRYVNTFDSYECRHGTGTCERSEAGVCVST
GRWVLNNDYYRSLPGVFCGVDAVNLLTNMFTPLIQPIGALDISASIVAGGIVAIIVVTCLAYYFMRFRRAFGEYSHVVAFTNLLFLMSFTVLCCLTPVYSFPLPGVYSVIYLYLTFYLTNDVS
FLAHIQMVMFTPLVPFWTIIYVICISTKHFWFFSNYLKRRVFNNGVSFSTFEEAALCTFLLNKEMYKLRSDVLLPLTQYNNRYLALYKXYFSGAMDTSYREAAACCHLAKALND
SNSGSDVLYQPPQTSITSAILQSGFRKMAFPSPGKVEGCMVQVTCGTTLNGWLDVYVCPRHVITKEMLPNNVDELLIRKSNHNPVLQAGNVQLRVIRGHSNMCVLKLKVDNTPKT
PKYKFVRIPQGTFSVLACYNSSPGSVYQCAMRPNFTIKGSLFNGSCSGSVGNIDYDCVSCFYMHMELPTGVHAGTDLEGTFFYGFFVDRQTAQAAGQDITITVNVLAWLYAAVINGDRW
FLNRFTTTLNDFNLVAMKYNIEPLTDHVDILGLPSAQTGIAVLDMCASLQVHNGMGRITLGSALDEBETFPDQVVRQCSGVTFQSAVKRTIKGTHWLLTILTSLLVLQVSTQ
LFFFVYENAFPLFAMGIIAMSAFAMMFVKHKAFLCLFLPLSLATVAYFNMVMPASWVMRIMTWLDMVDTSLSGFKLDCVMYASAVVLIILMTARTVYDGGARVMTLMNVLTLYVK
YYGNALDQAIISWALLISVTSNYSNGVVTVMFLARGIVFMCVEYCPIFFITGNTLQCILMYCYFLGFCYCTCYFGLFCLLNRVFRILTGVYDYLVSTQEFYRMYNSQGLLPKNSIDAFKLN
IKLLVGKGKPCIKVATQVQSKMSDVKTSSVLLSVLQQLRVESKSLWALQCVLHNDILAKDTTEAFKEMKSLVLLSVLQSMQADINKLCEMLDNKATQILASSEFSSLPYAAFAATQ
EAYEQAVANGDSEVVLKLLKLSLVAKSEFDRDAAMQRKLEKMAQDQMTQMYKQARSEDKRAKVTSAMQTMFLTMLRKLDNDALNNIINNARDGCVPLNIIPLTAAKLMVVIDPYNTYK
NTCDGTFTFYASALWEIQQVVDADSKIVQLSIESMDNSPNLAWPLIVTALRANSAPVQLQNNELSPVALRQMSCAAGTTQACTDDNALAYNTTKGGRFVLAALLSDQLDKWARFPKSGD
TGTIYFTELEPPCRFVYTDTPKPGKPVYLYLFIKGLNNLNRGMVLGSLAATVRLQAGNATEVVPANSTVLSQCAFAYDAAKAYKDYLASGGQPICTNCVKMLCTHTGTGQKAIITVTPPEANMDQESF
GGASCCLYCRCHIDHFNPKGFCDLKGKVVQIPTTCANDPVGFTLKMTVCTVCGMMWKGSGCSDQLREBMLQSDAQSLNRCVCGVSAARLTPCGTGTSTDVVYRAFDIYNDKVAGFAKFL
KTNCCRFQEKDEDDNLDISYFVVKRHTFSNYQHEETIYNLLKDCPAVAKHDFKFRIDGMVPHISRQRLTKMPTMADLVYALRHDFDEGNCDLTKEILVTYNCCDDYFNKKWDYDFVENP
DILRVYANLGERVRQALLTKVQFCDAMRDAGIVGTLTDNQDLNGWYDFDGIITTPGSGVPVIVDSYSLTLYMPTILTLTRALTAEHVSDTLTKPPIKWDLLYDFTTEERKLDFRKYFY
WDQTYHFNVCNCLDDRCILHCAENFVLFSTVFPPTSGFPLVRKIFVDGVFPVSVTGYHFRELGVHNNQDVNLHSSRLSFKELLVYAADPAMHAASGNLLDKRKTFCFSAALTNNAVFTA
VKPGNFNDPFDYFAVSKGFEKGGSSDKVCTSSVLLSVLQQLRVESKSLWALQCVLHNDILAKDTTEAFKEMKSLVLLSVLQSMQADINKLCEMLDNKATQILASSEFSSLPYAAFAATQ
YTKRNVIPITITQMNKLKYAISAKNRARTVAGVSICTMTNRQFHQKLLKSIATARGATTVIGTSKFYGGWHNMLKTVYSDVENPHLMGWDPKCDRAMPNMLRIMASLVLARKHHTCCSL
HRFYRLANECQVLSSEMVMCGGSLYVVKPGTSSGDDATYANVSFNICQAVTANVALLSTDGNIKADKHVRNLQHRLYECLYRNRDVTDFVNEFYAYLRKHFMSMIISDDAVFCNST
YASQGLVASIKNFKSVLYYQNNVFMSEAKWTEEDTLTKGHEFCQSHTMLVKQGDYVLYLPDPBSRILGAGCFVDDIVKTGDTLMIERFVSLAIDAYPLTKHNPGEYADVDFHLYLQYIR
KLHDELTGHMLDMYSVMLTNDNTSRWEPEFEAMYTPHTVLQVAGACVLCNSQTSLRCAICIRRPFLCKCCYDHHVISTSHKLVLSVNPVYCNAPGCDNRDVTQYLYLGGMSSYCKSHKP
PISFPLCANGQVFGYKNTCVGSDNVDTFNAIATKWTNAGDYIANTCTERLKLFAETLIKATEETFKLSYGIATVREVLSDRELHLSWEVGKFRPPLNRVYTVGTGRVTKNSKQIGE
YTFEKGDYGDADVYKGTTTYKLNVGDYFVLTSHTVPLSAPTLVPQEHYVRTITGLYPTPLNLSDEFSSNNVANYQKVGMMQKYSITLQGGPPTGKSHAIFALAIYPSARIYVTCASHAAVDAL
CEKALKYLPIDKCSRIIPARARVECKDFKFNVTLEQYVFCTVNALPETTADIVFDEISMATNLDLSVNARLAKHXYVIGDPAQLAPARTLTLTKGTLEPEYFNSVCRMLKGTIPGDMF
LGTCCRCPAEIVDSRTSALIVYDNKLKAHKDKSAQCCKMYKGVITHDVPASINRQPIGVREFLTRNPAWRKAVIISPYNSQAWQPGVAMPNLYKMLGLLEKCDLQVNGDSATLPTQTTETAHSCN
VNRFNVAITRAKVGILCIMSDDRLDYDKLQFTSLEIPRRNVATLQAEVNTGLFKDCSKVITGLHPTQAPTHLSVDTKFKTEGLCVDIPGPKDMTYRRLISMMGFKMNYQVNGYPNMFITR
EEAIRHVRWAIIGFVDEGGHATREASTVNTLPLQLGFGSTGVNLVAFPTGYVDTPNNTDFSRSVSAKPPGQGFKHLIPMYKGLPWNVVRKIIVQMLSDTLKNSDRVFLVWAGHFELTSMK
YFVKIGPERTCCLDRRATCFSTAGTYACWHHSIGFDVYNPFMDIVDQVQGTGNLQSNHGRYCVQGHNAVASCDAMTRCLAVHECFVYKRVDMTIEYPIIGDELKINAAKRCVQHMV
VKAALLDAKFYPLVLDIGNPKAIFKVPQADVEWKFYDAQPCSDKAYKIEELFYSYATHSDKFTDGVCLFWMNCVNDRYPANSIVCRFDTRVLNLSNLPGCDGGSLYVNKHAFTPAFDKSAF
VNLKQLPFFYYSDPSCSEHGKQVSDIDYVPLKSACTIRCNLGGAVCRHHAENYRLIYLDAYNMMISAGFSLVWYKQFDPTYNLWNTFTRLQSLLENVAFNNGKHFDGQGGVEPVPSIINN
TVTYKVDGVDVLEFNKTTLPVNAFELWAKRNIIPVEVKILNNLNGDIAAANTYIDWYKRDAPAHISTIGVCSMTDIAKKPTENICAPLTVPFDRGVNQQVLDFFNRANRGVLIITEGSVK
GLQPSVGPQASLQNTLILGAEAVTQFNYYKVDGVVQQLPETYFTQTSRNLKEFK

REAAACCHLAKALNDFSNSQSDVLYQPPQTSITSAVLQSGFRKMAFPSPSGKVEGCMVQVTCGTTTTLNGLWLDVVYCPRHVICTSEDMLNPNYEDLLIRKSNHNFVLQAGNVQLRVIGHSMQ
NCVLKLVKVDNTANPKTPKYKFVRIQPGQTFVSLACYNGPSPSGVYQCAMRPNFTIKGSFLNGSCSGSVGFNIIDYDCVSCFYMHMELPTGVHAGTDELEGTFFYGFVDRQTAQAAGTDDTTITVNV
LWLAAYAAVINGDRWFLNFKFTTTLNDFNLVAMKYNIEPLTQDHVDILGLPSAQGTGIAVLDMCASLKELLQNGMNGRTILGSALLEDEFTPFDDVVRQCSGVTQSAVAKRTIKGTHHWLLTL
ITLSLVLVQSTQWSLFFVYENAPFLFAMGIIAMSAFAMMFVKHHAFLCLFLPLSLATVAYFNMVMPASVWMVRIMTLDWMVDTSLSGFKLDCVMYASAVVLLILMTARTVDDGAR
RVWTLNMNVLTLYVKVYGNALDQAIISMWALLISVTSNYSNGVVTVMFLARGIVFMCVEYCFIFFITGNTLQCIIMLVYCFLGYFCTCYFGLFCLLNRYFRLTLGVYDYLSTQEFRYMNSQ
GLLPFPKNSIDAFKLNILKLLGVGGKPCIKVATVQSKMSDVKCTSVVLLSVLQQLRVRESSSKLWAQCVQLHNDILLAKDTTTAEFKMVSLLSVLLSMQGAVDINKLCEEMLDNRATLQAAS
EFSSLSPSYAAAFATAQEAQEAVANGDSEVLLKLLKSLNVAKSEFDRDAAMQRKLEKMAQDAMTQMYKQARSEDKRAKVTSAMQTMFLTMLRKLDNDALNNIINNARDGCVPLNIIPLT
AAKLMVVIDPYNTYKNTCDGTTFTTYASALWEIQQVVDADSKIIVQLSEISMDSNPNLAWPLIVTALTRANSAVKLQNNELSPVALRQMSCAAGTTQTACTDDNALAYYNTTKGGRFVLLALS
DLQDLKWARFPKSDGTGTIYTELEPPCRFVTDTPKGPVKVLYFIKGLNNLNRGMVLGSLAATVRLQAGNATEVPANSTVLSFCFAFVDAAKAYKDYLASGGQPIITNCVKMLCTHTGTGTQ
AITVTPPEANMDQESFGGASCCLYCRCHIDHNPNGKFCDLKGKVVQIPTTCANDPVGFTLKNTVCTVCGMWKGYGSCDQLREPMLQSADAAQSFNLNGFAVMFVFLVLLPLVSSQCVNLTR
TQLPPEAYTNSSTRGVVYPDKVFRSSVLLHTQDLFLPFSSNVTFWFAIHVSGTNGIKRFDNPVLFDNDGVYFASTEKSNIIRGWIFGTTLDLSKTQSLILVNNAENVVKVCFQFCNDPEL
GVYYHKNNKSNWMESEFRVYSSANNCTTFYVVSQPFPLMDLEGGQGNFKNLEFVFKNIDGYFKIYSKHTPINLVRDLPGQFSALEPLVDLPIGINTIRFQTLTLLHRSYVLTNSTFSFTFKCYG
AAAYVGYLQPRFTLKLNYENGTITDAVDADLPSETKCTKLSFTVEKGIYQTSNFRVQPTDSIVRFPNITNLCPFGEVFNATRFASVYAWNRRKISNCVADYSVLYNSTFSFTFKCYG
VSPQTLNDLVCTNVYADSFVIRGDEQVIAPGQTVGKTIADYNYKLPDDFTGCVLIWANXKHIDATEGGNFNIADTLFRKSNLKPFERDISTEITYAGSKPCNGQTFNCYPLYRGFYPTD
GVGYQPRVVLVLSFELLNAPATVCGPKKSTLVNKNKCNVFNFLGTGVLTSNEKSKFLPFQGFGRDIADTLDAVRDPQTLIELDITPCSFGGVSVITPGTNASQNVAVLYQDVNCTEVP
VAIHADQLTPTWRVYSTGSNVFQTRAGCLIGAEHVNNSYECDIPIGAGICASYQTQTNRSRVSQSIATYMSLGAENSVAYSNNSIAPTNFTISVYTEILPVSMTKTSVDCMTMYICGD
STECSNLLLLQGSFCTQLNRLALTGIAVEQDKNTQEVFAQVKQIYKTPPIKDFGGNFNSQILPDPSPKSPKRSFIEDLLFNKVTLADAGFIKQYGDCLGDIARBLICAQKFNGLTVLPPLL
TDEMIAGQTSALLAGTITSGWTFGAGAAQIPFAMQMAFYRFNGIQTQNVLVYENQKLITANGFNIAIGKIQDLSLSTASALGKLQDVVNQNAQALNTLVKLQSSNFAGAISSVNDLILSRDL
KVEAEVQIDRLITGRLQSLQTYVTQGLIRAAEIRASANLAATKMSCEVLGSKSRVDFCGQYHLMSPFQSAAPHGVVFLHVTVYPAQEKNTTAPAIICHDGKAHFPRGEGVFNSTGTHWFT
QRNFYEPQIITTDNTFVSGNCDVGIIVNNTVYDPLQPELDSFKEBLDYKFNHTLPSDVLGDTSGINASVNIQKEIDRLNEVAKNNLSESLDILQBLGKYEQIYKWPYIWLGTIAGLI
AIVMVTIMLCMTSCCSCCLKGCCSCGSCCKFDEDDSEPVKGVKLYHTMDLFMRIFTLGTVTLKQGEIKDATPSDSVRATATIPQASLPFGWLIVGVALLAVFQASAKIITLKKRWQLA
LSKGVHFICNLLLFVTVYSHLLLVAAAGLEAPFLYLYALVYFLQSINFVRIIMRLWLCKWCRSNPLLYDANVFLCWHNTCYDYCIPIYNSVTSISIVITSGDGTTSPISEHDYQIGGYTEK
WESGVKDCVVLHSHYFTSDEAYQLYSTQDLSTDGTGVHEVHTFFIYNKIVDEPEEHVQIHTIDGSSGVNVPMPEIYDEPTTTTSVPLMMLTTSFVGILIVMTIYVYLTIVMYSFVSEETGTLIVN
SVLLFLAFVVLVLVTLAILTALRLCAYCCNIVNVSLVKPSFYVYSRVKNLNSRVPDLLVMADNGTITVBEELKKLLEQWNVLVIGLFLTWCILCLQFAYANRNFYLIKILFIPLWLLWPVT
LACFVLAAYRINWITGGIAIAMAKVLGLMWSLYFIASFRLFARTSRMSFNPEITNILLNVPLHGTILTRPFLSESELVIGAVILRGHLRIAGHHLGRCDIKPLKEITVATSRTLISYYKL
GASQRVAGDSGFAAYSRRIKYNLCTHSSSDNIALLVQMFLHVDQVTTAEILLIIMRTFVSVTWNLDIINLIKLNLSKSLTENKYSQLEDEEOPMEIDMKIILFLVLITLATCEYL
HYQCEVCRGTTVLLKPECCSGTGYEGNSPFLPHLADNKFALTCFSTQFAFACPDQGVHQVYLQARSVPKFLIRQEEV-QELYSPIFLIVAAIVFIFLCTCLTRKQNTSEMSELSDIFLYCLFLAF
LLFLVLILFIWFSLELDQHNETHAMKLLVFLGILTTVTAFHQECSLQCAQHQPVYVDDPCPIHFYSKYIRVGARKSAPLIELCVDVEGSKSLPIQYIDIGNYTVSCSPPTINCEP
KLGLSVVRCSFYEDFLEYHDVRVVLDFIMSDNGPQNQRNAPRITFGGSPDSTGSNQNGERSGARPKQRRPQGLPNNTASWFTALTQHKGEDLKFRPGQGVPIINTNSSPDDQIGIYRRATR
RIRGGDGKMKDLSPRWYFYLLGTGPEAGLPYGAANKDGIIVWATEGALNTPKDHIGTRNPANNAIIVLQPGQTTLPKGFYAEGRSGGQASRSSSSRNSRNSNSTPGSSRGTSFARMAG
NGSDAALALLLLDRILNQLESKMSGKQQQOQTGTTKSSAAEASKPRQKRTATQYNNVTOQAFYGRRGEQOELIRQGTDYKHWPOIAQGFAPASAAFFGMSRIGMEVTPSGTWLT
YTGAIKLDDKDPNFKDQVILLNKHIDAYKTFPPTPEPKDKKKKADETTQALPQRQKKQQTIVLLPAADLDDFSKQLQOSMSADSTQAMDPKTNEMHPALRLVDPQQLAVTRMENAVEHD
QNNVGLKVYPIILRLGSPSLNMARKTLNLSLEDAKFLRPIAVQMTKLATTEELPDEFVVVTVMKMLQSCYNFLKEQHCQKASTQKGAEVAVKLLLALHHVVATVQETQLQAAVGELPLL
WLAMAVMLLLCCCLTD

>Bat-SL-CoV:

MESLVPGFNEKTHGQLSLPVLQVRDVLVRFGDSEVEALSEARQHLKDGTCGLVEVEKGVLPQLEQPYVFIKRSDARTAPHGHVMVELVAELDGIQYGRSGETLGLVLPHVGEVVPAYRK
VLLRKNGNKAGAGHSYGADLKSFDLDELGTDPIDEPQENWNTHKGSVGTRELKRELNGGAYTRYVDNNFCGPDGYPLECIKDLLARAGKASCTLSEQLDFIDTKRGVYCCREHEHEIAW
YTERSEKSYELQTPPEIKLAKKFDTFNCECNPFVPLNSTIKTIQPRVCKKLDGFMKIRISVPVASEPNECQMCLSTLMKCDHCGETSQWTDGFVRATCEFCFGTENLTKEGATTCGYL
PQNAVVIYCPACHNPEVGPETHSLAEYHNESEGTLTVLRKGGRTIAYGGVFYSYGVNCPVMEPIYDEPTTTTSVPLMMLTTSFVGILIVMTIYVYLTIVMYSFVSEETGTLIVN
SASTSAFVETVTKGLDYKTFKQIVESCNGFKVTKGKAKKGAWNIGEOKSILSPLYAFASEAARVRSISFSTLETAQHSVRVLQKAAITILDGISQYSRLIDAMMFTSDLVTNNLVMMAY
ITGGVVQNTSQWLNTAFIETGVTEYKELKPLVDLLEEKFKEGVEFLRDGWEIVKFISTCACEIVGGQIVTCAKEIKESVQTFFKLVNKFALCADSIIIGGAKLALNLTGFTVTHSKGLYRK
VRSREETGLMLPAKMEIIFLEGETLPLETVIEEVVLKTGVLPQLEQPTNTEAVEAPLGVTPVCINGMLLEIKDTEKYCALAPNMMVTNNNTTFLTKGGAATKVFTEGDDTVIEVQGYKSVN
ITFELDERISDKVNEKCSNNTVELGTVEYNEFACVAVADAVIKTLQPVSELLIPLGLDLEWMSMATIYLFDESSEGFKLSSHMYCSFYPPDEDEGEDDCEEEEFSTQYEGYEGDADQGGKPL
EFGATSSSSQSEEDKEDWDSQDQETVAENKIPSEVVPVLESTPVTVTESEVNNNTGYLKLDMNVFIKNADIVEEAKKVKPVTVVVNAADIVKPGSVGGLKADNATKNANMQ
VESDKYITTNGLPLVGGSCVLSGHNLAKNCLHVVGNPNVRGEDIQLLNKAYENFNQHEVLLAPLLSAGIFGADPVHSLRVCVETVRTNVYLAVFKNLYDKLVSSFLEMKSEKQVEQKVA
ENKPEEVEFPFTTENKPSVEQRQAEEKIKACIEEVTTLTEETKFTENLLYIDINGNLHPDSATIVKLIDITFLKKDAPYIGVDGKEGALTAUVIPPKKAGGTTEMLAKALRKVPDPT
NYITTYPGQGLKPYTSEAYQLYSTQDLSTDGTGVHEVHTFFIYNKIVDEPEEHVQIHTIDGSSGVNVPMPEIYDEPTTTTSVPLMMLTTSFVGILIVMTIYVYLTIVMYSFVSEETGTLIVN
TLVTMPLGVYTHGLNLEEAARYMSRLKVPATVSVSSPDAVTAYNGYLTSSSKTPEEHIEDTISLAGYSKDWYSQGSTQLGIEFLKRGDKSVYVTSNPTTFHLDGVEVITFDNLKLTLLSLR
EVRTIKVFTTVDNINLHTQVDDMSMTYQQQFGPTIYLDGADVTKIKPHNSHEGKTIFYPLNPDLDLRAVEAFEYHYTTDPSFLGRYMSALNHTKKWKYPQVNGLSIKWADNDCNYLATALLTI
QOIELKFNPAQLQDAYIYVRRAGEAMNYFALLIAYCNKTVGELGDVRETMNYLFQHANLDGSKRVNLNVVCTHQQQQTTLKGVEAVMYMGKVGQIIPCMCGKQATQYLYQGESQ
FVMMSPAPPAQYELKHGDTFVFCASEYTGNYCGGHYKHITSKETLYCIDGALLTKSSYKGPITDVFYKENSYTTTIKPVTYKLDGVVCTEIDPKLDGKYKKNDSYFTEQPIDLVLPNQYFPA
SDFNFKFVCDNKLQTLTGKFKPASRELKVTFFPDLNGDVVAIDYKHTPSFKMLKHLHKPIVHVNNAATNKATYKPNIWICRLWTSKFPVETSFDVLELDTQKLEMDLACEV
LKPVSSEEVENPTIQKDILECNVKTTEVVGDIILKPASDGLKITEEVGHTDLMAAYVDNSSLTIKKPNELSRVLGLKTLATHGLAAINSVPWDTIANYAKPFLNKVSTTTNIVTRCLNR
VCTNMPYFLITLTLQLCTFTKSTNSRIKASMPTTIAKNTVKSVGKFCLEASFNKLSPNFSKLIINVIWFLLLSVCLGSLIYSTAALGVLMSNLGMPSYCTVYREGYLNSTNVTIATYCT
GSTPCSVGLSGLDLSYTLCTPSTLTIQITSSFFKWLDTAFGLVAEWFAYLILFTRFFYVLGLAAIMQLFSSYFAVHFISNSWMLMWLIINLVQMPASISAMVRMIFEFASFYVWKSYVHVVGD
CTSSTCMCYKRNRRATRVBECTTIVNGVRRSFYVYVANGGKGFKCLLHNWNCINCDFCAGSTFISEVARDLSLQFKRPINPTDQSSYIVDSVTVKNGSILHYFDKAGQKTYERHSLSHFVN
LDNLRAKNTKGLSLPINVIVFDGSKCEASSASVYYSQMLCQPIILLDQALVSDVGSAAEVAMKFDAYVNTFSSTFNVPMEKLKALVATAEAEALKANVSLDNLVSTFISAAQGGFVD
SDVETKDNVECLKLSHKTIVETGDSKNNSMYLTYNKVENMTPRDLGACIDCSARHINAKVGSANHIALIWNVDKFMLSLEQLRKQIRSAAKNNMLPRLTCASTRQVNVNVTITKALGGK
KIVNNVLKQLIKVTYVLFPIAVIFLYITPVHVMKSHNDFSSEIIGYKATLDGGVTRDIADSTCFANKHADFDWSFQRGGSYNTDKACPLIAAVITREVGVFYVGLPGTILRTINGDFLH
FLRPVFSAVGNIKDVTSSKLIETYDFTASCAALAEETIFKDSAGKFPVPCYDNTNLEGSVAYESLRDPTYRVRVMDGSIQFPNTYLEGSVRVVTTFDSEYCRHGTCESEAGVCVSTSGR
WVLNNDYYSRLPGVFCGDVAVNLLTNMFTPLIQPIGALDISASIVAGGIVAIIVTCLLAYIFMRFRRAFGEYSHVAVFNTLLFLMSFTVLCITPVYSFLPGVYSVIYLYLTFFYLTNDVSFL
AHTQWVMFTPLVPFWMTIVYVICSTKHFWFFSNYLKRRVFNFGVFSFTEEEAALCTFLLNKEYMLKLRSDVLLPTQYNRYLALYNKYKYPFGAMDTYSYREAAACCHLAKAINDFS
SGSDVLYQPPQTSITSAVLQSGFRKMAFPSPSGKVEGCMVQVTCGTTTTLNGLWLDVVYCPRHVICTSEDMLNPNYEDLLIRKSNHNFVLQAGNVQLRVIGHSMQNCVLKLVKVDNTANPKTP
KYFVRIQPGQTFVSLACYNGPSPSGVYQCAMRPNFTIKGSFLNGSCSGSVGFNIIDYDCVSCFYMHMELPTGVHAGTDELEGTFFYGFVDRQTAQAAGTDDTTITVNVLAWLYAAVINGDRWFL
NRFTTTTLNDFNLVAMKYNIEPLTQDHVDILGLPSAQGTGIAVLDMCASLKELLQNGMNGRTILGSALLEDEFTPFDDVVRQCSGVTQSAVAKRTIKGTHHWLLTLVLTSLVLVQSTQWSL
FFVYENAPFLFAMGIIAMSAFAMMFVKHHAFLCLFLLPSLATVAYFNMVMPASVWMVRIMTLDVDTLSYGFKLKDCVMYASAVVLLILMTARTVDDGARNVNMTLMNVLTLYVKVY
GNALDQAIISMWALLISVTSNYSNGVVTVMFLARGIVFMCVEYCFIFFITGNTLQCIIMLVYCFLGYFCTCYFGLFCLLNRYFRLTLGVYDYLSTQEFRYMNSOGLLPKSSIDAFKLNIL
LLGIGKPCIKVATVQSKMSDVKCTSVVLLSVLQQLRVRESSSKLWAQCVQLHNDILLAKDTTTAEFKMVSLLSVLLSMQGAVDINKLCEEMLDNRATLQAISEFSSLSPSYAAAYATAQEA
YEQAVANGDSEVLLKLLKSLNVAKSEFDRDAAMQRKLEKMAQDAMTQMYKQARSEDKRAKVTSAMQTMFLTMLRKLDNDALNNIINNARDGCVPLNIIPLTAAKLMVVIDPYDGYKNT
CDGNTFTYASALWEIQQVVDADSKIIVQLSEISMDSNPNLAWPLIVTALTRANSAVKLQNNELSPVALRQMSCAAGTTQTACTDDNALAYNNSKGRFVLLALSDHDLQDLKWARFPKSDGTG
TITYTELEPPCRFVTDTPKGPVKVLYFIKGLNNLNRGMVLGSLAATVRLQAGNATEVPANSTVLSFCFAFVDAKAYKDYLASGGQPIITNCVKMLCTHTGTGQAITVTPPEANMDQESFGG
ASCCLYCRCHIDHNPNGKFCDLKGKVVQIPTTCANDPVGFTLRNTVCTVCGMWKGYGSCDQLREPMMQASADASTFLNRVCVGSAAARLTPCGTGTSTDDVYVRAFDIYNEKVAGFAKFLTK
NCCRFQEKDEEGNLLDSYFVVKRHTMSNYQHEETIYNLVKGCPAVAHVDFMKFRVDDGMVPHISQRQLTKYTMADLVYALRHFDGEGNCDTLKEILVTYKCCDDDYFNKKDWYDFVENPDI
LRYANLGERVQRALLKTVFCFCDAMRAGIYGVLTLDNQDLNGNWDFDGFVQVAPGCGVPIVDSYSLYMLITLTRALAESHMDADLAKPLIKDWLKLCTDFTTEERLCLDYFTTEERLCLDYFYKWD
QTYHPNCFINCDRLCHCANFNVLSTFVTFPFGSLVRKIFVGDVFPVSTGYHFLRELVGVHNDQVNLHSSRLSKFELLYVYAADPAMHAASCNLLLDKRTTCFSAALTNNVAFQTVK
PGNFKNDFYDFAVSKGFKGSSVELHKEFFAQDGNAAISDYDYRYNRLTMCDIRLGLLVFEVVEVYDFCDYDGGCINANQVIVNNLDKSAAGFSFNKMGKARLYLSDMSYQDQDALFAYT
KRNVIPITITQMLNKYAIASAKNRARTVAGVSCSTMTRNQPHQKLLKSIATRGTAVVIGTSKFIYGGWHNMLKTVYSDVESPHLMGWDPKCDRAMPNMLRIMASVLARKHSTCCNLSHR
FYRLANECAGVLELYEMVMGGSYLVPKPGTSSGDAATAYANSVNIICQAVTANVNALLSDGNKTIADRYNKLQHRLEYCLYRNRDVGQEFVDFEYAYLRKHFSMMILSSDAVYVYNSNYA
AQLVASIKNFKAIVLYQNNVMSAKWCTETDLTKGPHEFCQSQHTMLVKQGDQVYLYPDPDSRLIAGCFFVDIDVKTDTGLMIERFVSLAIDAYPLTGTHPNQEYADVFLHYLQYIRKL
HDELTHGMLDMYSVMLTNDNTSRYWEPFEFYEAMTPTHTVLQAVGACVLCNSQTSILRCGACIIRRFELCKCCYDHSVISTSHKLVLSVNPVVCNAPGCDVTDVOTQLYLGMSYCYCKSHKPI
SFPLCANQGVFLGYKNTCYGNDVTFDNAIATCDNAGDYILANTCTERLKLFAAETLKATEETFKLSYGIATREVLSDRLEHLSWEVKGKPRPPLNNRYVITGYRVKNTSKNVQIGEY
FEKGDVADAVYRGTTVGLNVDYFVLTSTVMPLSAPTLVQPEHYVRIITGLYPTLNIIDEFSNNAVQKVGVMQKYSTLQGPPTGKSHGAFILGLALYPSARIYVYACSAHAADVLCAL
KALKYLPIDKCSRIIPARARVEKDKFKVNSTLQYVYFCTVNALPETTADIVVDFEISMATNLYDSVNNARLAKHYVYIGDPAQLPAPRTLLTKGTFLEPYENSVCLRMKTIIGPDMFLG
TRCRCPAEIKDVTISALVYDNKLAHKEKSAQCEKMFYKGVITHDVSSAINRPQIGVRFVTRNPAWRKAVFTISPYNSQNAVASKILGLPTQTVDDSSQGEYDYVITQTQTHETACNVN
RFNVAITRAKIGILCIMSDDRLYDKLQFTSLEIPRRNVATLQAEENVTLGFKDCSKIITGLHPTQAPTHLSVDTKFKTEGLCVDIPGPKDMTYRRLISMMGFKMNYQVNGYPNMFTREE
AIRHVRVAIGFVDEGCHATRDAVGTNLPQLGFGSTGVNLVAVPTGVVDTENSTETRVNAPKPPGQDKHLIPLMYKGLPWNVVRIKTVQMLSOTLKGLSDRVVFLWAHGELFELTSMKYF

VKIGPERTCCLCDKRATCFSTSSDITYACWNHSGVGFDDYVYNPFMIDVQQWGTGNLQSNHDQHCQVHGNHAVASCDAIMTRCLAVHECFVKVRDWSIEYPIIGDELKINAACRVQHVMVVK
SALLADKFPVLHDI GNPKAIRCVQPAQEVDMVKFYDAQPCSDKAYKIEELFYSYATHHDKFTDGVCLFWNCNVDRYPANAIVCRFDRTRVLSNLNLPGCGDGGSLYNNKHAFHTPAFDKSAFTH
LKQLPFFYYSVCSPEHGKQVSDIVDVPVLPKSATCITRCLNGAGVCRHHANEYRQGLDAYNMMSIAGFSLWIYKQFDTYNLWNTFTKLQSLIENVAYNVKNVGHGFDQNGEAPVSIINNVA
YTKVDGVDEIFENKTLTPNVNVAPELMAKRNKIPVPEIKILNNLGVDAIANTVINDWYKREAPAHVSTIGVCTMTDIAKKPTESACSSITLVDFDGRBEVQGLDFERNRANGVILTEGSRVGL
TPSKGPAQASVNGVTLIGESVKTQFNFYKKVDGIIQQLPETYFTQSRDLEDFKPRSQMETDFLELAMDEFIERYKLEGYAFEHIVYGDFSHGQGLGGLHLLIGLAKRSQDSLKLEDFIPM
DSTVKNYFITDAQTGSSKCVSVIIDLDDDFVEIISQDLSVVSKVKTVIDYTEISFMLWCKDGHVETFPYKQLQSSQAWQPGVAMPNLYKMQRMLLEKCDLQNYGDSATLPGKIMMNVVA
KYTQLCQYINTLTLAVPYNMRYHEFGAGSDKGAAPGTAVLRQWLPTGTLLLVDSLDNDFVSADSLTIGHCATVHTNTANKWDLIISDMYDPKTKNVTKENDSKEGFTYICGFIQQLKALGG
SVAVKITEHSWNADLYKLMGHFAWWTAFVNTNVNASSEAFILGNYLKGPREQIDGYVMHANYIFWRNTNFIQLSSYSLFDMSKFPFLKRGTAVMMSLKEQGINDMILSLLSKGRLIIREN
NRVVISDVLVNNMESLVPVGFNEKTHGQLSLPVLQVRDVLVRGFGDSVEEALSEARQHLKDGTGCLVEVEKGVLPQLEQPYVFIKRSDARTAPHGHVMVELVAELDGIQYGRSGETLGV
VPHVGEVPVAYRKLRLKNGKAGGHSYGADLKSFDLGDDELGTDEIDFQENWNTKHGSVTRRELKRENGGAYTRYVDNNFCGPDGYPLECIKDLLARAGKASCTLSEQLDDFIDTKRG
VYCCREHEHEIAWYTERSEKSYELQTPFEIKLAKKFDTFNGECPNFVPLNSTIKTIQPRVEKKKLKDGFMGRIRSVYPVASPNECNQMCLSTLMKCDHCGETASWQTFGEVRATCEFCGTE
NLTKGATTCCGYLPQNAVVKIYCPACHNYPEGPEHSLAEYHNESGLKTVLRKGGRITIAGGCVFSYVGCYNKCAIYWPVRASANIGCHNTGVGEGSESLNDNLLEILQKEKVNINIVGDF
KLNEEIAIILASFSASTSAFVETVKDLYTKTFQIVESCGNFVKTKGAKKGAWNIGEQKSIISLPYAFASEAARVVRISFRTLETAQHSVRVLQAAITILDGSIQYXSLRIDAMMFT
SDLVTNNLVMAIYITGGVQMTSQWLNTNIFGTVYEKLPVLDWLEEKFGVEFLRDGEVIVKFISTACEIIVGGQIVTCAKEIKESVQTFEYKLVNPFALMCADSIIGGAKALKALNLTGE
TFVTHSKGYLRKCVRSREETGLLMLPKAEIIFLEGETLPTVEVLTKTGLVQLPQGTNEAVEAPLVTPVCINGMLMLEIKDTEKYLCAFNPMNNTNTFTLKGAGPTKTVTFGD
DTVIEVQGYKSVNITFELDERIDKVLNEKCSNYTVELGETEVNEFACVAVADAVIKTLQVPSELLIPLGIDLDDEWSMATYYLFDSEGEFLLSSHMVCSYFPDDEDEGEDDCEEEFEFPSTQY
EYGTEDDYQGKPLEFGATSFSSSSQEEEQEEDWLDSDSDQDQETAVEENKPIVSEVPPVPLEVESTVPVTTSEVNNFTGYLKLTDNVPFKINADIVEEAKVKPTVVVNAANVYLKHGGGV
AGLVGNLNNAMQVESDKYITTINGPLVGVGSCVLSGHNLAKNCLVGVGNPNVRNGEDQLLKNAYENFNQHEVLLAPLLSAGIFGADPVHSLRVCVETAVNVLAVDFQDKNLYDQSLSSFL
EMKSEKQVQKVAENLKEPEVKFPFTENKPSVEQRRQAAEKKIKACIEEVTPTLEETKFLTENLLYIDINGNLHDPDSATLVKIDITIFLKNVSTIYIGVDVKEGALTAVVIVPTKAGAGTT
EMLAKALRKPVPDNNYITTPYGGQJLNGYVVEAKTVLKCKSAFYILPSIISNAQKEILGTSSWNLREMLAHAEETRKMLPVCMTKAIVSTIQRYKQIKIQEGVVDYGARYFYTSKTT
VASLINTLNNLNETLVTMPLGYVTHGNLNEEAARYMRSCLKVPATVSVSSPDAVTAYNGYLTSSSKTPEEHFIETISLAGSYKDWYSYQSGTQGLGIEFLKRGDKSVYTSNPTTFHLDGEV
ITPDNLKTLTSLREVRTIKVFTTVDNINLHTQVVDMSMTYGGQFGPTLYDGAADVTKIKPHNSHEGKTFYVLPNDDTLRVEAFEYHYHTDPSFLGRYMSALNHTKKWYQPVGNLTSIKWA
DNNCYLATALLIQQIELKFNPLPQGLDAYIRARAGEAANFCALILAYCNVTVGELGDBVRETMVYLFQHANLDSCKRVLNVVCKTCGQQOQTLTKGVEAVMYMGLTSLYEQLKKGVQIPCMCG
KQATQYLVQQESPFFVMMSAPPAQYELKHGTFVCCASEYTGNYQCGHYKHTISKETLYCIGDALLTKSSEYKGPITDVIFYKENSYTTTIKPVTYKLDGVVCTEIDPKLDGYKKDNSYFTTEQ
PIDLVPNQYPNASFDNFVKFCDNIKADDNLQLTGYKKPASRELKVTFPDLNGDVVAIDYKHYTSPFKKGAKLLHKPIVWHVNNATNKATYKPNIWCIRCLNSWSTKPVNETSNSFDVLKL
EDTQGMNDLACEVLPKPVSEEVNPTIKQDILECNVKTTEVVGDIILKPPASDGLKITEEVGDTLMAAYVNDSSLTIKKPNELSRVLGKLTATHGLAAINSVPWDTIANYAKFPLNKVV
STTTNIVTRCLNRVCTNMPYPLFTLLQLCTFTKSTNSRIKASMPMTIAKNTVKSQVGFCKLEASFNLYKLSPNFSKLINIWIWFLLSVCLGSLIYSTAALGVLMSNLGMPFSYCTVYREGY
LNSTNVTIATYCTGSIPCSVCLGDLSDLTYPGLEITQITISSFKWDLTAFGLVAWEFLAYLITREFFYVLAIAIMQLFFSYFAVHFISNSWMLNLIINLVQMAIISAMVRMYIFFASFI
YYVWKSJVHVVDGCTSSSTCMCYKRNARTRVECTTIVNGVRRSFYVYANGGKGFCKLHNWNCINCDTFCAGSTFISDEVARDSLQFKRPINPTDQSSYIVDSVTVKNKGSIHLYFDKAGQ
KTYERHLSHFVNLNDLRANNTKQGLSPINIVFDGKSKECESSAKSAYSYYSQLMQCPILLDQALVSDVGDGSAEVAVKMFDAIYNTFSSTFNPMMEKKLALVATAEELAKNVLSDNLV
STPIISAARGGFVDSVDETKDVVECLKLSHQSDIEVTGDSCNNMYLTYNKVENMTPRDLGACIDCSARHINAQVAKSHNIALIWNVKDFMSEJQLRQKISAAKKNLFPRLTTCATTROV
VNVVTTKIALKGKGIIVNNWLKQLIKVTLVFLFAIVIFYLITIPVHVMSKHNDPSSSEIIGYKAIDGGVTRDIASDTDTCFANKHADFDSDWFSQRGGSYTNDKACPLIAAVITREGVFVVPGLP
GTILRTINGDFLHFLPRVFSAVGNICYTPSKLIEYTDFAATSACVLAACEITFKDASGKPPVPCYDNTNVLEGSVAYESLRPDRTRYVLMDGSIIQFPNTYLEGSVRVVTTFDSEYCRHGTE
RSEAGCVSTSGRWVNLNDYRSLPGLVFCGVDAVNLLTNMFTPLIQPIGALDISASIVAGGIVAIIVTCLAYYFMRFRFAFGESHVVAFNLTLLFMSFTVTLCLTPVFSFLPGVYSVIYL
YLTFFYLTNDVPSFLAHIQMMVFMTPLVFPWMTIVVYICISITKHIFYWFSNLYLKRVRVFNQVGSSTFEEAALCTPLTLNKMERYLKLRSVDLLPLTQYNRYLALYNNKYFSGAMQDTYSYREA
CCKLKAINDFNSNGSDVLVQPPQSTISITAVLQSGFRKMAFSPSGVCMGVQTCGTTTLNGLNDVVYCPRHVICTSEMDLNPENYEDLLIRKDSNNHFLVQAGNVLRVIGHSMNQCVL
KLKVDATANPKTPKYKVFVRIQPGQTFSVLACYNGSPSGVYQCAMRPNFTIKGSFLNGSCGSGVGNIDYDCVSCFYMHMELPTGVHAGTDLEGTfyGPFVDRQTAQAAGTDTTITVNVLAW
LYAAVINGDRWFLNRFTTTLNDFNLVAMKYNIEPLTQDHDVILGLPLSAQGTIAVLDMCASLKEQLLQNGMNGRTILGSALLEDEFTFPDVRQCSGVTFQSAVARTIKGTHWLLLTVLTS
LLVLVGSTQWSLFFVYENAFPLFAMGIIAMSAFAMMFVKHKAFLCLHLLPLSLATVAIYFNMVYASWVMRIMTWDLIDVDTSLSGFKLKDCCVMYASAVVLLMTARTVYDDGARRVMT
LMNVLTLVYKVYYGNALQDAISMMALISVTSNYSGVVTTVMFLARGIVFMCVEYCPIFFITGTNLTQICIMLVVYCFLGYFCTCYFGLFCLLNRYFRLTLGVYDYLVSQTEFRYMNQSGLLP
PKSSIDAFKLNKILGLGGKPCIKVATVQSKMSDVKCTSVVLLSVLQQLRVESSSKLAQCQVQLHNDILLAKDTEAFEEKMVSLLSVLLSMQGAVDINKLCEEMLDNRATLQAIASEFSS
LPSYAAAYATAQEAYQAVANGDSIEVLLKLLKLSLNAVAKSEFDRDAAMQRKLEKMAQDQAMTQYKQARSEDKRAKVTASAMQTMFLTMLRKLLNDALNINIINNARDGCVPLNIIPLTTAAKL
MVVVVPDGYTKNTCDGNTFTYASALNEIQQVVDADSKIVQLSIENMDNSPNLAWPLIIVTALRANASAVKLQNNLESVALRQMCSAAGTTQACTDDNALAQQYNNSKGRGFRVLLTSDHSDQ
LKWARFPKSDGTGTIYITTELEPFCRFEVDTPKGPKVKYLYFIKGLNNLRGMVGLSLAATVRLQAGNAVEPANSTVLSFCAFAVDPAKAYKDYLASGQYINTCNVKMLTCHTGTQAITV
TPEANMDQESFGGASCCLYCRCHIDHPNPKGFCDLKGKVIQIPTTCANDPVGFTLRNTVCTVCGMMWKGYGCSCDQLREPMMQSADASTFLNGFAVMLFFFLQLQALVNSQCQVNLTRGTP
NPAYTNSSRGQVYYPDTIYRSDVLLHQDYLFPFYSNVSWYSLTVNNAAKTRFDNPIILDFKDGVYFPAATEHNSIIRGWI FGTTLDNTQSLLVNATNVAIIVKCNPFDFCYDPLYSYGY
HNKTKSIREFAVSSAANCTFEYVSKFSMLDISGKGGNFKTLREFFVFNKVDGHEFKYISKFTPVNLRNGRLTGFSVLQPLVELPVSINIKTFRTLLAIHRGDEMPMNSQGTAFSAAYFVG
LKPRTFMLYKNENGITIDAVDCALDPLSETKCTLKLSTVQKGIYQTSNFRVQPTQGISVRFPNITNVCPFFHKVFNATRFPSVYAWERTIKISDCVADYTVLYNSTSFSTFKCYGVSPSKILID
LCFTSVYADDTFLIRFSEVRQVAPGQTGVIAIDYNYKLPPDDFTGCVIAWNTAKQDVGNVGYFYSRHKTKLKPFERDLSSDENGVRTLSTYDFNPVPLEYQATRVVLSFELLNATPVCGPK
LSLQVLNQCQFVFNGLKGTGLVLTDSKSRVQSFQFGGRDASDFTSDVRDPQTEILIDITPCSPFGVGSYITPGTNTSLEVAVLYQDVNCTVPTAIEHADQLTPAWRVYATAGTNVFTQAG
CLIGAEHNVNYESCDIPITGAGICASYHTASILRSTSQKSIIVATYMSLGAENIAYANNSIAIPTNFSISVTTTEVMPVMSMAKTSVDCTMYICGDSIECSNLQYLGQSFCTQLNRALTGTAI
EQDKNTEQVEVFAQYKTPPIKLDGFFHTASQLLPDPSPKPSKRSFTIEDLLFNKVTLDADAGEIKQDGLCDLISARDLICAQKFNGLTVLPPLLTDEMIANYTAALISGTATVGTFFGAGA
ALQIPFAMQMAYRFGNGIVTQNVLYENQKLIANQFNSAIGKIQDLSSTASALGKLQDVVNQNAQALNTLVKQLSSNFGAISSVLNDILSRLDKVEAEVQIDRLITGRQLSQTYYTQQL
IRAAEIRASANLAATKMSECVLGQSKRVDFCGKGYHLMSPQSAPHGVLVHVTYVPSQEKNFTTAPAIICHEGAHFPREGVFSNGTHWFVTQRNFYEPQIITDNTDTEVSGNCDVPTGI
INNTVYDPLDPSFKEELDXYKFNHTSPDVLGDISGINASVNIQKIEDRLNEVAKNLNESLIDLQELKGYEQYIKWPWYVWLGFIAGLIAIVMTITLLCCMTSCCSCCLKGCSCGS
CCKFDEDDSEPLVKGVKLHYTMDLFMRITFLGTVTLLKQGEIKDATPSDSVRATATPIQATLPFGWLVIGVALLAVFQSAASKIITLKKRWQALSKGVHFVCNLLLLFTVTVSHILLVAA
GLEATFVFLYALAYCLQTVNDFVRIIMRFLWCLWCKRSKNPLLDANYIFLCHWNTNCYDIPYNSVTSISITVSGDGTNPISEDYQIGGYTEKWESGVKDCVVLHYSFTSIDYYQLYSTQL
SDTGFHEHTVFIYINKVIDEENFEHVIQHTIDGSSGVVNPAMEYIYDEPTTTSVPLMPTTFVFGVILVMTIYHNTIVMYSFVSEETGLTVNSVLGVLVFLVLTVALITLRLCA
CCNIIVNVSLVKPSFVYVSRVKNLNSRVPDLLVMAGDNGTITVEELKSELVQWNLVIGFLPLTICWLLQCLQYAFANRRNRLYIIKLIFFLWLPVTLACQFVLAAYVRINWITGGTIAIACML
VGLMWLSYFIASFRLFAVTRSMWSFNPNETIILNLVPLHGTILTRPLESSELVIGAVILRGLHRIAGHLHGRCDIKDLPEKITVATSRITLSYKLAQSRQVAGDSGFAAYSRIGRYNKL
TDHSSSSDNIALLVQMFLHVDFOVTIAEILLIMRTFKVSIWNLDYIINLIINKLSKPPTENNCSQLDEEQPMEIDMKIILFLLTIALATCELYHYQECVRGTVTLLEKPCPSGTYESGNS
PFHPLADNKFAITCSSTHYFACADQTRHTYQLRARSVPKPLFIRIQEEVHQELYSPLFVIAALVFIILCFTIKRKTMESEFSLIDFYFLCLAPLFLVLIMLIIFWFSLEIQDHNETFH
AMKIIFFLVLHYITLVGTGEQCEIKGTITVLLKEPCSSGTYESGPFPHLADNKFALACFTQAFACPDGVRHTFQLRARSVSPKFLTRQEEVEQELYSFVFLVIAAVFIILCFTFKRK
IEMSDNGPQNRSAPRITFGGPSDSTNSQNGERSGARPKQRRPQGLPNNTASWFTALTQHGKENLTFPRRGQVPIINTNSKDDQIGYRRATRRIRGGDGKMKELSPRWYFYFLGTGPE
AGLPYGANKEGIIWATEGALNTPKDHIGTRNPANNAIIVLQLPQGTTLPGKGYAFEGESRSGSSQASSRSSRSRNSRNSTPGSSRGTSPPARMAGNGGDTALALLLLDRNLQLESKVS
QQQQGQTVTKKSAAEASKPRQKRTATKQYNVTAQFGRRGPEQTQNGFGDQLIRQGTDYKHWPQIAQFAPSASAFFGMSRIGMEVTPSGTWTLYHGAIKLDDKDPQFDDNVIILNKHID
AYKTFPPTPEPKDKKKKADELQALPQRQKKQTVTLLPAADLDDFSKQLQQSSMSGADSTQAMDPKTNVVLPAHLHVDPPQIQLTITRMEADVHVHQNAGPKVYPIILRLGSQLSLSMARR
NLDSEARAFQSTPIVVKMTKLATTEELPDEFVVVTAKMLQSCYNFLKEQHCQKASTQKGAEAAVKLLHAPHHVAVTVQETQLQAAVAGELLLEWLAMAVTLLLLCC

>SARS-CoV:

MESLVLGVNKEKTHVQLSLPVLQVRDVLVRGFGDSVEEALSEAREHLKNAATCGLVELEKGVLPQLEQPYVFIKRSDALSTNHGHKVVETVAEMDGIQYGRSGITLGVLPVHGETPIAYRN
VLRKNGNKAGAGHSYGLDKSYDLGDELGTDPIDYEQNNWTKHGSALRELTRELNGGAVTRYVDNNFCGPDGYPDLCIKDFLARAGKSMCTLSQLDYIESKRGVYCCRDHEHEIAW
FTERSDKSYEHQTPFEIKSAKKFDTFKGCEPKFVFLPNSKVVIQPRVEKKKTEGFMGRIRSVYPVASPQECNNMHLSTLMKCNHCEDEVSWQTCDFLKAATCEHCGTENLIVEGPTTCGYL
PTNAVVKMPCACQDPEIGPEHSVADYHNHNSNIETRLRKGGRTRCFGGCVFAYGVCYNKRAYVPRASADIGSGHTGITGDNVETLNEDLLEILSRERVNINIVGDFHNLNEEVAIILASF
SASTSAFIDTIKSLDYKSFITIVESCDGNYVTKGPKAGNIGQORSVLPYLCGFPQSAQWVRSIIPARTLDAANHSIPDLQRAAVITLDGISEQSLRVDAVMVTSLLDNTNSVIIMAY
TVTGLVQQTQSQWLSNLLGTTEVEKLRPIFWEIEAKLSAGVEFLKDAWEILKFLITGVDFIVKGQIVASDNIKDCVKCFIDVNVKALEMCIQNVITAGAKRLSDNEVFIAQSKGLRYQC
IRKGEQLQLLMLPKAKPEVTLFRGSDHETVLTSEVVLKNGLEADTLPVDSFTNAGVITGTPVCVNGMLMLEIKDKEQYCALSPGLLATDNVNVFRKLKGGAPIKGVTFEGEDTVWEVQGYKN
RITFELDERVDKVLNEKCSVYTVESGTEVTEFACVVAEAVVKTLPQVSDLLTNMGIIDLDEWSVATFYFLDGDAGEENFSSRMVCSYFPDDEEEEDDAECEEIEIDETCEHEYGTEDDYQGL
PLEFGASATRVVEEEEEEDWLDITTEQSEIEPEPEPTPEEPVNOFTGYGLTLDNVAIKQCVIVKEAQASANPMVIVNAANILHLKHGGGVAGALNKATNGAMQKESDDYIKLNGPLTVGGS
CLFSGHNLAKKCLVHVEVGNLNAEDDITLLKAAAYENFSQDILAPLLSAGTIFGAKPLQSLKQVDTQVTRTQVYIVANDKALYEQVVMYDLDNKLPRVBAAPQEEPPNTDESQTEESKVQK
PVDVKPKIKACIDEVTTLEETKFLTNKLLFLADINGKLYHDSQNMRLRGEDMSFLEKADAPYMGVDVITSGDITCVVIPSKKAGGTTEMLSRALKKVPVDEYITTPYQGCAGYTLLEAKT
ALKKCKSAFYVLPSEAPNAKEEILGTVSNWNLREMLAHAEETRKLMPICMDVRIAMATIQRYKQIKQIEGIVDYGVRRFFYTSKEPVASIIITKLSNLEPLVTMPIGYVTHGFNLNEEAR
CMRSLKAPAVVSSPDVATVYNGYLTSSKTVSSKTVSAGSYGRDLESYQGTLELGVFKLGRIGIVYHTLESVFLHDEVLSDLKLSLREVKTIKVFTTVLNTLNRHTQL
VDSMTYGGQFGPTLYDGAADVTKIKPHVNHEGKTFVFLPSDDTLRSEAFEYHYHTLDESFLGRYMSALNHTKKWYFPQVGGLTSIKWADNNCYLSVLLALQQLEVKNFALQAEYRAR
AGDAANFCALILAYSNFTVGLGDVRETMTHLLQHANLESAKRVLNVVCKHCGYKTLTITGVEAVMYMGLTSLYDNLKTGVSIPCVCGRADTQYLVQGEQSSFFVMMSAPPAEYKLGQGTFLC
ANEYTGNYQCGHYTHITAKETLYRIDGAHLTKMSEYKGPVTDVIFYKETSyttTIKPVSYKLDGVTYTEIEPKLDGYKKDNAYYTEQPIDLVPTQPLPNASFDNFKLTCSNTKFADDLQ
MTGTFKPSARELSVTFPDLNGDVVAIDYRHSASFPKGAKLHHPVHINQATTKTTFKPNTWCLRLCWSKTPVDTSNSFEVLAVEDTQGMNDLACESQQPSTSEVENPTIQTKEVIE

CDVKTTEVVGNVILKPSDEGVKVTQELGHEDLMAAYVENTSITIKKPNELSLALGLKTIATHGIAAINSVPWSKILAYVKPFLGQAAITTSNCAKRLAQRVFNMYPVFTLLFQLCTFT
KSTNSRIRASLPPTIAKNSVGSVAKRLCLDAGINVKSPKFSKLFTTAMWLLLLSLICLSGLICVTAAGFVLLSNFGAPSYCNGVRELYLNSNVTTMDPCEGSPFPCSICLSGLDSDLSYPA
LETIQVTISSYKLDLITLGLAAEWLWYMLFTKFFYLLGLSAIMQVFFGYFASHFTISNSWLMWFIISIVQMAPVSAMVRMYIFFASFYYIWKSVYHIMDGTSTSCMMCXYKRNARTRVECT
TITVNGMKRSFVYVANGRGFCCKTHQWNLNCDTFTCGSTFISDEVARLDLSQFKRPINPTDQSSYIVDSVAVKNGALHLHYFDKAGQKTYERHPLSHFVNLDNLRANNTKRSGLPINVIVF
DGKSKCEDASAKSVSYSQLMCQPILLDDQALVSDVDGSTEVSVKMFDAYVDTFSATFVSVPMEKLKALVATAHSELAKGVALDGVLSFTFVSAAQQGVVDTDVDTKDVEICLKLSHSHSD
EVTGDSCNNFMVLTYNKVENMTPRDLGACIDCNARHINQAQVAKSHNVSLIWNVKDYMSSLEQLRKQIRSAAKKNNIIPRLTCATTATQVNVNITTKISLKGKGIIVSTCFKMLKATLLCLVLA
ALVCYIVMPVHTLSIHGDGTNEIIGYKAIQDGVTRDIISTDDCFANKHAGFDPAWFSQRGGSYKNDKSCPVAIAITREIGFIVPGLPGTVLRAINGDFLHFLPRFVSAVGNICYTPSKLI
EYSDFATSACVLAEECTIFKDDAMGKPVVPCYDNTLLEGSISYSELRPDTRYVLMDSGSI IQFPNTYLEGSRVVRVTTFDAEYCRHGTCEERVEGICLSTSGRWLVNNEHYRLSGVFCGVDA
MNLIANIFTPLVQPVGALDVSASVAGGIIAILVTCAAYYFMKFRFVGEYNHVVAANALLFLMSFTILCLVPAYSFLPGVYSVFYLYLTFFYFTNDVVSFLAHLQWFAMFSPVFPWITAI
YVFCISLKHCHWFFNNYLKRRVMFNGVTFSTFEEAALCTFLLNKEMYLKLRSETLLPLTQYNRYALANYKYKFSGALDPTTSYREAAACCHLAKALNDFSNSGADVLYQPPQTSITSAVLQSGFRKMA
FSPGKMGVFCGCVQVTCGTTTGLNLWLDLDDTVYCPRHVICTAEDMLNPNYEDLLIRKSNHSLFLVQAGNVQLRVIGHSMQNCLLRLKVDTSNPKTPKYKFVRIQPGQTFVSLVACYNG
SPSGVYQCAMRPNHTIKGSFLNGSCGSVGFNIIDCVSFCYMHMMLPTGVHAGTDLEKGFYGFVDRQTAQAAGTDPTITLNVLAWLAAVINGDRWFLNRFTTITLNDFNLMVKMNYEPLTDQHV
DILGPLSAQTGIAVDMCAALKELLQNGMNGRTILGSTILEDEFTFPDVRQCSGVTFFQKGFKKIKVGTGHHWMLLTFLTSLILVQSTQWSLFFVYENAFPLPTLGIMAIAACAMLLVK
HKAFLCLLFLPSLATVAYFNMVMPASWVMRIMTWLELADTSLSGYRLKDCVMYASALVILIMTARTVYDAAARRVMTLMNVITLVKYVYNALDQAI SMWALVIVSTNSYSGVVT
IMFLARAIIVFCVCEYVPLFITGNLTQCLIMLVYFCFLGYCCCCYFLGFLCLLNRFRLLTGLVYDYLVTQEFQRYMNSQGLLPKSSIDAFKLNILKLLGIGGKPCIKVATVQSKMS
VLLSVLQQLRVESSSKLWACQVQLHNDILLAKDTTEAFEKMSVLLSVLLSMQGAVIDNRLCEEMLDNRATLQAIASEFSSLP SYAAYATAQEAQEYQAVANGDSEVVLKLLKKS
LNVAKSEFFRDAAMQRKLEKMAQDMATQMYKQARSEDKRAKVTSAMQTMFLTMLRLKLDNALNNIINNARDGCVPLNIIPLTAAKLMVVVPDYGTYNKTCGNTFTYASALWEIQVVD
ADSKINQLSEINMDSNVKAWPLIVTALRANSVAVKLQNNELSPVALRQMSCAAGTTQACTDDNALAYNNSKGGRFVALLSDHQDLKWARFPKSDGTGTITILEPPCRFRVTDTPKGP
KVYKLYFVIGKLNLRNGMVLGSLAATVRLQAGNATEVPANSTVLSFCAFAVDPAKAYKDYLAGSQQPTINCVMKLCTHTGTGQAITVTPEANMDQESFGGASCCLYCRCHIDHPNPKGFC
DLKGKYYQIPTTCAMDPVGTFLRNTVCTVCGMMKGYGCSCDQLREPLMQSADASTFLNRVCGVSAARLTPCGTGTSTDVVYRAFDIYNEKVAGFAKFLKTNCCRFQEKDEGNLLDSYFV
VKRHTMSNYQHEETIYNLVKDCPAVAFHDEFFKFRVDDGMVPHISRQLRFTKYTMADLVLFKHFHDEGNCDTLKEILVITYNCCDDYFNKKDWDFVENPDILRVYANLGERGVRLSLTKVQ
FCDAMRDAGIVGVLTLDNQDLNGNMYDFGDFVQVAPGCGVPIVDSYSYLLMPLITLTLRALAAESHMDADLAKPLIKWDLKLYDFTTEERLCLFDRYFKYWDQTYHPNCINCLDDRCILHCA
NFNVLFSTFVFPPTSFGPLVRKIFVYDGVFVFTGSHFRELGVVHNDQVNLHSSRLSFKELLYVYAADPAMHAASGNLLLDKRTTCFSVAALTNNAVFQTVKGFNFKNKFIYDPAVSGSKVFE
GSSVELKHFFFAQDGNAAISDYDYRYNLPMTCDIRQLLFVVEVDKYFDCYDGGCINANQVIVNNLDKSGAGFPFNKGWAKARLYYDSMSYEDQDALFAYTKRNVIPITITQMNLYAISAK
NRARTVAGVSICTMTNRQFHQKLLKSIAATRGATTVIGTSKFYGGHNMMLTKTVSYDVETPHLMGWDFPKCDRAMPNMLRIMASLVLRKHNTCCNLSHRFYRLANECAGQVLSMVMCGG
SLYVKGPTSSGSDATTAYANSIQCQAVTANVALLSTDGNKIAKGYVNRQLHRLSELDVNRDNDVHEFVDEFEYAYLRKHFSMMILSDDDAVVCYNNSAAQGLVASIKNFKAVALYQNN
VFMSAEAKWTETDLTKGHEFCSQHTMLVKGQDDYVYLPYDPSRILGAGCFVDDIVKTDTGLMIERFVSLAIDAYPLTKHPNQEYADVFLHYLQYIRKLHEDLTHGMMLDMSVMLTNDN
TSRYWEPEFYEAMTYHTVPLQAVGACVLCSNQSLSRCGACIRFPFLCCCKCYDHIYSTSHKLVLSNVPYCNAPGPDVTDVTLQYLGGMSYKSKHPISFPLCANGQVFLGYKNCTVCG
SDNVDPFNAITCDWNTAGDYILANTCTERLKLFAAETLKATEETFKLSYGIATVREVLSDRELHLSWEVGKRPDPLNRNYVFTGYRVTKNSKYQIEGYTFEKGDYGDVAVYRGTTTYKL
NVGDYFVLTSHTVMPLSAFTVLPQBYHYIRITGLYPTLNIISDEFSSNVANYQVGMQKXYSTLQGGPPTGKSHFAIGLALYYPASIRVYACSHAADVDMCEKALYKIPDKCSRIIPARAE
VECFDEKFNSTMLEQYVFTVNALPETHETADIVVEDEISMATNYDLDSVNARLAKHYVYIGDPAQLPABRTLLTKGTLEPEYFNSVCRMLKMTIGYDPLKTCRCRCPAEIIVDTVVALVYDN
KLKAHKDKSAQCCKMFYKGVITHDVSSAINRPQIGVVREFLTRNPAWRKAVFISPYNSQNAVASKILGLPTQTVDSSQSGSEYDYVIFTQTTTEHAHSCNVNRFNVAITRAKIGILCIMS
DLYDKLQFTSLEIPRRNVATLQAEVNTGLFCKDSKIIITGLHPTQAPTHLSVDIKFKTEBGLCVDIPGIPKDMTYRRIISMMGFKMNYQVNGYPNMFIITREEAIRHVRWAGI6DVEGCHATR
DAVGTNLPLQLGFGSTPNLVAVPTGYVDTENNTEFTRVNAKPPGQDQFKHLIPLMYKGLPNNVRIKIVQMSLDDTLKGLSDRVVFLWAHGFEKTSKMYFVKIPEPRTCCDKRATCF
TSSDTPAEACWNHSGVDFYVYNPFMIDVQWQWGTGNLQSNHDQHCQVHGNHVASCAIMTRCLAVHECFVRRVDSVEYPIIGDELRVNSACRKQVHMVVKSAALLADKFPVLHIDGNPKAI
KCPVQAEVEWKFYADQPCSDKAYKIEELFYSATHHDKFTDGVCLFWNCNVDYRANAI VCRFDRFVLSNLRNLNPGCDGGSGLYVKNHAFHTPAFDKSAFTNLKQLFFYYSIDSPCESHGKQ
VSDIDYVPLKSAATICTRNLKGSAVCRHANEYQYLDAYNNMI SAGFSRLWYKQDFDYNLWNTFTRLQSLLENVAYNVNKGHFDHGAGEAPVSIINNAVYTKVDGIDIVEIFENKTTLPV
NVAFELWAKRNIKVPPEIKILNNLGVDIAANTVWDYKREAPAHVSTIGVCTMTDIAKPPTESACSSLTVLFDGRVEGGVDLFRNARNGLVITEGSVKGLTPSKGPAQASVNGVTLIGES
NVQFNFTFVFPPTSFGPLVRKIFVYDGVFVFTGSHFRELGVVHNDQVNLHSSRLSFKELLYVYAADPAMHAASGNLLLDKRTTCFSVAALTNNAVFQTVKGFNFKNKFIYDPAVSGSKV
CSVIDLLDDFVEI IKSQDLSVISKVVKTIDYAEISFMLWCKDGHVETFPYKQLQASQAWQPGVAMPNLYKMQRMLLEKCDLQNYGENAVIPKGINMNVAKYTLQCLQYLNLTILAVPYNM
RHFHFGAGSDKGVAPGTAVALRWQLPTGTLVLVDSDLNDFVSDADSTLIGDCAVTHTANWKDILISDMYDPRTKHVTKENDSKEGFFTYLCGFIKQKLAGGSIAVKTIEHSWNADLYKLMG
RVSWHTAFVTVNVAASSSEAFILGANLYLKGKPEQIDGYTMHANYIFWRNTNPQLSSYSLFPMFSKPLKLRGAVMSLKENQINDMISYLLLEKGRILIRENNRVVSSDILVNMMESVLVG
VNEKTHVQLSLPVLQVRDVLVRGFGVESSEALSEAREHLKNGTCGLVLEKNGVLPQLEQPVPYFIKRSDALSTNHGHKVVLEVAEMDGIQYGRSGITLGLVLPVHGETPIAYRNVLDLRKNG
NKGAGGSHSYGIDLKSYLDGLEDGTDPIEDYEQWNWTKHGSGALRELTRELNGGAVTRYVDNNFCGPDGPLDCIKDFLARAGKSMCTLSEQLDYIESKRGVYCCRDHEHEIAWFTERSDK
SYEHGTFPEIKSAKKFDTFGKEGCKPFVFLPNSKVKVILQPRVEKKKTEGFMGRIRSVYVPSAPSCNNMHLSTLMKCNHCDVEKQTDPLFKATECGSTENLVEIGPTQGLPTNAVVK
MPCPAQDQPEIGEPHSVADVHNHNSNIETRLRKGGRTTRCFGGCVFAVYGCYNKRAYVWRASADIDGSGHTGITGDNVETNELDLEILSRERVNINIVGDFHNEEVAIILASFASTSAF
IDTILKSLDYKSFCTIYESCGNYKVTGKGPVKGAWNIQQRSSVLTPLCGFSAQAGVIRISFARTDLAANHSIPLDQRAAVTILDGLISEQSRLVLDLSTNSVIMLAVYSTGGLVQ
QTSQWLSNLLGTTVEKLRPIFEWIEAKLSAGVEFLKDAWEILKFLITGVDFIVKGQIQVASDNKIDCVKCFIDVVNKALEMCIDQVTIAGAKRLSLNLGEVFI AQSKGLYRQCIRGKEQL
KLLMPLKAPKEVTFLEGGSDHDTVLSEEVVLKNGELEALETPVDSFTNGAIVDTEFPVCVNGLMLLEIKDKBQKCALSPGLLATNNVFRLKGGAIPKGVTFGEDTVWEVQGYKNRITFIELD
ERLDVNLNKEKSVYTVESGTEVEFACVVAEAVVKTLPQVSDLLTMNGDILGDESWAFTVILFDGAGEENFSRMYSFYPPDEEEEDDAECSEEEIIDECHEGYGEDDYYQGLPLEFGAS
AETVYRVEEEEEEDWLDDTTEQSEIEPEPEPTPEEPVQNQFTGYLKLTDNVAIKCVDIVKEAQSANPYNVMAANIHLKHGGGVAGALNKATNGAMQKESDDYIKLNGPLTVGGSCLLSGHN
LAKKCLHVVGNPLNAGEDIQLLKAAENFNFSQDILLAPLSAGIFGAKPLQSLQVCVQTVRTQVYIAVNDKALYEQGVMDYLDNLKPRVEAPKQVEPPNTDESKEEKSVEVVKRPVDVKPK
IKACIDEVTTTLEETKFLNLLKADYFNHSLYDQSNLKGEDMSFLBKEDPAVMGVDTISGDICTCVIIPSKAGQVTEMLSRALKVPVDEYITIPGGCAGQVLEAKATLKKKS
AFVYLPSEAPNAKEIELGTVSNWNLREMLAHAAETRLKMPICMDVRAIMATIQKRYKGIQIEGIVDVGVRFFYTFYTSKEPVASIIITKLNSLNEPLVTMPIGYVTHGNLNEEAARCKMSLKA
PAVVSVSSPDVAITYNGYLTTSSSKTIEEHFVETVSLAGSYRDWSYSGQRTLELGLFKRGDKIVYHTLESFVEHLDGEVLLDGLKLSLSVEFHTKIVTTHDNLNLEATQLVDMSTMY
GQQFGPTYLDGADVTKIKPHVNHGKTFVFLPSDDTLRSEAFEYHYHTLDESFLGRYMSALNHTKKWKFPQVGGTISIKWADNNCYLSSVLLALQQLLEVKNAPALQEAAYYRARAGDAANF
CALILAYSNKTVGELGDVREMTHTLLQHANLESAKRVLNNVCKHGKQKTTTLTGTGEAVMYMGTLISYDNLTKTGSVIPCVCGRDATQYLVQJESSFVMSAPPAEYKLGQVTFLLCANBYTGN
YQCGHYITAKETLYRIDAGHTLKMSEYKGPVTDVYKETSYYTITIKPVSYKGLTIEPEKLDGYKKDNAYYTEQPIDLVPTQPLPNASFDPKLTACNTKPIFADDLNGQVGTFTKRP
ASRELSVTFPFDLNGDVADLYRHYSAFSGKAKALLHKPIVWHINQATTTFTFKNTWCLRCLWSTKPVDTSNSFEVLAVEDTQGMNDLACESQOQPTSEEVVENPTIQKEVIECBVKYTE
VVGNVILKPSDEGVKVTQELGHEDLMAAYVENTSITIKKPNELSLALGLKTIATHGIAAINSVPWSKILAYVKPFLGQAAITTSNCAKRLAQRVFNMYPVFTLLFQLCTFTKSTNSRI
RASLPPTIAKNSVGSVAKRLCLDAGINVKSPKFSKLFTIAMWLLLLSLICLSGLICVTAAGFVLLSNFGAPSYCNGVRELYLNSNVTTMDPCEGSPFPCSICLSGLDSDLSYPALETIQVT
ISSYKLDLITLGLAAEWLWYMLFTKFFYLLGLSAIMQVFFGYFASHFTISNSWLMWFIISIVQMAPVSAMVRMYIFFASFYYIWKSVYHIMDGTSTSCMMCXYKRNARTRVECTITVNMG
KRFSFYVANGRGFCCKTHQWNLNCDTFTCGSTFISDEVARLDLSQFKRPINPTDQSSYIVDSVAVKNGALHLHYFDKAGQKTYERHPLSHFVNLDNLRANNTKRSGLPINVIVFDDGSKCD
ESASKSASVYSQLMCQPILLDDQALVSDVDGSTEVSVKMFDAYVDTFSATFVSVPMEKLKALVATAHSELAKGVALDGVLSFTFVSAAQQGVVDTDVDTKDVEICLKLSHSHSDLEVTGDSC
NNFMVLTYNKVENMTPRDLGACIDCNARHINQAQVAKSHNVSLIWNVKDYMSSLEQLRKQIRSAAKKNNIIPRLTCATTATQVNVNITTKISLKGKGIIVSTCFKMLKATLLCLVLAALVCYIV
MPVHTLSIHGDGTNEIIGYKAIQDGVTRDIISTDDCFANKHAGFDPAWFSQRGGSYKNDKSCPVAIAITREIGFIVPGLPGTVLRAINGDFLHFLPRFVSAVGNICYTPSKLIEYSDFAT
SACVLAEECTIFKDDAMGKPVVPCYDNTLLEGSISYSELRPDTRYVLMDSGSI IQFPNTYLEGSRVVRVTTFDAEYCRHGTCEERVEGICLSTSGRWLVNNEHYRLSGVFCGVDAAMNLIANI
FTPLVQPVGALDVSASVAGGIIAILVTCAAYYFMKFRFVGEYNHVVAANALLFLMSFTILCLVPAYSFLPGVYSVFYLYLTFFYFTNDVVSFLAHLQWFAMFSPVFPWITAIYVFCISL
KHCHWFFNNYLKRRVMFNGVTFSTFEEAALCTFLLNKEMYLKLRSETLLPLTQYNRYALANYKYKFSGALDPTTSYREAAACCHLAKALNDFSNSGADVLYQPPQTSITSAVLQSGFRKMA
FSPGKMGVFCGCVQVTCGTTTGLNLWLDLDDTVYCPRHVICTAEDMLNPNYEDLLIRKSNHSLFLVQAGNVQLRVIGHSMQNCLLRLKVDTSNPKTPKYKFVRIQPGQTFVSLVACYNG
CAMRPNHTIKGSFLNGSCGSVGFNIIDCVSFCYMHMMLPTGVHAGTDLEKGFYGFVDRQTAQAAGTDPTITLNVLAWLAAVINGDRWFLNRFTTITLNDFNLMVKMNYEPLTDQHV
DILGPLSAQTGIAVDMCAALKELLQNGMNGRTILGSTILEDEFTFPDVRQCSGVTFFQKGFKKIKVGTGHHWMLLTFLTSLILVQSTQWSLFFVYENAFPLPTLGIMAIAACAMLLVK
HKAFLCLLFLPSLATVAYFNMVMPASWVMRIMTWLELADTSLSGYRLKDCVMYASALVILIMTARTVYDAAARRVMTLMNVITLVKYVYNALDQAI SMWALVIVSTNSYSGVVT
IMFLARAIIVFCVCEYVPLFITGNLTQCLIMLVYFCFLGYCCCCYFLGFLCLLNRFRLLTGLVYDYLVTQEFQRYMNSQGLLPKSSIDAFKLNILKLLGIGGKPCIKVATVQSKMSDVKCTSV
VLLSVLQQLRVESSSKLWACQVQLHNDILLAKDTTEAFEKMSVLLSVLLSMQGAVIDNRLCEEMLDNRATLQAIASEFSSLP SYAAYATAQEAQEYQAVANGDSEVVLKLLKKS
LNVAKSEFFRDAAMQRKLEKMAQDMATQMYKQARSEDKRAKVTSAMQTMFLTMLRLKLDNALNNIINNARDGCVPLNIIPLTAAKLMVVVPDYGTYNKTCGNTFTYASALWEIQVVDADSKIVQ
LEINMDSNVKAWPLIVTALRANSVAVKLQNNELSPVALRQMSCAAGTTQACTDDNALAYNNSKGGRFVALLSDHQDLKWARFPKSDGTGTITILEPPCRFRVTDTPKGP
KVYKLYFVIGKLNLRNGMVLGSLAATVRLQAGNATEVPANSTVLSFCAFAVDPAKAYKDYLAGSQQPTINCVMKLCTHTGTGQAITVTPEANMDQESFGGASCCLYCRCHIDHPNPKGFC
DLKGKYYQIPTTCAMDPVGTFLRNTVCTVCGMMKGYGCSCDQLREPLMQSADASTFLNRVCGVSAARLTPCGTGTSTDVVYRAFDIYNEKVAGFAKFLKTNCCRFQEKDEGNLLDSYFV
VKRHTMSNYQHEETIYNLVKDCPAVAFHDEFFKFRVDDGMVPHISRQLRFTKYTMADLVLFKHFHDEGNCDTLKEILVITYNCCDDYFNKKDWDFVENPDILRVYANLGERGVRLSLTKVQ
FCDAMRDAGIVGVLTLDNQDLNGNMYDFGDFVQVAPGCGVPIVDSYSYLLMPLITLTLRALAAESHMDADLAKPLIKWDLKLYDFTTEERLCLFDRYFKYWDQTYHPNCINCLDDRCILHCA
NFNVLFSTFVFPPTSFGPLVRKIFVYDGVFVFTGSHFRELGVVHNDQVNLHSSRLSFKELLYVYAADPAMHAASGNLLLDKRTTCFSVAALTNNAVFQTVKGFNFKNKFIYDPAVSGSKVFE
GSSVELKHFFFAQDGNAAISDYDYRYNLPMTCDIRQLLFVVEVDKYFDCYDGGCINANQVIVNNLDKSGAGFPFNKGWAKARLYYDSMSYEDQDALFAYTKRNVIPITITQMNLYAISAK
NRARTVAGVSICTMTNRQFHQKLLKSIAATRGATTVIGTSKFYGGHNMMLTKTVSYDVETPHLMGWDFPKCDRAMPNMLRIMASLVLRKHNTCCNLSHRFYRLANECAGQVLSMVMCGG
SLYVKGPTSSGSDATTAYANSIQCQAVTANVALLSTDGNKIAKGYVNRQLHRLSELDVNRDNDVHEFVDEFEYAYLRKHFSMMILSDDDAVVCYNNSAAQGLVASIKNFKAVALYQNN
VFMSAEAKWTETDLTKGHEFCSQHTMLVKGQDDYVYLPYDPSRILGAGCFVDDIVKTDTGLMIERFVSLAIDAYPLTKHPNQEYADVFLHYLQYIRKLHEDLTHGMMLDMSVMLTNDN
TSRYWEPEFYEAMTYHTVPLQAVGACVLCSNQSLSRCGACIRFPFLCCCKCYDHIYSTSHKLVLSNVPYCNAPGPDVTDVTLQYLGGMSYKSKHPISFPLCANGQVFLGYKNCTVCG
SDNVDPFNAITCDWNTAGDYILANTCTERLKLFAAETLKATEETFKLSYGIATVREVLSDRELHLSWEVGKRPDPLNRNYVFTGYRVTKNSKYQIEGYTFEKGDYGDVAVYRGTTTYKL
NVGDYFVLTSHTVMPLSAFTVLPQBYHYIRITGLYPTLNIISDEFSSNVANYQVGMQKXYSTLQGGPPTGKSHFAIGLALYYPASIRVYACSHAADVDMCEKALYKIPDKCSRIIPARAE
VECFDEKFNSTMLEQYVFTVNALPETHETADIVVEDEISMATNYDLDSVNARLAKHYVYIGDPAQLPABRTLLTKGTLEPEYFNSVCRMLKMTIGYDPLKTCRCRCPAEIIVDTVVALVYDN
KLKAHKDKSAQCCKMFYKGVITHDVSSAINRPQIGVVREFLTRNPAWRKAVFISPYNSQNAVASKILGLPTQTVDSSQSGSEYDYVIFTQTTTEHAHSCNVNRFNVAITRAKIGILCIMS
DLYDKLQFTSLEIPRRNVATLQAEVNTGLFCKDSKIIITGLHPTQAPTHLSVDIKFKTEBGLCVDIPGIPKDMTYRRIISMMGFKMNYQVNGYPNMFIITREEAIRHVRWAGI6DVEGCHATR
DAVGTNLPLQLGFGSTPNLVAVPTGYVDTENNTEFTRVNAKPPGQDQFKHLIPLMYKGLPNNVRIKIVQMSLDDTLKGLSDRVVFLWAHGFEKTSKMYFVKIPEPRTCCDKRATCF
TSSDTPAEACWNHSGVDFYVYNPFMIDVQWQWGTGNLQSNHDQHCQVHGNHVASCAIMTRCLAVHECFVRRVDSVEYPIIGDELRVNSACRKQVHMVVKSAALLADKFPVLHIDGNPKAI
KCPVQAEVEWKFYADQPCSDKAYKIEELFYSATHHDKFTDGVCLFWNCNVDYRANAI VCRFDRFVLSNLRNLNPGCDGGSGLYVKNHAFHTPAFDKSAFTNLKQLFFYYSIDSPCESHGKQ
VSDIDYVPLKSAATICTRNLKGSAVCRHANEYQYLDAYNNMI SAGFSRLWYKQDFDYNLWNTFTRLQSLLENVAYNVNKGHFDHGAGEAPVSIINNAVYTKVDGIDIVEIFENKTTLPV
NVAFELWAKRNIKVPPEIKILNNLGVDIAANTVWDYKREAPAHVSTIGVCTMTDIAKPPTESACSSLTVLFDGRVEGGVDLFRNARNGLVITEGSVKGLTPSKGPAQASVNGVTLIGES
NVQFNFTFVFPPTSFGPLVRKIFVYDGVFVFTGSHFRELGVVHNDQVNLHSSRLSFKELLYVYAADPAMHAASGNLLLDKRTTCFSVAALTNNAVFQTVKGFNFKNKFIYDPAVSGSKV
CSVIDLLDDFVEI IKSQDLSVISKVVKTIDYAEISFMLWCKDGHVETFPYKQLQASQAWQPGVAMPNLYKMQRMLLEKCDLQNYGENAVIPKGINMNVAKYTLQCLQYLNLTILAVPYNM
RHFHFGAGSDKGVAPGTAVALRWQLPTGTLVLVDSDLNDFVSDADSTLIGDCAVTHTANWKDILISDMYDPRTKHVTKENDSKEGFFTYLCGFIKQKLAGGSIAVKTIEHSWNADLYKLMG
RVSWHTAFVTVNVAASSSEAFILGANLYLKGKPEQIDGYTMHANYIFWRNTNPQLSSYSLFPMFSKPLKLRGAVMSLKENQINDMISYLLLEKGRILIRENNRVVSSDILVNMMESVLVG
VNEKTHVQLSLPVLQVRDVLVRGFGVESSEALSEAREHLKNGTCGLVLEKNGVLPQLEQPVPYFIKRSDALSTNHGHKVVLEVAEMDGIQYGRSGITLGLVLPVHGETPIAYRNVLDLRKNG
NKGAGGSHSYGIDLKSYLDGLEDGTDPIEDYEQWNWTKHGSGALRELTRELNGGAVTRYVDNNFCGPDGPLDCIKDFLARAGKSMCTLSEQLDYIESKRGVYCCRDHEHEIAWFTERSDK
SYEHGTFPEIKSAKKFDTFGKEGCKPFVFLPNSKVKVILQPRVEKKKTEGFMGRIRSVYVPSAPSCNNMHLSTLMKCNHCDVEKQTDPLFKATECGSTENLVEIGPTQGLPTNAVVK
MPCPAQDQPEIGEPHSVADVHNHNSNIETRLRKGGRTTRCFGGCVFAVYGCYNKRAYVWRASADIDGSGHTGITGDNVETNELDLEILSRERVNINIVGDFHNEEVAIILASFASTSAF
IDTILKSLDYKSFCTIYESCGNYKVTGKGPVKGAWNIQQRSSVLTPLCGFSAQAGVIRISFARTDLAANHSIPLDQRAAVTILDGLISEQSRLVLDLSTNSVIMLAVYSTGGLVQ
QTSQWLSNLLGTTVEKLRPIFEWIEAKLSAGVEFLKDAWEILKFLITGVDFIVKGQIQVASDNKIDCVKCFIDVVNKALEMCIDQVTIAGAKRLSLNLGEVFI AQSKGLYRQCIRGKEQL
KLLMPLKAPKEVTFLEGGSDHDTVLSEEVVLKNGELEALETPVDSFTNGAIVDTEFPVCVNGLMLLEIKDKBQKCALSPGLLATNNVFRLKGGAIPKGVTFGEDTVWEVQGYKNRITFIELD
ERLDVNLNKEKSVYTVESGTEVEFACVVAEAVVKTLPQVSDLLTMNGDILGDESWAFTVILFDGAGEENFSRMYSFYPPDEEEEDDAECSEEEIIDECHEGYGEDDYYQGLPLEFGAS
AETVYRVEEEEEEDWLDDTTEQSEIEPEPEPTPEEPVQNQFTGYLKLTDNVAIKCVDIVKEAQSANPYNVMAANIHLKHGGGVAGALNKATNGAMQKESDDYIKLNGPLTVGGSCLLSGHN
LAKKCLHVVGNPLNAGEDIQLLKAAENFNFSQDILLAPLSAGIFGAKPLQSLQVCVQTVRTQVYIAVNDKALYEQGVMDYLDNLKPRVEAPKQVEPPNTDESKEEKSVEVVKRPVDVKPK
IKACIDEVTTTLEETKFLNLLKADYFNHSLYDQSNLKGEDMSFLBKEDPAVMGVDTISGDICTCVIIPSKAGQVTEMLSRALKVPVDEYITIPGGCAGQVLEAKATLKKKS
AFVYLPSEAPNAKEIELGTVSNWNLREMLAHAAETRLKMPICMDVRAIMATIQKRYKGIQIEGIVDVGVRFFYTFYTSKEPVASIIITKLNSLNEPLVTMPIGYVTHGNLNEEAARCKMSLKA
PAVVSVSSPDVAITYNGYLTTSSSKTIEEHFVETVSLAGSYRDWSYSGQRTLELGLFKRGDKIVYHTLESFVEHLDGEVLLDGLKLSLSVEFHTKIVTTHDNLNLEATQLVDMSTMY
GQQFGPTYLDGADVTKIKPHVNHGKTFVFLPSDDTLRSEAFEYHYHTLDESFLGRYMSALNHTKKWKFPQVGGTISIKWADNNCYLSSVLLALQQLLEVKNAPALQEAAYYRARAGDAANF
CALILAYSNKTVGELGDVREMTHTLLQHANLESAKRVLNNVCKHGKQKTTTLTGTGEAVMYMGTLISYDNLTKTGSVIPCVCGRDATQYLVQJESSFVMSAPPAEYKLGQVTFLLCANBYTGN
YQCGHYITAKETLYRIDAGHTLKMSEYKGPVTDVYKETSYYTITIKPVSYKGLTIEPEKLDGYKKDNAYYTEQPIDLVPTQPLPNASFDPKLTACNTKPIFADDLNGQVGTFTKRP
ASRELSVTFPFDLNGDVADLYRHYSAFSGKAKALLHKPIVWHINQATTTFTFKNTWCLRCLWSTKPVDTSNSFEVLAVEDTQGMNDLACESQOQPTSEEVVENPTIQKEVIECBVKYTE
VVGNVILKPSDEGVKVTQELGHEDLMAAYVENTSITIKKPNELSLALGLKTIATHGIAAINSVPWSKILAYVKPFLGQAAITTSNCAKRLAQRVFNMYPVFTLLFQLCTFTKSTNSRI
RASLPPTIAKNSVGSVAKRLCLDAGINVKSPKFSKLFTIAMWLLLLSLICLSGLICVTAAGFVLLSNFGAPSYCNGVRELYLNSNVTTMDPCEGSPFPCSICLSGLDSDLSYPALETIQVT
ISSYKLDLITLGLAAEWLWYMLFTKFFYLLGLSAIMQVFFGYFASHFTISNSWLMWFIISIVQMAPVSAMVRMYIFFASFYYIWKSVYHIMDGTSTSCMMCXYKRNARTRVECTITVNMG
KRFSFYVANGRGFCCKTHQWNLNCDTFTCGSTFISDEVARLDLSQFKRPINPTDQSSYIVDSVAVKNGALHLHYFDKAGQKTYERHPLSHFVNLDNLRANNTKRSGLPINVIVFDDGSKCD
ESASKSASVYSQLMCQPILLDDQALVSDVDGSTEVSVKMFDAYVDTFSATFVSVPMEKLKALVATAHSELAKGVALDGVLSFTFVSAAQQGVVDTDVDTKDVEICLKLSHSHSDLEVTGDSC
NNFMVLTYNKVENMTPRDLGACIDCNARHINQAQVAKSHNVSLIWNVKDYMSSLEQLRKQIRSAAKKNNIIPRLTCATTATQVNVNITTKISLKGKGIIVSTCFKMLKATLLCLVLAALVCYIV
MPVHTLSIHGDGTNEIIGYKAIQDGVTRDIISTDDCFANKHAGFDPAWFSQRGGSYKNDKSCPVAIAITREIGFIVPGLPGTVLRAINGDFLHFLPRFVSAVGNICYTPSKLIEYSDFAT
SACVLAEECTIFKDDAMGKPVVPCYDNTLLEGSISYSELRPDTRYVLMDSGSI IQFPNTYLEGSRVVRVTTFDAEYCRHGTCEERVEGICLSTSGRWLVNNEHYRLSGVFCGVDAAMNLIANI
FTPLVQPVGALDVSASVAGGIIAILVTCAAYYFMKFRFVGEYNHVVAANALLFLMSFTILCLVPAYSFLPGVYSVFYLYLTFFYFTNDVVSFLAHLQWFAMFSPVFPWITAIYVFCISL
KHCHWFFNNYLKRRVMFNGVTFSTFEEAALCTFLLNKEMYLKLRSETLLPLTQYNRYALANYKYKFSGALDPTTSYREAAACCHLAKALNDFSNSGADVLYQPPQTSITSAVLQSGFRKMA
FSPGKMGVFCGCVQVTCGTTTGLNLWLDLDDTVYCPRHVICTAEDMLNPNYEDLLIRKSNHSLFLVQAGNVQLRVIGHSMQNCLLRLKVDTSNPKTPKYKFVRIQPGQTFVSLVACYNG
CAMRPNHTIKGSFLNGSCGSVGFNIIDCVSFCYMHMMLPTGVHAGTDLEKGFYGFVDRQTAQAAGTDPTITLNVLAWLAAVINGDRWFLNRFTTITLNDFNLMVKMNYEPLTDQHV
DILGPLSAQTGIAVDMCAALKELLQNGMNGRTILGSTILEDEFTFPDVRQCSGVTFFQKGFKKIKVGTGHHWMLLTFLTSLILVQSTQWSLFFVYENAFPLPTLGIMAIAACAMLLVK
HKAFLCLLFLPSLATVAYFNMVMPASWVMRIMTWLELADTSLSGYRLKDCVMYASALVILIMTARTVYDAAARRVMTLMNVITLVKYVYNALDQAI SMWALVIVSTNSYSGVVT
IMFLARAIIVFCVCEYVPLFITGNLTQCLIMLVYFCFLGYCCCCYFLGFLCLLNRFRLLTGLVYDYLVTQEFQRYMNSQGLLPKSSIDAFKLNILKLLGIGGKPCIKVATVQSKMSDVKCTSV
VLLSVLQQLRVESSSKLWACQVQLHNDILLAKDTTEAFEKMSVLLSVLLSMQGAVIDNRLCEEMLDNRATLQAIASEFSSLP SYAAYATAQEAQEYQAVANGDSEVVLKLLKKS
LNVAKSEFFRDAAMQRKLEKMAQDMATQMYKQARSEDKRAKVTSAMQTMFLTMLRLKLDNALNNIINNARDGCVPLNIIPLTAAKLMVVVPDYGTYNKTCGNTFTYASALWEIQVVDADSKIVQ
LEINMDSNVKAWPLIVTALRANSVAVKLQNNELSPVALRQMSCAAGTTQACTDDNALAYNNSKGGRFVALLSDHQDLKWARFPKSDGTGTITILEPPCRFRVTDTPKGP
KVYKLYFVIGKLNLRNGMVLGSLAATVRLQAGNATEVPANSTVLSFCAFAVDPAKAYKDYLAGSQQPTINCVMKLCTHTGTGQAITVTPEANMDQESFGGASCCLYCRCHIDHPNPKGFC
DLKGKYYQIPTTCAMDPVGTFLRNTVCTVCGMMKGYGCSCDQLREPLMQSADASTFLNRVCGVSAARLTPCGTGTSTDVVYRAFDIYNEKVAGFAKFLKTNCCRFQEKDEGNLLDSYFV
VKRHTMSNYQHEETIYNLVKDCPAVAFHDEFFKFRVDDGMVPHISRQLRFTKYTMADLVLFKHFHDEGNCDTLKEILVITYNCCDDYFNKKDWDFVENPDILRVYANLGERGVRLSLTKVQ
FCDAMRDAGIVGVLTLDNQDLNGNMYDFGDFVQVAPGCGVPIVDSYSYLLMPLITLTLRALAAESHMDADLAKPLIKWDLKLYDFTTEERLCLFDRYFKYWDQTYHPNCINCLDDRCILHCA
NFNVLFSTFVFPPTSFGPLVRKIFVYDGVFVFTGSHFRELGVVHNDQVNLHSSRLSFKELLYVYAADPAMHAASGNLLLDKRTTCFSVAALTNNAVFQTVKGFNFKNKFIYDPAVSGSKVFE
GSSVELKHFFFAQDGNAAISDYDYRYNLPMTCDIRQLLFVVEVDKYFDCYDGGCINANQVIVNNLDKSGAGFPFNKGWAKARLYYDSMSYEDQDALFAYTKRNVIPITITQMNLYAISAK
NRARTVAGVSICTMTNRQFHQKLLKSIAATRGATTVIGTSKFYGGHNMMLTKTVSYDVETPHLMGWDFPKCDRAMPNMLRIMASLVLRKHNTCCNLSHRFYRLANECAGQVLSMVMCGG
SLYVKGPTSSGSDATTAYANSIQCQAVTANVALLSTDGNKIAKGYVNRQLHRLSELDVNRDNDVHEFVDEFEYAYLRKHFSMMILSDDDAVVCYNNSAAQGLVASIKNFKAVALYQNN
VFMSAEAKWTETDLTKGHEFCSQHTMLVKGQDDYVYLPYDPSRILGAGCFVDDIVKTDTGLMIERFVSLAIDAYPLTKHPNQEYADVFLHYLQYIRKLHEDLTHGMMLDMSVMLTNDN
TSRYWEPEFYEAMTYHTVPLQAVGACVLCSNQSLSRCGACIRFPFLCCCKCYDHIYSTSHKLVLSNVPYCNAPGPDVTDVTLQYLGGMSYKSKHPISFPLCANGQVFLGYKNCTVCG
SDNVDPFNAITCDWNTAGDYILANTCTERLKLFAAETLKATEETFKLSYGIATVREVLSDRELHLSWEVGKRPDPLNRNYVFTGYRVTKNSKYQIEGYTFEKGDYGDVAVYRGTTTYKL
NVGDYFVLTSHTVMPLSAFTVLPQBYHYIRITGLYPTLNIISDEFSSNVANYQVGMQKXYSTLQGGPPTGKSHFAIGLALYYPASIRVYACSHAADVDMCEKALYKIPDKCSRIIPARAE
VECFDEKFNSTMLEQYVFTVNALPETHETADIVVEDEISMATNYDLDSVNARLAKHYVYIGDPAQLPABRTLLTKGTLEPEYFNSVCRMLKMTIGYDPLKTCRCRCPAEIIVDTVVALVYDN
KLKAHKDKSAQCCKMFYKGVITHDVSSAINRPQIGVVREFLTRNPAWRKAVFISPYNSQNAVASKILGLPTQTVDSSQSGSEYDYVIFTQTTTEHAHSCNVNRFNVAITRAKIGILCIMS
DLYDKLQFTSLEIPRRNVATLQAEVNTGLFCKDSKIIITGLHPTQAPTHLSVDIKFKTEBGLCVDIPGIPKDMTYRRIISMMGFKMNYQVNGYPNMFIITREEAIRHVRWAGI6DVEGCHATR
DAVGTNLPLQLGFGSTPNLVAVPTGYVDTENNTEFTRVNAKPPGQDQFKHLIPLMYKGLPNNVRIKIVQMSLDDTLKGLSDRVVFLWAHGFEKTSKMYFVKIPEPRTCCDKRATCF
TSSDTPAEACWNHSGVDFYVYNPFMIDVQWQWGTGNLQSNHDQHCQVHGNHVASCAIMTRCLAVHECFVRRVDSVEYPIIGDELRVNSACRKQVHMVVKSAALLADKFPVLHIDGNPKAI
KCPVQAEVEWKFYADQPCSDKAYKIEELFYSATHHDKFTDGVCLFWNCNVDYRANAI VCRFDRFVLSNLRNLNPGCDGGSGLYVKNHAFHTPAFDKSAFTNLKQLFFYYSIDSPCESHGKQ
VSDIDYVPLKSAATICTRNLKGSAVCRHANEYQYLDAYNNMI SAGFSRLWYKQDFDYNLWNTFTRLQSLLENVAYNVNKGHFDHGAGEAPVSIINNAVYTKVDGIDIVEIFENKTTLPV
NVAFELWAKRNIKVPPEIKILNNLGVDIAANTVWDYKREAPAHVSTIGVCTMTDIAKPPTESACSSLTVLFDGRVEGGVDLFRNARNGLVITEGSVKGLTPSKGPAQASVNGVTLIGES
NVQFNFTFVFPPTSFGPLVRKIFVYDGVFVFTGSHFRELGVVHNDQVNLHSSRLSFKELLYVYAADPAMHAASGNLLLDKRTTCFSVAALTNNAVFQTVKGFNFKNKFIYDPAVSGSKV
CSVIDLLDDFVEI IKSQDLSVISKVVKTIDYAEISFMLWCKDGHVETFPYKQLQASQAWQPGVAMPNLYKMQRMLLEKCDLQNYGENAVIPKGINMNVAKYTLQCLQYLNLTILAVPYNM
RHFHFGAGSDKGVAPGTAVALRWQLPTGTLVLVDSDLNDFVSDADSTLIGDCAVTHTANWKDILISDMYDPRTKHVTKENDSKEGFFTYLCGFIKQKLAGGSIAVKTIEHSWNADLYKLMG
RVSWHTAFVTVNVAASSSEAFILGANLYLKGKPEQIDGYTMHANYIFWRNTNPQLSSYSLFPMFSKPLKLRGAVMSLKENQINDMISYLLLEKGRILIRENNRVVSSDILVNMMESVLVG
VNEKTHVQLSLPVLQVRDVLVRGFGVESSEALSEAREHLKNGTCGLVLEKNGVLPQLEQPVPYFIKRSDALSTNHGHKVVLEVAEMDGIQYGRSGITLGLVLPVHGETPIAYRNVLDLRKNG
NKGAGGSHSYGIDLKSYLDGLEDGTDPIEDYEQWNWTKHGSGALRELTRELNGGAVTRYVDNNFCGPDGPLDCIKDFLARAGKSMCTLSEQLDYIESKRGVYCCRDHEHEIAWFTERSDK
SYEHGTFPEIKSAKKFDTFGKEGCKPFVFLPNSKVKVILQPRVEKKKTEGFMGRIRSVYVPSAPSCNNMHLSTLMKCNHCDVEKQTDPLFKATECGSTENLVEIGPTQGLPTNAVVK
MPCPAQDQPEIGEPHSVADVHNHNSNIETRLRKGGRTTRCFGGCVFAVYGCYNKRAYVWRASADIDGSGHTGITGDNVETNELDLEILSRERVNINIVGDFHNEEVAIILASFASTSAF
IDTILKSLDYKSFCTIYESCGNYKVTGKGPVKGAWNIQQRSSVLTPLCGFSAQAGVIRISFARTDLAANHSIPLDQRAAVTILDGLISEQSRLVLDLSTNSVIMLAVYSTGGLVQ
QTSQWLSNLLGTTVEKLRPIFEWIEAKLSAGVEFLKDAWEILKFLITGVDFIVKGQIQVASDNKIDCVKCFIDVVNKALEMCIDQVTIAGAKRLSLNLGEVFI AQSKGLYRQCIRGKEQL
KLLMPLKAPKEVTFLEGGSDHDTVLSEEVVLKNGELEALETPVDSFTNGAIVDTEFPVCVNGLMLLEIKDKBQKCALSPGLLATNNVFRLKGGAIPKGVTFGEDTVWEVQGYKNRITFIELD
ERLDVNLNKEKSVYTVESGTEVEFACVVAEAVVKTLPQVSDLLTMNGDILGDESWAFTVILFDGAGEENFSRMYSFYPPDEEEEDDAECSEEEIIDECHEGYGEDDYYQGLPLEFGAS
AETVYRVEEEEEEDWLDDTTEQSEIEPEPEPTPEEPVQNQFTGYLKLTDNVAIKCVDIVKEAQSANPYNVMAANIHLKHGGGVAGALNKATNGAMQKESDDYIKLNGPLTVGGSCLLSGHN
LAKKCLHVVGNPLNAGEDIQLLKAAENFNFSQDILLAPLSAGIFGAKPLQSLQVCVQTVRTQVYIAVNDKALYEQGVMDYLDNLKPRVEAPKQVEPPNTDESKEEKSVEVVKRPVDVKPK
IKACIDEVTTTLEETKFLNLLKADYFNHSLYDQSNLKGEDMSFLBKEDPAVMGVDTISGDICTCVIIPSKAGQVTEMLSRALKVPVDEYITIPGGCAGQVLEAKATLKKKS
AFVYLPSEAPNAKEIELGTVSNWNLREMLAHAAETRLKMPICMDVRAIMATIQKRYKGIQIEGIVDVGVRFFYTFYTSKEPVASIIITKLNSLNEPLVTMPIGYVTHGNLNEEAARCKMSLKA
PAVVSVSSPDVAITYNGYLTTSSSKTIEEHFVETVSLAGSYRDWSYSGQRTLELGLFKRGDKIVYHTLESFVEHLDGEVLLDGLKLSLSVEFHTKIVTTHDNLNLEATQLVDMSTMY
GQQFGPTYLDGADVTKIKPHVNHGKTFVFLPSDDTLRSEAFEYHYHTLDESFLGRYMSALNHTKKWKFPQVGGTISIKWADNNCYLSSVLLALQQLLEVKNAPALQEAAYYRARAGDAANF
CALILAYSNKTVGELGDVREMT

KGDYHLMSPFQAPHHGVFLHVTYVXPSEEFHTTAPACHGKAYFPREGVVFNGTWSFIQORNFFSPQIITDNTFVSGNDVVIGINTNTYVDPLQPELDSFEELDKYFKNHTSPD
 VLDIGDSINASVNNIKEDIRNEAVKNESLIDLQELGKEQYIKWPWVVLGFIAGLIAVIMVTILLCMTCSSCLKAGCSGCFEDDESPVGLKVLHXTMDLMFRFTT
 RSITAPQVKINDNASPASTVHATATIPLOASLPGFWLGVIAFLVQFASQATIALNKRQWLALYKGFQFCINLLLVFTVYSHLLLVAGGMEAQFLYLALYFLYQLCINACRIIMRCWL
 WKCKSNKPLLYDANFYCVTWHHTSNVMDICIPYNSVTDVITVETGGDITSPKLKEDYQGGYSEDRHSSKTKLVVVVHGHTVEVYQLESTQITDGTENATFIFNKLVKDPNPVQIHTIDG
 SSGVANPAMDPIYDFTTHYVPLMPTTFLAGHTITMTVYHTVTSQILSKLLVAFQHNSKKTTLKVLVIRIGTQVLLKSLMYAISPKFTTSSLSLHKLLQTVLVLKMLHSSSLK
 LKTHRMCKYTQSTALQELLIQQWIFQMMSSRRRLACLCKHKKVSTNLCTHSFRKKQVRMYSFVSEETGTLIVNSVLLFLAFVVLVLTALITALRLCAYCCNIVNVSLVKPTVYVYSRV
 KNLNSEGVPDLLMADNGTITVEELKQLQLEQWNLVIGFLFAMILLQFAPYNSNRNVIYIKLVLWLWPLVTLACFLVAQVIRINWVTGGIAIACIMVLGMLWSYVASFRLFATR
 SMSFNPTNILLNVPLRGITVTRPEMSELVIGAVIRGHLRMLSGSLGRCDIKDLPEITVATSRTLSPYKLGASLRVGTDSGFAAYNRIRIGNYKMLTDHAGSNNDIALLQVMPHL
 DFQVTTAEILIIIMRTFRIAIVNLDLVISSIVRLFKPLTKKNYSELDBEEMPELDYPMKILFTLTLVFTSECLHYHQECVRGRTVTLKEPCPSGTDEEPCPSFPHPLADNKFALCTCTSH
 FAFACADGRTHRYQLRARSVSKLIRIQEEVQQLYSPLFLIVAALVFLICLCTIRKKTMMNELTIDFLYCLFLAFVLVLIIMLIIFWFSLEIQDEEPECTKMKMLLIVLTICSLCS
 CTVVQRCSANPKHVLDEPCKVQHMKLILVRYNTRGNTYSTAWLCAKGLKVLPHRWHMTMVQCTCPTNVTINCQDPAGGALIRCWYLHEHGQTAARFVVLVNLKMNMSDNGPQNSQRS
 PRITFGGPTDSTDDNNQGGNRGAPKQRRPQGLPNNTASWPTALTGHQKELEFRPRGQVQVINTNSGDDQIYGYRRATRRVGGDGKMLKSSPRWFYFLYGLTGPEASLPYGANKEGIVW
 VATEGALNTPKDHITGRNPNNAATVLPQGLTTLPKGFYAEGRSGQSQRSSRSRGSNSRSTPGSSRQNSPARMASGGGALALLKLLDLRLNLQESKVSQKQQQQQVTVKKSAA
 EASKKPRKQRTAKQYNTVQAFGRGRPEQTQNGFGDQDLIRMSGADTQDKYHWPQIAQFAPSASAFHGMRSIRGEMVTPSGTWTLYHGAIKLDDKDPQFKDNVLLNKHIDAYKTFPFTEPKKKD
 KKKTDEAQPLPQRQKQPTVTLPAADMDDFSRLQNLKSGASADSTQAMDNPQNTVVPALHVLVDPQIQLTITRMEDAMGQKQNSADPKVPIYILRLGSQLSLMARRNLDSLEARAF
 STPIVQMTKLATTEELPDEFVVTAKMLPPCYFLNKQHQKQASTQREAAAEVAPLLAPHHVVAIQEQLLAAVGEILLEWLAEVVLLPSRYCC

>SARS-CoV-2:

LSLPGFNKGTHQVLSLPLQVLRQDVLVRGDSVEEVLSEARQHLKDGTCGLVEKGVKLPQLEQYVFKRSRDARTAPGHVVMVLAELGEGIQGRSGTEGLVLVPHVGEIPVAYRK
LLVRKNKGAGGHSYGADLKSFDLGBELGDPYEDFQENWNRHTKSSGVTFSLRMLRNGAYTRVYDNNFCFGDGPLECIKDLARAGAKSCTELSQELDIDTKRGVYCCREHEHAIW
YTERSEKSYELQTPFEIKLAKKFDTFNGECPNFVFPPLNSIKTIQPRVEKKKLDGFMGRIRSVYPVASPNECNCQMCLSTLMKCDHCGETSWQTDGFVKATCEPCGTENLTKEGATTCGYL
PQNAVVKIYCPACHNSEVEPHELSAEYHNESGLKTI LRKGWRTIAGFCGVSPVGCNHKAYVWPASRANICGNHTGVGSEGLNDNLEILQKEKVNIINIVGDFKLNEEIIAIILASF
SASTSAFVETVAGNLDGYKAFKQIVESCNGVFLTKGAKKAGWNIGEQSLSPLYAFASAAARVVRSIFSRLETAQNSVRVLQKAAITILDGISOYSLRIIDAMMTESLDNLNLMVMA
ITGGVVLQTSQWLNTIFGTVEYKELKPLVDWLEEKFEKGVFLRDGWEIVKFIISTCAICEIVGGQIVTCAKEIKESVQTFPFLVKNKFLALCADIIGGAKLALNLTGETVTHSKGLYRK
VKSRETEGLMLPKAPKEIIIFLEGETLPEVLTEEVVLKTDGLQPLEQPTSEAEAPLVGTPVCINGMLMLEIKDTEKYCALPAMNMNTNTFLKGGAPKTVFGDDTVIEVQGYKSVNI
ITFELDERIDKVLNEKCSAYTEVLGETEVNEFACVADAVIKTLPQVSELLTPLGIDLDWSMATYLLFDESGEFLASHMYCSFYPPDEDEEGDCEEEFEFPSTQYEGYETDGYQKPL
EFGATSAALQPEEEQEDWLDLDDSDSQVTQGGQDSEDNTTIQTIIEVQPOLEMELTPVQTIIEVNSFSGYLKLTDNVYIKNADIVEAAKVKPTVVVNAANYVLKHGGVAGALNKATN
NAMQVDSIETIATNGLKVGKGSVLSGHNKLAKHLHVGPNNQKEDQILQLSAYENFQHOEVLALPLTISAGIFGADPHTSLRVCVCTDTRVNTVLAFDKNLVLKDLVSSFLEMSEKQVE
QKIAEIPKEEVKPFITESKPSVEQRQDDKKIKACVEEVTTLTEETKFLTENILLYIDINGNLHPDSATLVSDIDITFLKKDAPYIVGDDVQEGVLTAUVIPTKKAGGTTEMLAKLRKV
PDNTYITVYPGQGLNGYVTEAAKVLKCKCSAFYILPSIISNEQKEILGTVSNWREMLAHAEETRLMPLVCVETKGAIVSTTQRKYKGLQKEGVVDYGARFFYVITDKTIVASILTNI
LNBTIYTMPLGLVYTHGLNEAAKRYMSLRKVPATVSSVSDPAAYNGULTSSSTPEEHFETIISLAGYKWDYSVSTQJOLGIEFLKRGDKSVYTSNTFFHLDGKVTITFDNLKTL
SLEVVITKVFTTVDNINLHTQVVDMSMTYQQQGFYTLGDGAVTCKIKPHNSHEGKTFFVLPNDDTLRVEAFEYHTTDPFSLGRYMAALNHTKKWYQVGNLQTSIKKCDKQSYLATAV
TLQQIIEKFNPPALQDQYARAGEAANFCALIIYACNKTVYVAGLGDVETMSYLFQHANLDSCKRVVNVCKTGGQQQTLKKGVEAMVMGTLSSYEQFKKGVQIPCTCGKQATKYLVQQ
ESPFFVMSAPPAQYELKHGFTCASEYTYNGCGHYKHITSETKLYCIDGALLTSEKSYKGPITDVYKENSYTTIKPTVYKLDGVCTEIDPKNLNYKDNSYFTEQPIDLVPNQPY
PNASFDNFVEFCVNDIKFADDNLQLTGYKKPASRELKVTFFPDLNGLDVDAIDYKHYPFSFKGAKLHKHPYVHVHVNANATKATYKNTVCIRCLSTKPTKSVFDLVKSEADQGMNDLA
CEDLKPVSSEEVNPTIQTQDLNCEVNTKEVVGDIILKPNNSLKITIEVGHDTLMAAYVNDSSTLKKPNELSRVLGLTLATHGLAAVNSFPWDITIANYAKPFLNVSVTNTINVTRC
LNRVCTNYMPYFTLLQLCTFTRSTNSRIKASMPITIAKNTVKSVGKFCLEASFNYLKSFPNSKLINIIEWLLSVCLGSLIYSTAALGVLMNSLGMPSYCTGYREGYNLSTNVITAT
YCTGSPICSVCLSGDLSDTYPSLETIQTISFQKWLITAPGLVAWEFLAYILTRFFRYVLGLAAIMQLFSSYFAVHTISNWLWMLIINLVQMAPISAMVMRYIFFAFSPYVWKSVVHV
VDGNSSTCMCYKKNRARTVECTITVNGRFSYVYANGKGFECLHNNVCNDCFTAGSTFIDESEVARDLSQFKRPINPTDQSSIVDSVTVKNGSILHYFDKAGQKTYERHLSH
FVNLNDNRNYSRLPGFVGCDVANNLTDTMTFTLTIQIGALDISASIVAGGIVAVUTVCLAYFMRFAFEGYSHVVAENTLLMSFTVCLTIPVYSLFGVYSIVLYLTFLTYND
SFLAHIQWVMVMTPLVPFWITIIAYIIICISTKHFWFFSNYLKRRVVFNGFSTFEEAALCTFLNLKEMYLKRSVDVLLPLOTQYNRYALNKKYKFSGAMDTTSYREACCHLKEHALIW
FNSGSDYKQPPQPTSITSAVLQSGFRKAFQPSKGVGECMVQTCGTTILNGLDWDVYVCPRHVITCTSEMDLNNPYEDLLRKSNNHFLVQAGNVGLRIVGHSMMQCVKLKVDYDNTANK
TPKYKFVRIPQGTQESVLACNGSPGVQKAMPNFTIKGSLFNGSCSVGNIDYDCVSFCYMHMHELPTGVHAGTDLEGNHFGYFPGVDRTQAAGDTTITVNLWLAIVAAINGDR
WFLNRFTTTLNDNLVAMKYNYPEPLTDQHDVILGLPSAQGTIAVLDKASAKELLQNGNMASVGLSALLEDEFTFPDVRQCSQVTFQSAVKRTIKGTHHWWLLTILTSLLVLVQSTQW
SLFFFILYENAFILFAMGIIAMSAFAMFVKKHHAFLCLFLPLSPATVAYPINVMYMPASVWMRIMTLDMDVTLSLGFGLKDCVMYASAVLLIMTARTYVDDGARVWTLMLNVLTYK
VYGNALQAFISMAWLLISVTSNYSVGVTTVMFLARGIVFMCVEKTPFFITGNTQLCMLVYCYFLGYFCTCYFLGLKCNRYFRLLTGLYDVLVSQTEFPRYMSQGLLPPKNSIDAFKL
NICKLLGVGKGPICVATVYQKMSDVKCTSVLLSLDQQRVLESSKMLWQCVLHNDILLAKDTEAEFKMMSVLLSVLSMOGADVINKLEEMDLNRATLQIAESEFSLMVVIAFAFATA
QEAYEQVANGCDESVVLKKLKSNLVAKSEFDRVAQMLQRLEKMAKDQAMTQMYKHNSDDRAKVTASAMQTMFLTMLRKLNDNALNNINCLNEARDNVPLNIILPTLAASLMSVPIPDYNT
KNTCDGTFTTYSALWEIQQVDAADSKIVQLSEIISMDSNPLAWPLIVTALRANSVAVKLQNNELSPVALRQMSACAGTTQTACTDDNALAYNTTKGGRFVALLSLDLQDLKWARFPKSQ
GTGTYILEPLPCRFVDTDPKGPKVYKLYIFKGLNLRNMGVLSGLATVTLQAGNATEVNPANSTLSFCAFAVDAKAYKDYLAGSGQPTITNCVMKLTCTGTGAQITVPEANMVGFS
FGGASGLCYRCHIDHPNKGFCGLDKGVYQIPTTCCANDPVGFTLKNTVCTVQMGNAWGGYCSCDQLEPMLQASQFLNRVCSGVSAARLTCGTGTSDDVYVRAFDIYNKDVGAFK
LKTNCCRFQEKEDDDNLDISYFVVKRHTFSNYQHEETIYNLLKDCPAVAKHDFKFRIDGDMVPHISRQRLTKYTMADLYALRHFDGECNDTLKEILVTYNCDDDYFNKKDWDFEN
PLTIRLYVANLGRVQRALLKTVQCDAMRNGAIVGLVTLNDQJLNDGNWYDFDGIPTTGGSVPVDSYSYSLMPLITLTLRATAESHVDTLTKPYIKWDLKLYVDFTEERKLFDRYK
YWDQTYHNCVNLCDRCKILHCANFNFTVSTFPPSGFLVRKIVDGVFPVSTGYTHFRELGVHNNQDVLNHSRSLFKELLVYADAPMAHSAASLNDLKRCTFSVAALTNNAVAFQ
TVKPGNFNDKQYDFVAFKSGFFKEGSSVELKHFFFAAQDGNAAISDYRRYRNLTMCDIRQLLEFVVEVVYKFCDCYDGGCINANQVIVNLDKLSAGFFPNKQWGARLYVDSMSYEDQALF
SHYFRNIPTITQMLNKYIASAKNRATVAGVISCSTMTRNQHOKLLKSIATRAGTAVYIGTSKFGYGGHNNKLYTSDVENPHLMGWYDPCDARMNMLRIMASLVARSHRTCCS
ATKRYRLANECAPQVLESMVMCGGSLYVKPGTSSGDATTAYANSVFNICQAVTANVALLSTDGNKIDAKYVRNLQRLYIECLYRNRDNDTDFVNEFYAYLRKHFSMMILKSDDAVVCNS
TYSQGLVASINKFNSVLYYQNNVSEMAKCTEPTDLTKGHEPFCSTQHTMLVQGGDYVILYLPDPSPRIAGLGCFFHDVITKGTILRDEFVSLADIAYPLTKHNQYEAUDFVHLIYQYI
RKLHDELTGHMLDYSVMLTNDNTSRMEPEFYEAMYPHTVTLQAVGACVLCNSQTLRSGCACIRPFCLCCYDHDISTGKLVLSVNPVNCAGPDVDVTQJLYGMSYKCSKH
PPIFPLCANGCVFGLKYNTCVGSDNVDTCTDNTAGDYILANTCTVRLKFAETILKATEETFKLSYGIATVREVLSDRELHLSWVGKPRPPLNRNRYVTVGYRVTKNSKVQIG
EYTFEKGYDGAIVYRGTTTYKLVNGDYFVLNHTSVMPLSAPTVQEHYRITVLGTPPLTNISEDFSSNVANYQKVGMOQYVTLQGGPGTKSHFAGLALYPSARIVYACSHAADV
LCEKALYILDKCSRIIPARARVECFDKFVNLSTLEQYVCTFVNALPETTADIVFDEISATNLDLSVNARLAKHYVIGDPAQLPAPRTLTKTGLEPEYFNSVCLRMKTIGDM
FLGTCRRCPAEIIVTDSVSLVYDNKLKHKQDSAQCFMKYKGVITHDVSSANRQPIGVVREFLRNPAWRKAVTISPYNQSAVASKILGLPTQILSDMSGEYDMVITQTTETAHS
NVRNFRNAVITRAKVSILCIMSDRYDLKLOKTSLEIPRRNVATIQHVKDCSVITGLHPTASQVATHLSVDTKFKTEGLCVDIPGIPKDMTYRRLISSQGEYDNYVQVNGYPMFMT
REBAIRHVRAWIGFVDEGCHATREAVGTNLPLQLGFSTGVNLVAPPTGYVDTPNNTDTSRVSAAKPPGQDKHLILPMYKGLPWNVRIKIVQMSDLTKNLSDRVFLVWAGFELTSM
KYVKIIGPERTCCLDRARTCFSTADTYACHMHSIGFDYVNPFFMIDVQWGGFTGNLQSHNDLQCVQHNAHVASCDIAMTRCLATVHVCFSVRKVDWTIEYPIIDELKINACRKYQHVM
VYKAAALADKFLVLHIDGNPAKICVQPADDEWKFYDAQPSDQAKYIEELFYSATHSDKFTDGVCLVNCNVDRYDANSICRVDFTRVSLNLDLPCGDDSGSVLYNKHAFPTAFDKSA
FVNLKQLPFFYYSVDEPENSEHGQVSSDIDYVPLKSAATCITRCLNGGACRHHANEYRILYLDANMMISAGESLWVYKQFDTYNLNTMTFRLQSLNFAVNFVNKHGFDGQQGEVPSIIN
NTVYTKVDGVDELFPENKTLIPVNAFELWAKRNIKVPVEVKILNNLNGDIAANTYIDWKQDAHAHISTIGVCSMTDIAKPPETIICAPLTVFDGVRDVGQVDLFRNARGVLTGESS
KGLQPSVGPQKASLNGVTLIGEAUVQTFQNYKKYKDVGVQKLPETYFTQSRNLQEKFPKRSPMEIDFLELAMDIEFERYLKEGYAFEHIVGDFSGLQGLLHLILGAKRFSPEFLEDF
IPMDSYVKNYFITDAQTGSSKVCVSLDILLDDFVEIKSQDLSVSVKSVKVTIDYETISFMLWCKDGHVETFPYKLQSSQAWQPGVAMPNLYKMQRMLKECDLQNYGDSATLPKGMIM
NAVKYTQLCQYLNTILADVPYNNMRVHFHAGSGDKVGPATVLRQLWLTGLVSDLDNLFVDSADSTLIGDCAVTKANWDLIISDMYDPKTKNTKENDSEKGGFTYICGFIQKQLA
LGVSVAIKITESHNSWADLYKIMGHFAWTAFTVNVNASSSEAFILGCVNLGKPREQIDGYVMHANYIFWRNTNPQLSSYSLFDMSKFPFLKRGTAVMSLEKQINDMILSLSKGRLLI
RENNRVISSDVLNNMSESLVPGNEKTHVQLSLPLQVLRQDVLVRGFGDSVEEVLSEARQHLKDGTCGLVEKGVKLPQLEQYVFKRSRDARTAPGHVVMVLAELGEGIQGRSGTEGLVLVPHVGEIPVAYRK
LLVRKNKGAGGHSYGADLKSFDLGBELGDPYEDFQENWNRHTKSSGVTFSLRMLRNGAYTRVYDNNFCFGDGPLECIKDLARAGAKSCTELSQELDIDTKRGVYCCREHEHAIW
YTERSEKSYELQTPFEIKLAKKFDTFNGECPNFVFPPLNSIKTIQPRVEKKKLDGFMGRIRSVYPVASPNECNCQMCLSTLMKCDHCGETSWQTDGFVKATCEPCGTENLTKEGATTCGYL
PQNAVVKIYCPACHNSEVEPHELSAEYHNESGLKTI LRKGWRTIAGFCGVSPVGCNHKAYVWPASRANICGNHTGVGSEGLNDNLEILQKEKVNIINIVGDFKLNEEIIAIILASF
SASTSAFVET

ELSLPGFNEKTHVLQSLPLVQLVRDLVRGKSVSEEAELSEARQHLNDGTCGLVDVEKGVLPLEQEPYVFIKRSDDARTAPHGVMVVELVAELDGVQYGRSGETLGLVLPVHVGGETPVAYRK
 VLRKNGKNGAGGHSYGADLKSGLDGLDGTDPYEDFDQNNWTHKSGSVTRMLRELNGGAYTRYVDNNFCEGQYPLECICKDLLARAGKASCFTLSEQLDFIDTKRGVYCCREHEHEIAY
 YTERSKDSYELQTPFEIKLAKKFDNPTGECPNFVPLNSTIKTQPRVEKKLDFMGFRISRVYPNACEQMYLSITLMKCEHCSTESWQTDGLKATCEFCQENQVKEGPTTCGYL
 PQNAVVKIYCPACHNPEIGPEHSLAEYHNESGVIKTKLRKGRTQAGFCGVSYVGCNKHCAYYWPRAAANGCNHGTGVGVEGSESLDNLLEILPEKVCININIVGDFKLNEAIILASF
 SASTASVETVTKGLDYKSFQYILVSGNFKVTKGAKGAWNICEPKSILSLPYAFSEAARVRSIFSRTELAQHSVRVLQKAAITLIDGSIQSYSLRIDAMMTESDFATDNLVMVAY
 VTGGVVQMTQTWLNTNIGFTVYEKLPILDWLEEKFKEGIEFLRDGWEIVKFISTCACEIIGGQIVTCAKEIKDSVQTPFFKLVNKLALCADSIIIGGAKLKALNGETTFVAHSRGLYKKQ
 VKSRGSDGLMLPKAPKEVILFDGETLPEVLSEEVILKTGELQPLEEPTAAVEAIPVTPVCINFGMLLEIKDTEKYCALAPNMWNTNTFTLKGGAPTFTFGDDTPIEVQGNKVNIV
 ITFELDERDGNLNEKSNYTVLEGTNVNELCAVDADVITLQPVSSELLPLGIDLDDEWGIATYLFDESGEYTLSSRMYSQYPPDEDEEYEESEEPQEQPTQYEGTSEYDKGLPI
 EFGASSVQQQEEQEDWLETEAEVVEQEVPTTEQEEELPITEIVPAVEQTTTVELEWNNFTGYLKLTDNVSIKNADIVEEAKVKVPTVVVNAANVYLKHGGGVAGALNKATNNAMQVESD
 YIARNGPNLVNGQSCLLNGHKLAKNCLHVGNPLNGKEQIDQLLKVAYENFNHEHKLAPLLSAGIFAQGPQITLSKVCIVETBRTQVFLAVFDKDLVEELVASFLEMKSETPKVQNLAEIPKD
 EVKFIETENKPSVEQSTKEEKPKNKCPLEEVTTLTEETLFLENLLYIDINGNLHEDPILASVKDIDITFLKSDAIVPGDITISGNLTITTVIPTKGAGGETMLAKLRKVPDTHYITTY
 PGCGCGVGYTIEEAKTLKRSKSAYYVLPISIIPNKEEILGTVSNLREMLAEAEETRKLMPICMETKAIMSTVQRKYKGIKIQEGVVYDVGRFYFTSKTPVATLIATLNSLGETLVTMP
 LGYVTHGLNLEEAARYMSRLKVPATVSVSSPDADVATYNGYLTSSSKTPEEHFIETISLAGSYKDWYSQSGSTELGIEFVKGDKIVYTTSTFHMHDEGINIDSLKLLALREVTKI
 KVPTTNNINLHQTVDMSMTYQGQGPPLYLDAGVNTIKPHNSHDGKTFYLPNDTDLRGEAFEYHETITDESFLGRYMSALNHTKKWYQPVNGLTSIKWADNNCYLATALLTQLOIEL
 KFNPNALQDAYYRAGDAANTGALILAYCNKTVGELGDVRETSYLFQHANLDDCKRVNLNVCKTCGQQQTTLKLGVEAVMYMTGLSYEQLKKGVPVPCVCGKQATQYLVQVESPFVMMS
 APPAEYKLKHGTFLLCSEAENFYQCQGHKKHTSKETLYIGDAGALLTKSSEYKGPITDVPYKENSYTTIKPIVYKLDGVVCTEIDPKLDNYKKDNAYATQPIDLVPTQYPPNASFNE
 KFCVDCNIFKADDDNMQSYGKPPASRELVTFFPDLNDGVVAIDYKHTYPSFKFAGKLHKHPIVHVNNNTNKATYKPTWCIRLWSTKPVETSNFVQLQESDQGMNDLACEDIKLV
 EYEVETPTIQKIDIBCTSDNKTIEAGVDVILPKAGDVGKITEEVGHEDMLAAYVNDSLTIKIPNLSLVMGLKGLTKLTHGLSAAVSNVPWDTIYACYPFLNKYTVSVAASGVARCLNRCIGY
 MPYFETLLTQCFCTFTRVSRIRKASMPTTIQAQNTVKSVGKCLEASPMYLSNPFSTKLITINIVWFLLSVCLGSLSYSSAALGVLSNLMGPSYCTPREGYLSNNTVNTATYTCVSI
 SVCLSGMDSLDAYPALETIQVTISSFKWDLTAFGIIAEWCLAYILFTRFFYVLGLAAIMQLFFSYFAVHFISNSWMLMLILNLVQMAPISAMVRMYIFFASFYVVKWSYVHVVDGTSST
 CMCKYKRNARTRVECTITVNGVRSSFYVYANGGKFCQKLHNWNCVNDFCAGSTFIDEVARDLSTIQFRKPNINPTDQSSYVSDVASVKNGLHLYFDKAGQYTERHSLSFVNLDNLR
 ANNTKGYSLPINIVFDGKSCEESSAKAASVYSQLMCPILTLDLQALVSDGSAEAVKMFDAYNFTSSTFNPMDBKLTLIATAEALKNLNSDLNSTFPIISAARGVYVDSVDET
 KDVVECLKLSHQSDIEVTDGSCNNYMLTYKNVENMTPRDLGACDICSARHINAQVAKSHNISLIWNKDFMSLSEQLRKQIRSAAKNNPLFKLTATTQVNVNVVTTKIALKGGKFVTH
 WFKYLLKATLVCVVIACTVFYLLTPVHVMTKHTDFDAEIIKYKADIGDVTDRIDSNDTFCANKHADDFTFWSQRGSSYNDKCAFPVAAVITRDGVGFVHGLPGTILRTTNGDGLFHLFPRV
 FSVAVNICSTPSKLEIYDTFATSACLAECATIFDKAAGKVPYPCYDITNLGSLDVGSEYVESLSPDRDTRYVLMDSGIIPQNTYLEGSVRVVITFDPEYCHGCTERSEAGICVSTSGRWLNVN
 DYYRSLPGVFCGVDSVNLNTNMFTPLIQPIGALDISAIVAGGLVAIFVTCLLAYIFMFRFRAFGEYSHVAVFNTLFLMSFTVLCITPVYSFLPGVYSVIYLYLTFYLTNDVDSFLAHVQN
 VMVMTPLVPFWITIVYVICITSTKCHYVFSNVLRRRVFNGTFSFTEFAEALCTFLNKKEMYLLKRSVDLPLTQYNNYALALNYKYKQFSGAMDTYSREACAEKALKALDNLSNGSDV
 LYPQOPTSITSAVQSGFRKMAPSGKVEGCMVYTCGTITLNLGLWDDVYCPRHVITCETSDMLNPNYEDLLTQRNRYLVQAGNVQLRIGSHSCNVCVLKLVKDVTANPTKPKYFVR
 IQPGQTFVSLACYNGSGSPGVYQCAMREPTIKGSFLNGSCSGVGFNIIDYCVSFCYMHMLGSLTGVHAGTDLEGTYPGFVDVQTAQAAGDTDTTITINLAWLJYAAVINGDRWFLNRFTI
 TLNDFNLVAMKYNYEPLTDQHDVILPSAQGTIAVLDMCASLKELLQNGMNGRTILHGSALLEDEFTTFDDVVRQCSGVTFSQAIRKTIKGTTHWLLLTILSLLVQSTQWSLVFFVYE
 NAFPLPALGIAMSAFAMFVKHKHAFCLFLPLPSFATVAYFNMVYPMASWVMINTLWDMVDTLSGFKLKDCVMYASAVMLLIMTARTVYDGGARRVNTLMNVLTLVKYVYVGNALD
 QATSMWALLISVTSNSGVVTTVMFLARGLVFMVEYCPILFITGNTLQCLIMLVYCYLGYCTFQYGLFCLNLRNYFRLLTGLVYDYLVSSTQEFYRMSQGLLPKNSIDAFKLNILKLGQV
 GKPCIKIVATYQSKMSDVKCTSVLLSVLQLRVESSSKLMAQCVQLHNDLLEKADTTEAFKEMVSLSVLLSMQGAVDINKLCEEMLDNRATLQIASEFSSPLSYAFAQTAEAYEQAV
 ANGDESVLLKLLKSLNVAKSEFDRDAAMQRLEKMDAQMTQYQKARSEDKRAKVTSAQMTLFTMLRKLNDALNINIINNARDGCVPLNIIPLTAAKLMVVIPODNTYKNTCDGT

Figure S1: The prototype aa sequences of the whole ORFs of the CoVs. The prototype sequence for each CoVs was selected manually by choosing the most prevalent aa at the same position.