

Computational Identification of the Antibody Recognition Regions of Dengue NS1 proteins

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Supplementary Materials

A)

DSGC**vvswnkel**LCGSGIFITDNVH**twteqykfq**PESPSKLASAIQKAHEEGICGIRSVTRLE**nlmwk**
qitpelnhilsENEVKLTIMTGDIKGI**mqagkrslrpqptelkyswk**TWGKAKML**steshnqtfl**I
 DGPETAEC**cpntnrawn**SLEVEDYGFGVFTTNIW**Lklrekqdvf**CDSKLMSA**aikdnravh**ADMGYW
 IESALNDTWKMEKASFIEVKSchWPKSHTLWSNGVLESEMIIPKSFA**gpvsqhnyrpgyytqt**AGP
 WHLGKLEMDFDCEGTTVV**VTedcgnrgps**LRTTTASGKLITEWCCR**SCTlpplryrged**GCWYGM
 EIRPLKEKEENLVNSLVTA

B)

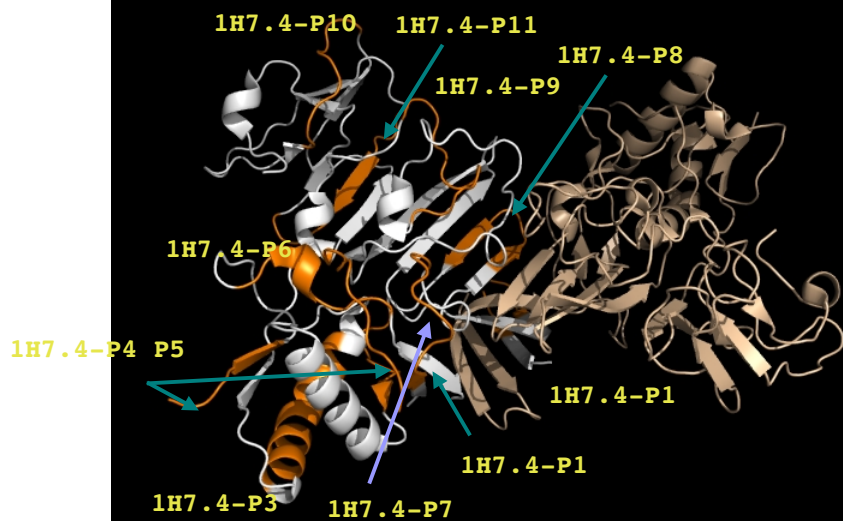
Summary of the binder peptides (as listed above) of DENV2 for the antibody 1H7.4 predicted from sequence search only. The peptides can be considered as epitopes are highlighted in bold and colored in magenta.

Peptides	Regions	Sequence	Length (mer)	Secondary Structure	Surface Accessibility	Epitopes
1H7.4-P1	5-13	vvswnkel	9	Turn	Exposed ^a	
1H7.4-P2	27-35	twteqykfq	9	Loop	exposed	1
1H7.4-P3	65-80	nlmwkqitpelnhils	16	Helix	exposed	
1H7.4-P4	97-116	mqagkrslrpqptelkyswk	19	Loop	exposed	2
1H7.4-P5	125-133	steshnqtfl	10	Loop	exposed	3
1H7.4-P6	143-151	cpntnrawn	9	Loop	exposed	4
1H7.4-P7	170-178	klrekqdvf	9	Loop	exposed	5
1H7.4-P8	187-195	aikdnravh	9	2 β stands	buried	
1H7.4-P9	249-264	gpvsqhnyrpgyytqt	16	Loop	dimer interface ^b	
1H7.4-P10	289-297	edcgnrgps	9	Loop	exposed	6
1H7.4-P11	318-327	lpplryrged	10	β stand	buried	

^a peptide is exposed and close to membrane surface.

^b peptide is located on the dimer interface.

C)



D)

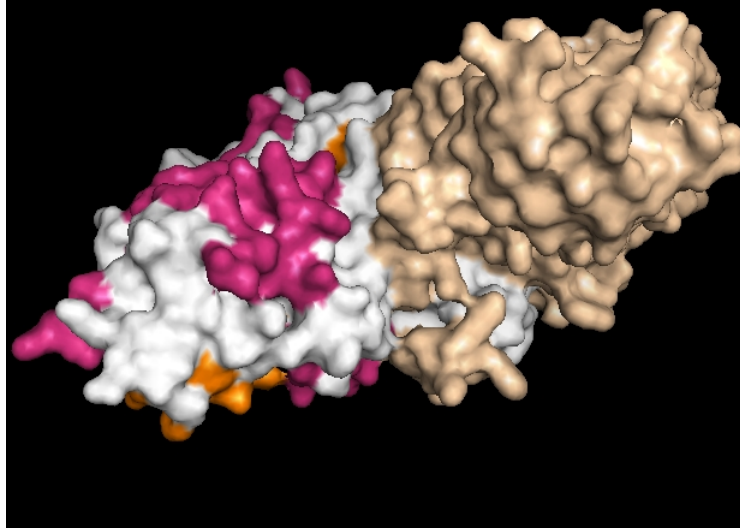


Figure S1: Predicted Binder peptides of DENV2 to the antibody 1H7.4. A) the sequence of DENV2 NS1 protein with the binder peptides highlighted in lower case and colored in orange. The final epitopes are colored in magenta. B) Summary of the binder peptides according to the secondary structure and surface accessibility. C) Illustration of the binder peptides in the crystal structure of dimer form of DENV2 NS1 protein. D) the location of the binder peptides on the surface of dimer form of DENV2 NS1 protein. The final epitopes selected based on secondary structure and surface accessibility are colored in magenta.

A)

DSgcvvswkNKElKCGSGIFitdnvhtwtEQYKFQPESPSKLASAIQKAHEEGICGIRSVTRLENL
mwkqitpelnhilsenEVKLTIMTGDlKGIMQAGKRSLRPQPTelkyswktwggkakmlstesHNQT
FLIDGPETAECpNTNRawnslevedyggFGVFTTNIWLKLRekqdvfcdsKLMSAAIKdnravhadm
gywiesalndtwkmeKASFIEVKSchWPKSHTLWsnvglesemIIPKSFAGPVSQHNYRPGYYTQT
AGPWhlgklemdfDFCEgttvvvtedcGNRGPslRTTTasgklitewcCRSCTLpplryrgedgcw
ygmeiRPLKEKEENLVNSLVTA

B)

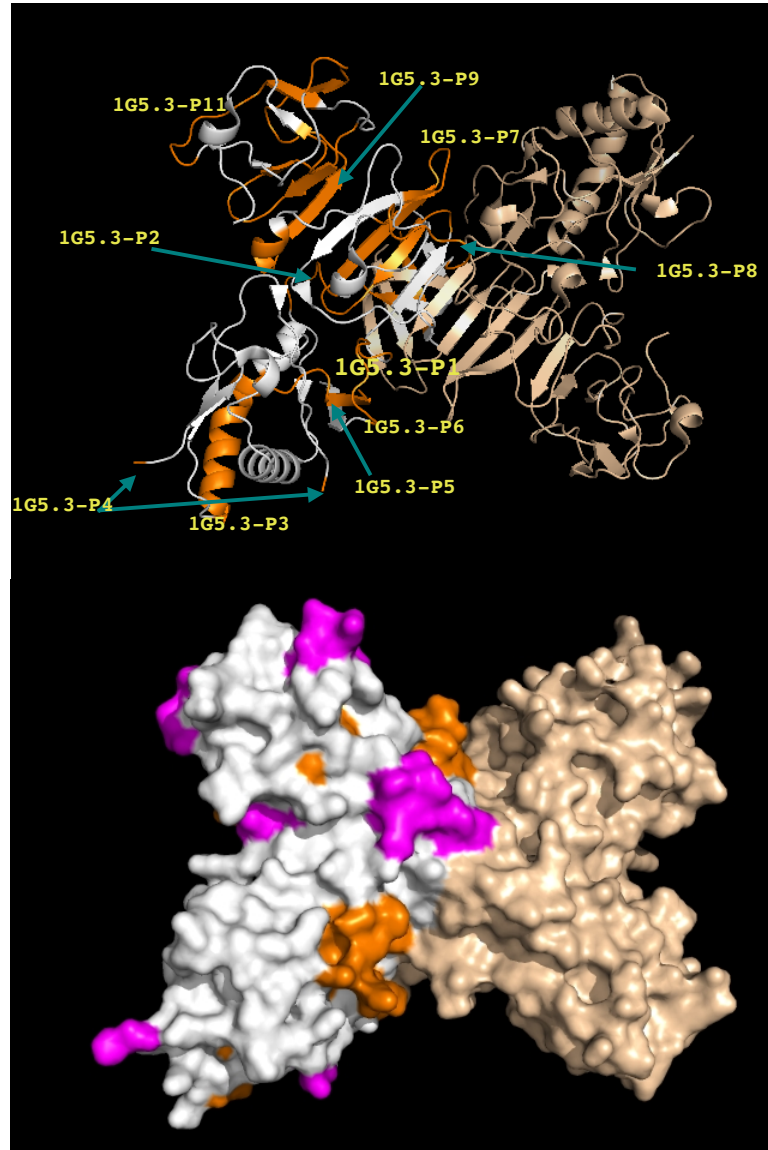
Summary of the binder peptides of DENV2 (shown in above) for the antibody 1G5.3 predicted from sequence search only. The peptides can be considered as epitopes are highlighted in bold and colored in magenta.

Peptides	Regions	Sequence	Length (mer)	Secondary Structure	Surface Accessibility	Epitopes
1G5.3-P1	2-9	gcvvswk	7	β stand	exposed ^a	
1G5.3-P2	21-29	itdnvhtwt	9	loop	buried	
1G5.3-P3	67-82	mwkqitpelnhilsen	16	helix	exposed	
1G5.3-P4	111-128	lkyswktwggkakmlstes	18	loop	exposed	I
1G5.3-P5	149-159	awnslevedyg	10	β stand	buried	
1G5.3-P6	173-181	ekqdvfcds	9	loop	buried ^b	
1G5.3-P7	190-214	dnravhadmgywiesalndtw kmeK	24	2 β stands	buried	
1G5.3-P8	233-241	sngvlesem	9	loop	exposed	II
1G5.3-P9	269-277	hlgklemdf	9	β stand	buried	
1G5.3-P10	282-291	gttvvvtedc	10	loop	exposed	III
1G5.3-P11	303-312	asgklitewc	10	loop	exposed	IV
1G5.3-P12	319-335	pplryrgedgcwygmei	17	2 β stands	buried	

^a peptide is exposed and close to membrane surface (Panel B).

^b peptide is buried in the dimer form (Panel B)

C)



D)

Figure S2: Predicted Binder peptides of DENV2 to the antibody 1G5.3. A) the sequence of DENV2 NS1 protein with the binder peptides highlighted in lower case and colored in orange. The final epitopes are colored in magenta. B) Summary of the binder peptides according to the secondary structure and surface accessibility. C) Illustration of the binder peptides in the crystal structure of dimer form of DENV2 NS1 protein. D) the location of the binder peptides on the surface of dimer form of DENV2 NS1 protein. The final epitopes selected based on secondary structure and surface accessibility are colored in magenta.

A)

DSgcvvswknkelKCGSGIFITDNVHtwteqykfqpespsklasaiqkaheEGICGIRSVTRlenl
mwkqiTPELNHILSENEVKLTIMTGDIKGIMQAGKRSRLRPQPTelkyswktwGKAKMlsteshnqt
FLIDGPETAECpntrawnsleVEDYGFVFTTNIWLKLREKQDVFCDSKLMSAAIKDNRAVHadm
gywiesalndtwkmeKASFIEVKSWPKSHTLWSNGVLESEMIIPKSFAGpvsqhnyrpgyyttqt
AGPWHLGKLEMDFDCEGTTVVVTTEDCGNRGPSLRTTTASGKLITEWCCRSTlpplryrgedGCW
YGMEIRPLKEKEENLVNSLVTA

B)

Summary of the binder peptides of DENV2 (shown in above) for the antibody GUS2 predicted from sequence search only. The peptides can be considered as epitopes are highlighted in bold and colored in magenta.

Peptides	Regions	Sequence	Length (mer)	Secondary Structure	Surface Accessibility	Epitopes
GUS2-P1	3-13	gcvvswknkel	11	2 β stands	exposed ^a	
GUS2-P2	27-36	twteqykfqp	10	loop	exposed	A
GUS2-P3	42-51	lasaiqkahe	10	helix	buried	
GUS2-P4	63-71	lenlmwkqi	9	helix	exposed	
GUS2-P5	110-118	elkyswktw	9	loop	exposed	B
GUS2-P6	124-132	lsteshnqt	9	loop	exposed	C
GUS2-P7	145-153	ntnrawnsle	9	loop	buried	
GUS2-P8	196-213	admgywiesalndtwkme	18	2 β stands	Buried ^b	
GUS2-P9	249-264	gpvsqhnyrpgyyttqt	16	loop	exposed	D
GUS2-P10	318-327	lpplryrged	10	β stand	buried	

^a peptide is exposed and close to membrane surface (Panel B).

^b peptide is located on the dimer interface (Panel B)

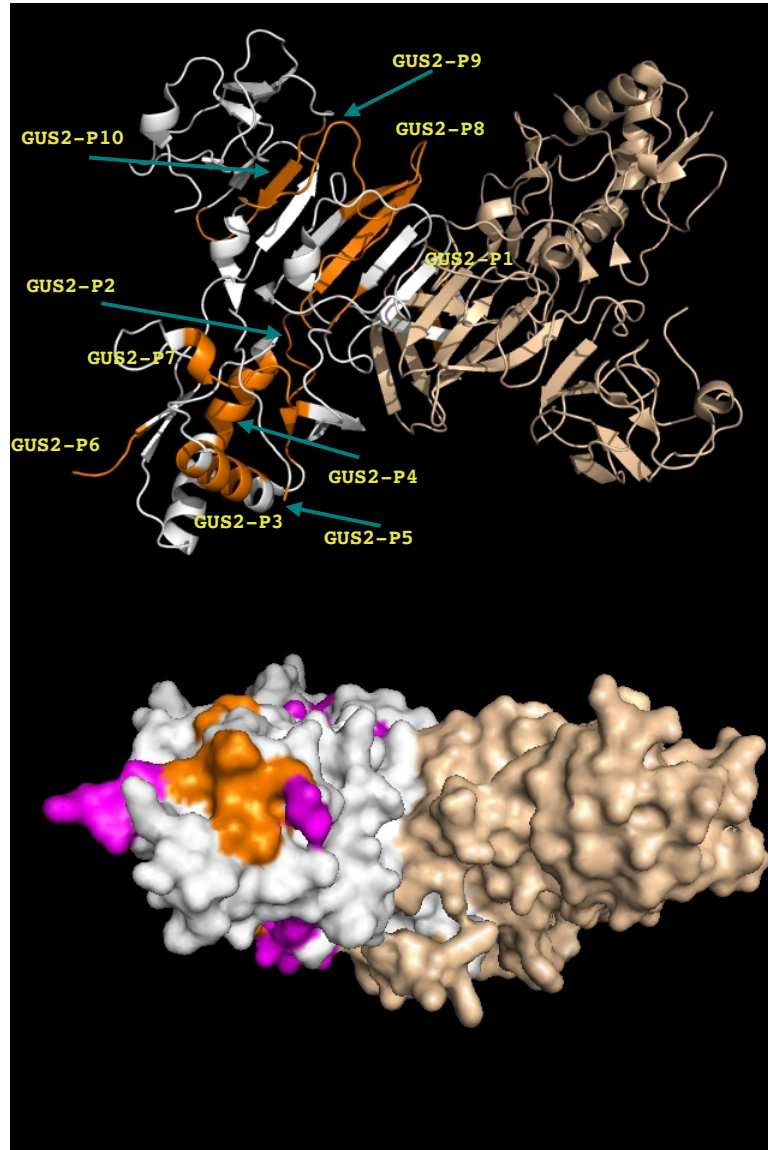


Figure S3: Predicted Binder peptides of DENV2 to the antibody GUS2. A) the sequence of DENV2 NS1 protein with the binder peptides highlighted in lower case and colored in orange. The final epitopes are colored in magenta. B) Summary of the binder peptides according to the secondary structure and surface accessibility. C) Illustration of the binder peptides in the crystal structure of dimer form of DENV2 NS1 protein. D) the location of the binder peptides on the surface of dimer form of DENV2 NS1 protein. The final epitopes selected based on secondary structure and surface accessibility are colored in magenta.

Appendix S1: peptide libraries of NS1 proteins of DENV serotypes bind to antibody 1H7.4

DENV1

1 DSGCVINWKGRELKCGSGIFVTNEVHTWteqykfqadspkrlsAAIGKAWEEGVCGIRSATRLenimwkqisnelnhILLENDMKFTVVVGDVSGILA
2 DSGCVINWKGRELKCGSGIFVTNEVHTWteqykfqadspkrlsAAIGKAWEEGVCGIRSATRLenimwkqisnelnhILLENDMKFTVVVGDVSGILA
3 DSGCVINWKGRELKCGSGIFVTNEVHTWteqykfqadspkrlsaAIGKAWEEGVCGIRSATRLenimwkqisnelnhILLENDMKFTVVVGDVSGILA
4 DSGCVINWKGRELKCGSGIFVTNEvhtwteqykfqadspkrlsaaIGKAWEEGVCGIRSATRLenimwkqisnelnhilleNDMKFTVVVGDVSGILA
5 DSGCVINWKGRELKCGSGIFVTNEVhtwteqykfqadspkrlsaaiGKAWEEGVCGIRSATRLenimwkqisnelnhilleNDMKFTVVVGDVSGILA
6 DSGCVINWKGRELKCGSGIFVTNEVhtwteqykfqadspkrlsAAIGKAWEEGVCGIRSATRLenimwkqisnelnhillenDMKFTVVVGDVSGILA
7 DSGCVINWKGRELKCGSGIFVTNEVhtwteqykfqadspkrlsAAIGKAWEEGVCGIRSATRLenimwkqisnelnhILLENDMKFTVVVGDVSGILA

1 QGKKMIRpqpmehkYSWKS WGKAKIIGA dvqntt fIIDGPNT pecpdnqRAWNIWEVEDYGF GIFTTNIWLKL RDSYtqvcdhrlMSAAIKDSKAVHA
2 QGKKMIRPqpmehkySWKS WGKAKIIGAD vqntt fIIDGPNT pecpdnqrAWNIWEVEDYGF GIFTTNIWLKL RDSYtqvcdhrlMSAAIKDSKAVHA
3 QGKKMIRPQpmehkysWKS WGKAKIIGADV qntt fIIDGPNTPE cpdnqrawNIWEVEDYGF GIFTTNIWLKL RDSYtqvcdhrlmSAAIKDSKAVHA
4 QGKKMIRPQpmehkysWKS WGKAKI igadvqntt fIIDGPNTPE cpdnqrawNIWEVEDYGF GIFTTNIWLKL RDSYtqvcdhrlmsAAIKDSKAVHA
5 QGKKMIRPQPMehkyswkSWGKAKI igadvqntt fIIDGPNTPECP dnqrawnIWEVEDYGF GIFTTNIWLKL RDSYtqvcdhrlmsaaIKDSKAVHA
6 QGKKMIRPQPMehkyswksWGKAKI igadvqnt fIIDGPNTPECP dnqrawnIWEVEDYGF GIFTTNIWLKL RDSYtqvcdhrlmsaaIKDSKAVHA
7 QGKKMIRPQPMehkyswksWGKAKI igadvqntt fIIDGPNT pecpdnqrawnIwEVEDYGF GIFTTNIWLKL RDSytqvcdhrlMSAAIKDSKAVHA

1 DMGYWIEseketwKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGPISqhnyrpgyFTQTAGPWHLGKLELDFDLCEGTTVVVdehcgnr
2 DMGYWIEseketwkKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYggpisqhnyrpgyFTQTAGPWHLGKLELDFDLCEGTTVVVdehcgnr
3 DMGYWIEseketwklARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYggpisqhnyrpgyFTQTAGPWHLGKLELDFDLCEGTTVVVdehcgnr
4 DMGYwiesekNETWKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYggpisqhnyrpgyFTQTAGPWHLGKLELDFDLCEGTTVVVdehcgnr
5 DMGYwiesekNETWKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGpisqhnyRPGYFTQTAGPWHLGKLELDFDLCEGTTVVVdehcgnr
6 DMGYwiesekneTWKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGPisqhnyrPGYFTQTAGPWHLGKLELDFDLCEGTTVVVdehcgnr
7 DMGYWIEseketwKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGPISqhnyrpgyFTQTAGPWHLGKLELDFDLCEGTTVVdehcgnr

1 GPSLRTTTVTGKTIHEWCCRSTLPPLRFKGEDGCWYGMEIRPVKEKEENLVKSMVSA
2 gPSLRTTTVTGKTIHEWCCRSTLPPLRFKGEDGCWYGMEIRPVKEKEENLVKSMVSA
3 gpSLRTTTVTGKTIHEWCCRSTLPPLRFKGEDGCWYGMEIRPVKEKEENLVKSMVSA
4 gpsLRTTTVTGKTIHEWCCRSTLPPLRFKGEDGCWYGMEIRPVKEKEENLVKSMVSA
5 gpslRRTTTVTGKTIHEWCCRSTLPPLRFKGEDGCWYGMEIRPVKEKEENLVKSMVSA
6 gpslrTTT VTGKTIHEWCCRSTLPPLRFKGEDGCWYGMEIRPVKEKEENLVKSMVSA
7 GPSLRTTTVTGKTIHEWCCRSTLPPLRFKGEDGCWYGMEIRPVKEKEENLVKSMVSA

DENV2

1 DSGCVVSwknkelkCGSGIFITDNVHTWteqykfqPESPSKLASAIQKAHEEGICGIRSVTRlenlmwkqitpelnhILSENEVKLTIMTGDIKGIMQ
2 DSGCVVSWknkelkCGSGIFITDNVHTWteqykfqPESPSKLASAIQKAHEEGICGIRSVTRlenlmwkqitpelnhILSENEVKLTIMTGDIKGIMQ
3 DsgcvvswkNKLKCGSGIFITDNVHTWteqykfqPESPSKLASAIQKAHEEGICGIRSVTRLENlmwkqitpelnhILSENEVKLTIMTGDIKGIMQ
4 DSGcvvswknKELKCGSGIFITDNvhtwteqYKFQPESPSKLASAIQKAHEEGICGIRSVTRLENlmwkqitpelnhILSENEVKLTIMTGDIKGIMQ
5 DSGCvvswknKELKCGSGIFITDNVhtwteqYKFQPESPSKLASAIQKAHEEGICGIRSVTRLENlmwkqitpelnhILSENEVKLTIMTGDIKGIMQ
6 DSGCVvswknkELKCGSGIFITDNVhtwteqYKFQPESPSKLASAIQKAHEEGICGIRSVTRLENlmwkqitpelnhILSEN EVKLTIMTGDIKGIMQ
7 DSGCVVswknkelKCGSGIFITDNVhtwteqYKFQPESPSKLASAIQKAHEEGICGIRSVTRlenlmwkqitpelnhILSENEVKLTIMTGDIKGIMQ

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2 AgkrslrpqptelkySWKTWKGAKMLSTeshnqtfLIDGPETAecpntnrAWNSLEVEDYGFVFTTNiWklrekqDVFCD SKLMSAAIKdnravha
3 AGkrslrpqptelkysWKTWKGAKMLSTeshnqtfLIDGPETAECpntnraWNSLEVEDYGFVFTTNiWklrekqDVFCD SKLMSAAIKdnravha
4 agkrSLRPQPTelkyswKTWKGAKmlsteshnqtfLIDGPETAECpntnraWNSLEVEDYGFVFTTNiWklrekqDVFCD SKLMSAAIKdnravha
5 agkrSLRPQPTelkyswKTWKGAKmlsteshnqtfLIDGPETAECpntnraWNSLEVEDYGFVFTTNiWklrekqDVFCD SKLMSAAIKdnravha
6 agkrslRPQPTelkyswktWKGAKMLsteshnqtfLIDGPETAECpntnraWNSLEVEDYGFVFTTNiWklrekqDVFCD SKLMSAAIKdnravha
7 agkrslRPQPTelkyswktWKGAKMLsteshnqtfLIDGPETAECpntnraWNSLEVEDYGFVFTTNiWklrekqDVFCD SKLMSAAIKdnravha

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3 DMGYWIESALNDTWKMEKASFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFagpvsqhnyrpgyytqtagPWHLGKLEMDFDCEGTTVVVtedcgnr
4 DMGYWIESALNDTWKMEKASFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFagpvsqhnyrpgyytqtagPWHLGKLEMDFDCEGTTVVVtedcgnr
5 DMGYWIESALNDTWKMEKASFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFAGpvsqhnyrpgyytqtagPWHLGKLEMDFDCEGTTVVVtedcgnr
6 DMGYWIESALNDTWKMEKASFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFAGPvsqhnyrpgyytqtagPWHLGKLEMDFDCEGTTVVVtedcgnr
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6 gpslrTTTASGKLITEWCCRScTlPPlryrgedGCWYGMEIRPLKEKEENLVNSLVTA
7 GPSLRTTTASGKLITEWCCRScTlPPlryrgedgcWYGMEIRPLKEKEENLVNSLVTA

DENV3

1 DMGCVINWKGKELKCGSGIFVTNEVHTWteqykfqadspkrlATAIAGAWENGVCGIRSTTRMenllwkqianelnyilwennikLTVVVGDIITGVLE
2 DMGCVINWKGKELKCGSGIFVTNEVHTWteqykfqadspkrlATAIAGAWENGVCGIRSTTRMenllwkqianelnyilwennikLTVVVGDIITGVLE
3 DMGCVINWKGKELKCGSGIFVTNEVHTWteqykfqadspkrlATAIAGAWENGVCGIRSTTRMenllwkqianelnyilwennikLTVVVGDIITGVLE
4 DMGCVINWKGKELKCGSGIFVTNEvhtwteqyKQADSprklataIAGAWENGVCGIRSTTRMENllwkqianelnyilwennikltVVVGDIITgvle
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6 DMGCVINWKGKELKCGSGIFVTNEVHtwteqykfqadspkrlATAIAGAWENGVCGIRSTTRMENllwkqianelnyilwenNIKLTVVVGDIITGVle
7 DMGCVINWKGKELKCGSGIFVTNEVHTwteqykfqadspkrLATAIAGAWENGVCGIRSTTRmenllwkqianelnyilwennIKLTVVVGDIITGVLe

1 qgkrtltppqpmelkYSWKTWKGAKIVTAetqnssfiIDGPSTPECPSASRAWNVWEVEDYGFGVFTTNIWLKLREYVYtqlcdhrLMSAAVKDERAVHA
2 QgkrtltppqpmelkySWKTWKGAKIVTAetqnssfiIDGPSTPECPSASRAWNVWEVEDYGFGVFTTNIWLKLREYVYtqlcdhr1MSAAVKDERAVHA
3 QQkrtltppqpmelkysWKTWKGAKIVTAetqnssfiIDGPSTPECPSASRAWNVWEVEDYGFGVFTTNIWLKLREYVYtqlcdhr1mSAAVKDERAVHA
4 qgkRTLTQPmelkysWKTWKGAKivtaetqnSSfiIDGPSTPECPSASRAWNVWEVEDYGFGVFTTNIWLKLREYVYtQLcdhr1msAAVKDERAVHA
5 qgkrTLTPQPMelkysWKTWKGAKIVtaetqnSSfiIDGPSTPECPSASRAWNVWEVEDYGFGVFTTNIWLKLREYVYtQLcdhr1msAAVKDERAVHA
6 qgkrtLTQPMElkysWKTWKGAKIVtaetqnsSfiIDGPSTPECPSASRAWNVWEVEDYGFGVFTTNIWLKLREYVYtQLcdhr1msAAVKDERAVHA
7 qgkrtLTQPMElkysWKTWKGAKIVtaetqnssfiIDGPSTPECPSASRAWNVWEVEDYGFGVFTTNIWLKLREYytqlcdhrLMSAAVKDERAVHA

1 DMGYWIEsqkngswKLEKASLIEVKCTWPKSHTLWSNGVLESDMIIPKSLAGPISqhnhrpgyhtqtagPWHLGKleldfnyceGTTVVISENCGR
2 DMGYWIESqkngswKLEKASLIEVKCTWPKSHTLWSNGVLESDMIIPKSLagpisqhnhrpgyHTQTAGPWHLGKleldfnyceGTTVVISENCGR
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4 DMGYwiesqkngswKLEKASLIEVKCTWPKSHTLWSNGVLESDMIIPKSLagpisqhnhrpgyHTQTAGPWHLGKleldfnycegtTVVISENCGR
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6 DMGYwiesqkngswKLEKASLIEVKCTWPKSHTLWSNGVLESDMIIPKSLAGpisqhnhrpgyHTQTAGPWHLGkleldfnyceGTTVVISENCGR
7 DMGYWiesqkngswKLEKASLIEVKCTWPKSHTLWSNGVLESDMIIPKSLAGPIsqhnhrpgyHTQTAGPWHLGleldfnyceGTTVVISENCGR

1 GPSLRTTTVSGKLIHEWCCRScTlpplrYMGEDGCWYGMEIRPINEKEENMVKSLASA
2 GPSLRTTTVSGKLIHEWCCRScTlpplryMGEDGCWYGMEIRPINEKEENMVKSLASA
3 GPSLRTTTVSGKLIHEWCCRScTlpplryMGEDGCWYGMEIRPINEKEENMVKSLASA
4 GPSLRTTTVSGKLIHEWCCRScTlpplryMGEDGCWYGMEIRPINEKEENMVKSLASA
5 GPSLRTTTVSGKLIHEWCCRScTLPplryMGEDGCWYGMEIRPINEKEENMVKSLASA
6 GPSLRTTTVSGKLIHEWCCRScTLPPlryMGEDGCWYGMEIRPINEKEENMVKSLASA
7 GPSLRTTTVSGKLIHEWCCRScTLPPLryMGEDGCWYGMEIRPINEKEENMVKSLASA

DENV4

1 DMGCVVSWSGKELKCGSGIFVADNVHTWteqykfqPESPARLASAILNAHKDGVCGIRSTTRLENvmwkqitnelnyVLWEGGHDLTVVAGDVKGVLt
2 DMGCVVSWSGKELKCGSGIFVADNVHTWteqykfqPESPARLASAILNAHKDGVCGIRSTTRLENvmwkqitnelnyVLWEGGHDLTVVAGDVKGVLt
3 DMGCVVSWSGKELKCGSGIFVADNVHTWteqykfqPESPARLASAILNAHKDGVCGIRSTTRLENvmwkqitnelnyVLWEGGHDLTVVAGDVKGVLt
4 DMGCVVSWSGKELKCGSGIFVADNVhtwteqYKFQPEPARLASAILNAHKDGVCGIRSTTRLENvmwkqitnelnyVLWEGGHDLTVVAGDVKGvlt
5 DMGCVVSWSGKELKCGSGIFVADNVhtwteqYKFQPEPARLASAILNAHKDGVCGIRSTTRLENvmwkqitnelnyVLWEGGHDLTVVAGDVKGvlt
6 DMGCVVSWSGKELKCGSGIFVADNVhtwteqYKFQPEPARLASAILNAHKDGVCGIRSTTRLENvmwkqitnelnyVLWEGGHDLTVVAGDVKGvlt
7 DMGCVVSWSGKELKCGSGIFVADNVhtwteqYKFQPEPARLASAILNAHKDGVCGIRSTTRlenvmwkqitnelnYVLWEGGHDLTVVAGDVKGVLt

1 kgkraltppvndlkYSWKTWKGAKIFTPEarnstfLIDGPDtsecpnerRAWNFLEVEDYGFGMFTTNIWMKFREGSsevcdhrLMSAAIKDQKAVHA
2 KgkraltppvndlkySWKTWKGAKIFTPEarnstfLIDGPDtsecpnerrAWNfLEVEDYGFGMFTTNIWMKFREGSsevcdhr1MSAAIKDQKAVHA
3 KGkraltppvndlkysWKTWKGAKIFTPEarnstfLIDGPDtsecpnerrawnfLEVEDYGFGMFTTNIWMKFREGSSEvcdhr1mSAAIKDQKAVHA
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6 kgkrALTppvndlkysWKTWKGAKiftpearnSTFLIDGPDtsecpnerrawnfLEVEDYGFGMFTTNIWMKFREGSSEvcdhr1msAAIKDQKAVHA
7 kgkrALTppvndlkysWKTWKGAKiftpearnSTFLIDGPDtsecpnerrawnfLEVEDYGFGMFTTNIWMKFREGSsevcdhrLMSAAIKDQKAVHA

1 DMGYWIEssknqtWQIEKASLIEVKTC LWPKHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIqedcdhr
2 DMGYWIESsknqtWQIEKASLIEVKTC LWPKHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIqedcdhr
3 DMGYWIESSknqtWQIEKASLIEVKTC LWPKHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQedcdhr
4 DMGYwiessknqtWQIEKASLIEVKTC LWPKHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQedcdhr
5 DMGYwiessknqtWQIEKASLIEVKTC LWPKHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQedcdhr
6 DMGYwiessknqtWQIEKASLIEVKTC LWPKHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQedcdhr
7 DMGYWIEssknqtWQIEKASLIEVKTC LWPKHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIqedcdhr

1 GPSLRTTTASGKLVTQWCCRSC TMPLRFLGEDGCWYGMEIRPLSEKEENMVKSQVTA
2 gPSLRTTTASGKLVTQWCCRSC TMPLRFLGEDGCWYGMEIRPLSEKEENMVKSQVTA
3 gpSLRTTTASGKLVTQWCCRSC TMPLRFLGEDGCWYGMEIRPLSEKEENMVKSQVTA
4 gpsLRTTTASGKLVTQWCCRSC TMPLRFLGEDGCWYGMEIRPLSEKEENMVKSQVTA
5 gpslRRTTTASGKLVTQWCCRSC TMPLRFLGEDGCWYGMEIRPLSEKEENMVKSQVTA
6 gpslrTTTASGKLVTQWCCRSC TMPLRFLGEDGCWYGMEIRPLSEKEENMVKSQVTA
7 GPSLRTTTASGKLVTQWCCRSC TMPLRFLGEDGCWYGMEIRPLSEKEENMVKSQVTA

Appendix S2: peptide libraries of NS1 proteins of DENV serotypes bind to antibody 1G5.3

DENV1

1 dsgcvinWKGRELKcgsgifvtnevhtwTEQYKFQADSPKRLSAAIGKAWEEGVCGIRSATRLENIMWKQisnelnhillendmkftvvvgDVSgILA
2 DsgcvinwKGRELKcgsgifvtnevhtwTEQYKFQADSPKRLSAAIGKAWEEGVCGIRSATRLEnimwkqisnelnhillendmkftvvvgdVSGILA
3 DSGcvinwkGRELKCGsgifvtnevhtwTEQYKFQADSPKRLSAAIGKAWEEGVCGIRSATRLEnimwkqisnelnhillendmkftvvvgdvSGILA
4 DSGcvinwkGRELKCGsgifvtnevhtwTEQYKFQADSPKRLSAAIGKAWEEGVCGIRSATRLEnimwkqisnelnhilleNDMKFTvvvgdvsGILA
5 DSGCvinwkgrELKCGSGifvtnevHTWTEQYKFQADSPKRLSAAIGKAWEEGVCGIRSATRLENIMwkqisnelnhilleNDMKFTVvvgdvsgILA
6 DSGCVINWKGRELKCGSGIfvtnevHTWTEQYKFQADSPKRLSAAIGKAWEEGVCGIRSATRLENIMWKqisnelnhillendmkftvvvGDVSGILA
7 DSGCVINWKGRELKCGSGIfvtnevHTWTEQYKFQADSPKRLSAAIGKAWEEGVCGIRSATRLENIMWKqisnelnhillendmkftvvvGDVSGILA

1 QGKKMIRPQPMEHKyswkswgkakiigaDVQNTTFIIDGPNTPECPDNQrawnawevedygfgIFTTNIWLKLDSYTVQCDHRLMSAAIKdskavha
2 QGKKMIRPQPMEHKyswkswgkakiigadVQNTTFIIDGPNTPECPDNQrawnaweVEDYGFIFTTNIWLKLDSYTVQCDHRLMSAAIKdskavha
3 QGKKMIRPQPMEHKyswkswgkakiigadVQNTTFIIDGPNTPECPDNQrawnaweVEDYGFIFTTNIWLKLDSYTVQCDHRLMSAAIKdskavha
4 QGKKMIRPQPMehkyswksWGKAKIigadvQNTTFIIDGPNTPECPdnqrawnawevedYGFIFTTNIWLKLDSYTVQCDHRLMSAAIKdskavha
5 QGKKMIRPQPMehkyswksWGKAKIigadvQNTTFIIDGPNTPECPdnqrawnawevedYGFIFTTNIWLKLDSYTVQCDHRLMSAAIKdskavha
6 QGKKMIRPQPMehkyswkswgkakiigADVQNTTFIIDGPNTPECPdnqrawnawevedyFGIFTTNIWLKLDSYTVQCDHRLMSAAIKdskavha
7 QGKKMIRPQPMEHkyswkswgkakiigADVQNTTFIIDGPNTPECPdnqrawnawevedyFGIFTTNIWLKLDSYTVQCDHRLMSAAIKdskavha

1 dmgywieSEKNETWKLARASFIEVKTCIWPKSHTLwsngvleSEMIIPKIYGGPISQHNYPGYFTQTAGPwhlgkleldfdlcegttvvvDEHCGNR
2 dmgywiesEKNETWKLARASFIEVKTCIWPKSHTLwsngvleSEMIIPKIYGGPISQHNYPGYFTQTAGPwhlgkleldfdlcegttvvvdEHCGNR
3 dmgywieseKNETWKLARASFIEVKTCIWPKSHTLwsngvleseMIIPKIYGGPISQHNYPGYFTQTAGPwhlgkleldFDLCEGttvvvdeHCGNR
4 dmgywiesekNETWKLARASFIEVKTCIWPKSHTLwsngvlesemiIPKIYGGPISQHNYPGYFTQTAGPwhlgkleldFDLCEGttvvvdehCGNR
5 dmgywiesekNETWKLARASFIEVKTCIWPKSHTLwsngvlesemiIPKIYGGPISQHNYPGYFTQTAGPwhlgkleldFDLCEGttvvvdehcgNR
6 dmgywiesekneTWKLARASFIEVKTCIWPKSHTLwsngvlesemiIPKIYGGPISQHNYPGYFTQTAGPwhlgkleldfdlcegttvvvdehcgNR
7 dmgywieSEKNETWKLARASFIEVKTCIWPKSHTlwsngvleSEMIIPKIYGGPISQHNYPGYFTQTAGPwhlgkleldfdlcegttvvvDEHCGNR

1 GPSLRTTvtvgktiHEWCCRSTLPPLRFKGEDGcwgygmeirPVKEKEENLVKSMVSA
2 GPSLRTTvtvgktihEWCCRSTLPPLRFKGEDGcwgygmeirPVKEKEENLVKSMVSA
3 GPSLRTTvtvgktihEWCCRSTLPPLRFKgedgcygMEIRPVKEKEENLVKSMVSA
4 GPSLRTTvtvgktihEWCCRSTLPPLRFKgedgcygMEIRPVKEKEENLVKSMVSA
5 GPSLRTTvtvgktihewCCRSTLPPLRFKGEDgcygMEIRPVKEKEENLVKSMVSA
6 GPSLRTTvtvgktihewCCRSTLPPLRFKGEDgcygMEIRPVKEKEENLVKSMVSA
7 GPSLRTTvtgktihewCCRSTLPPLRFKGEDgcygMEIRPVKEKEENLVKSMVSA

DENV2

1 dsgcvvsWKNKELKCGSGIFITdnvhtwTEQYKFQPEPSKLASAIQKAHEEGICGIRSVTRLENLMWKQitpelnhilseneVKLTIMTGDIKGIMQ
2 DsgcvvsWKNKELKCGSGIFITdnvhtwTEQYKFQPEPSKLASAIQKAHEEGICGIRSVTRLENlmwkqitpelnhilSENEVKLTIMTGDIKGIMQ
3 DSGcvvsWKNKELKCGSGIFITDnvhtwTEQYKFQPEPSKLASAIQKAHEEGICGIRSVTRLENlmwkqitpelnhilSENEVKLTIMTGDIKGIMQ
4 DSGcvvsWKNKELKCGSGIFITDnvhtwTEQYKFQPEPSKLASAIQKAHEEGICGIRSVTRLENlmwkqitpelnhilSENEVKLTIMTGDIKGIMQ
5 DSGCvvsWKNKELKCGSGIfitdnvHTWTEQYKFQPEPSKLASAIQKAHEEGICGIRSVTRLENlmwkqitpelnhilSENEVKLTIMTGDIKGIMQ
6 DSGCVVSWKNKELKCGSGIfitdnvHTWTEQYKFQPEPSKLASAIQKAHEEGICGIRSVTRLENLMWKqitpelnhilsenEVKLTIMTGDIKGIMQ
7 DSGCVVSWKNKELKCGSGIfitdnvHTWTEQYKFQPEPSKLASAIQKAHEEGICGIRSVTRLENLMWKqitpelnhilseneVKLTIMTGDIKGIMQ

1 AGKRSLRPQPTELKyswktwgkakmlstESHNQTFLIDGPETAACPNTNrawnslevedygfgVFTTNIWLKLREKQdvfcDSLMSAAIKdnravha
2 AGKRSLRPQPTELKYswktwgkakmlstESHNQTFLIDGPETAACPNTNrawnsleVEDYGFVFTTNIWLKLREKQDVFCDSLMSAAIKdnravha
3 AGKRSLRPQPTELKYSwktwgkakmlstesHNQTFLIDGPETAACPNTNRAWnslevedYGFVFTTNIWLKLrekqdvFCDSLMSAAIKDNravha
4 AGKRSLRPQPTelkyswktwgkakmlsteshNQTFLIDGPETAACPNTNRAWnslevedYGFVFTTNIWLKLrekqdvFCDSLMSAAIKDNravha
5 AGKRSLRPQPTelkyswktwgkakmlsteshNQTFLIDGPETAACPNTNRAWnslevedYGFVFTTNIWLKLrekqdvfcDSLMSAAIKDNRAvha
6 AGKRSLRPQPTelkyswktwgkakmlstESHNQTFLIDGPETAACPNTNRAWNSlevedyFGVFTTNIWLKLREkqdvfcDSLMSAAIKdnravha
7 AGKRSLRPQPTELkyswktwgkakmlstESHNQTFLIDGPETAACPNTnrawnslevedygfgVFTTNIWLKLREKQdvfcDSLMSAAIKdnravha

1 dmgywiesalndtwKMEKASFIEVKSCHWPKSHTLwsngvleSEMIIPKSFAGPVSQHNYRPGYYTQTAGPwhlgkleMDFDFCEgttvvvtedCGNR
2 dmgywiesalndtwKMEKASFIEVKSCHWPKSHTLwsngvleseMIIPKSFAGPVSQHNYRPGYYTQTAGPwhlgkleMDFDFCEgttvvvtedCGNR
3 dmgywiesalndtwKMEKASFIEVKSCHWPKSHTLwsngvleseMIIPKSFAGPVSQHNYRPGYYTQTAGPwhlgkleMDFDFCEgttvvvtedCGNR
4 dmgywiesalndtwKMEKASFIEVKSCHWPKSHTLwsngvlesemiIPKSFAGPVSQHNYRPGYYTQTAGPwhlgkleMDFDFCEgttvvvtedCGNR
5 dmgyWIESALndtwKmekASFIEVKSCHWPKSHTLwsngvlesemiIPKSFAGPVSQHNYRPGYYTQTAGPwhlgkleMDFDFCEgttvvvtedcGNR
6 dmgywIESALndtwKmekASFIEVKSCHWPKSHTLwsngvlesemiIPKSFAGPVSQHNYRPGYYTQTAGPwhlgkleMDFDFCEgttvvvtedcGNR
7 dmgywIESALNDtwKmekASFIEVKSCHWPKSHTlwsngvleSEMIIPKSFAGPVSQHNYRPGYYTQTAGPwhlgkleMDFDFCEgttvvvtedcGnR

1 GPSLRTTtasgkliTEWCCRSTLPPLRyrgedgcwygmeIRPLKEKEENLVNSLVTA
2 GPSLRTTTasgklitEWCCRSTLPPLryRGEDGCWygmeIRPLKEKEENLVNSLVTA
3 GPSLRTTTASgklitewCCRSTLPPLryrgedgcwygMEIRPLKEKEENLVNSLVTA
4 GPSLRTTTASgklitewCCRSTLPPLryrgedgcwygMEIRPLKEKEENLVNSLVTA
5 GPSLRTTTASGklitewCCRSTLPPLryrgedgcwygMEIRPLKEKEENLVNSLVTA
6 GPSLRTTTASGklitewCCRSTLPPLryrgedgcwygMEIRPLKEKEENLVNSLVTA
7 GPSLRTTtasgklitewCCRSTLPPLryrgedgcwygmeIRPLKEKEENLVNSLVTA

DENV3

1 dmGcvinwKGKELKcgsgifvtnevhtwTEQYKFQADSPKRLATAIAGAWENGVCGIRSTTRMENLLWKQianelnyilwennikltvvvgDITGVLE
2 DMgcvinwKGKELKcgsgifvtnevhtwTEQYKFQADSPKRLATAIAGAWENGVCGIRSTTRMENllwkqianelnyilWENNikltvvvgdITGVLE
3 DMgcvinwKGKELKcgsgifvtnevhtwTEQYKFQADSPKRLATAIAGAWENGVCGIRSTTRMENllwkqianelnyilWENNikltvvvgditGVLE
4 DMGcvinwkgKELKCGSgifvtnevhtwteqYKFQADSPKRLATAIAGAWENGVCGIRSTTRMENLlwKqianelnyilwENNikltvvvgditGVLE
5 DMGCvinwkgKELKCGSGifvtnevHTWTEQYKFQADSPKRLATAIAGAWENGVCGIRSTTRMENLlwKqianelnyilweNNikltVvvgditgVLE
6 DMGCVINWKGKELKCGSGIfvtnevhtwTEQYKFQADSPKRLATAIAGAWENGVCGIRSTTRMENLLWkqianelnyilwennikltvvvgDITGVLE
7 DMGCVINWKGKELKCGSGIFvtnevhtwTEQYKFQADSPKRLATAIAGAWENGVCGIRSTTRMENLLWkqianelnyilwennikltvvvgDITGVLE

1 QGKRTLTPQPMELKyswktwggkakivtaETQNSSFIIDGPSTPECPSASrawnvwevedygfgVFTTNIWLKLREYVTQLCDHRLmsaavkderavha
2 QGKRTLTPQPMELKYswktwggkakivtaETQNSSFIIDGPSTPECPSASrawnvweVEDYGFgVFTTNIWLKLREYVTQLCDHRLmsaavkderavha
3 QGKRTLTPQPMELKYSwktwggkakivtaETQNSSFIIDGPSTPECPSASrawnvwevedYGFgVFTTNIWLKLREYVTQLCDHRLmsaavkderavha
4 QGKRTLTPQPMelkyswktwGKAKivtaetqNSSFIIDGPSTPECpsasrawnvwevedYGFgVFTTNIWLKLREYVTQLCDHRLmsaavkderavha
5 QGKRTLTPQPMelkyswktwGKAKivtaetqNSSFIIDGPSTPECpsasrawnvwevedYGFgVFTTNIWLKLREYVTQLCDHRLmsaavkderavha
6 QGKRTLTPQPMelkyswktwggkakivTAETQNSSFIIDGPSTPECPSasrawnvwevedygFGVFTTNIWLKLREYVTQLCDHRLmsaavkderavha
7 QGKRTLTPQPMELkyswktwggkakivTAETQNSSFIIDGPSTPECPSASrawnvwevedygfgVFTTNIWLKLREYVTQLCDHRLmsaavkderavha

1 dmgywiesqkngswKLEKASLIEVKTCTWPKSHTLwsngvlesDMIIPKSLAGPISQHNHRPGYHTQTAGPwhlgkleldfNYcegttvviSENCGTR
2 dmgywiesqkngswKLEKASLIEVKTCTWPKSHTLwsngvlesDMIIPKSLAGPISQHNHRPGYHTQTAGPwhlgkleldfNYcegttvvisENCGTR
3 dmgywiesqkngswkleKASLIEVKTCTWPKSHTLwsngvlesdMIIPKSLAGPISQHNHRPGYHTQTAGPwhlgkleldfNYcegttvvisENCGTR
4 dmgywiesqkngswkleKASLIEVKTCTWPKSHTLwsngvlesdMIIPKSLAGPISQHNHRPGYHTQTAGPwhlgkleldfNYcegttvvisENCGTR
5 dmgywIESQKNGswkleKASLIEVKTCTWPKSHTLwsngvlesdMIIPKSLAGPISQHNHRPGYHTQTAGPwhlgkleldfNYcegttvvisencGTR
6 dmgywIESQKNGswklekaSLIEVKTCTWPKSHTLwsngvlesdMIIPKSLAGPISQHNHRPGYHTQTAGPwhlgkleldfNYcegttvvisencGTR
7 dmgywiESQKNGSwklekaSLIEVKTCTWPKSHTLwsngvlesdMIIPKSLAGPISQHNHRPGYHTQTAGPwhlgkleldfnycegttvviSENCGTR

1 GPSLRTTtvsgkliHEWCCRSTLpPLRymgedgcwygmeirPINEKEENMVKSLASA
2 GPSLRTTtvsgkliHEWCCRSTlppLryMGEDGCWygmeirPINEKEENMVKSLASA
3 GPSLRTTtvsgkliHEWCCRSTLpplrymgedgcwygMEIRPINEKEENMVKSLASA
4 GPSLRTTtvsgkliHEWCCRSTLpplrymgedgcwygMEIRPINEKEENMVKSLASA
5 GPSLRTTtvsgkliHEWCCRSTLpLrymgedgcwygmEIRPINEKEENMVKSLASA
6 GPSLRTTtvsgkliHEWCCRSTLpLrymgedgcwygmeIRPINEKEENMVKSLASA
7 GPSLRTTtvsgkliHEWCCRSTLpPLrymgedgcwygmeIRPINEKEENMVKSLASA

DENV4

1 dmgcvvswSGKELKCGSGIFVadnvhtwTEQYKFQEPESPARLASAILNAHKDGVCGIRSTTRLENVMWQKitnelnyvlewghdltvvagDVKGVLT
2 DMgcvvswSGKELKCGSGIFVadnvhtwTEQYKFQEPESPARLASAILNAHKDGVCGIRSTTRLENvmwqkitnelnyvlewghdltvvagdVKGVL
3 DMgcvvswSGKELKCGSGIFVADnvhtwTEQYKFQEPESPARLASAILNAHKDGVCGIRSTTRLENvmwqkitnelnyvlewghdltvvagdVKGVL
4 DMGcvvswsgKELKCGSGIFVADNVhtwteqYKFQEPESPARLASAILNAHKDGVCGIRSTTRLENvmwqkitnelnyvlewghdltvvagdVKGVL
5 DMGCvvswsgKELKCGSGIfvadnvHTWTEQYKFQEPESPARLASAILNAHKDGVCGIRSTTRLENVMwkqitnelnyvlewghdltvvagdVKGVL
6 DMGCVVSWSGKELKCGSGIfvadnvHTWTEQYKFQEPESPARLASAILNAHKDGVCGIRSTTRLENVMwkqitnelnyvlewghdltvvAGDVKGVL
7 DMGCVVSWSGKELKCGSGIFvadnvHTWTEQYKFQEPESPARLASAILNAHKDGVCGIRSTTRLENVMWkqitnelnyvlewghdltvvaGDVKGVL

1 KGKRALTPPVNDLkyswktwGKAKIFTPEARNSTFLIDGPDSECPNERrawnflevedygfgMFTTNIWMKFREGSSEVCDHRLMSAAIKdqkavha
2 KGKRALTPPVNDLkyswktwGKAKIFTPEARNSTFLIDGPDSECPNERRawnflevedygfgMFTTNIWMKFREGSSEVCDHRLMSAAIKdqkavha
3 KGKRALTPPVNDLkyswktwGKAKIFTPEARNSTFLIDGPDSECPNERRawnflevedygfgMFTTNIWMKFREGSSEVCDHRLMSAAIKDQkavha
4 KGKRALTPPVndlkyswktwGKAKIFTPEARNSTFLIDGPDSECPNERRawnflevedygfgMFTTNIWMKFREGSSEVCDHRLMSAAIKDQkavha
5 KGKRALTPPVndlkyswktwGKAKIFTPEARNSTFLIDGPDSECPNERRawnflevedygfgMFTTNIWMKFREGSSEVCDHRLMSAAIKDQKAvha
6 KGKRALTPPVNDlkyswktwGKAKIFTPEARNSTFLIDGPDSECPNERRawnflevedygfgMFTTNIWMKFREGSSEVCDHRLMSAAIKdqkavha
7 KGKRALTPPVNDLkyswktwGKAKIFTPEARNSTFLIDGPDSECPNERRawnflevedygfgMFTTNIWMKFREGSSEVCDHRLMSAAIKdqkavha

1 dmgywiessknqtwQIEKASLIEVKTCLWPKTHTLWSNGVLESQMLIPKSYAGPFSQHNYRQGYatqtvpgpwhlgkleIDFGECpgttvtiQEDCDHR
2 dmgywiessknqtwQIEKASLIEVKTCLWPKTHTLWSNGVLESQMLIPKSYAGPFSQHNYRQGYatqtvpgpwhlgkleIDFGECpgttvtiQEDCDHR
3 dmgywiessknqtwqIEKASLIEVKTCLWPKTHTLWSNGVLESQMLIPKSYAGPFSQHNYRQGYATqtvpgpwhlgkleIDFGECpgttvtiQEDCDHR
4 dmgywiessknqtwqIEKASLIEVKTCLWPKTHTLWSNGVLESQMLIPKSYAGPFSQHNYRQGYATqtvpgpwhlgkleIDFGECpgttvtiQEDCDHR
5 dmgyWIESSKNqtwqIEKASLIEVKTCLWPKTHTLWSNGVLESQMLIPKSYAGPFSQHNYRQGYATQTVpgpwhlgkleIDFGECpgttvtiQEDCDHR
6 dmgyWIESSKNqtwqIEKASLIEVKTCLWPKTHTLWSNGVLESQMLIPKSYAGPFSQHNYRQGYATQTVpgpwhlgkleIDFGECpgttvtiQEDCDHR
7 dmgyWIESSKNQTWqIEKASLIEVKTCLWPKTHTLWSNGVLESQMLIPKSYAGPFSQHNYRQGYATQTVGPWHLGKleIDFGECpgttvtiQEDCDHR

1 GPSLRTTtasgklvTQWCCRSCMPPLRflgedgcwygmeIRPLSEKEENMVKSQVTA
2 GPSLRTTTasgklvTQWCCRSCMPPLRflgedgcwygmeIRPLSEKEENMVKSQVTA
3 GPSLRTTTasgklvTQWCCRSCMPPLRflgedgcwygmeIRPLSEKEENMVKSQVTA
4 GPSLRTTTasgklvTQWCCRSCMPPLRflgedgcwygmeIRPLSEKEENMVKSQVTA
5 GPSLRTTTasgklvTQWCCRSCMPPLRflgedgcwygmeIRPLSEKEENMVKSQVTA
6 GPSLRTTTasgklvTQWCCRSCMPPLRflgedgcwygmeIRPLSEKEENMVKSQVTA
7 GPSLRTTTasgklvTQWCCRSCMPPLRflgedgcwygmeIRPLSEKEENMVKSQVTA

Appendix S3: peptide libraries of NS1 proteins of DENV serotypes bind to antibody GUS2

DENV1

1 dsgcvinwKGRELKCGSGIFVTNEVHTWteqykfqADSPKRLSAAIGKAWEEGVCGIRSATRLenimwkqISNELNHILLENDMKFTVVVGDVSGILA
2 DsgcvinwKGRELKCGSGIFVTNEVHTWteqykfqADSPKRLSAAIGKAWEEGVCGIRSATRLenimwkqiSNELNHILLENDMKFTVVVGDVSGILA
3 DSGcvinwkGRELKCGSGIFVTNEVHTWteqykfqADSPKRLSAAIGKAWEEGVCGIRSATRLenimwkqisNELNHILLENDMKFTVVVGDVsgila
4 DSGcvinwkGRELKCGSGIFVTNEvhtwteqykfqADSPKRLSAAIGKAWEEGVCGIRSATRLenimwkqisNELNHILLENDMKFTVVVGDVsgila
5 DSGCvinwkgRELKCGSGIFVTNEvhtwteqyKFQADSPKRLSAAIGKAWEEGVCGIRSATrlenimWKQISNELNHILLENDMKFTVVVGDVSGila
6 DSGCVinwkgRELKCGSGIFVTNEVHTwteqyKFQADSPKRLSAAIGKAWEEGVCGIRSATrlenimWKQISNELNHILLENDMKFTVVVGDVSGila
7 DSGCVinwkgRELKCGSGIFVTNEVHTwteqyKFQADSPKRLSAAIGKAWEEGVCGIRSATrlenimWKQISNELNHILLENDMKFTVVVGDVSGILA

1 qgkkmirppmehkyswksWGKAKIIGadvqnttFIIDGPNTpecpdnqrawniweVEDYGFGITFTNIWLKLDSYTVQCDHRLMSAAIKDSKAVHA
2 QgkkmirppmehkyswksWGKAKIIGadvqnttFIIDGPNTpecpdnqrawniweVEDYGFGITFTNIWLKLDSYTVQCDHRLMSAAIKDSKAVHA
3 qgkkmirppmehkyswksWGKAKIIGadvqnttFIIDGPNTpecpdnqrawniweVEDYGFGITFTNIWLKLDSYTVQCDHRLMSAAIKDSKAVHA
4 qgkkmirppmehkyswksWGKAKIIGadvqnttFIIDGPNTpecpdnqrawniweVEDYGFGITFTNIWLKLDSYTVQCDHRLMSAAIKDSKAVHA
5 qgkkmirppmehkyswksWGKAKIIGadvqnttFIIDGPNTpecpdnqrawniweVEDYGFGITFTNIWLKLDSYTVQCDHRLMSAAIKDSKAVHA
6 qgkkmirppmehkyswksWGKAKIIGadvqntFIIDGPNTpecpdnqrawniweVEDYGFGITFTNIWLKLDSYTVQCDHRLMSAAIKDSKAVHA
7 qgkkmirppmehkyswksWGKAKIIGadvqntFIIDGPNTpecpdnqrawniweVEDYGFGITFTNIWLKLDSYTVQCDHRLMSAAIKDSKAVHA

1 dmgywieseknetwKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGPISqhnryrpgyftqtagPWHLGKLELDFDLCEGTTVVVDEHCGNR
2 DmgywieseknetwKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGPISqhnryrpgyftqtagPWHLGKLELDFDLCEGTTVVVDEHCGNR
3 DMgywieseknetwKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGPISqhnryrpgyftqtagPWHLGKLELDFDLCEGTTVVVDEHCGNR
4 DMgywieseknetwKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGPISqhnryrpgyftqtagPWHLGKLELDFDLCEGTTVVVDEHCGNR
5 dmgywieseknetwKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGPISqhnryrpgyftqtagPWHLGKLELDFDLCEGTTVVVDEHCGNR
6 dmgywieseknetwKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGPISqhnryrpgyftqtagPWHLGKLELDFDLCEGTTVVVDEHCGNR
7 dmgywieseknetwKLARASFIEVKTCIWPKSHTLWSNGVLESEMIIPKIYGGPISqhnryrpgyftqtagPWHLGKLELDFDLCEGTTVVVDEHCGNR

1 GPSLRTTTVTGKTIHEWCCRSCtlpplrFKGEDGCWYGMEIRPVKEEENLVKSMVSA
2 GPSLRTTTVTGKTIHEWCCRSCtlpplrFKGEDGCWYGMEIRPVKEEENLVKSMVSA
3 GPSLRTTTVTGKTIHEWCCRSCtlpplrFKGEDGCWYGMEIRPVKEEENLVKSMVSA
4 GPSLRTTTVTGKTIHEWCCRSCtlpplrFKGEDGCWYGMEIRPVKEEENLVKSMVSA
5 GPSLRTTTVTGKTIHEWCCRSCtlpplrFKGEDGCWYGMEIRPVKEEENLVKSMVSA
6 GPSLRTTTVTGKTIHEWCCRSCtlpplrFKGEDGCWYGMEIRPVKEEENLVKSMVSA
7 GPSLRTTTVTGKTIHEWCCRSCtlpplrFKGEDGCWYGMEIRPVKEEENLVKSMVSA

DENV2

1 dsgcvvswknkelkCGSGIFITDNVHTWteqykfqPESPSKLasaiqkaHEEGICGIRSVTRlenlmwkqITPELNHILSENEVKLTIMTGDIKGIMQ
2 DsgcvvswknkelkCGSGIFITDNVHTWteqykfqPESPSKLasaiqkahEEGICGIRSVTRlenlmwkqiTPELNHILSENEVKLTIMTGDIKGIMQ
3 DSGcvvswkNKLKCGSGIFITDNVHTWteqykfqPESPSKLASaiqkaheEGICGIRSVTRLENlmwkqitPELNHILSENEVKLTIMTGDIKGIMQ
4 DSGcvvswknKELKCGSGIFITDNvhtwteqykfqpesPSKLASaiqkaheEGICGIRSVTRLENlmwkqitPELNHILSENEVKLTIMTGDIKGIMQ
5 DSGCvvswknKELKCGSGIFITDNVhtwteqyKQPESPSklasaiqkaheegICGIRSVtrlenlmWKQITPELNHILSENEVKLTIMTGDIKGIMQ
6 DSGCVvswknkelKCGSGIFITDNVhtwteqyKQPESPSklasaiqkaHEEGICGIRSVTrlenlmwkQITPELNHILSENEVKLTIMTGDIKGIMQ
7 DSGCvvswknkelKCGSGIFITDNVhtwteqykfQPESPSKlasaiqkaHEEGICGIRSVTRlenlmwkQITPELNHILSENEVKLTIMTGDIKGIMQ

1 AGKRSLRPQPTELkyswktwgKAKMLSteshnqtfLIDGPETAECPNTNrawnsleVEDYGFGVFTTNIWLKLREKQDVFCD SKLMSAAIKDNRAVHA
2 AGKRSLRPQPTELKyswktwgKAKMLSteshnqtfLIDGPETAECPNTNrawnsleVEDYGFGVFTTNIWLKLREKQDVFCD SKLMSAAIKDNRAVHA
3 AGKRSLRPQptelkyswktwgKAKmlsteshnqtfLIDGPETAECpntnrawnsLEVEDYGFGVFTTNIWLKLREKQDVFCD SKLMSAAIKDNRAVHA
4 AGKRSLRPQPTelkyswktwgKAKmlsteshnqtfLIDGPETAECpntnrawnsLEVEDYGFGVFTTNIWLKLREKQDVFCD SKLMSAAIKDNRAVHA
5 AGKRSLRPQPTelkyswktwgKAKmlsteshnqtfLIDGPETAECpntnrawnsLEVEDYGFGVFTTNIWLKLREKQDVFCD SKLMSAAIKDNRAVha
6 AGKRSLRPQPTelkyswktwgKAKMLsteshnqtfLIDGPETAECpntnrawnsLEVEDYGFGVFTTNIWLKLREKQDVFCD SKLMSAAIKDNRAVha
7 AGKRSLRPQPTELkyswktwgKAKMLsteshnqtfLIDGPETAECPNTnrawnsLEVEDYGFGVFTTNIWLKLREKQDVFCD SKLMSAAIKDNRAVha

1 dmgywiesalndtwKMEKASFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFAGPVSqhnyrpgyytqtagPWHLGKLEMDFDCEGTTVVVTEDCGNR
2 DmgywiesalndtwkMEKASFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFagpvsqhnyrpgyyTQTAGPWHLGKLEMDFDCEGTTVVVTEDCGNR
3 DMgywiesalndtwkMEKASFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFagpvsqhnyrpgyyTQTAGPWHLGKLEMDFDCEGTTVVVTEDCGNR
4 DMGywiesalndtwkMEKASFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFagpvsqhnyrpgyytQTAGPWHLGKLEMDFDCEGTTVVVTEDCGNR
5 dmgyWIESALNdtwkmekASFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFAGpvsqhnyrpgyytQTAGPWHLGKLEMDFDCEGTTVVVTEDCGNR
6 dmgywIESALNdtwkmekaSFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFAGPvsqhnyrpgyytQTAGPWHLGKLEMDFDCEGTTVVVTEDCGNR
7 dmgywiesalndtWKMEKASFIEVKSCHWPKSHTLWSNGVLESEMIIPKSFAGPVsqhnyrpgyytQTAGPWHLGKLEMDFDCEGTTVVVTEDCGNR

1 GPSLRTTTASGKLITEWCCRScTlpllryrgedgcWYGMEIRPLKEKEENLVNSLVTA
2 GPSLRTTTASGKLITEWCCRScTlpllryRGEDGCWYGMEIRPLKEKEENLVNSLVTA
3 GPSLRTTTASGKLITEWCCRScTlpllryrGEDGCWYGMEIRPLKEKEENLVNSLVTA
4 GPSLRTTTASGKLITEWCCRScTLpllryrgEDGCWYGMEIRPLKEKEENLVNSLVTA
5 GPSLRTTTASGKLITEWCCRScTLPpllryrgEDGCWYGMEIRPLKEKEENLVNSLVTA
6 GPSLRTTTASGKLITEWCCRScTLPPllryrgedGCWYGMEIRPLKEKEENLVNSLVTA
7 GPSLRTTTASGKLITEWCCRScTLPPLlryrgedgcWYGMEIRPLKEKEENLVNSLVTA

DENV3

1 dm^gcvin^wKGKELKCGSGIFVTNEVHTW^{teqykfq}ADSPKRLATAIAGAWENGVCGIRSTTRME^{nllwkq}IANELNY^{ilwennik}LTVVVGDI^{TGVLE}
2 DM^gcvin^wKGKELKCGSGIFVTNEVHTW^{teqykfq}ADSPKRLATAIAGAWENGVCGIRSTTRME^{nllwkq}IANELNY^{ilwennik}LTVVVGDI^{TGVLE}
3 DM^gcvin^wKGKELKCGSGIFVTNEVHTW^{teqykfq}ADSPKRLATAIAGAWENGVCGIRSTTRME^{nllwkq}IANELNY^{ilwennik}LTVVVGDI^{TGVLE}
4 DM^gcvin^wKGKELKCGSGIFVTNE^{vhtwteqykfq}ADSPKRLATAIAGAWENGVCGIRSTTRMEN^{Llwq}IANELNY^{ilwennik}LTVVVGDI^{TGVLE}
5 DMGC^{vinw}kgKELKCGSGIFVTNEV^{htwteqy}KFQADSPKRLATAIAGAWENGVCGIRST^{trmen}llWKQIANE^{lnyilwe}NNIKLTVVVGDI^{TGVLE}
6 DMGC^{vinw}kgKELKCGSGIFVTNEVHT^{wteqyk}FQADSPKRLATAIAGAWENGVCGIRSTT^{rmen}llWKQIANEL^{nyilwen}NIKLTVVVGDI^{TGVLE}
7 DMGC^{vinw}kgkelKCGSGIFVTNEVHT^{wteqyk}FQADSPKRLATAIAGAWENGVCGIRSTTR^{men}llWKQIANELNY^{ilwennik}LTVVVGDI^{TGVLE}

1 QGKRTLTPQPMELK^{yswktw}gKAKIVTA^{aetqnssfi}IDGPSTPECPSAS^{rawnvw}EVEDYGF^{GVFTTNIWLKL}RE^{VYTQLCDHRLMSAAVKDERAVHA}
2 QGKRTLTPQPMELK^{yswktw}gKAKIVTA^{aetqnssfi}IDGPSTPECPSAS^{rawnvw}EVEDYGF^{GVFTTNIWLKL}RE^{VYTQLCDHRLMSAAVKDERAVHA}
3 QGKRTLTPQ^{pmelk}yswKTWGKA^{kivtaetqnssfi}IDGPSTPE^{cpsasra}WNVVEVEDYGF^{GVFTTNIWLKL}RE^{VYTQLCDHRLMSAAVKDERAVHA}
4 QGKRTLTPQ^{pmelk}yswKTWGKA^{kivtaetqnssfi}IDGPSTPEC^{pasra}WNVVEVEDYGF^{GVFTTNIWLKL}RE^{VYTQLCDHRLMSAAVKDERAVHA}
5 QGKRTLTPQPMEL^{kyswkt}WGKAKIV^{taetqnssfi}IDGPSTPEC^{pasra}WNVVEVEDYGF^{GVFTTNIWLKL}RE^{VYTQLCDHRLMSAAVKDERAVHA}
6 QGKRTLTPQPMEL^{kyswkt}WGKAKIV^{taetqnssfi}IDGPSTPEC^{pasra}WNVVEVEDYGF^{GVFTTNIWLKL}RE^{VYTQLCDHRLMSAAVKDERAVHA}
7 QGKRTLTPQPMEL^{kyswktw}gKAKIVT^{aetqnssfi}IDGPSTPECPSAS^{rawnvw}EVEDYGF^{GVFTTNIWLKL}RE^{VYTQLCDHRLMSAAVKDERAVHA}

1 dm^{gywiesqkngsw}KLEKASLIEVKTCTWPKSHTLWSNGVLESDMIIPKSLAGPIS^{qhnhrpgyhtqtag}PWHLGKLE^{ldfnyce}GTTTVISENC^{GTR}
2 DM^{gywiesqkngswk}LEKASLIEVKTCTWPKSHTLWSNGVLESDMIIPKSL^{agpisqhnhrpgyhtqtag}PWHLGKLE^{ldfnyce}GTTTVISENC^{GTR}
3 DM^{gywiesqkngswkle}LEKASLIEVKTCTWPKSHTLWSNGVLESDMIIPKSL^{agpisqhnhrpgyhtqtag}PWHLGKLE^{ldfnyce}GTTTVISENC^{GTR}
4 DM^{gywiesqkngswkle}LEKASLIEVKTCTWPKSHTLWSNGVLESDMIIPKSL^{agpisqhnhrpgyhtqtag}PWHL^{gkleldfnyce}GTTTVISENC^{GTR}
5 dm^{gywiesqkngswkle}LEKASLIEVKTCTWPKSHTLWSNGVLESDMIIPKSLAG^{pisqhnhrpgyhtqtag}PWHL^{gkleldfnyce}GTTTVISENC^{GTR}
6 dm^{gywiesqkngswkle}LEKASLIEVKTCTWPKSHTLWSNGVLESDMIIPKSLAGPIS^{qhnhrpgyhtqtag}PWHLG^{kleldfnyce}GTTTVISENC^{GTR}
7 dm^{gywiesqkngswkle}LEKASLIEVKTCTWPKSHTLWSNGVLESDMIIPKSLAGPIS^{qhnhrpgyhtqtag}PWHLGKLE^{ldfnyce}GTTTVISENC^{GTR}

1 GPSLRTTTVSGKLIHEWCCR^{Sctlpplr}YMGEDGCWYGMEIRPINEKEENMVKSLASA
2 GPSLRTTTVSGKLIHEWCCR^{Sctlpplry}MGEDGCWYGMEIRPINEKEENMVKSLASA
3 GPSLRTTTVSGKLIHEWCCR^{Sctlpplrym}GEDGCWYGMEIRPINEKEENMVKSLASA
4 GPSLRTTTVSGKLIHEWCCR^{Sctlpplrymg}EDGCWYGMEIRPINEKEENMVKSLASA
5 GPSLRTTTVSGKLIHEWCCR^{Sctlpplrymge}DGCWYGMEIRPINEKEENMVKSLASA
6 GPSLRTTTVSGKLIHEWCCR^{Sctlpplrymged}GCWYGMEIRPINEKEENMVKSLASA
7 GPSLRTTTVSGKLIHEWCCR^{Sctlpplrymgedg}CWYGMEIRPINEKEENMVKSLASA

DENV4

1 DMGCVVSWSGKELKCGSGIFVADNVHTWteqykfqPESPARLasailnahKDGVCGIRSTTRlenvmwkqITNELNYVLWEGGHDLTVVAGDVKGVL
2 DMGCVVSWSGKELKCGSGIFVADNVHTWteqykfqPESPARLasailnahKDGVCGIRSTTRlenvmwkqITNELNYVLWEGGHDLTVVAGDVKGVL
3 DMGCVVSWSGKELKCGSGIFVADNVHTWteqykfqPESPARLasailnahKDGVCGIRSTTRlenvmwkqITNELNYVLWEGGHDLTVVAGDVKGVL
4 DMGCVVSWSGKELKCGSGIFVADNVhtwteqykfqPESPARLasailnahKDGVCGIRSTTRlenvmwkqITNELNYVLWEGGHDLTVVAGDVKGVL
5 DMGCVVSWSGKELKCGSGIFVADNVhtwteqykfqPESPARLasailnahKDGVCGIRSTtrlenvmwkqITNELNYVLWEGGHDLTVVAGDVKGVL
6 DMGCVVSWSGKELKCGSGIFVADNVhtwteqykfqPESPARLasailnahKDGVCGIRSTtrlenvmwkqITNELNYVLWEGGHDLTVVAGDVKGVL
7 DMGCVVSWSGKELKCGSGIFVADNVhtwteqykfqPESPARLasailnahKDGVCGIRSTtrlenvmwkqITNELNYVLWEGGHDLTVVAGDVKGVL

1 KGKRALTPPVNDLKyswktwGKAKIFTpearnstfLIDGPDtsecpnerrawnfleVEDYGFGMFTTNIWMKFREGSSEVCDHRLMSAAIKdqkavha
2 KGKRALTPPVNDLKyswktwGKAKIFTpearnstfLIDGPDtsecpnerrawnfleVEDYGFGMFTTNIWMKFREGSSEVCDHRLmsaaidqkavha
3 KGKRALTPPVndlkyswktwGKAKiftpearnstfLIDGPDtsecpnerrawnfleVEDYGFGMFTTNIWMKFREGSSEVCDHRLmsaaidqkavha
4 KGKRALTPPVndlkyswktwGKAKiftpearnstfLIDGPDtsecpnerrawnfleVEDYGFGMFTTNIWMKFREGSSEVCDHRLmsaaidqkavha
5 KGKRALTPPVndlkyswktwGKAKiftpearnstfLIDGPDtsecpnerrawnfleVEDYGFGMFTTNIWMKFREGSSEVCDHRLMSAAIKdqkavha
6 KGKRALTPPVNDlkyswktwGKAKIFTpearnstfLIDGPDtsecpnerrawnfleVEDYGFGMFTTNIWMKFREGSSEVCDHRLMSAAIKdqkavha
7 KGKRALTPPVNDLKyswktwGKAKIFTpearnstfLIDGPDtsecpnerrawnfleVEDYGFGMFTTNIWMKFREGSSEVCDHRLMSAAIKdqkavha

1 dmgywiessknqtWQIEKASLIEVKTCCLWPKTHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQEDCDHR
2 dmgywiessknqtWQIEKASLIEVKTCCLWPKTHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQEDCDHR
3 DMgywiessKNQTWQIEKASLIEVKTCCLWPKTHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQEDCDHR
4 DMgywiessKNQTWQIEKASLIEVKTCCLWPKTHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQEDCDHR
5 dmgywiessKNQTWQIEKASLIEVKTCCLWPKTHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQEDCDHR
6 dmgywiessKNQTWQIEKASLIEVKTCCLWPKTHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQEDCDHR
7 dmgywiessKNQTWQIEKASLIEVKTCCLWPKTHTLWSNGVLESQMLIPKSYAGPFSqhnyrqgYATQTVGPWHLGKLEIDFGECPGTTVTIQEDCDHR

1 GPSLRTTTASGKLVtwccrsctmpplrFLGEDGCWYGMEIRPLSEKEENMVKSQVTA
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3 GPSLRTTTASgklvtqwCCRSCTmpplrFLGEDGCWYGMEIRPLSEKEENMVKSQVTA
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5 GPSLRTTTASgklvtqwccRSCTMPplrFLGEDGCWYGMEIRPLSEKEENMVKSQVTA
6 GPSLRTTTASGklvtqwccRSCTMPplrFLGEDGCWYGMEIRPLSEKEENMVKSQVTA
7 GPSLRTTTASGKLVtwccrsCTMPPLrFLGEDGCWYGMEIRPLSEKEENMVKSQVTA