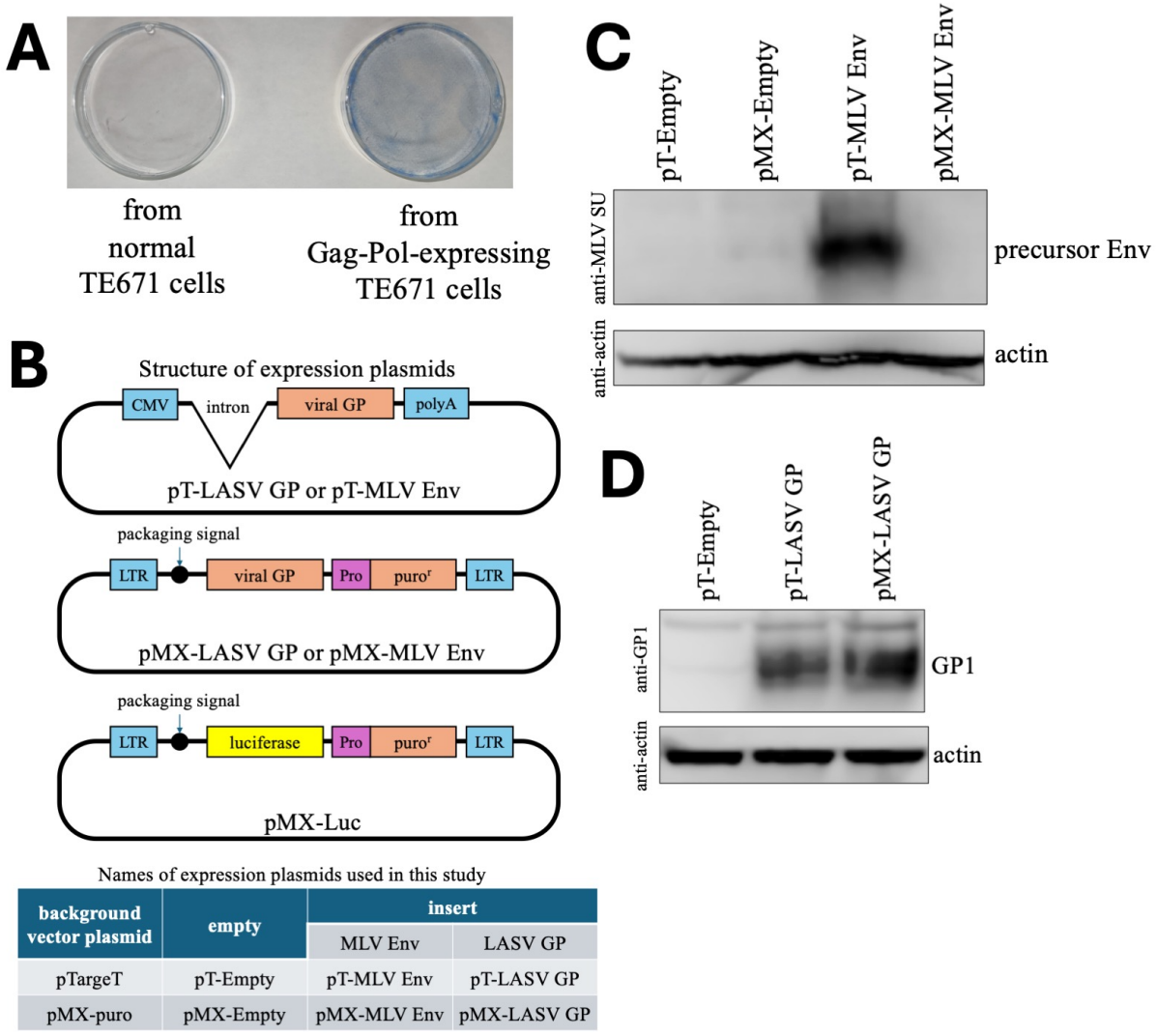


Names of expression plasmids used in this study

background vector plasmid	empty	insert	
		MLV Env	LASV GP
pTargeT	pT-Empty	pT-MLV Env	pT-LASV GP
pMX-puro	pMX-Empty	pMX-MLV Env	pMX-LASV GP

Figure S1. Establishment of the conditional replication system using LASV GP-encoding MLV vector. (A) LASV GP-encoding MLV vector was inoculated into normal (left panel) or Gag-Pol-expressing (right panel) TE671 cells. After puromycin selection, culture supernatants from the cells were filtered through 0.45-μm filters and inoculated into normal TE671 cells. The inoculated cells were then treated with puromycin and stained with methylene blue. (B) Structures and names of plasmids encoding LASV GP or amphotropic MLV Env are shown. (C) Human 293T cells were transfected with the indicated plasmids. Western blotting of lysates from the transfected cells was performed using anti-MLV SU or anti-actin antibody. (D) Human 293T cells were transfected with the indicated plasmids. Western blotting was performed using anti-LASV GP1 or anti-actin antibody.

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Original    ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA 30(10)
C2          ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA
C43         ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA
C48         ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA
C71         ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA

Original    GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC 60(20)
C2          GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC
C43         GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC
C48         GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC
C71         GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC

Original    ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA 90(30)
C2          ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA
C43         ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA
C48         ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA
C71         ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA

Original    GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA 120(40)
C2          GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA
C43         GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA
C48         GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA
C71         GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA

Original    TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG 150(50)
C2          TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG
C43         TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG
C48         TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG
C71         TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG

Original    CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA 180(60)
C2          CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA
C43         CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA
C48         CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA
C71         CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA
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Original     CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT 210(70)
C2           CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT
C43          CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT
C48          CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT
C71          CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT

Original     CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG 240(80)
C2           CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG
C43          CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG
C48          CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG
C71          CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG

Original     ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC 270(90)
C2           ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC
C43          ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC
C48          ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC
C71          ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC

Original     TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA 300(100)
C2           TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA
C43          TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA
C48          TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA
C71          TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA

Original     ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA 330(110)
C2           ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA
C43          ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA
C48          ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA
C71          ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA

Original     AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG 360(120)
C2           AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG
C43          AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG
C48          AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG
C71          AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG
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Original    AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC 390(130)
C2          AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC
C43         AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC
C48         AGC GAT GCC CAT AAG AAG GAC CTG TAT GAC
C71         AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC

Original    CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT 420(140)
C2          CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT
C43         CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT
C48         CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT
C71         CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT

Original    CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC 450(150)
C2          CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC
C43         CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC
C48         CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC
C71         CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC

Original    GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC 480(160)
C2          GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC
C43         GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC
C48         GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC
C71         GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC

Original    AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC 510(170)
C2          AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC
C43         AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC
C48         AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC
C71         AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC

Original    TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT 540(180)
C2          TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT
C43         TCC TAT GCC GGC GAT GCT GCC AAT CAT TGC
C48         TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT
C71         TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT
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Original    GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG 570(190)
C2          GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG
C43         GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG
C48         GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG
C71         GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG

Original    TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC 600(200)
C2          TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC
C43         TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC
C48         TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC
C71         TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC

Original    ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG 630(210)
C2          ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG
C43         ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG
C48         ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG
C71         ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG

Original    GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC 660(220)
C2          GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC
C43         GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC
C48         GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC
C71         GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC

original    ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC 690(230)
C2          ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC
C43         ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC
C48         ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC
C71         ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC

original    TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT 720(240)
C2          TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT
C43         TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT
C48         TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT
C71         TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT
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original    TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA 750(250)
C2          TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA
C43         TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA
C48         TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA
C71         TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA

original    GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT 780(260)
C2          GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT
C43         GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT
C48         GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT
C71         GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT

original    ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA 810(270)
C2          ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA
C43         ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA
C48         ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA
C71         ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA

original    GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG 840(280)
C2          GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG
C43         GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG
C48         GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG
C71         GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG

original    ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG 870(290)
C2          ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG
C43         ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG
C48         ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG
C71         ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG

original    AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA 900(300)
C2          AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA
C43         AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA
C48         AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA
C71         AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA
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original    TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT 930(310)
C2          TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT
C43         TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT
C48         TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT
C71         TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT

original    GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA 960(320)
C2          GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA
C43         GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA
C48         GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA
C71         GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA

original    CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT 990(330)
C2          CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT
C43         CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT
C48         CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT
C71         CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT

original    CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT 1020(340)
C2          CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT
C43         CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT
C48         CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT
C71         CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT

original    GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT 1050(350)
C2          GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT
C43         GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT
C48         GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT
C71         GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT

original    ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA 1080(360)
C2          ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA
C43         ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA
C48         ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA
C71         ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA
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original    ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG 1110(370)
C2          ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG
C43         ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG
C48         ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG
C71         ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG

Original    TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA 1140(380)
C2          TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA
C43         TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA
C48         TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA
C71         TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA

original    TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT 1170(390)
C2          TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT
C43         TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT
C48         TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT
C71         TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT

original    GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC 1200(400)
C2          GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC
C43         GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC
C48         GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC
C71         GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC

original    GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG 1230(410)
C2          GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG
C43         GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG
C48         GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG
C71         GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG

original    ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG 1260(420)
C2          ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG
C43         ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG
C48         ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG
C71         ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG
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original    GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC 1290(430)
C2          GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC
C43         GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC
C48         GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC
C71         GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC

original    GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC 1320(440)
C2          GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC
C43         GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC
C48         GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC
C71         GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC

original    TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC 1350(450)
C2          TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC
C43         TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC
C48         TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC
C71         TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC

original    AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA 1380(460)
C2          AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA
C43         AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA
C48         AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA
C71         AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA

original    AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT 1410(470)
C2          AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT
C43         AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT
C48         AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT
C71         AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT

original    CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC 1440(480)
C2          CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC
C43         CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC
C48         CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC
C71         CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC
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original      AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG 1470(490)
C2            AAG CAG cCg GGT GTG CCT GTG AAG TGG AAG
C43           AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
C48           AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
C71           AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG

original      CGG TGA
C2            CGG TGA
C43           CGG TGA
C48           CGG TGA
C71           CGG TGA
```

Figure S2. Nucleotide sequences of LASV GP expression clones isolated from the conditional replication system in the absence of inhibitors.

clone	No. nucleotide change	amino acid changes	infectivity
C2	0	no	○
C43	1	no	○
C48	1	N127D	○
C71	0	no	○

Figure S3. Numbers of nucleotide changes and amino acid substitutions in the LASV GP expression plasmids isolated from the conditional replication system in the absence of inhibitors.

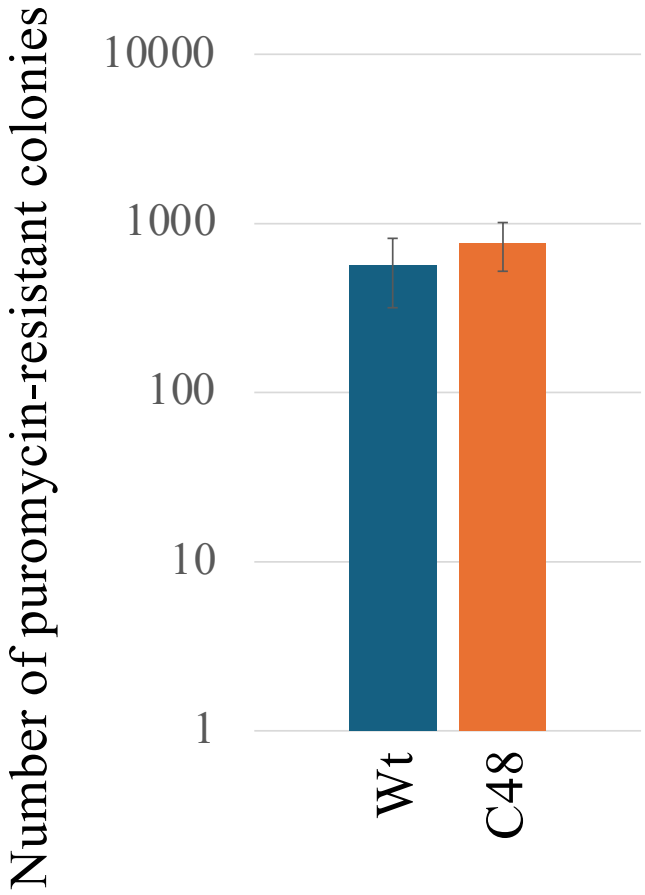


Figure S4. Numbers of puromycin-resistant colonies generated by conditional replication of Wt and C48 GP-encoding MLV vectors. Human 293T cells were transfected with Wt- or C48 GP-encoding MLV vector genome expression plasmid together with the Gag-Pol expression plasmid. The culture supernatants were collected and inoculated into Gag-Pol-expressing TE671 cells. After puromycin selection, culture supernatants from the puromycin-resistant cells were diluted 100-fold, and inoculated into normal TE671 cells. The inoculated cells were culture in the presence of puromycin, and puromycin-resistant colonies were counted.

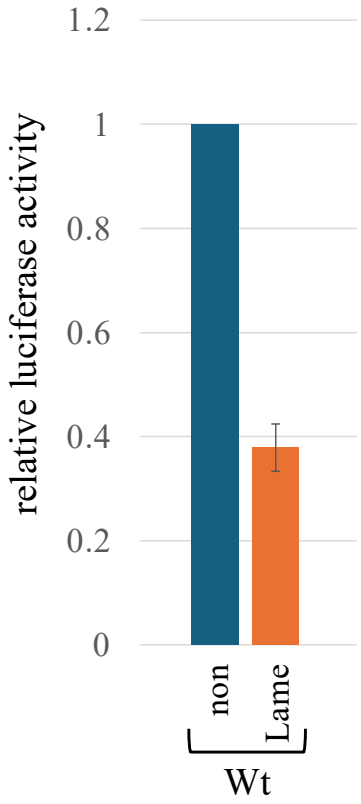


Figure S5. Inhibition of luciferase-encoding MLV vector pseudotyped with Wt LASV GP by lamellarin α 20-sulfate. Normal TE671 cells were inoculated with the Wt vector in the absence or presence of lamellarin α 20-sulfate (50 μM). Luciferase activity in the inoculated cells was measured. Luciferase activity in untreated cells was always set to 1, and relative values to untreated cells are indicated with p values.

Original	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	30(10)
L1	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
L5	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
L6	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
L7	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
L15	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
L20	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
L23	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	

Original	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	60(20)
L1	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
L5	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
L6	GTG CCA **CGC** GTA ATC GAA GAG GTG ATG AAC	
L7	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
L15	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
L20	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
L23	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	

Original	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	90(30)
L1	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
L5	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
L6	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
L7	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
L15	ATT GTT CTT ATT GCG TTG TCC **ATT** CTT GCA	
L20	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
L23	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	

Original	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	120(40)
L1	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
L5	**GCC** CTG AAG GGA CTG TAC AAT TTT GCA ACA	
L6	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
L7	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
L15	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
L20	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
L23	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	

Original	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	150(50)
L1	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
L5	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
L6	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
L7	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
L15	TGC GGC CTG GTA GGA CTG GTC ACA TTC CTG	
L20	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
L23	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	

Original	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	180(60)
L1	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
L5	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
L6	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
L7	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
L15	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
L20	CTC CTC TGT GGG CGC AGC TGC ACT ACT TCA	
L23	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	

Original	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	210(70)
L1	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
L5	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
L6	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
L7	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
L15	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
L20	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
L23	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	

Original	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	240(80)
L1	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
L5	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
L6	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
L7	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
L15	CTG GAG TTG AAT ATG GAA ACC CTG **AGT** ATG	
L20	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
L23	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	

Original	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	270(90)
L1	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
L5	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
L6	ACT ATG CCC TTG TCC TGC ACG AAG AAC AAC	
L7	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
L15	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
L20	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
L23	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	

Original	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	300(100)
L1	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
L5	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
L6	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
L7	TCT CAC CAC TAC ATT **ACG** GTG GGG AAC GAA	
L15	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
L20	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
L23	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	

Original	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	330(110)
L1	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
L5	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
L6	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
L7	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
L15	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
L20	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
L23	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	

Original	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	360(120)
L1	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
L5	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
L6	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
L7	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
L15	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
L20	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
L23	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	

Original	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	390(130)
L1	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
L5	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
L6	AGC GAT GCC CAT **GAG** AAG AAC CTG TAT GAC	
L7	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
L15	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
L20	AGC GAT GCC CAT **GAG** AAG AAC CTG TAT GAC	
L23	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	

Original	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	420(140)
L1	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
L5	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
L6	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
L7	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
L15	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
L20	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
L23	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	

Original	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	450(150)
L1	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
L5	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
L6	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
L7	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
L15	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
L20	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
L23	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	

Original	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	480(160)
L1	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
L5	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
L6	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
L7	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
L15	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
L20	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
L23	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	

Original	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	510(170)
L1	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
L5	AAG ATC AGC GTA CAG TAC **AGC** CTG TCC CAC	
L6	AAA ATC AGC GTA CAG TAC AAC CTG TCC CAC	
L7	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
L15	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
L20	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
L23	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	

Original	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	540(180)
L1	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
L5	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
L6	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
L7	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
L15	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
L20	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
L23	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	

Original	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	570(190)
L1	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
L5	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
L6	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
L7	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
L15	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
L20	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
L23	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	

Original	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	600(200)
L1	TTC **AAG** AGA ATG GCA TGG GGA GGT **AAT** TAC	
L5	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
L6	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
L7	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
L15	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
L20	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
L23	TTC ATG AGA ATG GCA TGG GGA GGT **AAT** TAC	

Original	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	630(210)
L1	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	
L5	ATT GCC CTT GAC AGT GGC AGA **GAC** AAC TGG	
L6	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	
L7	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	
L15	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	
L20	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	
L23	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	

Original	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	660(220)
L1	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
L5	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
L6	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
L7	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
L15	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
L20	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
L23	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	

original	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	690(230)
L1	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
L5	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
L6	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
L7	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
L15	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
L20	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
L23	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	

original	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	720(240)
L1	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
L5	TGC CaA TTC TCT AGG CCA AGC CCC ATC GGT	
L6	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
L7	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
L15	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
L20	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
L23	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	

original	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	750(250)
L1	TAT **CAC** GGG CTG CTC TCC CAA CGG ACT AGA	
L5	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
L6	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
L7	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
L15	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
L20	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
L23	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	

original	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	780(260)
L1	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
L5	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
L6	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
L7	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
L15	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
L6	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
L23	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	

original	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	810(270)
L1	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
L5	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
L6	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
L7	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
L15	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
L20	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
L23	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	

original	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	840(280)
L1	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
L5	GGA AAA GAT ACT CCA GGC GGA TAT TGT CTG	
L6	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
L7	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
L15	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
L20	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
L23	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	

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original     ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG 870(290)
L1           ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG
L5           ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG
L6           ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG
L7           ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG
L15          ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG
L20          ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG
L23          ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG

original     AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA 900(300)
L1           AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA
L5           AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA
L6           AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA
L7           AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA
L15          AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA
L20          AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA
L23          AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA

original     TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT 930(310)
L1           TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT
L5           TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT
L6           TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT
L7           TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT
L15          TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT
L20          TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT
L23          TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT

original     GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA 960(320)
L1           GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA
L5           GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA
L6           GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA
L7           GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA
L15          GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA
L20          GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA
L23          GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA
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original	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	990(330)
L1	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
L5	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
L6	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
L7	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
L15	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
L20	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
L23	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	

original	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	1020(340)
L1	CAA ATG AGC ATA CAA CTC ATC AAC AAA GCT	
L5	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
L6	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
L7	CAA ATG AGC ATA CAG CTC ATC **AGC** AAA GCT	
L15	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
L20	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
L23	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	

original	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	1050(350)
L1	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
L5	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
L6	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
L7	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
L15	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
L20	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
L23	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	

original	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	1080(360)
L1	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
L5	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
L6	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
L7	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
L15	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
L20	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
L23	**ATA** AAG AAT CAT CTG CGC GAC ATC ATG GGA	

original	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	1110(370)
L1	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
L5	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
L6	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
L7	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
L15	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
L20	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
L23	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	

Original	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	1140(380)
L1	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
L5	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
L6	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
L7	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
L15	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
L20	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
L23	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	

original	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	1170(390)
L1	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
L5	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
L6	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
L7	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
L15	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
L20	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
L23	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	

original	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	1200(400)
L1	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
L5	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
L6	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
L7	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
L15	GGT TCA TAC CTC **ATC** GAA ACC CAC TTT AGC	
L20	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
L23	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	

original	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	1230(410)
L1	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
L5	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
L6	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
L7	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
L15	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
L20	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
L23	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	

original	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	1260(420)
L1	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
L5	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
L6	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
L7	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
L15	ATC ACC GAG ATG TTG CAG AAA GAG TAT ATG	
L20	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
L23	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	

original	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	1290(430)
L1	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
L5	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
L6	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
L7	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
L15	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
L20	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
L23	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	

original	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	1320(440)
L1	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
L5	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
L6	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
L7	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
L15	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
L20	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
L23	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	

original	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	1350(450)
L1	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
L5	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
L6	TAC CTG ATT TCA ATT TTC CTG CAC CTG GTC	
L7	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
L15	TAT CTG ATT TCA ATT TTC CTG CAC CtG GTC	
L20	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
L23	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	

original	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	1380(460)
L1	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
L5	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
L6	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
L7	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
L15	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
L20	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
L23	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	

original	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	1410(470)
L1	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
L5	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
L6	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
L7	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
L15	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
L20	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
L23	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	

original	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	1440(480)
L1	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
L5	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
L6	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
L7	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
L15	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
L20	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
L23	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	

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original    AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG 1470(490)
L1          AAG CAG CCG GGT ATG CCT GTG AAG TGG AAG
L5          AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
L6          AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
L7          AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
L15         AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
L20         AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
L23         AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG

original    CGG TGA
L1          CGG TGA
L5          CGG TGA
L6          CGG TGA
L7          CGG TGA
L15         CGG TGA
L20         CGG TGA
L23         CGG TGA
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Figure S6. Nucleotide sequences of LASV GP variants isolated from the conditional replication system in the presence of lamellarin α 20-sulfate.

clone	No. nucleotide change	amino acid changes	infectivity
L1	5	M192I, S199N, L242H, V485M	○
L5	4	V41A, N167S, G208D	○
L6	5	**H13R, K125E**	○
L7	2	M96T, N338S	○
L15	5	V28I, N79S, N395I	○
L20	3	**H13R, K125E**	○
L23	2	S199N, M351I	○

Figure S7. Numbers of nucleotide changes and amino acid substitutions in the LASV GP expression plasmids isolated from the con conditional replication system in the presence of lamellarin α 20-sulfate.

clone	number of synonymous mutation	number of nonsynonymous mutation	ratio of nonsynonymous mutations to total mutations (%)
L1	1	4	80%
L5	1	3	75%
L6	3	2	40%
L7	0	2	100%
L15	2	3	60%
L20	1	2	67%
L23	0	2	100%
total	8	18	69%

Figure S8. Numbers of synonymous and nonsynonymous mutations and Ratios of nonsynonymous mutations in the LASV GP variants isolated from the conditional replication system in the presence of lamellarin α 20-sulfate.

clone	base change	number of G→A	total changes	ratio of G→A mutation (%)
1	T→A, **G→A**, T→A, **G→A**, **G→A**	3	5	60%
5	T→C, A→G, **G→A**, **G→A**	2	4	50%
6	A→G, A→G, A→G, **G→A**, T→C	1	5	20%
7	T→C, A→G	0	2	0%
15	**G→A**, **G→A**, A→G, A→T, C→T	2	5	40%
20	A→G, T→C, A→G	0	3	0%
23	**G→A**, **G→A**	2	2	100%
total	0 A→C, 8 A→G, 1 A→T, 0 C→A, 0 C→G, 1 C→T, **10 G→A**, 0 G→C, 0 G→T, 2 T→A, 4 T→C, 0 T→G	10	26	38%

Figure S9. Ratios of G-to-A nucleotide substitutions in the LASV GP variants isolated from the conditional replication system in the presence of lamellarin α 20-sulfate.

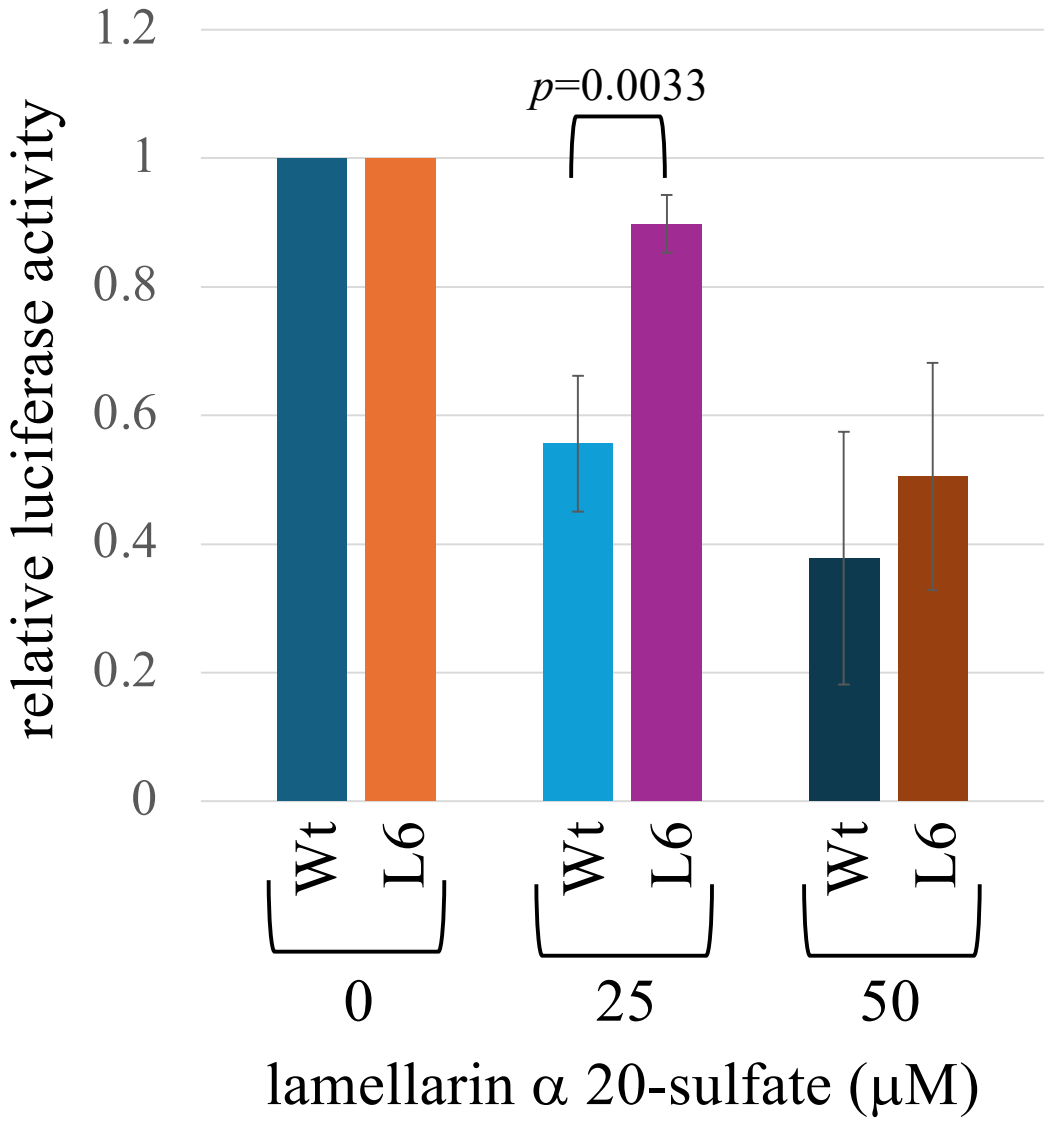


Figure S10. L9 GPC-mediated infection has reduced sensitivity to lamellarin α 20-sulfate. Luciferase-encoding MLV vector pseudotyped with the Wt or L6 GPC was inoculated into TE671 cells in the presence of lamellarin α 20-sulfate (0, 25, or 50 μM). Luciferase activity in the inculated cells were measured. Luciferase activity in the absence of the compound was always set to 1. Relative values ± SD are indicated (n=3).

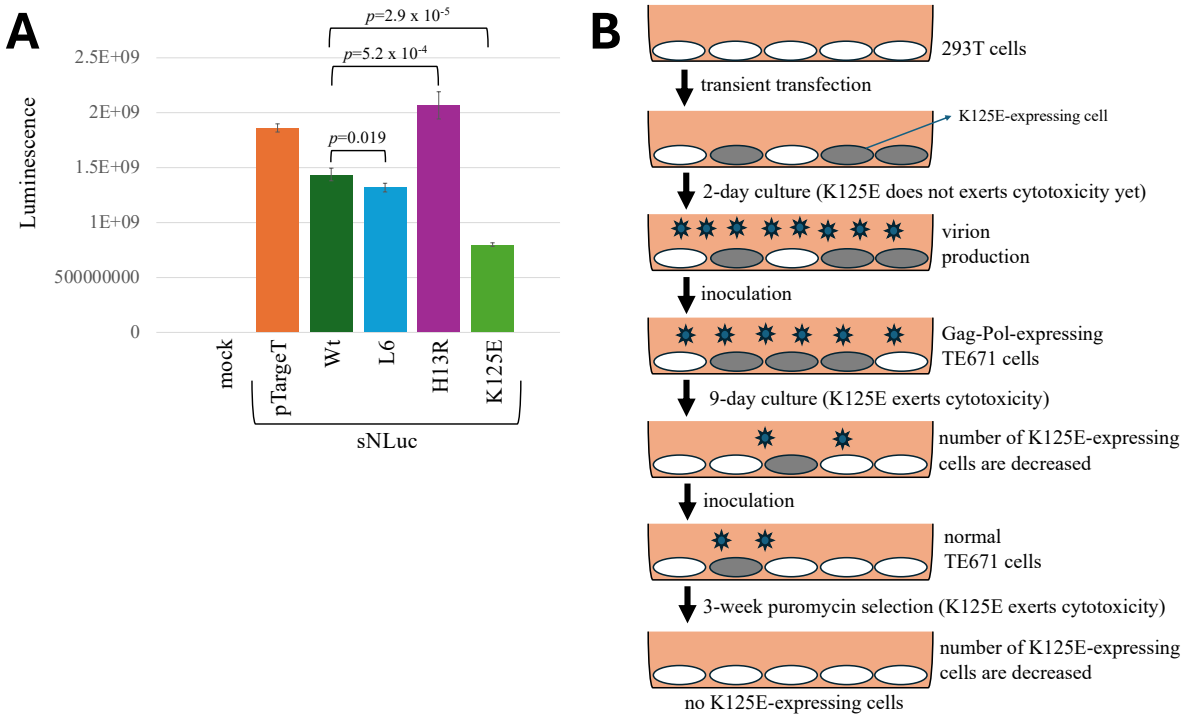


Figure S11. The K125E substitution induces cell death or suppresses cell growth. (A) TE671 cells were transfected with each LASV GP expression plasmid together with a plasmid encoding nano luciferase fused to the IL-6 signal peptide (sNLuc). Two days after transfection, luciferase activity in the culture supernatants was measured. Luminescence intensities are shown as means ± SD (n=3). (B) A mechanism by which no puromycin-resistant colonies were observed is speculated. The K125E-containing MLV vector that was produced by transient transfection exhibited significantly higher transduction efficiency than the Wt-containing vector, because the vectors were harvested 2 days after transfection before K125E exerted cytotoxicity. However, during 9-day culture of the inoculated Gag-Pol-expressing TE671 cells and 3-week puromycin selection of the inoculated normal TE671 cells, K125E exerted cytotoxicity, and K125E-expressing puromycin-resistant cells were disappeared.

Original	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	30(10)
NA2	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
NA3	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
NA5	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
NA8	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
NA9	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
NA10	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
NA11	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
NA108	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
NA112	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
NA125	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	
NA130	ATG GGG CAG ATC GTG ACC TTC TTT CAG GAA	

Original	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	60(20)
NA2	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
NA3	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
NA5	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
NA8	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
NA9	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
NA10	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
NA11	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
NA108	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
NA112	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
NA125	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	
NA130	GTG CCA CAC GTA ATC GAA GAG GTG ATG AAC	

Original	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	90(30)
NA2	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
NA3	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
NA5	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
NA8	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
NA9	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
NA10	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
NA11	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
NA108	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
NA112	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
NA125	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	
NA130	ATT GTT CTT ATT GCG TTG TCC GTT CTT GCA	

Original	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	120(40)
NA2	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
NA3	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
NA5	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
NA8	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
NA9	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
NA10	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
NA11	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
NA108	GTC CTG AAG GGA **CCG** TAC AAT TTT GCA ACA	
NA112	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
NA125	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	
NA130	GTC CTG AAG GGA CTG TAC AAT TTT GCA ACA	

Original	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	150(50)
NA2	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
NA3	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
NA5	TGC GGC CTG **ATG** GGA CTG GTC ACA TTC CTG	
NA8	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
NA9	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
NA10	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
NA11	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
NA108	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
NA112	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
NA125	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	
NA130	TGC GGC CTG GTG GGA CTG GTC ACA TTC CTG	

Original	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	180(60)
NA2	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
NA3	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
NA5	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
NA8	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
NA9	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
NA10	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
NA11	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
NA108	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
NA112	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
NA125	CTC CTC TGT GGG CGC AGT TGT ACT ACT TCA	
NA130	CTC CTC TGT GGG CGC **GGT** TGT ACT ACT TCA	

Original	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	210(70)
NA2	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
NA3	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
NA5	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
NA8	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
NA9	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
NA10	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
NA11	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
NA108	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
NA112	CTG TAT **AGA** GGC GTT TAC GAG CTG CAG ACT	
NA125	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	
NA130	CTG TAT AAA GGC GTT TAC GAG CTG CAG ACT	

Original	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	240(80)
NA2	CTG GAG TTA AAT ATG GAA ACC CTG AAT ATG	
NA3	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
NA5	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
NA8	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
NA9	CTG GAG TTA AAT ATG GAA ACC CTG AAT ATG	
NA10	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
NA11	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
NA108	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
NA112	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
NA125	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	
NA130	CTG GAG TTG AAT ATG GAA ACC CTG AAT ATG	

Original	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	270(90)
NA2	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
NA3	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
NA5	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
NA8	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
NA9	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
NA10	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
NA11	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
NA108	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
NA112	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
NA125	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	
NA130	ACT ATG CCC TTG TCC TGC ACA AAG AAC AAC	

Original	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	300(100)
NA2	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
NA3	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
NA5	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
NA8	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
NA9	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
NA10	TCT CAC CAC TAC ATT ATG GTG GGG **AGC** GAA	
NA11	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
NA108	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
NA112	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
NA125	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	
NA130	TCT CAC CAC TAC ATT ATG GTG GGG AAC GAA	

Original	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	330(110)
NA2	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
NA3	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
NA5	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
NA8	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
NA9	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
NA10	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
NA11	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
NA108	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
NA112	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
NA125	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	
NA130	ACG GGC CTC GAG CTG ACC TTG ACC AAC ACA	

Original	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	360(120)
NA2	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
NA3	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
NA5	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
NA8	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
NA9	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
NA10	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
NA11	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
NA108	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
NA112	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
NA125	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	
NA130	AGC ATT ATA AAT CAC AAG TTT TGC AAC CTG	

Original	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	390(130)
NA2	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
NA3	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
NA5	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
NA8	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
NA9	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
NA10	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
NA11	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
NA108	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
NA112	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
NA125	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	
NA130	AGC GAT GCC CAT AAG AAG AAC CTG TAT GAC	

Original	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	420(140)
NA2	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
NA3	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
NA5	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
NA8	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
NA9	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
NA10	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
NA11	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
NA108	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
NA112	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
NA125	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	
NA130	CAC GCT CTG ATG AGC ATA ATC TCC ACC TTT	

Original	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	450(150)
NA2	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
NA3	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
NA5	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
NA8	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
NA9	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
NA10	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
NA11	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
NA108	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
NA112	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
NA125	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	
NA130	CAT CTT AGT ATA CCC AAT TTC AAT CAG TAC	

Original	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	480(160)
NA2	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
NA3	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
NA5	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
NA8	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
NA9	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
NA10	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
NA11	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
NA108	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
NA112	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
NA125	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	
NA130	GAG GCA ATG AGC TGC GAT TTT AAC GGA GGC	

Original	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	510(170)
NA2	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
NA3	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
NA5	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
NA8	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
NA9	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
NA10	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
NA11	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
NA108	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
NA112	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
NA125	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	
NA130	AAG ATC AGC GTA CAG TAC AAC CTG TCC CAC	

Original	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	540(180)
NA2	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
NA3	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
NA5	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
NA8	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
NA9	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
NA10	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
NA11	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
NA108	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
NA112	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
NA125	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	
NA130	TCC TAT GCC GGC GAT GCT GCC AAT CAT TGT	

Original	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	570(190)
NA2	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
NA3	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
NA5	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
NA8	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
NA9	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
NA10	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
NA11	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
NA108	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
NA112	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
NA125	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	
NA130	GGC ACT GTT GCG AAT GGT GTG CTG CAG ACG	

Original	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	600(200)
NA2	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
NA3	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
NA5	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
NA8	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
NA9	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
NA10	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
NA11	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
NA108	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
NA112	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
NA125	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	
NA130	TTC ATG AGA ATG GCA TGG GGA GGT AGT TAC	

Original	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	630(210)
NA2	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	
NA3	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	
NA5	ATT GCC CTT GAC AGT GGC AGA **GAC** AAC TGG	
NA8	ATT GCC CTT GAC AGT GGT AGA GGC AAC TGG	
NA9	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	
NA10	ATT GCC CTT GAC AGT GGC AGA **GAC** AAC TGG	
NA11	ATT GCC CTT GAC AGT GGT AGA GGC AAC TGG	
NA108	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	
NA112	ATT GCC CTT GAC AGT GGC AGA GGC AAC TGG	
NA125	ATT GCC CTT GAC AGT GGT AGA GGC AAC TGG	
NA130	ATT GCC CTT GAC AGT GGC AGA **GAC** AAC TGG	

Original	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	660(220)
NA2	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
NA3	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
NA5	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
NA8	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
NA9	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
NA10	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
NA11	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
NA108	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
NA112	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
NA125	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	
NA130	GAT TGT ATC ATG ACA TCT TAC CAA TAT CTC	

Original	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	690(230)
NA2	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
NA3	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
NA5	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
NA8	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
NA9	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
NA10	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
NA11	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
NA108	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
NA112	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
NA125	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	
NA130	ATT ATC CAG AAT ACA ACC TGG GAG GAT CAC	

Original	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	720(240)
NA2	**TAC** CAA TTC TCT AGG CCA AGC CCC ATC GGT	
NA3	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
NA5	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
NA8	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
NA9	**TAC** CAA TTC TCT AGG CCA AGC CCC ATC GGT	
NA10	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
NA11	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
NA108	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
NA112	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
NA125	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	
NA130	TGC CAA TTC TCT AGG CCA AGC CCC ATC GGT	

Original	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	750(250)
NA2	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
NA3	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
NA5	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
NA8	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
NA9	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
NA10	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
NA11	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
NA108	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
NA112	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
NA125	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	
NA130	TAT CTC GGG CTG CTC TCC CAA CGG ACT AGA	

Original	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	780(260)
NA2	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
NA3	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
NA5	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
NA8	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
NA9	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
NA10	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
NA11	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
NA108	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
NA112	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
NA125	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	
NA130	GAC ATC TAT ATC TCT AGG CGC CTC TTG GGT	

Original	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	810(270)
NA2	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
NA3	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
NA5	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
NA8	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
NA9	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
NA10	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
NA11	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
NA108	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
NA112	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
NA125	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	
NA130	ACA TTC ACG TGG ACA CTG TCT GAT TCC GAA	

Original	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	840(280)
NA2	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
NA3	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
NA5	GGG AAA GAT ACT CCA GGC GGA TAT TGT TTG	
NA8	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
NA9	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
NA10	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
NA11	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
NA108	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
NA112	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
NA125	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	
NA130	GGG AAA GAT ACT CCA GGC GGA TAT TGT CTG	

Original	ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG	870(290)
NA2	ACT AGG TGG ATG CTT **ACA** GAG GCT GAG CTG	
NA3	ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG	
NA5	ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG	
NA8	**GCT** AGG TGG ATG CTT ATA GAG GCT GAG CTG	
NA9	ACT AGG TGG ATG CTT **ACA** GAG GCT GAG CTG	
NA10	ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG	
NA11	**GCT** AGG TGG ATG CTT ATA GAG GCT GAG CTG	
NA108	ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG	
NA112	ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG	
NA125	ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG	
NA130	ACT AGG TGG ATG CTT ATA GAG GCT GAG CTG	

Original	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	900(300)
NA2	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	
NA3	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	
NA5	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	
NA8	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	
NA9	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	
NA10	AAA TGC TTT **GAG** AAC ACC GCC GTG GCA AAA	
NA11	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	
NA108	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	
NA112	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	
NA125	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	
NA130	AAA TGC TTT GGG AAC ACC GCC GTG GCA AAA	

Original	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	930(310)
NA2	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	
NA3	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	
NA5	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	
NA8	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	
NA9	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	
NA10	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	
NA11	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	
NA108	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	
NA112	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	
NA125	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	
NA130	TGC AAC GAA AAG CAC GAC GAA GAA TTT TGT	

Original	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	960(320)
NA2	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	
NA3	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	
NA5	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	
NA8	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	
NA9	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	
NA10	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	
NA11	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	
NA108	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	
NA112	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	
NA125	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	
NA130	GAC ATG CTC AGG CTG TTC GAC TTC AAC AAA	

Original	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	990(330)
NA2	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
NA3	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
NA5	CAA GCC ATT CAG CGA CTG AAG GCC **AAG** GCT	
NA8	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
NA9	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
NA10	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
NA11	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
NA108	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
NA112	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
NA125	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	
NA130	CAA GCC ATT CAG CGA CTG AAG GCC GAG GCT	

Original	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	1020(340)
NA2	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
NA3	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
NA5	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
NA8	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
NA9	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
NA10	CAA ATG AGC **ATG** CAG CTC ATC AAC AAA GCT	
NA11	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
NA108	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
NA112	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
NA125	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	
NA130	CAA ATG AGC ATA CAG CTC ATC AAC AAA GCT	

Original	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	1050(350)
NA2	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
NA3	GTG AAT GCC CTG ATA AAT GAT CAG CTT ATT	
NA5	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
NA8	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
NA9	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
NA10	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
NA11	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
NA108	GTG AAT GCC cTG ATA AAC GAT CAG CTT ATT	
NA112	GTG AAT GCC cTG ATA AAC GAT CAG CTT ATT	
NA125	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	
NA130	GTG AAT GCC CTG ATA AAC GAT CAG CTT ATT	

Original	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	1080(360)
NA2	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
NA3	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
NA5	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
NA8	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
NA9	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
NA10	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
NA11	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
NA108	**ATA** AAG AAT CAT CTG CGC GAC ATC ATG GGA	
NA112	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
NA125	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	
NA130	ATG AAG AAT CAT CTG CGC GAC ATC ATG GGA	

Original	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	1110(370)
NA2	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
NA3	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
NA5	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
NA8	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
NA9	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
NA10	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
NA11	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
NA108	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
NA112	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
NA125	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	
NA130	ATC CCG TAC TGT AAC TAT AGC AAG TAT TGG	

Original	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	1140(380)
NA2	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
NA3	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
NA5	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
NA8	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
NA9	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
NA10	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
NA11	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
NA108	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
NA112	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
NA125	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	
NA130	TAC CTG AAT CAC ACC ACA ACC GGC CGA ACA	

Original	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	1170(390)
NA2	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
NA3	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
NA5	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
NA8	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
NA9	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
NA10	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
NA11	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
NA108	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
NA112	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
NA125	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	
NA130	TCT CTG CCT AAG TGT TGG CTT GTC AGC AAT	

Original	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	1200(400)
NA2	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
NA3	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
NA5	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
NA8	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
NA9	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
NA10	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
NA11	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
NA108	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
NA112	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
NA125	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	
NA130	GGT TCA TAC CTC AAC GAA ACC CAC TTT AGC	

Original	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	1230(410)
NA2	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
NA3	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
NA5	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
NA8	GAT GAC **ACC** GAG CAG CAG GCT GAC AAT ATG	
NA9	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
NA10	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
NA11	GAT GAC **ACC** GAG CAG CAG GCT GAC AAT ATG	
NA108	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
NA112	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	
NA125	GAT GAC **ACC** GAG CAG CAG GCT GAC AAT ATG	
NA130	GAT GAC ATC GAG CAG CAG GCT GAC AAT ATG	

Original	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	1260(420)
NA2	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
NA3	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
NA5	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
NA8	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
NA9	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
NA10	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
NA11	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
NA108	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
NA112	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
NA125	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	
NA130	ATC ACC GAG ATG TTG CAG AAA GAG TAC ATG	

Original	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	1290(430)
NA2	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
NA3	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
NA5	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
NA8	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
NA9	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
NA10	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
NA11	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
NA108	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
NA112	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
NA125	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	
NA130	GAG AGA CAG GGG AAA ACC CCA CTG GGC CTC	

Original	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	1320(440)
NA2	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
NA3	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
NA5	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
NA8	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
NA9	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
NA10	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
NA11	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
NA108	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
NA112	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
NA125	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	
NA130	GTA GAC CTG TTT GTG TTC TCA ACT AGT TTC	

Original	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	1350(450)
NA2	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
NA3	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
NA5	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
NA8	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
NA9	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
NA10	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
NA11	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
NA108	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
NA112	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
NA125	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	
NA130	TAT CTG ATT TCA ATT TTC CTG CAC CTG GTC	

Original	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	1380(460)
NA2	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
NA3	AAA **GTT** CCT ACG CAT CGG CAT ATC GTC GGA	
NA5	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
NA8	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
NA9	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
NA10	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
NA11	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
NA108	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
NA112	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
NA125	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	
NA130	AAA ATT CCT ACG CAT CGG CAT ATC GTC GGA	

Original	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	1410(470)
NA2	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
NA3	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
NA5	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
NA8	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
NA9	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
NA10	AAA TCC tGC CCC AAA CCT CAT CGT CTG AAT	
NA11	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
NA108	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
NA112	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
NA125	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	
NA130	AAA TCC TGC CCC AAA CCT CAT CGT CTG AAT	

Original	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	1440(480)
NA2	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
NA3	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
NA5	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
NA8	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
NA9	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
NA10	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
NA11	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
NA108	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
NA112	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
NA125	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	
NA130	CAT ATG GGA ATT TGC TCA TGC GGG TTG TAC	

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Original     AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG 1470(490)
NA2          AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
NA3          AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
NA5          AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
NA8          AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
NA9          AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
NA10         AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
NA11         AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
NA108        AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
NA112        AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
NA125        AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG
NA130        AAG CAG CCG GGT GTG CCT GTG AAG TGG AAG

Original     CGG TGA
NA2          CGG TGA
NA3          CGG TGA
NA5          CGG TGA
NA8          CGG TGA
NA9          CGG TGA
NA10         CGG TGA
NA11         CGG TGA
NA108        CGG TGA
NA112        CGG TGA
NA125        CGG TGA
NA130        CGG TGA
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Figure S12. Nucleotide sequences of LASV GP variants isolated from the conditional replication system in the presence of the 37.7H neutralizing antibody.

clone	No. nucleotide change	amino acid changes	infectivity
NA2	2	C231Y	
NA3	2	I452V	O
NA5	4	V44M, G208D, E329K	O
NA8	3	T281A, I403T	
NA9	3	C231Y, I286T	
NA10	4	N99S, G208D, G294E, I334M	O
NA11	3	T281A, I403T	
NA108	2	L35P, M351I	
NA112	1	K63R	O
NA125	2	I403T	O
NA130	2	S56G, G208D	

Figure S13. Numbers of nucleotide changes and amino acid substitutions in the LASV GP expression plasmids isolated from the con conditional replication system in the presence of the 37.7H neutralizing antibody.

clone	number of synonymous mutation	number of nonsynonymous mutation	ratio of nonsynonymous mutations to total mutations (%)
NA2	1	1	50%
NA3	1	1	50%
NA5	1	3	40%
NA8	1	2	75%
NA9	1	2	67%
NA10	0	4	100%
NA11	1	2	67%
NA108	0	2	100%
NA112	0	1	100%
NA125	1	1	50%
NA130	0	2	100%
total	7	21	75%

Figure S14. Numbers of synonymous and nonsynonymous mutations and Ratios of nonsynonymous mutations in the LASV GP variants isolated from the conditional replication system in the presence of the 37.7H neutralizing antibody.

clone	base change	number of G→A	total changes	ratio of G→A mutation (%)
NA2	**G→A**, **G→A**	2	2	100%
NA3	C→T, A→G	0	2	0%
NA5	**G→A**, **G→A**, A→G, C→T, **G→A**	3	5	60%
NA8	A→G, C→T, T→C	0	3	0%
NA9	**G→A**, **G→A**, T→C	2	3	67%
NA10	A→G, **G→A**, **G→A**, A→G	2	4	50%
NA11	C→T, A→G, T→C	0	3	0%
NA108	T→C, **G→A**	1	2	50%
NA112	A→G	0	1	0%
NA125	C→T, T→C	0	2	0%
NA130	A→G, **G→A**	1	2	50%
total	0 A→C, 8 A→G, 0 A→T, 0 C→A, 0 C→G, 5 C→T, **11 G→A**, 0 G→C, 0 G→T, 0 T→A, 5 T→C, 0 T→G	11	29	38%

Figure S15. Ratios of G-to-A nucleotide substitutions in the LASV GP variants isolated from the conditional replication system in the presence of the 37.7H neutralizing antibody.

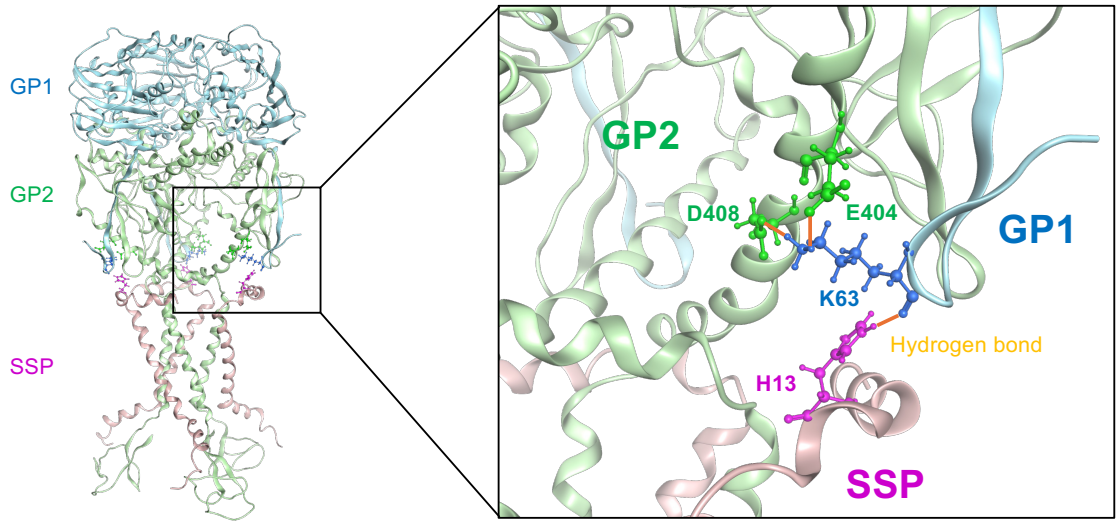


Figure S16. Interaction site between SSP, GP1, and GP2. The orange line indicates a hydrogen bond between the side chain of H13 on SSP, K63 on GP1, and E404 and D408 on GP2.

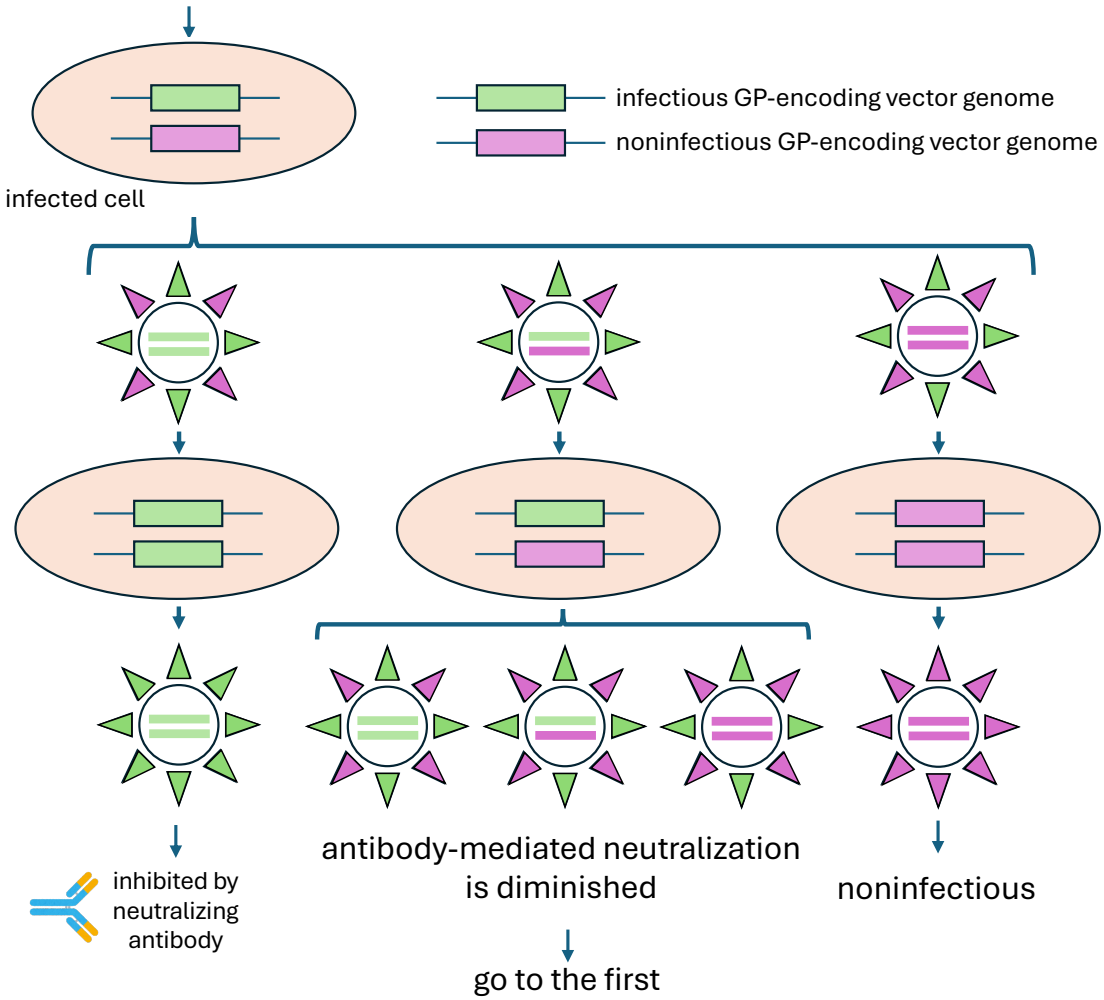


Figure S17. Mechanism by which noninfectious LASV GP variants were selected to resist neutralizing antibody.