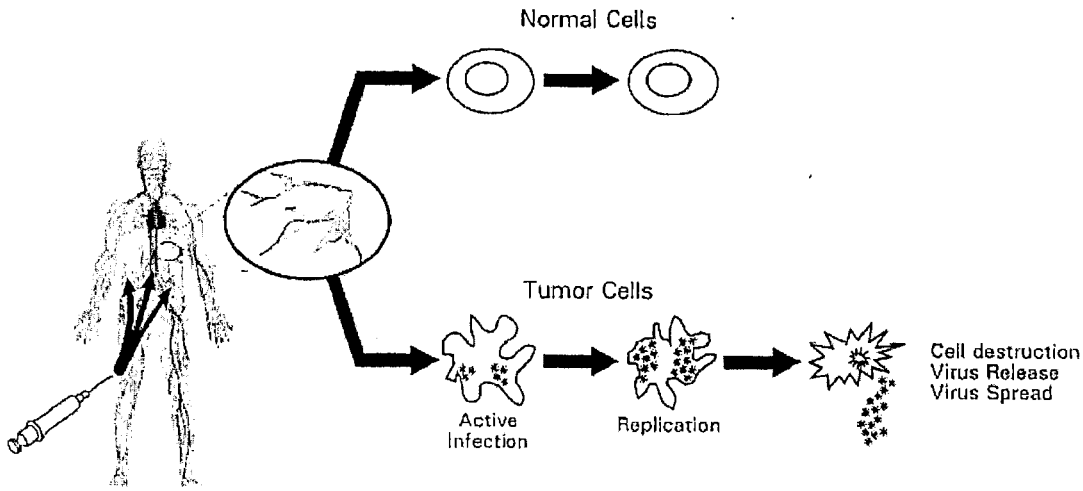

Normal Cells
Tumor Cells
Active Infection
Replication
Cell destruction
Virus Release
Virus Spread

FIG. 1



FIG. 2

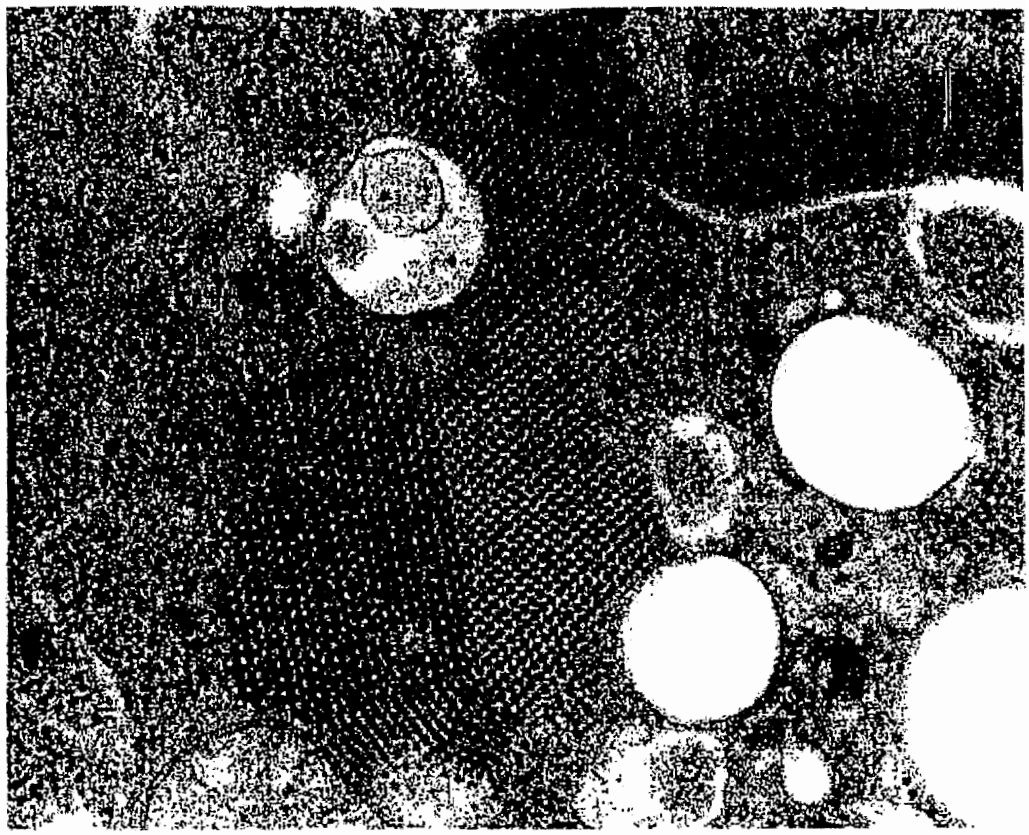


FIG. 3

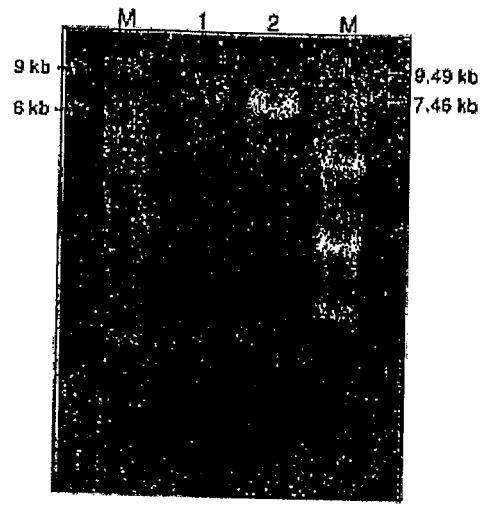


FIG. 4A

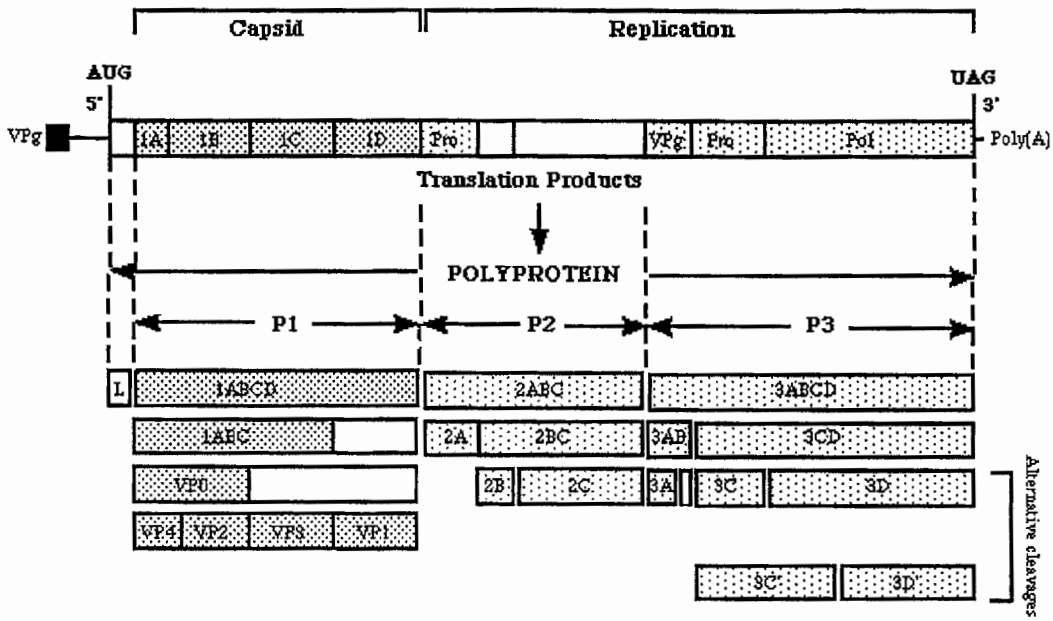
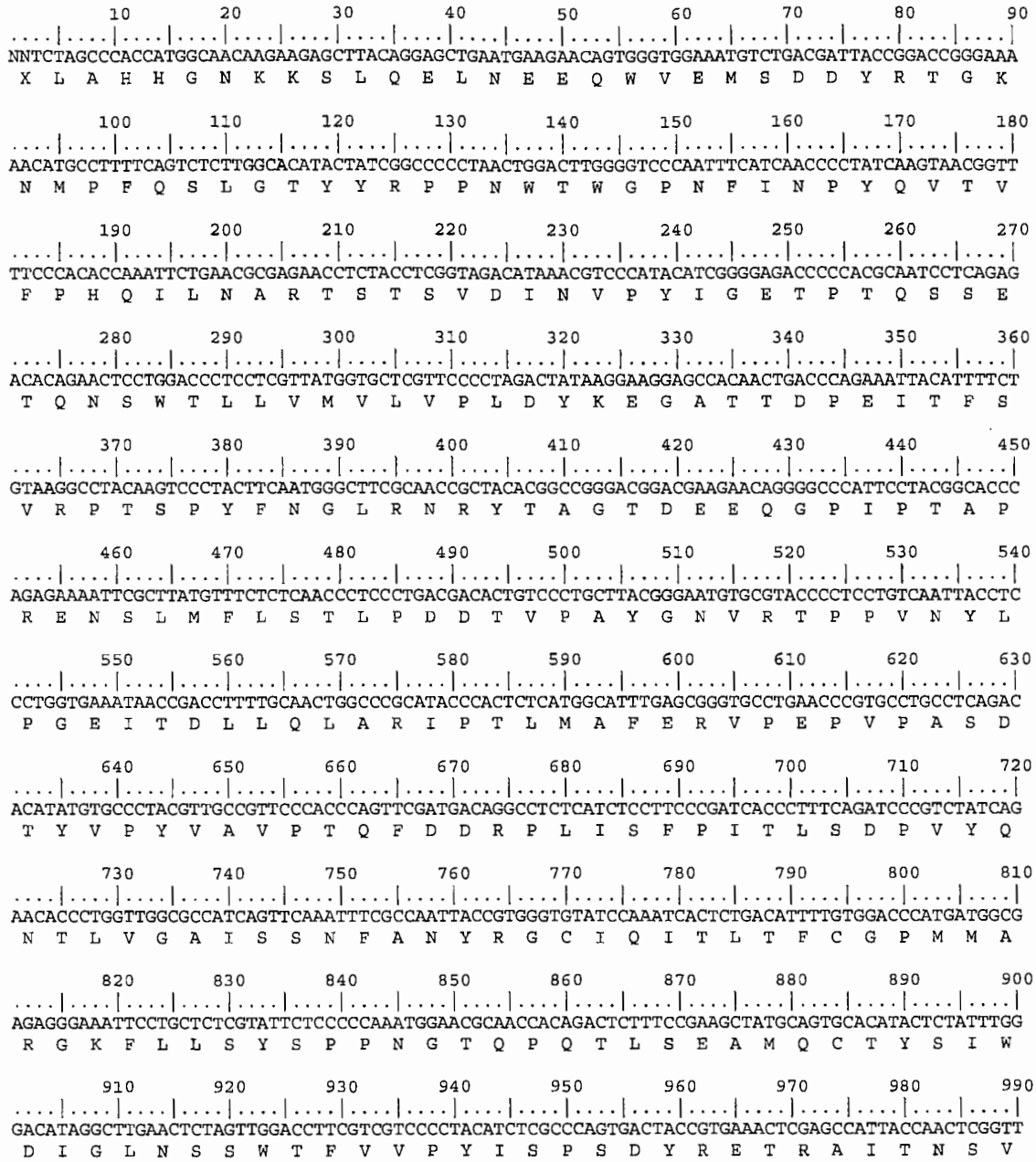

Capsid
Replication
AUG
5'
UAG
3'
VPg
1A
1B
1C
1D
Pro
VPg
Pro
Pol
Poly(A)
Translation Products
POLYPROTEIN
P1
P2
P3
L
1ABCD
2ABC
3ABCD
1AB
1BC
2A
2BC
3AB
3CD
VP0
2B
2C
3A
3C
3D
VP4
VP2
VP3
VP1
3C'
3D'
Alternative cleavages

FIG. 4B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100 110 120 130 140 150 160 170 180
AACATGCCTTTTCAGTCTCTTGGCACATACTATCGGCCCCCTAACTGGACTTGGGGTCCCAATTTCATCAACCCCTATCAAGTAACGGTT
N M P F Q S L G T Y Y R P P N W T W G P N F I N P Y Q V T V
190 200 210 220 230 240 250 260 270
TTCCCACACCAAATTCTGAACGCGAGAACCTCTACCTCGGTAGACATAAACGTCCCATACATCGGGGAGACCCCCACGCAATCCTCAGAG
F P H Q I L N A R T S T S V D I N V P Y I G E T P T Q S S E
280 290 300 310 320 330 340 350 360
ACACAGAACTCCTGGACCCTCCTCGTTATGGTGCTCGTTCCCCTAGACTATAAGGAAGGAGCCACAACTGACCCAGAAATTACATTTTCT
T Q N S W T L L V M V L V P L D Y K E G A T T D P E I T F S
370 380 390 400 410 420 430 440 450
GTAAGGCCTACAAGTCCCTACTTCAATGGGCTTCGCAACCGCTACACGGCCGGGACGGACGAAGAACAGGGGCCCATTCCTACGGCACCC
V R P T S P Y F N G L R N R Y T A G T D E E Q G P I P T A P
460 470 480 490 500 510 520 530 540
AGAGAAAATTCGCTTATGTTTCTCTCAACCCTCCCTGACGACACTGTCCCTGCTTACGGGAATGTGCGTACCCCTCCTGTCAATTACCTC
R E N S L M F L S T L P D D T V P A Y G N V R T P P V N Y L
550 560 570 580 590 600 610 620 630
CCTGGTGAAATAACCGACCTTTTGCAACTGGCCCGCATACCCACTCTCATGGCATTTGAGCGGGTGCCTGAACCCGTGCCTGCCTCAGAC
P G E I T D L L Q L A R I P T L M A F E R V P E P V P A S D
640 650 660 670 680 690 700 710 720
ACATATGTGCCCTACGTTGCCGTTCCCACCCAGTTCGATGACAGGCCTCTCATCTCCTTCCCGATCACCCTTTCAGATCCCGTCTATCAG
T Y V P Y V A V P T Q F D D R P L I S F P I T L S D P V Y Q
730 740 750 760 770 780 790 800 810
AACACCCTGGTTGGCGCCATCAGTTCAAATTTCGCCAATTACCGTGGGTGTATCCAAATCACTCTGACATTTTGTGGACCCATGATGGCG
N T L V G A I S S N F A N Y R G C I Q I T L T F C G P M M A
820 830 840 850 860 870 880 890 900
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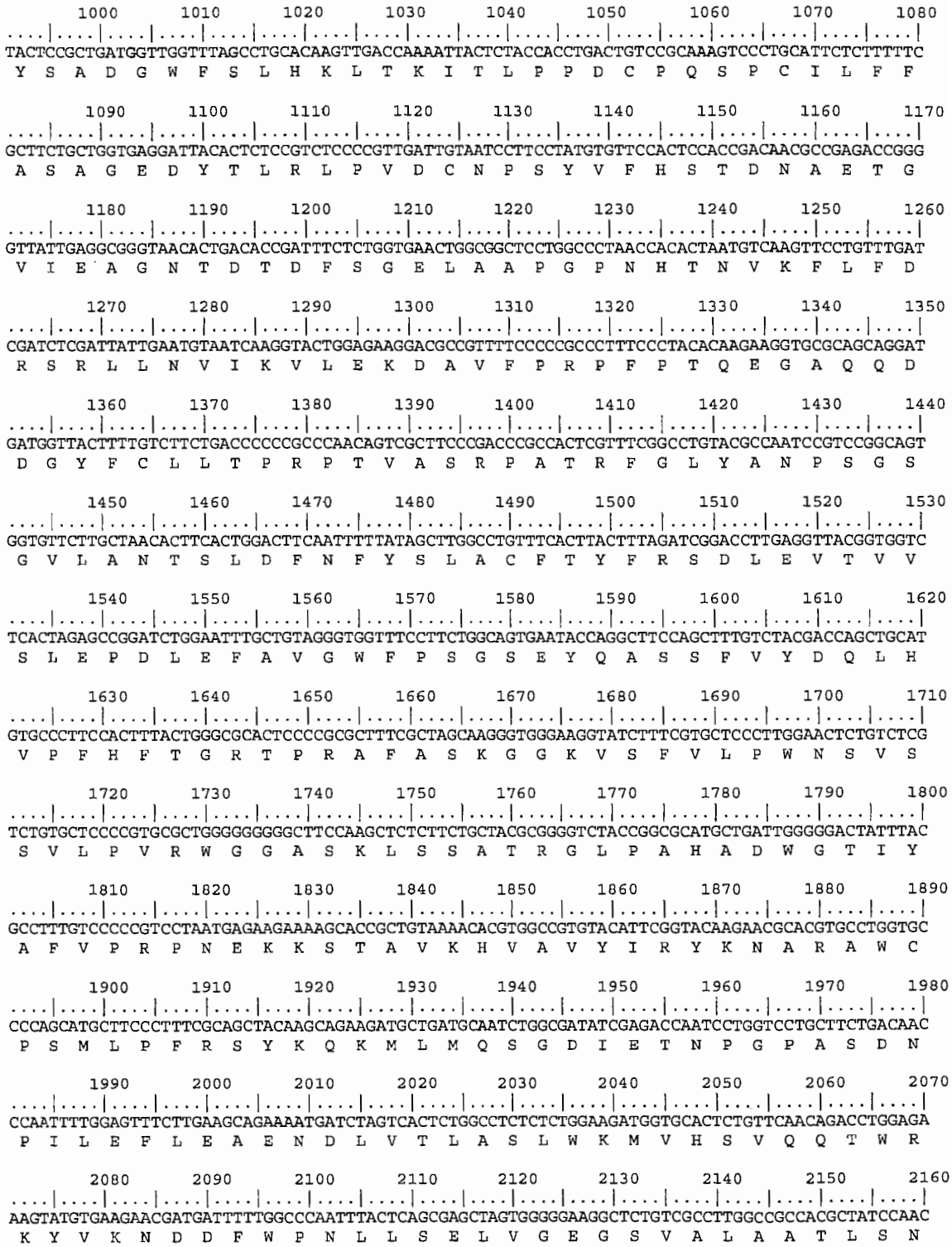
R G K F L L S Y S P P N G T Q P Q T L S E A M Q C T Y S I W
910 920 930 940 950 960 970 980 990
GACATAGGCTTGAACTCTAGTTGGACCTTCGTCGTCCCCTACATCTCGCCCAGTGACTACCGTGAAACTCGAGCCATTACCAACTCGGTT
D I G L N S S W T F V V P Y I S P S D Y R E T R A I T N S V

FIG. 5A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Y S A D G W F S L H K L T K I T L P P D C P Q S P C I L F F
1090 1100 1110 1120 1130 1140 1150 1160 1170
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A S A G E D Y T L R L P V D C N P S Y V F H S T D N A E T G
1180 1190 1200 1210 1220 1230 1240 1250 1260
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V I E A G N T D T D F S G E L A A P G P N H T N V K F L F D
1270 1280 1290 1300 1310 1320 1330 1340 1350
CGATCTCGATTATTGAATGTAATCAAGGTACTGGAGAAGGACGCCGTTTTCCCCCGCCCTTTCCCTACACAAGAAGGTGCGCAGCAGGAT
R S R L L N V I K V L E K D A V F P R P F P T Q E G A Q Q D
1360 1370 1380 1390 1400 1410 1420 1430 1440
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D G Y F C L L T P R P T V A S R P A T R F G L Y A N P S G S
1450 1460 1470 1480 1490 1500 1510 1520 1530
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G V L A N T S L D F N F Y S L A C F T Y F R S D L E V T V V
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S L E P D L E F A V G W F P S G S E Y Q A S S F V Y D Q L H
1630 1640 1650 1660 1670 1680 1690 1700 1710
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V P F H F T G R T P R A F A S K G G K V S F V L P W N S V S
1720 1730 1740 1750 1760 1770 1780 1790 1800
TCTGTGCTCCCCGTGCGCTGGGGGGGGGCTTCCAAGCTCTCTTCTGCTACGCGGGGTCTACCGGCGCATGCTGATTGGGGGACTATTTAC
S V L P V R W G G A S K L S S A T R G L P A H A D W G T I Y
1810 1820 1830 1840 1850 1860 1870 1880 1890
GCCTTTGTCCCCCGTCCTAATGAGAAGAAAAGCACCGCTGTAAAACACGTGGCCGTGTACATTCGGTACAAGAACGCACGTGCCTGGTGC
A F V P R P N E K K S T A V K H V A V Y I R Y K N A R A W C
1900 1910 1920 1930 1940 1950 1960 1970 1980
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P S M L P F R S Y K Q K M L M Q S G D I E T N P G P A S D N
1990 2000 2010 2020 2030 2040 2050 2060 2070
CCAATTTTGGAGTTTCTTGAAGCAGAAAATGATCTAGTCACTCTGGCCTCTCTCTGGAAGATGGTGCACTCTGTTCAACAGACCTGGAGA
P I L E F L E A E N D L V T L A S L W K M V H S V Q Q T W R
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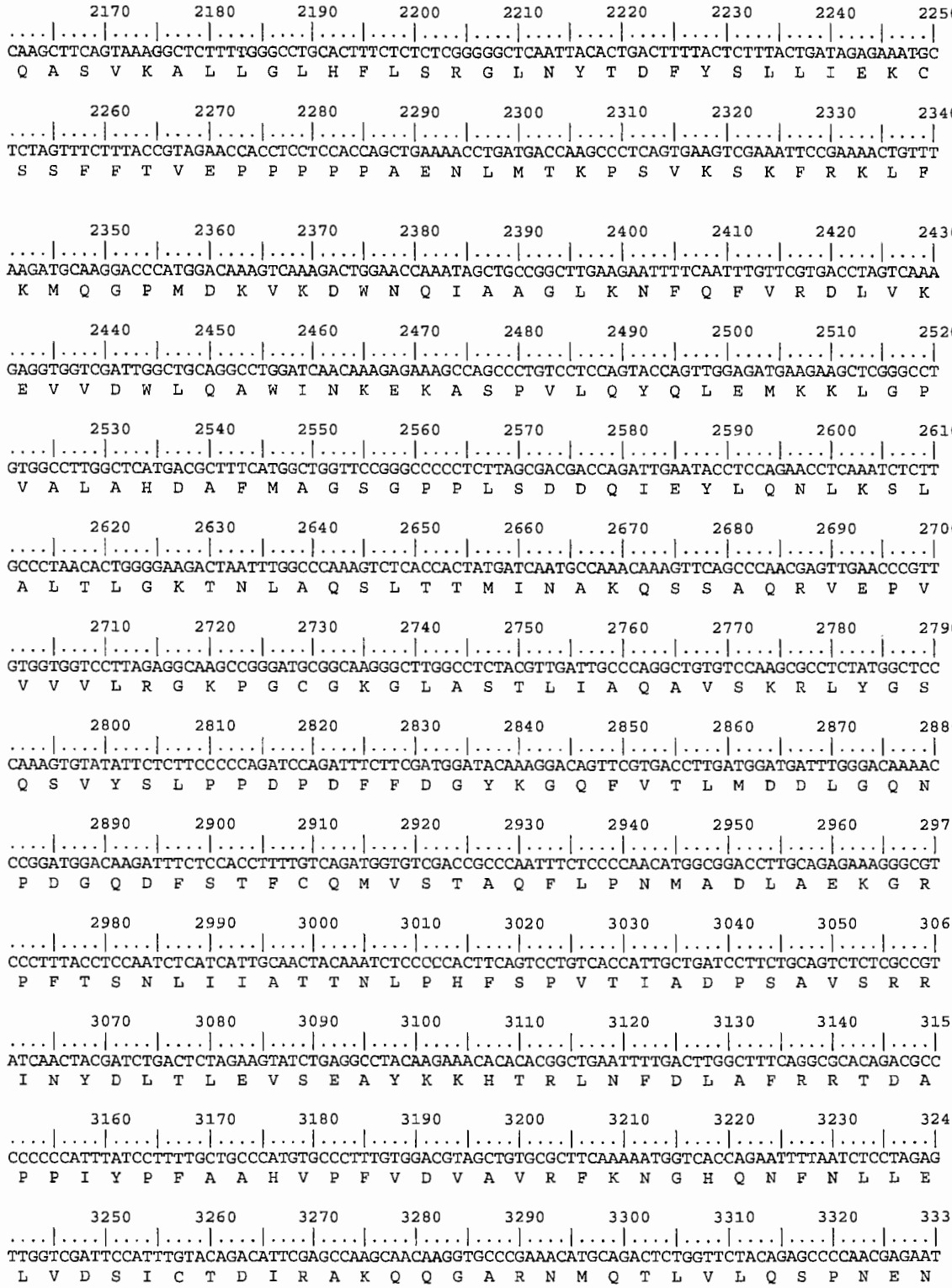
K Y V K N D D F W P N L L S E L V G E G S V A L A A T L S N

FIG. 5B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Q A S V K A L L G L H F L S R G L N Y T D F Y S L L I E K C
2260 2270 2280 2290 2300 2310 2320 2330 2340
TCTAGTTTCTTTACCGTAGAACCACCTCCTCCACCAGCTGAAAACCTGATGACCAAGCCCTCAGTGAAGTCGAAATTCCGAAAACTGTTT
S S F F T V E P P P P P A E N L M T K P S V K S K F R K L F
2350 2360 2370 2380 2390 2400 2410 2420 2430
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K M Q G P M D K V K D W N Q I A A G L K N F Q F V R D L V K
2440 2450 2460 2470 2480 2490 2500 2510 2520
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E V V D W L Q A W I N K E K A S P V L Q Y Q L E M K K L G P
2530 2540 2550 2560 2570 2580 2590 2600 2610
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V A L A H D A F M A G S G P P L S D D Q I E Y L Q N L K S L
2620 2630 2640 2650 2660 2670 2680 2690 2700
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A L T L G K T N L A Q S L T T M I N A K Q S S A Q R V E P V
2710 2720 2730 2740 2750 2760 2770 2780 2790
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V V V L R G K P G C G K G L A S T L I A Q A V S K R L Y G S
2800 2810 2820 2830 2840 2850 2860 2870 2880
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Q S V Y S L P P D P D F F D G Y K G Q F V T L M D D L G Q N
2890 2900 2910 2920 2930 2940 2950 2960 2970
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P D G Q D F S T F C Q M V S T A Q F L P N M A D L A E K G R
2980 2990 3000 3010 3020 3030 3040 3050 3060
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P F T S N L I I A T T N L P H F S P V T I A D P S A V S R R
3070 3080 3090 3100 3110 3120 3130 3140 3150
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I N Y D L T L E V S E A Y K K H T R L N F D L A F R R T D A
3160 3170 3180 3190 3200 3210 3220 3230 3240
CCCCCCATTTATCCTTTTGCTGCCCATGTGCCCTTTGTGGACGTAGCTGTGCGCTTCAAAAATGGTCACCAGAATTTTAATCTCCTAGAG
P P I Y P F A A H V P F V D V A V R F K N G H Q N F N L L E
3250 3260 3270 3280 3290 3300 3310 3320 3330
TTGGTCGATTCCATTTGTACAGACATTCGAGCCAAGCAACAAGGTGCCCGAAACATGCAGACTCTGGTTCTACAGAGCCCCAACGAGAAT
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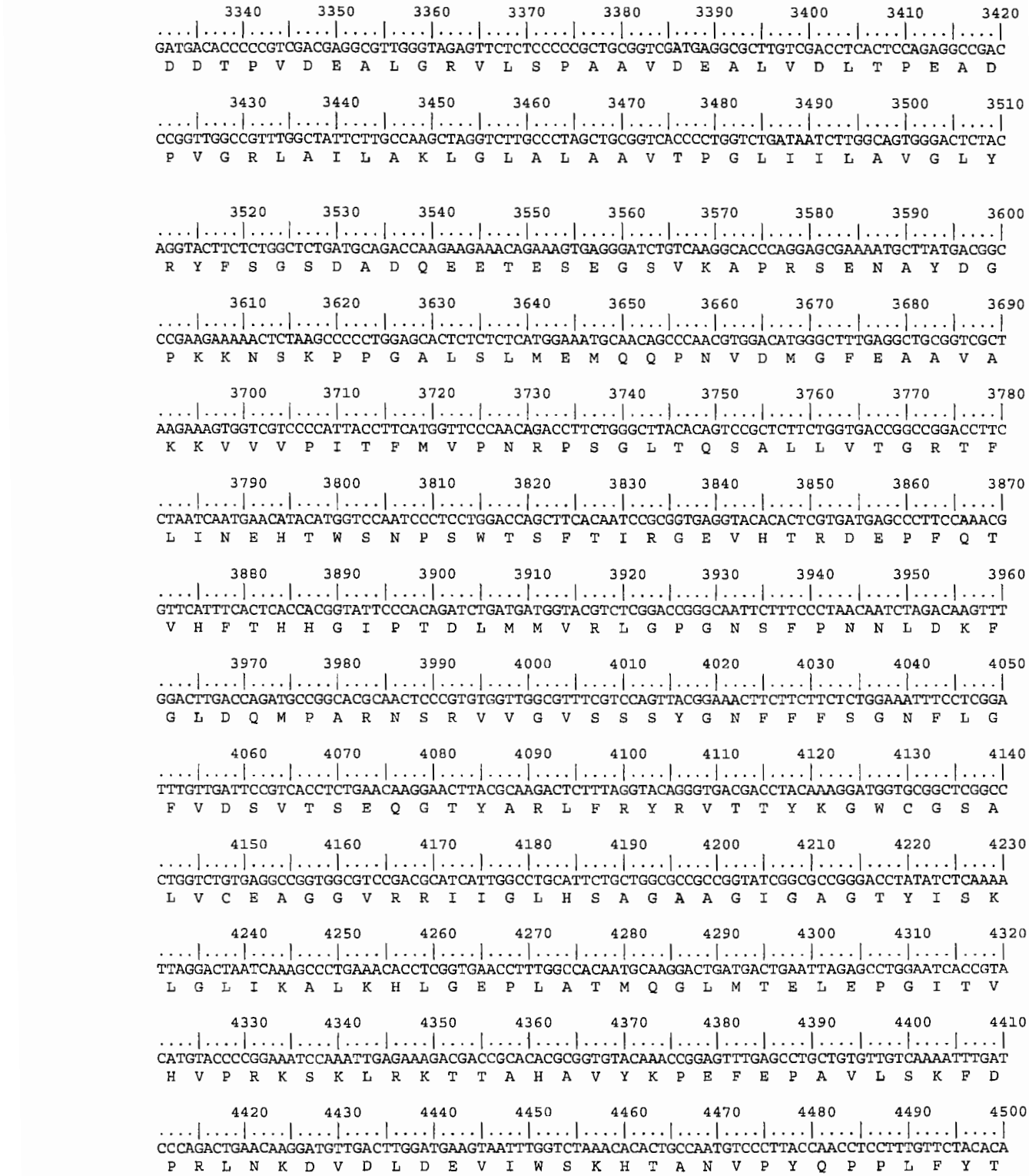
FIG. 5C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3430 3440 3450 3460 3470 3480 3490 3500 3510
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P V G R L A I L A K L G L A L A A V T P G L I I L A V G L Y
3520 3530 3540 3550 3560 3570 3580 3590 3600
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R Y F S G S D A D Q E E T E S E G S V K A P R S E N A Y D G
3610 3620 3630 3640 3650 3660 3670 3680 3690
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P K K N S K P P G A L S L M E M Q Q P N V D M G F E A A V A
3700 3710 3720 3730 3740 3750 3760 3770 3780
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K K V V V P I T F M V P N R P S G L T Q S A L L V T G R T F
3790 3800 3810 3820 3830 3840 3850 3860 3870
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L I N E H T W S N P S W T S F T I R G E V H T R D E P F Q T
3880 3890 3900 3910 3920 3930 3940 3950 3960
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V H F T H H G I P T D L M M V R L G P G N S F P N N L D K F
3970 3980 3990 4000 4010 4020 4030 4040 4050
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G L D Q M P A R N S R V V G V S S S Y G N F F F S G N F L G
4060 4070 4080 4090 4100 4110 4120 4130 4140
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4150 4160 4170 4180 4190 4200 4210 4220 4230
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L V C E A G G V R R I I G L H S A G A A G I G A G T Y I S K
4240 4250 4260 4270 4280 4290 4300 4310 4320
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L G L I K A L K H L G E P L A T M Q G L M T E L E P G I T V
4330 4340 4350 4360 4370 4380 4390 4400 4410
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H V P R K S K L R K T T A H A V Y K P E F E P A V L S K F D
4420 4430 4440 4450 4460 4470 4480 4490 4500
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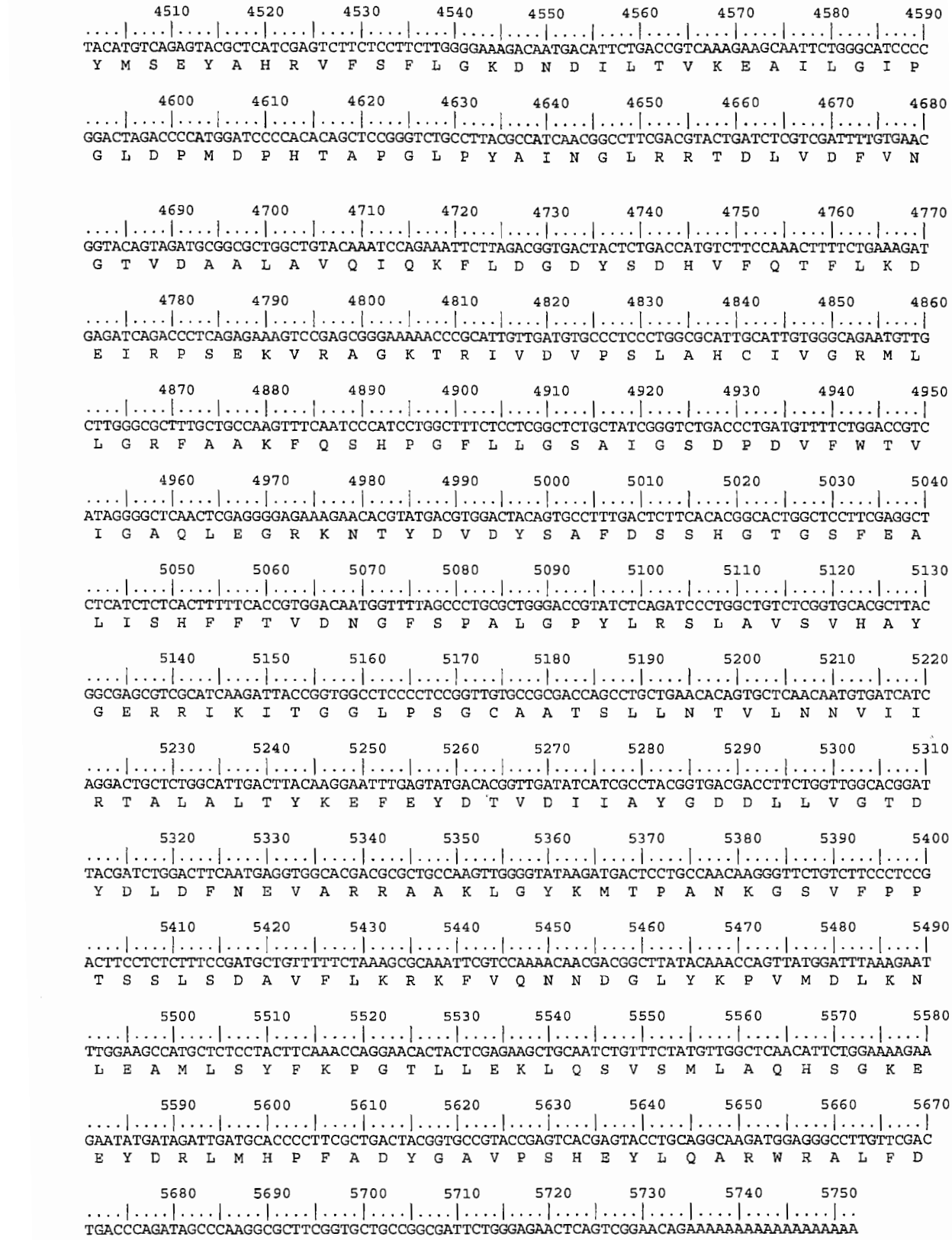
FIG. 5D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Y M S E Y A H R V F S F L G K D N D I L T V K E A I L G I P
4600 4610 4620 4630 4640 4650 4660 4670 4680
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G L D P M D P H T A P G L P Y A I N G L R R T D L V D F V N
4690 4700 4710 4720 4730 4740 4750 4760 4770
GGTACAGTAGATGCGGCGCTGGCTGTACAAATCCAGAAATTCTTAGACGGTGACTACTCTGACCATGTCTTCCAAACTTTTCTGAAAGAT
G T V D A A L A V Q I Q K F L D G D Y S D H V F Q T F L K D
4780 4790 4800 4810 4820 4830 4840 4850 4860
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E I R P S E K V R A G K T R I V D V P S L A H C I V G R M L
4870 4880 4890 4900 4910 4920 4930 4940 4950
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L G R F A A K F Q S H P G F L L G S A I G S D P D V F W T V
4960 4970 4980 4990 5000 5010 5020 5030 5040
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I G A Q L E G R K N T Y D V D Y S A F D S S H G T G S F E A
5050 5060 5070 5080 5090 5100 5110 5120 5130
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L I S H F F T V D N G F S P A L G P Y L R S L A V S V H A Y
5140 5150 5160 5170 5180 5190 5200 5210 5220
GGCGAGCGTCGCATCAAGATTACCGGTGGCCTCCCCTCCGGTTGTGCCGCGACCAGCCTGCTGAACACAGTGCTCAACAATGTGATCATC
G E R R I K I T G G L P S G C A A T S L L N T V L N N V I I
5230 5240 5250 5260 5270 5280 5290 5300 5310
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R T A L A L T Y K E F E Y D T V D I I A Y G D D L L V G T D
5320 5330 5340 5350 5360 5370 5380 5390 5400
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L E A M L S Y F K P G T L L E K L Q S V S M L A Q H S G K E
5590 5600 5610 5620 5630 5640 5650 5660 5670
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5680 5690 5700 5710 5720 5730 5740 5750
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*

FIG. 5E

```
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TTCCCACACC AAATTCTGAA CGCGAGAACC TCTACCTCGG TAGACATAAA CGTCCCATAC 240
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GTGCTCGTTC CCCTAGACTA TAAGGAAGGA GCCACAACTG ACCCAGAAAT TACATTTTCT 360
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CTCCCTGACG ACACTGTCCC TGCTTACGGG AATGTGCGTA CCCCTCCTGT CAATTACCTC 540
CCTGGTGAAA TAACCGACCT TTTGCAACTG GCCCGCATAC CCACTCTCAT GGCATTTGAG 600
CGGGTGCCTG AACCCGTGCC TGCCTCAGAC ACATATGTGC CCTACGTTGC CGTTCCCACC 660
CAGTTCGATG ACAGGCCTCT CATCTCCTTC CCGATCACCC TTTCAGATCC CGTCTATCAG 720
AACACCCTGG TTGGCGCCAT CAGTTCAAAT TTCGCCAATT ACCGTGGGTG TATCCAAATC 780
ACTCTGACAT TTTGTGGACC CATGATGGCG AGAGGGAAAT TCCTGCTCTC GTATTCTCCC 840
CCAAATGGAA CGCAACCACA GACTCTTTCC GAAGCTATGC AGTGCACATA CTCTATTTGG 900
GACATAGGCT TGAACTCTAG TTGGACCTTC GTCGTCCCCT ACATCTCGCC CAGTGACTAC 960
CGTGAAACTC GAGCCATTAC CAACTCGGTT TACTCCGCTG ATGGTTGGTT TAGCCTGCAC 1020
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TTCCCTACAC AAGAAGGTGC GCAGCAGGAT GATGGTTACT TTTGTCTTCT GACCCCCCGC 1380
CCAACAGTCG CTTCCCGACC CGCCACTCGT TTCGGCCTGT ACGCCAATCC GTCCGGCAGT 1440
GGTGTTCTTG CTAACACTTC ACTGGACTTC AATTTTTATA GCTTGGCCTG TTTCACTTAC 1500
```

FIG. 6A

TTTAGATCGG ACCTTGAGGT TACGGTGGTC TCACTAGAGC CGGATCTGGA ATTTGCTGTA 1560

GGGTGGTTTC CTTCTGGCAG TGAATACCAG GCTTCCAGCT TTGTCTACGA CCAGCTGCAT 1620

GTGCCCTTCC ACTTTACTGG GCGCACTCCC CGCGCTTTCG CTAGCAAGGG TGGGAAGGTA 1680

TCTTTCGTGC TCCCTTGGAA CTCTGTCTCG TCTGTGCTCC CCGTGCGCTG GGGGGGGGCT 1740

TCCAAGCTCT CTTCTGCTAC GCGGGGTCTA CCGGCGCATG CTGATTGGGG GACTATTTAC 1800

GCCTTTGTCC CCCGTCCTAA TGAGAAGAAA AGCACCGCTG TAAAACACGT GGCCGTGTAC 1860

ATTCGGTACA AGAACGCACG TGCCTGGTGC CCCAGCATGC TTCCCTTTCG CAGCTACAAG 1920

CAGAAGATGC TGATGCAATC TGGCGATATC GAGACCAATC CTGGTCCTGC TTCTGACAAC 1980

CCAATTTTGG AGTTTCTTGA AGCAGAAAAT GATCTAGTCA CTCTGGCCTC TCTCTGGAAG 2040

ATGGTGCACT CTGTTCAACA GACCTGGAGA AAGTATGTGA AGAACGATGA TTTTTGGCCC 2100

AATTTACTCA GCGAGCTAGT GGGGGAAGGC TCTGTCGCCT TGGCCGCCAC GCTATCCAAC 2160

CAAGCTTCAG TAAAGGCTCT TTTGGGCCTG CACTTTCTCT CTCGGGGGCT CAATTACACT 2220

GACTTTTACT CTTTACTGAT AGAGAAATGC TCTAGTTTCT TTACCGTAGA ACCACCTCCT 2280

CCACCAGCTG AAAACCTGAT GACCAAGCCC TCAGTGAAGT CGAAATTCCG AAAACTGTTT 2340

AAGATGCAAG GACCCATGGA CAAAGTCAAA GACTGGAACC AAATAGCTGC CGGCTTGAAG 2400

AATTTTCAAT TTGTTCGTGA CCTAGTCAAA GAGGTGGTCG ATTGGCTGCA GGCCTGGATC 2460

AACAAAGAGA AAGCCAGCCC TGTCCTCCAG TACCAGTTGG AGATGAAGAA GCTCGGGCCT 2520

GTGGCCTTGG CTCATGACGC TTTCATGGCT GGTTCCGGGC CCCCTCTTAG CGACGACCAG 2580

ATTGAATACC TCCAGAACCT CAAATCTCTT GCCCTAACAC TGGGGAAGAC TAATTTGGCC 2640

CAAAGTCTCA CCACTATGAT CAATGCCAAA CAAAGTTCAG CCCAACGAGT TGAACCCGTT 2700

GTGGTGGTCC TTAGAGGCAA GCCGGGATGC GGCAAGGGCT TGGCCTCTAC GTTGATTGCC 2760

CAGGCTGTGT CCAAGCGCCT CTATGGCTCC CAAAGTGTAT ATTCTCTTCC CCCAGATCCA 2820

GATTTCTTCG ATGGATACAA AGGACAGTTC GTGACCTTGA TGGATGATTT GGGACAAAAC 2880

CCGGATGGAC AAGATTTCCC CACCTTTTGT CAGATGGTGT CGACCGCCCA ATTTCTCCCC 2940

AACATGGCGG ACCTTGCAGA GAAAGGGCGT CCCTTTACCT CCAATCTCAT CATTGCAACT 3000

FIG. 6B

ACAAATCTCC CCCACTTCAG TCCTGTCACC ATTGCTGATC CTTCTGCAGT CTCTCGCCGT 3060

ATCAACTACG ATCTGACTCT AGAAGTATCT GAGGCCTACA AGAAACACAC ACGGCTGAAT 3120

TTTGACTTGG CTTTCAGGCG CACAGACGCC CCCCCCATTT ATCCTTTTGC TGCCCATGTG 3180

CCCTTTGTGG ACGTAGCTGT GCGCTTCAAA AATGGTCACC AGAATTTTAA TCTCCTAGAG 3240

TTGGTCGATT CCATTTGTAC AGACATTCGA GCCAAGCAAC AAGGTGCCCG AAACATGCAG 3300

ACTCTGGTTC TACAGAGCCC CAACGAGAAT GATGACACCC CCGTCGACGA GGCGTTGGGT 3360

AGAGTTCTCT CCCCCGCTGC GGTCGATGAG GCGCTTGTCG ACCTCACTCC AGAGGCCGAC 3420

CCGGTTGGCC GTTTGGCTAT TCTTGCCAAG CTAGGTCTTG CCCTAGCTGC GGTCACCCCT 3480

GGTCTGATAA TCTTGGCAGT GGGACTCTAC AGGTACTTCT CTGGCTCTGA TGCAGACCAA 3540

GAAGAAACAG AAAGTGAGGG ATCTGTCAAG GCACCCAGGA GCGAAAATGC TTATGACGGC 3600

CCGAAGAAAA ACTCTAAGCC CCCTGGAGCA CTCTCTCTCA TGGAAATGCA ACAGCCCAAC 3660

GTGGACATGG GCTTTGAGGC TGCGGTCGCT AAGAAAGTGG TCGTCCCCAT TACCTTCATG 3720

GTTCCCAACA GACCTTCTGG GCTTACACAG TCCGCTCTTC TGGTGACCGG CCGGACCTTC 3780

CTAATCAATG AACATACATG GTCCAATCCC TCCTGGACCA GCTTCACAAT CCGCGGTGAG 3840

GTACACACTC GTGATGAGCC CTTCCAAACG GTTCATTTCA CTCACCACGG TATTCCCACA 3900

GATCTGATGA TGGTACGTCT CGGACCGGGC AATTCTTTCC CTAACAATCT AGACAAGTTT 3960

GGACTTGACC AGATGCCGGC ACGCAACTCC CGTGTGGTTG GCGTTTCGTC CAGTTACGGA 4020

AACTTCTTCT TCTCTGGAAA TTTCCTCGGA TTTGTTGATT CCGTCACCTC TGAACAAGGA 4080

ACTTACGCAA GACTCTTTAG GTACAGGGTG ACGACCTACA AAGGATGGTG CGGCTCGGCC 4140

CTGGTCTGTG AGGCCGGTGG CGTCCGACGC ATCATTGGCC TGCATTCTGC TGGCGCCGCC 4200

GGTATCGGCG CCGGGACCTA TATCTCAAAA TTAGGACTAA TCAAAGCCCT GAAACACCTC 4260

GGTGAACCTT TGGCCACAAT GCAAGGACTG ATGACTGAAT TAGAGCCTGG AATCACCGTA 4320

CATGTACCCC GGAAATCCAA ATTGAGAAAG ACGACCGCAC ACGCGGTGTA CAAACCGGAG 4380

TTTGAGCCTG CTGTGTTGTC AAAATTTGAT CCCAGACTGA ACAAGGATGT TGACTTGGAT 4440

GAAGTAATTT GGTCTAAACA CACTGCCAAT GTCCCTTACC AACCTCCTTT GTTCTACACA 4500

FIG. 6C

TACATGTCAG AGTACGCTCA TCGAGTCTTC TCCTTCTTGG GGAAAGACAA TGACATTCTG 4560

ACCGTCAAAG AAGCAATTCT GGGCATCCCC GGACTAGACC CCATGGATCC CCACACAGCT 4620

CCGGGTCTGC CTTACGCCAT CAACGGCCTT CGACGTACTG ATCTCGTCGA TTTTGTGAAC 4680

GGTACAGTAG ATGCGGCGCT GGCTGTACAA ATCCAGAAAT TCTTAGACGG TGACTACTCT 4740

GACCATGTCT TCCAAACTTT TCTGAAAGAT GAGATCAGAC CCTCAGAGAA AGTCCGAGCG 4800

GGAAAAACCC GCATTGTTGA TGTGCCCTCC CTGGCGCATT GCATTGTGGG CAGAATGTTG 4860

CTTGGGCGCT TTGCTGCCAA GTTTCAATCC CATCCTGGCT TTCTCCTCGG CTCTGCTATC 4920

GGGTCTGACC CTGATGTTTT CTGGACCGTC ATAGGGGCTC AACTCGAGGG GAGAAAGAAC 4980

ACGTATGACG TGGACTACAG TGCCTTTGAC TCTTCACACG GCACTGGCTC CTTCGAGGCT 5040

CTCATCTCTC ACTTTTTCAC CGTGGACAAT GGTTTTAGCC CTGCGCTGGG ACCGTATCTC 5100

AGATCCCTGG CTGTCTCGGT GCACGCTTAC GGCGAGCGTC GCATCAAGAT TACCGGTGGC 5160

CTCCCCTCCG GTTGTGCCGC GACCAGCCTG CTGAACACAG TGCTCAACAA TGTGATCATC 5220

AGGACTGCTC TGGCATTGAC TTACAAGGAA TTTGAGTATG ACACGGTTGA TATCATCGCC 5280

TACGGTGACG ACCTTCTGGT TGGCACGGAT TACGATCTGG ACTTCAATGA GGTGGCACGA 5340

CGCGCTGCCA AGTTGGGGTA TAAGATGACT CCTGCCAACA AGGGTTCTGT CTTCCCTCCG 5400

ACTTCCTCTC TTTCCGATGC TGTTTTTCTA AAGCGCAAAT TCGTCCAAAA CAACGACGGC 5460

TTATACAAAC CAGTTATGGA TTTAAAGAAT TTGGAAGCCA TGCTCTCCTA CTTCAAACCA 5520

GGAACACTAC TCGAGAAGCT GCAATCTGTT TCTATGTTGG CTCAACATTC TGGAAAAGAA 5580

GAATATGATA GATTGATGCA CCCCTTCGCT GACTACGGTG CCGTACCGAG TCACGAGTAC 5640

CTGCAGGCAA GATGGAGGGC CTTGTTCGAC TGACCCAGAT AGCCCAAGGC GCTTCGGTGC 5700

TGCCGGCGAT TCTGGGAGAA CTCAGTCGGA ACAGAAAAAA AAAAAAAAAA AA 5752

(SEQ ID NO:1)

FIG. 6D

```
XLAHHGNKKS LQELNEEQWV EMSDDYRTGK NMPFQSLGTY YRPPNWTWGP NFINPYQVTV 60

FPHQILNART STSVDINVPY IGETPTQSSE TQNSWTLLVM VLVPLDYKEG ATTDPEITFS 120

VRPTSPYFNG LRNRYTAGTD EEQGPIPTAP RENSLMFLST LPDDTVPAYG NVRTPPVNYL 180

PGEITDLLQL ARIPTLMAFE RVPEPVPASD TYVPYVAVPT QFDDRPLISF PITLSDPVYQ 240

NTLVGAISSN FANYRGCIQI TLTFCGPMMA RGKFLLSYSP PNGTQPQTLS EAMQCTYSIW 300

DIGLNSSWTF VVPYISPSDY RETRAITNSV YSADGWFSLH KLTKITLPPD CPQSPCILFF 360

ASAGEDYTLR LPVDCNPSYV FHSTDNAETG VIEAGNTDTD FSGELAAPGP NHTNVKFLFD 420

RSRLLNVIKV LEKDAVFPRP FPTQEGAQQD DGYFCLLTPR PTVASRPATR FGLYANPSGS 480

GVLANTSLDF NFYSLACFTY FRSDLEVTVV SLEPDLEFAV GWFPSGSEYQ ASSFVYDQLH 540

VPFHFTGRTP RAFASKGGKV SFVLPWNSVS SVLPVRWGGA SKLSSATRGL PAHADWGTIY 600

AFVPRPNEKK STAVKHVAVY IRYKNARAWC PSMLPFRSYK QKMLMQSGDI ETNPGPASDN 660

PILEFLEAEN DLVTLASLWK MVHSVQQTWR KYVKNDDFWP NLLSELVGEG SVALAATLSN 720

QASVKALLGL HFLSRGLNYT DFYSLLIEKC SSFFTVEPPP PPAENLMTKP SVKSKFRKLF 780

KMQGPMDKVK DWNQIAAGLK NFQFVRDLVK EVVDWLQAWI NKEKASPVLQ YQLEMKKLGP 840

VALAHDAFMA GSGPPLSDDQ IEYLQNLKSL ALTLGKTNLA QSLTTMINAK QSSAQRVEPV 900

VVVLRGKPGC GKGLASTLIA QAVSKRLYGS QSVYSLPPDP DFFDGYKGQF VTLMDDLGQN 960

PDGQDFSTFC QMVSTAQFLP NMADLAEKGR PFTSNLIIAT TNLPHFSPVT IADPSAVSRR 1020

INYDLTLEVS EAYKKHTRLN FDLAFRRTDA PPIYPFAAHV PFVDVAVRFK NGHQNFNLLE 1080

LVDSICTDIR AKQQGARNMQ TLVLQSPNEN DDTPVDEALG RVLSPAAVDE ALVDLTPEAD 1140

PVGRLAILAK LGLALAAVTP GLIILAVGLY RYFSGSDADQ EETESEGSVK APRSENAYDG 1200
```

FIG. 7A

PKKNSKPPGA LSLMEMQQPN VDMGFEAAVA KKVVVPITFM VPNRPSGLTQ SALLVTGRTF 1260

LINEHTWSNP SWTSFTIRGE VHTRDEPFQT VHFTHHGIPT DLMMVRLGPG NSFPNNLDKF 1320

GLDQMPARNS RVVGVSSSYG NFFFSGNFLG FVDSVTSEQG TYARLFRYRV TTYKGWCGSA 1380

LVCEAGGVRR IIGLHSAGAA GIGAGTYISK LGLIKALKHL GEPLATMQGL MTELEPGITV 1440

HVPRKSKLRK TTAHAVYKPE FEPAVLSKFD PRLNKDVDLD EVIWSKHTAN VPYQPPLFYT 1500

YMSEYAHRVF SFLGKDNDIL TVKEAILGIP GLDPMDPHTA PGLPYAINGL RRTDLVDFVN 1560

GTVDAALAVQ IQKFLDGDYS DHVFQTFLKD EIRPSEKVRA GKTRIVDVPS LAHCIVGRML 1620

LGRFAAKFQS HPGFLLGSAI GSDPDVFWTV IGAQLEGRKN TYDVDYSAFD SSHGTGSFEA 1680

LISHFFTVDN GFSPALGPYL RSLAVSVHAY GERRIKITGG LPSGCAATSL LNTVLNNVII 1740

RTALALTYKE FEYDTVDIIA YGDDLLVGTD YDLDFNEVAR RAAKLGYKMT PANKGSVFPP 1800

TSSLSDAVFL KRKFVQNNDG LYKPVMDLKN LEAMLSYFKP GTLLEKLQSV SMLAQHSGKE 1860

EYDRLMHPFA DYGAVPSHEY LQARWRALFD * (SEQ ID NO:2) 1890

FIG. 7B

```
CTAGCCCACC ATGGCAACAA GAAGAGCTTA CAGGAGCTGA ATGAAGAACA GTGGGTGGAA 60
ATGTCTGACG ATTACCGGAC CGGGAAAAAC ATGCCTTTTC AGTCTCTTGG CACATACTAT 120
CGGCCCCCTA ACTGGACTTG GGGTCCCAAT TTCATCAACC CCTATCAAGT AACGGTTTTC 180
CCACACCAAA TTCTGAACGC GAGAACCTCT ACCTCGGTAG ACATAAACGT CCCATACATC 240
GGGGAGACCC CCACGCAATC CTCAGAGACA CAGAACTCCT GGACCCTCCT CGTTATGGTG 300
CTCGTTCCCC TAGACTATAA GGAAGGAGCC ACAACTGACC CAGAAATTAC ATTTTCTGTA 360
AGGCCTACAA GTCCCTACTT CAATGGGCTT CGCAACCGCT ACACGGCCGG GACGGACGAA 420
GAACAG (SEQ ID NO:3)                                              426
```

FIG. 8

```
LAHHGNKKSL QELNEEQWVE MSDDYRTGKN MPFQSLGTYY RPPNWTWGPN FINPYQVTVF 60
PHQILNARTS TSVDINVPYI GETPTQSSET QNSWTLLVMV LVPLDYKEGA TTDPEITFSV 120
RPTSPYFNGL RNRYTAGTDE EQ (SEQ ID NO:4)                            142
```

FIG. 9

GGGCCCATTC CTACGGCACC CAGAGAAAAT TCGCTTATGT TTCTCTCAAC CCTCCCTGAC 60

GACACTGTCC CTGCTTACGG GAATGTGCGT ACCCCTCCTG TCAATTACCT CCCTGGTGAA 120

ATAACCGACC TTTTGCAACT GGCCCGCATA CCCACTCTCA TGGCATTTGA GCGGGTGCCT 180

GAACCCGTGC CTGCCTCAGA CACATATGTG CCCTACGTTG CCGTTCCCAC CCAGTTCGAT 240

GACAGGCCTC TCATCTCCTT CCCGATCACC CTTTCAGATC CCGTCTATCA GAACACCCTG 300

GTTGGCGCCA TCAGTTCAAA TTTCGCCAAT TACCGTGGGT GTATCCAAAT CACTCTGACA 360

TTTTGTGGAC CCATGATGGC GAGAGGGAAA TTCCTGCTCT CGTATTCTCC CCCAAATGGA 420

ACGCAACCAC AGACTCTTTC CGAAGCTATG CAGTGCACAT ACTCTATTTG GGACATAGGC 480

TTGAACTCTA GTTGGACCTT CGTCGTCCCC TACATCTCGC CCAGTGACTA CCGTGAAACT 540

CGAGCCATTA CCAACTCGGT TTACTCCGCT GATGGTTGGT TTAGCCTGCA CAAGTTGACC 600

AAAATTACTC TACCACCTGA CTGTCCGCAA AGTCCCTGCA TTCTCTTTTT CGCTTCTGCT 660

GGTGAGGATT ACACTCTCCG TCTCCCCGTT GATTGTAATC CTTCCTATGT GTTCCAC 717

(SEQ ID NO:5)

FIG. 10

GPIPTAPREN SLMFLSTLPD DTVPAYGNVR TPPVNYLPGE ITDLLQLARI PTLMAFERVP 60

EPVPASDTYV PYVAVPTQFD DRPLISFPIT LSDPVYQNTL VGAISSNFAN YRGCIQITLT 120

FCGPMMARGK FLLSYSPPNG TQPQTLSEAM QCTYSIWDIG LNSSWTFVVP YISPSDYRET 180

RAITNSVYSA DGWFSLHKLT KITLPPDCPQ SPCILFFASA GEDYTLRLPV DCNPSYVFH 239

(SEQ ID NO:6)

FIG. 11

TCCACCGACA ACGCCGAGAC CGGGGTTATT GAGGCGGGTA ACACTGACAC CGATTTCTCT 60

GGTGAACTGG CGGCTCCTGG CCCTAACCAC ACTAATGTCA AGTTCCTGTT TGATCGATCT 120

CGATTATTGA ATGTAATCAA GGTACTGGAG AAGGACGCCG TTTTCCCCCG CCCTTTCCCT 180

ACACAAGAAG GTGCGCAGCA GGATGATGGT TACTTTTGTC TTCTGACCCC CCGCCCAACA 240

GTCGCTTCCC GACCCGCCAC TCGTTTCGGC CTGTACGCCA ATCCGTCCGG CAGTGGTGTT 300

CTTGCTAACA CTTCACTGGA CTTCAATTTT TATAGCTTGG CCTGTTTCAC TTACTTTAGA 360

TCGGACCTTG AGGTTACGGT GGTCTCACTA GAGCCGGATC TGGAATTTGC TGTAGGGTGG 420

TTTCCTTCTG GCAGTGAATA CCAGGCTTCC AGCTTTGTCT ACGACCAGCT GCATGTGCCC 480

TTCCACTTTA CTGGGCGCAC TCCCCGCGCT TTCGCTAGCA AGGGTGGGAA GGTATCTTTC 540

GTGCTCCCTT GGAACTCTGT CTCGTCTGTG CTCCCCGTGC GCTGGGGGGG GGCTTCCAAG 600

CTCTCTTCTG CTACGCGGGG TCTACCGGCG CATGCTGATT GGGGGACTAT TTACGCCTTT 660

GTCCCCCGTC CTAATGAGAA GAAAAGCACC GCTGTAAAAC ACGTGGCCGT GTACATTCGG 720

TACAAGAACG CACGTGCCTG GTGCCCCAGC ATGCTTCCCT TTCGCAGCTA CAAGCAG 777

(SEQ ID NO:7)

FIG. 12

STDNAETGVI EAGNTDTDFS GELAAPGPNH TNVKFLFDRS RLLNVIKVLE KDAVFPRPFP 60

TQEGAQQDDG YFCLLTPRPT VASRPATRFG LYANPSGSGV LANTSLDFNF YSLACFTYFR 120

SDLEVTVVSL EPDLEFAVGW FPSGSEYQAS SFVYDQLHVP FHFTGRTPRA FASKGGKVSF 180

VLPWNSVSSV LPVRWGGASK LSSATRGLPA HADWGTIYAF VPRPNEKKST AVKHVAVYIR 240

YKNARAWCPS MLPFRSYKQ (SEQ ID NO:8) 259

FIG. 13

AAGATGCTGA TGCAATCTGG CGATATCGAG ACCAATCCTG GT (SEQ ID NO:9) 42

FIG. 14

KMLMQSGDIE TNPG (SEQ ID NO:10) 14

FIG. 15

CCTGCTTCTG ACAACCCAAT TTTGGAGTTT CTTGAAGCAG AAAATGATCT AGTCACTCTG 60

GCCTCTCTCT GGAAGATGGT GCACTCTGTT CAACAGACCT GGAGAAAGTA TGTGAAGAAC 120

GATGATTTTT GGCCCAATTT ACTCAGCGAG CTAGTGGGGG AAGGCTCTGT CGCCTTGGCC 180

GCCACGCTAT CCAACCAAGC TTCAGTAAAG GCTCTTTTGG GCCTGCACTT TCTCTCTCGG 240

GGGCTCAATT ACACTGACTT TTACTCTTTA CTGATAGAGA AATGCTCTAG TTTCTTTACC 300

GTAGAACCAC CTCCTCCACC AGCTGAAAAC CTGATGACCA AGCCCTCAGT GAAGTCGAAA 360

TTCCGAAAAC TGTTTAAGAT GCAA (SEQ ID NO:11) 384

FIG. 16

PASDNPILEF LEAENDLVTL ASLWKMVHSV QQTWRKYVKN DDFWPNLLSE LVGEGSVALA 60

ATLSNQASVK ALLGLHFLSR GLNYTDFYSL LIEKCSSFFT VEPPPPPAEN LMTKPSVKSK 120

FRKLFKMQ (SEQ ID NO:12) 128

FIG. 17

GGACCCATGG ACAAAGTCAA AGACTGGAAC CAAATAGCTG CCGGCTTGAA GAATTTTCAA 60

TTTGTTCGTG ACCTAGTCAA AGAGGTGGTC GATTGGCTGC AGGCCTGGAT CAACAAAGAG 120

AAAGCCAGCC CTGTCCTCCA GTACCAGTTG GAGATGAAGA AGCTCGGGCC TGTGGCCTTG 180

GCTCATGACG CTTTCATGGC TGGTTCCGGG CCCCCTCTTA GCGACGACCA GATTGAATAC 240

CTCCAGAACC TCAAATCTCT TGCCCTAACA CTGGGGAAGA CTAATTTGGC CCAAAGTCTC 300

ACCACTATGA TCAATGCCAA ACAAAGTTCA GCCCAACGAG TTGAACCCGT TGTGGTGGTC 360

CTTAGAGGCA AGCCGGGATG CGGCAAGGGC TTGGCCTCTA CGTTGATTGC CCAGGCTGTG 420

TCCAAGCGCC TCTATGGCTC CCAAAGTGTA TATTCTCTTC CCCCAGATCC AGATTTCTTC 480

GATGGATACA AAGGACAGTT CGTGACCTTG ATGGATGATT TGGGACAAAA CCCGGATGGA 540

CAAGATTTCC CCACCTTTTG TCAGATGGTG TCGACCGCCC AATTTCTCCC CAACATGGCG 600

GACCTTGCAG AGAAAGGGCG TCCCTTTACC TCCAATCTCA TCATTGCAAC TACAAATCTC 660

CCCCACTTCA GTCCTGTCAC CATTGCTGAT CCTTCTGCAG TCTCTCGCCG TATCAACTAC 720

GATCTGACTC TAGAAGTATC TGAGGCCTAC AAGAAACACA CACGGCTGAA TTTTGACTTG 780

GCTTTCAGGC GCACAGACGC CCCCCCCATT TATCCTTTTG CTGCCCATGT GCCCTTTGTG 840

GACGTAGCTG TGCGCTTCAA AAATGGTCAC CAGAATTTTA ATCTCCTAGA GTTGGTCGAT 900

TCCATTTGTA CAGACATTCG AGCCAAGCAA CAAGGTGCCC GAAACATGCA GACTCTGGTT 960

CTACAG (SEQ ID NO:13) 966

FIG. 18

GPMDKVKDWN QIAAGLKNFQ FVRDLVKEVV DWLQAWINKE KASPVLQYQL EMKKLGPVAL 60

AHDAFMAGSG PPLSDDQIEY LQNLKSLALT LGKTNLAQSL TTMINAKQSS AQRVEPVVVV 120

LRGKPGCGKG LASTLIAQAV SKRLYGSQSV YSLPPDPDFF DGYKGQFVTL MDDLGQNPDG 180

QDFSTFCQMV STAQFLPNMA DLAEKGRPFT SNLIIATTNL PHFSPVTIAD PSAVSRRINY 240

DLTLEVSEAY KKHTRLNFDL AFRRTDAPPI YPFAAHVPFV DVAVRFKNGH QNFNLLELVD 300

SICTDIRAKQ QGARNMQTLV LQ (SEQ ID NO:14) 322

FIG. 19

AGCCCCAACG AGAATGATGA CACCCCCGTC GACGAGGCGT TGGGTAGAGT TCTCTCCCCC 60

GCTGCGGTCG ATGAGGCGCT TGTCGACCTC ACTCCAGAGG CCGACCCGGT TGGCCGTTTG 120

GCTATTCTTG CCAAGCTAGG TCTTGCCCTA GCTGCGGTCA CCCCTGGTCT GATAATCTTG 180

GCAGTGGGAC TCTACAGGTA CTTCTCTGGC TCTGATGCAG ACCAAGAAGA AACAGAAAGT 240

GAGGGATCTG TCAAGGCACC CAGGAGCGAA (SEQ ID NO:15) 270

FIG. 20

SPNENDDTPV DEALGRVLSP AAVDEALVDL TPEADPVGRL AILAKLGLAL AAVTPGLIIL 60

AVGLYRYFSG SDADQEETES EGSVKAPRSE (SEQ ID NO:16) 90

FIG. 21

AATGCTTATG ACGGCCCGAA GAAAAACTCT AAGCCCCCTG GAGCACTCTC TCTCATGGAA 60

ATGCAA (SEQ ID NO:17) 66

FIG. 22

NAYDGPKKNS KPPGALSLME MQ (SEQ ID NO:18) 22

FIG. 23

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   CAGCCCAACG TGGACATGGG CTTTGAGGCT GCGGTCGCTA AGAAAGTGGT CGTCCCCATT 60
ACCTTCATGG TTCCCAACAG ACCTTCTGGG CTTACACAGT CCGCTCTTCT GGTGACCGGC 120
CGGACCTTCC TAATCAATGA ACATACATGG TCCAATCCCT CCTGGACCAG CTTCACAATC 180
CGCGGTGAGG TACACACTCG TGATGAGCCC TTCCAAACGG TTCATTTCAC TCACCACGGT 240
ATTCCCACAG ATCTGATGAT GGTACGTCTC GGACCGGGCA ATTCTTTCCC TAACAATCTA 300
GACAAGTTTG GACTTGACCA GATGCCGGCA CGCAACTCCC GTGTGGTTGG CGTTTCGTCC 360
AGTTACGGAA ACTTCTTCTT CTCTGGAAAT TTCCTCGGAT TTGTTGATTC CGTCACCTCT 420
GAACAAGGAA CTTACGCAAG ACTCTTTAGG TACAGGGTGA CGACCTACAA AGGATGGTGC 480
GGCTCGGCCC TGGTCTGTGA GGCCGGTGGC GTCCGACGCA TCATTGGCCT GCATTCTGCT 540
GGCGCCGCCG GTATCGGCGC CGGGACCTAT ATCTCAAAAT TAGGACTAAT CAAAGCCCTG 600
AAACACCTCG GTGAACCTTT GGCCACAATG CAA (SEQ ID NO:19)                633
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FIG. 24

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QPNVDMGFEA AVAKKVVVPI TFMVPNRPSG LTQSALLVTG RTFLINEHTW SNPSWTSFTI 60
RGEVHTRDEP FQTVHFTHHG IPTDLMMVRL GPGNSFPNNL DKFGLDQMPA RNSRVVGVSS 120
SYGNFFFSGN FLGFVDSVTS EQGTYARLFR YRVTTYKGWC GSALVCEAGG VRRIIGLHSA 180
GAAGIGAGTY ISKLGLIKAL KHLGEPLATM Q (SEQ ID NO:20)                 211
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FIG. 25

GGACTGATGA CTGAATTAGA GCCTGGAATC ACCGTACATG TACCCCGGAA ATCCAAATTG 60

AGAAAGACGA CCGCACACGC GGTGTACAAA CCGGAGTTTG AGCCTGCTGT GTTGTCAAAA 120

TTTGATCCCA GACTGAACAA GGATGTTGAC TTGGATGAAG TAATTTGGTC TAAACACACT 180

GCCAATGTCC CTTACCAACC TCCTTTGTTC TACACATACA TGTCAGAGTA CGCTCATCGA 240

GTCTTCTCCT TCTTGGGGAA AGACAATGAC ATTCTGACCG TCAAAGAAGC AATTCTGGGC 300

ATCCCCGGAC TAGACCCCAT GGATCCCCAC ACAGCTCCGG GTCTGCCTTA CGCCATCAAC 360

GGCCTTCGAC GTACTGATCT CGTCGATTTT GTGAACGGTA CAGTAGATGC GGCGCTGGCT 420

GTACAAATCC AGAAATTCTT AGACGGTGAC TACTCTGACC ATGTCTTCCA AACTTTTCTG 480

AAAGATGAGA TCAGACCCTC AGAGAAAGTC CGAGCGGGAA AAACCCGCAT TGTTGATGTG 540

CCCTCCCTGG CGCATTGCAT TGTGGGCAGA ATGTTGCTTG GGCGCTTTGC TGCCAAGTTT 600

CAATCCCATC CTGGCTTTCT CCTCGGCTCT GCTATCGGGT CTGACCCTGA TGTTTTCTGG 660

ACCGTCATAG GGGCTCAACT CGAGGGGAGA AAGAACACGT ATGACGTGGA CTACAGTGCC 720

TTTGACTCTT CACACGGCAC TGGCTCCTTC GAGGCTCTCA TCTCTCACTT TTTCACCGTG 780

GACAATGGTT TTAGCCCTGC GCTGGGACCG TATCTCAGAT CCCTGGCTGT CTCGGTGCAC 840

GCTTACGGCG AGCGTCGCAT CAAGATTACC GGTGGCCTCC CCTCCGGTTG TGCCGCGACC 900

AGCCTGCTGA ACACAGTGCT CAACAATGTG ATCATCAGGA CTGCTCTGGC ATTGACTTAC 960

AAGGAATTTG AGTATGACAC GGTTGATATC ATCGCCTACG GTGACGACCT TCTGGTTGGC 1020

ACGGATTACG ATCTGGACTT CAATGAGGTG GCACGACGCG CTGCCAAGTT GGGGTATAAG 1080

ATGACTCCTG CCAACAAGGG TTCTGTCTTC CCTCCGACTT CCTCTCTTTC CGATGCTGTT 1140

TTTCTAAAGC GCAAATTCGT CCAAAACAAC GACGGCTTAT ACAAACCAGT TATGGATTTA 1200

AAGAATTTGG AAGCCATGCT CTCCTACTTC AAACCAGGAA CACTACTCGA GAAGCTGCAA 1260

TCTGTTTCTA TGTTGGCTCA ACATTCTGGA AAAGAAGAAT ATGATAGATT GATGCACCCC 1320

TTCGCTGACT ACGGTGCCGT ACCGAGTCAC GAGTACCTGC AGGCAAGATG GAGGGCCTTG 1380

TTCGACTGA (SEQ ID NO:21) 1389

FIG. 26

GLMTELEPGI TVHVPRKSKL RKTTAHAVYK PEFEPAVLSK FDPRLNKDVD LDEVIWSKHT 60

ANVPYQPPLF YTYMSEYAHR VFSFLGKDND ILTVKEAILG IPGLDPMDPH TAPGLPYAIN 120

GLRRTDLVDF VNGTVDAALA VQIQKFLDGD YSDHVFQTFL KDEIRPSEKV RAGKTRIVDV 180

PSLAHCIVGR MLLGRFAAKF QSHPGFLLGS AIGSDPDVFW TVIGAQLEGR KNTYDVDYSA 240

FDSSHGTGSF EALISHFFTV DNGFSPALGP YLRSLAVSVH AYGERRIKIT GGLPSGCAAT 300

SLLNTVLNNV IIRTALALTY KEFEYDTVDI IAYGDDLLVG TDYDLDFNEV ARRAAKLGYK 360

MTPANKGSVF PPTSSLSDAV FLKRKFVQNN DGLYKPVMDL KNLEAMLSYF KPGTLLEKLQ 420

SVSMLAQHSG KEEYDRLMHP FADYGAVPSH EYLQARWRAL FD * (SEQ ID NO:22) 462

FIG. 27

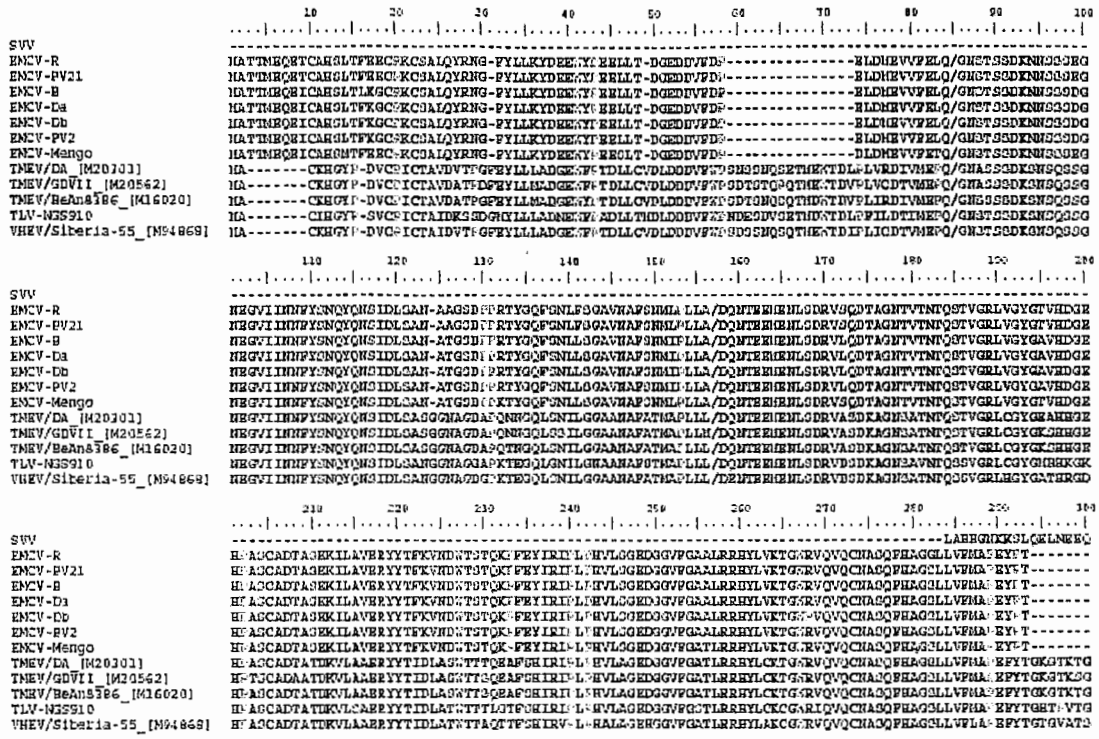


Fig. 28A

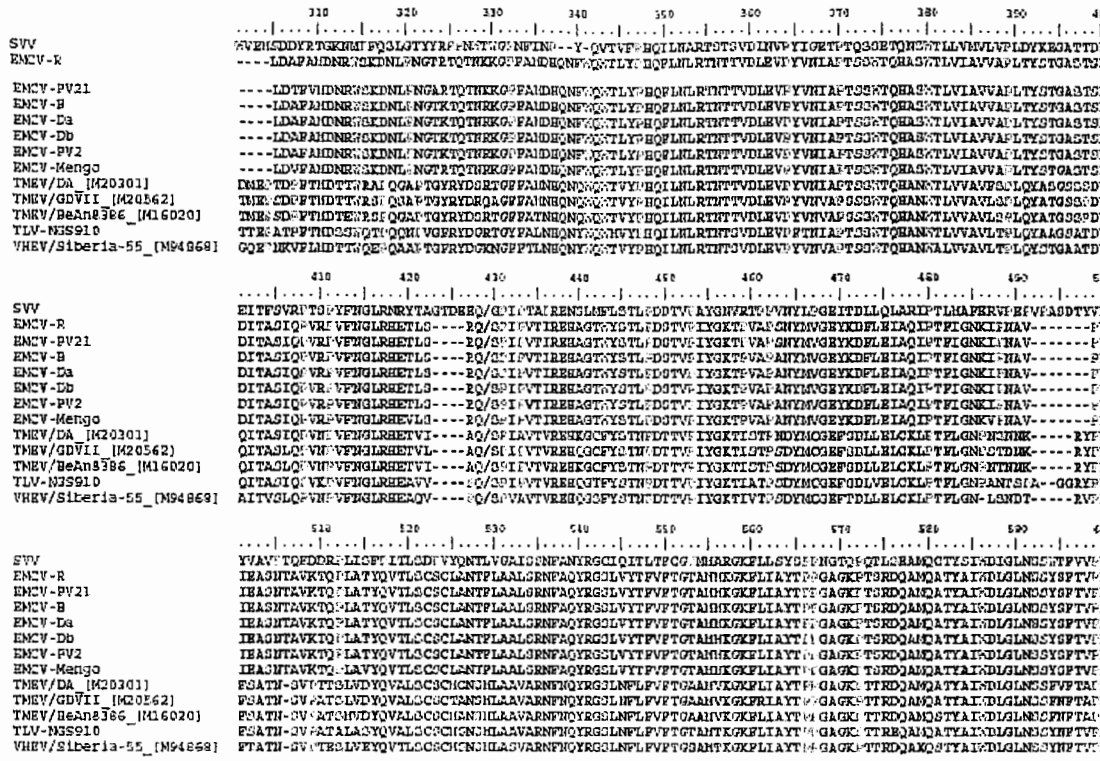


Fig. 28B

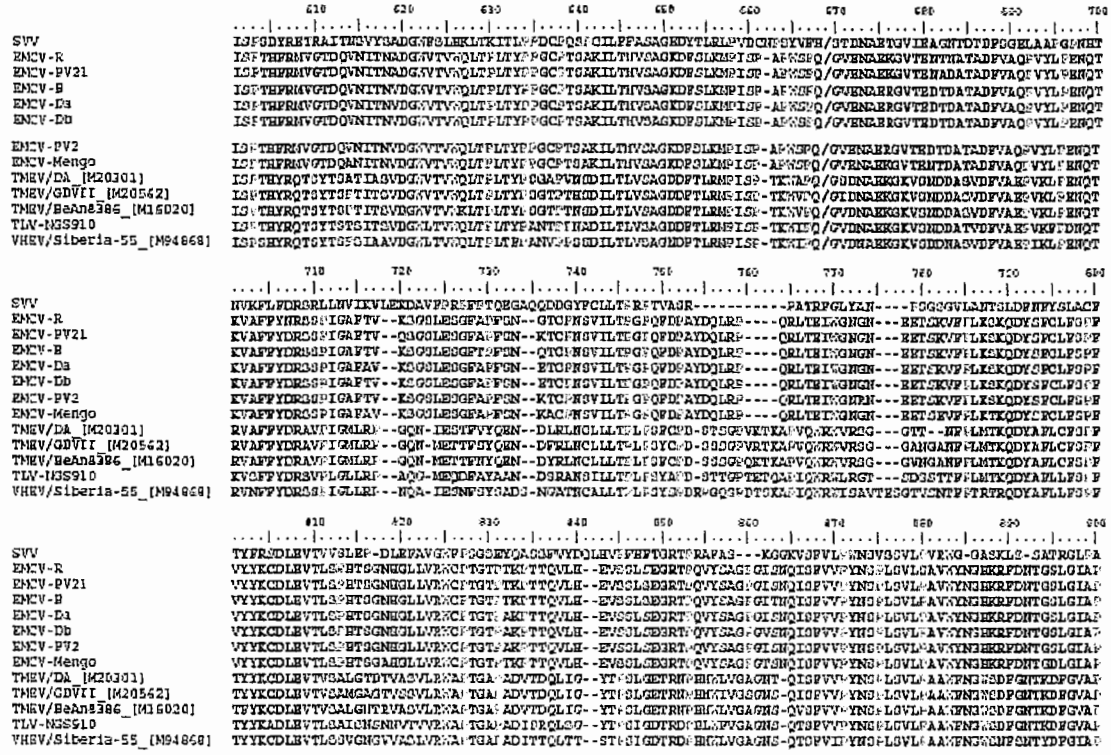


Fig. 28C

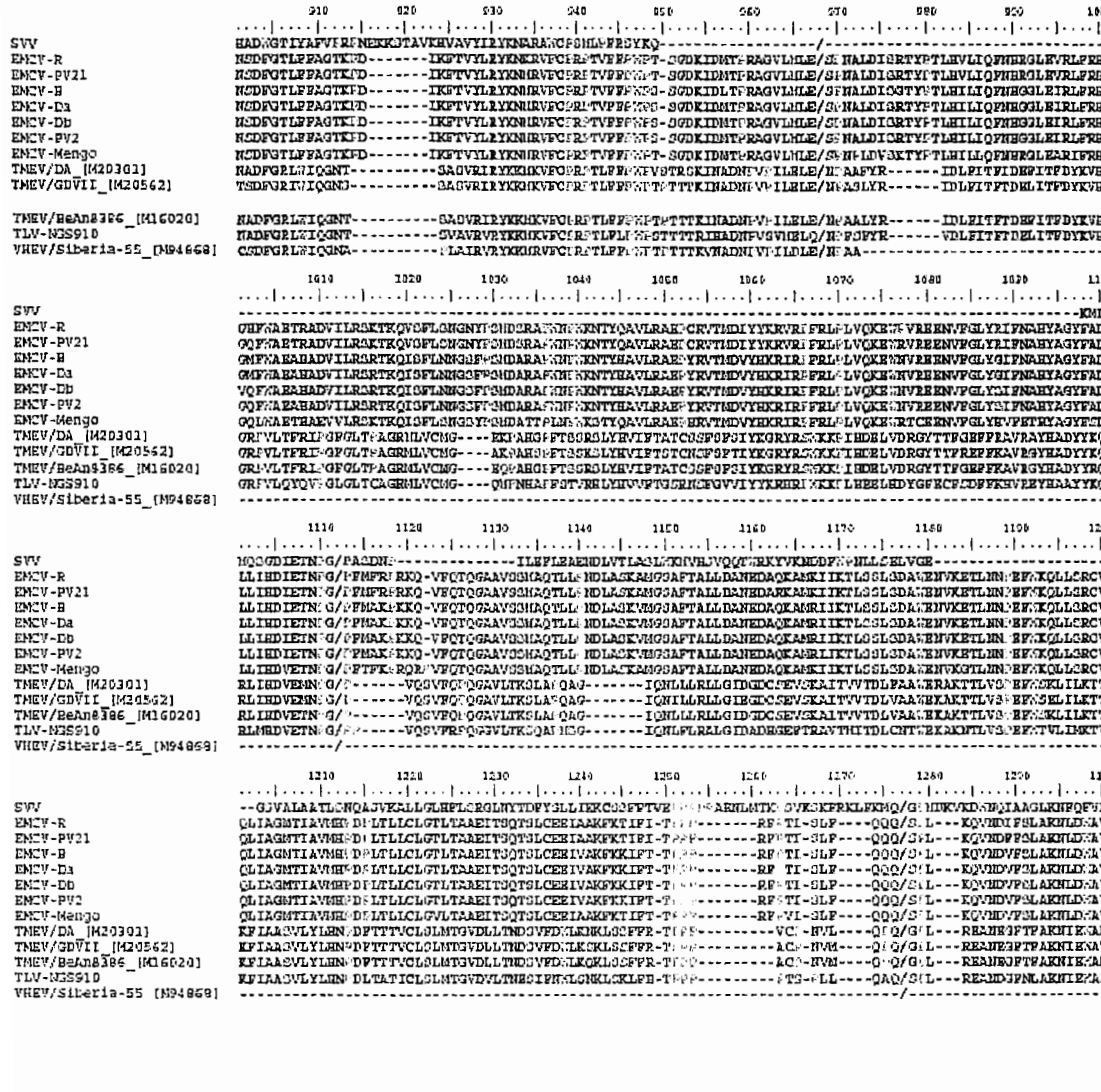


Fig. 28D

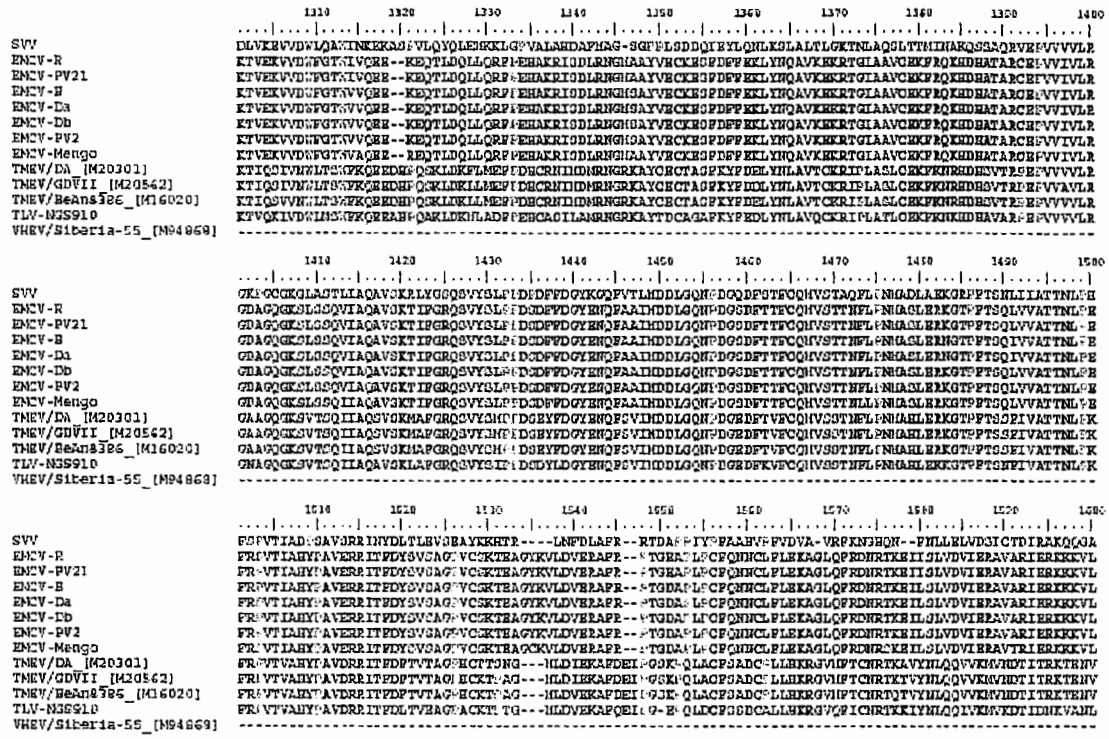

SVV
ENCV-R
ENCV-PV21
ENCV-B
ENCV-Da
ENCV-Db
ENCV-PV2
ENCV-Mengo
TMEV/DA_[M20301]
TMEV/GDVII_[M20562]
TMEV/BeAn8386_[M16020]
TLV-NJS910
VHEV/Siberia-55_[M94869]

Fig. 28E

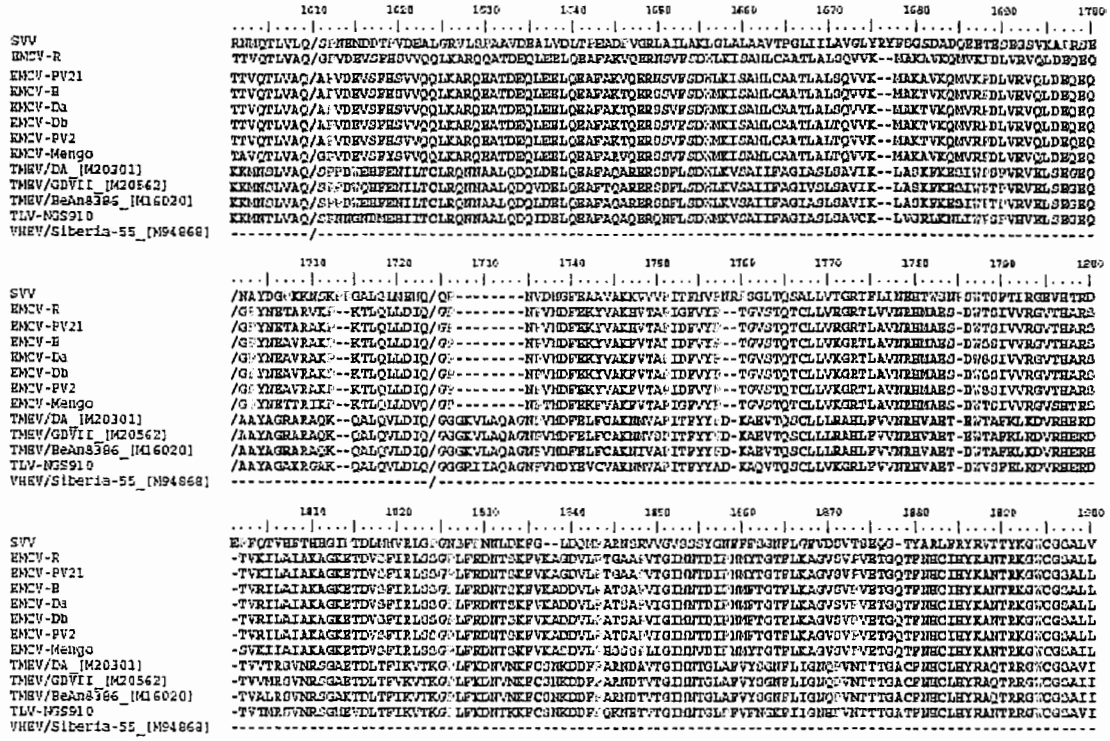


Fig. 28F

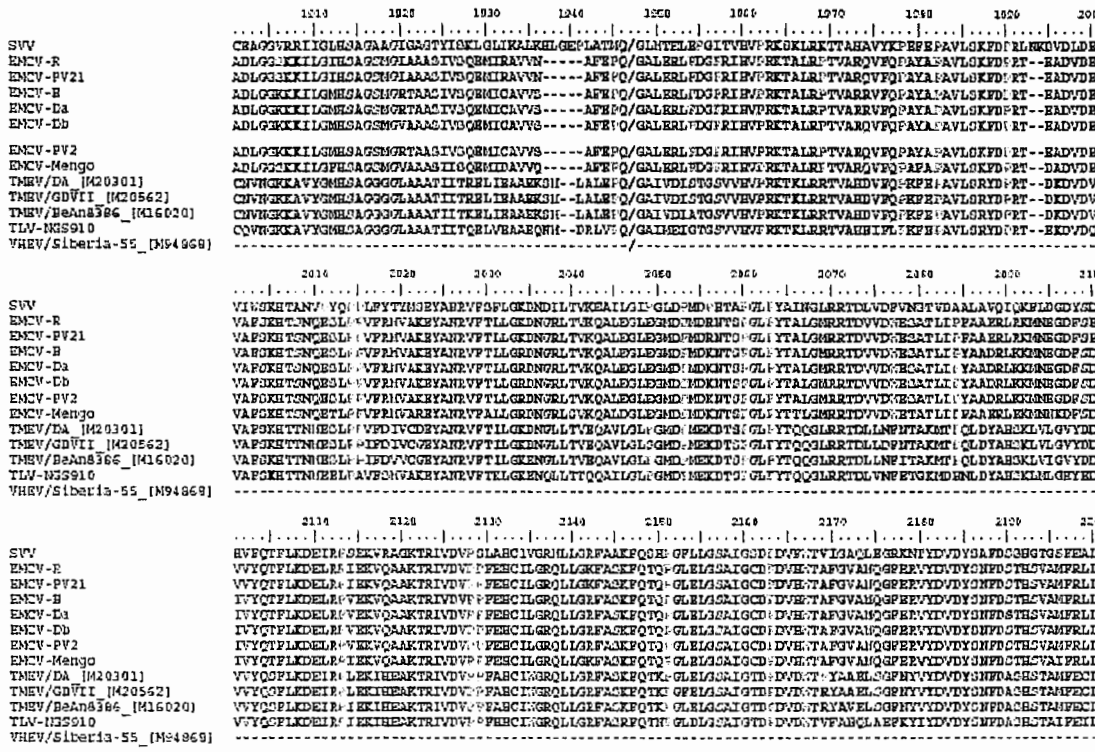


Fig. 28G

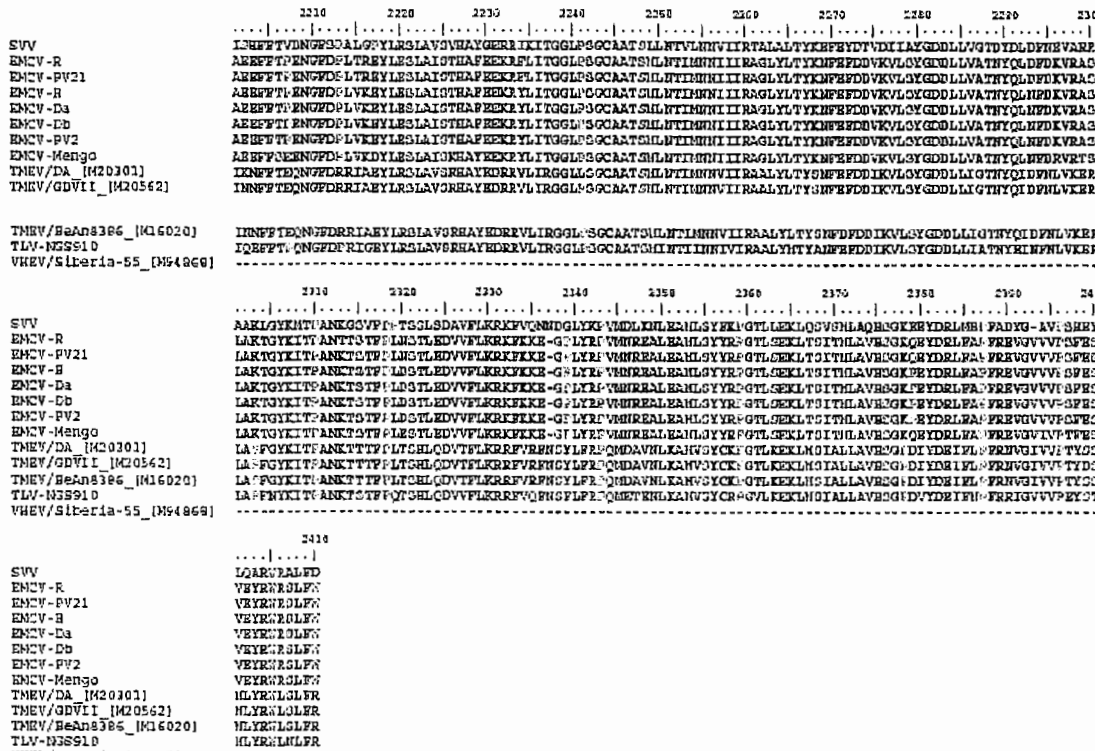


Fig. 28H

Polypeptide	aa	Predicted sequence
L Leader	?	No data
VP4 (1A)	?	No data
VP2 (1B)	>142	LAHHGNKKSLQELNEEQWVEMSDDYRTGKNMPFQSLGTYYRPPNWTWGPN FINPYQVTVFPHQILNARTSTSVDINVPYIGETPTQSSETQNSWTLLVMV LVPLDYKEGATTDPEITFSVRPTSPYFNGLRNRYTAGTDEEQ
VP3 (1C)	239	GPIPTAPRENSLMFLSTLPDDTVPAYGNVRTPPVNYLPGEITDLLQLARI PTLMAFERVPEPVPASDTYVPYVAVPTQFDDRPLISFPITLSDPVYQNTL VGAISSNFANYRGCIQITLTFCGPMMARGKFLLSYSPPNGTQPQTLSEAM QCTYSIWDIGLNSSWTFVVPYISPSDYRETRAITNSVYSADGWFSLHKLT KITLPPDCPQSPCILFFASAGEDYTLRLPVDCNPSYVFH
VP1 (1D)	259	STDNAETGVIEAGNTDTDFSGELAAPGPNHTNVKFLFDRSRLLNVIKVLE KDAVFPRPFPTQEGAQQDDGYFCLLTPRPTVASRPATRFGLYANPSGSGV LANTSLDFNFYSLACFTYFRSDLEVTVVSLEPDLEFAVGWFPSGSEYQAS SFVYDQLHVPFHFTGRTPRAFASKGGKVSFVLPWNSVSSVLPVRWGGASK LSSATRGLPAHADWGTIYAFVPRPNEKKSTAVKHVAVYIRYKNARAWCPS MLPFRSYKQ
2A	14	KMLMQSGDIET**NPG**
2B	128	**P**ASDNPILEFLEAENDLVTLASLWKMVHSVQQTWRKYVKNDDFWPNLLSE LVGEGSVALAATLSNQASVKALLGLHFLSRGLNYTDFYSLLIEKCSSFFT VEPPPPPAENLMTKPSVKSKFRKLFKMQ
2C	322	GPMDKVKDWNQIAAGLKNFQFVRDLVKEVVDWLQAWINKEKASPVLQYQL EMKKLGPVALAHDAFMAGSGPPLSDDQIEYLQNLKSLALTLGKTNLAQSL TTMINAKQSSAQRVEPVVVVLR**G**KP**G**C**GKG**LASTLIAQAVSKRLYGSQSV YSLPPDPDFFDGYKGQF**VTLMDD**LGQNPDGQDFSTFCQMVSTAQFLPNMA DLAEKGRPFTSNLIIATTNLPHFSPVTIADPSAVSRRINYDLTLEVSEAY KKHTRLNFDLAFRRTDAPPIYPFAAHVPFVDVAVRFKNGHQNFNLLELVD SICTDIRAKQQGARNMQTLVLQ
3A	90	SPNENDDTPVDEALGRVLSPAAVDEALVDLTPEADPVGRLAILAKLGLAL AAVTPGLIILAVGLYRYFSGSDADQEETESEGSVKAPRSE
3B (VPg)	22	NA**Y**DGPKKNSKPPGALSLMEMQ
3C (pro)	211	QPN**V**DMGFEAA**V**AKKVVVPITFMVPNRPSGLTQSALLVTGRTFLINE**H**TW SNPSWTSFTIRGEVHTRDEPFQTVHFTHHGIPTDLMMVRLGPGNSFPNNL DKFGLDQMPARNSRVVGVSSSYGNFFFSGNFLGFVDSVTSEQGTYARLFR YRVTTYKGW**C**GSALVCEAGGVRRIIGL**H**SAGAAGIGAGTYISKLGLIKAL KHLGEPLATMQ
3D (pol)	462	GLMTELEPGITVHVPRKSKLRKTTAHAVYKPEFEPAVLSKFDPRLNKDVD LDEVIWSKHTANVPYQPPLFYTYMSEYAHRVFSFLGKDNDILTVKEAILG IPGLDPMDPHTAPGLPYAINGLRRTDLVDFVNGTVDAALAVQIQKFLDGD YSDHVFQTFL**KDEIR**PSEKVRAGKTRIVDVPSLAHCIVGRMLLGRFAAKF QSHPGFLLGSAIGSDPDVFWTVIGAQLEGRKNTYDVDYSAFDSSHGTGSF EALISHFFTVDNGFSPALGPYLRSLAVSVHAYGERRIKITGGL**PSG**CAAT SLLNTVLNNVIIRTALALTYKEFEYDTVDIIA**YGDD**LLVGTDYDLDFNEV ARRAAKLGYKMTPANKGSVFPPTSSLSDAV**FLKR**KFVQNNDGLYKPVMDL KNLEAMLSYFKPGTLLEKLQSVSMLAQHSGKEEYDRLMHPFADYGAVPSH EYLQARWRALFD

Fig. 29

Genus	Species	Abbrev.	Serotype
Enterovirus	*Poliovirus*	PV-1	= Poliovirus 1
	Human enterovirus A	CV-A16	= Coxsackievirus A16
	Human enterovirus B	CV-B5	= Coxsackievirus B5
	Human enterovirus C	CV-A21	= Coxsackievirus A21
	Human enterovirus D	EV-70	= Enterovirus 70
	Simian enterovirus A	SEV-A	= Simian enterovirus A1
	Bovine enterovirus	BEV-1	= Bovine enterovirus 1
	Porcine enterovirus B	PEV-9	= Porcine enterovirus 9
Rhinovirus	*Human rhinovirus A*	HRV-2	= Human rhinovirus 2
	Human rhinovirus B	HRV-14	= Human rhinovirus 14
New genus?	Not yet designated	SV2	= Simian virus 2
	Porcine enterovirus A	PEV-8	= Porcine enterovirus 8
Cardiovirus	*Encephalomyocarditis virus*	EMCV	= Encephalomyocarditis virus
	Theilovirus	TMEV	= Theiler's murine encephalomyelitis virus
	?	SVV	= Seneca Valley virus
Aphthovirus	*Foot-and-mouth disease virus*	FMDV-O	= Foot-and-mouth disease virus O
	Equine rhinitis A virus	ERAV	= Equine rhinitis A virus
Hepatovirus	*Hepatitis A virus*	HAV	= Hepatitis A virus
	Avian encephalomyelitis-like viruses	AEV	= Avian encephalomyelitis virus
Parechovirus	*Human parechovirus*	HPeV-1	= Human parechovirus 1
	Ljungan virus	LV	= Ljungan virus
Kobuvirus	*Aichi virus*	AiV	= Aichi virus
	Bovine kobuvirus	BKV	= Bovine kobuvirus
Erbovirus	*Equine rhinitis B virus*	ERBV-1	= Equine rhinitis B virus 1
Teschovirus	*Porcine teschovirus*	PTV-1	= Porcine teschovirus 1

Fig. 30 (35/99)

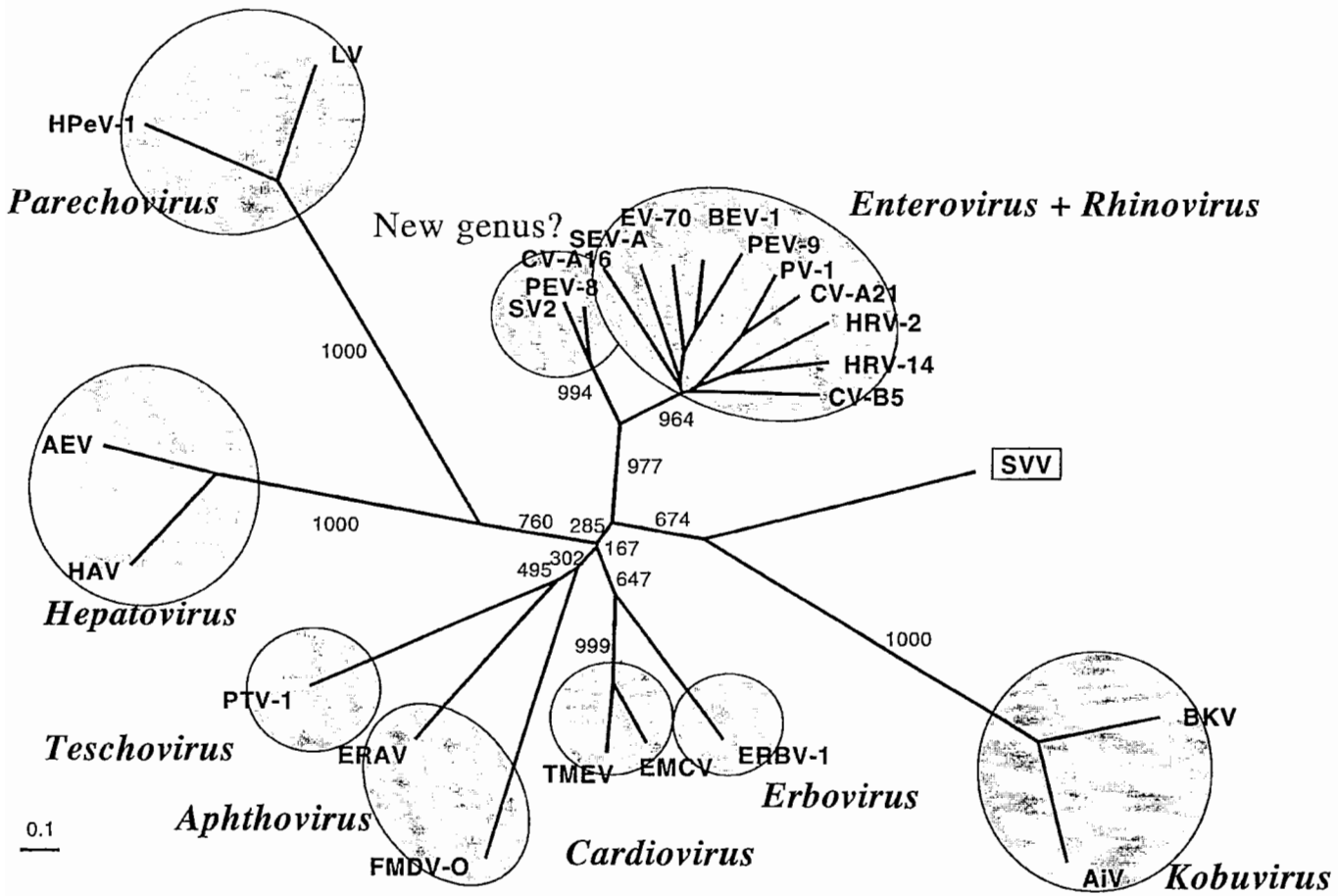

LV
HPeV-1
Parechovirus
New genus?
EV-70
BEV-1
SEV-A
PEV-9
CV-A16
PV-1
PEV-8
CV-A21
SV2
HRV-2
HRV-14
CV-B5
Enterovirus + Rhinovirus
1000
994
964
977
SVV
AEV
1000
760
285
674
167
HAV
495
302
647
Hepatovirus
999
1000
PTV-1
BKV
Teschovirus
ERAV
TMEV
EMCV
ERBV-1
Erbovirus
Aphthovirus
0.1
FMDV-O
Cardiovirus
AiV
Kobuvirus

Fig. 31 (36/99)

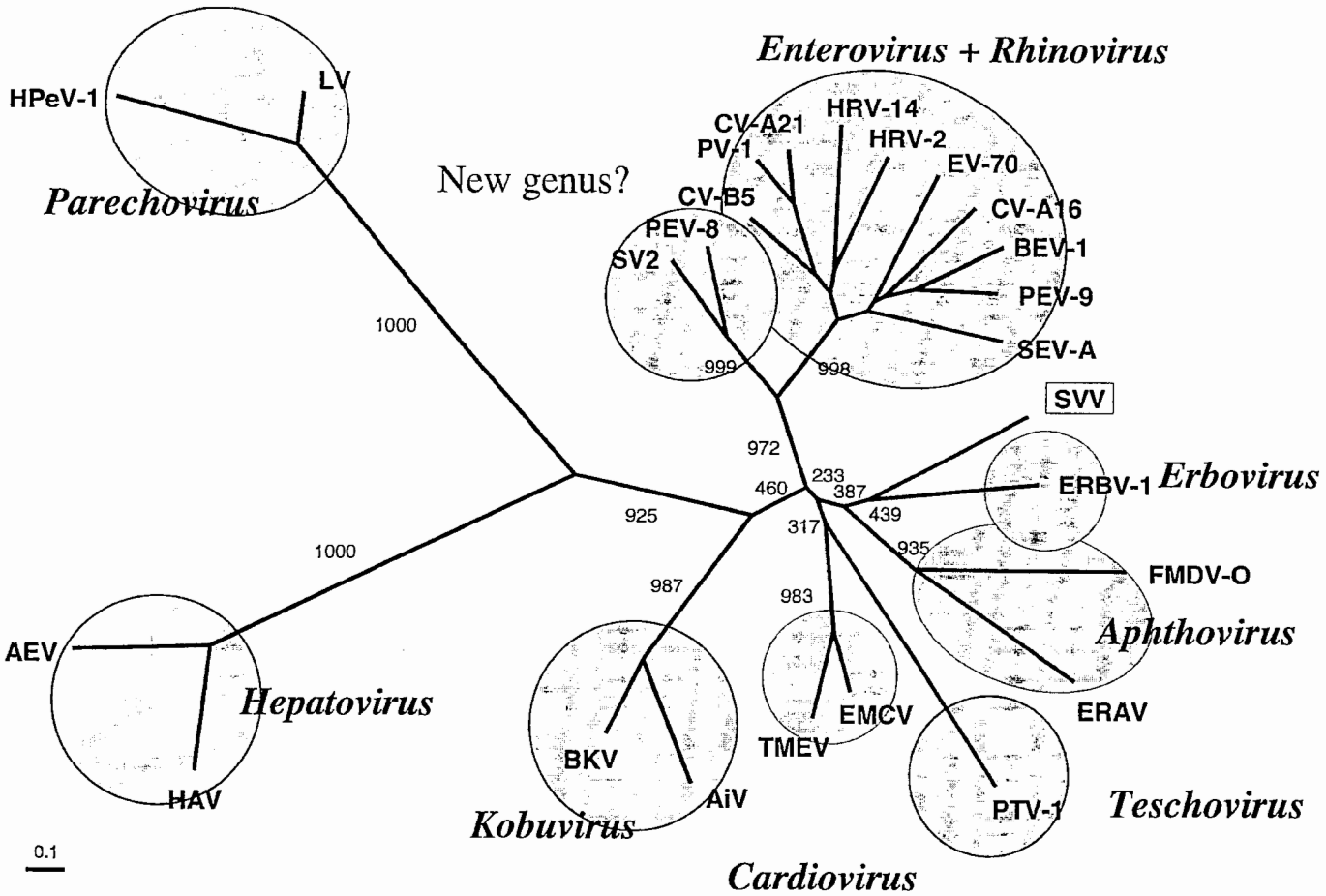

Enterovirus + Rhinovirus
HPeV-1
LV
Parechovirus
New genus?
CV-A21
HRV-14
PV-1
HRV-2
EV-70
CV-B5
CV-A16
PEV-8
BEV-1
SV2
PEV-9
SEV-A
1000
999
998
SVV
972
233
460
387
ERBV-1
Erbovirus
925
439
317
935
1000
FMDV-O
987
983
Aphthovirus
AEV
Hepatovirus
EMCV
ERAV
BKV
TMEV
HAV
AiV
PTV-1
Teschovirus
Kobuvirus
0.1
Cardiovirus

Fig. 32 (37/99)

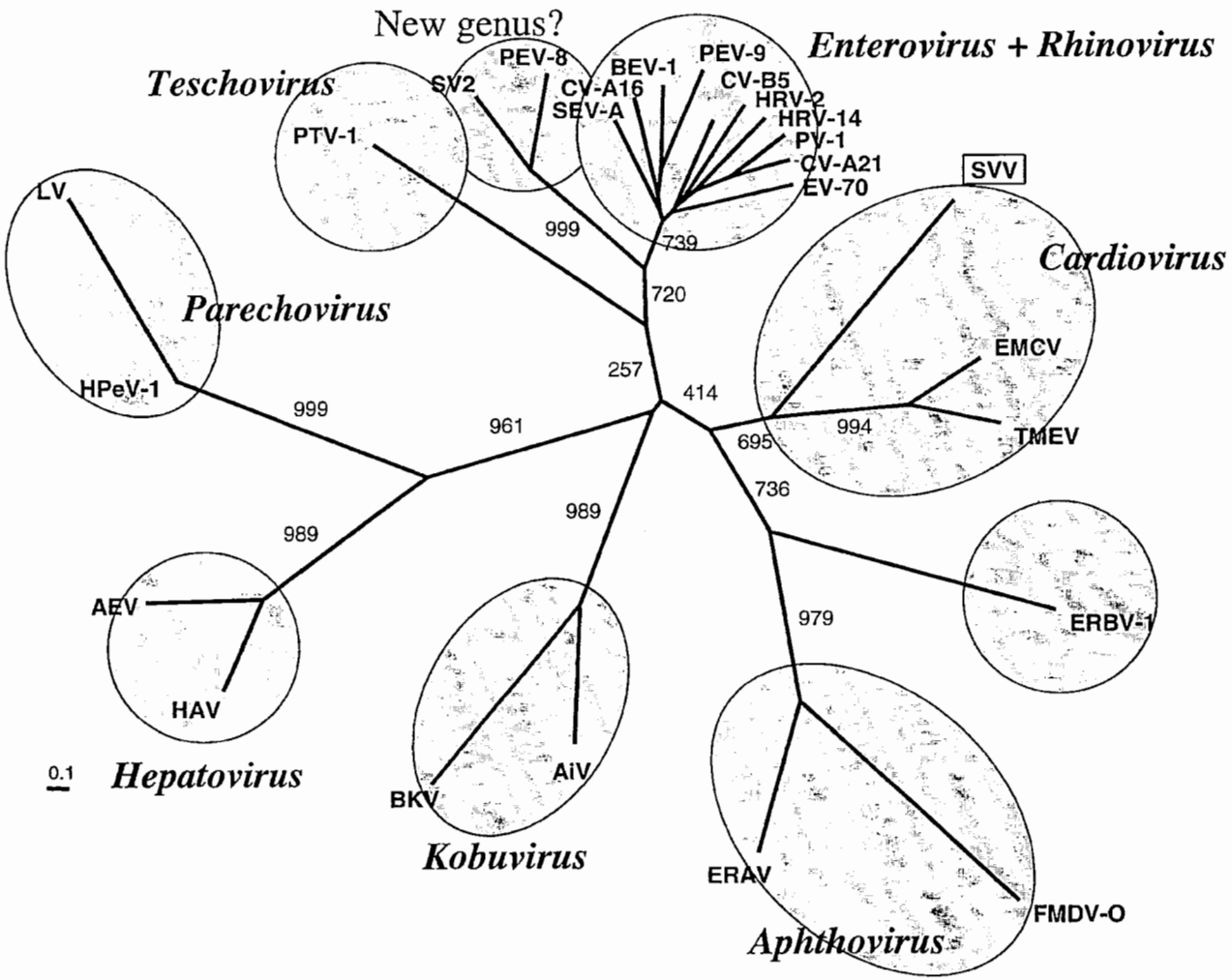

New genus?
Enterovirus + Rhinovirus
Teschovirus
PEV-8
SV2
BEV-1
PEV-9
CV-A16
CV-B5
SEV-A
HRV-2
HRV-14
PV-1
CV-A21
EV-70
PTV-1
SVV
LV
999
739
Cardiovirus
720
Parechovirus
EMCV
257
414
HPeV-1
999
961
994
TMEV
695
736
989
989
AEV
ERBV-1
979
HAV
0.1
Hepatovirus
AiV
BKV
Kobuvirus
ERAV
FMDV-O
Aphthovirus

Fig. 33 (38/99)

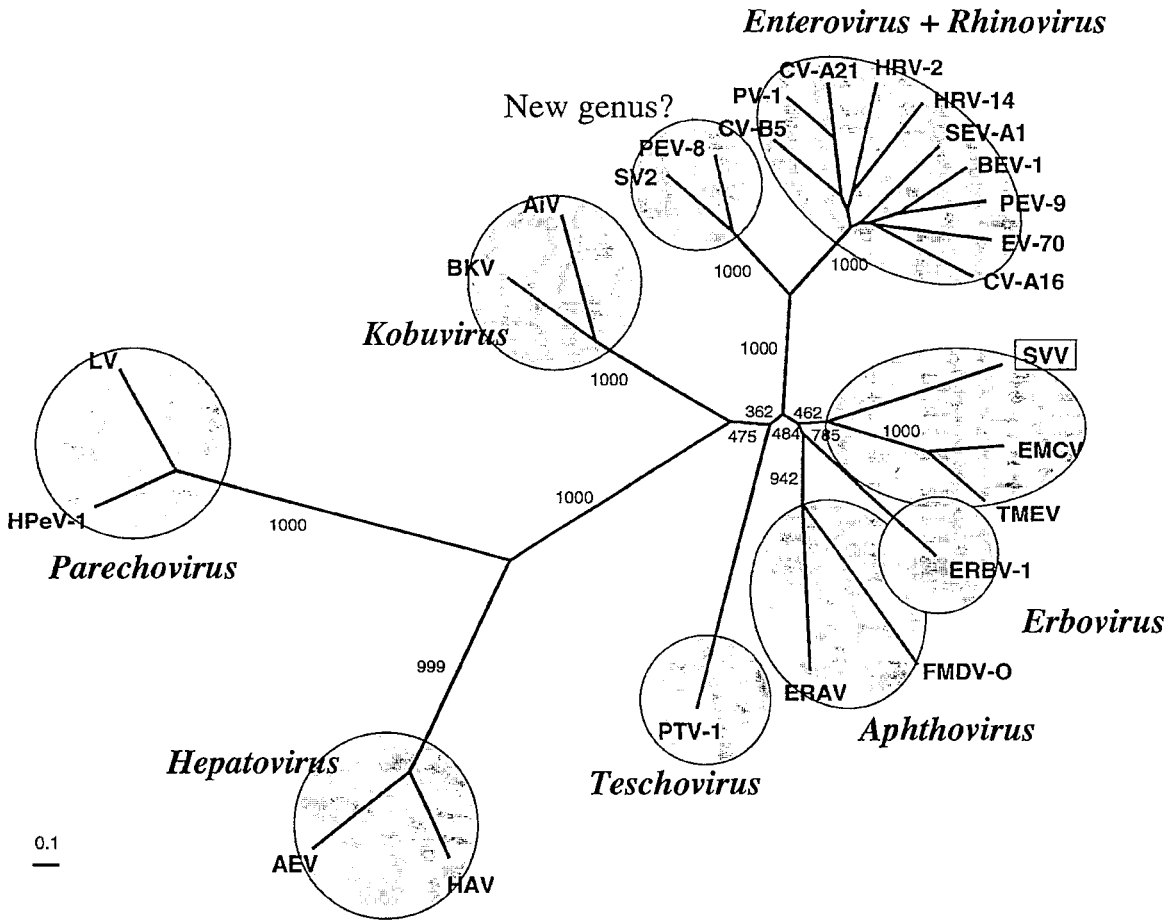

Enterovirus + Rhinovirus
CV-A21
HRV-2
PV-1
HRV-14
New genus?
CV-B5
SEV-A1
PEV-8
BEV-1
SV2
PEV-9
AiV
EV-70
BKV
1000
1000
CV-A16
Kobuvirus
1000
SVV
LV
1000
362
462
475
484
785
1000
EMCV
942
1000
TMEV
HPeV-1
1000
ERBV-1
Parechovirus
Erbovirus
999
FMDV-O
ERAV
PTV-1
Aphthovirus
Hepatovirus
Teschovirus
0.1
AEV
HAV

Fig. 34 (39/99)

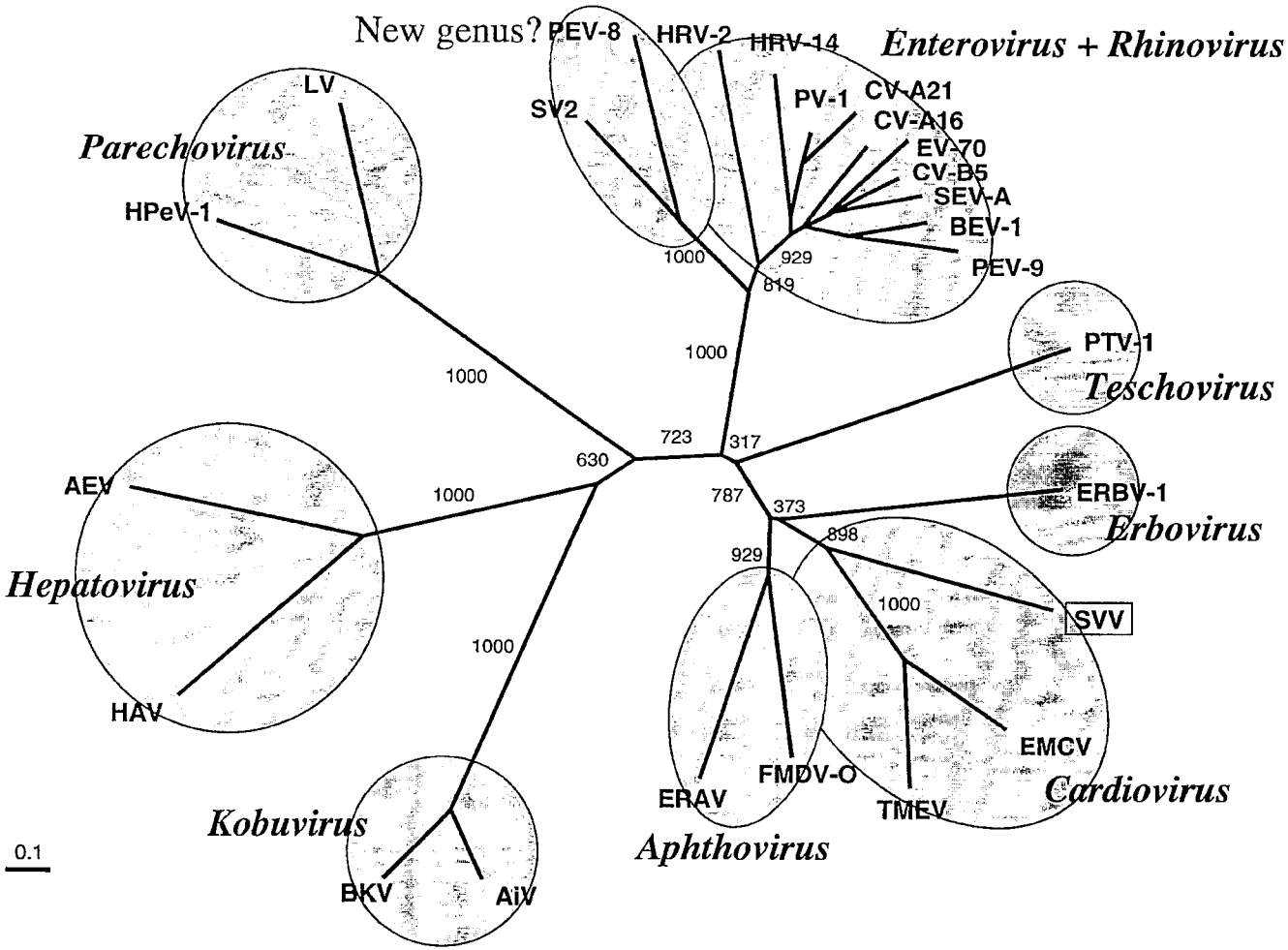

New genus?
PEV-8
HRV-2
HRV-14
Enterovirus + Rhinovirus
SV2
PV-1
CV-A21
CV-A16
EV-70
CV-B5
SEV-A
BEV-1
PEV-9
LV
Parechovirus
HPeV-1
1000
929
819
1000
1000
PTV-1
Teschovirus
723
317
630
787
373
ERBV-1
Erbovirus
AEV
1000
898
929
Hepatovirus
1000
SVV
1000
HAV
EMCV
FMDV-O
ERAV
TMEV
Cardiovirus
Kobuvirus
Aphthovirus
0.1
BKV
AiV

FIG. 35 (40/99)

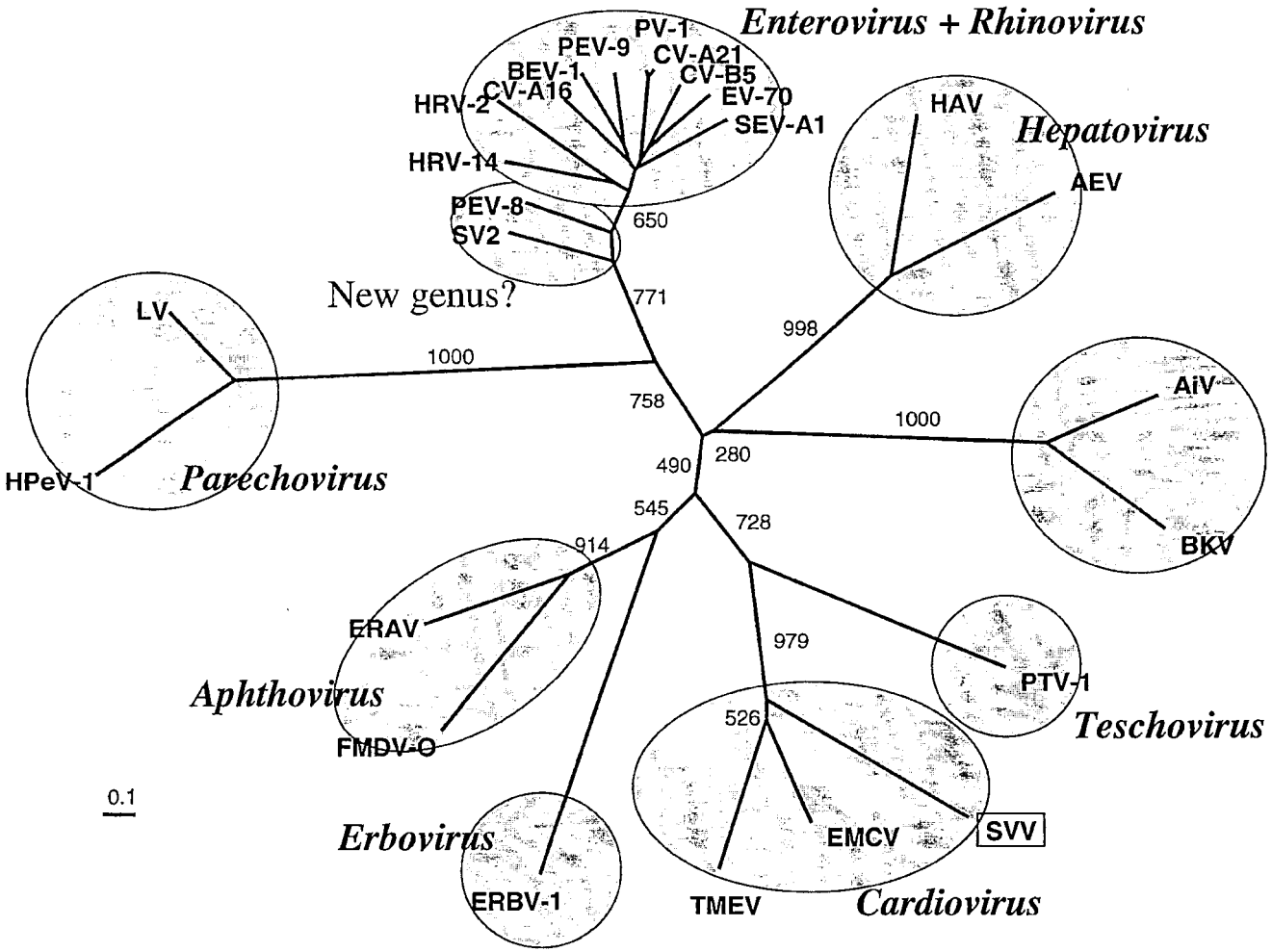

Enterovirus + Rhinovirus
PV-1
PEV-9
CV-A21
BEV-1
CV-B5
CV-A16
EV-70
HRV-2
SEV-A1
HRV-14
PEV-8
SV2
650
New genus?
771
LV
1000
HPeV-1
Parechovirus
758
490
545
914
ERAV
Aphthovirus
FMDV-O
0.1
Erbovirus
ERBV-1
998
HAV
Hepatovirus
AEV
1000
AiV
280
BKV
728
979
PTV-1
Teschovirus
526
EMCV
SVV
TMEV
Cardiovirus

FIG. 36 (41/99)

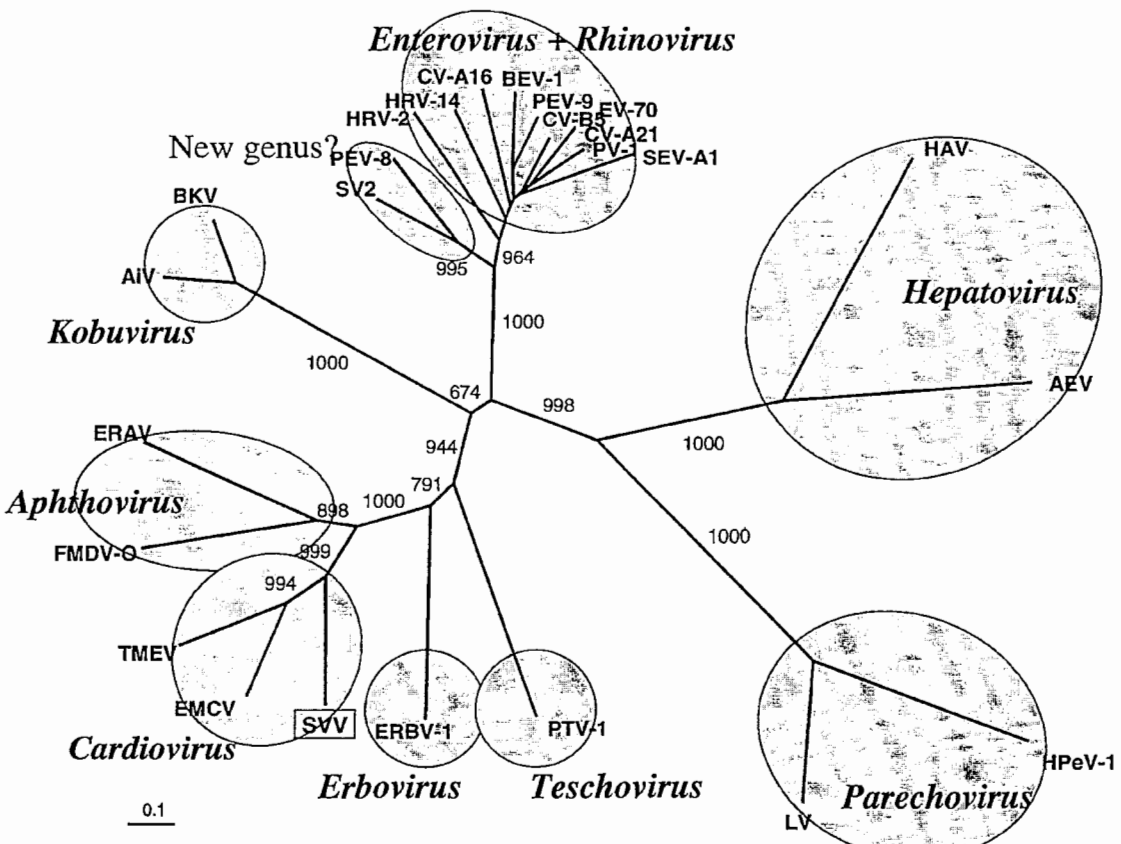

Enterovirus + Rhinovirus
CV-A16
BEV-1
HRV-14
PEV-9
EV-70
HRV-2
CV-B5
CV-A21
New genus?
PV-1
SEV-A1
PEV-8
SV2
BKV
AiV
Kobuvirus
995
964
1000
1000
674
998
HAV
Hepatovirus
AEV
1000
ERAV
944
791
Aphthovirus
898
1000
FMDV-O
999
994
1000
TMEV
EMCV
SVV
ERBV-1
PTV-1
Cardiovirus
Erbovirus
Teschovirus
HPeV-1
LV
Parechovirus
0.1

FIG. 37 (42/99)

	Cardiovirus			Aphthovirus		Erbo	Tescho	Enterovirus								Rhinovirus		Entero?		Kobu		Hepato		Parecho	
	SVV	EMCV	TMEV	FMDV-O	ERAV	ERBV	PTV-1	PV-1	CV-A21	CV-A16	CV-B5	EV-70	SEV-A	BEV-1	PEV-9	HRV-14	HRV-2	SV2	PEV-8	AiV	BKV	HAV	AEV	HPeV-1	LV
SVV	100	33	35	24	26	30	24	24	24	29	29	30	35	25	27	26	25	31	31	27	21	20	19	18	18
EMCV	33	100	70	32	35	47	29	32	30	31	34	30	34	34	31	34	33	40	37	20	21	25	25	22	21
TMEV	35	70	100	33	34	45	31	35	34	30	32	31	34	33	31	31	28	36	37	21	21	25	25	23	21
FMDV-O	24	32	33	100	31	35	31	27	26	30	27	25	28	28	25	31	25	32	29	15	17	24	24	19	17
ERAV	26	35	34	31	100	35	36	32	31	28	35	30	31	28	27	29	30	39	34	22	22	20	24	18	22
ERBV	30	47	45	35	35	100	29	26	28	34	31	31	33	30	31	33	32	36	35	21	21	26	28	20	21
PTV-1	24	29	31	31	36	29	100	30	31	27	29	26	30	30	30	30	26	28	30	18	22	25	22	19	22
PV-1	24	32	35	27	32	26	30	100	71	52	52	51	55	54	48	53	51	42	44	21	23	19	21	18	20
CV-A21	24	30	34	26	31	28	31	71	100	51	53	52	52	53	47	54	55	43	46	19	23	23	22	20	19
CV-A16	29	31	30	30	28	34	27	52	51	100	52	53	53	54	52	52	48	49	48	18	19	22	22	19	17
CV-B5	29	34	32	27	35	31	29	52	53	52	100	55	54	53	49	56	51	51	48	20	17	23	22	20	18
EV-70	30	30	31	25	30	31	26	51	52	53	55	100	57	63	62	52	53	46	49	20	20	25	23	18	17
SEV-A	35	34	34	28	31	33	30	55	52	53	54	57	100	55	54	47	50	43	45	21	20	21	22	22	19
BEV-1	25	34	33	28	28	30	30	54	53	54	53	63	55	100	67	54	52	45	46	20	23	21	21	16	16
PEV-9	27	31	31	25	27	31	30	48	47	52	49	62	54	67	100	53	49	45	45	21	23	24	25	20	18
HRV-14	26	34	31	31	29	33	30	53	54	52	56	52	47	54	53	100	61	46	49	23	21	22	21	19	21
HRV-2	25	33	28	25	30	32	26	51	55	48	51	53	50	52	49	61	100	46	46	22	21	22	24	20	22
SV2	31	40	36	32	39	36	28	42	43	49	51	46	43	45	45	46	46	100	74	23	22	25	27	20	19
PEV-8	31	37	37	29	34	35	30	44	46	48	48	49	45	46	45	49	46	74	100	24	22	25	26	18	21
AiV	27	20	21	15	22	21	18	21	19	18	20	20	21	20	21	23	22	23	24	100	56	19	18	16	16
BKV	21	21	21	17	22	21	22	23	23	19	17	20	20	23	23	21	21	22	22	56	100	16	18	16	16
HAV	20	25	25	24	20	26	25	19	23	22	23	25	21	21	24	22	22	25	25	19	16	100	57	18	23
AEV	19	25	25	24	24	28	22	21	22	22	22	23	22	21	25	21	24	27	26	18	18	57	100	18	23
HPeV-1	18	22	23	19	18	20	19	18	20	19	20	18	22	16	20	19	20	20	18	16	16	18	18	100	53
LV	18	21	21	17	22	21	22	20	19	17	18	17	19	16	18	21	22	19	21	16	16	23	23	53	100

Fig. 38 (43/99)

	Cardiovirus			Aphthovirus		Erbo	Tescho	Enterovirus								Rhinovirus		Entero?		Kobu		Hepato		Parecho	
	SVV	EMCV	TMEV	FMDV-O	ERAV	ERBV	PTV-1	PV-1	CV-A21	CV-A16	CV-B5	EV-70	SEV-A	BEV-1	PEV-9	HRV-14	HRV-2	SV2	PEV-8	AiV	BKV	HAV	AEV	HPeV-1	LV
SVV	100	42	39	32	34	43	31	32	30	25	29	26	30	25	29	28	28	35	30	26	28	19	17	17	19
EMCV	42	100	67	29	38	39	35	28	31	29	31	31	29	31	30	26	31	31	35	27	26	19	18	17	18
TMEV	39	67	100	31	37	35	33	29	29	31	29	27	27	27	28	26	30	31	35	27	28	18	17	17	20
FMDV-O	32	29	31	100	39	31	23	26	23	26	27	25	26	25	24	26	23	30	32	20	25	14	15	14	17
ERAV	34	38	37	39	100	38	25	25	24	20	27	23	23	23	25	24	27	31	32	25	24	20	15	15	19
ERBV	43	39	35	31	38	100	30	27	29	27	28	27	30	29	28	28	28	34	34	27	29	21	19	18	17
PTV-1	31	35	33	23	25	30	100	23	22	24	24	23	27	25	28	22	27	28	27	24	23	16	16	19	18
PV-1	32	28	29	26	25	27	23	100	75	42	55	42	46	41	43	43	50	36	36	24	29	17	17	15	15
CV-A21	30	31	29	23	24	29	22	75	100	43	61	42	46	42	45	48	53	36	35	24	26	16	20	13	13
CV-A16	25	29	31	26	20	27	24	42	43	100	48	51	50	55	54	40	41	40	38	24	26	13	14	13	14
CV-B5	29	31	29	27	27	28	24	55	61	48	100	47	48	49	49	51	52	40	36	24	27	16	17	14	15
EV-70	26	31	27	25	23	27	23	42	42	51	47	100	49	49	53	45	44	32	38	25	27	16	15	15	15
SEV-A	30	29	27	26	23	30	27	46	46	50	48	49	100	48	53	41	43	37	37	28	28	13	14	14	15
BEV-1	25	31	27	25	23	29	25	41	42	55	49	49	48	100	63	45	45	40	40	23	25	11	12	13	17
PEV-9	29	30	28	24	25	28	28	43	45	54	49	53	53	63	100	43	48	39	39	22	27	15	12	14	13
HRV-14	28	26	26	26	24	28	22	43	48	40	51	45	41	45	43	100	52	33	33	26	27	16	17	14	19
HRV-2	28	31	30	23	27	28	27	50	53	41	52	44	43	45	48	52	100	35	38	25	28	19	16	14	17
SV2	35	31	31	30	31	34	28	36	36	40	40	32	37	40	39	33	35	100	63	25	29	18	16	16	21
PEV-8	30	35	35	32	32	34	27	36	35	38	36	38	37	40	39	33	38	63	100	24	30	18	17	18	18
AiV	26	27	27	20	25	27	24	24	24	24	24	25	28	23	22	26	25	25	24	100	58	16	18	17	19
BKV	28	26	28	25	24	29	23	29	26	26	27	27	28	25	27	27	28	29	30	58	100	17	20	16	19
HAV	19	19	18	14	20	21	16	17	16	13	16	16	13	11	15	16	19	18	18	16	17	100	53	18	19
AEV	17	18	17	15	15	19	16	17	20	14	17	15	14	12	12	17	16	16	17	18	20	53	100	20	20
HPeV-1	17	17	17	14	15	18	19	15	13	13	14	15	14	13	14	14	14	16	18	17	16	18	20	100	55
LV	19	18	20	17	19	17	18	15	13	14	15	15	15	17	13	19	17	21	18	19	19	19	20	55	100

Fig. 39 (44/99)

	Cardiovirus			Aphthovirus		Erbo	Tescho	Enterovirus								Rhinovirus		Entero?		Kobu		Hepato		Parecho	
	SVV	EMCV	TMEV	FMDV-O	ERAV	ERBV	PTV-1	PV-1	CV-A21	CV-A16	CV-B5	EV-70	SEV-A	BEV-1	PEV-9	HRV-14	HRV-2	SV2	PEV-8	AiV	BKV	HAV	AEV	HPeV-1	LV
SVV	100	20	21	12	13	13	11	17	16	16	16	14	17	13	13	18	16	14	13	13	13	9	10	11	8
EMCV	20	100	48	11	15	16	15	16	16	14	14	15	18	17	17	17	15	16	16	14	13	12	12	11	11
TMEV	21	48	100	12	15	15	14	15	16	16	13	13	17	14	15	16	15	16	15	17	14	15	13	9	11
FMDV-O	12	11	12	100	23	13	9	11	13	12	11	11	11	10	11	10	13	9	12	12	8	11	10	11	10
ERAV	13	15	15	23	100	18	12	13	14	16	14	11	14	14	12	14	14	10	14	11	9	9	9	9	11
ERBV	13	16	15	13	18	100	13	13	13	14	15	15	13	12	11	12	12	12	13	17	12	10	12	13	11
PTV-1	11	15	14	9	12	13	100	19	18	21	19	19	18	17	17	18	17	17	17	16	12	12	9	13	12
PV-1	17	16	15	11	13	13	19	100	57	34	46	34	41	35	32	46	36	23	21	16	16	10	10	14	10
CV-A21	16	16	16	13	14	13	18	57	100	36	43	37	39	33	35	42	40	24	24	15	13	10	14	14	11
CV-A16	16	14	16	12	16	14	21	34	36	100	37	38	42	43	40	35	37	27	24	15	15	12	13	13	8
CV-B5	16	14	13	11	14	15	19	46	43	37	100	42	40	38	32	38	42	27	25	14	16	13	12	13	9
EV-70	14	15	13	11	11	15	19	34	37	38	42	100	37	39	33	38	37	24	23	13	13	16	12	13	12
SEV-A	17	18	17	11	14	13	18	41	39	42	40	37	100	39	40	39	40	25	25	13	13	13	13	14	12
BEV-1	13	17	14	10	14	12	17	35	33	43	38	39	39	100	46	37	35	25	25	15	14	15	11	12	10
PEV-9	13	17	15	11	12	11	17	32	35	40	32	33	40	46	100	36	34	23	22	13	13	12	11	12	9
HRV-14	18	17	16	10	14	12	18	46	42	35	38	38	39	37	36	100	42	23	22	15	16	11	13	14	10
HRV-2	16	15	15	13	14	12	17	36	40	37	42	37	40	35	34	42	100	24	21	16	14	13	14	14	9
SV2	14	16	16	9	10	12	17	23	24	27	27	24	25	25	23	23	24	100	46	15	12	11	12	12	11
PEV-8	13	16	15	12	14	13	17	21	24	24	25	23	25	25	22	22	21	46	100	14	12	13	12	13	8
AiV	13	14	17	12	11	17	16	16	15	15	14	13	13	15	13	15	16	15	14	100	28	11	13	11	10
BKV	13	13	14	8	9	12	12	16	13	15	16	13	13	14	13	16	14	12	12	28	100	11	11	13	10
HAV	9	12	15	11	9	10	12	10	10	12	13	16	13	15	12	11	13	11	13	11	11	100	43	15	14
AEV	10	12	13	10	9	12	9	10	14	13	12	12	13	11	11	13	14	12	12	13	11	43	100	18	14
HPeV-1	11	11	9	11	9	13	13	14	14	13	13	13	14	12	12	14	14	12	13	11	13	15	18	100	43
LV	8	11	11	10	11	11	12	10	11	8	9	12	12	10	9	10	9	11	8	10	10	14	14	43	100

Fig. 40 (45/99)

	Cardiovirus			Aphthovirus		Erbo	Tescho	Enterovirus								Rhinovirus		Entero?		Kobu		Hepato		Parecho	
	SVV	EMCV	TMEV	FMDV-O	ERAV	ERBV	PTV-1	PV-1	CV-A21	CV-A16	CV-B5	EV-70	SEV-A	BEV-1	PEV-9	HRV-14	HRV-2	SV2	PEV-8	AiV	BKV	HAV	AEV	HPeV-1	LV
SVV	100	34	33	26	27	30	22	23	23	22	24	22	24	21	22	22	21	25	24	22	22	15	15	14	12
EMCV	34	100	59	25	28	31	25	22	21	22	24	22	23	23	22	21	23	24	25	21	21	15	16	15	14
TMEV	33	59	100	27	29	30	24	23	22	24	21	21	22	22	22	22	22	24	26	24	24	15	15	14	14
FMDV-O	26	25	27	100	33	27	20	21	20	21	20	20	22	19	18	22	19	22	23	17	19	13	12	13	12
ERAV	27	28	29	33	100	32	23	21	20	17	23	19	20	20	20	21	21	25	25	22	20	16	15	13	15
ERBV	30	31	30	27	32	100	24	22	23	23	24	23	24	23	22	22	21	26	26	24	21	16	16	15	13
PTV-1	22	25	24	20	23	24	100	19	20	20	19	20	22	19	22	19	19	20	20	20	20	15	13	13	14
PV-1	23	22	23	21	21	22	19	100	66	39	50	40	44	40	39	44	43	29	30	18	22	14	14	11	11
CV-A21	23	21	22	20	20	23	20	66	100	40	51	42	42	40	40	44	44	29	32	18	20	14	15	10	11
CV-A16	22	22	24	21	17	23	20	39	40	100	43	47	46	49	46	40	40	33	32	19	20	12	11	11	11
CV-B5	24	24	21	20	23	24	19	50	51	43	100	46	44	44	41	45	46	35	35	19	20	14	14	12	10
EV-70	22	22	21	20	19	23	20	40	42	47	46	100	45	47	45	42	41	30	32	20	20	14	12	13	11
SEV-A	24	23	22	22	20	24	22	44	42	46	44	45	100	46	48	41	41	32	33	21	21	12	12	12	11
BEV-1	21	23	22	19	20	23	19	40	40	49	44	47	46	100	56	42	42	33	33	19	20	11	11	11	13
PEV-9	22	22	22	18	20	22	22	39	40	46	41	45	48	56	100	41	42	32	32	18	20	12	10	12	10
HRV-14	22	21	22	22	21	22	19	44	44	40	45	42	41	42	41	100	47	30	29	20	20	14	14	12	13
HRV-2	21	23	22	19	21	21	19	43	44	40	46	41	41	42	42	47	100	30	30	20	20	14	12	11	12
SV2	25	24	24	22	25	26	20	29	29	33	35	30	32	33	32	30	30	100	57	19	21	15	14	14	14
PEV-8	24	25	26	23	25	26	20	30	32	32	35	32	33	33	32	29	30	57	100	18	22	16	15	14	13
AiV	22	21	24	17	22	24	20	18	18	19	19	20	21	19	18	20	20	19	18	100	46	14	14	14	14
BKV	22	21	24	19	20	21	20	22	20	20	20	20	21	20	20	20	20	21	22	46	100	13	15	13	13
HAV	15	15	15	13	16	16	15	14	14	12	14	14	12	11	12	14	14	15	16	14	13	100	49	16	15
AEV	15	16	15	12	15	16	13	14	15	11	14	12	12	11	10	14	12	14	15	14	15	49	100	18	17
HPeV-1	14	15	14	13	13	15	13	11	10	11	12	13	12	11	12	12	11	14	14	14	13	16	18	100	50
LV	12	14	14	12	15	13	14	11	11	11	10	11	11	13	10	13	12	14	13	14	13	15	17	50	100

* not including VP4 or part of VP2

Fig. 41 (46/99)

	Cardiovirus			Aphthovirus		Erbo	Tescho	Enterovirus								Rhinovirus		Entero?		Kobu		Hepato		Parecho	
	SVV	EMCV	TMEV	FMDV-O	ERAV	ERBV	PTV-1	PV-1	CV-A21	CV-A16	CV-B5	EV-70	SEV-A	BEV-1	PEV-9	HRV-14	HRV-2	SV2	PEV-8	AiV	BKV	HAV	AEV	HPeV-1	LV
SVV	100	41	39	35	34	35	32	29	28	30	29	30	26	26	26	29	27	28	29	26	23	25	26	21	20
EMCV	41	100	60	37	36	35	30	27	27	29	28	28	27	27	27	25	27	26	25	23	24	27	25	20	21
TMEV	39	60	100	36	38	35	31	28	26	26	29	28	26	25	24	27	26	29	25	23	23	26	25	20	21
FMDV-O	35	37	36	100	47	38	30	31	28	32	30	32	30	31	27	31	28	31	31	27	28	25	24	20	21
ERAV	34	36	38	47	100	37	35	31	28	27	29	31	28	28	27	27	28	28	30	25	25	24	24	22	20
ERBV	35	35	35	38	37	100	27	29	27	30	30	29	30	27	30	28	26	27	27	23	23	27	24	23	24
PTV-1	32	30	31	30	35	27	100	27	28	30	30	29	28	29	27	27	29	28	28	27	26	21	22	21	24
PV-1	29	27	28	31	31	29	27	100	79	64	63	62	58	59	58	61	49	45	39	24	22	20	23	24	23
CV-A21	28	27	26	28	28	27	28	79	100	58	59	56	55	56	56	56	43	41	38	24	21	19	22	23	21
CV-A16	30	29	26	32	27	30	30	64	58	100	66	60	63	64	58	55	48	44	40	24	23	22	24	24	24
CV-B5	29	28	29	30	29	30	30	63	59	66	100	67	71	63	59	57	46	43	37	23	23	22	24	26	25
EV-70	30	28	28	32	31	29	29	62	56	60	67	100	65	59	56	53	45	43	39	24	23	21	22	25	23
SEV-A	26	27	26	30	28	30	28	58	55	63	71	65	100	61	60	54	45	42	40	21	22	21	22	25	25
BEV-1	26	27	25	31	28	27	29	59	56	64	63	59	61	100	67	53	47	44	40	23	23	21	21	24	24
PEV-9	26	27	24	27	27	30	27	58	56	58	59	56	60	67	100	52	42	41	38	22	21	22	22	23	21
HRV-14	29	25	27	31	27	28	27	61	56	55	57	53	54	53	52	100	47	42	40	21	20	21	19	22	23
HRV-2	27	27	26	28	28	26	29	49	43	48	46	45	45	47	42	47	100	40	37	22	21	21	20	22	24
SV2	28	26	29	31	28	27	28	45	41	44	43	43	42	44	41	42	40	100	52	22	22	22	20	21	21
PEV-8	29	25	25	31	30	27	28	39	38	40	37	39	40	40	38	40	37	52	100	21	20	21	20	21	20
AiV	26	23	23	27	25	23	27	24	24	24	23	24	21	23	22	21	22	22	21	100	69	24	22	22	22
BKV	23	24	23	28	25	23	26	22	21	23	23	23	22	23	21	20	21	22	20	69	100	25	23	22	22
HAV	25	27	26	25	24	27	21	20	19	22	22	21	21	21	22	21	21	22	21	24	25	100	41	20	21
AEV	26	25	25	24	24	24	22	23	22	24	24	22	22	21	22	19	20	20	20	22	23	41	100	22	23
HPeV-1	21	20	20	20	22	23	21	24	23	24	26	25	25	24	23	22	22	21	21	22	22	20	22	100	50
LV	20	21	21	21	20	24	24	23	21	24	25	23	25	24	21	23	24	21	20	22	22	21	23	50	100

Fig. 42 (47/99)

	Cardiovirus			Aphthovirus		Erbo	Tescho	Enterovirus								Rhinovirus		Entero?		Kobu		Hepato		Parecho	
	SVV	EMCV	TMEV	FMDV-O	ERAV	ERBV	PTV-1	PV-1	CV-A21	CV-A16	CV-B5	EV-70	SEV-A	BEV-1	PEV-9	HRV-14	HRV-2	SV2	PEV-8	AiV	BKV	HAV	AEV	HPeV-1	LV
SVV	100	38	37	24	21	19	27	19	18	14	16	17	14	18	19	18	15	17	16	16	14	17	16	13	14
EMCV	38	100	48	27	27	18	24	18	18	18	20	20	19	17	20	19	20	19	19	15	16	22	18	17	19
TMEV	37	48	100	20	28	20	25	19	20	20	18	20	16	19	18	15	18	17	17	16	17	17	16	16	19
FMDV-O	24	27	20	100	40	23	20	19	19	22	17	19	17	22	23	18	20	20	20	16	13	20	20	13	15
ERAV	21	27	28	40	100	25	22	21	20	20	20	21	22	20	18	19	20	21	22	19	20	22	22	15	17
ERBV	19	18	20	23	25	100	18	19	20	16	17	17	17	20	16	18	14	20	17	18	20	15	20	14	16
PTV-1	27	24	25	20	22	18	100	20	19	20	19	20	19	20	20	22	21	18	21	16	17	20	15	13	14
PV-1	19	18	19	19	21	19	20	100	95	55	60	60	56	57	60	46	44	43	47	21	17	18	18	18	18
CV-A21	18	18	20	19	20	20	19	95	100	56	59	57	57	57	60	46	44	42	46	22	17	18	18	19	18
CV-A16	14	18	20	22	20	16	20	55	56	100	56	54	57	57	60	51	45	46	50	17	18	19	18	20	22
CV-B5	16	20	18	17	20	17	19	60	59	56	100	64	55	58	56	52	49	46	52	20	19	19	19	19	20
EV-70	17	20	20	19	21	17	20	60	57	54	64	100	57	54	55	51	48	43	51	20	20	21	18	14	17
SEV-A	14	19	16	17	22	17	19	56	57	57	55	57	100	54	55	53	46	40	49	20	17	19	18	17	19
BEV-1	18	17	19	22	20	20	20	57	57	57	58	54	54	100	63	47	47	41	44	16	16	20	20	19	16
PEV-9	19	20	18	23	18	16	20	60	60	60	56	55	55	63	100	50	45	45	50	18	14	19	18	18	21
HRV-14	18	19	15	18	19	18	22	46	46	51	52	51	53	47	50	100	50	42	49	20	20	20	20	16	18
HRV-2	15	20	18	20	20	14	21	44	44	45	49	48	46	47	45	50	100	43	43	20	23	18	19	17	18
SV2	17	19	17	20	21	20	18	43	42	46	46	43	40	41	45	42	43	100	60	16	18	18	19	22	24
PEV-8	16	19	17	20	22	17	21	47	46	50	52	51	49	44	50	49	43	60	100	16	17	19	20	20	19
AiV	16	15	16	16	19	18	16	21	22	17	20	20	20	16	18	20	20	16	16	100	48	19	17	13	15
BKV	14	16	17	13	20	20	17	17	17	18	19	20	17	16	14	20	23	18	17	48	100	18	18	13	14
HAV	17	22	17	20	22	15	20	18	18	19	19	21	19	20	19	20	18	18	19	19	18	100	40	16	15
AEV	16	18	16	20	22	20	15	18	18	18	19	18	18	20	18	20	19	19	20	17	18	40	100	14	16
HPeV-1	13	17	16	13	15	14	13	18	19	20	19	14	17	19	18	16	17	22	20	13	13	16	14	100	48
LV	14	19	19	15	17	16	14	18	18	22	20	17	19	16	21	18	18	24	19	15	14	15	16	48	100

Fig. 43 (48/99)

	Cardiovirus			Aphthovirus		Erbo	Tescho	Enterovirus								Rhinovirus		Entero?		Kobu		Hepato		Parecho	
	SVV	EMCV	TMEV	FMDV-O	ERAV	ERBV	PTV-1	PV-1	CV-A21	CV-A16	CV-B5	EV-70	SEV-A	BEV-1	PEV-9	HRV-14	HRV-2	SV2	PEV-8	AiV	BKV	HAV	AEV	HPeV-1	LV
SVV	100	58	58	47	48	42	40	33	32	30	30	32	31	31	32	34	31	32	31	33	32	24	24	23	23
EMCV	58	100	65	43	46	46	38	31	30	29	30	29	31	30	31	32	32	31	31	35	33	24	25	21	24
TMEV	58	65	100	42	47	42	38	30	29	28	30	30	30	30	29	31	31	30	32	34	32	24	26	22	25
FMDV-O	47	43	42	100	50	37	39	31	31	30	30	31	32	28	31	32	31	31	31	35	35	22	24	21	23
ERAV	48	46	47	50	100	41	37	29	29	29	29	31	31	29	29	31	30	29	30	34	35	25	24	22	24
ERBV	42	46	42	37	41	100	40	33	33	33	34	34	34	33	35	35	35	34	35	33	34	21	25	23	26
PTV-1	40	38	38	39	37	40	100	34	34	32	34	34	35	31	35	34	34	36	35	31	31	27	23	22	23
PV-1	33	31	30	31	29	33	34	100	98	69	75	76	67	68	71	64	57	56	55	33	32	27	27	23	27
CV-A21	32	30	29	31	29	33	34	98	100	68	75	75	66	68	71	64	57	56	55	33	32	27	26	23	27
CV-A16	30	29	28	30	29	33	32	69	68	100	67	65	59	62	66	61	54	55	53	33	35	27	26	23	26
CV-B5	30	30	30	30	29	34	34	75	75	67	100	76	69	70	71	66	57	57	55	32	32	25	25	23	27
EV-70	32	29	30	31	31	34	34	76	75	65	76	100	65	67	68	63	58	58	55	33	35	25	26	22	26
SEV-A	31	31	30	32	31	34	35	67	66	59	69	65	100	64	65	58	56	55	53	33	33	25	27	25	26
BEV-1	31	30	30	28	29	33	31	68	68	62	70	67	64	100	75	60	57	54	53	31	31	25	26	25	27
PEV-9	32	31	29	31	29	35	35	71	71	66	71	68	65	75	100	64	58	58	54	32	33	29	27	23	28
HRV-14	34	32	31	32	31	35	34	64	64	61	66	63	58	60	64	100	56	53	54	34	34	27	28	24	27
HRV-2	31	32	31	31	30	35	34	57	57	54	57	58	56	57	58	56	100	53	54	31	32	25	27	23	27
SV2	32	31	30	31	29	34	36	56	56	55	57	58	55	54	58	53	53	100	67	35	36	27	28	21	26
PEV-8	31	31	32	31	30	35	35	55	55	53	55	55	53	53	54	54	54	67	100	33	33	26	28	26	28
AiV	33	35	34	35	34	33	31	33	33	33	32	33	33	31	32	34	31	35	33	100	75	25	27	23	23
BKV	32	33	32	35	35	34	31	32	32	35	32	35	33	31	33	34	32	36	33	75	100	25	27	23	24
HAV	24	24	24	22	25	21	27	27	27	27	25	25	25	25	29	27	25	27	26	25	25	100	40	24	23
AEV	24	25	26	24	24	25	23	27	26	26	25	26	27	26	27	28	27	28	28	27	27	40	100	26	24
HPeV-1	23	21	22	21	22	23	22	23	23	23	23	22	25	25	23	24	23	21	26	23	23	24	26	100	50
LV	23	24	25	23	24	26	23	27	27	26	27	26	26	27	28	27	27	26	28	23	24	23	24	50	100

Fig. 44 (49/99)

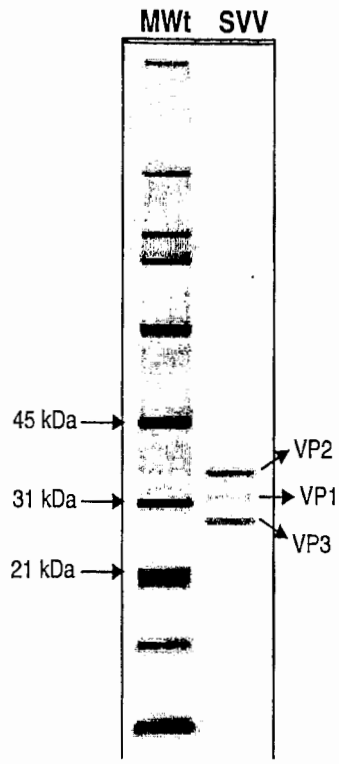


Fig. 45 (50/99)

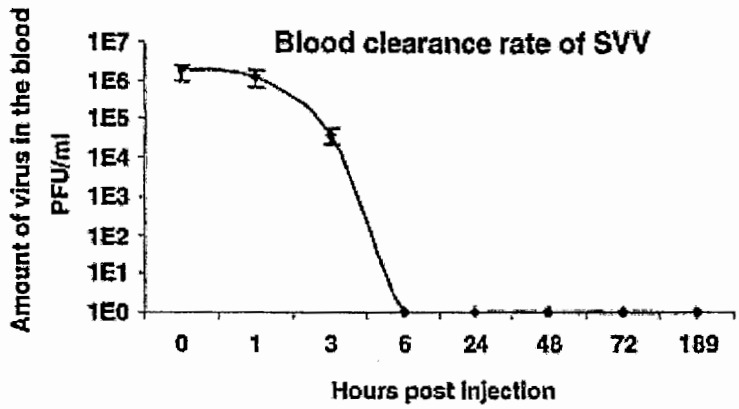


FIG. 46A

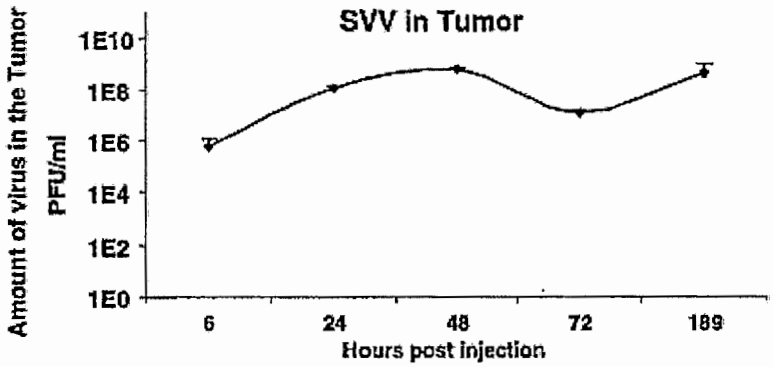


FIG. 46B

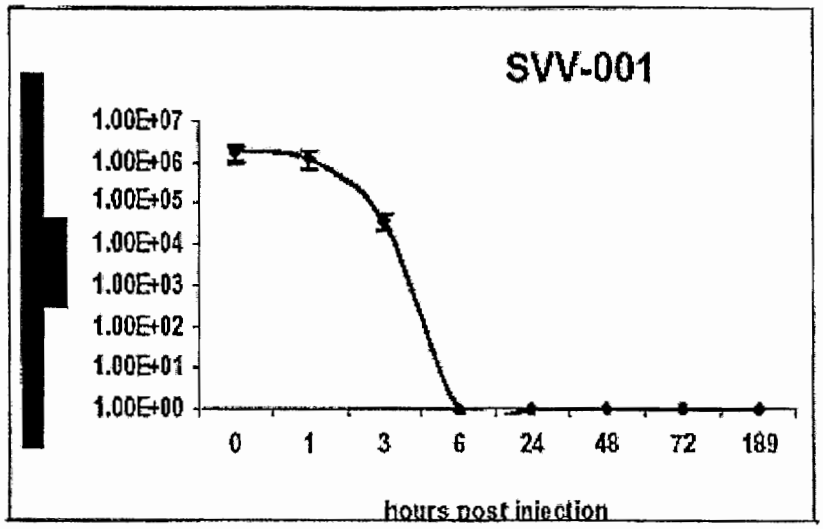


Fig. 46C

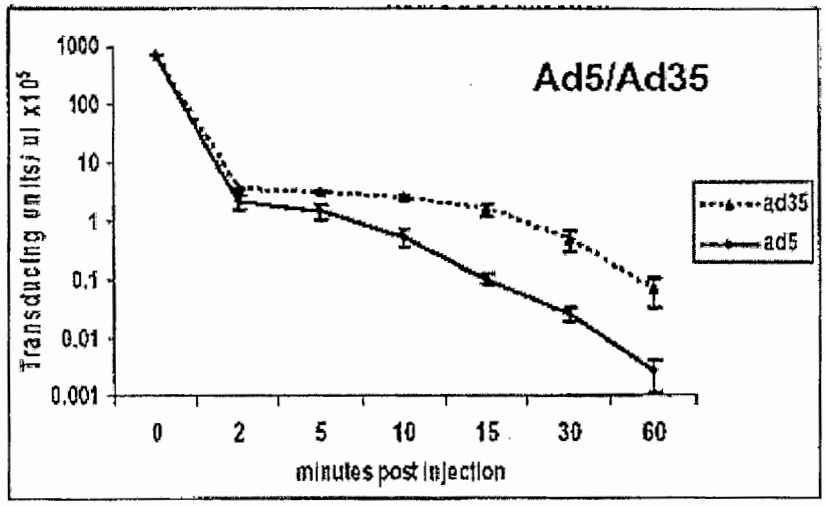


Fig. 46D

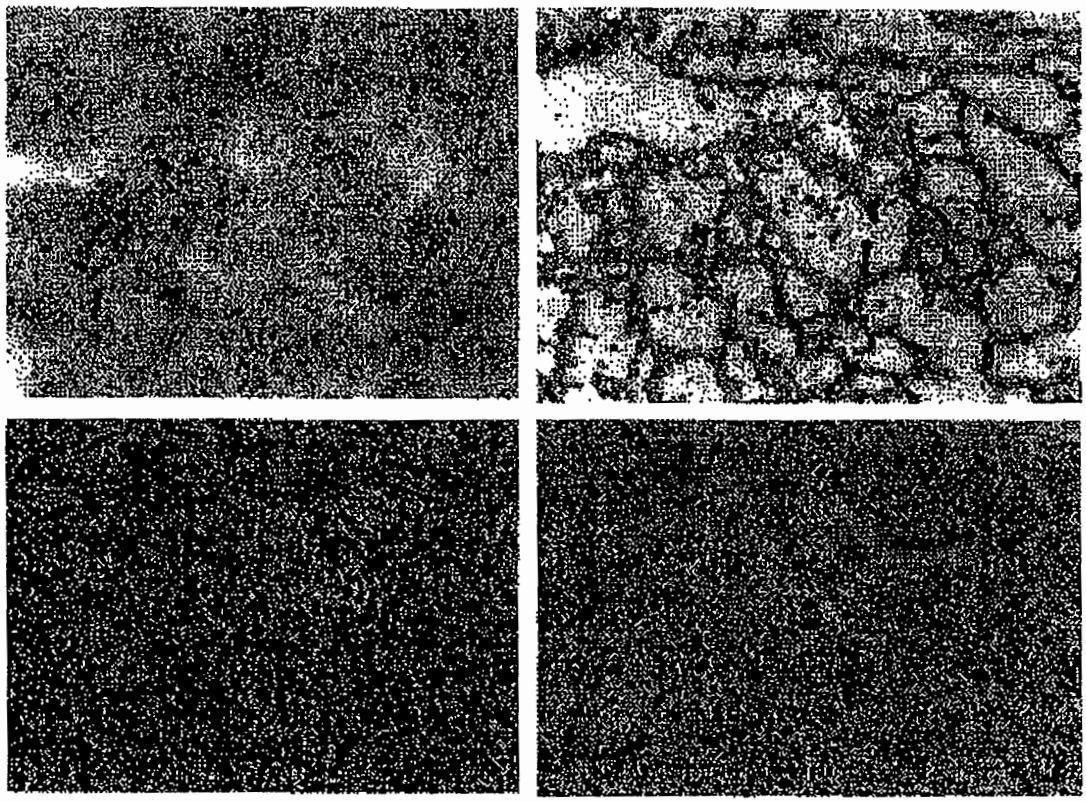


Fig. 47 (53/99)

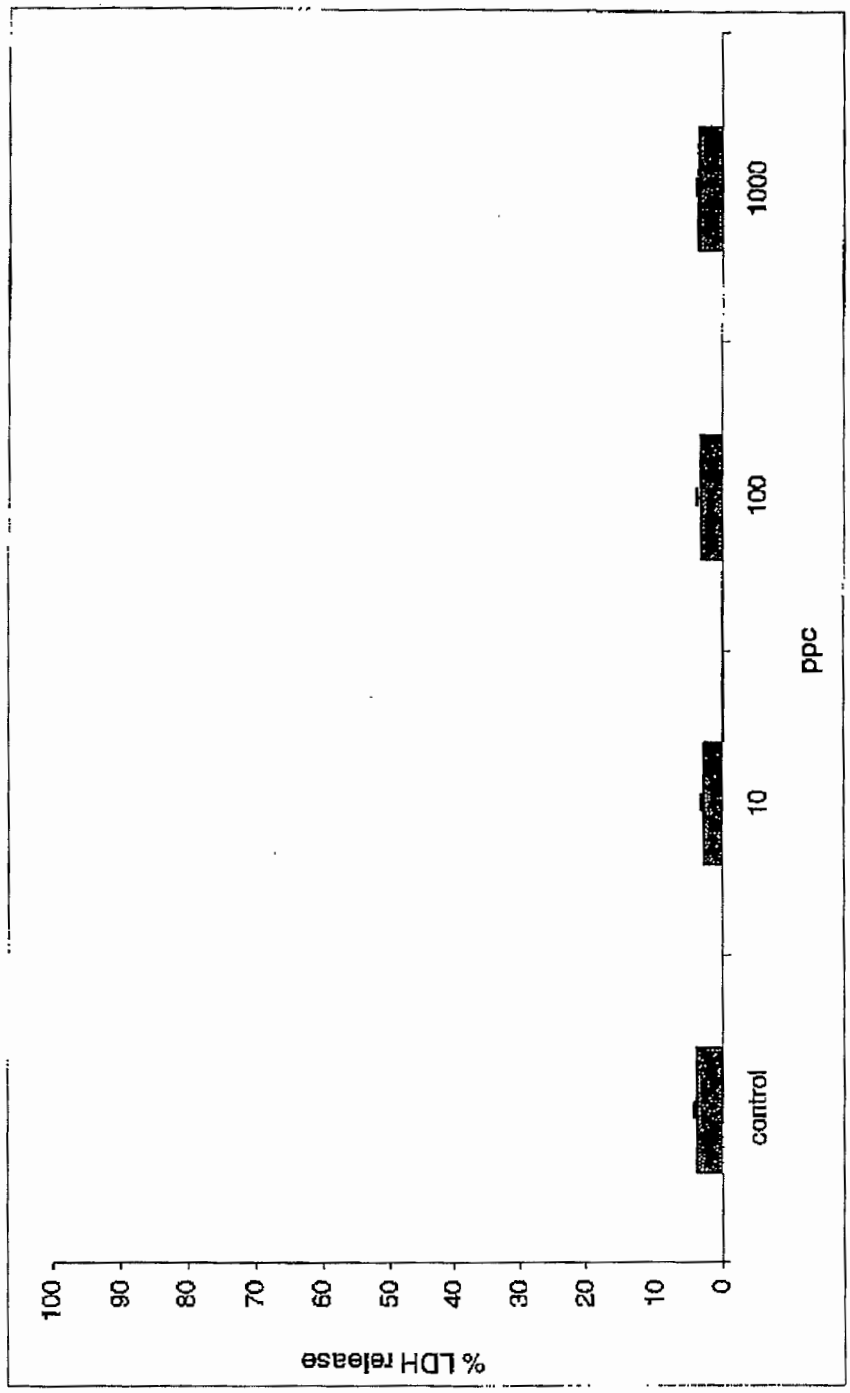

% LDH release
100
90
80
70
60
50
40
30
20
10
0
control
10
100
1000
ppc

Fig. 48

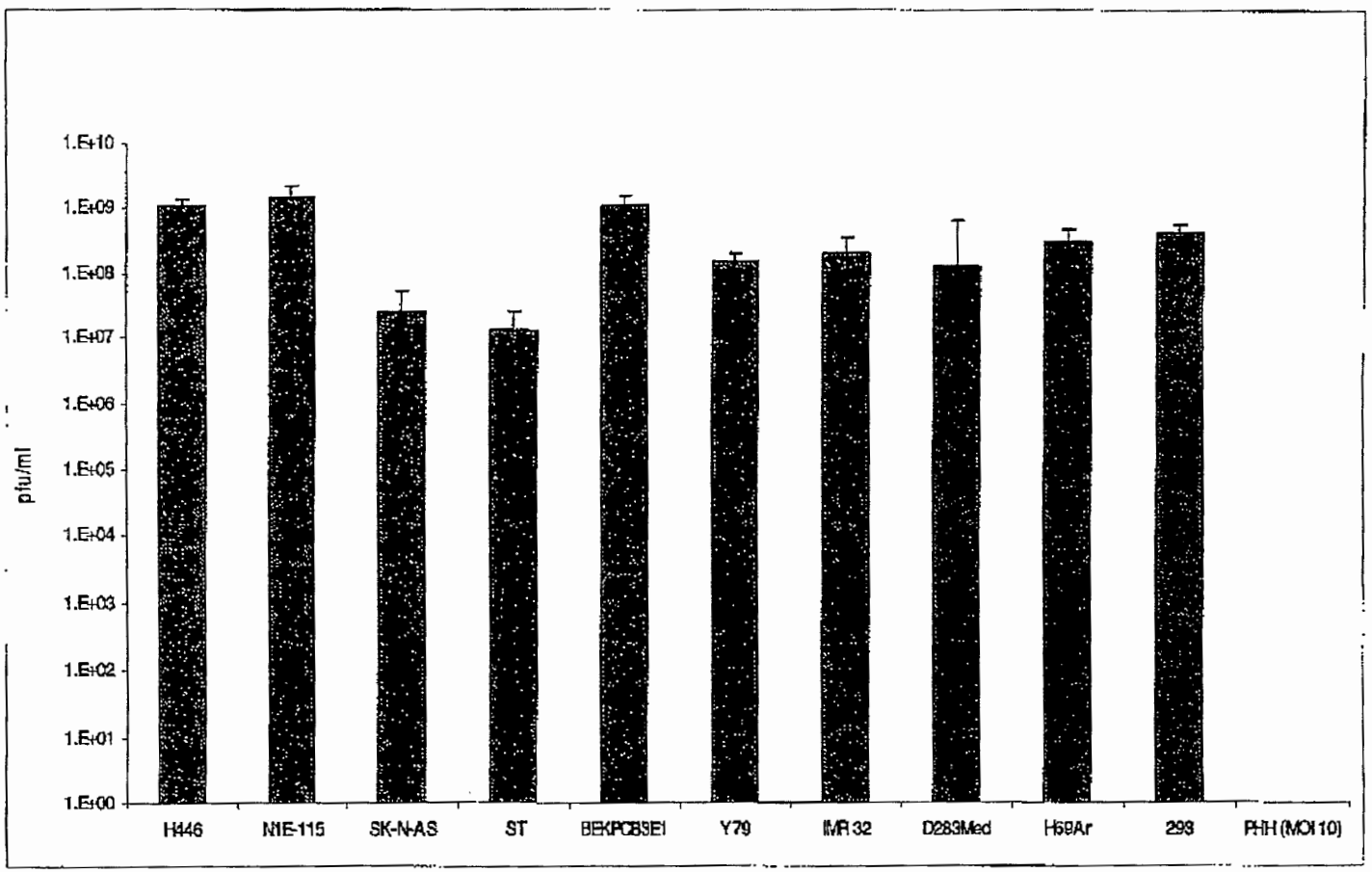

1.E+10
1.E+09
1.E+08
1.E+07
1.E+06
1.E+05
1.E+04
1.E+03
1.E+02
1.E+01
1.E+00
pfu/ml
H446
N1E-115
SK-N-AS
ST
BEKPCB3E1
Y79
IMR 32
D283Med
H69Ar
293
PHH (MOI 10)

Fig. 49

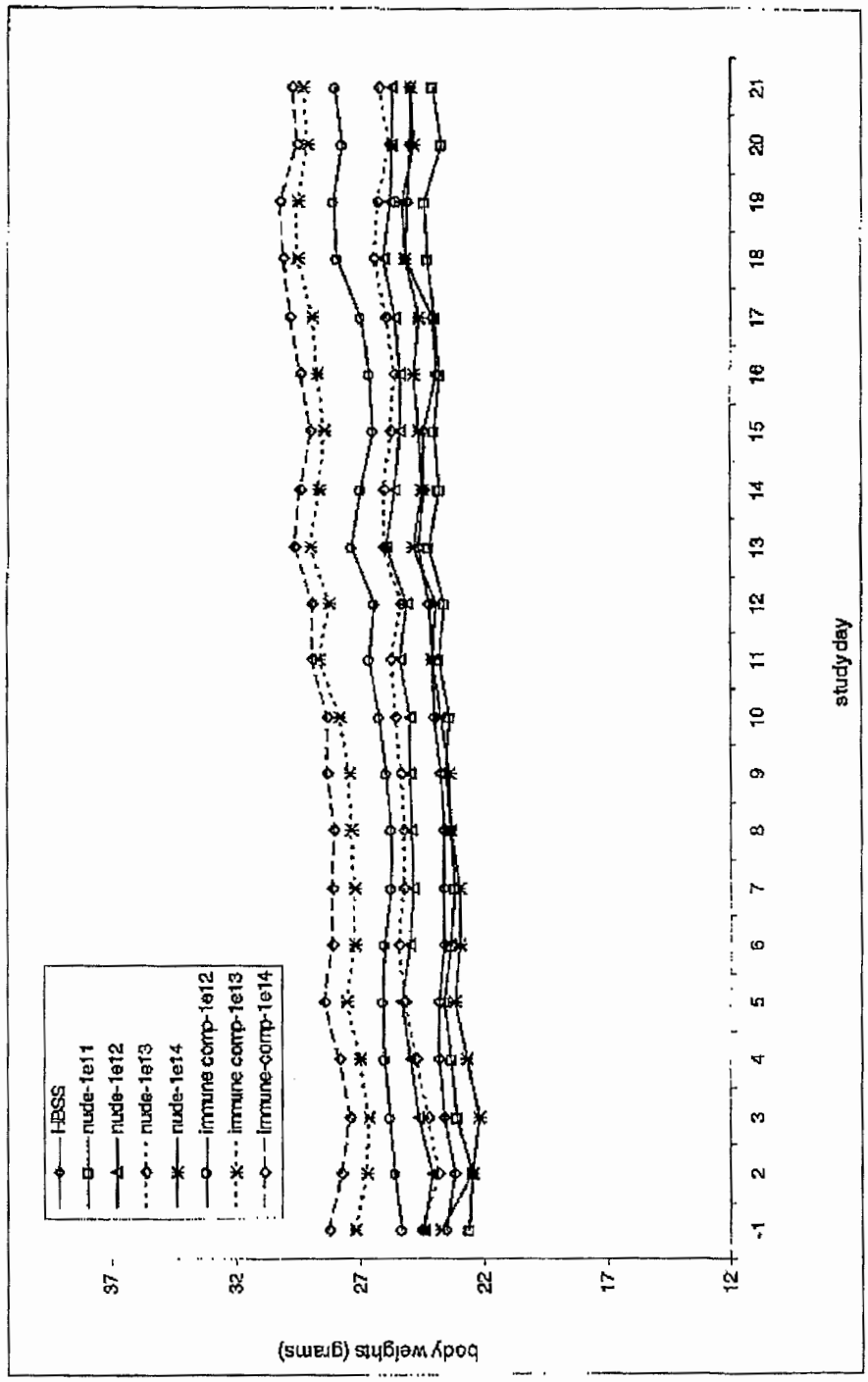

HBSS
nude-1e11
nude-1e12
nude-1e13
nude-1e14
immune comp-1e12
immune comp-1e13
immune-comp-1e14
body weights (grams)
37
32
27
22
17
12
-1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
study day

Fig. 50

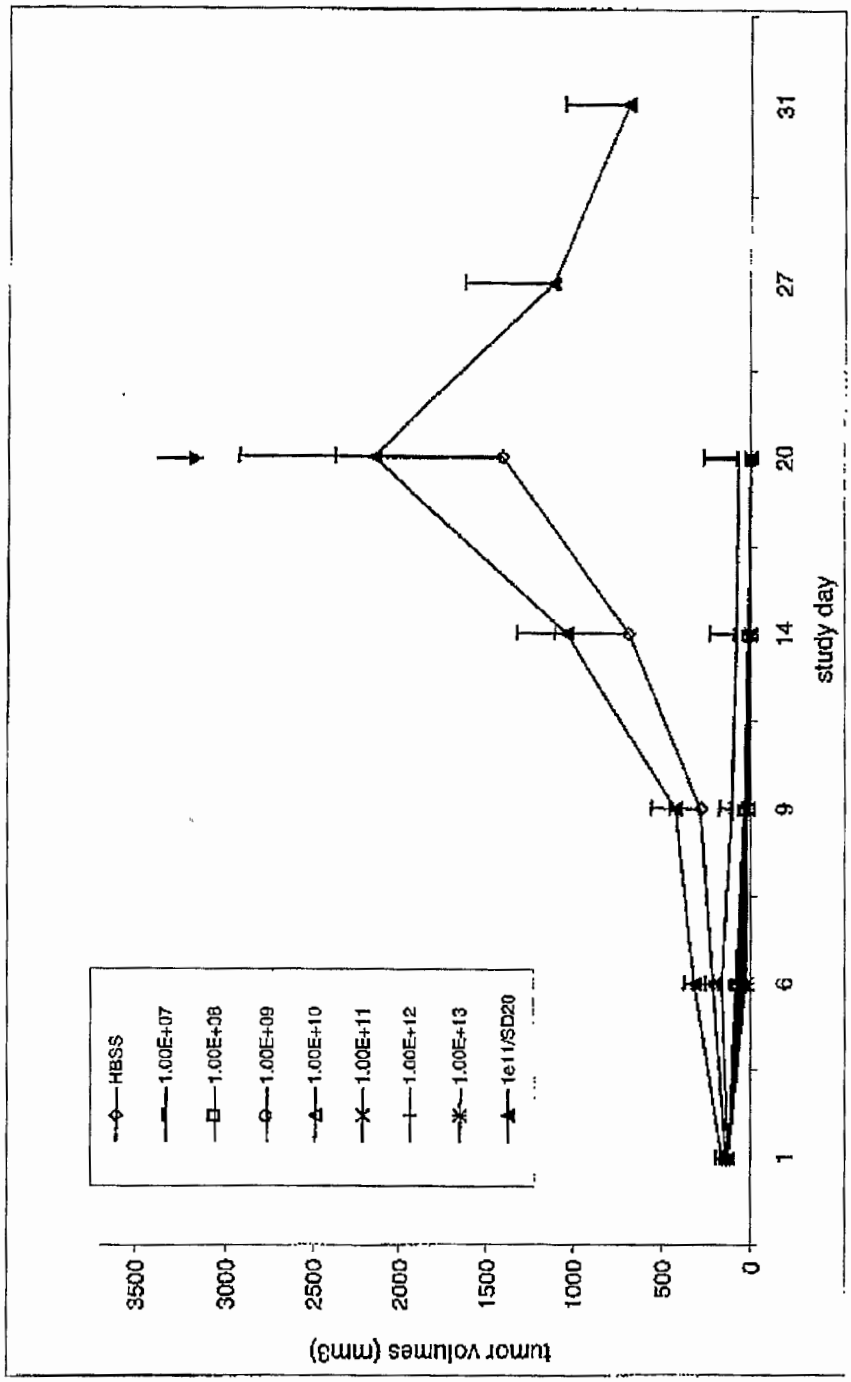

tumor volumes (mm3)
3500
3000
2500
2000
1500
1000
500
0
1
6
9
14
20
27
31
study day
HBSS
1.00E+07
1.00E+08
1.00E+09
1.00E+10
1.00E+11
1.00E+12
1.00E+13
1e11/SD20

Fig. 51

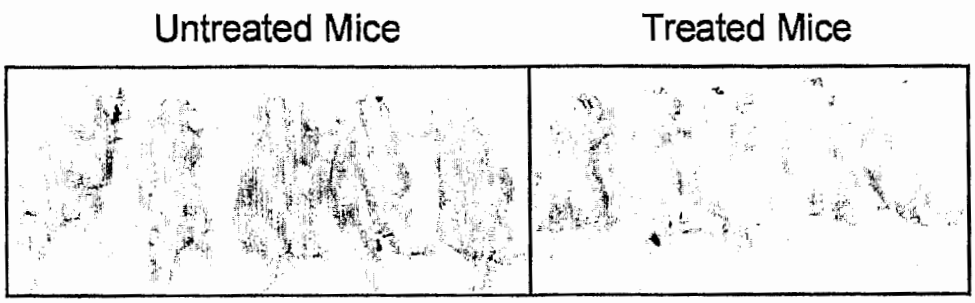


Fig. 52

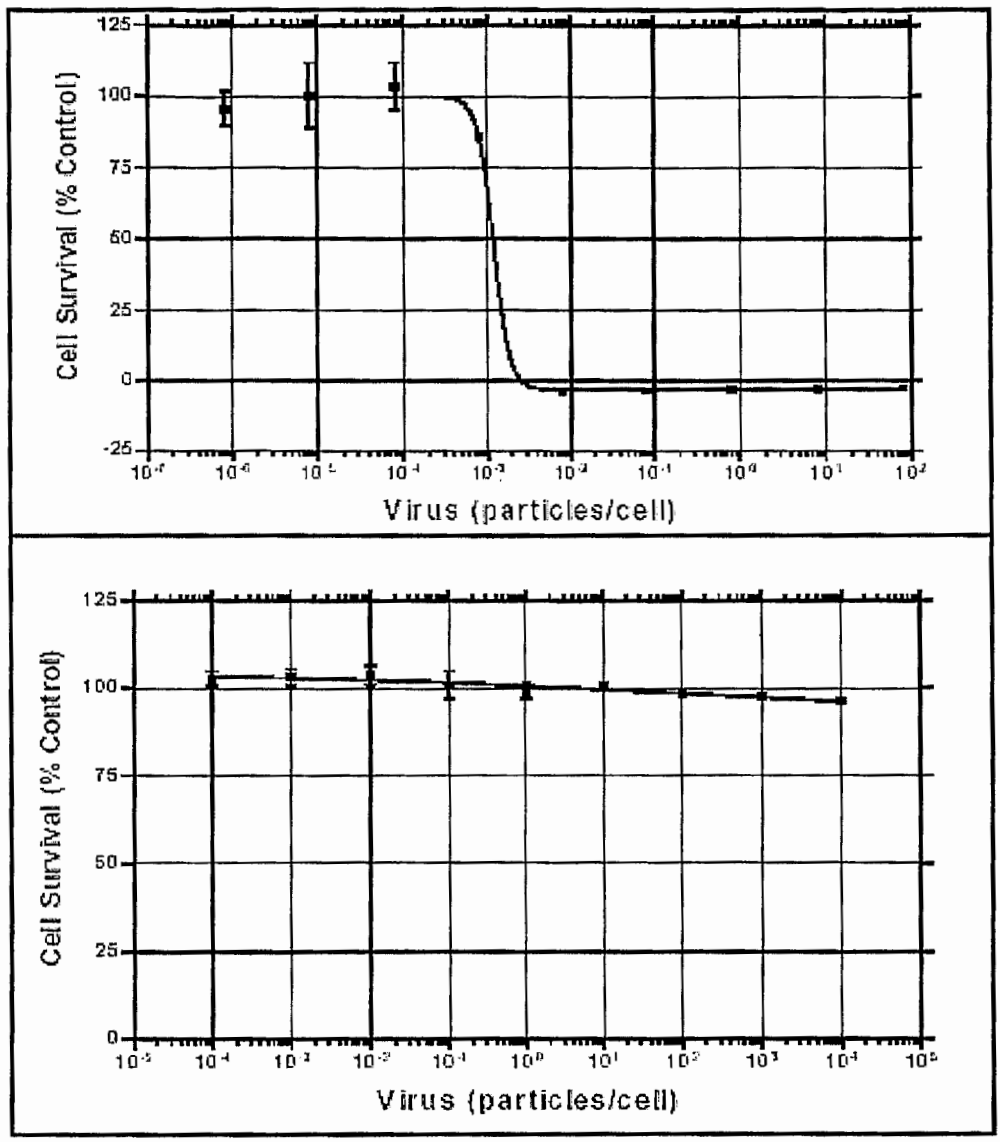

Cell Survival (% Control)
125
100
75
50
25
0
-25
Virus (particles/cell)
Cell Survival (% Control)
125
100
75
50
25
0
Virus (particles/cell)

Fig. 53

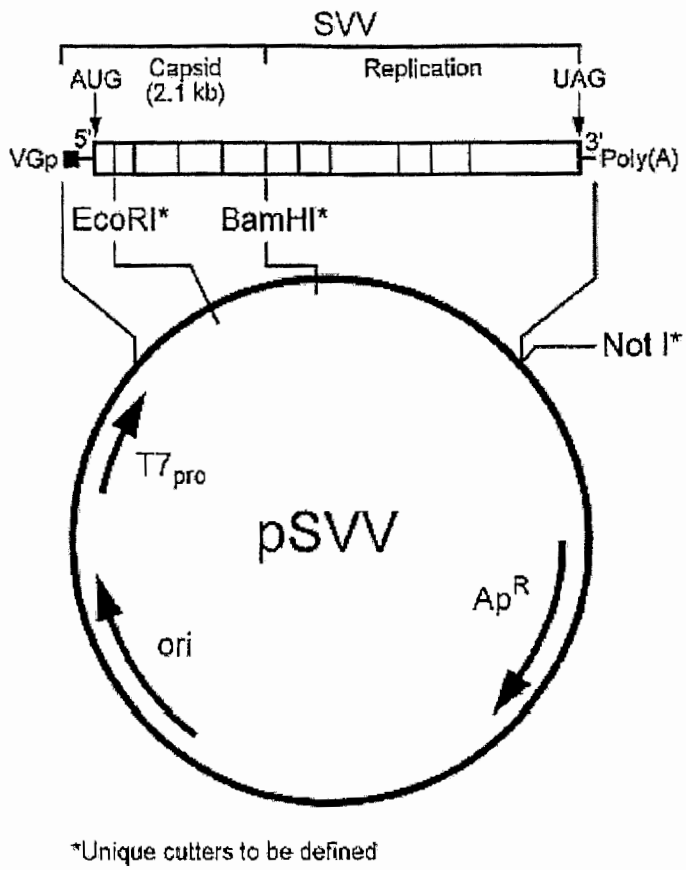

SVV
AUG
Capsid
(2.1 kb)
Replication
UAG
5'
3'
VGp
Poly(A)
EcoRI*
BamHI*
Not I*
T7pro
pSVV
ApR
ori
*Unique cutters to be defined

Fig. 54

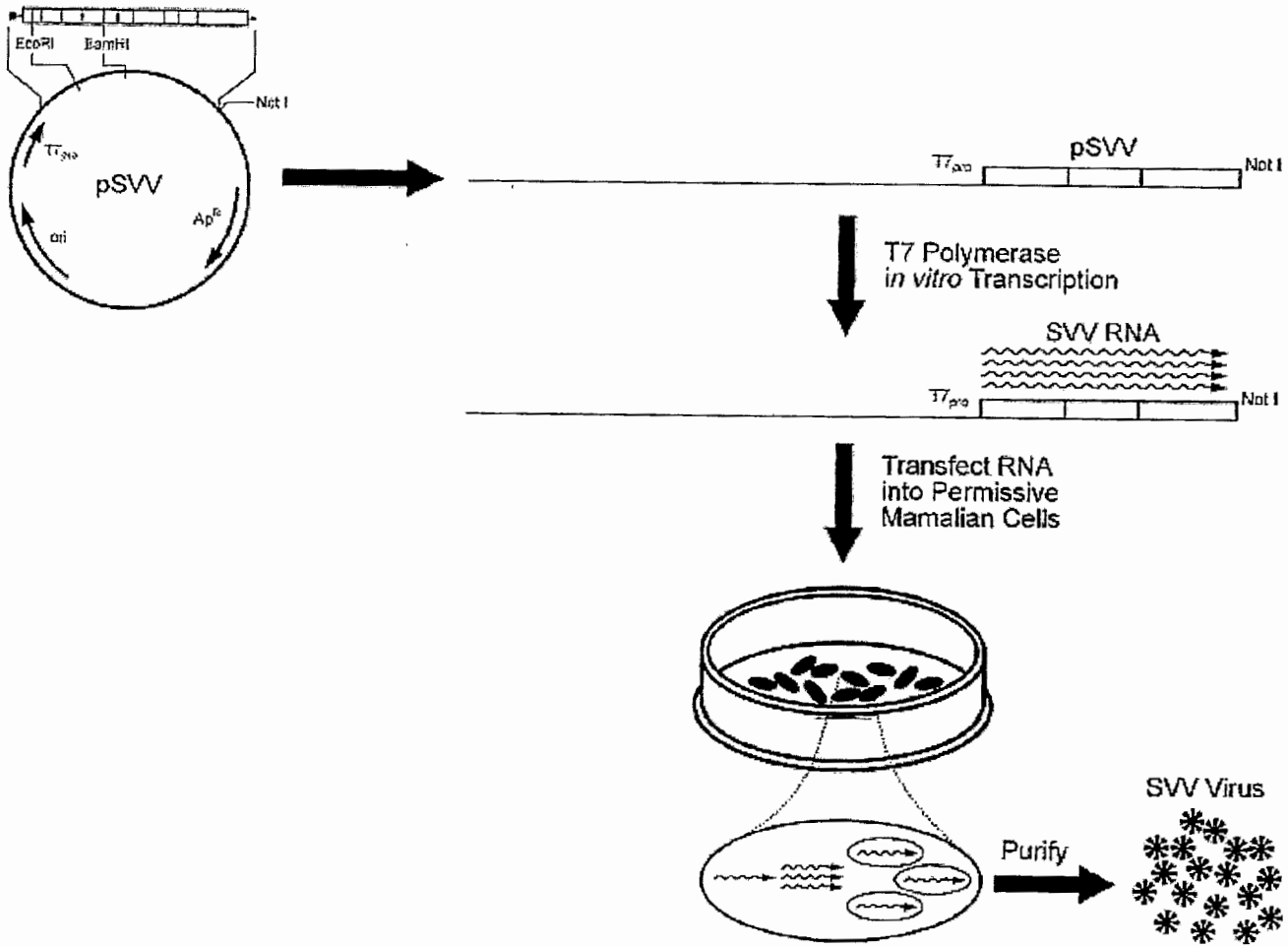

EcoRI
BamHI
Not I
pSVV
ori
T7 Polymerase
in vitro Transcription
SVV RNA
Not I
Transfect RNA
into Permissive
Mamalian Cells
SVV Virus
Purify

Fig. 55

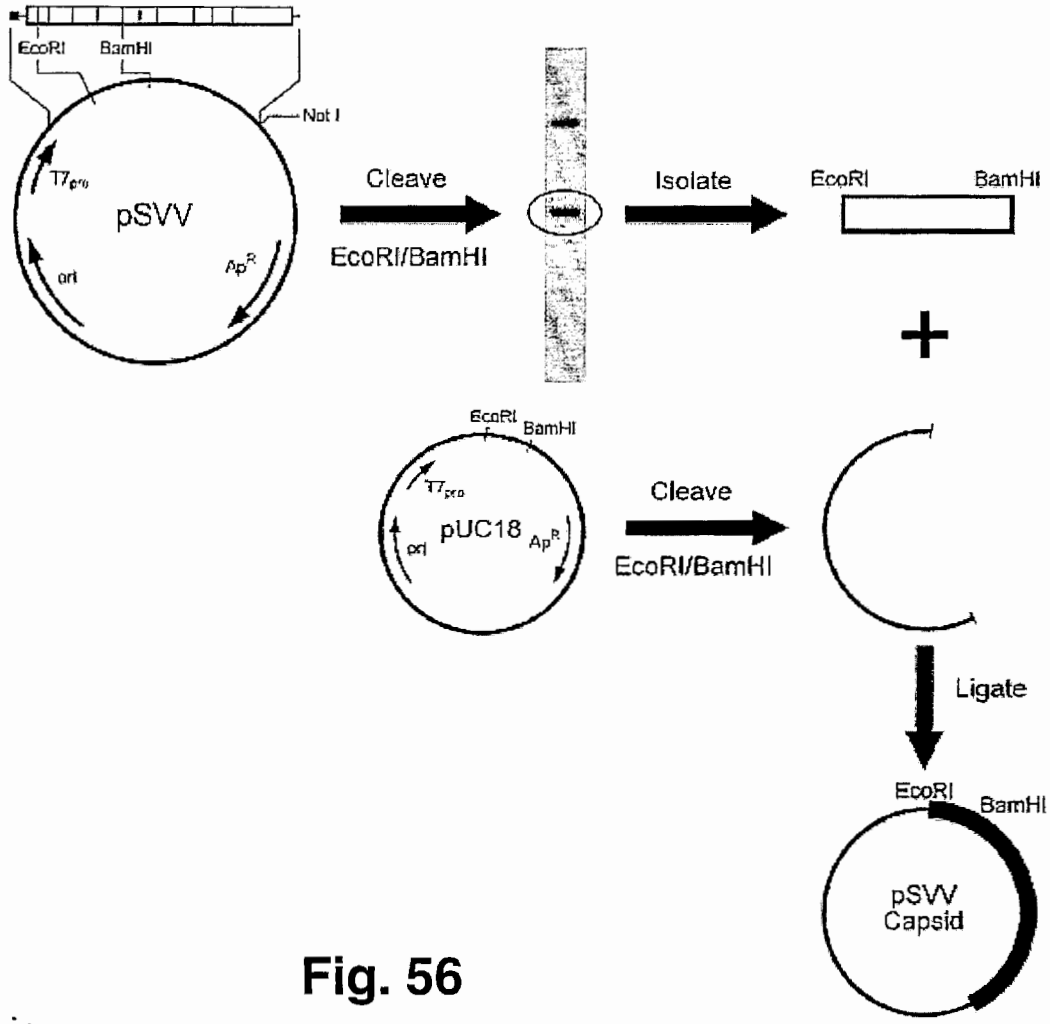

EcoRI
BamHI
Not I
pSVV
ori
Cleave
EcoRI/BamHI
Isolate
EcoRI
BamHI
+
pUC18
Cleave
EcoRI/BamHI
Ligate
pSVV
Capsid

Fig. 56

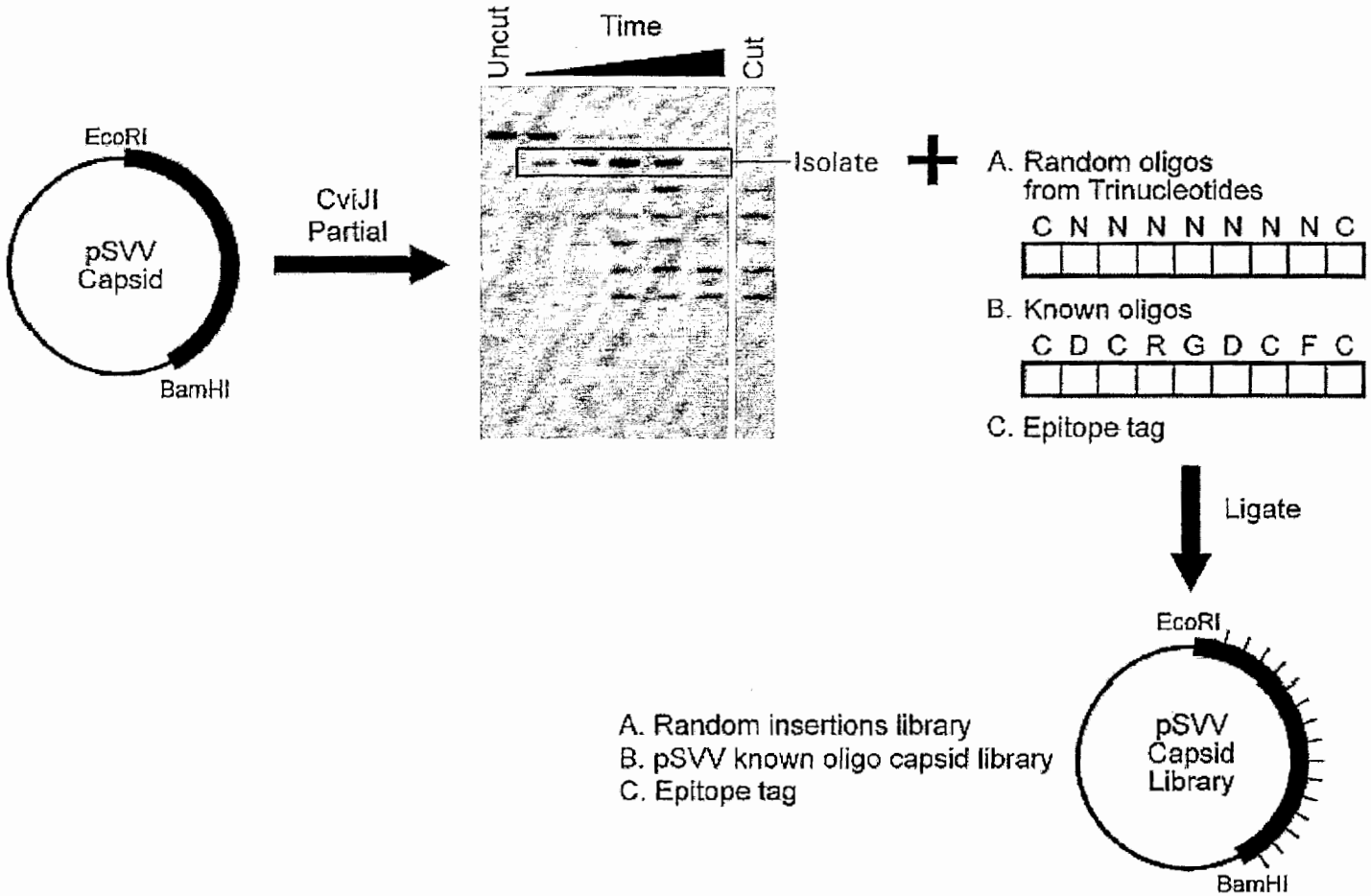

EcoRI
pSVV Capsid
BamHI
CviJI Partial
Uncut
Time
Cut
Isolate
A. Random oligos from Trinucleotides
C N N N N N N N C
B. Known oligos
C D C R G D C F C
C. Epitope tag
Ligate
EcoRI
pSVV Capsid Library
BamHI
A. Random insertions library
B. pSVV known oligo capsid library
C. Epitope tag

Fig. 57

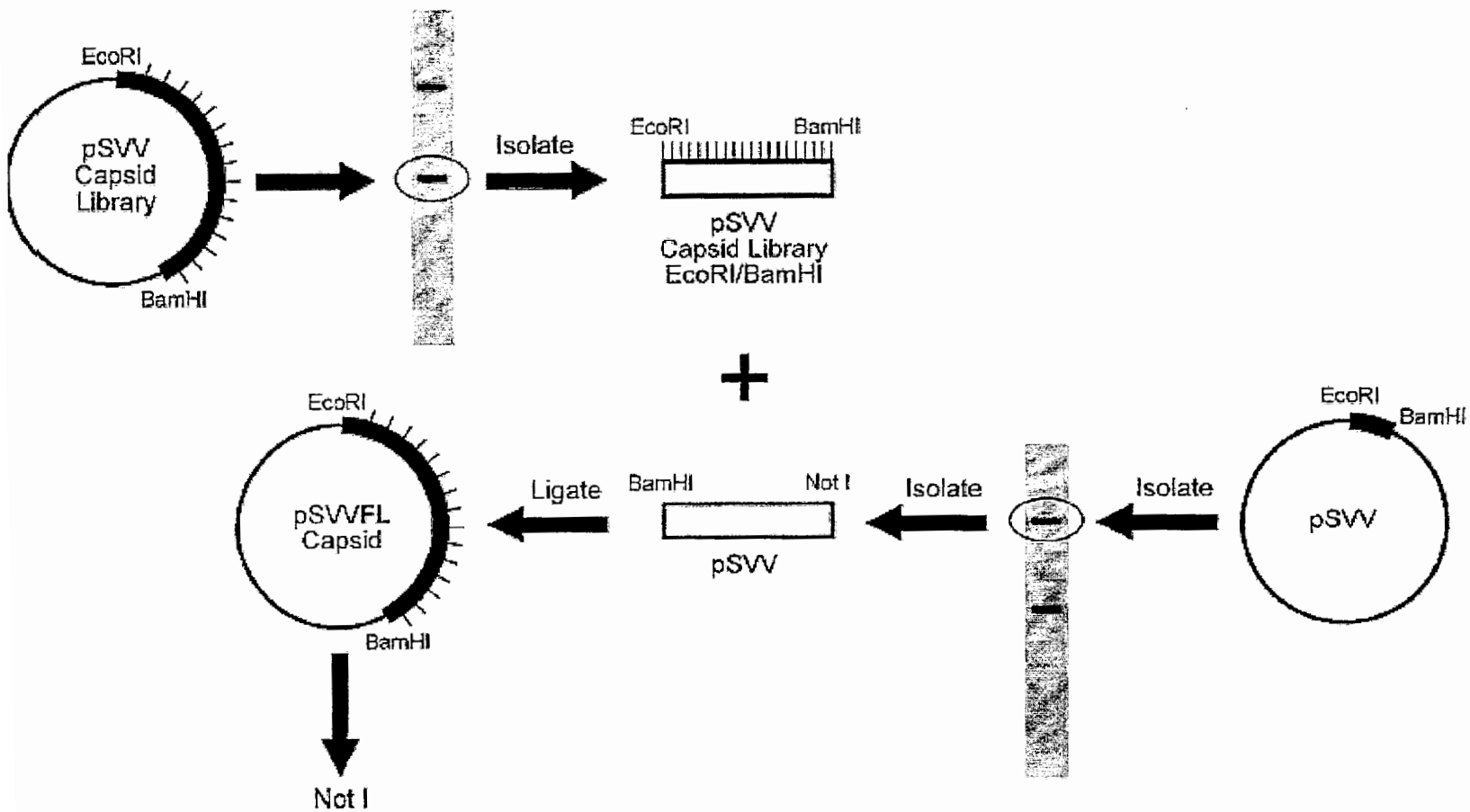

EcoRI
pSVV
Capsid
Library
BamHI
Isolate
EcoRI
BamHI
pSVV
Capsid Library
EcoRI/BamHI
+
EcoRI
BamHI
pSVV
Isolate
Isolate
BamHI
Not I
pSVV
Ligate
EcoRI
pSVVFL
Capsid
BamHI
Not I

Fig. 58

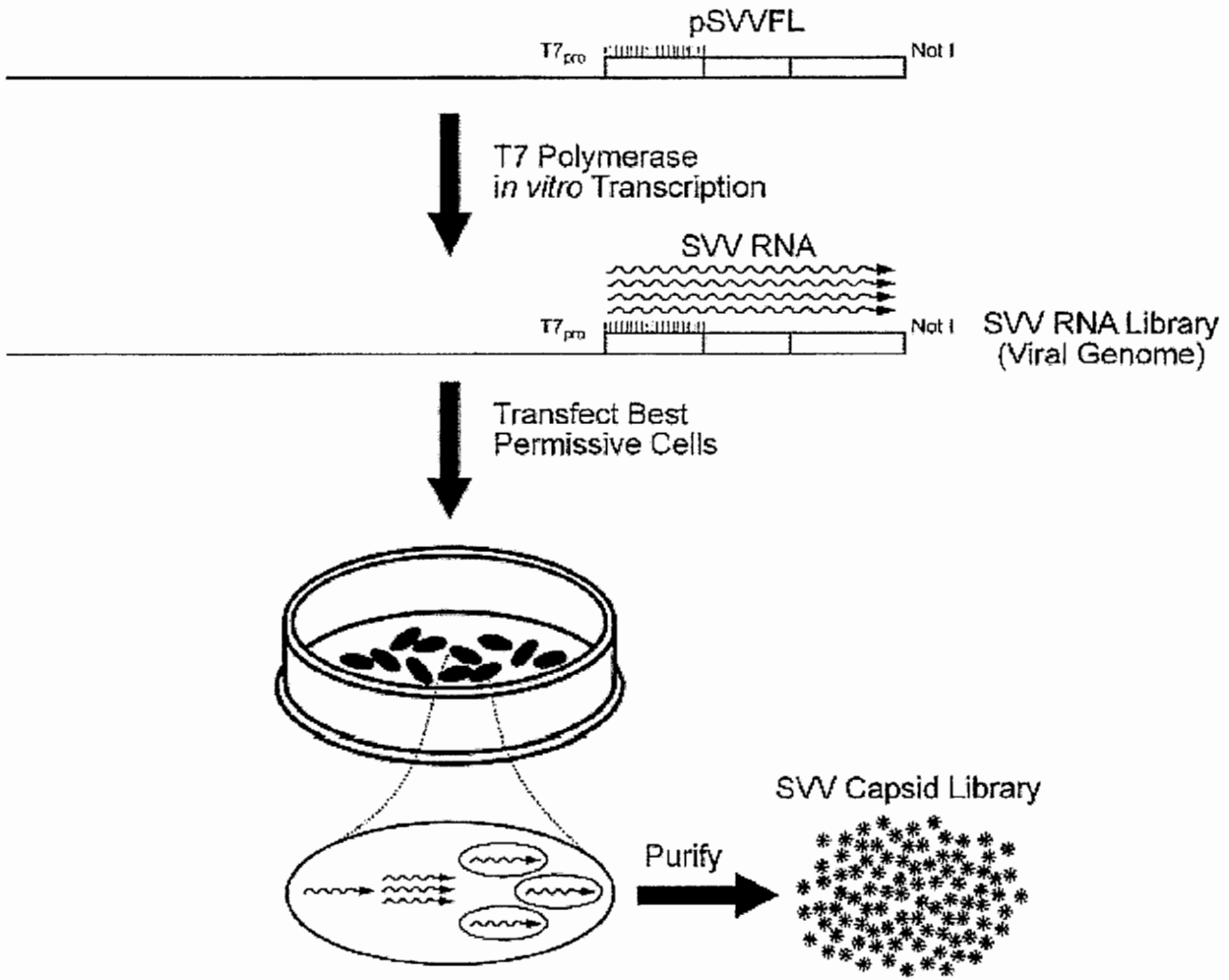

pSVVFL
T7pro
Not I
T7 Polymerase
in vitro Transcription
SVV RNA
T7pro
Not I
SVV RNA Library
(Viral Genome)
Transfect Best
Permissive Cells
SVV Capsid Library
Purify

Fig. 59

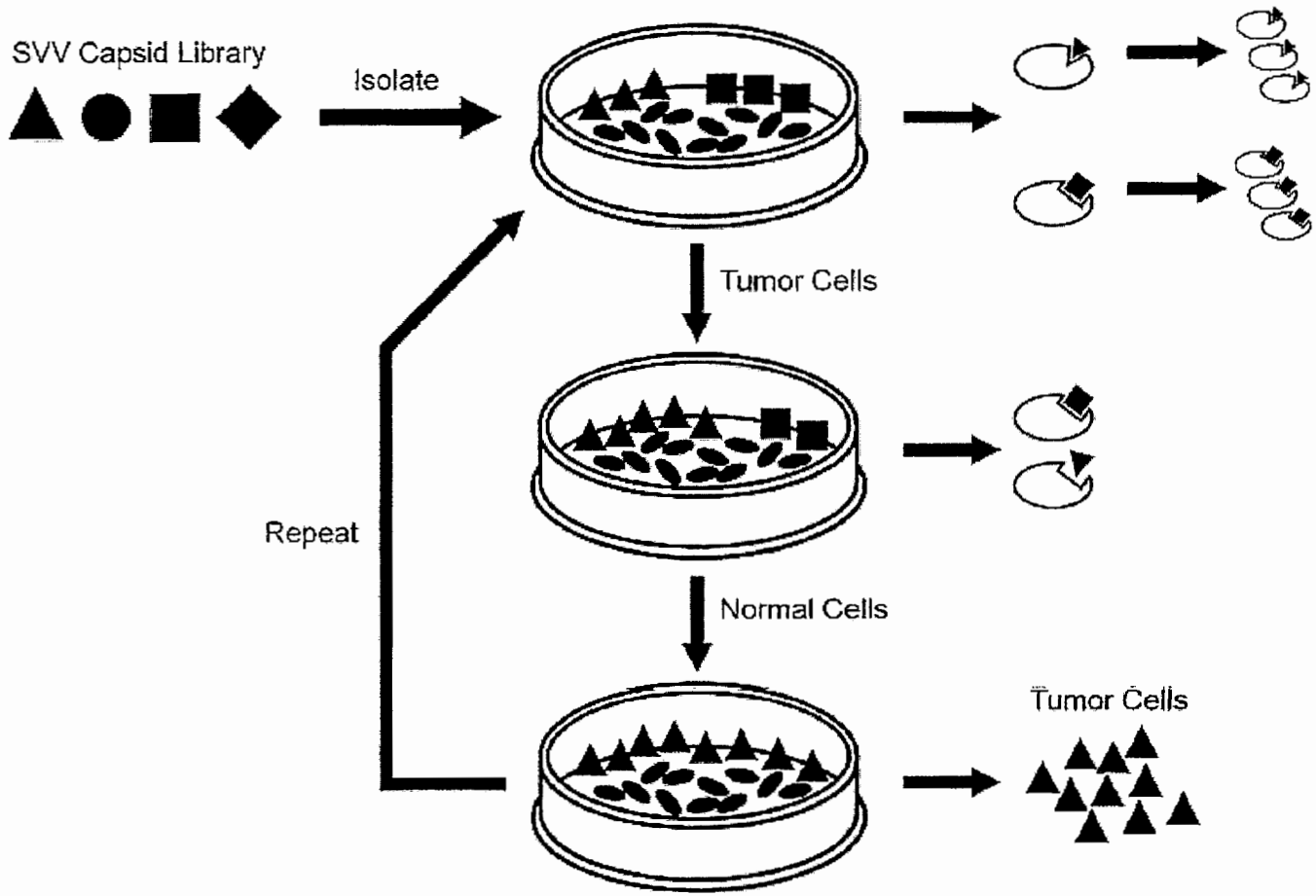

SVV Capsid Library
Isolate
Tumor Cells
Repeat
Normal Cells
Tumor Cells

Fig. 60

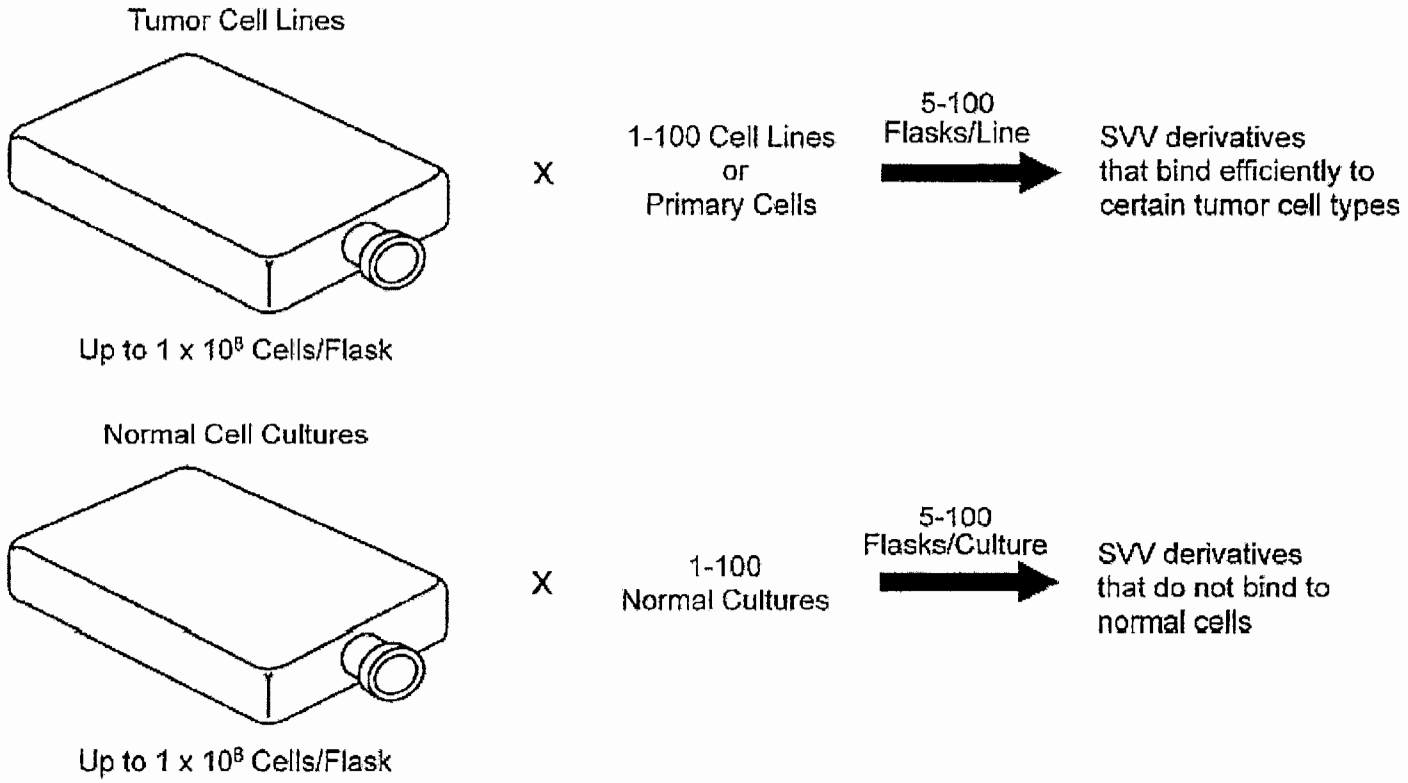

Tumor Cell Lines
Up to 1 x 10⁸ Cells/Flask
X
1-100 Cell Lines
or
Primary Cells
5-100
Flasks/Line
SVV derivatives
that bind efficiently to
certain tumor cell types
Normal Cell Cultures
Up to 1 x 10⁸ Cells/Flask
X
1-100
Normal Cultures
5-100
Flasks/Culture
SVV derivatives
that do not bind to
normal cells

Fig. 61

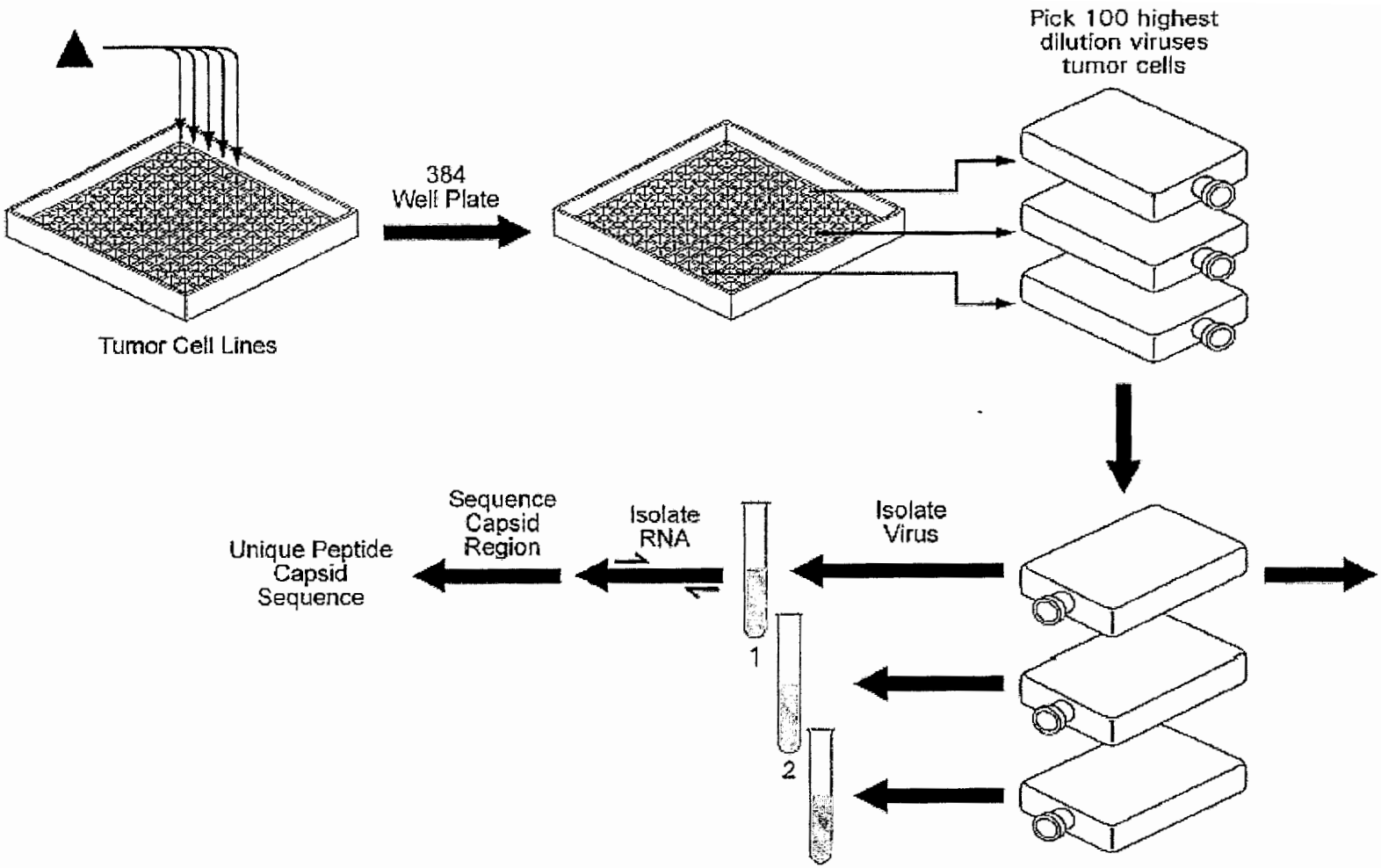

Pick 100 highest dilution viruses tumor cells
384 Well Plate
Tumor Cell Lines
Isolate Virus
Isolate RNA
Sequence Capsid Region
Unique Peptide Capsid Sequence
1
2

Fig. 62

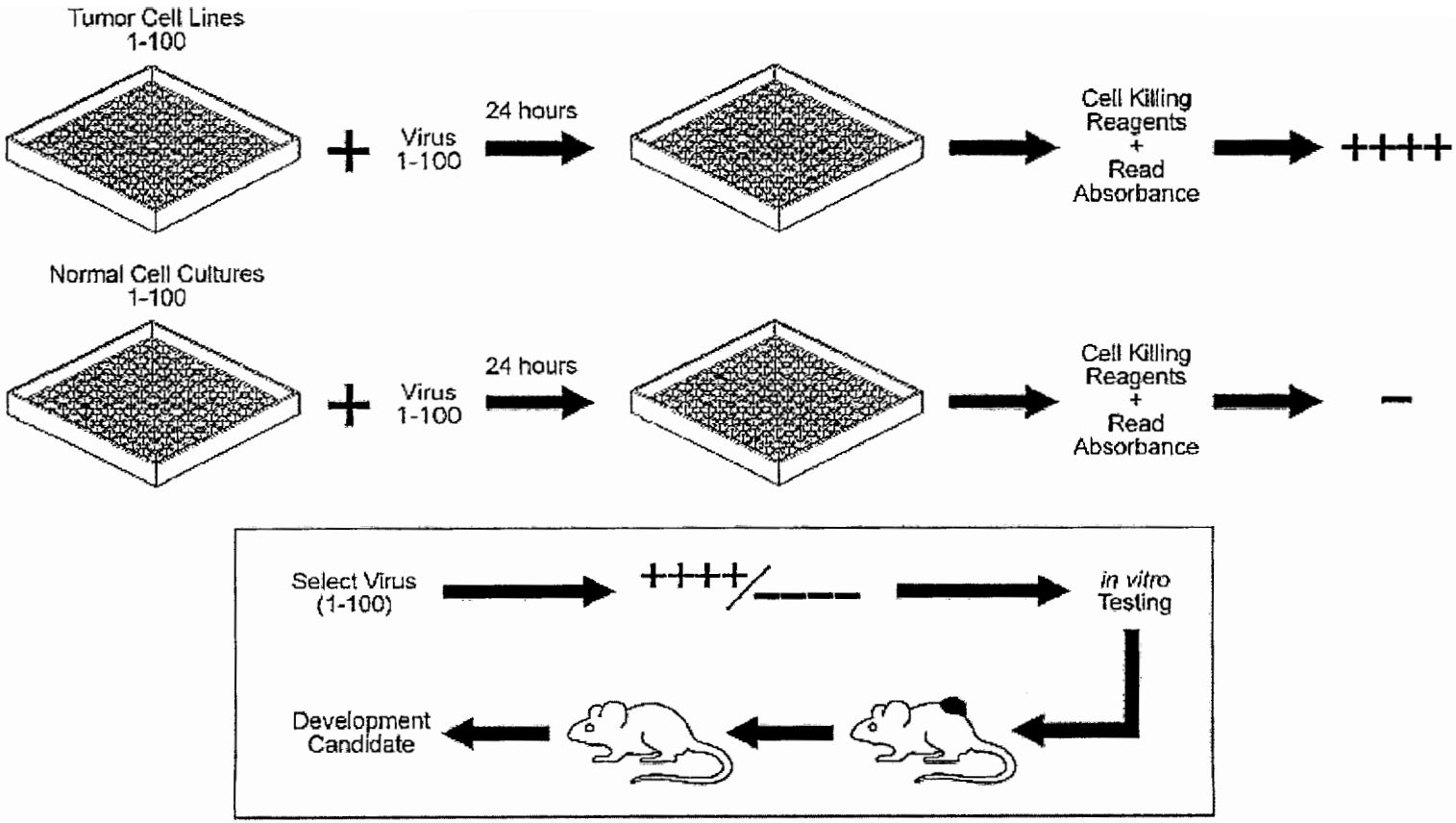

Tumor Cell Lines
1-100
Virus
1-100
24 hours
Cell Killing
Reagents
+
Read
Absorbance
++++
Normal Cell Cultures
1-100
Virus
1-100
24 hours
Cell Killing
Reagents
+
Read
Absorbance
–
Select Virus
(1-100)
++++/----
in vitro
Testing
Development
Candidate

Fig. 63

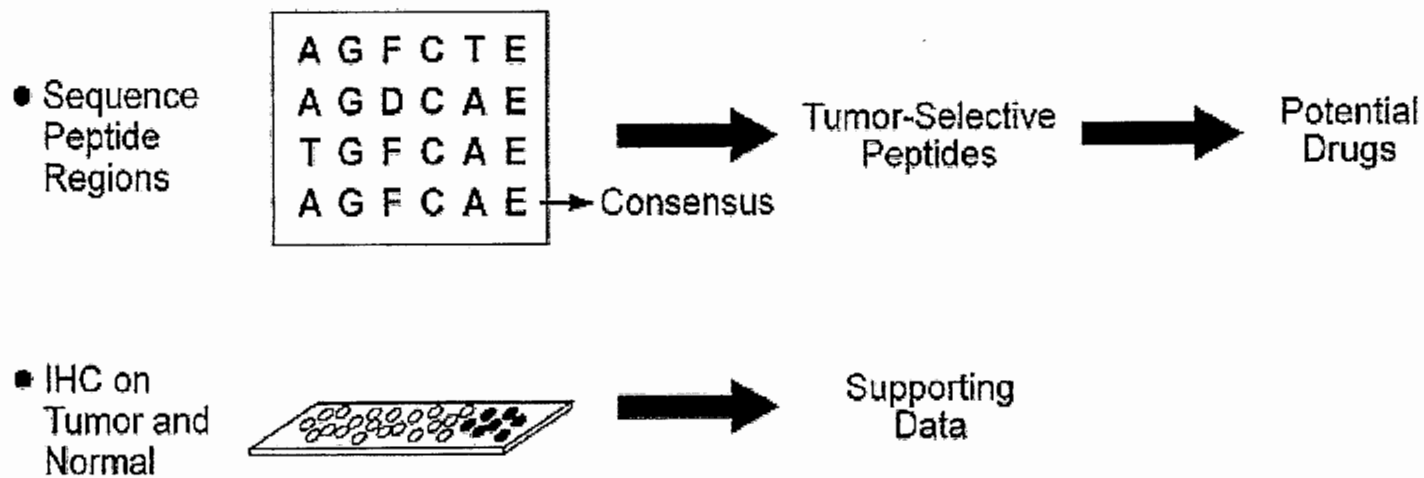

• Sequence Peptide Regions
A G F C T E
A G D C A E
T G F C A E
A G F C A E
Consensus
Tumor-Selective Peptides
Potential Drugs
• IHC on Tumor and Normal
Supporting Data

Fig. 64

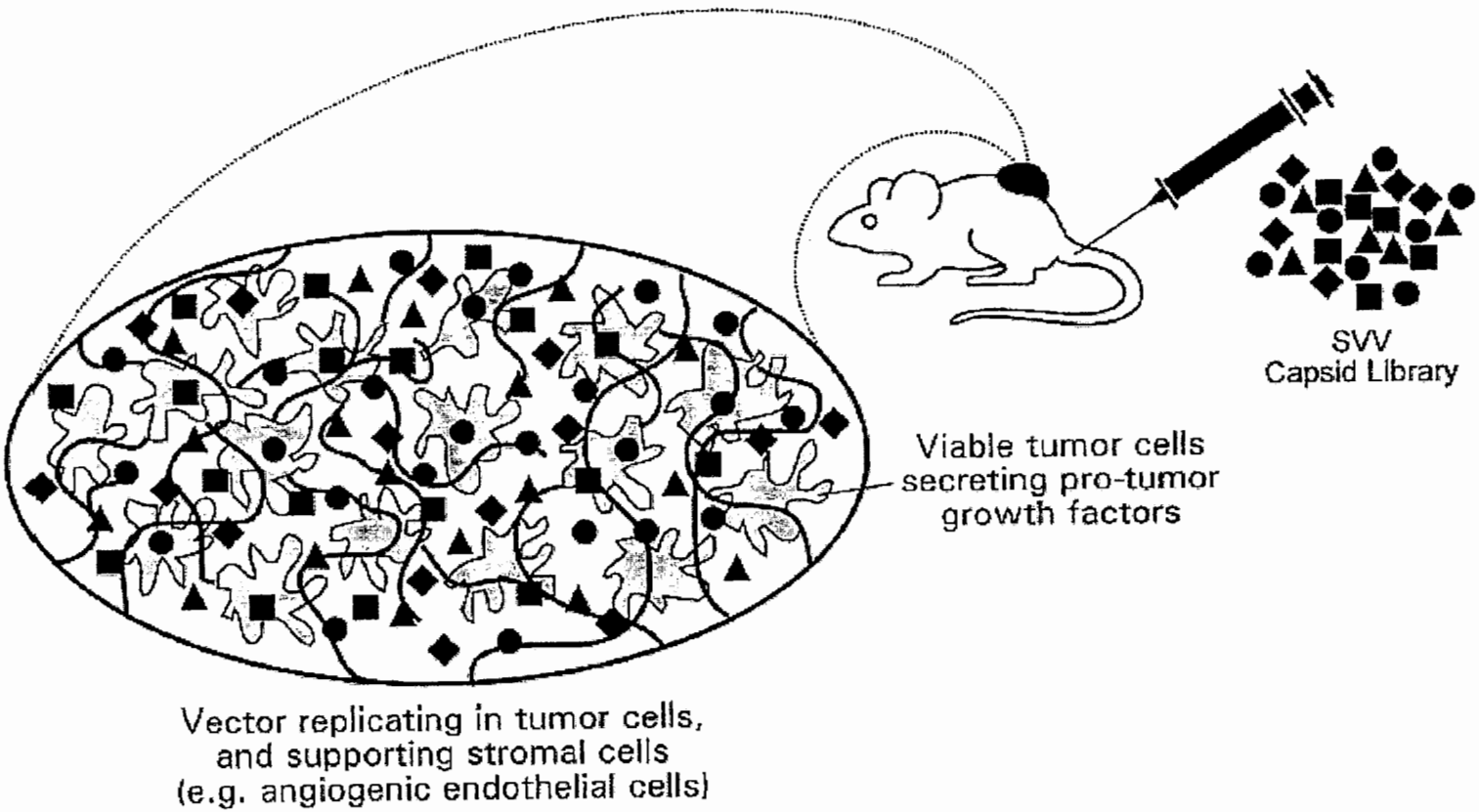

SVV
Capsid Library
Viable tumor cells
secreting pro-tumor
growth factors
Vector replicating in tumor cells,
and supporting stromal cells
(e.g. angiogenic endothelial cells)

Fig. 65

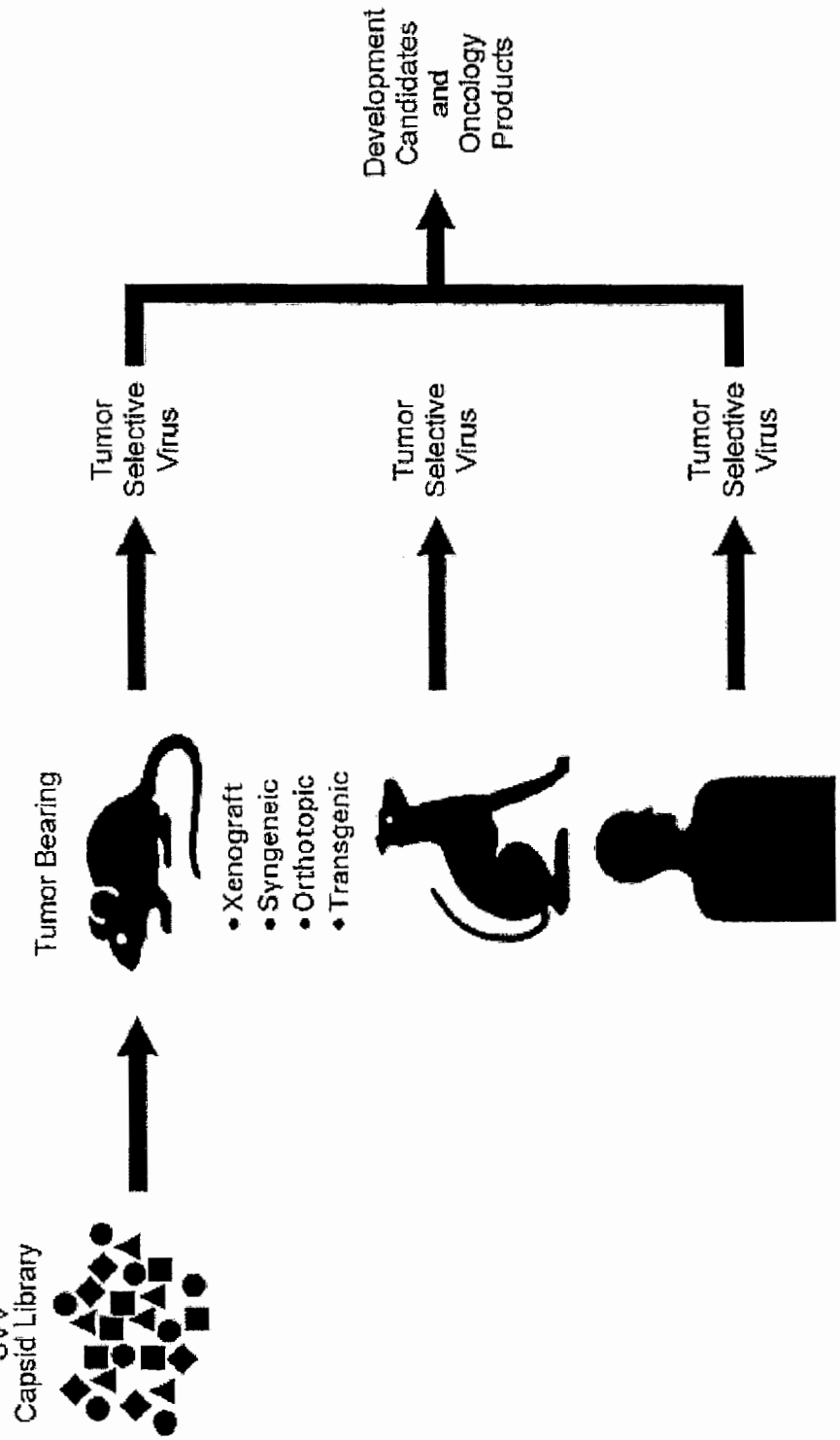
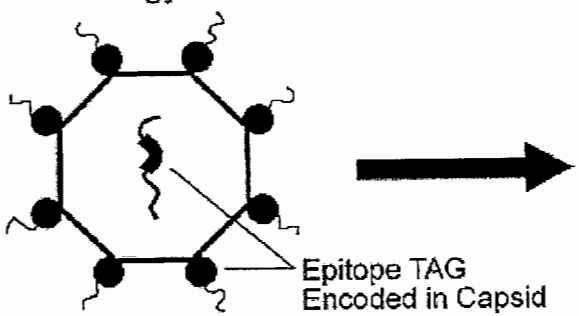

SVV
Capsid Library
Tumor Bearing
• Xenograft
• Syngeneic
• Orthotopic
• Transgenic
Tumor
Selective
Virus
Tumor
Selective
Virus
Tumor
Selective
Virus
Development
Candidates
and
Oncology
Products

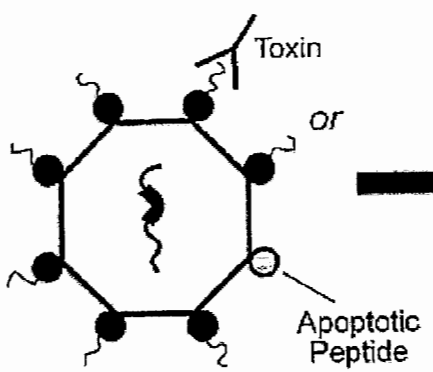
Fig. 66

1. TAG Strategy



TAG allows for:
- IHC in tumor/normal
- Prescreening patient samples
- Imaging
- Attach toxin to TAG for therapy

2. Alternative Therupeutic Strategy



Irradiate Virion → Therapy (like monoclonal ab)

Fig. 67

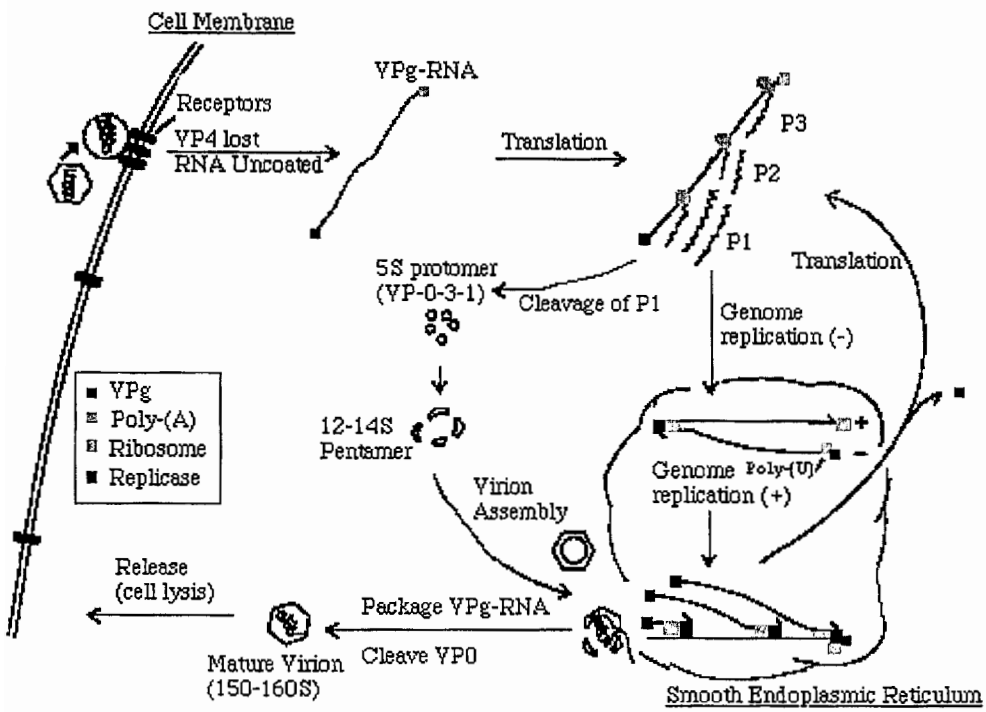

Cell Membrane
VPg-RNA
Receptors
VP4 lost
RNA Uncoated
Translation
P3
P2
P1
Translation
5S protomer
(VP-0-3-1)
Cleavage of P1
Genome
replication (-)
VPg
Poly-(A)
Ribosome
Replicase
12-14S
Pentamer
Virion
Assembly
Genome
replication (+)
Poly-(U)
Release
(cell lysis)
Package VPg-RNA
Cleave VP0
Mature Virion
(150-160S)
Smooth Endoplasmic Reticulum

Fig. 68

Polypeptide lengths of Seneca Valley virus compared to other picornaviruses

	SVV	EMCV	TMEV	ERBV-1	FMDV-O	ERAV	PTV-1	PV-1	HRV-1B	SV2	PEV-8	DPV	HAV	AEV	AiV	BKV	HPeV-1	LV
Polyprotein	?	2292		2590	2332	2249		2209	2157				2227	2134	2432	2463	2180	2253
P1	?	834		880	736	784		881	857				791	757	846	857	776	820
P2	465	618		616	488	467		575	559				631	590	636	634	598	606
P3	785	773		875	907	789		753	741				805	787	780	785	806	827
Leader	?	67		219	201	209		-	-				-	-	170	187	-	-
VP0	?	326		327	303	310		341	332				245	242	370	367	289	259
VP4	?	70		71	85	80		69	69				23	19	-	-	-	-
VP2	?	256		256	218	230		272	263				222	223	-	-	-	-
VP3	239	231		229	220	226		238	238				246	245	223	223	253	244
VP1	259	277		324	211	248		302	287				300	270	253	267	234	317
2A	14	143		16	18	16		149	142				45	13	136	134	147	135
2B	128	150		283	154	136		97	95				251	251	165	165	122	138
2C	323	325		317	318	315		329	322				335	326	335	335	329	333
3A	90	88		133	153	95		87	77				74	65	95	94	117	130
3B	22	20		21	23-24†	24		22	21				23	21	27	30	20	29
3C	211	205		252	213	205		183	183				219	215	190	192	200	198
3D	462	460		469	470	465		461	460				489	486	468	469	469	470

*, assuming that the 20 aa peptide ending in NPG is the C-terminus of VP1.
†, FMDV has three copies of VPg in tandem.
na, these individual polypeptides do not exist in these viruses.

Fig. 69

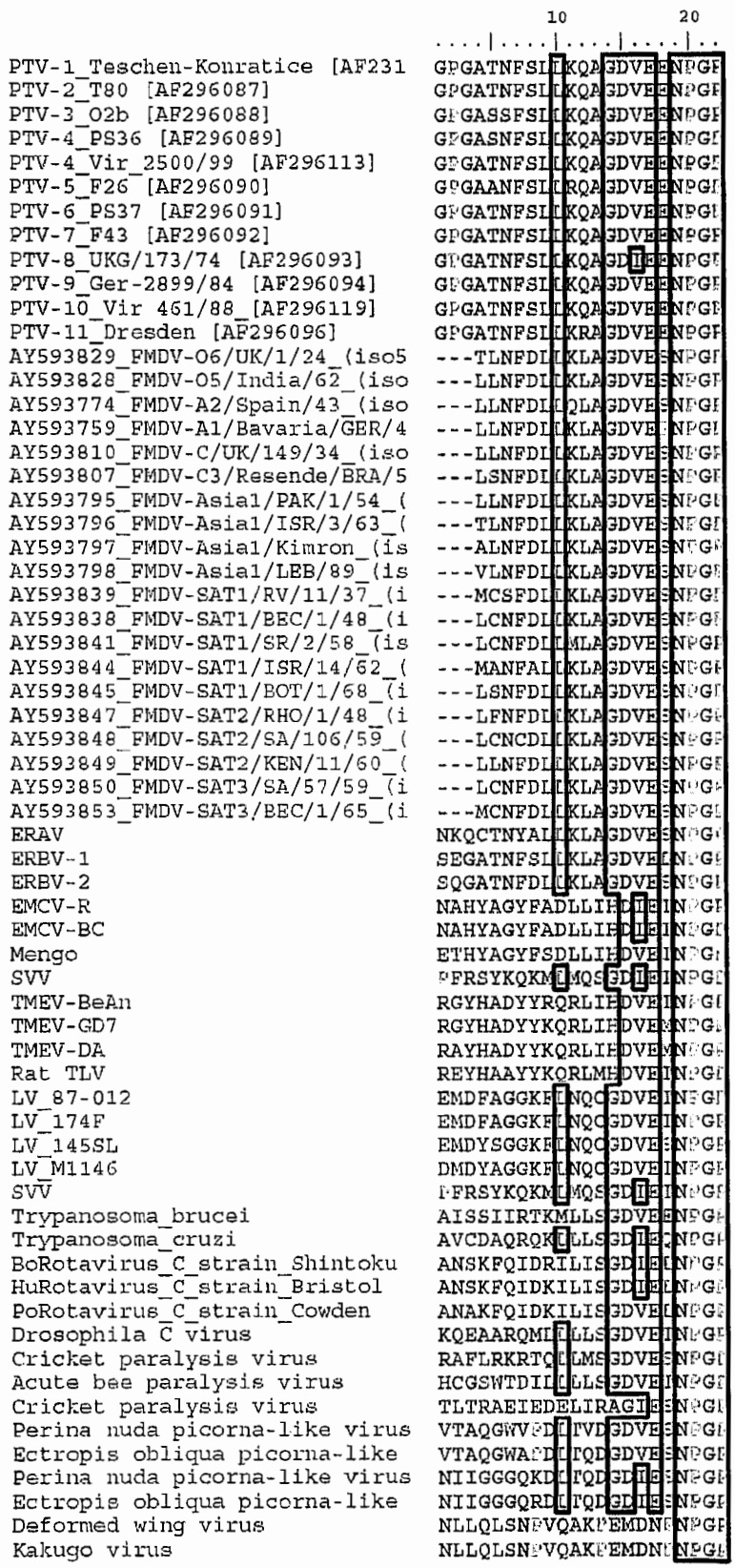

10
20
PTV-1_Teschen-Konratice [AF231
PTV-2_T80 [AF296087]
PTV-3_O2b [AF296088]
PTV-4_PS36 [AF296089]
PTV-4_Vir_2500/99 [AF296113]
PTV-5_F26 [AF296090]
PTV-6_PS37 [AF296091]
PTV-7_F43 [AF296092]
PTV-8_UKG/173/74 [AF296093]
PTV-9_Ger-2899/84 [AF296094]
PTV-10_Vir 461/88_[AF296119]
PTV-11_Dresden [AF296096]
AY593829_FMDV-O6/UK/1/24_(iso5
AY593828_FMDV-O5/India/62_(iso
AY593774_FMDV-A2/Spain/43_(iso
AY593759_FMDV-A1/Bavaria/GER/4
AY593810_FMDV-C/UK/149/34_(iso
AY593807_FMDV-C3/Resende/BRA/5
AY593795_FMDV-Asia1/PAK/1/54_(
AY593796_FMDV-Asia1/ISR/3/63_(
AY593797_FMDV-Asia1/Kimron_(is
AY593798_FMDV-Asia1/LEB/89_(is
AY593839_FMDV-SAT1/RV/11/37_(i
AY593838_FMDV-SAT1/BEC/1/48_(i
AY593841_FMDV-SAT1/SR/2/58_(is
AY593844_FMDV-SAT1/ISR/14/62_(
AY593845_FMDV-SAT1/BOT/1/68_(i
AY593847_FMDV-SAT2/RHO/1/48_(i
AY593848_FMDV-SAT2/SA/106/59_(
AY593849_FMDV-SAT2/KEN/11/60_(
AY593850_FMDV-SAT3/SA/57/59_(i
AY593853_FMDV-SAT3/BEC/1/65_(i
ERAV
ERBV-1
ERBV-2
EMCV-R
EMCV-BC
Mengo
SVV
TMEV-BeAn
TMEV-GD7
TMEV-DA
Rat TLV
LV_87-012
LV_174F
LV_145SL
LV_M1146
SVV
Trypanosoma_brucei
Trypanosoma_cruzi
BoRotavirus_C_strain_Shintoku
HuRotavirus_C_strain_Bristol
PoRotavirus_C_strain_Cowden
Drosophila C virus
Cricket paralysis virus
Acute bee paralysis virus
Cricket paralysis virus
Perina nuda picorna-like virus
Ectropis obliqua picorna-like
Perina nuda picorna-like virus
Ectropis obliqua picorna-like
Deformed wing virus
Kakugo virus

Fig. 70 (76/99)

```
   1 MATTMEQETC AHSLTFEECP KCSALQYRNG FYLLKYDEEW YPEELLTDGE DDVFDPELDM
  61 EVVFELQGNS TSSDKNNSSS EGNEGVIINN FYSNQYQNSI DLSANAAGSD PPRTYGQFSN
 121 LFSGAVNAFS NMLPLLADQN TEEMENLSDR VSQDTAGNTV TNTQSTVGRL VGYGTVHDGE
 181 HPASCADTAS EKILAVERYY TFKVNDWTST QKPFEYIRIP LPHVLSGEDG GVFGAALRRH
 241 YLVKTGWRVQ VQCNASQFHA GSLLVFMAPE YPTLDAFAMD NRWSKDNLPN GTRTQTNKKG
 301 PFAMDHQNFW QWTLYPHQFL NLRTNTTVDL EVPYVNIAPT SSWTQHASWT LVIAVVAPLT
 361 YSTGASTSLD ITASIQPVRP VFNGLRHETL SRQSPIPVTI REHAGTWYST LPDSTVPIYG
 421 KTPVAPSNYM VGEYKDFLEI AQIPTFIGNK IPNAVPYIEA SNTAVKTQPL ATYQVTLSCS
 481 CLANTFLAAL SRNFAQYRGS LVYTFVFTGT AMMKGKFLIA YTPPGAGKPT SRDQAMQATY
 541 AIWDLGLNSS YSFTVPFISP THFRMVGTDQ VNITNADGWV TVWQLTPLTY PPGCPTSAKI
 601 LTMVSAGKDF SLKMPISPAP WSPQGVENAE KGVTENTNAT ADFVAQPVYL PENQTKVAFF
 661 YNRSSPIGAF TVKSGSLESG FAPFSNGTCP NSVILTPGPQ FDPAYDQLRP QRLTEIWGNG
 721 NEETSKVFPL KSKQDYSFCL FSPFVYYKCD LEVTLSPHTS GNHGLLVRWC PTGTPTKPTT
 781 QVLHEVSSLS EGRTPQVYSA GPGISNQISF VVPYNSPLSV LSAVWYNGHK RFDNTGSLGI
 841 APNSDFGTLF FAGTKPDIKF TVYLRYKNKR VFCPRPTVFF PWPTSGDKID MTPRAGVLML
 901 ESPNALDISR TYPTLHVLIQ FNHRGLEVRL FRHGHFWAET RADVILRSKT KQVSFLSNGN
 961 YPSMDSRAPW NPWKNTYQAV LRAEPCRVTM DIYYKRVRPF RLPLVQKEWP VREENVFGLY
1021 RIFNAHYAGY FADLLIHDIE TNPGPFMFRP RKQVFQTQGA AVSSMAQTLL PNDLASKAMG
1081 SAFTALLDAN EDAQKAMKII KTLSSLSDAW ENVKETLNNP EFWKQLLSRC VQLIAGMTIA
1141 VMHPDPLTLL CLGTLTAAEI TSQTSLCEEI AAKFKTIFIT PPPRFPTISL FQQQSPLKQV
1201 NDIFSLAKNL DWAVKTVEKV VDWFGTWIVQ EEKEQTLDQL LQRFPEHAKR ISDLRNGMAA
1261 YVECKESFDF FEKLYNQAVK EKRTGIAAVC EKFRQKHDHA TARCEPVVIV LRGDAGQGKS
1321 LSSQVIAQAV SKTIFGRQSV YSLPPDSDFF DGYENQFAAI MDDLGQNPDG SDFTTFCQMV
1381 STTNFLPNMA SLERKGTPFT SQLVVATTNL PEFRPVTIAH YPAVERRITF DYSVSAGPVC
```

Fig. 71A (77/99)

1441 SKTEAGYKVL DVERAFRPTG EAPLPCFQNN CLFLEKAGLQ FRDNRTKEII SLVDVIERAV

1501 ARIERKKKVL TTVQTLVAQG PVDEVSFHSV VQQLKARQQA TDEQLEELQE AFAKVQERNS

1561 VFSDWLKISA MLCAATLALS QVVKMAKAVK QMVKPDLVRV QLDEQEQGPY NETARVKPKT

1621 LQLLDIQGPN PVMDFEKYVA KHVTAPIGFV YPTGVSTQTC LLVRGRTLVV NRHMAESDWT

1681 SIVVRGVTHA RSTVKILAIA KAGKETDVSF IRLSSGPLFR DNTSKFVKAG DVLPTGAAPV

1741 TGIMNTDIPM MYTGTFLKAG VSVPVETGQT FNHCIHYKAN TRKGWCGSAL LADLGGSKKI

1801 LGIHSAGSMG IAAASIVSQE MIRAVVNAFE PQGALERLPD GPRIHVPRKT ALRPTVARQV

1861 FQPAYAPAVL SKFDPRTEAD VDEVAFSKHT SNQESLPPVF RMVAKEYANR VFTLLGKDNG

1921 RLTVKQALEG LEGMDPMDRN TSPGLPYTAL GMRRTDVVDW ESATLIPFAA ERLRKMNEGD

1981 FSEVVYQTFL KDELRPIEKV QAAKTRIVDV PPFEHCILGR QLLGKFASKF QTQPGLELGS

2041 AIGCDPDVHW TAFGVAMQGF ERVYDVDYSN FDSTHSVAMF RLLAEEFFTP ENGFDPLTRE

2101 YLESLAISTH AFEEKRFLIT GGLPSGCAAT SMLNTIMNNI IIRAGLYLTY KNFEFDDVKV

2161 LSYGDDLLVA TNYQLDFDKV RASLAKTGYK ITPANKTSTF PLNSTLEDVV FLKRKFKKEG

2221 PLYRPVMNRE ALEAMLSYYR PGTLSEKLTS ITMLAVHSGK QEYDRLFAPF REVGVVVPSF

2281 ESVEYRWRSL FW (SEQ ID NO:23)

Fig. 71B

```
   1 MATTMEQETC AHSLTFEECP KCSALQYRNG FYLLKYDEEW YPEELLTDGE DDVFDPELDM
  61 EVVFELQGNS TSSDKNNSSS EGNEGVIINN FYSNQYQNSI DLSANAAGSD PPRTYGQFSN
 121 LFSGAVNAFS NMLPLLADQN TEEMENLSDR VSQDTAGNTV TNTQSTVGRL VGYGTVHDGE
 181 HPASCADTAS EKILAVERYY TFKVNDWTST QKPFEYIRIP LPHVLSGEDG GVFGAALRRH
 241 YLVKTGWRVQ VQCNASQFHA GSLLVFMAPE YPTLDTFVMD NRWSKDNLPN GARTQTNKKG
 301 PFAMDHQNFW QWTLYPHQFL NLRTNTTVDL EVPYVNIAPT SSWTQHASWT LVIAVVAPLT
 361 YSTGASTSLD ITASIQPVRP VFNGLRHETL SRQSPIPVTI REHAGTWYST LPDSTVPIYG
 421 KTPVAPSNYM VGEYKDFLEI AQIPTFIGNK IPNAVPYIEA SNTAVKTQPL ATYQVTLSCS
 481 CLANTFLAAL SRNFAQYRGS LVYTFVFTGT AMMKGKFLIA YTPPGAGKPT SRDQAMQATY
 541 AIWDLGLNSS YSFTVPFISP THFRMVGTDQ VNITNADGWV TVWQLTPLTY PPGCPTSAKI
 601 LTMVSAGKDF SLKMPISPAP WSPQGVENAE KGVTENADAT ADFVAQPVYL PENQTKVAFF
 661 YDRSSPIGAF TVQSGSLESG FAPFSNKTCP NSVILTPGPQ FDPAYDQLRP QRLTEIWGNG
 721 NEETSKVFPL KSKQDYSFCL FSPFVYYKCD LEVTLSPHTS GNHGLLVRWC PTGTPTKPTT
 781 QVLHEVSSLS EGRTPQVYSA GPGISNQISF VVPYNSPLSV LPAVWYNGHK RFDNTGSLGI
 841 APNSDFGTLF FAGTKPDIKF TVYLRYKNMR VFCPRPTVFF PWPTSGDKID MTPRAGVLML
 901 ESPNALDISR TYPTLHVLIQ FNHRGLEVRL FRHGQFWAET RADVILRSKT KQVSFLSNGN
 961 YPSMDSRAPW NPWKNTYQAV LRAEPCRVTM DIYYKRVRPF RLPLVQKEWR VREENVFGLY
1021 RIFNAHYAGY FADLLIHDIE TNPGPFMFRP RKQVFQTQGA AVSSMAQTLL PNDLASKAMG
1081 SAFTALLDAN EDARKAMKII KTLSSLSDAW ENVKETLNNP EFWKQLLSRC VQLIAGMTIA
1141 VMHPDPLTLL CLGTLTAAEI TSQTSLCEEI AAKFKTIFIT PPPRFPTISL FQQQSPLKQV
1201 NDFFSLAKNL DWAVKTVEKV VDWFGTWIVQ EEKEQTLDQL LQRFPEHAKR ISDLRNGMAA
1261 YVECKESFDF FEKLYNQAVK EKRTGIAAVC EKFRQKHDHA TARCEPVVIV LRGDAGQGKS
1321 LSSQVIAQAV SKTIFGRQSV YSLPPDSDFF DGYENQFAAI MDDLGQNPDG SDFTTFCQMV
```

Fig. 72A

1381 STTNFLPNMA SLERKGTPFT SQLVVATTNL PEFRPVTIAH YPAVERRITF DYSVSAGPVC

1441 SKTEAGYKVL DVERAFRPTG EAPLPCFQNN CLFLEKAGLQ FRDNRTKEII SLVDVIERAV

1501 ARIERKKKVL TTVQTLVAQA PVDEVSFHSV VQQLKARQEA TDEQLEELQE AFAKVQERNS

1561 VFSDWLKISA MLCAATLALS QVVKMAKAVK QMVKPDLVRV QLDEQEQGPY NETARAKPKT

1621 LQLLDIQGPN PVMDFEKYVA KHVTAPIDFV YPTGVSTQTC LLVRGRTLAV NRHMAESDWT

1681 SIVVRGVTHA RSTVKILAIA KAGKETDVSF IRLSSGPLFR DNTSKFVKAG DVLPTGAAPV

1741 TGIMNTDIPM MYTGTFLKAG VSVPVETGQT FNHCIHYKAN TRKGWCGSAL LADLGGSKKI

1801 LGIHSAGSMG IAAASIVSQE MIRAVVNAFE PQGALERLPD GPRIHVPRKT ALRPTVARQV

1861 FQPAYAPAVL SKFDPRTEAD VDEVAFSKHT SNQESLPPVF RMVAKEYANR VFTLLGKDNG

1921 RLTVKQALEG LEGMDPMDRN TSPGLPYTAL GMRRTDVVDW ESATLIPFAA ERLRKMNEGD

1981 FSEVVYQTFL KDELRPIEKV QAAKTRIVDV PPFEHCILGR QLLGKFASKF QTQPGLELGS

2041 AIGCDPDVHW TAFGVAMQGF ERVYDVDYSN FDSTHSVAMF RLLAEEFFTP ENGFDPLTRE

2101 YLESLAISTH AFEEKRFLIT GGLPSGCAAT SMLNTIMNNI IIRAGLYLTY KNFEFDDVKV

2161 LSYGDDLLVA TNYQLDFDKV RASLAKTGYK ITPANKTSTF PLNSTLEDVV FLKRKFKKEG

2221 PLYRPVMNRE ALEAMLSYYR PGTLSEKLTS ITMLAVHSGK QEYDRLFAPF REVGVVVPSF

2281 ESVEYRWRSL FW (SEQ ID NO:24)

Fig. 72B

```
   1 MATTMEQEIC AHSLTLKGCP KCSALQYRNG FYLLKYDEEW YPEELLTDGE DDVFDPELDM
  61 EVVFELQGNS TSSDKNNSSS DGNEGVIINN FYSNQYQNSI DLSANATGSD PPRTYGQFSN
 121 LLSGAVNAFS NMIPLLADQN TEEMENLSDR VLQDTAGNTV TNTQSTVGRL VGYGAVHDGE
 181 HPASCADTAS EKILAVERYY TFKVNDWTST QKPFEYIRIP LPHVLSGEDG GVFGAALRRH
 241 YLVKTGWRVQ VQCNASQFHA GSLLVFMAPE YPTLDAFAMD NRWSKDNLPN GTKTQTNRKG
 301 PFAMDHQNFW QWTLYPHQFL NLRTNTTVDL EVPYVNIAPT SSWTQHASWT LVIAVVAPLT
 361 YSTGASTSLD ITASIQPVRP VFNGLRHETL SRQSPIPVTI REHAGTWYST LPDSTVPIYG
 421 KTPVAPANYM VGEYKDFLEI AQIPTFIGNK IPNAVPYIEA SNTAVKTQPL ATYQVTLSCS
 481 CLANTFLAAL SRNFAQYRGS LVYTFVFTGT AMMKGKFLIA YTPPGAGKPT SRDQAMQATY
 541 AIWDLGLNSS YSFTVPFISP THFRMVGTDQ VNITNVDGWV TVWQLTPLTY PPGCPTSAKI
 601 LTMVSAGKDF SLKMPISPAP WSPQGVENAE RGVTEDTDAT ADFVAQPVYL PENQTKVAFF
 661 YDRSSPIGAF TVKSGSLESG FTPFSNQTCP NSVILTPGPQ FDPAYDQLRP QRLTEIWGNG
 721 NEETSKVFPL KSKQDYSFCL FSPFVYYKCD LEVTLSPHTS GNHGLLVRWC PTGTPTKPTT
 781 QVLHEVSSLS EGRTPQVYSA GPGITNQISF VVPYNSPLSV LPAVWYNGHK RFDNTGSLGI
 841 APNSDFGTLF FAGTKPDIKF TVYLRYKNMR VFCPRPTVFF PWPSSGDKID MTPRAGVLML
 901 ESPNALDISR TYPTLHILIQ FNHGGLEIRL FRHGMFWAEA HADVILRSRT KQISFLNNGS
 961 FPSMDARAPW NPWKNTYHAV LRAEPYRVTM DVYHKRIRPF RLPLVQKEWN VREENVFGLY
1021 GIFNAHYAGY FADLLIHDIE TNPGPFMAKP KKQVFQTQGA AVSSMAQTLL PNDLASKVMG
1081 SAFTALLDAN EDAQKAMRII KTLSSLSDAW ENVKETLNNP EFWKQLLSRC VQLIAGMTIA
1141 VMHPDPLTLL CLGTLTAAEI TSQTSLCEEI VAKFKKIFTT PPPRFPTISL FQQQSPLKQV
1201 NDVFSLAKNL DWAVKTVEKV VDWFGTWVVQ EEKEQTLDQL LQRFPEHAKR ISDLRNGMSA
1261 YVECKESFDF FEKLYNQAVK EKRTGIAAVC EKFRQKHDHA TARCEPVVIV LRGDAGQGKS
1321 LSSQVIAQAV SKTIFGRQSV YSLPPDSDFF DGYENQFAAI MDDLGQNPDG SDFTTFCQMV
```

Fig. 73A

1381 STTNFLPNMA SLERNGTPFT SQIVVATTNL PEFRPVTIAH YPAVERRITF DYSVSAGPVC

1441 SKTEAGYKVL DVERAFRPTG DAPLPCFQNN CLFLEKAGLQ FRDNRTKEIL SLVDVIERAV

1501 ARIERKKKVL TTVQTLVAQA PVDEVSFHSV VQQLKARQEA TDEQLEELQE AFAKTQERSS

1561 VFSDWMKISA MLCAATLALS QVVKMAKTVK QMVRPDLVRV QLDEQEQGPY NEAVRAKPKT

1621 LQLLDIQGPN PVMDFEKYVA KFVTAPIDFV YPTGVSTQTC LLVKGRTLAV NRHMAESDWS

1681 SIVVRGVTHA RSTVRILAIA KAGKETDVSF IRLSSGPLFR DNTSKFVKAD DVLPATSAPV

1741 IGIMNTDIPM MFTGTFLKAG VSVPVETGQT FNHCIHYKAN TRKGWCGSAL LADLGGKKKI

1801 LGMHSAGSMG RTAASIVSQE MICAVVSAFE PQGALERLPD GPRIHVPRKT ALRPTVARRV

1861 FQPAYAPAVL SKFDPRTEAD VDEVAFSKHT SNQESLPPVF RMVAKEYANR VFTLLGRDNG

1921 RLTVKQALEG LEGMDPMDKN TSPGLPYTAL GMRRTDVVDW ESATLIPYAA DRLKKMNEGD

1981 FSDIVYQTFL KDELRPVEKV QAAKTRIVDV PPFEHCILGR QLLGRFASKF QTQPGLELGS

2041 AIGCDPDVHW TAFGVAMQGF ERVYDVDYSN FDSTHSVAMF RLLAEEFFTP ENGFDPLVKE

2101 YLESLAISTH AFEEKRYLIT GGLPSGCAAT SMLNTIMNNI IIRAGLYLTY KNFEFDDVKV

2161 LSYGDDLLVA TNYQLNFDKV RASLAKTGYK ITPANKTSTF PLDSTLEDVV FLKRKFKKEG

2221 PLYRPVMNRE ALEAMLSYYR PGTLSEKLTS ITMLAVHSGK PEYDRLFAPF REVGVVVPSF

2281 ESVEYRWRSL FW (SEQ ID NO:25)

Fig. 73B

```
   1 MATTMEQEIC AHSLTFKGCP KCSALQYRNG FYLLKYDEEW YPEELLTDGE DDVFDPELDM
  61 EVVFELQGNS TSSDKNNSSS DGNEGVIINN FYSNQYQNSI DLSANATGSD PPRTYGQFSN
 121 LLSGAVNAFS NMIPLLADQN TEEMENLSDR VLQDTAGNTV TNTQSTVGRL VGYGAVHDGE
 181 HPASCADTAS EKILAVERYY TFKVNDWTST QKPFEYIRIP LPHVLSGEDG GVFGAALRRH
 241 YLVKTGWRVQ VQCNASQFHA GSLLVFMAPE YPTLDAFAMD NRWSKDNLPN GTKTQTNRKG
 301 PFAMDHQNFW QWTLYPHQFL NLRTNTTVDL EVPYVNIAPT SSWTQHASWT LVIAVVAPLT
 361 YSTGASTSLD ITASIQPVRP VFNGLRHETL SRQSPIPVTI REHAGTWYST LPDSTVPIYG
 421 KTPVAPANYM VGEYKDFLEI AQIPTFIGNK IPNAVPYIEA SNTAVKTQPL ATYQVTLSCS
 481 CLANTFLAAL SRNFAQYRGS LVYTFVFTGT AMMKGKFLIA YTPPGAGKPT SRDQAMQATY
 541 AIWDLGLNSS YSFTVPFISP THFRMVGTDQ VNITNVDGWV TVWQLTPLTY PPGCPTSAKI
 601 LTMVSAGKDF SLKMPISPAP WSPQGVENAE RGVTEDTDAT ADFVAQPVYL PENQTKVAFF
 661 YDRSSPIGAF AVKSGSLESG FAPFSNETCP NSVILTPGPQ FDPAYDQLRP QRLTEIWGNG
 721 NEETSKVFPL KSKQDYSFCL FSPFVYYKCD LEVTLSPHTS GNHGLLVRWC PTGTPAKPTT
 781 QVLHEVSSLS EGRTPQVYSA GPGISNQISF VVPYNSPLSV LPAVWYNGHK RFDNTGSLGI
 841 APNSDFGTLF FAGTKPDIKF TVYLRYKNMR VFCPRPTVFF PWPSSGDKID MTPRAGVLML
 901 ESPNALDISR TYPTLHILIQ FNHGGLEIRL FRHGMFWAEA HADVILRSRT KQISFLNNGS
 961 FPSMDARAPW NPWKNTYHAV LRAEPYRVTM DVYHKRIRPF RLPLVQKEWN VREENVFGLY
1021 GIFNAHYAGY FADLLIHDIE TNPGPFMAKP KKQVFQTQGA AVSSMAQTLL PNDLASKVMG
1081 SAFTALLDAN EDAQKAMRII KTLSSLSDAW ENVKETLNNP EFWKQLLSRC VQLIAGMTIA
1141 VMHPDPLTLL CLGTLTAAEI TSQTSLCEEI VAKFKKIFTT PPPRFPTISL FQQQSPLKQV
1201 NDVFSLAKNL DWAVKTVEKV VDWFGTWVVQ EEKEQTLDQL LQRFPEHAKR ISDLRNGMSA
1261 YVECKESFDF FEKLYNQAVK EKRTGIAAVC EKFRQKHDHA TARCEPVVIV LRGDAGQGKS
1321 LSSQVIAQAV SKTIFGRQSV YSLPPDSDFF DGYENQFAAI MDDLGQNPDG SDFTTFCQMV
```

Fig. 74A

1381 STTNFLPNMA SLERNGTPFT SQIVVATTNL PEFRPVTIAH YPAVERRITF DYSVSAGPVC

1441 SKTEAGYKVL DVERAFRPTG DAPLPCFQNN CLFLEKAGLQ FRDNRTKEIL SLVDVIERAV

1501 ARIERKKKVL TTVQTLVAQA PVAEVSFHSV VQQLKARQEA TDEQLEELQE AFAKTQERSS

1561 VFSDWMKISA MLCAATLALS QVVKMAKTVK QMVRPDLVRV QLDEQEQGPY NEAVRAKPKT

1621 LQLLDIQGPN PVMDFEKYVA KFVTAPIDFV YPTGVSTQTC LLVKGRTLAV NRHMAESDWS

1681 SIVVRGVTHA RSTVRILAIA KAGKETDVSF IRLSSGPLFR DNTSKFVKAD DVLPATSAPV

1741 IGIMNTDIPM MFTGTFLKAG VSVPVETGQT FNHCIHYKAN TRKGWCGSAL LADLGGKKKI

1801 LGMHSAGSMG RTAASIVSQE MICAVVSAFE PQGALERLPD GPRIHVPRKT ALRPTVARRV

1861 FQPAYAPAVL SKFDPRTEAD VDEVAFSKHT SNQESLPPVF RMVAKEYANR VFTLLGRDNG

1921 RLTVKQALEG LEGMDPMDKN TSPGLPYTAL GMRRTDVVDW ESATLIPYAA DRLKKMNEGD

1981 FSDIVYQTFL KDELRPVEKV QAAKTRIVDV PPFEHCILGR QLLGRFASKF QTQPGLELGS

2041 AIGCDPDVHW TAFGVAMQGF ERVYDVDYSN FDSTHSVAMF RLLAEEFFTP ENGFDPLVKE

2101 YLESLAISTH AFEEKRYLIT GGLPSGCAAT SMLNTIMNNI IIRAGLYLTY KNFEFDDVKV

2161 LSYGDDLLVA TNYQLNFDKV RASLAKTGYK ITPANKTSTF PLDSTLEDVV FLKRKFKKEG

2221 PLYRPVMNRE ALEAMLSYYR PGTLSEKLTS ITMLAVHSGK PEYDRLFAPF REVGVVVPSF

2281 ESVEYRWRSL FW (SEQ ID NO:26)

Fig. 74B

```
   1 MATTMEQEIC AHSLTFKGCP KCSALQYRNG FYLLKYDEEW YPEELLTDGE DDVFDPELDM
  61 EVVFELQGNS TSSDKNNSSS DGNEGVIINN FYSNQYQNSI DLSANATGSD PPRTYGQFSN
 121 LLSGAVNAFS NMIPLLADQN TEEMENLSDR VLQDTAGNTV TNTQSTVGRL VGYGAVHDGE
 181 HPASCADTAS EKILAVERYY TFKVNDWTST QKPFEYIRIP LPHVLSGEDG GVFGAALRRH
 241 YLVKTGWPVQ VQCNASQFHA GSLLVFMAPE YPTLDAFAMD NRWSKDNLPN GTKTQTNRKG
 301 PFAMDHQNFW QWTLYPHQFL NLRTNTTVDL EVPYVNIAPT SSWTQHASWT LVIAVVAPLT
 361 YSTGASTSLD ITASIQPVRP VFNGLRHETL SRQSPIPVTI REHAGTWYST LPDSTVPIYG
 421 KTPVAPANYM VGEYKDFLEI AQIPTFIGNK IPNAVPYIEA SNTAVKTQPL ATYQVTLSCS
 481 CLANTFLAAL SRNFAQYRGS LVYTFVFTGT AMMKGKFLIA YTPPGAGKPT SRDQAMQATY
 541 AIWDLGLNSS YSFTVPFISP THFRMVGTDQ VNITNVDGWV TVWQLTPLTY PPGCPTSAKI
 601 LTMVSAGKDF SLKMPISPAP WSPQGVENAE RGVTEDTDAT ADFVAQPVYL PENQTKVAFF
 661 YDRSSPIGAF TVKSGSLESG FAPFSNETCP NSVILTPGPQ FDPAYDQLRP QRLTEIWGNG
 721 NEETSKVFPL KSKQDYSFCL FSPFVYYKCD LEVTLSPHTS GNHGLLVRWC PTGTPAKPTT
 781 QVLHEVSSLS EGRTPQVYSA GPGVSNQISF VVPYNSPLSV LPAVWYNGHK RFDNTGSLGI
 841 APNSDFGTLF FAGTKPDIKF TVYLRYKNMR VFCPRPTVFF PWPSSGDKID MTPRAGVLML
 901 ESPNALDISR TYPTLHILIQ FNHGGLEIRL FRHVQFWAEA HADVILRSRT KQISFLNNGS
 961 FPSMDARAPW NPWKNTYHAV LRAEPYRVTM DVYHKRIRPF RLPLVQKEWN VREENVFGLY
1021 GIFNAHYAGY FADLLIHDIE TNPGPFMAKP KKQVFQTQGA AVSSMAQTLL PNDLASKVMG
1081 SAFTALLDAN EDAQKAMRII KTLSSLSDAW ENVKETLNNP EFWKQLLSRC VQLIAGMTIA
1141 VMHPDPLTLL CLGTLTAAEI TSQTSLCEEI VAKFKKIFTT PPPRFPTISL FQQQSPLKQV
1201 NDVFSLAKNL DWAVKTVEKV VDWFGTWVVQ EEKEQTLDQL LQRFPEHAKR ISDLRNGMSA
1261 YVECKESFDF FEKLYNQAVK EKRTGIAAVC EKFRQKHDHA TARCEPVVIV LRGDAGQGKS
```

Fig. 75A

1321 LSSQVIAQAV SKTIFGRQSV YSLPPDSDFF DGYENQFAAI MDDLGQNPDG SDFTTFCQMV

1381 STTNFLPNMA SLERNGTPFT SQLVVATTNL PEFRPVTIAH YPAVERRITF DYSVSAGPVC

1441 SKTEAGYKVL DVERAFRPTG DAPLPCFQNN CLFLEKAGLQ FRDNRTKEIL SLVDVIERAV

1501 ARIERKKKVL TTVQTLVAQA PVAEVSFHSV VQQLKARQEA TDEQLEELQE AFAKTQERSS

1561 VFSDWMKISA MLCAATLALT QVVKMAKTVK QMVRPDLVRV QLDEQEQGPY NEAVRAKPKT

1621 LQLLDIQGPN PVMDFEKYVA KFVTAPIDFV YPTGVSTQTC LLVKGRTLAV NRHMAESDWS

1681 SIVVRGVTHA RSTVRILAIA KAGKETDVSF IRLSSGPLFR DNTSKFVKAD DVLPATSAPV

1741 IGIMNTDIPM MFTGTFLKAG VSVPVETGQT FNHCIHYKAN TRKGWCGSAL LADLGGKKKI

1801 LGMHSAGSMG VAAASIVSQE MICAVVSAFE PQGALERLPD GPRIHVPRKT ALRPTVARQV

1861 FQPAYAPAVL SKFDPRTEAD VDEVAFSKHT SNQESLPPVF RMVAKEYANR VFTLLGRDNG

1921 RLTVKQALEG LEGMDPMDKN TSPGLPYTAL GMRRTDVVDW ESATLIPYAA DRLKKMNEGD

1981 FSDIVYQTFL KDELRPVEKV QAAKTRIVDV PPFEHCILGR QLLGRFASKF QTQPGLELGS

2041 AIGCDPDVHW TAFGVAMQGF ERVYDVDYSN FDSTHSVAMF RLLAEEFFTP ENGFDPLVKE

2101 YLESLAISTH AFEEKRYLIT GGLPSGCAAT SMLNTIMNNI IIRAGLYLTY KNFEFDDVKV

2161 LSYGDDLLVA TNYQLNFDKV RASLAKTGYK ITPANKTSTF PLDSTLEDVV FLKRKFKKEG

2221 PLYRPVMNRE ALEAMLSYYR PGTLSEKLTS ITMLAVHSGK PEYDRLFAPF REVGVVVPSF

2281 ESVEYRWRSL FW (SEQ ID NO:27)

Fig. 75B

```
   1 MATTMEQEIC AHSLTFKGCP KCSALQYRNG FYLLKYDEEW YPEELLTDGE DDVFDPELDM
  61 EVVFELQGNS TSSDKNNSSS DGNEGVIINN FYSNQYQNSI DLSANATGSD PPRTYGQFSN
 121 LLSGAVNAFS NMIPLLADQN TEEMENLSDR VLQDTAGNTV TNTQSTVGRL VGYGAVHDGE
 181 HPASCADTAS EKILAVERYY TFKVNDWTST QKPFEYIRIP LPHVLSGEDG GVFGAALRRH
 241 YLVKTGWRVQ VQCNASQFHA GSLLVFMAPE YPTLDAFAMD NRWSKDNLPN GTKTQTNRKG
 301 PFAMDHQNFW QWTLYPHQFL NLRTNTTVDL EVPYVNIAPT SSWTQHASWT LVIAVVAPLT
 361 YSTGASTSLD ITASIQPVRP VFNGLRHETL SRQSPIPVTI REHAGTWYST LPDSTVPIYG
 421 KTPVAPANYM VGEYKDFLEI AQIPTFIGNK IPNAVPYIEA SNTAVKTQPL ATYQVTLSCS
 481 CLANTFLAAL SRNFAQYRGS LVYTFVFTGT AMMKGKFLIA YTPPGAGKPT SRDQAMQATY
 541 AIWDLGLNSS YSFTVPFISP THFRMVGTDQ VNITNVDGWV TVWQLTPLTY PPGCPTSAKI
 601 LTMVSAGKDF SLKMPISPAP WSPQGVENAE RGVTEDTDAT ADFVAQPVYL PENQTKVAFF
 661 YDRSSPIGAF TVKSGSLESG FAPFSNKTCP NSVILTPGPQ FDPAYDQLRP QRLTEIWGNR
 721 NEETSKVFPL KSKQDYSFCL FSPFVYYKCD LEVTLSPHTS GNHGLLVRWC PTGTPAKPTT
 781 QVLHEVSSLS EGRTPQVYSA GPGISNQISF VVPYNSPLSV LPAVWYNGHK RFDNTGSLGI
 841 APNSDFGTLF FAGTKPDIKF TVYLRYKNMR VFCPRPTVFF PWPSSGDKID MTPRAGVLML
 901 ESPNALDISR TYPTLHILIQ FNHGGLEIRL FRHGQFWAEA HADVILRSRT KQISFLNNGS
 961 FPSMDARAPW NPWKNTYHAV LRAEPYRVTM DVYHKRIRPF RLPLVQKEWN VREENVFGLY
1021 SIFNAHYAGY FADLLIHDIE TNPGPFMAKP KKQVFQTQGA AVSSMAQTLL PNDLASKVMG
1081 SAFTALLDAN EDAQKAMRII KTLSSLSDAW ENVKETLNNP EFWKQLLSRC VQLIAGMTIA
1141 VMHPDPLTLL CLGTLTAAEI TSQTSLCEEI VAKFKKIFTT PPPRFPTISL FQQQSPLKQV
1201 NDVFSLAKNL DWAVKTVEKV VDWFGTWVVQ EEKEQTLDQL LQRFPEHAKR ISDLRNGMSA
1261 YVECKESFDF FEKLYNQAVK EKRTGIAAVC EKFRQKHDHA TARCEPVVIV LRGDAGQGKS
1321 LSSQVIAQAV SKTIFGRQSV YSLPPDSDFF DGYENQFAAI MDDLGQNPDG SDFTTFCQMV
```

Fig. 76A

1381 STTNFLPNMA SLERKGTPFT SQLVVATTNL PEFRPVTIAH YPAVERRITF DYSVSAGPVC

1441 SKTEAGYKVL DVERAFRPTG DAPLPCFQNN CLFLEKAGLQ FRDNRTKEIL SLVDVIERAV

1501 ARIERKKKVL TTVQTLVAQA PVDEVSFHSV VQQLKARQEA TDEQLEELQE AFAKTQERSS

1561 VFSDWMKISA MLCAATLALT QVVKMAKTVK QMVRPDLVRV QLDEQEQGPY NEAVRAKPKT

1621 LQLLDIQGPN PVMDFEKYVA KFVTAPIDFV YPTGVSTQTC LLVKGRTLAV NRHMAESDWS

1681 SIVVRGVTHA RSTVRILAIA KAGKETDVSF IRLSSGPLFR DNTSKFVKAD DVLPATSAPV

1741 IGIMNTDIPM MFTGTFLKAG VSVPVETGQT FNHCIHYKAN TRKGWCGSAL LADLGGKKKI

1801 LGMHSAGSMG RTAASIVSQE MICAVVSAFE PQGALERLPD GPRIHVPRKT ALRPTVARQV

1861 FQPAYAPAVL SKFDPRTEAD VDEVAFSKHT SNQESLPPVF RMVAKEYANR VFTLLGRDNG

1921 RLTVKQALEG LEGMDPMDKN TSPGLPYTAL GMRRTDVVDW ESATLIPYAA DRLKKMNEGD

1981 FSDIVYQTFL KDELRPVEKV QAAKTRIVDV PPFEHCILGR QLLGRFASKF QTQPGLELGS

2041 AIGCDPDVHW TAFGVAMQGF ERVYDVDYSN FDSTHSVAMF RLLAEEFFTP ENGFDPLVKE

2101 YLESLAISTH AFEEKRYLIT GGLPSGCAAT SMLNTIMNNI IIRAGLYLTY KNFEFDDVKV

2161 LSYGDDLLVA TNYQLNFDKV RASLAKTGYK ITPANKTSTF PLDSTLEDVV FLKRKFKKEG

2221 PLYRPVMNRE ALEAMLSYYR PGTLSEKLTS ITMLAVHSGK PEYDRLFAPF REVGVVVPSF

2281 ESVEYRWRSL FW (SEQ ID NO:28)

Fig. 76B

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   1 MATTMEQEIC AHSMTFEECP KCSALQYRNG FYLLKYDEEW YPEESLTDGE DDVFDPDLDM
  61 EVVFETQGNS TSSDKNNSSS EGNEGVIINN FYSNQYQNSI DLSANATGSD PPKTYGQFSN
 121 LLSGAVNAFS NMLPLLADQN TEEMENLSDR VSQDTAGNTV TNTQSTVGRL VGYGTVHDGE
 181 HPASCADTAS EKILAVERYY TFKVNDWTST QKPFEYIRIP LPHVLSGEDG GVFGATLRRH
 241 YLVKTGWRVQ VQCNASQFHA GSLLVFMAPE YPTLDVFAMD NRWSKDNLPN GTRTQTNRKG
 301 PFAMDHQNFW QWTLYPHQFL NLRTNTTVDL EVPYVNIAPT SSWTQHASWT LVIAVVAPLT
 361 YSTGASTSLD ITASIQPVRP VFNGLRHEVL SRQSPIPVTI REHAGTWYST LPDSTVPIYG
 421 KTPVAPANYM VGEYKDFLEI AQIPTFIGNK VPNAVPYIEA SNTAVKTQPL AVYQVTLSCS
 481 CLANTFLAAL SRNFAQYRGS LVYTFVFTGT AMMKGKFLIA YTPPGAGKPT SRDQAMQATY
 541 AIWDLGLNSS YSFTVPFISP THFRMVGTDQ ANITNVDGWV TVWQLTPLTY PPGCPTSAKI
 601 LTMVSAGKDF SLKMPISPAP WSPQGVENAE KGVTENTDAT ADFVAQPVYL PENQTKVAFF
 661 YDRSSPIGAF AVKSGSLESG FAPFSNKACP NSVILTPGPQ FDPAYDQLRP QRLTEIWGNG
 721 NEETSEVFPL KTKQDYSFCL FSPFVYYKCD LEVTLSPHTS GAHGLLVRWC PTGTPTKPTT
 781 QVLHEVSSLS EGRTPQVYSA GPGTSNQISF VVPYNSPLSV LPAVWYNGHK RFDNTGDLGI
 841 APNSDFGTLF FAGTKPDIKF TVYLRYKNMR VFCPRPTVFF PWPTSGDKID MTPRAGVLML
 901 ESPNPLDVSK TYPTLHILLQ FNHRGLEARI FRHGQLWAET HAEVVLRSKT KQISFLSNGS
 961 YPSMDATTPL NPWKSTYQAV LRAEPHRVTM DVYHKRIRPF RLPLVQKEWR TCEENVFGLY
1021 HVFETHYAGY FSDLLIHDVE TNPGPFTFKP RQRPVFQTQG AAVSSMAQTL LPNDLASKAM
1081 GSAFTALLDA NEDAQKAMKI IKTLSSLSDA WENVKGTLNN PEFWKQLLSR CVQLIAGMTI
1141 AVMHPDPLTL LCLGVLTAAE ITSQTSLCEE IAAKFKTIFT TPPPRFPVIS LFQQQSPLKQ
1201 VNDVFSLAKN LDWAVKTVEK VVDWFGTWVA QEEREQTLDQ LLQRFPEHAK RISDLRNGMA
1261 AYVECKESFD FFEKLYNQAV KEKRTGIAAV CEKFRQKHDH ATARCEPVVI VLRGDAGQGK
```

Fig. 77A

1321 SLSSQIIAQA VSKTIFGRQS VYSLPPDSDF FDGYENQFAA IMDDLGQNPD GSDFTTFCQM

1381 VSTTNLLPNM ASLERKGTPF TSQLVVATTN LPEFRPVTIA HYPAVERRIT FDYSVSAGPV

1441 CSKTEAGCKV LDVERAFRPT GDAPLPCFQN NCLFLEKAGL QFRDNRSKEI LSLVDVIERA

1501 VTRIERKKKV LTAVQTLVAQ GPVDEVSFYS VVQQLKARQE ATDEQLEELQ EAFARVQERS

1561 SVFSDWMKIS AMLCAATLAL TQVVKMAKAV KQMVRPDLVR VQLDEQEQGP YNETTRIKPK

1621 TLQLLDVQGP NPTMDFEKFV AKFVTAPIGF VYPTGVSTQT CLLVKGRTLA VNRHMAESDW

1681 TSIVVRGVSH TRSSVKIIAI AKAGKETDVS FIRLSSGPLF RDNTSKFVKA SDVLPHSSSP

1741 LIGIMNVDIP MMYTGTFLKA GVSVPVETGQ TFNHCIHYKA NTRKGWCGSA ILADLGGSKK

1801 ILGFHSAGSM GVAAASIISQ EMIDAVVQAF EPQGALERLP DGPRIHVPRK TALRPTVARQ

1861 VFQPAFAPAV LSKFDPRTDA DVDEVAFSKH TSNQETLPPV FRMVAREYAN RVFALLGRDN

1921 GRLSVKQALD GLEGMDPMDK NTSPGLPYTT LGMRRTDVVD WETATLIPFA AERLEKMNNK

1981 DFSDIVYQTF LKDELRPIEK VQAAKTRIVD VPPFEHCILG RQLLGKFASK FQTQPGLELG

2041 SAIGCDPDVH WTAFGVAMQG FERVYDVDYS NFDSTHSVAI FRLLAEEFFS EENGFDPLVK

2101 DYLESLAISK HAYEEKRYLI TGGLPSGCAA TSMLNTIMNN IIIRAGLYLT YKNFEFDDVK

2161 VLSYGDDLLV ATNYQLNFDR VRTSLAKTGY KITPANKTST FPLESTLEDV VFLKRKFKKE

2221 GPLYRPVMNR EALEAMLSYY RPGTLSEKLT SITMLAVHSG KQEYDRLFAP FREVGVIVPT

2281 FESVEYRWRS LFW (SEQ ID NO:29)

Fig. 77B

```
   1 MACKHGYPDV CPICTAVDVT PGFEYLLLAD GEWFPTDLLC VDLDDDVFWP SNSSNQSETM
  61 EWTDLPLVRD IVMEPQGNAS SSDKSNSQSS GNEGVIINNF YSNQYQNSID LSASGGNAGD
 121 APQNNGQLSN ILGGAANAFA TMAPLLLDQN TEEMENLSDR VASDKAGNSA TNTQSTVGRL
 181 CGYGEAHHGE HPASCADTAT DKVLAAERYY TIDLASWTTT QEAFSHIRIP LPHVLAGEDG
 241 GVFGATLRRH YLCKTGWRVQ VQCNASQFHA GSLLVFMAPE FYTGKGTKTG DMEPTDPFTM
 301 DTTWRAPQGA PTGYRYDSRT GFFAMNHQNQ WQWTVYPHQI LNLRTNTTVD LEVPYVNIAP
 361 TSSWTQHANW TLVVAVFSPL QYASGSSSDV QITASIQPVN PVFNGLRHET VIAQSPIAVT
 421 VREHKGCFYS TNPDTTVPIY GKTISTPNDY MCGEFSDLLE LCKLPTFLGN PNSNNKRYPY
 481 FSATNSVPTT SLVDYQVALS CSCMCNSMLA AVARNFNQYR GSLNFLFVFT GAAMVKGKFL
 541 IAYTPPGAGK PTTRDQAMQA TYAIWDLGLN SSFVFTAPFI SPTHYRQTSY TSATIASVDG
 601 WVTVWQLTPL TYPSGAPVNS DILTLVSAGD DFTLRMPISP TKWAPQGSDN AEKGKVSNDD
 661 ASVDFVAEPV KLPENQTRVA FFYDRAVPIG MLRPGQNIES TFVYQENDLR LNCLLLTPLP
 721 SFCPDSTSGP VKTKAPVQWR WVRSGGTTNF PLMTKQDYAF LCFSPFTYYK CDLEVTVSAL
 781 GTDTVASVLR WAPTGAPADV TDQLIGYTPS LGETRNPHMW LVGAGNTQIS FVVPYNSPLS
 841 VLPAAWFNGW SDFGNTKDFG VAPNADFGRL WIQGNTSASV RIRYKKMKVF CPRPTLFFPW
 901 PVSTRSKINA DNPVPILELE NPAAFYRIDL FITFIDEFIT FDYKVHGRPV LTFRIPGFGL
 961 TPAGRMLVCM GEKPAHGPFT SSRSLYHVIF TATCSSFSFS IYKGRYRSWK KPIHDELVDR
1021 GYTTFGEFFR AVRAYHADYY KQRLIHDVEM NPGPVQSVFQ PQGAVLTKSL APQAGIQNLL
1081 LRLLGIDGDC SEVSKAITVV TDLFAAWERA KTTLVSPEFW SKLILKTTKF IAASVLYLHN
1141 PDFTTTVCLS LMTGVDLLTN DSVFDWLKNK LSSFFRTPPP VCPNVLQPQG PLREANEGFT
1201 FAKNIEWAMK TIQSIVNWLT SWFKQEEDHP QSKLDKFLME FPDHCRNIMD MRNGRKAYCE
1261 CTASFKYFDE LYNLAVTCKR IPLASLCEKF KNRHDHSVTR PEPVVVVLRG AAGQGKSVTS
1321 QIIAQSVSKM AFGRQSVYSM PPDSEYFDGY ENQFSVIMDD LGQNPDGEDF TVFCQMVSST
```

Fig. 78A

1381 NFLPNMAHLE RKGTPFTSSF IVATTNLPKF RPVTVAHYPA VDRRITFDFT VTAGPHCTTS

1441 NGMLDIEKAF DEIPGSKPQL ACFSADCPLL HKRGVMFTCN RTKAVYNLQQ VVKMVNDTIT

1501 RKTENVKKMN SLVAQSPPDW EHFENILTCL RQNNAALQDQ LDELQEAFAQ ARERSDFLSD

1561 WLKVSAIIFA GIASLSAVIK LASKFKESIW PSPVRVELSE GEQAAYAGRA RAQKQALQVL

1621 DIQGGGKVLA QAGNPVMDFE LFCAKNMVAP ITFYYPDKAE VTQSCLLLRA HLFVVNRHVA

1681 ETEWTAFKLK DVRHERDTVV TRSVNRSGAE TDLTFIKVTK GPLFKDNVNK FCSNKDDFPA

1741 RNDAVTGIMN TGLAFVYSGN FLIGNQPVNT TTGACFNHCL HYRAQTRRGW CGSAVICNVN

1801 GKKAVYGMHS AGGGGLAAAT IITRELIEAA EKSMLALEPQ GAIVDISTGS VVHVPRKTKL

1861 RRTVAHDVFQ PKFEPAVLSR YDPRTDKDVD VVAFSKHTTN MESLPPVFDI VCDEYANRVF

1921 TILGKDNGLL TVEQAVLGLP GMDPMEKDTS PGLPYTQQGL RRTDLLNFNT AKMTPQLDYA

1981 HSKLVLGVYD DVVYQSFLKD EIRPLEKIHE AKTRIVDVPP FAHCIWGRQL LGRFASKFQT

2041 KPGLELGSAI GTDPDVDWTP YAAELSGFNY VYDVDYSNFD ASHSTAMFEC LIKNFFTEQN

2101 GFDRRIAEYL RSLAVSRHAY EDRRVLIRGG LLSGCAATSM LNTIMNNVII RAALYLTYSN

2161 FEFDDIKVLS YGDDLLIGTN YQIDFNLVKE RLAPFGYKIT PANKTTTFPL TSHLQDVTFL

2221 KRRFVRFNSY LFRPQMDAVN LKAMVSYCKP GTLKEKLMSI ALLAVHSGPD IYDEIFLPFR

2281 NVGIVVPTYS SMLYRWLSLF R (SEQ ID NO:30)

Fig. 78B

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   1 MACKHGYPDV CPICTAVDAT PDFEYLLMAD GEWFPTDLLC VDLDDDVFWP SDTSTQPQTM
  61 EWTDVPLVCD TVMEPQGNAS SSDKSNSQSS GNEGVIINNF YSNQYQNSID LSASGGNAGD
 121 APQNNGQLSS ILGGAANAFA TMAPLLMDQN TEEMENLSDR VASDKAGNSA TNTQSTVGRL
 181 CGYGKSHHGE HPTSCADAAT DKVLAAERYY TIDLASWTTS QEAFSHIRIP LPHVLAGEDG
 241 GVFGATLRRH YLCKTGWRVQ VQCNASQFHA GSLLVFMAPE FYTGKGTKSG TMEPSDPFTM
 301 DTTWRSPQSA PTGYRYDRQA GFFAMNHQNQ WQWTVYPHQI LNLRTNTTVD LEVPYVNVAP
 361 SSSWTQHANW TLVVAVLSPL QYATGSSPDV QITASLQPVN PVFNGLRHET VLAQSPIPVT
 421 VREHQGCFYS TNPDTTVPIY GKTISTPSDY MCGEFSDLLE LCKLPTFLGN PSTDNKRYPY
 481 FSATNSVPAT SLVDYQVALS CSCTANSMLA AVARNFNQYR GSLNFLFVFT GAAMVKGKFR
 541 IAYTPPGAGK PTTRDQAMQA TYAIWDLGLN SSFNFTAPFI SPTHYRQTSY TSPTITSVDG
 601 WVTVWQLTPL TYPSGTPTHS DILTLVSAGD DFTLRMPISP TKWVPQGIDN AEKGKVSNDD
 661 ASVDFVAEPV KLPENQTRVA FFYDRAVPIG MLRPGQNMET TFSYQENDFR LNCLLLTPLP
 721 SYCPDSSSGP VRTKAPVQWR WVRSGGANGA NFPLMTKQDY AFLCFSPFTY YKCDLEVTVS
 781 AMGAGTVSSV LRWAPTGAPA DVTDQLIGYT PSLGETRNPH MWIVGSGNSQ ISFVVPYNSP
 841 LSVLPAAWFN GWSDFGNTKD FGVAPTSDFG RIWIQGNSSA SVRIRYKKMK VFCPRPTLFF
 901 PWPTPTTTKI NADNPVPILE LENPASLYRI DLFITFTDEL ITFDYKVHGR PVLTFRIPGF
 961 GLTPAGRMLV CMGAKPAHSP FTSSKSLYHV IFTSTCNSFS FTIYKGRYRS WKKPIHDELV
1021 DRGYTTFREF FKAVRGYHAD YYKQRLIHDV EMNPGPVQSV FQPQGAVLTK SLAPQAGIQN
1081 ILLRLLGIEG DCSEVSKAIT VVTDLVAAWE KAKTTLVSPE FWSELILKTT KFIAASVLYL
1141 HNPDFTTTVC LSLMTGVDLL TNDSVFDWLK SKLSSFFRTP PPACPNVMQP QGPLREANEG
1201 FTFAKNIEWA TKTIQSIVNW LTSWFKQEED HPQSKLDKLL MEFPDHCRNI MDMRNGRKAY
1261 CECTASFKYF DDLYNLAVTC KRIPLASLCE KFKNRHDHSV TRPEPVVAVL RGAAGQGKSV
1321 TSQIIAQSVS KMAFGRQSVY SMPPDSEYFD GYENQFSVIM DDLGQNPDGE DFTVFCQMVS
1381 STNFLPNMAH LERKGTPFTS SFIVATTNLP KFRPVTVAHY PAVDRRITFD FTVTAGPHCK
```

Fig. 79A

1441 TPAGMLDIEK AFDEIPGSKP QLACFSADCP LLHKRGVMFT CNRTKTVYNL QQVVKMVNDT

1501 ITRKTENVKK MNSLVAQSPP DWQHFENILT CLRQNNAALQ DQVDELQEAF TQARERSDFL

1561 SDWLKVSAII FAGIVSLSAV IKLASKFKES IWPTPVRVEL SEGEQAAYAG RARAQKQALQ

1621 VLDIQGGGKV LAQAGNPVMD FELFCAKNMV SPITFYYPDK AEVTQSCLLL RAHLFVVNRH

1681 VAETEWTAFK LRDVRHERDT VVMRSVNRSG AETDLTFVKV TKGPLFKDNV NKFCSNKDDF

1741 PARNDTVTGI MNTGLAFVYS GNFLIGNQPV NTTTGACFNH CLHYRAQTRR GWCGSAIICN

1801 VNGKKAVYGM HSAGGGGLAA ATIITRELIE AAEKSMLALE PQGAIVDIST GSVVHVPRKT

1861 KLRRTVAHDV FQPKFEPAVL SRYDPRTDKD VDVVAFSKHT TNMESLPPIF DIVCGEYANR

1921 VFTILGKDNG LLTVEQAVLG LSGMDPMEKD TSPGLPYTQQ GLRRTDLLDF NTAKMTPQLD

1981 YAHSKLVLGV YDDVVYQSFL KDEIRPLEKI HEAKTRIVDV PPFAHCIWGR QLLGRFASKF

2041 QTKPGFELGS AIGTDPDVDW TRYAAELSGF NYVYDVDYSN FDASHSTAMF ECLINNFFTE

2101 QNGFDRRIAE YLRSLAVSRH AYEDRRVLIR GGLPSGCAAT SMLNTIMNNV IIRAALYLTY

2161 SNFEFDDIKV LSYGDDLLIG TNYQIDFNLV KERLAPFGYK ITPANKTTTF PLTSHLQDVT

2221 FLKRRFVRFN SYLFRPQMDA VNLKAMVSYC KPGTLKEKLM SIALLAVHSG PDIYDEIFLP

2281 FRNVGIVVPT YDSMLYRWLS LFR (SEQ ID NO:31)

Fig. 79B

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   1 MACKHGYPDV CPICTAVDAT PGFEYLLMAD GEWYPTDLLC VDLDDDVFWP SDTSNQSQTM
  61 DWTDVPLIRD IVMEPQGNSS SSDKSNSQSS GNEGVIINNF YSNQYQNSID LSASGGNAGD
 121 APQTNGQLSN ILGGAANAFA TMAPLLLDQN TEEMENLSDR VASDKAGNSA TNTQSTVGRL
 181 CGYGKSHHGE HPASCADTAT DKVLAAERYY TIDLASWTTS QEAFSHIRIP LPHVLAGEDG
 241 GVFGATLRRH YLCKTGWRVQ VQCNASQFHA GSLLVFMAPE FYTGKGTKTG TMEPSDPFTM
 301 DTEWRSPQGA PTGYRYDSRT GFFATNHQNQ WQWTVYPHQI LNLRTNTTVD LEVPYVNVAP
 361 SSSWTQHANW TLVVAVLSPL QYATGSSPDV QITASLQPVN PVFNGLRHET VIAQSPIPVT
 421 VREHKGCFYS TNPDTTVPIY GKTISTPSDY MCGEFSDLLE LCKLPTFLGN PNTNNKRYPY
 481 FSATNSVPAT SMVDYQVALS CSCMANSMLA AVARNFNQYR GSLNFLFVFT GAAMVKGKFL
 541 IAYTPPGAGK PTTRDQAMQS TYAIWDLGLN SSFNFTAPFI SPTHYRQTSY TSPTITSVDG
 601 WVTVWKLTPL TYPSGTPTNS DILTLVSAGD DFTLRMPISP TKWVPQGVDN AEKGKVSNDD
 661 ASVDFVAEPV KLPENQTRVA FFYDRAVPIG MLRPGQNMET TFNYQENDYR LNCLLLTPLP
 721 SFCPDSSSGP QKTKAPVQWR WVRSGGVNGA NFPLMTKQDY AFLCFSPFTF YKCDLEVTVS
 781 ALGMTRVASV LRWAPTGAPA DVTDQLIGYT PSLGETRNPH MWLVGAGNSQ VSFVVPYNSP
 841 LSVLPAAWFN GWSDFGNTKD FGVAPNADFG RLWIQGNTSA SVRIRYKKMK VFCPRPTLFF
 901 PWPTPTTTKI NADNPVPILE LENPAALYRI DLFITFTDEF ITFDYKVHGR PVLTFRIPGF
 961 GLTPAGRMLV CMGEQPAHGP FTSSRSLYHV IFTATCSSFS FSIYKGRYRS WKKPIHDELV
1021 DRGYTTFGEF FKAVRGYHAD YYRQRLIHDV ETNPGPVQSV FQPQGAVLTK SLAPQAGIQN
1081 LLLRLLGIDG DCSEVSKAIT VVTDLVAAWE KAKTTLVSPE FWSKLILKTT KFIAASVLYL
1141 HNPDFTTTVC LSLMTGVDLL TNDSVFDWLK QKLSSFFRTP PPACPNVMQP QGPLREANEG
1201 FTFAKNIEWA MKTIQSVVNW LTSWFKQEED HPQSKLDKLL MEFPDHCRNI MDMRNGRKAY
1261 CECTASFKYF DELYNLAVTC KRIPLASLCE KFKNRHDHSV TRPEPVVVVL RGAAGQGKSV
1321 TSQIIAQSVS KMAFGRQSVY SMPPDSEYFD GYENQFSVIM DDLGQNPDGE DFTVFCQMVS
1381 STNFLPNMAH LERKGTPFTS SFIVATTNLP KFRPVTVAHY PAVDRRITFD FTVTAGPHCK
```

Fig. 80A

1441 TPAGMLDVEK AFDEIPGSKP QLACFSADCP LLHKRGVMFT CNRTQTVYNL QQVVKMVNDT

1501 ITRKTENVKK MNSLVAQSPP DWEHFENILT CLRQNNAALQ DQLDELQEAF AQARERSDFL

1561 SDWLKVSAII FAGIASLSAV IKLASKFKES IWPTPVRVEL SEGEQAAYAG RARAQKQALQ

1621 VLDIQGGGKV LAQAGNPVMD FELFCAKNIV APITFYYPDK AEVTQSCLLL RAHLFVVNRH

1681 VAETDWTAFK LKDVRHERHT VALRSVNRSG AKTDLTFIKV TKGPLFKDNV NKFCSNKDDF

1741 PARNDTVTGI MNTGLAFVYS GNFLIGNQPV NTTTGACFNH CLHYRAQTRR GWCGSAIICN

1801 VNGKKAVYGM HSAGGGGLAA ATIITKELIE AAEKSMLALE PQGAIVDIAT GSVVHVPRKT

1861 KLRRTVAHDV FQPKFEPAVL SRYDPRTDKD VDVVAFSKHT TNMESLPPIF DVVCGEYANR

1921 VFTILGKENG LLTVEQAVLG LPGMDPMEKD TSPGLPYTQQ GLRRTDLLNF ITAKMTPQLD

1981 YAHSKLVIGV YDDVVYQSFL KDEIRPIEKI HEAKTRIVDV PPFAHCIWGR QLLGRFASKF

2041 QTKPGLELGS AIGTDPDVDW TRYAVELSGF NYVYDVDYSN FDASHSTAMF ECLINNFFTE

2101 QNGFDRRIAE YLRSLAVSRH AYEDRRVLIR GGLPSGCAAT SMLNTIMNNV IIRAALYLTY

2161 SNFDFDDIKV LSYGDDLLIG TNYQIDFNLV KERLAPFGYK ITPANKTTTF PLTSHLQDVT

2221 FLKRRFVRFN SYLFRPQMDA VNLKAMVSYC KPGTLKEKLM SIALLAVHSG PDIYDEIFLP

2281 FRNVGIVVPT YSSMLYRWLS LFR (SEQ ID NO:32)

Fig. 80B

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   1 MMACIHGYPS VCPICTAIDK SSDGMYLLLA DNEWFPADLL TMDLDDDVFW PNDESDVSET
  61 MDWTDLPFIL DTIMEPQGNS TSSDKSNSQS SGNEGVIINN FYSNQYQNSI DLSANGGNAG
 121 GAPKTEGQLG NILGNAANAF STMAPLLLDQ NTEEMENLSD RVDSDKAGNS AVNTQSSVGR
 181 LCGYGMHHKG KHPASCADTA TDKVLSAERY YTIDLATWTT TLGTFSHIRI PLPHVLAGED
 241 GGVFGSTLRR HYLCKCGWRI QVQCNASQFH AGSLLVFMAP EFYTGHTPVT GTTEPATPFT
 301 MDSSWQTPQQ NPVGFRYDGR TGYFALNHQN YWQWMVYPHQ ILNLRTNTSV DLEVPFTNIA
 361 PTSSWTQHAN WTLVVAVLTP LQYAAGSATD VQITASIQPV KPVFNGLRHE AVVPQSPIPV
 421 TVREHQGTFY STNPDTTVPI YGKTIATPSD YMCGEFSDLV ELCKLPTFLG NPANTSPAGG
 481 RYPYFSATNS VPATALASYQ VALSCSCMSN SMLAAVARNF NQYRGSLNFL FVFTGTAMTK
 541 GKFLIAYTPP GAGKPTTREQ AMQATYAIWD LGLNSSYNFT VPFISPTHYR QTSYTSTSIT
 601 SVDGWLTVWQ LTPLTYPANT PPNADILTLV SAGDDFTLRM PISPTKWIPQ GVDNAEKGKV
 661 SNDDATVDFV AEPVKFPDNQ TKVSFFYDRS VPLGLLRPAQ GMEQDFAYAA NDSRANSILL
 721 TPLPSYAPDS TTGPTETQAP IQWRWLRGTS DGSTTFPLMT KQDYAFLLFS PFTYYKADLE
 781 VTLSAISNSN NVTVVRWAPT GAPADISRQL SGYTPSIGDT RDPHLWFVGA GNSQTSFVVP
 841 YNSPLSVLPA AWFNGWSDFG NTKDFGVAPN ADFGRLWIQG NTSVAVRVRY KKMKVFCPRP
 901 TLFLPWPSTT TTRIHADNPV SVMELQNPFS FYRVDLFITF TDELITFDYK VHGRPVLQYQ
 961 VPGLGLTCAG RMLVCMGQMP NHAPFSTVRH LYHVVFTGSR NSFGVVIYYK RHRPWKKPLH
1021 EELHDYGFEC FSDFFKHVRE YHAAYYKQRL MHDVETNPGP PVQSVFRPQG GVLTKSQAPM
1081 SGIQNLFLRA LGIDADHGEF TRAVTMITDL CNTWEKAKNT LVSPEFWTVL IMKTVKFIAA
1141 SVLYLHNPDL TATICLSLMT GVDVLTNESI FNWLSNKLSK LFHTPPPPTS PLLQAQSPLR
1201 EANDGFNLAK NIEWAIKTVQ KIVDWLMSWF KQEEAHPQAK LDKMLADFPE HCASILAMRN
1261 GRKAYTDCAG AFKYFEDLYN LAVQCKRIPL ATLCEKFKNK HDHAVARPEP VVVVLRGNAG
1321 QGKSVTSQII AQAVSKLAFG RQSVYSIPPD SDYLDGYENQ FSVIMDDLGQ NPDGEDFKVF
1381 CQMVSSTNFL PNMAHLEKKG TPFTSNFIVA TTNLPKFRPV TVAHYPAVDR RITFDLTVEA
```

Fig. 81A

1441 GPACKTPTGM LDVEKAFQEI PGEPQLDCFS SDCALLHKRG VQFICNRTKK IYNLQQIVKM

1501 VKDTIDNKVA NLKKMNTLVA QSPNNGNDME HIITCLRQNN AALQDQIDEL QEAFAQAQER

1561 QNFLSDWMKV SAIIFAGIAS LSAVCKLVGR LKNLIWPSPV HVELSEGEQA AYAGAKRGAK

1621 QALQVLDLQG GGRIIAQAGN PVMDYEVCVA KNMVAPITFY YADKAQVTQS CLLVKGRLFV

1681 VNRHVAETDW VSFELRDVRH ERDTVTMRSV NRSGMEVDLT FIKVTKGPLF KDNTKKFCSN

1741 KDDFPQKNET VTGIMNTGLP FVFNGKFIIG NHPVNTTTGA TFNHCLHYRA NTRRGWCGSA

1801 VICQVNGKKA VYGMHSAGGG GLAAATIITQ ELVEAAEQNM DRLVPQGAIM EIGTGSVVHV

1861 PRKTKLRRTV AHEIFLPKFE PAVLSRYDPR TEKDVDQVAF SKHTTNMEEL PAVFSMVAKE

1921 YANRVFTKLG KENQLLTTQQ AILGLPGMDP MEKDTSPGLP YTQQGLRRTD LVNFETGKMD

1981 HNLDYAHSKL MLGHYEDVVY QSFLKDEIRP IEKIHEAKTR IVDVPPFHHC IWGRQLLGRF

2041 ASRFQTNPGL DLGSAIGTDP DVDWTVFAHQ LAEFKYIYDV DYSNFDASHS TAIFEILIQE

2101 FFTPQNGFDP RIGEYLRSLA VSRHAYEDRR VLIRGGLPSG CAATSMINTI INNIVIRAAL

2161 YMTYANFEFD DIKVLSYGDD LLIATNYEIN FNLVKERLAP FNYKITPANK TSTFPQTSHL

2221 QDVVFLKRRF VQFNSFLFRP QMETENLKAM VSYCRPGVLK EKLMSIALLA VHSGPDVYDE

2281 IFMPFRRIGV VVPEYSTMLY RWLNLFR (SEQ ID NO:33)

Fig. 81B

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   1 MACKHGYPDV CPICTAIDVT PGFEYLLLAD GEWFPTDLLC VDLDDDVFWP SDSSNQSQTM
  61 EWTDIPLICD TVMEPQGNST SSDKSNSQSS GNEGVIINNF YSNQYQNSID LSANGGNAGD
 121 GPKTEGQLSN ILGGAANAFA TMAPLLLDEN TEEMENLSDR VDSDKAGNSA TNTQSSVGRL
 181 HGYGATHRGD HPASCADTAT DKVLAAERYY TIDLATWTTA QTTFSHIRVP LPHALAGEHG
 241 GVFGATLRRH YLAKCGWRVQ VQCNASQFHA GSLLVFLAPE FYTGTGVATS GQEPNKVFLM
 301 DTTWQEPQAA PTGFRYDGKN GFFTLNHQNY WQWTVYPHQI LNLRTNTSVD LEVPYVNVAP
 361 TSSWTQHANW ALVVAVLTPL QYSTGAATDV AITVSLQPVN PVFNGLRHEA QVPQSPVAVT
 421 VREHQGSFYS TNPDTTVPIY GKTIVTPSDY MCGEFTDLLE LCKLPTFLGN LSNDTRVPFF
 481 TATNSVPTES LVEYQVTLSC SCMSNSMLAS VARNFNQYRG SLNFLFVFTG SAMTKGKFLI
 541 AYTPPGAGKP TTRDQAXQST YAIWDLGLNS SYNFTVPFIS PSHYRQTSYT SPSIAAVDGW
 601 LTVWQLTPLT FPANVPPSSD ILTLVSAGND FTLRMPISPT KWIPQGVDNA EKGKVSDDNA
 661 SVDFVAEPIK LPENQTRVNF FYDRSSPIGL LRPNQAIESN FSYSADSNGA TNCALLTPLP
 721 SYSPDRPGQS PDTSKAPIQW RWISAVTESG TVSNTFPTRT RQDYAFLLFS PFTYYKCDLE
 781 VTLSSVGNGV VASLVRWAPT GAPADITTQL TTSTPSIGDT RDPHMWLVGA GNSQTSFVIP
 841 YNSPLSVLPA AWFNGWSNFS NTYDFGIAPC SDFGRLWIQG NAPLAIRVRY KKMRVFCPRP
 901 TLFFPWPTPT TTKVNADNPV PILDLENPAA (SEQ ID NO:34)
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Fig. 82