CTL Nef Epitopes

Location	Epitope	Antigen	Species(HLA)	Reference
	Comments			
Nef(66-80 BRU)	VGFPVTPQVPLRMT	HIV-1 infection	human(A1,B8)	[Hadida (1992)]
	HIV-1 specific CTLs detected in lymphoid organs of HIV-1 infected patients			
Nef(73-82 NL432)	QVPLRPMTYK	HIV-1 infection	human(A3.1)	[Koenig (1990)]
	Tyr is critical for binding to A3.1			
Nef(73-82 BRU)	QVPLRPMTYK	HIV-1 infection	human(A3,A11,B35)	[Culmann (1991)]
	Nef CTL clones from HIV+ donors			
Nef(73-82 LAI)	QVPLRPMTYK	HIV-1 infection	human(A2)	[Robertson (1993)]
	Development of a retroviral vector (pNeoNef) to generate autologous CTL targets			
Nef(73-82 LAI)	QVPLRPMTYK	HIV-1 infection	human(A11)	[Couillin (1994)]
	Mutational variation in HIV epitopes in individuals with appropriate HLA types can result in evasion of CTL response			
Nef(73-82)	VPLRPMTYK		human(A11)	[Zhang (1993)]
	Exploration of A11 binding motif			
Nef(73-82 LAI)	VPLRPMTY		human(B35)	[McMichael & Walker(1994)]
	Review of HIV CTL epitopes; defined by B35 motif found within a larger peptide			
Nef(73-82 LAI)	VPLRPMTY	HIV-1 or -2 infection	human(B35)	[Rowland-Jones (1995)]
	VPLRPMTY also recognized by CTL from HIV-2 seropositives, epitope is conserved			
Nef(74-82)	VPLRPMTY		human(A3)	[Carreno (1992)]
	Included in A3 binding peptide competition study			
Nef(75-82 LAI)	PLRPMTYK	HIV-1 infection	human(A11)	[McMichael & Walker(1994)]
	Review of HIV CTL epitopes; defined by All motif found within a larger peptide			
Nef(83-94 BRU)	AAVDLSHFLKEK	HIV-1 infection	human(A11)	[Culmann (1991)]
	Epitope defined by boundaries of overlapping peptides that stimulate Nef CTL clones			
Nef(84-92 LAI)	AVDLSHFLK	HIV-1 infection	human(A11)	[McMichael & Walker(1994)]
	Review of HIV CTL epitopes; defined by A11 motif found within a larger peptide			
Nef(84-92 LAI)	AVDLSHFLK	HIV-1 infection	human(A11)	[Couillin (1994)]
	Mutational variation in HIV epitopes in individuals with appropriate HLA types can result in evasion of CTL response			
Nef(86-100 LAI)	DLSHFLKEKGGLEGL		human(B35)	[Buseyne (1993)]
Nef(86-100 LAI)	DLSHFLKEKGGLEGL	HIV-1 infection	human(A2)	[Robertson (1993)]
	Development of a retroviral vector (pNeoNef) to generate autologous targets			

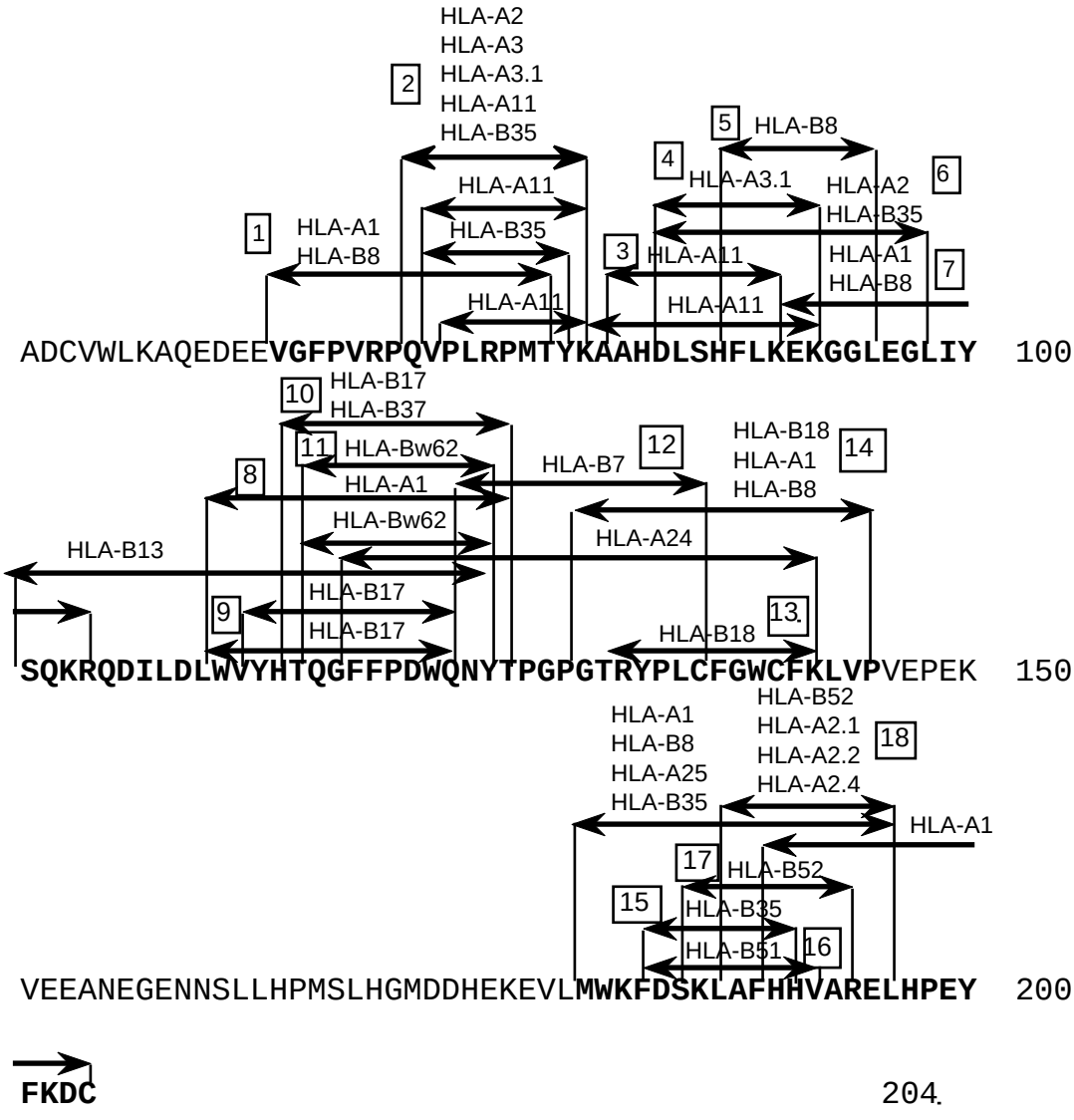
CTL Nef Epitopes

Location	Epitope	Antigen	Species(HLA)	Reference
	Comments			
Nef(84-92 LAI)	DLSHFLKEK		human(A3.1)	[McMichael & Walker(1994)]
	Review of HIV CTL epitopes; defined by A3.1 motif found within a larger peptide			
Nef(89-97 LAI)	FLKEKGGL		human(B8)	[Brander & Walker(1995)]
	Unpublished, E. Gromard and P. Gould; defined by B8 motif found within a larger peptide in [McMichael & Walker(1994)]			
Nef(93-106 BRU)	EKGGLEGLIHSQRR	HIV-1 infection	human(A1,B8)	[Hadida (1992)]
	HIV-1 specific CTLs detected in lymphoid organs of HIV-1 infected patients			
Nef(103-127 PV22)	SQRRQDILDLWIYHTQGYFPDWQNY	HIV-1 infection	human(B13)	[Jassoy (1993)]
	HIV-1 specific CTLs release γ-IFN, and α- and β-TNF			
Nef(113-128 BRU)	WIYHTQGYFPDWQNYT	HIV-1 infection	human(A1)	[Hadida (1992)]
	HIV-1 specific CTLs detected in lymphoid organs of HIV-1 infected patients			
Nef(113-125 BRU)	WIYHTQGYFPDWQ	HIV-1 infection	human(B17)	[Culmann (1989)]
	Nef CTL clones from HIV+ donors			
Nef(115-125 BRU)	YHTQGYFPQWQ	HIV-1 infection	human(B17)	[Culmann (1991)]
	Nef CTL clones from HIV+ donors			
Nef(117-128 BRU)	TQGYFPDWQNYT	HIV-1 infection	human(B17 and B37)	[Culmann (1991)]
	Nef CTL clones from HIV+ donors			
Nef(118-127 LAI)	QGYFPDWQNY		human(Bw62)	[McMichael & Walker(1994)]
	Review of HIV CTL epitopes; defined by Bw62 motif found within a larger peptide			
Nef(120-144 SF2)	YFPDWQNYTPGPGIRYPLTFGWCYK	HIV-1 infection	human(A24)	[Jassoy (1992)]
	Epitope recognized by CTL clone derived from CSF			
Nef(126-138 BRU)	NYTPGPGVRYPLT	HIV-1 infection	human(B7)	[Culmann (1991)]
	Nef CTL clones from HIV+ donors			
Nef(132-147 BRU)	GVRYPLTFGWCYKLVP	HIV-1 infection	human(A1,B8)	[Hadida (1992)]
	HIV-1 specific CTLs detected in lymphoid organs			
Nef(132-147 BRU)	GVRYPLTFGWCYKLVP	HIV-1 infection	human(B18)	[Culmann (1991)]
	Nef CTL clones from HIV+ donors			

CTL Nef Epitopes

Location	Epitope	Antigen	Species(HLA)	Reference
	Comments			
Nef(134-144 LAI)	RYPLTFGWCYK	HIV-1 infection	human(B18)	[Couillin (1994)]
	Mutational variation in HIV epitopes in individuals with appropriate HLA types can result in evasion of CTL response			
Nef(182-198 BRU)	EWRFDSRLAFHHVAREL	HIV-1 infection	human(A1,B8)	[Hadida (1992)]
	HIV-1 specific CTLs detected in lymphoid organs of HIV-1 infected patients			
Nef(182-198 BRU)	EWRFDSRLAFHHVAREL	HIV-1 infection	human(A25)	[Cheynier (1992)]
	CTL isolated in children born to HIV-1 positive mothers			
Nef(182-198 LAI)	EWRFDSRLAFHHVAREL	HIV-1 infection	human(B35)	[Hadida (1995)]
	The C-terminal region of Nef (182-205) contains multiple CTL epitopes with 5 distinct HLA restrictions			
Nef(182-198 LAI)	EWRFDSRLAFHHVAREL	HIV-1 infection	human(A1,A25(10))	[Hadida (1995)]
	The C-terminal region of Nef (182-205) contains multiple CTL epitopes with 5 distinct HLA restrictions			
Nef(186-193 LAI)	DSRLAFHH	HIV-1 infection	human(B35)	[Hadida (1995)]
	The C-terminal region of Nef (182-205) contains multiple CTL epitopes with 5 distinct HLA restrictions			
Nef(186-194 BRU)	DSRLAFHHV		human(B51)	[Connan (1994)]
	Produced the significant assembly of HLA-B51; anchor residues: V (position 9) and L (position 4)			
Nef(188-196 LAI)	RLAFHHVAR	HIV-1 infection	human(B52)	[Hadida (1995)]
	The C-terminal region of Nef (182-205) contains multiple CTL epitopes with 5 distinct HLA restrictions			
Nef(192-206 BRU)	HHVARELHPEYFKNC	HIV-1 infection	human(A1)	[Hadida (1992)]
	HIV-1 specific CTLs detected in lymphoid organs of HIV-1 infected patients			
Nef(190-198 LAI)	AFHHVAREL	HIV-1 infection	human(B52,A2)	[Hadida (1995)]
	CTL recognition in the context of HLA B52 and A2.1, A2.2 and A2.4; high effector cell frequency			
Nef(190-198 LAI)	AFHHVAREK	HIV-1 infection	human(A3)	[Hadida (1995)]
	Naturally occurring L to K anchor substitution abrogates A2 binding, but permits HLA-A3 binding			

Nef CTL-EPITOPES



Epitopes and protein variability:

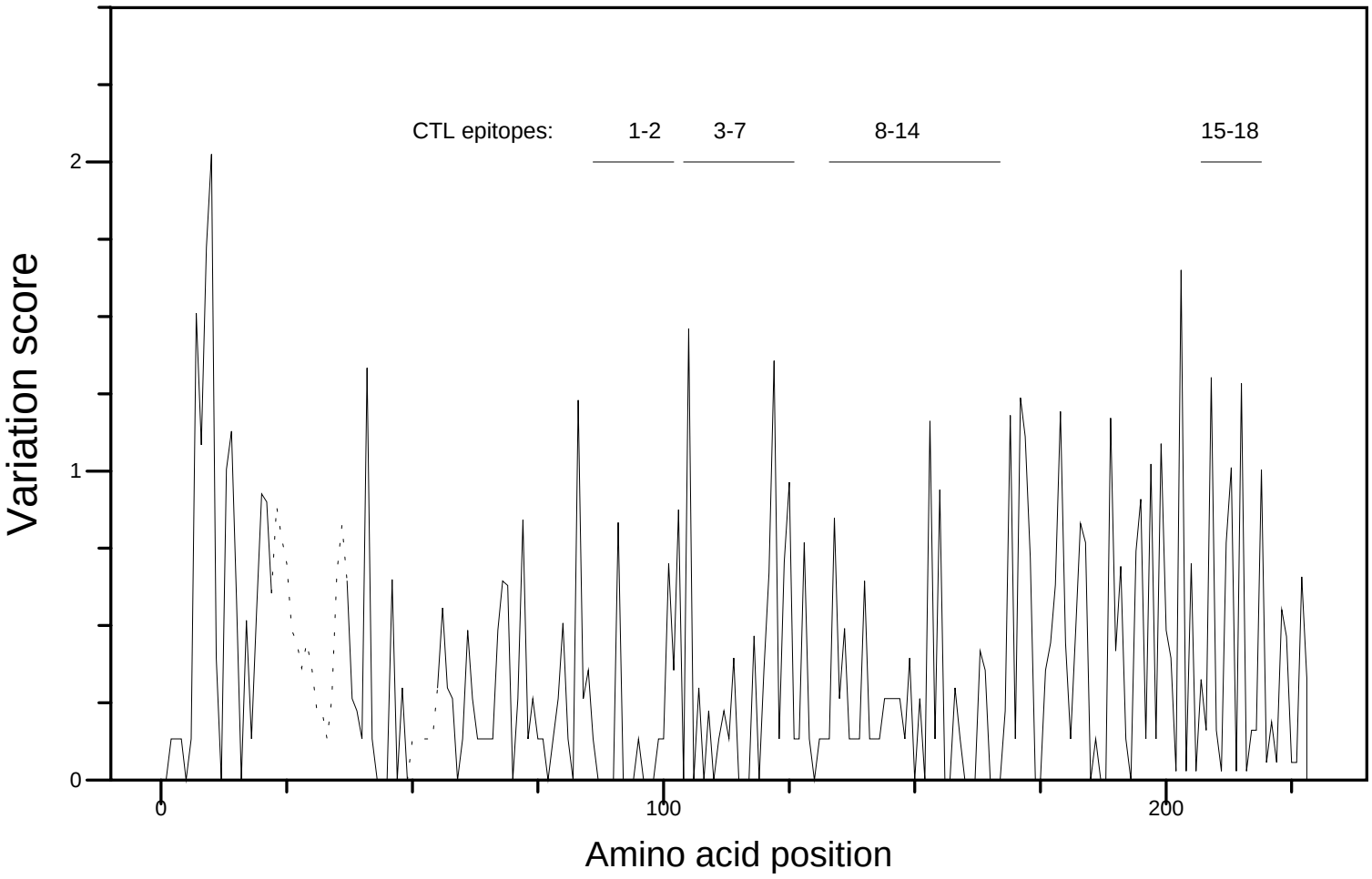
This plot shows a score that is a measure of variability for each position in the Nef protein alignment, and the relative positions of regions with defined CTL epitopes as seen on the CTL epitope map. The solid lines are positions where the most common character in a Nef protein alignment is an amino acid; the dashed lines represent regions where the most common character is an insertion (dash) incorporated to maintain the alignments. The alignment used corresponds to the 1995 Nef protein alignment, publically available at the Human Retroviruses and AIDS database, totaling 34 sequences. See the "how to use the CTL section" information for more details on the variability measure. The higher scores indicate more variation; 0 is perfectly conserved. The different protein alignments (gp120, gp41, p24, p15, p17, Nef and RT) used to create these plots contain different sets of sequences; therefore each plot is internally consistent, but cannot be compared to other protein plots.

Most common amino acid in each position in the Nef protein is shown below. The numbering corresponds to the numbering in the variability plot for the Nef protein.

NEF CONSENSUS:

```
MGGKWSKSSMVGWPAVRERMRRA--------------EPAADGVGAVSRD  50

-----LEKHGAITSSNTAATNADCAWLEAQ--EEEEVGFPVRPQVPLRPM  100

TYKAAVDLSHFLKEKGGLEGLIYSQKRQDILDLWVYHTQGYFPDWQNYTP  150

GPGIRYPLTFGWCFKLVPVEPEKVE-EANEGENNSLLHPMSLHGMDDPER  200

EVLEWRFDSRLAFHHMARELHPEYY-KDC
```

Variation in positions in the Nef protein



Nef CTL epitope 1

HLA-A1, HLA-B8

```
CONSENSUS-B VGFPVRPQVPLRPMY
Epitope1    -----T---------

CONSENSUS-A ---------------
HIVU455     ---------------

CONSENSUS-B ---------------
HIVLAI      -----T---------
HIVNL43     -----T---------
HIVGLNEF3   ---------------
HIVGLNEF5   -----T---------
HIVGLNEF6   -----T---------
HIVBRVA     -----K---------
HIVMN       -----K---------
HIVSC       ---------------
HIVBAL1     ---------------
HIVJRCSF    ---------------
HIVJRFL     ---------------
HIVNH53     ---------------
HIVOYI      ---------------
HIVSF2      ---------------
HIVSF162    ---------------
HIVCAM1     ---------------
HIVHEI39BL  ---------------
HIVHEI3BL   ---------------
HIVHEI4BL   ---------------
HIVSF33     -----K---------
HIVSWB84    ---------------
HIVHAN      E---------------
HIVD31      -----K---------
HIVRF       ---------------
HIVYU2      ---------------
HIVBCSG3C   -------------I-

CONSENSUS-D ---------------
HIVELI      ---------------
HIVNDK      ---------------
HIVZ6       ---------------

CONSENSUS-O -----?---------
HIVANT70    -----A---------
HIVMVP5180  ---------------

SIVCPZGAB   ----------T----

CONSENSUS-U ---------------
HIVMAL      ---------------
HIVZ321     ---------------
```

Nef CTL epitope 2

HLA-A2, HLA-A3, HLA-A3.1, HLA-11, HLA-B35

```
CONSENSUS-B QVPLRPMTYK
Epitope2    ----------
HLA-A3,B35   --------
HLA-A11       --------

CONSENSUS-A ----------
HIVU455     ----------

CONSENSUS-B ----------
HIVLAI      ----------
HIVNL43     ----------
HIVGLNEF3   ----------
HIVGLNEF5   ----------
HIVGLNEF6   ----------
HIVBRVA     ----------
HIVMN       ----------
HIVSC       ----------
HIVBAL1     --------RS
HIVJRCSF    ----------
HIVJRFL     ----------
HIVNH53     ----------
HIVOYI      ----------
HIVSF2      ----------
HIVSF162    ----------
HIVCAM1     ----------
HIVHEI39BL  --------SR
HIVHEI3BL   ----------
HIVHEI4BL   ----------
HIVSF33     ----------
HIVSWB84    --------RR
HIVHAN      ----------
HIVD31      ----------
HIVRF       --------F-
HIVYU2      --------H-
HIVBCSG3C   ------I---

CONSENSUS-D ----------
HIVELI      ----------
HIVNDK      ----------
HIVZ6       ----------

CONSENSUS-O --------?-
HIVANT70    ----------
HIVMVP5180  --------F-

SIVCPZGAB   ---T------

CONSENSUS-U --------?-
HIVMAL      ----------
HIVZ321     --------F-
```

Nef CTL epitope 3

HLA-A11

```
CONSENSUS-B A?DlSHFLK
Epitope3    -V-------

CONSENSUS-A -F---F---
HIVU455     -F---F---

CONSENSUS-B ---------
HIVLAI      -V-------
HIVNL43     -V-------
HIVGLNEF3   -V-------
HIVGLNEF5   -V-------
HIVGLNEF6   -V-------
HIVBRVA     -V-------
HIVMN       -L-------
HIVSC       -V-------
HIVBAL1     -I-----F-
HIVJRCSF    -I-------
HIVJRFL     -V-------
HIVNH53     -V-------
HIVOYI      -L-------
HIVSF2      -L-I-----
HIVSF162    -L-------
HIVCAM1     -L-I-----
HIVHEI20BL  -L-------
HIVHEI39BL  -R-------
HIVHEI3BL   -L-------
HIVHEI4BL   -V-------
HIVSF33     -L-------
HIVSWB84    -I------R
HIVHAN      -L-------
HIVD31      -V-------
HIVRF       -V-------
HIVYU2      -M-------
HIVBCSG3C   -V-I-----

CONSENSUS-D -v-------
HIVELI      -L-------
HIVNDK      -V-------
HIVZ6       -V-------

CONSENSUS-O -F---F---
HIVANT70    -F---F---
HIVMVP5180  -F---F---

SIVCPZGAB   -F-------

CONSENSUS-U -F---?---
HIVMAL      -F-------
HIVZ321     -F---F---
```

Nef CTL epitope 4

HLA-A3.1

```
CONSENSUS-B DLSHFLKEK
Epitope4    ---------

CONSENSUS-A ---F-----
HIVU455     ---F-----

CONSENSUS-B ---------
HIVLAI      ---------
HIVNL43     ---------
HIVGLNEF3   ---------
HIVGLNEF5   ---------
HIVGLNEF6   ---------
HIVBRVA     ---------
HIVMN       ---------
HIVSC       --------Q
HIVBAL1     -----F-K-
HIVJRCSF    ---------
HIVJRFL     ---------
HIVNH53     --------T
HIVOYI      ---------
HIVSF2      -I-------
HIVSF162    ---------
HIVCAM1     -I-------
HIVHEI20BL  --------N
HIVHEI28BL  ------R--
HIVHEI39BL  ---------
HIVHEI3BL   ---------
HIVHEI4BL   ---------
HIVSF33     ---------
HIVSWB84    ------R--
HIVHAN      ---------
HIVD31      ---------
HIVRF       ---------
HIVYU2      ---------
HIVBCSG3C   -I-------

CONSENSUS-D ---------
HIVELI      ---------
HIVNDK      ---------
HIVZ6       ---------

CONSENSUS-O ---F-----
HIVANT70    ---F-----
HIVMVP5180  ---F-----

SIVCPZGAB   ---------

CONSENSUS-U ---?-----
HIVMAL      ---------
HIVZ321     ---F-----
```

Nef CTL epitope 5

HLA-B8

```
CONSENSUS-B FLKEKGGL
Epitope5    --------

CONSENSUS-A --------
HIVU455     --------

CONSENSUS-B --------
HIVLAI      --------
HIVNL43     --------
HIVGLNEF3   --------
HIVGLNEF5   --------
HIVGLNEF6   --------
HIVBRVA     --------
HIVMN       --------
HIVSC       ----Q---
HIVBAL1     -F-K----
HIVJRCSF    --------
HIVJRFL     --------
HIVNH53     ----T---
HIVOYI      --------
HIVSF2      --------
HIVSF162    --------
HIVCAM1     --------
HIVHEI20BL  ----N---
HIVHEI28BL  --R-----
HIVHEI39BL  --------
HIVHEI3BL   --------
HIVHEI4BL   --------
HIVSF33     --------
HIVSWB84    --R-----
HIVHAN      --------
HIVD31      --------
HIVRF       --------
HIVYU2      --------
HIVBCSG3C   --------

CONSENSUS-D --------
HIVELI      --------
HIVNDK      --------
HIVZ6       --------

CONSENSUS-O --------
HIVANT70    --------
HIVMVP5180  --------

SIVCPZGAB   --------

CONSENSUS-U --------
HIVMAL      --------
HIVZ321     --------
```

Nef CTL epitope 6

HLA-A2, HLA-B35

```
CONSENSUS-B DlSHFLKEKGGLEGL
Epitope6    ---------------

CONSENSUS-A ---F--------D--
HIVU455     ---F--------D--

CONSENSUS-B ---------------
HIVLAI      ---------------
HIVNL43     ---------------
HIVGLNEF3   ---------------
HIVGLNEF5   ---------------
HIVGLNEF6   ---------------
HIVBRVA     ---------------
HIVMN       ------------D--
HIVSC       --------Q------
HIVBAL1     -----F-K-------
HIVJRCSF    ---------------
HIVJRFL     ---------------
HIVNH53     --------T------
HIVOYI      ---------------
HIVSF2      -I-------------
HIVSF162    ---------------
HIVCAM1     -I------------I
HIVHEI20BL  --------N------
HIVHEI28BL  ------R--------
HIVHEI39BL  ------------D-M
HIVHEI3BL   --------------I
HIVHEI4BL   ---------------
HIVSF33     ---------------
HIVSWB84    ------R--------
HIVHAN      ---------------
HIVD31      ---------------
HIVRF       ------------D--
HIVYU2      ---------------
HIVBCSG3C   -I-------------

CONSENSUS-D ---------------
HIVELI      ---------------
HIVNDK      ---------------
HIVZ6       ---------------

CONSENSUS-O ---F--------?--
HIVANT70    ---F-----------
HIVMVP5180  ---F--------D--

SIVCPZGAB   ---------------

CONSENSUS-U ---?--------D--
HIVMAL      ------------D--
HIVZ321     ---F--------D--
```

Nef CTL epitope 7

HLA-A1, HLA-B8

```
CONSENSUS-B EKGGLEGLI?AQKR
Epitope7    ---------HS-R-

CONSENSUS-A -----D---H----
HIVU455     -----D---H----

CONSENSUS-B --------------
HIVLAI      ---------H--R-
HIVNL43     ---------H--R-
HIVGLNEF3   --------VH----
HIVGLNEF5   --------TY----
HIVGLNEF6   ---------H--R-
HIVBRVA     ---------H--Q-
HIVMN       -----D---Y----
HIVSC       -Q-------TPRED
HIVBAL1     K--------H----
HIVJRCSF    ---------Y----
HIVJRFL     ---------H----
HIVNH53     -T-------F----
HIVOYI      ---------Y----
HIVSF2      ---------W--R-
HIVSF162    ---------Y----
HIVCAM1     -------I-Y--R-
HIVHEI20BL  -N------VY--R-
HIVHEI39BL  -----D-M-Y----
HIVHEI3BL   -------I-Y----
HIVHEI4BL   ---------W----
HIVSF33     --------VY----
HIVSWB84    --------VH----
HIVHAN      ---------Y-P--
HIVD31      --------VH----
HIVRF       -----D--VF----
HIVYU2      ---------H--Q-
HIVBCSG3C   ---------F--R-

CONSENSUS-D ---------W-K--
HIVELI      ---------W-K--
HIVNDK      ---------W-K--
HIVZ6       ---------W-K--

CONSENSUS-O -----?---Y-H--
HIVANT70    ---------Y-H--
HIVMVP5180  -----D---Y-H--

SIVCPZGAB   --------VY-RR-

CONSENSUS-U -----D--?--?--
HIVMAL      -----D--VW-P--
HIVZ321     -----D---Y-K--
```

Nef CTL epitope 8

HLA-A1

```
CONSENSUS-B WVYHTQGYFPDWQNYT
Epitope8    -I--------------

CONSENSUS-A -------F--------
HIVU455     -------F--------

CONSENSUS-B ----------------
HIVLAI      -I--------------
HIVNL43     -I--------------
HIVGLNEF3   ----------------
HIVGLNEF5   -I-----------KD-
HIVBRVA     ----------------
HIVMN       ----------------
HIVBAL1     ----------------
HIVJRCSF    -I--------------
HIVJRFL     ----------------
HIVNH53     -I--------------
HIVOYI      ----------------
HIVSF2      -I--------------
HIVSF162    -IH-------------
HIVCAM1     -I--------------
HIVHEI20BL  ----------------
HIVHEI28BL  ---N------------
HIVHEI39BL  ----------------
HIVHEI3BL   ----------------
HIVHEI4BL   ----------------
HIVSF33     -I--------------
HIVSWB84    ----------------
HIVHAN      ----------------
HIVD31      ----------------
HIVRF       ----------------
HIVYU2      ----------------
HIVBCSG3C   -T--------------

CONSENSUS-D ---N---I--------
HIVELI      ---N---I--------
HIVNDK      ---N---I--------
HIVZ6       ---N---I--------

CONSENSUS-O -?-?---F-----?--
HIVANT70    ---N---F--------
HIVMVP5180  -I-----F-----C--

SIVCPZGAB   -------F--------

CONSENSUS-U -------?----?---
HIVMAL      ----------------
HIVZ321     -------F----H---
```

Nef CTL epitope 9

HLA-B17

```
CONSENSUS-B YHTQQYFPDWQ
Epitope9    ----G---Q--

CONSENSUS-A -----F-----
HIVU455     -----F-----

CONSENSUS-B -----------
HIVLAI      -----------
HIVNL43     -----------
HIVGLNEF3   -----------
HIVGLNEF5   -----------
HIVBRVA     -----------
HIVMN       -----------
HIVBAL1     -----------
HIVJRCSF    -----------
HIVJRFL     -----------
HIVNH53     -----------
HIVOYI      -----------
HIVSF2      -----------
HIVSF162    H----------
HIVCAM1     -----------
HIVHEI20BL  -----------
HIVHEI28BL  -N---------
HIVHEI39BL  -----------
HIVHEI3BL   -----------
HIVHEI4BL   -----------
HIVSF33     -----------
HIVSWB84    -----------
HIVHAN      -----------
HIVD31      -----------
HIVRF       -----------
HIVYU2      -----------
HIVBCSG3C   -----------

CONSENSUS-D -N---I-----
HIVELI      -N---I-----
HIVNDK      -N---I-----
HIVZ6       -N---I-----

CONSENSUS-O -?---F-----
HIVANT70    -N---F-----
HIVMVP5180  -----F-----

SIVCPZGAB   -----F-----

CONSENSUS-U -----?----?
HIVMAL      -----------
HIVZ321     -----F----H
```

Nef CTL epitope 10

HLA-B17, HLA-B37

```
CONSENSUS-B TQGYFPDWQNYT
Epitope10   ------------

CONSENSUS-A ---F--------
HIVU455     ---F--------

CONSENSUS-B ------------
HIVLAI      ------------
HIVNL43     ------------
HIVGLNEF3   ------------
HIVGLNEF5   ---------KD-
HIVBRVA     ------------
HIVMN       ------------
HIVBAL1     ------------
HIVJRCSF    ------------
HIVJRFL     ------------
HIVNH53     ------------
HIVOYI      ------------
HIVSF2      ------------
HIVSF162    ------------
HIVCAM1     ------------
HIVHEI20BL  ------------
HIVHEI28BL  ------------
HIVHEI39BL  ------------
HIVHEI3BL   ------------
HIVHEI4BL   ------------
HIVSF33     ------------
HIVSWB84    ------------
HIVHAN      ------------
HIVD31      ------------
HIVRF       ------------
HIVYU2      ------------
HIVBCSG3C   ------------

CONSENSUS-D ---I--------
HIVELI      ---I--------
HIVNDK      ---I--------
HIVZ6       ---I--------

CONSENSUS-O ---F-----?--
HIVANT70    ---F--------
HIVMVP5180  ---F-----C--

SIVCPZGAB   ---F--------

CONSENSUS-U ---?----?---
HIVMAL      ------------
HIVZ321     ---F----H---
```

Nef CTL epitope 11

HLA-Bw62

```
CONSENSUS-B QGYFPDWQNY
Epitope11   ----------

CONSENSUS-A --F-------
HIVU455     --F-------

CONSENSUS-B ----------
HIVLAI      ----------
HIVNL43     ----------
HIVGLNEF3   ----------
HIVGLNEF5   --------KD
HIVBRVA     ----------
HIVMN       ----------
HIVBAL1     ----------
HIVJRCSF    ----------
HIVJRFL     ----------
HIVNH53     ----------
HIVOYI      ----------
HIVSF2      ----------
HIVSF162    ----------
HIVCAM1     ----------
HIVHEI20BL  ----------
HIVHEI28BL  ----------
HIVHEI39BL  ----------
HIVHEI3BL   ----------
HIVHEI4BL   ----------
HIVSF33     ----------
HIVSWB84    ----------
HIVHAN      ----------
HIVD31      ----------
HIVRF       ----------
HIVYU2      ----------
HIVBCSG3C   ----------

CONSENSUS-D --I-------
HIVELI      --I-------
HIVNDK      --I-------
HIVZ6       --I-------

CONSENSUS-O --F-----?-
HIVANT70    --F-------
HIVMVP5180  --F-----C-

SIVCPZGAB   --F-------

CONSENSUS-U --?----?--
HIVMAL      ----------
HIVZ321     --F----H--
```

Nef CTL epitope 12

HLA-B7

```
CONSENSUS-B NYTPGPG?RYPLT
Epitope12   -------------

CONSENSUS-A -------I-----
HIVU455     -------I-----

CONSENSUS-B -------------
HIVLAI      -------V-----
HIVNL43     -------V-----
HIVGLNEF3   ---S---V-F---
HIVGLNEF5   KD-----V-----
HIVGLNEF6   -------V-----
HIVBRVA     -------V-----
HIVMN       -------I-----
HIVBAL1     -------T-F---
HIVJRCSF    ---A---V-F---
HIVJRFL     -------I-F---
HIVNH53     -------I-----
HIVOYI      -------I----C
HIVSF2      -------I-----
HIVSF162    -------I-----
HIVCAM1     -------I-----
HIVHEI20BL  -------I-----
HIVHEI28BL  -------V-W---
HIVHEI39BL  -------T-----
HIVHEI3BL   -------V-----
HIVHEI4BL   -------V-F---
HIVSF33     -------V-F---
HIVSWB84    -------T-W---
HIVHAN      -------V-----
HIVD31      -------T-F---
HIVRF       -------T-----
HIVYU2      ------.-T-W---
HIVBCSG3C   -------I-----

CONSENSUS-D -------I-----
HIVELI      -------I-----
HIVNDK      -------I-----
HIVZ6       -------I-----

CONSENSUS-O ?--------F---
HIVANT70    -------T-F---
HIVMVP5180  C------P-F---

SIVCPZGAB   ---T---T-F--C

CONSENSUS-U ---------?--?
HIVMAL      -------I-F---
HIVZ321     -------T----C
```

Nef CTL epitope 13

HLA-B18

```
CONSENSUS-B RYPLTFGWCFK
Epitope13   ---------Y-

CONSENSUS-A ---------Y-
HIVU455     ---------Y-

CONSENSUS-B -----------
HIVLAI      ---------Y-
HIVNL43     ---------Y-
HIVGLNEF3   -F---------
HIVGLNEF5   -----------
HIVGLNEF6   ---------Y-
HIVBRVA     -----------
HIVMN       -----------
HIVSC       DI--C------
HIVBAL1     -F---------
HIVJRCSF    -F---------
HIVJRFL     -F---------
HIVNH53     -----------
HIVOYI      ----C------
HIVSF2      -----------
HIVSF162    -----------
HIVCAM1     -----------
HIVHEI20BL  -----------
HIVHEI28BL  -W---------
HIVHEI39BL  -----------
HIVHEI3BL   -----------
HIVHEI4BL   -F---------
HIVSF33     -F---------
HIVSWB84    -W---P-----
HIVHAN      -----------
HIVD31      -F---------
HIVRF       -----------
HIVYU2      -W---------
HIVBCSG3C   -----------

CONSENSUS-D ----------e
HIVELI      ---------YE
HIVNDK      ----------Q
HIVZ6       ----------E

CONSENSUS-O -F------L--
HIVANT70    -F------L--
HIVMVP5180  -F------L--

SIVCPZGAB   -F--C------

CONSENSUS-U -?--?------
HIVMAL      -F---------
HIVZ321     ----C------
```

Nef CTL epitope 14

HLA-B18, HLA-A1, HLA-B8

```
CONSENSUS-B G?RYPLTFGWCFKLVP
Epitope14   -V---------Y----

CONSENSUS-A -I---------Y----
HIVU455     -I---------Y----

CONSENSUS-B ---------------
HIVLAI      -V---------Y----
HIVNL43     -V---------Y----
HIVGLNEF3   -V-F------------
HIVGLNEF5   -V--------------
HIVGLNEF6   -V---------Y----
HIVBRVA     -V--------------
HIVMN       -I--------------
HIVSC       -SDI--C---------
HIVBAL1     -T-F------------
HIVJRCSF    -V-F------------
HIVJRFL     -I-F------------
HIVNH53     -I--------------
HIVOYI      -I----C---------
HIVSF2      -I--------------
HIVSF162    -I--------------
HIVCAM1     -I--------------
HIVHEI20BL  -I--------------
HIVHEI28BL  -V-W------------
HIVHEI39BL  -T--------------
HIVHEI3BL   -V--------------
HIVHEI4BL   -V-F------------
HIVSF33     -V-F------------
HIVSWB84    -T-W---P--------
HIVHAN      -V--------------
HIVD31      -T-F------------
HIVRF       -T--------------
HIVYU2      -T-W------------
HIVBCSG3C   -I--------------

CONSENSUS-D -I----------e---
HIVELI      -I---------YE---
HIVNDK      -I----------Q---
HIVZ6       -I----------E---

CONSENSUS-O ---F------L-----
HIVANT70    -T-F------L-----
HIVMVP5180  -P-F------L-----

SIVCPZGAB   -T-F--C---------

CONSENSUS-U ---?--?---------
HIVMAL      -I-F------------
HIVZ321     -T----C---------
```

Nef CTL epitope 15

HLA-B35

```
CONSENSUS-B DSRLAFHH
Epitope15   --------

CONSENSUS-A --T--LK-
HIVU455     --T--LK-

CONSENSUS-B --------
HIVLAI      --------
HIVNL43     --------
HIVGLNEF3   --------
HIVGLNEF5   --------
HIVGLNEF6   --------
HIVBRVA     --------
HIVSC       -N------
HIVBAL1     --S-----
HIVJRCSF    --K--L--
HIVJRFL     --K-----
HIVNH53     --H-----
HIVOYI      ------R-
HIVSF2      --K-----
HIVSF162    --------
HIVCAM1     --------
HIVHEI28BL  -----Y--
HIVHEI39BL  --Q-----
HIVHEI4BL   --------
HIVSF33     --H---R-
HIVSWB84    --S-----
HIVHAN      --H-----
HIVD31      ------K-
HIVRF       --------
HIVYU2      --------
HIVBCSG3C   --------

CONSENSUS-D N-----E-
HIVELI      N-----E-
HIVNDK      N----LE-
HIVZ6       N-----E-

CONSENSUS-O -RS-G?T-
HIVANT70    -RS-GNT-
HIVMVP5180  -RS-GLT-

SIVCPZGAB   -----LR-

CONSENSUS-U --S--??-
HIVMAL      --S--LR-
HIVZ321     --S--RK-
```

Nef CTL epitope 16

HLA-B51

```
CONSENSUS-B DSRLAFHHM
Epitope16   --------V

CONSENSUS-A --T--LK-R
HIVU455     --T--LK-R

CONSENSUS-B ---------
HIVLAI      --------V
HIVNL43     --------V
HIVGLNEF3   --------V
HIVGLNEF5   ---------
HIVGLNEF6   --------V
HIVBRVA     ---------
HIVSC       -N-------
HIVBAL1     --S-----V
HIVJRCSF    --K--L--V
HIVJRFL     --K-----V
HIVNH53     --H------
HIVOYI      ------R--
HIVSF2      --K------
HIVSF162    ---------
HIVCAM1     ---------
HIVHEI28BL  -----Y---
HIVHEI39BL  --Q-----V
HIVHEI3BL   --x-----V
HIVHEI4BL   ---------
HIVSF33     --H---R--
HIVSWB84    --S-----K
HIVHAN      --H-----K
HIVD31      ------K--
HIVRF       --------V
HIVYU2      --------V
HIVBCSG3C   ---------

CONSENSUS-D N-----E-K
HIVELI      N-----E-K
HIVNDK      N----LE-K
HIVZ6       N-----E-K

CONSENSUS-O -RS-G?T-?
HIVANT70    -RS-GNT-V
HIVMVP5180  -RS-GLT-I

SIVCPZGAB   -----LR-I

CONSENSUS-U --S--??-?
HIVMAL      --S--LR-R
HIVZ321     --S--RK-L
```

Nef CTL epitope 17

HLA-B52

```
CONSENSUS-B RLAFHHMAR
Epitope17   ------V--

CONSENSUS-A T--LK-R-Y
HIVU455     T--LK-R-Y

CONSENSUS-B ---------
HIVLAI      ------V--
HIVNL43     ------V--
HIVGLNEF3   ------V--
HIVGLNEF5   ---------
HIVGLNEF6   ------V--
HIVBRVA     ---------
HIVSC       ---------
HIVBAL1     S-----V--
HIVJRCSF    K--L--V--
HIVJRFL     K-----V--
HIVNH53     H--------
HIVOYI      ----R----
HIVSF2      K--------
HIVSF162    ---------
HIVCAM1     ---------
HIVHEI28BL  ---Y-----
HIVHEI39BL  Q-----V--
HIVHEI4BL   ---------
HIVSF33     H---R----
HIVSWB84    S-----K--
HIVHAN      H-----K--
HIVD31      ----K----
HIVRF       ------V--
HIVYU2      ------V--
HIVBCSG3C   ---------

CONSENSUS-D ----E-K--
HIVELI      ----E-K--
HIVNDK      ---LE-K--
HIVZ6       ----E-K--

CONSENSUS-O S-G?T-?-?
HIVANT70    S-GNT-V-M
HIVMVP5180  S-GLT-I-L

SIVCPZGAB   ---LR-I--

CONSENSUS-U S--??-?--
HIVMAL      S--LR-R--
HIVZ321     S--RK-L--
```

Nef CTL epitope 18

HLA-B52, HLA-A2.1, HLA-A2.2, HLA-A2.4

```
CONSENSUS-B AFHHMAREL
Epitope18   ----V----

CONSENSUS-A -LK-R-Y--
HIVU455     -LK-R-Y--

CONSENSUS-B ---------
HIVLAI      ----V----
HIVNL43     ----V----
HIVGLNEF3   ----V----
HIVGLNEF5   --------K
HIVGLNEF6   ----V----
HIVBRVA     ---------
HIVSC       -------D-
HIVBAL1     ----V----
HIVJRCSF    -L--V----
HIVJRFL     ----V----
HIVNH53     ---------
HIVOYI      --R-----V
HIVSF2      ---------
HIVSF162    ---------
HIVCAM1     --------K
HIVHEI28BL  -Y-------
HIVHEI39BL  ----V----
HIVHEI3BL   ----V----
HIVHEI4BL   ---------
HIVSF33     --R------
HIVSWB84    ----K----
HIVHAN      ----K----
HIVD31      --K------
HIVRF       ----V---K
HIVYU2      ----V----
HIVBCSG3C   ---------

CONSENSUS-D --E-K---m
HIVELI      --E-K---M
HIVNDK      -LE-K----
HIVZ6       --E-K---M

CONSENSUS-O G?T-?-???
HIVANT70    GNT-V-MIT
HIVMVP5180  GLT-I-LQK

SIVCPZGAB   -LR-I---Q

CONSENSUS-U -??-?---?
HIVMAL      -LR-R---Q
HIVZ321     -RK-L---M
```