CTL RT Epitopes

Location	Epitope Comments	Antigen	Species(HLA)	Reference
RT(160-184 HXB2)	IETVPVKLKPGMDGPKVKQWPLTEE	HIV-1 infection	human(B8)	[Walker (1989)]
	One of five epitopes defined for RT specific CTL clones			
RT(185-193 LAI)	GPKVKQWPL		human(B8)	[Sutton (1993)]
	Predicted epitope based on B8 binding motifs, from larger peptide IETVPVKLKPGMDGPKVKQWPLTEE			
RT(205-219 BRU)	CTEMEKEGKISKIGP	recRT injection	murine($H2^k$)	[De Groot (1991)]
	Murine and human helper and CTL epitope			
RT(205-219)	CTEMEKEGKISKIGP	HIV-1 infection	human(broad)	[Hosmalin (1990)]
	Murine and human helper and CTL epitope			
RT(308-320)	WKGSPAIFQSSMT		human(B7)	[Brander & Walker(1995)]
	Unpublished, B. Wilkens			
RT(325-349 PV22)	AIFQSSMTKILEPFRKQNPDIVIYQ	HIV-1 infection	human(A11)	[Jassoy (1993)]
	HIV-1 specific CTLs release γ-IFN, and α- and β-TNF			
RT(325-349)	AIFQSSMTKILEPFRKQNPDIVIYQ	HIV-1 infection	human(A11)	[Price (1995)]
	Study of cytokines released by HIV-1 specific activated CTL			
RT(325-333)	AIFQSSMTK		human(A3.1)	[Brander & Walker(1995)]
	Unpublished, B. Wilkens			
RT(325-333 LAI)	AIFQSSMTK		human(A11)	[Zhang (1993)]
	Exploration of A11 binding motif; this peptide is mislabeled as a gag peptide in Zhang et al.			
RT(325-333 LAI)	AIFQSSMTK		human(A11)	[McMichael & Walker(1994)]
	Review of HIV CTL epitopes; defined as minimal peptide by titration curve			
RT(325-333 LAI)	AIFQSSMTK		human(A33)	[K. Ariyoshi, unpublished]
	Defined as minimal peptide by titration curve, S. Rowland-Jones, per. comm.			
RT(342-366 LAI)	NPDIVIYQYMDDLYVGSDLEIGQHR	HIV-1 infection	human(A11)	[Walker (1989)]
	One of five epitopes defined for RT specific CTL clones			
RT(342-350 LAI)	HPDIVIYQY		human(B35)	[McMichael & Walker(1994)]
	Review of HIV CTL epitopes; defined as minimal peptide by titration curve			

CTL RT Epitopes

Location	Epitope Comments	Antigen	Species(HLA)	Reference
RT(329-337)	HPDIVIYQY	HIV infection	human(B35)	[Rowland-Jones (1995)]
	NPDIVIYQY preferred sequence for some CTL clones, HIV-2 NPDVILIQY is also recognized			
RT(346-354 LAI)	VIYQYMDDL		human(A2)	[Brander & Walker(1995)]
	Unpublished, T. Harrer; defined as minimal peptide by titration curve [McMichael & Walker(1994)]			
RT(359-383 HXB2)	DLEIGQHRTKIEELRQHLLRWGLTT	HIV-1 infection	human(Bw60)	[Walker (1989)]
	One of five epitopes defined for RT specific CTL clones			
RT(461-485 HXB2)	PLTEEAELELAENREILKEPVHGVY	HIV-1 infection	human(A2)	[Walker (1989)]
	One of five epitopes defined for RT specific CTL clones			
RT(476-484)	ILKEPVHGV	HIV-1 infection	human(A2)	[Tsomides (1994)]
	CTL clones recognize naturally processed peptide; peptide abundance corresponded to level of CTL killing			
RT(476-485 LAI)	ILKEPVHGVY		human(Bw62)	[McMichael & Walker(1994)]
	Review of HIV CTL epitopes; defined as minimal peptide by titration curve			
RT(476-484 LAI)	ILKEPVHGV	HIV-1 infection	human(A2)	[Tsomides (1991)]
	Precise identification of the nonamer that binds to A2			
RT(476-484 LAI)	ILKEPVHGV		human(A2)	[Connan (1994)]
	Promotes assembly of HLA-A2 molecules in T2 cell lysates			
RT(510-518)	ILKEPVHGV		human(A2)	[Parker (1992)]
	Studied in the context of HLA A2 peptide binding			
RT(495-515 LAI)	EIQKQGQGQWTYQIYQEPFKNLKTG	HIV-1 infection	human(A11)	[Walker (1989)]
	One of five epitopes defined for RT specific CTL clones			
RT(507-519 LAI)	QIYQEPFKNLKTG		human(A11)	[Johnson & Walker(1994)]
	This epitope was listed in a review			
RT(507-516)	QIYQEPFKNLK	HIV-1 infection	human(?)	[Price (1995)]
	Study of cytokines released by HIV-1 specific activated CTL			

CTL RT Epitopes

Location	Epitope	Antigen	Species(HLA)	Reference
	Comments			
RT(648-672 PV22)	AIYLALQDSGLEVNIVTDSQYALGI	HIV-1 infection	human(B14)	[Kalams (1994)]
	A CTL response used to study gene usage in HLA B14 response			
RT(648-672)	AIYLALQDSGLEVNIVTDSQYALGI	HIV-1 infection	human(?)	[Price (1995)]
	Study of cytokines released by HIV-1 specific activated CTL			
RT(648-672)	ALQDSGLEVVTDSQYALGI		human(B14)	[Brander & Walker(1995)]
	Unpublished, S. Kalams			
RT(640-648 HXB2R)	ALQDSGLEV		human(A2)	[Brander (1995)]
	Epitope studied in the context of inclusion in a synthetic vaccine			
RT(663-672 LAI)	VTDSQYALGI		human(B14)	[Brander & Walker(1995)]
	Unpublished, P. Johnson; defined as minimal peptide by titration curve [McMichael & Walker(1994)]			
RT(956-964 HXB2R)	LLWKGEGAV		human(A2)	[Parker (1992), Parker (1994)]
	Studied in the context of HLA A2 peptide binding			
RT(956-964 HXB2R)	LLWKGEGAV		human(A2)	[Brander (1995)]
	Epitope studied in the context of inclusion in a synthetic vaccine			

RT CTL-EPITOPES

```
1     FFREDLVFPKGKAREFSSEQTRTNSPTRRELQVQGRDNNSLSEAGANRQG    50

51    AVSFNFPQITLWQRPLVTIKIEGQLKEALLDTGADDTVLEDMNLPGKWKP   100

101   KMIGGIGGFIKVRQYDQVPIEICGHKAIGTVLVGPTPVNIIGRNLLTQIG   150

151   CTLNFPISPIETVPVKLKPGMDGPKVKQWPLTEEKIKALVEICTEMEKEG   200

201   KISKIGPENPYNTPVFAIKKKDSTKWRKLVDFRELNKRTQDFWEVQLGIP   250

251   HPSGLKKKKSVTVLDVGDAYFSVPLDEDFRKYTAFTIPSINNETPGIRYQ   300

301   YNVLPQGWKGSPAIFQSSMTKILEPFRKQNPDIVIYQYMDDLYVGSDLEI   350

351   GQHRTKIEELRQHLLRWGFTTPDKKHQKDPPFLWMGYELHPDKWTVQPIK   400

401   LPEKESWTVNDIQKLVGKLNWASQIYAGIKVKQLCKLLRGTKALTEIIPI   450

451   TEEAELELAENREILKEPVHGVYYDPSKDLIAELQKQGQGQWTYQIYQEP   500

501   FKNLKTGKYARVRGAHTNDVKQLTEAVQKITTESIVIWGKTPKFKLPIQK   550

551   ETWETWWTEYWQATWIPEWEFVNTPPLVKLWYQLEKEPIVGAETFYVDGA   600

601   ANKETKLGKAGYVTNRGRQRVVSLTDTTNQKTELQAIHLALQDSGLEVNI   650

651   VTDSQYALGIIQAQPDQSESELVSQIIEQLIKKEKVYLAWVPAHKGIGGN   700

701   EQVDKLVSSGIRKVLFLDGIDKAQEEHEKYHSNWRAMASDFNLPPVVAKE   750

751   IVASCDKCQLKGEAMHGQVDCSPGIWQLDCTHLEGKIILVAVHVASGYIE   800

801   AEVIPAETGQETAYFILKLAGRWPVKTIHTDNGSNFTSTTVKAACWWAGI   850

851   KQEFGIPYNPQSQGVIESMNKELKKIIGQVRDQAEHLKTAVQMAVFIHNF   900
```

RT CTL-EPITOPES continued

```
901    KRKGGIGGYSAGERIIDIIATDIQTQQLQKQITKIQNFRVYYRDSRDPLW    950
              HLA-A2 12
951    KGPAKLLWKGEGAVVIQDNSDIKVVPRRKAKIIRDYGKQMAGDDCVASRQ   1000

1001   DED                                                  1003
```

Epitopes and protein variability:

This plot shows a score that is a measure of variability for each position in the RT 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 gp41 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 gp41 protein alignment, publically available at the Human Retroviruses and AIDS database, totaling 21 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 RT protein is shown below. The numbering corresponds to the numbering in the variability plot for the RT protein.

RT CONSENSUS:

FFREDLAFPQGKAREF----------SSEQTRANSPTRRELQVWGRDN 50

NSLS----EAGADRQGTVSFSFPQITLWQRPLVTIKIGGQLKEALLDTGA 100

DDTVLEEMNLPGRWKPKMIGGIGGFIKVRQYDQILIEICGHKAIGTVLVG 150

PTPVNIIGRNLLTQIGCTLNFPISPIETVPVKLKPGMDGPKVKQWPLTEE 200

KIKALVEICTEMEKEGKISKIGPENPYNTPVFAIKKKDSTKWRKLVDFRE 250

LNKRTQDFWEVQLGIPHPAGLKKKKSVTVLDVGDAYFSVPLDKDFRKYTA 300

FTIPSINNETPGIRYQYNVLPQGWKGSPAIFQSSMTKILEPFRKQNPDIV 350

IYQYMDDLYVGSDLEIGQHRTKIEELRQHLLRWGFTTPDKKHQKEPPFLW 400

MGYELHPDKWTVQPIVLPEKDSWTVNDIQKLVGKLNWASQIYAGIKVKQL 450

CKLLRGTKALTEVIPLTEEAELELAENREILKEPVHGVYYDPSKDLIAEI 500

QKQGQGQWTYQIYQEPFKNLKTGKYARMRGAHTNDVKQLTEAVQKIATES 550

IVIWGKTPKFKLPIQKETWEAWWTEYWQATWIPEWEFVNTPPLVKLWYQL 600

EKEPIVGAETFYVDGAANRETKLGKAGYVTDRGRQKVVSLTDTTNQKTEL 650

QAIHLALQDSGLEVNIVTDSQYALGIIQAQPDKSESELVSQIIEQLIKKE 700

KVYLAWVPAHKGIGGNEQVDKLVSAGIRKVLFLDGIDKAQEEHEKYHSNW 750

RAMASDFNLPPVVAKEIVASCDKCQLKGEAMHGQVDCSPGIWQLDCTHLE 800

GKVILVAVHVASGYIEAEVIPAETGQETAYFLLKLAGRWPVKTIHTDNGS 850

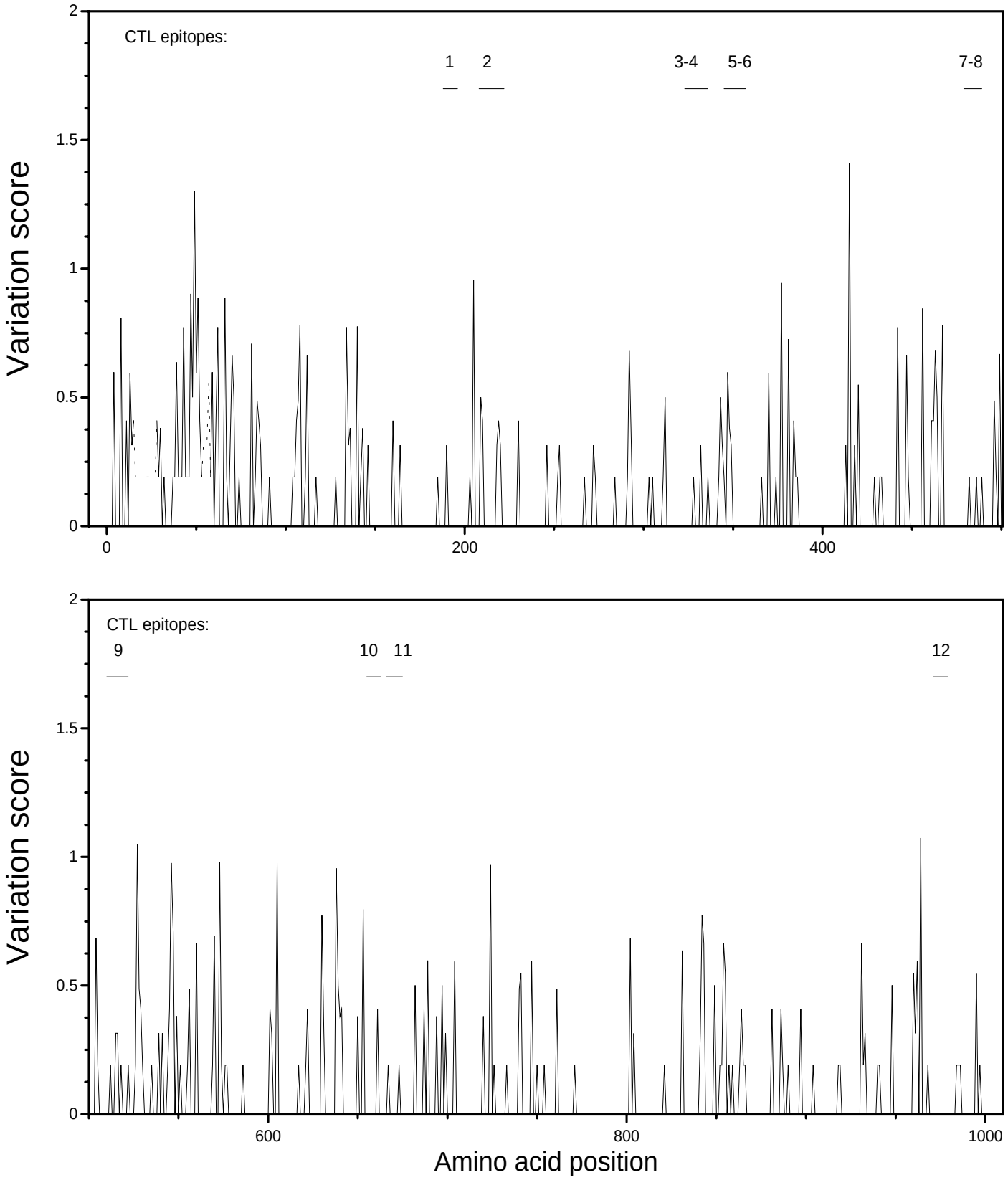
NFTSTTVKAACWWAGIKQEFGIPYNPQSQGVVESMNKELKKIIGQVRDQA 900

EHLKTAVQMAVFIHNFKRKGGIGGYSAGERIVDIIATDIQTKELQKQITK 950

IQNFRVYYRDSRDPLWKGPAKLLWKGEGAVVIQDNSDIKVVPRRKAKIIR 1000

DY

Variation in positions in the RT protein



Pol CTL epitope 1

HLA-B8

```
CONSENSUS-B GPKVKQWPL
Epitope1    ---------

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

CONSENSUS-B ---------
HIVLAI      ---------
HIVHXB2R    ---------
HIVMN       ---------
HIVJRCSF    ---------
HIVJRFL     ---------
HIVOYI      ---------
HIVSF2      ---------
HIVNY5CG    ---------
HIVNL43     ---------
HIVCAM1     ---------
HIVHAN      ---------
HIVD31      ---------
HIVRF       ---------
HIVYU2      ---------
HIVBCSG3C   ---------

CONSENSUS.D ---------
HIVELI      ---------
HIVZ2Z6     ---------
HIVNDK      ---------

CONSENSUS-O ---------
HIVMAL      --R------
HIVANT70    ---------
HIVMVP5180  ---------

SIVCPZGAB   ---------
SIVCPZANT   --R------
```

Pol CTL epitope 2

HLA-broad, murine H2K

```
CONSENSUS-B CTEMEKEGKISKIGP
Epitope2    ---------------

CONSENSUS.A -N-------------
HIVU455     -N-------------

CONSENSUS-B ---------------
HIVLAI      ---------------
HIVHXB2R    ---------------
HIVMN       ---------------
HIVJRCSF    ---------------
HIVJRFL     ---------------
HIVOYI      ------------V--
HIVSF2      ---------------
HIVNY5CG    ---------------
HIVNL43     ---------------
HIVCAM1     ---------------
HIVHAN      ---------------
HIVD31      ---------------
HIVRF       ---------------
HIVYU2      ---------------
HIVBCSG3C   ---------------

CONSENSUS.D -----------R---
HIVELI      --D--------R---
HIVZ2Z6     -----------RV--
HIVNDK      -----------R---

CONSENSUS-O -q---q-----r---
HIVMAL      -KD-------L----
HIVANT70    -Q---Q-----R---
HIVMVP5180  -Q---Q-----R---

SIVCPZGAB   -Q-------------
SIVCPZANT   -DKL-A-N---R---
```

Pol CTL epitope 3

HLA-B7

```
CONSENSUS-B WKGSPAIFQSSMT
Epitope3    -------------

CONSENSUS.A -----S-------
HIVU455     -----S-------

CONSENSUS-B -------------
HIVLAI      -------------
HIVHXB2R    -------------
HIVMN       -------------
HIVJRCSF    -------------
HIVJRFL     -------------
HIVOYI      -------------
HIVSF2      -------------
HIVNY5CG    ---------C---
HIVNL43     ---------C---
HIVCAM1     -------------
HIVHAN      -------------
HIVD31      -------------
HIVRF       -------------
HIVYU2      -------------
HIVBCSG3C   -------------

CONSENSUS.D -------------
HIVELI      -------------
HIVZ2Z6     -------------
HIVNDK      -------------

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

SIVCPZGAB   -----S-------
SIVCPZANT   ---------A---
```

Pol CTL epitope 4

HLA-A11, HLA-A3.1, HLA-A33

```
CONSENSUS-B AIFQSSMTK
Epitope4    ---------

CONSENSUS.A S--------
HIVU455     S--------

CONSENSUS-B ---------
HIVLAI      ---------
HIVHXB2R    ---------
HIVMN       ---------
HIVJRCSF    ---------
HIVJRFL     ---------
HIVOYI      ---------
HIVSF2      ---------
HIVNY5CG    ----C----
HIVNL43     ----C----
HIVCAM1     ---------
HIVHAN      ---------
HIVD31      ---------
HIVRF       ---------
HIVYU2      --------T
HIVBCSG3C   ---------

CONSENSUS.D ---------
HIVELI      ---------
HIVZ2Z6     ---------
HIVNDK      ---------

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

SIVCPZGAB   S--------
SIVCPZANT   ----A----
```

Pol CTL epitope 5

HLA-B35

```
CONSENSUS-B NPDIVIYQY
Epitope5    ---------
Alt form    H--------

CONSENSUS.A H--------
HIVU455     H--------

CONSENSUS-B ---------
HIVLAI      ---------
HIVHXB2R    ---------
HIVMN       ---------
HIVJRCSF    ----I----
HIVJRFL     ----I----
HIVOYI      ---------
HIVSF2      ---------
HIVNY5CG    ---------
HIVNL43     ---------
HIVCAM1     ---------
HIVHAN      ---------
HIVD31      ---------
HIVRF       --E------
HIVYU2      ---L-----
HIVBCSG3C   ---------

CONSENSUS.D --E------
HIVELI      --EM-----
HIVZ2Z6     --E------
HIVNDK      --E------

CONSENSUS-O --E?e----
HIVMAL      --E------
HIVANT70    --ELE-C--
HIVMVP5180  --EVE----

SIVCPZGAB   ----T----
SIVCPZANT   Y-AVE----
```

Pol CTL epitope 6

HLA-A2

```
CONSENSUS-B VIYQYMDDL
Epitope6    ---------

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

CONSENSUS-B ---------
HIVLAI      ---------
HIVHXB2R    ---------
HIVMN       ---------
HIVJRCSF    I--------
HIVJRFL     I--------
HIVOYI      ---------
HIVSF2      ---------
HIVNY5CG    ---------
HIVNL43     ---------
HIVCAM1     ---------
HIVHAN      ---------
HIVD31      ---------
HIVRF       ---------
HIVYU2      ---------
HIVBCSG3C   ---------

CONSENSUS.D ---------
HIVELI      ---------
HIVZ2Z6     ---------
HIVNDK      ---------

CONSENSUS-O e--------
HIVMAL      ---------
HIVANT70    E-C------
HIVMVP5180  E----I---

SIVCPZGAB   T--------
SIVCPZANT   E--------
```

Pol CTL epitope 7

HLA-A2

```
CONSENSUS-B ILKEPVHGV
Epitope7    ---------

CONSENSUS.A ---D-----
HIVU455     ---D-----

CONSENSUS-B ---------
HIVLAI      ---------
HIVHXB2R    ---------
HIVMN       ---------
HIVJRCSF    ---------
HIVJRFL     ---------
HIVOYI      ---------
HIVSF2      -------E-
HIVNY5CG    ---------
HIVNL43     ---------
HIVCAM1     ---------
HIVHAN      ---------
HIVD31      ---------
HIVRF       ---------
HIVYU2      ---------
HIVBCSG3C   ---------

CONSENSUS.D ---------
HIVELI      ---------
HIVZ2Z6     ---------
HIVNDK      ---------

CONSENSUS-O ?--------
HIVMAL      ---------
HIVANT70    R--Q-----
HIVMVP5180  K--------

SIVCPZGAB   -VST-----
```

Pol CTL epitope 8

HLA-Bw62

```
CONSENSUS-B ILKEPVHGVY
Epitope8    ----------

CONSENSUS.A ---D------
HIVU455     ---D------

CONSENSUS-B ----------
HIVLAI      ----------
HIVHXB2R    ----------
HIVMN       ----------
HIVJRCSF    ----------
HIVJRFL     ----------
HIVOYI      ----------
HIVSF2      -------E--
HIVNY5CG    ----------
HIVNL43     ----------
HIVCAM1     ----------
HIVHAN      ----------
HIVD31      ----------
HIVRF       ----------
HIVYU2      ----------
HIVBCSG3C   ----------

CONSENSUS.D ----------
HIVELI      ----------
HIVZ2Z6     ----------
HIVNDK      ----------

CONSENSUS-O ?---------
HIVMAL      ----------
HIVANT70    R--Q------
HIVMVP5180  K---------

SIVCPZGAB   -VST------
```

Pol CTL epitope 9

HLA-A11

```
CONSENSUS-B QIYQEPFKNLKTG
Epitope9    -------------

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

CONSENSUS-B -------------
HIVLAI      -------------
HIVHXB2R    -------------
HIVMN       -------------
HIVJRCSF    --F----------
HIVJRFL     --------I----
HIVOYI      -------------
HIVSF2      -------------
HIVNY5CG    -------------
HIVNL43     -------------
HIVCAM1     -------------
HIVHAN      -------------
HIVD31      -------------
HIVRF       -------------
HIVYU2      -------------
HIVBCSG3C   ------------A

CONSENSUS.D -------------
HIVELI      -------------
HIVZ2Z6     -------------
HIVNDK      -------------

CONSENSUS-O -----eh------
HIVMAL      -----QY------
HIVANT70    -----EH------
HIVMVP5180  -V--DEH------

SIVCPZGAB   --F---H------
SIVCPZANT   ----NEG-L--A-
```

Pol CTL epitope 10

HLA-A2

```
CONSENSUS-B ALQDSGLEV
Epitope10   ---------

CONSENSUS.A ------S--
HIVU455     ------S--

CONSENSUS-B ---------
HIVLAI      ---------
HIVHXB2R    ---------
HIVMN       ---------
HIVJRCSF    ---------
HIVJRFL     ---------
HIVOYI      ---------
HIVSF2      ---------
HIVNY5CG    ---------
HIVNL43     ---------
HIVCAM1     ---------
HIVHAN      ---------
HIVD31      ---------
HIVRF       ---------
HIVYU2      ---------
HIVBCSG3C   ---------

CONSENSUS.D ---------
HIVELI      ---------
HIVZ2Z6     ---------
HIVNDK      ---------

CONSENSUS-O -----ke?-
HIVMAL      ------S--
HIVANT70    -----KET-
HIVMVP5180  -----KEQ-

SIVCPZGAB   -----DQQ-
SIVCPZANT   --E--TGP-
```

Pol CTL epitope 11

HLA-B14

```
CONSENSUS-B VTDSQYALGI
Epitope11   ----------

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

CONSENSUS-B ----------
HIVLAI      ----------
HIVHXB2R    ----------
HIVMN       ----------
HIVJRCSF    ----------
HIVJRFL     ----------
HIVOYI      ----------
HIVSF2      ----------
HIVNY5CG    ----------
HIVNL43     ----------
HIVCAM1     ----------
HIVHAN      ----------
HIVD31      -S-----I--
HIVRF       ----------
HIVYU2      ----------
HIVBCSG3C   ----------

CONSENSUS.D ----------
HIVELI      ----------
HIVZ2Z6     ----------
HIVNDK      ----------

CONSENSUS-O ----------
HIVMAL      ----------
HIVANT70    ---------V
HIVMVP5180  ------V---

SIVCPZGAB   ------V---
SIVCPZANT   ---------V
```

Pol CTL epitope 12

HLA-A2

```
CONSENSUS-B LLWKGEGAV
Epitope12   ---------

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

CONSENSUS-B ---------
HIVLAI      ---------
HIVHXB2R    ---------
HIVMN       ---------
HIVJRCSF    ---------
HIVJRFL     ---------
HIVOYI      ---------
HIVSF2      ---------
HIVNY5CG    ---------
HIVNL43     ---------
HIVCAM1     ---------
HIVHAN      ---------
HIVD31      ---------
HIVRF       ---------
HIVYU2      ---------
HIVBCSG3C   ---------

CONSENSUS.D ---------
HIVELI      ---------
HIVZ2Z6     ---------
HIVNDK      ---------

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

SIVCPZGAB   ---------
SIVCPZANT   ---------
```