

Table 2: **p24**

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(132-140 SF2)	p24(1-6)	NYPIVQNL	HIV-1 infection	human(A*2402)	[IkedaMoore97]
	NOTES:				
					<ul style="list-style-type: none"> • The epitope starts in p17 and ends in p24 • Defined using reverse immunogenetics – 59 HLA-A-A*2402 binding peptides were predicted by searching for A*2402 anchors in HIV proteins, (Tyr at 2, and Phe, Leu or Ile at the C term) – 53 of the 59 peptides bound A*2402 • This peptide induced CTL in 1/4 HIV-1+ people tested • NYPIVQNL bound to A*2402 with medium strength, the epitope can be processed in a vaccinia construct and presented – two specific CTL clones were obtained
p24(140-152 IIIB)	p24(8-20)	GQMVHQAISPRRTL	HIV-1 infection	human(Cw3)	[Litaua91]
	NOTES:				<ul style="list-style-type: none"> • Fine specificity of human Cw3 restricted Gag CTL epitope
p24(140-159)	p24(8-27)	GQMVHQAISPRRLNAWVKVV	HIV-1 infection	human(B14)	[Musey97]
	NOTES:				<ul style="list-style-type: none"> • CTL specific for this epitope were found in the peripheral blood but not cervical mucosa of one donor
p24(143-164 BH10)	p24(11-32)	VHQAISPRRLNAWVKVV- EEKAF	HIV-1 infection	human(Bw57)	[Johnson91]
	NOTES:				<ul style="list-style-type: none"> • Gag CTL response studied in three individuals
p24(145-155 LAI)	p24(13-23)	QAISPRRLNAW		human(A5)	[KuranePerCom]
p24(147-155 IIIB)	p24(15-23)	ISPRRLNAW	HIV-1 infection	human(B*5801, B*57)	[Goulder96]
	NOTES:				<ul style="list-style-type: none"> • Five slow progressors made a response to this epitope, and in two it was the dominant response • Peptide defined on the basis of B*5801 binding motif, yet not cross-restricted except at high concentrations

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(148-156)	p24(16-24)	SPRTLNAWV		human(B7)	[Brander'97]
	NOTES:				
					<ul style="list-style-type: none"> Optimal peptide mapped by titration, per. comm. from D. Lewinson to C. Brander and B. Walker
p24(151-159)	p24(19-27)	TLNAWVKVV	HIV-1 infection	human(A2)	[Parker'92, Parker'94]
	NOTES:				
					<ul style="list-style-type: none"> Study of sequence motifs preferred for peptide binding to class I HLA-A2
p24(153-174 BH10)	p24(21-42)	NAWVKVVEEKAFSPEVI- PMFSA	HIV-1 infection	human(Bw57)	[Johnson'91]
	NOTES:				
					<ul style="list-style-type: none"> Gag CTL response studied in three individuals
p24(153-172 SF2)	p24(21-40)	NAWVKVVEEKAFSPEVIPMF	HIV-1 infection	human	[Lieberman'97]
	NOTES:				
					<ul style="list-style-type: none"> Of 25 patients, most had CTL specific for more than 1 HIV-1 protein 12 subjects had CTL that could recognize vaccinia expressed LAI gag One of these 12 had CTL response to this peptide The responding subject was HLA-A2, B21
p24(153-172 SF2)	p24(21-40)	NAWVKVVEEKAFSPEVIPMF	HIV-1 Pr55gag VLP with anchored gp120 or V3+CD4 linear domains	Macaca mulatta	[Wagner'98]
	NOTES:				
					<ul style="list-style-type: none"> A VLP is a non-infectious virus-like particle self-assembled from HIV Pr55 gag – macaques were immunized with VLPs bound to either gp120 or V3+CD4 linear domains – gag and env specific CTL were stimulated in each case, and Ab response to gag and gp120 and was elicited, but the gp120 neutralizing response occurred only with whole gp120, not V3+CD4 – despite the CTL and Ab response, immunized macaques were infected by intravenous challenge with SHIV chimeric challenge stock [Wagner'98] CTL specific for this epitope could be found both before and after SHIV challenge
p24(160-179)	p24(28-47)	EEKAFSPEVIPMFALSSEGA	HIV-1 infection	human(B27)	[Musey'97]
	NOTES:				
					<ul style="list-style-type: none"> Cervical and peripheral blood derived CTL clones from an HIV infected woman recognized this epitope

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(162-172 LAI)	p24(30-40) NOTES:	KAFSPEVIPMF	HIV-1 infection	human(B*57)	[Goulder'96]
			<ul style="list-style-type: none"> This peptide was recognized by CTL from five slow progressors Peptide defined on the basis of B*5801 binding motif, yet not cross-restricted except at high concentrations This epitope is highly conserved 		
p24(163-182)	p24(31-50) NOTES:	AFSPEVIPMFSALSEGATPQ	HIV infection	human	[Lieberman'95]
			<ul style="list-style-type: none"> HIV-specific CTL lines developed by <i>ex vivo</i> stimulation with peptide 		
p24(163-182 SF2)	p24(31-50) NOTES:	AFSPEVIPMFSALSEGATPQ	HIV infection	human	[Lieberman'97]
			<ul style="list-style-type: none"> Of 25 patients, most had CTL specific for more than 1 HIV-1 protein 12 subjects had CTL that could recognize vaccinia expressed LAI gag One of these 12 had CTL response to this peptide The responding subject was HLA-A2, B21 		
p24(163-182 SF2)	p24(31-50) NOTES:	AFSPEVIPMFSALSEGATPQ	HIV-1 infection	human	[Lieberman'97b]
			<ul style="list-style-type: none"> CTL expanded <i>ex vivo</i> were later infused into HIV-1 infected patients 		
p24(167-175 LAI)	p24(35-43) NOTES:	EVIPMFSAL		human(A26)	[Goulder'96b]
			<ul style="list-style-type: none"> Identified as optimal epitope within Gag sequence AFSPEVIPMFSALSEGATPQ Relatively conserved epitope within B clade and in other clades Suspected binding motif for HLA-A26 includes T or V anchor at position 2, negative charge at position 1 		
p24(168-175 LAI)	p24(36-43)	VIPMFSAL		human(Cw*0102)	[Goulder'97f]

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(169-184 LAI)	p24(37-52) NOTES:	IPMFSALSEGATPQDL	HIV-1 infection	human(B12(44))	[Buseyne93]
			• Clustering of Gag p24 CTL epitopes recognized in 29 HIV infected people		
p24(173-192 SF2)	p24(41-60) NOTES:	SALSEGATPQDLNTMLNTVG	HIV-1 infection	human	[Lieberman97]
			• Of 25 patients, most had CTL specific for more than 1 HIV-1 protein • 12 subjects had CTL that could recognize vaccinia expressed LAI gag • Three of these 12 had CTL response to this peptide • The responding subjects were HLA-A3, A32, B7, B14; and HLA-A2, A3, B14, B44		
p24(173-192 SF2)	p24(41-60) NOTES:	SALSEGATPQDLNTMLNTVG	HIV-1 infection	human	[Lieberman97b]
			• CTL expanded <i>ex vivo</i> were later infused into HIV-1 infected patients		
p24(173-194 BH10)	p24(41-62) NOTES:	SALSEGATPQDLNTMLN- TVGGH	HIV-1 infection	human(B14)	[Johnson91]
			• Gag CTL response studied in three individuals		
p24(173-192)	p24(41-60) NOTES:	SALSEGATPQDLNMLNIVG	HIV-1 infection	human(B*8101)	
			• Clade A epitope, per. comm. S. Rowland-Jones		
p24(181-192)	p24(47-58) NOTES:	CTPYDINQMLNC?	HIV-2 infection	human(B58)	[BertolottiPerComm98]
			• HIV-2 epitope defined from an infection in the Gambia, Bertolotti, Per. Comm		
p24(180-187 IIIB)	p24(48-55) NOTES:	TPQDLNTM	HIV-1 infection	human(B7)	[Walkerpercom96]
			• Epitope defined in the context of the Pediatric AIDS Foundation ARIEL Project, a mother-infant HIV transmission study		

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(181-189)	p24(49-57) NOTES:	PQDLNTMLN	HIV-1 infection	human(B14)	[Lubaki97]
	<ul style="list-style-type: none"> • 82 HIV-1-specific CTL clones from 5 long term non-progressors were isolated and analyzed for breadth of response • A sustained Gag, Env and Nef response was observed, and clones were restricted by multiple HLA epitopes, indicating a polyclonal response • Despite this being a well defined conserved epitope, none of the 11 gag-specific clones from a B-14 positive subject could recognize either it or p24 RAEQASQEV (C. Brander reported this is actually a Cw8 epitope) 				
p24(183-202 SF2)	p24(51-70) NOTES:	DLNTMLNTVGGHQAAAMQMLK	HIV-1 infection	human	[Lieberman97]
	<ul style="list-style-type: none"> • Of 25 patients, most had CTL specific for more than 1 HIV-1 protein • 12 subjects had CTL that could recognize vaccinia expressed LAI gag • One of these 12 had CTL response to this peptide • The responding subject was HLA-A26, A30, B38 				
p24(183-191 LAI)	p24(51-59) NOTES:	DLNTMLNTV	HIV-1 infection	human(B14)	[McMichael94]
	<ul style="list-style-type: none"> • Review of HIV CTL epitopes – defined by B14 motif found within a larger peptide 				
p24(183-191 LAI)	p24(51-59) NOTES:	DLNTMLNTV	HIV-1 infection	human(B14?)	[Nixon88, Johnson92]
	<ul style="list-style-type: none"> • No minimal epitope shown, could possibly be HLA-Cw4 (C. Brander, per. comm.) 				
p24	p24(51-59) NOTES:	DLNTMLNTV	HIV-1 exposure	human(B14)	[RowlandJones98]
	<ul style="list-style-type: none"> • A CTL response was found in exposed but uninfected prostitutes from Nairobi using previously defined B clade epitopes that tended to be conserved in A and D clades – such cross-reactivity could protect against both A and D and confer protection in Nairobi where both subtypes are circulating • The A subtype consensus is identical to the B clade epitope • The D subtype consensus is DLNmmMLNTV 				

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(193-214 BHI10)	p24(61-82)	GHQAAMQMLKETINEEA-AEWDR	HIV-1 infection	human(Bw52)	[Johnson91]
	NOTES:				
					<ul style="list-style-type: none"> Gag CTL response studied in three individuals
p24(193-212 SF2)	p24(61-80)	GHQAAMQMKETTINEEAIEW	HIV-1 infection	human	[Lieberman97]
	NOTES:				
					<ul style="list-style-type: none"> Of 25 patients, most had CTL specific for more than 1 HIV-1 protein 12 subjects had CTL that could recognize vaccinia expressed LAI gag One of these 12 had CTL response to this peptide The responding subject was HLA-A26, A30, B38
p24(193-203 BRU)	p24(61-71)	GHQAAMQMLKE	HIV-1 infection	human(A2)	[Claverie88]
	NOTES:				
					<ul style="list-style-type: none"> 1 of 4 epitopes first predicted, then shown to stimulate HLA-A2 restricted CTL line
p24(193-201 LAI)	p24(61-69)	GHQAAMQML		human(B39)	[KuranePerCom]
	NOTES:				
					<ul style="list-style-type: none"> Optimal peptide defined by titration, I. Kurane and K. West, pers. comm.
p24(194-202 LAI)	p24(62-70)	HQAAMQMLK		human(B52)	[Brandner96]
	NOTES:				
					<ul style="list-style-type: none"> P. Goulder, pers. comm.
p24(199-207 SF2)	p24(65-73)	AMQMLKETI	DNA plasmid immunization	murine(H-2K ^d)	[Selby97]
	NOTES:				
					<ul style="list-style-type: none"> Murine CTL response to peptide observed after immunization with DNA plasmid containing HIV-1 (SF2) p55 gag gene regulated by bacteriophage T7 promoter CTL response required coadministration of rec vaccinia virus expressing T7 RNA polymerase or T7 RNA polymerase soluble protein

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(199-207 SF2)	p24(65-73)	AMQMLKETI	vaccinia expressing gag and pol	murine(H-2K ^d)	[Doe97]
	NOTES:		<ul style="list-style-type: none"> Immunodominant murine CTL response to this peptide observed after immunization with vaccine VV gagpol Optimal peptide was defined 		
p24(203-212)	p24(71-80)	ETINEEAAEW	HIV-1 infection	human(A25)	[Klenerman96]
	NOTES:		<ul style="list-style-type: none"> The epitope was defined through direct stimulation of PBMC with 20-mer peptides It is in a conserved region, ETINEEAAEW is found in most B, D, and E subtype isolates DTINEEAAEW is found in A and some D subtype sequences 		
p24(203-212)	p24(71-80)	ETINEEAAEW	HIV-1 infection	human(A25)	[vanBalen96]
	NOTES:		<ul style="list-style-type: none"> Conserved between B and D subtypes, variable in other clades; a consensus of clades A,C, F, G, and H and a peptide of HIV-2ROD over this region were not recognized by CTL recognizing the index peptide 		
p24(203-222 SF2)	p24(71-90)	ETINEEAAEWDRVHPVVHAGP	HIV-1 infection	human	[Lieberman97]
	NOTES:		<ul style="list-style-type: none"> Of 25 patients, most had CTL specific for more than 1 HIV-1 protein 12 subjects had CTL that could recognize vaccinia expressed LAI gag One of these 12 had CTL response to this peptide The responding subject was HLA-A2, B21 		
p24(215-223 IIIB)	p24(83-92)	VHPVHAGPIA	HIV-1 infection	human(B55)	[Sipsas97]
	NOTES:		<ul style="list-style-type: none"> HIV IIIB proteins were used to define the range of CTL epitopes recognized by 3 lab workers accidentally infected with HIV-1 IIIB LHPVHAGPVA, a variant found in HIV-1 PH136, was also recognized LHPVHAGPIA, a variant found in HIV-1 RF, was also recognized LHPVHAGPIT, a variant found in HIV-1 MN, was also recognized LHPAQAGPIA, a variant found in HIV-1 JH3, was recognized at high peptide concentrations 		

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(219-233 BRU)	p24(87-101)	HAGPIAPGQMREPRG	HIV-1 infection	human(A2)	[Claverie88]
	NOTES:				
			<ul style="list-style-type: none"> • 1 of 4 epitopes predicted then shown to stimulate HLA-A2 restricted CTL line 		
p24(223-242 SF2)	p24(91-110)	IAPGQMRPRGSDIAGTTST	HIV-1 infection	human	[Lieberman97]
	NOTES:				
			<ul style="list-style-type: none"> • Of 25 patients, most had CTL specific for more than 1 HIV-1 protein • 12 subjects had CTL that could recognize vaccinia expressed LAI gag • One of these 12 had CTL response to this peptide • The responding subject was HLA-A2, A24, B13, B35 		
p24(233-252 SF2)	p24(101-120)	GSDIAGTTSTLQEIQWMTN	HIV-1 infection	human	[Lieberman97]
	NOTES:				
			<ul style="list-style-type: none"> • Of 25 patients, most had CTL specific for more than 1 HIV-1 protein • 12 subjects had CTL that could recognize vaccinia expressed LAI gag • One of these 12 had CTL response to this peptide • The responding subject was HLA-A26, A30, B38 		
p24(240-249 LAI)	p24(108-117)	TSTLQEIQGW	HIV-1 infection	human(B*57, B*5801)	[Goulder96]
	NOTES:				
			<ul style="list-style-type: none"> • Response to this epitope was found in 4 slow progressing HLA-B*57 individuals, in 2 it was dominant or very strong • For one donor (from Zimbabwe) this was defined as the optimal peptide • This epitope can be presented in the context of the closely related HLA molecules B*5801 and B*57 		
p24(241-250)	p24(108-117)	TSTVVEEQW	HIV-2 infection	human(B58)	[BertolettiPerComm98]
	NOTES:				
			<ul style="list-style-type: none"> • HIV-2 epitope defined from an infection in the Gambia, Bertoletti, Per. Comm • All HIV-2 sequences from the database are TSTVVEEQW in this region, not TSTVVEEQW 		

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(253-274 BH10)	p24(121-142)	NPPIPVGEIYKRWIILGLNKIV	HIV-1 infection	human(B8)	[Johnson91]
	NOTES:				
					<ul style="list-style-type: none"> Gag CTL response studied in three individuals
p24(253-272)	p24(121-140)	NPPIPVGEIYKRWIILGLNK	HIV infection	human	[Lieberman95]
	NOTES:				
					<ul style="list-style-type: none"> HIV-specific CTL lines developed by <i>ex vivo</i> stimulation with peptide
p24(253-272 SF2)	p24(121-140)	NPPIPVGEIYKRWIILGLNK	HIV infection	human	[Lieberman97]
	NOTES:				
					<ul style="list-style-type: none"> Of 25 patients, most had CTL specific for more than 1 HIV-1 protein 12 subjects had CTL that could recognize vaccinia expressed LAI gag Two of these 12 had CTL response to this peptide The responding subjects were HLA-A2, A3, B8, B62, and HLA-A1, B8, B18
p24(253-272 SF2)	p24(121-140)	NPPIPGEIKRWIILGNIK	HIV-1 infection	human	[Lieberman97b]
	NOTES:				
					<ul style="list-style-type: none"> CTL expanded <i>ex vivo</i> were later infused into HIV-1 infected patients
p24(253-267)	p24(121-135)	NPPIPVGEIYKRWII	HIV-1 infection	human(B8)	[Gotch90]
	NOTES:				
					<ul style="list-style-type: none"> High frequency of memory and effector Gag specific CTL
p24(255-274 SF2)	p24(121-140)	NPPIPVGEIYKRWIILGLNK	HIV-1 infection	human	[vanBaalen93]
	NOTES:				
					<ul style="list-style-type: none"> Gag CTL epitope precursor frequencies were estimated and peptide mapping was performed

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(255-274 SF2)	p24(121-135) NOTES:	NPPIPVGEIYKRWII	HIV-1 infection	human(B8)	[Phillips91, Goulder97e]
			<ul style="list-style-type: none"> • Longitudinal study of CTL escape mutants – little variation was observed in the immunodominant B27 epitope, relative to B8 epitopes, which varied over time, in people with the appropriate HLA types • [Goulder97e] is a review of immune escape that points out that there may be a protective effect associated with B27, and that HLA-B8 individuals tend to progress more rapidly than HLA B27 patients 		
p24(260-268 LAI)	p24(122-130) NOTES:	PPIPVGDIIY	HIV-1 or -2 infection	human(B35)	[RowlandJones95]
			<ul style="list-style-type: none"> • Defined as minimal peptide by titration curve. PPIPVGIIY and HIV-2 form NPVPVGNIIY are also recognized 		
p24(260-268 LAI)	p24(122-130) NOTES:	PPIPVGDIIY	none	human(B35)	[Lalvan97]
			<ul style="list-style-type: none"> • A peptide based protocol was optimized for restimulation of CTLp using optimized peptide and IL-7 concentrations – importantly this protocol does not stimulate a primary response, only secondary – peptide-specific CTLp counts could be obtained via staining with peptide-Class I tetramers • This peptide was one of the B35 presented test peptides used in control experiments showing that the assay gave no activity using lymphocytes from 21 healthy B35 seronegative donors 		
p24(260-268 LAI)	p24(122-130) NOTES:	PPIPVGDIIY	HIV-1 infection	human(B35)	[McMichael94]
			<ul style="list-style-type: none"> • Review of HIV CTL epitopes 		
p24(256-270 LAI)	p24(124-138) NOTES:	IPVGEIYKRWIIILGL	HIV-1 infection	human(B8)	[Buseyne93]
			<ul style="list-style-type: none"> • Clustering of Gag p24 CTL epitopes recognized in 29 HIV infected people 		
p24(261-269)	p24(127-135) NOTES:	GEIYKRWII	HIV-1 infection	human(B8)	[Sutton93]
			<ul style="list-style-type: none"> • Predicted epitope based on B8 binding motifs, from larger peptide NPPIPVGEIYKRWII 		

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(259-267 LAI)	p24(127-135) NOTES: • Naturally occurring variant GDIIYKRWII may act as antagonist	GEIYKRWII	HIV-1 infection	human(B8)	[Klenerman94]
p24(259-267)	p24(127-135) NOTES: • Longitudinal study of CTL response and study of immune escape – GDIIYKRWII could also stimulate CTL, reactivity fluctuated	GEIYKRWII	HIV-1 infection	human(B8)	[Nowak95]
p24(259-267)	p24(127-135) NOTES: • Equivalent sequence GDIIYKRWII also recognized by CTL from some donors	GEIYKRWII	HIV-1 infection	human(B8)	[McAdam95]
p24(259-267 SF2)	p24(127-135) NOTES: • GDIIYKRWII specific CTL clone also recognized GEIYKRWII	GDIYKRWII	HIV-1 infection	human(B*0801)	[McAdam98]
p24(260-267 LAI)	p24(128-135) NOTES: • Defined in a study of the B8 binding motif	EIYKRWII		human(B8)	[Goulder97c]
p24(265-280 BRU)	p24(130-148) NOTES: • Used as a positive control for HLA specificity	YKRWIIIGLNKIVRMYSPT	HIV-1 infection	human(B27)	[Dadaglio91]
p24(260-269 HIV-2)	p24(131-140) NOTES: • HIV-2, HLA-B*2703, S. Rowland-Jones, pers. comm.	RRWIQLGLQK		human(B27)	[Brander96]

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(263-270 SF2)	p24(129-136)	IYKRWIII	HIV-1 infection	human(A*2402)	[KedamMoore97]
	NOTES:				
					<ul style="list-style-type: none"> Defined using reverse immunogenetics – 59 HLA-A-A*2402 binding peptides were predicted by searching for A*2402 anchors in HIV proteins, (Tyr at 2, and Phe, Leu or Ile at the C term) – 53 of the 59 peptides bound A*2402 This peptide induced CTL in 1/4 HIV-1+ people tested IYKRWIII bound to A*2402 with medium strength, the epitope can be processed in a vaccinia construct and presented – two specific CTL clones were obtained
p24(263-272 SF2)	p24(129-138)	IYKRWIIIGL	HIV-1 infection	human(A*2402)	[KedamMoore97]
	NOTES:				
					<ul style="list-style-type: none"> Defined using reverse immunogenetics – 59 HLA-A-A*2402 binding peptides were predicted by searching for A*2402 anchors in HIV proteins, (Tyr at 2, and Phe, Leu or Ile at the C term) – 53 of the 59 peptides bound A*2402 This peptide induced CTL in 1/4 HIV-1+ people tested IYKRWIIIGL bound to A*2402 with medium strength, the epitope can be processed in a vaccinia construct and presented – two specific CTL clones were obtained
p24(263-284 BH10)	p24(131-152)	KRWIIIGLNKIVRMYSPTSILD	HIV-1 infection	human(Bw62)	[Johnson91]
	NOTES:				
					<ul style="list-style-type: none"> Gag CTL response studied in three individuals
p24(265-284 SF2)	p24(131-150)	KRWIIIGLNKIVRMYSPTSI	HIV-1 infection	human(Bw62?)	[vanBaalen93]
	NOTES:				
					<ul style="list-style-type: none"> Gag CTL epitope precursor frequencies estimated
p24(263-282 SF2)	p24(131-150)	KRWIIIGLNKIVRMYSPTSI	HIV-1 infection	human	[Lieberman97]
	NOTES:				
					<ul style="list-style-type: none"> Of 25 patients, most had CTL specific for more than 1 HIV-1 protein 12 subjects had CTL that could recognize vaccinia expressed LAI gag One of these 12 A-2 had CTL response to this peptide The responding subject was HLA-A3, A32, B51, B62

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(266-277)	p24(131-145) NOTES: <ul style="list-style-type: none"> Gag CTL epitope mapped with rec gag-vaccinia and synthetic peptides This was the first HIV-1 epitope to be mapped 	KRWIILGLNKIVRMY	rec gag-vaccinia	human(B27)	[Nixon88]
p24(263-277 LAI)	p24(131-145) NOTES: <ul style="list-style-type: none"> Clustering of Gag p24 CTL epitopes recognized in 29 HIV infected people 	KRWIILGLNKIVRMY	HIV-1 infection	human(A33)	[Buseyne93]
p24(266-277 LAI)	p24(131-145) NOTES: <ul style="list-style-type: none"> Longitudinal study showing persistence of epitope despite CTL activity 	KRWIILGLNKIVRMY	HIV-1 infection	human(B27)	[Meyershans91]
p24(265-279)	p24(131-145) NOTES: <ul style="list-style-type: none"> HIV-1 and HIV-2 cross-reactive CTL clone, highly conserved epitope 	KRWIILGLNKIVRMY	HIV-1 infection	human(B27)	[Nixon90]
p24(265-279C)	p24(131-146) NOTES: <ul style="list-style-type: none"> HLA-B27 restricted epitope also binds to HLA-A2 and HLA-B37 in solid phase assay 	KRWIILGLNKIVRMYC	HIV-1 infection	human(B27)	[Bouillot89]
p24(265-276)	p24(131-142) NOTES: <ul style="list-style-type: none"> Epitope examined in the context of peptide binding to HLA-B27 	KRWIILGLNKIV	no CTL shown	human(B27)	[Jardetzky91]
p24(263-274 LAI)	p24(131-142) NOTES: <ul style="list-style-type: none"> The capacity of dendritic cells to process and present antigen and stimulate anti-HIV-1 CTL memory responses was studied 	KRWIILGLNKIV	HIV-1 infection	human(B27)	[Fan97]

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(263-272 LAI)	p24(131-140)	KRWIILGLNK	HIV-1 infection	human(B27)	[Fan97]
	NOTES:				<ul style="list-style-type: none"> The capacity of dendritic cells to process and present antigen and stimulate anti-HIV-1 CTL memory responses was studied
p24(263-272 SF2)	p24(131-139)	KRWIILGLNK	HIV-1 infection	human(B*27)	[McAdam98]
	NOTES:				<ul style="list-style-type: none"> Epitope invariant across clades A, B, C, and D
p24(263-272 LAI)	p24(131-140)	KRWIILGLNK	HIV-1 infection	human(B27)	[Wilson98]
	NOTES:				<ul style="list-style-type: none"> HIV+ individuals were followed longitudinally using MHC tetramers in combination with 14 anti-BV chain MAbs, and clonal expansion of HIV-specific T cells was followed <i>in vivo</i> Seven HIV+ people were studied, and all showed expansions of particular TCR BV clones, often several, relative to uninfected controls Three patients were followed in detail, TCR VB expansions persisted for 2 to 3 years, with occasional transient increases
p24	p24(131-139)	KRWIILGLNK	HIV infection	human(B27)	[RowlandJones97]
	NOTES:				<ul style="list-style-type: none"> Described in this review as the first identified HIV CTL epitope
p24(263-272 LAI)	p24(131-140)	KRWIILGLNK	HIV-1 infection	human(B*2705)	[Goulder97d, Goulder97e]
	NOTES:				<ul style="list-style-type: none"> HLA-B*2705 is associated with slow HIV disease progression 11/11 HLA-B*2705 donors make a response to this epitope, usually an immunodominant response This is a highly conserved epitope The HLA-B*2705 binding motif includes R at position 2, and L in the C-term position [Goulder97e] is a review on CTL immune escape that discusses this epitope in the context of the difficulty in detection of immune escape – KRWIILGLNK and a R2K change, KKWIILGLNK, show little difference in titration curves, yet the K2 variants fail to bind to targets for more than 1 hour, while the R2 form can sensitize lysis by CTL for over 24 hours – minigene transfection experiments confirmed the importance of this for the CTL response

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(263-272 LAI)	p24(131-140) NOTES: • Clustering of Gag p24 CTL epitopes recognized in 29 HIV infected people	KRWIILGLNK	HIV-1 infection	human(B27)	[Buseyne93]
p24(263-272 LAI)	p24(131-140) NOTES: • Review of HIV CTL epitopes	KRWIILGLNK	HIV-1 infection	human(B27)	[McMichael94]
p24(263-272)	p24(131-140) NOTES: • Naturally occurring variant KRWIILGLNK may act as antagonist	KRWIMGLNK	HIV-1 infection	human(B27)	[Klenerman94]
p24(263-272)	p24(131-140) NOTES: • Naturally occurring variant KRWIILGLNK may act as antagonist	KRWIMGLNK	HIV-1 infection	human(B27)	[Klenerman95]
p24(265-274)	p24(131-140) NOTES: • In one individual, TCR usage changed over time indicating that new populations of CTL can be recruited • TCR usage showed a CTL clonal response to this epitope that persisted over 5 years • CTL clones specific for HIV epitopes may represent between 0.2 and 1% of the total CD8+ population of T cells	KRWIILGLNK	HIV infection	human(B27)	[Moss95]
p24(265-276)	p24(131-140) NOTES: • Included in HLA-B27 binding peptide competition study	KRWIILGLNK		human(B27)	[Carreno92]

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(265-274 SF2)	p24(131-140)	KRWIILGLNK	HIV-1 infection	human(B27)	[Phillips91, Goulder97e]
	NOTES:				
			<ul style="list-style-type: none"> • Longitudinal study of CTL escape mutants – little variation was observed in the immunodominant B27 epitope, relative to B8 epitope • [Goulder97e] is a review of immune escape that points out that there may be a protective effect associated with B27, and that HLA-B8 individuals tend to progress more rapidly than HLA B27 patients 		
p24(263-272)	p24(131-140)	KRWIILGLNK	HIV-1 infection	human(B27)	[Nietfeld95, Goulder97e]
	NOTES:				
			<ul style="list-style-type: none"> • Single point mutations were introduced and viral viability and CTL recognition tested – an Arg to Lys change at anchor position P2 abrogates binding to B27, but doesn't change viral viability <i>in vitro</i> • [Goulder97e] is a review of immune escape that summarizes this study 		
p24(263-272)	p24(131-139)	KRWIIMGNK	HIV-1 infection	human(B27)	[Nowak95]
	NOTES:				
			<ul style="list-style-type: none"> • Longitudinal study of CTL response and immune escape – the form KRWIILGNK was also found, and both forms stimulate CTL 		
gag(263-272)	p24(131-139)	KRWIILGNK	HIV-1 infection	human(B27)	[Dural98]
	NOTES:				
			<ul style="list-style-type: none"> • Cross-clade CTL response was studied by determining the CTL activity in seven patients from Bangui, (6 A subtype, and 1 AG recombinant infections) and one A subtype infection from a person living in France originally from Togo, to different antigens expressed in vaccinia • Pol reactivity: 8/8 had CTL to A subtype, and 7/8 to B subtype, and HIV-2 Pol was not tested • Gag reactivity: 7/8 reacted with A or B subtype gag, 3/8 with HIV-2 Gag • Nef reactivity: 7/8 reacted with A subtype, and 5/8 with B subtype, none with HIV-2 Nef • Env reactivity: 3/8 reacted with A subtype, 1/8 with B subtype, none with HIV-2 Env • One of the patients was shown to react to this epitope: KRWIILGNK 		

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(263-272)	p24(131-139)	KRWIMGLNK	HIV-1 infection	human(B27)	[Goulder'97b, Goulder'97e]
	NOTES:				
					<ul style="list-style-type: none"> • Six HLA-B27 donors studied make a strong response to this epitope • In 4/6 cases, this was the immunodominant or only CTL response • Two of the cases had an epitope switch to the form KKWIMGLNK during a period of rapid decline to AIDS, following their asymptomatic period • The arginine to lysine switch is in an anchor residue, and results in immune escape due to severely diminished binding to the B27 molecule • [Goulder'97e] is a review of immune escape that summarizes this study in the context of CTL escape to fixation
p24(268-277 LAI)	p24(136-145)	LGLNKIVRMVY	Predicted from larger peptide	human(Bw62)	[McMichael94]
	NOTES:				
					<ul style="list-style-type: none"> • Review of HIV CTL epitopes • Also P. Johnson, per. comm.
p24(271-281)	p24(136-146)	LGLNKIVRMYS	HIV-1 infection	human(B62)	[Lubaki97]
	NOTES:				
					<ul style="list-style-type: none"> • 82 HIV-1-specific CTL clones from 5 long term non-progressors were isolated and analyzed for breadth of response • A sustained Gag, Env and Nef response was observed, and clones were restricted by multiple HLA epitopes, indicating a polyclonal response • A subject who was B62+ had CTL that recognized this peptide, p17 KIRLRPGGKKKKYKL, and one additional unknown epitope • The two clones that recognized this epitope used two different Vβ genes, further demonstrating a polyclonal response
p24(272-280)	p24(137-145)	GLNKIVRMVY	HIV-1 infection	human(B62)	[Goulder'97e]
	NOTES:				
					<ul style="list-style-type: none"> • This paper is a review of CTL and immune evasion, but it presents a study of a shift from an HLA-A*0201 response to SLXNTVAVTL, to a B62 response to GLNKIVRMVY • As long as a strong CTL response to SLXNTVAVTL was evident, the epitope variants SLFNTVAVTL or SLXNTIATL dominated the viral population – eventually the CTL response to the index peptide became undetectable, the CTL response shifted to a focus on GLNKIVRMVY, and the index peptide SLXNTVAVTL once again established itself as the dominant form

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(273-282 IIB)	p24(143-150) NOTES: • Epitope defined in the context of the Pediatric AIDS Foundation ARIEL Project	RMYSPTSI	HIV-1 infection	human(B52)	[Walkerpercom96]
p24(283-302 SF2)	p24(151-170)	LDIRQGPKPEPRDYVDRFYK	HIV-1 infection	human	[McAdam98]
p24 (287-309)	p24 (155-177) NOTES: • Mice immunized with this synthetic peptide generated specific CTLs, a proliferative response, and antibodies • The amino acids shown in the epitope field were based on the numbering provided by Nakamura et al., and may not be correct • The CTL epitope was shown to be located in positions 291-300	QGPKPEPRDYVDRFYKT- LRAEQA	Peptide vaccination	murine	[Nakamura97]
p24(290-309)	p24(157-178) NOTES: • Cervical and peripheral blood derived CTL clones from an HIV infected woman recognized this epitope	PKEPFRDYVDRFYKTLRAEQAS	HIV-1 infection	human(B14)	[Musey97]
p24(293-312 SF2)	p24(161-180) NOTES: • Of 25 patients, most had CTL specific for more than 1 HIV-1 protein • 12 subjects had CTL that could recognize vaccinia expressed LAI gag • One of these 12 had CTL response to this peptide • The responding subject was HLA-A2, A3, B8, B62	FRDYVDRFYKTLRAEQASQD	HIV-1 infection	human	[Lieberman97]
p24(293-312 SF2)	p24(161-180) NOTES: • CTL expanded <i>ex vivo</i> were later infused into HIV-1 infected patients	FRDYVDRFYKTLRAEQASQD	HIV-1 infection	human	[Lieberman97b]
p24(293-312 SF2)	p24(161-180)	FRDYVDRFYKTLRAEQASQD	HIV-1 infection	human(B71)	[McAdam98]

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(293-312 SF2)	p24(162-180)	RDYVDRFYKTL	HIV-1 infection	human(A26 or B70)	[Ogg98b]
p24(298-306)	p24(164-172)	YVDRFFKTL	HIV-1 infection, clade B	human(A26 or B70)	[Dorrell98]
	NOTES:				
					• CTL from Clade B infection reacts with clade A epitope (S. Rowland-Jones, per. comm.)
p24(298-306 IIIB)	p24(166-174)	DRFYKTLRA	HIV-1 infection	human(B14)	[Walkenpercom96]
	NOTES:				
					• Epitope defined in the context of the Pediatric AIDS Foundation ARIEL Project, a mother-infant HIV transmission study
					• DRFYKTLRA, a naturally occurring variant, was found in mother, and is recognized although less reactive
					• DQFYKTLRA, a naturally occurring variant, was found in infant and is not recognized
p24(298-306 IIIB)	p24(166-174)	DRFYKTLRA	HIV-1 infection	human(B14)	[Cao97]
	NOTES:				
					• The consensus peptide for clades B and D is DRFYKTLRA
					• The consensus peptide for clades A and C is DRFFKTLRA and it is equally reactive
p24(298-306 HXB2)	p24(166-174)	DRFYKTLRA	HIV-1 infection	human(B14)	[Yang97b]
	NOTES:				
					• A chimeric universal T-cell receptor was created by linking CD4 or an HIV-specific anti-gp41 Ig sequence to the signaling domain of the T cell receptor chain ζ , and transducing into CD8+ cells
					• The response using universal-receptor-bearing CD8+ cells to lyse infected cells <i>in vitro</i> was comparable to the natural occurring responses of CTL- clones from HIV+ individuals in terms of kinetics and efficiency
					• A CTL clone specific for this epitope was used for the comparison
p24	p24(166-174)	DRFWKTLRA	HIV-1 exposure	human(B14)	[RowlandJones98]
	NOTES:				
					• A CTL response was found in exposed but uninfected prostitutes from Nairobi using previously defined B clade epitopes that tended to be conserved in A and D clades – such cross-reactivity could protect against both A and D and confer protection in Nairobi where both subtypes are circulating
					• The D subtype consensus is identical to the B clade epitope
					• The A subtype consensus is drFFKTLRA

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(298-306 LAI)	p24(166-174)	DRFYKTLRA	HIV-1 infection	human(B14)	[Harret96b]
gag(298-306)	p24(166-174)	DRFYKTLRA	HIV-1 infection	human(B14)	[Yang96]
					NOTES: <ul style="list-style-type: none"> • CD4+ cell lines acutely infected with HIV were studied to determine their susceptibility to lysis by CTL • Clones specific for RT lysed HIV-1 infected cells at lower levels than Env or Gag specific clones • The distinction was thought to be due to lower expression of RT relative to Env and Gag • CTL can lyse infected cells early after infection, possibly prior to viral production
gag(298-306)	p24(166-174)	DRFYKTLRA	HIV-1 infection	human(B14)	[Yang97]
					NOTES: <ul style="list-style-type: none"> • CTL inhibit HIV-1 replication at effector cell concentrations comparable to those found <i>in vivo</i> • CTL produced HIV-1-suppressive soluble factors – MIP-1α, MIP-1β, RANTES, after antigen-specific activation • CTL suppress HIV replication more efficiently in HLA-matched cells
p24(305-313)	p24(173-181)	RAEQASQEV	HIV-1 infection	human(Cw8)	[Johnson91]
					NOTES: <ul style="list-style-type: none"> • Originally reported as HLA-B14 restricted, but subsequently found not to be presented by cells transfected with B14 • Thought to be HLA-Cw8 restricted (C. Brander and B. Walker)
p24	p24(173-181)	RAEQASQEV	HIV-1 exposure	human(Cw8)	[RowlandJones98]
					NOTES: <ul style="list-style-type: none"> • A CTL response was found in exposed but uninfected prostitutes from Nairobi using previously defined B clade epitopes that tended to be conserved in A and D clades – such cross-reactivity could protect against both A and D and confer protection in Nairobi where both subtypes are circulating • The A subtype consensus is RAeQAQEV • The D subtype consensus is RAEQsQdV • Thought to be HLA-Cw8 restricted, not B14 as originally reported (C. Brander, B. Walker, and S. Rowland-Jones, personal communication)

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(305-313)	p24(173-181) NOTES:	RAEQASQEV	HIV-1 infection	human(B14?)	[Price95]
	<ul style="list-style-type: none"> • Study of cytokines released by HIV-1 specific activated CTL • Thought to be HLA-Cw8 restricted, not B14 as originally reported (C. Brander, B. Walker, and S. Rowland-Jones, personal communication) 				
p24(305-313)	p24(173-181) NOTES:	RAEQASQEV	HIV-1 infection	human	[Lubaki97]
	<ul style="list-style-type: none"> • 82 HIV-1-specific CTL clones from 5 long term non-progressors were isolated and analyzed for breadth of response • A sustained Gag, Env and Nef response was observed, and clones were restricted by multiple HLA epitopes, indicating a polyclonal response • Despite this being a well defined conserved epitope, and thought to be presented by B14, none of the 11 gag-specific clones from a B-14 positive subject could recognize either it or p24 PQDLNTMLN • Thought to be HLA-Cw8 restricted, not B14 as originally reported (C. Brander, B. Walker, and S. Rowland-Jones, personal communication) 				
p24(306-316 LAI)	p24(174-184) NOTES:	AEQASQDVKNW		human(B44)	[Brander97]
	<ul style="list-style-type: none"> • Per. comm. from D. Lewinsohn to C. Brander and B. Walker 				
p24(309-317 LAI)	p24(176-184) NOTES:	QASQEVKNW	HIV-1 infection	human(B*57)	[Goulder96]
	<ul style="list-style-type: none"> • Recognition of this peptide by two long term non-progressors • Peptide defined on the basis of B*5801 binding motif, yet not cross-restricted except at high concentrations 				
p24(308-316 LAI)	p24(176-184) NOTES:	QASQEVKNW	HIV-1 infection	human(Cw*0401)	[Buseyne97]
	<ul style="list-style-type: none"> • Minimal sequence determined through epitope mapping • This is a relatively conserved epitope • HLA-Cw*0401 was defined as the restricting element, but cells that carry Cw*0401 varied in their ability to present this epitope – this could be the result of diminished cell-surface expression of Cw*0401 in some cells 				

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(313-322 LAI)	p24(181-190) NOTES: • P. Johnson pers. comm.	VKNWMTETLL		human(B8)	[Brander'96]
p24(323-342 SF2)	p24(191-210) NOTES: • Of 25 patients, most had CTL specific for more than 1 HIV-1 protein • 12 subjects had CTL that could recognize vaccinia expressed LAI gag • Three of these 12 had CTL response to this peptide • The responding subjects were HLA-A3, A24, B8, B55; HLA-A1, A11, B8, B27	VQNNANPPDCKTILKALGPAAT	HIV-1 infection	human	[Lieberman97]
p24(323-342 SF2)	p24(191-210) NOTES: • CTL expanded <i>ex vivo</i> were later infused into HIV-1 infected patients	VQNNANPPDCKTILKALGPAAT	HIV-1 infection	human	[Lieberman97b]
p24(323-337)	p24(191-205) NOTES: • Two CTL epitopes defined (see also p17(21-35))	VQNNANPPDCKTILKAL	HIV-1 infection	human(B8)	[Nixon91]
p24(325-339 SF2)	p24(191-205) NOTES: • Longitudinal study of CTL escape mutants – little variation was observed in the immunodominant B27 epitope, relative to the B8 epitopes, which varied over time, in people with the appropriate HLA types • [Goulder'97e] is a review of immune escape that points out that there may be a protective effect associated with B27, and that HLA-B8 individuals tend to progress more rapidly than HLA B27 patients	VQNNANPPDCKTILKAL	HIV-1 infection	human(B8)	[Phillips91, Goulder'97e]
p24(325-333 IIB)	p24(193-201) NOTES: • Epitope defined in the context of the Pediatric AIDS Foundation ARIEL Project, a mother-infant HIV transmission study	NANPPDCKTI	HIV-1 infection	human(B51)	[Walkerpercom96]

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(329-337 LAI)	p24(197-205)	DCKTILKAL		human(B8)	[Sutton93]
	NOTES:				
					<ul style="list-style-type: none"> • Predicted epitope based on B8 binding motifs, from larger peptide VQNaNPPDCKTILKAL
p24(329-337)	p24(197-205)	DCKTILKAL	HIV-1 infection	human(B8)	[Nowak95]
	NOTES:				
					<ul style="list-style-type: none"> • In a longitudinal study of CTL response and immune escape – the variant DCKTILKAL was also found, binds to B8, but is not recognized
p24(329-337)	p24(197-205)	DCKTILKAL		human(B8)	[McAdam95]
	NOTES:				
					<ul style="list-style-type: none"> • Defined as minimal epitope by titration and binding studies
p24(197-205)	p24(197-205)	DCKTILKAL		human(B8)	[Goulder97c]
	NOTES:				
					<ul style="list-style-type: none"> • Included in a study of the B8 binding motif
p24(345-364 SF2)	p24(211-230)	LHEEMMTACQGVGGPGHKARV	HIV-1 infection	human	[vanBaten93]
	NOTES:				
					<ul style="list-style-type: none"> • Gag CTL epitope precursor frequencies estimated, peptide mapping
p24(343-362 SF2)	p24(211-230)	LHEEMMTACQGVGGPGHKARV	HIV-1 infection	human(B7)	[McAdam98]
p24(343-362 SF2)	p24(211-231)	LHEEMMTACQGVGGPGHK-ARVVL	HIV-1 infection	human	[Lieberman97]
	NOTES:				
					<ul style="list-style-type: none"> • Of 25 patients, most had CTL specific for more than 1 HIV-1 protein • 12 subjects had CTL that could recognize vaccinia expressed LAI gag • One of these 12 had CTL response to this peptide • The responding subject was HLA-A1, A2, B50, B57

HIV CTL Epitopes

Location	WEAU	Sequence	Immunogen	Species(HLA)	References
p24(349-359 IIIB)	p24(217-227)	ACQGVGGPGHK	HIV-1 infection	human(A11)	[Sipsas'97]
	NOTES: <ul style="list-style-type: none"> • HIV IIIB proteins were used to define the range of CTL epitopes recognized by three lab workers accidentally infected with HIV-1 IIIB • ACQGVGGPSHK, a variant found in HIV RF, was also recognized 				
p24(355-363 LAI)	p24(223-231)	GPGHKARVYL	HIV-1 infection	human(B7)	[Goulder'97, Goulder'97e]
	NOTES: <ul style="list-style-type: none"> • Identical twin hemophiliac brothers were both infected with the same batch of factor VIII • One had a strong response to this peptide, the other a weak response • [Goulder'97e] is a review of immune escape that summarizes this study 				
p24	p24		p24-VLP virus-like particle	human	[Klein96]
	NOTES: <ul style="list-style-type: none"> • Immunization of HIV+ people with an HIV-1 p17/p24 Ty virus-like particle (p24-VLP) resulted in a marginal, short-lived increased proliferative response to p24 and p17 and a transient elevation in viral load • Two of four subjects that received 500 or 1000 µg of p24-VLP had an increase in gag-specific CTL 				