



# wwPDB X-ray Structure Validation Summary Report ⓘ

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PDB ID : 2YPL  
Title : Structural features underlying T-cell receptor sensitivity to concealed MHC class I micropolymorphisms  
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Deposited on : 2012-10-30  
Resolution : 2.40 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.  
We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)  
A user guide is available at  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.7 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

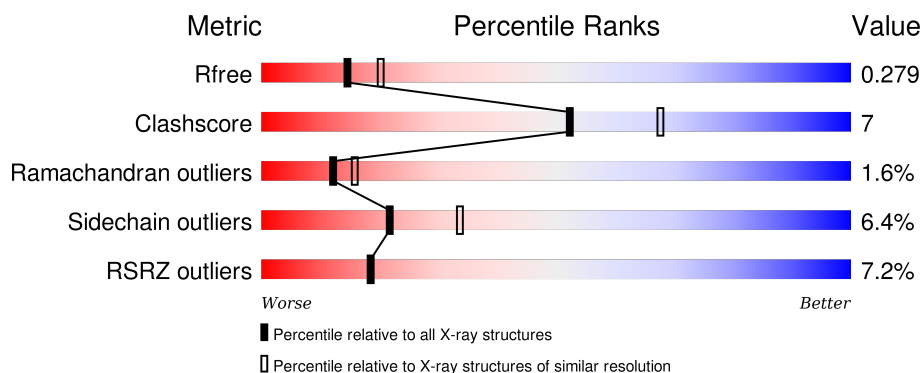
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.40 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	91344	2919 (2.40-2.40)
Clashscore	102246	3407 (2.40-2.40)
Ramachandran outliers	100387	3351 (2.40-2.40)
Sidechain outliers	100360	3352 (2.40-2.40)
RSRZ outliers	91569	2928 (2.40-2.40)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	274	<div> <div>86%</div> <div>13%</div> </div>
2	B	99	<div>5%</div> <div>81%</div> <div>18%</div>
3	C	11	<div>18%</div> <div>64%</div> <div>36%</div>
4	D	199	<div>14%</div> <div>77%</div> <div>17%</div> <div>6%</div>
5	E	238	<div>8%</div> <div>83%</div> <div>14%</div>

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 6796 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called HLA CLASS I HISTOCOMPATIBILITY ANTIGEN, B-57 ALPHA CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	274	Total	C	N	O	S	0	0	0
			2228	1394	404	421	9			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	116	TYR	SER	CONFLICT	UNP P18465
A	143	ILE	THR	CONFLICT	UNP P18465

- Molecule 2 is a protein called BETA-2-MICROGLOBULIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	99	Total	C	N	O	S	0	0	0
			829	528	140	158	3			

- Molecule 3 is a protein called KF11 P24 GAG PEPTIDE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	11	Total	C	N	O	S	0	0	0
			89	61	12	15	1			

- Molecule 4 is a protein called AGA T-CELL RECEPTOR ALPHA CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	199	Total	C	N	O	S	0	0	0
			1565	981	254	321	9			

- Molecule 5 is a protein called AGA T-CELL RECEPTOR BETA CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	238	Total 1890	C 1191	N 331	O 361	S 7	0	0	0

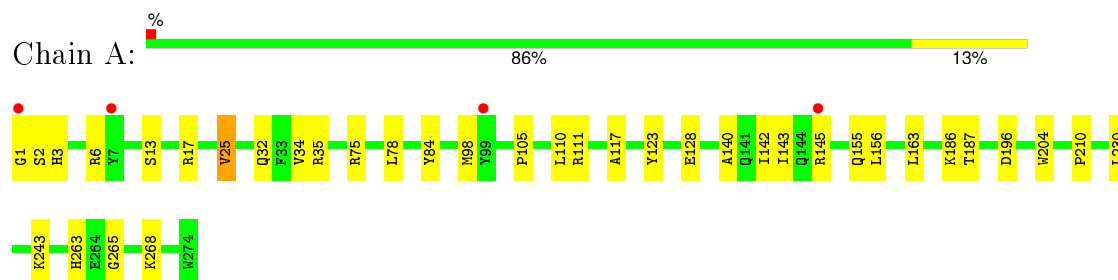
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	77	Total 77	O 77	0	0
6	B	16	Total 16	O 16	0	0
6	C	2	Total 2	O 2	0	0
6	D	51	Total 51	O 51	0	0
6	E	49	Total 49	O 49	0	0

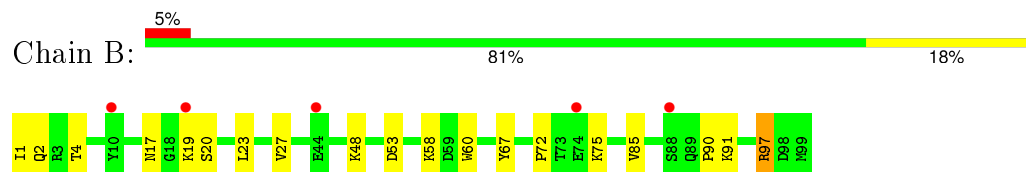
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ( $RSRZ > 2$ ). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

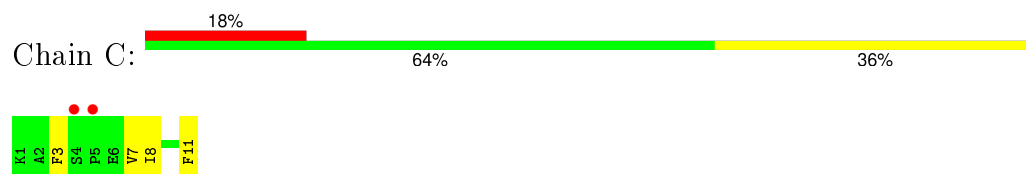
- Molecule 1: HLA CLASS I HISTOCOMPATIBILITY ANTIGEN, B-57 ALPHA CHAIN



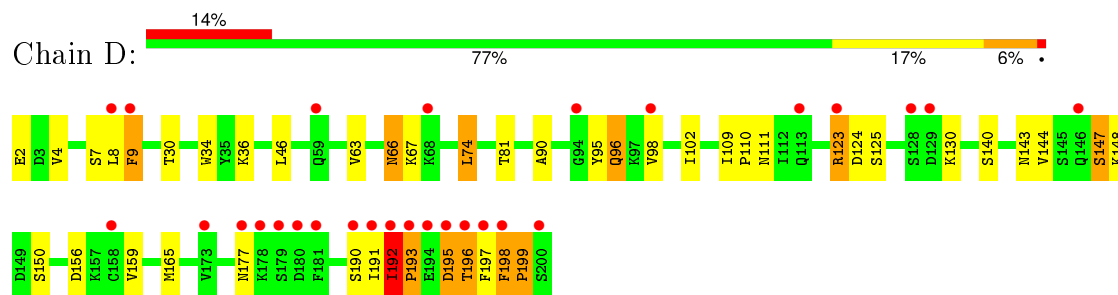
- Molecule 2: BETA-2-MICROGLOBULIN



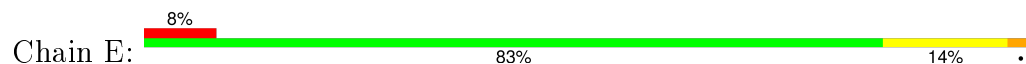
- Molecule 3: KF11 P24 GAG PEPTIDE

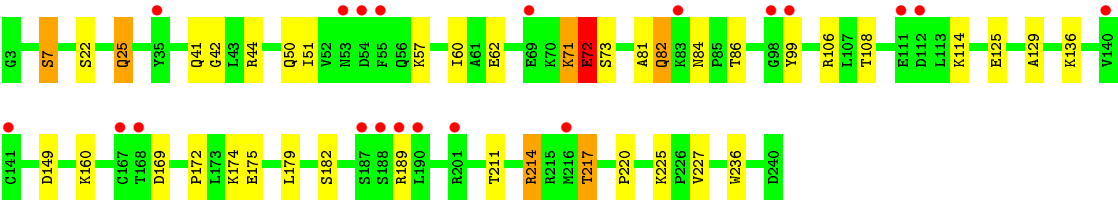


- Molecule 4: AGA T-CELL RECEPTOR ALPHA CHAIN



- Molecule 5: AGA T-CELL RECEPTOR BETA CHAIN





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	56.35Å 75.61Å 241.53Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.77 – 2.40 29.77 – 2.40	Depositor EDS
% Data completeness (in resolution range)	98.7 (29.77-2.40) 98.7 (29.77-2.40)	Depositor EDS
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.35 (at 2.39Å)	Xtriage
Refinement program	REFMAC 5.7.0029	Depositor
R, $R_{free}$	0.221 , 0.277 0.222 , 0.279	Depositor DCC
$R_{free}$ test set	2053 reflections (5.28%)	DCC
Wilson B-factor (Å <sup>2</sup> )	53.1	Xtriage
Anisotropy	0.574	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 39.6	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	2 of 40951 reflections (0.005%)	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	6796	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	66.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.85% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup> Intensities estimated from amplitudes.

<sup>2</sup> Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

## 5 Model quality

### 5.1 Standard geometry

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z  > 5$	RMSZ	$\# Z  > 5$
1	A	0.41	0/2290	0.61	0/3112
2	B	0.36	0/852	0.53	0/1152
3	C	0.50	0/92	0.56	0/122
4	D	0.48	1/1595 (0.1%)	0.68	0/2159
5	E	0.37	0/1941	0.58	0/2637
All	All	0.41	1/6770 (0.0%)	0.61	0/9182

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
4	D	0	2

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	190	SER	CB-OG	-8.70	1.30	1.42

There are no bond angle outliers.

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
4	D	192	ILE	Peptide
4	D	8	LEU	Peptide



## 5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2228	0	2102	26	0
2	B	829	0	794	7	0
3	C	89	0	92	5	0
4	D	1565	0	1497	39	0
5	E	1890	0	1813	24	0
6	A	77	0	0	0	0
6	B	16	0	0	1	0
6	C	2	0	0	0	0
6	D	51	0	0	7	0
6	E	49	0	0	3	0
All	All	6796	0	6298	87	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 7.

The worst 5 of 87 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:D:192:ILE:HG23	4:D:193:PRO:HD2	1.26	1.16
1:A:155:GLN:HE22	3:C:7:VAL:H	1.10	0.98
4:D:123:ARG:H	4:D:123:ARG:HD3	1.37	0.86
4:D:7:SER:HB2	4:D:9:PHE:HB2	1.56	0.86
4:D:63:VAL:HG11	6:D:2017:HOH:O	1.75	0.84

There are no symmetry-related clashes.

## 5.3 Torsion angles ⓘ

### 5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was

analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	272/274 (99%)	263 (97%)	8 (3%)	1 (0%)	39	56
2	B	97/99 (98%)	95 (98%)	2 (2%)	0	100	100
3	C	9/11 (82%)	9 (100%)	0	0	100	100
4	D	197/199 (99%)	172 (87%)	17 (9%)	8 (4%)	3	3
5	E	236/238 (99%)	220 (93%)	12 (5%)	4 (2%)	11	14
All	All	811/821 (99%)	759 (94%)	39 (5%)	13 (2%)	12	16

5 of 13 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	D	9	PHE
4	D	193	PRO
4	D	199	PRO
4	D	192	ILE
5	E	72	GLU

### 5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	228/228 (100%)	219 (96%)	9 (4%)	39	59
2	B	94/94 (100%)	85 (90%)	9 (10%)	10	15
3	C	10/10 (100%)	10 (100%)	0	100	100
4	D	181/181 (100%)	167 (92%)	14 (8%)	16	24
5	E	207/207 (100%)	193 (93%)	14 (7%)	20	31
All	All	720/720 (100%)	674 (94%)	46 (6%)	22	34

5 of 46 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
4	D	74	LEU

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Mol	Chain	Res	Type
4	D	123	ARG
5	E	175	GLU
4	D	81	THR
4	D	102	ILE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
4	D	66	ASN
4	D	96	GLN
5	E	50	GLN
2	B	17	ASN
5	E	25	GLN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<sup>th</sup> percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å <sup>2</sup> )	Q<0.9
1	A	274/274 (100%)	-0.02	4 (1%) 76 75	37, 53, 82, 105	0
2	B	99/99 (100%)	0.34	5 (5%) 32 32	48, 72, 105, 110	0
3	C	11/11 (100%)	1.28	2 (18%) 2 2	46, 50, 61, 71	0
4	D	199/199 (100%)	0.79	28 (14%) 4 4	33, 63, 119, 173	0
5	E	238/238 (100%)	0.50	20 (8%) 14 13	42, 68, 112, 118	0
All	All	821/821 (100%)	0.39	59 (7%) 18 18	33, 61, 105, 173	0

The worst 5 of 59 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	D	193	PRO	13.7
4	D	194	GLU	9.6
4	D	129	ASP	6.2
4	D	192	ILE	6.0
1	A	1	GLY	5.1

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

### 6.3 Carbohydrates [i](#)

There are no carbohydrates in this entry.

### 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.