



# wwPDB X-ray Structure Validation Summary Report ⓘ

Oct 17, 2021 – 07:30 AM EDT

PDB ID : 1KPR  
Title : The human non-classical major histocompatibility complex molecule HLA-E  
Authors : Holmes, M.A.; Strong, R.K.  
Deposited on : 2002-01-02  
Resolution : 2.80 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

<https://www.wwpdb.org/validation/2017/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 : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.23.2

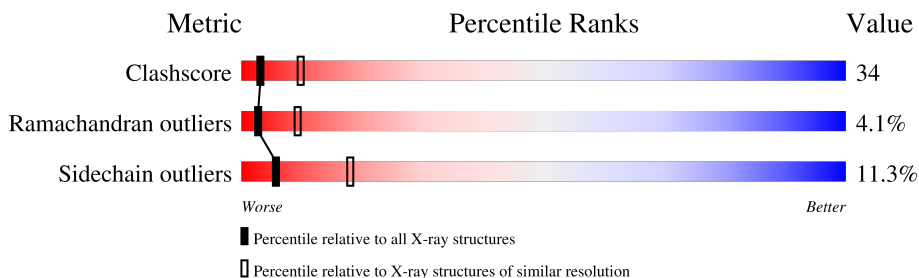
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.80 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))
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)

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 of the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. 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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	274	<div> <div>43%</div> <div>43%</div> <div>11%</div> <div>.</div> </div>
1	C	274	<div> <div>41%</div> <div>43%</div> <div>13%</div> <div>.</div> </div>
2	B	100	<div> <div>52%</div> <div>39%</div> <div>8%</div> <div>.</div> </div>
2	D	100	<div> <div>44%</div> <div>48%</div> <div>7%</div> <div>.</div> </div>
3	P	9	<div> <div>56%</div> <div>33%</div> <div>11%</div> </div>
3	Q	9	<div> <div>67%</div> <div>33%</div> </div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6210 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, ALPHA CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	274	Total	C	N	O	S	0	0	0
			2206	1380	391	428	7			
1	C	274	Total	C	N	O	S	0	0	0
			2205	1379	393	426	7			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	107	GLY	ARG	engineered mutation	UNP P13747
A	256	ALA	ARG	engineered mutation	UNP P13747
C	107	GLY	ARG	engineered mutation	UNP P13747
C	256	ALA	ARG	engineered mutation	UNP P13747

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	100	Total	C	N	O	S	0	0	0
			828	526	139	159	4			
2	D	100	Total	C	N	O	S	0	0	0
			828	526	139	159	4			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1	MET	-	cloning artifact	UNP P61769
D	1	MET	-	cloning artifact	UNP P61769

- Molecule 3 is a protein called Peptide VMAPRTVLL.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	P	9	Total	C	N	O	S	0	0	0
			69	45	12	11	1			
3	Q	9	Total	C	N	O	S	0	0	0
			69	45	12	11	1			

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		

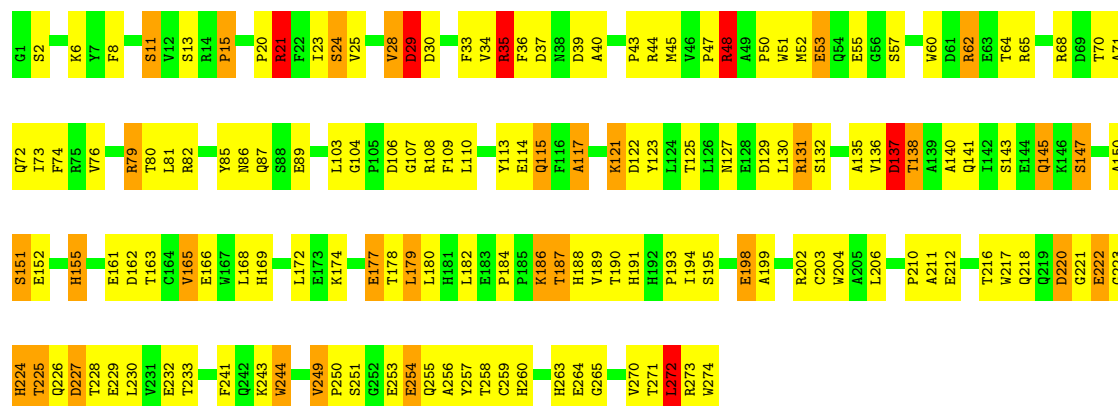
### 3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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. 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.

Note EDS was not executed.

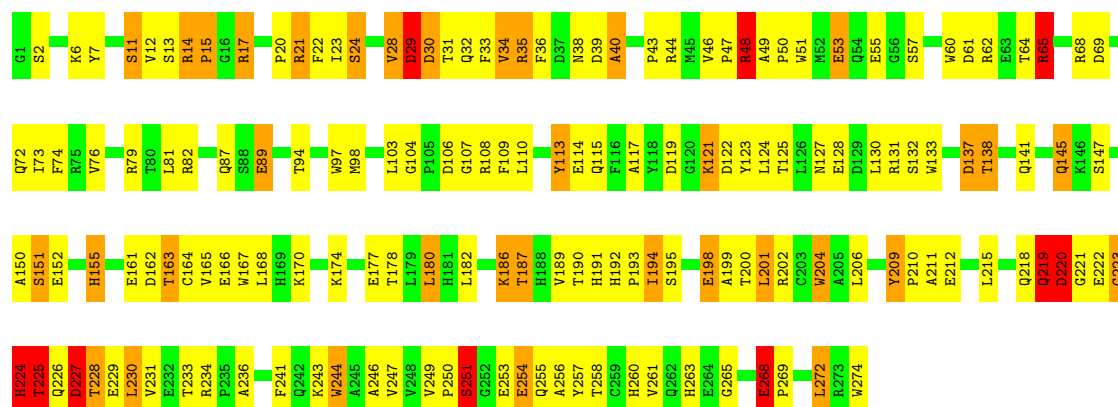
#### • Molecule 1: HLA CLASS I HISTOCOMPATIBILITY ANTIGEN, ALPHA CHAIN

Chain A: 



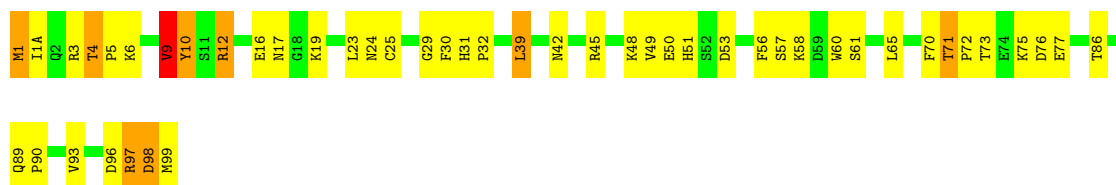
#### • Molecule 1: HLA CLASS I HISTOCOMPATIBILITY ANTIGEN, ALPHA CHAIN

Chain C: 



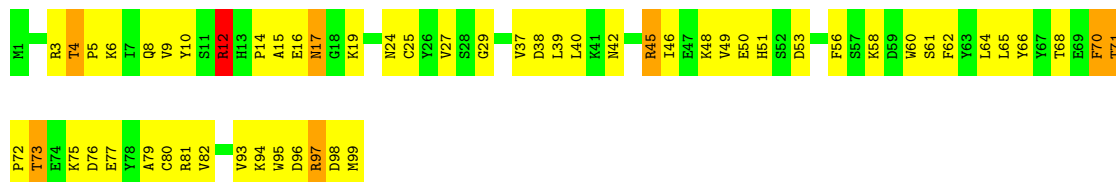
#### • Molecule 2: BETA-2-MICROGLOBULIN

Chain B: 



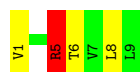
• Molecule 2: BETA-2-MICROGLOBULIN

Chain D: 44% 48% 7%



• Molecule 3: Peptide VMAPRTVLL

Chain P: 56% 33% 11%



• Molecule 3: Peptide VMAPRTVLL

Chain Q: 67% 33%



## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	178.70Å 178.70Å 88.20Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	20.00 – 2.80	Depositor
% Data completeness (in resolution range)	(Not available) (20.00-2.80)	Depositor
$R_{merge}$	0.05	Depositor
$R_{sym}$	(Not available)	Depositor
Refinement program	CNS	Depositor
R, $R_{free}$	0.235 , 0.289	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	6210	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	64.0	wwPDB-VP

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4

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	1.25	5/2272 (0.2%)	1.25	16/3092 (0.5%)
1	C	1.32	9/2271 (0.4%)	1.34	26/3089 (0.8%)
2	B	1.52	6/851 (0.7%)	1.44	9/1152 (0.8%)
2	D	1.15	0/851	1.30	8/1152 (0.7%)
3	P	1.53	0/69	1.45	1/92 (1.1%)
3	Q	1.22	0/69	1.35	0/92
All	All	1.30	20/6383 (0.3%)	1.32	60/8669 (0.7%)

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
1	C	0	2

The worst 5 of 20 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	34	VAL	CB-CG1	9.61	1.73	1.52
1	C	256	ALA	CA-CB	9.27	1.72	1.52
2	B	10	TYR	CE2-CZ	8.95	1.50	1.38
2	B	10	TYR	CG-CD1	7.30	1.48	1.39
1	C	224	HIS	CA-CB	7.00	1.69	1.53

The worst 5 of 60 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	12	ARG	NE-CZ-NH1	10.75	125.68	120.30
1	C	79	ARG	NE-CZ-NH2	-9.78	115.41	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	45	ARG	NE-CZ-NH1	9.52	125.06	120.30
1	C	224	HIS	N-CA-C	8.73	134.57	111.00
1	A	180	LEU	CA-CB-CG	-8.67	95.35	115.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	209	TYR	Sidechain
1	C	22	PHE	Sidechain

## 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	2206	0	2028	150	0
1	C	2205	0	2027	167	0
2	B	828	0	780	49	0
2	D	828	0	780	56	0
3	P	69	0	83	12	0
3	Q	69	0	83	10	0
4	A	5	0	0	1	0
All	All	6210	0	5781	403	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 34.

The worst 5 of 403 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)
2:B:1:MET:SD	2:B:1:MET:CE	2.08	1.41
1:A:218:GLN:HB2	1:A:223:GLY:HA2	1.25	1.16
1:C:65:ARG:HH11	1:C:65:ARG:CB	1.67	1.08
1:C:219:GLN:HG3	1:C:220:ASP:N	1.68	1.04
1:C:65:ARG:HH11	1:C:65:ARG:HB2	1.20	1.03

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

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%)	231 (85%)	31 (11%)	10 (4%)	3	11
1	C	272/274 (99%)	230 (85%)	24 (9%)	18 (7%)	1	3
2	B	98/100 (98%)	92 (94%)	5 (5%)	1 (1%)	15	44
2	D	98/100 (98%)	89 (91%)	7 (7%)	2 (2%)	7	24
3	P	7/9 (78%)	7 (100%)	0	0	100	100
3	Q	7/9 (78%)	7 (100%)	0	0	100	100
All	All	754/766 (98%)	656 (87%)	67 (9%)	31 (4%)	3	9

5 of 31 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	29	ASP
1	A	40	ALA
1	A	177	GLU
1	C	15	PRO
1	C	29	ASP

### 5.3.2 Protein sidechains [i](#)

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	230/234 (98%)	203 (88%)	27 (12%)	5	16

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	C	229/234 (98%)	200 (87%)	29 (13%)	4	14
2	B	93/95 (98%)	86 (92%)	7 (8%)	13	37
2	D	93/95 (98%)	84 (90%)	9 (10%)	8	24
3	P	8/8 (100%)	6 (75%)	2 (25%)	0	2
3	Q	8/8 (100%)	7 (88%)	1 (12%)	4	14
All	All	661/674 (98%)	586 (89%)	75 (11%)	6	18

5 of 75 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	230	LEU
2	D	73	THR
1	C	251	SER
2	D	14	PRO
1	A	258	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 23 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	127	ASN
1	C	219	GLN
1	C	145	GLN
1	C	255	GLN
1	A	224	HIS

### 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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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  $|Z| > 2$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
4	SO4	A	275	-	4,4,4	0.37	0	6,6,6	0.39	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	275	SO4	1	0

## 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](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.