



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 21, 2020 – 05:28 am BST

PDB ID : 5W69  
Title : HLA-C\*06:02 presenting ARFNDLRFV  
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Deposited on : 2017-06-16  
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
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

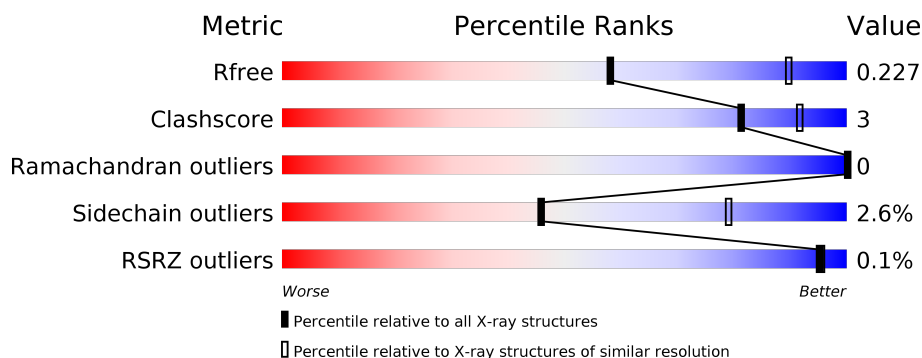
# 1 Overall quality at a glance

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))
$R_{free}$	130704	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (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 on 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  $\leq 5\%$ . 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	276	<div> <div>92%</div> <div>7%</div> <div>.</div> </div>
1	C	276	<div> <div>91%</div> <div>7%</div> <div>..</div> </div>
1	E	276	<div> <div>87%</div> <div>12%</div> <div>.</div> </div>
1	G	276	<div> <div>88%</div> <div>9%</div> <div>.</div> </div>
2	B	100	<div> <div>94%</div> <div>6%</div> </div>
2	D	100	<div> <div>90%</div> <div>10%</div> </div>

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Mol	Chain	Length	Quality of chain
2	F	100	 95%5%
2	H	100	 94%6%
3	I	9	 89%11%
3	J	9	 44%56%
3	K	9	 67%33%
3	L	9	 89%11%

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 13233 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, Cw-6 alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	273	Total	C	N	O	S	0	1	0
			2231	1390	406	428	7			
1	C	273	Total	C	N	O	S	0	1	0
			2218	1385	402	424	7			
1	E	273	Total	C	N	O	S	0	0	0
			2230	1389	408	427	6			
1	G	268	Total	C	N	O	S	0	0	0
			2180	1360	395	419	6			

- 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
			825	524	138	159	4			
2	D	100	Total	C	N	O	S	0	0	0
			825	524	138	159	4			
2	F	100	Total	C	N	O	S	0	0	0
			813	517	137	155	4			
2	H	100	Total	C	N	O	S	0	0	0
			817	520	138	155	4			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	MET	-	initiating methionine	UNP P61769
D	0	MET	-	initiating methionine	UNP P61769
F	0	MET	-	initiating methionine	UNP P61769
H	0	MET	-	initiating methionine	UNP P61769

- Molecule 3 is a protein called ALA-ARG-PHE-ASN-ASP-LEU-ARG-PHE-VAL.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	I	9	Total	C	N	O	0	0	0
			81	52	16	13			
3	J	9	Total	C	N	O	0	0	0
			81	52	16	13			
3	K	9	Total	C	N	O	0	0	0
			81	52	16	13			
3	L	9	Total	C	N	O	0	0	0
			81	52	16	13			

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	183	Total	O	0	0
			183	183		
4	B	78	Total	O	0	0
			78	78		
4	C	123	Total	O	0	0
			123	123		
4	D	69	Total	O	0	0
			69	69		
4	E	134	Total	O	0	0
			134	134		
4	F	36	Total	O	0	0
			36	36		
4	G	103	Total	O	0	0
			103	103		
4	H	37	Total	O	0	0
			37	37		
4	I	2	Total	O	0	0
			2	2		
4	J	2	Total	O	0	0
			2	2		
4	K	1	Total	O	0	0
			1	1		
4	L	2	Total	O	0	0
			2	2		

### 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 the various outlier classes 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, Cw-6 alpha chain

Chain A: 




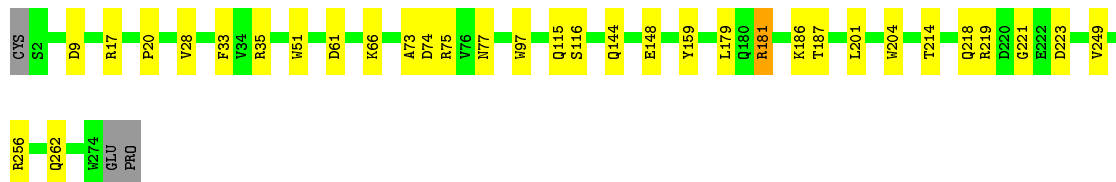
- Molecule 1: HLA class I histocompatibility antigen, Cw-6 alpha chain

Chain C: 




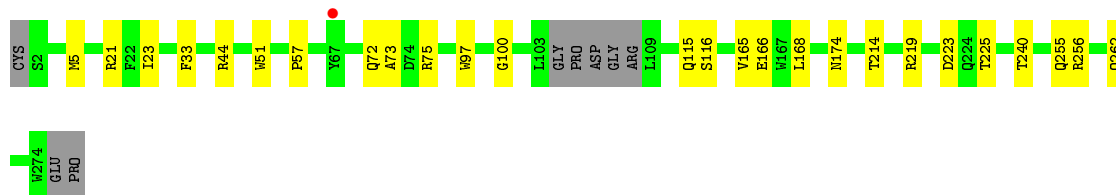
- Molecule 1: HLA class I histocompatibility antigen, Cw-6 alpha chain

Chain E: 



- Molecule 1: HLA class I histocompatibility antigen, Cw-6 alpha chain

Chain G: 



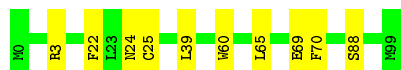
- Molecule 2: Beta-2-microglobulin

Chain B: 



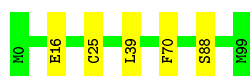
- Molecule 2: Beta-2-microglobulin

Chain D: 90% 10%



- Molecule 2: Beta-2-microglobulin

Chain F: 95% 5%



- Molecule 2: Beta-2-microglobulin

Chain H: 94% 6%



- Molecule 3: ALA-ARG-PHE-ASN-ASP-LEU-ARG-PHE-VAL

Chain I: 89% 11%



- Molecule 3: ALA-ARG-PHE-ASN-ASP-LEU-ARG-PHE-VAL

Chain J: 44% 56%



- Molecule 3: ALA-ARG-PHE-ASN-ASP-LEU-ARG-PHE-VAL

Chain K: 67% 33%



- Molecule 3: ALA-ARG-PHE-ASN-ASP-LEU-ARG-PHE-VAL

Chain L: 89% 11%





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	51.18Å 182.14Å 222.74Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.99 – 2.80 48.11 – 2.80	Depositor EDS
% Data completeness (in resolution range)	100.0 (40.99-2.80) 100.0 (48.11-2.80)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.95 (at 2.81Å)	Xtriage
Refinement program	BUSTER 2.10.2	Depositor
R, $R_{free}$	0.164 , 0.223 0.172 , 0.227	Depositor DCC
$R_{free}$ test set	2672 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	32.3	Xtriage
Anisotropy	0.441	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 54.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	13233	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	34.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 28.58 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.7979e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<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, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

## 5 Model quality [i](#)

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

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	0.55	0/2297	0.76	0/3124
1	C	0.52	0/2285	0.72	0/3110
1	E	0.53	0/2294	0.72	0/3120
1	G	0.53	0/2242	0.71	0/3052
2	B	0.55	0/848	0.73	0/1150
2	D	0.51	0/848	0.72	0/1150
2	F	0.48	0/836	0.69	0/1136
2	H	0.48	0/840	0.69	0/1140
3	I	0.67	0/82	0.82	0/107
3	J	0.53	0/82	0.73	0/107
3	K	0.61	0/82	0.79	0/107
3	L	0.53	0/82	0.65	0/107
All	All	0.53	0/12818	0.72	0/17410

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 5.2 Too-close contacts [i](#)

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	2231	0	2063	10	0
1	C	2218	0	2042	12	0
1	E	2230	0	2062	17	0
1	G	2180	0	1994	16	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	825	0	770	3	0
2	D	825	0	770	5	0
2	F	813	0	751	2	0
2	H	817	0	762	2	0
3	I	81	0	81	0	0
3	J	81	0	81	4	0
3	K	81	0	81	3	0
3	L	81	0	81	1	0
4	A	183	0	0	2	0
4	B	78	0	0	0	0
4	C	123	0	0	0	0
4	D	69	0	0	0	0
4	E	134	0	0	2	0
4	F	36	0	0	0	0
4	G	103	0	0	1	0
4	H	37	0	0	0	0
4	I	2	0	0	0	0
4	J	2	0	0	0	0
4	K	1	0	0	0	0
4	L	2	0	0	0	0
All	All	13233	0	11538	62	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 3.

The worst 5 of 62 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)
1:G:219:ARG:HD2	1:G:256:ARG:NH2	2.00	0.76
1:E:20:PRO:HD2	1:E:75:ARG:HG3	1.73	0.70
1:A:88:SER:HB3	1:G:255:GLN:OE1	2.02	0.60
1:G:72:GLN:HG2	1:G:75:ARG:HH12	1.67	0.59
1:G:223:ASP:OD2	1:G:225:THR:HG22	2.02	0.59

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	272/276 (99%)	266 (98%)	6 (2%)	0	100	100
1	C	272/276 (99%)	266 (98%)	6 (2%)	0	100	100
1	E	271/276 (98%)	265 (98%)	6 (2%)	0	100	100
1	G	264/276 (96%)	256 (97%)	8 (3%)	0	100	100
2	B	98/100 (98%)	96 (98%)	2 (2%)	0	100	100
2	D	98/100 (98%)	97 (99%)	1 (1%)	0	100	100
2	F	98/100 (98%)	96 (98%)	2 (2%)	0	100	100
2	H	98/100 (98%)	96 (98%)	2 (2%)	0	100	100
3	I	7/9 (78%)	7 (100%)	0	0	100	100
3	J	7/9 (78%)	7 (100%)	0	0	100	100
3	K	7/9 (78%)	7 (100%)	0	0	100	100
3	L	7/9 (78%)	7 (100%)	0	0	100	100
All	All	1499/1540 (97%)	1466 (98%)	33 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	227/233 (97%)	222 (98%)	5 (2%)	52	83
1	C	224/233 (96%)	217 (97%)	7 (3%)	40	74

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	E	227/233 (97%)	221 (97%)	6 (3%)	46	79
1	G	220/233 (94%)	216 (98%)	4 (2%)	59	86
2	B	92/95 (97%)	90 (98%)	2 (2%)	52	83
2	D	92/95 (97%)	90 (98%)	2 (2%)	52	83
2	F	89/95 (94%)	87 (98%)	2 (2%)	52	83
2	H	90/95 (95%)	88 (98%)	2 (2%)	52	83
3	I	8/8 (100%)	7 (88%)	1 (12%)	4	14
3	J	8/8 (100%)	6 (75%)	2 (25%)	0	2
3	K	8/8 (100%)	8 (100%)	0	100	100
3	L	8/8 (100%)	8 (100%)	0	100	100
All	All	1293/1344 (96%)	1260 (97%)	33 (3%)	46	79

5 of 33 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	D	70	PHE
1	E	115	GLN
3	I	7	ARG
2	D	88	SER
1	E	17	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	218	GLN
3	I	4	ASN
1	G	127	ASN
1	E	141	GLN
1	G	72	GLN

### 5.3.3 RNA ⓘ

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 ⓘ

### 6.1 Protein, DNA and RNA chains ⓘ

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	273/276 (98%)	-0.62	0 100 100	6, 22, 48, 64	3 (1%)
1	C	273/276 (98%)	-0.56	0 100 100	10, 32, 61, 89	0
1	E	273/276 (98%)	-0.64	0 100 100	13, 31, 57, 74	1 (0%)
1	G	268/276 (97%)	-0.30	1 (0%) 92 91	9, 48, 77, 98	4 (1%)
2	B	100/100 (100%)	-0.79	0 100 100	7, 25, 51, 68	0
2	D	100/100 (100%)	-0.81	0 100 100	10, 24, 47, 58	0
2	F	100/100 (100%)	-0.53	0 100 100	17, 39, 68, 80	0
2	H	100/100 (100%)	-0.40	0 100 100	25, 42, 64, 74	0
3	I	9/9 (100%)	-0.57	0 100 100	14, 18, 31, 48	0
3	J	9/9 (100%)	-0.50	0 100 100	23, 32, 49, 57	0
3	K	9/9 (100%)	-0.20	0 100 100	27, 36, 52, 66	0
3	L	9/9 (100%)	-0.06	0 100 100	36, 51, 63, 69	0
All	All	1523/1540 (98%)	-0.55	1 (0%) 95 95	6, 32, 66, 98	8 (0%)

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	67	TYR	2.2

### 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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

### 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 6.4 Ligands

There are no ligands in this entry.

## 6.5 Other polymers

There are no such residues in this entry.