



# Full wwPDB X-ray Structure Validation Report ⓘ

May 26, 2020 – 02:16 pm BST

PDB ID : 5GJY  
Title : Crystal structure of DUCK MHC CLASS I for 1.71 angstrom  
Authors : Wu, Y.; Xia, C.  
Deposited on : 2016-07-02  
Resolution : 1.71 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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

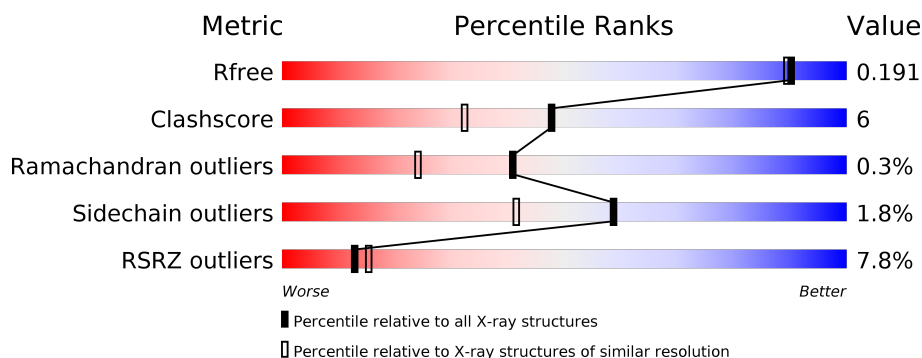
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.71 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	5722 (1.74-1.70)
Clashscore	141614	6152 (1.74-1.70)
Ramachandran outliers	138981	6051 (1.74-1.70)
Sidechain outliers	138945	6051 (1.74-1.70)
RSRZ outliers	127900	5629 (1.74-1.70)

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	273	<div> <div>10%</div> <div> <div></div> <div>85%</div> <div>12%</div> <div>••</div> </div> </div>
2	B	104	<div> <div>2%</div> <div> <div></div> <div>87%</div> <div>10%</div> <div>•</div> </div> </div>
3	C	9	<div> <div>11%</div> <div> <div></div> <div>56%</div> <div>11%</div> <div>11%</div> <div>22%</div> </div> </div>

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 3321 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 MHC class I antigen.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	266	Total	C	N	O	S	0	0	0
			2162	1352	385	416	9			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP Q6I7L2
A	2	GLU	-	expression tag	UNP Q6I7L2
A	3	PHE	-	expression tag	UNP Q6I7L2
A	220	GLY	ALA	engineered mutation	UNP Q6I7L2

- 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
			813	522	135	152	4			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1	MET	-	expression tag	UNP Q14U75
B	2	GLU	-	expression tag	UNP Q14U75
B	3	PHE	-	expression tag	UNP Q14U75

- Molecule 3 is a protein called MET-VAL-MET-GLU-LEU-ILE-ARG-MET-ILE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	7	Total	C	N	O	S	0	0	0
			59	39	10	8	2			

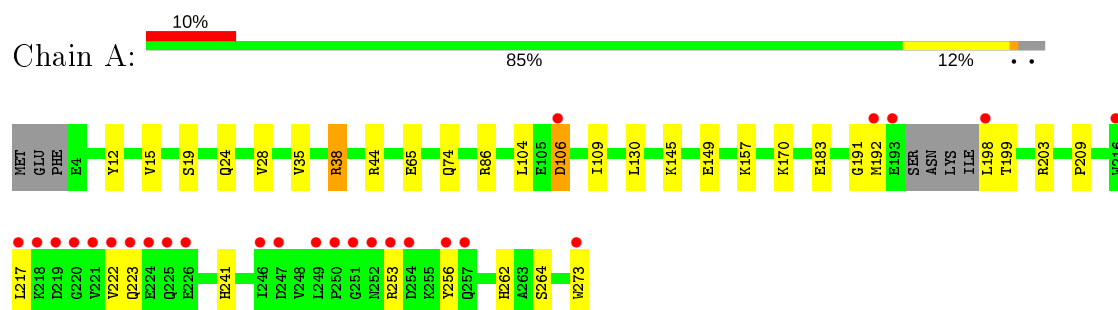
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	196	Total 196	O 196	0	0
4	B	87	Total 87	O 87	0	0
4	C	4	Total 4	O 4	0	0

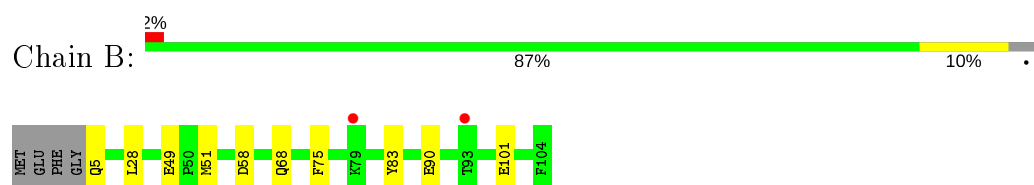
### 3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of 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: MHC class I antigen



- Molecule 2: Beta-2-microglobulin



- Molecule 3: MET-VAL-MET-GLU-LEU-ILE-ARG-MET-ILE



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	46.27Å 64.39Å 77.92Å 90.00° 105.74° 90.00°	Depositor
Resolution (Å)	50.00 – 1.71 37.50 – 1.71	Depositor EDS
% Data completeness (in resolution range)	89.5 (50.00-1.71) 89.5 (37.50-1.71)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	0.06	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.29 (at 1.71Å)	Xtriage
Refinement program	PHENIX 1.5_2, REFMAC 5.8.0073	Depositor
R, $R_{free}$	0.157 , 0.197 0.151 , 0.191	Depositor DCC
$R_{free}$ test set	2100 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	22.5	Xtriage
Anisotropy	0.110	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.41 , 54.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.025 for h,-k,-h-l	Xtriage
$F_o, F_c$ correlation	0.97	EDS
Total number of atoms	3321	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	33.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.54% 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, 0.333 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	1.13	2/2218 (0.1%)	1.01	4/3010 (0.1%)
2	B	1.16	1/840 (0.1%)	0.96	0/1144
3	C	1.87	3/57 (5.3%)	2.07	2/71 (2.8%)
All	All	1.16	6/3115 (0.2%)	1.03	6/4225 (0.1%)

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	19	SER	CB-OG	6.15	1.50	1.42
2	B	90	GLU	CD-OE2	6.14	1.32	1.25
3	C	2	VAL	CB-CG1	-6.00	1.40	1.52
1	A	106	ASP	CB-CG	5.21	1.62	1.51
3	C	2	VAL	CB-CG2	5.03	1.63	1.52
3	C	1	MET	N-CA	5.01	1.56	1.46

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	2	VAL	CG1-CB-CG2	-9.69	95.40	110.90
1	A	38	ARG	NE-CZ-NH1	9.53	125.06	120.30
1	A	38	ARG	NE-CZ-NH2	-8.07	116.27	120.30
1	A	86	ARG	NE-CZ-NH2	-6.71	116.95	120.30
3	C	2	VAL	CA-CB-CG2	5.63	119.34	110.90
1	A	104	LEU	CB-CG-CD1	-5.48	101.69	111.00

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	2162	0	2039	30	0
2	B	813	0	765	9	0
3	C	59	0	74	2	0
4	A	196	0	0	13	0
4	B	87	0	0	3	0
4	C	4	0	0	0	0
All	All	3321	0	2878	36	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 6.

All (36) 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:49:GLU:HG2	4:B:270:HOH:O	1.69	0.92
1:A:12:TYR:OH	3:C:2:VAL:HG23	1.81	0.80
2:B:5:GLN:N	4:B:201:HOH:O	2.18	0.75
1:A:109:ILE:HG22	4:A:436:HOH:O	1.85	0.74
1:A:65:GLU:OE1	3:C:2:VAL:HG12	1.88	0.74
1:A:198:LEU:CD1	1:A:253:ARG:HG2	2.19	0.72
1:A:15:VAL:HG22	4:A:382:HOH:O	1.90	0.70
1:A:191:GLY:HA2	1:A:199:THR:O	1.96	0.66
1:A:262:HIS:HD2	1:A:264:SER:OG	1.78	0.66
2:B:51:MET:CE	2:B:83:TYR:HD1	2.10	0.64
2:B:51:MET:HE1	2:B:83:TYR:HD1	1.63	0.64
1:A:273:TRP:O	4:A:302:HOH:O	2.15	0.64
1:A:38:ARG:NE	4:A:301:HOH:O	2.03	0.61
1:A:192:MET:O	1:A:198:LEU:HA	2.04	0.58
1:A:74:GLN:HG3	4:A:303:HOH:O	2.06	0.56
1:A:209:PRO:O	1:A:262:HIS:HE1	1.88	0.55
1:A:203:ARG:HH22	2:B:101:GLU:HB2	1.71	0.55
1:A:130:LEU:HD21	1:A:157:LYS:HD2	1.87	0.55
1:A:198:LEU:HD12	1:A:253:ARG:HG2	1.89	0.55
1:A:241:HIS:HE1	4:A:449:HOH:O	1.88	0.55
1:A:44:ARG:NH1	4:A:305:HOH:O	2.38	0.53
1:A:170:LYS:HE3	4:A:459:HOH:O	2.08	0.53
1:A:24:GLN:HG2	4:A:399:HOH:O	2.12	0.49
1:A:38:ARG:HD2	2:B:58:ASP:OD1	2.13	0.49
2:B:5:GLN:N	4:B:204:HOH:O	2.45	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:262:HIS:CD2	1:A:264:SER:H	2.33	0.47
1:A:109:ILE:CG2	4:A:334:HOH:O	2.65	0.44
1:A:15:VAL:HG23	4:A:380:HOH:O	2.17	0.44
1:A:217:LEU:O	1:A:256:TYR:HA	2.19	0.42
1:A:273:TRP:N	4:A:307:HOH:O	2.48	0.42
1:A:38:ARG:NH1	2:B:58:ASP:OD1	2.52	0.41
1:A:253:ARG:HE	1:A:253:ARG:HB2	1.64	0.41
1:A:28:VAL:HG13	1:A:35:VAL:HG13	2.02	0.41
2:B:28:LEU:CD2	2:B:51:MET:HE1	2.51	0.41
1:A:145:LYS:CE	4:A:324:HOH:O	2.68	0.41
1:A:192:MET:CE	1:A:192:MET:HA	2.52	0.40

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	262/273 (96%)	259 (99%)	2 (1%)	1 (0%)	34	18
2	B	98/104 (94%)	98 (100%)	0	0	100	100
3	C	3/9 (33%)	3 (100%)	0	0	100	100
All	All	363/386 (94%)	360 (99%)	2 (1%)	1 (0%)	41	24

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	222	VAL

### 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	233 /240 (97%)	229 (98%)	4 (2%)	60	44
2	B	88 /91 (97%)	86 (98%)	2 (2%)	50	31
3	C	7 /9 (78%)	7 (100%)	0	100	100
All	All	328 /340 (96%)	322 (98%)	6 (2%)	59	41

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	106	ASP
1	A	149	GLU
1	A	183	GLU
1	A	223	GLN
2	B	68	GLN
2	B	75	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	88	ASN
1	A	205	HIS
1	A	235	ASN
1	A	241	HIS
1	A	262	HIS
2	B	96	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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	266/273 (97%)	0.27	26 (9%) <b>7</b> <b>8</b>	13, 27, 75, 101	0
2	B	100/104 (96%)	-0.05	2 (2%) 65 69	17, 27, 49, 63	0
3	C	7/9 (77%)	0.93	1 (14%) <b>2</b> <b>2</b>	18, 26, 40, 41	0
All	All	373/386 (96%)	0.20	29 (7%) <b>13</b> <b>15</b>	13, 27, 70, 101	0

All (29) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	249	LEU	6.0
1	A	198	LEU	6.0
1	A	221	VAL	5.8
1	A	222	VAL	5.4
1	A	192	MET	5.0
1	A	225	GLN	4.5
1	A	251	GLY	4.2
1	A	253	ARG	3.5
2	B	93	THR	3.5
1	A	223	GLN	2.9
1	A	193	GLU	2.9
1	A	246	ILE	2.9
1	A	217	LEU	2.9
1	A	219	ASP	2.9
1	A	273	TRP	2.8
1	A	250	PRO	2.7
1	A	257	GLN	2.7
1	A	247	ASP	2.7
1	A	220	GLY	2.6
1	A	256	TYR	2.5
1	A	226	GLU	2.5
1	A	224	GLU	2.4
1	A	218	LYS	2.4

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Mol	Chain	Res	Type	RSRZ
3	C	2	VAL	2.3
1	A	106	ASP	2.2
1	A	252	ASN	2.2
1	A	254	ASP	2.1
2	B	79	LYS	2.1
1	A	216	TRP	2.0

## 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.