



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jan 31, 2016 – 09:04 PM GMT

PDB ID : 1N5A  
Title : Crystal structure of the Murine class I Major Histocompatibility Complex of H-2DB, B2-Microglobulin, and A 9-Residue immunodominant peptide epitope gp33 derived from LCMV  
Authors : Achour, A.; Michaelsson, J.; Harris, R.A.; Odeberg, J.; Grufman, P.; Sandberg, J.K.; Levitsky, V.; Karre, K.; Sandalova, T.; Schneider, G.  
Deposited on : 2002-11-05  
Resolution : 2.85 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.

---

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

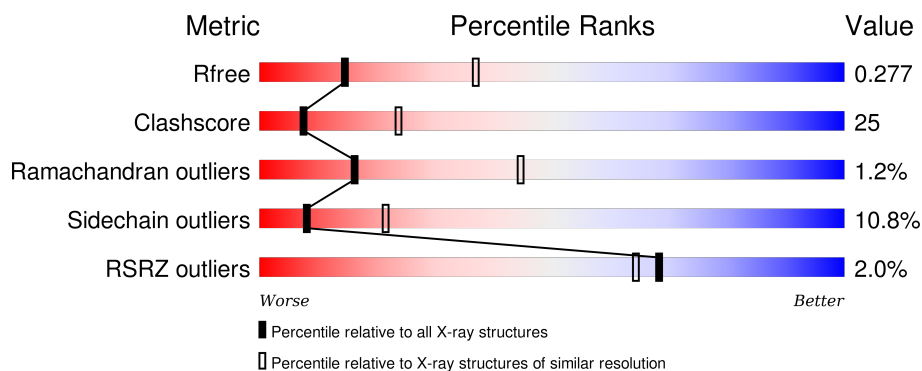
# 1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.85 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	2228 (2.90-2.82)
Clashscore	102246	2499 (2.90-2.82)
Ramachandran outliers	100387	2439 (2.90-2.82)
Sidechain outliers	100360	2442 (2.90-2.82)
RSRZ outliers	91569	2236 (2.90-2.82)

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	276	<div> <div>2%</div> <div>52% 39% 8% .</div> </div>
1	D	276	<div> <div>6%</div> <div>53% 37% 7% ..</div> </div>
1	G	276	<div> <div>2%</div> <div>53% 39% 6% ..</div> </div>
1	J	276	<div> <div>2%</div> <div>58% 36% . ..</div> </div>
2	B	99	<div> <div>6%</div> <div>54% 37% 6% ..</div> </div>

*Continued on next page...*

Continued from previous page...

Mol	Chain	Length	Quality of chain
2	E	99	<div><div><div>%</div><div><div></div><div>64%</div><div>34%</div><div></div></div><div></div></div></div>
2	H	99	<div><div><div>65%</div><div>31%</div><div></div></div><div></div></div>
2	K	99	<div><div><div>64%</div><div>33%</div><div></div></div><div></div></div>
3	C	9	<div><div><div>44%</div><div>44%</div><div>11%</div></div><div></div></div>
3	F	9	<div><div><div>11%</div><div>22%</div><div>33%</div><div>44%</div></div><div></div></div>
3	I	9	<div><div><div>33%</div><div>33%</div><div>22%</div><div>11%</div></div><div></div></div>
3	L	9	<div><div><div>22%</div><div>56%</div><div>11%</div><div>11%</div></div><div></div></div>

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 12633 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 H-2 class I histocompatibility antigen, D-B alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	276	Total	C	N	O	S	0	0	0
			2265	1430	400	426	9			
1	D	274	Total	C	N	O	S	0	0	0
			2248	1420	398	421	9			
1	G	273	Total	C	N	O	S	0	0	0
			2244	1418	397	420	9			
1	J	273	Total	C	N	O	S	0	0	0
			2244	1418	397	420	9			

- Molecule 2 is a protein called Beta-2-microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	98	Total	C	N	O	S	0	0	0
			812	519	137	150	6			
2	E	99	Total	C	N	O	S	0	0	0
			821	524	138	152	7			
2	H	99	Total	C	N	O	S	0	0	0
			821	524	138	152	7			
2	K	99	Total	C	N	O	S	0	0	0
			821	524	138	152	7			

- Molecule 3 is a protein called nonameric peptide, gp33 derived from lymphocytic choriomeningitis virus.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	9	Total	C	N	O	S	0	0	0
			73	48	11	13	1			
3	F	9	Total	C	N	O	S	0	0	0
			73	48	11	13	1			
3	I	9	Total	C	N	O	S	0	0	0
			73	48	11	13	1			
3	L	9	Total	C	N	O	S	0	0	0
			73	48	11	13	1			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	9	MET	CYS	ENGINEERED	UNP Q9QDK7
F	9	MET	CYS	ENGINEERED	UNP Q9QDK7
I	9	MET	CYS	ENGINEERED	UNP Q9QDK7
L	9	MET	CYS	ENGINEERED	UNP Q9QDK7

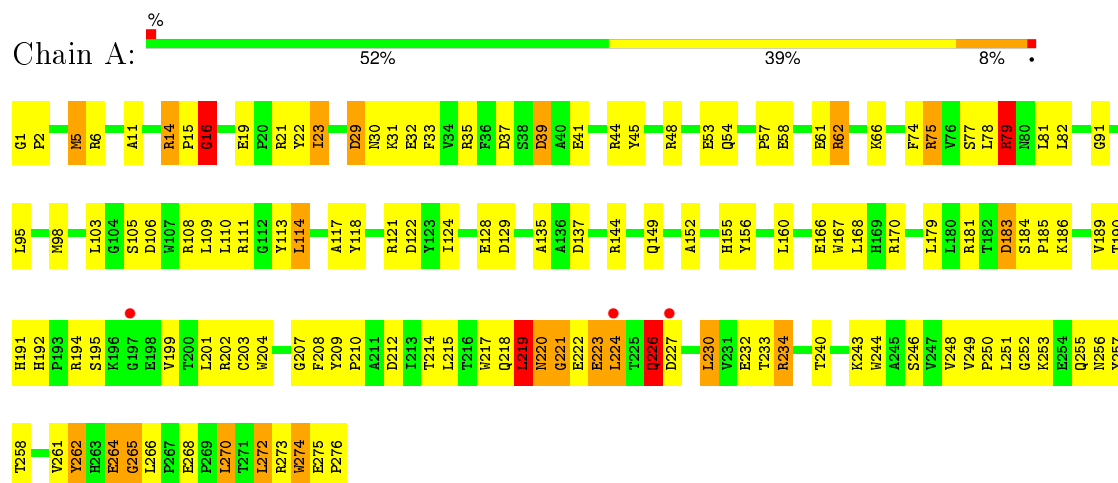
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	12	Total O 12 12	0	0
4	B	7	Total O 7 7	0	0
4	D	12	Total O 12 12	0	0
4	E	2	Total O 2 2	0	0
4	G	9	Total O 9 9	0	0
4	H	5	Total O 5 5	0	0
4	J	10	Total O 10 10	0	0
4	K	7	Total O 7 7	0	0
4	L	1	Total O 1 1	0	0

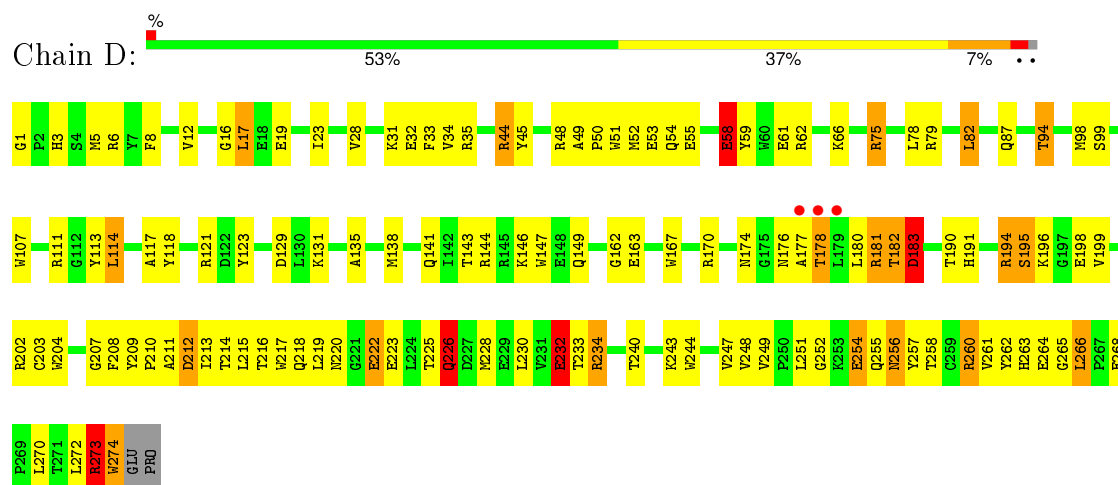
### 3 Residue-property plots

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.

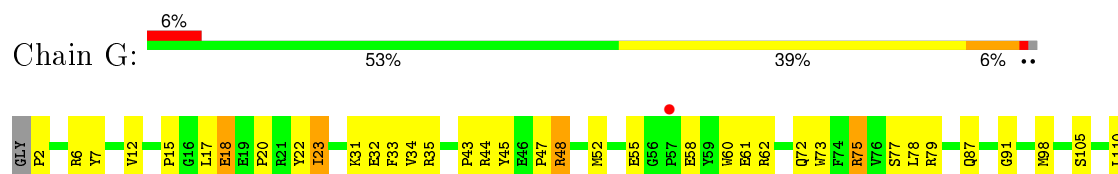
- Molecule 1: H-2 class I histocompatibility antigen, D-B alpha chain

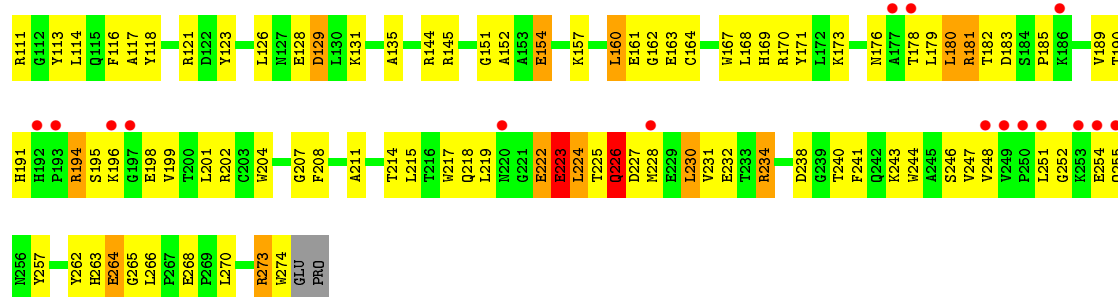


- Molecule 1: H-2 class I histocompatibility antigen, D-B alpha chain

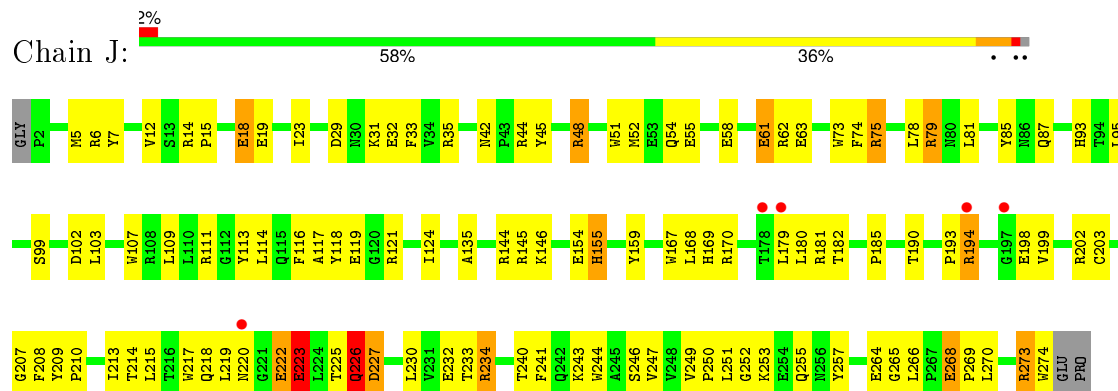


- Molecule 1: H-2 class I histocompatibility antigen, D-B alpha chain

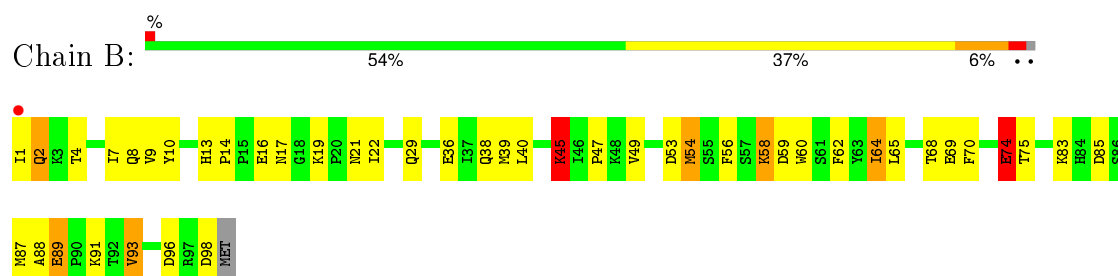




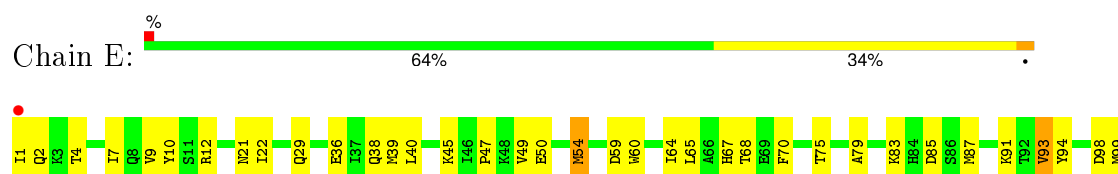
- Molecule 1: H-2 class I histocompatibility antigen, D-B alpha chain



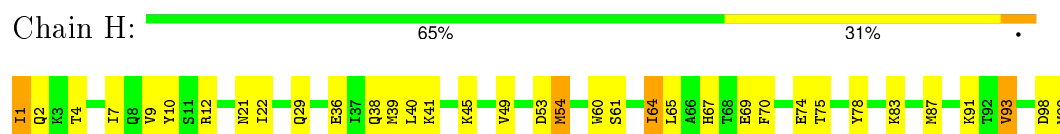
- Molecule 2: Beta-2-microglobulin



- Molecule 2: Beta-2-microglobulin



- Molecule 2: Beta-2-microglobulin

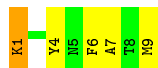


- Molecule 2: Beta-2-microglobulin

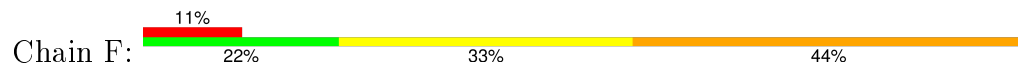




- Molecule 3: nonameric peptide, gp33 derived from lymphocytic choriomeningitis virus



- Molecule 3: nonameric peptide, gp33 derived from lymphocytic choriomeningitis virus



- Molecule 3: nonameric peptide, gp33 derived from lymphocytic choriomeningitis virus



- Molecule 3: nonameric peptide, gp33 derived from lymphocytic choriomeningitis virus





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	92.00 Å 122.66 Å 99.18 Å 90.00° 103.34° 90.00°	Depositor
Resolution (Å)	19.92 – 2.85 19.93 – 2.84	Depositor EDS
% Data completeness (in resolution range)	100.0 (19.92-2.85) 90.8 (19.93-2.84)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.10	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.95 (at 2.83 Å)	Xtriage
Refinement program	REFMAC 5	Depositor
R, $R_{free}$	0.251 , 0.279 0.252 , 0.277	Depositor DCC
$R_{free}$ test set	2280 reflections (5.27%)	DCC
Wilson B-factor (Å <sup>2</sup> )	46.0	Xtriage
Anisotropy	0.384	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 15.4	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.45$ , $\langle L^2 \rangle = 0.28$	Xtriage
Outliers	0 of 45779 reflections	Xtriage
$F_o, F_c$ correlation	0.87	EDS
Total number of atoms	12633	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	11.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.47% 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	1.00	8/2332 (0.3%)	1.16	21/3166 (0.7%)
1	D	1.08	14/2314 (0.6%)	1.16	17/3142 (0.5%)
1	G	1.04	11/2310 (0.5%)	1.05	8/3136 (0.3%)
1	J	1.03	9/2310 (0.4%)	1.03	6/3136 (0.2%)
2	B	0.94	1/838 (0.1%)	1.22	10/1138 (0.9%)
2	E	0.91	0/847	1.02	1/1148 (0.1%)
2	H	0.86	0/847	0.99	1/1148 (0.1%)
2	K	0.89	0/847	1.00	1/1148 (0.1%)
3	C	1.63	1/74 (1.4%)	1.30	1/97 (1.0%)
3	F	2.99	8/74 (10.8%)	1.16	0/97
3	I	2.02	3/74 (4.1%)	2.20	4/97 (4.1%)
3	L	1.58	1/74 (1.4%)	2.36	6/97 (6.2%)
All	All	1.04	56/12941 (0.4%)	1.11	76/17550 (0.4%)

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	D	0	1
1	J	0	1
All	All	0	2

The worst 5 of 56 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	F	9	MET	C-OXT	-17.64	0.89	1.23
1	D	58	GLU	CD-OE1	-10.75	1.13	1.25
3	I	4	TYR	CB-CG	-10.09	1.36	1.51
1	J	58	GLU	CD-OE2	-9.89	1.14	1.25
1	A	58	GLU	CD-OE2	-9.75	1.15	1.25

The worst 5 of 76 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	75	ARG	NE-CZ-NH1	-14.72	112.94	120.30
3	I	4	TYR	CB-CG-CD2	-14.44	112.33	121.00
3	L	4	TYR	CB-CG-CD1	-12.93	113.24	121.00
1	D	274	TRP	N-CA-C	-12.84	76.34	111.00
1	A	111	ARG	NE-CZ-NH2	11.43	126.02	120.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	223	GLU	Mainchain
1	J	223	GLU	Mainchain

## 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	2265	0	2136	144	0
1	D	2248	0	2123	133	0
1	G	2244	0	2118	119	0
1	J	2244	0	2118	132	0
2	B	812	0	787	34	0
2	E	821	0	796	38	0
2	H	821	0	796	25	0
2	K	821	0	796	30	0
3	C	73	0	74	6	0
3	F	73	0	74	13	0
3	I	73	0	73	9	0
3	L	73	0	74	17	0
4	A	12	0	0	1	0
4	B	7	0	0	0	0
4	D	12	0	0	0	0
4	E	2	0	0	0	0
4	G	9	0	0	2	0
4	H	5	0	0	0	0
4	J	10	0	0	0	0

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	K	7	0	0	0	0
4	L	1	0	0	0	0
All	All	12633	0	11965	625	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 25.

The worst 5 of 625 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:A:194:ARG:CG	1:A:195:SER:H	1.42	1.30
1:D:273:ARG:CG	1:D:274:TRP:O	1.77	1.30
1:A:1:GLY:O	1:A:105:SER:HA	1.38	1.21
1:G:181:ARG:HB2	1:G:181:ARG:HH11	1.07	1.18
1:J:155:HIS:HB3	3:L:6:PHE:CE1	1.79	1.16

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	274/276 (99%)	250 (91%)	20 (7%)	4 (2%)	13	38
1	D	272/276 (99%)	252 (93%)	15 (6%)	5 (2%)	11	33
1	G	271/276 (98%)	249 (92%)	19 (7%)	3 (1%)	17	47
1	J	271/276 (98%)	249 (92%)	20 (7%)	2 (1%)	26	59
2	B	96/99 (97%)	95 (99%)	0	1 (1%)	19	49
2	E	97/99 (98%)	94 (97%)	2 (2%)	1 (1%)	19	49
2	H	97/99 (98%)	95 (98%)	2 (2%)	0	100	100
2	K	97/99 (98%)	95 (98%)	1 (1%)	1 (1%)	19	49

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	C	7/9 (78%)	6 (86%)	1 (14%)	0	100	100
3	F	7/9 (78%)	5 (71%)	1 (14%)	1 (14%)	0	0
3	I	7/9 (78%)	5 (71%)	2 (29%)	0	100	100
3	L	7/9 (78%)	6 (86%)	1 (14%)	0	100	100
All	All	1503/1536 (98%)	1401 (93%)	84 (6%)	18 (1%)	16	44

5 of 18 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	226	GLN
1	G	180	LEU
1	J	226	GLN
1	A	16	GLY
1	A	219	LEU

### 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	234/234 (100%)	207 (88%)	27 (12%)	7	19
1	D	232/234 (99%)	205 (88%)	27 (12%)	7	18
1	G	232/234 (99%)	207 (89%)	25 (11%)	8	21
1	J	232/234 (99%)	216 (93%)	16 (7%)	19	45
2	B	93/94 (99%)	79 (85%)	14 (15%)	3	9
2	E	94/94 (100%)	85 (90%)	9 (10%)	10	28
2	H	94/94 (100%)	83 (88%)	11 (12%)	7	17
2	K	94/94 (100%)	83 (88%)	11 (12%)	7	17
3	C	7/7 (100%)	7 (100%)	0	100	100
3	F	7/7 (100%)	6 (86%)	1 (14%)	4	10
3	I	7/7 (100%)	5 (71%)	2 (29%)	0	1
3	L	7/7 (100%)	6 (86%)	1 (14%)	4	10

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	1333/1340 (100%)	1189 (89%)	144 (11%)	8 21

5 of 144 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	268	GLU
1	G	45	TYR
2	K	4	THR
1	D	273	ARG
2	E	70	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 38 such sidechains are listed below:

Mol	Chain	Res	Type
2	E	31	HIS
1	G	220	ASN
2	K	29	GLN
1	G	54	GLN
1	G	255	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 ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

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	276/276 (100%)	-0.17	3 (1%) 82 80	2, 10, 24, 76	0
1	D	274/276 (99%)	-0.24	3 (1%) 82 80	2, 9, 24, 61	0
1	G	273/276 (98%)	0.14	17 (6%) 24 17	2, 9, 22, 65	0
1	J	273/276 (98%)	-0.16	5 (1%) 71 68	2, 9, 22, 64	0
2	B	98/99 (98%)	-0.31	1 (1%) 84 81	5, 8, 13, 17	0
2	E	99/99 (100%)	-0.23	1 (1%) 84 81	5, 8, 13, 34	0
2	H	99/99 (100%)	-0.19	0 100 100	5, 8, 13, 40	0
2	K	99/99 (100%)	-0.34	0 100 100	5, 8, 13, 36	0
3	C	9/9 (100%)	0.18	0 100 100	7, 9, 10, 11	0
3	F	9/9 (100%)	0.16	1 (11%) 7 4	7, 9, 10, 11	0
3	I	9/9 (100%)	0.32	0 100 100	7, 9, 10, 11	0
3	L	9/9 (100%)	0.17	0 100 100	7, 9, 10, 11	0
All	All	1527/1536 (99%)	-0.14	31 (2%) 68 64	2, 9, 22, 76	0

The worst 5 of 31 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	196	LYS	5.2
1	G	220	ASN	4.5
1	J	178	THR	4.4
1	D	177	ALA	4.2
1	G	251	LEU	4.1

### 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 [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.