Full wwPDB X-ray Structure Validation Report ⓘ

Dec 9, 2024 – 02:20 PM EST

PDB ID	:	8TMU
Title	:	HLA-B*73:01 bound to a 10mer peptide in complex with KIR2DL2
Authors	:	Ross, P.; Adams, E.
Deposited on	:	2023-07-31
Resolution	:	2.90 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

|		
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.21
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.004 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.40

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 2.90 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.
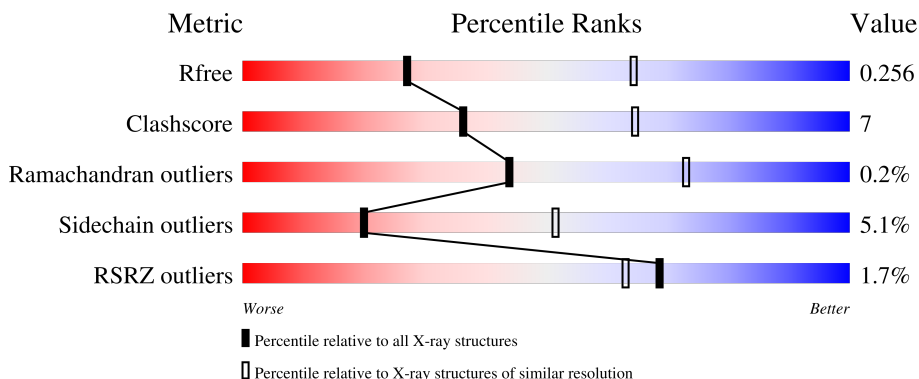
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	2335 (2.90-2.90)
Clashscore	180529	2564 (2.90-2.90)
Ramachandran outliers	177936	2514 (2.90-2.90)
Sidechain outliers	177891	2516 (2.90-2.90)
RSRZ outliers	164620	2337 (2.90-2.90)

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 >=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 <=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	277	79% 17% · ·
2	B	101	78% 20% ·
3	C	225	74% 16% · 9%
4	E	10	60% 30% 10%

2 Entry composition ⓘ

There are 8 unique types of molecules in this entry. The entry contains 4761 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-B*73:01.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	275	Total 2192	C 1365	N 399	O 420	S 8	8	1	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	initiating methionine	UNP A0A583ZBV1
A	270	LEU	CYS	engineered mutation	UNP A0A583ZBV1

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	99	Total 821	C 523	N 138	O 157	S 3	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	MET	-	initiating methionine	UNP P61769
B	1	GLY	-	expression tag	UNP P61769

- Molecule 3 is a protein called Killer cell immunoglobulin-like receptor 2DL2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	204	Total 1554	C 978	N 271	O 297	S 8	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	225	LEU	ILE	conflict	UNP P43627

- Molecule 4 is a protein called KP1.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
4	E	10	Total	C	N	O	0	0	0
			75	49	14	12			

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).
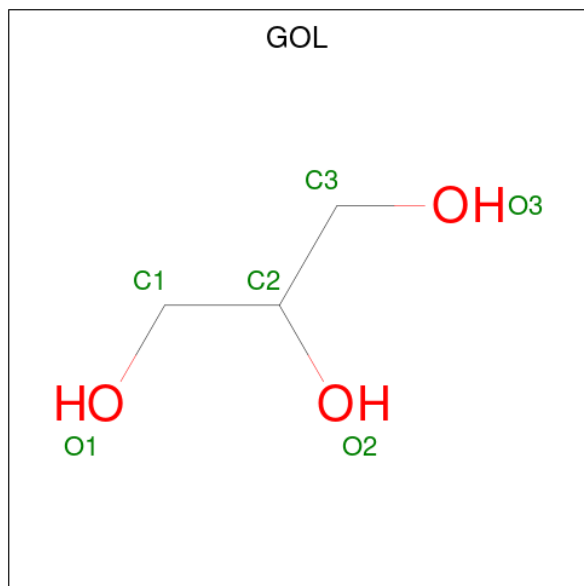
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			6	3	3		
5	A	1	Total	C	O	0	0
			6	3	3		
5	A	1	Total	C	O	0	0
			6	3	3		
5	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 6 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: $C_4H_{10}O_3$).

PEG

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total 7	C 4	O 3	0	0

- Molecule 7 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: $C_8H_{15}NO_6$).

NAG
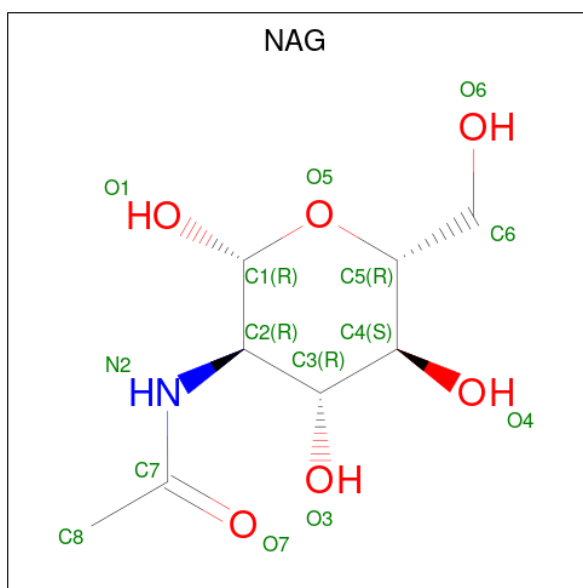
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	C	1	Total 14	C 8	N 1	O 5	14	0
7	C	1	Total 14	C 8	N 1	O 5	0	0

- Molecule 8 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	28	Total O 28 28		0	0
8	B	9	Total O 9 9		0	0
8	C	23	Total O 23 23		0	0

3 Residue-property plots (i)

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 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.
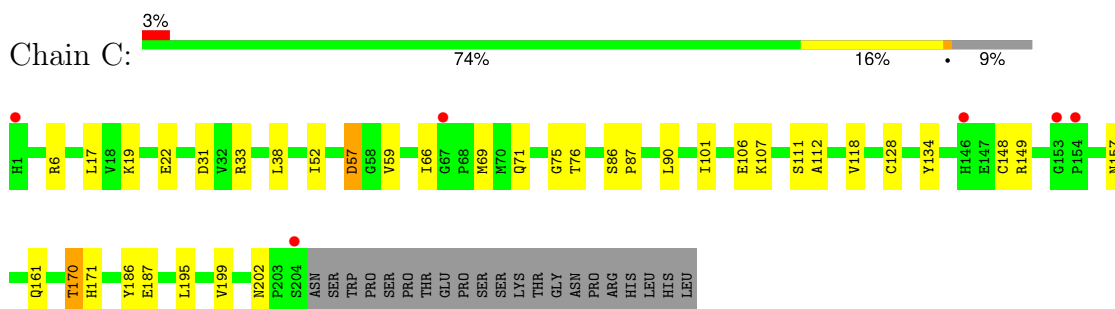
- Molecule 1: HLA-B*73:01

Chain A:
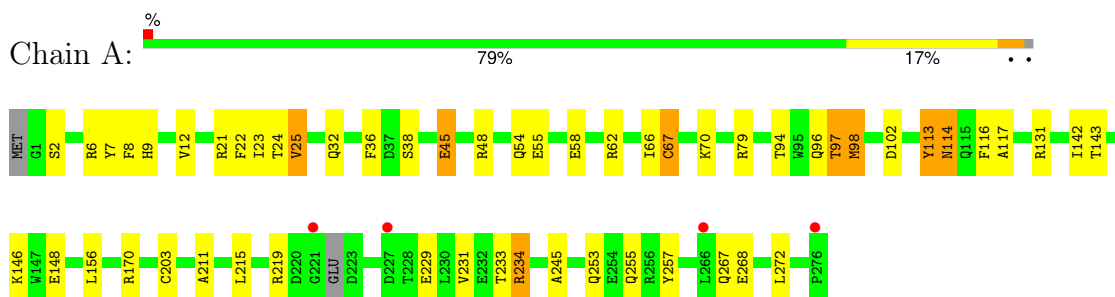
- Molecule 2: Beta-2-microglobulin

Chain B:
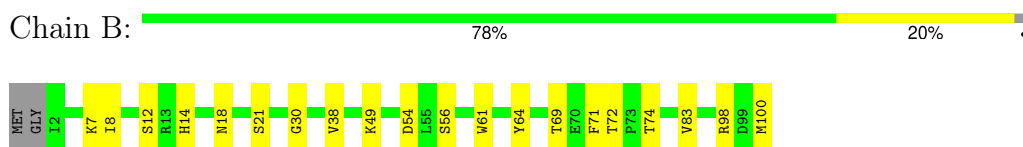
- Molecule 3: Killer cell immunoglobulin-like receptor 2DL2

Chain C:

- Molecule 4: KP1

Chain E:

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α, β, γ	92.69Å 92.69Å 200.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	54.30 – 2.90 54.30 – 2.90	Depositor EDS
% Data completeness (in resolution range)	100.0 (54.30-2.90) 100.0 (54.30-2.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.25 (at 2.91Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487+SVN	Depositor
R, R_{free}	0.215 , 0.258 0.214 , 0.256	Depositor DCC
R_{free} test set	999 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å^2)	68.8	Xtriage
Anisotropy	0.140	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 59.0	EDS
L-test for twinning [2]	$< |L| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	4761	wwPDB-VP
Average B, all atoms (Å^2)	69.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.47% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5   Model quality ⓘ

5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: PEG, NAG, GOL

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	0.24	0/2252	0.53	0/3069
2	B	0.24	0/844	0.48	0/1143
3	C	0.27	0/1599	0.54	1/2174 (0.0%)
4	E	0.30	0/76	0.55	0/98
All	All	0.25	0/4771	0.52	1/6484 (0.0%)

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
3	C	0	1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	57	ASP	CB-CG-OD1	5.08	122.87	118.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
3	C	86	SER	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	2192	0	1991	39	0
2	B	821	0	774	13	0
3	C	1554	0	1468	15	0
4	E	75	0	75	7	0
5	A	18	0	24	1	0
5	B	6	0	8	0	0
6	A	7	0	10	0	0
7	C	28	0	26	0	0
8	A	28	0	0	1	0
8	B	9	0	0	0	0
8	C	23	0	0	1	0
All	All	4761	0	4376	64	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.

All (64) 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:9:HIS:HB2	1:A:97:THR:HG23	1.68	0.75
1:A:24:THR:OG1	4:E:2:ARG:NH2	2.23	0.72
1:A:55:GLU:OE2	1:A:170:ARG:NH1	2.27	0.68
1:A:268:GLU:N	1:A:268:GLU:OE2	2.28	0.66
3:C:112:ALA:HB2	3:C:195:LEU:HD21	1.81	0.62
4:E:10:LEU:H	4:E:10:LEU:HD23	1.65	0.60
1:A:148:GLU:HB2	5:A:303:GOL:H11	1.84	0.60
1:A:253:GLN:HG3	1:A:253:GLN:O	2.03	0.59
2:B:7:LYS:HE3	2:B:30:GLY:HA3	1.88	0.55
1:A:67:CYS:HA	1:A:70:LYS:HB3	1.89	0.55
1:A:267:GLN:HB2	1:A:268:GLU:OE2	2.06	0.55
2:B:49:LYS:O	2:B:69:THR:OG1	2.20	0.55
1:A:203:CYS:HB3	1:A:215:LEU:HD21	1.88	0.55
3:C:71:GLN:NE2	3:C:187:GLU:OE1	2.37	0.54
1:A:131:ARG:NH2	8:A:403:HOH:O	2.41	0.54
3:C:170:THR:HG23	3:C:171:HIS:H	1.72	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:102:ASP:OD1	1:A:113:TYR:OH	2.25	0.52
2:B:38:VAL:HG22	2:B:83:VAL:HG22	1.93	0.51
3:C:57:ASP:O	3:C:59:VAL:HG13	2.10	0.50
1:A:156:LEU:HD21	4:E:6:PHE:HE2	1.77	0.50
3:C:157:ASN:ND2	8:C:403:HOH:O	2.43	0.49
1:A:21:ARG:HH11	1:A:23:ILE:HD11	1.78	0.49
1:A:12:VAL:HG22	1:A:94:THR:HG23	1.94	0.48
1:A:70:LYS:NZ	1:A:97:THR:HG21	2.29	0.48
1:A:21:ARG:NH1	1:A:23:ILE:HD11	2.28	0.48
2:B:74:THR:O	2:B:98:ARG:NH2	2.47	0.47
1:A:142:ILE:O	1:A:146:LYS:HG3	2.14	0.47
2:B:12:SER:OG	2:B:14:HIS:O	2.22	0.47
3:C:75:GLY:HA2	3:C:186:TYR:CD1	2.50	0.47
2:B:8:ILE:HG12	2:B:83:VAL:HG21	1.97	0.46
3:C:118:VAL:O	3:C:199:VAL:HA	2.15	0.46
2:B:18:ASN:OD1	2:B:98:ARG:NH2	2.33	0.46
1:A:7:TYR:CZ	4:E:2:ARG:HG2	2.52	0.45
1:A:45:GLU:OE2	4:E:2:ARG:NH1	2.49	0.45
1:A:97:THR:HB	1:A:116:PHE:CD1	2.52	0.45
1:A:22:PHE:H	1:A:38:SER:HB3	1.81	0.44
1:A:234:ARG:NH1	2:B:100:MET:O	2.48	0.44
3:C:106:GLU:O	3:C:134:TYR:OH	2.28	0.44
1:A:32:GLN:HE21	1:A:48:ARG:HG3	1.82	0.44
1:A:229:GLU:O	1:A:245:ALA:HA	2.18	0.44
2:B:21:SER:HA	2:B:72:THR:HG22	2.00	0.43
1:A:8:PHE:HB2	1:A:25:VAL:HG12	1.99	0.43
3:C:6:ARG:NH1	3:C:31:ASP:OD2	2.52	0.43
3:C:52:ILE:H	3:C:52:ILE:HG13	1.67	0.42
1:A:211:ALA:HB1	1:A:233:THR:HG21	2.02	0.42
1:A:219:ARG:HG3	1:A:257:TYR:CZ	2.54	0.42
3:C:69:MET:HG3	3:C:101:ILE:HD12	2.02	0.42
1:A:25:VAL:HG22	1:A:32:GLN:HG3	2.02	0.42
1:A:117:ALA:HB2	2:B:61:TRP:CE2	2.55	0.42
1:A:32:GLN:NE2	2:B:54:ASP:OD2	2.40	0.42
1:A:66:ILE:HG21	4:E:2:ARG:HB2	2.01	0.42
1:A:70:LYS:HZ1	1:A:97:THR:HG21	1.84	0.41
3:C:19:LYS:HB2	3:C:22:GLU:HG3	2.02	0.41
1:A:24:THR:CG2	1:A:36:PHE:HB3	2.50	0.41
1:A:66:ILE:CD1	4:E:4:ALA:HA	2.50	0.41
2:B:56:SER:HB3	2:B:64:TYR:CZ	2.56	0.41
1:A:114:ASN:C	1:A:114:ASN:HD22	2.24	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:38:LEU:HD22	3:C:90:LEU:HD21	2.03	0.41
1:A:58:GLU:O	1:A:62:ARG:HB3	2.21	0.40
3:C:66:ILE:HD13	3:C:66:ILE:HA	1.79	0.40
1:A:6:ARG:HG2	1:A:98:MET:CE	2.51	0.40
3:C:128:CYS:O	3:C:161:GLN:HA	2.21	0.40
1:A:96:GLN:NE2	2:B:61:TRP:O	2.53	0.40
1:A:255:GLN:C	1:A:257:TYR:H	2.25	0.40

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	272/277 (98%)	263 (97%)	9 (3%)	0	100	100
2	B	97/101 (96%)	94 (97%)	3 (3%)	0	100	100
3	C	202/225 (90%)	189 (94%)	12 (6%)	1 (0%)	25	56
4	E	8/10 (80%)	8 (100%)	0	0	100	100
All	All	579/613 (94%)	554 (96%)	24 (4%)	1 (0%)	44	73

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	C	87	PRO

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	219/234 (94%)	205 (94%)	14 (6%)	14	41
2	B	92/95 (97%)	91 (99%)	1 (1%)	70	90
3	C	170/195 (87%)	161 (95%)	9 (5%)	19	49
4	E	6/6 (100%)	5 (83%)	1 (17%)	2	5
All	All	487/530 (92%)	462 (95%)	25 (5%)	20	51

All (25) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	SER
1	A	25	VAL
1	A	45	GLU
1	A	54	GLN
1	A	67	CYS
1	A	79	ARG
1	A	97	THR
1	A	98	MET
1	A	113	TYR
1	A	114	ASN
1	A	143	THR
1	A	231	VAL
1	A	234	ARG
1	A	272	LEU
2	B	71	PHE
3	C	17	LEU
3	C	33	ARG
3	C	76	THR
3	C	107	LYS
3	C	111	SER
3	C	148	CYS
3	C	149	ARG
3	C	170	THR
3	C	202	ASN
4	E	6	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	174	ASN
1	A	180	GLN
1	A	218	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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

7 ligands are 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	$\#|Z| > 2$
5	GOL	A	301	-	5,5,5	0.96	0	5,5,5	1.04	0
5	GOL	A	303	-	5,5,5	0.94	0	5,5,5	1.06	0
7	NAG	C	302	3	14,14,15	0.33	0	17,19,21	0.51	0
7	NAG	C	301	3	14,14,15	0.25	0	17,19,21	0.47	0
5	GOL	A	304	-	5,5,5	0.91	0	5,5,5	1.01	0
6	PEG	A	302	-	6,6,6	0.14	0	5,5,5	0.07	0
5	GOL	B	201	-	5,5,5	0.92	0	5,5,5	1.07	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	GOL	A	301	-	-	2/4/4/4	-
5	GOL	A	303	-	-	0/4/4/4	-
7	NAG	C	302	3	-	2/6/23/26	0/1/1/1
7	NAG	C	301	3	-	0/6/23/26	0/1/1/1
5	GOL	A	304	-	-	0/4/4/4	-
6	PEG	A	302	-	-	3/4/4/4	-
5	GOL	B	201	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (9) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	301	GOL	O1-C1-C2-O2
5	A	301	GOL	O1-C1-C2-C3
5	B	201	GOL	O1-C1-C2-C3
5	B	201	GOL	O1-C1-C2-O2
6	A	302	PEG	O2-C3-C4-O4
6	A	302	PEG	C1-C2-O2-C3
7	C	302	NAG	C3-C2-N2-C7
7	C	302	NAG	C1-C2-N2-C7
6	A	302	PEG	C4-C3-O2-C2

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	303	GOL	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 ⓘ

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, 95th 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(Å²)	Q<0.9
1	A	275/277 (99%)	0.10	4 (1%)	71	66	33, 74, 121, 146	1 (0%)
2	B	99/101 (98%)	-0.37	0	100	100	44, 57, 86, 104	0
3	C	204/225 (90%)	-0.08	6 (2%)	54	48	43, 58, 101, 130	0
4	E	10/10 (100%)	0.29	0	100	100	68, 78, 87, 90	0
All	All	588/613 (95%)	-0.04	10 (1%)	69	63	33, 64, 111, 146	1 (0%)

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	276	PRO	6.4
3	C	67	GLY	5.1
3	C	204	SER	3.8
1	A	227	ASP	3.8
3	C	153	GLY	2.7
1	A	221	GLY	2.6
1	A	266	LEU	2.2
3	C	154	PRO	2.2
3	C	146	HIS	2.1
3	C	1	HIS	2.1

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 ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

LIGAND-RSR INFOmissingINFO

6.5 Other polymers ⓘ

There are no such residues in this entry.