



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 22, 2024 – 06:28 AM EDT

PDB ID : 4GRL
Title : Crystal structure of a autoimmune TCR-MHC complex
Authors : Sethi, D.K.; Wucherpfennig, K.W.
Deposited on : 2012-08-25
Resolution : 2.86 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) : 1.20.1
EDS : 3.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.003 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.39

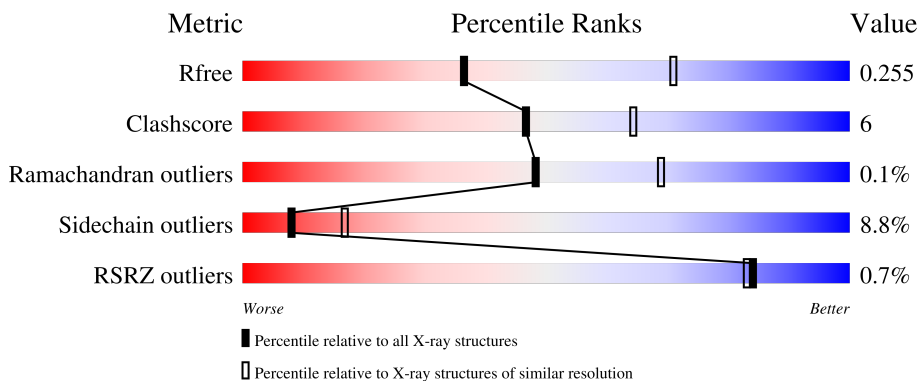
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.86 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	1268 (2.88-2.84)
Clashscore	180529	1351 (2.88-2.84)
Ramachandran outliers	177936	1318 (2.88-2.84)
Sidechain outliers	177891	1319 (2.88-2.84)
RSRZ outliers	164620	1269 (2.88-2.84)

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 $\leq 5\%$. 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	183	 80% 18% ..
2	B	200	 68% 20% • 10%
3	C	209	 70% 20% • 9%
4	D	268	 82% 12% • •

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
5	NAG	B	201	X	-	-	-

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6448 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 II HLA-DQ-alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	182	1450	933	236	276	5	0	0	0

- Molecule 2 is a protein called MHC class II antigen.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	181	1474	930	265	273	6	0	0	0

- Molecule 3 is a protein called TCR Hy.1B11 alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	C	191	1480	918	249	306	7	0	0	0

- Molecule 4 is a protein called TCR Hy.1B11 beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
4	D	257	1995	1259	346	384	6	0	0	0

- Molecule 5 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: C₈H₁₅NO₆).



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

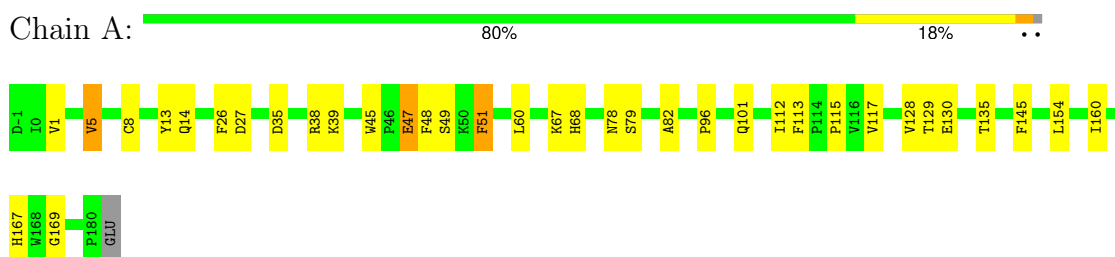
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	6	Total	O	0	0
			6	6		
6	B	7	Total	O	0	0
			7	7		
6	C	7	Total	O	0	0
			7	7		
6	D	15	Total	O	0	0
			15	15		

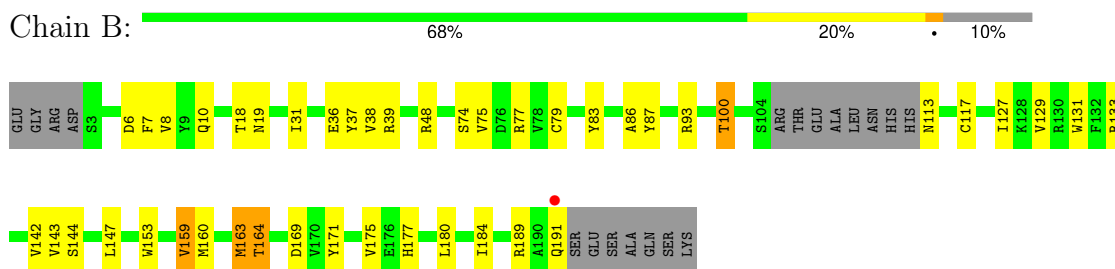
3 Residue-property plots [i](#)

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.

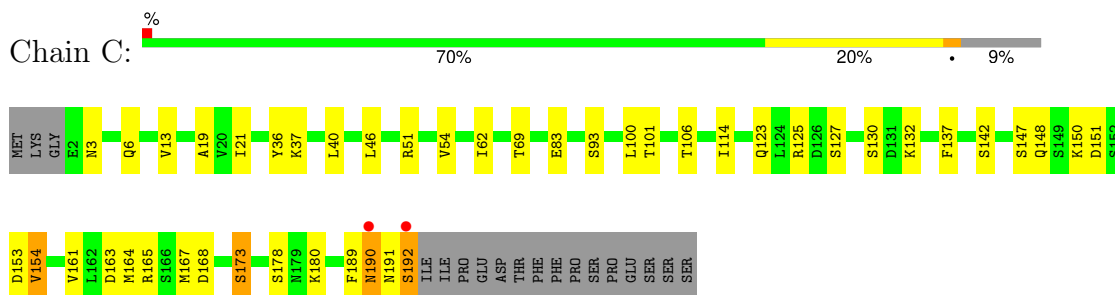
- Molecule 1: MHC class II HLA-DQ-alpha chain



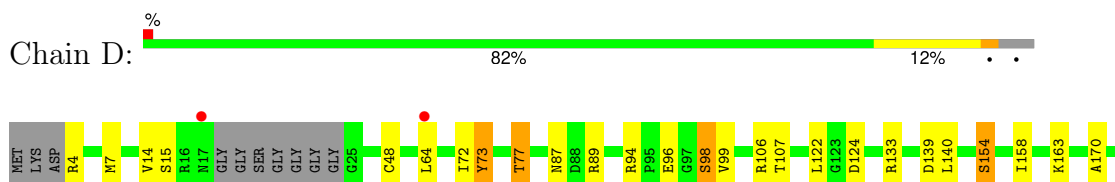
- Molecule 2: MHC class II antigen



- Molecule 3: TCR Hy.1B11 alpha chain



- Molecule 4: TCR Hy.1B11 beta chain





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	72.01Å 125.58Å 134.79Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	36.60 – 2.86 36.60 – 2.86	Depositor EDS
% Data completeness (in resolution range)	99.3 (36.60-2.86) 99.0 (36.60-2.86)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.58 (at 2.73Å)	Xtrriage
Refinement program	PHENIX 1.8.2_1309	Depositor
R, R_{free}	0.202 , 0.256 0.208 , 0.255	Depositor DCC
R_{free} test set	1428 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	65.4	Xtrriage
Anisotropy	0.614	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 31.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	6448	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.44% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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](#)

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

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	0.43	0/1495	0.62	0/2041
2	B	0.48	0/1511	0.67	1/2058 (0.0%)
3	C	0.46	0/1509	0.65	1/2047 (0.0%)
4	D	0.43	0/2045	0.61	0/2785
All	All	0.45	0/6560	0.64	2/8931 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	143	VAL	CB-CA-C	-5.56	100.83	111.40
3	C	190	ASN	C-N-CA	5.16	134.60	121.70

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	1450	0	1366	17	0
2	B	1474	0	1408	24	0
3	C	1480	0	1394	24	0
4	D	1995	0	1893	16	0
5	B	14	0	13	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	A	6	0	0	1	0
6	B	7	0	0	0	0
6	C	7	0	0	2	0
6	D	15	0	0	0	0
All	All	6448	0	6074	70	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 (70) 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)
3:C:21:ILE:HG12	3:C:106:THR:HG21	1.43	1.00
3:C:190:ASN:HB3	3:C:191:ASN:HB2	1.77	0.67
1:A:47:GLU:OE2	2:B:93:ARG:NH1	2.27	0.66
1:A:35:ASP:OD2	1:A:38:ARG:NH1	2.31	0.62
1:A:39:LYS:HG2	1:A:60:LEU:HD11	1.79	0.62
4:D:241:SER:N	4:D:244:ASP:OD1	2.33	0.60
2:B:83:TYR:HA	2:B:87:TYR:HB2	1.84	0.58
2:B:133:ARG:NH1	2:B:169:ASP:OD2	2.37	0.57
2:B:129:VAL:HG11	2:B:159:VAL:HG11	1.86	0.57
3:C:191:ASN:OD1	3:C:192:SER:N	2.37	0.57
1:A:96:PRO:HG2	2:B:100:THR:HG21	1.88	0.56
2:B:113:ASN:HB3	2:B:163:MET:O	2.07	0.55
2:B:129:VAL:HG11	2:B:159:VAL:CG1	2.38	0.54
4:D:87:ASN:OD1	4:D:89:ARG:HB2	2.07	0.53
2:B:127:ILE:HD12	2:B:177:HIS:HB2	1.90	0.53
2:B:75:VAL:O	2:B:79:CYS:HB2	2.08	0.53
2:B:37:TYR:CD2	2:B:38:VAL:HG12	2.45	0.52
3:C:13:VAL:HG11	3:C:19:ALA:HB2	1.90	0.52
4:D:64:LEU:HD11	4:D:133:ARG:HH21	1.75	0.52
1:A:45:TRP:HH2	1:A:135:THR:HG22	1.74	0.51
3:C:62:ILE:HD11	6:C:304:HOH:O	2.11	0.51
1:A:78:ASN:ND2	6:A:206:HOH:O	2.43	0.51
2:B:180:LEU:HD13	2:B:184:ILE:HG13	1.93	0.50
2:B:163:MET:HG3	2:B:171:TYR:CZ	2.46	0.49
1:A:115:PRO:HG3	1:A:145:PHE:CD2	2.48	0.48
3:C:130:SER:OG	3:C:132:LYS:HG2	2.13	0.48
3:C:123:GLN:O	4:D:154:SER:HB2	2.13	0.47
4:D:140:LEU:HD13	4:D:240:LEU:HD22	1.96	0.47
2:B:129:VAL:HG22	2:B:175:VAL:HG22	1.98	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:D:170:ALA:HB2	4:D:235:VAL:HG21	1.97	0.47
3:C:189:PHE:O	3:C:190:ASN:ND2	2.48	0.46
1:A:112:ILE:HD13	1:A:117:VAL:HG11	1.98	0.46
2:B:36:GLU:OE2	2:B:39:ARG:HB2	2.16	0.46
3:C:6:GLN:NE2	3:C:106:THR:HG22	2.30	0.46
1:A:68:HIS:CD2	4:D:14:VAL:HG13	2.50	0.45
3:C:163:ASP:O	3:C:164:MET:HG3	2.17	0.45
4:D:98:SER:HB3	4:D:99:VAL:H	1.64	0.45
3:C:151:ASP:HB3	3:C:154:VAL:HG13	1.98	0.45
3:C:127:SER:HB3	3:C:130:SER:HB3	1.98	0.45
3:C:93:SER:HB2	3:C:100:LEU:HD23	1.99	0.45
1:A:48:PHE:CZ	2:B:153:TRP:CD2	3.05	0.45
2:B:10:GLN:HB2	2:B:31:ILE:HB	1.98	0.45
1:A:68:HIS:ND1	4:D:77:THR:HB	2.32	0.44
3:C:51:ARG:NH2	4:D:124:ASP:OD2	2.44	0.44
3:C:153:ASP:HB2	3:C:180:LYS:HE2	2.00	0.44
2:B:142:VAL:HA	2:B:160:MET:O	2.17	0.44
4:D:154:SER:O	4:D:158:ILE:HG13	2.18	0.43
1:A:167:HIS:CD2	1:A:169:GLY:H	2.35	0.43
3:C:37:LYS:HD3	6:C:305:HOH:O	2.18	0.43
2:B:164:THR:O	2:B:164:THR:OG1	2.31	0.43
3:C:154:VAL:HB	3:C:178:SER:HB2	1.99	0.43
4:D:64:LEU:CD1	4:D:133:ARG:HH21	2.32	0.43
1:A:14:GLN:HB3	2:B:8:VAL:HG22	2.00	0.43
2:B:37:TYR:CE2	2:B:38:VAL:HG12	2.54	0.43
3:C:40:LEU:HD12	3:C:40:LEU:H	1.83	0.43
4:D:122:LEU:HD23	4:D:122:LEU:HA	1.86	0.43
2:B:6:ASP:OD2	2:B:7:PHE:N	2.52	0.42
2:B:117:CYS:HB2	2:B:131:TRP:CZ2	2.54	0.42
2:B:48:ARG:HD3	2:B:48:ARG:HA	1.86	0.42
4:D:72:ILE:HG12	4:D:73:TYR:N	2.35	0.42
3:C:36:TYR:CE2	3:C:46:LEU:HB2	2.55	0.42
1:A:13:TYR:OH	1:A:67:LYS:HE3	2.20	0.42
1:A:82:ALA:HB1	1:A:113:PHE:HE2	1.84	0.42
1:A:51:PHE:HB2	2:B:86:ALA:HA	2.02	0.41
3:C:164:MET:HE1	4:D:218:ARG:HD3	2.02	0.41
3:C:137:PHE:O	3:C:173:SER:HA	2.21	0.41
1:A:5:VAL:O	1:A:26:PHE:O	2.39	0.41
3:C:114:ILE:HD13	3:C:114:ILE:HA	1.88	0.40
3:C:150:LYS:H	3:C:150:LYS:HG2	1.77	0.40
3:C:164:MET:CE	4:D:163:LYS:HD3	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	180/183 (98%)	173 (96%)	7 (4%)	0	100	100
2	B	177/200 (88%)	167 (94%)	10 (6%)	0	100	100
3	C	189/209 (90%)	173 (92%)	16 (8%)	0	100	100
4	D	253/268 (94%)	240 (95%)	12 (5%)	1 (0%)	30	49
All	All	799/860 (93%)	753 (94%)	45 (6%)	1 (0%)	48	69

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	D	176	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	160/163 (98%)	146 (91%)	14 (9%)	8	17
2	B	161/180 (89%)	149 (92%)	12 (8%)	11	24
3	C	169/189 (89%)	153 (90%)	16 (10%)	7	14
4	D	212/223 (95%)	192 (91%)	20 (9%)	7	14
All	All	702/755 (93%)	640 (91%)	62 (9%)	8	17

All (62) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	VAL
1	A	5	VAL
1	A	8	CYS
1	A	27	ASP
1	A	47	GLU
1	A	49	SER
1	A	51	PHE
1	A	79	SER
1	A	101	GLN
1	A	128	VAL
1	A	129	THR
1	A	130	GLU
1	A	154	LEU
1	A	160	ILE
2	B	18	THR
2	B	19	ASN
2	B	74	SER
2	B	77	ARG
2	B	100	THR
2	B	144	SER
2	B	147	LEU
2	B	159	VAL
2	B	163	MET
2	B	164	THR
2	B	189	ARG
2	B	191	GLN
3	C	3	ASN
3	C	54	VAL
3	C	69	THR
3	C	83	GLU
3	C	101	THR
3	C	125	ARG
3	C	142	SER
3	C	147	SER
3	C	148	GLN
3	C	154	VAL
3	C	161	VAL
3	C	165	ARG
3	C	167	MET
3	C	168	ASP
3	C	173	SER
3	C	192	SER

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Mol	Chain	Res	Type
4	D	4	ARG
4	D	7	MET
4	D	15	SER
4	D	48	CYS
4	D	73	TYR
4	D	77	THR
4	D	94	ARG
4	D	96	GLU
4	D	98	SER
4	D	106	ARG
4	D	107	THR
4	D	139	ASP
4	D	154	SER
4	D	194	CYS
4	D	203	GLN
4	D	208	ASP
4	D	216	ARG
4	D	236	GLN
4	D	240	LEU
4	D	242	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
2	B	30	HIS
3	C	190	ASN

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 oligosaccharides 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
5	NAG	B	201	2	14,14,15	0.28	0	17,19,21	0.63	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	NAG	B	201	2	1/1/5/7	2/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
5	B	201	NAG	C1

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	B	201	NAG	O5-C5-C6-O6
5	B	201	NAG	C4-C5-C6-O6

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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(Å ²)	Q<0.9
1	A	182/183 (99%)	-0.51	0 100 100	28, 56, 100, 117	0
2	B	181/200 (90%)	-0.67	1 (0%) 85 84	29, 47, 74, 118	0
3	C	191/209 (91%)	-0.43	2 (1%) 79 78	26, 48, 75, 105	0
4	D	257/268 (95%)	-0.50	3 (1%) 76 74	28, 49, 87, 104	0
All	All	811/860 (94%)	-0.52	6 (0%) 84 83	26, 50, 87, 118	0

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	D	17	ASN	4.2
3	C	190	ASN	3.4
4	D	64	LEU	3.1
3	C	192	SER	3.1
4	D	177	HIS	3.0
2	B	191	GLN	2.5

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

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

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum,

median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	NAG	B	201	14/15	0.68	0.14	118,127,136,140	0

6.5 Other polymers [i](#)

There are no such residues in this entry.