Full wwPDB X-ray Structure Validation Report ⓘ

Aug 9, 2020 – 03:34 AM BST

PDB ID	:	3WPI
Title	:	Crystal structure of mouse TLR9 in complex with inhibitory DNA_super
Authors	:	Ohto, U.; Shimizu, T.
Deposited on	:	2014-01-11
Resolution	:	2.25 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 following versions of software and data (see references ⓘ) were used in the production of this report:

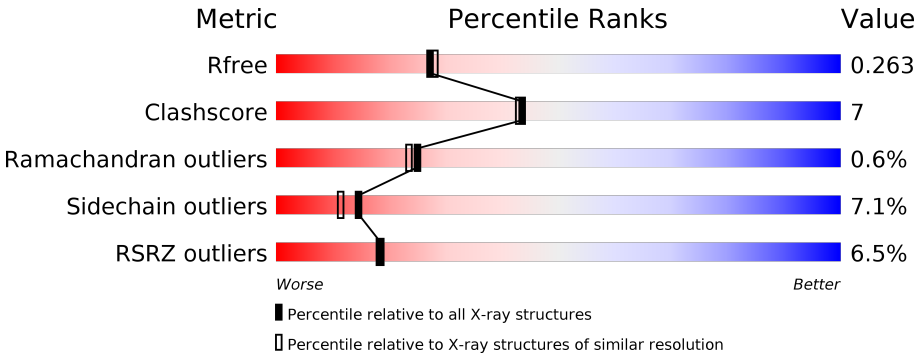
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.13.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.13.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.25 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	2391 (2.26-2.22)
Clashscore	141614	2539 (2.26-2.22)
Ramachandran outliers	138981	2489 (2.26-2.22)
Sidechain outliers	138945	2490 (2.26-2.22)
RSRZ outliers	127900	2353 (2.26-2.22)

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 >=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	803	6% 71% 17% • 9%
2	B	18	6% 39% 11% 50%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6049 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 Toll-like receptor 9.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	727	Total	C	N	O	S	0	0	0
			5750	3671	1014	1036	29			

There are 17 discrepancies between the modelled and reference sequences:

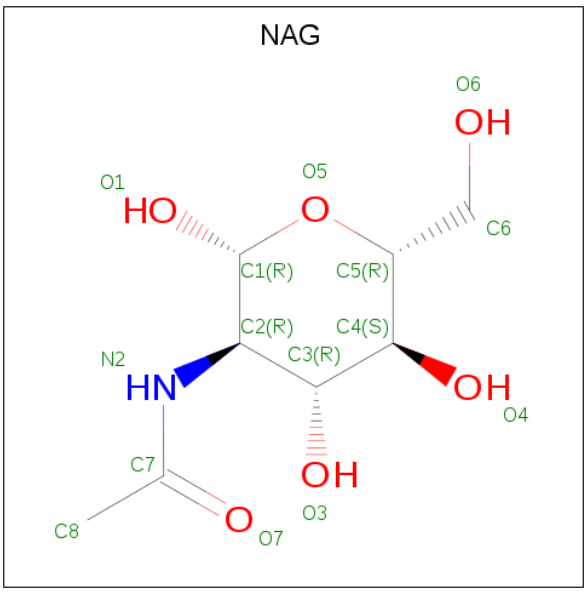
Chain	Residue	Modelled	Actual	Comment	Reference
A	22	ARG	-	expression tag	UNP Q9EQU3
A	23	SER	-	expression tag	UNP Q9EQU3
A	24	PRO	-	expression tag	UNP Q9EQU3
A	25	TRP	-	expression tag	UNP Q9EQU3
A	200	GLN	ASN	engineered mutation	UNP Q9EQU3
A	242	GLN	ASN	engineered mutation	UNP Q9EQU3
A	309	GLN	ASN	engineered mutation	UNP Q9EQU3
A	495	GLN	ASN	engineered mutation	UNP Q9EQU3
A	568	GLN	ASN	engineered mutation	UNP Q9EQU3
A	695	GLN	ASN	engineered mutation	UNP Q9EQU3
A	752	GLN	ASN	engineered mutation	UNP Q9EQU3
A	819	GLU	-	expression tag	UNP Q9EQU3
A	820	PHE	-	expression tag	UNP Q9EQU3
A	821	LEU	-	expression tag	UNP Q9EQU3
A	822	VAL	-	expression tag	UNP Q9EQU3
A	823	PRO	-	expression tag	UNP Q9EQU3
A	824	ARG	-	expression tag	UNP Q9EQU3

- Molecule 2 is a DNA chain called DNA (5'-D(*CP*CP*TP*CP*AP*AP*TP*AP*GP*GP*GP*TP*GP*AP*GP*GP*GP*G)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	9	Total	C	N	O	P	0	0	0
			183	87	36	52	8			

- Molecule 3 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula:

$C_8H_{15}NO_6$).



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

- Molecule 4 is water.

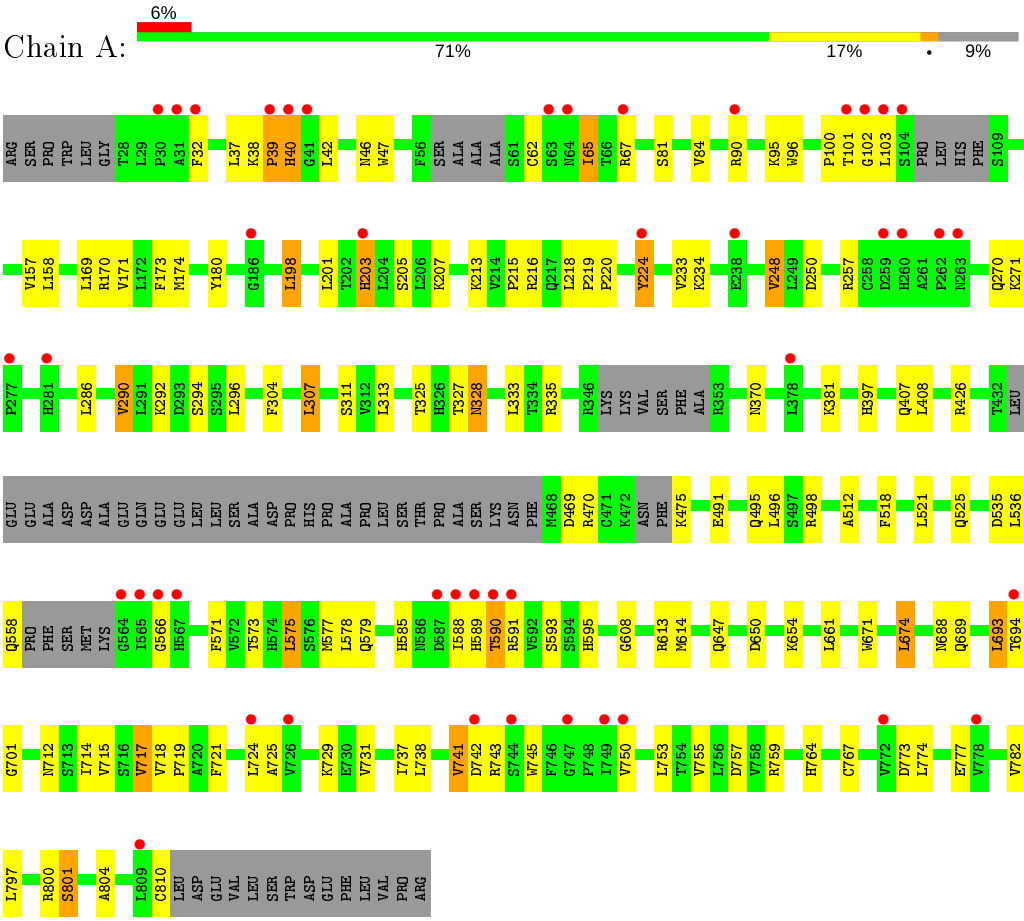
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	96	Total O 96 96	0	0
4	B	6	Total O 6 6	0	0

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.

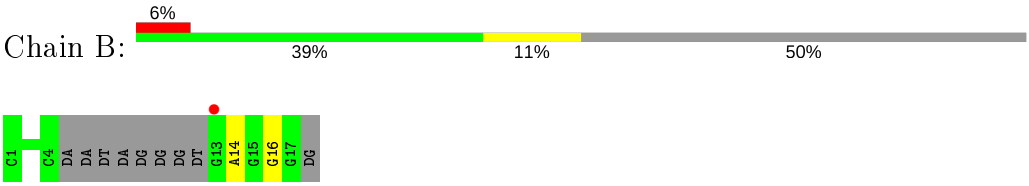
- Molecule 1: Toll-like receptor 9

Chain A:



- Molecule 2: DNA (5'-D(*CP*CP*TP*CP*AP*AP*TP*AP*GP*GP*GP*TP*GP*AP*GP*GP *GP*G)-3')

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	137.33Å 129.72Å 71.36Å 90.00° 92.17° 90.00°	Depositor
Resolution (Å)	36.34 – 2.25 47.98 – 2.25	Depositor EDS
% Data completeness (in resolution range)	96.9 (36.34-2.25) 97.0 (47.98-2.25)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$< I/\sigma(I) >$ [1]	2.35 (at 2.24Å)	Xtriage
Refinement program	PHENIX 1.8.1_1168	Depositor
R, R_{free}	0.221 , 0.254 0.227 , 0.263	Depositor DCC
R_{free} test set	2911 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	39.2	Xtriage
Anisotropy	0.919	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.38 , 48.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.025 for -h,-k,l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	6049	wwPDB-VP
Average B, all atoms (Å^2)	52.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.06% of the height of the origin peak. No significant pseudotranslation is detected.*

[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: 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	0.27	0/5872	0.49	0/7966
2	B	0.45	0/204	0.97	0/311
All	All	0.28	0/6076	0.52	0/8277

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

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	5750	0	5803	80	0
2	B	183	0	103	2	0
3	A	14	0	13	0	0
4	A	96	0	0	0	0
4	B	6	0	0	0	0
All	All	6049	0	5919	80	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 (80) 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:42:LEU:HD13	1:A:67:ARG:HG2	1.58	0.84
1:A:475:LYS:NZ	1:A:525:GLN:OE1	2.18	0.76
1:A:328:ASN:OD1	1:A:328:ASN:N	2.27	0.68
1:A:408:LEU:HB3	1:A:496:LEU:HD11	1.76	0.66
1:A:566:GLY:O	1:A:591:ARG:NH1	2.27	0.66
1:A:650:ASP:O	1:A:654:LYS:NZ	2.27	0.66
1:A:234:LYS:NZ	1:A:270:GLN:OE1	2.30	0.64
1:A:743:ARG:NH1	1:A:777:GLU:OE1	2.32	0.62
1:A:171:VAL:HG22	1:A:203:HIS:CD2	2.35	0.61
1:A:767:CYS:SG	1:A:810:CYS:N	2.73	0.61
1:A:224:TYR:HB3	1:A:248:VAL:HG13	1.80	0.61
1:A:215:PRO:HB2	1:A:218:LEU:HD21	1.82	0.61
1:A:32:PHE:HE2	1:A:37:LEU:HD12	1.66	0.60
1:A:32:PHE:CE2	1:A:37:LEU:HD12	2.37	0.59
1:A:800:ARG:HG3	1:A:804:ALA:HB2	1.86	0.58
1:A:304:PHE:HB3	1:A:333:LEU:HD21	1.87	0.57
1:A:694:THR:HG23	1:A:695:GLN:HG2	1.85	0.57
1:A:714:ILE:HG22	1:A:738:LEU:HD21	1.87	0.56
1:A:95:LYS:HG2	1:A:96:TRP:CD1	2.41	0.56
1:A:304:PHE:HA	1:A:307:LEU:HD22	1.88	0.55
1:A:100:PRO:O	1:A:102:GLY:HA3	2.06	0.55
1:A:800:ARG:NH1	1:A:801:SER:HB3	2.22	0.55
1:A:545:LEU:HB3	1:A:548:LEU:HB2	1.91	0.53
1:A:773:ASP:OD1	1:A:774:LEU:N	2.42	0.52
1:A:694:THR:HA	1:A:718:VAL:HG23	1.92	0.51
1:A:759:ARG:HD2	1:A:783:PRO:O	2.11	0.51
1:A:213:LYS:HD2	1:A:216:ARG:NH2	2.26	0.51
1:A:171:VAL:HA	1:A:203:HIS:HB2	1.93	0.51
1:A:233:VAL:HG23	1:A:234:LYS:HD3	1.92	0.51
1:A:693:LEU:HB2	1:A:717:VAL:HB	1.92	0.51
1:A:757:ASP:OD1	1:A:759:ARG:HD3	2.11	0.51
1:A:38:LYS:HB3	1:A:39:PRO:HD2	1.94	0.50
1:A:198:LEU:HB3	1:A:201:LEU:HB2	1.92	0.50
1:A:743:ARG:HH12	1:A:777:GLU:CD	2.14	0.50
1:A:742:ASP:OD1	1:A:743:ARG:N	2.45	0.50
1:A:693:LEU:HG	1:A:721:PHE:CZ	2.48	0.48
1:A:715:VAL:HG12	1:A:737:ILE:HB	1.94	0.48
1:A:101:THR:HA	1:A:102:GLY:HA3	1.58	0.48
1:A:180:TYR:OH	2:B:14:DA:H5"	2.13	0.48
1:A:286:LEU:HD23	1:A:307:LEU:HG	1.96	0.47
1:A:518:PHE:HB2	1:A:545:LEU:HD11	1.97	0.47
1:A:327:THR:OG1	1:A:328:ASN:N	2.48	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:575:LEU:HD23	1:A:578:LEU:HD22	1.98	0.46
1:A:577:MET:HB2	1:A:577:MET:HE2	1.84	0.46
1:A:146:VAL:HG13	1:A:170:ARG:HD2	1.98	0.46
1:A:207:LYS:NZ	2:B:16:DG:O6	2.19	0.46
1:A:800:ARG:HH11	1:A:801:SER:H	1.64	0.45
1:A:589:HIS:CG	1:A:590:THR:H	2.34	0.45
1:A:370:ASN:HA	1:A:397:HIS:HB2	1.98	0.45
1:A:224:TYR:CB	1:A:248:VAL:HG13	2.44	0.44
1:A:585:HIS:CD2	1:A:608:GLY:HA3	2.52	0.44
1:A:700:ASN:HA	1:A:701:GLY:HA2	1.69	0.44
1:A:764:HIS:ND1	1:A:793:SER:OG	2.28	0.44
1:A:95:LYS:HG2	1:A:96:TRP:HD1	1.83	0.44
1:A:729:LYS:HD3	1:A:729:LYS:HA	1.84	0.44
1:A:588:ILE:HD12	1:A:614:MET:SD	2.58	0.43
1:A:158:LEU:HD21	1:A:174:MET:HE1	2.00	0.43
1:A:688:ASN:O	1:A:712:ASN:HA	2.18	0.43
1:A:250:ASP:HA	1:A:290:VAL:HG13	2.00	0.43
1:A:275:LEU:HA	1:A:275:LEU:HD12	1.78	0.43
1:A:294:SER:HB2	1:A:296:LEU:HG	2.01	0.43
1:A:536:LEU:HB3	1:A:571:PHE:HE2	1.85	0.42
1:A:173:PHE:HD1	1:A:205:SER:HB3	1.84	0.42
1:A:518:PHE:HB3	1:A:521:LEU:HD12	2.01	0.42
1:A:81:SER:HA	1:A:84:VAL:HG23	2.01	0.42
1:A:39:PRO:HG2	1:A:40:HIS:ND1	2.35	0.41
1:A:46:ASN:HB3	1:A:47:TRP:CE3	2.54	0.41
1:A:741:VAL:HA	1:A:745:TRP:CH2	2.56	0.41
1:A:593:SER:OG	1:A:595:HIS:O	2.33	0.41
1:A:794:PRO:HD2	1:A:797:LEU:HD12	2.02	0.41
1:A:213:LYS:HD2	1:A:216:ARG:HH22	1.85	0.41
1:A:647:GLN:OE1	1:A:647:GLN:N	2.46	0.41
1:A:512:ALA:HA	1:A:535:ASP:OD1	2.21	0.41
1:A:257:ARG:HD3	1:A:257:ARG:HA	1.85	0.41
1:A:62:CYS:O	1:A:65:ILE:HG23	2.21	0.41
1:A:381:LYS:HG3	1:A:407:GLN:OE1	2.21	0.40
1:A:718:VAL:HG12	1:A:719:PRO:O	2.22	0.40
1:A:219:PRO:HA	1:A:220:PRO:HD2	1.97	0.40
1:A:671:TRP:O	1:A:674:LEU:HB2	2.22	0.40
1:A:698:LEU:O	1:A:724:LEU:HB2	2.20	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	713/803 (89%)	647 (91%)	62 (9%)	4 (1%)	25 23

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	40	HIS
1	A	470	ARG
1	A	725	ALA
1	A	39	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	663/728 (91%)	616 (93%)	47 (7%)	14 11

All (47) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	65	ILE
1	A	90	ARG
1	A	103	LEU
1	A	120	LEU
1	A	138	VAL
1	A	157	VAL
1	A	169	LEU

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Mol	Chain	Res	Type
1	A	198	LEU
1	A	203	HIS
1	A	224	TYR
1	A	248	VAL
1	A	271	LYS
1	A	272	SER
1	A	273	LEU
1	A	275	LEU
1	A	290	VAL
1	A	292	LYS
1	A	307	LEU
1	A	311	SER
1	A	313	LEU
1	A	325	THR
1	A	328	ASN
1	A	335	ARG
1	A	426	ARG
1	A	469	ASP
1	A	491	GLU
1	A	495	GLN
1	A	498	ARG
1	A	545	LEU
1	A	558	GLN
1	A	573	THR
1	A	575	LEU
1	A	579	GLN
1	A	590	THR
1	A	613	ARG
1	A	661	LEU
1	A	674	LEU
1	A	689	GLN
1	A	693	LEU
1	A	717	VAL
1	A	731	VAL
1	A	741	VAL
1	A	750	VAL
1	A	753	LEU
1	A	755	VAL
1	A	782	VAL
1	A	801	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 monosaccharides in this entry.

5.6 Ligand geometry

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	$\#\|Z\| > 2$
3	NAG	A	901	1	14,14,15	0.54	0	17,19,21	0.64	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
3	NAG	A	901	1	-	1/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	901	NAG	O5-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 (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^{th} 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	727/803 (90%)	0.41	47 (6%) 18 18	22, 48, 88, 119	0
2	B	9/18 (50%)	0.81	1 (11%) 5 4	49, 60, 81, 87	0
All	All	736/821 (89%)	0.42	48 (6%) 18 18	22, 48, 88, 119	0

All (48) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	40	HIS	5.3
1	A	224	TYR	5.1
1	A	564	GLY	4.8
1	A	590	THR	4.7
1	A	591	ARG	4.6
1	A	565	ILE	4.5
1	A	262	PRO	4.5
1	A	589	HIS	4.3
1	A	749	ILE	4.2
1	A	587	ASP	4.2
1	A	203	HIS	4.1
1	A	103	LEU	4.0
1	A	102	GLY	3.9
1	A	63	SER	3.7
1	A	104	SER	3.7
1	A	778	VAL	3.6
1	A	588	ILE	3.5
1	A	694	THR	3.5
1	A	277	PRO	3.2
1	A	750	VAL	3.2
1	A	724	LEU	3.1
1	A	259	ASP	2.9
1	A	260	HIS	2.9
1	A	744	SER	2.8

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Mol	Chain	Res	Type	RSRZ
1	A	39	PRO	2.8
2	B	13	DG	2.6
1	A	31	ALA	2.4
1	A	809	LEU	2.3
1	A	276	HIS	2.3
1	A	186	GLY	2.3
1	A	747	GLY	2.3
1	A	90	ARG	2.3
1	A	32	PHE	2.3
1	A	67	ARG	2.2
1	A	566	GLY	2.2
1	A	64	ASN	2.2
1	A	772	VAL	2.2
1	A	101	THR	2.2
1	A	30	PRO	2.2
1	A	238	GLU	2.2
1	A	41	GLY	2.2
1	A	742	ASP	2.1
1	A	263	ASN	2.1
1	A	726	VAL	2.1
1	A	700	ASN	2.1
1	A	281	HIS	2.0
1	A	567	HIS	2.0
1	A	378	LEU	2.0

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, 95^{th} 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
3	NAG	A	901	14/15	0.84	0.16	40,53,56,63	0

6.5 Other polymers (i)

There are no such residues in this entry.