Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 05:49 PM GMT

PDB ID	:	4JKL
Title	:	Crystal Structure of Streptococcus agalactiae beta-glucuronidase in space group P21212
Authors	:	Wallace, B.D.; Redinbo, M.R.
Deposited on	:	2013-03-09
Resolution	:	2.29 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
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:

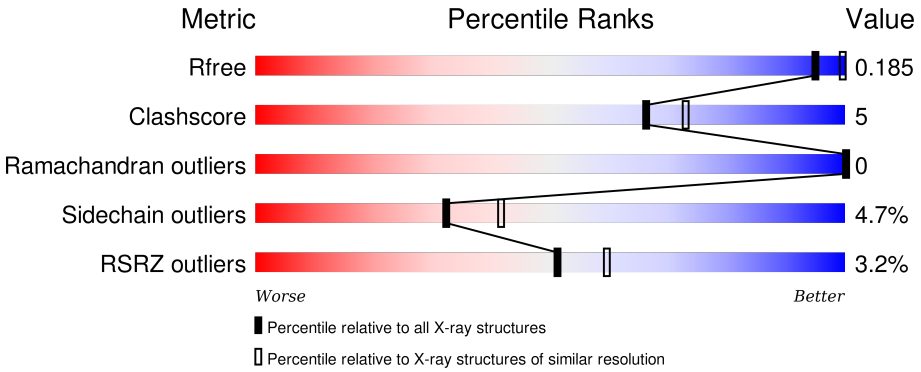
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.29 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	5193 (2.30-2.26)
Clashscore	102246	5929 (2.30-2.26)
Ramachandran outliers	100387	5851 (2.30-2.26)
Sidechain outliers	100360	5850 (2.30-2.26)
RSRZ outliers	91569	5204 (2.30-2.26)

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. 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	602	4% 82% 15%
1	B	602	2% 82% 14%

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
2	MG	A	602	-	-	-	X
2	MG	A	603	-	-	-	X
2	MG	B	601	-	-	-	X

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 10412 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 Beta-glucuronidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	587	Total	C	N	O	S	0	4	0
			4812	3080	811	900	21			
1	B	587	Total	C	N	O	S	0	6	0
			4822	3088	814	898	22			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	SER	-	EXPRESSION TAG	UNP Q8E0N2
A	-1	ASN	-	EXPRESSION TAG	UNP Q8E0N2
A	0	ALA	-	EXPRESSION TAG	UNP Q8E0N2
B	-2	SER	-	EXPRESSION TAG	UNP Q8E0N2
B	-1	ASN	-	EXPRESSION TAG	UNP Q8E0N2
B	0	ALA	-	EXPRESSION TAG	UNP Q8E0N2

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	1	Total	Mg	0	0
			1	1		
2	A	3	Total	Mg	0	0
			3	3		

- Molecule 3 is water.

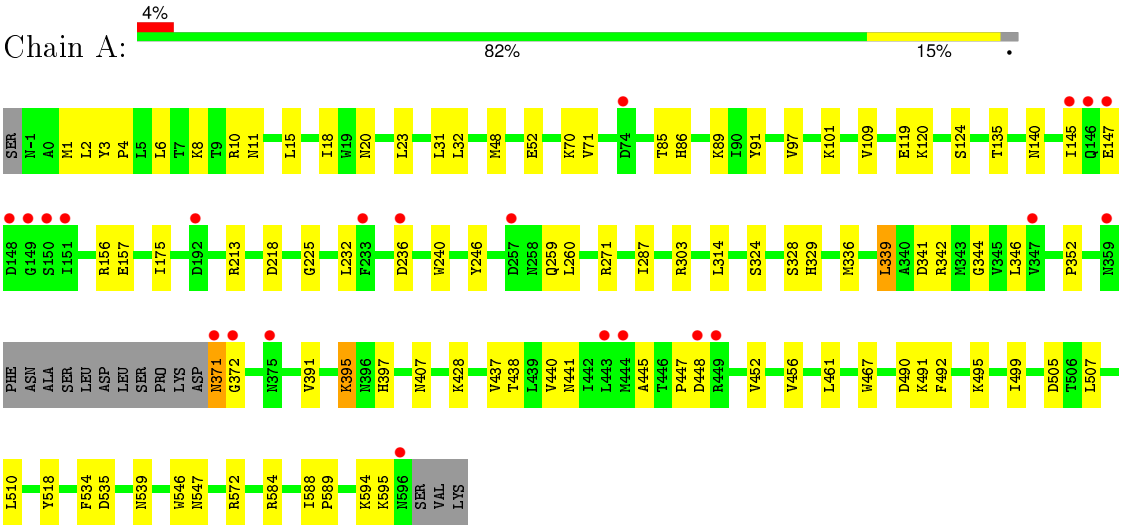
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	409	Total	O	0	0
			409	409		
3	B	365	Total	O	0	0
			365	365		

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 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.

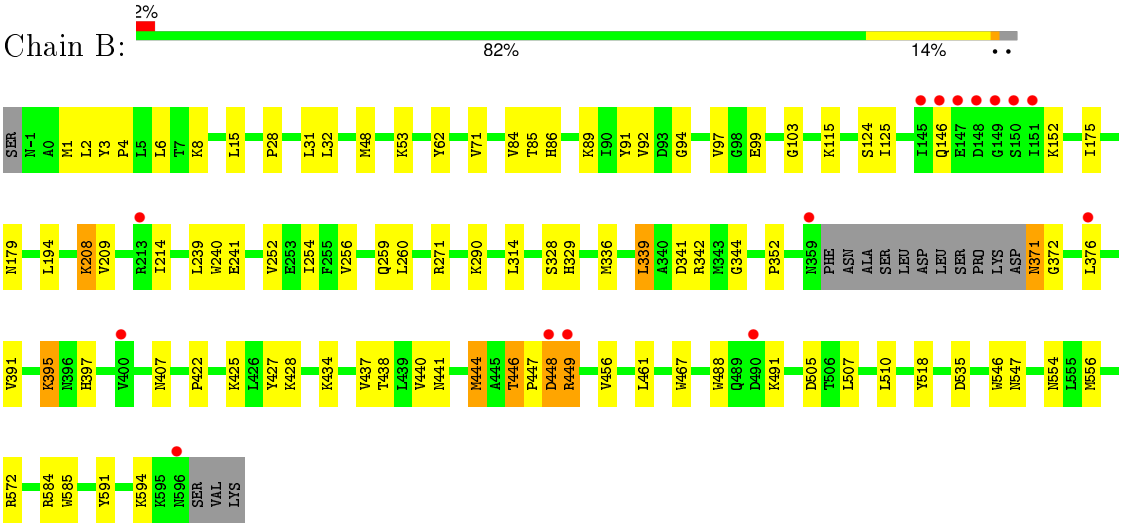
- Molecule 1: Beta-glucuronidase

Chain A:



- Molecule 1: Beta-glucuronidase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	85.00Å 198.76Å 75.57Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.31 – 2.29 37.31 – 2.29	Depositor EDS
% Data completeness (in resolution range)	98.1 (37.31-2.29) 97.8 (37.31-2.29)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.91 (at 2.29Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.8_1069)	Depositor
R, R_{free}	0.174 , 0.226 0.183 , 0.185	Depositor DCC
R_{free} test set	2912 reflections (5.35%)	DCC
Wilson B-factor (Å^2)	22.1	Xtriage
Anisotropy	0.743	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.31 , 38.0	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Outliers	0 of 57480 reflections	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	10412	wwPDB-VP
Average B, all atoms (Å^2)	19.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.67% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: MG

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	0.22	0/4941	0.41	0/6700
1	B	0.22	0/4957	0.42	0/6720
All	All	0.22	0/9898	0.41	0/13420

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	4812	0	4698	44	0
1	B	4822	0	4718	51	0
2	A	3	0	0	0	0
2	B	1	0	0	0	0
3	A	409	0	0	3	0
3	B	365	0	0	4	0
All	All	10412	0	9416	93	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 5.

All (93) 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:B:208:LYS:HE2	1:B:209:VAL:H	1.55	0.71
1:B:446:THR:HG23	1:B:447:PRO:HD2	1.75	0.68
1:B:179:ASN:ND2	3:B:1050:HOH:O	2.27	0.67
1:A:91:TYR:HB2	1:A:124:SER:HB2	1.79	0.64
1:A:157:GLU:OE2	3:A:1044:HOH:O	2.16	0.62
1:A:507:LEU:HB2	1:A:510:LEU:HD22	1.82	0.61
1:B:449:ARG:HD2	1:B:449:ARG:H	1.67	0.60
1:B:535:ASP:OD2	1:B:584:ARG:NH2	2.34	0.59
1:A:140:ASN:HB2	1:A:156:ARG:HB3	1.85	0.58
1:B:89:LYS:HG2	1:B:99:GLU:HG2	1.85	0.57
1:B:447:PRO:HD3	1:B:488:TRP:CE2	2.39	0.57
1:A:539:ASN:OD1	1:A:595:LYS:NZ	2.30	0.57
1:A:535:ASP:OD2	1:A:584:ARG:NH2	2.38	0.56
1:B:209:VAL:HG11	1:B:254:ILE:HB	1.88	0.55
1:B:290:LYS:HD2	1:B:585:TRP:CD1	2.42	0.55
1:B:507:LEU:HB2	1:B:510:LEU:HD22	1.88	0.55
1:B:314:LEU:HD22	1:B:339:LEU:HD13	1.90	0.53
1:B:425[A]:LYS:NZ	3:B:877:HOH:O	2.40	0.52
1:B:428:LYS:HE2	1:B:437:VAL:HG13	1.92	0.52
1:B:434:LYS:NZ	3:B:846:HOH:O	2.43	0.51
1:B:241:GLU:OE1	1:B:591:TYR:OH	2.20	0.51
1:B:91:TYR:HB2	1:B:124:SER:HB2	1.93	0.51
1:A:145:ILE:HG22	1:A:147:GLU:H	1.75	0.50
1:A:341:ASP:OD2	1:A:397:HIS:ND1	2.38	0.50
1:A:456:VAL:O	1:A:495:LYS:HE3	2.12	0.49
1:B:467:TRP:CZ2	1:B:505:ASP:HB2	2.47	0.49
1:A:447:PRO:O	1:A:491:LYS:NZ	2.37	0.49
1:A:20:ASN:OD1	1:B:342[A]:ARG:NH2	2.46	0.48
1:A:467:TRP:CZ2	1:A:505:ASP:HB2	2.48	0.48
1:A:18:ILE:HD11	1:B:339:LEU:HG	1.94	0.48
1:B:341:ASP:OD2	1:B:397:HIS:ND1	2.40	0.48
1:B:48:MET:HE2	1:B:53:LYS:HB3	1.95	0.47
1:B:85:THR:HA	1:B:86:HIS:HA	1.60	0.47
1:B:407:ASN:HA	1:B:440:VAL:HB	1.96	0.47
1:B:209:VAL:HA	1:B:256:VAL:HG22	1.97	0.46
1:B:92:VAL:HG23	1:B:97:VAL:HG21	1.98	0.46
1:A:407:ASN:HA	1:A:440:VAL:HB	1.95	0.46
1:A:441:ASN:HB3	1:A:461:LEU:HD23	1.97	0.46
1:B:146:GLN:HE21	1:B:152:LYS:HD3	1.80	0.46
1:B:328:SER:HA	1:B:329:HIS:HA	1.58	0.46
1:B:438:THR:HA	1:B:456:VAL:HB	1.97	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:328:SER:HA	1:A:329:HIS:HA	1.58	0.46
1:A:70:LYS:HE2	1:A:70:LYS:HB2	1.69	0.46
1:A:225:GLY:HA3	1:A:232:LEU:HD21	1.98	0.46
1:B:422:PRO:HA	1:B:425[A]:LYS:HE3	1.98	0.46
1:A:314:LEU:HD22	1:A:339:LEU:HD13	1.97	0.46
1:B:146:GLN:HE21	1:B:152:LYS:HB2	1.81	0.45
1:A:324:SER:HB3	1:A:346:LEU:HB2	1.97	0.45
1:B:554[B]:ASN:OD1	3:B:993:HOH:O	2.21	0.45
1:A:85:THR:HA	1:A:86:HIS:HA	1.61	0.45
1:A:89:LYS:NZ	3:A:899:HOH:O	2.41	0.45
1:A:438:THR:HA	1:A:456:VAL:HB	1.99	0.45
1:B:71:VAL:HG22	1:B:175:ILE:HD12	1.98	0.44
1:B:546:TRP:HA	1:B:547:ASN:HA	1.70	0.44
1:B:3:TYR:HA	1:B:4:PRO:HD3	1.88	0.44
1:B:444:MET:SD	1:B:444:MET:N	2.89	0.44
1:A:240:TRP:CZ2	1:A:344:GLY:HA2	2.51	0.44
1:B:391:VAL:O	1:B:395:LYS:HB3	2.17	0.44
1:B:62:TYR:HB2	1:B:125:ILE:HB	2.00	0.44
1:B:447:PRO:O	1:B:491:LYS:NZ	2.43	0.43
1:B:214:ILE:HG12	1:B:252:VAL:HG22	2.00	0.43
1:A:101:LYS:HE3	1:A:135:THR:HG22	2.00	0.43
1:B:28:PRO:HB2	1:B:94:GLY:HA2	2.01	0.43
1:A:371:ASN:OD1	1:A:371:ASN:N	2.51	0.43
1:B:448:ASP:OD1	1:B:448:ASP:N	2.48	0.42
1:B:48:MET:CE	1:B:53:LYS:HE3	2.49	0.42
1:B:48:MET:HE3	1:B:53:LYS:HE3	2.01	0.42
1:A:505:ASP:O	1:A:518:TYR:HA	2.20	0.42
1:A:329:HIS:O	1:A:352:PRO:HA	2.20	0.42
1:A:371:ASN:HB2	1:A:372:GLY:H	1.41	0.42
1:A:218:ASP:HB2	1:A:246:TYR:OH	2.20	0.42
1:B:447:PRO:HD3	1:B:488:TRP:NE1	2.34	0.42
1:A:546:TRP:HA	1:A:547:ASN:HA	1.67	0.41
1:B:441:ASN:HB3	1:B:461:LEU:HD23	2.02	0.41
1:A:499:ILE:HG13	1:A:534:PHE:CZ	2.56	0.41
1:A:11:ASN:HB2	1:A:175:ILE:HB	2.02	0.41
1:A:428:LYS:HE2	1:A:437:VAL:HG13	2.03	0.41
1:B:329:HIS:O	1:B:352:PRO:HA	2.21	0.41
1:A:10:ARG:NH2	3:A:859:HOH:O	2.42	0.41
1:B:194:LEU:HB3	1:B:239:LEU:HD11	2.03	0.41
1:A:97:VAL:HG13	1:A:109:VAL:HG11	2.02	0.41
1:B:240:TRP:CZ2	1:B:344:GLY:HA2	2.55	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:3:TYR:HA	1:A:4:PRO:HD3	1.94	0.41
1:A:441:ASN:HD21	1:A:445:ALA:HB3	1.86	0.41
1:B:84:VAL:O	1:B:103:GLY:HA2	2.21	0.40
1:A:23:LEU:HD11	1:A:48:MET:HE2	2.04	0.40
1:A:588:ILE:HA	1:A:589:PRO:HD3	1.95	0.40
1:A:71:VAL:HG22	1:A:175:ILE:HD12	2.02	0.40
1:A:119:GLU:HG2	1:A:120:LYS:HG3	2.03	0.40
1:A:492:PHE:HB3	1:A:495:LYS:HD2	2.01	0.40
1:B:505:ASP:O	1:B:518:TYR:HA	2.21	0.40
1:B:371:ASN:HB2	1:B:372:GLY:H	1.71	0.40
1:A:391:VAL:O	1:A:395:LYS:HB3	2.22	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	587/602 (98%)	567 (97%)	20 (3%)	0	100	100
1	B	589/602 (98%)	564 (96%)	25 (4%)	0	100	100
All	All	1176/1204 (98%)	1131 (96%)	45 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	532/545 (98%)	507 (95%)	25 (5%)	32	42
1	B	533/545 (98%)	507 (95%)	26 (5%)	31	40
All	All	1065/1090 (98%)	1014 (95%)	51 (5%)	32	40

All (51) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	1	MET
1	A	2	LEU
1	A	6	LEU
1	A	8	LYS
1	A	15	LEU
1	A	31	LEU
1	A	32	LEU
1	A	52	GLU
1	A	213	ARG
1	A	236	ASP
1	A	259	GLN
1	A	260	LEU
1	A	271	ARG
1	A	287	ILE
1	A	303	ARG
1	A	336	MET
1	A	339	LEU
1	A	342	ARG
1	A	371	ASN
1	A	395	LYS
1	A	448	ASP
1	A	452	VAL
1	A	490	ASP
1	A	572	ARG
1	A	594	LYS
1	B	1	MET
1	B	2	LEU
1	B	6	LEU
1	B	8	LYS
1	B	15	LEU
1	B	31	LEU
1	B	32	LEU
1	B	115	LYS
1	B	208	LYS
1	B	259	GLN

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Mol	Chain	Res	Type
1	B	260	LEU
1	B	271	ARG
1	B	336	MET
1	B	339	LEU
1	B	371	ASN
1	B	376	LEU
1	B	395	LYS
1	B	427	TYR
1	B	444	MET
1	B	446	THR
1	B	448	ASP
1	B	449	ARG
1	B	556[A]	MET
1	B	556[B]	MET
1	B	572	ARG
1	B	594	LYS

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

Mol	Chain	Res	Type
1	A	267	ASN
1	B	146	GLN
1	B	179	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 carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.7 Other polymers

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

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	587/602 (97%)	-0.16	22 (3%) 45 53	5, 16, 38, 110	0
1	B	587/602 (97%)	-0.09	15 (2%) 59 67	5, 18, 42, 107	0
All	All	1174/1204 (97%)	-0.13	37 (3%) 51 59	5, 17, 41, 110	0

All (37) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	596	ASN	7.2
1	A	147	GLU	7.1
1	A	149	GLY	5.8
1	A	359	ASN	5.5
1	A	596	ASN	4.8
1	B	150	SER	4.6
1	B	151	ILE	4.5
1	A	151	ILE	4.2
1	B	147	GLU	4.0
1	B	145	ILE	3.9
1	B	149	GLY	3.7
1	A	148	ASP	3.4
1	A	145	ILE	3.3
1	B	146	GLN	3.3
1	A	192	ASP	3.3
1	B	376	LEU	3.2
1	A	146	GLN	3.2
1	A	150	SER	3.1
1	B	148	ASP	3.0
1	A	449	ARG	3.0
1	A	375	ASN	2.9
1	B	449	ARG	2.9
1	A	257	ASP	2.8
1	A	233	PHE	2.8

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Mol	Chain	Res	Type	RSRZ
1	B	359	ASN	2.8
1	A	372	GLY	2.6
1	A	443	LEU	2.6
1	B	213	ARG	2.3
1	A	236	ASP	2.3
1	A	371	ASN	2.3
1	B	400	VAL	2.3
1	A	74	ASP	2.2
1	B	448	ASP	2.2
1	A	448	ASP	2.2
1	A	444	MET	2.1
1	A	347	VAL	2.1
1	B	490	ASP	2.1

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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(Å^2)	Q<0.9
2	MG	B	601	1/1	0.94	0.24	7.46	15,15,15,15	0
2	MG	A	603	1/1	0.98	0.16	5.37	14,14,14,14	0
2	MG	A	602	1/1	0.96	0.31	4.82	25,25,25,25	0
2	MG	A	601	1/1	0.97	0.14	-	24,24,24,24	0

6.5 Other polymers (i)

There are no such residues in this entry.