



Full wwPDB X-ray Structure Validation Report ⓘ

May 15, 2020 – 11:21 pm BST

PDB ID : 4LYZ
Title : Real-space refinement of the structure of hen egg-white lysozyme
Authors : Diamond, R.; Phillips, D.C.; Blake, C.C.F.; North, A.C.T.
Deposited on : 1975-02-01
Resolution : 2.00 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
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

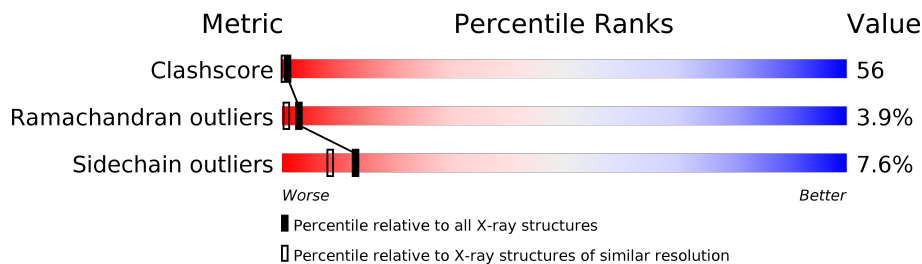
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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))
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	129	

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 1102 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 HEN EGG WHITE LYSOZYME.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	129	1001	613	193	185	10	0	0	0

- Molecule 2 is water.


Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	101	Total	O	0	0
			101	101		

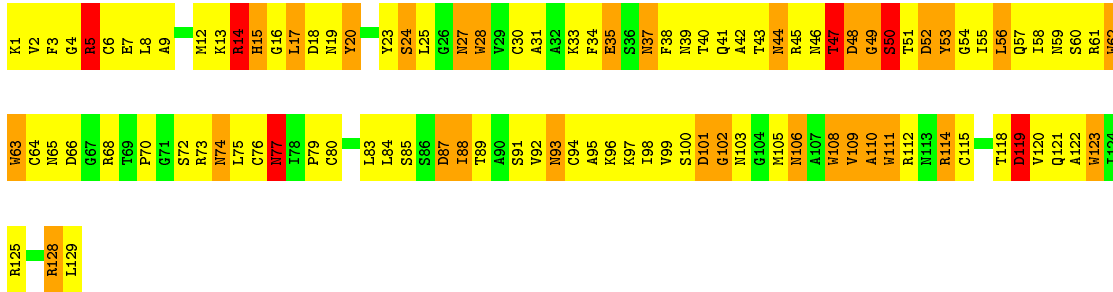
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. 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. 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.

Note EDS was not executed.

- Molecule 1: HEN EGG WHITE LYSOZYME

Chain A: 



4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	79.10Å 79.10Å 37.90Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	(Not available) – 2.00	Depositor
% Data completeness (in resolution range)	(Not available) ((Not available)-2.00)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	unknown	Depositor
R, R_{free}	(Not available) , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	1102	wwPDB-VP
Average B, all atoms (Å ²)	5.0	wwPDB-VP

5 Model quality i

5.1 Standard geometry i

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	1.48	20/1021 (2.0%)	2.01	48/1379 (3.5%)

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	A	0	3

All (20) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	28	TRP	NE1-CE2	-7.39	1.27	1.37
1	A	111	TRP	NE1-CE2	-7.38	1.27	1.37
1	A	123	TRP	NE1-CE2	-7.37	1.27	1.37
1	A	63	TRP	NE1-CE2	-7.37	1.27	1.37
1	A	62	TRP	NE1-CE2	-7.32	1.28	1.37
1	A	108	TRP	NE1-CE2	-7.32	1.28	1.37
1	A	59	ASN	CG-OD1	7.03	1.39	1.24
1	A	39	ASN	CG-OD1	7.02	1.39	1.24
1	A	19	ASN	CG-OD1	7.00	1.39	1.24
1	A	37	ASN	CG-OD1	7.00	1.39	1.24
1	A	46	ASN	CG-OD1	7.00	1.39	1.24
1	A	106	ASN	CG-OD1	7.00	1.39	1.24
1	A	77	ASN	CG-OD1	6.99	1.39	1.24
1	A	93	ASN	CG-OD1	6.97	1.39	1.24
1	A	44	ASN	CG-OD1	6.97	1.39	1.24
1	A	27	ASN	CG-OD1	6.97	1.39	1.24
1	A	66	ASP	CG-OD1	6.11	1.39	1.25
1	A	48	ASP	CG-OD1	6.08	1.39	1.25
1	A	7	GLU	CD-OE2	-5.26	1.19	1.25
1	A	35	GLU	CD-OE2	-5.22	1.20	1.25

All (48) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	76	CYS	N-CA-CB	21.03	148.46	110.60
1	A	115	CYS	N-CA-CB	11.87	131.97	110.60
1	A	73	ARG	N-CA-C	-10.64	82.27	111.00
1	A	102	GLY	N-CA-C	8.05	133.24	113.10
1	A	46	ASN	N-CA-C	-7.98	89.46	111.00
1	A	72	SER	N-CA-C	7.72	131.83	111.00
1	A	101	ASP	CB-CG-OD1	7.33	124.89	118.30
1	A	66	ASP	CB-CG-OD2	7.30	124.87	118.30
1	A	52	ASP	CB-CG-OD1	7.29	124.86	118.30
1	A	18	ASP	CB-CG-OD1	7.28	124.86	118.30
1	A	48	ASP	CB-CG-OD2	7.28	124.85	118.30
1	A	94	CYS	CB-CA-C	-7.28	95.85	110.40
1	A	87	ASP	CB-CG-OD1	7.27	124.84	118.30
1	A	119	ASP	CB-CG-OD1	7.26	124.84	118.30
1	A	123	TRP	CA-CB-CG	-7.19	100.03	113.70
1	A	47	THR	N-CA-C	7.08	130.12	111.00
1	A	15	HIS	N-CA-C	6.96	129.80	111.00
1	A	128	ARG	N-CA-C	-6.92	92.31	111.00
1	A	72	SER	CB-CA-C	-6.76	97.25	110.10
1	A	118	THR	N-CA-C	-6.60	93.19	111.00
1	A	20	TYR	CA-CB-CG	-6.54	100.97	113.40
1	A	110	ALA	N-CA-CB	-6.28	101.30	110.10
1	A	16	GLY	N-CA-C	6.00	128.11	113.10
1	A	114	ARG	N-CA-C	5.94	127.04	111.00
1	A	70	PRO	N-CA-C	5.89	127.42	112.10
1	A	115	CYS	CB-CA-C	-5.80	98.79	110.40
1	A	7	GLU	OE1-CD-OE2	5.79	130.25	123.30
1	A	63	TRP	CA-CB-CG	-5.79	102.69	113.70
1	A	35	GLU	OE1-CD-OE2	5.73	130.18	123.30
1	A	63	TRP	N-CA-C	5.67	126.32	111.00
1	A	110	ALA	N-CA-C	5.67	126.30	111.00
1	A	62	TRP	N-CA-C	5.65	126.26	111.00
1	A	73	ARG	CB-CA-C	5.64	121.67	110.40
1	A	114	ARG	CB-CA-C	-5.60	99.19	110.40
1	A	49	GLY	N-CA-C	-5.40	99.59	113.10
1	A	17	LEU	N-CA-C	5.39	125.55	111.00
1	A	60	SER	N-CA-C	5.38	125.52	111.00
1	A	15	HIS	CB-CA-C	-5.18	100.03	110.40
1	A	7	GLU	CG-CD-OE1	-5.17	107.97	118.30
1	A	23	TYR	CB-CG-CD1	-5.16	117.91	121.00
1	A	35	GLU	CG-CD-OE1	-5.16	107.99	118.30
1	A	20	TYR	CB-CG-CD1	-5.12	117.93	121.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	76	CYS	CB-CA-C	-5.12	100.17	110.40
1	A	53	TYR	CB-CG-CD1	-5.06	117.96	121.00
1	A	88	ILE	CB-CA-C	-5.06	101.47	111.60
1	A	4	GLY	N-CA-C	-5.03	100.53	113.10
1	A	100	SER	N-CA-C	5.02	124.56	111.00
1	A	20	TYR	N-CA-C	-5.02	97.46	111.00

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	114	ARG	Sidechain
1	A	14	ARG	Sidechain
1	A	5	ARG	Sidechain

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	1001	0	955	109	4
2	A	101	0	0	18	6
All	All	1102	0	955	109	7

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 56.

All (109) 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:122:ALA:HA	1:A:125:ARG:CD	1.41	1.50
1:A:101:ASP:CB	2:A:227:HOH:O	1.71	1.30
1:A:101:ASP:HB3	2:A:227:HOH:O	1.29	1.21
1:A:101:ASP:OD1	2:A:228:HOH:O	1.57	1.18
1:A:101:ASP:HB3	2:A:226:HOH:O	1.42	1.18
1:A:122:ALA:HA	1:A:125:ARG:HD2	1.19	1.17

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:12:MET:CE	1:A:17:LEU:CD1	2.32	1.07
1:A:13:LYS:NZ	1:A:129:LEU:OXT	1.88	1.05
1:A:122:ALA:CA	1:A:125:ARG:CD	2.35	1.04
1:A:122:ALA:HA	1:A:125:ARG:NE	1.57	1.01
1:A:12:MET:HE3	1:A:17:LEU:CD1	1.90	1.00
1:A:122:ALA:CA	1:A:125:ARG:NE	2.16	1.00
1:A:31:ALA:O	1:A:35:GLU:HB2	1.62	0.99
1:A:5:ARG:NH1	1:A:123:TRP:O	1.95	0.99
1:A:122:ALA:CA	1:A:125:ARG:HD2	1.93	0.98
1:A:97:LYS:O	1:A:101:ASP:OD1	1.84	0.96
1:A:12:MET:HE2	1:A:17:LEU:HD13	1.47	0.94
1:A:12:MET:HE2	1:A:17:LEU:CD1	1.98	0.94
1:A:12:MET:CE	1:A:17:LEU:HD13	1.96	0.93
1:A:6:CYS:HB2	2:A:140:HOH:O	1.69	0.92
1:A:106:ASN:O	1:A:112:ARG:NH2	2.04	0.91
1:A:45:ARG:NH1	1:A:68:ARG:HH12	1.69	0.91
1:A:55:ILE:HG23	1:A:56:LEU:N	1.88	0.88
1:A:45:ARG:NH1	1:A:68:ARG:NH1	2.24	0.86
1:A:63:TRP:CD1	2:A:206:HOH:O	2.31	0.83
1:A:63:TRP:HD1	2:A:206:HOH:O	1.60	0.83
1:A:106:ASN:HB3	1:A:112:ARG:HH21	1.41	0.82
1:A:45:ARG:CZ	1:A:68:ARG:NH1	2.43	0.81
1:A:12:MET:CE	1:A:17:LEU:HD12	2.08	0.80
1:A:103:ASN:O	1:A:106:ASN:HB2	1.81	0.79
1:A:122:ALA:HA	1:A:125:ARG:CG	2.14	0.78
1:A:101:ASP:HB2	2:A:227:HOH:O	1.48	0.77
1:A:55:ILE:CG2	1:A:56:LEU:N	2.48	0.77
1:A:24:SER:OG	2:A:153:HOH:O	1.88	0.75
1:A:85:SER:HB3	2:A:182:HOH:O	1.88	0.74
1:A:12:MET:HE3	1:A:17:LEU:HD12	1.68	0.74
1:A:3:PHE:O	1:A:38:PHE:HB3	1.90	0.72
1:A:98:ILE:O	2:A:211:HOH:O	2.09	0.71
1:A:121:GLN:CD	2:A:143:HOH:O	2.31	0.68
1:A:6:CYS:O	1:A:9:ALA:HB3	1.94	0.68
1:A:3:PHE:N	1:A:38:PHE:O	2.28	0.65
1:A:63:TRP:HH2	1:A:101:ASP:OD2	1.78	0.65
1:A:109:VAL:HG12	2:A:200:HOH:O	1.95	0.65
1:A:12:MET:CE	1:A:28:TRP:HB3	2.29	0.62
1:A:121:GLN:O	1:A:125:ARG:HG3	1.99	0.62
1:A:47:THR:HA	2:A:203:HOH:O	2.00	0.61
1:A:58:ILE:HD12	1:A:83:LEU:HD13	1.82	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:37:ASN:O	1:A:38:PHE:HB2	2.00	0.60
1:A:97:LYS:O	1:A:101:ASP:CG	2.39	0.59
1:A:25:LEU:O	1:A:25:LEU:HD23	2.02	0.59
1:A:2:VAL:HA	1:A:38:PHE:O	2.02	0.59
1:A:106:ASN:CB	1:A:112:ARG:HH21	2.15	0.58
1:A:119:ASP:CG	1:A:119:ASP:O	2.42	0.57
1:A:122:ALA:N	1:A:125:ARG:NE	2.53	0.56
1:A:63:TRP:CE2	1:A:98:ILE:HG12	2.40	0.56
1:A:62:TRP:O	1:A:75:LEU:HB2	2.06	0.56
1:A:12:MET:HE1	1:A:28:TRP:HB3	1.88	0.56
1:A:40:THR:O	1:A:54:GLY:HA2	2.06	0.55
1:A:3:PHE:HB3	1:A:8:LEU:HB2	1.89	0.53
1:A:12:MET:HE2	1:A:17:LEU:HD12	1.79	0.52
1:A:63:TRP:CH2	1:A:101:ASP:OD2	2.61	0.52
1:A:33:LYS:HG3	1:A:34:PHE:N	2.26	0.51
1:A:58:ILE:HD12	1:A:83:LEU:CD1	2.40	0.51
1:A:41:GLN:O	1:A:43:THR:HG23	2.11	0.51
1:A:89:THR:O	1:A:93:ASN:HB2	2.11	0.50
1:A:24:SER:O	1:A:27:ASN:HB2	2.10	0.50
1:A:62:TRP:HZ2	2:A:219:HOH:O	1.94	0.50
1:A:105:MET:O	1:A:111:TRP:CE3	2.65	0.49
1:A:65:ASN:O	1:A:79:PRO:HA	2.11	0.49
1:A:88:ILE:HD12	1:A:92:VAL:CG2	2.42	0.49
1:A:109:VAL:HG13	1:A:110:ALA:N	2.28	0.49
1:A:35:GLU:HG3	1:A:57:GLN:HB2	1.97	0.46
1:A:30:CYS:HB2	1:A:123:TRP:CD1	2.51	0.46
1:A:96:LYS:O	1:A:99:VAL:HG12	2.16	0.46
1:A:56:LEU:HD12	1:A:56:LEU:HA	1.80	0.46
1:A:95:ALA:HA	1:A:98:ILE:HD12	1.98	0.45
1:A:120:VAL:O	1:A:123:TRP:HB2	2.16	0.45
1:A:61:ARG:HG2	1:A:62:TRP:CE2	2.51	0.45
1:A:64:CYS:O	1:A:80:CYS:SG	2.75	0.45
1:A:33:LYS:O	1:A:37:ASN:HA	2.15	0.45
1:A:80:CYS:O	1:A:83:LEU:HB2	2.16	0.45
1:A:52:ASP:HB3	1:A:57:GLN:OE1	2.16	0.45
1:A:105:MET:HA	1:A:108:TRP:HE3	1.82	0.45
1:A:74:ASN:ND2	1:A:77:ASN:N	2.65	0.44
1:A:106:ASN:C	1:A:112:ARG:NH2	2.69	0.44
1:A:106:ASN:C	1:A:112:ARG:HH21	2.20	0.44
1:A:91:SER:O	1:A:95:ALA:N	2.37	0.44
1:A:92:VAL:O	1:A:96:LYS:HG3	2.18	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:51:THR:HG22	1:A:53:TYR:CE2	2.52	0.44
1:A:35:GLU:OE2	1:A:110:ALA:HB3	2.17	0.44
1:A:48:ASP:OD1	1:A:50:SER:HB3	2.17	0.44
1:A:85:SER:HB2	2:A:181:HOH:O	2.16	0.44
1:A:31:ALA:O	1:A:35:GLU:CB	2.51	0.43
1:A:12:MET:HE3	1:A:17:LEU:HD11	1.87	0.43
1:A:20:TYR:CD2	1:A:99:VAL:HG11	2.53	0.43
1:A:1:LYS:HG2	1:A:2:VAL:N	2.33	0.43
1:A:106:ASN:HB3	1:A:112:ARG:NH2	2.21	0.43
1:A:15:HIS:HB3	1:A:92:VAL:HG11	2.01	0.42
1:A:43:THR:HA	1:A:52:ASP:O	2.19	0.42
1:A:44:ASN:O	1:A:52:ASP:N	2.49	0.42
1:A:13:LYS:O	1:A:14:ARG:C	2.57	0.42
1:A:74:ASN:ND2	1:A:77:ASN:H	2.18	0.41
1:A:49:GLY:CA	2:A:214:HOH:O	2.67	0.41
1:A:65:ASN:O	1:A:80:CYS:N	2.48	0.41
1:A:40:THR:O	1:A:84:LEU:HA	2.20	0.41
1:A:85:SER:C	1:A:87:ASP:H	2.23	0.41
1:A:106:ASN:O	1:A:112:ARG:CZ	2.67	0.41
1:A:63:TRP:HA	1:A:63:TRP:CE3	2.56	0.41
1:A:83:LEU:HA	2:A:131:HOH:O	2.21	0.40

All (7) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:193:HOH:O	2:A:213:HOH:O[6_456]	0.06	2.14
2:A:141:HOH:O	2:A:185:HOH:O[8_555]	0.13	2.07
2:A:138(A):HOH:O	2:A:220:HOH:O[4_454]	0.16	2.04
1:A:128:ARG:CD	2:A:186:HOH:O[8_555]	0.89	1.31
1:A:128:ARG:NE	2:A:186:HOH:O[8_555]	1.69	0.51
1:A:47:THR:CG2	1:A:128:ARG:NE[3_555]	2.00	0.20
1:A:128:ARG:CG	2:A:186:HOH:O[8_555]	2.19	0.01

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	127/129 (98%)	107 (84%)	15 (12%)	5 (4%)	3 1

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	50	SER
1	A	42	ALA
1	A	109	VAL
1	A	5	ARG
1	A	102	GLY

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	105/105 (100%)	97 (92%)	8 (8%)	13 8

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	14	ARG
1	A	24	SER
1	A	47	THR
1	A	50	SER
1	A	56	LEU
1	A	74	ASN
1	A	77	ASN
1	A	119	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	44	ASN
1	A	46	ASN
1	A	74	ASN
1	A	121	GLN

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](#)

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

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.