



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 04:06 AM GMT

PDB ID : 2LYZ  
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](mailto: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.

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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) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

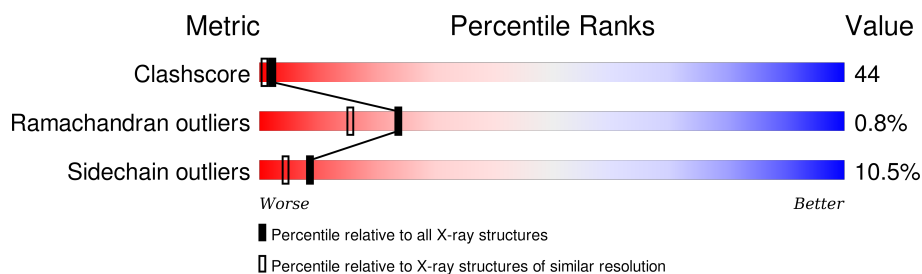
# 1 Overall quality at a glance

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	102246	7340 (2.00-2.00)
Ramachandran outliers	100387	7248 (2.00-2.00)
Sidechain outliers	100360	7247 (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  $\geq 3$ , 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  $\leq 5\%$ . 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	129	<div>34% 42% 22% .</div>

## 2 Entry composition

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
1	A	129	Total	C	N	O	S	0	0	0
			1001	613	193	185	10			

- Molecule 2 is water.

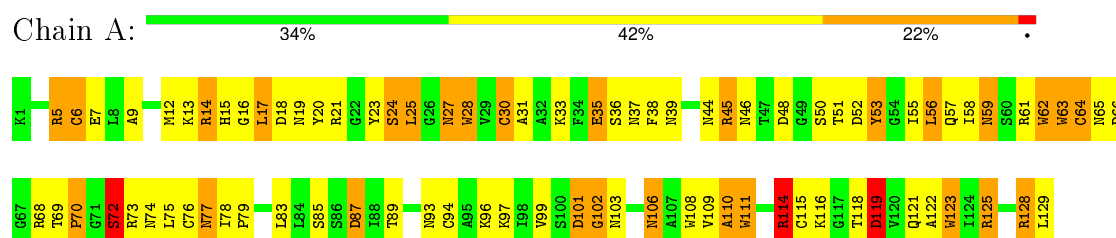
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	101	Total	O	0	0
			101	101		

### 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 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.

Note EDS was not executed.

#### • Molecule 1: HEN EGG WHITE LYSOZYME



## 4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section will therefore be incomplete.

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	79.10 Å 79.10 Å 37.90 Å 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	REAL-SPACE REFINEMENT	Depositor
R, $R_{free}$	(Not available) , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	1102	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	6.0	wwPDB-VP

## 5 Model quality ⓘ

### 5.1 Standard geometry ⓘ

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	1.51	22/1021 (2.2%)	1.93	39/1379 (2.8%)

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 (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	30	CYS	CA-CB	-7.61	1.37	1.53
1	A	123	TRP	NE1-CE2	-7.49	1.27	1.37
1	A	28	TRP	NE1-CE2	-7.39	1.27	1.37
1	A	108	TRP	NE1-CE2	-7.36	1.27	1.37
1	A	63	TRP	NE1-CE2	-7.33	1.28	1.37
1	A	111	TRP	NE1-CE2	-7.33	1.28	1.37
1	A	62	TRP	NE1-CE2	-7.33	1.28	1.37
1	A	106	ASN	CG-OD1	7.03	1.39	1.24
1	A	46	ASN	CG-OD1	7.03	1.39	1.24
1	A	39	ASN	CG-OD1	7.00	1.39	1.24
1	A	19	ASN	CG-OD1	7.00	1.39	1.24
1	A	44	ASN	CG-OD1	7.00	1.39	1.24
1	A	93	ASN	CG-OD1	6.99	1.39	1.24
1	A	59	ASN	CG-OD1	6.99	1.39	1.24
1	A	77	ASN	CG-OD1	6.99	1.39	1.24
1	A	37	ASN	CG-OD1	6.95	1.39	1.24
1	A	27	ASN	CG-OD1	6.94	1.39	1.24
1	A	48	ASP	CG-OD1	6.09	1.39	1.25
1	A	66	ASP	CG-OD1	6.06	1.39	1.25
1	A	64	CYS	CA-CB	5.72	1.66	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	7	GLU	CD-OE2	-5.30	1.19	1.25
1	A	35	GLU	CD-OE2	-5.29	1.19	1.25

All (39) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	72	SER	N-CA-C	12.57	144.95	111.00
1	A	76	CYS	N-CA-CB	11.33	131.00	110.60
1	A	72	SER	CB-CA-C	-10.85	89.48	110.10
1	A	73	ARG	N-CA-C	-10.41	82.90	111.00
1	A	6	CYS	CB-CA-C	8.62	127.65	110.40
1	A	6	CYS	CA-CB-SG	8.39	129.10	114.00
1	A	118	THR	N-CA-C	-7.90	89.67	111.00
1	A	63	TRP	CA-CB-CG	-7.47	99.50	113.70
1	A	119	ASP	CB-CG-OD1	7.35	124.92	118.30
1	A	87	ASP	CB-CG-OD1	7.35	124.91	118.30
1	A	48	ASP	CB-CG-OD2	7.33	124.89	118.30
1	A	101	ASP	CB-CG-OD1	7.30	124.87	118.30
1	A	18	ASP	CB-CG-OD1	7.27	124.84	118.30
1	A	66	ASP	CB-CG-OD2	7.26	124.83	118.30
1	A	52	ASP	CB-CG-OD1	7.25	124.82	118.30
1	A	128	ARG	N-CA-C	-6.74	92.80	111.00
1	A	46	ASN	N-CA-C	-6.40	93.72	111.00
1	A	17	LEU	N-CA-C	6.28	127.95	111.00
1	A	102	GLY	N-CA-C	6.25	128.74	113.10
1	A	76	CYS	CA-CB-SG	6.11	124.99	114.00
1	A	70	PRO	N-CA-C	5.98	127.65	112.10
1	A	62	TRP	N-CA-C	5.97	127.12	111.00
1	A	7	GLU	OE1-CD-OE2	5.83	130.30	123.30
1	A	35	GLU	OE1-CD-OE2	5.81	130.27	123.30
1	A	73	ARG	CB-CA-C	5.50	121.40	110.40
1	A	17	LEU	CB-CA-C	-5.42	99.89	110.20
1	A	53	TYR	N-CA-C	5.40	125.57	111.00
1	A	115	CYS	N-CA-CB	5.36	120.25	110.60
1	A	15	HIS	N-CA-C	5.27	125.23	111.00
1	A	36	SER	N-CA-C	5.26	125.21	111.00
1	A	125	ARG	N-CA-C	-5.20	96.95	111.00
1	A	16	GLY	N-CA-C	5.18	126.04	113.10
1	A	7	GLU	CG-CD-OE1	-5.18	107.95	118.30
1	A	35	GLU	CG-CD-OE1	-5.17	107.95	118.30
1	A	110	ALA	N-CA-CB	-5.13	102.92	110.10
1	A	63	TRP	N-CA-C	5.13	124.85	111.00

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	20	TYR	CB-CG-CD1	-5.10	117.94	121.00
1	A	23	TYR	CB-CG-CD1	-5.06	117.97	121.00
1	A	53	TYR	CB-CG-CD1	-5.03	117.98	121.00

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 ⓘ

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	958	87	10
2	A	101	0	0	12	13
All	All	1102	0	958	87	13

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 44.

All (87) 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:45:ARG:NH1	1:A:68:ARG:NH1	1.70	1.40
1:A:119:ASP:OD2	1:A:125:ARG:NH2	1.60	1.33
1:A:122:ALA:HA	1:A:125:ARG:CD	1.46	1.26
1:A:101:ASP:CB	2:A:227:HOH:O	1.79	1.25
1:A:5:ARG:NH2	1:A:125:ARG:O	1.73	1.19
1:A:101:ASP:OD1	2:A:228:HOH:O	1.59	1.17
1:A:5:ARG:NH1	1:A:123:TRP:O	1.79	1.15
1:A:101:ASP:HB3	2:A:227:HOH:O	1.39	1.14
1:A:101:ASP:HB3	2:A:226:HOH:O	1.52	1.08

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:121:GLN:NE2	2:A:144:HOH:O	1.68	1.07
1:A:122:ALA:CA	1:A:125:ARG:CD	2.34	0.96
1:A:45:ARG:CZ	1:A:68:ARG:NH1	2.27	0.96
1:A:45:ARG:HH12	1:A:68:ARG:NH1	1.62	0.93
1:A:45:ARG:NH1	1:A:68:ARG:HH12	1.43	0.89
1:A:12:MET:HE1	1:A:28:TRP:HB3	1.55	0.87
1:A:12:MET:CE	1:A:28:TRP:HB3	2.06	0.86
1:A:62:TRP:HZ2	2:A:219:HOH:O	1.59	0.83
1:A:101:ASP:HB2	2:A:227:HOH:O	1.50	0.82
1:A:122:ALA:HA	1:A:125:ARG:CG	2.10	0.81
1:A:122:ALA:HA	1:A:125:ARG:HD2	1.59	0.81
1:A:55:ILE:HG23	1:A:56:LEU:N	1.95	0.80
1:A:45:ARG:CZ	1:A:68:ARG:CZ	2.63	0.77
1:A:13:LYS:NZ	1:A:129:LEU:OXT	2.20	0.75
1:A:122:ALA:CA	1:A:125:ARG:HD2	2.15	0.75
1:A:55:ILE:CG2	1:A:56:LEU:N	2.50	0.74
1:A:97:LYS:O	1:A:101:ASP:OD1	2.06	0.73
1:A:63:TRP:HH2	1:A:101:ASP:OD2	1.75	0.70
1:A:6:CYS:HB2	2:A:140:HOH:O	1.89	0.70
1:A:12:MET:HE2	1:A:17:LEU:HD13	1.72	0.70
1:A:12:MET:CE	1:A:17:LEU:HD13	2.23	0.69
1:A:110:ALA:O	1:A:114:ARG:HG3	1.92	0.68
1:A:5:ARG:NH1	1:A:123:TRP:C	2.48	0.66
1:A:78:ILE:HG13	1:A:79:PRO:HD2	1.78	0.65
1:A:103:ASN:O	1:A:106:ASN:HB2	1.95	0.65
1:A:24:SER:OG	2:A:153:HOH:O	1.85	0.65
1:A:31:ALA:O	1:A:35:GLU:HB2	1.96	0.64
1:A:122:ALA:O	1:A:125:ARG:HD2	1.97	0.64
1:A:12:MET:HE3	1:A:17:LEU:CD1	2.29	0.63
1:A:12:MET:CE	1:A:17:LEU:CD1	2.76	0.63
1:A:121:GLN:O	1:A:125:ARG:HG3	1.98	0.62
1:A:45:ARG:NH2	1:A:68:ARG:HD2	2.14	0.62
1:A:87:ASP:OD1	1:A:89:THR:OG1	2.12	0.60
1:A:111:TRP:CZ3	1:A:116:LYS:HD2	2.38	0.59
1:A:109:VAL:HG13	1:A:110:ALA:N	2.18	0.57
1:A:58:ILE:HD13	1:A:94:CYS:SG	2.45	0.56
1:A:64:CYS:HA	1:A:74:ASN:ND2	2.23	0.53
1:A:35:GLU:HG3	1:A:57:GLN:HG3	1.90	0.53
1:A:45:ARG:HH12	1:A:68:ARG:HH11	1.49	0.52
1:A:17:LEU:HD22	1:A:28:TRP:CE2	2.45	0.51
1:A:45:ARG:HH22	1:A:68:ARG:HD2	1.76	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:12:MET:HE2	1:A:17:LEU:CD1	2.41	0.51
1:A:59:ASN:OD1	1:A:61:ARG:HB3	2.12	0.50
1:A:35:GLU:HG3	1:A:57:GLN:CG	2.41	0.50
1:A:96:LYS:O	1:A:99:VAL:HG12	2.11	0.50
1:A:122:ALA:C	1:A:125:ARG:HD2	2.30	0.50
1:A:38:PHE:HA	1:A:55:ILE:HD11	1.93	0.50
1:A:58:ILE:HD12	1:A:83:LEU:HD13	1.93	0.49
1:A:58:ILE:CG2	1:A:63:TRP:HB2	2.43	0.49
1:A:65:ASN:O	1:A:79:PRO:HA	2.13	0.49
1:A:109:VAL:HG12	2:A:200:HOH:O	2.12	0.48
1:A:45:ARG:HH11	1:A:68:ARG:HH12	1.44	0.48
1:A:62:TRP:CZ2	2:A:219:HOH:O	2.47	0.45
1:A:74:ASN:HD21	1:A:78:ILE:H	1.63	0.45
1:A:109:VAL:HG13	1:A:110:ALA:H	1.79	0.45
1:A:109:VAL:CG1	1:A:110:ALA:N	2.79	0.45
1:A:5:ARG:HG2	1:A:5:ARG:HH11	1.81	0.45
1:A:12:MET:HE2	1:A:28:TRP:HB3	1.94	0.45
1:A:62:TRP:O	1:A:75:LEU:HD23	2.16	0.44
1:A:45:ARG:NH1	1:A:68:ARG:HH11	1.93	0.44
1:A:6:CYS:O	1:A:9:ALA:HB3	2.17	0.44
1:A:87:ASP:OD1	1:A:89:THR:CB	2.65	0.44
1:A:63:TRP:CH2	1:A:101:ASP:OD2	2.64	0.43
1:A:24:SER:O	1:A:27:ASN:HB2	2.18	0.43
1:A:21:ARG:NE	2:A:217:HOH:O	2.12	0.43
1:A:56:LEU:HD12	1:A:56:LEU:HA	1.82	0.43
1:A:114:ARG:HE	1:A:114:ARG:HB3	1.73	0.43
1:A:25:LEU:O	1:A:25:LEU:HD23	2.19	0.43
1:A:119:ASP:OD2	1:A:119:ASP:O	2.36	0.42
1:A:30:CYS:HB2	1:A:123:TRP:CD1	2.53	0.42
1:A:122:ALA:HA	1:A:125:ARG:HG3	1.96	0.41
1:A:69:THR:HA	1:A:70:PRO:HD3	1.79	0.41
1:A:69:THR:O	1:A:72:SER:HB2	2.20	0.41
1:A:58:ILE:HG22	1:A:59:ASN:N	2.36	0.41
1:A:109:VAL:CG1	1:A:110:ALA:H	2.33	0.41
1:A:51:THR:HG22	1:A:53:TYR:CE2	2.56	0.41
1:A:33:LYS:HB2	1:A:38:PHE:CZ	2.56	0.41
1:A:61:ARG:HG3	1:A:61:ARG:O	2.22	0.40

All (13) 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]	0.39	1.81
1:A:128:ARG:NH2	2:A:205:HOH:O[8_555]	0.89	1.31
1:A:128:ARG:CZ	2:A:205:HOH:O[8_555]	1.19	1.01
1:A:128:ARG:NE	2:A:186:HOH:O[8_555]	1.34	0.86
1:A:128:ARG:CD	2:A:187(A):HOH:O[8_555]	1.82	0.38
1:A:128:ARG:CG	2:A:186:HOH:O[8_555]	1.87	0.33
1:A:128:ARG:NE	2:A:205:HOH:O[8_555]	2.03	0.17
1:A:128:ARG:CG	2:A:187(A):HOH:O[8_555]	2.09	0.11
1:A:128:ARG:NH1	2:A:205:HOH:O[8_555]	2.16	0.04
1:A:128:ARG:NE	2:A:187(A):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%)	117 (92%)	9 (7%)	1 (1%)	24 15

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
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%)	94 (90%)	11 (10%)	8 4

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	14	ARG
1	A	24	SER
1	A	25	LEU
1	A	45	ARG
1	A	50	SER
1	A	56	LEU
1	A	72	SER
1	A	77	ASN
1	A	85	SER
1	A	114	ARG
1	A	119	ASP

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

Mol	Chain	Res	Type
1	A	44	ASN
1	A	74	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](#)

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 will therefore be empty.

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

EDS was not executed - this section will therefore be empty.

### 6.3 Carbohydrates ⓘ

EDS was not executed - this section will therefore be empty.

### 6.4 Ligands ⓘ

EDS was not executed - this section will therefore be empty.

### 6.5 Other polymers ⓘ

EDS was not executed - this section will therefore be empty.