



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 09:50 AM UTC

PDB ID : 2BA1 / pdb_00002ba1
Title : Archaeal exosome core
Authors : Hopfner, K.P.; Buttner, K.; Wenig, K.
Deposited on : 2005-10-13
Resolution : 2.70 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : 4-5-2 with Phenix2.0
Xtrriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

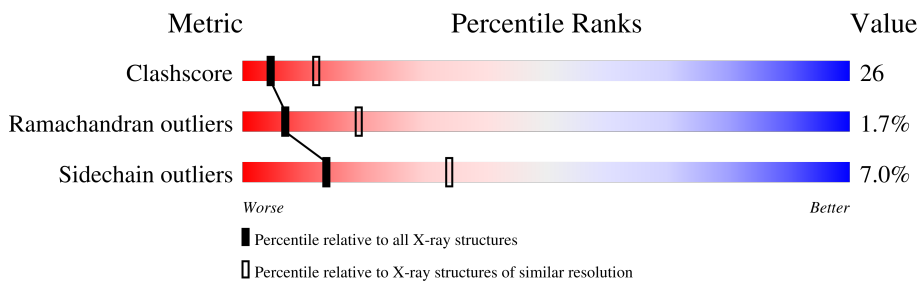
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 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	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)


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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	179	50% 44% 5% .
1	B	179	52% 43% . .
1	C	179	51% 46% .
2	D	258	53% 35% 6% 5%
2	E	258	50% 41% . 5%
2	F	258	55% 34% 5% 5%
3	G	259	53% 37% 5% 5%
3	H	259	51% 40% . . 5%

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Mol	Chain	Length	Quality of chain
3	I	259	 57% 33% 5% 5%

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 15740 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 Archaeal exosome RNA binding protein CSL4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	179	1371	855	242	266	8	0	0	0
1	C	179	1371	855	242	266	8	19	0	0
1	B	179	1371	855	242	266	8	23	0	0

- Molecule 2 is a protein called Archaeal exosome complex exonuclease RRP41.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	E	245	1921	1209	339	360	13	0	0	0
2	D	245	1921	1209	339	360	13	3	0	0
2	F	245	1921	1209	339	360	13	9	0	0

- Molecule 3 is a protein called Archaeal exosome complex exonuclease RRP42.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	H	247	1926	1213	320	387	6	3	0	0
3	G	247	1926	1213	320	387	6	21	0	0
3	I	247	1926	1213	320	387	6	14	0	0

- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Zn	0	0
			1	1		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	C	1	Total 1	Zn 1	0	0
4	B	1	Total 1	Zn 1	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total 1	O 1	0	0
5	C	2	Total 2	O 2	0	0
5	E	8	Total 8	O 8	0	0
5	D	9	Total 9	O 9	0	0
5	F	22	Total 22	O 22	0	0
5	H	13	Total 13	O 13	0	0
5	G	5	Total 5	O 5	0	0
5	I	23	Total 23	O 23	0	0

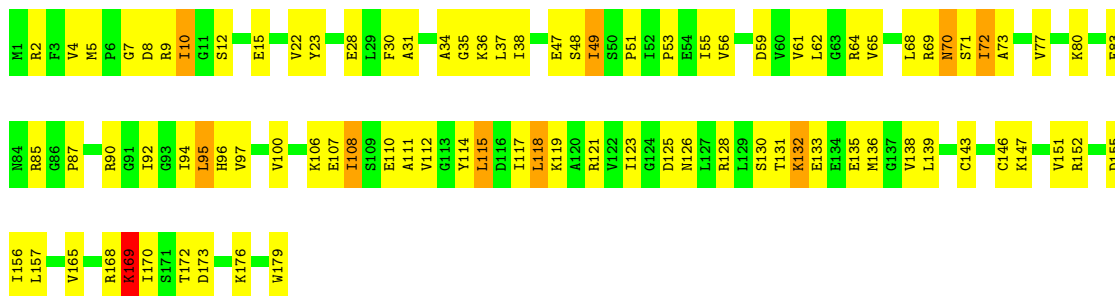
3 Residue-property plots [i](#)

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. 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: Archaeal exosome RNA binding protein CSL4

Chain A: 



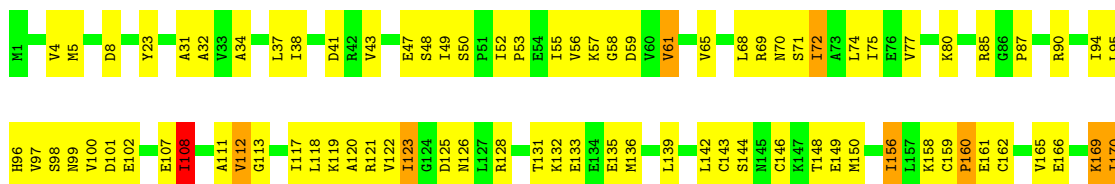
- Molecule 1: Archaeal exosome RNA binding protein CSL4

Chain C: 



- Molecule 1: Archaeal exosome RNA binding protein CSL4

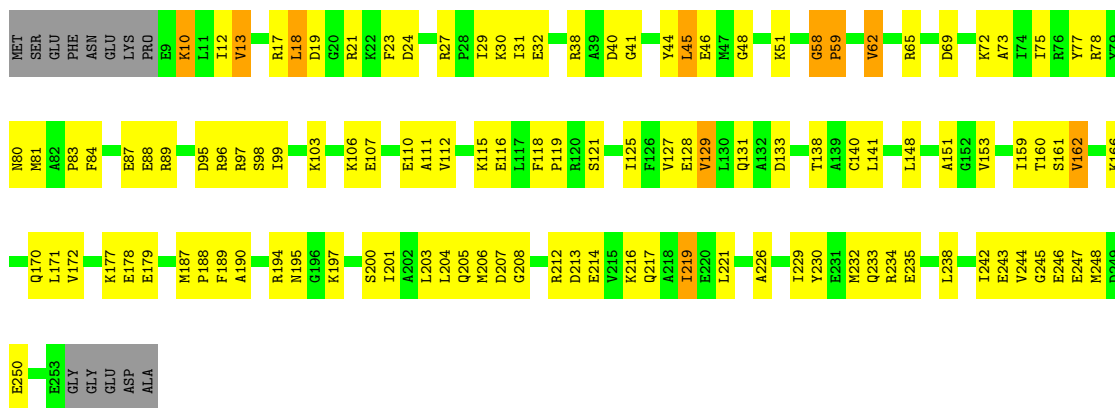
Chain B: 





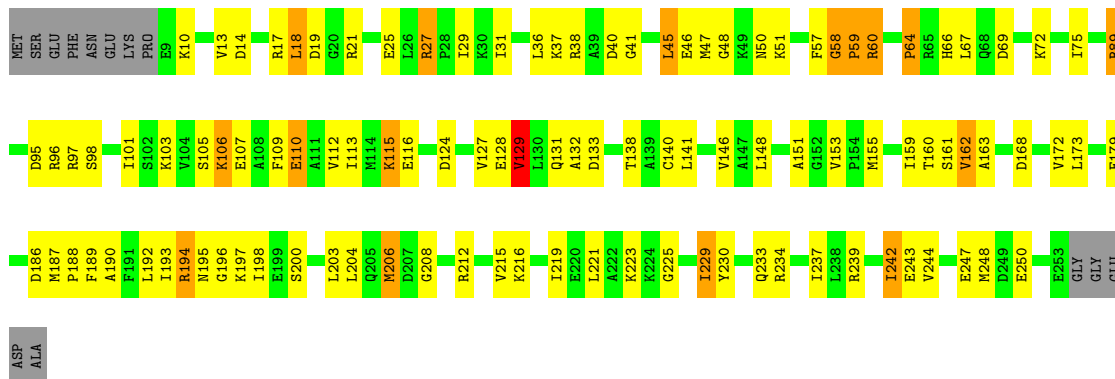
- Molecule 2: Archaeal exosome complex exonuclease RRP41

Chain E: 50% 41% 5%



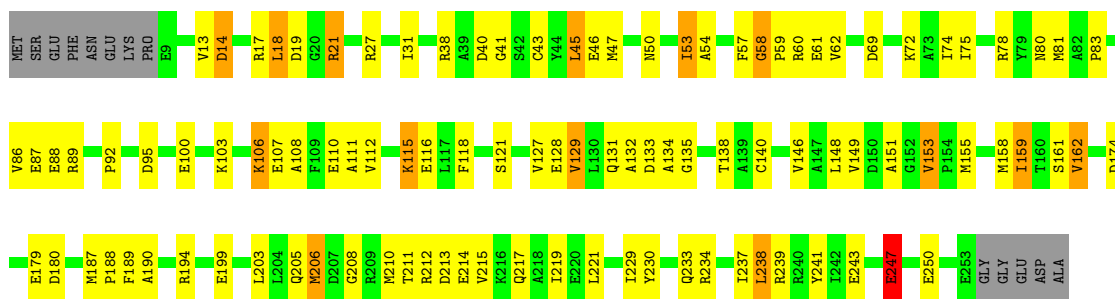
- Molecule 2: Archaeal exosome complex exonuclease RRP41

Chain D: 53% 35% 6% 5%

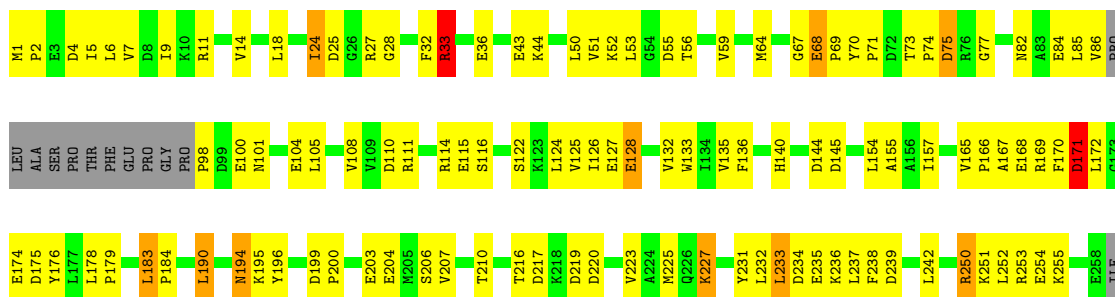


- Molecule 2: Archaeal exosome complex exonuclease RRP41

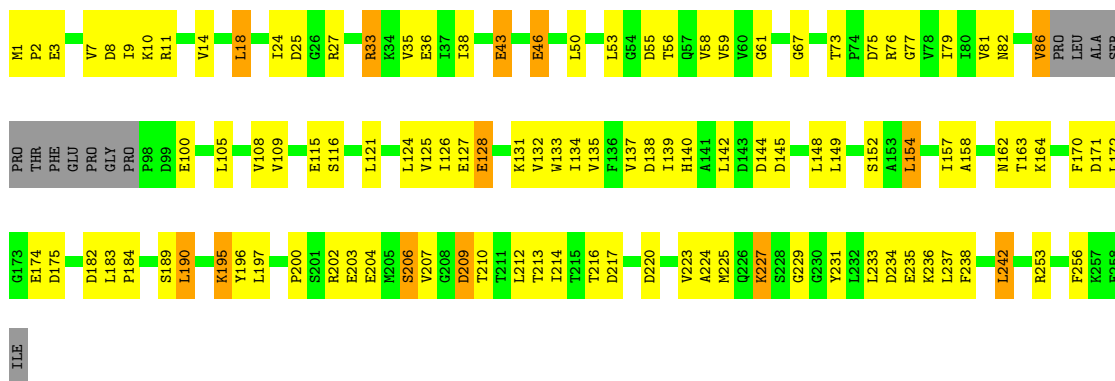
Chain F: 55% 34% 5% 5%



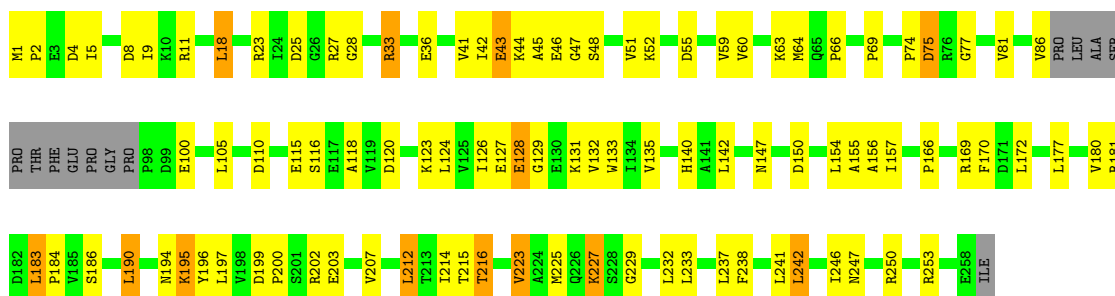
- Molecule 3: Archaeal exosome complex exonuclease RRP42



• Molecule 3: Archaeal exosome complex exonuclease RRP42



• Molecule 3: Archaeal exosome complex exonuclease RRP42



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 43 2 2	Depositor
Cell constants a, b, c, α , β , γ	137.46Å 137.46Å 261.01Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.70	Depositor
% Data completeness (in resolution range)	(Not available) (20.00-2.70)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.08	Depositor
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.224 , 0.275	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	15740	wwPDB-VP
Average B, all atoms (Å ²)	66.0	wwPDB-VP

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:
ZN

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	0.39	0/1385	0.89	1/1855 (0.1%)
1	B	0.34	0/1385	0.80	2/1855 (0.1%)
1	C	0.37	0/1385	0.86	2/1855 (0.1%)
2	D	0.51	1/1947 (0.1%)	1.00	6/2612 (0.2%)
2	E	0.48	0/1947	0.99	3/2612 (0.1%)
2	F	0.53	0/1947	1.02	3/2612 (0.1%)
3	G	0.44	0/1949	0.92	3/2638 (0.1%)
3	H	0.50	0/1949	0.94	5/2638 (0.2%)
3	I	0.51	0/1949	0.95	2/2638 (0.1%)
All	All	0.47	1/15843 (0.0%)	0.94	27/21315 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	129	VAL	CA-CB	5.16	1.60	1.54

The worst 5 of 27 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	G	43	GLU	N-CA-C	8.98	121.00	111.03
2	D	133	ASP	N-CA-C	-6.40	100.38	108.45
2	F	133	ASP	N-CA-C	-6.39	100.40	108.45
2	D	192	LEU	N-CA-C	-6.25	99.08	109.46
2	D	96	ARG	N-CA-C	-6.17	104.46	111.07

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	1371	0	1408	92	0
1	B	1371	0	1409	109	0
1	C	1371	0	1408	84	0
2	D	1921	0	1971	112	0
2	E	1921	0	1971	115	0
2	F	1921	0	1971	85	0
3	G	1926	0	1951	118	0
3	H	1926	0	1951	107	0
3	I	1926	0	1951	100	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
4	C	1	0	0	0	0
5	A	1	0	0	0	0
5	C	2	0	0	0	0
5	D	9	0	0	1	0
5	E	8	0	0	0	0
5	F	22	0	0	0	0
5	G	5	0	0	0	0
5	H	13	0	0	1	0
5	I	23	0	0	3	0
All	All	15740	0	15991	818	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 26.

The worst 5 of 818 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:C:117:ILE:HG21	3:H:9:ILE:HD11	1.29	1.09
2:E:112:VAL:HG21	2:E:159:ILE:HD11	1.10	1.05
2:D:31:ILE:HG12	2:D:45:LEU:HD22	1.43	1.00
3:G:76:ARG:HH21	3:G:121:LEU:HD12	1.26	0.94
2:E:201:ILE:HG12	3:H:233:LEU:HB3	1.45	0.94

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	177/179 (99%)	159 (90%)	15 (8%)	3 (2%)	7	19
1	B	177/179 (99%)	143 (81%)	26 (15%)	8 (4%)	2	4
1	C	177/179 (99%)	154 (87%)	22 (12%)	1 (1%)	21	44
2	D	243/258 (94%)	227 (93%)	11 (4%)	5 (2%)	5	15
2	E	243/258 (94%)	223 (92%)	15 (6%)	5 (2%)	5	15
2	F	243/258 (94%)	233 (96%)	8 (3%)	2 (1%)	16	37
3	G	243/259 (94%)	219 (90%)	22 (9%)	2 (1%)	16	37
3	H	243/259 (94%)	224 (92%)	14 (6%)	5 (2%)	5	15
3	I	243/259 (94%)	228 (94%)	13 (5%)	2 (1%)	16	37
All	All	1989/2088 (95%)	1810 (91%)	146 (7%)	33 (2%)	7	19

5 of 33 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	108	ILE
1	B	112	VAL
2	E	58	GLY
2	D	58	GLY
2	F	58	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	149/149 (100%)	140 (94%)	9 (6%)	17	41
1	B	149/149 (100%)	141 (95%)	8 (5%)	20	45
1	C	149/149 (100%)	140 (94%)	9 (6%)	17	41
2	D	204/214 (95%)	190 (93%)	14 (7%)	14	34
2	E	204/214 (95%)	188 (92%)	16 (8%)	11	29
2	F	204/214 (95%)	183 (90%)	21 (10%)	7	18
3	G	217/227 (96%)	203 (94%)	14 (6%)	15	37
3	H	217/227 (96%)	203 (94%)	14 (6%)	15	37
3	I	217/227 (96%)	202 (93%)	15 (7%)	14	34
All	All	1710/1770 (97%)	1590 (93%)	120 (7%)	14	34

5 of 120 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	F	18	LEU
3	I	183	LEU
2	F	159	ILE
3	I	154	LEU
3	I	241	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 32 such sidechains are listed below:

Mol	Chain	Res	Type
3	G	65	GLN
3	G	147	ASN
2	E	228	GLN
2	E	195	ASN
3	I	147	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](#)

Of 3 ligands modelled in this entry, 3 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 [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.