



wwPDB EM Validation Summary Report ⓘ

Dec 28, 2025 – 12:20 AM JST

PDB ID : 9J77 / pdb_00009j77
EMDB ID : EMD-61196
Title : Cryo-EM structure of CRL2-FEM1B (dimer 1)
Authors : Zhao, S.; Xu, C.
Deposited on : 2024-08-18
Resolution : 3.56 Å(reported)

This is a wwPDB EM 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/EMValidationReportHelp>

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:

EMDB validation analysis : **FAILED**
MolProbity : 4-5-2 with Phenix2.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
EM percentile statistics : **NOT EXECUTED**
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.47

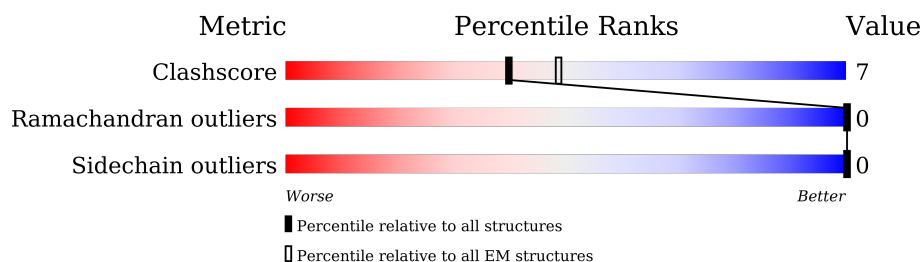
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.56 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.



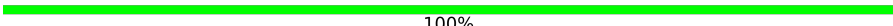
Metric	Whole archive (#Entries)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the 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 $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	C	96	82% 18%
1	G	96	76% 24%
2	D	121	65% 14% 21%
2	H	121	61% 18% 21%
3	E	96	72% 18% 10%
3	I	96	53% 23% 24%
4	A	749	80% 17% .
4	B	749	83% 14% .
5	F	627	81% 19%

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Mol	Chain	Length	Quality of chain
5	J	627	 81% 19%
6	K	10	 90% 10%
6	L	10	 100%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 26209 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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 Elongin-C.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	G	96	Total	C	N	O	S	0	0
			760	487	122	145	6		
1	C	96	Total	C	N	O	S	0	0
			760	487	122	145	6		

- Molecule 2 is a protein called Elongin-B.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	H	96	Total	C	N	O	S	0	0
			759	483	129	144	3		
2	D	96	Total	C	N	O	S	0	0
			759	483	129	144	3		

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
H	-2	GLY	-	expression tag	UNP Q15370
H	-1	GLY	-	expression tag	UNP Q15370
H	0	SER	-	expression tag	UNP Q15370
D	-2	GLY	-	expression tag	UNP Q15370
D	-1	GLY	-	expression tag	UNP Q15370
D	0	SER	-	expression tag	UNP Q15370

- Molecule 3 is a protein called E3 ubiquitin-protein ligase RBX1, N-terminally processed.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	I	73	Total	C	N	O	S	0	0
			598	383	110	96	9		
3	E	86	Total	C	N	O	S	0	0
			703	445	128	121	9		

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
I	13	SER	-	expression tag	UNP P62877
I	14	HIS	-	expression tag	UNP P62877
I	15	MET	-	expression tag	UNP P62877
E	13	SER	-	expression tag	UNP P62877
E	14	HIS	-	expression tag	UNP P62877
E	15	MET	-	expression tag	UNP P62877

- Molecule 4 is a protein called Cullin-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	B	725	Total	C	N	O	S	0	0
			5947	3781	1009	1113	44		
4	A	726	Total	C	N	O	S	0	0
			5953	3783	1011	1115	44		

There are 72 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-19	SER	-	expression tag	UNP Q13617
B	-18	ALA	-	expression tag	UNP Q13617
B	-17	SER	-	expression tag	UNP Q13617
B	-16	TRP	-	expression tag	UNP Q13617
B	-15	SER	-	expression tag	UNP Q13617
B	-14	HIS	-	expression tag	UNP Q13617
B	-13	PRO	-	expression tag	UNP Q13617
B	-12	GLN	-	expression tag	UNP Q13617
B	-11	PHE	-	expression tag	UNP Q13617
B	-10	GLU	-	expression tag	UNP Q13617
B	-9	LYS	-	expression tag	UNP Q13617
B	-8	GLY	-	expression tag	UNP Q13617
B	-7	GLY	-	expression tag	UNP Q13617
B	-6	GLY	-	expression tag	UNP Q13617
B	-5	SER	-	expression tag	UNP Q13617
B	-4	GLY	-	expression tag	UNP Q13617
B	-3	GLY	-	expression tag	UNP Q13617
B	-2	GLY	-	expression tag	UNP Q13617
B	-1	SER	-	expression tag	UNP Q13617
B	0	GLY	-	expression tag	UNP Q13617
B	1	THR	-	expression tag	UNP Q13617
B	?	-	LYS	deletion	UNP Q13617
B	?	-	LEU	deletion	UNP Q13617
B	?	-	THR	deletion	UNP Q13617
B	?	-	GLU	deletion	UNP Q13617

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Chain	Residue	Modelled	Actual	Comment	Reference
B	?	-	ALA	deletion	UNP Q13617
B	?	-	ASP	deletion	UNP Q13617
B	?	-	LEU	deletion	UNP Q13617
B	?	-	GLN	deletion	UNP Q13617
B	?	-	TYR	deletion	UNP Q13617
B	?	-	TYR	deletion	UNP Q13617
B	?	-	VAL	deletion	UNP Q13617
B	?	-	ASP	deletion	UNP Q13617
B	?	-	MET	deletion	UNP Q13617
B	?	-	ASN	deletion	UNP Q13617
B	?	-	GLU	deletion	UNP Q13617
A	-19	SER	-	expression tag	UNP Q13617
A	-18	ALA	-	expression tag	UNP Q13617
A	-17	SER	-	expression tag	UNP Q13617
A	-16	TRP	-	expression tag	UNP Q13617
A	-15	SER	-	expression tag	UNP Q13617
A	-14	HIS	-	expression tag	UNP Q13617
A	-13	PRO	-	expression tag	UNP Q13617
A	-12	GLN	-	expression tag	UNP Q13617
A	-11	PHE	-	expression tag	UNP Q13617
A	-10	GLU	-	expression tag	UNP Q13617
A	-9	LYS	-	expression tag	UNP Q13617
A	-8	GLY	-	expression tag	UNP Q13617
A	-7	GLY	-	expression tag	UNP Q13617
A	-6	GLY	-	expression tag	UNP Q13617
A	-5	SER	-	expression tag	UNP Q13617
A	-4	GLY	-	expression tag	UNP Q13617
A	-3	GLY	-	expression tag	UNP Q13617
A	-2	GLY	-	expression tag	UNP Q13617
A	-1	SER	-	expression tag	UNP Q13617
A	0	GLY	-	expression tag	UNP Q13617
A	1	THR	-	expression tag	UNP Q13617
A	?	-	LYS	deletion	UNP Q13617
A	?	-	LEU	deletion	UNP Q13617
A	?	-	THR	deletion	UNP Q13617
A	?	-	GLU	deletion	UNP Q13617
A	?	-	ALA	deletion	UNP Q13617
A	?	-	ASP	deletion	UNP Q13617
A	?	-	LEU	deletion	UNP Q13617
A	?	-	GLN	deletion	UNP Q13617
A	?	-	TYR	deletion	UNP Q13617
A	?	-	TYR	deletion	UNP Q13617

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Chain	Residue	Modelled	Actual	Comment	Reference
A	?	-	VAL	deletion	UNP Q13617
A	?	-	ASP	deletion	UNP Q13617
A	?	-	MET	deletion	UNP Q13617
A	?	-	ASN	deletion	UNP Q13617
A	?	-	GLU	deletion	UNP Q13617

- Molecule 5 is a protein called Protein fem-1 homolog B.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	J	627	Total	C	N	O	S	0	0
			4932	3092	882	929	29		
5	F	627	Total	C	N	O	S	0	0
			4932	3092	882	929	29		

- Molecule 6 is a protein called Poly-UNK.

Mol	Chain	Residues	Atoms				AltConf	Trace
6	K	10	Total	C	N	O	0	0
			50	30	10	10		
6	L	10	Total	C	N	O	0	0
			50	30	10	10		

- Molecule 7 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		AltConf
7	I	3	Total	Zn	0
			3	3	
7	E	3	Total	Zn	0
			3	3	

3 Residue-property plots

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.

- Molecule 1: Elongin-C

Chain G:  76% 24%



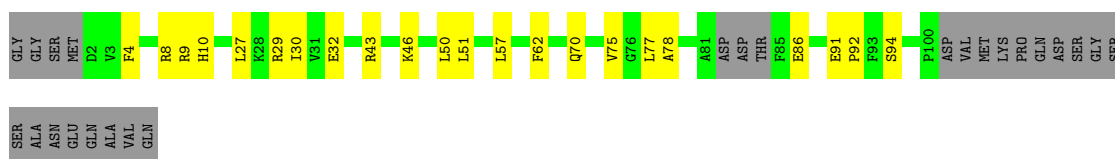
- Molecule 1: Elongin-C

Chain C:  82% 18%



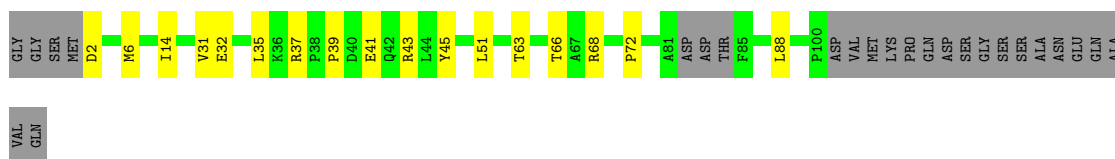
- Molecule 2: Elongin-B

Chain H:  61% 18% 21%



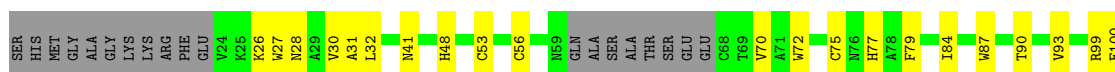
- Molecule 2: Elongin-B

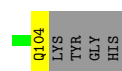
Chain D:  65% 14% 21%



- Molecule 3: E3 ubiquitin-protein ligase RBX1, N-terminally processed

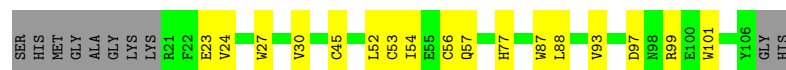
Chain I:  53% 23% 24%





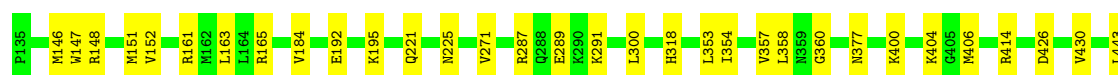
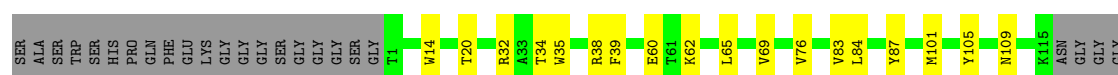
- Molecule 3: E3 ubiquitin-protein ligase RBX1, N-terminally processed

Chain E: 72% 18% 10%



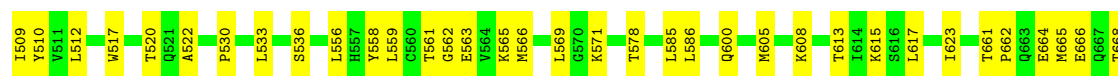
- Molecule 4: Cullin-2

Chain B: 83% 14% .



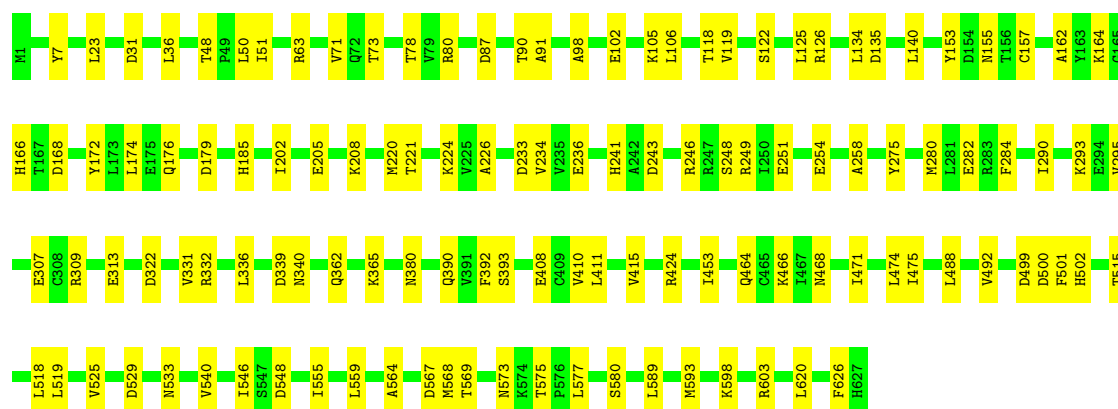
- Molecule 4: Cullin-2

Chain A: 80% 17% .



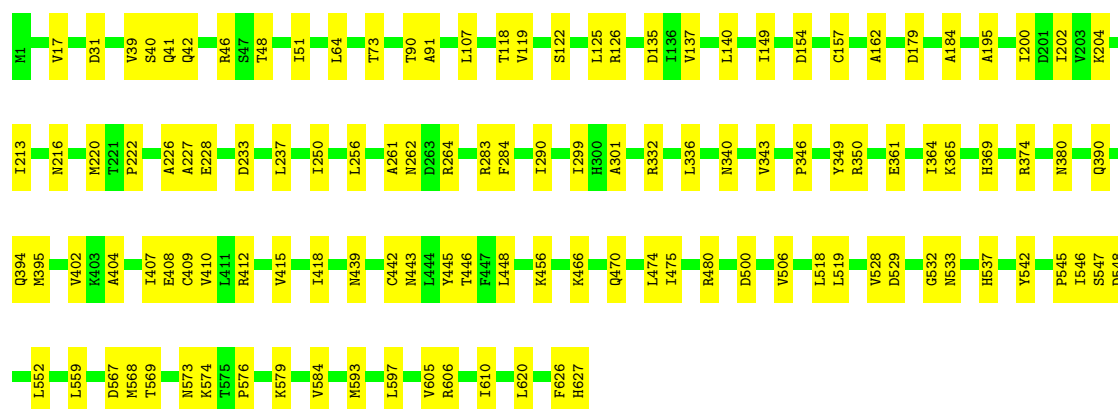
- Molecule 5: Protein fem-1 homolog B

Chain J: 81% 19%



• Molecule 5: Protein fem-1 homolog B

Chain F: 81% 19%



• Molecule 6: Poly-UNK

Chain K: 90% 10%



• Molecule 6: Poly-UNK

Chain L: 100%

There are no outlier residues recorded for this chain.

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	222336	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	55.8	Depositor
Minimum defocus (nm)	1800	Depositor
Maximum defocus (nm)	2900	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor

5 Model quality

5.1 Standard geometry

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	C	0.14	0/777	0.35	0/1050
1	G	0.12	0/777	0.35	0/1050
2	D	0.10	0/774	0.31	0/1045
2	H	0.12	0/774	0.38	0/1045
3	E	0.14	0/723	0.32	0/983
3	I	0.10	0/616	0.28	0/839
4	A	0.12	0/6069	0.29	0/8174
4	B	0.13	0/6063	0.35	1/8166 (0.0%)
5	F	0.11	0/5018	0.31	0/6803
5	J	0.12	0/5018	0.33	0/6803
All	All	0.12	0/26609	0.32	1/35958 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	620	VAL	N-CA-C	-5.32	107.29	112.29

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	C	760	0	749	12	0
1	G	760	0	749	18	0
2	D	759	0	761	10	0
2	H	759	0	761	17	0
3	E	703	0	652	14	0
3	I	598	0	557	17	0
4	A	5953	0	5951	84	0
4	B	5947	0	5952	63	0
5	F	4932	0	4912	78	0
5	J	4932	0	4912	77	0
6	K	50	0	12	1	0
6	L	50	0	12	0	0
7	E	3	0	0	0	0
7	I	3	0	0	0	0
All	All	26209	0	25980	359	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.

The worst 5 of 359 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)
4:B:147:TRP:O	4:B:151:MET:HB3	1.83	0.76
4:A:148:ARG:HB3	4:A:191:VAL:HG11	1.75	0.68
4:B:443:LEU:HB3	4:B:480:MET:HG3	1.76	0.68
4:A:566:MET:HB2	4:A:569:LEU:HB2	1.77	0.67
5:J:126:ARG:HH21	5:J:157:CYS:HB3	1.60	0.66

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 PDB entries followed by that with respect to all EM entries.

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	C	94/96 (98%)	85 (90%)	9 (10%)	0	100	100
1	G	94/96 (98%)	88 (94%)	6 (6%)	0	100	100
2	D	92/121 (76%)	89 (97%)	3 (3%)	0	100	100
2	H	92/121 (76%)	84 (91%)	8 (9%)	0	100	100
3	E	84/96 (88%)	82 (98%)	2 (2%)	0	100	100
3	I	69/96 (72%)	65 (94%)	4 (6%)	0	100	100
4	A	722/749 (96%)	688 (95%)	34 (5%)	0	100	100
4	B	721/749 (96%)	691 (96%)	30 (4%)	0	100	100
5	F	625/627 (100%)	591 (95%)	34 (5%)	0	100	100
5	J	625/627 (100%)	590 (94%)	35 (6%)	0	100	100
All	All	3218/3378 (95%)	3053 (95%)	165 (5%)	0	100	100

There are no Ramachandran outliers to report.

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 PDB entries followed by that with respect to all EM entries.

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	C	85/85 (100%)	85 (100%)	0	100	100
1	G	85/85 (100%)	85 (100%)	0	100	100
2	D	84/104 (81%)	84 (100%)	0	100	100
2	H	84/104 (81%)	84 (100%)	0	100	100
3	E	74/82 (90%)	74 (100%)	0	100	100
3	I	63/82 (77%)	63 (100%)	0	100	100
4	A	666/679 (98%)	666 (100%)	0	100	100
4	B	666/679 (98%)	666 (100%)	0	100	100
5	F	536/536 (100%)	536 (100%)	0	100	100
5	J	536/536 (100%)	536 (100%)	0	100	100
All	All	2879/2972 (97%)	2879 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 41 such sidechains are listed below:

Mol	Chain	Res	Type
4	A	71	HIS
4	A	283	HIS
4	A	169	ASN
4	A	234	GLN
4	A	332	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 6 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 ⓘ

There are no chain breaks in this entry.