



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 10, 2026 – 06:55 PM UTC

PDB ID : 3K1I / pdb_00003k1i
Title : Crystal structure of FliS-HP1076 complex in *H. pylori*
Authors : Lam, W.W.L.; Kotaka, M.; Ling, T.K.W.; Au, S.W.N.
Deposited on : 2009-09-28
Resolution : 2.70 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 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
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

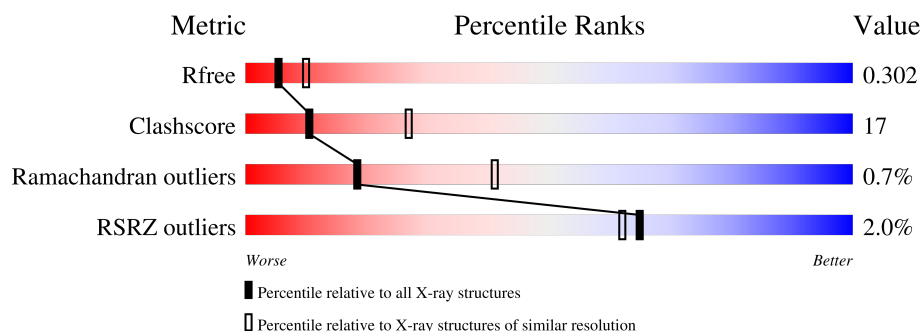
1 Overall quality at a glance

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))
R_{free}	180053	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (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 $\leq 5\%$. 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	131	2% 54% 27% 19%
1	B	131	2% 50% 29% 21%
2	C	178	2% 47% 20% 33%
2	D	178	2% 44% 24% 33%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3603 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 Flagellar protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	106	Total	C	N	O	S	0	0	0
			859	548	142	167	2			
1	B	104	Total	C	N	O	S	0	0	0
			842	539	140	161	2			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-4	GLY	-	expression tag	UNP O25448
A	-3	PRO	-	expression tag	UNP O25448
A	-2	LEU	-	expression tag	UNP O25448
A	-1	GLY	-	expression tag	UNP O25448
A	0	SER	-	expression tag	UNP O25448
B	-4	GLY	-	expression tag	UNP O25448
B	-3	PRO	-	expression tag	UNP O25448
B	-2	LEU	-	expression tag	UNP O25448
B	-1	GLY	-	expression tag	UNP O25448
B	0	SER	-	expression tag	UNP O25448

- Molecule 2 is a protein called Putative uncharacterized protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	119	Total	C	N	O	S	0	0	0
			938	599	150	184	5			
2	D	120	Total	C	N	O	S	0	0	0
			948	604	152	187	5			

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-6	HIS	-	expression tag	UNP O25709
C	-5	HIS	-	expression tag	UNP O25709

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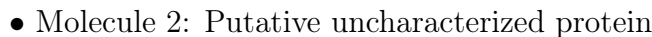
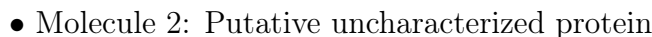
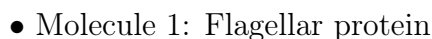
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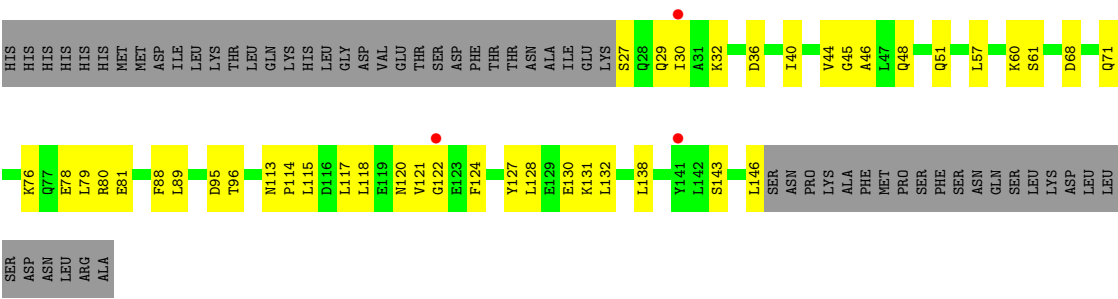
Chain	Residue	Modelled	Actual	Comment	Reference
C	-4	HIS	-	expression tag	UNP O25709
C	-3	HIS	-	expression tag	UNP O25709
C	-2	HIS	-	expression tag	UNP O25709
C	-1	HIS	-	expression tag	UNP O25709
C	0	MET	-	expression tag	UNP O25709
D	-6	HIS	-	expression tag	UNP O25709
D	-5	HIS	-	expression tag	UNP O25709
D	-4	HIS	-	expression tag	UNP O25709
D	-3	HIS	-	expression tag	UNP O25709
D	-2	HIS	-	expression tag	UNP O25709
D	-1	HIS	-	expression tag	UNP O25709
D	0	MET	-	expression tag	UNP O25709

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	4	Total O 4 4	0	0
3	B	3	Total O 3 3	0	0
3	C	3	Total O 3 3	0	0
3	D	6	Total O 6 6	0	0

- Molecule 1: Flagellar protein





4 Data and refinement statistics

Property	Value	Source
Space group	P 41	Depositor
Cell constants a, b, c, α , β , γ	50.25Å 50.25Å 242.01Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.33 – 2.70 19.33 – 2.70	Depositor EDS
% Data completeness (in resolution range)	100.0 (19.33-2.70) 93.0 (19.33-2.70)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.38 (at 2.70Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.258 , 0.299 (Not available) , 0.302	Depositor DCC
R_{free} test set	771 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å ²)	53.8	Xtriage
Anisotropy	0.006	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 18.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.27$	Xtriage
Estimated twinning fraction	0.408 for h,-k,-l	Xtriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	3603	wwPDB-VP
Average B, all atoms (Å ²)	44.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.47% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

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	0.92	0/871	1.10	1/1177 (0.1%)
1	B	0.89	0/854	1.06	0/1154
2	C	0.90	1/947 (0.1%)	1.02	2/1274 (0.2%)
2	D	0.87	1/957 (0.1%)	1.03	0/1287
All	All	0.90	2/3629 (0.1%)	1.05	3/4892 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	74	ILE	CA-CB	5.53	1.60	1.54
2	D	96	THR	CA-CB	5.22	1.62	1.53

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	47	ILE	N-CA-C	6.40	116.89	110.23
2	C	68	ASP	N-CA-CB	5.55	118.37	110.44
2	C	91	SER	CB-CA-C	5.07	116.50	108.84

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	859	0	865	34	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	842	0	855	38	0
2	C	938	0	953	24	0
2	D	948	0	964	38	0
3	A	4	0	0	0	0
3	B	3	0	0	0	0
3	C	3	0	0	0	0
3	D	6	0	0	1	0
All	All	3603	0	3637	122	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 17.

All (122) 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:65:LEU:CD2	2:D:30:ILE:HD11	1.82	1.10
2:D:76:LYS:HG2	2:D:118:LEU:HD13	1.39	1.02
2:C:76:LYS:HG2	2:C:118:LEU:HD13	1.37	1.02
1:A:65:LEU:HD23	2:D:30:ILE:HD11	1.43	0.96
2:C:32:LYS:HG2	2:C:36:ASP:OD2	1.85	0.76
1:A:65:LEU:CG	2:D:30:ILE:HD11	2.19	0.72
1:A:19:SER:N	1:A:20:PRO:HD3	2.06	0.71
1:A:39:LYS:HB2	1:A:103:ILE:HG21	1.72	0.70
2:D:143:SER:HA	2:D:146:LEU:HD12	1.73	0.70
2:C:77:GLN:O	2:C:81:GLU:HG3	1.93	0.68
1:A:55:ASN:HA	1:A:58:THR:HG23	1.75	0.68
1:B:55:ASN:HA	1:B:58:THR:HG23	1.76	0.67
2:D:32:LYS:HG2	2:D:36:ASP:OD2	1.96	0.66
2:C:117:LEU:HD12	2:C:124:PHE:HA	1.80	0.63
1:A:65:LEU:HG	2:D:30:ILE:CD1	2.29	0.63
1:B:93:GLN:NE2	2:C:146:LEU:O	2.33	0.62
2:C:128:LEU:O	2:C:132:LEU:HB2	1.99	0.62
1:B:39:LYS:HB2	1:B:103:ILE:HG21	1.82	0.61
2:D:60:LYS:HZ2	2:D:78:GLU:HG2	1.66	0.61
2:D:117:LEU:HD12	2:D:124:PHE:HA	1.83	0.61
2:D:114:PRO:HB2	2:D:124:PHE:HE1	1.64	0.60
2:C:114:PRO:HB2	2:C:124:PHE:HE1	1.65	0.60
2:D:128:LEU:O	2:D:132:LEU:HB2	2.02	0.59
1:B:65:LEU:HD13	1:B:84:TYR:HD2	1.68	0.59
1:A:19:SER:N	1:A:20:PRO:CD	2.68	0.57
2:D:80:ARG:HG3	2:D:115:LEU:CD1	2.35	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:143:SER:HA	2:C:146:LEU:HD12	1.87	0.57
1:B:19:SER:N	1:B:20:PRO:HD3	2.20	0.56
1:A:93:GLN:O	1:A:97:GLU:HG2	2.05	0.56
2:D:40:ILE:O	2:D:44:VAL:HG23	2.05	0.56
1:B:70:TYR:O	1:B:71:GLU:HG3	2.05	0.56
2:D:127:TYR:HA	2:D:130:GLU:HG2	1.87	0.56
1:B:23:LEU:CD1	1:B:27:LEU:HD21	2.35	0.56
1:A:23:LEU:O	1:A:27:LEU:HG	2.07	0.55
1:B:25:GLU:HG2	1:B:29:GLU:OE2	2.06	0.55
1:B:23:LEU:HD13	1:B:27:LEU:HD21	1.89	0.55
1:A:65:LEU:HD13	1:A:84:TYR:HD2	1.72	0.55
2:C:117:LEU:O	2:C:124:PHE:HB2	2.06	0.54
1:A:54:ILE:O	1:A:58:THR:CG2	2.55	0.53
2:D:60:LYS:HZ2	2:D:78:GLU:CG	2.20	0.53
1:A:54:ILE:O	1:A:58:THR:HG22	2.09	0.52
2:D:60:LYS:NZ	2:D:78:GLU:HG2	2.23	0.52
2:C:47:LEU:HD23	2:C:98:LEU:HD12	1.91	0.52
1:A:52:TYR:O	1:A:56:ARG:HB2	2.09	0.52
2:C:33:PHE:CE1	2:C:37:MET:HE2	2.45	0.52
1:B:65:LEU:HG	2:C:30:ILE:HD12	1.90	0.52
1:B:70:TYR:C	1:B:71:GLU:HG3	2.35	0.51
1:A:123:ASP:OD2	1:A:123:ASP:N	2.41	0.51
2:D:57:LEU:HD12	2:D:79:LEU:HD22	1.93	0.51
2:D:81:GLU:HG2	3:D:173:HOH:O	2.10	0.51
1:B:89:LYS:HE3	2:C:146:LEU:HA	1.94	0.51
2:D:36:ASP:O	2:D:40:ILE:HG13	2.11	0.50
1:A:27:LEU:O	1:A:31:ILE:HG12	2.12	0.50
1:A:24:ILE:HD12	1:A:117:TRP:CH2	2.46	0.50
1:B:54:ILE:O	1:B:58:THR:HG22	2.11	0.50
1:B:52:TYR:O	1:B:56:ARG:HB2	2.12	0.50
1:A:58:THR:HB	1:A:88:ILE:HG12	1.94	0.49
2:D:80:ARG:HA	2:D:115:LEU:HD11	1.94	0.49
1:A:65:LEU:HG	2:D:30:ILE:HD11	1.87	0.49
1:B:58:THR:HB	1:B:88:ILE:HG12	1.95	0.49
2:C:45:GLY:O	2:C:49:VAL:HG23	2.13	0.48
2:D:27:SER:HB2	2:D:29:GLN:H	1.78	0.48
1:A:57:VAL:HG12	1:A:91:LEU:HD11	1.94	0.48
1:A:76:VAL:HG23	1:B:76:VAL:HG13	1.94	0.48
1:B:86:HIS:O	1:B:90:VAL:HG23	2.13	0.48
1:A:92:THR:O	1:A:95:ASN:HB3	2.14	0.48
1:B:23:LEU:O	1:B:27:LEU:HG	2.14	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:57:LEU:HD12	2:C:79:LEU:HD22	1.95	0.48
2:D:60:LYS:NZ	2:D:78:GLU:CG	2.76	0.48
2:C:61:SER:HB3	2:C:124:PHE:HE2	1.79	0.48
1:B:65:LEU:HD12	1:B:68:LEU:HD22	1.96	0.48
2:D:120:ASN:O	2:D:122:GLY:N	2.48	0.47
2:C:58:PHE:O	2:C:61:SER:OG	2.31	0.47
2:D:117:LEU:O	2:D:124:PHE:HB2	2.14	0.47
1:A:109:VAL:O	1:A:113:LEU:HG	2.15	0.47
1:A:65:LEU:HD21	2:D:30:ILE:HD11	1.90	0.47
2:D:114:PRO:HB2	2:D:124:PHE:CE1	2.49	0.47
1:B:47:ILE:HD12	2:C:48:GLN:HE21	1.80	0.46
1:B:19:SER:N	1:B:20:PRO:CD	2.78	0.46
1:A:123:ASP:O	1:A:124:GLU:HG2	2.16	0.46
2:D:95:ASP:OD2	2:D:113:ASN:HB2	2.16	0.45
1:B:74:GLY:O	1:B:78:VAL:HG23	2.16	0.45
2:D:61:SER:HB3	2:D:124:PHE:HE2	1.80	0.45
1:B:24:ILE:HD12	1:B:117:TRP:CZ2	2.52	0.45
2:D:48:GLN:O	2:D:51:GLN:HB3	2.17	0.45
1:A:27:LEU:O	1:A:60:ILE:HG21	2.16	0.44
1:A:123:ASP:C	1:A:124:GLU:HG2	2.42	0.44
1:A:24:ILE:HD12	1:A:117:TRP:CZ2	2.52	0.44
1:A:75:GLU:HA	1:B:120:ILE:CD1	2.47	0.44
1:B:22:LYS:HG3	1:B:23:LEU:N	2.32	0.44
1:B:57:VAL:CG1	1:B:91:LEU:HD11	2.48	0.43
2:C:103:ASN:C	2:C:105:GLU:H	2.26	0.43
2:C:128:LEU:O	2:C:132:LEU:N	2.39	0.43
2:D:138:LEU:HD12	2:D:138:LEU:HA	1.82	0.43
1:A:57:VAL:CG1	1:A:91:LEU:HD11	2.48	0.43
1:A:41:CYS:HB3	1:A:50:LYS:HB2	2.00	0.43
2:D:120:ASN:C	2:D:122:GLY:H	2.27	0.43
1:B:57:VAL:HG12	1:B:91:LEU:HD11	2.01	0.42
2:C:88:PHE:CD2	2:C:89:LEU:HG	2.54	0.42
2:D:88:PHE:CD2	2:D:89:LEU:HG	2.55	0.42
2:D:45:GLY:O	2:D:46:ALA:C	2.62	0.42
1:B:34:PHE:CE1	1:B:56:ARG:HG2	2.54	0.42
1:B:24:ILE:HD12	1:B:117:TRP:CH2	2.54	0.42
2:D:27:SER:C	2:D:29:GLN:H	2.27	0.42
1:B:54:ILE:O	1:B:58:THR:CG2	2.68	0.41
2:C:71:GLN:O	2:C:75:ILE:HG13	2.20	0.41
1:B:65:LEU:HD13	1:B:84:TYR:CD2	2.52	0.41
1:B:93:GLN:O	1:B:97:GLU:HG2	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:132:LEU:HD12	2:C:132:LEU:HA	1.88	0.41
1:B:27:LEU:HB3	1:B:60:ILE:HG23	2.03	0.41
1:B:36:SER:O	1:B:39:LYS:HB3	2.20	0.41
2:D:127:TYR:OH	2:D:131:LYS:HE3	2.20	0.41
1:B:94:ALA:CB	1:B:103:ILE:HD13	2.51	0.41
1:A:22:LYS:HG3	1:A:23:LEU:N	2.35	0.41
2:D:120:ASN:C	2:D:122:GLY:N	2.78	0.41
1:B:61:PHE:O	1:B:65:LEU:HB2	2.21	0.41
1:B:65:LEU:O	1:B:68:LEU:HB2	2.20	0.41
2:C:138:LEU:HD12	2:C:138:LEU:HA	1.81	0.41
1:B:23:LEU:O	1:B:24:ILE:C	2.63	0.40
1:A:23:LEU:HD13	1:A:27:LEU:HD21	2.03	0.40
1:A:54:ILE:O	1:A:58:THR:HG23	2.21	0.40
2:D:68:ASP:HB2	2:D:71:GLN:H	1.86	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	104/131 (79%)	97 (93%)	6 (6%)	1 (1%)	12	32
1	B	102/131 (78%)	96 (94%)	5 (5%)	1 (1%)	12	32
2	C	117/178 (66%)	102 (87%)	15 (13%)	0	100	100
2	D	118/178 (66%)	108 (92%)	9 (8%)	1 (1%)	16	37
All	All	441/618 (71%)	403 (91%)	35 (8%)	3 (1%)	18	41

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	74	GLY

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Mol	Chain	Res	Type
1	B	74	GLY
2	D	121	VAL

5.3.2 Protein sidechains [i](#)

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

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](#)

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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, 95th 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	106/131 (80%)	0.22	1 (0%) 81 80	27, 42, 62, 74	0
1	B	104/131 (79%)	0.10	2 (1%) 66 63	27, 42, 62, 74	0
2	C	119/178 (66%)	0.21	3 (2%) 58 55	26, 44, 68, 73	0
2	D	120/178 (67%)	0.14	3 (2%) 58 55	27, 44, 68, 73	0
All	All	449/618 (72%)	0.17	9 (2%) 65 62	26, 43, 67, 74	0

All (9) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	122	GLY	2.9
1	A	38	ALA	2.7
2	D	141	TYR	2.6
2	D	30	ILE	2.5
1	B	122	SER	2.4
2	C	121	VAL	2.4
2	C	143	SER	2.3
2	C	124	PHE	2.2
1	B	69	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 oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.