



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 09:40 AM UTC

PDB ID : 3B8M / pdb_00003b8m
Title : Structure of FepE- Bacterial Polysaccharide Co-polymerase
Authors : Tocilj, A.; Matte, A.; Cygler, M.
Deposited on : 2007-11-01
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

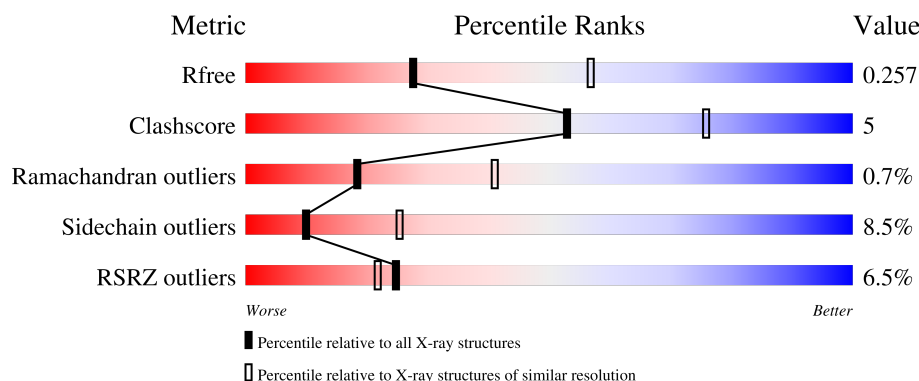
1 Overall quality at a glance

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)
Sidechain outliers	187428	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	280	
1	B	280	
1	C	280	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 6159 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 Ferric enterobactin (Enterochelin) transport.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	255	Total	C	N	O	S	0	0	0
			2048	1304	339	402	3			
1	B	255	Total	C	N	O	S	0	0	0
			2040	1299	337	401	3			
1	C	255	Total	C	N	O	S	0	0	0
			2043	1301	337	402	3			

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	52	MET	-	expression tag	UNP Q8XBV8
A	53	GLY	-	expression tag	UNP Q8XBV8
A	54	SER	-	expression tag	UNP Q8XBV8
A	55	SER	-	expression tag	UNP Q8XBV8
A	56	HIS	-	expression tag	UNP Q8XBV8
A	57	HIS	-	expression tag	UNP Q8XBV8
A	58	HIS	-	expression tag	UNP Q8XBV8
A	59	HIS	-	expression tag	UNP Q8XBV8
A	60	HIS	-	expression tag	UNP Q8XBV8
A	61	HIS	-	expression tag	UNP Q8XBV8
A	62	GLY	-	expression tag	UNP Q8XBV8
A	63	SER	-	expression tag	UNP Q8XBV8
B	52	MET	-	expression tag	UNP Q8XBV8
B	53	GLY	-	expression tag	UNP Q8XBV8
B	54	SER	-	expression tag	UNP Q8XBV8
B	55	SER	-	expression tag	UNP Q8XBV8
B	56	HIS	-	expression tag	UNP Q8XBV8
B	57	HIS	-	expression tag	UNP Q8XBV8
B	58	HIS	-	expression tag	UNP Q8XBV8
B	59	HIS	-	expression tag	UNP Q8XBV8
B	60	HIS	-	expression tag	UNP Q8XBV8
B	61	HIS	-	expression tag	UNP Q8XBV8
B	62	GLY	-	expression tag	UNP Q8XBV8

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Chain	Residue	Modelled	Actual	Comment	Reference
B	63	SER	-	expression tag	UNP Q8XBV8
C	52	MET	-	expression tag	UNP Q8XBV8
C	53	GLY	-	expression tag	UNP Q8XBV8
C	54	SER	-	expression tag	UNP Q8XBV8
C	55	SER	-	expression tag	UNP Q8XBV8
C	56	HIS	-	expression tag	UNP Q8XBV8
C	57	HIS	-	expression tag	UNP Q8XBV8
C	58	HIS	-	expression tag	UNP Q8XBV8
C	59	HIS	-	expression tag	UNP Q8XBV8
C	60	HIS	-	expression tag	UNP Q8XBV8
C	61	HIS	-	expression tag	UNP Q8XBV8
C	62	GLY	-	expression tag	UNP Q8XBV8
C	63	SER	-	expression tag	UNP Q8XBV8

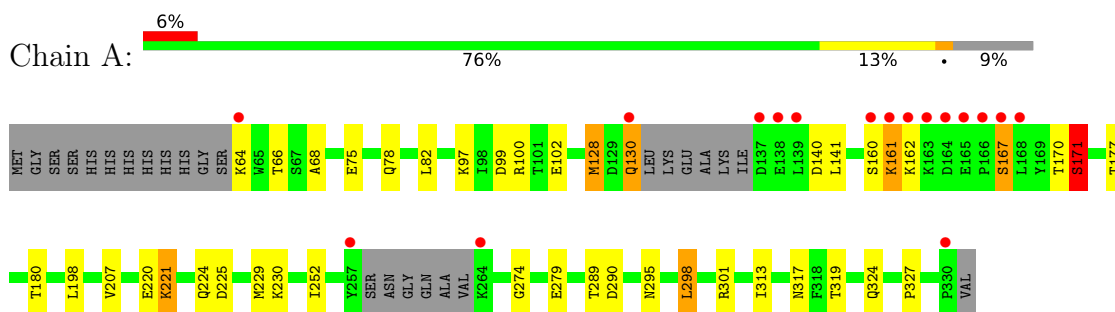
- Molecule 2 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	13	Total O 13 13	0	0
2	B	7	Total O 7 7	0	0
2	C	8	Total O 8 8	0	0

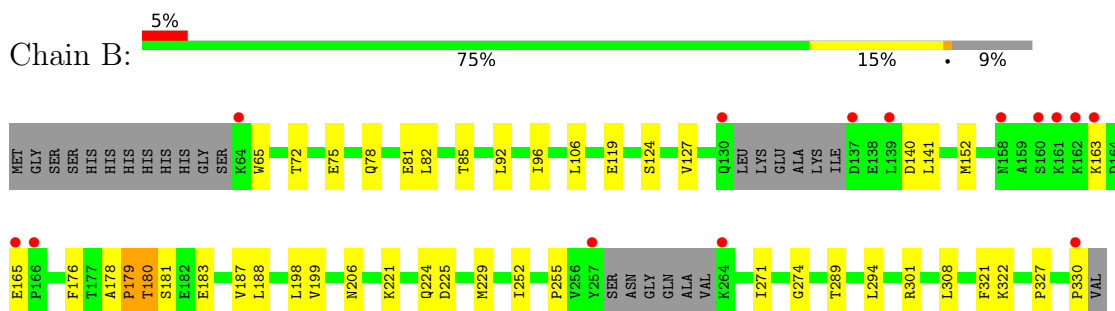
3 Residue-property plots [i](#)

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 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.

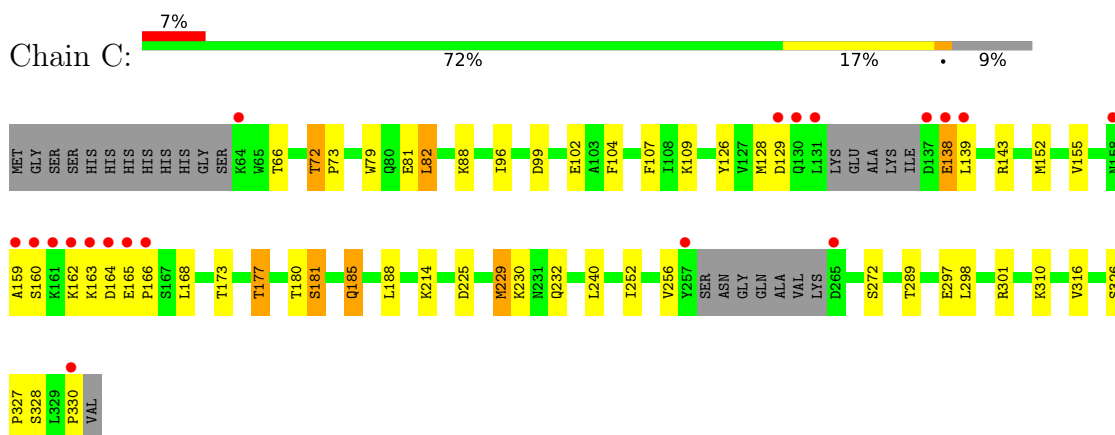
- Molecule 1: Ferric enterobactin (Enterochelin) transport



- Molecule 1: Ferric enterobactin (Enterochelin) transport



- Molecule 1: Ferric enterobactin (Enterochelin) transport



4 Data and refinement statistics

Property	Value	Source
Space group	P 63 2 2	Depositor
Cell constants a, b, c, α , β , γ	139.73Å 139.73Å 276.65Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	46.13 – 2.70 46.13 – 2.70	Depositor EDS
% Data completeness (in resolution range)	92.9 (46.13-2.70) 92.9 (46.13-2.70)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.36 (at 2.69Å)	Xtriage
Refinement program	REFMAC refmac_5.2.0019	Depositor
R, R_{free}	0.226 , 0.269 0.218 , 0.257	Depositor DCC
R_{free} test set	2072 reflections (4.65%)	wwPDB-VP
Wilson B-factor (Å ²)	46.0	Xtriage
Anisotropy	0.052	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 39.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	6159	wwPDB-VP
Average B, all atoms (Å ²)	47.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.07% 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	0.78	2/2081 (0.1%)	0.95	3/2814 (0.1%)
1	B	0.71	0/2073	0.90	0/2805
1	C	0.74	0/2076	0.92	1/2810 (0.0%)
All	All	0.74	2/6230 (0.0%)	0.92	4/8429 (0.0%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	167	SER	C-N	-6.04	1.26	1.33
1	A	167	SER	N-CA	-5.23	1.39	1.46

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	159	ALA	N-CA-C	-6.69	105.41	113.97
1	A	167	SER	CB-CA-C	-5.93	101.12	110.79
1	A	324	GLN	N-CA-C	-5.68	105.13	112.68
1	A	140	ASP	N-CA-C	-5.01	107.11	113.18

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	2048	0	2064	20	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	2040	0	2047	20	0
1	C	2043	0	2051	24	0
2	A	13	0	0	0	0
2	B	7	0	0	0	0
2	C	8	0	0	0	0
All	All	6159	0	6162	62	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 5.

All (62) 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:207:VAL:HG12	1:A:313:ILE:HD13	1.41	1.01
1:B:75:GLU:H	1:B:78:GLN:NE2	1.80	0.79
1:C:128:MET:HA	1:C:128:MET:HE2	1.68	0.76
1:B:180:THR:HB	1:B:183:GLU:H	1.56	0.71
1:A:128:MET:HA	1:A:128:MET:HE2	1.73	0.70
1:A:170:THR:O	1:A:171:SER:HB3	1.89	0.70
1:A:167:SER:O	1:A:167:SER:OG	2.08	0.69
1:A:229:MET:HE1	1:A:295:ASN:HD22	1.62	0.65
1:B:225:ASP:OD2	1:B:301:ARG:NH2	2.34	0.59
1:A:207:VAL:HG12	1:A:313:ILE:CD1	2.26	0.58
1:A:252:ILE:HG22	1:A:274:GLY:HA2	1.86	0.58
1:A:170:THR:O	1:A:171:SER:CB	2.49	0.57
1:A:221:LYS:HE2	1:A:224:GLN:OE1	2.04	0.57
1:A:170:THR:HG22	1:A:171:SER:N	2.20	0.56
1:A:75:GLU:H	1:A:78:GLN:HE21	1.54	0.55
1:A:289:THR:HG22	1:A:290:ASP:N	2.20	0.55
1:C:181:SER:HB2	1:C:330:PRO:HG2	1.89	0.55
1:B:221:LYS:NZ	1:B:224:GLN:OE1	2.40	0.54
1:B:106:LEU:HD23	1:B:199:VAL:HG13	1.89	0.54
1:C:162:LYS:C	1:C:164:ASP:H	2.14	0.54
1:C:72:THR:HG22	1:C:73:PRO:O	2.06	0.54
1:C:162:LYS:O	1:C:164:ASP:N	2.39	0.54
1:A:99:ASP:HB3	1:A:102:GLU:HB2	1.89	0.53
1:B:75:GLU:OE2	1:C:109:LYS:NZ	2.36	0.53
1:B:181:SER:HB2	1:B:330:PRO:HG2	1.92	0.52
1:C:185:GLN:HG3	1:C:328:SER:O	2.11	0.51
1:B:72:THR:HG22	1:B:322:LYS:O	2.11	0.50
1:C:326:SER:HB2	1:C:327:PRO:HD2	1.93	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:252:ILE:HD12	1:B:271:ILE:HD12	1.93	0.49
1:B:178:ALA:HB1	1:B:179:PRO:CD	2.44	0.48
1:C:297:GLU:O	1:C:301:ARG:HG3	2.14	0.48
1:C:82:LEU:HD13	1:C:316:VAL:HG11	1.97	0.47
1:C:138:GLU:HB2	1:C:139:LEU:HD22	1.97	0.46
1:B:188:LEU:HD23	1:B:327:PRO:HB3	1.96	0.46
1:C:225:ASP:OD2	1:C:301:ARG:NH1	2.49	0.46
1:A:130:GLN:HE21	1:A:130:GLN:N	2.13	0.46
1:A:225:ASP:OD2	1:A:301:ARG:NH2	2.49	0.46
1:C:185:GLN:HE21	1:C:185:GLN:HB3	1.62	0.46
1:C:81:GLU:HB3	1:C:316:VAL:HG13	1.97	0.46
1:C:99:ASP:HB3	1:C:102:GLU:HB2	1.98	0.46
1:C:164:ASP:O	1:C:166:PRO:HD3	2.15	0.46
1:C:66:THR:HG1	1:C:177:THR:HG1	1.55	0.45
1:B:72:THR:CG2	1:B:322:LYS:HB3	2.46	0.45
1:A:68:ALA:O	1:A:327:PRO:HA	2.17	0.45
1:C:152:MET:HE1	1:C:188:LEU:HA	1.99	0.45
1:A:170:THR:HG22	1:A:171:SER:H	1.82	0.44
1:C:168:LEU:HD12	1:C:168:LEU:HA	1.84	0.44
1:B:124:SER:HB3	1:B:127:VAL:HB	2.00	0.44
1:A:298:LEU:HD12	1:A:298:LEU:HA	1.80	0.44
1:B:176:PHE:CE2	1:B:187:VAL:HG11	2.53	0.43
1:C:229:MET:HE2	1:C:229:MET:HB3	1.82	0.43
1:B:321:PHE:CD1	1:B:321:PHE:C	2.96	0.43
1:B:65:TRP:HD1	1:B:179:PRO:O	2.01	0.42
1:A:160:SER:O	1:A:161:LYS:HB3	2.18	0.42
1:B:255:PRO:HG2	1:C:252:ILE:HD11	2.02	0.41
1:B:294:LEU:HD23	1:B:294:LEU:HA	1.92	0.41
1:C:126:TYR:CD2	1:C:126:TYR:C	2.98	0.41
1:C:240:LEU:HD12	1:C:240:LEU:HA	1.84	0.41
1:C:104:PHE:O	1:C:107:PHE:HB3	2.21	0.41
1:A:66:THR:HA	1:A:177:THR:HA	2.03	0.41
1:B:152:MET:HE1	1:B:188:LEU:HA	2.03	0.40
1:B:252:ILE:HG22	1:B:274:GLY:HA2	2.02	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	249/280 (89%)	237 (95%)	10 (4%)	2 (1%)	16	37
1	B	249/280 (89%)	240 (96%)	7 (3%)	2 (1%)	16	37
1	C	249/280 (89%)	241 (97%)	7 (3%)	1 (0%)	30	54
All	All	747/840 (89%)	718 (96%)	24 (3%)	5 (1%)	18	41

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	163	LYS
1	C	163	LYS
1	A	171	SER
1	A	162	LYS
1	B	179	PRO

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	229/251 (91%)	211 (92%)	18 (8%)	11	28
1	B	227/251 (90%)	212 (93%)	15 (7%)	15	36
1	C	228/251 (91%)	203 (89%)	25 (11%)	6	15
All	All	684/753 (91%)	626 (92%)	58 (8%)	10	25

All (58) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	64	LYS
1	A	82	LEU
1	A	97	LYS
1	A	100	ARG
1	A	128	MET
1	A	130	GLN
1	A	141	LEU
1	A	161	LYS
1	A	171	SER
1	A	180	THR
1	A	198	LEU
1	A	220	GLU
1	A	221	LYS
1	A	230	LYS
1	A	279	GLU
1	A	298	LEU
1	A	317	ASN
1	A	319	THR
1	B	81	GLU
1	B	82	LEU
1	B	85	THR
1	B	92	LEU
1	B	96	ILE
1	B	119	GLU
1	B	140	ASP
1	B	141	LEU
1	B	165	GLU
1	B	180	THR
1	B	198	LEU
1	B	206	ASN
1	B	229	MET
1	B	289	THR
1	B	308	LEU
1	C	72	THR
1	C	79	TRP
1	C	82	LEU
1	C	88	LYS
1	C	96	ILE
1	C	129	ASP
1	C	138	GLU
1	C	143	ARG
1	C	155	VAL
1	C	160	SER

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Mol	Chain	Res	Type
1	C	165	GLU
1	C	173	THR
1	C	177	THR
1	C	180	THR
1	C	181	SER
1	C	185	GLN
1	C	214	LYS
1	C	229	MET
1	C	230	LYS
1	C	232	GLN
1	C	256	VAL
1	C	272	SER
1	C	289	THR
1	C	298	LEU
1	C	310	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	78	GLN
1	A	105	ASN
1	A	130	GLN
1	A	206	ASN
1	A	324	GLN
1	B	78	GLN
1	C	78	GLN
1	C	142	HIS
1	C	158	ASN
1	C	185	GLN
1	C	206	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

6.1 Protein, DNA and RNA chains

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	255/280 (91%)	0.08	17 (6%) 24 21	22, 41, 92, 124	0
1	B	255/280 (91%)	0.03	14 (5%) 30 27	23, 42, 91, 122	0
1	C	255/280 (91%)	0.06	19 (7%) 20 17	24, 41, 95, 124	0
All	All	765/840 (91%)	0.06	50 (6%) 25 22	22, 41, 92, 124	0

All (50) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	131	LEU	7.7
1	A	137	ASP	7.3
1	C	137	ASP	6.8
1	B	139	LEU	6.5
1	C	139	LEU	6.4
1	B	130	GLN	6.4
1	A	139	LEU	5.9
1	B	137	ASP	5.6
1	B	166	PRO	5.4
1	C	257	TYR	5.1
1	A	166	PRO	5.0
1	A	161	LYS	5.0
1	B	161	LYS	5.0
1	A	257	TYR	4.8
1	C	163	LYS	4.6
1	A	167	SER	4.6
1	A	163	LYS	4.5
1	C	64	LYS	4.3
1	C	166	PRO	4.2
1	A	130	GLN	3.9
1	A	64	LYS	3.9
1	C	162	LYS	3.8
1	B	257	TYR	3.7

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Mol	Chain	Res	Type	RSRZ
1	A	264	LYS	3.6
1	C	164	ASP	3.6
1	C	165	GLU	3.6
1	B	163	LYS	3.6
1	C	161	LYS	3.5
1	B	160	SER	3.4
1	C	130	GLN	3.3
1	B	264	LYS	3.2
1	B	64	LYS	3.2
1	A	138	GLU	3.1
1	B	162	LYS	2.9
1	B	165	GLU	2.9
1	B	330	PRO	2.8
1	A	330	PRO	2.8
1	C	160	SER	2.8
1	A	165	GLU	2.7
1	C	330	PRO	2.7
1	C	265	ASP	2.6
1	A	168	LEU	2.6
1	A	164	ASP	2.5
1	A	160	SER	2.5
1	C	129	ASP	2.4
1	B	158	ASN	2.3
1	C	159	ALA	2.2
1	A	162	LYS	2.2
1	C	138	GLU	2.1
1	C	158	ASN	2.0

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.