WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report (i)

Jun 12, 2024 – 04:31 PM EDT

PDB ID	:	3FHL
Title	:	Crystal structure of a putative oxidoreductase from bacteroides fragilis nctc 9343
Authors	:	Patskovsky, Y.; Ramagopal, U.; Toro, R.; Gilmore, M.; Miller, S.; Sauder, J.M.; Burley, S.K.; Almo, S.C.; New York SGX Research Center for Structural Genomics (NYSGXRC)
Deposited on	:	2008-12-09
Resolution	:	1.93 Å(reported)

The following versions of software and data (see references (i)) were used in the production of this report:

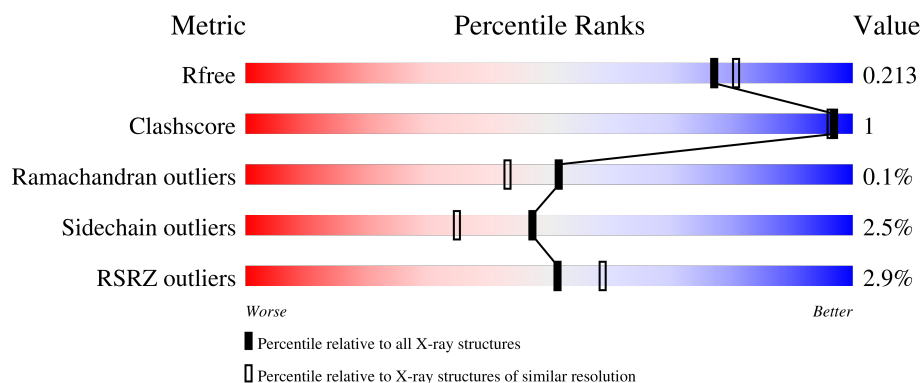|		
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	2.36.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36.2

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 1.93 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	Percentile Ranks	Value
Rfree		0.213
Clashscore		1
Ramachandran outliers		0.1%
Sidechain outliers		2.5%
RSRZ outliers		2.9%

Worse   *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	4310 (1.96-1.92)
Clashscore	141614	1023 (1.94-1.94)
Ramachandran outliers	138981	1007 (1.94-1.94)
Sidechain outliers	138945	1007 (1.94-1.94)
RSRZ outliers	127900	4250 (1.96-1.92)

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 <=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	362	% ... 84% ... 5% ... 11%
1	B	362	6% ... 82% ... 6% · 11%
1	C	362	% ... 90% ... · 7%
1	D	362	3% ... 90% ... · 7%

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 11782 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 Putative oxidoreductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	322	Total 2632	C 1699	N 444	O 482	S 7	0	11	0
1	B	321	Total 2609	C 1681	N 442	O 479	S 7	0	9	0
1	C	338	Total 2735	C 1760	N 462	O 506	S 7	0	8	0
1	D	338	Total 2773	C 1787	N 470	O 508	S 8	0	15	0

There are 40 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	SER	-	expression tag	UNP Q5LCX7
A	1	LEU	-	expression tag	UNP Q5LCX7
A	353	GLU	-	expression tag	UNP Q5LCX7
A	354	GLY	-	expression tag	UNP Q5LCX7
A	355	HIS	-	expression tag	UNP Q5LCX7
A	356	HIS	-	expression tag	UNP Q5LCX7
A	357	HIS	-	expression tag	UNP Q5LCX7
A	358	HIS	-	expression tag	UNP Q5LCX7
A	359	HIS	-	expression tag	UNP Q5LCX7
A	360	HIS	-	expression tag	UNP Q5LCX7
B	0	SER	-	expression tag	UNP Q5LCX7
B	1	LEU	-	expression tag	UNP Q5LCX7
B	353	GLU	-	expression tag	UNP Q5LCX7
B	354	GLY	-	expression tag	UNP Q5LCX7
B	355	HIS	-	expression tag	UNP Q5LCX7
B	356	HIS	-	expression tag	UNP Q5LCX7
B	357	HIS	-	expression tag	UNP Q5LCX7
B	358	HIS	-	expression tag	UNP Q5LCX7
B	359	HIS	-	expression tag	UNP Q5LCX7
B	360	HIS	-	expression tag	UNP Q5LCX7
C	0	SER	-	expression tag	UNP Q5LCX7

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Chain	Residue	Modelled	Actual	Comment	Reference
C	1	LEU	-	expression tag	UNP Q5LCX7
C	353	GLU	-	expression tag	UNP Q5LCX7
C	354	GLY	-	expression tag	UNP Q5LCX7
C	355	HIS	-	expression tag	UNP Q5LCX7
C	356	HIS	-	expression tag	UNP Q5LCX7
C	357	HIS	-	expression tag	UNP Q5LCX7
C	358	HIS	-	expression tag	UNP Q5LCX7
C	359	HIS	-	expression tag	UNP Q5LCX7
C	360	HIS	-	expression tag	UNP Q5LCX7
D	0	SER	-	expression tag	UNP Q5LCX7
D	1	LEU	-	expression tag	UNP Q5LCX7
D	353	GLU	-	expression tag	UNP Q5LCX7
D	354	GLY	-	expression tag	UNP Q5LCX7
D	355	HIS	-	expression tag	UNP Q5LCX7
D	356	HIS	-	expression tag	UNP Q5LCX7
D	357	HIS	-	expression tag	UNP Q5LCX7
D	358	HIS	-	expression tag	UNP Q5LCX7
D	359	HIS	-	expression tag	UNP Q5LCX7
D	360	HIS	-	expression tag	UNP Q5LCX7

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).

GOL
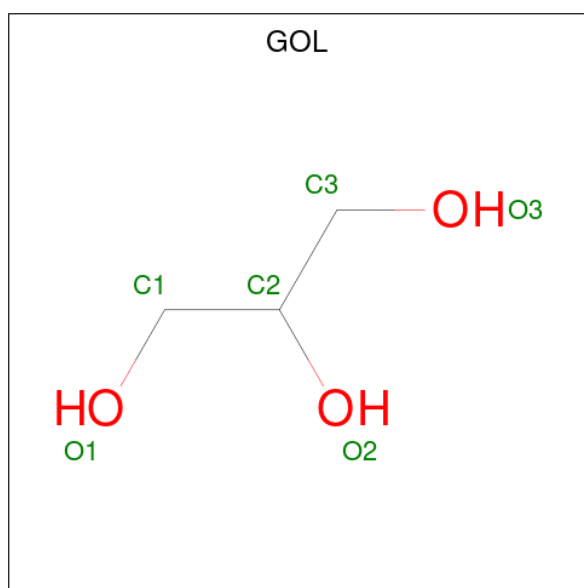
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total 6	C 3	O 3	0	0
2	A	1	Total 6	C 3	O 3	0	0

• Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total 1	Mg 1	0	0
3	D	1	Total 1	Mg 1	0	0

• Molecule 4 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	328	Total 328	O 328	0	0
4	B	153	Total 153	O 153	0	0
4	C	293	Total 293	O 293	0	0
4	D	245	Total 245	O 245	0	0

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 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.
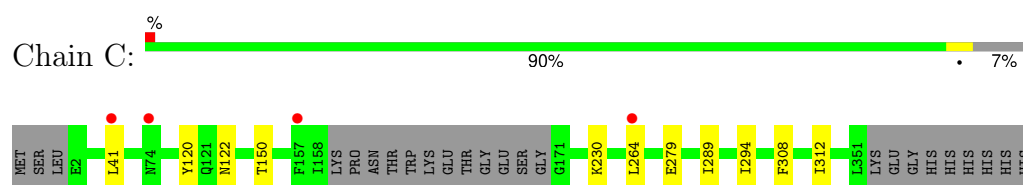
- Molecule 1: Putative oxidoreductase
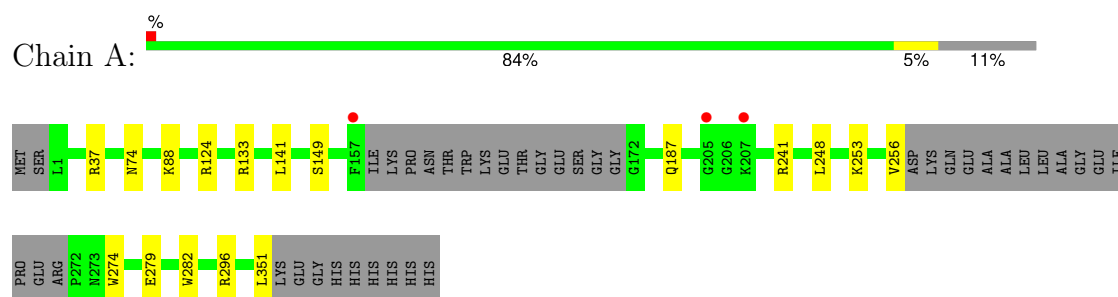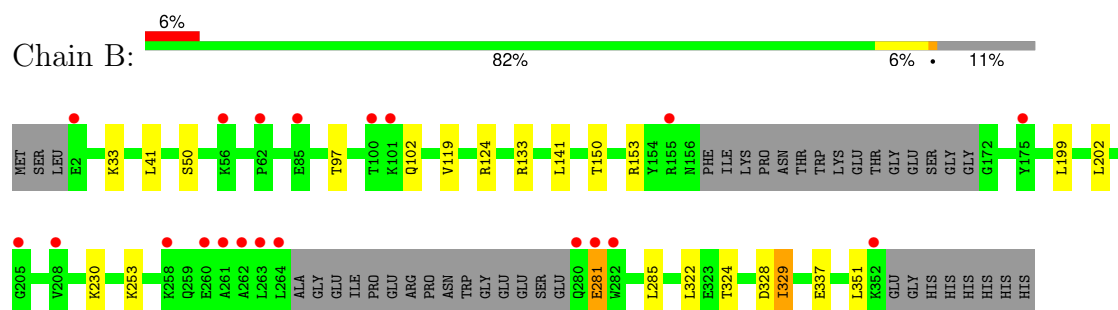
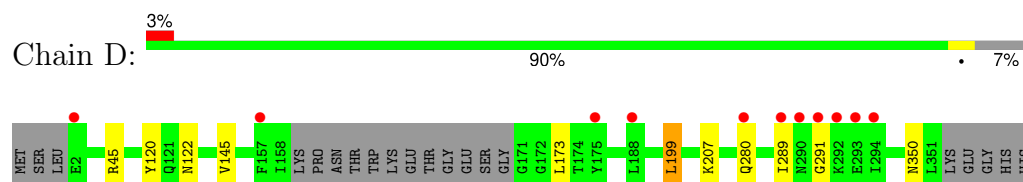Chain A:

- Molecule 1: Putative oxidoreductase

Chain B:

- Molecule 1: Putative oxidoreductase

Chain C:

- Molecule 1: Putative oxidoreductase

Chain D:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	196.26Å　　127.37Å　　79.89Å 90.00°　　112.01°　　90.00°	Depositor
Resolution (Å)	20.00　–　1.93 48.29　–　1.92	Depositor EDS
% Data completeness (in resolution range)	99.5 (20.00-1.93) 99.1 (48.29-1.92)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$< I/\sigma(I) >$ [1]	1.73 (at 1.92Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.186　,　0.215 0.184　,　0.213	Depositor DCC
R_{free} test set	4154 reflections (3.02%)	wwPDB-VP
Wilson B-factor (Å^2)	32.9	Xtriage
Anisotropy	0.359	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 50.1	EDS
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.017 for -h-2*l,-k,l	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	11782	wwPDB-VP
Average B, all atoms (Å^2)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.38% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MG, GOL

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	0.48	0/2723	0.59	0/3678
1	B	0.44	0/2690	0.61	0/3631
1	C	0.48	0/2819	0.59	0/3812
1	D	0.45	0/2878	0.59	1/3886 (0.0%)
All	All	0.46	0/11110	0.60	1/15007 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	D	199	LEU	CA-CB-CG	5.34	127.58	115.30

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	A	2632	0	2663	4	0
1	B	2609	0	2646	8	0
1	C	2735	0	2747	4	0
1	D	2773	0	2819	5	0
2	A	12	0	16	0	0
3	A	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	D	1	0	0	0	0
4	A	328	0	0	1	0
4	B	153	0	0	1	0
4	C	293	0	0	0	0
4	D	245	0	0	2	0
All	All	11782	0	10891	20	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 1.

All (20) 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:B:253[A]:LYS:NZ	1:B:281:GLU:O	2.27	0.67
1:B:150:THR:HG22	1:B:230:LYS:HB2	1.88	0.54
1:A:88[B]:LYS:NZ	4:A:494:HOH:O	2.43	0.52
1:D:45:ARG:NH1	4:D:454:HOH:O	2.47	0.47
1:C:120:TYR:CZ	1:C:122:ASN:HB3	2.50	0.47
1:C:308:PHE:O	1:C:312[B]:ILE:HG12	2.15	0.47
1:B:97:THR:HB	1:B:102:GLN:HG3	1.98	0.46
1:B:202:LEU:HD13	1:D:145:VAL:HB	1.98	0.45
1:A:124:ARG:CZ	1:A:187[A]:GLN:HG3	2.48	0.44
1:B:33:LYS:HG2	1:B:50:SER:HB2	2.01	0.43
1:B:119:VAL:HG11	1:B:329:ILE:HG13	2.01	0.43
1:B:322:LEU:HG	1:B:324:THR:H	1.83	0.42
1:C:289:ILE:HD12	1:C:294:ILE:HG12	2.01	0.42
1:B:133:ARG:NH2	4:B:861:HOH:O	2.49	0.42
1:A:149[B]:SER:OG	1:A:241:ARG:NH2	2.53	0.41
1:D:350:ASN:ND2	4:D:577:HOH:O	2.52	0.41
1:A:279:GLU:HA	1:A:282:TRP:CE2	2.56	0.41
1:D:120:TYR:CZ	1:D:122:ASN:HB3	2.55	0.41
1:C:150:THR:HA	1:C:230:LYS:O	2.21	0.40
1:D:173:LEU:HA	1:D:173:LEU:HD12	1.84	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	327/362 (90%)	319 (98%)	8 (2%)	0	100	100
1	B	324/362 (90%)	315 (97%)	9 (3%)	0	100	100
1	C	342/362 (94%)	333 (97%)	9 (3%)	0	100	100
1	D	349/362 (96%)	336 (96%)	12 (3%)	1 (0%)	41	32
All	All	1342/1448 (93%)	1303 (97%)	38 (3%)	1 (0%)	51	43

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	291	GLY

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 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	285/306 (93%)	275 (96%)	10 (4%)	36	21
1	B	281/306 (92%)	269 (96%)	12 (4%)	29	14
1	C	293/306 (96%)	290 (99%)	3 (1%)	76	71
1	D	300/306 (98%)	296 (99%)	4 (1%)	69	62
All	All	1159/1224 (95%)	1130 (98%)	29 (2%)	47	35

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	37	ARG
1	A	74	ASN
1	A	133	ARG
1	A	141	LEU
1	A	248	LEU
1	A	253	LYS
1	A	256	VAL
1	A	274	TRP
1	A	296	ARG
1	A	351	LEU
1	B	41	LEU
1	B	124	ARG
1	B	141	LEU
1	B	153	ARG
1	B	199	LEU
1	B	281	GLU
1	B	285	LEU
1	B	328[A]	ASP
1	B	328[B]	ASP
1	B	329	ILE
1	B	337	GLU
1	B	351	LEU
1	C	41	LEU
1	C	264	LEU
1	C	279	GLU
1	D	199	LEU
1	D	207	LYS
1	D	280	GLN
1	D	289	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	74	ASN
1	A	180	HIS
1	A	350	ASN
1	B	346	ASN
1	C	325	HIS
1	C	346	ASN
1	D	325	HIS

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 ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 4 ligands modelled in this entry, 2 are monoatomic - leaving 2 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
2	GOL	A	361	-	5,5,5	0.39	0	5,5,5	0.30	0
2	GOL	A	363	-	5,5,5	0.28	0	5,5,5	0.56	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	GOL	A	361	-	-	2/4/4/4	-
2	GOL	A	363	-	-	4/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	363	GOL	C1-C2-C3-O3
2	A	361	GOL	C1-C2-C3-O3
2	A	363	GOL	O1-C1-C2-C3
2	A	363	GOL	O2-C2-C3-O3
2	A	363	GOL	O1-C1-C2-O2
2	A	361	GOL	O2-C2-C3-O3

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 ⓘ

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(Å²)	Q<0.9
1	A	322/362 (88%)	-0.28	3 (0%)	84	87	23, 32, 55, 96	0
1	B	321/362 (88%)	0.05	20 (6%)	20	27	29, 43, 70, 116	0
1	C	338/362 (93%)	-0.12	4 (1%)	79	83	24, 34, 58, 81	0
1	D	338/362 (93%)	0.03	11 (3%)	46	54	27, 37, 60, 86	0
All	All	1319/1448 (91%)	-0.08	38 (2%)	51	59	23, 36, 62, 116	0

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	280	GLN	6.8
1	B	263	LEU	6.5
1	D	289	ILE	5.4
1	A	157	PHE	5.1
1	B	282	TRP	4.7
1	D	290	ASN	4.1
1	D	292	LYS	3.7
1	B	281	GLU	3.5
1	B	264	LEU	3.5
1	C	41	LEU	3.5
1	B	260	GLU	3.5
1	B	262	ALA	3.3
1	D	157	PHE	3.2
1	A	207	LYS	3.1
1	B	175	TYR	3.1
1	C	157	PHE	3.0
1	B	261	ALA	3.0
1	B	258	LYS	2.8
1	D	2	GLU	2.7
1	D	293	GLU	2.6
1	B	101	LYS	2.6

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Mol	Chain	Res	Type	RSRZ
1	D	294	ILE	2.5
1	B	56	LYS	2.4
1	A	205	GLY	2.4
1	B	62	PRO	2.4
1	D	291	GLY	2.4
1	B	85[A]	GLU	2.4
1	B	205	GLY	2.2
1	B	208	VAL	2.2
1	D	280	GLN	2.2
1	B	100	THR	2.2
1	B	155	ARG	2.1
1	C	74[A]	ASN	2.1
1	D	175	TYR	2.1
1	B	352	LYS	2.0
1	C	264	LEU	2.0
1	D	188	LEU	2.0
1	B	2	GLU	2.0

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

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	GOL	A	363	6/6	0.89	0.22	35,48,50,51	0
3	MG	D	361	1/1	0.94	0.07	38,38,38,38	0
2	GOL	A	361	6/6	0.95	0.15	36,61,66,74	0
3	MG	A	362	1/1	0.96	0.04	53,53,53,53	0

6.5 Other polymers ⓘ

There are no such residues in this entry.