



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 07:16 AM UTC

PDB ID : 3N6H / pdb_00003n6h
Title : Crystal structure of Mandelate racemase/muconate lactonizing protein from Actinobacillus succinogenes 130Z complexed with magnesium/sulfate
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Deposited on : 2010-05-25
Resolution : 2.30 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
Mogul	:	2022.3.0, CSD as543be (2022)
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

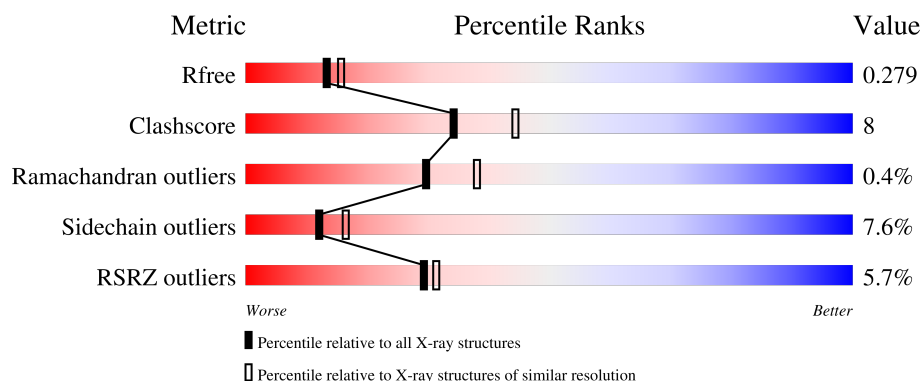
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	455	6% 72% 18% 6%
1	B	455	76% 16% 5%
1	C	455	6% 72% 20% 6%
1	D	455	13% 75% 17% 7%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 13719 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 Mandelate racemase/muconate lactonizing protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	429	Total	C	N	O	S	Se	0	1	0
			3356	2136	581	619	6	14			
1	B	432	Total	C	N	O	S	Se	0	2	0
			3386	2155	587	624	6	14			
1	C	426	Total	C	N	O	S	Se	0	1	0
			3328	2117	577	614	6	14			
1	D	424	Total	C	N	O	S	Se	0	2	0
			3316	2108	574	614	6	14			

There are 44 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MSE	-	expression tag	UNP A6VQF6
A	2	SER	-	expression tag	UNP A6VQF6
A	3	LEU	-	expression tag	UNP A6VQF6
A	448	GLU	-	expression tag	UNP A6VQF6
A	449	GLY	-	expression tag	UNP A6VQF6
A	450	HIS	-	expression tag	UNP A6VQF6
A	451	HIS	-	expression tag	UNP A6VQF6
A	452	HIS	-	expression tag	UNP A6VQF6
A	453	HIS	-	expression tag	UNP A6VQF6
A	454	HIS	-	expression tag	UNP A6VQF6
A	455	HIS	-	expression tag	UNP A6VQF6
B	1	MSE	-	expression tag	UNP A6VQF6
B	2	SER	-	expression tag	UNP A6VQF6
B	3	LEU	-	expression tag	UNP A6VQF6
B	448	GLU	-	expression tag	UNP A6VQF6
B	449	GLY	-	expression tag	UNP A6VQF6
B	450	HIS	-	expression tag	UNP A6VQF6
B	451	HIS	-	expression tag	UNP A6VQF6
B	452	HIS	-	expression tag	UNP A6VQF6
B	453	HIS	-	expression tag	UNP A6VQF6
B	454	HIS	-	expression tag	UNP A6VQF6

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Chain	Residue	Modelled	Actual	Comment	Reference
B	455	HIS	-	expression tag	UNP A6VQF6
C	1	MSE	-	expression tag	UNP A6VQF6
C	2	SER	-	expression tag	UNP A6VQF6
C	3	LEU	-	expression tag	UNP A6VQF6
C	448	GLU	-	expression tag	UNP A6VQF6
C	449	GLY	-	expression tag	UNP A6VQF6
C	450	HIS	-	expression tag	UNP A6VQF6
C	451	HIS	-	expression tag	UNP A6VQF6
C	452	HIS	-	expression tag	UNP A6VQF6
C	453	HIS	-	expression tag	UNP A6VQF6
C	454	HIS	-	expression tag	UNP A6VQF6
C	455	HIS	-	expression tag	UNP A6VQF6
D	1	MSE	-	expression tag	UNP A6VQF6
D	2	SER	-	expression tag	UNP A6VQF6
D	3	LEU	-	expression tag	UNP A6VQF6
D	448	GLU	-	expression tag	UNP A6VQF6
D	449	GLY	-	expression tag	UNP A6VQF6
D	450	HIS	-	expression tag	UNP A6VQF6
D	451	HIS	-	expression tag	UNP A6VQF6
D	452	HIS	-	expression tag	UNP A6VQF6
D	453	HIS	-	expression tag	UNP A6VQF6
D	454	HIS	-	expression tag	UNP A6VQF6
D	455	HIS	-	expression tag	UNP A6VQF6

- Molecule 2 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total O S 5 4 1	0	0
2	B	1	Total O S 5 4 1	0	0
2	C	1	Total O S 5 4 1	0	0
2	D	1	Total O S 5 4 1	0	0

- Molecule 3 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

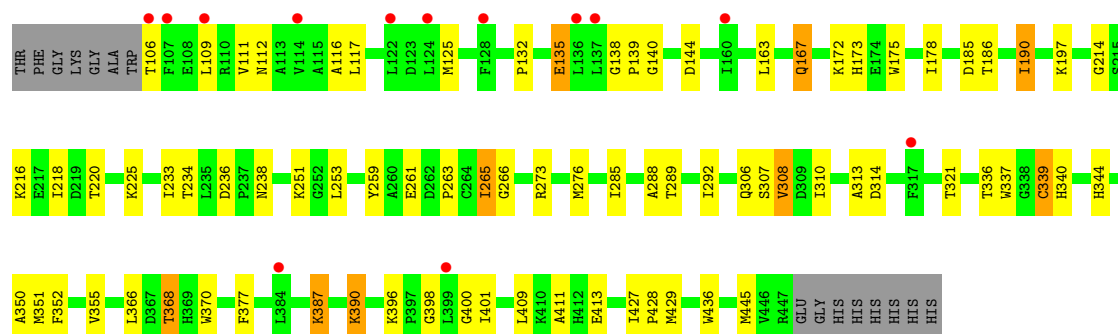
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Mg 1 1	0	0
3	B	1	Total Mg 1 1	0	0
3	C	1	Total Mg 1 1	0	0
3	D	1	Total Mg 1 1	0	0

- Molecule 4 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

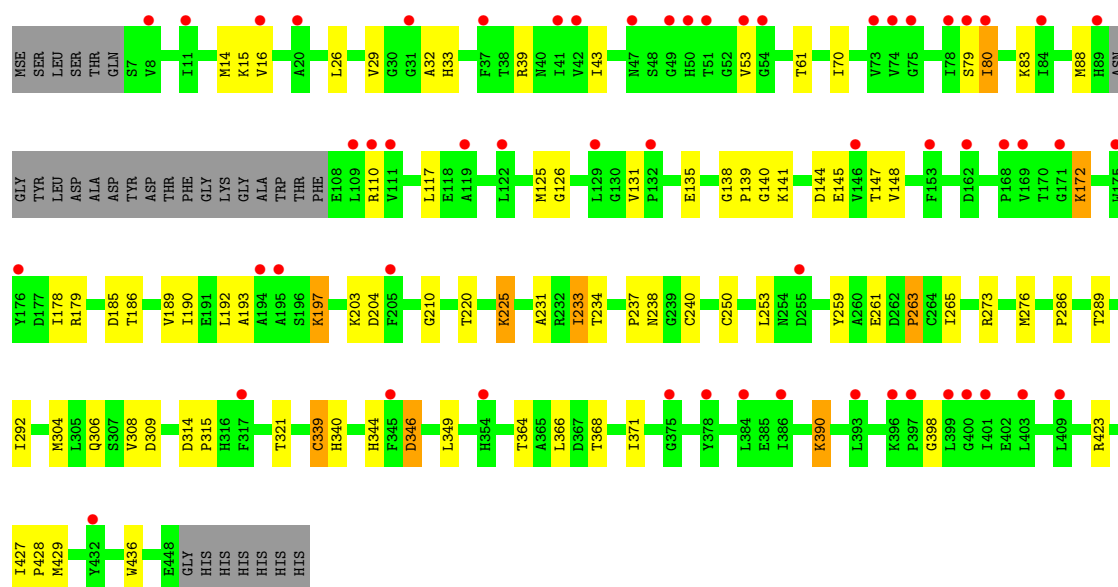
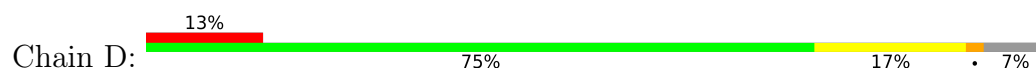
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	1	Total Cl 1 1	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	150	Total O 150 150	0	0
5	B	105	Total O 105 105	0	0
5	C	41	Total O 41 41	0	0
5	D	12	Total O 12 12	0	0



● Molecule 1: Mandelate racemase/muconate lactonizing protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	97.40Å 85.88Å 112.42Å 90.00° 96.03° 90.00°	Depositor
Resolution (Å)	20.00 – 2.30 20.00 – 2.30	Depositor EDS
% Data completeness (in resolution range)	77.9 (20.00-2.30) 77.8 (20.00-2.30)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.98 (at 2.30Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.219 , 0.278 0.220 , 0.279	Depositor DCC
R_{free} test set	1907 reflections (2.99%)	wwPDB-VP
Wilson B-factor (Å ²)	35.1	Xtriage
Anisotropy	0.028	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 42.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	13719	wwPDB-VP
Average B, all atoms (Å ²)	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.51% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CL, SO4, MG

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	0.64	3/3428 (0.1%)	0.90	3/4632 (0.1%)
1	B	0.57	0/3463	0.88	2/4679 (0.0%)
1	C	0.48	0/3398	0.81	1/4590 (0.0%)
1	D	0.47	0/3388	0.80	0/4576
All	All	0.55	3/13677 (0.0%)	0.85	6/18477 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	427	ILE	CA-CB	6.49	1.57	1.54
1	A	33	HIS	C-O	-5.21	1.17	1.23
1	A	340	HIS	C-O	-5.03	1.17	1.23

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	317	PHE	N-CA-C	6.54	118.49	111.36
1	A	341	SER	N-CA-C	5.33	117.08	109.14
1	B	314	ASP	CA-C-N	5.31	125.63	119.47
1	B	314	ASP	C-N-CA	5.31	125.63	119.47
1	A	354	HIS	N-CA-C	5.07	116.88	111.36
1	C	308	VAL	N-CA-C	5.03	115.90	108.45

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	3356	0	3307	65	0
1	B	3386	0	3330	47	0
1	C	3328	0	3286	48	0
1	D	3316	0	3274	46	0
2	A	5	0	0	1	0
2	B	5	0	0	0	0
2	C	5	0	0	0	0
2	D	5	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	B	1	0	0	0	0
5	A	150	0	0	3	0
5	B	105	0	0	3	0
5	C	41	0	0	1	0
5	D	12	0	0	1	0
All	All	13719	0	13197	203	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 8.

All (203) 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:D:26:LEU:HB2	1:D:33:HIS:CD2	1.96	1.00
1:D:79:SER:HA	1:D:125:MSE:HE1	1.45	0.98
1:A:306:GLN:HG3	1:C:306:GLN:HG3	1.55	0.88
1:D:26:LEU:HB2	1:D:33:HIS:HD2	1.36	0.87
1:B:298:GLU:HG2	5:B:536:HOH:O	1.78	0.82
1:B:172:LYS:HG2	1:B:173:HIS:H	1.47	0.79
1:D:314:ASP:HB2	1:D:340:HIS:HB3	1.66	0.78
1:A:314:ASP:OD1	1:A:340:HIS:HD2	1.68	0.76
1:D:29:VAL:HG21	1:D:238:ASN:HB2	1.68	0.76
1:A:237:PRO:HG2	1:A:263:PRO:HA	1.69	0.75

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:173:HIS:HD2	1:C:175:TRP:H	1.35	0.73
1:A:135:GLU:HG3	1:A:141:LYS:H	1.54	0.72
1:B:107:PHE:N	1:B:107:PHE:CD2	2.59	0.71
1:A:39:ARG:HD2	1:A:344:HIS:HA	1.73	0.70
1:C:310:ILE:HG12	1:C:336:THR:HB	1.74	0.70
1:A:29:VAL:HG22	1:A:210:GLY:HA3	1.74	0.69
1:A:289:THR:HG22	1:A:308:VAL:HG11	1.75	0.69
1:B:339:CYS:HB2	1:B:366:LEU:HD22	1.75	0.68
1:D:427:ILE:HB	1:D:428:PRO:HD3	1.75	0.68
1:A:317:PHE:HD1	1:A:317:PHE:N	1.91	0.68
1:A:281:ARG:HH11	1:A:281:ARG:HG2	1.59	0.68
1:C:56:ALA:HB2	1:C:116:ALA:HB2	1.77	0.67
1:A:317:PHE:N	1:A:317:PHE:CD1	2.63	0.66
1:A:306:GLN:HB2	1:C:306:GLN:HE21	1.61	0.65
1:C:214:GLY:O	1:C:218:ILE:HG12	1.96	0.65
1:A:313:ALA:HB3	1:A:337:TRP:HE1	1.60	0.65
1:A:29:VAL:HG21	1:A:238:ASN:HB2	1.78	0.64
1:B:293:ALA:HA	1:B:298:GLU:HB3	1.79	0.64
1:A:314:ASP:OD1	1:A:340:HIS:CD2	2.51	0.64
1:B:298:GLU:CG	5:B:536:HOH:O	2.43	0.63
1:D:135:GLU:HG3	1:D:141:LYS:H	1.63	0.63
1:A:134:ALA:H	1:A:354:HIS:HD2	1.47	0.63
1:A:265:ILE:HG23	1:A:266:GLY:H	1.65	0.62
1:B:427:ILE:HB	1:B:428:PRO:HD3	1.81	0.62
1:B:56:ALA:HB2	1:B:116:ALA:HB2	1.80	0.62
1:B:237:PRO:HG2	1:B:263:PRO:HA	1.83	0.61
1:A:178:ILE:HG23	1:A:192:LEU:HD23	1.82	0.61
1:D:263:PRO:HD2	1:D:276:MSE:SE	2.50	0.61
1:A:281:ARG:HH11	1:A:281:ARG:CG	2.12	0.61
1:A:340:HIS:CD2	1:A:340:HIS:C	2.77	0.61
1:A:276:MSE:HG3	1:A:292:ILE:HD13	1.83	0.60
1:D:273:ARG:HA	1:D:292:ILE:HD12	1.83	0.60
1:C:314:ASP:HB2	1:C:340:HIS:HB3	1.83	0.60
1:D:237:PRO:HG2	1:D:263:PRO:HA	1.83	0.60
1:A:339:CYS:O	1:A:367:ASP:HB2	2.02	0.60
1:C:263:PRO:HD2	1:C:276:MSE:SE	2.51	0.60
1:D:186:THR:HG23	1:D:220:THR:HA	1.85	0.58
1:B:304:MSE:HE2	1:B:304:MSE:HA	1.86	0.58
1:D:29:VAL:HG22	1:D:210:GLY:HA3	1.84	0.58
1:C:167:GLN:HA	1:C:167:GLN:HE21	1.69	0.58
1:A:265:ILE:HG23	1:A:266:GLY:N	2.19	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:24:SER:HB2	1:B:26:LEU:HD13	1.86	0.57
1:D:33:HIS:HE1	1:D:423:ARG:CZ	2.17	0.57
1:C:396:LYS:HB3	1:C:400:GLY:HA2	1.86	0.57
1:B:39:ARG:HD2	1:B:344:HIS:HA	1.87	0.56
1:C:289:THR:CG2	1:C:308:VAL:HG11	2.36	0.56
1:D:15:LYS:HB2	1:D:43:ILE:HB	1.87	0.56
1:B:41:ILE:CD1	1:B:55:GLU:HG3	2.36	0.55
1:B:281:ARG:HD3	5:D:468:HOH:O	2.06	0.55
1:B:48:SER:HG	1:B:50:HIS:HD1	1.54	0.55
1:C:427:ILE:HB	1:C:428:PRO:HD3	1.88	0.55
1:D:29:VAL:CG2	1:D:238:ASN:HB2	2.36	0.55
1:A:108:GLU:O	1:A:111:VAL:HG12	2.07	0.55
1:B:265:ILE:HG23	1:B:266:GLY:N	2.22	0.55
1:A:70:ILE:HB	1:A:71:PRO:HD3	1.90	0.54
1:A:106:THR:HG22	1:A:110:ARG:HB2	1.88	0.54
1:C:261:GLU:HA	1:C:288:ALA:O	2.07	0.54
1:C:409:LEU:O	1:C:413:GLU:HG2	2.08	0.54
1:A:265:ILE:CG2	1:A:266:GLY:N	2.71	0.53
1:A:178:ILE:CG2	1:A:192:LEU:HD23	2.38	0.53
1:B:276:MSE:HG3	1:B:292:ILE:HD13	1.90	0.52
1:A:261:GLU:HB3	1:A:288:ALA:HB3	1.91	0.52
1:C:39:ARG:HD2	1:C:344:HIS:HA	1.92	0.52
1:A:68:GLU:O	1:A:71:PRO:HD2	2.09	0.52
1:A:56:ALA:HB2	1:A:116:ALA:HB2	1.92	0.52
1:D:250:CYS:HA	1:D:253:LEU:HD12	1.92	0.52
1:A:55:GLU:H	1:A:351:MSE:SE	2.43	0.52
1:C:313:ALA:HB3	1:C:337:TRP:HE1	1.74	0.52
1:A:109:LEU:HD21	5:A:555:HOH:O	2.10	0.51
1:C:289:THR:HG22	1:C:308:VAL:HG11	1.92	0.51
1:C:429:MSE:HE1	1:C:445:MSE:SE	2.60	0.51
1:D:80:ILE:HG22	1:D:83:LYS:HB3	1.92	0.51
1:B:6:GLN:OE1	1:B:6:GLN:HA	2.10	0.51
1:B:85:VAL:HG21	1:B:118:GLU:HG3	1.92	0.51
1:D:144:ASP:OD2	1:D:144:ASP:N	2.44	0.51
1:C:265:ILE:HG23	1:C:266:GLY:N	2.25	0.51
1:C:186:THR:HG23	1:C:220:THR:HA	1.93	0.50
1:D:147:THR:HA	1:D:390:LYS:HG3	1.94	0.50
1:C:35:PRO:HG3	1:C:163:LEU:HB3	1.93	0.50
1:D:225:LYS:HG2	1:D:233:ILE:HD13	1.94	0.50
1:B:273:ARG:NH1	1:B:298:GLU:HG3	2.27	0.50
1:C:15:LYS:HB2	1:C:43:ILE:HB	1.94	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:57:PRO:HD2	1:A:112:ASN:HB3	1.93	0.49
1:D:39:ARG:HD2	1:D:344:HIS:HA	1.93	0.49
1:A:64:ASN:HA	1:A:67:THR:OG1	2.11	0.49
1:A:179:ARG:HG3	1:A:180:ARG:HG2	1.94	0.49
1:A:133:VAL:HG23	1:A:398:GLY:C	2.37	0.49
1:A:423:ARG:O	1:A:423:ARG:HG3	2.12	0.49
1:D:346:ASP:OD2	1:D:346:ASP:N	2.43	0.49
1:C:339:CYS:HB2	1:C:366:LEU:HD22	1.95	0.49
1:C:77:PRO:HD2	1:C:80:ILE:HD11	1.94	0.49
1:D:135:GLU:HA	1:D:140:GLY:HA2	1.95	0.48
1:A:135:GLU:HG2	5:A:522:HOH:O	2.13	0.48
1:C:78:ILE:HG22	1:C:125:MSE:HE2	1.95	0.48
1:B:14:MSE:HG2	1:B:70:ILE:HG12	1.94	0.48
1:B:32:ALA:HB3	1:B:428:PRO:HB2	1.96	0.48
1:B:289:THR:CG2	1:B:308:VAL:HG11	2.44	0.48
1:B:304:MSE:HG3	5:B:559:HOH:O	2.14	0.48
1:D:126:GLY:HA3	1:D:398:GLY:HA2	1.96	0.48
1:B:39:ARG:HD3	1:B:55:GLU:OE2	2.14	0.48
1:D:276:MSE:HG3	1:D:292:ILE:HD13	1.95	0.48
1:A:208:LYS:HE3	2:A:500:SO4:O4	2.14	0.48
1:B:112:ASN:HA	1:B:316:HIS:O	2.14	0.47
1:C:368:THR:HG22	1:C:370:TRP:H	1.78	0.47
1:A:239:GLY:N	1:A:262:ASP:O	2.47	0.47
1:C:55:GLU:H	1:C:351:MSE:SE	2.48	0.47
1:B:169:VAL:HG13	1:B:171:GLY:HA3	1.97	0.47
1:C:387:LYS:NZ	5:C:482:HOH:O	2.48	0.47
1:D:33:HIS:HE1	1:D:423:ARG:NH2	2.13	0.47
1:D:148:VAL:HG12	1:D:366:LEU:HB2	1.96	0.47
1:D:193:ALA:O	1:D:197:LYS:HB2	2.14	0.47
1:D:189:VAL:HA	1:D:192:LEU:HD12	1.97	0.47
1:B:78:ILE:HD11	1:B:124:LEU:C	2.41	0.46
1:D:289:THR:CG2	1:D:308:VAL:HG11	2.46	0.46
1:B:263:PRO:HD2	1:B:276:MSE:SE	2.66	0.46
1:A:261:GLU:CB	1:A:288:ALA:HB3	2.45	0.46
1:B:300:CYS:O	1:B:304:MSE:HG2	2.15	0.46
1:A:387:LYS:HD3	1:A:388:ASP:OD1	2.16	0.46
1:C:132:PRO:HA	1:C:398:GLY:O	2.16	0.46
1:A:212:PHE:HB3	1:A:213:GLU:OE1	2.15	0.46
1:A:242:SER:HA	1:A:267:GLU:OE2	2.16	0.46
1:D:203:LYS:O	1:D:231:ALA:HA	2.16	0.46
1:A:289:THR:CG2	1:A:308:VAL:HG11	2.45	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:13:ASP:HB3	1:B:45:THR:OG1	2.16	0.45
1:A:147:THR:HA	1:A:390:LYS:HG3	1.98	0.45
1:C:350:ALA:HB3	1:C:401:ILE:HD11	1.99	0.45
1:A:29:VAL:HG23	1:A:238:ASN:HD22	1.81	0.45
1:B:289:THR:HG22	1:B:308:VAL:HG11	1.98	0.45
1:D:314:ASP:HB2	1:D:340:HIS:CB	2.39	0.45
1:A:69:ALA:O	1:A:73:VAL:HG23	2.17	0.45
1:A:106:THR:O	1:A:110:ARG:HB2	2.17	0.45
1:B:172:LYS:HG2	1:B:173:HIS:N	2.26	0.45
1:A:234:THR:HG21	1:A:259:TYR:CE1	2.52	0.45
1:A:342:ASN:O	1:A:344:HIS:HD2	2.00	0.45
1:B:133:VAL:HG23	1:B:398:GLY:C	2.42	0.45
1:C:109:LEU:O	1:C:112:ASN:HB2	2.17	0.44
1:B:306:GLN:HG3	1:D:306:GLN:HG3	1.99	0.44
1:B:41:ILE:HD13	1:B:55:GLU:HG3	2.00	0.44
1:B:81:LEU:HD11	1:B:122:LEU:HD23	1.98	0.44
1:A:78:ILE:HG22	1:A:125:MSE:HE2	1.98	0.44
1:C:186:THR:O	1:C:190:ILE:HD12	2.17	0.44
1:C:273:ARG:HA	1:C:292:ILE:HD12	2.00	0.44
1:D:26:LEU:HD12	1:D:33:HIS:HD2	1.82	0.44
1:C:351:MSE:O	1:C:355:VAL:HG23	2.17	0.44
1:D:286:PRO:HA	1:D:309:ASP:OD1	2.16	0.44
1:D:88:MSE:SE	1:D:117:LEU:HD22	2.68	0.44
1:D:178:ILE:HG23	1:D:192:LEU:HD23	2.00	0.44
1:D:234:THR:HG21	1:D:259:TYR:CE1	2.53	0.43
1:C:218:ILE:HG23	1:C:253:LEU:HD11	2.00	0.43
1:A:204:ASP:OD1	1:A:232:ARG:HB2	2.17	0.43
1:B:70:ILE:HB	1:B:71:PRO:HD3	2.00	0.43
1:C:88:MSE:SE	1:C:117:LEU:HD22	2.68	0.43
1:D:429:MSE:HG2	1:D:436:TRP:CD2	2.54	0.43
1:A:423:ARG:NH1	5:A:577:HOH:O	2.49	0.43
1:B:78:ILE:HD11	1:B:125:MSE:N	2.34	0.43
1:B:127:GLN:HA	1:B:397:PRO:HB2	2.00	0.43
1:B:344:HIS:HB2	1:B:348:SER:HB2	2.00	0.43
1:C:32:ALA:HB3	1:C:428:PRO:HB2	2.00	0.43
1:C:234:THR:HG21	1:C:259:TYR:CE1	2.54	0.43
1:B:278:GLU:O	1:B:282:ARG:HG3	2.19	0.42
1:C:11:ILE:HG21	1:C:73:VAL:HG12	2.01	0.42
1:C:265:ILE:CG2	1:C:266:GLY:N	2.81	0.42
1:D:138:GLY:HA3	1:D:139:PRO:HD3	1.87	0.42
1:B:378:TYR:CD1	1:B:383:PRO:HG3	2.55	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:42:VAL:CG2	1:B:66:LEU:HD13	2.50	0.42
1:A:186:THR:O	1:A:190:ILE:HD12	2.19	0.42
1:A:412:HIS:O	1:A:416:LYS:HG3	2.20	0.42
1:A:429:MSE:HG2	1:A:436:TRP:CD2	2.54	0.42
1:C:429:MSE:HG2	1:C:436:TRP:CD2	2.55	0.42
1:A:305:LEU:O	1:A:306:GLN:HB2	2.19	0.42
1:A:145:GLU:HA	1:A:391:ILE:O	2.20	0.42
1:C:236:ASP:HB2	1:C:261:GLU:HG2	2.02	0.42
1:C:390:LYS:HB2	1:C:390:LYS:HE3	1.92	0.42
1:D:179:ARG:NH1	1:D:371:ILE:O	2.51	0.42
1:D:315:PRO:HD3	1:D:339:CYS:SG	2.60	0.42
1:D:346:ASP:O	1:D:349:LEU:HB3	2.20	0.42
1:A:288:ALA:HA	1:A:310:ILE:O	2.20	0.41
1:A:289:THR:HG22	1:A:308:VAL:CG1	2.49	0.41
1:B:29:VAL:HG13	1:B:210:GLY:HA3	2.02	0.41
1:A:352:PHE:CD1	1:A:352:PHE:C	2.97	0.41
1:C:352:PHE:CD1	1:C:352:PHE:C	2.98	0.41
1:D:14:MSE:HG2	1:D:70:ILE:HG12	2.02	0.41
1:A:214:GLY:O	1:A:218:ILE:HG12	2.21	0.41
1:D:234:THR:HG21	1:D:259:TYR:CZ	2.55	0.41
1:C:135:GLU:HA	1:C:140:GLY:HA2	2.02	0.41
1:B:61:THR:HG23	1:B:105:TRP:HB3	2.03	0.41
1:C:377:PHE:CE2	1:C:411:ALA:HB2	2.56	0.41
1:D:32:ALA:HB3	1:D:428:PRO:HB2	2.03	0.41
1:C:17:ILE:HA	1:C:18:PRO:HD2	1.97	0.40
1:A:352:PHE:CE2	1:A:368:THR:HG23	2.56	0.40
1:A:234:THR:HG21	1:A:259:TYR:CZ	2.57	0.40
1:B:110:ARG:O	1:B:114:VAL:HG23	2.22	0.40
1:C:138:GLY:HA3	1:C:139:PRO:HD3	1.90	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	426/455 (94%)	401 (94%)	24 (6%)	1 (0%)	43	55
1	B	430/455 (94%)	413 (96%)	15 (4%)	2 (0%)	24	31
1	C	423/455 (93%)	407 (96%)	15 (4%)	1 (0%)	43	55
1	D	422/455 (93%)	399 (94%)	20 (5%)	3 (1%)	18	23
All	All	1701/1820 (94%)	1620 (95%)	74 (4%)	7 (0%)	30	38

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	448	GLU
1	D	172	LYS
1	A	425	ASP
1	C	81	LEU
1	B	171	GLY
1	D	80	ILE
1	D	263	PRO

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	356/361 (99%)	326 (92%)	30 (8%)	10	14
1	B	359/361 (99%)	333 (93%)	26 (7%)	13	18
1	C	354/361 (98%)	326 (92%)	28 (8%)	11	15
1	D	353/361 (98%)	330 (94%)	23 (6%)	15	22
All	All	1422/1444 (98%)	1315 (92%)	107 (8%)	12	17

All (107) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	SER
1	A	16	VAL
1	A	29	VAL
1	A	67	THR

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Mol	Chain	Res	Type
1	A	78	ILE
1	A	81	LEU
1	A	90	ASN
1	A	110	ARG
1	A	117	LEU
1	A	135	GLU
1	A	160	ILE
1	A	172	LYS
1	A	178	ILE
1	A	185	ASP
1	A	190	ILE
1	A	203	LYS
1	A	225	LYS
1	A	233	ILE
1	A	261	GLU
1	A	265	ILE
1	A	281	ARG
1	A	308	VAL
1	A	317	PHE
1	A	346	ASP
1	A	368	THR
1	A	387	LYS
1	A	388	ASP
1	A	390	LYS
1	A	423	ARG
1	A	441	LYS
1	B	7	SER
1	B	15	LYS
1	B	26	LEU
1	B	29	VAL
1	B	79	SER
1	B	105	TRP
1	B	106	THR
1	B	107	PHE
1	B	169	VAL
1	B	170	THR
1	B	172	LYS
1	B	174	GLU
1	B	187	GLN
1	B	190	ILE
1	B	197	LYS
1	B	216	LYS

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Mol	Chain	Res	Type
1	B	225	LYS
1	B	255	ASP
1	B	265	ILE
1	B	298	GLU
1	B	312	LEU
1	B	314	ASP
1	B	325	ARG
1	B	339	CYS
1	B	396	LYS
1	B	440	ARG
1	C	16	VAL
1	C	28	ASN
1	C	80	ILE
1	C	83	LYS
1	C	89	HIS
1	C	106	THR
1	C	111	VAL
1	C	135	GLU
1	C	144	ASP
1	C	167	GLN
1	C	172	LYS
1	C	178	ILE
1	C	185	ASP
1	C	190	ILE
1	C	197	LYS
1	C	216	LYS
1	C	225	LYS
1	C	233	ILE
1	C	238	ASN
1	C	251	LYS
1	C	265	ILE
1	C	285	ILE
1	C	307	SER
1	C	321	THR
1	C	339	CYS
1	C	368	THR
1	C	387	LYS
1	C	390	LYS
1	D	16	VAL
1	D	53	VAL
1	D	61	THR
1	D	110	ARG

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Mol	Chain	Res	Type
1	D	131	VAL
1	D	145	GLU
1	D	172	LYS
1	D	185	ASP
1	D	190	ILE
1	D	197	LYS
1	D	204	ASP
1	D	225	LYS
1	D	233	ILE
1	D	240	CYS
1	D	261	GLU
1	D	265	ILE
1	D	304	MSE
1	D	321	THR
1	D	339	CYS
1	D	346	ASP
1	D	364	THR
1	D	368	THR
1	D	390	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (23) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	50	HIS
1	A	89	HIS
1	A	238	ASN
1	A	306	GLN
1	A	328	GLN
1	A	340	HIS
1	A	342	ASN
1	A	343	ASN
1	A	354	HIS
1	A	415	HIS
1	B	290	ASN
1	C	112	ASN
1	C	173	HIS
1	C	238	ASN
1	C	268	ASN
1	C	306	GLN
1	D	33	HIS
1	D	89	HIS
1	D	112	ASN

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Mol	Chain	Res	Type
1	D	127	GLN
1	D	142	GLN
1	D	328	GLN
1	D	420	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 9 ligands modelled in this entry, 5 are monoatomic - leaving 4 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	SO4	C	500	-	4,4,4	0.23	0	6,6,6	0.31	0
2	SO4	D	500	-	4,4,4	0.27	0	6,6,6	0.09	0
2	SO4	A	500	-	4,4,4	0.32	0	6,6,6	0.19	0
2	SO4	B	500	-	4,4,4	0.25	0	6,6,6	0.29	0

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.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	500	SO4	1	0

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	415/455 (91%)	-0.17	4 (0%) 79 80	13, 28, 48, 80	1 (0%)
1	B	418/455 (91%)	-0.23	4 (0%) 79 80	14, 30, 47, 72	2 (0%)
1	C	412/455 (90%)	0.52	29 (7%) 22 24	20, 51, 102, 122	1 (0%)
1	D	410/455 (90%)	1.03	57 (13%) 6 7	25, 79, 109, 124	2 (0%)
All	All	1655/1820 (90%)	0.29	94 (5%) 29 31	13, 39, 100, 124	6 (0%)

All (94) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	169	VAL	4.3
1	A	105	TRP	4.1
1	D	78	ILE	3.8
1	C	78	ILE	3.7
1	D	397	PRO	3.6
1	C	42	VAL	3.5
1	C	49	GLY	3.5
1	D	20	ALA	3.4
1	A	104	ALA	3.2
1	C	79	SER	3.1
1	D	51	THR	3.1
1	D	80	ILE	3.1
1	C	317	PHE	3.1
1	D	54	GLY	3.0
1	D	89	HIS	3.0
1	D	399	LEU	3.0
1	B	105	TRP	2.9
1	D	8	VAL	2.9
1	D	16	VAL	2.9
1	C	106	THR	2.9
1	C	52	GLY	2.9

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Mol	Chain	Res	Type	RSRZ
1	D	37	PHE	2.8
1	D	122	LEU	2.8
1	D	386	ILE	2.7
1	C	136	LEU	2.7
1	C	84	ILE	2.7
1	C	44	LEU	2.7
1	C	43	ILE	2.7
1	C	11	ILE	2.6
1	D	354	HIS	2.6
1	D	255[A]	ASP	2.6
1	D	109	LEU	2.6
1	A	107	PHE	2.6
1	D	31	GLY	2.6
1	D	110	ARG	2.6
1	D	401	ILE	2.6
1	D	42	VAL	2.5
1	D	53	VAL	2.5
1	D	378	TYR	2.5
1	D	175	TRP	2.5
1	D	74	VAL	2.5
1	D	129	LEU	2.5
1	C	107	PHE	2.5
1	C	124	LEU	2.5
1	C	90	ASN	2.5
1	D	73	VAL	2.4
1	D	345	PHE	2.4
1	D	50	HIS	2.4
1	B	107	PHE	2.4
1	C	114	VAL	2.4
1	D	403	LEU	2.4
1	D	432	TYR	2.4
1	D	146	VAL	2.4
1	D	393	LEU	2.4
1	D	41	ILE	2.4
1	A	422	ALA	2.3
1	D	375	GLY	2.3
1	D	79	SER	2.3
1	D	11	ILE	2.3
1	C	128	PHE	2.3
1	D	153	PHE	2.3
1	D	176	TYR	2.3
1	C	122	LEU	2.3

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Mol	Chain	Res	Type	RSRZ
1	D	168	PRO	2.3
1	D	132	PRO	2.2
1	D	75	GLY	2.2
1	D	194	ALA	2.2
1	C	384	LEU	2.2
1	D	111	VAL	2.2
1	D	317	PHE	2.2
1	D	84	ILE	2.2
1	D	205	PHE	2.2
1	D	162	ASP	2.2
1	B	91	GLY	2.2
1	D	195	ALA	2.2
1	C	137	LEU	2.2
1	C	53	VAL	2.1
1	D	47	ASN	2.1
1	D	119	ALA	2.1
1	C	41	ILE	2.1
1	D	384	LEU	2.1
1	D	396	LYS	2.1
1	D	171	GLY	2.1
1	D	400	GLY	2.1
1	D	409	LEU	2.1
1	B	340[A]	HIS	2.1
1	C	70	ILE	2.1
1	D	49	GLY	2.1
1	C	109	LEU	2.0
1	C	17	ILE	2.0
1	C	160	ILE	2.0
1	C	77	PRO	2.0
1	C	81	LEU	2.0
1	C	399	LEU	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](#)

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
3	MG	B	501	1/1	0.80	0.16	45,45,45,45	0
3	MG	C	501	1/1	0.89	0.07	40,40,40,40	0
2	SO4	D	500	5/5	0.90	0.09	75,76,78,82	0
3	MG	D	501	1/1	0.92	0.10	49,49,49,49	0
2	SO4	A	500	5/5	0.94	0.10	40,41,41,48	0
3	MG	A	501	1/1	0.95	0.03	28,28,28,28	0
2	SO4	C	500	5/5	0.95	0.08	42,48,49,50	0
4	CL	B	503	1/1	0.95	0.11	56,56,56,56	0
2	SO4	B	500	5/5	0.96	0.07	38,38,38,40	0

6.5 Other polymers [i](#)

There are no such residues in this entry.