



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 08:16 PM UTC

PDB ID : 7YBA / pdb_00007yba
Title : Aspartyl/Asparaginyl beta-hydroxylase (AspH) oxygenase and TPR domains
in complex with D-4-hydroxy-2-oxoglutarate
Authors : Nakashima, Y.; Brewitz, L.; Schofield, C.J.
Deposited on : 2022-06-29
Resolution : 1.86 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
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
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

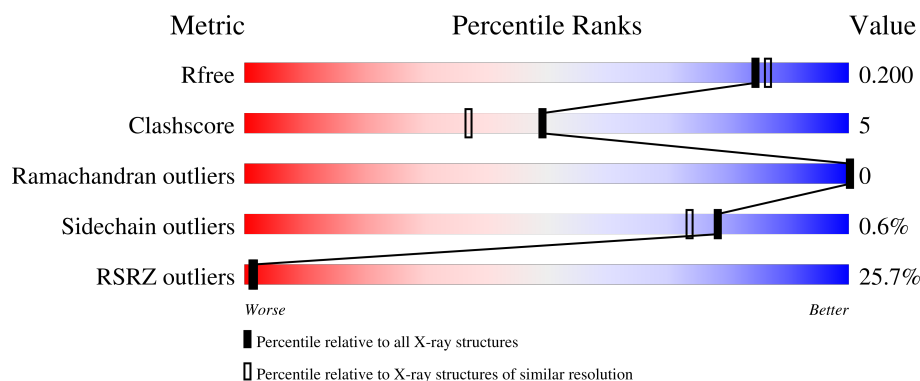
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.86 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	3428 (1.86-1.86)
Clashscore	190562	3579 (1.86-1.86)
Ramachandran outliers	187476	3553 (1.86-1.86)
Sidechain outliers	187428	3553 (1.86-1.86)
RSRZ outliers	180081	3429 (1.86-1.86)

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	429	26% 87% 13%

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 6757 atoms, of which 3178 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.

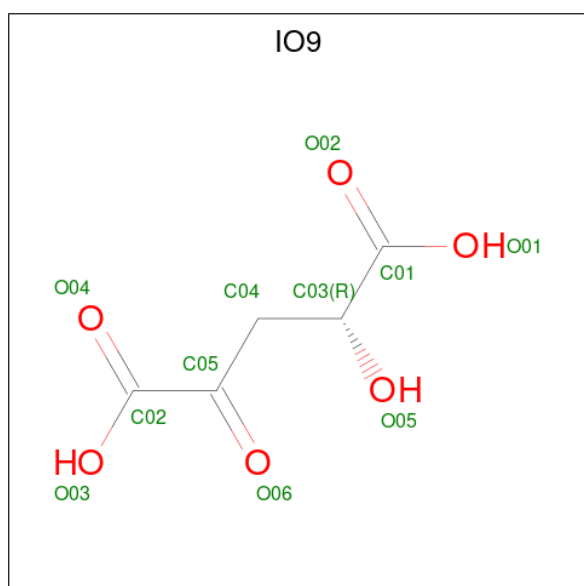
- Molecule 1 is a protein called Aspartyl/asparaginyl beta-hydroxylase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	428	Total	C	H	N	O	S	0	4	0
			6519	2120	3174	597	616	12			

- Molecule 2 is MANGANESE (II) ION (CCD ID: MN) (formula: Mn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Mn	0	0
			1	1		

- Molecule 3 is (2 {R})-2-oxidanyl-4-oxidanylidene-pentanedioic acid (CCD ID: IO9) (formula: C₅H₆O₆) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	H	O	0	0
			15	5	4	6		

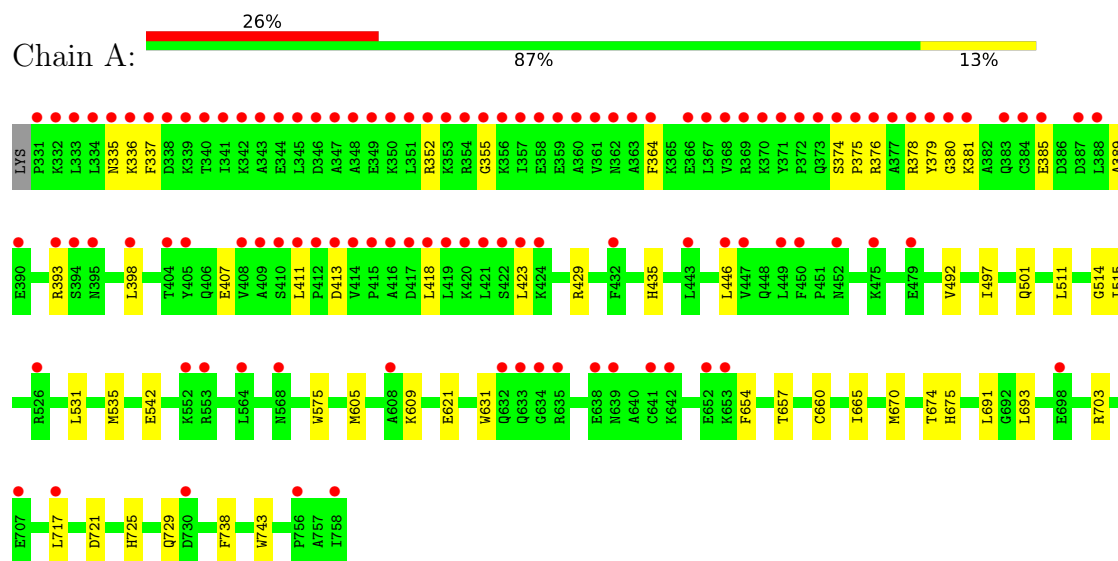
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	222	Total 222	O 222	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: Aspartyl/asparaginyl beta-hydroxylase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	48.70Å 70.20Å 172.45Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	86.22 – 1.86 86.22 – 1.86	Depositor EDS
% Data completeness (in resolution range)	59.3 (86.22-1.86) 59.6 (86.22-1.86)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.14 (at 1.86Å)	Xtriage
Refinement program	PHENIX 1.17.1_3660	Depositor
R, R_{free}	0.181 , 0.202 0.181 , 0.200	Depositor DCC
R_{free} test set	1532 reflections (3.00%)	wwPDB-VP
Wilson B-factor (Å ²)	35.1	Xtriage
Anisotropy	0.037	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.45 , 91.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	6757	wwPDB-VP
Average B, all atoms (Å ²)	63.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.51% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: IO9, MN

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	0.75	0/3437	0.80	0/4659

There are no bond length outliers.

There are no bond angle outliers.

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	3345	3174	3172	35	0
2	A	1	0	0	0	0
3	A	11	4	0	0	0
4	A	222	0	0	2	3
All	All	3579	3178	3172	35	3

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 (35) 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:335:ASN:ND2	1:A:413:ASP:O	2.18	0.76
1:A:352:ARG:O	1:A:355:GLY:N	2.24	0.70
1:A:492:VAL:HG13	1:A:514:GLY:HA3	1.80	0.62
1:A:693:LEU:HD11	1:A:738:PHE:HB2	1.84	0.59
1:A:398:LEU:HD11	1:A:429:ARG:HD3	1.85	0.58
1:A:423:LEU:HB2	1:A:446:LEU:HD21	1.85	0.57
1:A:375:PRO:HA	1:A:411:LEU:HD12	1.86	0.57
1:A:531:LEU:O	1:A:535:MET:HG3	2.06	0.55
1:A:378:ARG:NH1	1:A:407:GLU:OE1	2.44	0.50
1:A:379:TYR:CG	1:A:418:LEU:HD11	2.47	0.50
1:A:497:ILE:O	1:A:501:GLN:HG3	2.11	0.50
1:A:703:ARG:O	1:A:725:HIS:HA	2.11	0.49
1:A:379:TYR:CD2	1:A:418:LEU:HD11	2.47	0.49
1:A:364:PHE:CE1	1:A:380:GLY:HA3	2.47	0.49
1:A:575:TRP:CZ3	1:A:717:LEU:HD22	2.48	0.49
1:A:535:MET:HE1	1:A:542:GLU:HB3	1.94	0.48
1:A:389:ALA:O	1:A:393:ARG:N	2.46	0.47
1:A:670:MET:HG3	1:A:674:THR:HG21	1.97	0.47
1:A:631:TRP:HB2	1:A:665:ILE:HD12	1.96	0.46
1:A:435:HIS:HD2	4:A:1004:HOH:O	1.98	0.46
1:A:609:LYS:NZ	4:A:906:HOH:O	2.49	0.46
1:A:374:SER:O	1:A:378:ARG:HG2	2.17	0.45
1:A:376:ARG:HH21	1:A:376:ARG:HG3	1.82	0.45
1:A:621:GLU:OE1	1:A:675:HIS:ND1	2.46	0.45
1:A:378:ARG:HG3	1:A:411:LEU:HD11	2.00	0.44
1:A:429:ARG:NE	1:A:429:ARG:HA	2.32	0.43
1:A:381:LYS:O	1:A:385:GLU:HG3	2.19	0.43
1:A:411:LEU:HD23	1:A:411:LEU:N	2.34	0.42
1:A:654:PHE:O	1:A:657:THR:HG22	2.20	0.42
1:A:691:LEU:HB3	1:A:738:PHE:HB3	2.01	0.42
1:A:335:ASN:OD1	1:A:335:ASN:C	2.63	0.41
1:A:336:LYS:O	1:A:337:PHE:C	2.62	0.41
1:A:660:CYS:HA	1:A:743:TRP:CE2	2.56	0.41
1:A:721:ASP:HB2	1:A:725:HIS:CE1	2.56	0.40
1:A:511:LEU:O	1:A:515:ILE:HG13	2.21	0.40

All (3) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:946:HOH:O	4:A:1078:HOH:O[3_454]	1.77	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:1057:HOH:O	4:A:1078:HOH:O[3_454]	1.79	0.41
4:A:1050:HOH:O	4:A:1086:HOH:O[1_655]	2.15	0.05

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	430/429 (100%)	413 (96%)	17 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	332/371 (90%)	330 (99%)	2 (1%)	78	73

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	605	MET
1	A	729	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	406	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 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 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$
3	IO9	A	802	2	10,10,10	4.06	3 (30%)	13,13,13	2.98	8 (61%)

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
3	IO9	A	802	2	-	2/12/12/12	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	802	IO9	C05-C02	-10.38	1.37	1.53
3	A	802	IO9	O03-C02	5.66	1.46	1.30
3	A	802	IO9	C04-C05	4.24	1.58	1.51

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	802	IO9	C04-C05-C02	5.14	125.05	115.89
3	A	802	IO9	O01-C01-O02	-4.14	114.68	124.08
3	A	802	IO9	O06-C05-C02	-4.11	113.80	119.67
3	A	802	IO9	O03-C02-O04	-4.10	114.13	123.90
3	A	802	IO9	O02-C01-C03	3.95	130.48	122.60
3	A	802	IO9	O03-C02-C05	3.14	122.28	113.59
3	A	802	IO9	O05-C03-C04	2.34	115.58	109.96
3	A	802	IO9	C04-C03-C01	2.02	115.47	110.53

There are no chirality outliers.

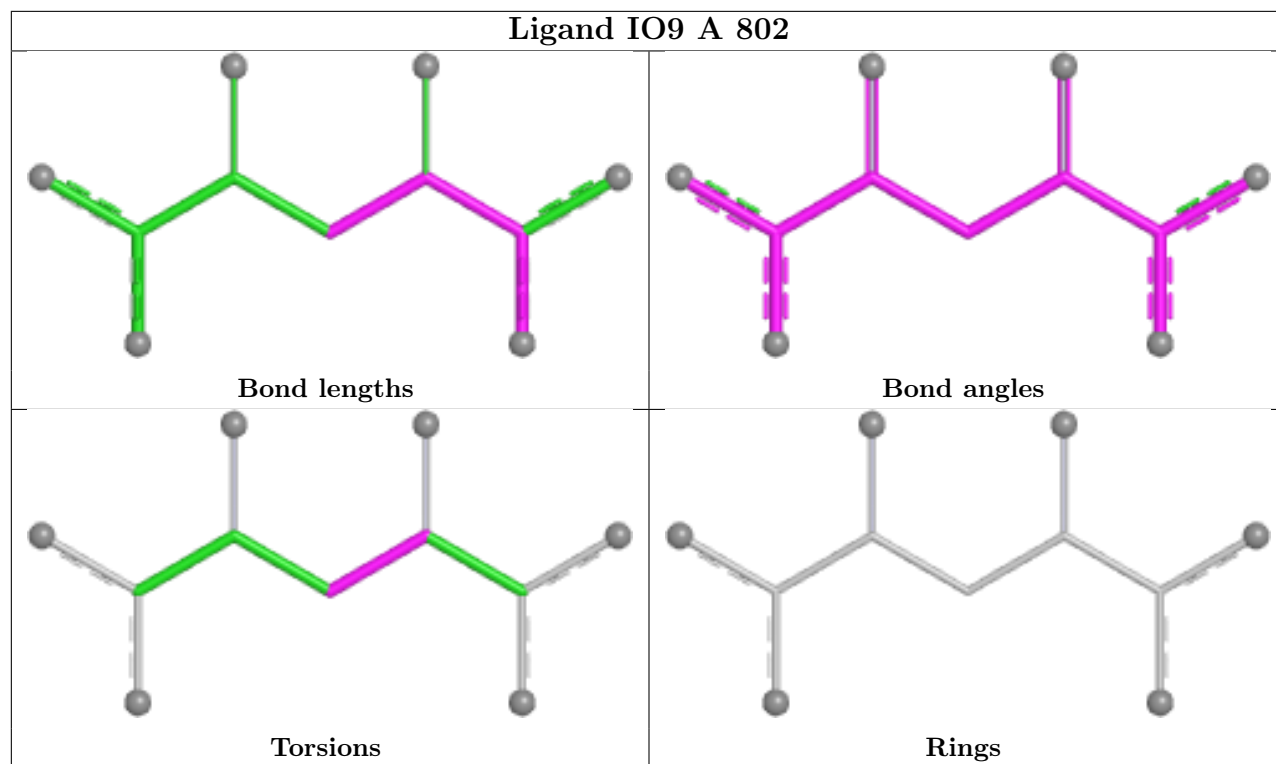
All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	802	IO9	C03-C04-C05-O06
3	A	802	IO9	C03-C04-C05-C02

There are no ring outliers.

No monomer is involved in short contacts.

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



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	428/429 (99%)	1.18	110 (25%) 1 1	27, 47, 156, 270	3 (0%)

All (110) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	377	ALA	9.4
1	A	338	ASP	9.4
1	A	346	ASP	8.1
1	A	348	ALA	8.1
1	A	364	PHE	7.7
1	A	368	VAL	7.5
1	A	367	LEU	7.4
1	A	413	ASP	7.3
1	A	408	VAL	7.3
1	A	758	ILE	6.6
1	A	345	LEU	6.6
1	A	341	ILE	6.4
1	A	357	ILE	6.4
1	A	340	THR	6.4
1	A	335	ASN	6.3
1	A	363	ALA	6.1
1	A	412	PRO	6.1
1	A	356	LYS	6.1
1	A	372	PRO	6.1
1	A	635	ARG	5.7
1	A	351	LEU	5.7
1	A	375	PRO	5.7
1	A	414	VAL	5.6
1	A	349	GLU	5.6
1	A	343	ALA	5.5
1	A	336	LYS	5.4
1	A	730	ASP	5.4

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Mol	Chain	Res	Type	RSRZ
1	A	333	LEU	5.4
1	A	334	LEU	5.3
1	A	378	ARG	5.3
1	A	376	ARG	5.2
1	A	371	TYR	5.2
1	A	380	GLY	5.2
1	A	337	PHE	5.1
1	A	331	PRO	5.0
1	A	379	TYR	4.6
1	A	388	LEU	4.5
1	A	370	LYS	4.4
1	A	432	PHE	4.3
1	A	332	LYS	4.3
1	A	339	LYS	4.3
1	A	385	GLU	4.3
1	A	369	ARG	4.2
1	A	418	LEU	4.2
1	A	354	ARG	4.2
1	A	381	LYS	4.1
1	A	446	LEU	4.1
1	A	366	GLU	4.1
1	A	361	VAL	4.0
1	A	359	GLU	3.9
1	A	642	LYS	3.9
1	A	347	ALA	3.9
1	A	350	LYS	3.9
1	A	390	GLU	3.9
1	A	411	LEU	3.8
1	A	475	LYS	3.8
1	A	374	SER	3.8
1	A	352	ARG	3.7
1	A	419	LEU	3.7
1	A	479	GLU	3.6
1	A	360	ALA	3.6
1	A	639	ASN	3.6
1	A	564	LEU	3.6
1	A	384	CYS	3.5
1	A	394	SER	3.4
1	A	398	LEU	3.4
1	A	393	ARG	3.4
1	A	362	ASN	3.4
1	A	449	LEU	3.4

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Mol	Chain	Res	Type	RSRZ
1	A	450	PHE	3.4
1	A	553	ARG	3.4
1	A	405	TYR	3.3
1	A	415	PRO	3.3
1	A	404	THR	3.2
1	A	632	GLN	3.1
1	A	342	LYS	3.0
1	A	717	LEU	3.0
1	A	652[A]	GLU	3.0
1	A	358	GLU	3.0
1	A	608	ALA	2.8
1	A	638	GLU	2.8
1	A	707	GLU	2.8
1	A	410	SER	2.8
1	A	568	ASN	2.8
1	A	653[A]	LYS	2.7
1	A	634	GLY	2.7
1	A	353	LYS	2.7
1	A	344	GLU	2.7
1	A	416	ALA	2.7
1	A	641	CYS	2.7
1	A	355	GLY	2.6
1	A	526	ARG	2.6
1	A	417	ASP	2.6
1	A	423	LEU	2.5
1	A	698	GLU	2.5
1	A	383	GLN	2.5
1	A	409	ALA	2.5
1	A	447	VAL	2.5
1	A	452	ASN	2.4
1	A	422	SER	2.4
1	A	443	LEU	2.4
1	A	420	LYS	2.4
1	A	424	LYS	2.4
1	A	421	LEU	2.3
1	A	552[A]	LYS	2.3
1	A	387	ASP	2.3
1	A	633	GLN	2.3
1	A	373	GLN	2.2
1	A	395	ASN	2.1
1	A	756	PRO	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](#)

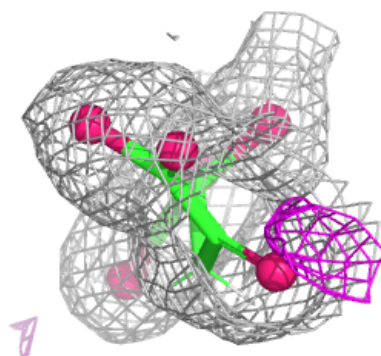
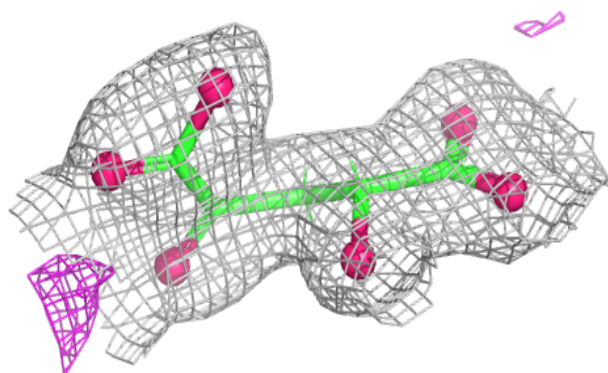
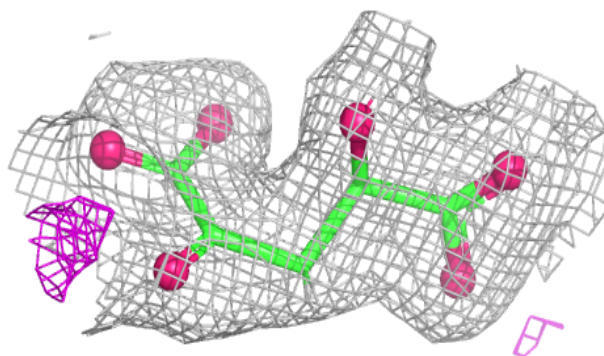
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	IO9	A	802	11/11	0.98	0.05	25,30,41,45	0
2	MN	A	801	1/1	0.99	0.04	23,23,23,23	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around IO9 A 802:

$2mF_o - DF_c$ (at 0.7 rmsd) in gray
 $mF_o - DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)



6.5 Other polymers [i](#)

There are no such residues in this entry.