WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Nov 11, 2024 – 06:52 PM EST

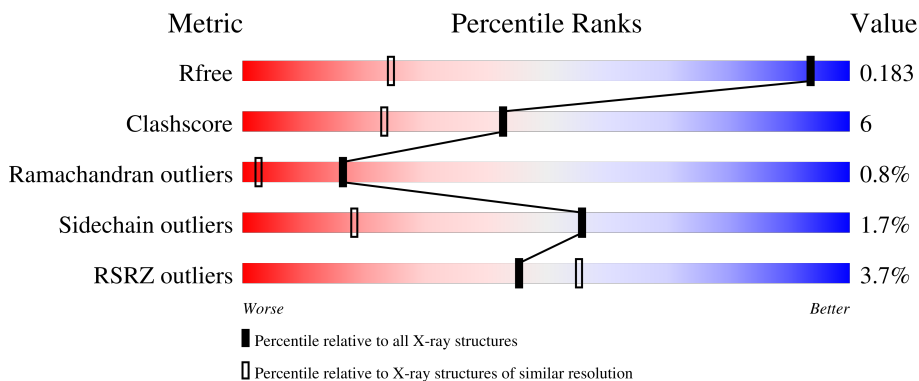|		
PDB ID	:	7FYR
Title	:	Crystal Structure of human FABP4 in complex with 5-(3,4-dichlorophenyl)-5-methyl-2-sulfanylidene-1,3-diazinane-4,6-dione, i.e. SMILES C1(c2cc(c(cc2)Cl)Cl)(C(=O)NC(=S)NC1=O)C with IC50=3.3 microM
Authors	:	Ehler, A.; Benz, J.; Obst, U.; Borgulya, J.; Rudolph, M.G.
Deposited on	:	2023-04-27
Resolution	:	1.05 Å(reported)

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 1.05 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		0.183
Clashscore		6
Ramachandran outliers		0.8%
Sidechain outliers		1.7%
RSRZ outliers		3.7%

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}	164625	1027 (1.08-1.04)
Clashscore	180529	1152 (1.08-1.04)
Ramachandran outliers	177936	1127 (1.08-1.04)
Sidechain outliers	177891	1128 (1.08-1.04)
RSRZ outliers	164620	1026 (1.08-1.04)

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	135	4% / 83% / 12% · ·

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	FMT	A	203	-	X	-	-

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 2515 atoms, of which 1149 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 Fatty acid-binding protein, adipocyte.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	134	Total 2253	C 706	H 1142	N 182	O 216	S 7	0	12	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	GLY	-	expression tag	UNP P15090
A	-2	SER	-	expression tag	UNP P15090
A	-1	HIS	-	expression tag	UNP P15090

- Molecule 2 is 5-(3,4-dichlorophenyl)-5-methyl-2-sulfanylidene-1,3-diazinane-4,6-dione (three-letter code: W9F) (formula: $C_{11}H_8Cl_2N_2O_2S$) (labeled as "Ligand of Interest" by depositor).

W9F
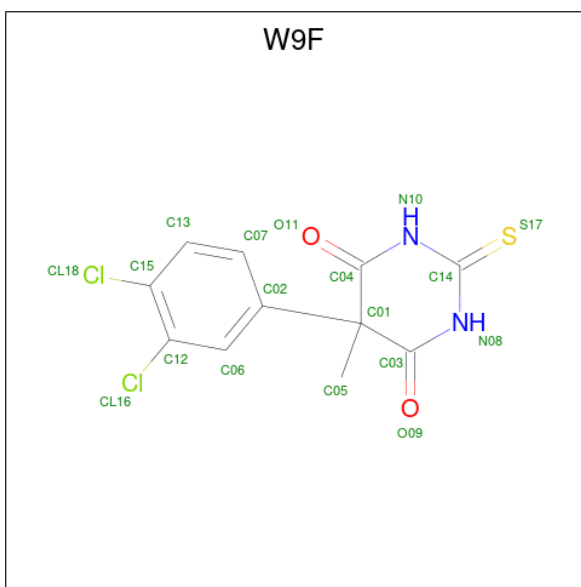
Mol	Chain	Residues	Atoms							ZeroOcc	AltConf
2	A	1	Total 25	C 11	Cl 2	H 7	N 2	O 2	S 1	0	0

• Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O_4S).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total O S 5 4 1			0	0
3	A	1	Total O S 5 4 1			0	0

• Molecule 4 is FORMIC ACID (three-letter code: FMT) (formula: CH_2O_2).
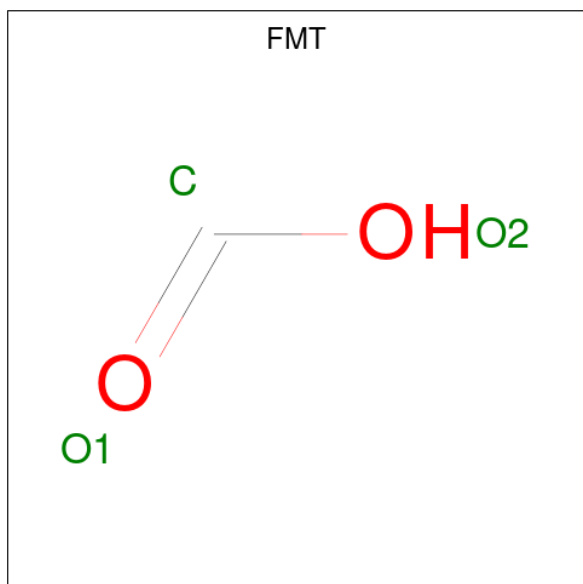
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total C O 3 1 2			0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	223	Total O 224 224	0	1

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: Fatty acid-binding protein, adipocyte

4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	32.51Å 53.77Å 75.09Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.73 – 1.05 43.72 – 1.05	Depositor EDS
% Data completeness (in resolution range)	96.6 (43.73-1.05) 96.6 (43.72-1.05)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	0.05	Depositor
$< I/\sigma(I) >$ [1]	1.29 (at 1.05Å)	Xtriage
Refinement program	REFMAC 5.6.0119	Depositor
R, R_{free}	0.149 , 0.184 0.147 , 0.183	Depositor DCC
R_{free} test set	3162 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å^2)	11.0	Xtriage
Anisotropy	0.269	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 31.9	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.98	EDS
Total number of atoms	2515	wwPDB-VP
Average B, all atoms (Å^2)	15.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.59% 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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, W9F, FMT

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	1.08	2/1161 (0.2%)	1.22	13/1557 (0.8%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	71[A]	ASP	CB-CG	5.81	1.64	1.51
1	A	71[B]	ASP	CB-CG	5.81	1.64	1.51

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	0	MET	CG-SD-CE	-12.01	80.98	100.20
1	A	86	LEU	CA-CB-CG	7.87	133.39	115.30
1	A	78	ARG	NE-CZ-NH2	-7.79	116.40	120.30
1	A	130	ARG	NE-CZ-NH2	-6.99	116.81	120.30
1	A	71[A]	ASP	CB-CG-OD1	6.75	124.38	118.30
1	A	71[B]	ASP	CB-CG-OD1	6.75	124.38	118.30
1	A	126	ARG	NE-CZ-NH1	5.91	123.26	120.30
1	A	0	MET	CB-CG-SD	-5.88	94.77	112.40
1	A	130	ARG	NE-CZ-NH1	5.87	123.23	120.30
1	A	78	ARG	NE-CZ-NH1	5.73	123.16	120.30
1	A	18	ASP	CB-CG-OD1	5.44	123.19	118.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	128	TYR	CB-CG-CD1	5.42	124.25	121.00
1	A	106	ARG	NE-CZ-NH1	5.26	122.93	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	126	ARG	Sidechain

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	1111	1142	1160	14	0
2	A	18	7	0	0	0
3	A	10	0	0	0	0
4	A	3	0	2	0	0
5	A	224	0	0	3	2
All	All	1366	1149	1162	14	2

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 6.

All (14) 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:15[A]:ASN:OD1	5:A:302:HOH:O	1.60	1.19
1:A:69[A]:GLU:OE2	5:A:303:HOH:O	1.71	1.07
1:A:-1:HIS:HB3	1:A:0:MET:HA	1.75	0.69
1:A:40:MET:HE1	1:A:113[A]:LEU:HD22	1.75	0.68
1:A:71[A]:ASP:OD1	1:A:81[A]:LYS:HG2	2.03	0.58
1:A:15[A]:ASN:ND2	5:A:307:HOH:O	2.37	0.56
1:A:4:PHE:CD1	1:A:113[B]:LEU:HD11	2.41	0.55
1:A:-1:HIS:ND1	1:A:1:CYS:N	2.54	0.55
1:A:73:VAL:HG22	1:A:79[B]:LYS:HD2	1.90	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:-2:SER:C	1:A:-1:HIS:O	2.46	0.52
1:A:-2:SER:O	1:A:-1:HIS:O	2.29	0.50
1:A:-1:HIS:CB	1:A:0:MET:HA	2.43	0.48
1:A:76:ASP:O	1:A:77[A]:ASP:HB2	2.13	0.47

All (2) 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)
5:A:361:HOH:O	5:A:514:HOH:O[3_555]	1.95	0.25
5:A:423:HOH:O	5:A:461:HOH:O[3_555]	2.15	0.05

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	144/135 (107%)	141 (98%)	2 (1%)	1 (1%)	19 3

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	-1	HIS

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	130/118 (110%)	128 (98%)	2 (2%)	60 21

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

Mol	Chain	Res	Type
1	A	-2	SER
1	A	86	LEU

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	39	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 ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

4 ligands are modelled in this entry.

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	W9F	A	201	-	17,19,19	2.47	8 (47%)	24,29,29	1.79	4 (16%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
4	FMT	A	203	-	2,2,2	3.83	2 (100%)	1,1,1	1.59	0
3	SO4	A	202	-	4,4,4	0.52	0	6,6,6	0.42	0
3	SO4	A	204	-	4,4,4	1.26	0	6,6,6	0.95	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	W9F	A	201	-	-	0/6/26/26	0/2/2/2

All (10) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	201	W9F	C14-N08	5.98	1.43	1.36
2	A	201	W9F	C14-N10	3.98	1.41	1.36
4	A	203	FMT	O2-C	3.94	1.48	1.28
4	A	203	FMT	O1-C	3.73	1.42	1.22
2	A	201	W9F	C05-C01	-3.01	1.50	1.55
2	A	201	W9F	C14-S17	-2.88	1.61	1.68
2	A	201	W9F	C03-N08	2.52	1.41	1.37
2	A	201	W9F	C01-C02	2.25	1.59	1.54
2	A	201	W9F	C15-CL18	-2.09	1.68	1.73
2	A	201	W9F	O11-C04	-2.05	1.19	1.22

All (4) bond angle outliers are listed below:

| Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	201	W9F	O09-C03-C01	5.23	126.09	121.77
2	A	201	W9F	C01-C04-N10	3.70	122.41	118.03
2	A	201	W9F	O11-C04-N10	-3.23	115.36	120.59
2	A	201	W9F	O09-C03-N08	-2.86	115.96	120.59

There are no chirality outliers.

There are no torsion outliers.

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 then 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.

Ligand W9F A 201

Bond lengths

Bond angles

Torsions

Rings
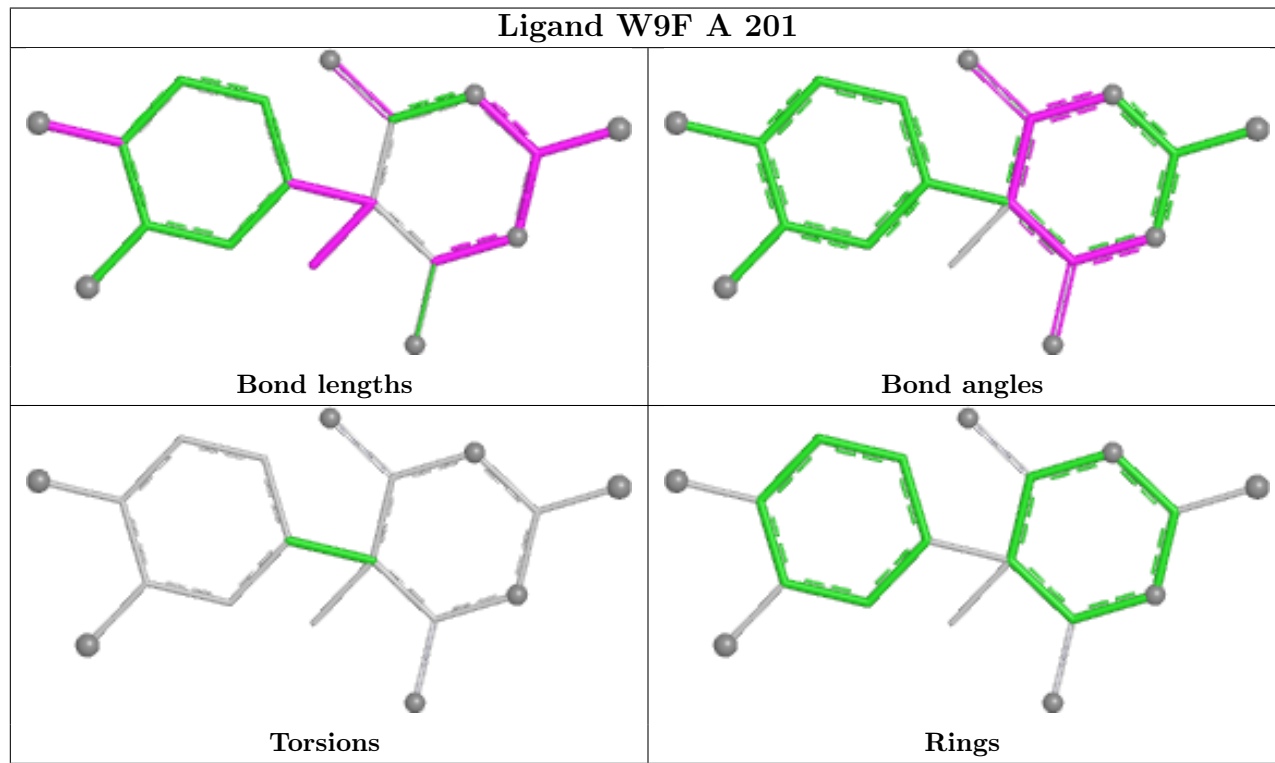
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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	134/135 (99%)	-0.21	5 (3%)	45	55	6, 12, 25, 35	12 (8%)

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	-1	HIS	5.3
1	A	-2	SER	2.9
1	A	0	MET	2.7
1	A	1	CYS	2.5
1	A	39	ASN	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.
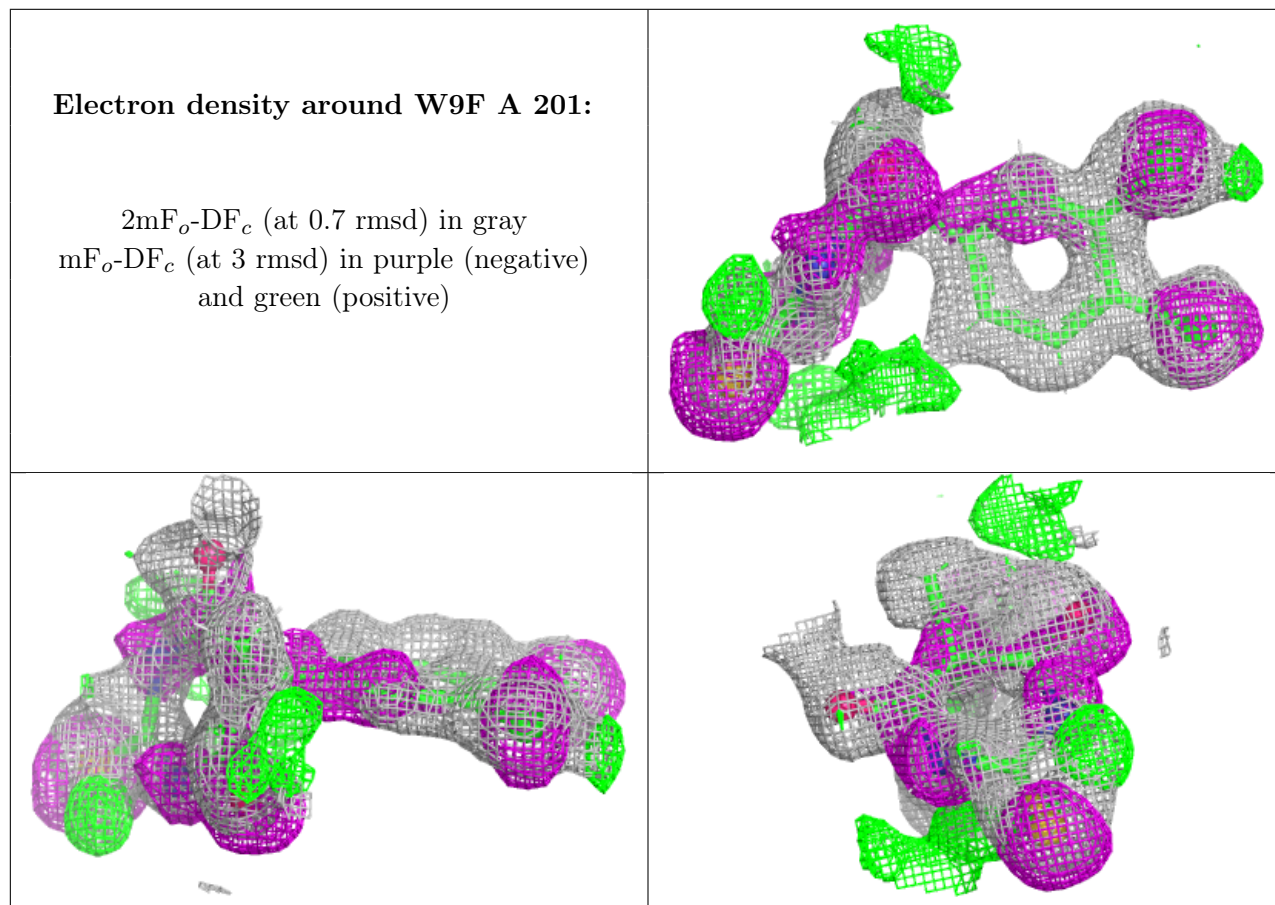
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	SO4	A	204	5/5	0.85	0.16	12,22,30,36	0
3	SO4	A	202	5/5	0.94	0.11	23,24,28,33	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
4	FMT	A	203	3/3	0.94	0.08	14,14,16,23	0
2	W9F	A	201	18/18	0.95	0.10	14,18,21,23	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 W9F A 201:

$2mF_o$-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 ⓘ

There are no such residues in this entry.