Full wwPDB X-ray Structure Validation Report (i)

Nov 6, 2023 – 12:04 am GMT

PDB ID : 6T4V

Title : Crystal structure of 2-methylisocitrate lyase (PrpB) from Pseudomonas aeruginosa in apo form.

Authors : Wijaya, A.J.; Brear, P.; Dolan, S.K.; Welch, M.

Deposited on : 2019-10-15

Resolution : 1.81 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 1.81 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		0.214
Clashscore		2
Ramachandran outliers		0
Sidechain outliers		1.3%
RSRZ outliers		3.1%

Worse *Better*

▌Percentile relative to all X-ray structures

▯Percentile relative to X-ray structures of similar resolution
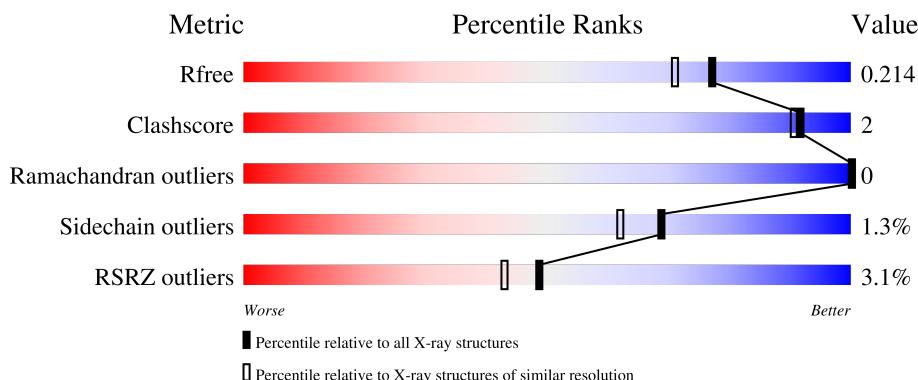
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

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	298	% / 88% · 7%
1	B	298	2% / 89% · 7%
1	C	298	2% / 88% 5% 7%
1	D	298	6% / 86% 7% 7%
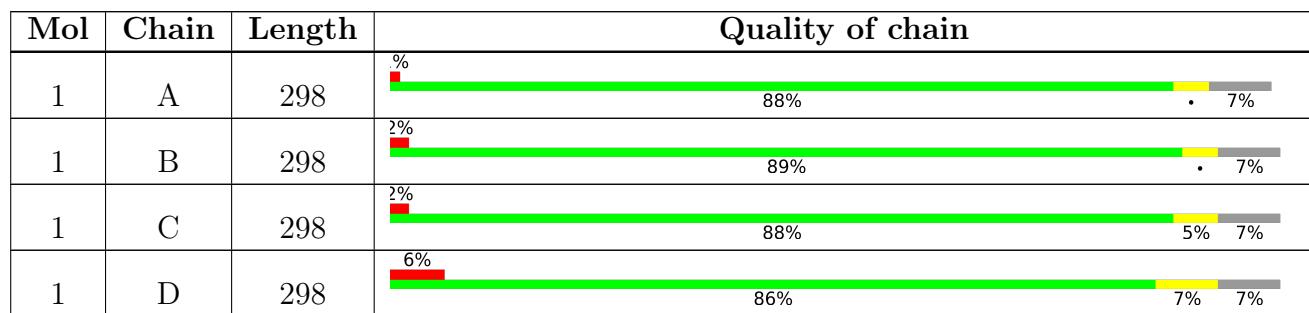
The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

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
2	PYR	C	301	-	X	-	-
2	PYR	D	301	-	X	-	-

2 Entry composition ⓘ

There are 3 unique types of molecules in this entry. The entry contains 8883 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 2-methylisocitrate lyase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	277	Total	C	N	O	S	0	5	0
			2135	1341	368	413	13			
1	A	276	Total	C	N	O	S	0	2	0
			2104	1323	361	407	13			
1	B	277	Total	C	N	O	S	0	2	0
			2110	1326	361	410	13			
1	D	276	Total	C	N	O	S	0	1	0
			2096	1319	359	405	13			

- Molecule 2 is PYRUVIC ACID (three-letter code: PYR) (formula: $C_3H_4O_3$).
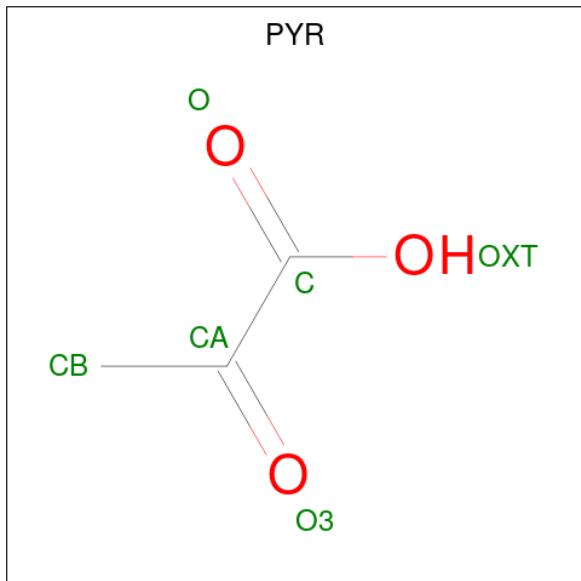
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	C	1	Total	C	O	0	0
			6	3	3		
2	A	1	Total	C	O	0	0
			6	3	3		

Continued on next page...

Continued from previous page...

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total 6	C 3	O 3	0	0
2	D	1	Total 6	C 3	O 3	0	0

• Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	C	148	Total 150	O 150	0	2
3	A	90	Total 90	O 90	0	0
3	B	114	Total 114	O 114	0	0
3	D	60	Total 60	O 60	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: 2-methylisocitrate lyase
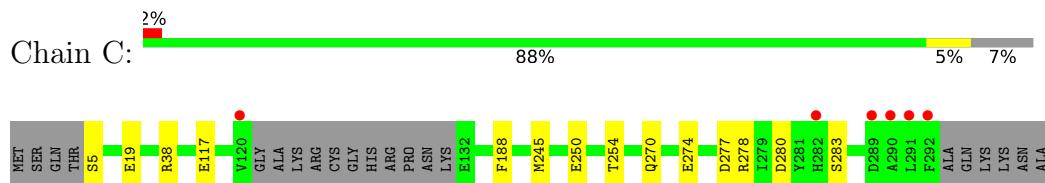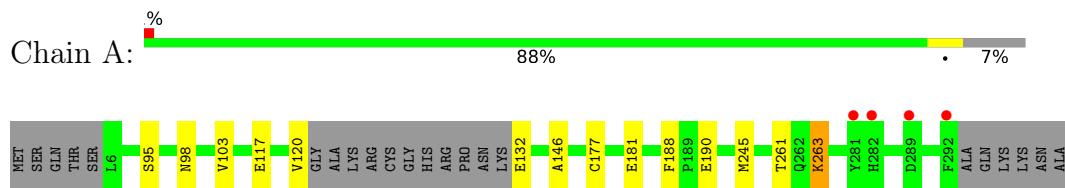
Chain C:

• Molecule 1: 2-methylisocitrate lyase

Chain A:

• Molecule 1: 2-methylisocitrate lyase

Chain B:

• Molecule 1: 2-methylisocitrate lyase

Chain D:
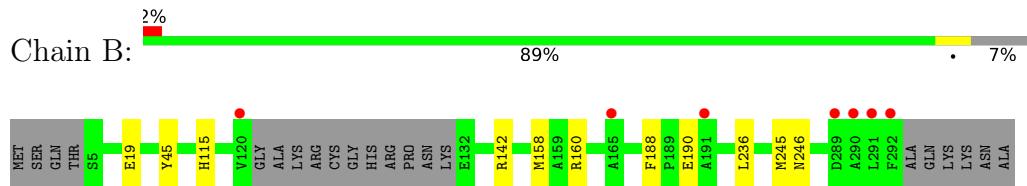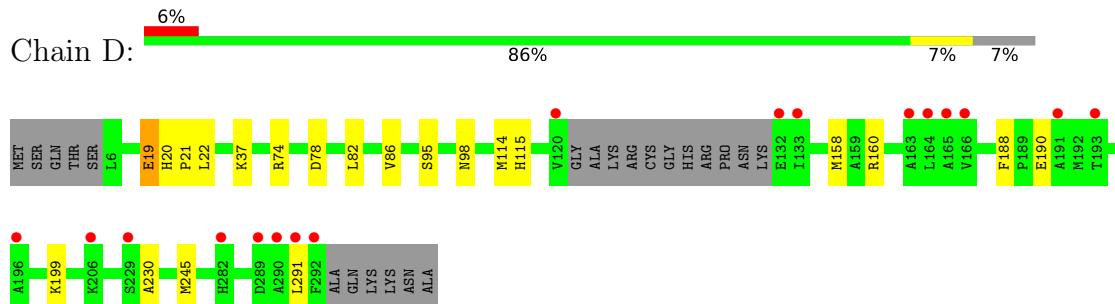
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	152.86Å 59.19Å 148.11Å 90.00° 120.08° 90.00°	Depositor
Resolution (Å)	64.08 – 1.81 64.08 – 1.81	Depositor EDS
% Data completeness (in resolution range)	99.1 (64.08-1.81) 99.1 (64.08-1.81)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.29 (at 1.81Å)	Xtriage
Refinement program	PHENIX 1.12_2829	Depositor
R, R_{free}	0.194 , 0.215 0.194 , 0.214	Depositor DCC
R_{free} test set	5195 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å^2)	22.4	Xtriage
Anisotropy	0.694	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.41 , 48.6	EDS
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.002 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	8883	wwPDB-VP
Average B, all atoms (Å^2)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 16.40% of the height of the origin peak. No significant pseudotranslation is detected.*

---

[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: PYR

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	0.82	1/2133 (0.0%)	0.83	0/2889
1	B	0.84	1/2139 (0.0%)	0.86	0/2897
1	C	0.90	3/2164 (0.1%)	0.83	0/2931
1	D	0.80	1/2125 (0.0%)	0.82	0/2878
All	All	0.84	6/8561 (0.1%)	0.83	0/11595

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	19	GLU	CD-OE2	-5.88	1.19	1.25
1	B	19	GLU	CD-OE1	-5.83	1.19	1.25
1	C	117	GLU	CD-OE2	-5.70	1.19	1.25
1	A	117	GLU	CD-OE2	-5.38	1.19	1.25
1	C	19	GLU	CD-OE1	-5.33	1.19	1.25
1	D	19	GLU	CD-OE2	-5.32	1.19	1.25

There are no bond angle outliers.

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	2104	0	2101	6	0

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	2110	0	2104	5	0
1	C	2135	0	2132	8	0
1	D	2096	0	2096	10	0
2	A	6	0	0	0	0
2	B	6	0	0	0	0
2	C	6	0	0	0	0
2	D	6	0	0	0	0
3	A	90	0	0	0	0
3	B	114	0	0	0	0
3	C	150	0	0	2	0
3	D	60	0	0	0	0
All	All	8883	0	8433	27	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 2.

All (27) 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:C:254[B]:THR:HG21	3:C:478:HOH:O	1.99	0.61
1:C:250:GLU:O	1:C:254[B]:THR:HG22	2.01	0.60
1:C:270:GLN:HE22	1:B:246:ASN:HD22	1.59	0.50
1:D:115:HIS:HA	1:D:158:MET:O	2.12	0.49
1:D:74[B]:ARG:NH2	1:D:78:ASP:OD2	2.49	0.46
1:C:280:ASP:OD1	1:C:283:SER:HB3	2.16	0.44
1:A:177:CYS:O	1:A:181:GLU:HG2	2.18	0.44
1:A:120:VAL:HG21	1:A:132:GLU:HG2	1.99	0.44
1:D:37:LYS:HA	1:D:82:LEU:HD11	2.00	0.44
1:D:20:HIS:HA	1:D:21:PRO:HA	1.83	0.43
1:D:95:SER:HB3	1:D:98:ASN:OD1	2.19	0.43
1:B:115:HIS:HA	1:B:158:MET:O	2.19	0.42
1:A:103:VAL:HG21	1:A:146:ALA:HA	2.00	0.42
1:A:95:SER:HB3	1:A:98:ASN:OD1	2.19	0.42
1:D:86:VAL:O	1:D:114:MET:HA	2.19	0.42
1:D:19:GLU:HG2	1:D:22:LEU:HA	2.01	0.42
1:D:199:LYS:HA	1:D:230:ALA:O	2.20	0.42
1:C:38[B]:ARG:NH2	1:C:277:ASP:OD2	2.52	0.42
1:A:190:GLU:HA	1:A:190:GLU:OE1	2.20	0.41
1:C:270:GLN:NE2	1:B:246:ASN:HD22	2.18	0.41
1:C:274:GLU:O	1:C:278:ARG:HG2	2.20	0.41
1:C:254[B]:THR:HG21	3:C:534:HOH:O	2.21	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:160:ARG:HH21	1:B:190:GLU:CD	2.24	0.40
1:B:45:TYR:CG	1:B:236:LEU:HD11	2.56	0.40
1:D:160:ARG:HH21	1:D:190:GLU:CD	2.25	0.40
1:D:291:LEU:HA	1:D:291:LEU:HD23	1.73	0.40
1:A:261:THR:CG2	1:A:263:LYS:HG2	2.52	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	274/298 (92%)	268 (98%)	6 (2%)	0	100	100
1	B	275/298 (92%)	270 (98%)	5 (2%)	0	100	100
1	C	278/298 (93%)	272 (98%)	6 (2%)	0	100	100
1	D	273/298 (92%)	267 (98%)	6 (2%)	0	100	100
All	All	1100/1192 (92%)	1077 (98%)	23 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	220/235 (94%)	217 (99%)	3 (1%)	67	59

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	B	221/235 (94%)	218 (99%)	3 (1%)	67	59
1	C	224/235 (95%)	221 (99%)	3 (1%)	69	62
1	D	219/235 (93%)	217 (99%)	2 (1%)	78	75
All	All	884/940 (94%)	873 (99%)	11 (1%)	69	65

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	5	SER
1	C	188	PHE
1	C	245	MET
1	A	188	PHE
1	A	245	MET
1	A	263	LYS
1	B	142	ARG
1	B	188	PHE
1	B	245	MET
1	D	188	PHE
1	D	245	MET

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	C	264	ASN
1	C	270	GLN
1	C	282	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 ⓘ

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	PYR	A	301	-	5,5,5	3.26	2 (40%)	3,6,6	0.75	0
2	PYR	C	301	-	5,5,5	3.18	2 (40%)	3,6,6	1.56	1 (33%)
2	PYR	B	301	-	5,5,5	3.29	2 (40%)	3,6,6	1.23	1 (33%)
2	PYR	D	301	-	5,5,5	3.03	2 (40%)	3,6,6	1.20	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	PYR	A	301	-	-	2/4/4/4	-
2	PYR	C	301	-	-	4/4/4/4	-
2	PYR	B	301	-	-	2/4/4/4	-
2	PYR	D	301	-	-	4/4/4/4	-

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	301	PYR	CA-C	-6.65	1.30	1.54
2	C	301	PYR	CA-C	-6.60	1.30	1.54
2	A	301	PYR	CA-C	-6.25	1.32	1.54
2	D	301	PYR	CA-C	-6.22	1.32	1.54
2	A	301	PYR	OXT-C	-3.34	1.20	1.30
2	B	301	PYR	OXT-C	-3.00	1.21	1.30
2	D	301	PYR	OXT-C	-2.55	1.23	1.30
2	C	301	PYR	OXT-C	-2.37	1.23	1.30

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	301	PYR	OXT-C-CA	2.45	120.69	113.97
2	B	301	PYR	OXT-C-CA	2.01	119.47	113.97

There are no chirality outliers.

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	C	301	PYR	O-C-CA-O3
2	C	301	PYR	OXT-C-CA-O3
2	C	301	PYR	OXT-C-CA-CB
2	A	301	PYR	OXT-C-CA-CB
2	B	301	PYR	OXT-C-CA-CB
2	D	301	PYR	O-C-CA-O3
2	D	301	PYR	OXT-C-CA-O3
2	C	301	PYR	O-C-CA-CB
2	A	301	PYR	O-C-CA-CB
2	B	301	PYR	O-C-CA-CB
2	D	301	PYR	O-C-CA-CB
2	D	301	PYR	OXT-C-CA-CB

There are no ring outliers.

No monomer is involved in short contacts.

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	276/298 (92%)	-0.10	4 (1%)	75	72	17, 30, 49, 66	0
1	B	277/298 (92%)	-0.08	7 (2%)	57	52	14, 24, 49, 64	0
1	C	277/298 (92%)	-0.20	6 (2%)	62	57	13, 21, 42, 62	0
1	D	276/298 (92%)	0.29	17 (6%)	20	16	20, 35, 61, 80	0
All	All	1106/1192 (92%)	-0.02	34 (3%)	49	43	13, 28, 52, 80	0

All (34) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	292	PHE	9.9
1	D	292	PHE	9.8
1	B	291	LEU	6.5
1	D	290	ALA	6.5
1	D	291	LEU	5.8
1	D	289	ASP	5.8
1	D	166	VAL	5.0
1	C	292	PHE	4.9
1	D	191	ALA	4.9
1	D	165	ALA	4.0
1	B	191	ALA	4.0
1	B	165	ALA	3.9
1	A	289	ASP	3.5
1	B	120	VAL	3.1
1	D	229	SER	2.9
1	A	292	PHE	2.7
1	D	164	LEU	2.6
1	C	291	LEU	2.5
1	D	120	VAL	2.5
1	D	196	ALA	2.4
1	D	282	HIS	2.4

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	B	290	ALA	2.4
1	C	289	ASP	2.4
1	A	281	TYR	2.3
1	D	133	ILE	2.3
1	D	163	ALA	2.3
1	A	282	HIS	2.3
1	B	289	ASP	2.2
1	D	206	LYS	2.2
1	C	290	ALA	2.2
1	C	120	VAL	2.1
1	D	193	THR	2.0
1	C	282	HIS	2.0
1	D	132	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	PYR	A	301	6/6	0.77	0.25	20,20,20,20	0
2	PYR	D	301	6/6	0.78	0.35	20,20,20,20	0
2	PYR	C	301	6/6	0.85	0.28	20,20,20,20	0
2	PYR	B	301	6/6	0.87	0.28	20,20,20,20	0

6.5 Other polymers ⓘ

There are no such residues in this entry.