Full wwPDB X-ray Structure Validation Report (i)

Feb 28, 2024 – 06:20 PM EST

PDB ID	:	5TEQ
Title	:	C20S C293G MUTANT N-TERMINAL HUMAN ATP CITRATE LYASE BOUND TO CITRATE
Authors	:	Hu, J.; Fraser, M.E.
Deposited on	:	2016-09-22
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 (i) 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 (i)) were used in the production of this report:

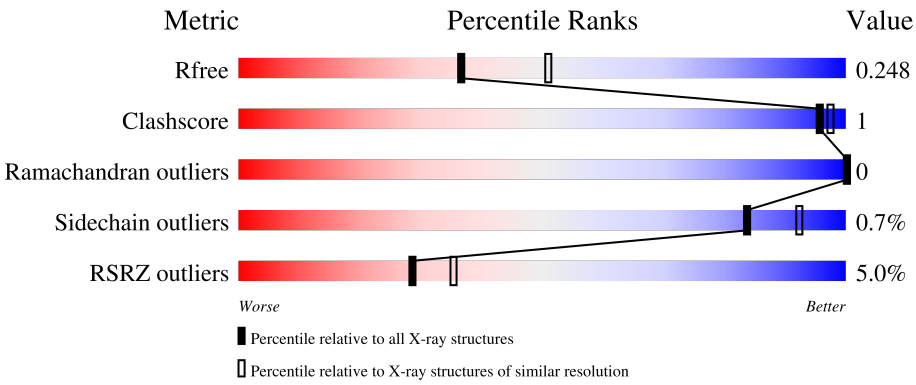
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

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}	130704	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (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 <=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	828	3% 86% • 11%
1	B	828	6% 86% • 11%

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
3	PO4	A	902	-	X	-	-
3	PO4	B	902	-	X	-	-

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 23452 atoms, of which 11489 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 ATP-citrate synthase.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	736	11432	3648	5734	965	1059	26	0	1	0
1	B	737	11455	3656	5745	966	1062	26	0	2	0

There are 26 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	20	SER	CYS	engineered mutation	UNP P53396
A	293	GLY	CYS	engineered mutation	UNP P53396
A	818	ALA	-	expression tag	UNP P53396
A	819	ALA	-	expression tag	UNP P53396
A	820	LEU	-	expression tag	UNP P53396
A	821	GLU	-	expression tag	UNP P53396
A	822	HIS	-	expression tag	UNP P53396
A	823	HIS	-	expression tag	UNP P53396
A	824	HIS	-	expression tag	UNP P53396
A	825	HIS	-	expression tag	UNP P53396
A	826	HIS	-	expression tag	UNP P53396
A	827	HIS	-	expression tag	UNP P53396
A	828	HIS	-	expression tag	UNP P53396
B	20	SER	CYS	engineered mutation	UNP P53396
B	293	GLY	CYS	engineered mutation	UNP P53396
B	818	ALA	-	expression tag	UNP P53396
B	819	ALA	-	expression tag	UNP P53396
B	820	LEU	-	expression tag	UNP P53396
B	821	GLU	-	expression tag	UNP P53396
B	822	HIS	-	expression tag	UNP P53396
B	823	HIS	-	expression tag	UNP P53396
B	824	HIS	-	expression tag	UNP P53396
B	825	HIS	-	expression tag	UNP P53396
B	826	HIS	-	expression tag	UNP P53396
B	827	HIS	-	expression tag	UNP P53396

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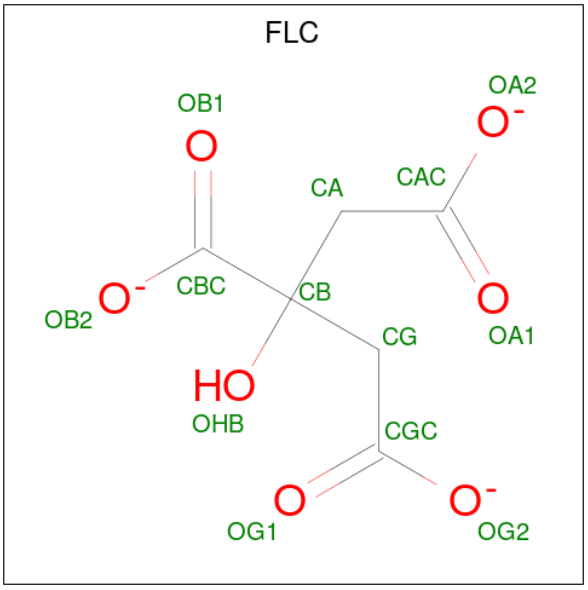
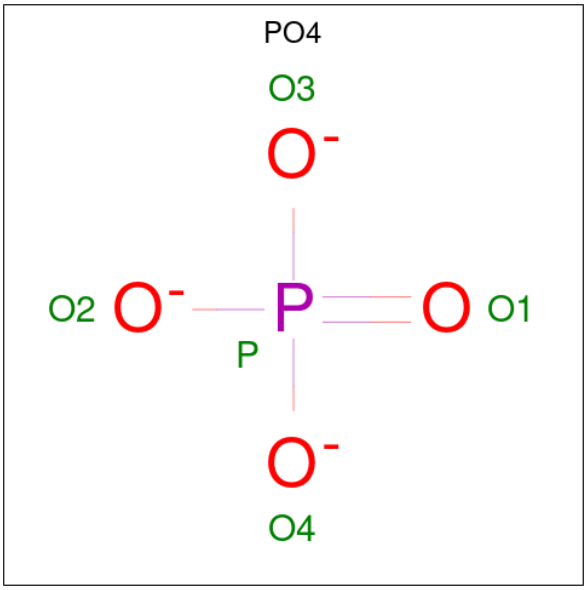
Chain	Residue	Modelled	Actual	Comment	Reference
B	828	HIS	-	expression tag	UNP P53396

- Molecule 2 is CITRATE ANION (three-letter code: FLC) (formula: $C_6H_5O_7$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	H	O		
2	A	1	18	6	5	7	0	0
			Total	C	H	O		
2	B	1	18	6	5	7	0	0

- Molecule 3 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).



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

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Na		
4	A	1	1	1	0	0
			Total	Na		
4	B	1	1	1	0	0

- Molecule 5 is water.

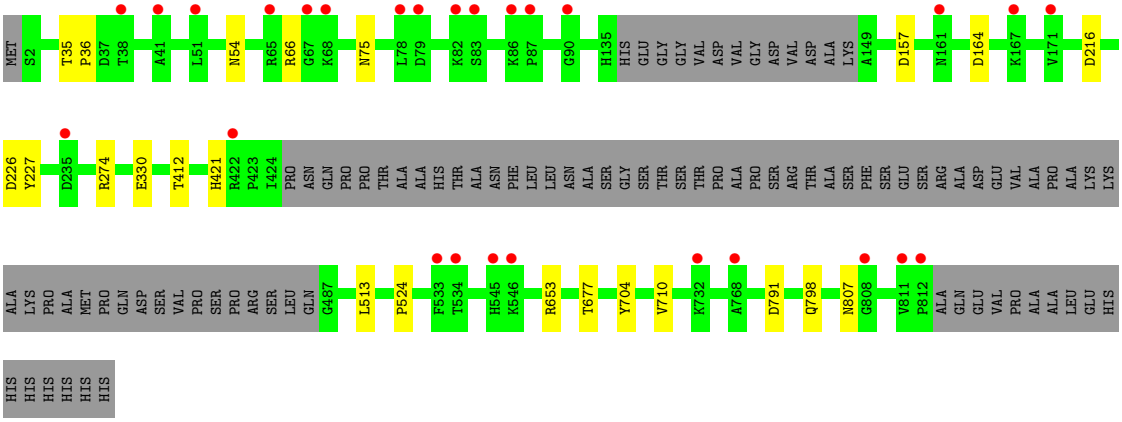
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	248	248	248	0	0
			Total	O		
5	B	269	269	269	0	0

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.

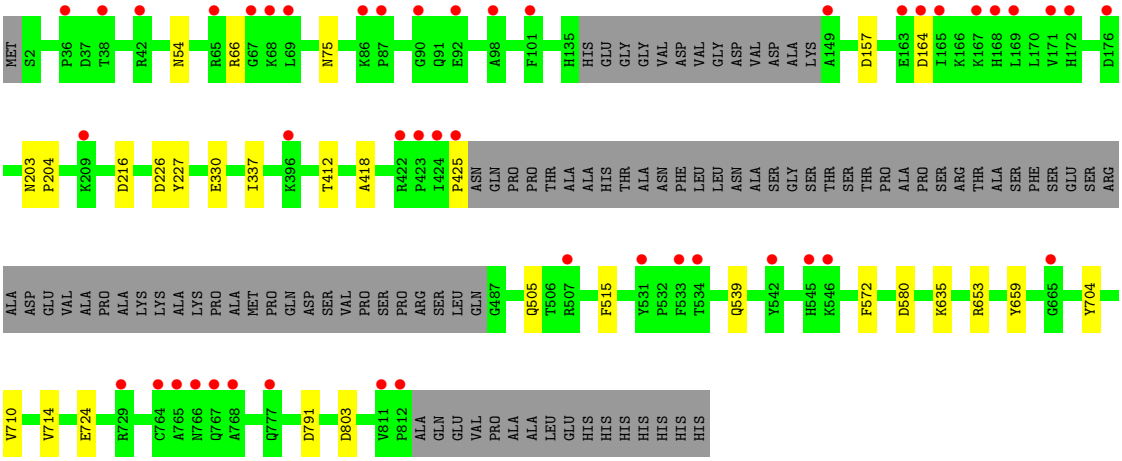
- Molecule 1: ATP-citrate synthase

Chain A:



- Molecule 1: ATP-citrate synthase

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	95.11Å 73.10Å 131.12Å 90.00° 97.89° 90.00°	Depositor
Resolution (Å)	41.46 – 2.30 45.08 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.7 (41.46-2.30) 99.7 (45.08-2.30)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.91 (at 2.29Å)	Xtriage
Refinement program	PHENIX (1.10_2152: ???)	Depositor
R, R_{free}	0.202 , 0.245 0.203 , 0.248	Depositor DCC
R_{free} test set	3988 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å^2)	30.2	Xtriage
Anisotropy	0.612	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.43 , 48.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	23452	wwPDB-VP
Average B, all atoms (Å^2)	41.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 16.34% 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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: NA, PO4, FLC

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	0.25	0/5823	0.44	0/7884
1	B	0.25	0/5839	0.44	0/7907
All	All	0.25	0/11662	0.44	0/15791

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	5698	5734	5733	11	0
1	B	5710	5745	5744	15	0
2	A	13	5	5	0	0
2	B	13	5	5	0	0
3	A	5	0	0	0	0
3	B	5	0	0	0	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	248	0	0	1	0
5	B	269	0	0	2	0
All	All	11963	11489	11487	24	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 (24) 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:66:ARG:NH2	1:B:216:ASP:OD1	2.31	0.64
1:B:580:ASP:OD2	5:B:1001:HOH:O	2.15	0.64
1:A:226:ASP:OD1	1:A:227:TYR:N	2.34	0.61
1:A:807:ASN:ND2	1:B:425:PRO:O	2.35	0.59
1:A:66:ARG:NH2	1:A:216:ASP:OD1	2.36	0.58
1:B:226:ASP:OD1	1:B:227:TYR:N	2.36	0.58
1:B:539:GLN:NE2	5:B:1007:HOH:O	2.33	0.52
1:A:54:ASN:ND2	1:A:75:ASN:OD1	2.39	0.51
1:B:54:ASN:ND2	1:B:75:ASN:OD1	2.43	0.48
1:A:513:LEU:HD22	1:A:524:PRO:HB3	1.96	0.47
1:B:337:ILE:HG21	1:B:418:ALA:HB1	1.98	0.46
1:A:412:THR:OG1	1:A:791:ASP:OD1	2.32	0.45
1:B:659:TYR:HA	1:B:714:VAL:O	2.17	0.44
1:A:421:HIS:HE1	1:B:803:ASP:OD2	2.00	0.44
1:A:677:THR:HB	1:A:798:GLN:HB2	1.99	0.44
1:B:704:TYR:HB3	1:B:710:VAL:HG11	2.00	0.43
1:A:274:ARG:NH2	5:A:1004:HOH:O	2.36	0.43
1:B:505:GLN:HG3	1:B:572:PHE:CG	2.54	0.42
1:B:515:PHE:CG	1:B:635:LYS:HD3	2.54	0.42
1:B:412:THR:OG1	1:B:791:ASP:OD1	2.31	0.42
1:A:704:TYR:HB3	1:A:710:VAL:HG11	2.01	0.42
1:B:724:GLU:OE1	1:B:724:GLU:N	2.46	0.41
1:A:35:THR:OG1	1:A:36:PRO:HD2	2.20	0.41
1:B:203:ASN:HA	1:B:204:PRO:HA	1.93	0.41

There are no symmetry-related clashes.

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	731/828 (88%)	721 (99%)	10 (1%)	0	100	100
1	B	733/828 (88%)	722 (98%)	11 (2%)	0	100	100
All	All	1464/1656 (88%)	1443 (99%)	21 (1%)	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	606/678 (89%)	602 (99%)	4 (1%)	84	92
1	B	608/678 (90%)	604 (99%)	4 (1%)	84	92
All	All	1214/1356 (90%)	1206 (99%)	8 (1%)	84	92

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	157	ASP
1	A	164	ASP
1	A	330	GLU
1	A	653	ARG
1	B	157	ASP
1	B	164	ASP
1	B	330	GLU
1	B	653	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 6 ligands modelled in this entry, 2 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	$\#\|Z\| > 2$
3	PO4	A	902	-	4,4,4	3.75	1 (25%)	6,6,6	1.95	3 (50%)
2	FLC	B	901	-	12,12,12	1.12	1 (8%)	17,17,17	1.22	1 (5%)
2	FLC	A	901	-	12,12,12	1.06	0	17,17,17	1.18	1 (5%)
3	PO4	B	902	-	4,4,4	3.75	1 (25%)	6,6,6	1.92	3 (50%)

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	FLC	B	901	-	-	0/16/16/16	-
2	FLC	A	901	-	-	0/16/16/16	-

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	902	PO4	P-O4	7.41	1.76	1.54
3	B	902	PO4	P-O4	7.37	1.76	1.54
2	B	901	FLC	CB-CBC	2.08	1.55	1.53

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	901	FLC	OB1-CBC-CB	-3.33	117.54	122.25
2	A	901	FLC	OB1-CBC-CB	-3.25	117.66	122.25
3	A	902	PO4	O4-P-O2	-3.20	97.70	107.97
3	B	902	PO4	O4-P-O2	-2.91	98.63	107.97
3	B	902	PO4	O4-P-O1	-2.42	102.03	110.89
3	A	902	PO4	O3-P-O2	2.24	115.15	107.97
3	B	902	PO4	O3-P-O2	2.16	114.89	107.97
3	A	902	PO4	O4-P-O1	-2.14	103.05	110.89

There are no chirality outliers.

There are no torsion outliers.

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 (i)

6.1 Protein, DNA and RNA chains (i)

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	736/828 (88%)	0.34	27 (3%)	41	48	20, 34, 58, 82	0
1	B	737/828 (89%)	0.43	46 (6%)	20	26	21, 35, 59, 80	0
All	All	1473/1656 (88%)	0.39	73 (4%)	28	35	20, 35, 58, 82	0

All (73) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	68	LYS	5.9
1	B	171	VAL	5.4
1	B	172	HIS	4.8
1	B	425	PRO	4.8
1	B	545	HIS	4.7
1	B	167	LYS	4.5
1	B	168	HIS	4.1
1	A	161	ASN	4.0
1	B	767	GLN	3.9
1	B	69	LEU	3.7
1	A	86	LYS	3.7
1	A	167	LYS	3.5
1	B	149	ALA	3.4
1	B	209	LYS	3.4
1	B	764	CYS	3.4
1	B	422	ARG	3.3
1	A	422	ARG	3.2
1	B	533	PHE	3.2
1	B	38	THR	3.1
1	B	423	PRO	3.0
1	A	90	GLY	2.9
1	B	163	GLU	2.9
1	B	531	TYR	2.8
1	A	51	LEU	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	811	VAL	2.7
1	A	546	LYS	2.7
1	A	83	SER	2.7
1	A	65	ARG	2.7
1	B	86	LYS	2.7
1	B	165	ILE	2.7
1	B	766	ASN	2.6
1	A	768	ALA	2.6
1	A	82	LYS	2.6
1	B	534	THR	2.6
1	A	87	PRO	2.6
1	B	164	ASP	2.6
1	B	546	LYS	2.5
1	B	424	ILE	2.5
1	A	79	ASP	2.5
1	B	68	LYS	2.5
1	B	768	ALA	2.5
1	A	812	PRO	2.5
1	B	42	ARG	2.4
1	B	542	TYR	2.4
1	B	777	GLN	2.4
1	A	235	ASP	2.4
1	A	38	THR	2.4
1	A	533	PHE	2.4
1	A	732	LYS	2.3
1	B	507	ARG	2.3
1	B	36	PRO	2.3
1	B	92	GLU	2.3
1	B	67	GLY	2.3
1	A	78	LEU	2.3
1	B	169	LEU	2.3
1	B	729	ARG	2.3
1	B	396	LYS	2.3
1	B	90	GLY	2.2
1	B	812	PRO	2.2
1	A	67	GLY	2.2
1	A	811	VAL	2.2
1	B	101	PHE	2.2
1	B	98	ALA	2.2
1	B	87	PRO	2.1
1	A	545	HIS	2.1
1	A	534	THR	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	765	ALA	2.1
1	A	41	ALA	2.1
1	A	171	VAL	2.1
1	B	176	ASP	2.0
1	B	665	GLY	2.0
1	B	65	ARG	2.0
1	A	808	GLY	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 monosaccharides 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
4	NA	A	903	1/1	0.76	0.09	45,45,45,45	0
4	NA	B	903	1/1	0.85	0.25	51,51,51,51	0
2	FLC	A	901	13/13	0.96	0.16	22,28,36,36	0
2	FLC	B	901	13/13	0.96	0.18	18,29,40,40	0
3	PO4	A	902	5/5	0.97	0.21	29,32,42,48	0
3	PO4	B	902	5/5	0.98	0.21	29,31,33,42	0

6.5 Other polymers (i)

There are no such residues in this entry.