wwPDB X-ray Structure Validation Summary Report (i)

Nov 2, 2021 – 08:48 AM EDT

PDB ID	:	1Z6R
Title	:	Crystal structure of Mlc from Escherichia coli
Authors	:	Schiefner, A.; Gerber, K.; Seitz, S.; Welte, W.; Diederichs, K.; Boos, W.
Deposited on	:	2005-03-23
Resolution	:	2.70 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 following versions of software and data (see references (i)) were used in the production of this report:

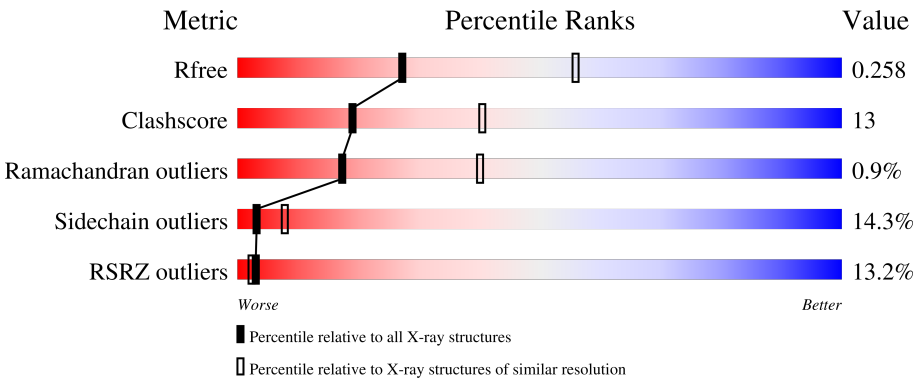
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

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 2.70 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	2808 (2.70-2.70)
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)
RSRZ outliers	127900	2737 (2.70-2.70)

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	406	12%; 64%; 24%; 6%; 6%
1	B	406	4%; 60%; 29%; 5%; 6%
1	C	406	10%; 56%; 33%; •; •; 6%
1	D	406	22%; 61%; 30%; •; 6%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 11728 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 Mlc protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	382	2931	1855	514	549	4	9	0	0	0
1	B	382	2931	1855	514	549	4	9	0	0	0
1	C	382	2931	1855	514	549	4	9	0	0	0
1	D	382	2931	1855	514	549	4	9	0	0	0

There are 44 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MSE	MET	modified residue	UNP P50456
A	52	HIS	ARG	engineered mutation	UNP P50456
A	54	MSE	MET	modified residue	UNP P50456
A	167	MSE	MET	modified residue	UNP P50456
A	176	MSE	MET	modified residue	UNP P50456
A	201	MSE	MET	modified residue	UNP P50456
A	286	MSE	MET	modified residue	UNP P50456
A	289	MSE	MET	modified residue	UNP P50456
A	329	MSE	MET	modified residue	UNP P50456
A	384	MSE	MET	modified residue	UNP P50456
A	394	MSE	MET	modified residue	UNP P50456
B	1	MSE	MET	modified residue	UNP P50456
B	52	HIS	ARG	engineered mutation	UNP P50456
B	54	MSE	MET	modified residue	UNP P50456
B	167	MSE	MET	modified residue	UNP P50456
B	176	MSE	MET	modified residue	UNP P50456
B	201	MSE	MET	modified residue	UNP P50456
B	286	MSE	MET	modified residue	UNP P50456
B	289	MSE	MET	modified residue	UNP P50456
B	329	MSE	MET	modified residue	UNP P50456
B	384	MSE	MET	modified residue	UNP P50456

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Chain	Residue	Modelled	Actual	Comment	Reference
B	394	MSE	MET	modified residue	UNP P50456
C	1	MSE	MET	modified residue	UNP P50456
C	52	HIS	ARG	engineered mutation	UNP P50456
C	54	MSE	MET	modified residue	UNP P50456
C	167	MSE	MET	modified residue	UNP P50456
C	176	MSE	MET	modified residue	UNP P50456
C	201	MSE	MET	modified residue	UNP P50456
C	286	MSE	MET	modified residue	UNP P50456
C	289	MSE	MET	modified residue	UNP P50456
C	329	MSE	MET	modified residue	UNP P50456
C	384	MSE	MET	modified residue	UNP P50456
C	394	MSE	MET	modified residue	UNP P50456
D	1	MSE	MET	modified residue	UNP P50456
D	52	HIS	ARG	engineered mutation	UNP P50456
D	54	MSE	MET	modified residue	UNP P50456
D	167	MSE	MET	modified residue	UNP P50456
D	176	MSE	MET	modified residue	UNP P50456
D	201	MSE	MET	modified residue	UNP P50456
D	286	MSE	MET	modified residue	UNP P50456
D	289	MSE	MET	modified residue	UNP P50456
D	329	MSE	MET	modified residue	UNP P50456
D	384	MSE	MET	modified residue	UNP P50456
D	394	MSE	MET	modified residue	UNP P50456

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

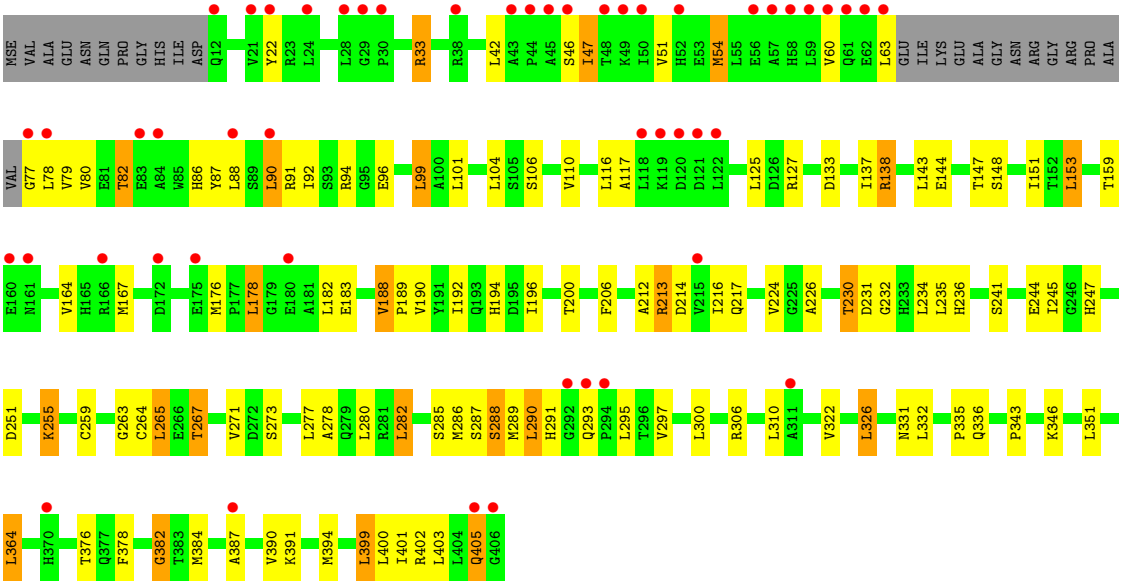
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total Zn 1 1	0	0
2	B	1	Total Zn 1 1	0	0
2	C	1	Total Zn 1 1	0	0
2	D	1	Total Zn 1 1	0	0

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.

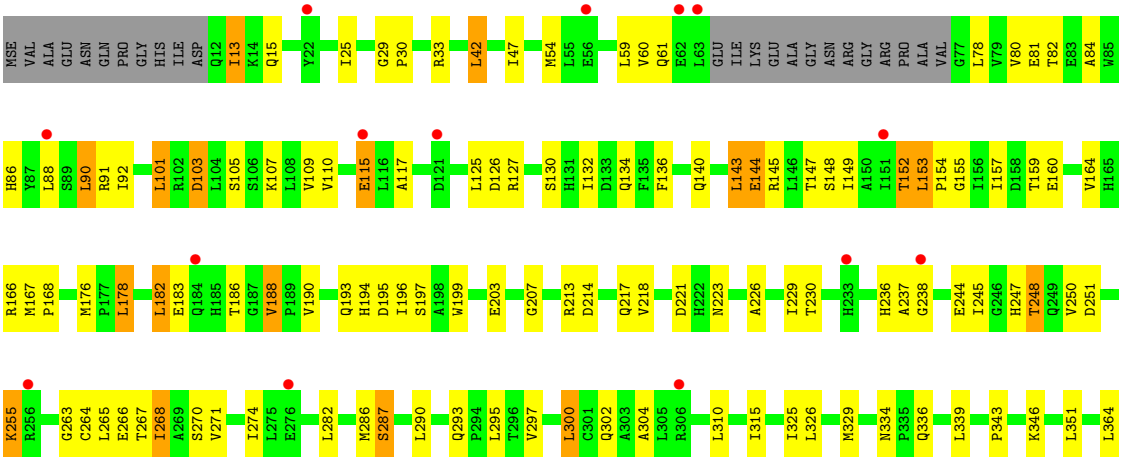
- Molecule 1: Mlc protein

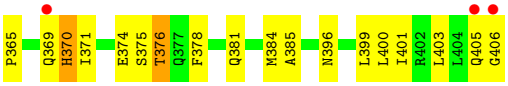
Chain A:



- Molecule 1: Mlc protein

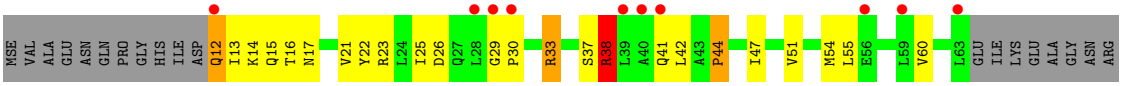
Chain B:

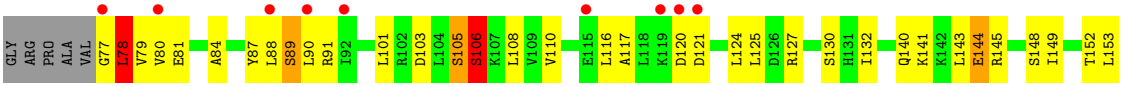


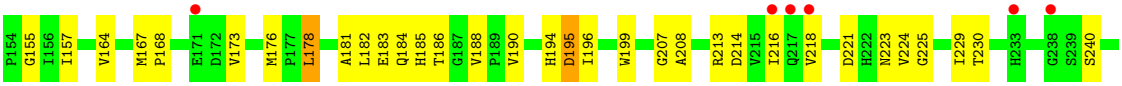


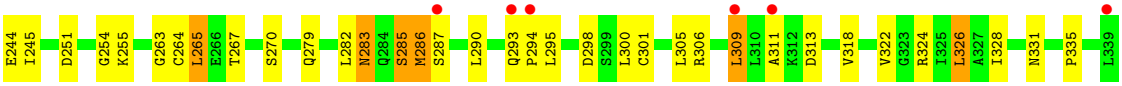
• Molecule 1: Mlc protein

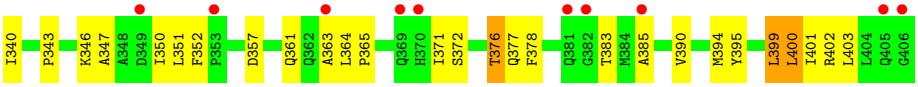
Chain C:





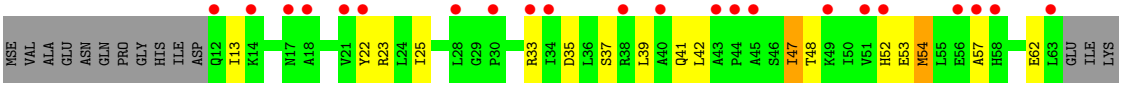


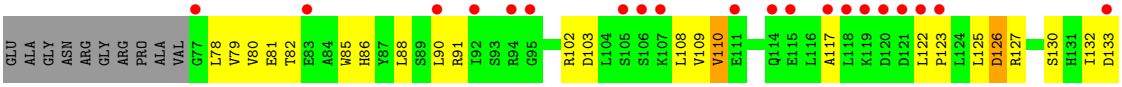


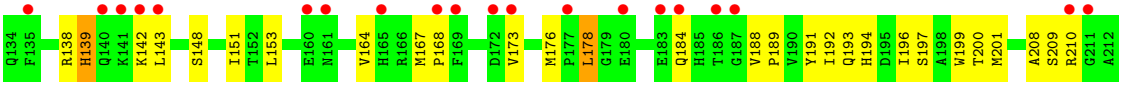


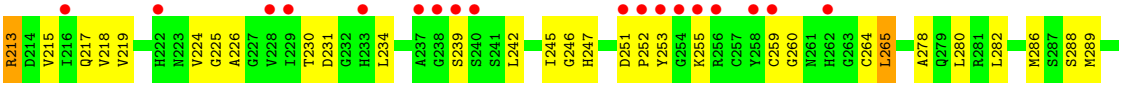
• Molecule 1: Mlc protein

Chain D:









4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	235.95Å 74.71Å 154.95Å 90.00° 129.15° 90.00°	Depositor
Resolution (Å)	19.94 – 2.70 19.94 – 2.70	Depositor EDS
% Data completeness (in resolution range)	100.0 (19.94-2.70) 99.0 (19.94-2.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.10	Depositor
$< I/\sigma(I) >$ [1]	1.37 (at 2.71Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.203 , 0.263 0.201 , 0.258	Depositor DCC
R_{free} test set	2856 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	67.0	Xtriage
Anisotropy	0.084	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 80.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	0.025 for -h-2*l,-k,l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	11728	wwPDB-VP
Average B, all atoms (Å^2)	71.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.23% 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: ZN

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	0.66	5/2969 (0.2%)	0.75	3/4010 (0.1%)
1	B	0.78	1/2969 (0.0%)	0.81	3/4010 (0.1%)
1	C	1.00	10/2969 (0.3%)	0.83	9/4010 (0.2%)
1	D	0.78	12/2969 (0.4%)	0.73	4/4010 (0.1%)
All	All	0.82	28/11876 (0.2%)	0.78	19/16040 (0.1%)

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	C	0	3

The worst 5 of 28 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	285	SER	CB-OG	26.01	1.76	1.42
1	C	38	ARG	CZ-NH1	22.97	1.62	1.33
1	B	406	GLY	C-O	16.27	1.49	1.23
1	C	77	GLY	N-CA	13.24	1.66	1.46
1	D	133	ASP	CG-OD1	12.36	1.53	1.25

The worst 5 of 19 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	38	ARG	NE-CZ-NH1	-10.10	115.25	120.30
1	C	33	ARG	NE-CZ-NH2	-9.88	115.36	120.30
1	A	138	ARG	NE-CZ-NH2	-9.88	115.36	120.30
1	C	44	PRO	O-C-N	7.72	135.05	122.70

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	406	GLY	CA-C-O	-6.51	108.88	120.60

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	286	MSE	Mainchain
1	C	38	ARG	Sidechain
1	C	44	PRO	Mainchain

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	2931	0	2988	70	0
1	B	2931	0	2988	92	0
1	C	2931	0	2988	88	0
1	D	2931	0	2988	70	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
All	All	11728	0	11952	307	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 13.

The worst 5 of 307 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:38:ARG:CG	1:C:38:ARG:CD	1.76	1.57
1:B:384:MSE:CE	1:B:384:MSE:SE	2.16	1.44
1:D:289:MSE:SE	1:D:289:MSE:CE	2.15	1.43
1:C:285:SER:OG	1:C:285:SER:CB	1.76	1.33
1:D:91:ARG:CZ	1:D:380:ASN:HD21	1.59	1.13

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	378/406 (93%)	346 (92%)	25 (7%)	7 (2%)	8 20
1	B	378/406 (93%)	353 (93%)	25 (7%)	0	100 100
1	C	378/406 (93%)	344 (91%)	31 (8%)	3 (1%)	19 43
1	D	378/406 (93%)	351 (93%)	24 (6%)	3 (1%)	19 43
All	All	1512/1624 (93%)	1394 (92%)	105 (7%)	13 (1%)	17 40

5 of 13 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	290	LEU
1	C	106	SER
1	D	369	GLN
1	A	286	MSE
1	C	294	PRO

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	321/329 (98%)	279 (87%)	42 (13%)	4 10
1	B	321/329 (98%)	276 (86%)	45 (14%)	3 8
1	C	321/329 (98%)	273 (85%)	48 (15%)	3 7

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	D	321/329 (98%)	272 (85%)	49 (15%)	2 7
All	All	1284/1316 (98%)	1100 (86%)	184 (14%)	3 8

5 of 184 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	287	SER
1	D	78	LEU
1	C	300	LEU
1	C	372	SER
1	D	122	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 26 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	193	GLN
1	C	283	ASN
1	D	380	ASN
1	C	279	GLN
1	C	284	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

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.

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	373/406 (91%)	0.90	50 (13%)	3	2	57, 71, 78, 87	0
1	B	373/406 (91%)	0.36	17 (4%)	32	31	61, 71, 78, 87	0
1	C	373/406 (91%)	0.65	41 (10%)	5	4	61, 71, 77, 84	0
1	D	373/406 (91%)	1.17	89 (23%)	0	0	60, 71, 77, 86	0
All	All	1492/1624 (91%)	0.77	197 (13%)	3	2	57, 71, 78, 87	0

The worst 5 of 197 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	382	GLY	12.6
1	A	62	GLU	11.0
1	B	406	GLY	8.8
1	A	77	GLY	7.9
1	C	406	GLY	7.6

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
2	ZN	C	503	1/1	0.97	0.07	71,71,71,71	0
2	ZN	D	504	1/1	0.97	0.11	86,86,86,86	0
2	ZN	A	501	1/1	0.98	0.10	55,55,55,55	0
2	ZN	B	502	1/1	0.99	0.07	46,46,46,46	0

6.5 Other polymers (i)

There are no such residues in this entry.