wwPDB X-ray Structure Validation Summary Report (i)

Nov 24, 2021 – 06:14 pm GMT

PDB ID	:	6Z9Y
Title	:	Copper transporter OprC
Authors	:	Bhamidimarri, S.P.; van den Berg, B.
Deposited on	:	2020-06-04
Resolution	:	2.95 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 (1)) were used in the production of this report:

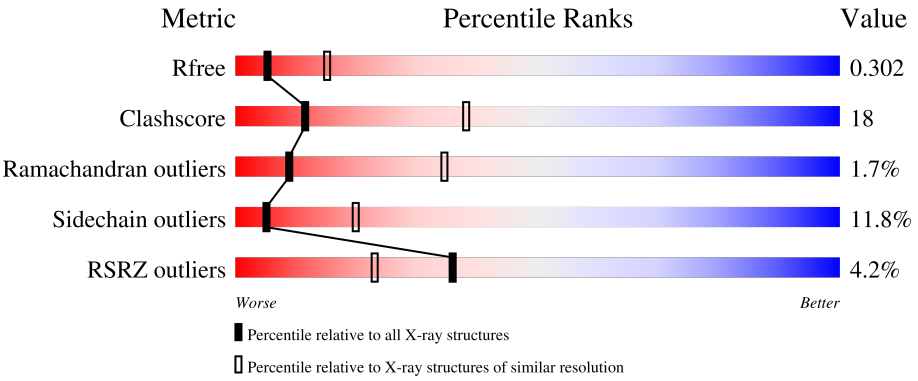
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0267
CCP4	:	7.1.010 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation 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 2.95 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	3104 (3.00-2.92)
Clashscore	141614	3462 (3.00-2.92)
Ramachandran outliers	138981	3340 (3.00-2.92)
Sidechain outliers	138945	3343 (3.00-2.92)
RSRZ outliers	127900	2986 (3.00-2.92)

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	723	4% 54% 33% · 9%
1	B	723	3% 54% 32% · 11%
1	C	723	4% 46% 37% 5% 11%
1	D	723	5% 52% 35% · 9%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 20158 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 Putative copper transport outer membrane porin OprC.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	657	Total	C	N	O	S	0	0	0
			5092	3195	899	979	19			
1	B	645	Total	C	N	O	S	0	0	0
			5004	3141	882	966	15			
1	C	640	Total	C	N	O	S	0	0	0
			4970	3123	878	955	14			
1	D	656	Total	C	N	O	S	0	1	0
			5088	3194	898	977	19			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	323	ALA	HIS	engineered mutation	UNP G3XD89
B	323	ALA	HIS	engineered mutation	UNP G3XD89
C	323	ALA	HIS	engineered mutation	UNP G3XD89
D	323	ALA	HIS	engineered mutation	UNP G3XD89

- Molecule 2 is COPPER (II) ION (three-letter code: CU) (formula: Cu).

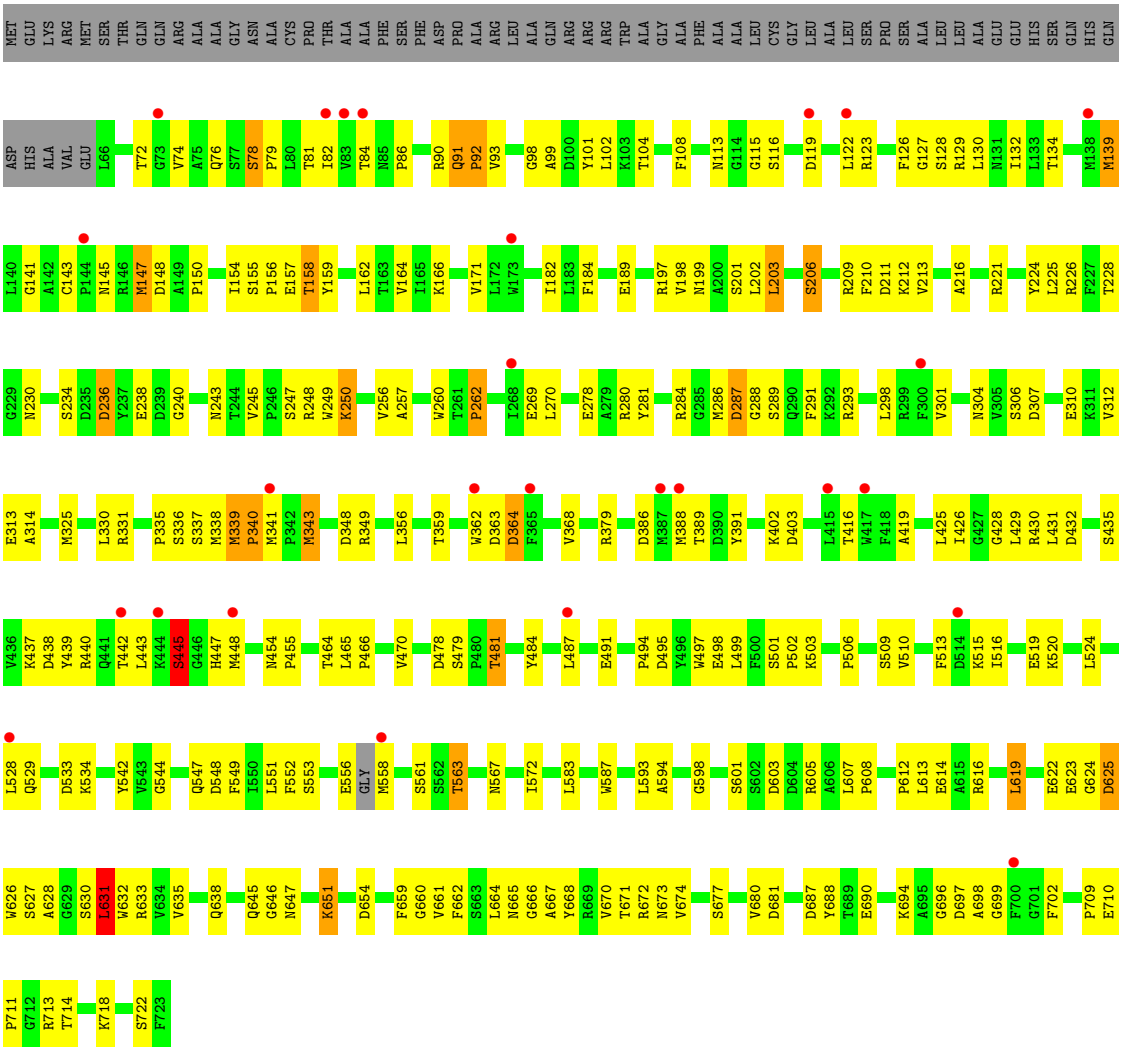
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Cu	0	0
			1	1		
2	B	1	Total	Cu	0	0
			1	1		
2	C	1	Total	Cu	0	0
			1	1		
2	D	1	Total	Cu	0	0
			1	1		

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.

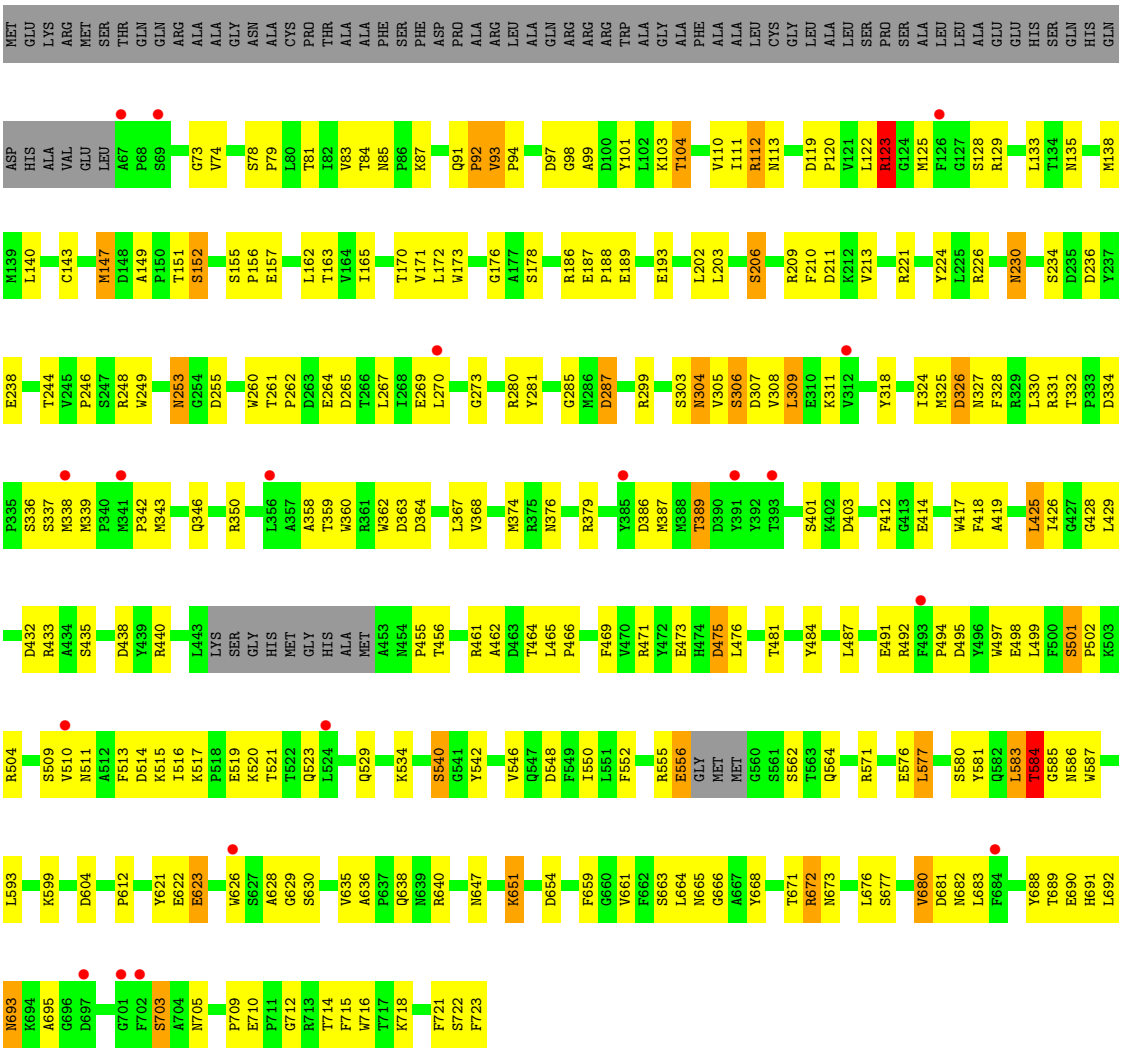
• Molecule 1: Putative copper transport outer membrane porin OprC

Chain A:



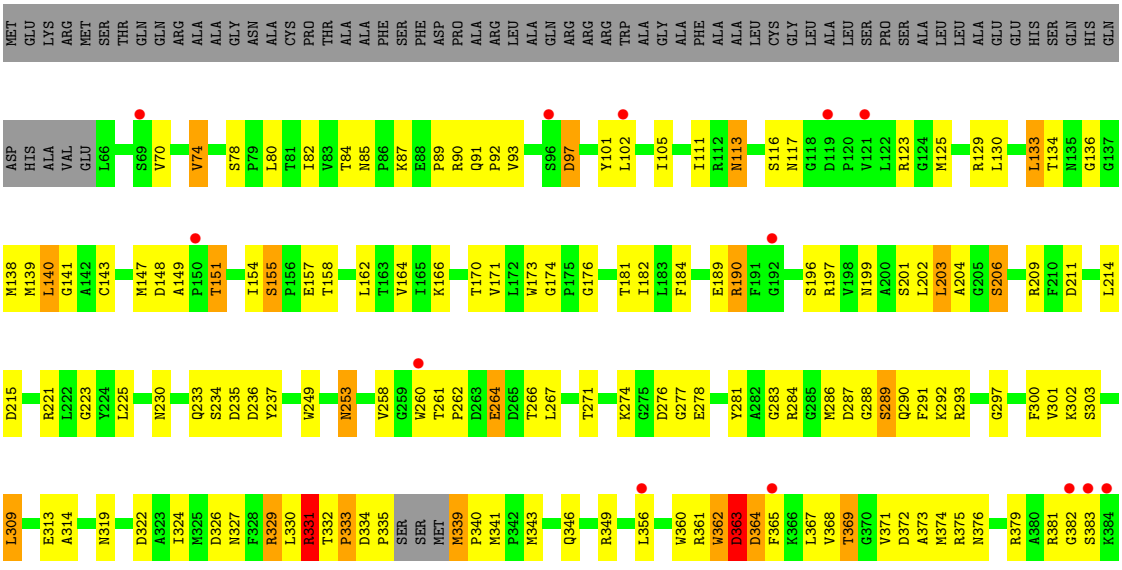
• Molecule 1: Putative copper transport outer membrane porin OprC

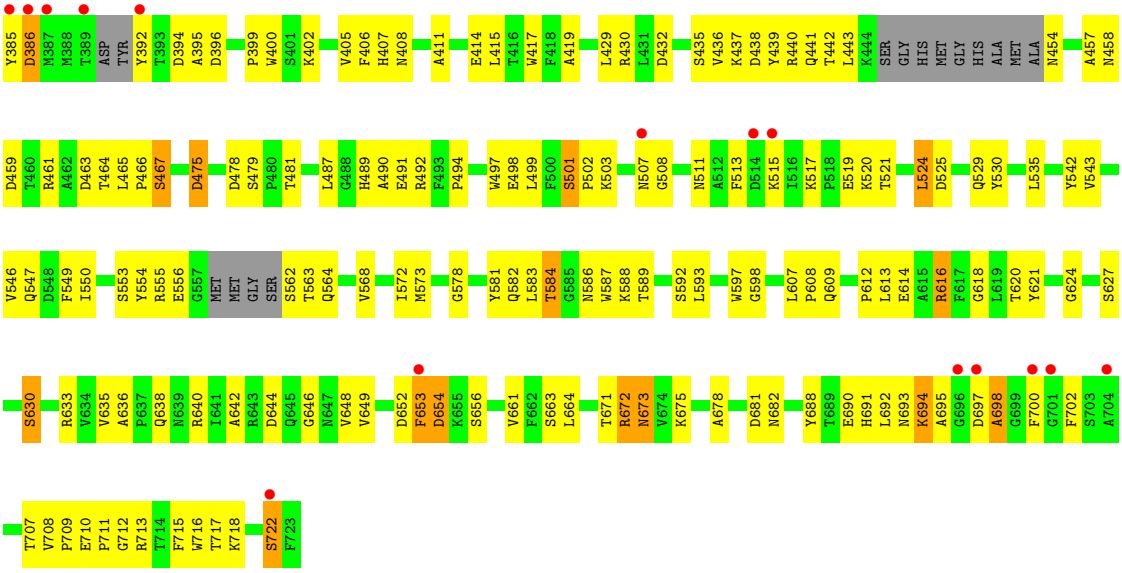
Chain B:



• Molecule 1: Putative copper transport outer membrane porin OprC

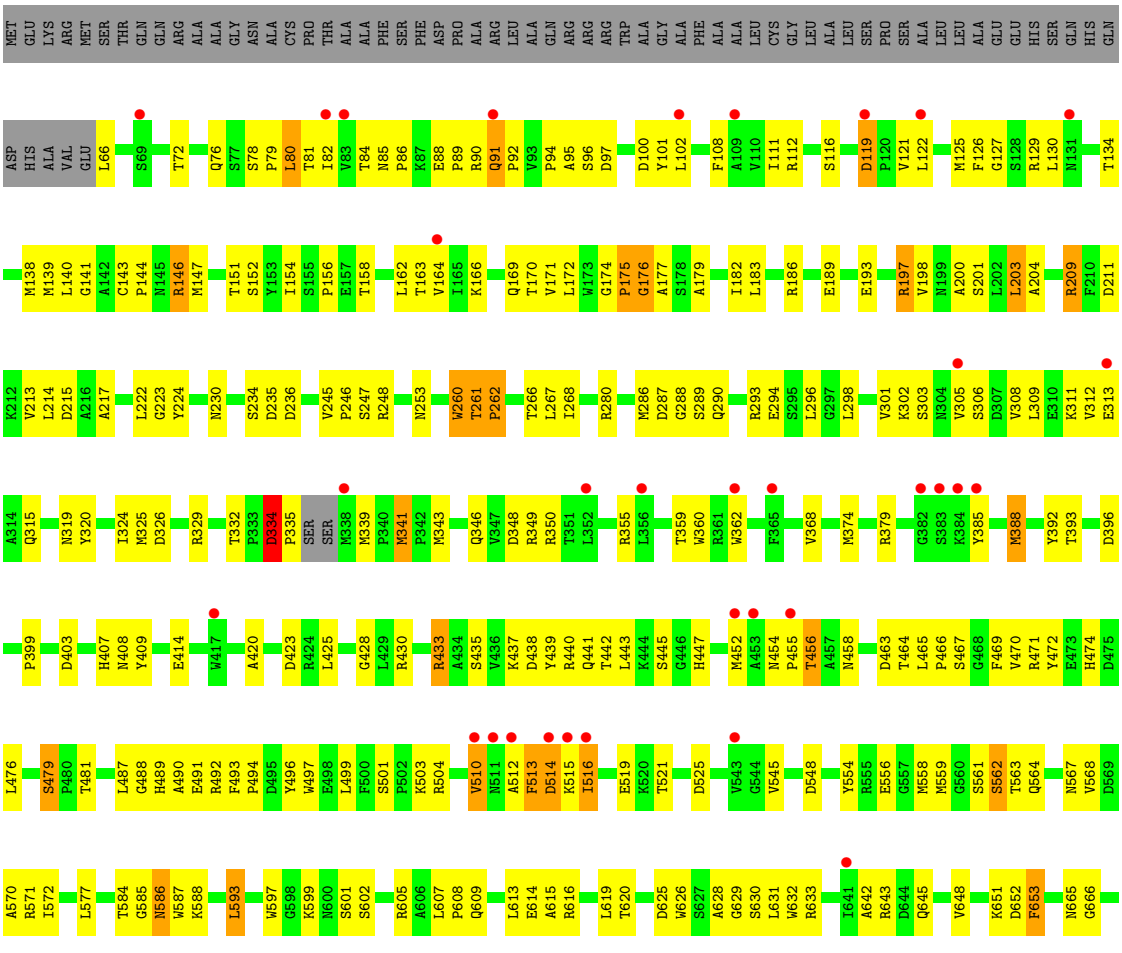
Chain C:

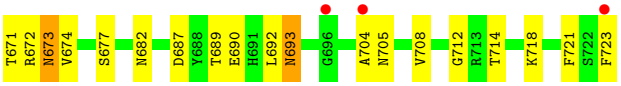




• Molecule 1: Putative copper transport outer membrane porin OprC

Chain D:




T671
R672
N673
V674
S677
N682
D687
Y688
T689
E690
H691
L692
N693
G696
A704
N705
V708
G712
R713
T714
K718
F721
S722
F723

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	67.34Å 197.67Å 171.75Å 90.00° 88.75° 90.00°	Depositor
Resolution (Å)	85.85 – 2.95 171.71 – 2.95	Depositor EDS
% Data completeness (in resolution range)	98.0 (85.85-2.95) 93.7 (171.71-2.95)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.15 (at 2.96Å)	Xtriage
Refinement program	PHENIX 1.18_3855	Depositor
R, R_{free}	0.242 , 0.302 0.244 , 0.302	Depositor DCC
R_{free} test set	4619 reflections (4.91%)	wwPDB-VP
Wilson B-factor (Å^2)	69.5	Xtriage
Anisotropy	0.404	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	(Not available) , (Not available)	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	0.238 for h,-k,-l	Xtriage
F_o,F_c correlation	0.88	EDS
Total number of atoms	20158	wwPDB-VP
Average B, all atoms (Å^2)	66.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.24% 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: CU

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	0.47	0/5218	0.69	2/7072 (0.0%)
1	B	0.51	0/5127	0.70	0/6952
1	C	0.49	1/5090 (0.0%)	0.70	1/6898 (0.0%)
1	D	0.44	0/5217	0.67	2/7071 (0.0%)
All	All	0.48	1/20652 (0.0%)	0.69	5/27993 (0.0%)

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	B	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	713	ARG	CG-CD	5.56	1.65	1.51

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	340	PRO	C-N-CA	8.15	142.09	121.70
1	D	334	ASP	C-N-CD	6.40	141.84	128.40
1	C	102	LEU	CA-CB-CG	5.22	127.31	115.30
1	D	222	LEU	CA-CB-CG	5.21	127.29	115.30
1	A	631	LEU	CA-CB-CG	5.16	127.16	115.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	92	PRO	Peptide

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	5092	0	4870	170	0
1	B	5004	0	4779	171	0
1	C	4970	0	4759	195	0
1	D	5088	0	4870	164	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	20158	0	19278	692	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 18.

The worst 5 of 692 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:171:VAL:HG22	1:B:414:GLU:HG3	1.51	0.93
1:B:504:ARG:HH12	1:B:555:ARG:HB3	1.37	0.90
1:A:630:SER:HB3	1:A:664:LEU:HD23	1.53	0.88
1:D:253:ASN:HD22	1:D:293:ARG:HH21	1.26	0.84
1:D:324:ILE:HG12	1:D:346:GLN:HG3	1.59	0.84

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	653/723 (90%)	577 (88%)	68 (10%)	8 (1%)	13 43
1	B	639/723 (88%)	582 (91%)	50 (8%)	7 (1%)	14 46
1	C	630/723 (87%)	541 (86%)	74 (12%)	15 (2%)	6 26
1	D	653/723 (90%)	578 (88%)	60 (9%)	15 (2%)	6 27
All	All	2575/2892 (89%)	2278 (88%)	252 (10%)	45 (2%)	9 34

5 of 45 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	624	GLY
1	B	583	LEU
1	C	386	ASP
1	C	395	ALA
1	D	175	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	525/572 (92%)	477 (91%)	48 (9%)	9 31
1	B	516/572 (90%)	455 (88%)	61 (12%)	5 20
1	C	512/572 (90%)	439 (86%)	73 (14%)	3 13
1	D	524/572 (92%)	460 (88%)	64 (12%)	5 19
All	All	2077/2288 (91%)	1831 (88%)	246 (12%)	5 20

5 of 246 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	133	LEU
1	D	479	SER
1	C	363	ASP

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Mol	Chain	Res	Type
1	D	456	THR
1	D	613	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 16 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	441	GLN
1	D	253	ASN
1	C	230	ASN
1	D	76	GLN
1	C	135	ASN

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

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, 95^{th} 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	657/723 (90%)	0.38	26 (3%)	38	25	42, 61, 91, 122	0
1	B	645/723 (89%)	0.36	19 (2%)	51	35	40, 59, 85, 121	0
1	C	640/723 (88%)	0.41	28 (4%)	34	21	44, 67, 102, 132	0
1	D	656/723 (90%)	0.42	36 (5%)	25	15	45, 68, 101, 131	0
All	All	2598/2892 (89%)	0.39	109 (4%)	36	23	40, 64, 96, 132	0

The worst 5 of 109 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	362	TRP	7.2
1	C	385	TYR	5.7
1	A	558	MET	5.6
1	D	723	PHE	5.2
1	C	389	THR	4.9

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, 95^{th} 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	CU	B	801	1/1	0.92	0.11	99,99,99,99	0
2	CU	C	801	1/1	0.92	0.14	109,109,109,109	0
2	CU	A	801	1/1	0.94	0.18	85,85,85,85	0
2	CU	D	801	1/1	0.98	0.12	98,98,98,98	0

6.5 Other polymers (i)

There are no such residues in this entry.