



# wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 01:28 PM UTC

PDB ID : 4UV2 / pdb\_00004uv2  
Title : Structure of the curli transport lipoprotein CsgG in a non-lipidated, pre-pore conformation  
Authors : Goyal, P.; Krasteva, P.V.; Gerven, N.V.; Gubellini, F.; Broeck, I.V.D.; Troupiotis-Tsailaki, A.; Jonckheere, W.; Pehau-Arnaudet, G.; Pinkner, J.S.; Chapman, M.R.; Hultgren, S.J.; Howorka, S.; Fronzes, R.; Remaut, H.  
Deposited on : 2014-08-04  
Resolution : 2.80 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](mailto: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 ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 2.0  
EDS : 3.0  
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)  
CCP4 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

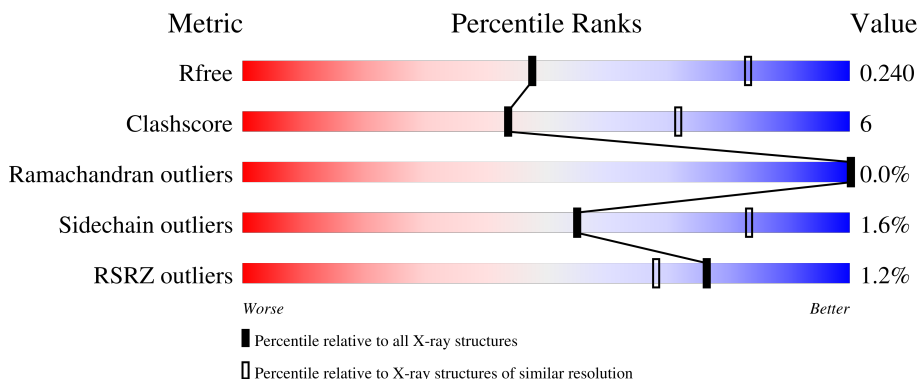
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.80 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))
$R_{free}$	180053	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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  $\geq 3$ , 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  $\leq 5\%$ . 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	262	76% 12% 11%
1	B	262	79% 11% 10%
1	C	262	79% 11% 11%
1	D	262	74% 15% 10%

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Mol	Chain	Length	Quality of chain
1	E	262	<p>% 81% 11% 8%</p>
1	F	262	<p>2% 76% 13% 11%</p>
1	G	262	<p>% 75% 15% 10%</p>
1	H	262	<p>% 69% 20% 10%</p>
1	I	262	<p>% 80% 9% 10%</p>
1	J	262	<p>2% 72% 15% 13%</p>
1	K	262	<p>% 77% 12% 11%</p>
1	L	262	<p>% 76% 12% 11%</p>
1	M	262	<p>% 69% 13% 17%</p>
1	N	262	<p>% 77% 12% 11%</p>
1	O	262	<p>2% 71% 13% 17%</p>
1	P	262	<p>2% 69% 13% 18%</p>

## 2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 28853 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.

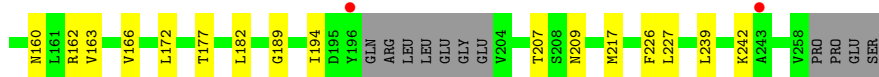
- Molecule 1 is a protein called CURLI PRODUCTION TRANSPORT COMPONENT CSGG.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
1	A	234	Total 1817	C 1151	N 312	O 348	S 1	Se 5	95	0	0
1	B	236	Total 1835	C 1162	N 317	O 350	S 1	Se 5	75	0	0
1	C	234	Total 1817	C 1151	N 312	O 348	S 1	Se 5	41	0	0
1	D	235	Total 1828	C 1157	N 316	O 349	S 1	Se 5	68	0	0
1	E	241	Total 1879	C 1187	N 326	O 360	S 1	Se 5	91	0	0
1	F	234	Total 1821	C 1152	N 315	O 348	S 1	Se 5	115	0	0
1	G	235	Total 1830	C 1157	N 317	O 350	S 1	Se 5	121	0	0
1	H	236	Total 1835	C 1162	N 317	O 350	S 1	Se 5	72	0	0
1	I	235	Total 1828	C 1157	N 316	O 349	S 1	Se 5	117	0	0
1	J	228	Total 1785	C 1131	N 309	O 339	S 1	Se 5	110	0	0
1	K	234	Total 1821	C 1152	N 315	O 348	S 1	Se 5	119	0	0
1	L	234	Total 1821	C 1152	N 315	O 348	S 1	Se 5	119	0	0
1	M	217	Total 1705	C 1079	N 294	O 326	S 1	Se 5	80	0	0
1	N	233	Total 1814	C 1147	N 314	O 347	S 1	Se 5	162	0	0
1	O	218	Total 1714	C 1085	N 296	O 327	S 1	Se 5	92	0	0
1	P	216	Total 1703	C 1080	N 293	O 324	S 1	Se 5	99	0	0

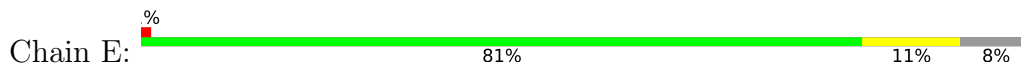
There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	SER	-	expression tag	UNP P0AEA2
B	1	SER	-	expression tag	UNP P0AEA2
C	1	SER	-	expression tag	UNP P0AEA2
D	1	SER	-	expression tag	UNP P0AEA2
E	1	SER	-	expression tag	UNP P0AEA2
F	1	SER	-	expression tag	UNP P0AEA2
G	1	SER	-	expression tag	UNP P0AEA2
H	1	SER	-	expression tag	UNP P0AEA2
I	1	SER	-	expression tag	UNP P0AEA2
J	1	SER	-	expression tag	UNP P0AEA2
K	1	SER	-	expression tag	UNP P0AEA2
L	1	SER	-	expression tag	UNP P0AEA2
M	1	SER	-	expression tag	UNP P0AEA2
N	1	SER	-	expression tag	UNP P0AEA2
O	1	SER	-	expression tag	UNP P0AEA2
P	1	SER	-	expression tag	UNP P0AEA2

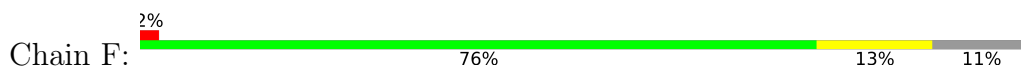




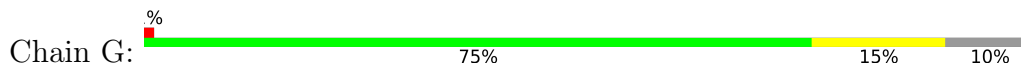
- Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



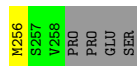
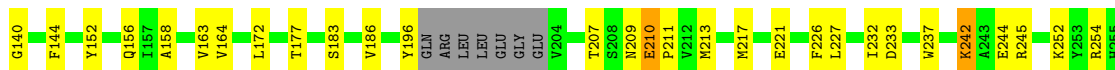
- Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



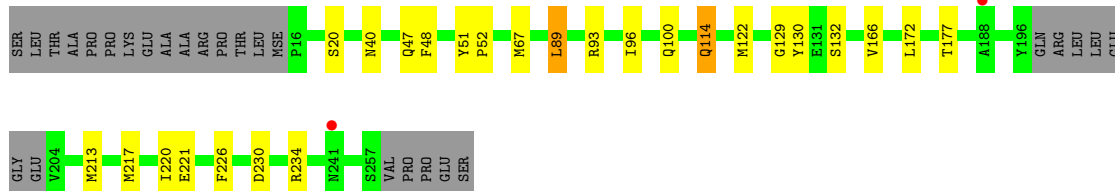
- Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



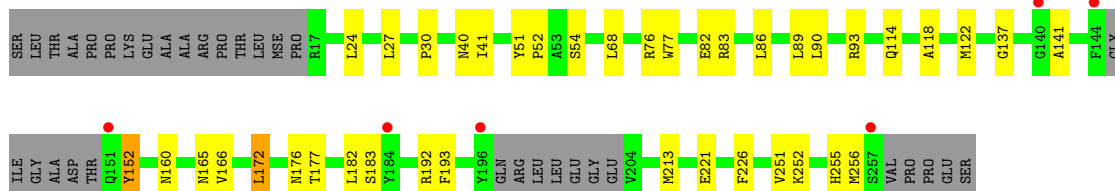
- Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



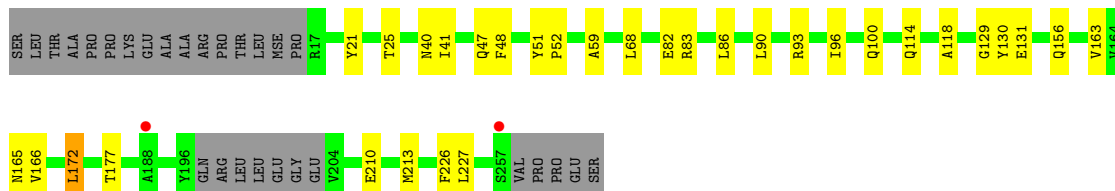
- Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



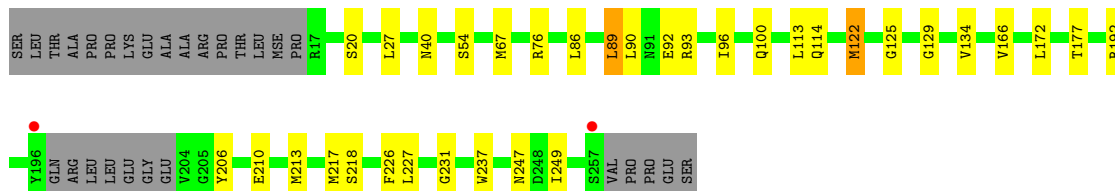
• Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



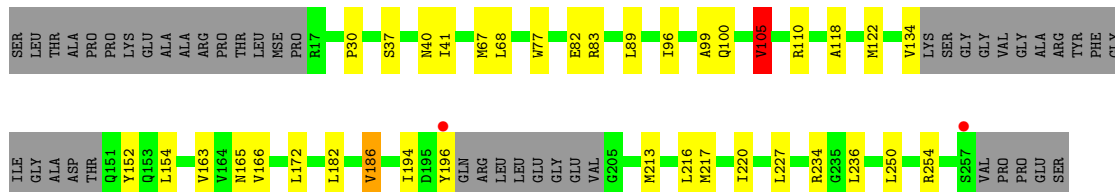
• Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



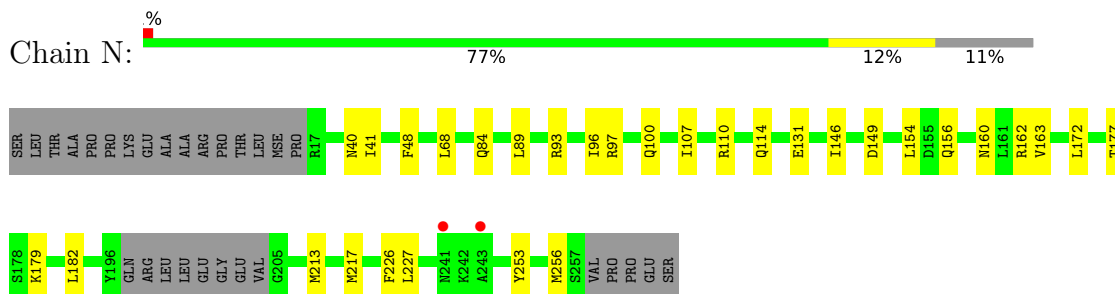
• Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



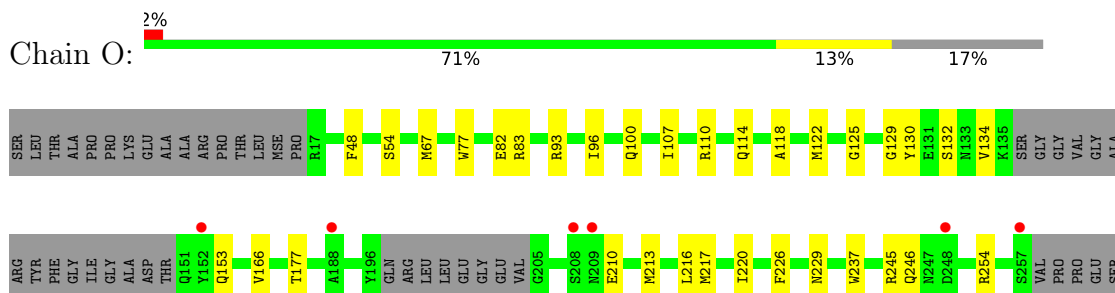
• Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



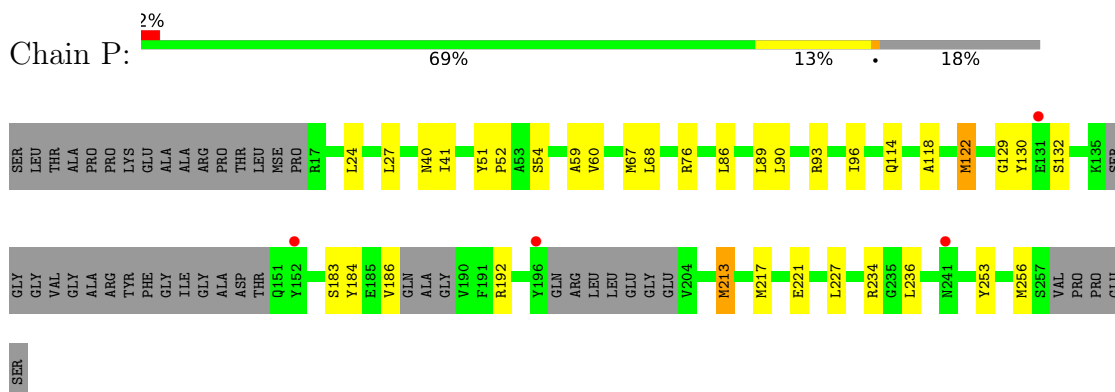
- Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



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- Molecule 1: CURLI PRODUCTION TRANSPORT COMPONENT CSGG



## 4 Data and refinement statistics i

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	101.33Å 103.60Å 141.74Å 111.33° 90.55° 118.21°	Depositor
Resolution (Å)	29.77 – 2.80 29.77 – 2.80	Depositor EDS
% Data completeness (in resolution range)	99.0 (29.77-2.80) 98.9 (29.77-2.80)	Depositor EDS
$R_{merge}$	0.15	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.70 (at 2.80Å)	Xtriage
Refinement program	PHENIX (PHENIX.REFINE)	Depositor
R, $R_{free}$	0.188 , 0.234 0.195 , 0.240	Depositor DCC
$R_{free}$ test set	5624 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	46.8	Xtriage
Anisotropy	0.197	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 61.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.000 for k,-h-k,h+k+1 0.000 for -h-k,h,k+1 0.002 for h,-h-k,-l 0.019 for -h-k,k,-k-l 0.004 for k,h,-h-k-l	Xtriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	28853	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	57.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.11% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  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](#)

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	0.64	0/1842	0.93	3/2491 (0.1%)
1	B	0.66	0/1861	0.92	2/2516 (0.1%)
1	C	0.62	0/1842	0.95	2/2491 (0.1%)
1	D	0.66	1/1853 (0.1%)	0.97	3/2505 (0.1%)
1	E	0.61	0/1905	0.89	0/2575
1	F	0.59	0/1846	0.93	2/2495 (0.1%)
1	G	0.66	0/1855	0.98	1/2507 (0.0%)
1	H	0.66	0/1861	0.94	2/2516 (0.1%)
1	I	0.59	0/1854	0.92	2/2506 (0.1%)
1	J	0.61	0/1809	0.93	2/2443 (0.1%)
1	K	0.61	0/1846	0.94	2/2495 (0.1%)
1	L	0.59	0/1846	0.93	2/2495 (0.1%)
1	M	0.63	1/1727 (0.1%)	0.94	4/2334 (0.2%)
1	N	0.61	0/1839	0.93	2/2485 (0.1%)
1	O	0.63	0/1736	0.93	1/2345 (0.0%)
1	P	0.65	0/1724	0.95	1/2328 (0.0%)
All	All	0.63	2/29246 (0.0%)	0.94	31/39527 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	M	105	VAL	CA-CB	5.08	1.59	1.54
1	D	127	ILE	CA-CB	-5.05	1.48	1.53

The worst 5 of 31 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	40	ASN	N-CA-C	6.80	119.60	110.35
1	F	40	ASN	N-CA-C	6.53	119.23	110.35
1	A	186	VAL	N-CA-C	-6.44	106.68	111.90
1	J	40	ASN	N-CA-C	6.31	118.94	110.35
1	P	40	ASN	N-CA-C	6.27	118.88	110.35

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	1817	0	1823	23	0
1	B	1835	0	1844	18	0
1	C	1817	0	1823	18	0
1	D	1828	0	1836	28	0
1	E	1879	0	1886	19	0
1	F	1821	0	1827	24	0
1	G	1830	0	1835	29	0
1	H	1835	0	1844	39	0
1	I	1828	0	1835	19	0
1	J	1785	0	1793	23	0
1	K	1821	0	1827	22	0
1	L	1821	0	1827	23	0
1	M	1705	0	1712	27	0
1	N	1814	0	1818	23	0
1	O	1714	0	1725	24	0
1	P	1703	0	1717	22	0
All	All	28853	0	28972	329	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 6.

The worst 5 of 329 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:H:28:PRO:HB3	1:H:244:GLU:HG2	1.49	0.95
1:A:122:MSE:HE2	1:A:166:VAL:HG22	1.52	0.90
1:C:122:MSE:HE1	1:D:89:LEU:HA	1.53	0.90
1:O:67:MSE:HE2	1:O:220:ILE:HD12	1.52	0.88
1:M:67:MSE:HE2	1:M:220:ILE:HD12	1.60	0.84

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	230/262 (88%)	228 (99%)	2 (1%)	0	100	100
1	B	232/262 (88%)	229 (99%)	3 (1%)	0	100	100
1	C	230/262 (88%)	228 (99%)	2 (1%)	0	100	100
1	D	231/262 (88%)	227 (98%)	4 (2%)	0	100	100
1	E	239/262 (91%)	234 (98%)	4 (2%)	1 (0%)	30	60
1	F	230/262 (88%)	226 (98%)	4 (2%)	0	100	100
1	G	231/262 (88%)	227 (98%)	4 (2%)	0	100	100
1	H	232/262 (88%)	229 (99%)	3 (1%)	0	100	100
1	I	231/262 (88%)	228 (99%)	3 (1%)	0	100	100
1	J	222/262 (85%)	218 (98%)	4 (2%)	0	100	100
1	K	230/262 (88%)	224 (97%)	6 (3%)	0	100	100
1	L	230/262 (88%)	225 (98%)	5 (2%)	0	100	100
1	M	211/262 (80%)	207 (98%)	4 (2%)	0	100	100
1	N	229/262 (87%)	224 (98%)	5 (2%)	0	100	100
1	O	212/262 (81%)	208 (98%)	4 (2%)	0	100	100
1	P	208/262 (79%)	207 (100%)	1 (0%)	0	100	100
All	All	3628/4192 (86%)	3569 (98%)	58 (2%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	E	196	TYR

### 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	199/217 (92%)	194 (98%)	5 (2%)	42	76
1	B	201/217 (93%)	197 (98%)	4 (2%)	48	80
1	C	199/217 (92%)	198 (100%)	1 (0%)	81	93
1	D	200/217 (92%)	195 (98%)	5 (2%)	42	76
1	E	205/217 (94%)	202 (98%)	3 (2%)	57	84
1	F	199/217 (92%)	194 (98%)	5 (2%)	42	76
1	G	200/217 (92%)	198 (99%)	2 (1%)	68	88
1	H	201/217 (93%)	195 (97%)	6 (3%)	36	72
1	I	200/217 (92%)	197 (98%)	3 (2%)	57	84
1	J	196/217 (90%)	195 (100%)	1 (0%)	81	93
1	K	199/217 (92%)	198 (100%)	1 (0%)	81	93
1	L	199/217 (92%)	195 (98%)	4 (2%)	48	80
1	M	189/217 (87%)	186 (98%)	3 (2%)	55	83
1	N	198/217 (91%)	195 (98%)	3 (2%)	57	84
1	O	190/217 (88%)	189 (100%)	1 (0%)	81	93
1	P	190/217 (88%)	186 (98%)	4 (2%)	47	79
All	All	3165/3472 (91%)	3114 (98%)	51 (2%)	55	83

5 of 51 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	172	LEU
1	K	172	LEU
1	P	186	VAL
1	H	186	VAL
1	I	114	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 29 such sidechains are listed below:

Mol	Chain	Res	Type
1	G	109	ASN
1	P	156	GLN

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Mol	Chain	Res	Type
1	J	40	ASN
1	M	19	GLN
1	I	102	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 oligosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

### 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	229/262 (87%)	-0.23	3 (1%) 75 66	25, 46, 97, 128	26 (11%)
1	B	231/262 (88%)	-0.28	3 (1%) 75 66	17, 46, 87, 101	22 (9%)
1	C	229/262 (87%)	-0.39	1 (0%) 88 84	23, 48, 78, 103	15 (6%)
1	D	230/262 (87%)	-0.22	3 (1%) 75 66	21, 47, 90, 138	22 (9%)
1	E	236/262 (90%)	-0.25	2 (0%) 82 75	26, 49, 83, 104	30 (12%)
1	F	229/262 (87%)	-0.14	4 (1%) 69 60	20, 48, 97, 132	36 (15%)
1	G	230/262 (87%)	-0.13	3 (1%) 75 66	24, 46, 91, 123	36 (15%)
1	H	231/262 (88%)	-0.18	0 100 100	17, 46, 75, 95	29 (12%)
1	I	230/262 (87%)	-0.31	2 (0%) 81 74	22, 47, 81, 106	44 (19%)
1	J	223/262 (85%)	-0.13	6 (2%) 56 46	27, 48, 87, 118	33 (14%)
1	K	229/262 (87%)	-0.21	2 (0%) 81 74	25, 48, 92, 113	36 (15%)
1	L	229/262 (87%)	-0.10	2 (0%) 81 74	25, 54, 92, 116	35 (15%)
1	M	212/262 (80%)	-0.24	2 (0%) 81 74	24, 48, 79, 101	29 (13%)
1	N	228/262 (87%)	-0.09	2 (0%) 81 74	24, 50, 91, 123	53 (23%)
1	O	213/262 (81%)	-0.14	6 (2%) 55 45	21, 47, 88, 105	30 (14%)
1	P	211/262 (80%)	-0.10	4 (1%) 66 57	27, 50, 91, 112	29 (13%)
All	All	3620/4192 (86%)	-0.20	45 (1%) 76 68	17, 48, 89, 138	505 (13%)

The worst 5 of 45 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	149	ASP	3.9
1	F	196	TYR	3.9
1	O	188	ALA	3.4
1	G	241	ASN	3.4
1	J	151	GLN	3.2

## 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 oligosaccharides in this entry.

## 6.4 Ligands [i](#)

There are no ligands in this entry.

## 6.5 Other polymers [i](#)

There are no such residues in this entry.