



wwPDB X-ray Structure Validation Summary Report ⓘ

May 12, 2020 – 11:46 pm BST

PDB ID : 5CDI
Title : Chloroplast chaperonin 60b1 of Chlamydomonas
Authors : Zhang, S.; Zhou, H.; Yu, F.; Gao, F.; He, J.; Liu, C.
Deposited on : 2015-07-04
Resolution : 3.81 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 ⓘ symbol.

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

MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
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)	:	2.11

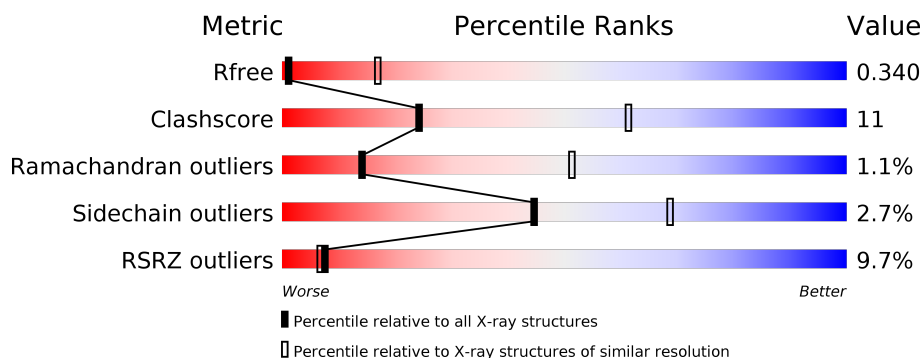
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.81 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	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1212 (4.00-3.60)
Clashscore	141614	1288 (4.00-3.60)
Ramachandran outliers	138981	1243 (4.00-3.60)
Sidechain outliers	138945	1237 (4.00-3.60)
RSRZ outliers	127900	1121 (4.00-3.60)

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 on 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 $\leq 5\%$. 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	552	<div> <div>8%</div> <div> <div></div> <div>69%</div> <div>25%</div> <div>• •</div> </div> </div>
1	B	552	<div> <div>7%</div> <div> <div></div> <div>76%</div> <div>18%</div> <div>• •</div> </div> </div>
1	C	552	<div> <div>7%</div> <div> <div></div> <div>74%</div> <div>21%</div> <div>• •</div> </div> </div>
1	D	552	<div> <div>6%</div> <div> <div></div> <div>73%</div> <div>22%</div> <div>• •</div> </div> </div>
1	E	552	<div> <div>5%</div> <div> <div></div> <div>65%</div> <div>26%</div> <div>• •</div> </div> </div>
1	F	552	<div> <div>6%</div> <div> <div></div> <div>76%</div> <div>18%</div> <div>• •</div> </div> </div>

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Mol	Chain	Length	Quality of chain
1	G	552	<div><div>9%</div><div><div></div><div></div><div></div></div><div>74%</div><div>21%</div><div><div></div><div></div></div></div>
1	H	552	<div><div>9%</div><div><div></div><div></div><div></div></div><div>75%</div><div>20%</div><div><div></div><div></div></div></div>
1	I	552	<div><div>11%</div><div><div></div><div></div><div></div></div><div>74%</div><div>21%</div><div><div></div><div></div></div></div>
1	J	552	<div><div>10%</div><div><div></div><div></div><div></div></div><div>74%</div><div>21%</div><div><div></div><div></div></div></div>
1	K	552	<div><div>12%</div><div><div></div><div></div><div></div></div><div>76%</div><div>19%</div><div><div></div><div></div></div></div>
1	L	552	<div><div>14%</div><div><div></div><div></div><div></div></div><div>75%</div><div>20%</div><div><div></div><div></div></div></div>
1	M	552	<div><div>14%</div><div><div></div><div></div><div></div></div><div>75%</div><div>20%</div><div><div></div><div></div></div></div>
1	N	552	<div><div>11%</div><div><div></div><div></div><div></div></div><div>78%</div><div>17%</div><div><div></div><div></div></div></div>

2 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 55706 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 Chaperonin 60B1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	N	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	B	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	C	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	D	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	E	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	F	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	G	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	H	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	I	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	J	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	K	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	L	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			
1	M	528	Total	C	N	O	S	0	0	0
			3979	2471	696	788	24			

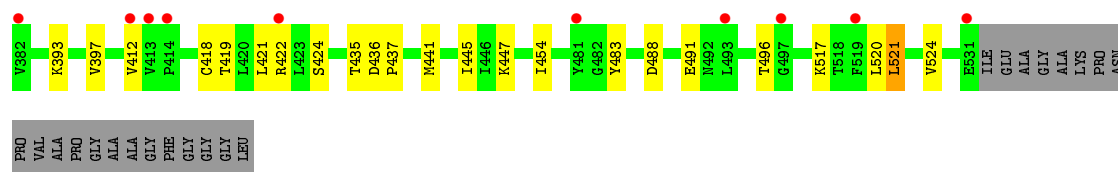
There are 28 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP A8JE91

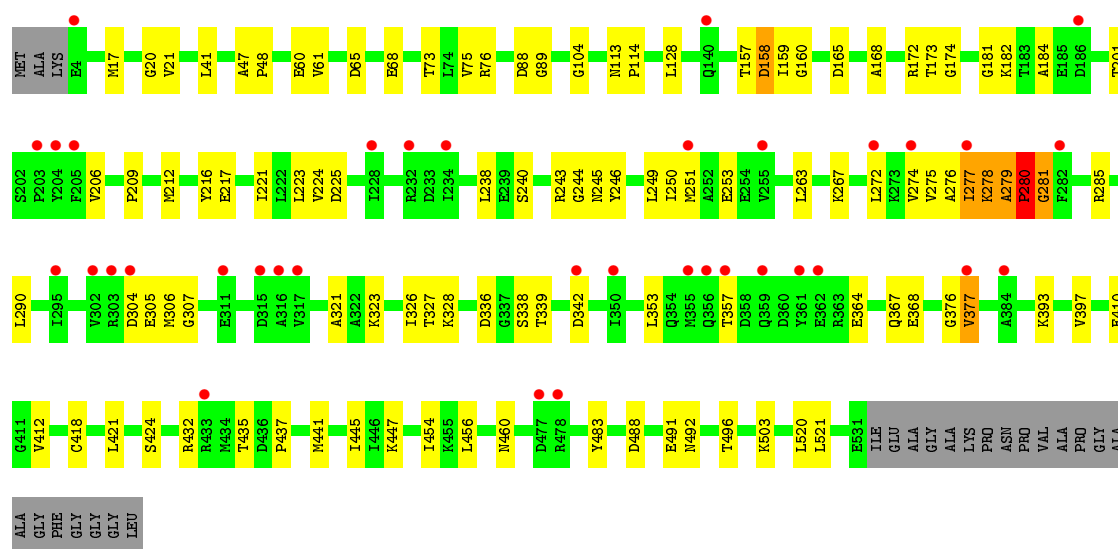
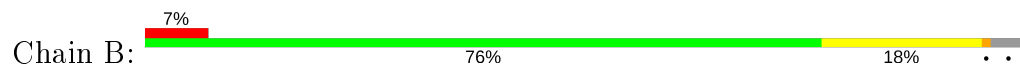
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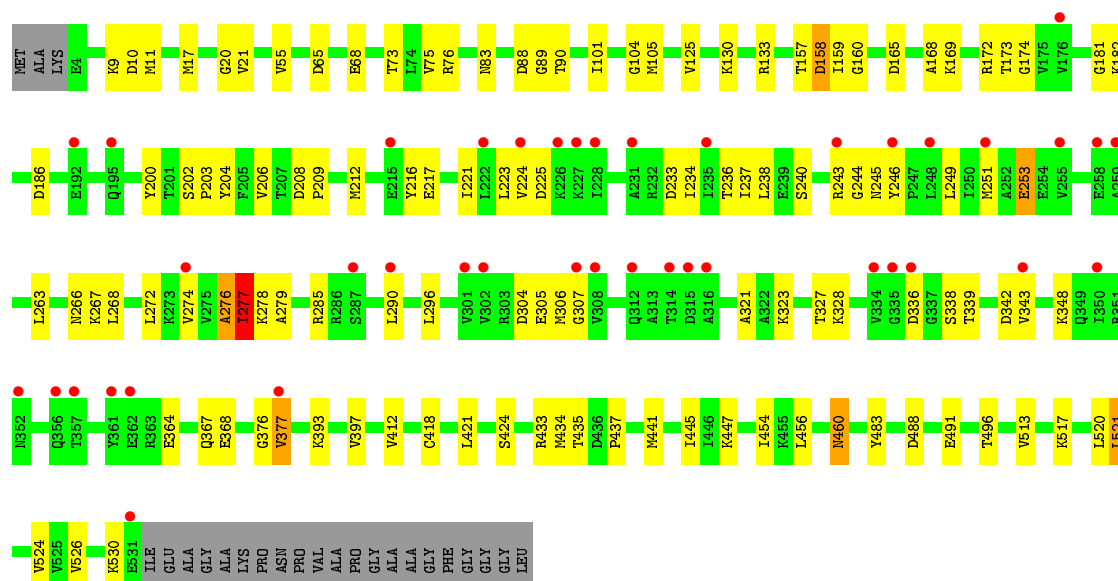
Chain	Residue	Modelled	Actual	Comment	Reference
A	138	VAL	-	see sequence details	UNP A8JE91
N	1	MET	-	expression tag	UNP A8JE91
N	138	VAL	-	see sequence details	UNP A8JE91
B	1	MET	-	expression tag	UNP A8JE91
B	138	VAL	-	see sequence details	UNP A8JE91
C	1	MET	-	expression tag	UNP A8JE91
C	138	VAL	-	see sequence details	UNP A8JE91
D	1	MET	-	expression tag	UNP A8JE91
D	138	VAL	-	see sequence details	UNP A8JE91
E	1	MET	-	expression tag	UNP A8JE91
E	138	VAL	-	see sequence details	UNP A8JE91
F	1	MET	-	expression tag	UNP A8JE91
F	138	VAL	-	see sequence details	UNP A8JE91
G	1	MET	-	expression tag	UNP A8JE91
G	138	VAL	-	see sequence details	UNP A8JE91
H	1	MET	-	expression tag	UNP A8JE91
H	138	VAL	-	see sequence details	UNP A8JE91
I	1	MET	-	expression tag	UNP A8JE91
I	138	VAL	-	see sequence details	UNP A8JE91
J	1	MET	-	expression tag	UNP A8JE91
J	138	VAL	-	see sequence details	UNP A8JE91
K	1	MET	-	expression tag	UNP A8JE91
K	138	VAL	-	see sequence details	UNP A8JE91
L	1	MET	-	expression tag	UNP A8JE91
L	138	VAL	-	see sequence details	UNP A8JE91
M	1	MET	-	expression tag	UNP A8JE91
M	138	VAL	-	see sequence details	UNP A8JE91



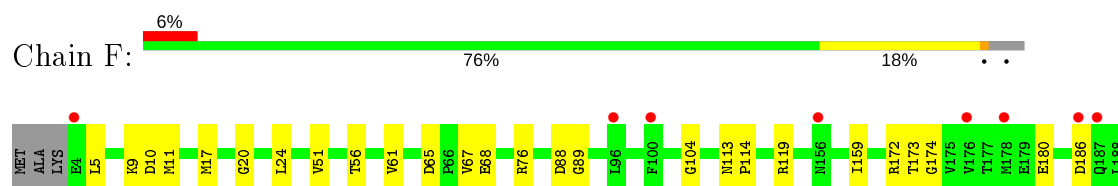
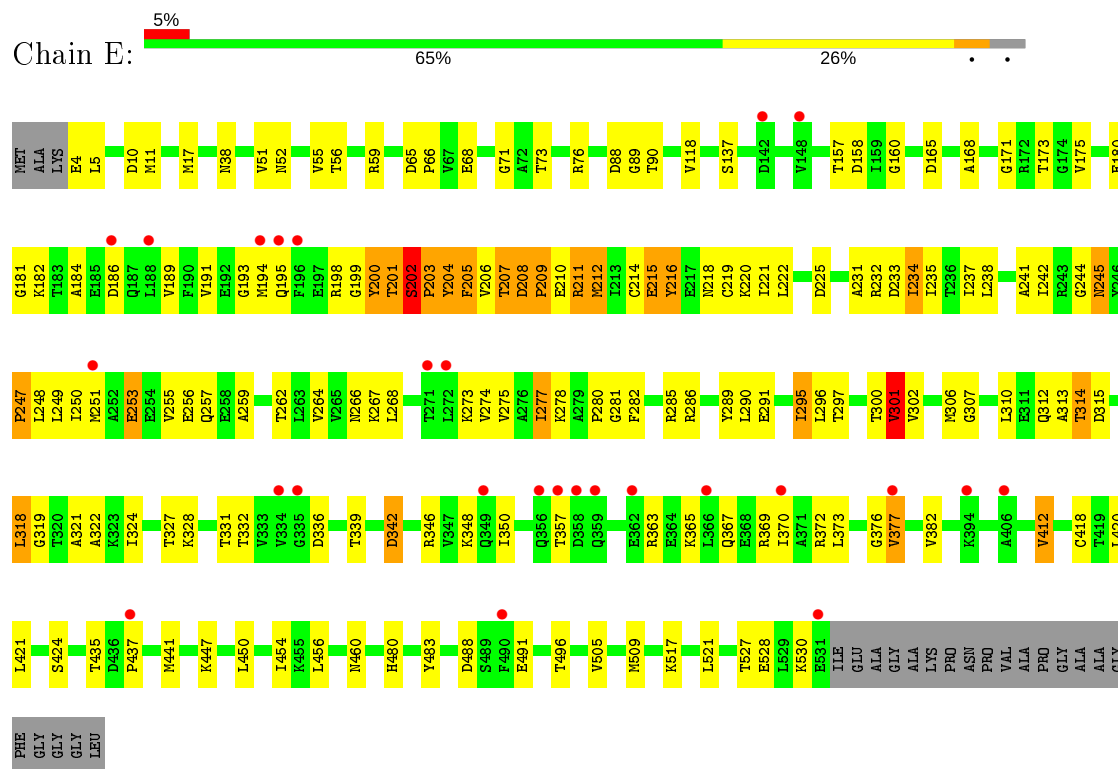
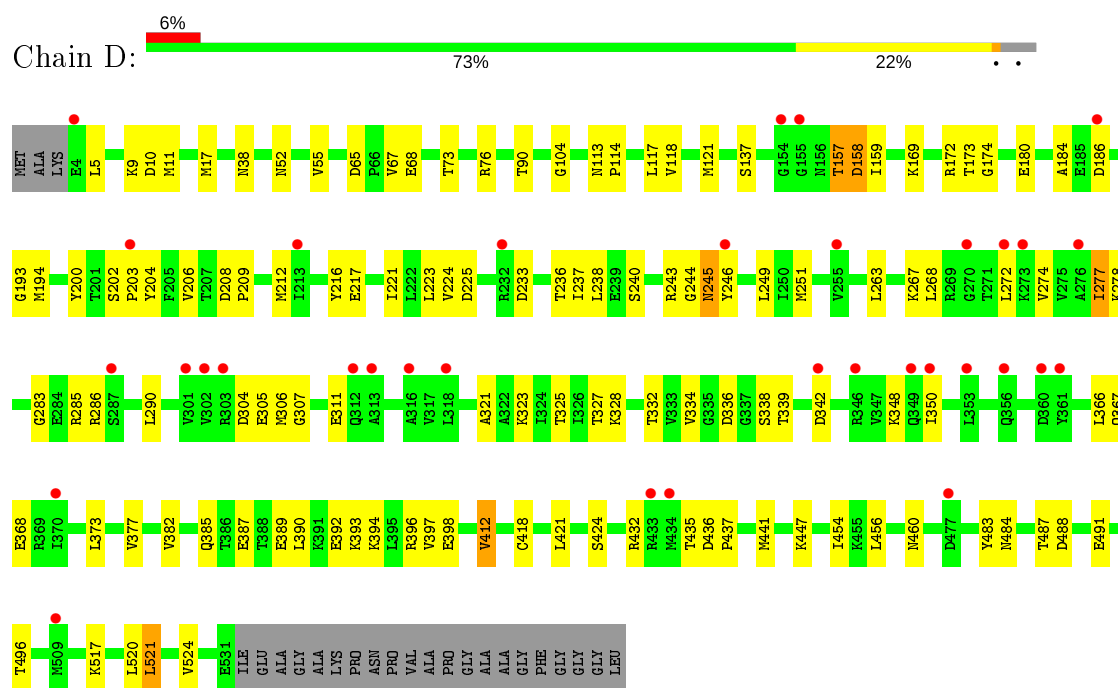
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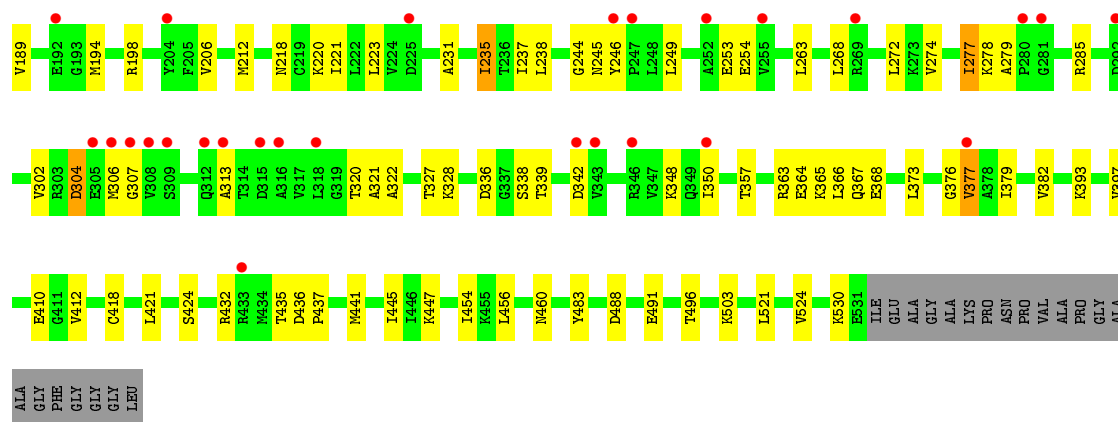


• Molecule 1: Chaperonin 60B1

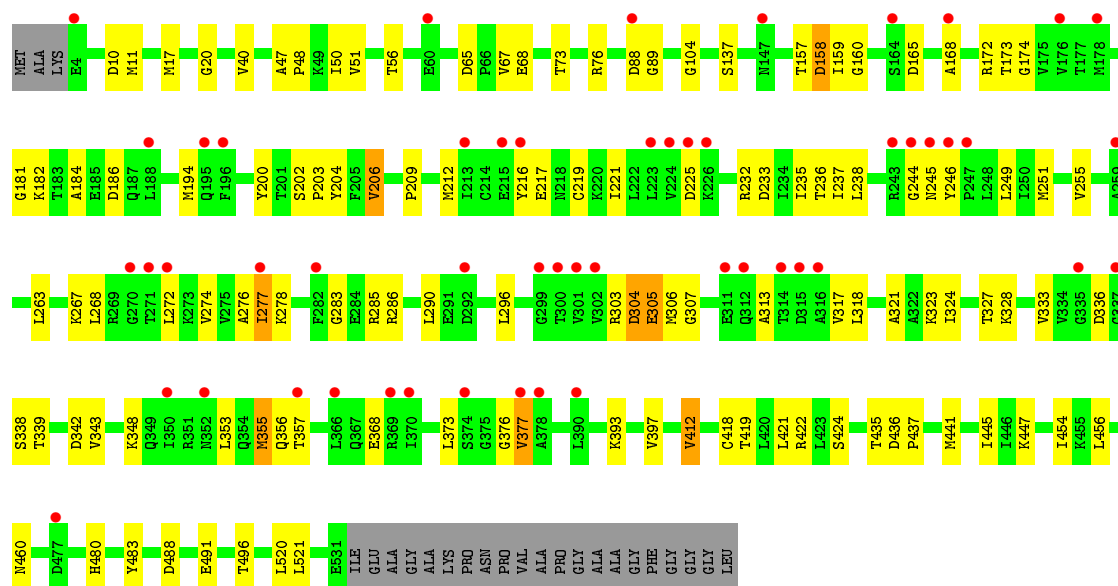
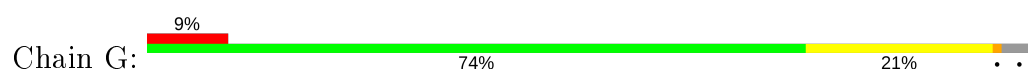


• Molecule 1: Chaperonin 60B1

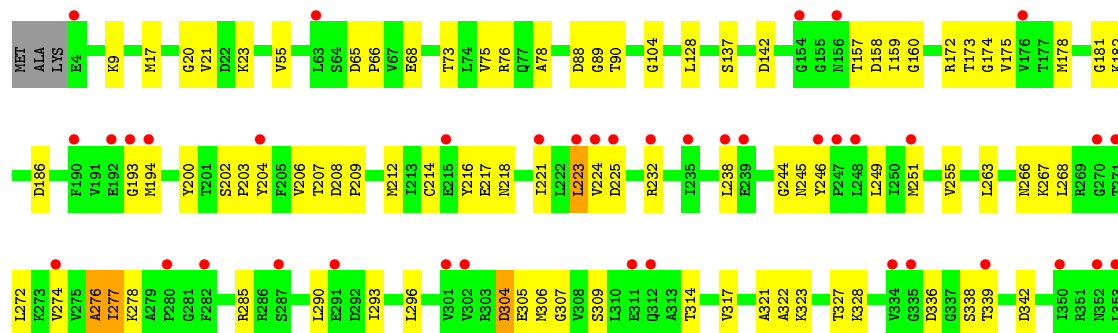
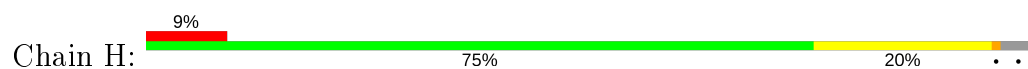




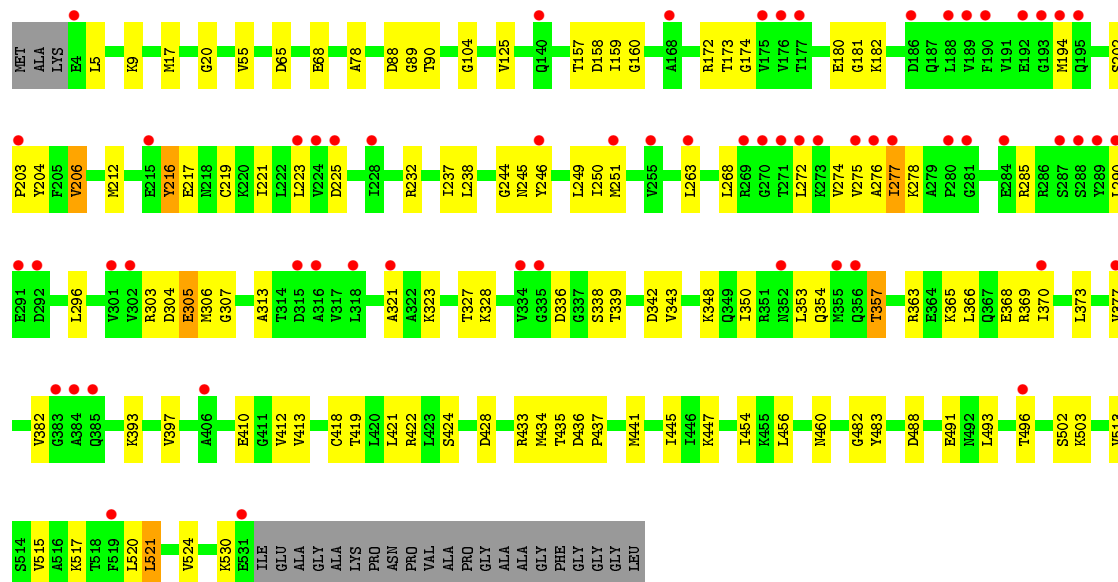
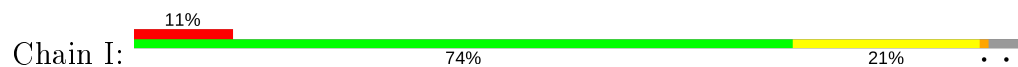
• Molecule 1: Chaperonin 60B1



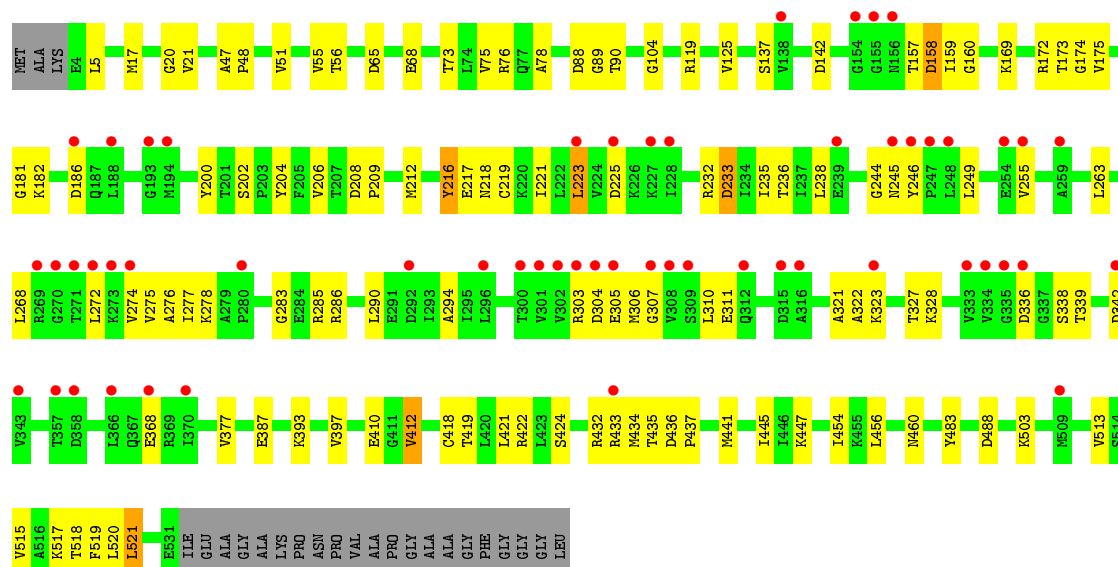
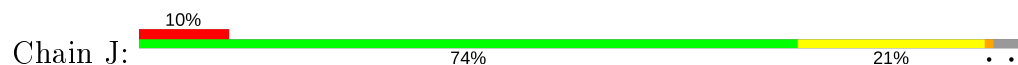
• Molecule 1: Chaperonin 60B1



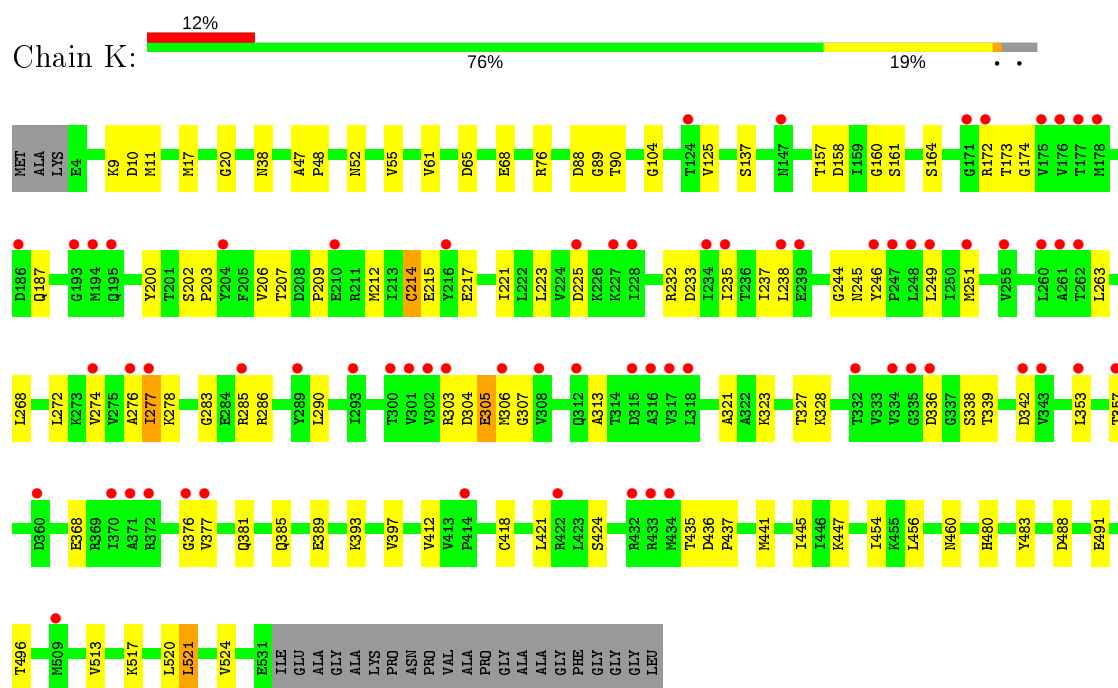
- Molecule 1: Chaperonin 60B1



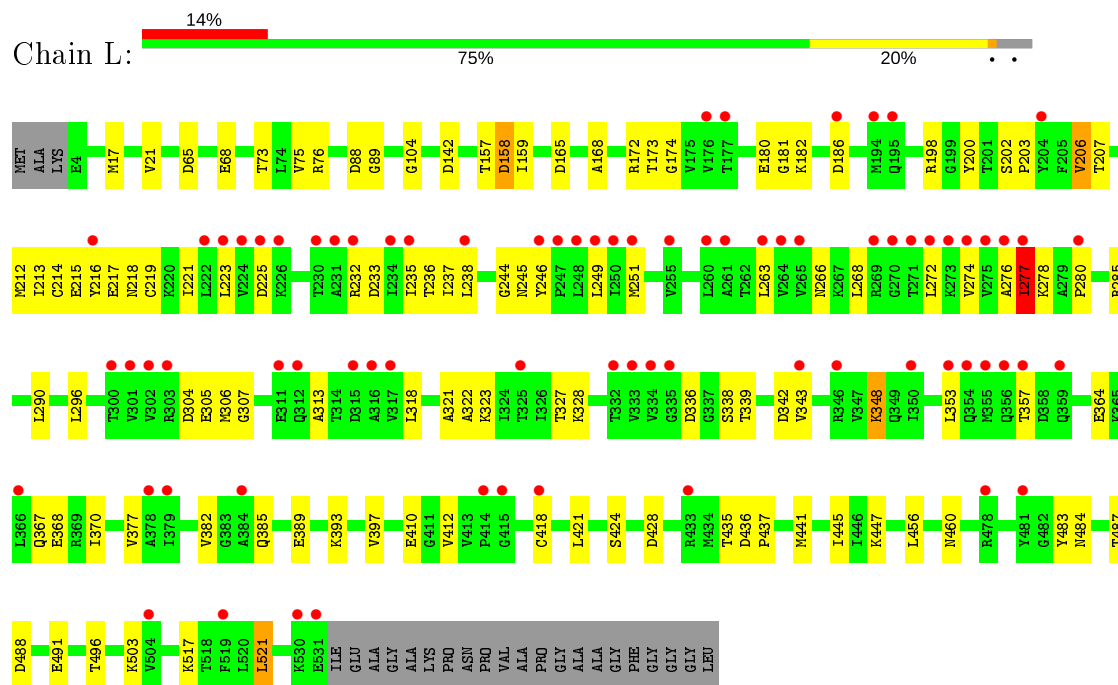
- Molecule 1: Chaperonin 60B1



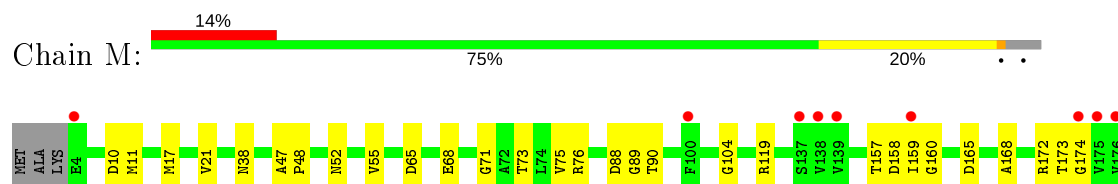
- Molecule 1: Chaperonin 60B1

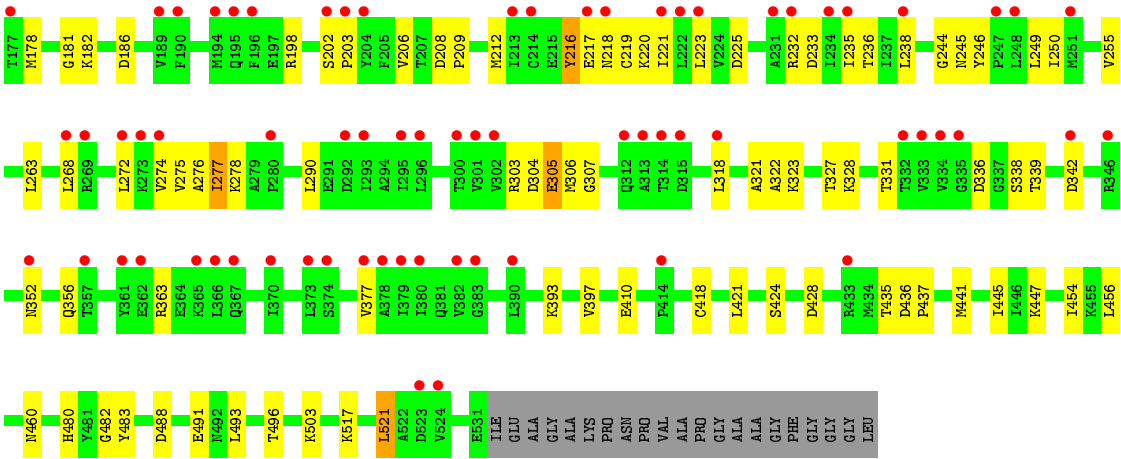


• Molecule 1: Chaperonin 60B1



• Molecule 1: Chaperonin 60B1





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	143.34Å 174.39Å 213.68Å 90.00° 94.69° 90.00°	Depositor
Resolution (Å)	48.66 – 3.81 48.66 – 3.81	Depositor EDS
% Data completeness (in resolution range)	96.7 (48.66-3.81) 85.1 (48.66-3.81)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.77 (at 3.77Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.275 , 0.325 0.296 , 0.340	Depositor DCC
R_{free} test set	2003 reflections (2.01%)	wwPDB-VP
Wilson B-factor (Å ²)	129.8	Xtriage
Anisotropy	0.235	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.27 , 114.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.89	EDS
Total number of atoms	55706	wwPDB-VP
Average B, all atoms (Å ²)	186.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.25% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	0.21	0/4011	0.40	0/5417
1	B	0.25	1/4011 (0.0%)	0.43	1/5417 (0.0%)
1	C	0.25	0/4011	0.44	3/5417 (0.1%)
1	D	0.23	0/4011	0.41	0/5417
1	E	0.32	3/4011 (0.1%)	0.49	4/5417 (0.1%)
1	F	0.23	0/4011	0.41	0/5417
1	G	0.25	1/4011 (0.0%)	0.40	0/5417
1	H	0.23	0/4011	0.43	2/5417 (0.0%)
1	I	0.22	0/4011	0.41	0/5417
1	J	0.24	0/4011	0.40	0/5417
1	K	0.21	0/4011	0.43	1/5417 (0.0%)
1	L	0.22	0/4011	0.41	0/5417
1	M	0.24	0/4011	0.40	0/5417
1	N	0.24	1/4011 (0.0%)	0.41	0/5417
All	All	0.24	6/56154 (0.0%)	0.42	11/75838 (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
1	C	0	1
1	E	0	1
1	L	0	1
All	All	0	4

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	E	377	VAL	C-N	10.25	1.57	1.34
1	N	276	ALA	C-N	-5.80	1.20	1.34

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	G	206	VAL	C-N	-5.68	1.21	1.34
1	E	209	PRO	N-CD	5.45	1.55	1.47
1	B	280	PRO	N-CD	5.40	1.55	1.47

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	276	ALA	O-C-N	-7.55	110.61	122.70
1	H	276	ALA	O-C-N	-6.88	111.69	122.70
1	B	277	ILE	N-CA-C	6.17	127.65	111.00
1	C	277	ILE	O-C-N	-5.72	113.55	122.70
1	K	376	GLY	O-C-N	-5.68	113.61	122.70

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	279	ALA	Peptide
1	C	277	ILE	Mainchain
1	E	202	SER	Peptide
1	L	277	ILE	Mainchain

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	3979	0	4104	88	0
1	B	3979	0	4104	88	0
1	C	3979	0	4103	82	0
1	D	3979	0	4104	94	0
1	E	3979	0	4104	212	0
1	F	3979	0	4104	87	0
1	G	3979	0	4103	82	0
1	H	3979	0	4103	75	0
1	I	3979	0	4104	71	0
1	J	3979	0	4104	81	0
1	K	3979	0	4104	71	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	L	3979	0	4104	71	0
1	M	3979	0	4103	69	0
1	N	3979	0	4103	75	0
All	All	55706	0	57451	1242	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 11.

The worst 5 of 1242 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:E:205:PHE:CE2	1:E:267:LYS:CB	1.85	1.55
1:E:205:PHE:CE2	1:E:267:LYS:HB3	0.97	1.47
1:E:59:ARG:HH22	1:E:212:MET:CE	1.27	1.46
1:E:251:MET:HA	1:E:277:ILE:CG2	1.46	1.46
1:E:277:ILE:HD12	1:E:278:LYS:N	1.27	1.43

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	526/552 (95%)	480 (91%)	40 (8%)	6 (1%)	14	51
1	B	526/552 (95%)	473 (90%)	46 (9%)	7 (1%)	12	48
1	C	526/552 (95%)	479 (91%)	40 (8%)	7 (1%)	12	48
1	D	526/552 (95%)	479 (91%)	42 (8%)	5 (1%)	15	52
1	E	526/552 (95%)	472 (90%)	40 (8%)	14 (3%)	5	35
1	F	526/552 (95%)	480 (91%)	42 (8%)	4 (1%)	19	57
1	G	526/552 (95%)	483 (92%)	37 (7%)	6 (1%)	14	51

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	H	526/552 (95%)	478 (91%)	43 (8%)	5 (1%)	15	52
1	I	526/552 (95%)	482 (92%)	39 (7%)	5 (1%)	15	52
1	J	526/552 (95%)	480 (91%)	42 (8%)	4 (1%)	19	57
1	K	526/552 (95%)	478 (91%)	43 (8%)	5 (1%)	15	52
1	L	526/552 (95%)	478 (91%)	43 (8%)	5 (1%)	15	52
1	M	526/552 (95%)	475 (90%)	47 (9%)	4 (1%)	19	57
1	N	526/552 (95%)	480 (91%)	42 (8%)	4 (1%)	19	57
All	All	7364/7728 (95%)	6697 (91%)	586 (8%)	81 (1%)	14	51

5 of 81 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	158	ASP
1	A	173	THR
1	A	245	ASN
1	N	158	ASP
1	N	173	THR

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	433/445 (97%)	422 (98%)	11 (2%)	47	70
1	B	433/445 (97%)	424 (98%)	9 (2%)	53	74
1	C	433/445 (97%)	424 (98%)	9 (2%)	53	74
1	D	433/445 (97%)	422 (98%)	11 (2%)	47	70
1	E	433/445 (97%)	410 (95%)	23 (5%)	22	54
1	F	433/445 (97%)	422 (98%)	11 (2%)	47	70
1	G	433/445 (97%)	421 (97%)	12 (3%)	43	68
1	H	433/445 (97%)	421 (97%)	12 (3%)	43	68
1	I	433/445 (97%)	420 (97%)	13 (3%)	41	66

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	J	433/445 (97%)	422 (98%)	11 (2%)	47	70
1	K	433/445 (97%)	424 (98%)	9 (2%)	53	74
1	L	433/445 (97%)	420 (97%)	13 (3%)	41	66
1	M	433/445 (97%)	421 (97%)	12 (3%)	43	68
1	N	433/445 (97%)	425 (98%)	8 (2%)	59	77
All	All	6062/6230 (97%)	5898 (97%)	164 (3%)	44	69

5 of 164 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	235	ILE
1	G	435	THR
1	L	521	LEU
1	F	277	ILE
1	G	235	ILE

Some 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 carbohydrates 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 ⓘ

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	528/552 (95%)	0.41	45 (8%) 10 9	64, 175, 274, 319	0
1	B	528/552 (95%)	0.41	36 (6%) 17 13	49, 165, 283, 325	0
1	C	528/552 (95%)	0.40	41 (7%) 13 10	50, 166, 284, 318	0
1	D	528/552 (95%)	0.31	34 (6%) 19 15	55, 153, 262, 292	0
1	E	528/552 (95%)	0.30	26 (4%) 29 25	26, 159, 234, 301	0
1	F	528/552 (95%)	0.41	35 (6%) 18 14	69, 184, 271, 303	0
1	G	528/552 (95%)	0.56	52 (9%) 7 7	55, 193, 280, 315	0
1	H	528/552 (95%)	0.43	48 (9%) 9 7	57, 182, 288, 319	0
1	I	528/552 (95%)	0.54	61 (11%) 4 5	57, 192, 299, 325	0
1	J	528/552 (95%)	0.51	55 (10%) 6 5	84, 203, 315, 369	0
1	K	528/552 (95%)	0.65	68 (12%) 3 4	71, 189, 307, 340	0
1	L	528/552 (95%)	0.70	77 (14%) 2 2	70, 185, 310, 357	0
1	M	528/552 (95%)	0.71	78 (14%) 2 2	81, 207, 326, 366	0
1	N	528/552 (95%)	0.64	60 (11%) 5 5	77, 194, 294, 335	0
All	All	7392/7728 (95%)	0.50	716 (9%) 7 7	26, 178, 296, 369	0

The worst 5 of 716 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	L	302	VAL	18.9
1	C	302	VAL	11.9
1	G	316	ALA	10.4
1	M	362	GLU	9.8
1	L	225	ASP	9.1

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 carbohydrates 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.