



wwPDB X-ray Structure Validation Summary Report

Feb 27, 2014 – 01:22 PM GMT

PDB ID : 1M3X
Title : Photosynthetic Reaction Center From Rhodobacter Sphaeroides
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Deposited on : 2002-07-01
Resolution : 2.55 Å(reported)

This is a wwPDB validation summary report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

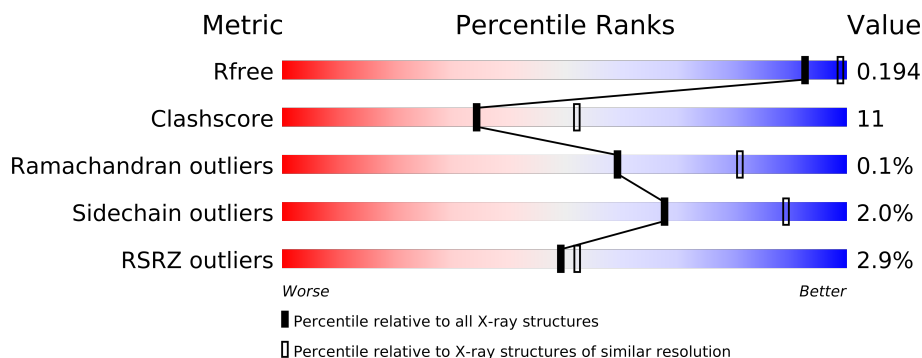
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity	:	4.02b-467
Mogul	:	1.15 2013
Xtriage (Phenix)	:	dev-1323
EDS	:	stable22639
Percentile statistics	:	21963
Refmac	:	5.8.0049
CCP4	:	6.3.0 (Settle)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP)	:	stable22683

1 Overall quality at a glance

The reported resolution of this entry is 2.55 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}	66092	3413 (2.58-2.50)
Clashscore	79885	4284 (2.58-2.50)
Ramachandran outliers	78287	4193 (2.58-2.50)
Sidechain outliers	78261	4195 (2.58-2.50)
RSRZ outliers	66119	3414 (2.58-2.50)

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. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	L	281	
2	M	307	
3	H	260	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
11	PC1	L	901	-	X
12	GGD	M	902	-	X
6	BCL	L	850	-	X
6	BCL	L	851	-	X
6	BCL	L	853	-	X

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Mol	Type	Chain	Res	Geometry	Electron density
6	BCL	M	852	-	X
7	BPH	L	855	-	X
7	BPH	M	854	-	X
8	U10	L	858	-	X
8	U10	M	857	-	X
9	SPO	M	859	-	X

2 Entry composition

There are 13 unique types of molecules in this entry. The entry contains 7323 atoms, of which 0 are hydrogen and 0 are deuterium.

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 Photosynthetic Reaction center protein L chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	L	281	Total	C	N	O	S	0	0	0
			2232	1507	355	362	8			

- Molecule 2 is a protein called Photosynthetic Reaction center protein M chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	M	302	Total	C	N	O	S	0	0	0
			2408	1607	394	397	10			

- Molecule 3 is a protein called Photosynthetic Reaction center protein H chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	H	238	Total	C	N	O	S	0	0	0
			1814	1160	311	334	9			

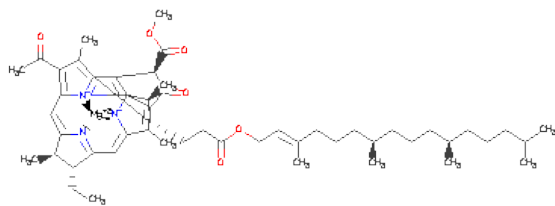
- Molecule 4 is FE (III) ION (three-letter code: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	M	1	Total	Fe	0	0
			1	1		

- Molecule 5 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

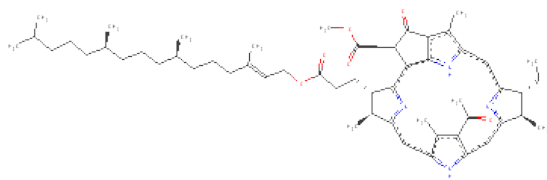
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	M	1	Total	Cl	0	0
			1	1		

- Molecule 6 is BACTERIOCHLOROPHYLL A (three-letter code: BCL) (formula: C₅₅H₇₄MgN₄O₆).



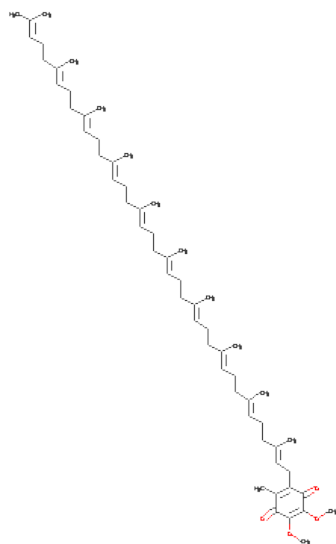
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	L	1	Total	C	Mg	N	O	0	0
			52	41	1	4	6		
6	L	1	Total	C	Mg	N	O	0	0
			66	55	1	4	6		
6	M	1	Total	C	Mg	N	O	0	0
			66	55	1	4	6		
6	L	1	Total	C	Mg	N	O	0	0
			66	55	1	4	6		

- Molecule 7 is BACTERIOPHEOPHYTIN A (three-letter code: BPH) (formula: C₅₅H₇₆N₄O₆).



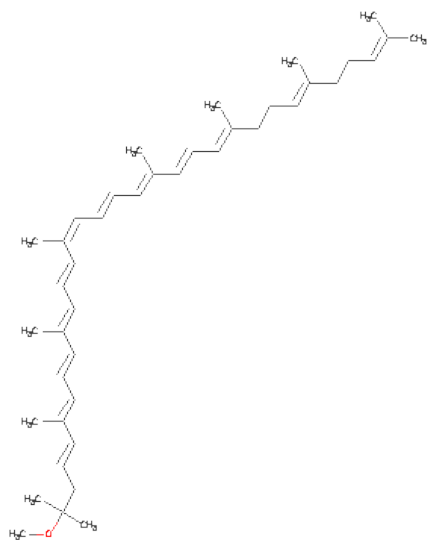
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	M	1	Total	C	N	O	0	0
			65	55	4	6		
7	L	1	Total	C	N	O	0	0
			65	55	4	6		

- Molecule 8 is UBIQUINONE-10 (three-letter code: U10) (formula: C₅₉H₉₀O₄).



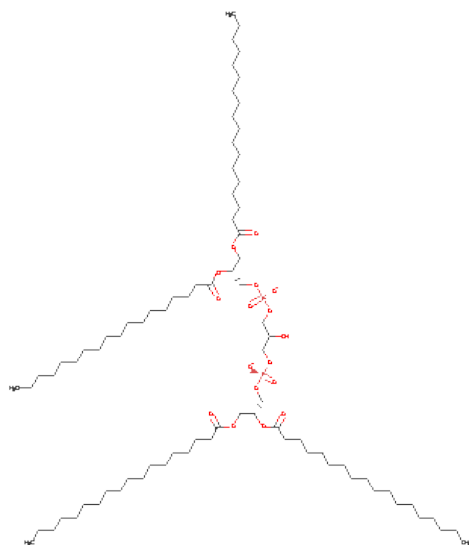
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	M	1	Total	C	O	0	0
			48	44	4		
8	L	1	Total	C	O	0	0
			13	9	4		

- Molecule 9 is SPHEROIDENE (three-letter code: SPO) (formula: C₄₁H₆₀O).



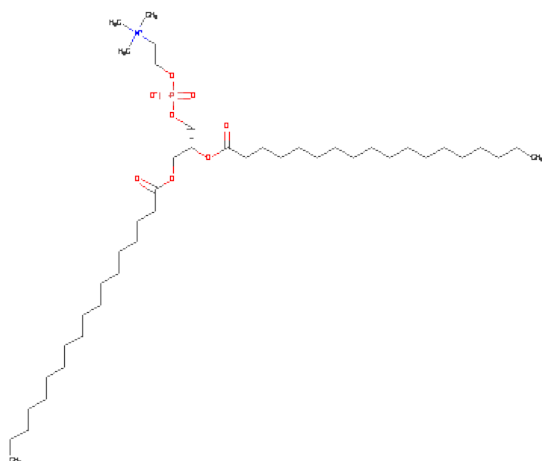
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	M	1	Total	C	O	0	0
			42	41	1		

- Molecule 10 is CARDIOLIPIN (three-letter code: CDL) (formula: $C_{81}H_{156}O_{17}P_2$).



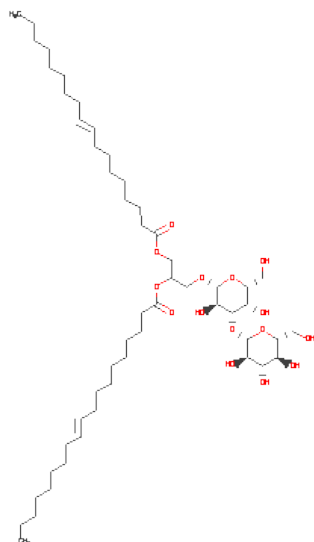
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
10	M	1	Total	C	O	P	0	0
			81	62	17	2		

- Molecule 11 is 1,2-DIACYL-SN-GLYCERO-3-PHOSPHOCHOLINE (three-letter code: PC1) (formula: $C_{44}H_{88}NO_8P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
11	L	1	Total	C	N	O	P	0	0
			43	33	1	8	1		

- Molecule 12 is NONADEC-10-ENOIC ACID 2-[3,4-DIHYDROXY-6-HYDROXYMETHYL L-5-(3,4,5-TRIHYDROXY-6-HYDROXYMETHYL-TETRAHYDRO-PYRAN-2-YLOXY)-TETRAHYDRO-PYRAN-2-YLOXY]-1-OCTADEC-9-ENOYLOXYMETHYL-ETHYL LESTER (three-letter code: GGD) (formula: C₅₂H₉₄O₁₅).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
12	M	1	Total	C	O	0	0
			57	42	15		

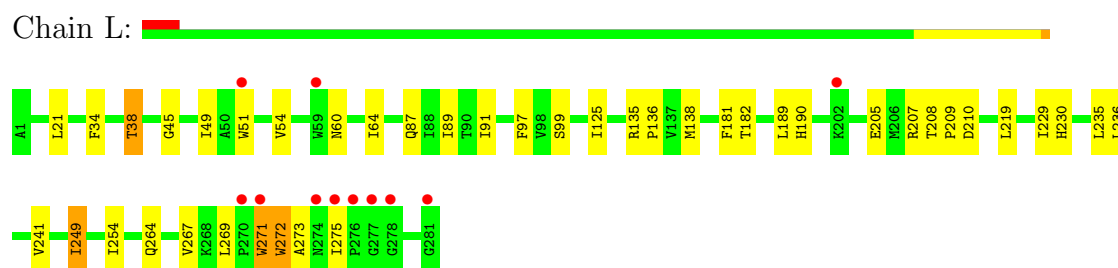
- Molecule 13 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
13	H	72	Total 72	O 72	0	0
13	L	63	Total 63	O 63	0	0
13	M	68	Total 68	O 68	0	0

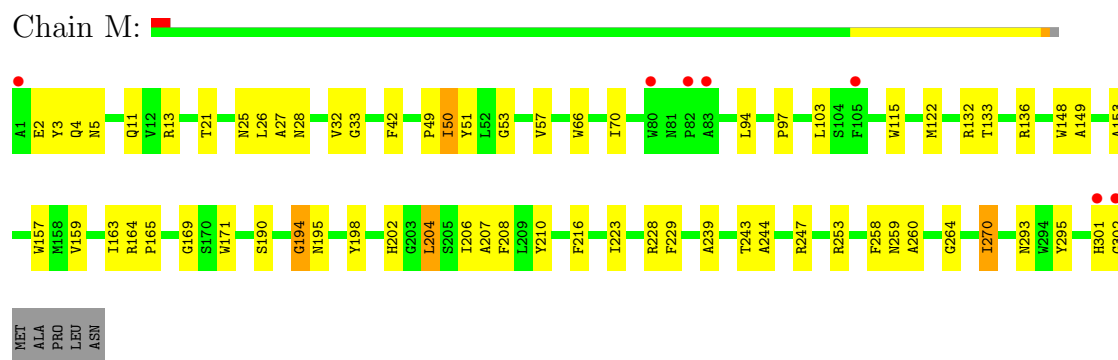
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

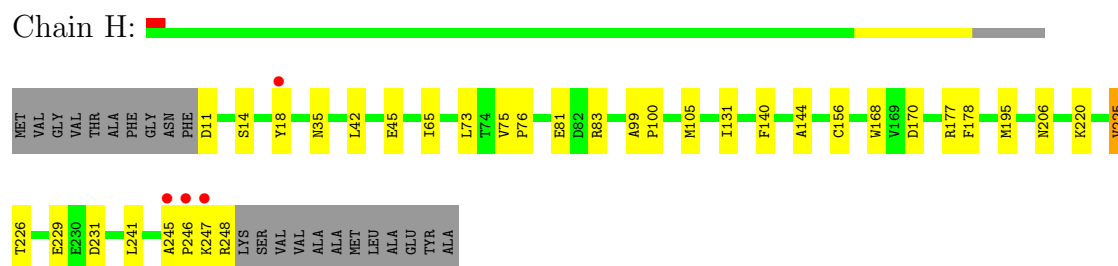
- Molecule 1: Photosynthetic Reaction center protein L chain



- Molecule 2: Photosynthetic Reaction center protein M chain



- Molecule 3: Photosynthetic Reaction center protein H chain



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	141.80Å 141.80Å 187.50Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	29.91 – 2.55 30.84 – 2.55	Depositor EDS
% Data completeness (in resolution range)	96.2 (29.91-2.55) 96.9 (30.84-2.55)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	0.11	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.53 (at 2.54Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.185 , 0.209 0.179 , 0.194	Depositor DCC
R_{free} test set	6974 reflections (11.26%)	DCC
Wilson B-factor (Å ²)	33.4	Xtriage
Anisotropy	0.202	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 52.3	EDS
Estimated twinning fraction	0.016 for -h,-k,l	Xtriage
L-test for twinning	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Outliers	0 of 68925 reflections	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	7323	wwPDB-VP
Average B, all atoms (Å ²)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.67% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: BCL, CL, CDL, BPH, PC1, GGD, FE, SPO, U10

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	L	0.40	0/2320	0.56	0/3175
2	M	0.40	0/2500	0.55	1/3413 (0.0%)
3	H	0.35	0/1862	0.61	0/2534
All	All	0.38	0/6682	0.57	1/9122 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	M	194	GLY	N-CA-C	-5.64	99.00	113.10

There are no chirality outliers.

There are no planarity outliers.

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	L	2232	0	2187	46	0
2	M	2408	0	2321	62	0
3	H	1814	0	1818	34	0
4	M	1	0	0	0	0
5	M	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	L	184	0	191	14	0
6	M	66	0	74	5	0
7	L	65	0	76	6	0
7	M	65	0	76	7	0
8	L	13	0	9	2	0
8	M	48	0	63	4	0
9	M	42	0	60	0	0
10	M	81	0	106	0	0
11	L	43	0	60	8	0
12	M	57	0	65	16	0
13	H	72	0	0	3	0
13	L	63	0	0	1	0
13	M	68	0	0	2	0
All	All	7323	0	7106	154	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 11.

The worst 5 of 154 close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
11:L:901:PC1:C1	11:L:901:PC1:C2	1.74	1.64
11:L:901:PC1:C1	11:L:901:PC1:O11	1.74	1.35
2:M:202:HIS:O	2:M:206:ILE:HD13	1.78	0.84
11:L:901:PC1:C1	11:L:901:PC1:P	2.76	0.74
2:M:207:ALA:CB	12:M:902:GGD:OB3	2.36	0.73

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	L	279/281 (99%)	267 (96%)	12 (4%)	0	100	100
2	M	300/307 (98%)	289 (96%)	10 (3%)	1 (0%)	50	71

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	H	236/260 (91%)	227 (96%)	9 (4%)	0	100	100
All	All	815/848 (96%)	783 (96%)	31 (4%)	1 (0%)	59	81

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	M	301	HIS

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	L	220/220 (100%)	213 (97%)	7 (3%)	51	77
2	M	236/240 (98%)	232 (98%)	4 (2%)	73	92
3	H	193/208 (93%)	191 (99%)	2 (1%)	85	96
All	All	649/668 (97%)	636 (98%)	13 (2%)	68	89

5 of 13 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	L	271	TRP
1	L	272	TRP
2	M	270	ILE
1	L	249	ILE
2	M	216	PHE

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
2	M	4	GLN
2	M	28	ASN
2	M	188	ASN
2	M	259	ASN
2	M	299	GLN

5.3.3 RNA ⓘ

There are no RNA chains in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 14 ligands modelled in this entry, 2 are monoatomic - leaving 12 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	$\# Z > 2$
6	BCL	L	850	2	60,60,74	2.71	14 (23%)	79,98,115	2.17	22 (27%)
6	BCL	L	851	1	74,74,74	1.46	13 (17%)	97,115,115	1.90	25 (25%)
6	BCL	L	853	1	74,74,74	1.55	16 (21%)	97,115,115	2.26	27 (27%)
7	BPH	L	855	-	70,70,70	1.39	8 (11%)	94,101,101	2.01	21 (22%)
8	U10	L	858	-	11,13,63	1.79	3 (27%)	13,18,79	1.20	1 (7%)
11	PC1	L	901	-	42,42,53	2.92	14 (33%)	50,50,61	2.12	14 (28%)
6	BCL	M	852	2	74,74,74	1.41	10 (13%)	97,115,115	1.88	22 (22%)
7	BPH	M	854	-	70,70,70	1.49	6 (8%)	94,101,101	1.94	19 (20%)
8	U10	M	857	-	48,48,63	2.27	15 (31%)	59,61,79	2.38	22 (37%)
9	SPO	M	859	-	41,41,41	3.53	26 (63%)	50,50,50	2.90	17 (34%)
10	CDL	M	900	-	80,80,99	1.31	6 (7%)	92,92,111	1.01	6 (6%)
12	GGD	M	902	-	57,58,68	2.86	20 (35%)	71,72,82	4.38	35 (49%)

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
6	BCL	L	850	2	-	0/25/121/137	0/0/9/9
6	BCL	L	851	1	-	0/41/137/137	0/0/9/9
6	BCL	L	853	1	-	0/41/137/137	0/0/9/9
7	BPH	L	855	-	2/2/18/22	0/49/105/105	0/0/6/6
8	U10	L	858	-	-	0/4/24/87	0/1/1/1
11	PC1	L	901	-	-	0/46/46/57	0/0/0/0
6	BCL	M	852	2	-	0/41/137/137	0/0/9/9
7	BPH	M	854	-	2/2/18/22	0/49/105/105	0/0/6/6
8	U10	M	857	-	-	0/45/69/87	0/1/1/1
9	SPO	M	859	-	-	0/47/47/47	0/0/0/0
10	CDL	M	900	-	1/1/9/9	0/91/91/110	0/0/0/0
12	GGD	M	902	-	-	1/47/87/97	0/2/2/2

The worst 5 of 151 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	L	850	BCL	C6-C5	-16.88	1.48	1.55
12	M	902	GGD	OC6-CC4	-12.20	1.16	1.46
9	M	859	SPO	C15-C16	8.96	1.58	1.34
11	L	901	PC1	C1-C2	8.60	1.74	1.50
12	M	902	GGD	OA1-CC3	7.70	1.58	1.43

The worst 5 of 231 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
12	M	902	GGD	CB1-OB1-CA3	18.73	165.77	117.99
12	M	902	GGD	OA1-CC3-CC4	16.66	150.62	110.99
9	M	859	SPO	C25-C23-C22	-11.39	101.47	118.97
6	L	853	BCL	CAA-C2A-C1A	-9.50	87.93	111.62
12	M	902	GGD	CC4-OC6-CC5	9.25	140.74	117.92

All (5) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
10	M	900	CDL	CA4
7	M	854	BPH	C8
7	M	854	BPH	C13
7	L	855	BPH	C8
7	L	855	BPH	C13

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
12	M	902	GGD	CA1-OA1-CC3-CC4

There are no ring outliers.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues

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	L	281/281 (100%)	-0.45	11 (3%) 37 40	15, 29, 64, 80	0
2	M	302/307 (98%)	-0.29	7 (2%) 57 61	13, 34, 67, 79	0
3	H	238/260 (91%)	-0.45	4 (1%) 67 70	20, 33, 53, 80	0
All	All	821/848 (96%)	-0.39	22 (2%) 49 55	13, 32, 64, 80	0

The worst 5 of 22 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	M	1	ALA	5.7
3	H	18	TYR	5.0
1	L	281	GLY	4.5
2	M	302	GLY	4.5
1	L	59	TRP	4.4

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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	RSR	LLDF	B-factors(\AA^2)	Q<0.9
8	U10	L	858	13/63	0.47	16.03	55,56,57,59	13
12	GGD	M	902	57/67	0.37	9.72	66,79,80,80	0
11	PC1	L	901	43/54	0.41	7.42	65,79,80,80	0
7	BPH	M	854	65/65	0.20	3.90	30,35,80,80	0
8	U10	M	857	48/63	0.21	3.30	27,39,67,68	0
6	BCL	L	850	52/66	0.18	3.05	23,28,54,56	0
6	BCL	L	853	66/66	0.18	2.77	11,17,52,59	0
7	BPH	L	855	65/65	0.16	2.61	18,23,33,43	0
9	SPO	M	859	42/42	0.25	2.37	34,47,65,68	0
6	BCL	L	851	66/66	0.16	2.34	16,23,36,44	0
6	BCL	M	852	66/66	0.17	2.07	19,24,56,69	0
10	CDL	M	900	81/100	0.19	1.35	55,67,78,80	0
5	CL	M	2000	1/1	0.30	0.96	80,80,80,80	0
4	FE	M	856	1/1	0.05	-3.72	18,18,18,18	0

6.5 Other polymers ⓘ

There are no such residues in this entry.