wwPDB X-ray Structure Validation Summary Report (i)

Jan 31, 2016 – 08:56 PM GMT

PDB ID	:	1MPS
Title	:	PHOTOSYNTHETIC REACTION CENTER MUTANT WITH PHE M 197 REPLACED WITH ARG AND TYR M 177 REPLACED WITH PHE (CHAIN M, Y177F, F197R)
Authors	:	Mcauley-Hecht, K.E.; Fyfe, P.K.; Ridge, J.P.; Prince, S.; Hunter, C.N.; Isaacs, N.W.; Cogdell, R.J.; Jones, M.R.
Deposited on	:	1998-03-09
Resolution	:	2.55 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
http://wwpdb.org/validation/2016/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:

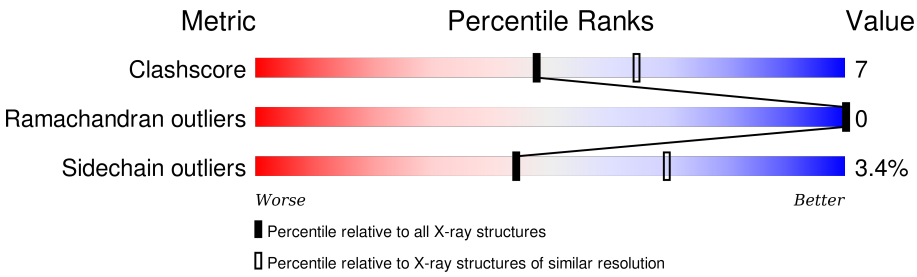
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

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 2.55 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))
Clashscore	102246	5292 (2.58-2.50)
Ramachandran outliers	100387	5194 (2.58-2.50)
Sidechain outliers	100360	5196 (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. 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.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	L	281	84% 15% •
2	M	307	82% 16% • •
3	H	260	77% 14% • 8%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
6	BCL	L	302	X	-	-	-

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Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
6	BCL	M	802	X	-	-	-
7	BPH	L	401	X	-	-	-
7	BPH	L	402	X	-	-	-

2 Entry composition (i)

There are 11 unique types of molecules in this entry. The entry contains 7155 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 PHOTOSYNTHETIC REACTION CENTER.

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

- Molecule 2 is a protein called PHOTOSYNTHETIC REACTION CENTER.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	M	302	2407	1604	397	396	10	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
M	177	PHE	TYR	ENGINEERED MUTATION	UNP P02953
M	197	ARG	PHE	ENGINEERED MUTATION	UNP P02953

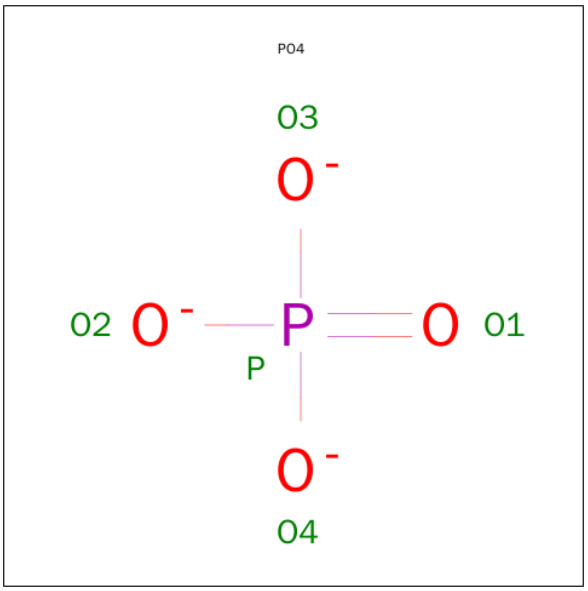
- Molecule 3 is a protein called PHOTOSYNTHETIC REACTION CENTER.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	H	240	1829	1169	314	337	9	0	0	0

- Molecule 4 is FE (II) ION (three-letter code: FE2) (formula: Fe).

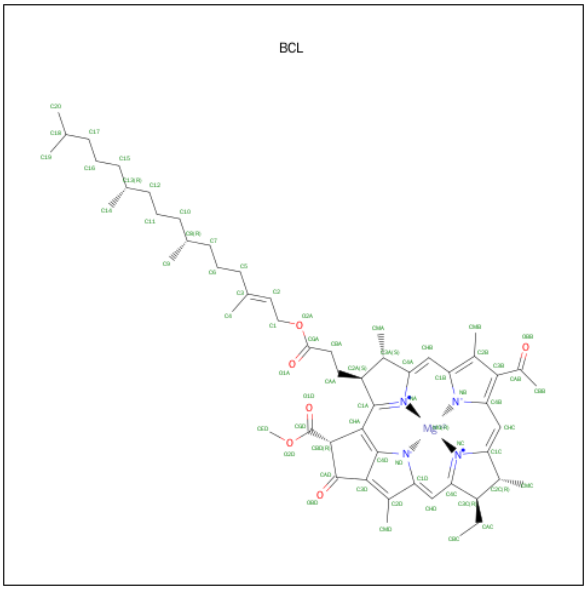
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Fe		
4	M	1	1	1	0	0

- Molecule 5 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	P		
5	M	1	5	4	1	0	0

- Molecule 6 is BACTERIOCHLOROPHYLL A (three-letter code: BCL) (formula: $C_{55}H_{74}MgN_4O_6$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Mg	N	O		
6	M	1	66	55	1	4	6	17	0
			Total	C	Mg	N	O		
6	L	1	66	55	1	4	6	0	0
			Total	C	Mg	N	O		
6	M	1	66	55	1	4	6	0	0

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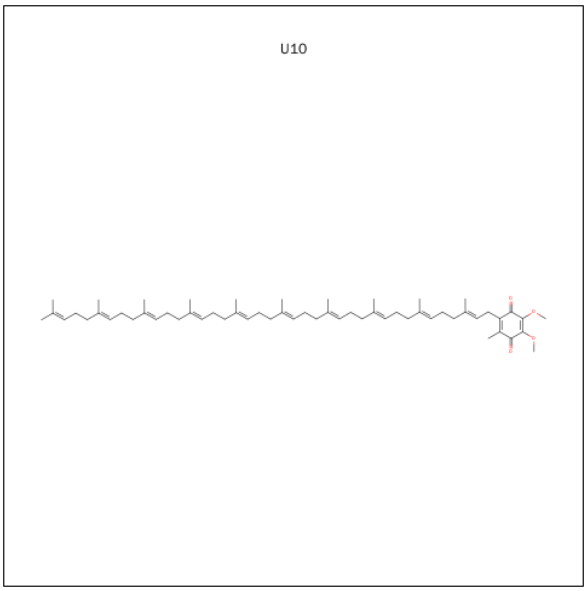
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Mg	N	O		
6	L	1	66	55	1	4	6	0	0

- Molecule 7 is BACTERIOPHEOPHYTIN A (three-letter code: BPH) (formula: $C_{55}H_{76}N_4O_6$).

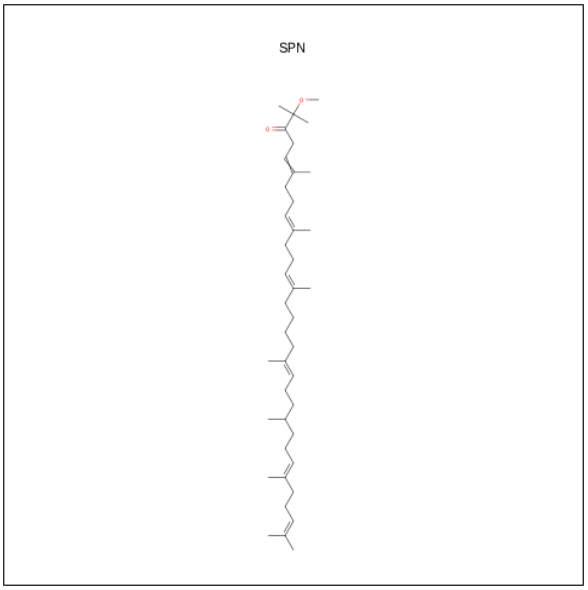
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
7	L	1	65	55	4	6	17	0
			Total	C	N	O		
7	L	1	65	55	4	6	0	0

- Molecule 8 is UBIQUINONE-10 (three-letter code: U10) (formula: $C_{59}H_{90}O_4$).



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

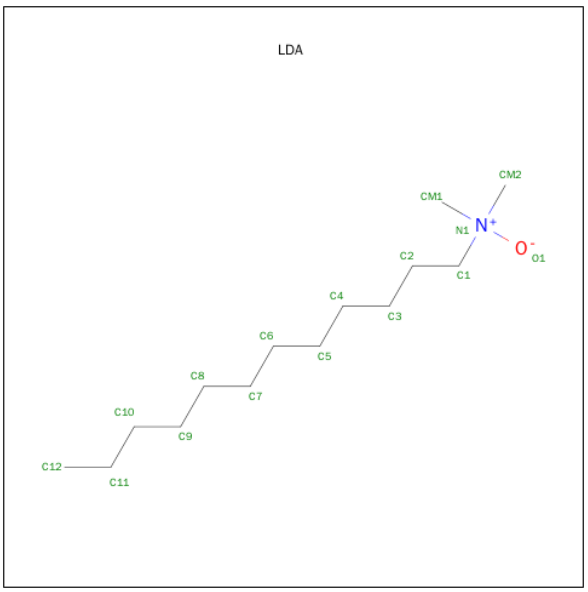
- Molecule 9 is SPEROIDENONE (three-letter code: SPN) (formula: $C_{41}H_{70}O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
9	M	1	43	41	2	11	0

- Molecule 10 is LAURYL DIMETHYLAMINE-N-OXIDE (three-letter code: LDA) (formula:

$C_{14}H_{31}NO$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
10	M	1	Total	C	N	O	0	0
			16	14	1	1		
10	M	1	Total	C	N	O	0	0
			16	14	1	1		
10	M	1	Total	C	N	O	0	0
			16	14	1	1		

- Molecule 11 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
11	H	37	Total	O	0	0
			37	37		
11	L	28	Total	O	0	0
			28	28		
11	M	35	Total	O	0	0
			35	35		

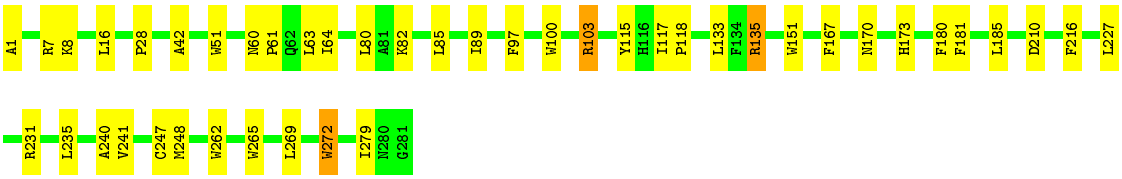
3 Residue-property plots (i)

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.

Note EDS was not executed.

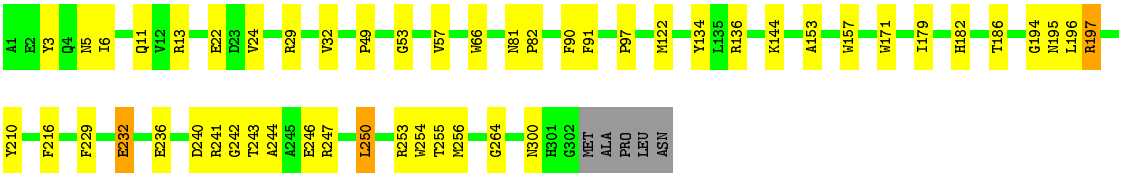
- Molecule 1: PHOTOSYNTHETIC REACTION CENTER

Chain L:



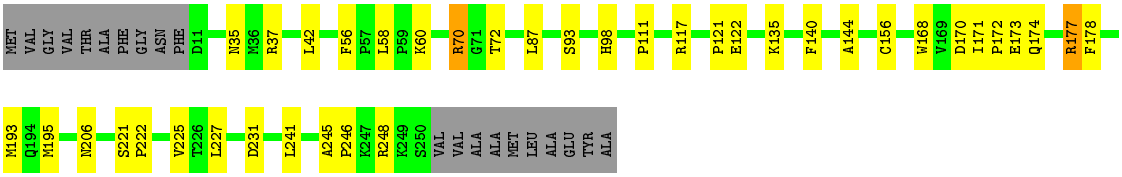
- Molecule 2: PHOTOSYNTHETIC REACTION CENTER

Chain M:



- Molecule 3: PHOTOSYNTHETIC REACTION CENTER

Chain H:



4 Data and refinement statistics (i)

Xtriage (Phenix) and EDS were not executed - this section will therefore be incomplete.

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α, β, γ	141.90Å 141.90Å 187.90Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	11.00 – 2.55	Depositor
% Data completeness (in resolution range)	76.5 (11.00-2.55)	Depositor
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.194 , 0.217	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	7155	wwPDB-VP
Average B, all atoms (Å^2)	39.0	wwPDB-VP

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: BCL, LDA, BPH, PO4, FE2, SPN, 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	0.41	0/2320	0.56	0/3175
2	M	0.40	0/2498	0.53	0/3409
3	H	0.37	0/1877	0.64	2/2553 (0.1%)
All	All	0.40	0/6695	0.57	2/9137 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	H	195	MET	CG-SD-CE	5.78	109.44	100.20
3	H	193	MET	CG-SD-CE	5.30	108.69	100.20

There are no chirality outliers.

There are no planarity outliers.

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	L	2232	0	2187	34	0
2	M	2407	0	2325	42	0
3	H	1829	0	1836	26	0
4	M	1	0	0	0	0
5	M	5	0	0	0	0
6	L	132	0	148	9	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	M	132	0	148	8	0
7	L	130	0	152	15	0
8	L	48	0	63	0	0
8	M	48	0	63	3	0
9	M	43	0	69	1	0
10	M	48	0	93	2	0
11	H	37	0	0	3	0
11	L	28	0	0	1	0
11	M	35	0	0	1	0
All	All	7155	0	7084	103	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 7.

The worst 5 of 103 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:L:241:VAL:HG21	7:L:402:BPH:HAC2	1.61	0.83
7:L:402:BPH:HHC	7:L:402:BPH:HBB3	1.65	0.78
2:M:242:GLY:HA2	3:H:117:ARG:HD2	1.68	0.76
7:L:401:BPH:HHC	7:L:401:BPH:HBB3	1.67	0.76
2:M:253:ARG:HD3	11:M:829:HOH:O	1.88	0.73

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	L	279/281 (99%)	267 (96%)	12 (4%)	0	100 100
2	M	300/307 (98%)	288 (96%)	12 (4%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	H	238/260 (92%)	229 (96%)	9 (4%)	0	100	100
All	All	817/848 (96%)	784 (96%)	33 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	L	220/220 (100%)	211 (96%)	9 (4%)	37	61
2	M	236/240 (98%)	229 (97%)	7 (3%)	48	74
3	H	195/208 (94%)	189 (97%)	6 (3%)	47	73
All	All	651/668 (98%)	629 (97%)	22 (3%)	44	70

5 of 22 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	M	22	GLU
2	M	216	PHE
3	H	225	VAL
2	M	182	HIS
2	M	197	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 7 such sidechains are listed below:

Mol	Chain	Res	Type
1	L	264	GLN
3	H	98	HIS
2	M	299	GLN
1	L	159	ASN
2	M	300	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 carbohydrates in this entry.

5.6 Ligand geometry (i)

Of 14 ligands modelled in this entry, 1 is monoatomic - leaving 13 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	302	1	53,74,74	1.26	5 (9%)	57,115,115	1.79	11 (19%)
6	BCL	L	304	1	53,74,74	1.07	4 (7%)	57,115,115	2.04	9 (15%)
7	BPH	L	401	-	64,70,70	1.12	4 (6%)	73,101,101	1.88	11 (15%)
7	BPH	L	402	-	64,70,70	1.15	4 (6%)	73,101,101	1.76	10 (13%)
8	U10	L	502	-	48,48,63	1.90	12 (25%)	58,61,79	1.20	5 (8%)
8	U10	M	501	-	48,48,63	1.97	16 (33%)	58,61,79	1.04	5 (8%)
9	SPN	M	600	-	41,42,42	4.25	20 (48%)	41,52,52	2.50	20 (48%)
10	LDA	M	701	-	15,15,15	4.99	3 (20%)	16,17,17	0.71	0
10	LDA	M	702	-	15,15,15	4.11	4 (26%)	16,17,17	0.64	0
10	LDA	M	703	-	15,15,15	4.12	4 (26%)	16,17,17	0.59	0
5	PO4	M	800	-	4,4,4	1.35	0	6,6,6	0.28	0
6	BCL	M	801	2	53,74,74	1.24	4 (7%)	57,115,115	2.08	12 (21%)
6	BCL	M	802	2	53,74,74	1.21	4 (7%)	57,115,115	1.95	11 (19%)

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	302	1	1/1/21/25	0/37/137/137	0/0/9/9
6	BCL	L	304	1	-	0/37/137/137	0/0/9/9
7	BPH	L	401	-	2/2/18/22	0/54/105/105	0/1/6/6
7	BPH	L	402	-	1/1/18/22	0/54/105/105	0/1/6/6
8	U10	L	502	-	-	0/45/69/87	0/1/1/1
8	U10	M	501	-	-	0/45/69/87	0/1/1/1
9	SPN	M	600	-	-	0/50/51/51	0/0/0/0
10	LDA	M	701	-	-	0/13/13/13	0/0/0/0
10	LDA	M	702	-	-	0/13/13/13	0/0/0/0
10	LDA	M	703	-	-	0/13/13/13	0/0/0/0
5	PO4	M	800	-	-	0/0/0/0	0/0/0/0
6	BCL	M	801	2	-	0/37/137/137	0/0/9/9
6	BCL	M	802	2	1/1/21/25	0/37/137/137	0/0/9/9

The worst 5 of 84 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
10	M	701	LDA	O1-N1	-18.70	1.21	1.39
10	M	703	LDA	O1-N1	-15.52	1.24	1.39
10	M	702	LDA	O1-N1	-15.19	1.25	1.39
9	M	600	SPN	C3-C4	-7.34	1.39	1.50
9	M	600	SPN	C17-C18	-5.40	1.39	1.51

The worst 5 of 94 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
7	L	401	BPH	O1D-CGD-CBD	-7.33	114.12	124.62
6	L	304	BCL	O1D-CGD-CBD	-6.87	114.78	124.62
7	L	402	BPH	O1D-CGD-CBD	-6.76	114.93	124.62
6	M	802	BCL	O1D-CGD-CBD	-6.58	115.19	124.62
6	M	801	BCL	O1D-CGD-CBD	-6.47	115.35	124.62

All (5) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
6	M	802	BCL	C13
7	L	402	BPH	C8
6	L	302	BCL	C13
7	L	401	BPH	C8

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Mol	Chain	Res	Type	Atom
7	L	401	BPH	C13

There are no torsion outliers.

There are no ring outliers.

9 monomers are involved in 36 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	L	302	BCL	5	0
6	L	304	BCL	4	0
7	L	401	BPH	6	0
7	L	402	BPH	9	0
8	M	501	U10	3	0
9	M	600	SPN	1	0
10	M	701	LDA	2	0
6	M	801	BCL	4	0
6	M	802	BCL	4	0

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)

EDS was not executed - this section will therefore be empty.

6.2 Non-standard residues in protein, DNA, RNA chains (i)

EDS was not executed - this section will therefore be empty.

6.3 Carbohydrates (i)

EDS was not executed - this section will therefore be empty.

6.4 Ligands (i)

EDS was not executed - this section will therefore be empty.

6.5 Other polymers (i)

EDS was not executed - this section will therefore be empty.