



# Full wwPDB X-ray Structure Validation Report ⓘ

Dec 23, 2021 – 12:12 PM EST

PDB ID : 7MH8  
Title : Crystal structure of R. sphaeroides Photosynthetic Reaction Center variant;  
Y(M210)3-methyltyrosine  
Authors : Mathews, I.; Weaver, J.; Boxer, S.G.  
Deposited on : 2021-04-14  
Resolution : 2.75 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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.

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

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
Xtrriage (Phenix) : 1.13  
EDS : 2.25  
buster-report : 1.1.7 (2018)  
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) : 2.25

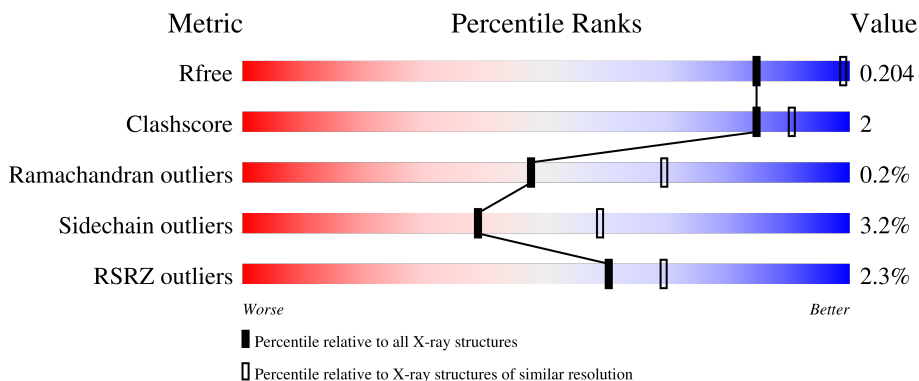
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.75 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	1235 (2.78-2.74)
Clashscore	141614	1277 (2.78-2.74)
Ramachandran outliers	138981	1257 (2.78-2.74)
Sidechain outliers	138945	1257 (2.78-2.74)
RSRZ outliers	127900	1207 (2.78-2.74)

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	H	266	 2% 84% 6% 10%
2	L	282	 4% 93% 7%
3	M	308	 % 90% 7% .

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	BPH	M	407	X	-	-	-

## 2 Entry composition

There are 11 unique types of molecules in this entry. The entry contains 7221 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 Reaction center protein H chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	H	239	1823	1166	313	335	9	0	0	0

There are 7 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
H	260	VAL	-	expression tag	UNP P0C0Y7
H	261	HIS	-	expression tag	UNP P0C0Y7
H	262	HIS	-	expression tag	UNP P0C0Y7
H	263	HIS	-	expression tag	UNP P0C0Y7
H	264	HIS	-	expression tag	UNP P0C0Y7
H	265	HIS	-	expression tag	UNP P0C0Y7
H	266	HIS	-	expression tag	UNP P0C0Y7

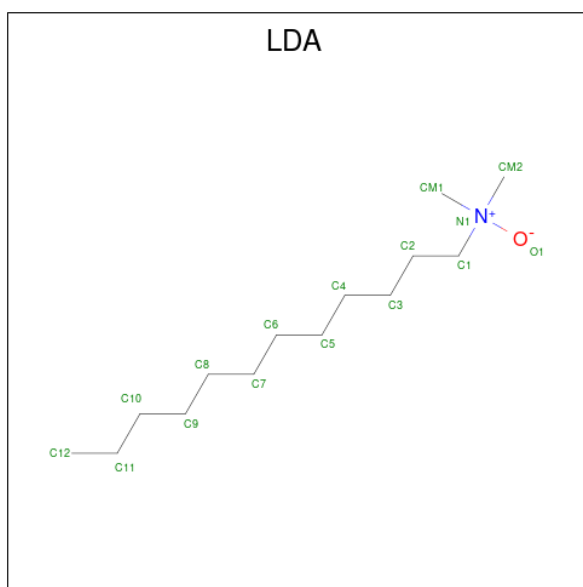
- Molecule 2 is a protein called Reaction center protein L chain.

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

- Molecule 3 is a protein called Reaction center protein M chain.

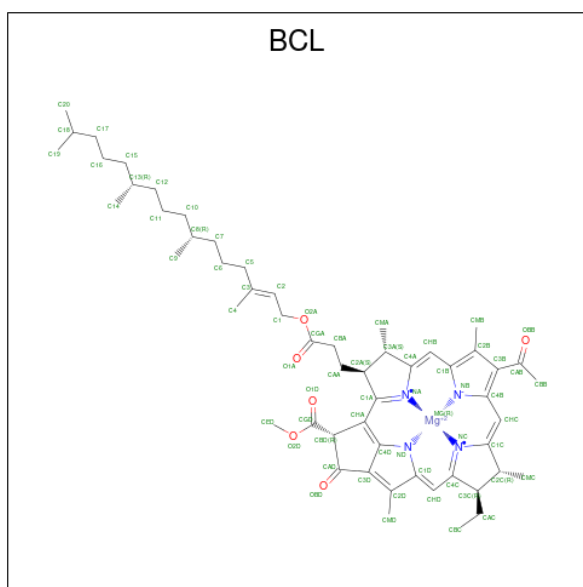
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	M	301	2404	1605	393	396	10	0	0	0

- Molecule 4 is LAURYL DIMETHYLAMINE-N-OXIDE (three-letter code: LDA) (formula: C<sub>14</sub>H<sub>31</sub>NO).



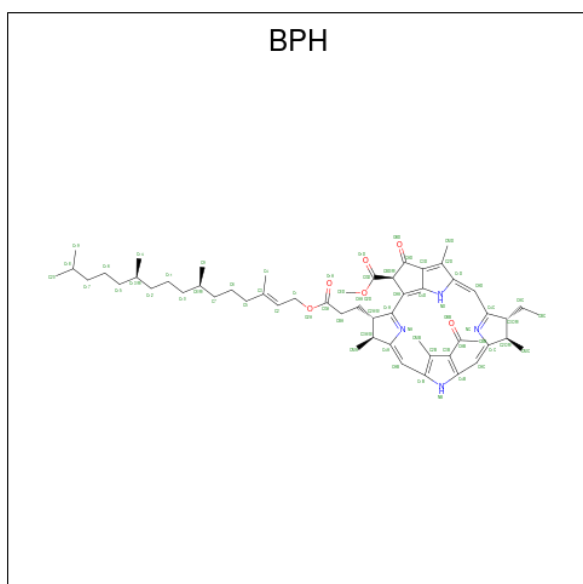
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
4	H	1	Total 16	C 14	N 1	O 1	0	0
4	M	1	Total 16	C 14	N 1	O 1	0	0
4	M	1	Total 16	C 14	N 1	O 1	0	0
4	M	1	Total 16	C 14	N 1	O 1	0	0
4	M	1	Total 16	C 14	N 1	O 1	0	0

- Molecule 5 is BACTERIOCHLOROPHYLL A (three-letter code: BCL) (formula:  $C_{55}H_{74}MgN_4O_6$ ) (labeled as "Ligand of Interest" by depositor).



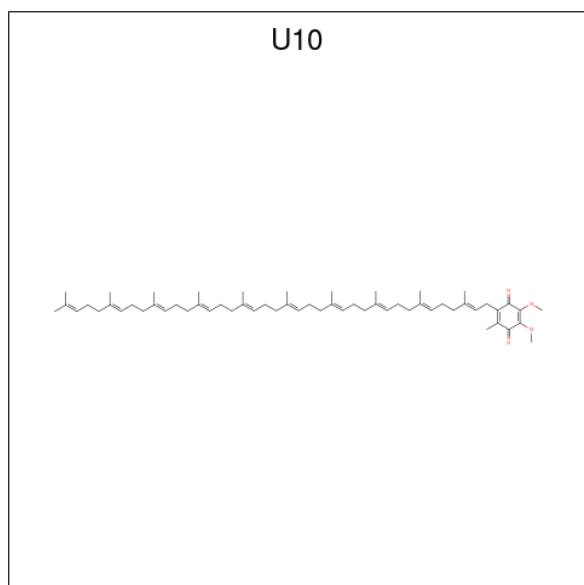
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf		
			Total	C	Mg	N			O	
5	L	1	Total	66	55	1	4	6	0	0
5	L	1	Total	66	55	1	4	6	0	0
5	L	1	Total	51	40	1	4	6	0	0
5	M	1	Total	66	55	1	4	6	0	0

- Molecule 6 is BACTERIOPHEOPHYTIN A (three-letter code: BPH) (formula:  $C_{55}H_{76}N_4O_6$ ) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	L	1	Total	C	N	O	0	0
			65	55	4	6		
6	M	1	Total	C	N	O	0	0
			55	45	4	6		

- Molecule 7 is UBIQUINONE-10 (three-letter code: U10) (formula:  $C_{59}H_{90}O_4$ ) (labeled as "Ligand of Interest" by depositor).

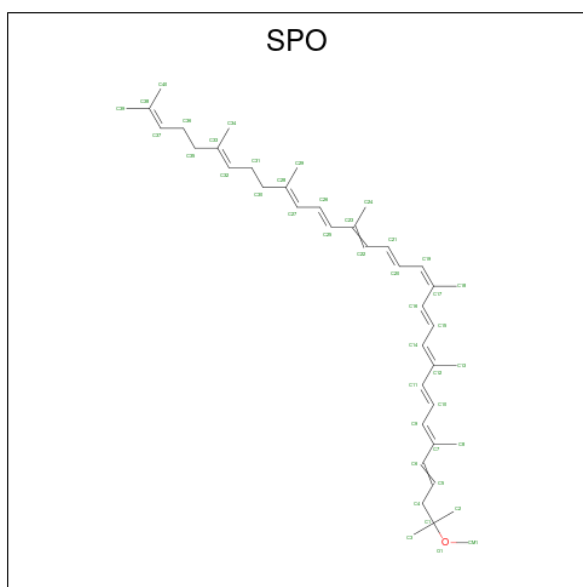


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	L	1	Total	C	O	0	0
			18	14	4		
7	M	1	Total	C	O	0	0
			48	44	4		

- Molecule 8 is FE (III) ION (three-letter code: FE) (formula: Fe).

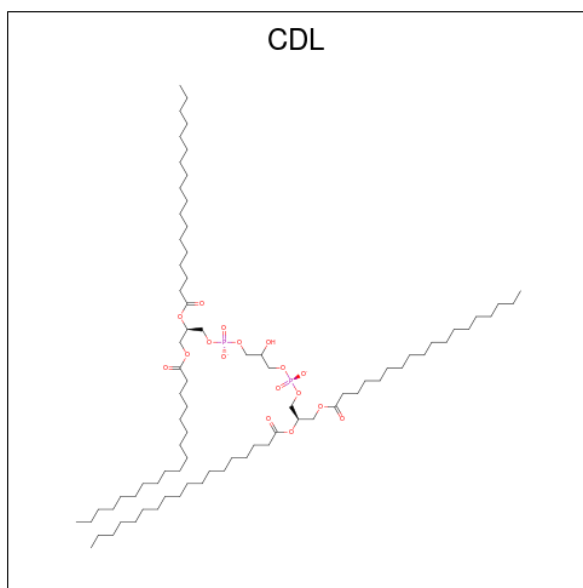
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	M	1	Total	Fe	0	0
			1	1		

- Molecule 9 is SPHEROIDENE (three-letter code: SPO) (formula:  $C_{41}H_{60}O$ ).



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
			69	50	17	2		

- Molecule 11 is water.



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
11	H	58	Total O 59 59	0	1
11	L	31	Total O 31 31	0	0
11	M	43	Total O 45 45	0	2



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	140.96Å 140.96Å 187.01Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	38.96 – 2.75 38.96 – 2.75	Depositor EDS
% Data completeness (in resolution range)	99.7 (38.96-2.75) 99.8 (38.96-2.75)	Depositor EDS
$R_{merge}$	0.15	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.80 (at 2.77Å)	Xtrriage
Refinement program	REFMAC 5.8.0267	Depositor
R, $R_{free}$	0.179 , 0.201 0.185 , 0.204	Depositor DCC
$R_{free}$ test set	2811 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	61.7	Xtrriage
Anisotropy	0.032	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 57.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.023 for -h,-k,l	Xtrriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	7221	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	65.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.63% 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](#)

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

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	H	0.62	0/1871	0.75	0/2545
2	L	0.63	0/2320	0.69	0/3175
3	M	0.63	0/2481	0.72	0/3385
All	All	0.63	0/6672	0.72	0/9105

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	H	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	H	138	ALA	Peptide

### 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	H	1823	0	1831	5	0
2	L	2232	0	2187	10	0
3	M	2404	0	2304	10	0
4	H	16	0	31	0	0
4	M	64	0	124	0	0
5	L	183	0	189	7	0
5	M	66	0	74	5	0
6	L	65	0	76	1	0
6	M	55	0	53	3	0
7	L	18	0	15	0	0
7	M	48	0	63	1	0
8	M	1	0	0	0	0
9	M	42	0	60	0	0
10	M	69	0	82	1	0
11	H	59	0	0	0	0
11	L	31	0	0	0	0
11	M	45	0	0	0	0
All	All	7221	0	7089	33	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 2.

All (33) 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)
3:M:16:ALA:HB1	3:M:32:VAL:HG11	1.64	0.78
5:L:305:BCL:HHC	5:L:305:BCL:HBB2	1.73	0.70
6:L:302:BPH:HBB3	6:L:302:BPH:HHC	1.74	0.68
5:L:301:BCL:HBB2	5:L:301:BCL:HHC	1.77	0.65
2:L:181:PHE:CD2	6:M:407:BPH:HBB1	2.37	0.59
2:L:157:VAL:HG11	5:M:401:BCL:HBB1	1.86	0.58
1:H:148:PRO:HA	1:H:151:LEU:HD12	1.87	0.56
5:L:304:BCL:CBB	5:L:304:BCL:HMB1	2.36	0.56
3:M:229:PHE:HB2	3:M:244:ALA:HB2	1.90	0.54
3:M:21:THR:HG23	3:M:26:LEU:HD21	1.88	0.54
3:M:197:PHE:CZ	5:M:401:BCL:HBB2	2.44	0.52
5:L:305:BCL:HHC	5:L:305:BCL:CBB	2.43	0.48
2:L:135:ARG:HB3	2:L:136:PRO:HD3	1.96	0.47
1:H:245:ALA:N	1:H:246:PRO:CD	2.79	0.46
2:L:128:TYR:HD1	5:L:301:BCL:HBB1	1.81	0.45
2:L:181:PHE:HB3	6:M:407:BPH:CBB	2.47	0.45
5:M:401:BCL:HHC	5:M:401:BCL:HBB3	1.98	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:L:304:BCL:HMB1	5:L:304:BCL:HBB3	1.98	0.45
3:M:197:PHE:CE1	5:M:401:BCL:HBB2	2.52	0.44
1:H:130:LYS:HE3	1:H:170:ASP:OD2	2.18	0.43
3:M:270:ILE:O	3:M:274:VAL:HG13	2.19	0.43
2:L:181:PHE:HB3	6:M:407:BPH:HBB2	2.00	0.43
2:L:177:ILE:HG12	5:L:304:BCL:HMB3	2.02	0.42
5:M:401:BCL:HAA2	5:M:401:BCL:HBD	2.02	0.42
2:L:66:VAL:HG12	2:L:86:TRP:HB2	2.02	0.41
1:H:140:PHE:HA	3:M:13:ARG:O	2.20	0.41
1:H:40:TYR:HB3	1:H:58:LEU:HD21	2.02	0.41
2:L:180:PHE:CD2	2:L:240:ALA:HB1	2.55	0.41
7:M:408:U10:H4M2	7:M:408:U10:O3	2.20	0.41
2:L:18:GLY:O	2:L:21:LEU:HB2	2.20	0.41
3:M:148:TRP:CD2	10:M:410:CDL:H511	2.55	0.41
3:M:151:LEU:HD12	3:M:151:LEU:HA	1.93	0.41
3:M:164:ARG:HB3	3:M:165:PRO:HD3	2.02	0.41

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	H	237/266 (89%)	231 (98%)	6 (2%)	0	100	100
2	L	279/282 (99%)	270 (97%)	9 (3%)	0	100	100
3	M	298/308 (97%)	289 (97%)	7 (2%)	2 (1%)	22	39
All	All	814/856 (95%)	790 (97%)	22 (3%)	2 (0%)	47	69

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	M	301	HIS

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Mol	Chain	Res	Type
3	M	195	ASN

### 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	H	194/215 (90%)	188 (97%)	6 (3%)	40	60
2	L	220/221 (100%)	211 (96%)	9 (4%)	30	50
3	M	235/240 (98%)	229 (97%)	6 (3%)	46	66
All	All	649/676 (96%)	628 (97%)	21 (3%)	39	59

All (21) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	12	LEU
1	H	92	VAL
1	H	118	ARG
1	H	200	SER
1	H	231	ASP
1	H	247	LYS
2	L	21	LEU
2	L	82	LYS
2	L	202	LYS
2	L	207	ARG
2	L	210	ASP
2	L	216	PHE
2	L	235	LEU
2	L	247	CYS
2	L	272	TRP
3	M	39	LEU
3	M	104	SER
3	M	170	SER
3	M	216	PHE
3	M	278	LEU
3	M	292	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	H	98	HIS
2	L	183	ASN
3	M	77	GLN
3	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](#)

1 non-standard protein/DNA/RNA residue is modelled in this entry.

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	$\# Z  > 2$
3	ZDJ	M	210	3	12,13,14	0.55	0	14,17,19	1.62	3 (21%)

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
3	ZDJ	M	210	3	-	2/5/6/8	0/1/1/1

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	M	210	ZDJ	CME-CE1-CZ	3.56	123.98	120.73
3	M	210	ZDJ	CD1-CE1-CZ	2.76	119.77	117.56

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	M	210	ZDJ	OH-CZ-CE1	2.39	122.59	117.63

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	M	210	ZDJ	CA-CB-CG-CD1
3	M	210	ZDJ	CA-CB-CG-CD2

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

Of 16 ligands modelled in this entry, 1 is monoatomic - leaving 15 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
7	U10	M	408	-	48,48,63	0.62	2 (4%)	58,61,79	0.46	0
4	LDA	M	402	-	12,15,15	0.20	0	14,17,17	0.40	0
5	BCL	L	301	-	58,74,74	1.57	9 (15%)	69,115,115	1.75	15 (21%)
4	LDA	M	404	-	12,15,15	0.17	0	14,17,17	0.22	0
6	BPH	L	302	-	64,70,70	0.56	0	76,101,101	0.79	4 (5%)
4	LDA	H	301	-	12,15,15	0.14	0	14,17,17	0.34	0
5	BCL	M	401	-	58,74,74	1.61	10 (17%)	69,115,115	1.68	15 (21%)
9	SPO	M	409	-	40,41,41	1.63	8 (20%)	47,50,50	1.24	7 (14%)
10	CDL	M	410	-	68,68,99	0.35	0	74,80,111	0.39	0
4	LDA	M	405	-	12,15,15	0.15	0	14,17,17	0.16	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	LDA	M	403	-	12,15,15	0.13	0	14,17,17	0.30	0
5	BCL	L	304	-	58,74,74	1.61	8 (13%)	69,115,115	1.56	16 (23%)
6	BPH	M	407	-	54,60,70	0.62	0	64,89,101	0.91	4 (6%)
5	BCL	L	305	-	43,59,74	1.87	9 (20%)	51,97,115	1.81	14 (27%)
7	U10	L	303	-	18,18,63	1.02	2 (11%)	22,25,79	0.63	0

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
7	U10	M	408	-	-	6/45/69/87	0/1/1/1
4	LDA	M	402	-	-	6/13/13/13	-
5	BCL	L	301	-	-	7/37/137/137	-
4	LDA	M	404	-	-	4/13/13/13	-
6	BPH	L	302	-	-	10/54/105/105	0/5/6/6
4	LDA	H	301	-	-	8/13/13/13	-
5	BCL	M	401	-	-	7/37/137/137	-
9	SPO	M	409	-	-	3/47/47/47	-
10	CDL	M	410	-	-	28/79/79/110	-
4	LDA	M	405	-	-	4/13/13/13	-
4	LDA	M	403	-	-	5/13/13/13	-
5	BCL	L	304	-	-	3/37/137/137	-
6	BPH	M	407	-	1/1/16/22	13/42/93/105	0/5/6/6
5	BCL	L	305	-	-	0/19/119/137	-
7	U10	L	303	-	-	3/9/33/87	0/1/1/1

All (48) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	L	301	BCL	O2D-CGD	5.17	1.45	1.33
5	L	305	BCL	O2D-CGD	5.15	1.45	1.33
5	M	401	BCL	O2D-CGD	5.11	1.45	1.33
5	L	304	BCL	O2D-CGD	5.10	1.45	1.33
5	L	304	BCL	OBD-CAD	4.92	1.29	1.22
5	M	401	BCL	OBD-CAD	4.74	1.28	1.22
5	L	305	BCL	C3B-C2B	4.68	1.47	1.39

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	L	304	BCL	C3B-C2B	4.58	1.47	1.39
9	M	409	SPO	C9-C7	4.57	1.41	1.35
5	L	305	BCL	C3D-C2D	4.47	1.47	1.39
5	L	305	BCL	O2A-CGA	4.43	1.46	1.33
5	L	301	BCL	O2A-CGA	4.34	1.46	1.33
5	M	401	BCL	C3B-C2B	4.29	1.47	1.39
5	L	301	BCL	OBD-CAD	4.28	1.28	1.22
5	L	304	BCL	O2A-CGA	4.25	1.45	1.33
5	M	401	BCL	C3D-C2D	4.16	1.46	1.39
5	L	304	BCL	C3D-C2D	4.07	1.46	1.39
5	L	301	BCL	C3D-C2D	4.01	1.46	1.39
5	L	301	BCL	C3B-C2B	3.95	1.46	1.39
5	L	305	BCL	OBD-CAD	3.94	1.27	1.22
5	M	401	BCL	O2A-CGA	3.92	1.44	1.33
9	M	409	SPO	C19-C17	3.84	1.40	1.35
9	M	409	SPO	C14-C12	3.48	1.40	1.35
9	M	409	SPO	C22-C23	3.47	1.40	1.35
5	M	401	BCL	C2D-C1D	3.28	1.50	1.42
5	L	305	BCL	C2D-C1D	3.17	1.49	1.42
5	L	304	BCL	C2D-C1D	2.99	1.49	1.42
5	L	301	BCL	C2D-C1D	2.97	1.49	1.42
7	L	303	U10	C6-C1	2.59	1.39	1.35
9	M	409	SPO	C25-C23	-2.55	1.40	1.45
5	L	305	BCL	C1B-CHB	2.54	1.48	1.41
5	L	301	BCL	MG-NA	-2.54	2.00	2.06
9	M	409	SPO	C16-C17	-2.47	1.40	1.45
9	M	409	SPO	C11-C12	-2.42	1.40	1.45
5	L	301	BCL	C1B-CHB	2.40	1.47	1.41
7	L	303	U10	C3-C2	-2.32	1.42	1.48
5	L	305	BCL	C4B-CHC	2.30	1.47	1.41
5	L	304	BCL	C4B-CHC	2.28	1.47	1.41
5	M	401	BCL	MG-NC	-2.27	2.00	2.06
5	L	304	BCL	C1B-CHB	2.25	1.47	1.41
5	M	401	BCL	C4B-CHC	2.24	1.47	1.41
9	M	409	SPO	C6-C7	-2.20	1.41	1.45
5	L	305	BCL	MG-NA	-2.16	2.01	2.06
7	M	408	U10	C3-C2	-2.14	1.42	1.48
5	M	401	BCL	C1B-CHB	2.05	1.46	1.41
5	L	301	BCL	C4B-CHC	2.05	1.46	1.41
5	M	401	BCL	CHD-C4C	2.04	1.47	1.41
7	M	408	U10	C4-C5	-2.01	1.43	1.48

All (75) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	L	301	BCL	O2D-CGD-CBD	5.50	121.03	111.27
5	L	305	BCL	O2D-CGD-CBD	4.91	119.99	111.27
5	L	301	BCL	CHD-C4C-NC	4.68	130.27	125.08
5	M	401	BCL	CHD-C4C-NC	4.42	129.99	125.08
5	L	305	BCL	C3C-C4C-CHD	-4.32	114.17	123.39
5	L	304	BCL	CHD-C4C-NC	4.30	129.85	125.08
5	L	305	BCL	CHD-C4C-NC	4.23	129.78	125.08
5	L	304	BCL	C3C-C4C-CHD	-4.19	114.44	123.39
5	L	301	BCL	C3C-C4C-CHD	-4.16	114.50	123.39
5	L	301	BCL	C4C-CHD-C1D	-4.14	119.77	125.88
5	L	304	BCL	C4C-CHD-C1D	-4.07	119.87	125.88
5	M	401	BCL	C3C-C4C-CHD	-3.97	114.92	123.39
5	M	401	BCL	O2D-CGD-CBD	3.89	118.18	111.27
5	L	301	BCL	C1C-NC-C4C	-3.73	105.03	106.71
5	M	401	BCL	C4C-CHD-C1D	-3.67	120.47	125.88
5	M	401	BCL	C1C-NC-C4C	-3.55	105.11	106.71
5	L	301	BCL	CHC-C1C-NC	3.42	129.25	124.51
5	L	305	BCL	C4C-CHD-C1D	-3.39	120.87	125.88
5	L	301	BCL	CHB-C4A-NA	3.23	128.98	124.51
5	L	304	BCL	CHB-C4A-NA	3.21	128.96	124.51
5	M	401	BCL	O2D-CGD-O1D	-3.13	117.72	123.84
5	M	401	BCL	CHC-C1C-NC	3.11	128.82	124.51
5	M	401	BCL	CHB-C4A-NA	3.10	128.80	124.51
5	L	301	BCL	C4A-NA-C1A	3.06	108.08	106.71
5	L	304	BCL	CHC-C1C-NC	3.05	128.73	124.51
5	L	305	BCL	CHC-C1C-NC	2.95	128.59	124.51
5	M	401	BCL	CMB-C2B-C3B	2.93	130.17	124.68
5	L	304	BCL	O2A-CGA-CBA	2.90	121.01	111.91
5	M	401	BCL	O2A-CGA-CBA	2.90	121.01	111.91
5	L	304	BCL	CAD-C3D-C4D	2.83	110.05	108.47
5	L	304	BCL	C1C-NC-C4C	-2.80	105.45	106.71
5	L	305	BCL	CMB-C2B-C3B	2.76	129.83	124.68
5	M	401	BCL	CED-O2D-CGD	2.75	122.16	115.94
6	M	407	BPH	C1C-NC-C4C	-2.72	108.15	110.54
5	L	304	BCL	CMB-C2B-C3B	2.70	129.72	124.68
9	M	409	SPO	C21-C20-C19	2.68	128.96	123.47
5	M	401	BCL	C4B-C3B-CAB	2.67	132.28	127.13
5	L	305	BCL	C1-O2A-CGA	2.61	123.30	116.44
5	L	304	BCL	C4-C3-C5	2.57	119.60	115.27
5	L	304	BCL	O2D-CGD-CBD	2.57	115.83	111.27
5	L	305	BCL	CHB-C4A-NA	2.55	128.04	124.51
9	M	409	SPO	C13-C12-C14	-2.50	119.42	122.92
5	L	305	BCL	O2A-CGA-CBA	2.50	119.74	111.91

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	L	305	BCL	C1C-NC-C4C	-2.49	105.58	106.71
9	M	409	SPO	C18-C17-C19	-2.41	119.55	122.92
5	L	301	BCL	C1-O2A-CGA	2.40	122.75	116.44
6	M	407	BPH	C4A-NA-C1A	-2.40	106.20	108.14
9	M	409	SPO	C10-C9-C7	2.39	130.72	127.31
5	L	304	BCL	C4B-CHC-C1C	-2.38	125.40	130.12
5	L	301	BCL	C4B-CHC-C1C	-2.37	125.41	130.12
6	L	302	BPH	C1C-NC-C4C	-2.34	108.48	110.54
5	L	301	BCL	O1D-CGD-CBD	-2.34	119.69	124.48
5	L	301	BCL	O2D-CGD-O1D	-2.34	119.26	123.84
5	L	305	BCL	C1-C2-C3	-2.33	122.97	126.75
5	L	305	BCL	O1D-CGD-CBD	-2.32	119.74	124.48
5	L	304	BCL	C1B-CHB-C4A	-2.27	125.61	130.12
5	M	401	BCL	O2A-CGA-O1A	-2.25	117.91	123.59
5	M	401	BCL	C4B-CHC-C1C	-2.24	125.67	130.12
6	L	302	BPH	C1B-NB-C4B	2.24	110.73	106.51
5	L	305	BCL	C4B-CHC-C1C	-2.23	125.69	130.12
6	L	302	BPH	CHD-C4C-NC	-2.21	122.58	125.20
9	M	409	SPO	C21-C22-C23	2.19	130.44	127.31
5	L	301	BCL	O2A-CGA-CBA	2.17	118.73	111.91
6	M	407	BPH	C1B-NB-C4B	2.15	110.56	106.51
5	L	301	BCL	C1B-CHB-C4A	-2.14	125.88	130.12
5	L	305	BCL	C1B-CHB-C4A	-2.13	125.89	130.12
9	M	409	SPO	C24-C23-C22	-2.09	120.00	122.92
5	L	304	BCL	O2A-CGA-O1A	-2.09	118.33	123.59
5	L	301	BCL	CMB-C2B-C3B	2.07	128.56	124.68
6	L	302	BPH	C4D-CHA-C1A	-2.06	125.43	130.51
5	L	304	BCL	C2A-C1A-CHA	-2.05	120.27	123.86
6	M	407	BPH	CHD-C4C-NC	-2.05	122.77	125.20
5	L	304	BCL	CED-O2D-CGD	2.05	120.56	115.94
9	M	409	SPO	C20-C21-C22	2.03	127.64	123.47
5	M	401	BCL	CAD-C3D-C4D	2.01	109.59	108.47

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
6	M	407	BPH	C8

All (107) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	H	301	LDA	C2-C1-N1-O1

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Mol	Chain	Res	Type	Atoms
4	H	301	LDA	C2-C1-N1-CM1
4	H	301	LDA	C2-C1-N1-CM2
4	M	402	LDA	C2-C1-N1-O1
4	M	402	LDA	C2-C1-N1-CM1
4	M	403	LDA	N1-C1-C2-C3
6	M	407	BPH	C4C-C3C-CAC-CBC
6	M	407	BPH	C2C-C3C-CAC-CBC
6	M	407	BPH	C4B-C3B-CAB-CBB
6	M	407	BPH	C4B-C3B-CAB-OBB
10	M	410	CDL	CA2-OA2-PA1-OA4
10	M	410	CDL	CA3-OA5-PA1-OA4
10	M	410	CDL	CB2-OB2-PB2-OB3
5	M	401	BCL	CBD-CGD-O2D-CED
7	L	303	U10	C7-C8-C9-C10
7	L	303	U10	C7-C8-C9-C11
5	L	301	BCL	C15-C16-C17-C18
6	M	407	BPH	C5-C6-C7-C8
5	M	401	BCL	O1D-CGD-O2D-CED
10	M	410	CDL	CA3-OA5-PA1-OA2
10	M	410	CDL	CB2-OB2-PB2-OB5
10	M	410	CDL	C39-C40-C41-C42
4	H	301	LDA	C6-C7-C8-C9
10	M	410	CDL	C13-C14-C15-C16
10	M	410	CDL	C36-C37-C38-C39
10	M	410	CDL	C33-C34-C35-C36
10	M	410	CDL	CA7-C31-C32-C33
10	M	410	CDL	OA7-CA5-OA6-CA4
5	L	304	BCL	C15-C16-C17-C18
4	M	404	LDA	C1-C2-C3-C4
5	L	304	BCL	C2A-CAA-CBA-CGA
4	M	405	LDA	C3-C4-C5-C6
10	M	410	CDL	C11-CA5-OA6-CA4
4	M	403	LDA	C1-C2-C3-C4
5	L	301	BCL	CBD-CGD-O2D-CED
4	M	405	LDA	C1-C2-C3-C4
10	M	410	CDL	C71-C72-C73-C74
10	M	410	CDL	OA5-CA3-CA4-CA6
6	L	302	BPH	C13-C15-C16-C17
4	H	301	LDA	C9-C10-C11-C12
9	M	409	SPO	C4-C1-O1-CM1
9	M	409	SPO	C3-C1-O1-CM1
4	H	301	LDA	C1-C2-C3-C4

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Mol	Chain	Res	Type	Atoms
4	M	402	LDA	C4-C5-C6-C7
4	M	402	LDA	C11-C10-C9-C8
4	M	403	LDA	C6-C7-C8-C9
4	M	404	LDA	C9-C10-C11-C12
5	M	401	BCL	C16-C17-C18-C19
10	M	410	CDL	CA2-OA2-PA1-OA5
10	M	410	CDL	CB7-C71-C72-C73
5	M	401	BCL	C16-C17-C18-C20
7	M	408	U10	C29-C31-C32-C33
6	M	407	BPH	C4-C3-C5-C6
5	M	401	BCL	C13-C15-C16-C17
4	M	402	LDA	C2-C3-C4-C5
4	M	404	LDA	C4-C5-C6-C7
5	L	304	BCL	CAD-CBD-CGD-O2D
6	L	302	BPH	CAD-CBD-CGD-O2D
6	M	407	BPH	CAD-CBD-CGD-O2D
6	L	302	BPH	C4-C3-C5-C6
7	M	408	U10	C24-C26-C27-C28
10	M	410	CDL	OB5-CB3-CB4-OB6
4	M	402	LDA	C2-C1-N1-CM2
10	M	410	CDL	C17-C18-C19-C20
6	M	407	BPH	C2-C3-C5-C6
10	M	410	CDL	CA5-C11-C12-C13
7	M	408	U10	C30-C29-C31-C32
10	M	410	CDL	CA2-OA2-PA1-OA3
10	M	410	CDL	CA3-OA5-PA1-OA3
10	M	410	CDL	CB2-OB2-PB2-OB4
10	M	410	CDL	OB5-CB3-CB4-CB6
7	L	303	U10	C5-C4-O4-C4M
10	M	410	CDL	OA5-CA3-CA4-OA6
10	M	410	CDL	C72-C71-CB7-OB8
5	L	301	BCL	O1D-CGD-O2D-CED
10	M	410	CDL	C72-C73-C74-C75
6	M	407	BPH	O1A-CGA-O2A-C1
6	L	302	BPH	C2-C3-C5-C6
9	M	409	SPO	C2-C1-O1-CM1
7	M	408	U10	C28-C29-C31-C32
6	M	407	BPH	CBA-CGA-O2A-C1
6	M	407	BPH	C2-C1-O2A-CGA
7	M	408	U10	C5-C4-O4-C4M
6	L	302	BPH	C14-C13-C15-C16
4	M	405	LDA	C9-C10-C11-C12

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Mol	Chain	Res	Type	Atoms
6	L	302	BPH	O2A-C1-C2-C3
6	M	407	BPH	O2A-C1-C2-C3
4	M	403	LDA	C7-C8-C9-C10
4	H	301	LDA	C5-C6-C7-C8
4	M	404	LDA	C11-C10-C9-C8
6	L	302	BPH	C4B-C3B-CAB-CBB
6	L	302	BPH	C4B-C3B-CAB-OBB
4	H	301	LDA	C2-C3-C4-C5
6	M	407	BPH	C2B-C3B-CAB-OBB
4	M	403	LDA	C2-C3-C4-C5
10	M	410	CDL	C76-C77-C78-C79
5	L	301	BCL	CHA-CBD-CGD-O1D
5	L	301	BCL	CHA-CBD-CGD-O2D
4	M	405	LDA	C2-C3-C4-C5
7	M	408	U10	C14-C16-C17-C18
6	L	302	BPH	C16-C17-C18-C20
6	L	302	BPH	C8-C10-C11-C12
5	M	401	BCL	CAA-CBA-CGA-O2A
5	M	401	BCL	CAD-CBD-CGD-O1D
5	L	301	BCL	C3-C5-C6-C7
10	M	410	CDL	C11-C12-C13-C14
5	L	301	BCL	C12-C13-C15-C16

There are no ring outliers.

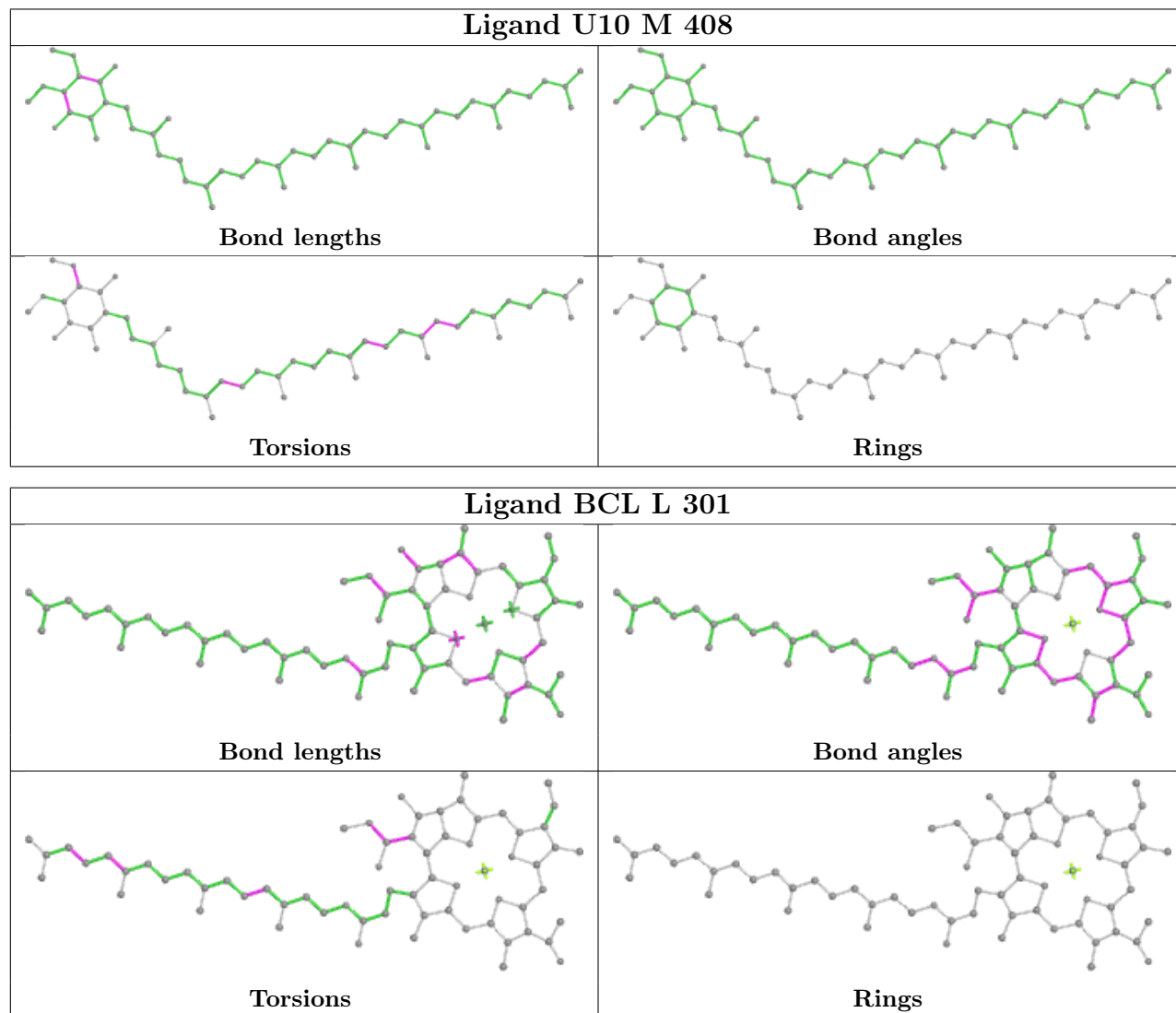
8 monomers are involved in 18 short contacts:

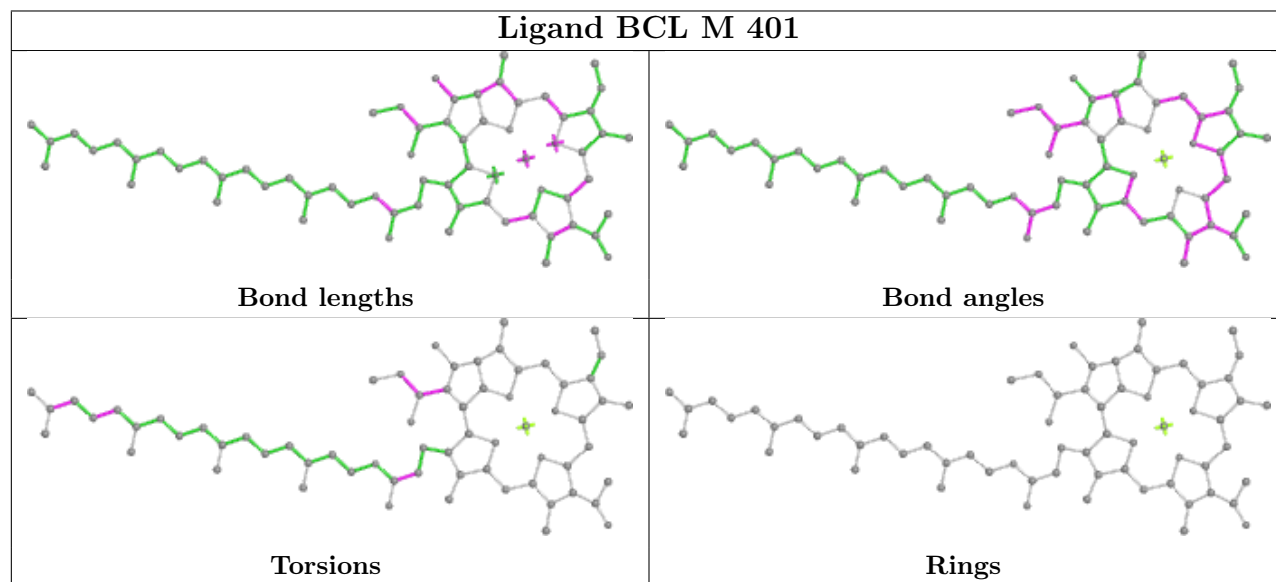
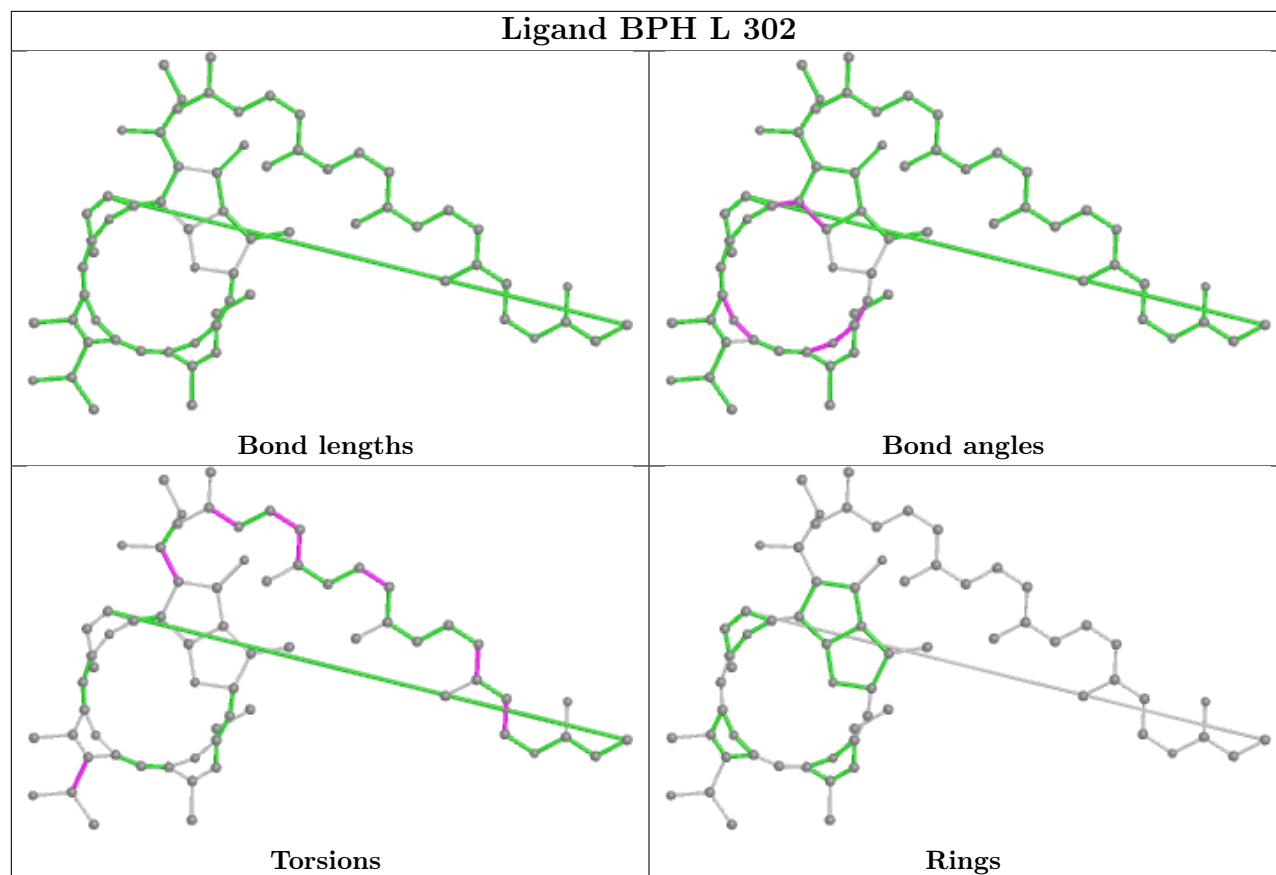
Mol	Chain	Res	Type	Clashes	Symm-Clashes
7	M	408	U10	1	0
5	L	301	BCL	2	0
6	L	302	BPH	1	0
5	M	401	BCL	5	0
10	M	410	CDL	1	0
5	L	304	BCL	3	0
6	M	407	BPH	3	0
5	L	305	BCL	2	0

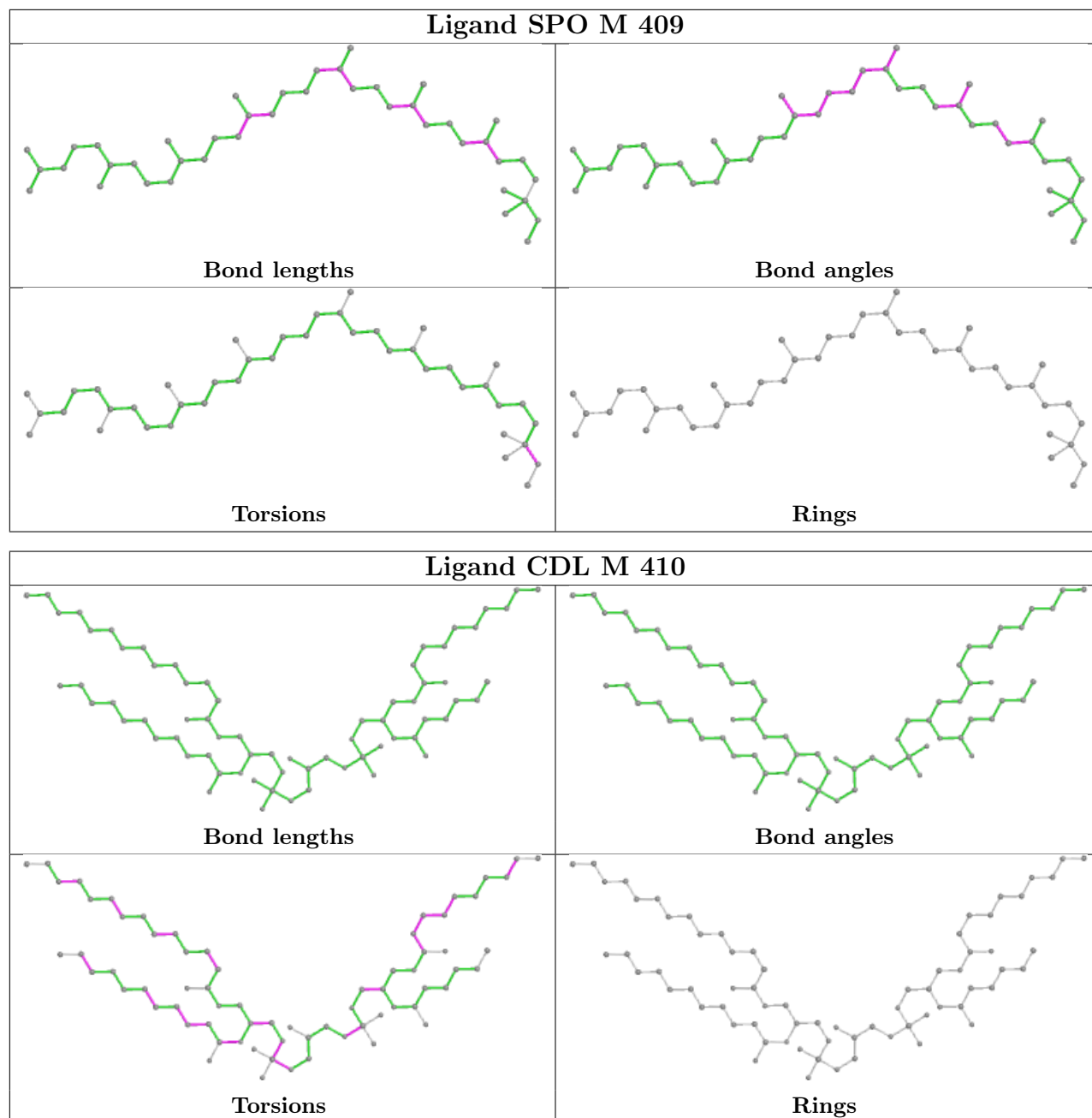
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be

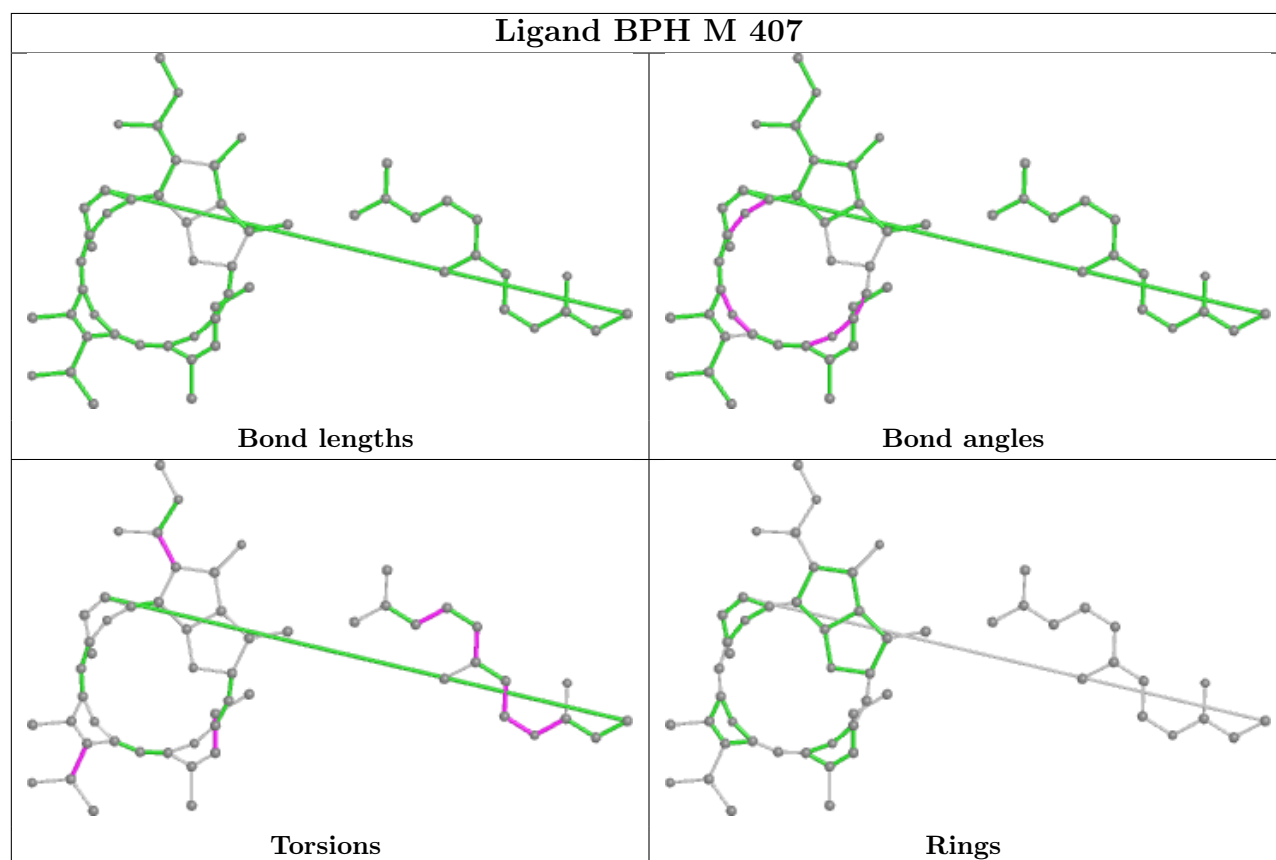
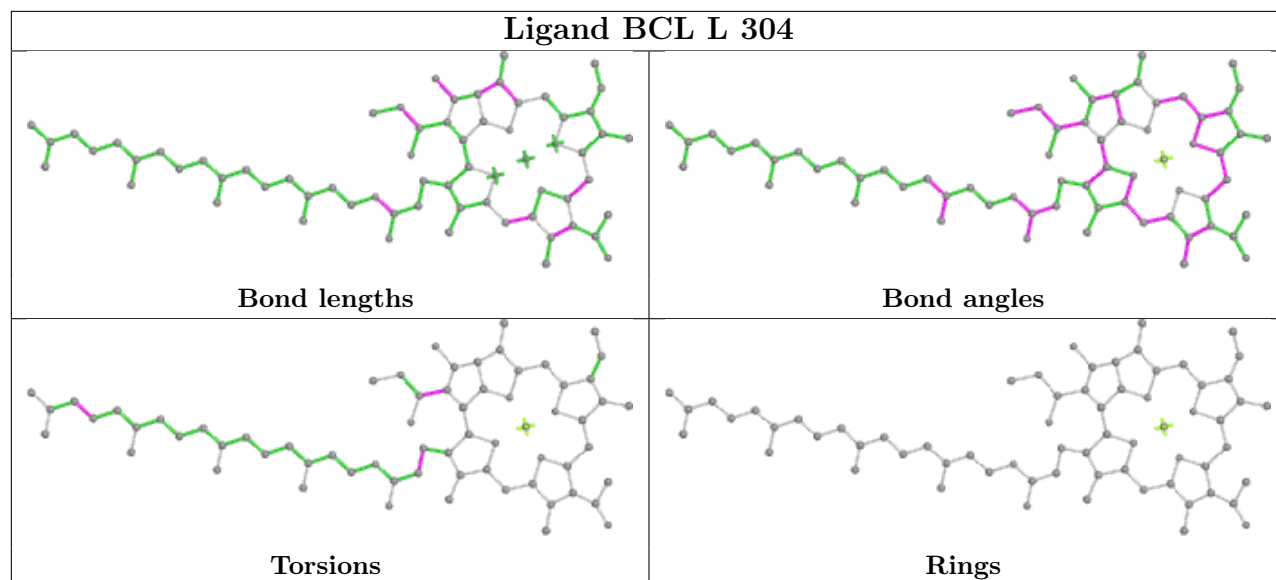


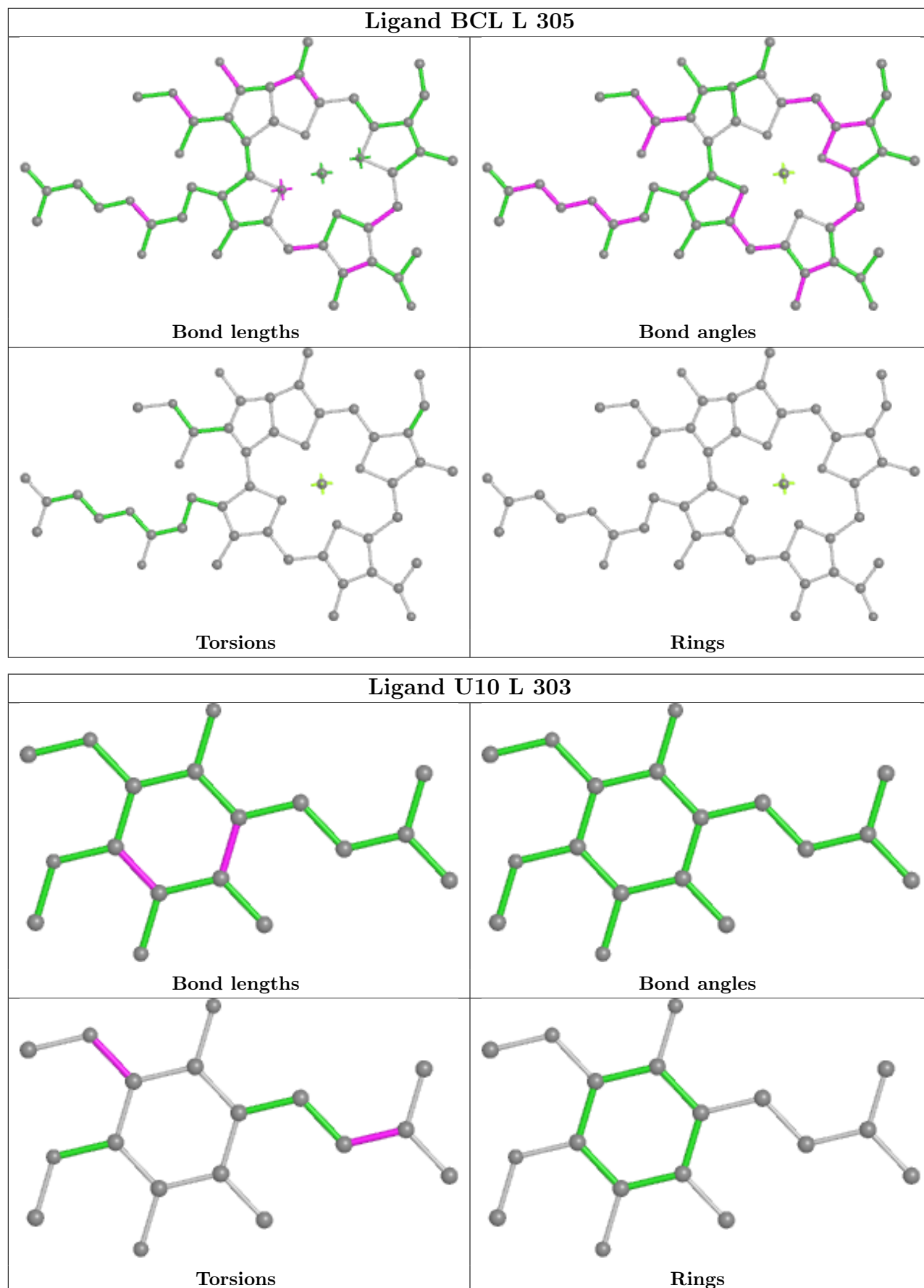
highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.











## 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<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	H	239/266 (89%)	-0.49	5 (2%) 63 72	47, 61, 83, 95	0
2	L	281/282 (99%)	-0.28	12 (4%) 35 42	47, 59, 96, 112	0
3	M	300/308 (97%)	-0.44	2 (0%) 87 91	43, 63, 94, 119	0
All	All	820/856 (95%)	-0.40	19 (2%) 60 69	43, 61, 92, 119	0

All (19) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	L	72	GLU	3.9
2	L	59	TRP	3.8
2	L	202	LYS	3.8
2	L	270	PRO	3.4
1	H	146	LYS	2.9
2	L	268	LYS	2.7
1	H	18	TYR	2.6
2	L	276	PRO	2.5
2	L	271	TRP	2.5
2	L	76	GLY	2.5
2	L	73	TYR	2.4
2	L	75	LEU	2.4
2	L	281	GLY	2.4
3	M	68	PHE	2.3
1	H	200	SER	2.3
2	L	74	GLY	2.3
3	M	301	HIS	2.2
1	H	184	LYS	2.1
1	H	201	ASN	2.1

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

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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
3	ZDJ	M	210	13/14	0.96	0.18	50,52,54,54	0

## 6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 6.4 Ligands [i](#)

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<sup>th</sup> 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.

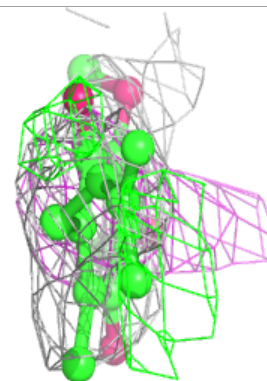
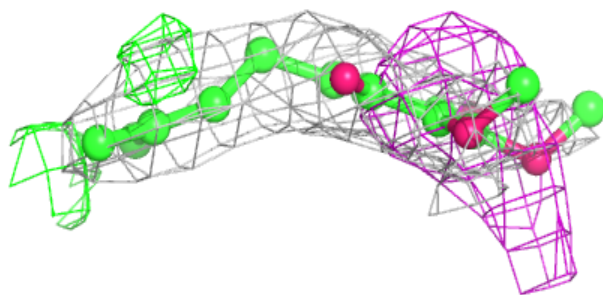
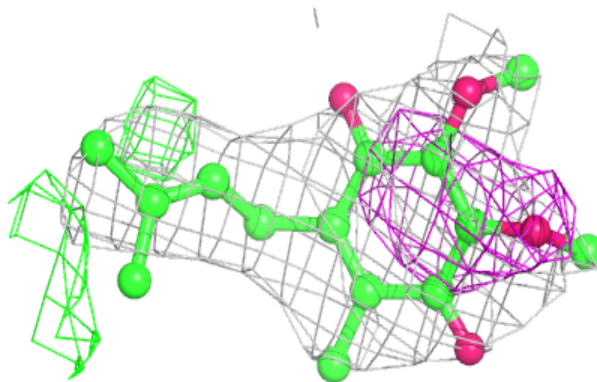
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
4	LDA	M	405	16/16	0.73	0.20	95,104,139,143	0
4	LDA	M	404	16/16	0.84	0.24	98,112,115,116	0
7	U10	L	303	18/63	0.86	0.27	86,89,94,95	0
10	CDL	M	410	69/100	0.86	0.25	79,110,130,150	0
4	LDA	M	403	16/16	0.88	0.40	90,99,121,123	0
4	LDA	M	402	16/16	0.92	0.22	80,84,87,89	0
9	SPO	M	409	42/42	0.93	0.21	61,74,104,110	0
4	LDA	H	301	16/16	0.94	0.15	69,79,99,102	0
7	U10	M	408	48/63	0.95	0.22	47,64,112,115	0
5	BCL	L	304	66/66	0.96	0.15	48,54,71,83	0
6	BPH	M	407	55/65	0.96	0.16	52,61,88,89	0
5	BCL	L	305	51/66	0.97	0.16	49,51,73,79	0
5	BCL	M	401	66/66	0.97	0.17	49,54,81,97	0
6	BPH	L	302	65/65	0.97	0.14	41,51,65,67	0
5	BCL	L	301	66/66	0.97	0.14	43,47,81,87	0
8	FE	M	406	1/1	0.99	0.12	50,50,50,50	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.



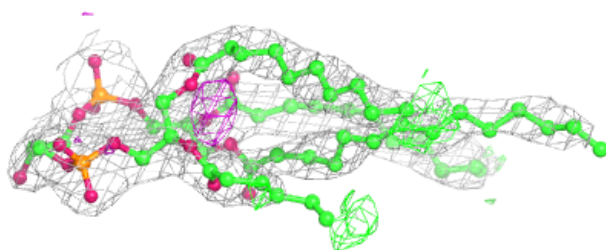
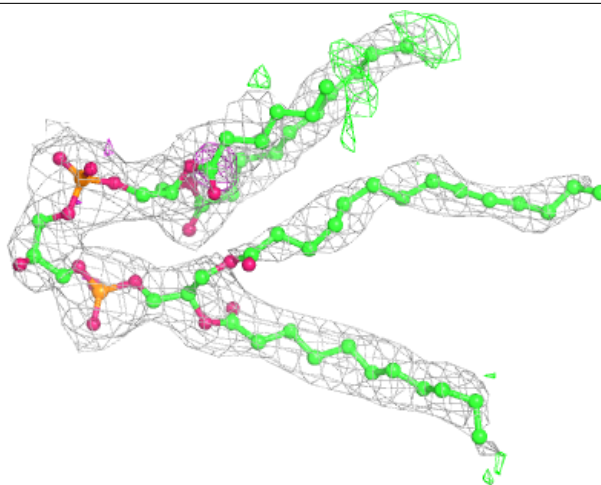
**Electron density around U10 L 303:**

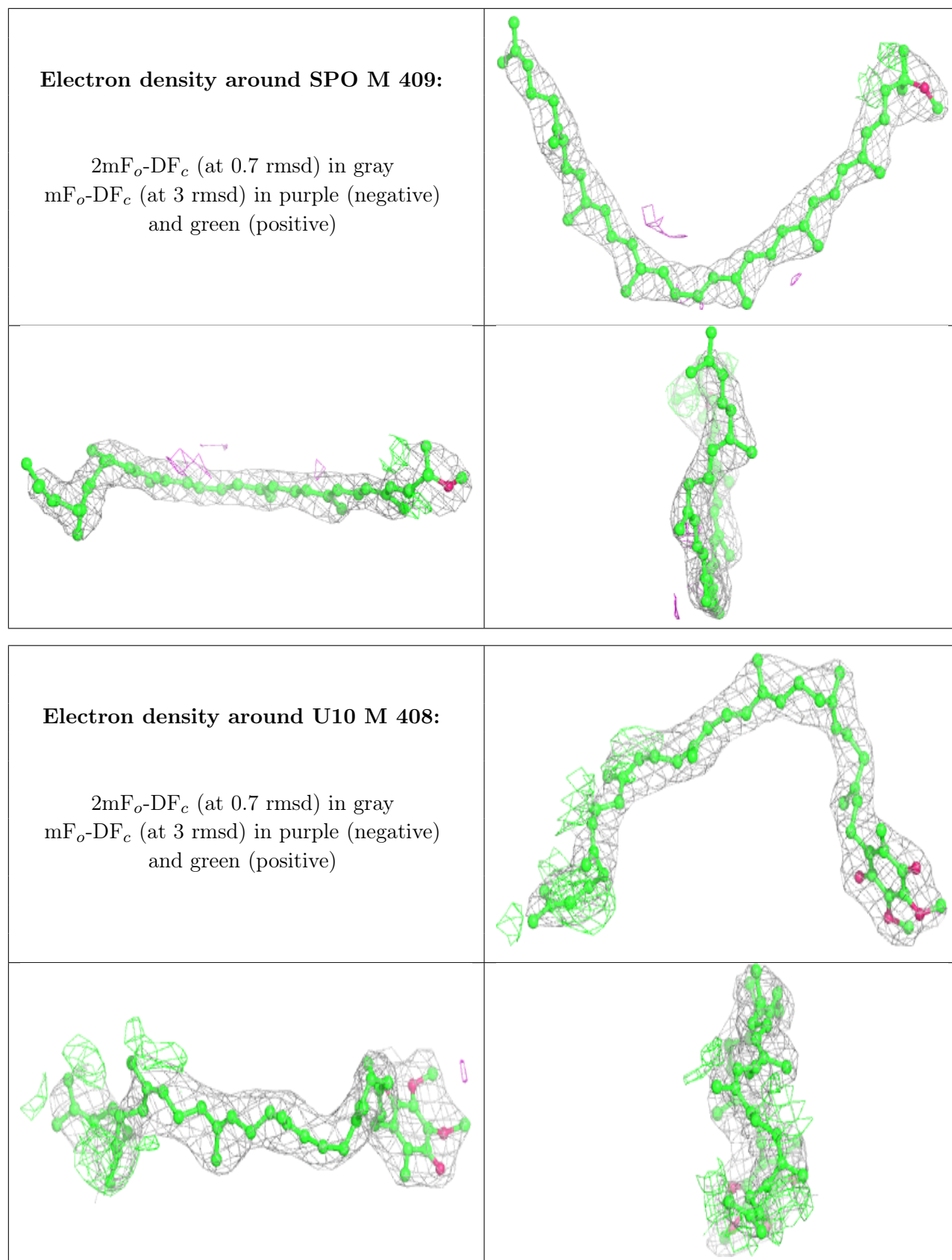
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around CDL M 410:**

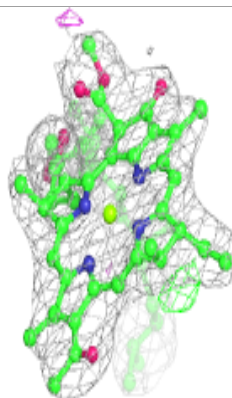
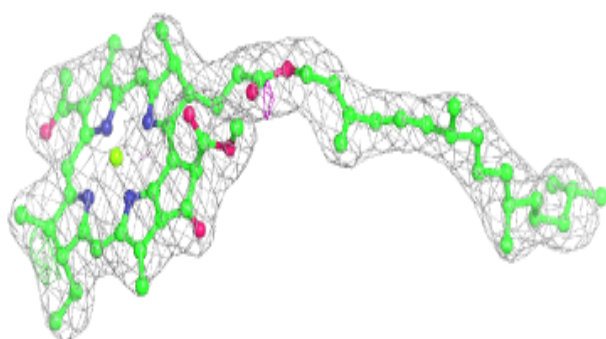
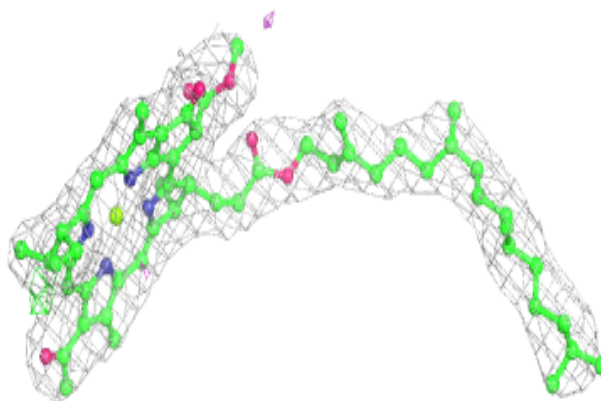
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 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



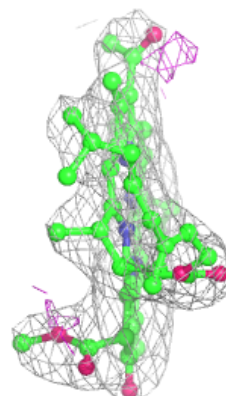
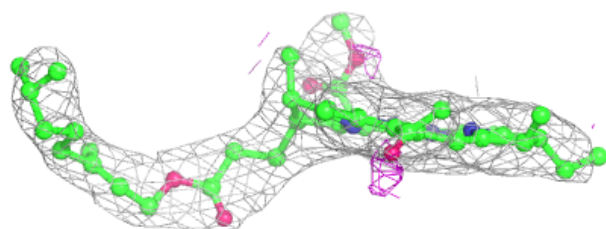
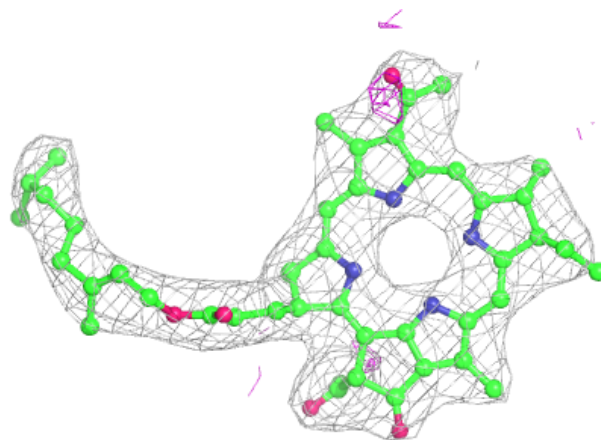


**Electron density around BCL L 304:**

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 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

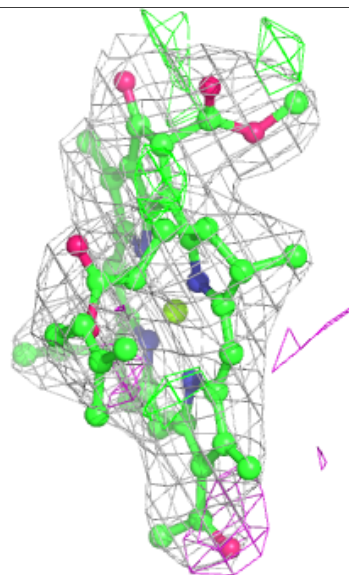
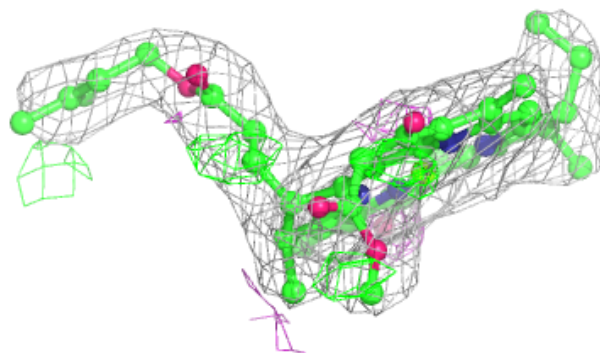
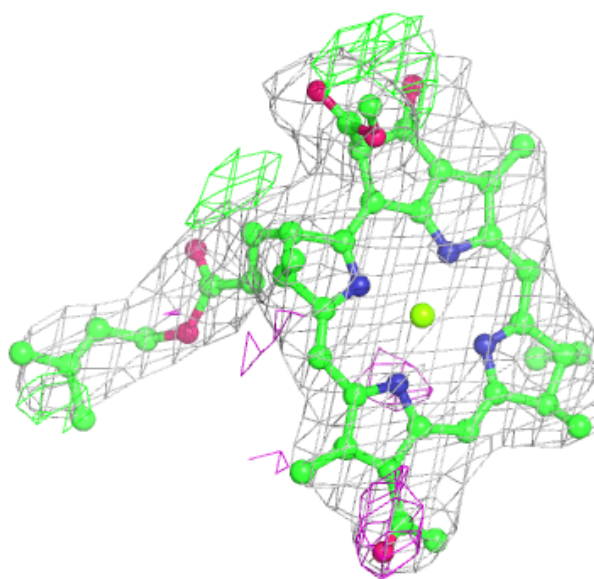
**Electron density around BPH M 407:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



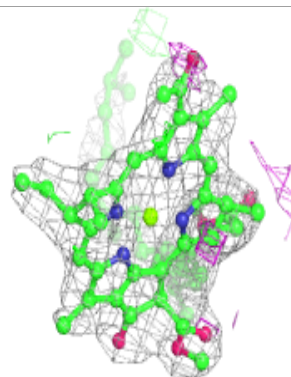
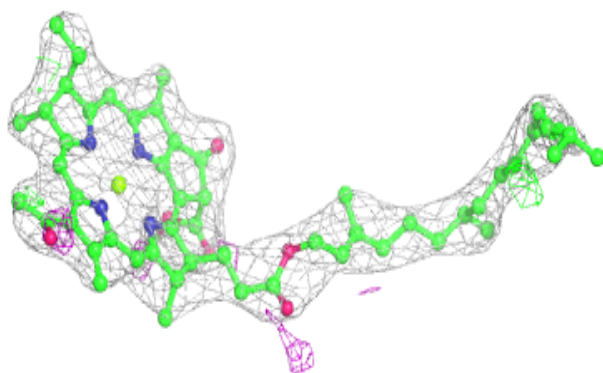
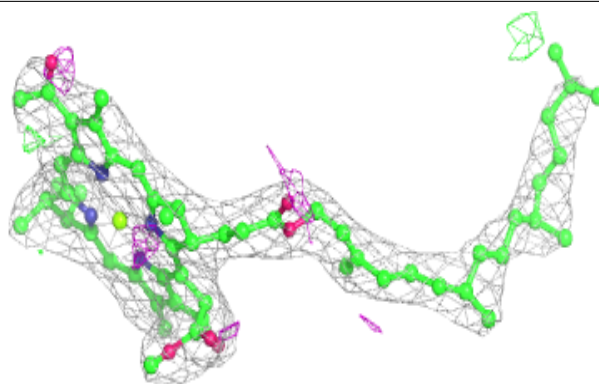
**Electron density around BCL L 305:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
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and green (positive)

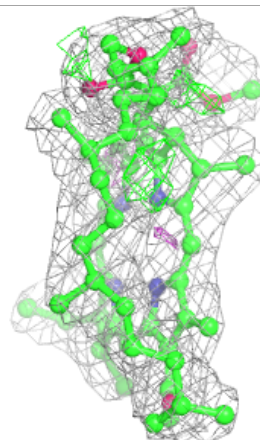
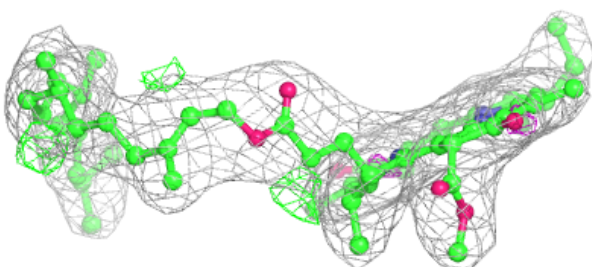
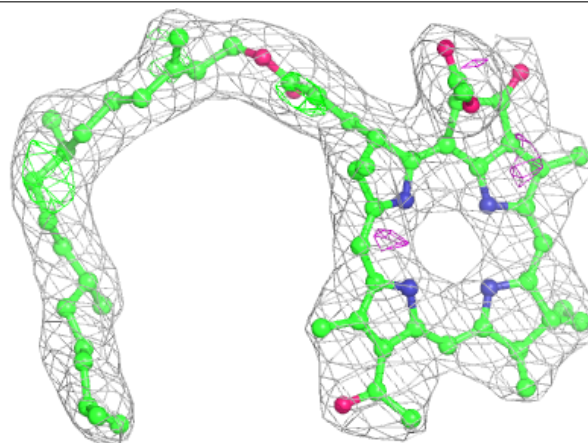


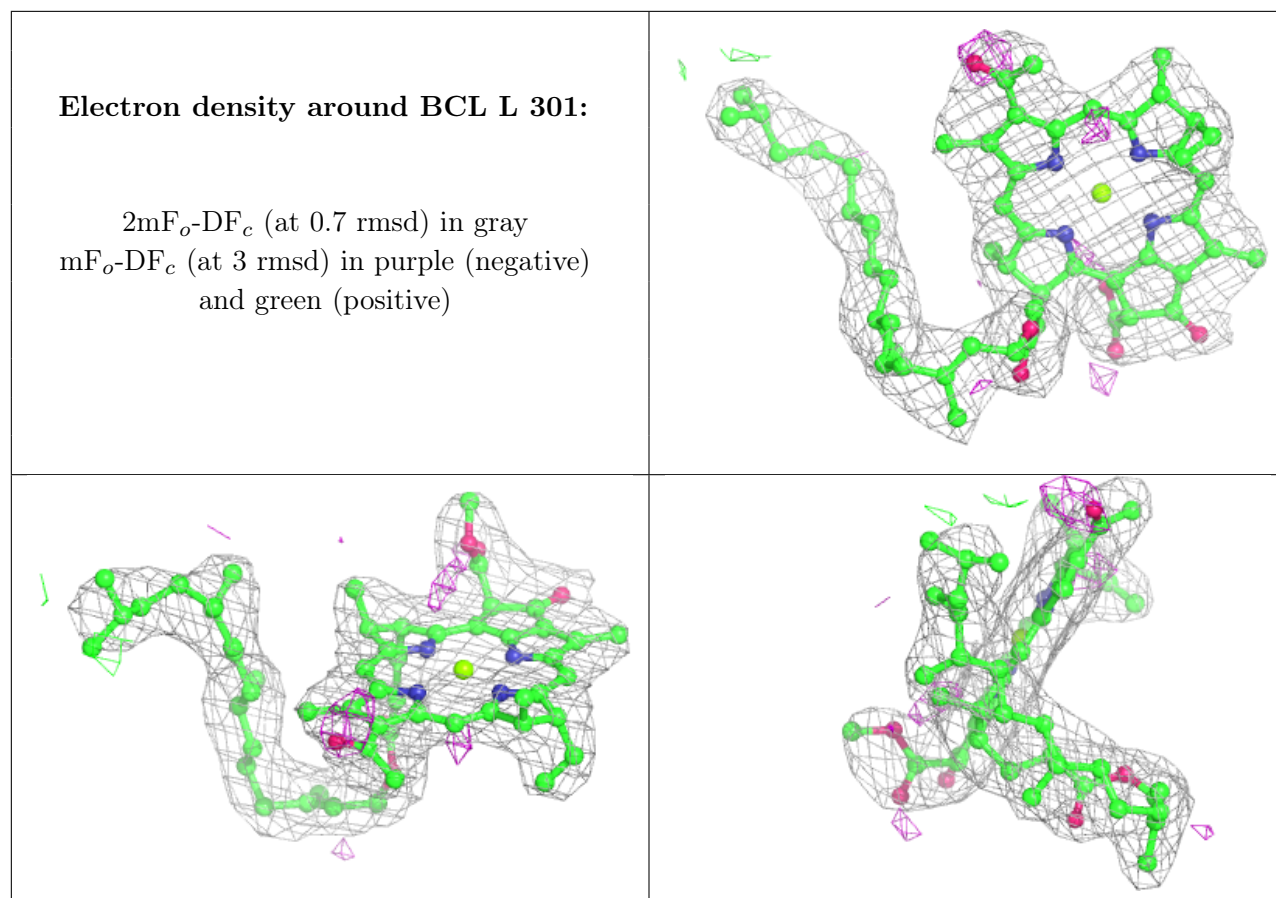
**Electron density around BCL M 401:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)

**Electron density around BPH L 302:**

$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





## 6.5 Other polymers [i](#)

There are no such residues in this entry.