Full wwPDB X-ray Structure Validation Report (i)

Jun 24, 2024 – 02:05 PM EDT

PDB ID	:	6IBB
Title	:	Crystal structure of the rat isoform of the succinate receptor SUCNR1 (GPR91) in complex with a nanobody
Authors	:	Haffke, M.; Jaakola, V.-P.
Deposited on	:	2018-11-29
Resolution	:	2.12 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*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

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

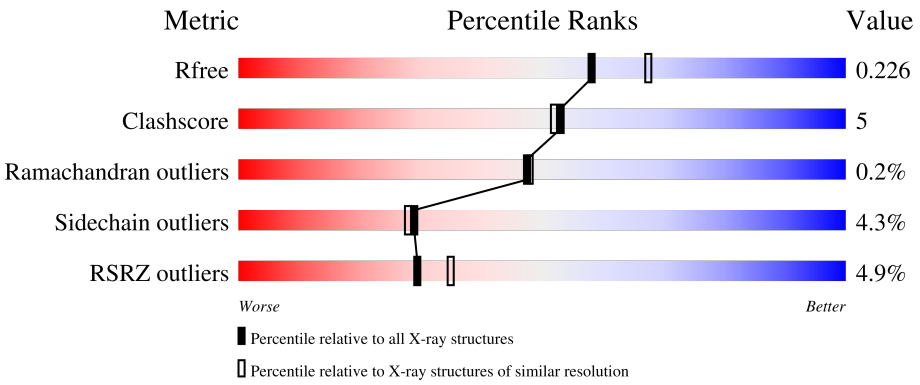
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 2.12 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	6241 (2.14-2.10)
Clashscore	141614	6778 (2.14-2.10)
Ramachandran outliers	138981	6705 (2.14-2.10)
Sidechain outliers	138945	6706 (2.14-2.10)
RSRZ outliers	127900	6112 (2.14-2.10)

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 >=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 <=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	342	5% 79% 8% • 12%
1	C	342	5% 69% 13% • 17%
2	B	142	% 84% 8% • 6%
2	D	142	4% 77% 8% 14%

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
3	OLC	A	403	-	-	-	X
3	OLC	A	405	-	-	-	X
3	OLC	C	402	-	-	-	X

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 7330 atoms, of which 14 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 Succinate receptor 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	301	2454	1649	383	404	18	0	0	0
1	C	285	2279	1529	354	378	18	0	0	0

There are 52 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-6	ASP	-	expression tag	UNP Q6IYF9
A	-5	TYR	-	expression tag	UNP Q6IYF9
A	-4	LYS	-	expression tag	UNP Q6IYF9
A	-3	ASP	-	expression tag	UNP Q6IYF9
A	-2	ASP	-	expression tag	UNP Q6IYF9
A	-1	ASP	-	expression tag	UNP Q6IYF9
A	0	ASP	-	expression tag	UNP Q6IYF9
A	1	LYS	-	expression tag	UNP Q6IYF9
A	318	LEU	-	expression tag	UNP Q6IYF9
A	319	GLU	-	expression tag	UNP Q6IYF9
A	320	VAL	-	expression tag	UNP Q6IYF9
A	321	LEU	-	expression tag	UNP Q6IYF9
A	322	PHE	-	expression tag	UNP Q6IYF9
A	323	GLN	-	expression tag	UNP Q6IYF9
A	324	GLY	-	expression tag	UNP Q6IYF9
A	325	PRO	-	expression tag	UNP Q6IYF9
A	326	HIS	-	expression tag	UNP Q6IYF9
A	327	HIS	-	expression tag	UNP Q6IYF9
A	328	HIS	-	expression tag	UNP Q6IYF9
A	329	HIS	-	expression tag	UNP Q6IYF9
A	330	HIS	-	expression tag	UNP Q6IYF9
A	331	HIS	-	expression tag	UNP Q6IYF9
A	332	HIS	-	expression tag	UNP Q6IYF9
A	333	HIS	-	expression tag	UNP Q6IYF9
A	334	HIS	-	expression tag	UNP Q6IYF9

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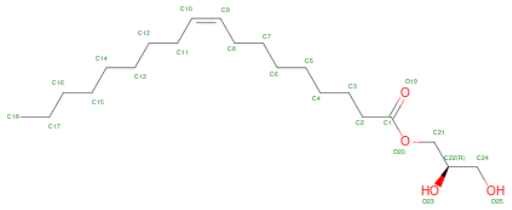
Chain	Residue	Modelled	Actual	Comment	Reference
A	335	HIS	-	expression tag	UNP Q6IYF9
C	-6	ASP	-	expression tag	UNP Q6IYF9
C	-5	TYR	-	expression tag	UNP Q6IYF9
C	-4	LYS	-	expression tag	UNP Q6IYF9
C	-3	ASP	-	expression tag	UNP Q6IYF9
C	-2	ASP	-	expression tag	UNP Q6IYF9
C	-1	ASP	-	expression tag	UNP Q6IYF9
C	0	ASP	-	expression tag	UNP Q6IYF9
C	1	LYS	-	expression tag	UNP Q6IYF9
C	318	LEU	-	expression tag	UNP Q6IYF9
C	319	GLU	-	expression tag	UNP Q6IYF9
C	320	VAL	-	expression tag	UNP Q6IYF9
C	321	LEU	-	expression tag	UNP Q6IYF9
C	322	PHE	-	expression tag	UNP Q6IYF9
C	323	GLN	-	expression tag	UNP Q6IYF9
C	324	GLY	-	expression tag	UNP Q6IYF9
C	325	PRO	-	expression tag	UNP Q6IYF9
C	326	HIS	-	expression tag	UNP Q6IYF9
C	327	HIS	-	expression tag	UNP Q6IYF9
C	328	HIS	-	expression tag	UNP Q6IYF9
C	329	HIS	-	expression tag	UNP Q6IYF9
C	330	HIS	-	expression tag	UNP Q6IYF9
C	331	HIS	-	expression tag	UNP Q6IYF9
C	332	HIS	-	expression tag	UNP Q6IYF9
C	333	HIS	-	expression tag	UNP Q6IYF9
C	334	HIS	-	expression tag	UNP Q6IYF9
C	335	HIS	-	expression tag	UNP Q6IYF9

- Molecule 2 is a protein called Nanobody6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	133	1000	627	169	199	5	0	0	0
			Total	C	N	O	S			
2	D	122	910	567	156	182	5	0	0	0

- Molecule 3 is (2R)-2,3-dihydroxypropyl (9Z)-octadec-9-enoate (three-letter code: OLC) (formula: $C_{21}H_{40}O_4$).

OLC



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
3	A	1	12	8	4	0	0
			Total	C	O		
3	A	1	11	7	4	0	0
			Total	C	O		
3	A	1	25	21	4	0	0
			Total	C	O		
3	A	1	19	15	4	0	0
			Total	C	O		
3	A	1	25	21	4	0	0
			Total	C	O		
3	A	1	25	21	4	0	0
			Total	C	O		
3	A	1	25	21	4	0	0
			Total	C	O		
3	A	1	21	17	4	0	0
			Total	C	O		
3	C	1	13	9	4	0	0
			Total	C	O		
3	C	1	25	21	4	0	0
			Total	C	O		
3	C	1	25	21	4	0	0
			Total	C	O		
3	C	1	25	21	4	0	0
			Total	C	O		
3	C	1	25	21	4	0	0
			Total	C	O		
3	C	1	25	21	4	0	0

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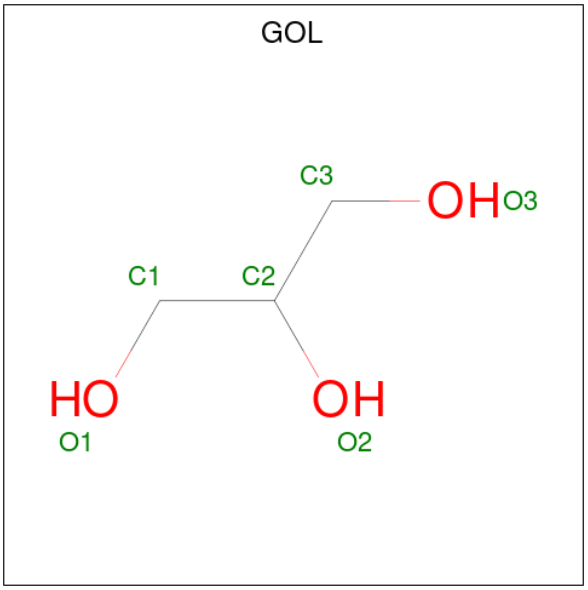
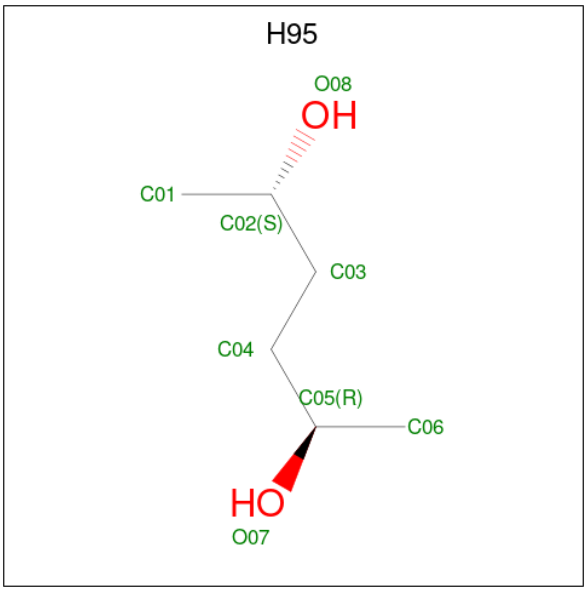
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
3	C	1	25	21	4	0	0

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



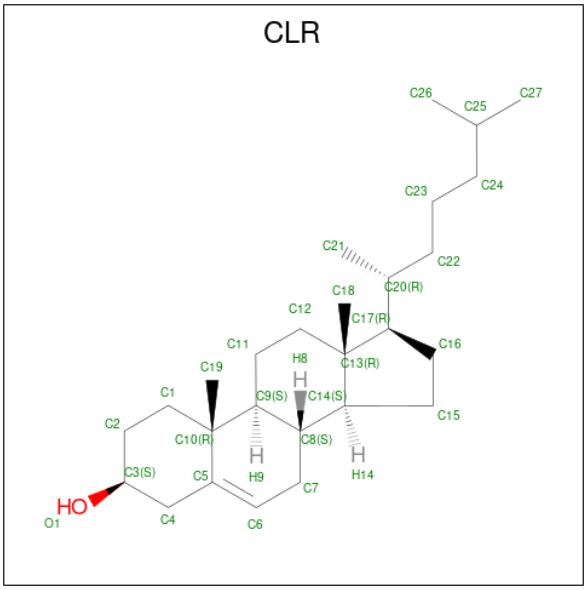
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
4	A	1	6	3	3	0	0
			Total	C	O		
4	C	1	6	3	3	0	0

- Molecule 5 is (2 {S},5 {R})-hexane-2,5-diol (three-letter code: H95) (formula: $C_6H_{14}O_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	H	O		
5	A	1	22	6	14	2	0	0

- Molecule 6 is CHOLESTEROL (three-letter code: CLR) (formula: $C_{27}H_{46}O$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
6	C	1	28	27	1	0	0

- Molecule 7 is water.

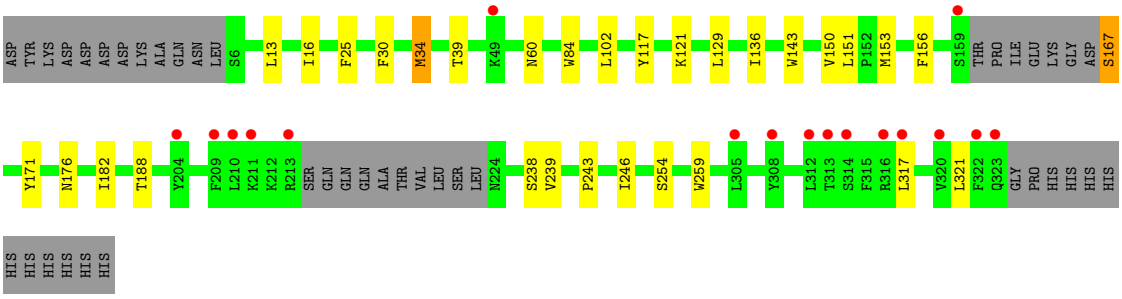
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
7	A	124	124	124	0	0
			Total	O		
7	B	56	56	56	0	0
			Total	O		
7	C	83	83	83	0	0
			Total	O		
7	D	36	36	36	0	0

3 Residue-property plots (i)

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

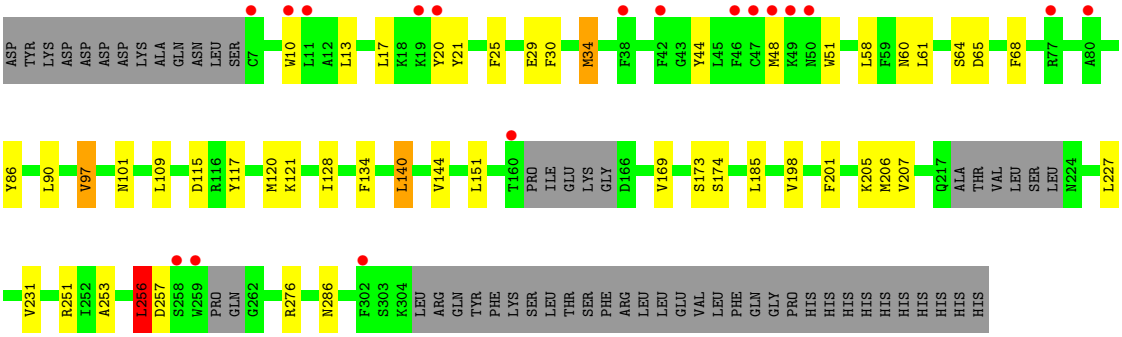
• Molecule 1: Succinate receptor 1

Chain A:



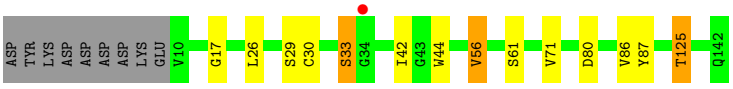
• Molecule 1: Succinate receptor 1

Chain C:



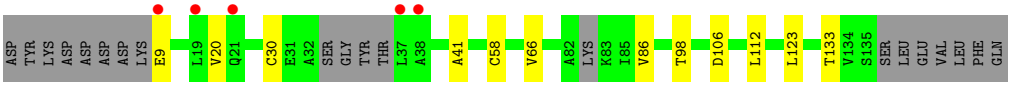
• Molecule 2: Nanobody6

Chain B:



• Molecule 2: Nanobody6

Chain D:


ASP
TYR
LYS
ASP
ASP
ASP
ASP
LYS
E9
L19
V20
Q21
C30
E31
A32
SER
GLY
TYR
THR
L37
A38
A41
C58
V66
A82
LYS
K83
I85
V86
T98
D106
L112
L123
T133
V134
S135
SER
LEU
GLU
VAL
LEU
PHE
GLN

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	60.22Å 164.00Å 63.42Å 90.00° 102.63° 90.00°	Depositor
Resolution (Å)	41.55 – 2.12 82.00 – 2.10	Depositor EDS
% Data completeness (in resolution range)	61.0 (41.55-2.12) 59.4 (82.00-2.10)	Depositor EDS
R_{merge}	0.76	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.18 (at 2.10Å)	Xtriage
Refinement program	BUSTER 2.11.7	Depositor
R, R_{free}	0.178 , 0.216 0.185 , 0.226	Depositor DCC
R_{free} test set	1951 reflections (4.73%)	wwPDB-VP
Wilson B-factor (Å^2)	39.8	Xtriage
Anisotropy	0.028	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 74.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	7330	wwPDB-VP
Average B, all atoms (Å^2)	56.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.62% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ 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: OLC, CLR, H95, GOL

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	0.53	0/2521	0.65	0/3423
1	C	0.53	0/2338	0.66	0/3177
2	B	0.48	0/1019	0.72	0/1382
2	D	0.46	0/927	0.74	0/1257
All	All	0.51	0/6805	0.68	0/9239

There are no bond length outliers.

There are no bond angle outliers.

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	A	2454	0	2503	24	0
1	C	2279	0	2292	28	0
2	B	1000	0	959	6	0
2	D	910	0	853	5	0
3	A	163	0	238	21	0
3	C	163	0	255	23	0
4	A	6	0	8	0	0
4	C	6	0	8	1	0
5	A	8	14	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	C	28	0	46	3	0
7	A	124	0	0	0	0
7	B	56	0	0	1	0
7	C	83	0	0	1	0
7	D	36	0	0	0	0
All	All	7316	14	7162	76	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 5.

All (76) 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:A:60:ASN:HD21	3:A:407:OLC:H8A	1.38	0.86
1:C:173:SER:HB3	1:C:251:ARG:HH11	1.58	0.69
2:B:42:ILE:HG13	2:B:86:VAL:HG21	1.78	0.66
1:C:276:ARG:HH12	4:C:409:GOL:H32	1.61	0.65
1:A:239:VAL:HG21	1:C:151:LEU:HD11	1.76	0.65
3:C:404:OLC:H15A	3:C:407:OLC:H8A	1.81	0.63
1:C:117:TYR:CZ	1:C:121:LYS:HD2	2.36	0.61
1:A:176:ASN:HB3	3:A:408:OLC:H24A	1.83	0.60
1:C:60:ASN:HD21	3:C:404:OLC:H9	1.64	0.60
6:C:403:CLR:H152	3:C:408:OLC:H9	1.86	0.56
1:A:39:THR:HG21	3:A:403:OLC:H7A	1.88	0.56
1:A:16:ILE:HD13	1:C:128:ILE:HG21	1.87	0.56
3:A:406:OLC:H12	3:C:407:OLC:H4A	1.88	0.55
1:C:144:VAL:HG22	3:C:402:OLC:H7	1.89	0.55
3:C:404:OLC:H13A	3:C:407:OLC:H5	1.89	0.54
3:A:403:OLC:H15A	3:A:403:OLC:H9	1.89	0.53
2:B:17:GLY:HA2	2:B:26:LEU:HD13	1.90	0.53
1:A:143:TRP:CD1	3:A:407:OLC:H13	2.43	0.53
1:C:253:ALA:O	1:C:256:LEU:HB2	2.09	0.53
1:A:30:PHE:O	1:A:34:MET:HB2	2.09	0.53
1:C:64:SER:OG	1:C:101:ASN:HA	2.10	0.52
1:A:239:VAL:HG22	3:C:402:OLC:H2	1.92	0.51
2:D:98:THR:HG23	2:D:133:THR:HA	1.93	0.51
1:C:68:PHE:HA	1:C:97:VAL:HG13	1.95	0.49
1:A:143:TRP:HB3	3:A:404:OLC:H11A	1.95	0.49
1:C:144:VAL:HG22	3:C:402:OLC:C7	2.43	0.49
2:D:41:ALA:HB3	2:D:106:ASP:HB3	1.95	0.49
3:A:404:OLC:H10	3:A:407:OLC:H17	1.95	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:176:ASN:CB	3:A:408:OLC:H24A	2.43	0.48
1:C:30:PHE:O	1:C:34:MET:HB2	2.13	0.48
1:A:151:LEU:HD13	3:A:404:OLC:H2A	1.95	0.48
1:A:254:SER:HA	1:A:259:TRP:CD2	2.48	0.48
1:A:60:ASN:OD1	3:A:407:OLC:H11	2.14	0.48
1:C:115:ASP:HA	3:C:408:OLC:H24A	1.95	0.47
1:A:243:PRO:CG	3:C:402:OLC:H7A	2.44	0.47
3:A:406:OLC:H15A	3:C:402:OLC:H8	1.97	0.47
1:C:201:PHE:HE1	3:C:405:OLC:H22	1.79	0.47
2:D:30:CYS:HB3	2:D:86:VAL:HG22	1.96	0.46
3:A:405:OLC:H12	3:A:405:OLC:H16	1.97	0.46
3:A:406:OLC:H12	3:C:407:OLC:H3	1.97	0.46
1:A:238:SER:HB3	3:C:402:OLC:H21	1.96	0.45
2:D:112:LEU:HD13	2:D:123:LEU:HD11	1.98	0.45
1:A:84:TRP:HB3	1:A:167:SER:HB3	1.99	0.45
1:C:134:PHE:HE2	3:C:408:OLC:H21A	1.81	0.45
3:C:407:OLC:H3A	3:C:407:OLC:H7A	1.98	0.45
1:C:173:SER:CB	1:C:251:ARG:HH11	2.27	0.45
1:C:17:LEU:HA	1:C:21:TYR:HB3	1.99	0.45
2:B:80:ASP:HB3	2:B:87:TYR:HE1	1.82	0.45
1:C:140:LEU:HD11	3:C:407:OLC:H2	1.99	0.44
1:C:51:TRP:CD2	3:C:404:OLC:H2	2.53	0.44
1:A:156:PHE:CD1	3:A:408:OLC:H24	2.53	0.44
1:A:136:ILE:HG23	3:A:407:OLC:H9	1.98	0.43
1:C:198:VAL:HG11	6:C:403:CLR:H121	1.98	0.43
1:A:246:ILE:HA	3:A:402:OLC:H2	2.00	0.43
3:C:406:OLC:H18A	7:C:547:HOH:O	2.18	0.43
2:D:58:CYS:HB3	2:D:66:VAL:HG23	2.00	0.43
3:A:406:OLC:H5	3:A:406:OLC:H2A	1.70	0.42
3:C:404:OLC:H16	3:C:407:OLC:H11A	2.00	0.42
1:A:117:TYR:CZ	1:A:121:LYS:HD2	2.53	0.42
1:C:86:TYR:HB3	1:C:90:LEU:HD13	2.00	0.42
1:C:207:VAL:HG12	1:C:227:LEU:HD11	2.00	0.42
6:C:403:CLR:H162	3:C:408:OLC:H10	2.00	0.42
1:A:150:VAL:O	1:A:153:MET:HB2	2.18	0.42
3:A:404:OLC:H10	3:A:407:OLC:H15A	2.01	0.42
2:B:56:VAL:HG13	2:B:71:VAL:HG21	2.01	0.42
2:B:125:THR:HG23	7:B:206:HOH:O	2.19	0.42
1:C:51:TRP:CD1	3:C:404:OLC:H21	2.55	0.41
1:C:120:MET:HE1	1:C:206:MET:HA	2.02	0.41
1:C:227:LEU:O	1:C:231:VAL:HG23	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:182:ILE:HG22	3:A:408:OLC:H8A	2.02	0.41
1:A:188:THR:HG21	3:A:402:OLC:H3A	2.02	0.41
1:C:44:TYR:CD1	1:C:48:MET:HG3	2.54	0.41
1:A:243:PRO:HG3	3:C:402:OLC:H7A	2.03	0.41
2:B:30:CYS:HB2	2:B:44:TRP:CZ2	2.56	0.41
1:C:58:LEU:O	1:C:61:LEU:HB3	2.21	0.41
1:C:65:ASP:OD2	1:C:286:ASN:OD1	2.39	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	A	295/342 (86%)	290 (98%)	5 (2%)	0	100	100
1	C	277/342 (81%)	270 (98%)	6 (2%)	1 (0%)	34	32
2	B	131/142 (92%)	124 (95%)	6 (5%)	1 (1%)	19	14
2	D	118/142 (83%)	110 (93%)	8 (7%)	0	100	100
All	All	821/968 (85%)	794 (97%)	25 (3%)	2 (0%)	47	48

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	33	SER
1	C	256	LEU

5.3.2 Protein sidechains (i)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	272/315 (86%)	263 (97%)	9 (3%)	38	39
1	C	247/315 (78%)	232 (94%)	15 (6%)	18	15
2	B	107/118 (91%)	102 (95%)	5 (5%)	26	24
2	D	95/118 (80%)	93 (98%)	2 (2%)	53	57
All	All	721/866 (83%)	690 (96%)	31 (4%)	29	28

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	13	LEU
1	A	25	PHE
1	A	34	MET
1	A	102	LEU
1	A	129	LEU
1	A	167	SER
1	A	171	TYR
1	A	317	LEU
1	A	321	LEU
2	B	29	SER
2	B	33	SER
2	B	56	VAL
2	B	61	SER
2	B	125	THR
1	C	10	TRP
1	C	13	LEU
1	C	20	TYR
1	C	25	PHE
1	C	29	GLU
1	C	34	MET
1	C	97	VAL
1	C	109	LEU
1	C	140	LEU
1	C	169	VAL
1	C	174	SER
1	C	185	LEU
1	C	205	LYS
1	C	256	LEU
1	C	257	ASP
2	D	9	GLU

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Mol	Chain	Res	Type
2	D	20	VAL

Sometimes 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 monosaccharides in this entry.

5.6 Ligand geometry (i)

19 ligands are 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	$\#\|Z\| > 2$
5	H95	A	410	-	7,7,7	0.60	0	8,8,8	1.14	1 (12%)
3	OLC	C	401	-	12,12,24	0.75	0	13,13,25	0.52	0
3	OLC	A	406	-	24,24,24	0.73	0	25,25,25	0.46	0
3	OLC	A	403	-	24,24,24	0.72	0	25,25,25	0.42	0
3	OLC	A	407	-	24,24,24	0.73	0	25,25,25	0.48	0
3	OLC	A	401	-	11,11,24	0.73	0	12,12,25	0.49	0
4	GOL	A	409	-	5,5,5	0.87	0	5,5,5	0.40	0
3	OLC	A	405	-	24,24,24	0.71	0	25,25,25	0.46	0
3	OLC	A	408	-	20,20,24	0.71	0	21,21,25	0.51	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\| > 2$	Counts	RMSZ	$\#\|Z\| > 2$
3	OLC	A	402	-	10,10,24	0.69	0	11,11,25	0.53	0
4	GOL	C	409	-	5,5,5	0.67	0	5,5,5	0.60	0
3	OLC	C	405	-	24,24,24	0.73	0	25,25,25	0.43	0
6	CLR	C	403	-	31,31,31	1.34	4 (12%)	48,48,48	0.81	0
3	OLC	C	407	-	24,24,24	0.73	0	25,25,25	0.43	0
3	OLC	A	404	-	18,18,24	0.71	0	18,19,25	0.69	0
3	OLC	C	408	-	24,24,24	0.68	0	25,25,25	0.53	0
3	OLC	C	402	-	24,24,24	0.72	0	25,25,25	0.60	0
3	OLC	C	406	-	24,24,24	0.69	0	25,25,25	0.51	0
3	OLC	C	404	-	24,24,24	0.76	0	25,25,25	0.60	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
5	H95	A	410	-	-	4/5/5/5	-
3	OLC	C	401	-	-	5/12/12/24	-
3	OLC	A	406	-	-	15/24/24/24	-
3	OLC	A	403	-	-	12/24/24/24	-
3	OLC	A	407	-	-	13/24/24/24	-
3	OLC	A	401	-	-	9/11/11/24	-
4	GOL	A	409	-	-	2/4/4/4	-
3	OLC	A	405	-	-	12/24/24/24	-
3	OLC	A	408	-	-	13/20/20/24	-
3	OLC	A	402	-	-	4/10/10/24	-
4	GOL	C	409	-	-	0/4/4/4	-
3	OLC	C	405	-	-	11/24/24/24	-
6	CLR	C	403	-	-	3/10/68/68	0/4/4/4
3	OLC	C	407	-	-	13/24/24/24	-
3	OLC	A	404	-	-	9/18/18/24	-
3	OLC	C	408	-	-	17/24/24/24	-
3	OLC	C	402	-	-	10/24/24/24	-
3	OLC	C	406	-	-	11/24/24/24	-
3	OLC	C	404	-	-	16/24/24/24	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	C	403	CLR	C11-C9	2.14	1.57	1.53
6	C	403	CLR	C20-C17	2.10	1.58	1.54
6	C	403	CLR	C1-C10	2.05	1.58	1.54
6	C	403	CLR	C4-C3	2.01	1.55	1.52

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	A	410	H95	C04-C03-C02	-2.10	110.13	113.10

There are no chirality outliers.

All (179) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	401	OLC	C21-C22-C24-O25
3	A	401	OLC	O20-C21-C22-C24
3	A	402	OLC	O20-C21-C22-C24
3	A	402	OLC	O20-C21-C22-O23
3	A	404	OLC	C9-C10-C11-C12
3	A	405	OLC	C21-C22-C24-O25
3	A	405	OLC	O23-C22-C24-O25
3	A	405	OLC	O20-C21-C22-C24
3	A	405	OLC	O20-C21-C22-O23
3	A	407	OLC	C21-C22-C24-O25
3	A	407	OLC	O23-C22-C24-O25
3	A	408	OLC	C21-C22-C24-O25
3	C	401	OLC	O20-C21-C22-C24
3	C	401	OLC	O20-C21-C22-O23
3	C	406	OLC	O20-C21-C22-C24
3	C	408	OLC	C21-C22-C24-O25
3	C	408	OLC	O20-C21-C22-C24
4	A	409	GOL	C1-C2-C3-O3
5	A	410	H95	C03-C04-C05-C06
3	A	405	OLC	O19-C1-O20-C21
3	A	408	OLC	O19-C1-O20-C21
3	C	402	OLC	O19-C1-O20-C21
3	C	404	OLC	O19-C1-O20-C21
3	C	407	OLC	O19-C1-O20-C21
3	A	405	OLC	C2-C1-O20-C21
3	C	402	OLC	C2-C1-O20-C21
3	C	404	OLC	C2-C1-O20-C21
3	A	407	OLC	C2-C1-O20-C21

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Mol	Chain	Res	Type	Atoms
3	A	408	OLC	C2-C1-O20-C21
3	C	407	OLC	C2-C1-O20-C21
3	C	406	OLC	O19-C1-O20-C21
3	A	403	OLC	C2-C1-O20-C21
3	C	406	OLC	C2-C1-O20-C21
3	A	401	OLC	O20-C21-C22-O23
3	C	404	OLC	O20-C21-C22-O23
3	C	406	OLC	O20-C21-C22-O23
3	C	408	OLC	O20-C21-C22-O23
3	A	406	OLC	C13-C14-C15-C16
3	A	403	OLC	O19-C1-O20-C21
6	C	403	CLR	C21-C20-C22-C23
3	A	407	OLC	O19-C1-O20-C21
3	A	402	OLC	C2-C1-O20-C21
6	C	403	CLR	C17-C20-C22-C23
3	A	402	OLC	O19-C1-O20-C21
3	A	407	OLC	O20-C21-C22-C24
3	C	404	OLC	O20-C21-C22-C24
3	A	407	OLC	O20-C21-C22-O23
3	C	405	OLC	C2-C1-O20-C21
3	A	406	OLC	C1-C2-C3-C4
3	C	407	OLC	C12-C13-C14-C15
3	C	405	OLC	O19-C1-O20-C21
3	A	408	OLC	C1-C2-C3-C4
3	A	404	OLC	O20-C21-C22-O23
3	A	406	OLC	C6-C7-C8-C9
3	A	403	OLC	C12-C13-C14-C15
3	A	405	OLC	C4-C5-C6-C7
3	C	406	OLC	C4-C5-C6-C7
3	A	404	OLC	O20-C21-C22-C24
3	C	405	OLC	C13-C14-C15-C16
3	A	406	OLC	C14-C15-C16-C17
3	A	406	OLC	C2-C3-C4-C5
3	A	406	OLC	C5-C6-C7-C8
3	A	404	OLC	C21-C22-C24-O25
3	C	404	OLC	C21-C22-C24-O25
3	C	407	OLC	C10-C11-C12-C13
3	A	408	OLC	C5-C6-C7-C8
3	A	404	OLC	C2-C3-C4-C5
3	C	404	OLC	C14-C15-C16-C17
3	A	403	OLC	C3-C4-C5-C6
3	A	405	OLC	C11-C12-C13-C14

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Mol	Chain	Res	Type	Atoms
3	C	408	OLC	C12-C13-C14-C15
3	C	408	OLC	C4-C5-C6-C7
3	A	401	OLC	C1-C2-C3-C4
3	A	408	OLC	C4-C5-C6-C7
3	C	406	OLC	C2-C3-C4-C5
3	A	408	OLC	O23-C22-C24-O25
3	C	404	OLC	O23-C22-C24-O25
3	C	408	OLC	O23-C22-C24-O25
4	A	409	GOL	O2-C2-C3-O3
3	C	404	OLC	C2-C3-C4-C5
3	C	402	OLC	C2-C3-C4-C5
3	A	405	OLC	C13-C14-C15-C16
3	A	406	OLC	C4-C5-C6-C7
3	C	401	OLC	C1-C2-C3-C4
3	A	403	OLC	C10-C11-C12-C13
3	A	405	OLC	C6-C7-C8-C9
3	A	408	OLC	C10-C11-C12-C13
6	C	403	CLR	C22-C23-C24-C25
3	C	401	OLC	C2-C3-C4-C5
3	A	408	OLC	O20-C21-C22-C24
3	C	407	OLC	C14-C15-C16-C17
3	C	407	OLC	C2-C3-C4-C5
3	C	402	OLC	C3-C4-C5-C6
3	C	405	OLC	C6-C7-C8-C9
3	C	407	OLC	C6-C7-C8-C9
3	A	407	OLC	C3-C4-C5-C6
3	C	404	OLC	C6-C7-C8-C9
3	C	402	OLC	C9-C10-C11-C12
3	C	407	OLC	C15-C16-C17-C18
3	C	404	OLC	C13-C14-C15-C16
3	A	401	OLC	O23-C22-C24-O25
3	A	404	OLC	O23-C22-C24-O25
3	A	407	OLC	C10-C11-C12-C13
3	A	408	OLC	C6-C7-C8-C9
3	C	405	OLC	C2-C3-C4-C5
3	A	403	OLC	C15-C16-C17-C18
3	C	408	OLC	C2-C1-O20-C21
3	C	405	OLC	C15-C16-C17-C18
3	A	403	OLC	O20-C21-C22-C24
3	C	401	OLC	C3-C4-C5-C6
3	C	407	OLC	C4-C5-C6-C7
3	A	405	OLC	C2-C3-C4-C5

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Mol	Chain	Res	Type	Atoms
3	C	402	OLC	C10-C11-C12-C13
3	C	408	OLC	C6-C7-C8-C9
3	C	405	OLC	C12-C13-C14-C15
3	A	403	OLC	C5-C6-C7-C8
3	C	405	OLC	C3-C4-C5-C6
3	C	404	OLC	C11-C12-C13-C14
3	A	407	OLC	C11-C12-C13-C14
5	A	410	H95	C01-C02-C03-C04
5	A	410	H95	O08-C02-C03-C04
3	C	405	OLC	C14-C15-C16-C17
3	C	404	OLC	C5-C6-C7-C8
3	A	406	OLC	C10-C11-C12-C13
3	C	404	OLC	C12-C13-C14-C15
3	C	408	OLC	O19-C1-O20-C21
3	A	406	OLC	C11-C12-C13-C14
3	C	407	OLC	C5-C6-C7-C8
3	C	408	OLC	C5-C6-C7-C8
3	C	408	OLC	C10-C11-C12-C13
3	C	407	OLC	C1-C2-C3-C4
3	C	406	OLC	C13-C14-C15-C16
3	C	406	OLC	C3-C4-C5-C6
3	A	403	OLC	C11-C12-C13-C14
3	C	402	OLC	C21-C22-C24-O25
3	A	406	OLC	C3-C4-C5-C6
3	A	403	OLC	C1-C2-C3-C4
3	C	406	OLC	C12-C13-C14-C15
3	A	407	OLC	C13-C14-C15-C16
3	A	404	OLC	C4-C5-C6-C7
3	A	407	OLC	C15-C16-C17-C18
3	A	404	OLC	C5-C6-C7-C8
3	C	406	OLC	C15-C16-C17-C18
3	A	406	OLC	O20-C21-C22-O23
3	C	407	OLC	C3-C4-C5-C6
3	A	407	OLC	C7-C8-C9-C10
3	C	408	OLC	C3-C4-C5-C6
3	C	404	OLC	C7-C8-C9-C10
3	A	403	OLC	O20-C21-C22-O23
3	C	408	OLC	C13-C14-C15-C16
3	A	406	OLC	O19-C1-O20-C21
3	C	404	OLC	C1-C2-C3-C4
3	A	401	OLC	C2-C3-C4-C5
3	C	408	OLC	C9-C10-C11-C12

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Mol	Chain	Res	Type	Atoms
3	A	401	OLC	O19-C1-O20-C21
3	C	407	OLC	C9-C10-C11-C12
3	A	406	OLC	C2-C1-O20-C21
3	C	405	OLC	C10-C11-C12-C13
3	C	408	OLC	O20-C1-C2-C3
3	A	408	OLC	C7-C8-C9-C10
3	C	406	OLC	C14-C15-C16-C17
3	A	404	OLC	C7-C8-C9-C10
3	A	408	OLC	O20-C21-C22-O23
3	A	406	OLC	C7-C8-C9-C10
3	C	408	OLC	C7-C8-C9-C10
3	C	405	OLC	C21-C22-C24-O25
3	A	403	OLC	C9-C10-C11-C12
3	C	408	OLC	O19-C1-C2-C3
3	C	404	OLC	C3-C4-C5-C6
3	A	407	OLC	C1-C2-C3-C4
5	A	410	H95	C03-C04-C05-O07
3	A	405	OLC	C1-C2-C3-C4
3	C	402	OLC	O23-C22-C24-O25
3	A	408	OLC	C9-C10-C11-C12
3	C	402	OLC	O20-C1-C2-C3
3	A	401	OLC	O20-C1-C2-C3
3	A	401	OLC	O19-C1-C2-C3
3	C	402	OLC	O19-C1-C2-C3
3	A	406	OLC	O20-C1-C2-C3

There are no ring outliers.

15 monomers are involved in 43 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	406	OLC	4	0
3	A	403	OLC	2	0
3	A	407	OLC	6	0
3	A	405	OLC	1	0
3	A	408	OLC	4	0
3	A	402	OLC	2	0
4	C	409	GOL	1	0
3	C	405	OLC	1	0
6	C	403	CLR	3	0
3	C	407	OLC	7	0
3	A	404	OLC	4	0
3	C	408	OLC	4	0

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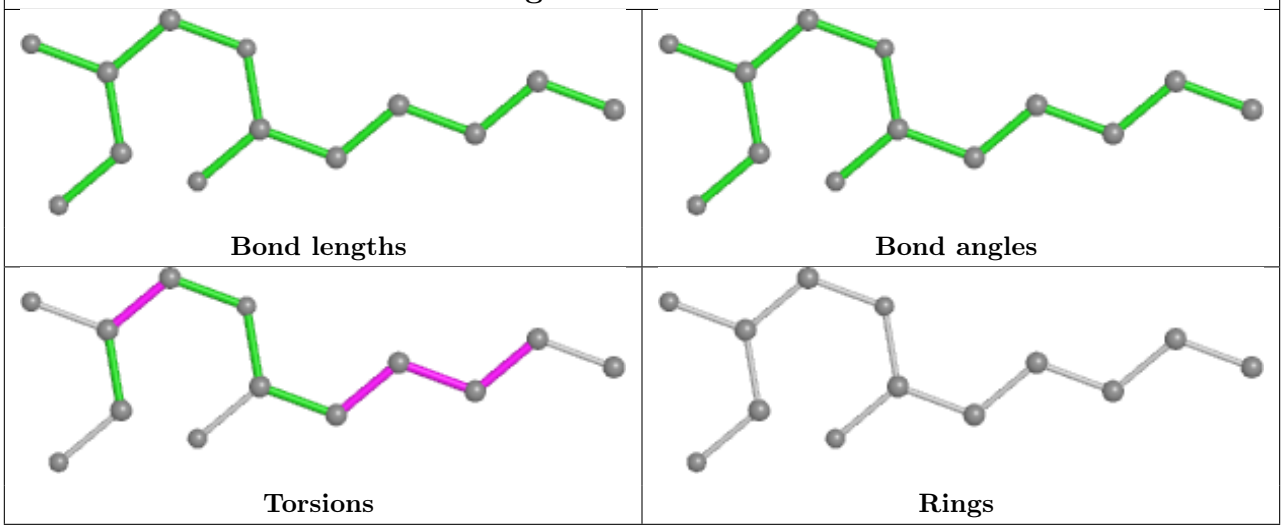
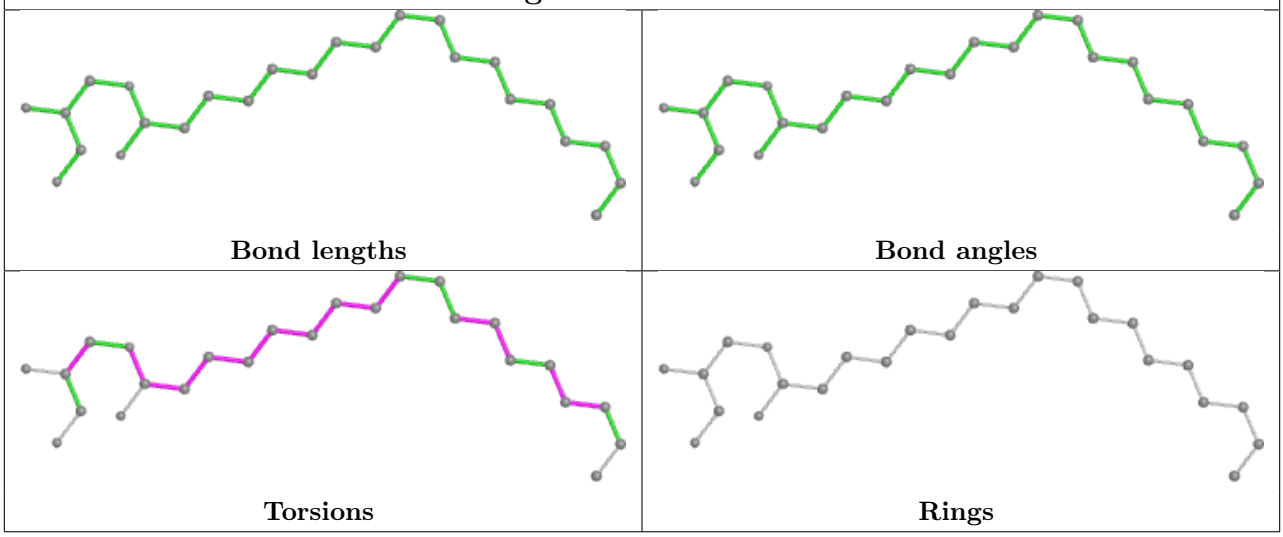
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	402	OLC	7	0
3	C	406	OLC	1	0
3	C	404	OLC	6	0

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 then 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.

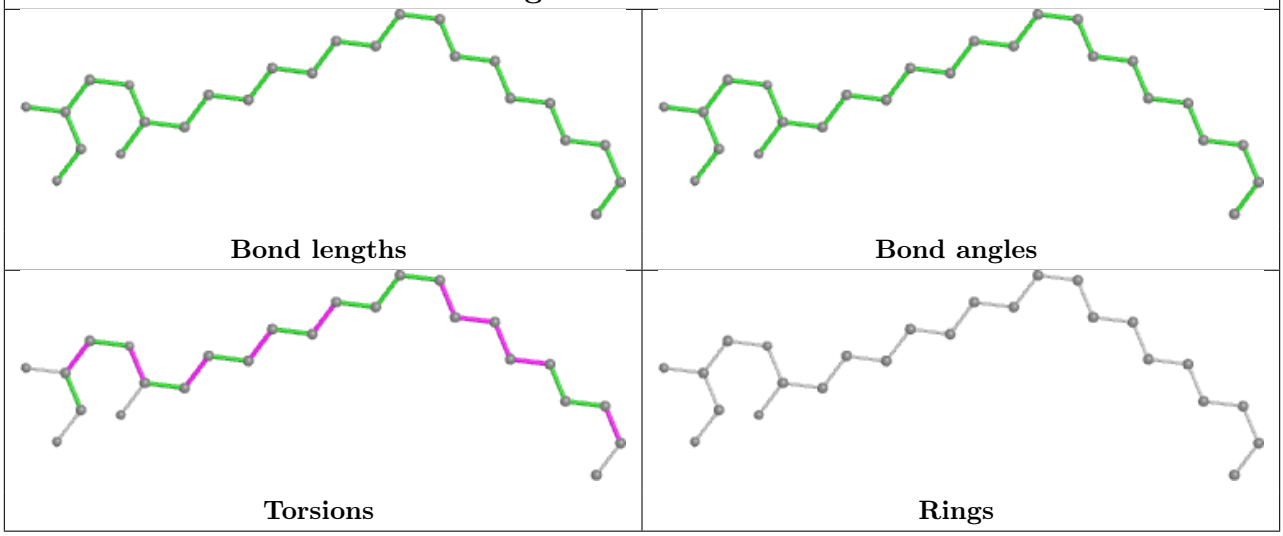
Ligand OLC C 401



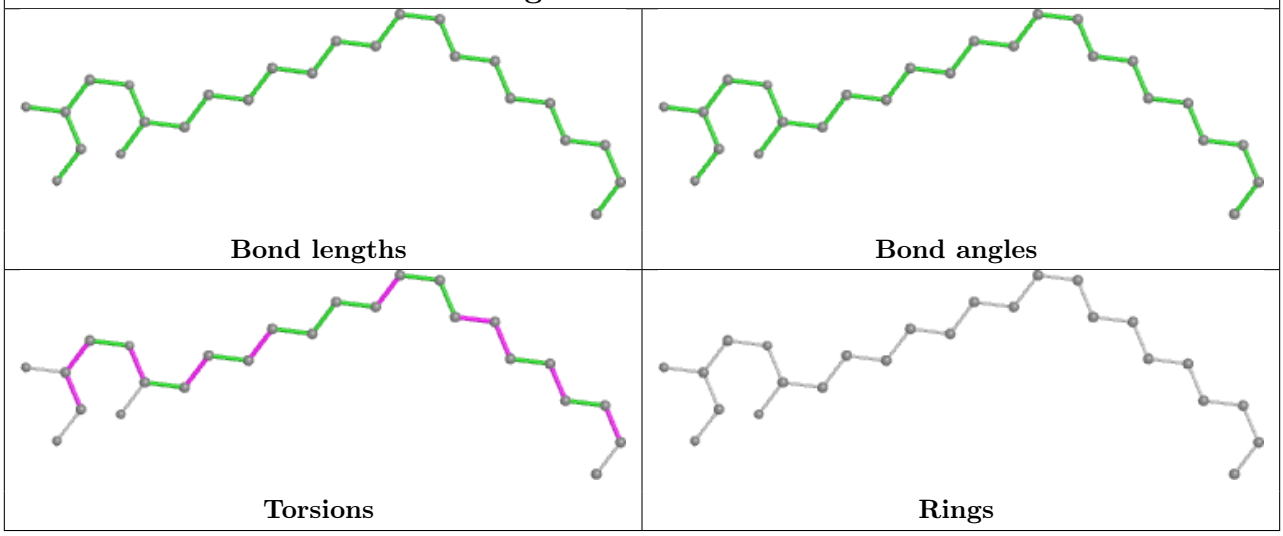
Ligand OLC A 406



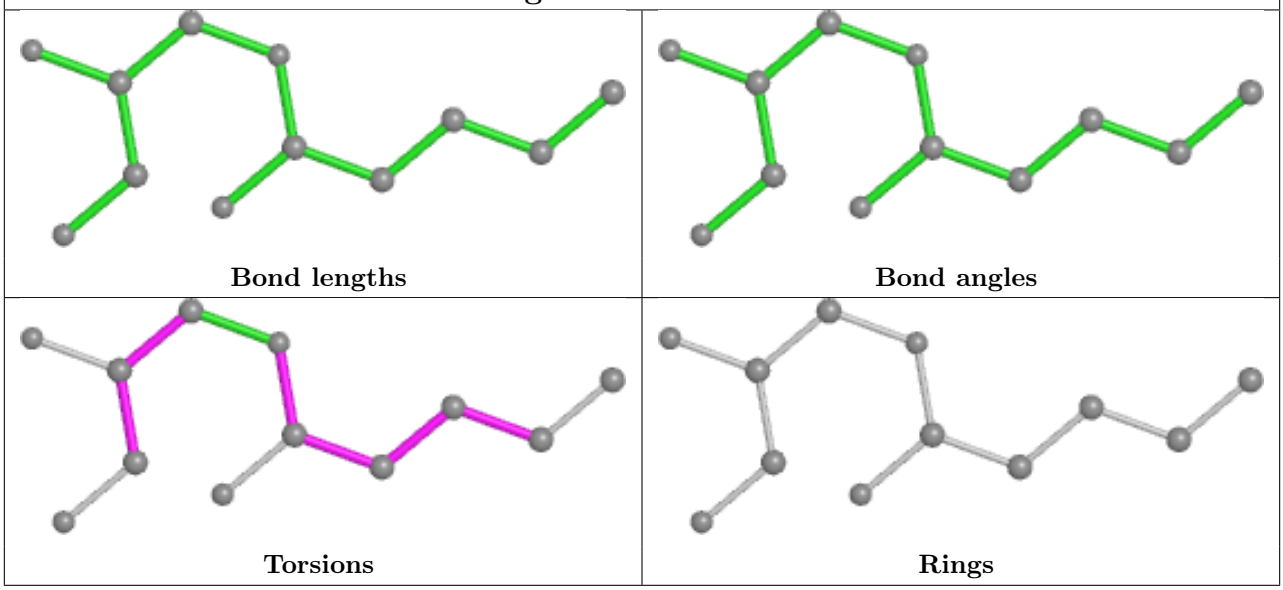
Ligand OLC A 403



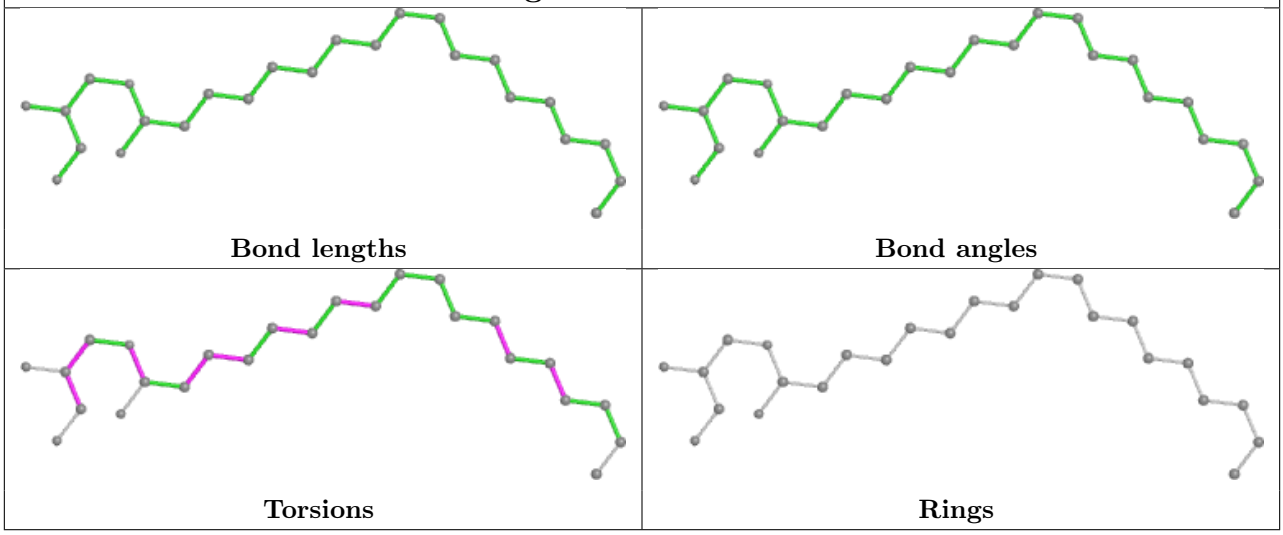
Ligand OLC A 407



Ligand OLC A 401



Ligand OLC A 405



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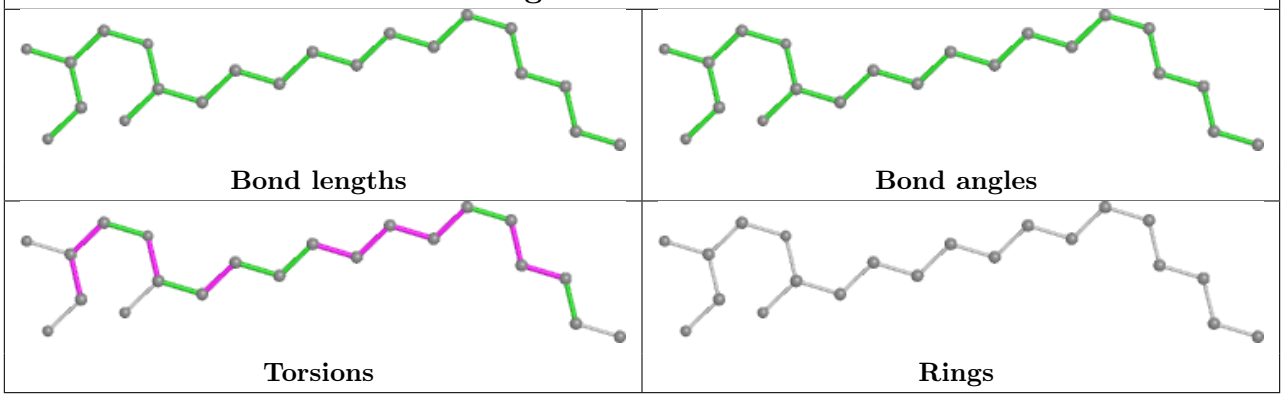
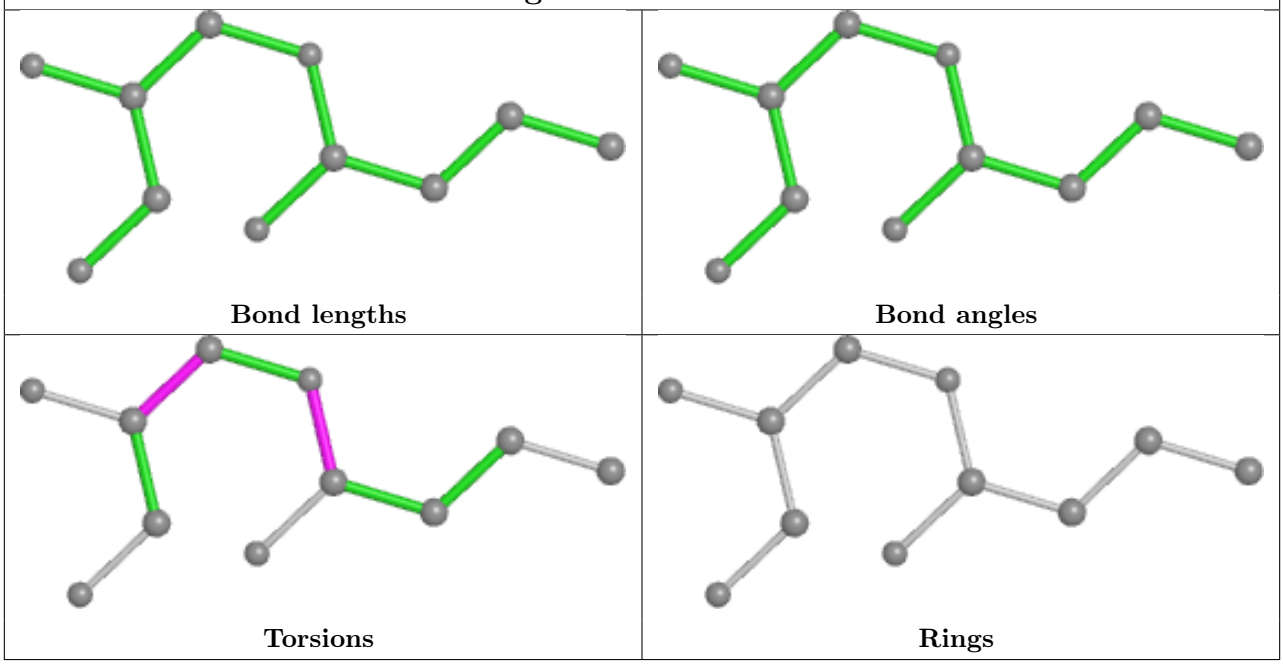
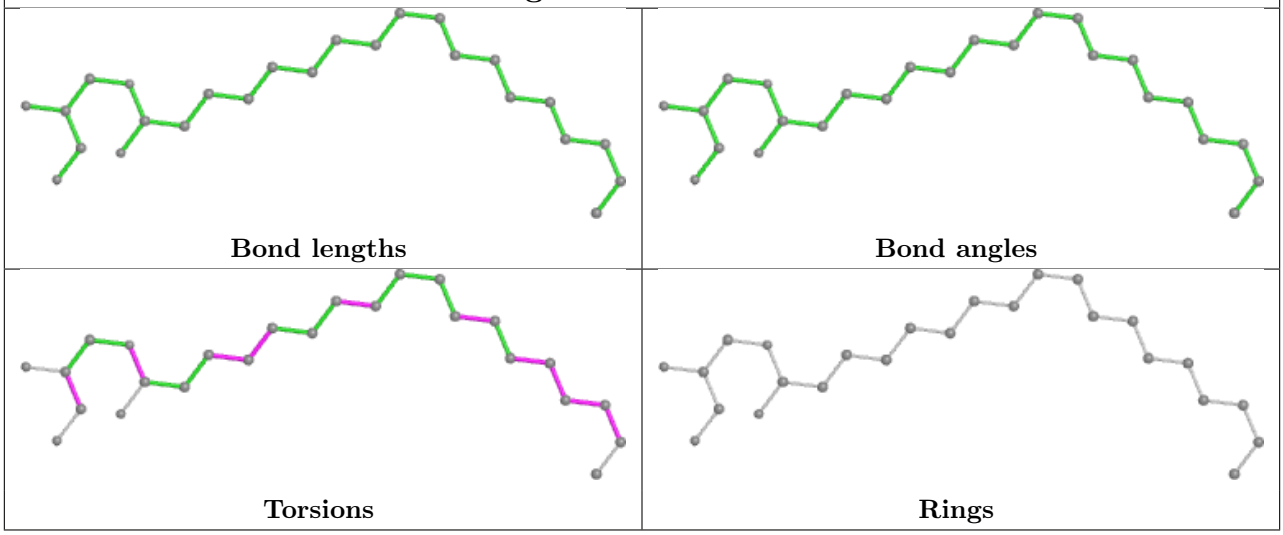


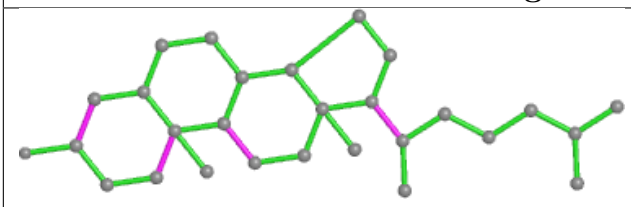
Ligand OLC A 402



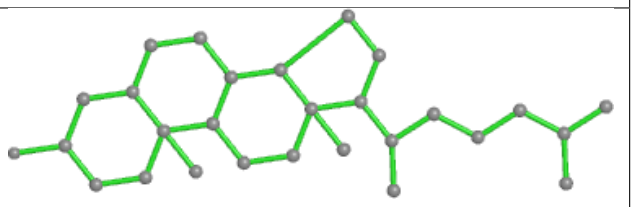
Ligand OLC C 405



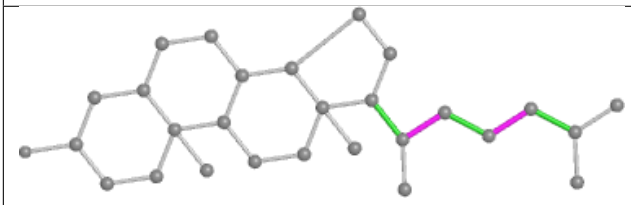
Ligand CLR C 403



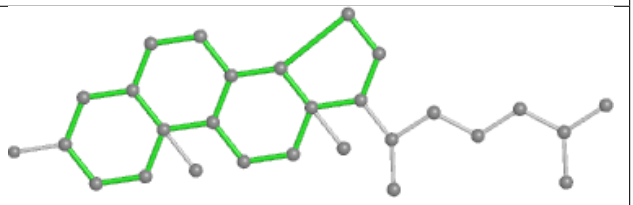
Bond lengths



Bond angles

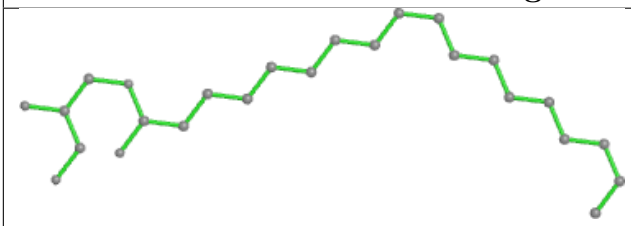


Torsions

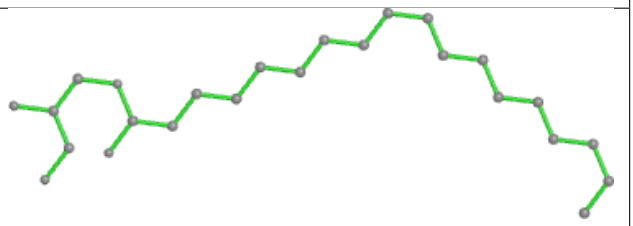


Rings

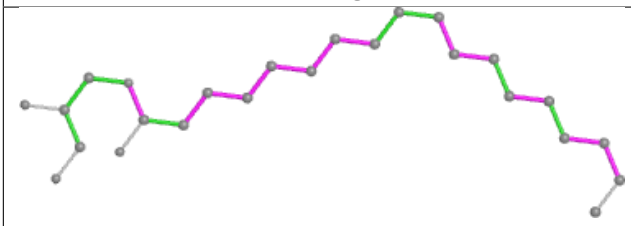
Ligand OLC C 407



Bond lengths



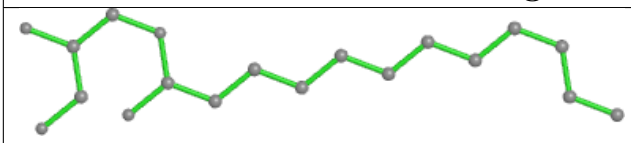
Bond angles



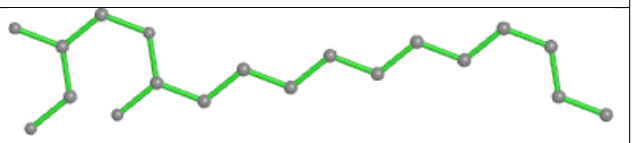
Torsions

Rings

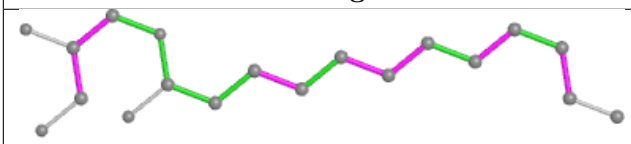
Ligand OLC A 404



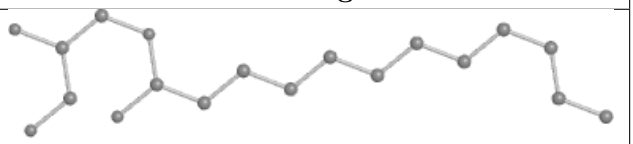
Bond lengths



Bond angles

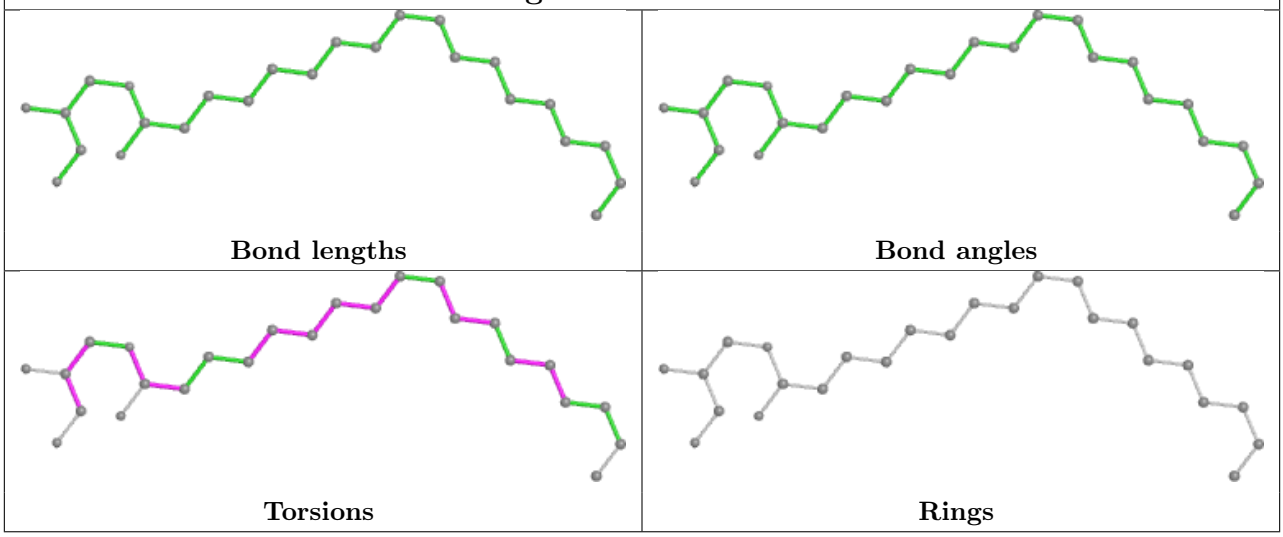


Torsions

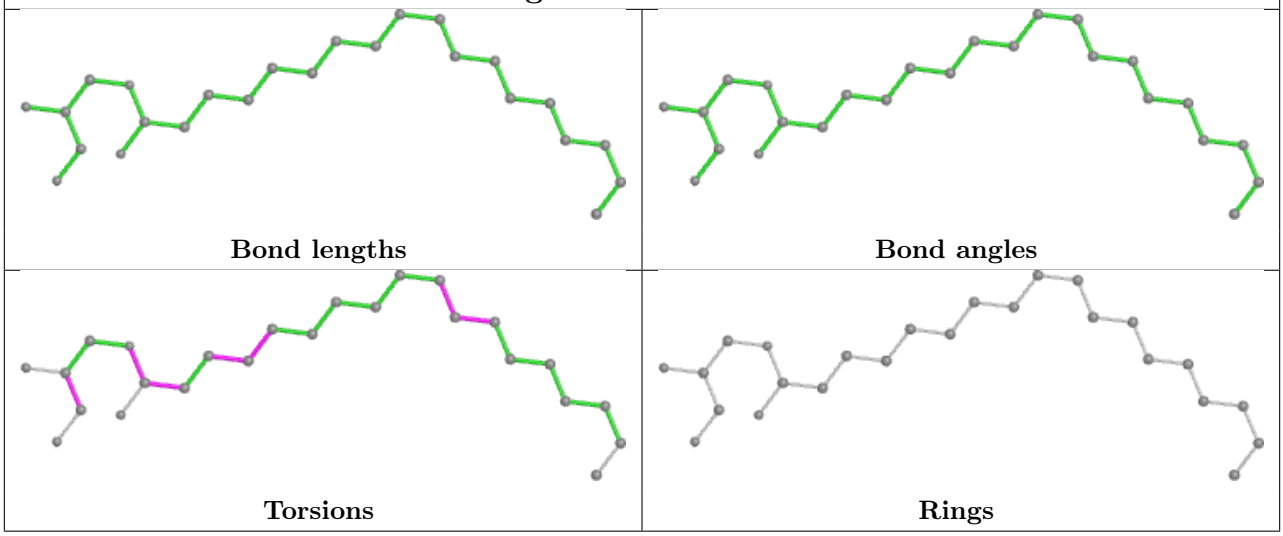


Rings

Ligand OLC C 408



Ligand OLC C 402



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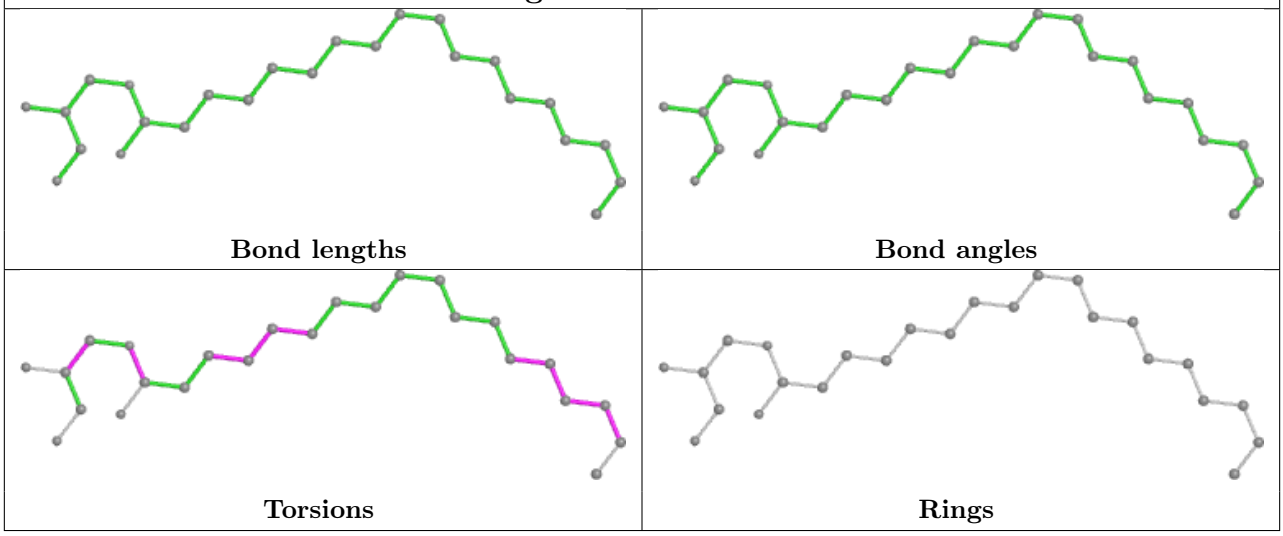

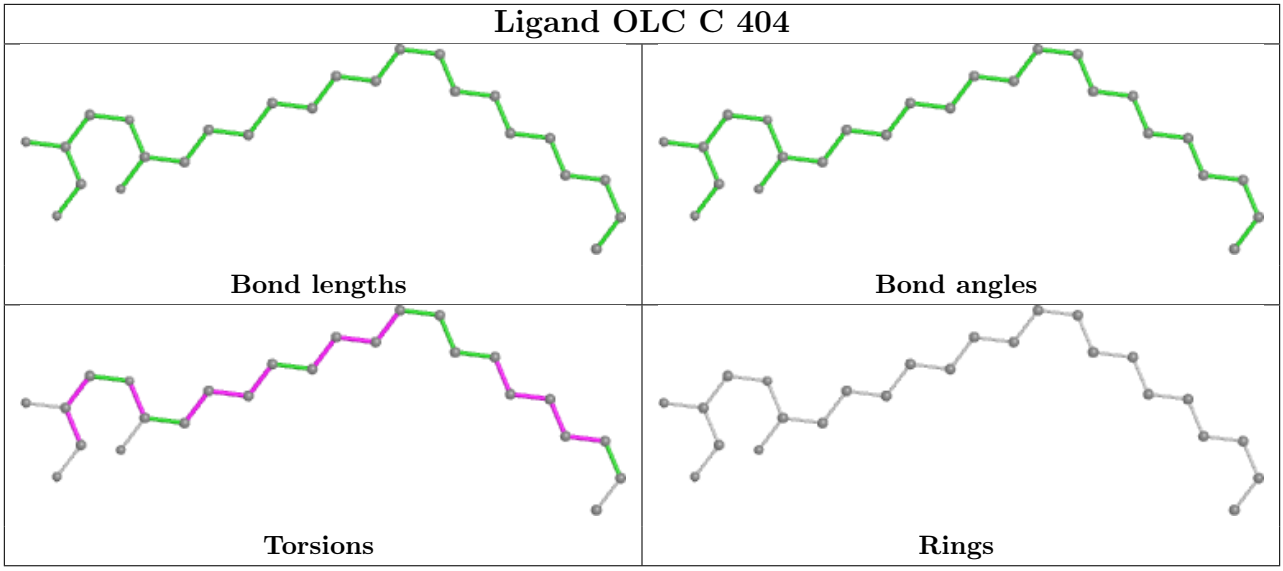

5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 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	301/342 (88%)	0.19	17 (5%)	24	29	25, 38, 121, 208	0
1	C	285/342 (83%)	0.27	18 (6%)	20	24	27, 51, 102, 129	0
2	B	133/142 (93%)	-0.04	1 (0%)	86	88	35, 50, 92, 104	0
2	D	122/142 (85%)	0.30	5 (4%)	37	43	37, 65, 103, 118	0
All	All	841/968 (86%)	0.19	41 (4%)	29	35	25, 48, 103, 208	0

All (41) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	20	TYR	7.5
1	A	308	TYR	5.7
1	A	305	LEU	5.7
1	A	213	ARG	5.4
1	C	302	PHE	4.1
1	C	46	PHE	4.0
1	C	47	CYS	4.0
1	C	42	PHE	4.0
2	D	19	LEU	3.9
1	C	259	TRP	3.7
2	D	9	GLU	3.6
2	D	38	ALA	3.4
1	A	312	LEU	3.4
1	A	314	SER	3.3
1	A	317	LEU	3.2
1	C	11	LEU	3.2
1	C	80	ALA	3.1
1	A	316	ARG	3.0
1	C	48	MET	3.0
1	A	313	THR	2.9
1	A	323	GLN	2.8

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Mol	Chain	Res	Type	RSRZ
2	B	34	GLY	2.8
1	A	322	PHE	2.7
1	C	160	THR	2.7
1	C	50	ASN	2.7
1	C	10	TRP	2.7
1	A	204	TYR	2.6
1	A	49	LYS	2.5
2	D	37	LEU	2.5
1	C	258	SER	2.5
1	A	209	PHE	2.4
1	A	320	VAL	2.3
1	A	211	LYS	2.3
1	A	159	SER	2.3
1	C	19	LYS	2.1
1	C	38	PHE	2.1
2	D	21	GLN	2.1
1	C	49	LYS	2.1
1	C	7	CYS	2.1
1	A	210	LEU	2.0
1	C	77	ARG	2.0

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 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, 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	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	OLC	A	407	25/25	0.51	0.31	70,85,90,90	0
3	OLC	C	402	25/25	0.62	0.41	78,86,92,93	0
3	OLC	A	405	25/25	0.66	0.41	94,97,102,102	0

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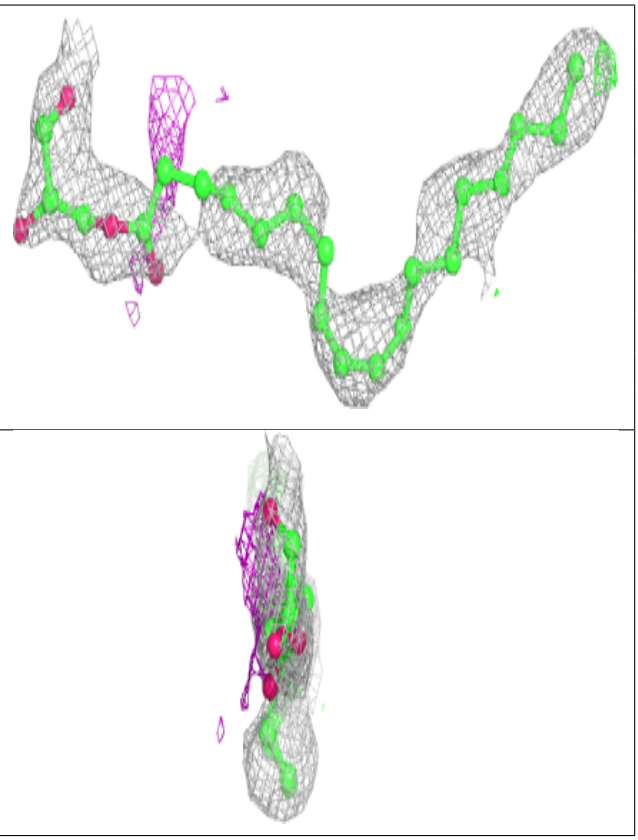
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
3	OLC	C	404	25/25	0.66	0.28	69,76,84,85	0
3	OLC	A	406	25/25	0.69	0.28	60,67,96,99	0
3	OLC	C	405	25/25	0.70	0.20	79,83,99,100	0
3	OLC	C	406	25/25	0.71	0.27	58,72,81,82	0
3	OLC	A	408	21/25	0.72	0.27	57,80,88,90	0
3	OLC	C	407	25/25	0.73	0.27	75,89,101,102	0
5	H95	A	410	8/8	0.75	0.20	57,64,77,78	0
3	OLC	A	403	25/25	0.77	0.43	77,82,87,88	0
3	OLC	C	408	25/25	0.79	0.24	48,57,78,81	0
3	OLC	A	402	11/25	0.84	0.22	46,63,67,70	0
3	OLC	A	404	19/25	0.85	0.23	64,70,78,78	0
3	OLC	A	401	12/25	0.85	0.14	59,74,77,77	0
4	GOL	C	409	6/6	0.88	0.10	66,73,74,76	0
3	OLC	C	401	13/25	0.90	0.14	59,68,70,71	0
6	CLR	C	403	28/28	0.90	0.13	60,70,75,78	0
4	GOL	A	409	6/6	0.93	0.14	47,57,60,61	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.

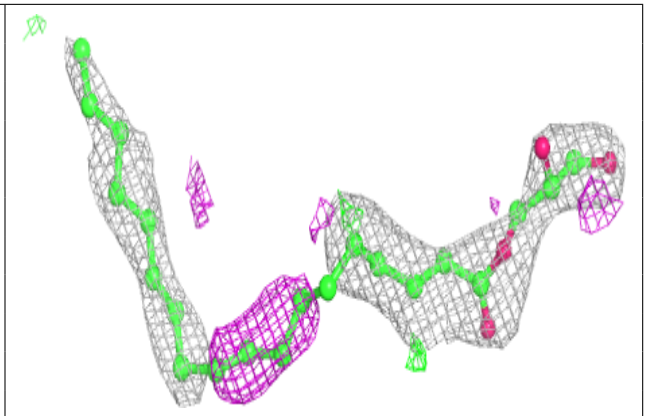
Electron density around OLC A 407:

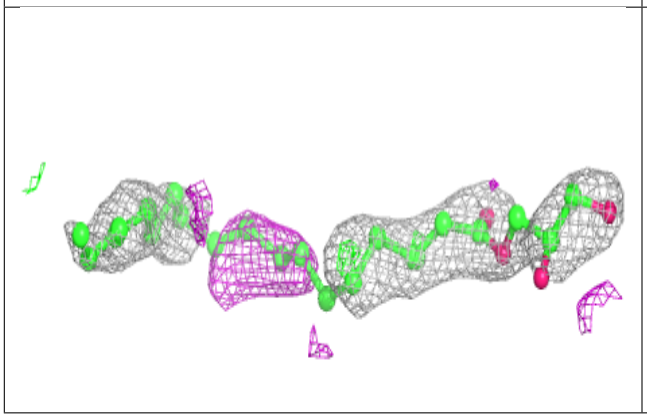
2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative) and green (positive)

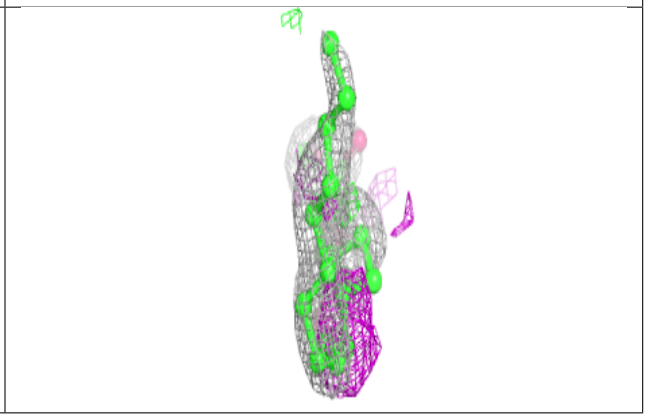


Electron density around OLC C 402:

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

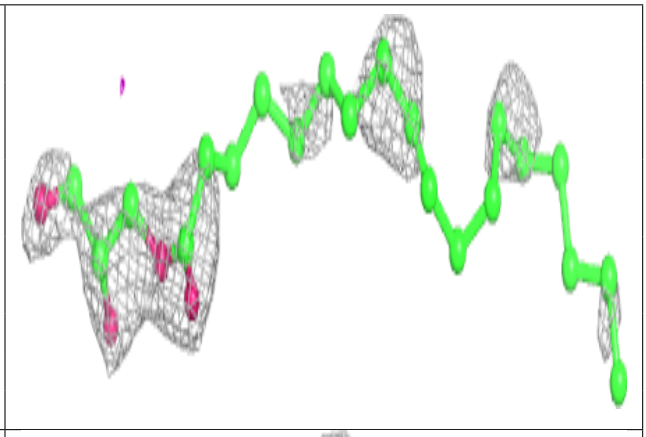


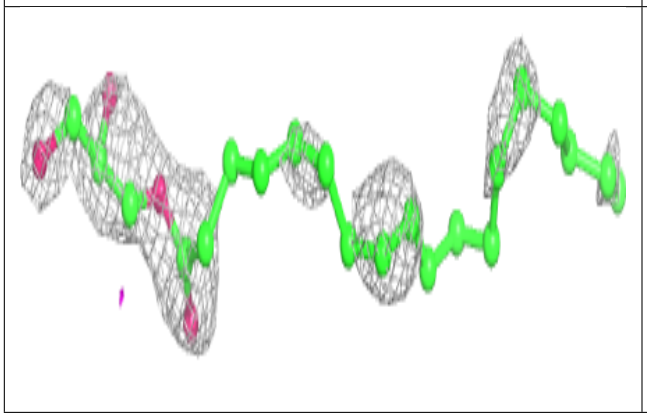


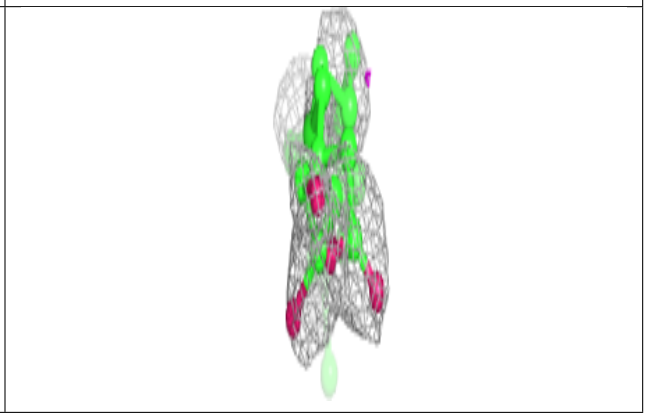


Electron density around OLC A 405:

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

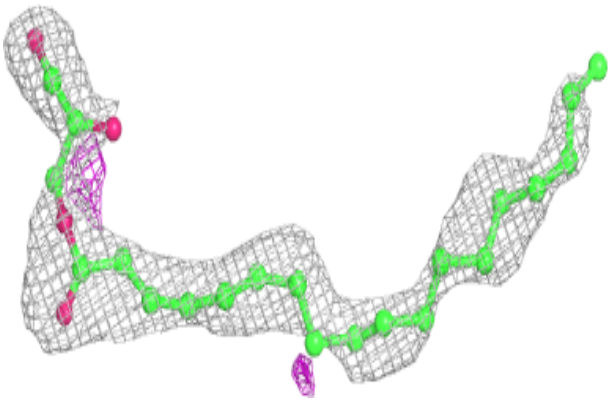


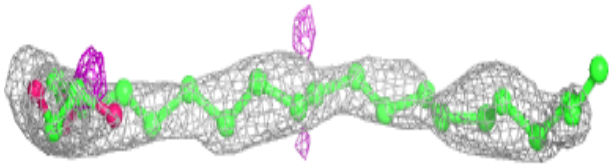


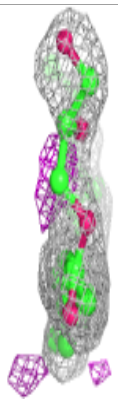


Electron density around OLC C 404:

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

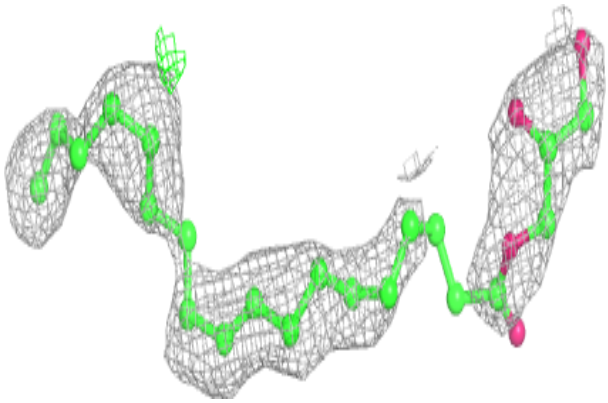


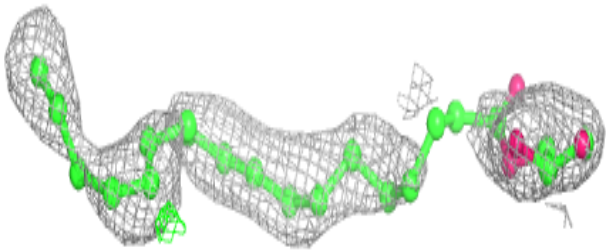


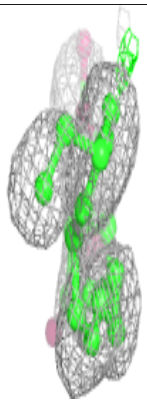


Electron density around OLC A 406:

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

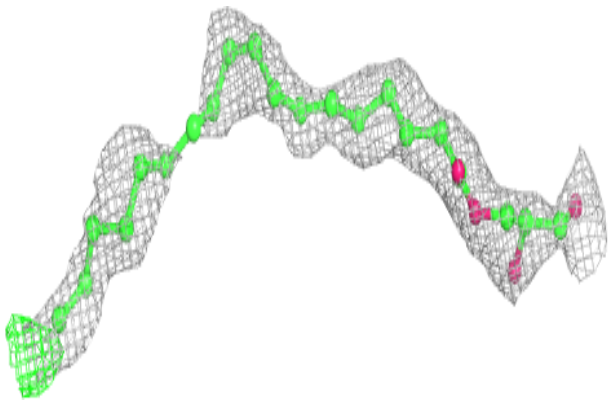


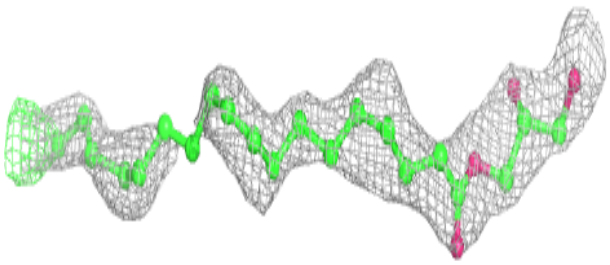


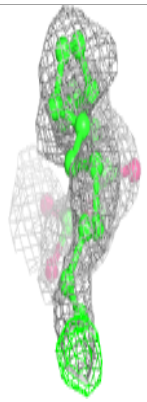


Electron density around OLC C 405:

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

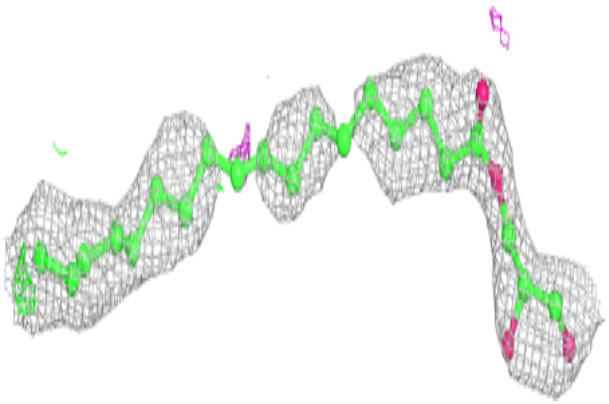


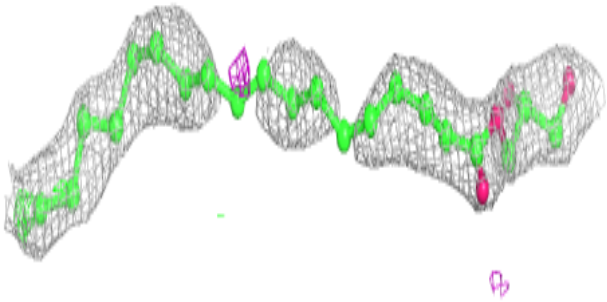


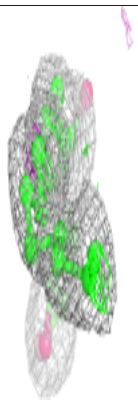


Electron density around OLC C 406:

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

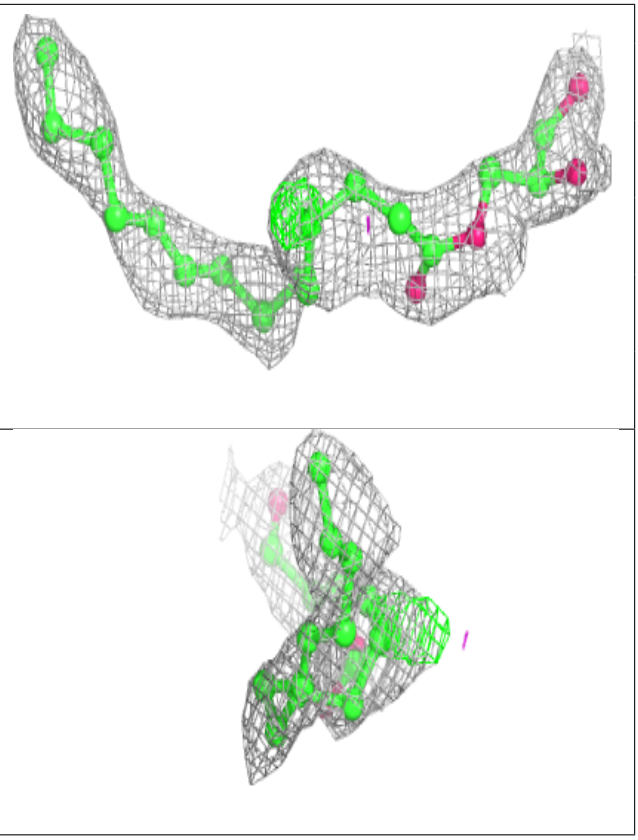






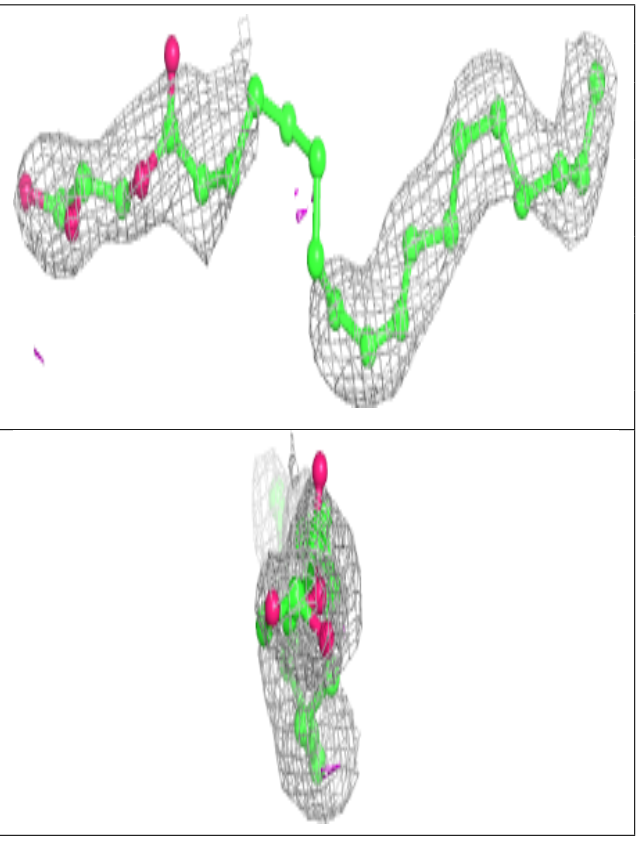
Electron density around OLC A 408:

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



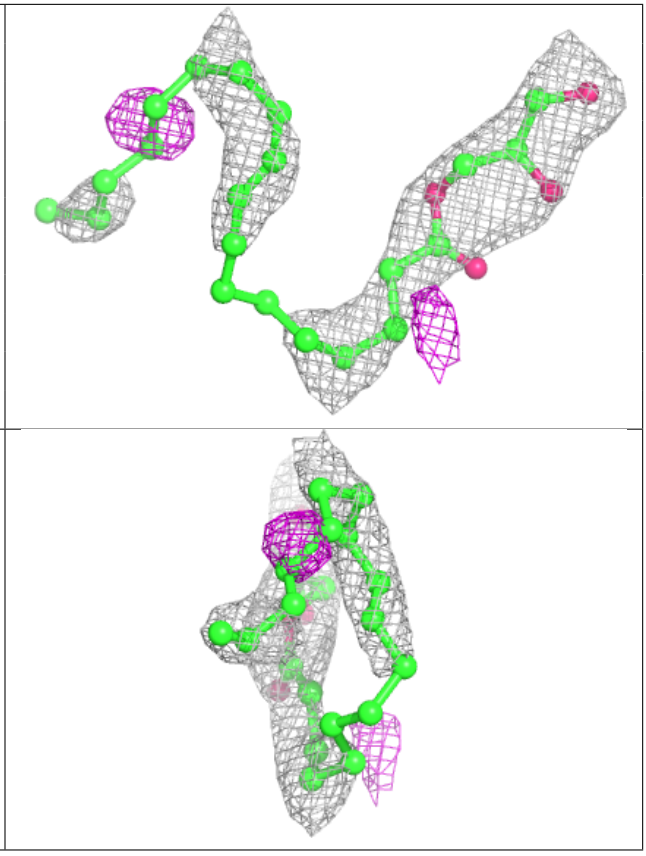
Electron density around OLC C 407:

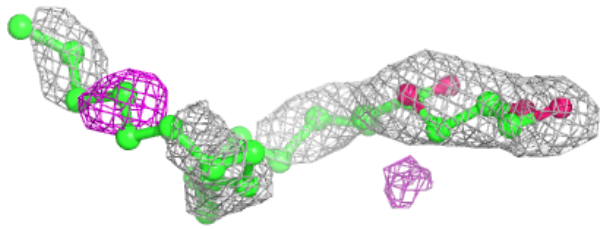
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around OLC A 403:

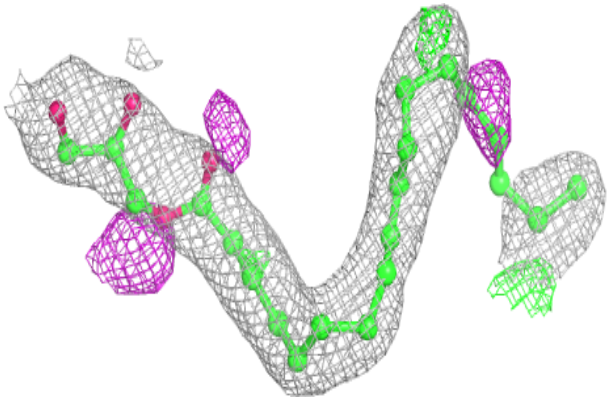
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

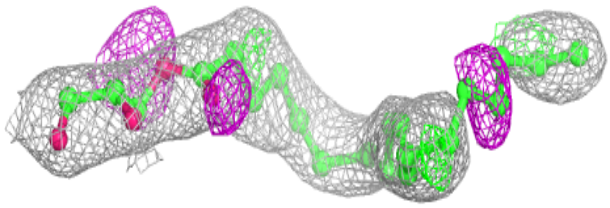


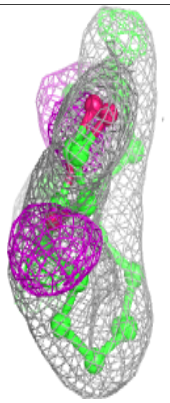


Electron density around OLC C 408:

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

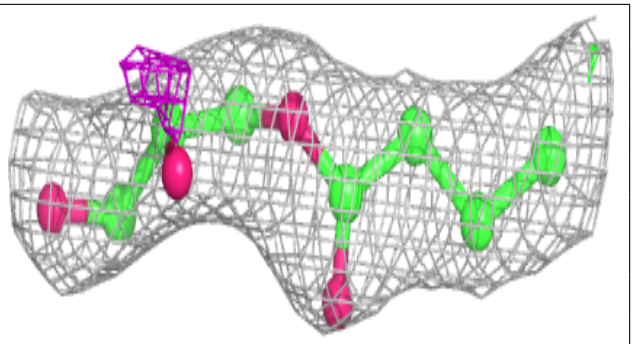


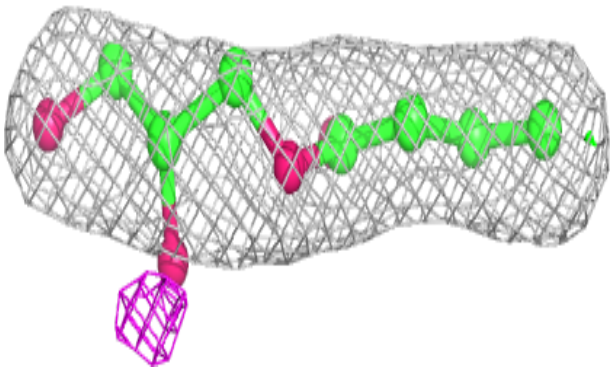


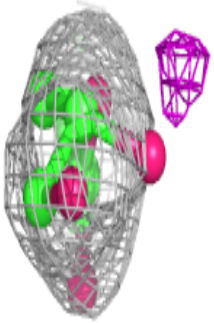


Electron density around OLC A 402:

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

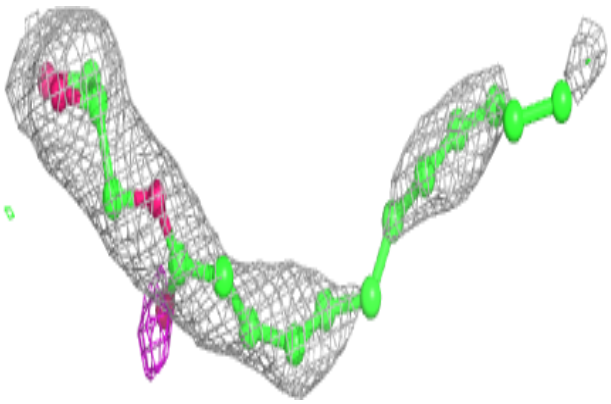


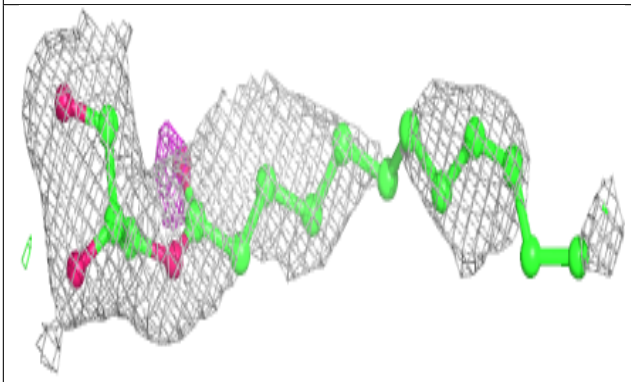


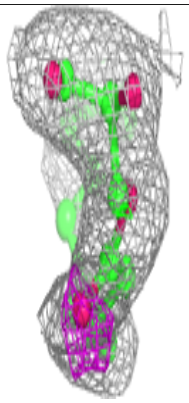


Electron density around OLC A 404:

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

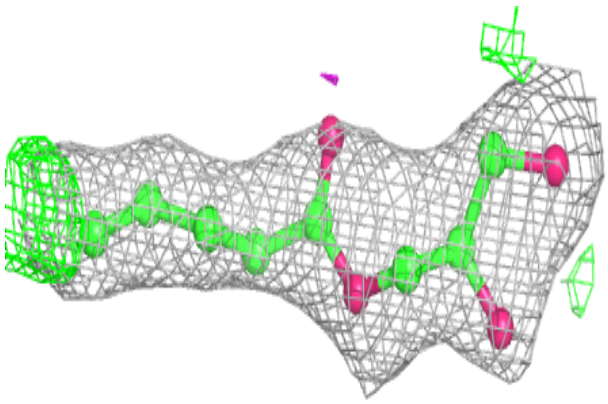


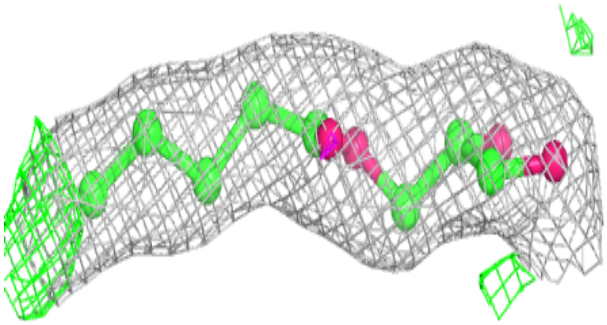


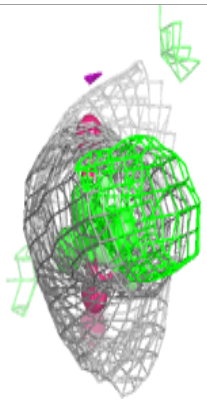


Electron density around OLC A 401:

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

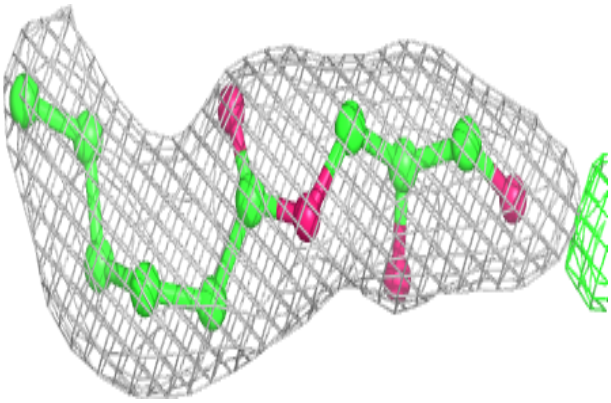


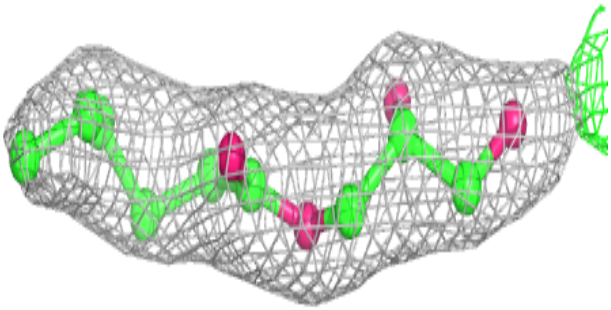


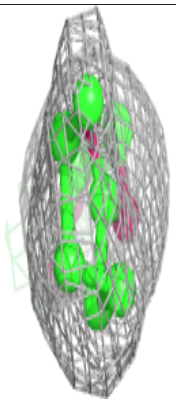


Electron density around OLC C 401:

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

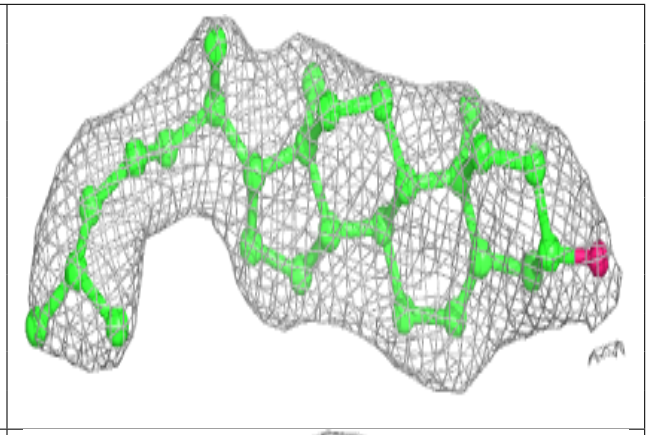


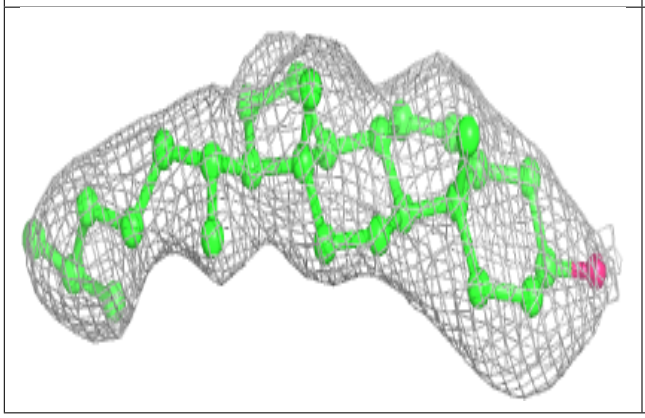


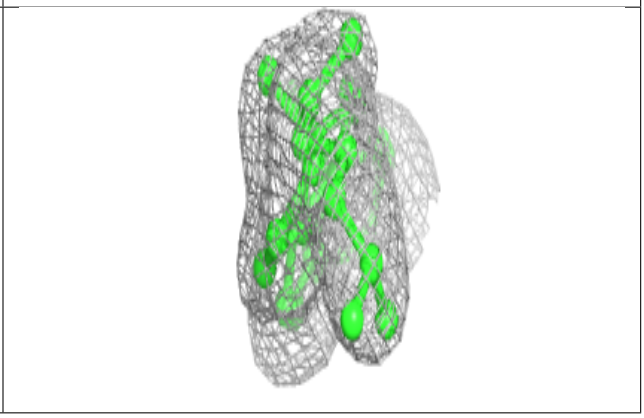


Electron density around CLR C 403:

$2mF_o$-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.