



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 04:21 PM UTC

PDB ID : 4QI1 / pdb_00004qi1
Title : Crystal structure of H. walsbyi bacteriorhodopsin
Authors : Wang, A.H.J.; Hsu, M.F.; Yang, C.S.; Fu, H.Y.
Deposited on : 2014-05-30
Resolution : 1.85 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 ⓘ 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 ⓘ](#)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

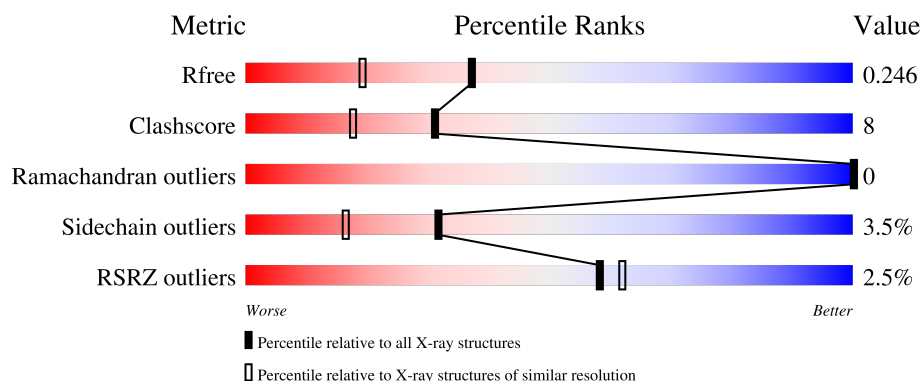
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

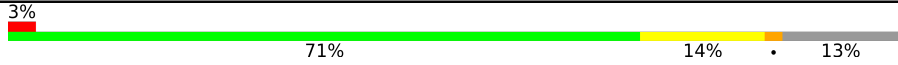
The reported resolution of this entry is 1.85 Å.

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}	180053	3428 (1.86-1.86)
Clashscore	190562	3579 (1.86-1.86)
Ramachandran outliers	187476	3553 (1.86-1.86)
Sidechain outliers	187428	3553 (1.86-1.86)
RSRZ outliers	180081	3429 (1.86-1.86)

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 $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	262	
1	B	262	
1	C	262	

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 6329 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 Bacteriorhodopsin-I.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	228	Total	C	N	O	S	0	2	0
			1771	1179	272	313	7			
1	B	228	Total	C	N	O	S	0	3	0
			1779	1186	273	313	7			
1	C	228	Total	C	N	O	S	0	3	0
			1779	1184	273	315	7			

There are 30 discrepancies between the modelled and reference sequences:

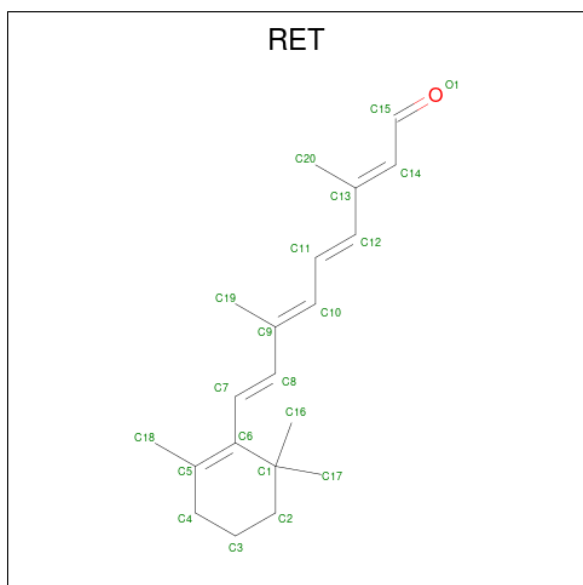
Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP Q18DH8
A	2	ALA	-	expression tag	UNP Q18DH8
A	255	LEU	-	expression tag	UNP Q18DH8
A	256	GLU	-	expression tag	UNP Q18DH8
A	257	HIS	-	expression tag	UNP Q18DH8
A	258	HIS	-	expression tag	UNP Q18DH8
A	259	HIS	-	expression tag	UNP Q18DH8
A	260	HIS	-	expression tag	UNP Q18DH8
A	261	HIS	-	expression tag	UNP Q18DH8
A	262	HIS	-	expression tag	UNP Q18DH8
B	1	MET	-	expression tag	UNP Q18DH8
B	2	ALA	-	expression tag	UNP Q18DH8
B	255	LEU	-	expression tag	UNP Q18DH8
B	256	GLU	-	expression tag	UNP Q18DH8
B	257	HIS	-	expression tag	UNP Q18DH8
B	258	HIS	-	expression tag	UNP Q18DH8
B	259	HIS	-	expression tag	UNP Q18DH8
B	260	HIS	-	expression tag	UNP Q18DH8
B	261	HIS	-	expression tag	UNP Q18DH8
B	262	HIS	-	expression tag	UNP Q18DH8
C	1	MET	-	expression tag	UNP Q18DH8
C	2	ALA	-	expression tag	UNP Q18DH8
C	255	LEU	-	expression tag	UNP Q18DH8

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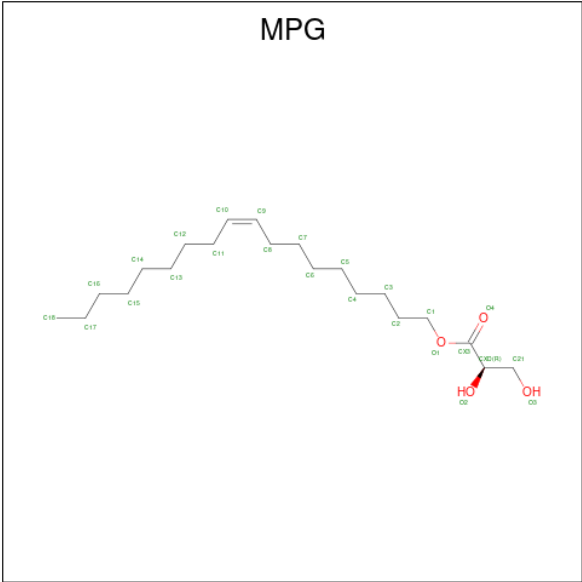
Chain	Residue	Modelled	Actual	Comment	Reference
C	256	GLU	-	expression tag	UNP Q18DH8
C	257	HIS	-	expression tag	UNP Q18DH8
C	258	HIS	-	expression tag	UNP Q18DH8
C	259	HIS	-	expression tag	UNP Q18DH8
C	260	HIS	-	expression tag	UNP Q18DH8
C	261	HIS	-	expression tag	UNP Q18DH8
C	262	HIS	-	expression tag	UNP Q18DH8

- Molecule 2 is RETINAL (CCD ID: RET) (formula: C₂₀H₂₈O).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C 20 20	0	0
2	B	1	Total C 20 20	0	0
2	C	1	Total C 20 20	0	0

- Molecule 3 is [(Z)-octadec-9-enyl] (2R)-2,3-bis(oxidanyl)propanoate (CCD ID: MPG) (formula: C₂₁H₄₀O₄).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			24	21	3		
3	A	1	Total	C	O	0	0
			24	21	3		
3	A	1	Total	C	O	0	0
			24	21	3		
3	B	1	Total	C	O	0	0
			24	21	3		
3	B	1	Total	C	O	0	0
			24	21	3		
3	B	1	Total	C	O	0	0
			24	21	3		
3	B	1	Total	C	O	0	0
			24	21	3		
3	C	1	Total	C	O	0	0
			24	21	3		

- Molecule 4 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



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

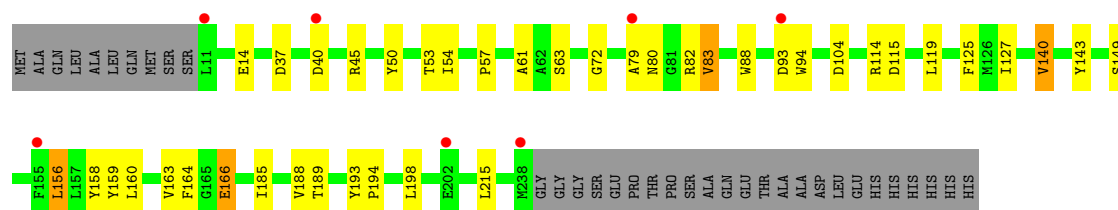
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	272	Total	O	0	0
			272	272		
5	B	249	Total	O	0	0
			249	249		
5	C	197	Total	O	0	0
			197	197		

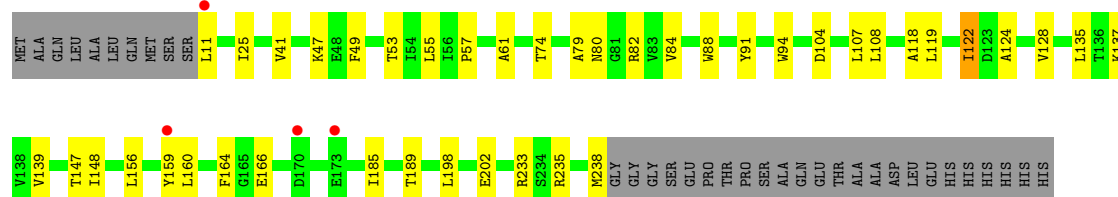
3 Residue-property plots

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.

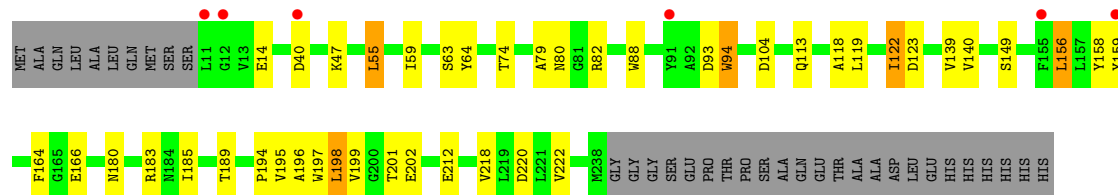
• Molecule 1: Bacteriorhodopsin-I



• Molecule 1: Bacteriorhodopsin-I



• Molecule 1: Bacteriorhodopsin-I



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	106.70Å 61.63Å 119.51Å 90.00° 116.17° 90.00°	Depositor
Resolution (Å)	26.73 – 1.85 26.73 – 1.85	Depositor EDS
% Data completeness (in resolution range)	78.8 (26.73-1.85) 78.8 (26.73-1.85)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	0.04	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.04 (at 1.85Å)	Xtriage
Refinement program	REFMAC 5.7.0029	Depositor
R, R_{free}	0.197 , 0.237 0.207 , 0.246	Depositor DCC
R_{free} test set	2354 reflections (3.97%)	wwPDB-VP
Wilson B-factor (Å ²)	18.4	Xtriage
Anisotropy	0.146	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.41 , 91.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.037 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	6329	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 16.01% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: RET, MPG, 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	1.30	4/1810 (0.2%)	1.20	3/2470 (0.1%)
1	B	1.25	4/1818 (0.2%)	1.15	2/2482 (0.1%)
1	C	1.29	6/1818 (0.3%)	1.18	5/2482 (0.2%)
All	All	1.28	14/5446 (0.3%)	1.17	10/7434 (0.1%)

All (14) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	158	TYR	C-O	6.63	1.31	1.24
1	C	196	ALA	C-O	6.38	1.31	1.24
1	C	198	LEU	C-O	6.34	1.31	1.24
1	B	148	ILE	C-O	6.17	1.31	1.24
1	A	125	PHE	C-O	5.67	1.30	1.24
1	A	61	ALA	C-O	-5.45	1.17	1.24
1	C	197	TRP	N-CA	5.42	1.52	1.46
1	B	49	PHE	N-CA	5.42	1.52	1.46
1	C	149	SER	C-O	5.42	1.30	1.24
1	A	149	SER	C-O	5.28	1.30	1.24
1	B	107	LEU	C-O	-5.19	1.18	1.24
1	B	139	VAL	C-O	5.13	1.29	1.24
1	C	94	TRP	C-O	5.09	1.30	1.24
1	C	158	TYR	C-O	5.08	1.29	1.24

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	79	ALA	CA-C-N	6.76	130.02	120.28
1	A	79	ALA	C-N-CA	6.76	130.02	120.28
1	B	79	ALA	CA-C-N	5.99	130.19	120.60
1	B	79	ALA	C-N-CA	5.99	130.19	120.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	127	ILE	N-CA-C	5.95	116.12	110.53
1	C	79	ALA	CA-C-N	5.80	129.88	120.60
1	C	79	ALA	C-N-CA	5.80	129.88	120.60
1	C	139	VAL	N-CA-C	5.18	115.39	110.42
1	C	123	ASP	N-CA-C	5.04	116.46	111.07
1	C	199	VAL	N-CA-C	5.02	118.16	111.44

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1771	0	1814	28	1
1	B	1779	0	1826	29	0
1	C	1779	0	1822	28	1
2	A	20	0	27	5	0
2	B	20	0	27	4	0
2	C	20	0	27	2	0
3	A	72	0	120	3	0
3	B	120	0	200	9	0
3	C	24	0	40	4	0
4	A	6	0	8	0	0
5	A	272	0	0	12	1
5	B	249	0	0	4	1
5	C	197	0	0	8	2
All	All	6329	0	5911	95	3

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 8.

All (95) 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:163:VAL:O	1:A:166:GLU:HG3	1.56	1.04

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:14:GLU:OE2	5:C:423:HOH:O	1.78	1.02
1:B:137:LYS:HG3	3:B:303:MPG:H181	1.48	0.96
1:A:14:GLU:OE2	5:A:421:HOH:O	1.90	0.90
1:C:74[B]:THR:HG23	1:C:88:TRP:HE1	1.37	0.89
1:B:233:ARG:NH1	5:B:444:HOH:O	2.11	0.84
1:C:194:PRO:HG2	5:C:495:HOH:O	1.78	0.83
1:C:195:VAL:HG23	5:C:495:HOH:O	1.83	0.76
1:A:45:ARG:NH2	5:A:469:HOH:O	2.17	0.73
1:A:115:ASP:OD1	3:A:304:MPG:H212	1.86	0.73
1:A:83:VAL:HG22	5:A:521:HOH:O	1.90	0.72
1:A:94:TRP:CD1	2:A:301:RET:H14	2.27	0.70
1:A:115:ASP:OD2	5:A:604:HOH:O	2.10	0.70
1:C:180:ASN:OD1	1:C:183:ARG:NH1	2.26	0.69
1:B:137:LYS:HG3	3:B:303:MPG:C18	2.22	0.67
1:B:94:TRP:CD1	2:B:301:RET:H14	2.31	0.65
1:C:122:ILE:HG21	5:C:562:HOH:O	1.97	0.65
1:C:202:GLU:HG2	5:C:419:HOH:O	1.96	0.65
1:A:163:VAL:O	1:A:166:GLU:CG	2.41	0.65
1:B:166:GLU:HB3	5:B:561:HOH:O	1.96	0.64
1:C:113:GLN:H	3:C:302:MPG:H141	1.63	0.64
1:C:122:ILE:HD11	1:C:156:LEU:HB2	1.80	0.64
1:B:235:ARG:HA	1:B:238:MET:HE3	1.83	0.59
1:C:118:ALA:O	1:C:122:ILE:HG23	2.03	0.59
1:A:54:ILE:HG13	5:A:546:HOH:O	2.03	0.58
1:A:80:ASN:HB3	1:A:82:ARG:H	1.68	0.58
1:B:185:ILE:O	1:B:189:THR:HG23	2.03	0.58
1:A:50:TYR:HD1	5:A:546:HOH:O	1.85	0.58
1:A:140:VAL:HG12	5:A:412:HOH:O	2.04	0.57
1:C:201[B]:THR:HG22	1:C:212:GLU:OE1	2.05	0.56
1:C:80:ASN:HB3	1:C:82:ARG:H	1.71	0.56
1:A:119:LEU:HD21	1:A:159:TYR:HB2	1.90	0.54
1:C:74[B]:THR:HG23	1:C:88:TRP:NE1	2.15	0.54
1:B:119:LEU:HD22	1:B:156:LEU:HD12	1.90	0.53
1:B:61:ALA:HB1	3:B:306:MPG:H171	1.91	0.53
2:B:301:RET:H8	2:B:301:RET:H171	1.89	0.53
1:B:119:LEU:HD21	1:B:159:TYR:HB2	1.90	0.52
2:C:301:RET:H171	2:C:301:RET:H8	1.90	0.52
1:A:156:LEU:C	1:A:156:LEU:HD23	2.34	0.52
1:B:41:VAL:HG12	1:B:47:LYS:HG3	1.92	0.52
1:C:185:ILE:O	1:C:189:THR:HG23	2.09	0.52
1:B:147:THR:HG23	3:B:304:MPG:H131	1.93	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:55:LEU:HD23	5:C:516:HOH:O	2.12	0.50
1:A:185:ILE:O	1:A:189:THR:HG23	2.12	0.49
1:B:119:LEU:HD22	1:B:156:LEU:CD1	2.43	0.49
1:C:94:TRP:CD1	2:C:301:RET:H14	2.47	0.49
1:C:113:GLN:N	3:C:302:MPG:H141	2.27	0.49
1:B:84[B]:VAL:HG11	1:B:202:GLU:OE1	2.13	0.49
1:B:55:LEU:HD21	3:B:302:MPG:H52C	1.93	0.49
1:A:114:ARG:NH2	5:A:450:HOH:O	2.45	0.49
1:B:122:ILE:HD11	1:B:156:LEU:HB2	1.95	0.48
1:A:63[B]:SER:OG	1:A:93:ASP:HB2	2.14	0.48
1:B:124:ALA:O	1:B:128[A]:VAL:HG12	2.13	0.48
1:C:218:VAL:O	1:C:222:VAL:HG12	2.14	0.47
2:A:301:RET:H8	2:A:301:RET:H171	1.95	0.47
1:B:160:LEU:O	1:B:164:PHE:HB2	2.15	0.47
2:A:301:RET:H171	2:A:301:RET:C8	2.45	0.47
1:B:53:THR:O	1:B:57:PRO:HD2	2.15	0.47
1:B:135:LEU:O	3:B:303:MPG:H172	2.15	0.46
1:A:72:GLY:HA2	1:A:88:TRP:CZ2	2.51	0.46
1:C:113:GLN:H	3:C:302:MPG:H152	1.81	0.45
1:B:119:LEU:HD12	1:B:164:PHE:CZ	2.51	0.45
2:B:301:RET:H8	2:B:301:RET:H161	1.99	0.45
1:B:80:ASN:HB3	1:B:82:ARG:H	1.82	0.44
1:B:41:VAL:O	1:B:47:LYS:HE3	2.17	0.44
2:B:301:RET:H171	2:B:301:RET:C8	2.48	0.44
1:C:119:LEU:HD21	1:C:159:TYR:HB2	1.99	0.44
2:A:301:RET:H8	2:A:301:RET:H161	2.00	0.44
1:B:118:ALA:O	1:B:122:ILE:HG23	2.17	0.44
1:A:160:LEU:O	1:A:164:PHE:HB2	2.18	0.43
1:B:88:TRP:CD2	3:B:303:MPG:H72C	2.53	0.43
1:A:53:THR:O	1:A:57:PRO:HD2	2.18	0.43
1:B:25:ILE:HG21	5:B:584:HOH:O	2.18	0.43
1:B:91:TYR:OH	5:B:498:HOH:O	2.20	0.43
1:A:119:LEU:HD12	1:A:164:PHE:CZ	2.54	0.43
1:C:14:GLU:O	1:C:14:GLU:HG3	2.19	0.43
1:B:74:THR:HG21	3:B:303:MPG:H122	1.99	0.42
2:A:301:RET:H7	2:A:301:RET:H181	1.84	0.42
1:C:113:GLN:H	3:C:302:MPG:C14	2.31	0.42
3:B:303:MPG:H172	3:B:303:MPG:H141	1.84	0.42
1:A:119:LEU:HA	1:A:119:LEU:HD23	1.79	0.42
1:B:119:LEU:HD21	1:B:159:TYR:CB	2.49	0.42
3:A:304:MPG:H122	1:C:59:ILE:HD11	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:63[B]:SER:OG	1:C:93:ASP:HB2	2.21	0.41
1:A:215:LEU:HD21	5:A:538:HOH:O	2.21	0.41
1:A:188:VAL:HG22	5:A:545:HOH:O	2.22	0.40
1:C:122:ILE:HG12	5:C:562:HOH:O	2.20	0.40
1:A:143:TYR:HB2	5:A:476:HOH:O	2.20	0.40
3:A:304:MPG:C18	5:C:482:HOH:O	2.69	0.40
1:A:163:VAL:HA	1:A:166:GLU:HG2	2.02	0.40
1:A:193:TYR:N	1:A:194:PRO:HD2	2.37	0.40
1:C:119:LEU:HD12	1:C:164:PHE:CZ	2.57	0.40
1:A:54:ILE:CD1	5:A:546:HOH:O	2.69	0.40
1:C:47:LYS:HB2	1:C:47:LYS:HE3	1.89	0.40
1:C:64:TYR:OH	1:C:220:ASP:OD2	2.37	0.40

All (3) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:A:494:HOH:O	5:C:401:HOH:O[3_445]	2.16	0.04
1:C:40:ASP:OD2	5:B:513:HOH:O[1_565]	2.16	0.04
1:A:40:ASP:OD2	5:C:478:HOH:O[3_445]	2.18	0.02

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	228/262 (87%)	228 (100%)	0	0	100	100
1	B	229/262 (87%)	228 (100%)	1 (0%)	0	100	100
1	C	229/262 (87%)	228 (100%)	1 (0%)	0	100	100
All	All	686/786 (87%)	684 (100%)	2 (0%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	183/207 (88%)	176 (96%)	7 (4%)	29	14
1	B	184/207 (89%)	179 (97%)	5 (3%)	39	24
1	C	184/207 (89%)	177 (96%)	7 (4%)	29	14
All	All	551/621 (89%)	532 (97%)	19 (3%)	32	17

All (19) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	37	ASP
1	A	83	VAL
1	A	104	ASP
1	A	140	VAL
1	A	156	LEU
1	A	166	GLU
1	A	198	LEU
1	B	11	LEU
1	B	104	ASP
1	B	108	LEU
1	B	122	ILE
1	B	198	LEU
1	C	55	LEU
1	C	104	ASP
1	C	122	ILE
1	C	140	VAL
1	C	156	LEU
1	C	166	GLU
1	C	198	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

13 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	$\# Z > 2$
4	GOL	A	305	-	5,5,5	0.17	0	5,5,5	0.67	0
3	MPG	B	302	-	23,23,24	0.52	0	23,23,25	1.04	1 (4%)
2	RET	C	301	-	20,20,21	0.91	0	27,27,28	1.94	9 (33%)
3	MPG	B	306	-	23,23,24	0.40	0	23,23,25	1.14	1 (4%)
2	RET	A	301	-	20,20,21	1.21	2 (10%)	27,27,28	1.76	5 (18%)
3	MPG	B	304	-	23,23,24	0.38	0	23,23,25	1.08	1 (4%)
3	MPG	A	303	-	23,23,24	0.35	0	23,23,25	0.95	1 (4%)
3	MPG	A	302	-	23,23,24	0.39	0	23,23,25	0.89	1 (4%)
3	MPG	B	303	-	23,23,24	0.49	0	23,23,25	1.01	1 (4%)
2	RET	B	301	-	20,20,21	1.37	1 (5%)	27,27,28	1.78	8 (29%)
3	MPG	A	304	-	23,23,24	0.64	1 (4%)	23,23,25	1.74	1 (4%)
3	MPG	B	305	-	23,23,24	0.47	0	23,23,25	0.74	0
3	MPG	C	302	-	23,23,24	0.37	0	23,23,25	1.00	2 (8%)

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
4	GOL	A	305	-	-	2/4/4/4	-
3	MPG	B	302	-	-	12/22/22/25	-
2	RET	C	301	-	-	0/13/30/31	0/1/1/1
3	MPG	B	306	-	-	14/22/22/25	-
2	RET	A	301	-	-	0/13/30/31	0/1/1/1
3	MPG	B	304	-	-	16/22/22/25	-
3	MPG	A	303	-	-	11/22/22/25	-
3	MPG	A	302	-	-	9/22/22/25	-
3	MPG	B	303	-	-	10/22/22/25	-
2	RET	B	301	-	-	0/13/30/31	0/1/1/1
3	MPG	A	304	-	-	11/22/22/25	-
3	MPG	B	305	-	-	12/22/22/25	-
3	MPG	C	302	-	-	14/22/22/25	-

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	301	RET	C14-C13	-4.61	1.30	1.33
3	A	304	MPG	O1-CX3	2.50	1.48	1.42
2	A	301	RET	C20-C13	-2.26	1.46	1.50
2	A	301	RET	C8-C9	2.21	1.50	1.46

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	304	MPG	O1-CX3-CXD	7.57	132.82	109.56
2	A	301	RET	C20-C13-C12	6.28	127.67	118.09
2	C	301	RET	C20-C13-C12	5.08	125.84	118.09
3	B	306	MPG	O1-CX3-CXD	4.62	123.76	109.56
3	B	304	MPG	O1-CX3-CXD	4.45	123.22	109.56
3	B	302	MPG	O1-CX3-CXD	4.24	122.59	109.56
2	B	301	RET	C8-C9-C10	-3.95	112.80	119.01
3	A	302	MPG	O1-CX3-CXD	3.56	120.49	109.56
2	B	301	RET	C19-C9-C8	3.40	123.28	118.09
2	C	301	RET	C10-C11-C12	-3.08	114.28	123.20
2	C	301	RET	C1-C6-C7	3.01	123.81	115.65
2	B	301	RET	C20-C13-C12	2.87	122.48	118.09

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	301	RET	C8-C9-C10	-2.85	114.52	119.01
2	B	301	RET	C12-C13-C14	-2.79	111.15	118.55
2	C	301	RET	C7-C6-C5	-2.78	115.16	121.56
2	A	301	RET	C7-C8-C9	-2.77	122.14	126.23
3	C	302	MPG	O2-CXD-CX3	-2.75	100.18	109.70
2	C	301	RET	C17-C1-C2	-2.73	98.47	108.95
2	B	301	RET	C11-C10-C9	-2.72	123.46	127.28
3	A	303	MPG	O1-CX3-CXD	2.69	117.82	109.56
3	B	303	MPG	C1-O1-CX3	2.59	124.96	113.58
2	C	301	RET	C8-C9-C10	-2.50	115.08	119.01
2	C	301	RET	C11-C10-C9	-2.42	123.88	127.28
2	B	301	RET	C17-C1-C2	-2.42	99.66	108.95
2	A	301	RET	C12-C13-C14	-2.38	112.24	118.55
3	C	302	MPG	O1-CX3-CXD	2.34	116.75	109.56
2	B	301	RET	C1-C6-C7	2.18	121.56	115.65
2	B	301	RET	C10-C11-C12	-2.14	117.01	123.20
2	A	301	RET	C1-C6-C7	2.06	121.23	115.65
2	C	301	RET	C3-C4-C5	-2.03	110.44	114.06
2	C	301	RET	C12-C13-C14	-2.01	113.22	118.55

There are no chirality outliers.

All (111) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	303	MPG	O3-C21-CXD-O2
3	A	303	MPG	O3-C21-CXD-CX3
3	B	303	MPG	O3-C21-CXD-CX3
3	B	304	MPG	O3-C21-CXD-CX3
3	B	305	MPG	O1-CX3-CXD-O2
3	B	306	MPG	O1-CX3-CXD-O2
4	A	305	GOL	O2-C2-C3-O3
3	B	304	MPG	O1-CX3-CXD-O2
3	B	306	MPG	O1-CX3-CXD-C21
3	C	302	MPG	O1-CX3-CXD-O2
3	C	302	MPG	O1-C1-C2-C3
3	B	303	MPG	O1-C1-C2-C3
3	C	302	MPG	O1-CX3-CXD-C21
3	A	302	MPG	O1-C1-C2-C3
3	B	306	MPG	O3-C21-CXD-CX3
4	A	305	GOL	C1-C2-C3-O3
3	B	302	MPG	C14-C15-C16-C17
3	B	302	MPG	C12-C13-C14-C15

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Mol	Chain	Res	Type	Atoms
3	B	306	MPG	C4-C5-C6-C7
3	C	302	MPG	C13-C14-C15-C16
3	B	304	MPG	O1-C1-C2-C3
3	B	303	MPG	O3-C21-CXD-O2
3	B	304	MPG	O3-C21-CXD-O2
3	B	306	MPG	O3-C21-CXD-O2
3	B	305	MPG	C12-C13-C14-C15
3	A	302	MPG	C5-C6-C7-C8
3	A	302	MPG	C11-C12-C13-C14
3	A	303	MPG	C4-C5-C6-C7
3	A	304	MPG	O1-C1-C2-C3
3	B	305	MPG	C3-C4-C5-C6
3	B	305	MPG	C14-C15-C16-C17
3	C	302	MPG	C12-C13-C14-C15
3	B	305	MPG	O1-CX3-CXD-C21
3	A	304	MPG	C3-C4-C5-C6
3	B	306	MPG	O1-C1-C2-C3
3	A	302	MPG	C10-C11-C12-C13
3	B	302	MPG	C10-C11-C12-C13
3	A	304	MPG	C14-C15-C16-C17
3	B	306	MPG	C11-C12-C13-C14
3	B	302	MPG	C2-C3-C4-C5
3	A	304	MPG	C6-C7-C8-C9
3	B	305	MPG	C2-C3-C4-C5
3	B	304	MPG	C13-C14-C15-C16
3	B	302	MPG	C1-C2-C3-C4
3	A	304	MPG	O3-C21-CXD-O2
3	A	303	MPG	C5-C6-C7-C8
3	B	303	MPG	C12-C13-C14-C15
3	C	302	MPG	C2-C3-C4-C5
3	B	306	MPG	CXD-CX3-O1-C1
3	A	302	MPG	C13-C14-C15-C16
3	A	304	MPG	C10-C11-C12-C13
3	B	302	MPG	C6-C7-C8-C9
3	C	302	MPG	C10-C11-C12-C13
3	B	303	MPG	C13-C14-C15-C16
3	B	304	MPG	C5-C6-C7-C8
3	A	303	MPG	O1-CX3-CXD-O2
3	A	303	MPG	C6-C7-C8-C9
3	B	304	MPG	C6-C7-C8-C9
3	A	304	MPG	C2-C3-C4-C5
3	B	304	MPG	C3-C4-C5-C6

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Mol	Chain	Res	Type	Atoms
3	B	305	MPG	C11-C12-C13-C14
3	B	306	MPG	C10-C11-C12-C13
3	B	306	MPG	C1-C2-C3-C4
3	B	304	MPG	O1-CX3-CXD-C21
3	B	302	MPG	C5-C6-C7-C8
3	B	306	MPG	C2-C3-C4-C5
3	A	304	MPG	C12-C13-C14-C15
3	B	305	MPG	C5-C6-C7-C8
3	A	302	MPG	C12-C13-C14-C15
3	B	303	MPG	C11-C12-C13-C14
3	B	302	MPG	O3-C21-CXD-O2
3	C	302	MPG	O3-C21-CXD-O2
3	B	302	MPG	C4-C5-C6-C7
3	A	302	MPG	C3-C4-C5-C6
3	B	305	MPG	O1-C1-C2-C3
3	A	303	MPG	C2-C1-O1-CX3
3	A	302	MPG	C2-C3-C4-C5
3	B	304	MPG	C2-C3-C4-C5
3	A	304	MPG	C15-C16-C17-C18
3	C	302	MPG	C1-C2-C3-C4
3	B	304	MPG	C15-C16-C17-C18
3	B	302	MPG	C13-C14-C15-C16
3	C	302	MPG	CXD-CX3-O1-C1
3	B	306	MPG	C7-C8-C9-C10
3	C	302	MPG	C4-C5-C6-C7
3	B	303	MPG	C14-C15-C16-C17
3	B	306	MPG	C2-C1-O1-CX3
3	B	304	MPG	C1-C2-C3-C4
3	B	305	MPG	C9-C10-C11-C12
3	C	302	MPG	C2-C1-O1-CX3
3	B	304	MPG	C10-C11-C12-C13
3	C	302	MPG	C15-C16-C17-C18
3	B	302	MPG	CXD-CX3-O1-C1
3	B	304	MPG	CXD-CX3-O1-C1
3	B	303	MPG	C1-C2-C3-C4
3	B	305	MPG	C6-C7-C8-C9
3	A	303	MPG	C12-C13-C14-C15
3	A	303	MPG	C11-C12-C13-C14
3	A	302	MPG	CXD-CX3-O1-C1
3	A	303	MPG	O1-CX3-CXD-C21
3	B	306	MPG	C13-C14-C15-C16
3	B	302	MPG	C9-C10-C11-C12

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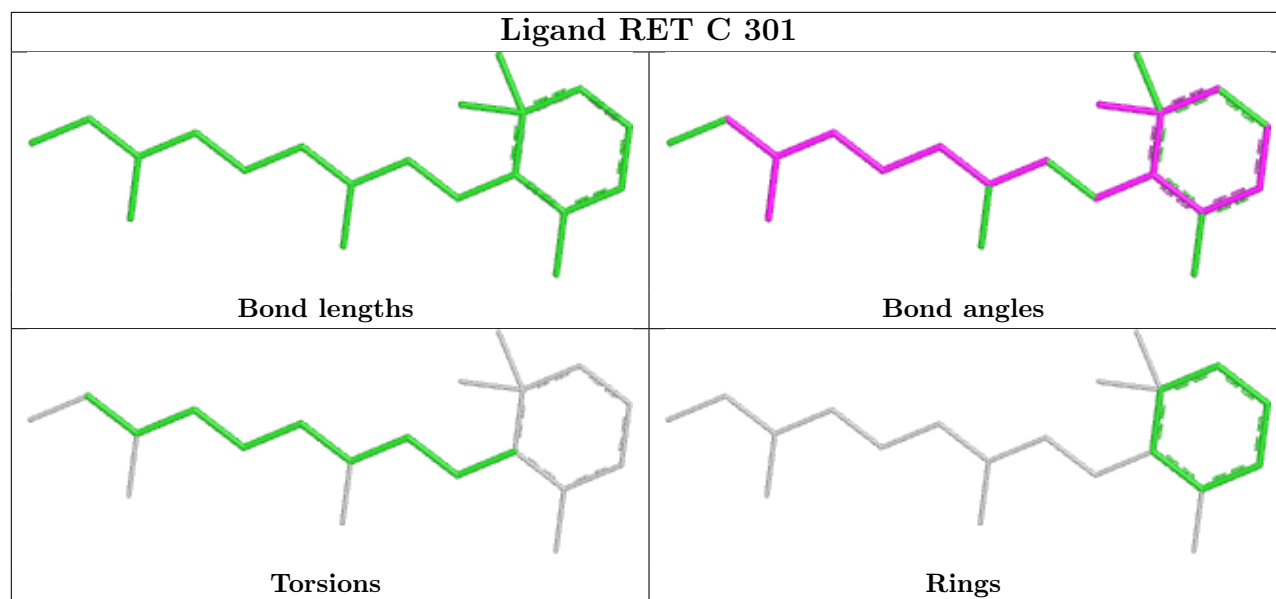
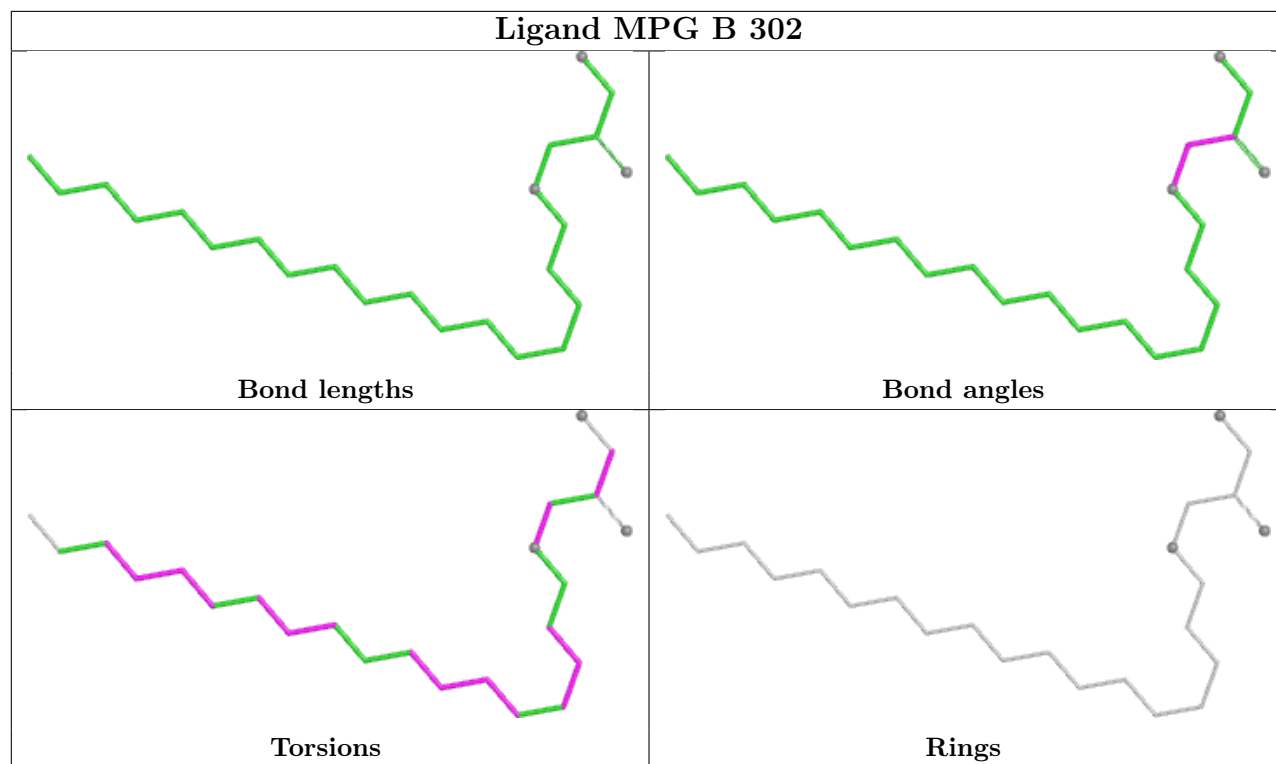
Mol	Chain	Res	Type	Atoms
3	B	304	MPG	C9-C10-C11-C12
3	B	303	MPG	O1-CX3-CXD-C21
3	A	304	MPG	C9-C10-C11-C12
3	B	304	MPG	C7-C8-C9-C10
3	B	305	MPG	C2-C1-O1-CX3
3	A	303	MPG	CXD-CX3-O1-C1
3	B	303	MPG	C9-C10-C11-C12
3	C	302	MPG	C7-C8-C9-C10
3	A	304	MPG	C5-C6-C7-C8

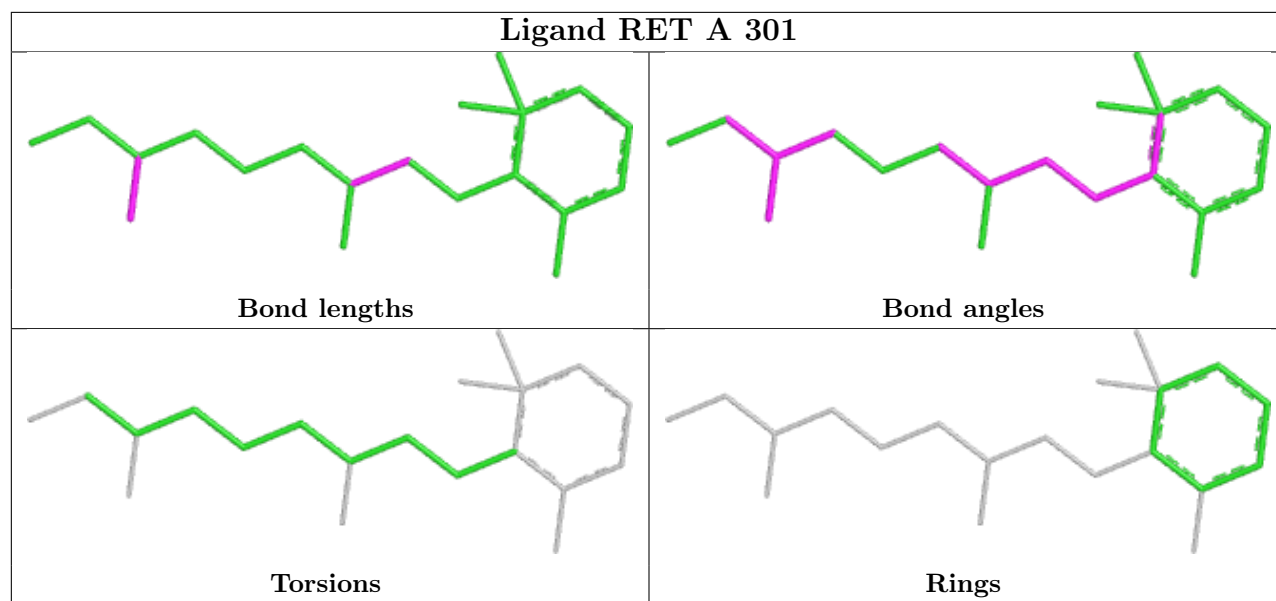
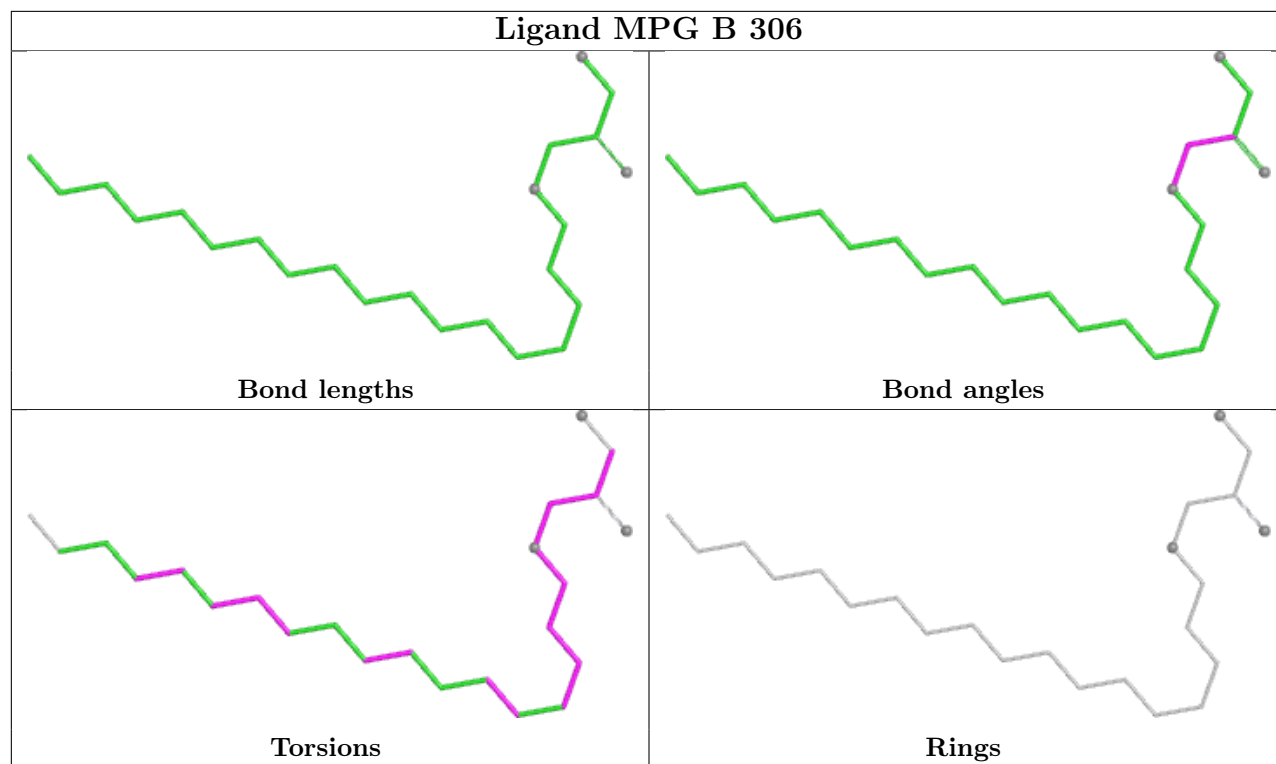
There are no ring outliers.

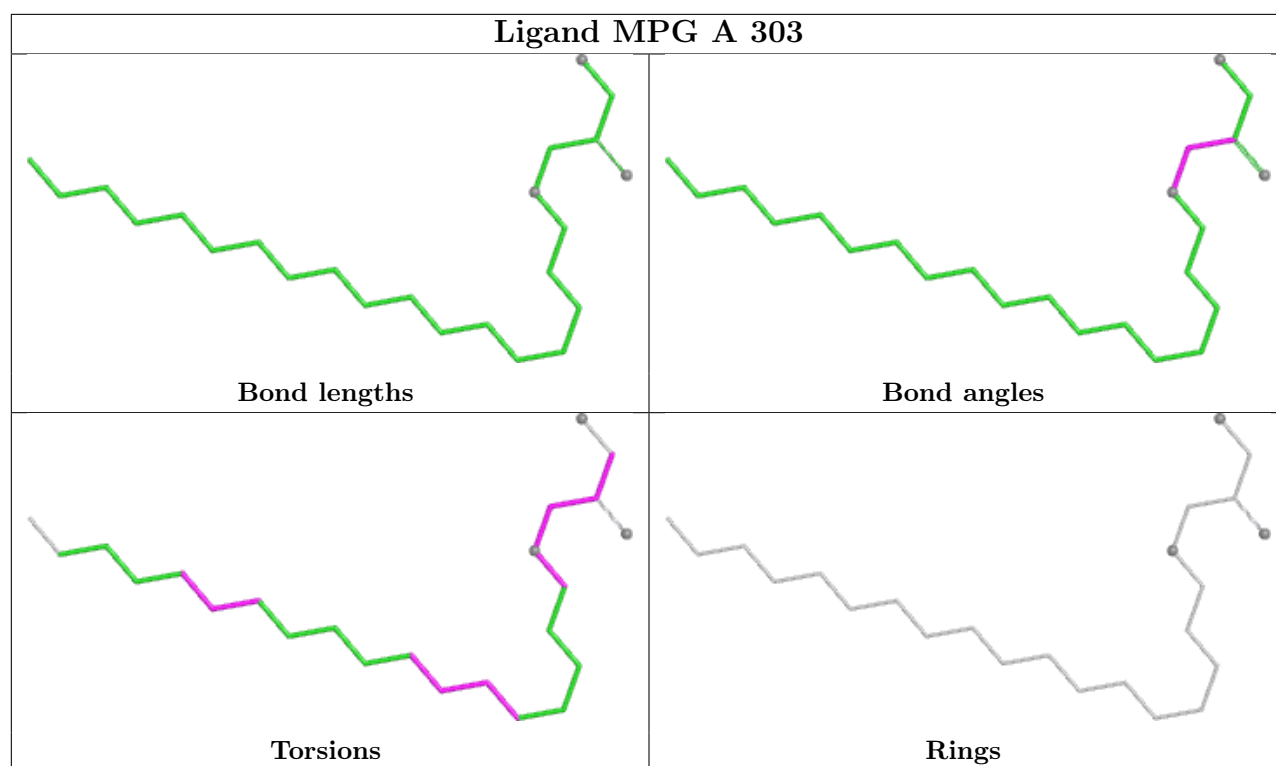
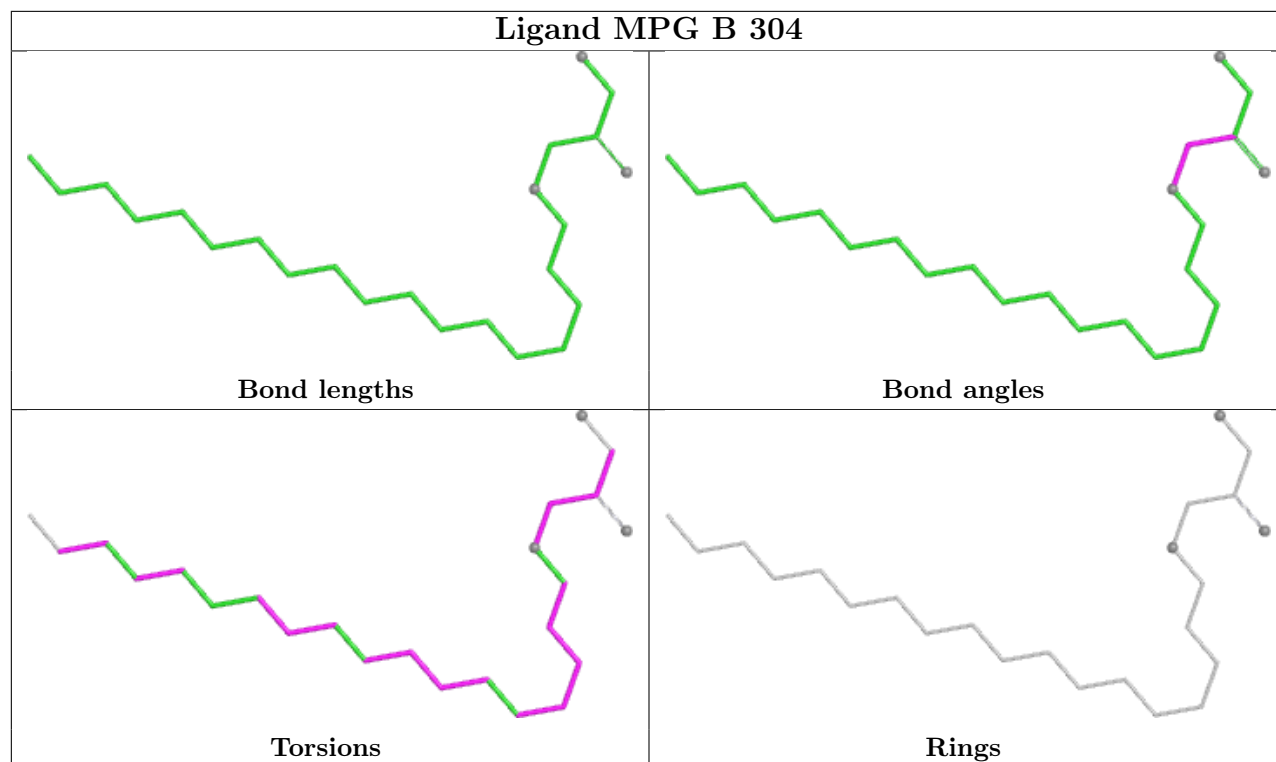
9 monomers are involved in 27 short contacts:

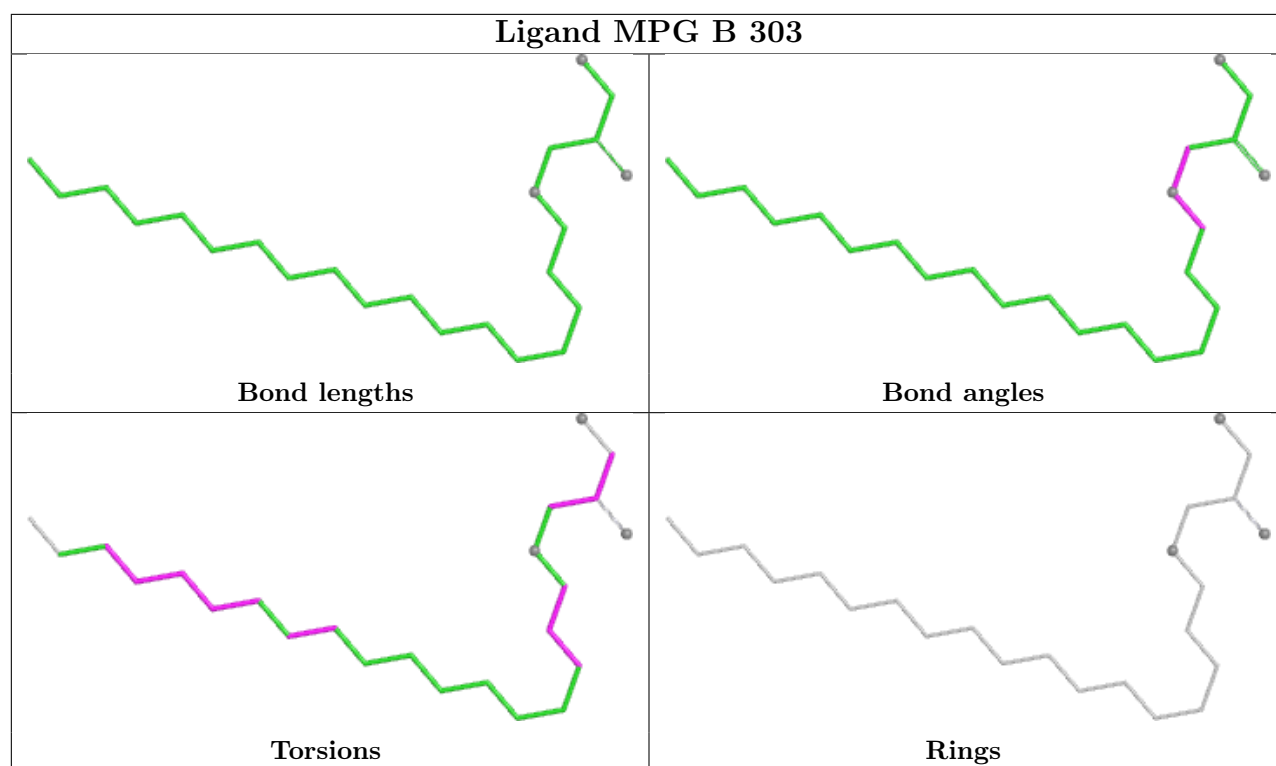
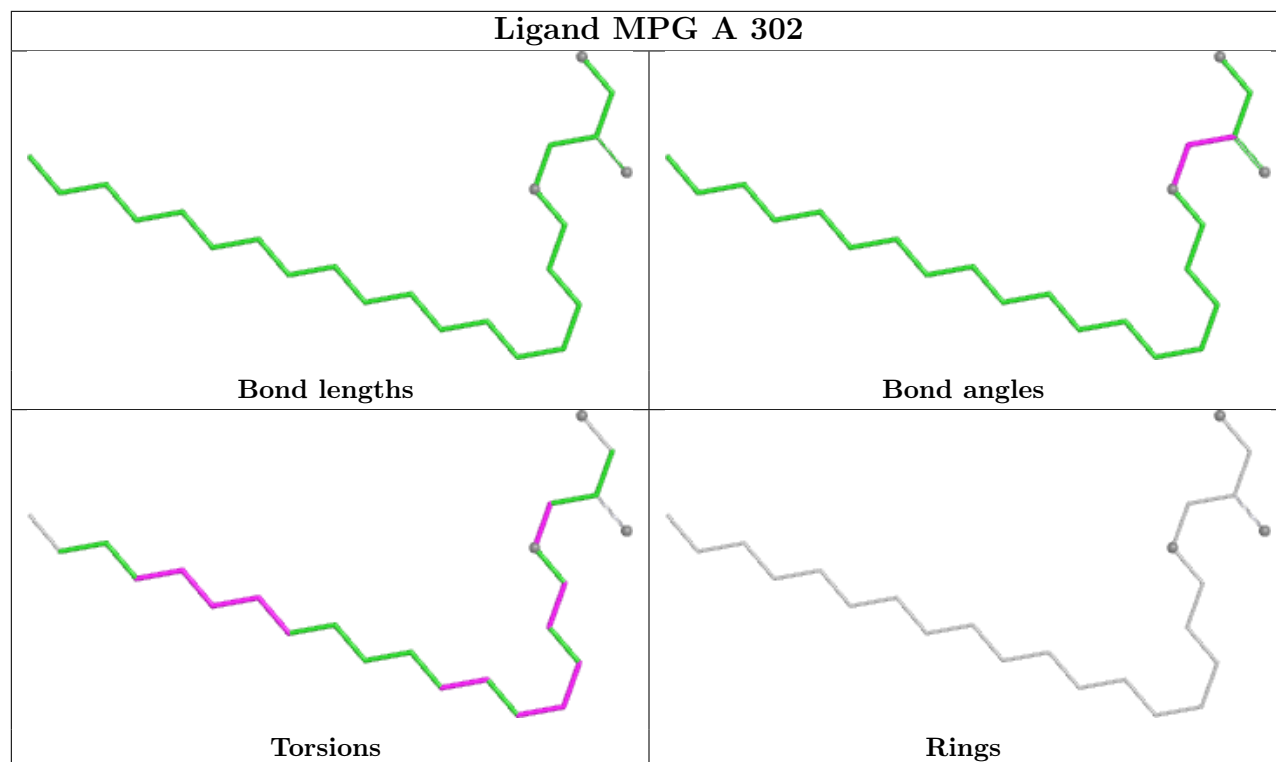
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	302	MPG	1	0
2	C	301	RET	2	0
3	B	306	MPG	1	0
2	A	301	RET	5	0
3	B	304	MPG	1	0
3	B	303	MPG	6	0
2	B	301	RET	4	0
3	A	304	MPG	3	0
3	C	302	MPG	4	0

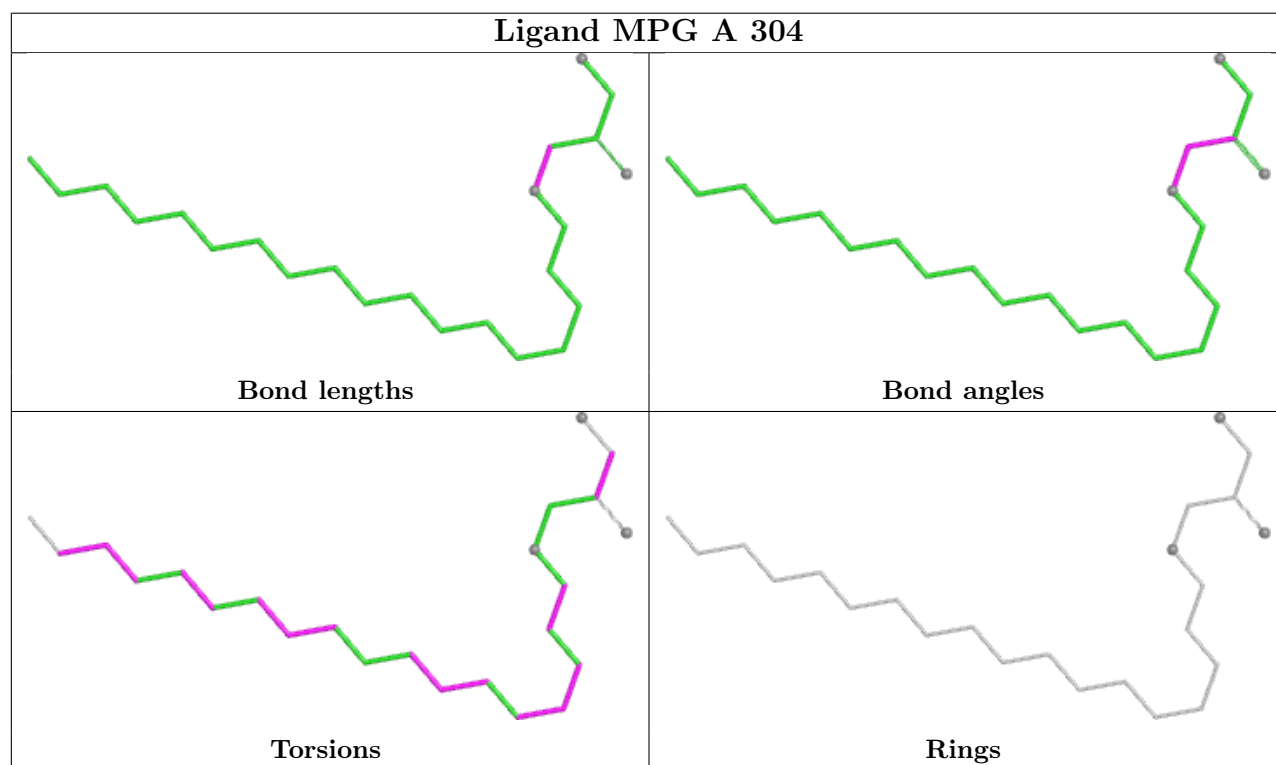
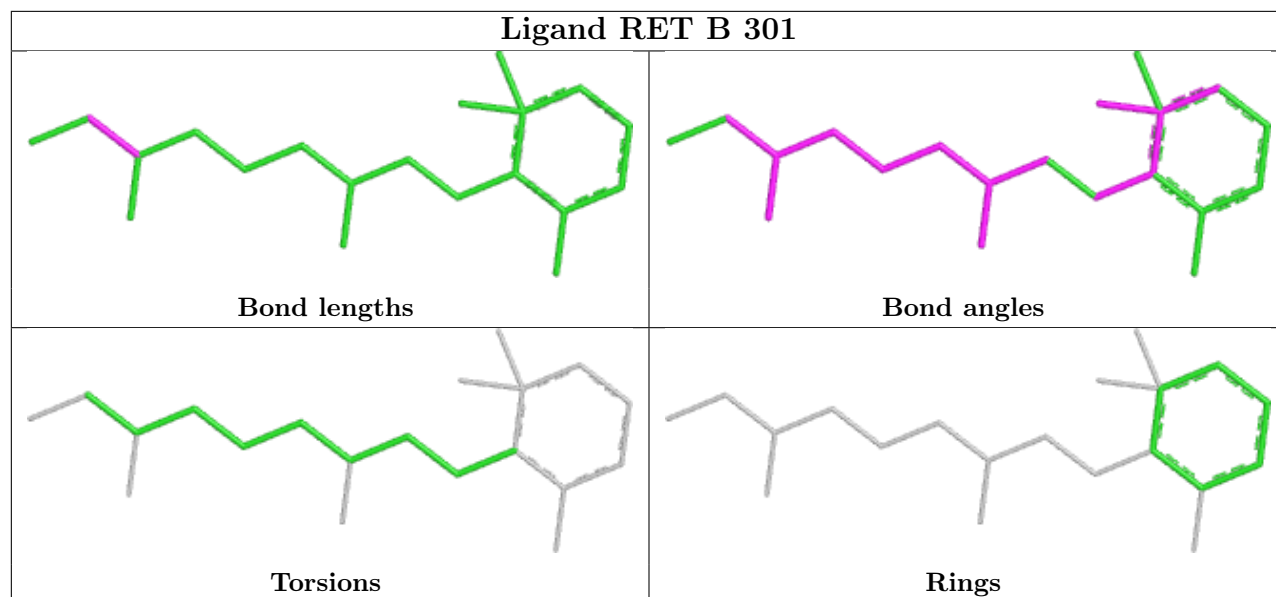
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

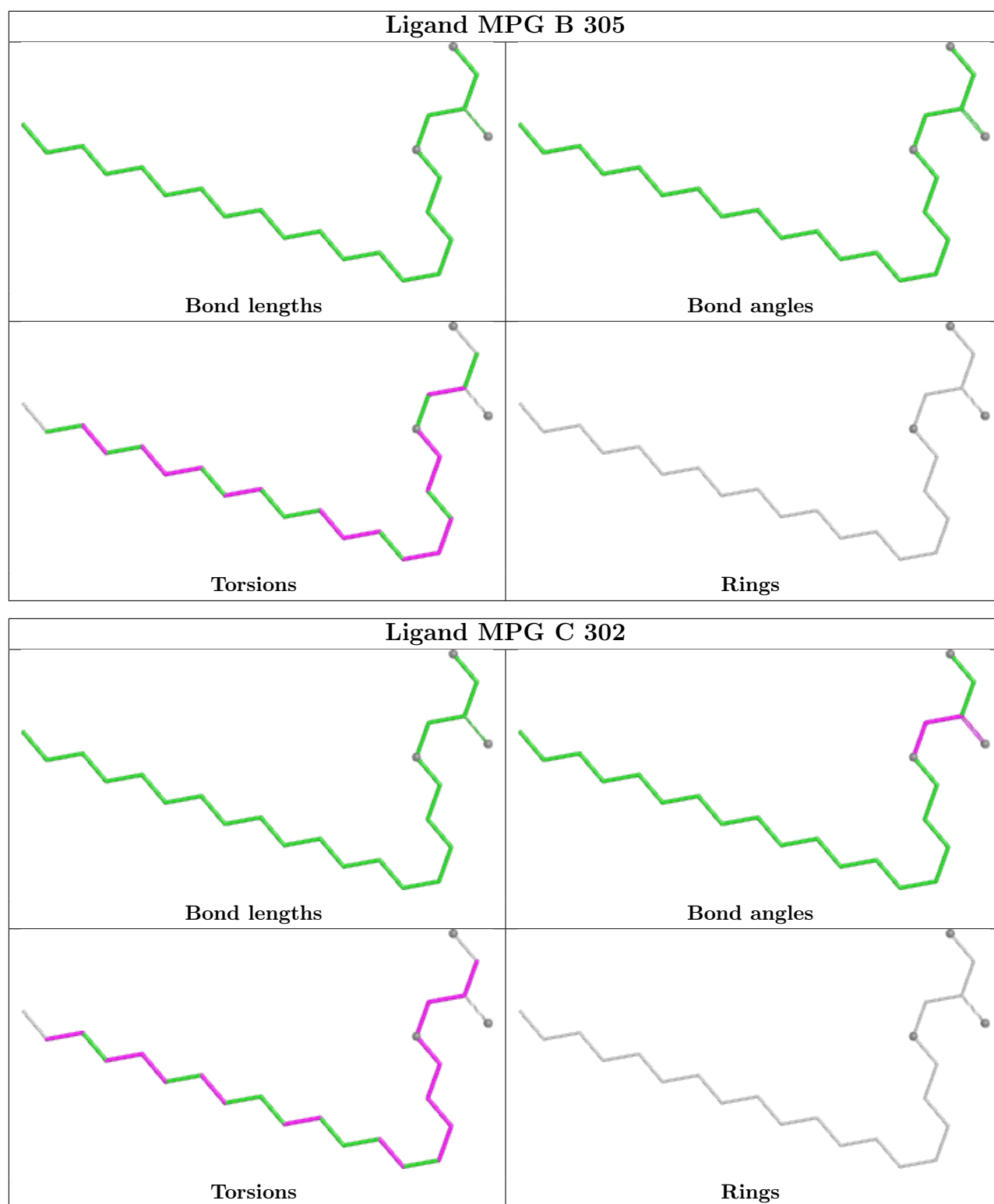












5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.

6 Fit of model and data [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	228/262 (87%)	0.49	7 (3%) 51 55	7, 17, 33, 46	2 (0%)
1	B	228/262 (87%)	0.41	4 (1%) 67 71	6, 18, 32, 48	3 (1%)
1	C	228/262 (87%)	0.42	6 (2%) 57 61	7, 18, 31, 48	3 (1%)
All	All	684/786 (87%)	0.44	17 (2%) 58 62	6, 18, 32, 48	8 (1%)

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	12	GLY	4.3
1	B	170	ASP	3.9
1	C	40	ASP	3.6
1	B	11	LEU	3.1
1	A	11	LEU	3.1
1	B	173	GLU	2.9
1	A	40	ASP	2.9
1	A	238	MET	2.7
1	A	93	ASP	2.6
1	A	79	ALA	2.4
1	C	155	PHE	2.4
1	C	11	LEU	2.3
1	C	159	TYR	2.3
1	A	202	GLU	2.2
1	C	91	TYR	2.2
1	A	155	PHE	2.0
1	B	159	TYR	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

There are no oligosaccharides in this entry.

6.4 Ligands

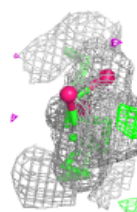
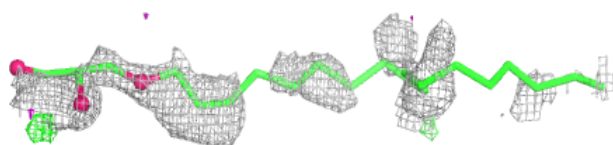
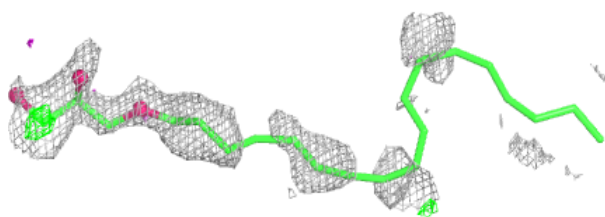
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	MPG	B	305	24/25	0.72	0.21	38,49,88,89	0
3	MPG	B	304	24/25	0.77	0.16	46,52,59,60	0
3	MPG	A	302	24/25	0.77	0.17	43,49,60,63	0
3	MPG	B	303	24/25	0.82	0.16	28,37,53,55	0
4	GOL	A	305	6/6	0.82	0.16	38,44,51,51	0
3	MPG	A	304	24/25	0.83	0.12	39,46,55,58	0
3	MPG	B	306	24/25	0.84	0.14	33,45,77,79	0
2	RET	B	301	20/21	0.84	0.11	12,15,19,22	0
3	MPG	B	302	24/25	0.86	0.13	32,36,47,53	0
3	MPG	A	303	24/25	0.86	0.12	32,38,51,53	0
3	MPG	C	302	24/25	0.88	0.11	34,38,46,51	0
2	RET	C	301	20/21	0.88	0.10	14,17,22,23	0
2	RET	A	301	20/21	0.92	0.08	14,16,23,24	0

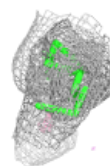
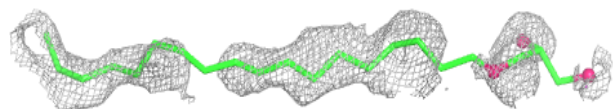
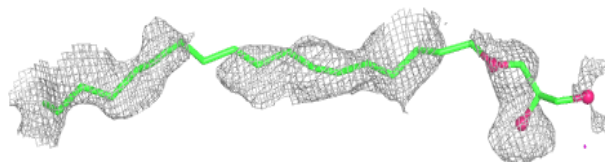
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around MPG B 305:

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

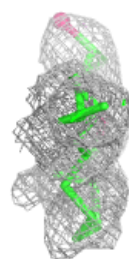
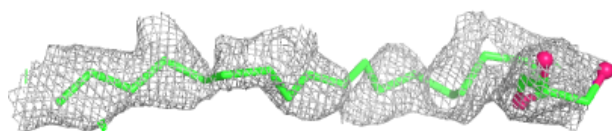
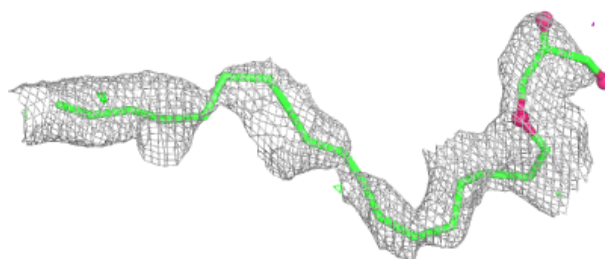
**Electron density around MPG B 304:**

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

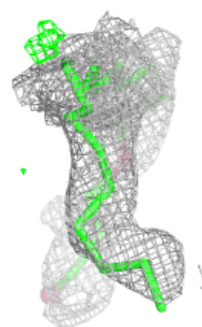
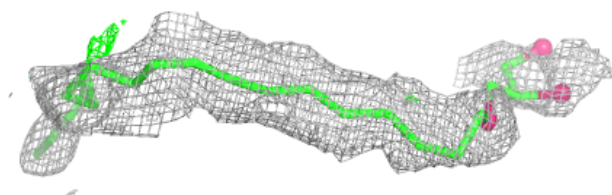
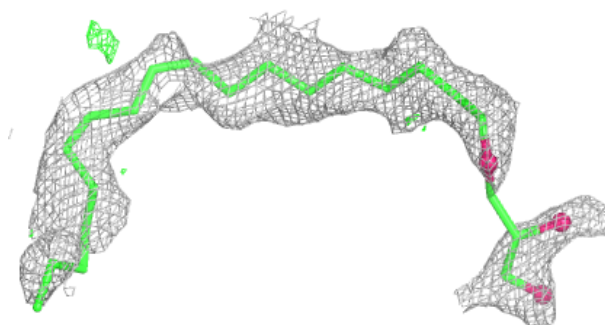


Electron density around MPG A 302:

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

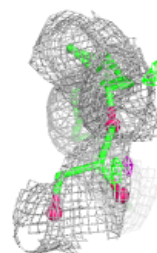
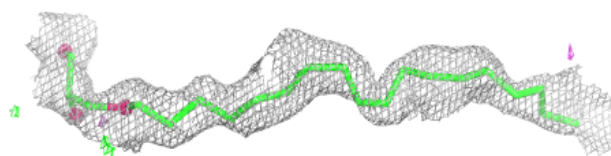
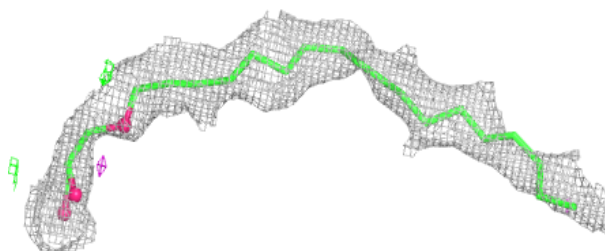
**Electron density around MPG B 303:**

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

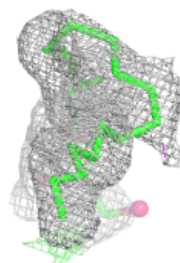
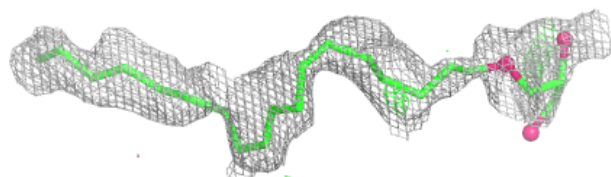
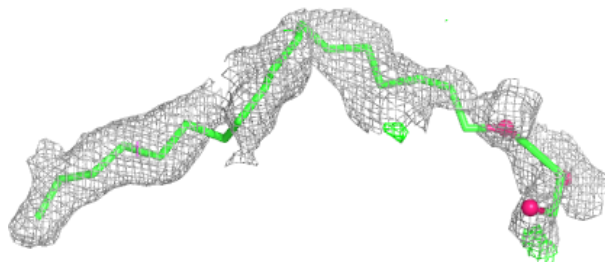


Electron density around MPG A 304:

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

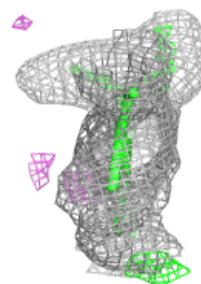
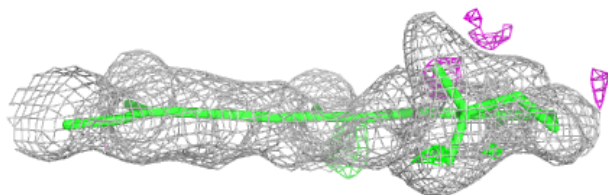
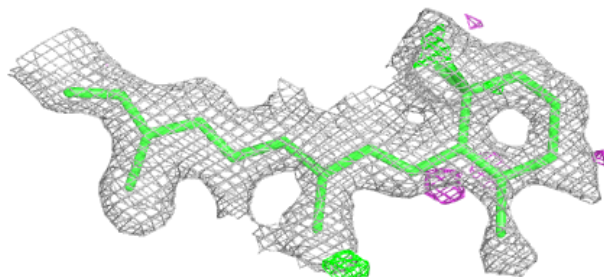
**Electron density around MPG B 306:**

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

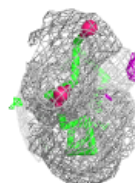
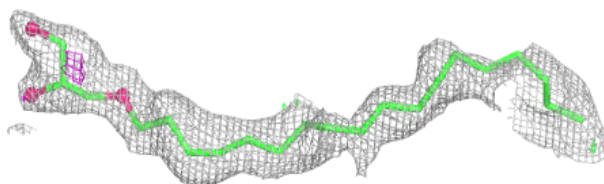


Electron density around RET B 301:

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

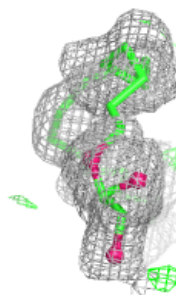
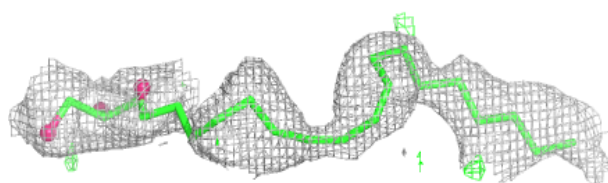
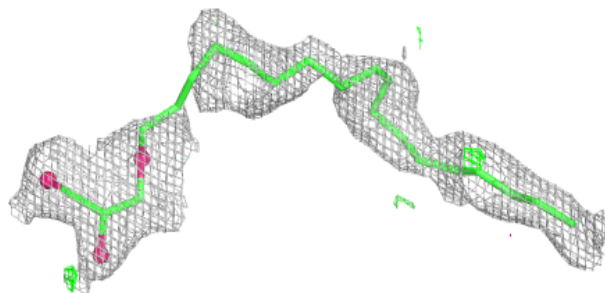
**Electron density around MPG B 302:**

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

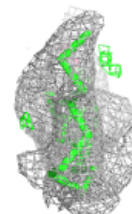
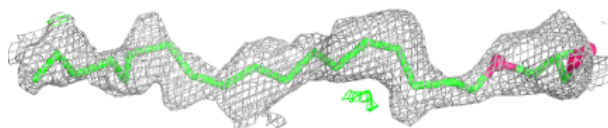
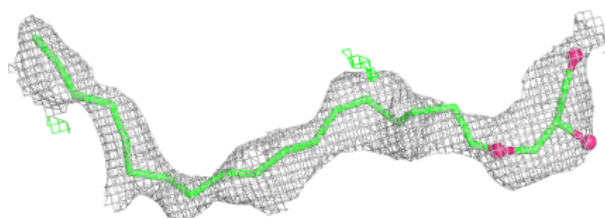


Electron density around MPG A 303:

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

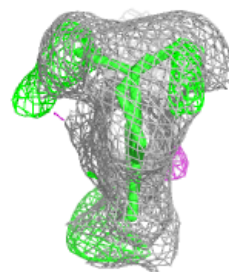
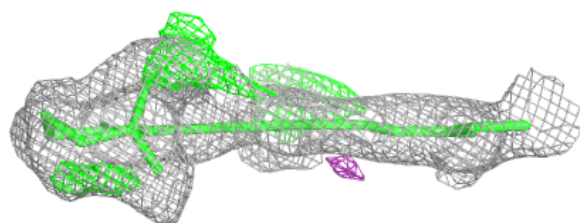
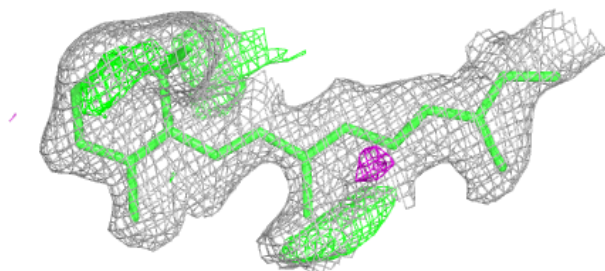
**Electron density around MPG C 302:**

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

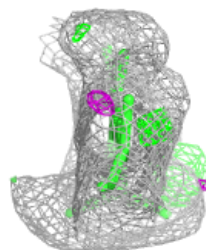
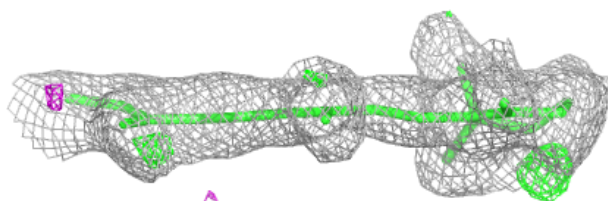
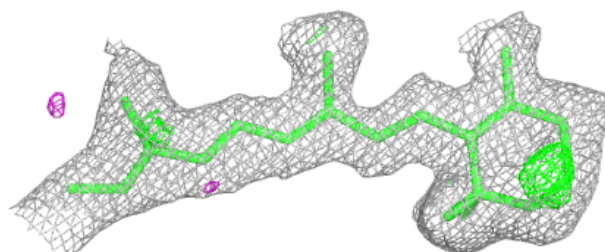


Electron density around RET C 301:

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

**Electron density around RET A 301:**

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



6.5 Other polymers ⓘ

There are no such residues in this entry.