



## Full wwPDB EM Validation Report ⓘ

Oct 2, 2024 – 12:06 PM JST

PDB ID : 8HBV  
EMDB ID : EMD-34644  
Title : Structure of human UCP1 in the nucleotide-free state  
Authors : Chen, L.; Kang, Y.  
Deposited on : 2022-10-31  
Resolution : 2.51 Å(reported)

This is a Full wwPDB EM Validation Report for a publicly released PDB entry.

We welcome your comments at [validation@mail.wwpdb.org](mailto:validation@mail.wwpdb.org)

A user guide is available at

<https://www.wwpdb.org/validation/2017/EMValidationReportHelp>

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>.

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

EMDB validation analysis : **FAILED**  
Mogul : 1.8.5 (274361), CSD as541be (2020)  
MolProbity : 4.02b-467  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
MapQ : **FAILED**  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.39

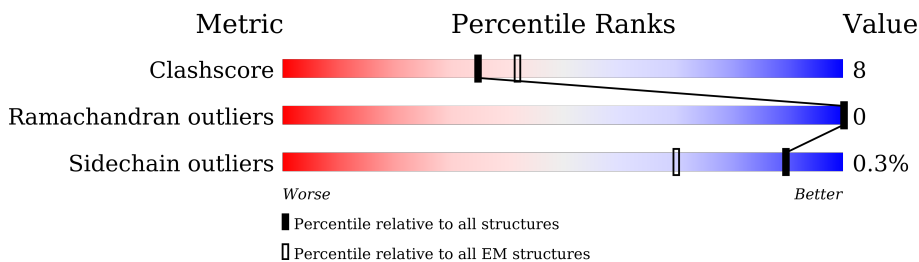
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*ELECTRON MICROSCOPY*

The reported resolution of this entry is 2.51 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	363	
2	B	131	

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 3279 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, 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.

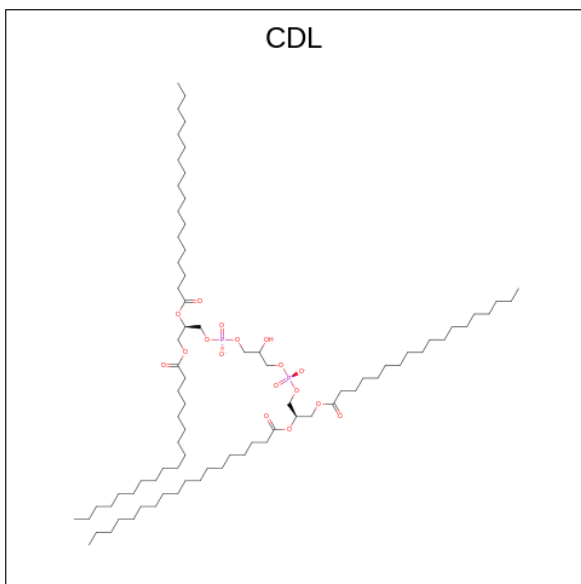
- Molecule 1 is a protein called Mitochondrial brown fat uncoupling protein 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	290	2180	1400	371	396	13	0	0

- Molecule 2 is a protein called Sybody 12F2.

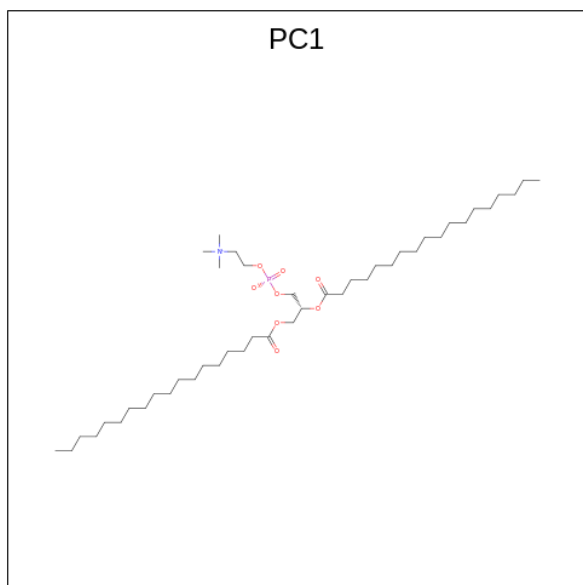
Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
2	B	124	997	635	172	185	5	0	0

- Molecule 3 is CARDIOLIPIN (three-letter code: CDL) (formula:  $C_{81}H_{156}O_{17}P_2$ ).



Mol	Chain	Residues	Atoms				AltConf
			Total	C	O	P	
3	A	1	48	29	17	2	0

- Molecule 4 is 1,2-DIACYL-SN-GLYCERO-3-PHOSPHOCHOLINE (three-letter code: PC1) (formula:  $C_{44}H_{88}NO_8P$ ) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				AltConf
			Total	C	O	P	
4	A	1	29	20	8	1	0
4	A	1	25	16	8	1	0



## 4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	544602	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN	Depositor
Voltage (kV)	300	Depositor
Electron dose ( $e^-/\text{\AA}^2$ )	52	Depositor
Minimum defocus (nm)	1500	Depositor
Maximum defocus (nm)	1800	Depositor
Magnification	Not provided	
Image detector	GATAN K3 BIOQUANTUM (6k x 4k)	Depositor

## 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: PC1, CDL

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with  $|Z| > 5$  is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# Z  >5	RMSZ	# Z  >5
1	A	0.35	0/2223	0.49	0/3022
2	B	0.45	0/1028	0.50	0/1398
All	All	0.39	0/3251	0.50	0/4420

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	2180	0	2241	35	0
2	B	997	0	929	18	0
3	A	48	0	40	3	0
4	A	54	0	54	2	0
All	All	3279	0	3264	51	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 8.

All (51) 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:178:PRO:HG3	1:A:250:VAL:HG11	1.74	0.70
2:B:40:ALA:HB3	2:B:43:LYS:HE3	1.75	0.69
2:B:100:ASP:OD2	2:B:104:ARG:NH1	2.31	0.64
1:A:238:ARG:NH1	1:A:261:GLU:OE1	2.29	0.61
1:A:262:GLY:HA3	2:B:101:PHE:CD2	2.38	0.58
1:A:290:GLN:OE1	1:A:293:ARG:NH2	2.35	0.57
1:A:112:LEU:HD11	1:A:191:LEU:HB3	1.87	0.56
1:A:250:VAL:HB	3:A:401:CDL:HA31	1.86	0.55
2:B:32:TYR:O	2:B:72:ARG:NH2	2.40	0.54
1:A:210:ASP:O	1:A:213:CYS:N	2.38	0.54
1:A:212:PRO:O	1:A:216:VAL:HG23	2.08	0.53
2:B:4:LEU:HD11	2:B:98:VAL:HG23	1.89	0.53
2:B:29:VAL:O	2:B:72:ARG:NH2	2.41	0.52
1:A:57:VAL:HG22	1:A:272:PRO:HG3	1.92	0.52
2:B:88:PRO:HA	2:B:119:VAL:HB	1.92	0.52
1:A:256:LYS:HE3	2:B:53:SER:HB2	1.91	0.52
1:A:112:LEU:HD13	1:A:195:ASP:OD2	2.09	0.51
1:A:41:GLN:HG2	1:A:234:VAL:HG22	1.93	0.51
1:A:77:LEU:HD23	4:A:402:PC1:H331	1.94	0.49
1:A:290:GLN:HA	1:A:293:ARG:HH22	1.77	0.49
2:B:91:THR:HG23	2:B:118:THR:HA	1.95	0.49
1:A:40:LEU:HD12	1:A:272:PRO:HG2	1.95	0.48
2:B:34:MET:HG3	2:B:79:VAL:HG21	1.96	0.48
2:B:34:MET:SD	2:B:98:VAL:HG22	2.54	0.48
2:B:101:PHE:HD1	2:B:107:ALA:HB2	1.79	0.47
2:B:51:ILE:HD13	2:B:72:ARG:HB2	1.96	0.47
2:B:12:VAL:HG11	2:B:86:LEU:HD13	1.98	0.46
1:A:285:PHE:O	1:A:289:GLU:HG2	2.15	0.45
1:A:173:TRP:O	1:A:176:THR:OG1	2.28	0.45
1:A:57:VAL:HG21	1:A:275:LEU:HD12	1.98	0.45
1:A:177:THR:OG1	1:A:178:PRO:HD3	2.16	0.45
2:B:87:LYS:HG3	2:B:89:GLU:HG2	1.98	0.45
1:A:120:LEU:HD22	1:A:184:VAL:HG22	1.98	0.45
1:A:18:SER:HA	1:A:291:LEU:HD23	2.00	0.44
1:A:196:LEU:O	1:A:199:GLU:HG3	2.16	0.44
1:A:175:GLY:C	1:A:178:PRO:HD2	2.38	0.44
2:B:36:TRP:HE1	2:B:79:VAL:HG12	1.82	0.43
1:A:201:PHE:HD1	1:A:206:ILE:HB	1.83	0.43
1:A:24:CYS:O	1:A:28:VAL:HG13	2.19	0.43
1:A:290:GLN:HA	1:A:293:ARG:NH2	2.34	0.43
1:A:153:TYR:CD1	1:A:159:ALA:HA	2.54	0.42
1:A:123:GLY:O	1:A:127:VAL:HG23	2.18	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:163:ILE:HG23	1:A:167:GLU:OE2	2.19	0.42
2:B:22:CYS:O	2:B:78:THR:HA	2.20	0.42
1:A:27:ASP:HB2	1:A:84:GLN:HG3	2.01	0.42
1:A:173:TRP:CD2	3:A:401:CDL:H722	2.55	0.42
1:A:101:PHE:CD2	1:A:102:LEU:HD22	2.55	0.41
1:A:271:VAL:HB	1:A:272:PRO:HD3	2.01	0.41
1:A:128:PHE:CZ	3:A:401:CDL:H721	2.56	0.41
1:A:74:TYR:CZ	4:A:402:PC1:H261	2.56	0.40
2:B:91:THR:HA	2:B:117:VAL:O	2.20	0.40

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 PDB entries followed by that with respect to all EM entries.

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	288/363 (79%)	282 (98%)	6 (2%)	0	100	100
2	B	122/131 (93%)	120 (98%)	2 (2%)	0	100	100
All	All	410/494 (83%)	402 (98%)	8 (2%)	0	100	100

There are no Ramachandran outliers to report.

#### 5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all PDB entries followed by that with respect to all EM entries.

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	237/303 (78%)	236 (100%)	1 (0%)	89	96
2	B	101/107 (94%)	101 (100%)	0	100	100
All	All	338/410 (82%)	337 (100%)	1 (0%)	90	97

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	276	ARG

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 oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

3 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
3	CDL	A	401	-	47,47,99	1.34	4 (8%)	53,59,111	1.49	8 (15%)
4	PC1	A	402	-	28,28,53	1.26	2 (7%)	32,33,61	1.29	4 (12%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z  > 2	Counts	RMSZ	# Z  > 2
4	PC1	A	403	-	24,24,53	1.35	2 (8%)	28,29,61	1.30	3 (10%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	CDL	A	401	-	-	15/57/57/110	-
4	PC1	A	402	-	-	10/30/30/57	-
4	PC1	A	403	-	-	5/26/26/57	-

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	401	CDL	OA6-CA5	4.68	1.45	1.35
3	A	401	CDL	OA8-CA7	4.31	1.45	1.33
4	A	403	PC1	O31-C31	4.23	1.45	1.33
4	A	402	PC1	O21-C21	4.13	1.46	1.34
4	A	402	PC1	O31-C31	4.13	1.45	1.33
4	A	403	PC1	O21-C21	4.07	1.45	1.34
3	A	401	CDL	OB8-CB7	3.91	1.44	1.33
3	A	401	CDL	OB6-CB5	3.82	1.45	1.34

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	401	CDL	OA6-CA5-C11	4.97	120.24	111.09
3	A	401	CDL	OB6-CB5-C51	4.08	120.30	111.50
4	A	402	PC1	O21-C21-C22	3.53	119.11	111.50
4	A	403	PC1	O21-C21-C22	3.44	118.91	111.50
3	A	401	CDL	OB8-CB7-C71	3.36	122.46	111.91
3	A	401	CDL	CA4-OA6-CA5	-3.05	112.21	117.90
3	A	401	CDL	OA8-CA7-C31	2.94	121.14	111.91
4	A	402	PC1	O31-C31-C32	2.69	120.36	111.91
4	A	403	PC1	O31-C31-C32	2.58	120.00	111.91
3	A	401	CDL	OB8-CB7-OB9	-2.41	117.51	123.59
4	A	402	PC1	O12-P-O14	2.41	120.12	110.68
3	A	401	CDL	CB2-C1-CA2	-2.30	106.01	112.79
3	A	401	CDL	CB4-OB6-CB5	-2.29	112.15	117.79
4	A	403	PC1	O12-P-O14	2.13	119.03	110.68

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	A	402	PC1	C3-C2-C1	-2.06	106.91	111.79

There are no chirality outliers.

All (30) torsion outliers are listed below:

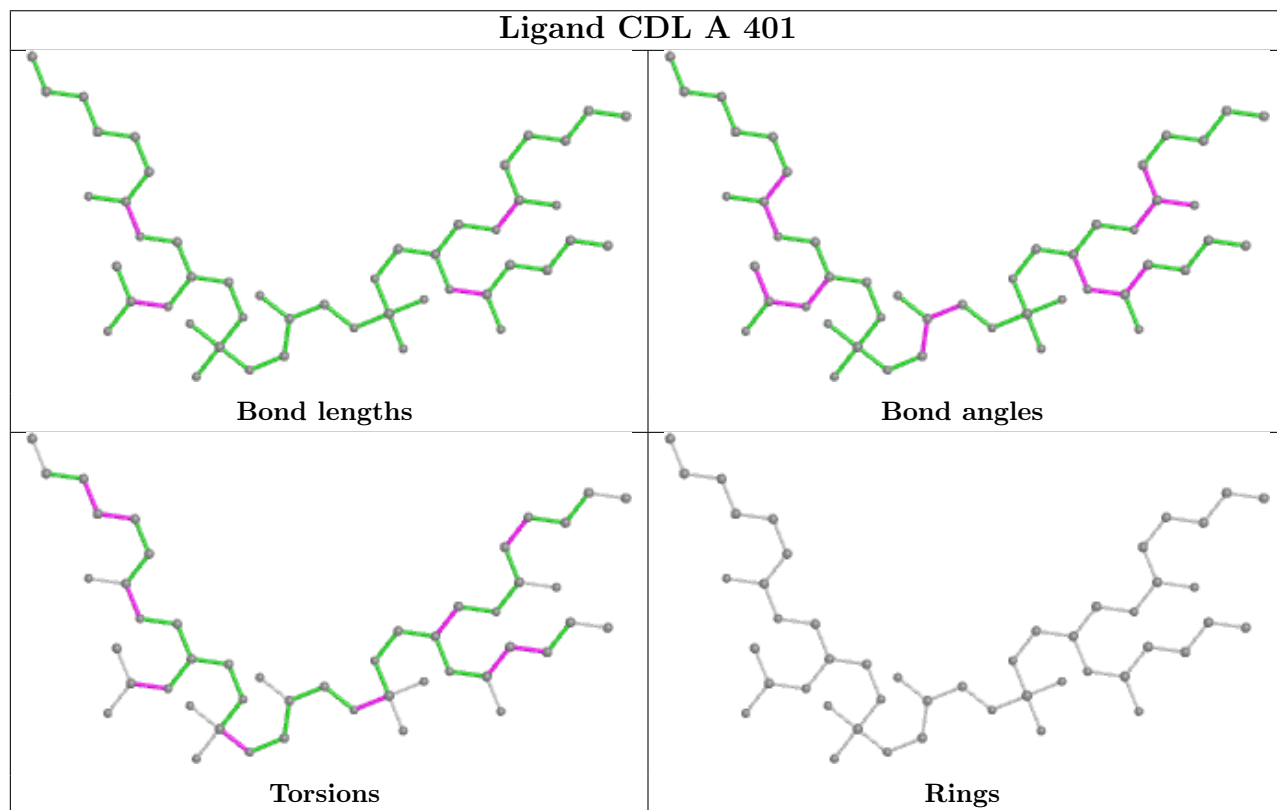
Mol	Chain	Res	Type	Atoms
3	A	401	CDL	CA2-OA2-PA1-OA4
3	A	401	CDL	C11-CA5-OA6-CA4
4	A	402	PC1	O21-C2-C3-O31
3	A	401	CDL	CB5-C51-C52-C53
4	A	403	PC1	C22-C21-O21-C2
3	A	401	CDL	CA2-OA2-PA1-OA5
4	A	403	PC1	O22-C21-O21-C2
4	A	402	PC1	C22-C21-O21-C2
4	A	402	PC1	O22-C21-O21-C2
3	A	401	CDL	OA7-CA5-OA6-CA4
4	A	402	PC1	C24-C25-C26-C27
4	A	402	PC1	C33-C34-C35-C36
4	A	403	PC1	O21-C2-C3-O31
4	A	402	PC1	C1-C2-C3-O31
4	A	403	PC1	C1-C2-C3-O31
4	A	402	PC1	C23-C24-C25-C26
3	A	401	CDL	C31-CA7-OA8-CA6
3	A	401	CDL	OA9-CA7-OA8-CA6
3	A	401	CDL	CB3-CB4-CB6-OB8
3	A	401	CDL	CB7-C71-C72-C73
4	A	402	PC1	O11-C1-C2-C3
4	A	402	PC1	O11-C1-C2-O21
3	A	401	CDL	OB6-CB4-CB6-OB8
3	A	401	CDL	CB2-OB2-PB2-OB5
4	A	402	PC1	C31-C32-C33-C34
3	A	401	CDL	C31-C32-C33-C34
3	A	401	CDL	CB2-OB2-PB2-OB3
3	A	401	CDL	C32-C33-C34-C35
3	A	401	CDL	C52-C51-CB5-OB6
4	A	403	PC1	O31-C31-C32-C33

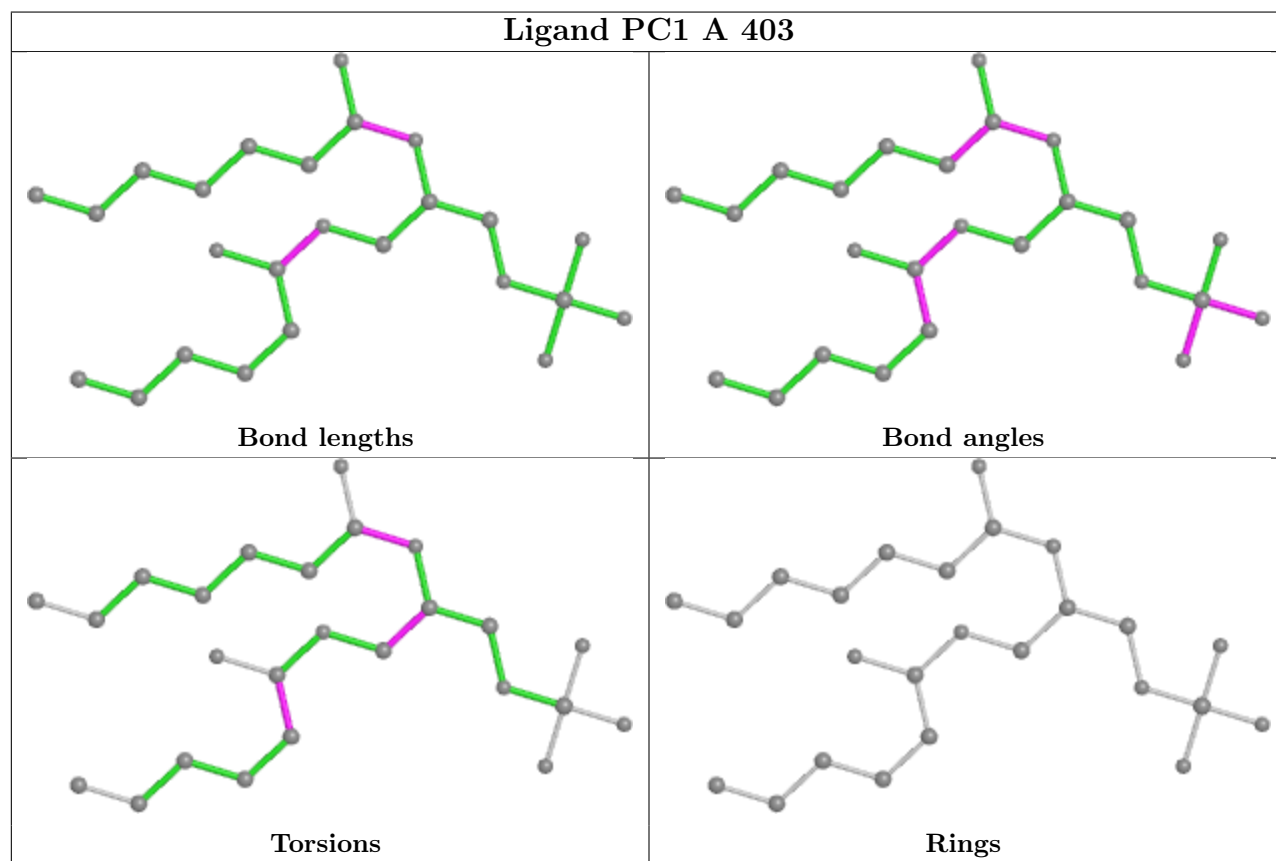
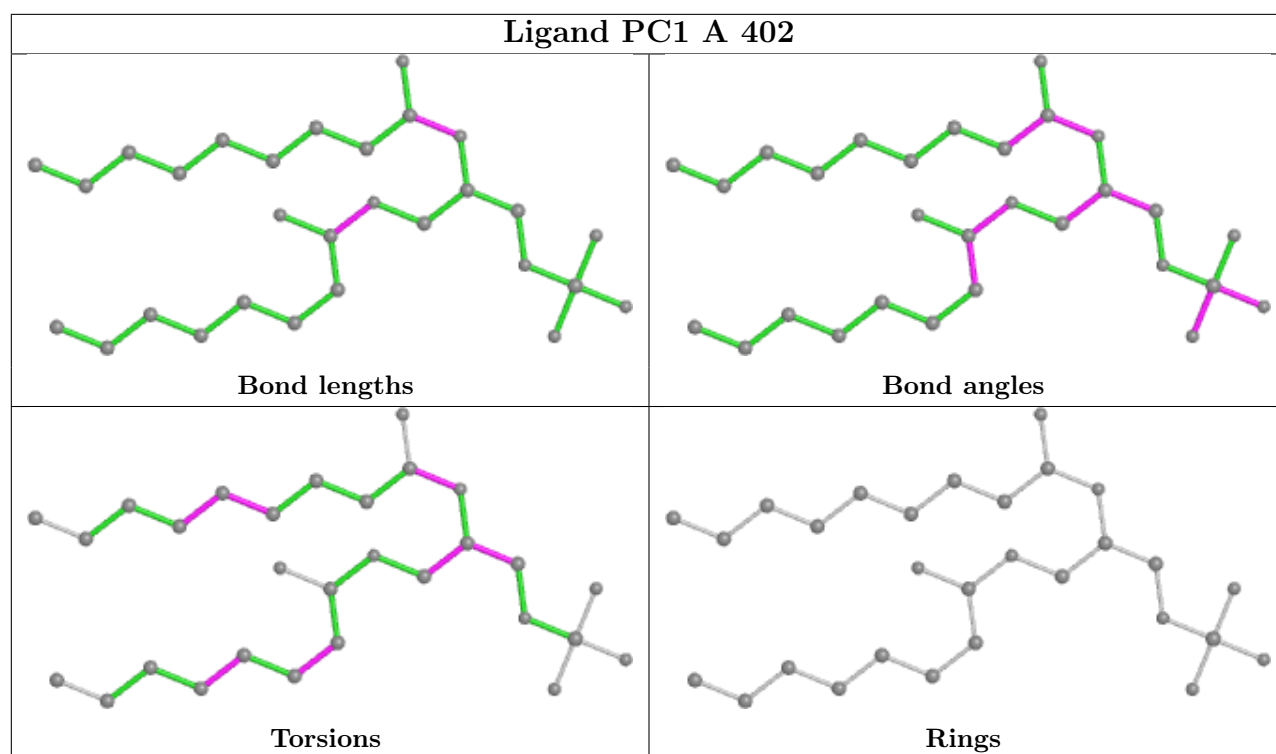
There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	401	CDL	3	0
4	A	402	PC1	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.





## 5.7 Other polymers [\(i\)](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues

There are no chain breaks in this entry.