



## Full wwPDB EM Validation Report ⓘ

Feb 20, 2025 – 07:51 AM EST

PDB ID : 3M9I  
Title : Electron crystallographic structure of lens Aquaporin-0 (AQP0) (lens MIP) in E. coli polar lipids  
Authors : Hite, R.K.; Li, Z.; Walz, T.  
Deposited on : 2010-03-22  
Resolution : 2.50 Å (reported)

This is a Full wwPDB EM Validation Report for a publicly released PDB/EMDB 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:

MolProbity : 4.02b-467  
Mogul : 2022.3.0, CSD as543be (2022)  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.004 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.41.4

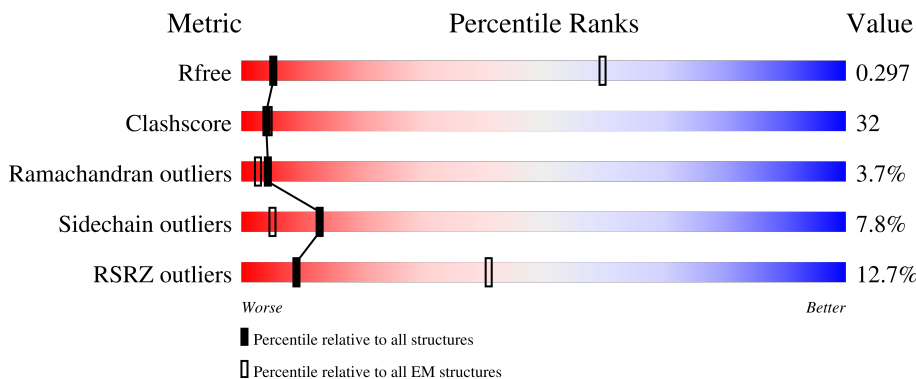
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*ELECTRON CRYSTALLOGRAPHY*

The reported resolution of this entry is 2.50 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)
$R_{free}$	164678	53
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415
RSRZ outliers	164674	54

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	220	

## 2 Entry composition i

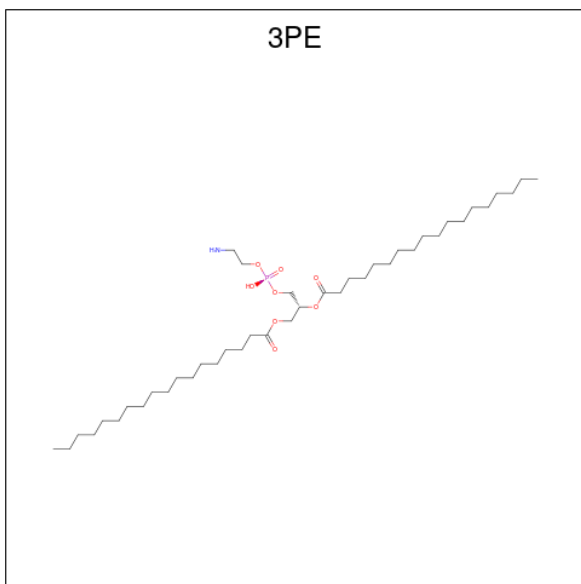
There are 3 unique types of molecules in this entry. The entry contains 1949 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Lens fiber major intrinsic protein.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	220	1668	1110	279	274	5	0	0

- Molecule 2 is 1,2-Distearoyl-sn-glycerophosphoethanolamine (three-letter code: 3PE) (formula:  $C_{41}H_{82}NO_8P$ ).



Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
2	A	1	28	18	1	8	1	0
2	A	1	37	27	1	8	1	0
2	A	1	42	32	1	8	1	0
2	A	1	40	30	1	8	1	0
2	A	1	38	28	1	8	1	0

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Mol	Chain	Residues	Atoms					AltConf
			Total	C	N	O	P	
2	A	1	48	38	1	8	1	0
2	A	1	40	30	1	8	1	0

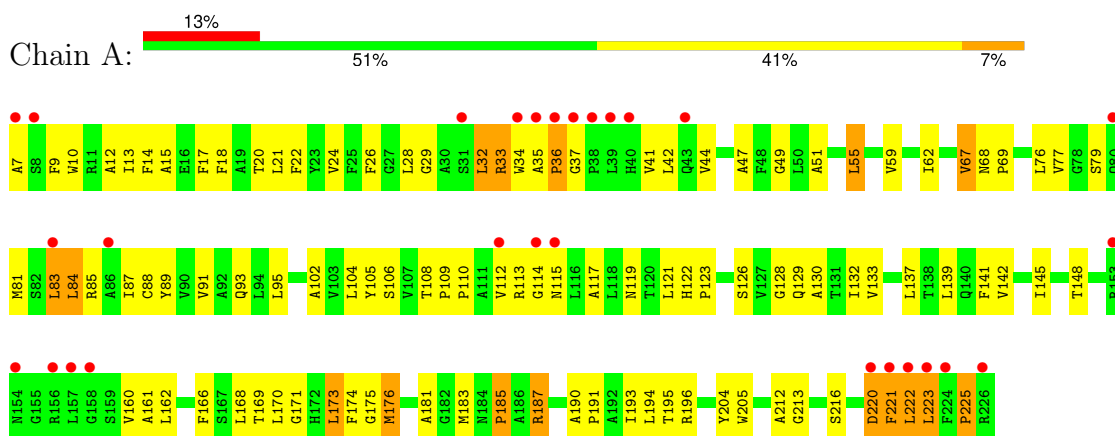
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		AltConf
3	A	8	Total	O	0
			8	8	

### 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. 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. 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: Lens fiber major intrinsic protein



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 4 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	65.50Å 65.50Å 200.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	15.89 – 2.50 15.89 – 2.50	Depositor EDS
% Data completeness (in resolution range)	89.8 (15.89-2.50) 89.3 (15.89-2.50)	Depositor EDS
$R_{merge}$	0.23	Depositor
$R_{sym}$	0.19	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.12 (at 2.48Å)	Xtrriage
Refinement program	CNS 1.2	Depositor
R, $R_{free}$	0.250 , 0.284 0.266 , 0.297	Depositor DCC
$R_{free}$ test set	1453 reflections (10.19%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	35.2	Xtrriage
Anisotropy	0.608	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 59.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.44$ , $\langle L^2 \rangle = 0.27$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.89	EDS
Total number of atoms	1949	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	48.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.76% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

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

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 3PE

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	0.42	0/1718	0.66	2/2350 (0.1%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	221	PHE	CB-CA-C	9.15	128.70	110.40
1	A	223	LEU	N-CA-CB	-7.25	95.90	110.40

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	1668	0	1687	108	0
2	A	273	0	364	32	0
3	A	8	0	0	0	0
All	All	1949	0	2051	128	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 32.

All (128) 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)
2:A:303:3PE:C2E	2:A:306:3PE:C39	2.36	1.03
1:A:222:LEU:O	1:A:225:PRO:HD3	1.63	0.98
2:A:303:3PE:C2E	2:A:306:3PE:H391	1.94	0.97
2:A:303:3PE:C2E	2:A:306:3PE:C3A	2.44	0.94
2:A:304:3PE:C3E	2:A:307:3PE:H3A1	1.97	0.94
2:A:303:3PE:C2E	2:A:306:3PE:C3B	2.49	0.91
1:A:24:VAL:O	1:A:28:LEU:HB2	1.76	0.84
1:A:41:VAL:HG22	1:A:176:MET:HG2	1.60	0.84
2:A:303:3PE:C2E	2:A:306:3PE:H3B2	2.07	0.83
1:A:59:VAL:HG12	1:A:59:VAL:O	1.77	0.82
1:A:33:ARG:HH11	1:A:36:PRO:HB3	1.43	0.82
2:A:307:3PE:H111	2:A:307:3PE:H11	1.61	0.82
1:A:10:TRP:HE1	2:A:306:3PE:H11	1.45	0.81
1:A:126:SER:OG	1:A:129:GLN:HG3	1.83	0.78
1:A:69:PRO:HA	1:A:93:GLN:HE22	1.49	0.77
1:A:33:ARG:HB3	1:A:36:PRO:HG3	1.67	0.76
1:A:137:LEU:HD21	1:A:174:PHE:HD2	1.51	0.75
1:A:108:THR:HG23	1:A:113:ARG:HD3	1.69	0.73
1:A:67:VAL:HG12	1:A:67:VAL:O	1.89	0.72
1:A:20:THR:HA	1:A:67:VAL:HG13	1.71	0.72
1:A:121:LEU:HD22	1:A:130:ALA:HB1	1.71	0.71
1:A:196:ARG:NH1	2:A:302:3PE:O14	2.24	0.71
2:A:304:3PE:C3D	2:A:307:3PE:H3A1	2.21	0.71
2:A:303:3PE:H2D2	2:A:306:3PE:H3B2	1.73	0.71
1:A:142:VAL:HG21	1:A:212:ALA:HA	1.72	0.70
2:A:303:3PE:C2D	2:A:306:3PE:H3B2	2.19	0.70
1:A:59:VAL:O	1:A:59:VAL:CG1	2.42	0.68
1:A:194:LEU:HD22	2:A:303:3PE:H31	1.75	0.68
2:A:307:3PE:H111	2:A:307:3PE:C1	2.25	0.67
1:A:148:THR:HB	1:A:160:VAL:HG23	1.77	0.67
1:A:137:LEU:HD11	1:A:175:GLY:HA3	1.76	0.66
1:A:220:ASP:O	1:A:225:PRO:HA	1.96	0.65
1:A:108:THR:CG2	1:A:113:ARG:HD3	2.27	0.65
1:A:69:PRO:CA	1:A:93:GLN:HE22	2.12	0.63
1:A:87:ILE:O	1:A:91:VAL:HG23	1.99	0.63
2:A:304:3PE:C3E	2:A:307:3PE:H3C1	2.28	0.62
1:A:15:ALA:HB1	1:A:59:VAL:CG1	2.30	0.62
2:A:304:3PE:C3E	2:A:307:3PE:C3A	2.75	0.61
1:A:24:VAL:HG13	1:A:28:LEU:HD22	1.82	0.61
1:A:33:ARG:NE	1:A:36:PRO:HG3	2.16	0.60
1:A:119:ASN:HB3	1:A:204:TYR:CZ	2.36	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:104:LEU:O	1:A:108:THR:HG22	2.01	0.59
1:A:33:ARG:HE	1:A:36:PRO:HG3	1.68	0.59
1:A:36:PRO:HG2	1:A:37:GLY:H	1.67	0.59
1:A:24:VAL:CG1	1:A:28:LEU:HD22	2.33	0.59
1:A:33:ARG:HE	1:A:36:PRO:CB	2.16	0.59
2:A:303:3PE:C2E	2:A:306:3PE:H3A1	2.33	0.58
1:A:28:LEU:HG	1:A:117:ALA:HB3	1.83	0.58
1:A:17:PHE:CE2	2:A:303:3PE:H2B1	2.38	0.58
1:A:33:ARG:NH1	1:A:36:PRO:HB3	2.17	0.57
1:A:128:GLY:O	1:A:132:ILE:HG12	2.05	0.57
1:A:51:ALA:O	1:A:55:LEU:HD22	2.06	0.56
1:A:34:TRP:CE2	1:A:112:VAL:HG11	2.41	0.56
1:A:44:VAL:O	1:A:47:ALA:HB3	2.05	0.56
2:A:307:3PE:H11	2:A:307:3PE:C11	2.33	0.56
1:A:174:PHE:CD2	1:A:175:GLY:N	2.74	0.55
1:A:33:ARG:HE	1:A:36:PRO:CG	2.19	0.55
1:A:196:ARG:HH21	2:A:303:3PE:H111	1.72	0.55
1:A:29:GLY:O	1:A:32:LEU:HB2	2.06	0.55
1:A:222:LEU:O	1:A:225:PRO:CD	2.46	0.55
2:A:304:3PE:C3E	2:A:307:3PE:C3E	2.86	0.54
1:A:113:ARG:O	1:A:113:ARG:HG3	2.08	0.54
2:A:304:3PE:H11	2:A:304:3PE:O22	2.08	0.54
1:A:76:LEU:HD21	1:A:83:LEU:HD13	1.90	0.53
1:A:14:PHE:HA	2:A:307:3PE:H241	1.90	0.53
1:A:12:ALA:HA	1:A:62:ILE:HG22	1.90	0.53
1:A:108:THR:HG21	1:A:113:ARG:HB3	1.91	0.53
1:A:221:PHE:O	1:A:225:PRO:HG3	2.09	0.53
1:A:137:LEU:HD21	1:A:174:PHE:CD2	2.40	0.52
1:A:133:VAL:HG13	1:A:174:PHE:HE2	1.74	0.52
1:A:122:HIS:HD2	1:A:123:PRO:O	1.93	0.51
1:A:10:TRP:NE1	2:A:306:3PE:H11	2.20	0.51
1:A:69:PRO:HG3	1:A:93:GLN:HE21	1.75	0.51
1:A:15:ALA:HB1	1:A:59:VAL:HG13	1.92	0.51
1:A:139:LEU:HD23	1:A:139:LEU:O	2.11	0.51
1:A:9:PHE:HE1	1:A:85:ARG:HG3	1.76	0.50
1:A:35:ALA:N	1:A:36:PRO:CD	2.74	0.50
1:A:67:VAL:O	1:A:67:VAL:CG1	2.57	0.50
2:A:303:3PE:H2D2	2:A:306:3PE:C3B	2.42	0.50
1:A:22:PHE:O	1:A:26:PHE:HD2	1.95	0.49
1:A:162:LEU:HG	1:A:166:PHE:CE2	2.45	0.49
1:A:49:GLY:HA3	1:A:169:THR:OG1	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:106:SER:HB3	2:A:304:3PE:C3	2.43	0.49
1:A:119:ASN:OD1	1:A:187:ARG:CZ	2.61	0.48
1:A:62:ILE:HD12	1:A:62:ILE:N	2.28	0.48
1:A:222:LEU:O	1:A:223:LEU:C	2.52	0.48
1:A:89:TYR:O	1:A:93:GLN:HG3	2.13	0.48
1:A:137:LEU:HD22	1:A:171:GLY:O	2.14	0.48
1:A:191:PRO:O	1:A:195:THR:HB	2.13	0.47
1:A:102:ALA:O	1:A:105:TYR:HB3	2.14	0.47
1:A:185:PRO:HB3	1:A:205:TRP:CE3	2.50	0.47
1:A:193:ILE:HG23	1:A:194:LEU:N	2.29	0.47
1:A:15:ALA:HB1	1:A:59:VAL:HG11	1.96	0.47
1:A:187:ARG:HE	1:A:187:ARG:C	2.18	0.47
1:A:119:ASN:HB3	1:A:204:TYR:CE2	2.50	0.47
1:A:41:VAL:HA	1:A:176:MET:HE2	1.96	0.46
1:A:108:THR:CG2	1:A:113:ARG:HB3	2.45	0.46
1:A:141:PHE:CE2	1:A:145:ILE:HD11	2.51	0.46
1:A:41:VAL:HA	1:A:176:MET:CE	2.46	0.46
1:A:160:VAL:HG13	1:A:161:ALA:N	2.31	0.46
1:A:139:LEU:HD23	1:A:139:LEU:C	2.36	0.45
1:A:13:ILE:HD12	1:A:88:CYS:HB3	1.99	0.45
1:A:106:SER:HB3	2:A:304:3PE:H32	1.98	0.45
1:A:69:PRO:CA	1:A:93:GLN:NE2	2.78	0.45
1:A:69:PRO:N	1:A:93:GLN:NE2	2.65	0.44
1:A:141:PHE:CZ	1:A:145:ILE:HD11	2.53	0.44
1:A:21:LEU:C	1:A:21:LEU:HD23	2.38	0.44
1:A:187:ARG:HH21	1:A:191:PRO:HG3	1.82	0.44
1:A:190:ALA:O	1:A:193:ILE:HG22	2.18	0.44
1:A:17:PHE:HE2	2:A:303:3PE:H2B1	1.81	0.44
1:A:121:LEU:HD22	1:A:130:ALA:CB	2.42	0.43
1:A:81:MET:HE2	1:A:85:ARG:HB3	2.00	0.43
2:A:304:3PE:O22	2:A:304:3PE:H31	2.15	0.43
1:A:190:ALA:HB3	1:A:191:PRO:CD	2.49	0.43
1:A:10:TRP:HB2	2:A:307:3PE:O12	2.19	0.43
2:A:303:3PE:C2D	2:A:306:3PE:C3B	2.91	0.43
1:A:7:ALA:C	1:A:9:PHE:H	2.22	0.42
1:A:84:LEU:HD22	1:A:84:LEU:O	2.19	0.42
1:A:108:THR:HG23	1:A:108:THR:O	2.19	0.42
1:A:28:LEU:HD11	1:A:187:ARG:CZ	2.50	0.41
1:A:77:VAL:C	1:A:79:SER:H	2.23	0.41
1:A:33:ARG:H	1:A:33:ARG:HG2	1.75	0.41
1:A:213:GLY:O	1:A:216:SER:HB3	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:95:LEU:HD22	2:A:303:3PE:H291	2.03	0.41
1:A:68:ASN:ND2	1:A:183:MET:O	2.47	0.41
1:A:81:MET:HE3	1:A:85:ARG:HD3	2.02	0.41
1:A:173:LEU:HA	1:A:173:LEU:HD12	1.82	0.41
1:A:109:PRO:HA	1:A:110:PRO:HD3	1.84	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	218/220 (99%)	181 (83%)	29 (13%)	8 (4%)	<b>2</b> <b>3</b>

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	33	ARG
1	A	36	PRO
1	A	181	ALA
1	A	114	GLY
1	A	220	ASP
1	A	83	LEU
1	A	225	PRO
1	A	67	VAL

#### 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	166/166 (100%)	153 (92%)	13 (8%)	10 21

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	18	PHE
1	A	32	LEU
1	A	42	LEU
1	A	55	LEU
1	A	84	LEU
1	A	115	ASN
1	A	168	LEU
1	A	170	LEU
1	A	173	LEU
1	A	176	MET
1	A	185	PRO
1	A	187	ARG
1	A	222	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	57	GLN
1	A	66	HIS
1	A	93	GLN
1	A	115	ASN
1	A	122	HIS
1	A	200	ASN

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

## 5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

7 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
2	3PE	A	304	-	39,39,50	0.51	0	42,44,55	1.16	3 (7%)
2	3PE	A	306	-	47,47,50	0.48	0	50,52,55	1.10	3 (6%)
2	3PE	A	303	-	41,41,50	0.50	0	44,46,55	1.14	3 (6%)
2	3PE	A	307	-	39,39,50	0.52	0	42,44,55	1.16	3 (7%)
2	3PE	A	305	-	37,37,50	0.53	0	40,42,55	1.18	3 (7%)
2	3PE	A	301	-	27,27,50	0.60	0	30,32,55	1.31	3 (10%)
2	3PE	A	302	-	36,36,50	0.53	0	39,41,55	1.19	3 (7%)

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
2	3PE	A	304	-	-	22/43/43/54	-
2	3PE	A	306	-	-	39/51/51/54	-
2	3PE	A	303	-	-	25/45/45/54	-
2	3PE	A	307	-	-	23/43/43/54	-
2	3PE	A	305	-	-	21/41/41/54	-
2	3PE	A	301	-	-	15/31/31/54	-
2	3PE	A	302	-	-	29/40/40/54	-

There are no bond length outliers.

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	305	3PE	O31-C31-O32	-4.52	112.33	123.63
2	A	306	3PE	O31-C31-O32	-4.51	112.34	123.63
2	A	301	3PE	O31-C31-O32	-4.51	112.36	123.63
2	A	307	3PE	O31-C31-O32	-4.51	112.36	123.63
2	A	303	3PE	O31-C31-O32	-4.50	112.37	123.63
2	A	304	3PE	O31-C31-O32	-4.49	112.40	123.63
2	A	302	3PE	O31-C31-O32	-4.49	112.40	123.63
2	A	305	3PE	O31-C31-C32	3.86	123.59	111.83
2	A	306	3PE	O31-C31-C32	3.85	123.58	111.83
2	A	301	3PE	O31-C31-C32	3.85	123.56	111.83
2	A	307	3PE	O31-C31-C32	3.84	123.55	111.83
2	A	302	3PE	O31-C31-C32	3.84	123.55	111.83
2	A	304	3PE	O31-C31-C32	3.84	123.54	111.83
2	A	303	3PE	O31-C31-C32	3.83	123.52	111.83
2	A	303	3PE	C2-O21-C21	-2.52	111.76	117.80
2	A	305	3PE	C2-O21-C21	-2.52	111.77	117.80
2	A	301	3PE	C2-O21-C21	-2.51	111.78	117.80
2	A	302	3PE	C2-O21-C21	-2.51	111.80	117.80
2	A	304	3PE	C2-O21-C21	-2.50	111.81	117.80
2	A	307	3PE	C2-O21-C21	-2.50	111.81	117.80
2	A	306	3PE	C2-O21-C21	-2.49	111.83	117.80

There are no chirality outliers.

All (174) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	3PE	C1-O11-P-O14
2	A	301	3PE	O21-C2-C3-O31
2	A	301	3PE	O22-C21-O21-C2
2	A	302	3PE	C1-O11-P-O14
2	A	302	3PE	C11-O13-P-O11
2	A	302	3PE	C11-O13-P-O12
2	A	302	3PE	C11-O13-P-O14
2	A	302	3PE	O13-C11-C12-N
2	A	303	3PE	C1-O11-P-O12
2	A	303	3PE	C1-O11-P-O13
2	A	303	3PE	O13-C11-C12-N
2	A	303	3PE	C22-C21-O21-C2
2	A	304	3PE	C1-O11-P-O14
2	A	304	3PE	O13-C11-C12-N
2	A	305	3PE	C1-O11-P-O12

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Mol	Chain	Res	Type	Atoms
2	A	305	3PE	C1-O11-P-O13
2	A	305	3PE	C1-O11-P-O14
2	A	305	3PE	O13-C11-C12-N
2	A	305	3PE	O22-C21-O21-C2
2	A	305	3PE	C22-C21-O21-C2
2	A	306	3PE	C1-O11-P-O12
2	A	306	3PE	C1-O11-P-O13
2	A	306	3PE	C11-O13-P-O12
2	A	307	3PE	C11-O13-P-O11
2	A	307	3PE	O13-C11-C12-N
2	A	307	3PE	C22-C21-O21-C2
2	A	302	3PE	O22-C21-O21-C2
2	A	307	3PE	O22-C21-O21-C2
2	A	301	3PE	C22-C21-O21-C2
2	A	302	3PE	C22-C21-O21-C2
2	A	304	3PE	C32-C31-O31-C3
2	A	307	3PE	O32-C31-O31-C3
2	A	303	3PE	O22-C21-O21-C2
2	A	305	3PE	C32-C31-O31-C3
2	A	307	3PE	C32-C31-O31-C3
2	A	304	3PE	O32-C31-O31-C3
2	A	305	3PE	O32-C31-O31-C3
2	A	306	3PE	C32-C31-O31-C3
2	A	303	3PE	C31-C32-C33-C34
2	A	306	3PE	O32-C31-O31-C3
2	A	301	3PE	O11-C1-C2-O21
2	A	303	3PE	C32-C31-O31-C3
2	A	302	3PE	C21-C22-C23-C24
2	A	304	3PE	C31-C32-C33-C34
2	A	303	3PE	C21-C22-C23-C24
2	A	303	3PE	O32-C31-O31-C3
2	A	302	3PE	C34-C35-C36-C37
2	A	304	3PE	C35-C36-C37-C38
2	A	304	3PE	C38-C39-C3A-C3B
2	A	304	3PE	C3A-C3B-C3C-C3D
2	A	304	3PE	C26-C27-C28-C29
2	A	306	3PE	C37-C38-C39-C3A
2	A	307	3PE	C22-C23-C24-C25
2	A	307	3PE	C25-C26-C27-C28
2	A	302	3PE	C36-C37-C38-C39
2	A	301	3PE	C21-C22-C23-C24
2	A	305	3PE	C21-C22-C23-C24

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Mol	Chain	Res	Type	Atoms
2	A	306	3PE	C31-C32-C33-C34
2	A	301	3PE	C33-C34-C35-C36
2	A	305	3PE	C24-C25-C26-C27
2	A	306	3PE	C28-C29-C2A-C2B
2	A	306	3PE	C33-C34-C35-C36
2	A	303	3PE	C26-C27-C28-C29
2	A	306	3PE	C2C-C2D-C2E-C2F
2	A	302	3PE	C32-C31-O31-C3
2	A	304	3PE	C37-C38-C39-C3A
2	A	305	3PE	C33-C34-C35-C36
2	A	307	3PE	C35-C36-C37-C38
2	A	301	3PE	C32-C33-C34-C35
2	A	302	3PE	C37-C38-C39-C3A
2	A	305	3PE	C22-C23-C24-C25
2	A	305	3PE	C23-C24-C25-C26
2	A	306	3PE	C24-C25-C26-C27
2	A	307	3PE	C3A-C3B-C3C-C3D
2	A	306	3PE	C22-C23-C24-C25
2	A	305	3PE	C36-C37-C38-C39
2	A	303	3PE	C38-C39-C3A-C3B
2	A	307	3PE	C31-C32-C33-C34
2	A	303	3PE	C27-C28-C29-C2A
2	A	305	3PE	C3A-C3B-C3C-C3D
2	A	306	3PE	C38-C39-C3A-C3B
2	A	302	3PE	C35-C36-C37-C38
2	A	307	3PE	C32-C33-C34-C35
2	A	307	3PE	C34-C35-C36-C37
2	A	307	3PE	C24-C25-C26-C27
2	A	304	3PE	C22-C21-O21-C2
2	A	307	3PE	C27-C28-C29-C2A
2	A	304	3PE	C32-C33-C34-C35
2	A	306	3PE	C25-C26-C27-C28
2	A	304	3PE	C33-C34-C35-C36
2	A	302	3PE	O32-C31-O31-C3
2	A	302	3PE	O21-C2-C3-O31
2	A	306	3PE	C3D-C3E-C3F-C3G
2	A	304	3PE	O22-C21-O21-C2
2	A	302	3PE	C33-C34-C35-C36
2	A	306	3PE	C34-C35-C36-C37
2	A	305	3PE	C35-C36-C37-C38
2	A	303	3PE	C35-C36-C37-C38
2	A	303	3PE	C28-C29-C2A-C2B

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Mol	Chain	Res	Type	Atoms
2	A	306	3PE	C27-C28-C29-C2A
2	A	307	3PE	C23-C24-C25-C26
2	A	306	3PE	C22-C21-O21-C2
2	A	303	3PE	C1-C2-C3-O31
2	A	306	3PE	C29-C2A-C2B-C2C
2	A	304	3PE	C3-C2-O21-C21
2	A	302	3PE	C3A-C3B-C3C-C3D
2	A	301	3PE	C22-C23-C24-C25
2	A	306	3PE	C3A-C3B-C3C-C3D
2	A	302	3PE	C24-C25-C26-C27
2	A	303	3PE	C33-C34-C35-C36
2	A	302	3PE	C3B-C3C-C3D-C3E
2	A	306	3PE	C2D-C2E-C2F-C2G
2	A	301	3PE	C32-C31-O31-C3
2	A	304	3PE	C34-C35-C36-C37
2	A	306	3PE	C2B-C2C-C2D-C2E
2	A	307	3PE	C38-C39-C3A-C3B
2	A	306	3PE	C3E-C3F-C3G-C3H
2	A	306	3PE	C3B-C3C-C3D-C3E
2	A	301	3PE	O11-C1-C2-C3
2	A	307	3PE	C3B-C3C-C3D-C3E
2	A	302	3PE	C1-C2-C3-O31
2	A	306	3PE	O11-C1-C2-O21
2	A	307	3PE	O11-C1-C2-O21
2	A	306	3PE	C39-C3A-C3B-C3C
2	A	303	3PE	C36-C37-C38-C39
2	A	304	3PE	C24-C25-C26-C27
2	A	303	3PE	C29-C2A-C2B-C2C
2	A	302	3PE	C32-C33-C34-C35
2	A	303	3PE	C2-C1-O11-P
2	A	306	3PE	O22-C21-O21-C2
2	A	301	3PE	O32-C31-O31-C3
2	A	301	3PE	C1-C2-C3-O31
2	A	302	3PE	C25-C26-C27-C28
2	A	306	3PE	C3C-C3D-C3E-C3F
2	A	303	3PE	O21-C2-C3-O31
2	A	306	3PE	O21-C2-C3-O31
2	A	306	3PE	C36-C37-C38-C39
2	A	304	3PE	C39-C3A-C3B-C3C
2	A	303	3PE	O11-C1-C2-C3
2	A	307	3PE	O11-C1-C2-C3
2	A	304	3PE	C2-C1-O11-P

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Mol	Chain	Res	Type	Atoms
2	A	303	3PE	O11-C1-C2-O21
2	A	305	3PE	C11-O13-P-O14
2	A	306	3PE	C1-O11-P-O14
2	A	306	3PE	C11-O13-P-O11
2	A	307	3PE	C11-O13-P-O14
2	A	304	3PE	C27-C28-C29-C2A
2	A	302	3PE	C38-C39-C3A-C3B
2	A	304	3PE	C36-C37-C38-C39
2	A	306	3PE	O11-C1-C2-C3
2	A	307	3PE	C28-C29-C2A-C2B
2	A	302	3PE	O11-C1-C2-O21
2	A	306	3PE	C26-C27-C28-C29
2	A	302	3PE	C39-C3A-C3B-C3C
2	A	303	3PE	C23-C24-C25-C26
2	A	306	3PE	C2A-C2B-C2C-C2D
2	A	303	3PE	C2A-C2B-C2C-C2D
2	A	307	3PE	C36-C37-C38-C39
2	A	306	3PE	C1-C2-C3-O31
2	A	302	3PE	O11-C1-C2-C3
2	A	304	3PE	C28-C29-C2A-C2B
2	A	302	3PE	C22-C23-C24-C25
2	A	306	3PE	O21-C21-C22-C23
2	A	305	3PE	C32-C33-C34-C35
2	A	302	3PE	O21-C21-C22-C23
2	A	305	3PE	C25-C26-C27-C28
2	A	305	3PE	O31-C31-C32-C33
2	A	301	3PE	O31-C31-C32-C33
2	A	303	3PE	C22-C23-C24-C25
2	A	306	3PE	C32-C33-C34-C35
2	A	305	3PE	O32-C31-C32-C33
2	A	306	3PE	O22-C21-C22-C23
2	A	301	3PE	O32-C31-C32-C33
2	A	302	3PE	O22-C21-C22-C23

There are no ring outliers.

5 monomers are involved in 32 short contacts:

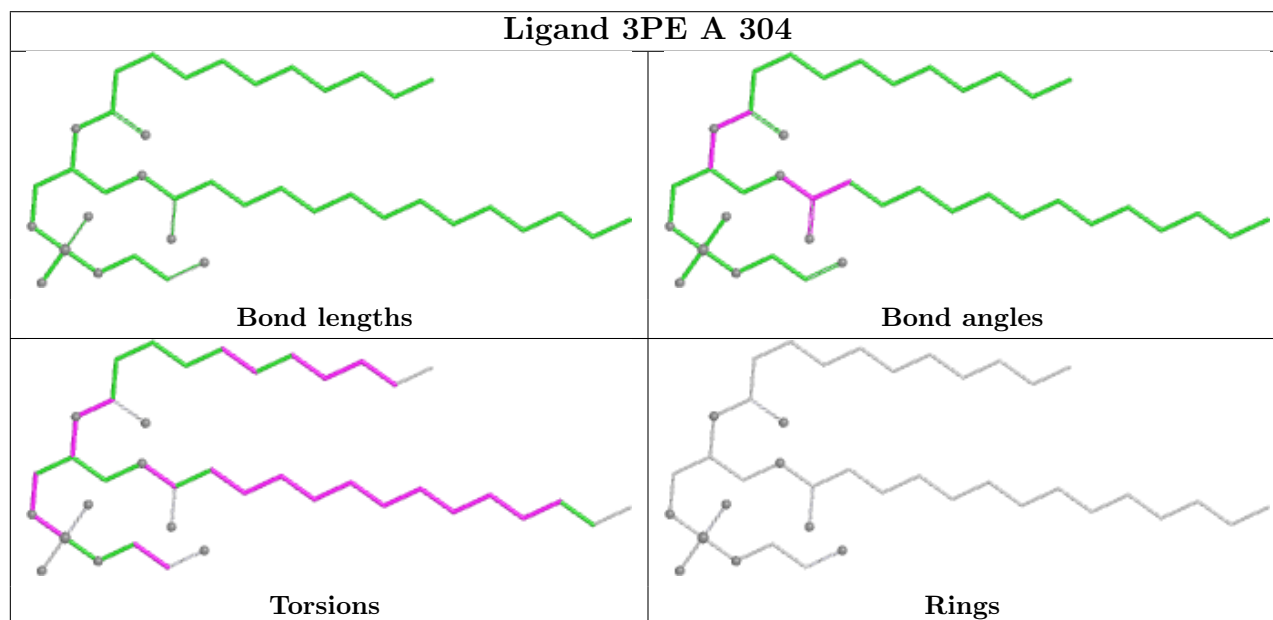
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	304	3PE	9	0
2	A	306	3PE	12	0
2	A	303	3PE	15	0
2	A	307	3PE	10	0

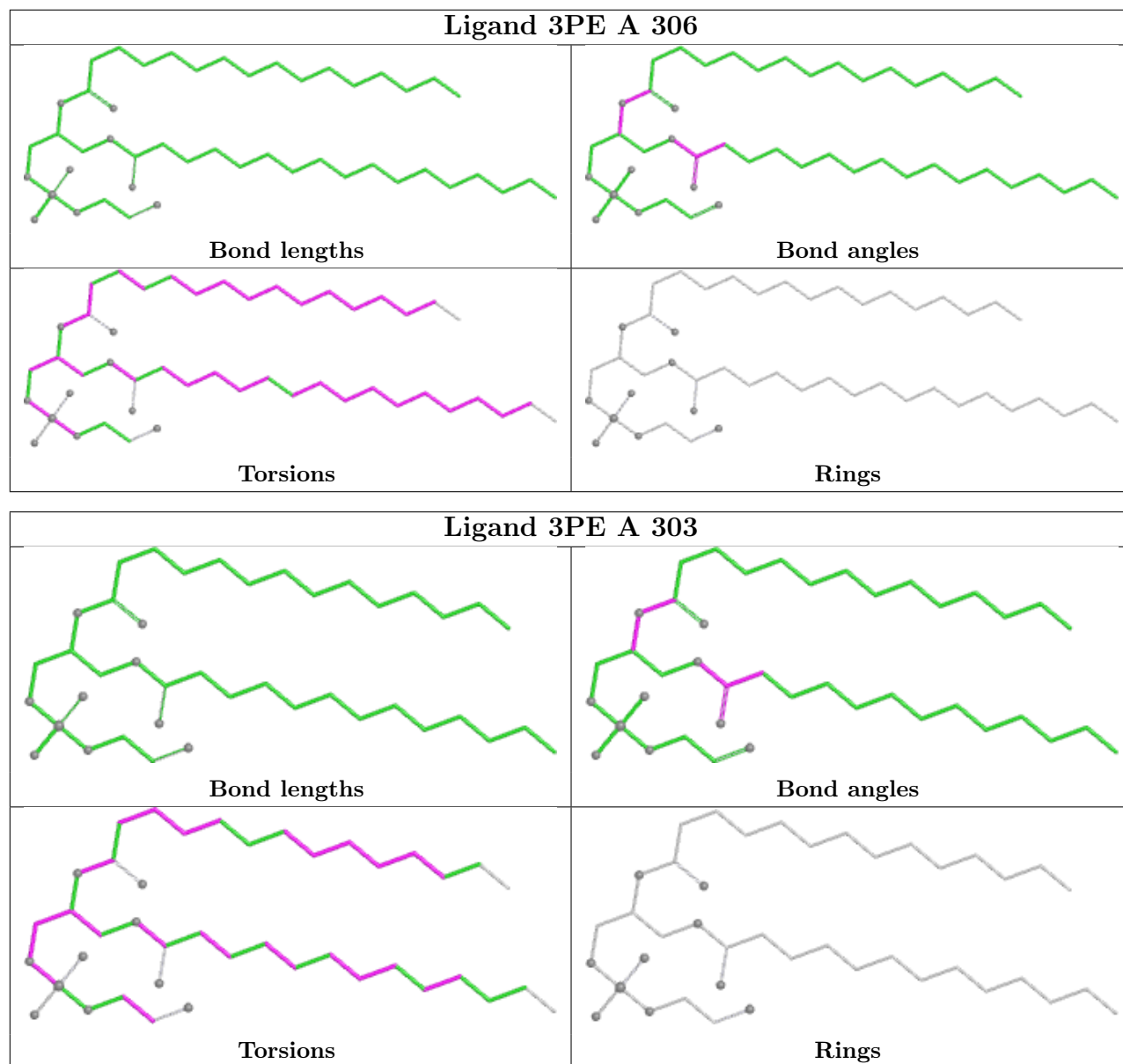
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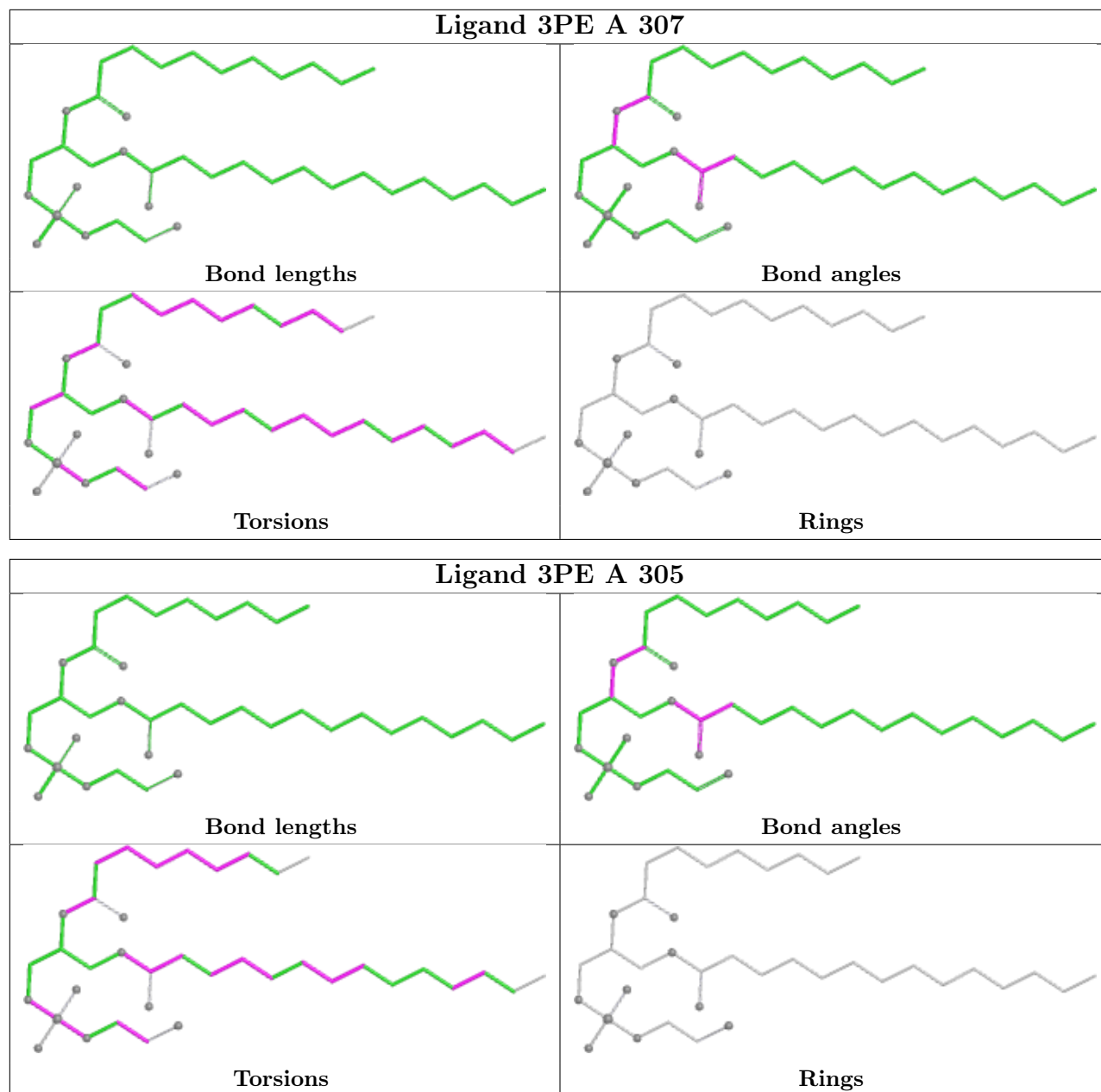
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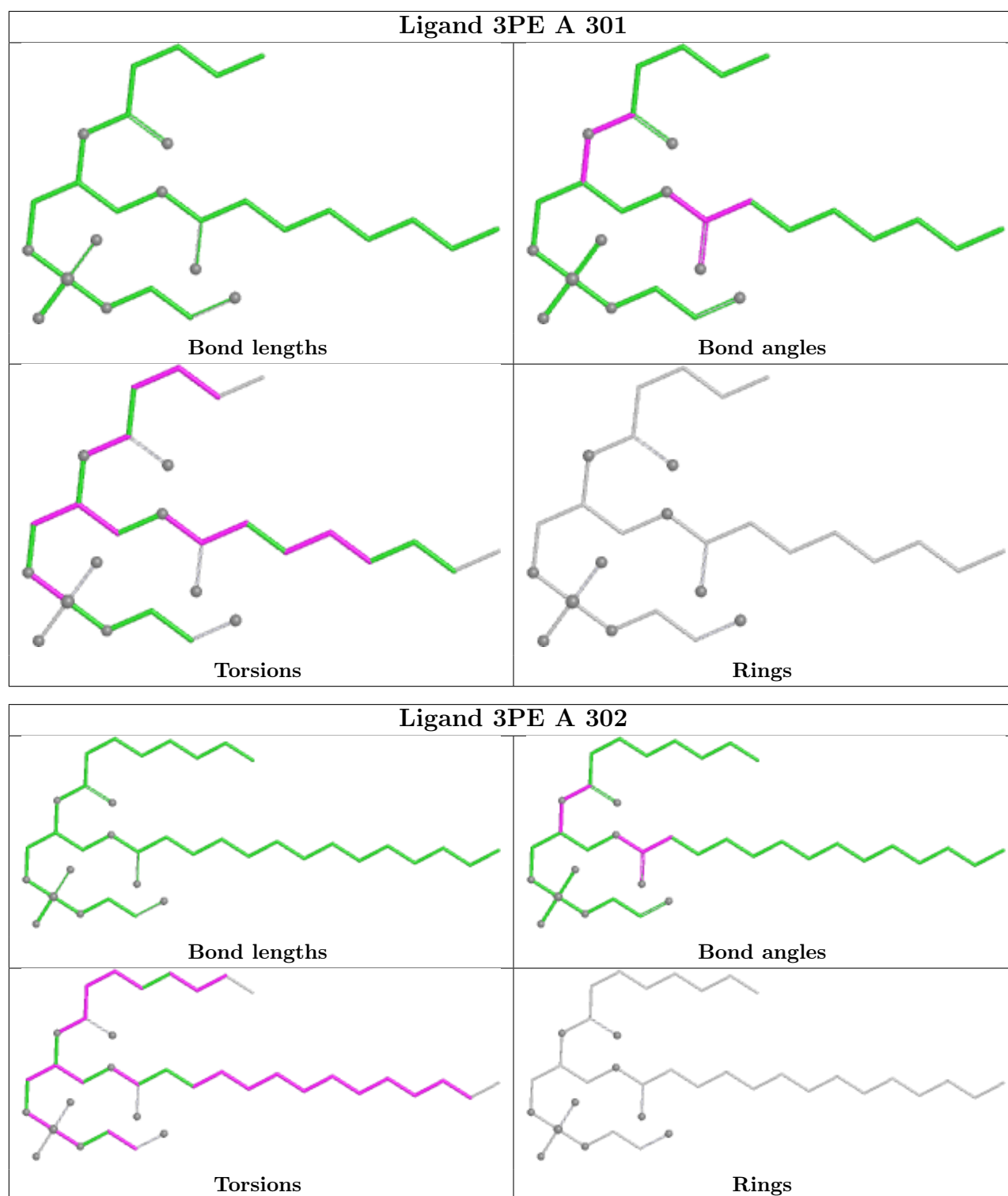
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	302	3PE	1	0

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.