



wwPDB/EMDatabank EM Map/Model Validation Summary Report ⓘ

Sep 16, 2019 – 12:46 PM EDT

PDB ID : 6PW5
EMDB ID: : EMD-20499
Title : Cryo-EM Structure of Thermo-Sensitive TRP Channel TRP1 from the Alga
Chlamydomonas reinhardtii in Nanodiscs
Authors : McGoldrick, L.L.; Singh, A.K.; Sobolevsky, A.I.
Deposited on : 2019-07-22
Resolution : 3.45 Å(reported)

This is a wwPDB/EMDatabank EM Map/Model Validation Summary Report
for a publicly released PDB/EMDB entry.

We welcome your comments at 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.

MolProbity : 4.02b-467
Mogul : 1.8.0 (224370), CSD as540be (2019)
Percentile statistics : 20171227.v01 (using entries in the PDB archive December 27th 2017)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : 2.4

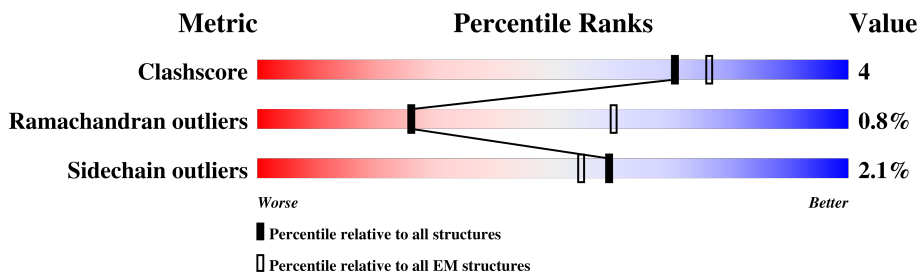
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.45 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	136327	1886
Ramachandran outliers	132723	1663
Sidechain outliers	132532	1531

The table below summarises the geometric issues observed across the polymeric chains. The red, orange, yellow and green segments on the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	901	72% 9% • 19%
1	B	901	75% 11% • 13%
1	C	901	72% 9% • 19%
1	D	901	74% 11% • 13%

2 Entry composition ⓘ

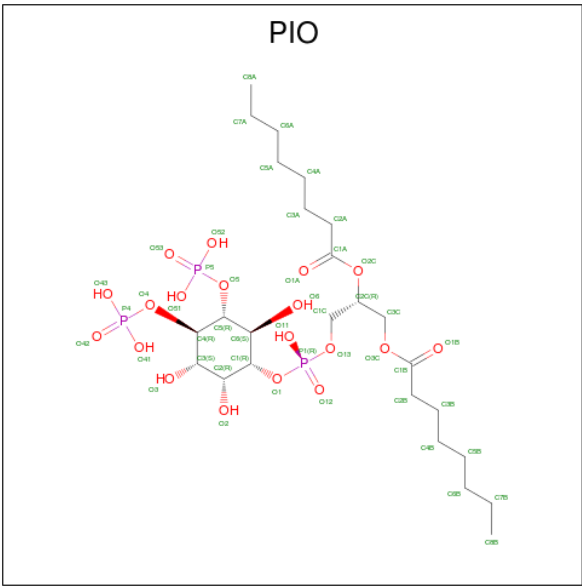
There are 4 unique types of molecules in this entry. The entry contains 24740 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 TRP-like ion channel.

Mol	Chain	Residues	Atoms					AltConf	Trace
			Total	C	N	O	S		
1	A	734	Total 5858	3794	977	1040	47	0	0
1	B	782	Total 6197	3992	1039	1118	48	0	0
1	C	734	Total 5858	3794	977	1040	47	0	0
1	D	782	Total 6197	3992	1039	1118	48	0	0

- Molecule 2 is [(2R)-2-octanoyloxy-3-[oxidanyl-[(1R,2R,3S,4R,5R,6S)-2,3,6-tris(oxidanyl)-4,5-diphosphonooxy-cyclohexyl]oxy-phosphoryl]oxy-propyl] octanoate (three-letter code: PIO) (formula: C₂₅H₄₉O₁₉P₃).



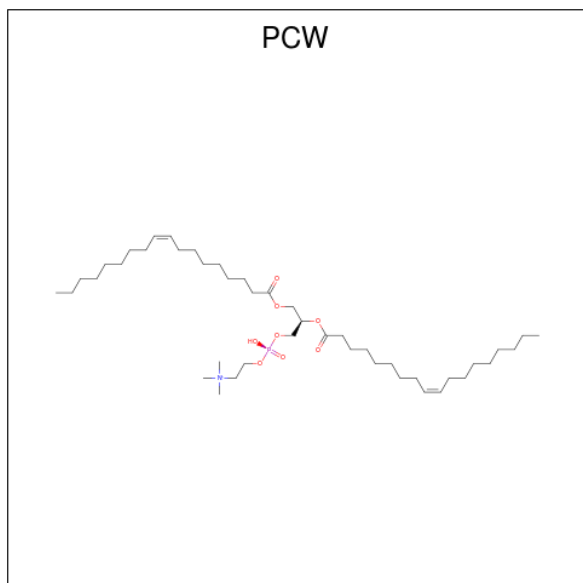
Mol	Chain	Residues	Atoms				AltConf
			Total	C	O	P	
2	A	1	Total 47	25	19	3	0
2	B	1	Total 47	25	19	3	0

Continued on next page...

Continued from previous page...

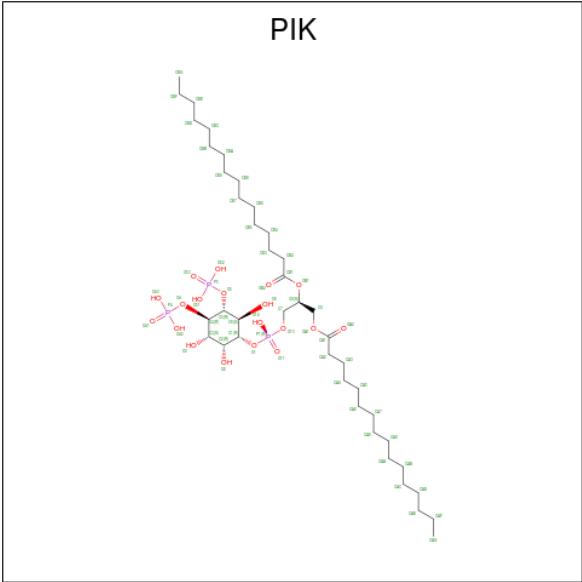
Mol	Chain	Residues	Atoms				AltConf
2	C	1	Total	C	O	P	0
			47	25	19	3	
2	D	1	Total	C	O	P	0
			47	25	19	3	

- Molecule 3 is 1,2-DIOLEOYL-SN-GLYCERO-3-PHOSPHOCHOLINE (three-letter code: PCW) (formula: $C_{44}H_{85}NO_8P$) (labeled as "Ligand of Interest" by author).



Mol	Chain	Residues	Atoms					AltConf
3	A	1	Total	C	N	O	P	0
			54	44	1	8	1	
3	B	1	Total	C	N	O	P	0
			41	31	1	8	1	
3	C	1	Total	C	N	O	P	0
			54	44	1	8	1	
3	D	1	Total	C	N	O	P	0
			41	31	1	8	1	

- Molecule 4 is (2S)-3-[[[(R)-hydroxy{[(1R,2R,3S,4R,5R,6S)-2,3,6-trihydroxy-4,5-bis(phosphonoxy)cyclohexyl]oxy}phosphoryl]oxy}propane-1,2-diyl dihexadecanoate (three-letter code: PIK) (formula: $C_{41}H_{81}O_{19}P_3$).

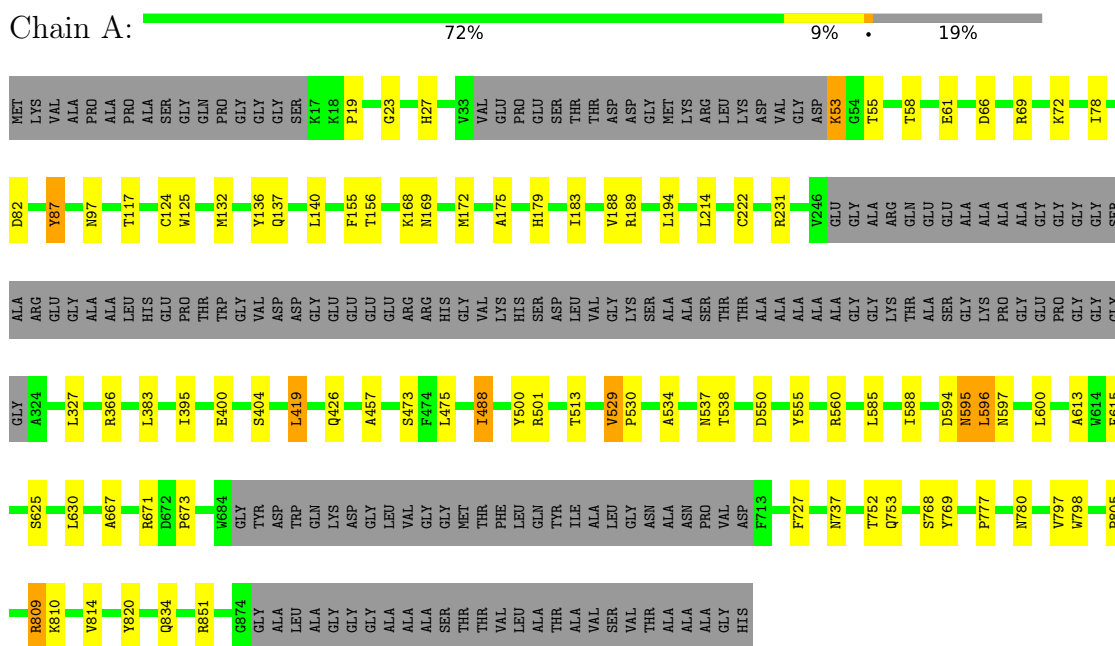


Mol	Chain	Residues	Atoms				AltConf
4	A	1	Total	C	O	P	0
			63	41	19	3	
4	B	1	Total	C	O	P	0
			63	41	19	3	
4	C	1	Total	C	O	P	0
			63	41	19	3	
4	D	1	Total	C	O	P	0
			63	41	19	3	

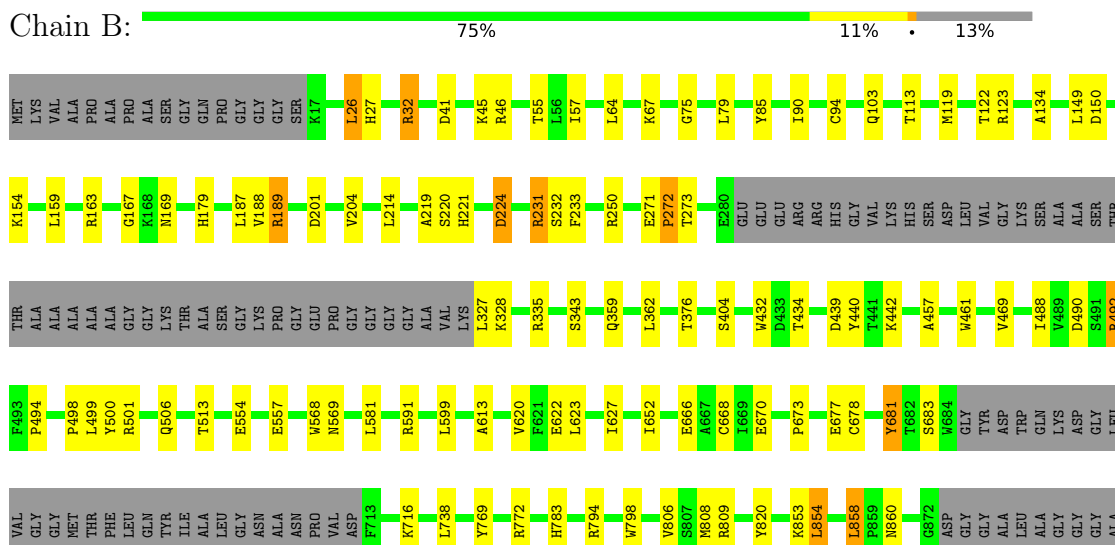
3 Residue-property plots

These plots are drawn for all protein, RNA and DNA 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: TRP-like ion channel



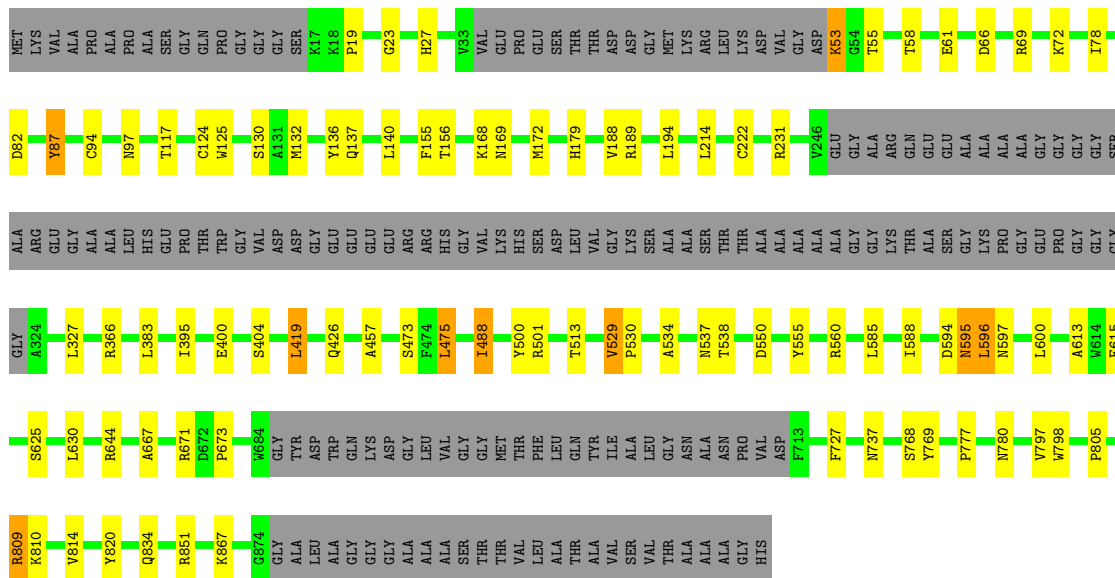
- Molecule 1: TRP-like ion channel



ALA
ALA
SER
THR
THR
VAL
LEU
ALA
THR
ALA
VAL
SER
VAL
THR
ALA
ALA
ALA
GLY
HIS

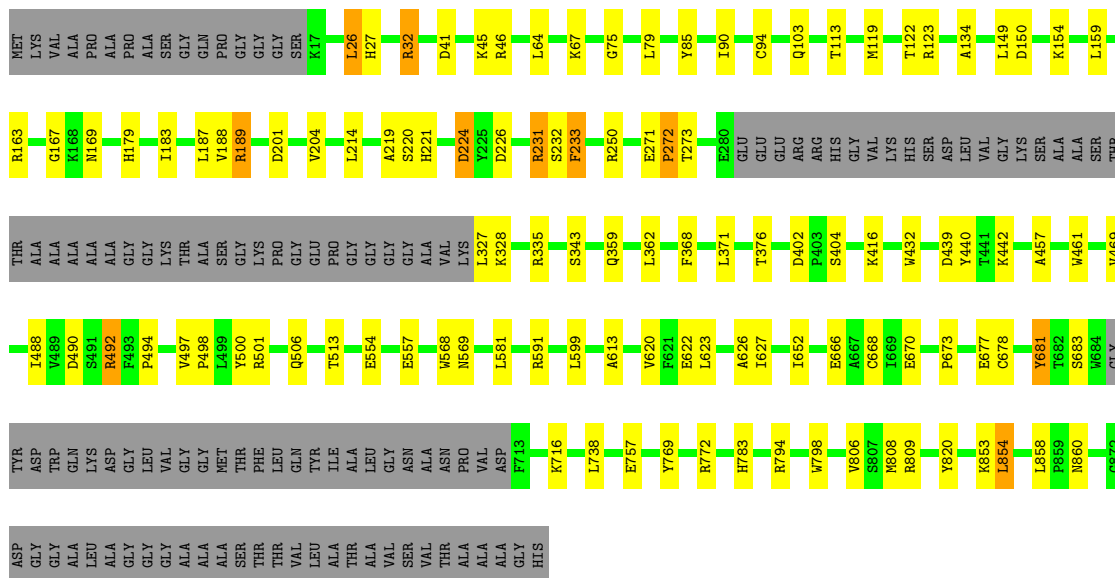
- Molecule 1: TRP-like ion channel

Chain C:  72% 9% 19%



- Molecule 1: TRP-like ion channel

Chain D: 74% 11% • 13%



4 Experimental information

Property	Value	Source
Reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	Depositor
Number of particles used	255973	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI POLARA 300	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	71	Depositor
Minimum defocus (nm)	Not provided	Depositor
Maximum defocus (nm)	Not provided	Depositor
Magnification	Not provided	Depositor
Image detector	GATAN K3 (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: PIK, PCW, PIO

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	$\# Z > 2$	RMSZ	$\# Z > 2$
1	A	0.57	0/5991	0.70	6/8133 (0.1%)
1	B	0.57	0/6336	0.74	6/8601 (0.1%)
1	C	0.57	0/5991	0.70	6/8133 (0.1%)
1	D	0.57	0/6336	0.74	5/8601 (0.1%)
All	All	0.57	0/24654	0.72	23/33468 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	3
1	B	0	7
1	C	0	3
1	D	0	7
All	All	0	20

There are no bond length outliers.

The worst 5 of 23 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	159	LEU	CA-CB-CG	8.34	134.48	115.30
1	D	159	LEU	CA-CB-CG	8.33	134.47	115.30
1	D	623	LEU	CB-CG-CD2	-7.06	99.00	111.00
1	B	623	LEU	CB-CG-CD2	-7.05	99.02	111.00
1	C	419	LEU	CA-CB-CG	6.80	130.94	115.30

There are no chirality outliers.

5 of 20 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	488	ILE	Peptide
1	A	797	VAL	Peptide
1	A	820	TYR	Peptide
1	B	122	THR	Peptide
1	B	75	GLY	Peptide

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	5858	0	5916	51	0
1	B	6197	0	6215	54	0
1	C	5858	0	5916	54	0
1	D	6197	0	6215	60	0
2	A	47	0	44	2	0
2	B	47	0	44	2	0
2	C	47	0	44	1	0
2	D	47	0	44	2	0
3	A	54	0	82	2	0
3	B	41	0	53	3	0
3	C	54	0	82	2	0
3	D	41	0	53	3	0
4	A	63	0	77	1	0
4	B	63	0	75	1	0
4	C	63	0	77	0	0
4	D	63	0	75	1	0
All	All	24740	0	25012	196	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 4.

The worst 5 of 196 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:C:53:LYS:N	1:C:58:THR:HG1	1.58	1.02
1:A:53:LYS:N	1:A:58:THR:HG1	1.58	1.00
1:A:625:SER:H	2:A:1001:PIO:H2	1.65	0.62

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:440:TYR:HE2	3:B:1002:PCW:H32	1.65	0.61
1:B:27:HIS:HA	1:C:404:SER:HA	1.83	0.61

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	726/901 (81%)	645 (89%)	79 (11%)	2 (0%)	43	78
1	B	776/901 (86%)	671 (86%)	95 (12%)	10 (1%)	13	51
1	C	726/901 (81%)	644 (89%)	80 (11%)	2 (0%)	43	78
1	D	776/901 (86%)	672 (87%)	95 (12%)	9 (1%)	14	53
All	All	3004/3604 (83%)	2632 (88%)	349 (12%)	23 (1%)	26	62

5 of 23 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	273	THR
1	D	273	THR
1	B	220	SER
1	B	488	ILE
1	D	220	SER

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	638/740 (86%)	623 (98%)	15 (2%)	52	79
1	B	669/740 (90%)	657 (98%)	12 (2%)	62	84
1	C	638/740 (86%)	623 (98%)	15 (2%)	52	79
1	D	669/740 (90%)	657 (98%)	12 (2%)	62	84
All	All	2614/2960 (88%)	2560 (98%)	54 (2%)	59	81

5 of 54 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	591	ARG
1	C	189	ARG
1	D	492	ARG
1	B	820	TYR
1	C	53	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 27 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	843	ASN
1	C	86	HIS
1	D	506	GLN
1	B	860	ASN
1	A	179	HIS

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 carbohydrates in this entry.

5.6 Ligand geometry

12 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	PIO	A	1001	-	47,47,47	1.18	6 (12%)	61,65,65	1.17	6 (9%)
3	PCW	A	1002	-	53,53,53	0.98	5 (9%)	59,61,61	1.20	6 (10%)
4	PIK	A	1003	-	63,63,63	1.03	5 (7%)	77,81,81	0.98	4 (5%)
2	PIO	B	1001	-	47,47,47	1.19	5 (10%)	61,65,65	1.07	3 (4%)
3	PCW	B	1002	-	40,40,53	1.15	5 (12%)	46,48,61	1.03	2 (4%)
4	PIK	B	1003	-	63,63,63	1.06	6 (9%)	77,81,81	1.00	2 (2%)
2	PIO	C	1001	-	47,47,47	1.18	6 (12%)	61,65,65	1.17	6 (9%)
3	PCW	C	1002	-	53,53,53	0.99	5 (9%)	59,61,61	1.19	6 (10%)
4	PIK	C	1003	-	63,63,63	1.04	5 (7%)	77,81,81	0.99	5 (6%)
2	PIO	D	1001	-	47,47,47	1.19	5 (10%)	61,65,65	1.07	3 (4%)
3	PCW	D	1002	-	40,40,53	1.15	5 (12%)	46,48,61	1.03	2 (4%)
4	PIK	D	1003	-	63,63,63	1.06	6 (9%)	77,81,81	1.00	2 (2%)

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	PIO	A	1001	-	-	16/44/68/68	0/1/1/1
3	PCW	A	1002	-	-	27/57/57/57	-
4	PIK	A	1003	-	-	21/60/84/84	0/1/1/1
2	PIO	B	1001	-	-	18/44/68/68	0/1/1/1
3	PCW	B	1002	-	-	20/44/44/57	-
4	PIK	B	1003	-	-	27/60/84/84	0/1/1/1
2	PIO	C	1001	-	-	16/44/68/68	0/1/1/1
3	PCW	C	1002	-	-	27/57/57/57	-

Continued on next page...

Continued from previous page...

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	PIK	C	1003	-	-	23/60/84/84	0/1/1/1
2	PIO	D	1001	-	-	18/44/68/68	0/1/1/1
3	PCW	D	1002	-	-	20/44/44/57	-
4	PIK	D	1003	-	-	27/60/84/84	0/1/1/1

The worst 5 of 64 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	1001	PIO	P4-O4	3.40	1.65	1.59
2	B	1001	PIO	P4-O4	3.40	1.65	1.59
4	B	1003	PIK	P4-O4	3.29	1.65	1.59
4	A	1003	PIK	P5-O5	3.24	1.65	1.59
4	D	1003	PIK	P4-O4	3.23	1.65	1.59

The worst 5 of 47 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1001	PIO	O2C-C1A-C2A	4.82	122.03	111.51
2	D	1001	PIO	O2C-C1A-C2A	4.82	122.03	111.51
2	A	1001	PIO	O2C-C1A-C2A	4.06	120.38	111.51
2	C	1001	PIO	O2C-C1A-C2A	4.06	120.37	111.51
3	D	1002	PCW	O2-C31-C32	3.98	120.19	111.51

There are no chirality outliers.

5 of 260 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1002	PCW	C1-O3P-P-O2P
3	A	1002	PCW	C1-O3P-P-O4P
4	C	1003	PIK	C6-C1-O1-P1
4	C	1003	PIK	CA2-CA1-OA1-C9
2	D	1001	PIO	C2-C1-O1-P1

There are no ring outliers.

11 monomers are involved in 20 short contacts:

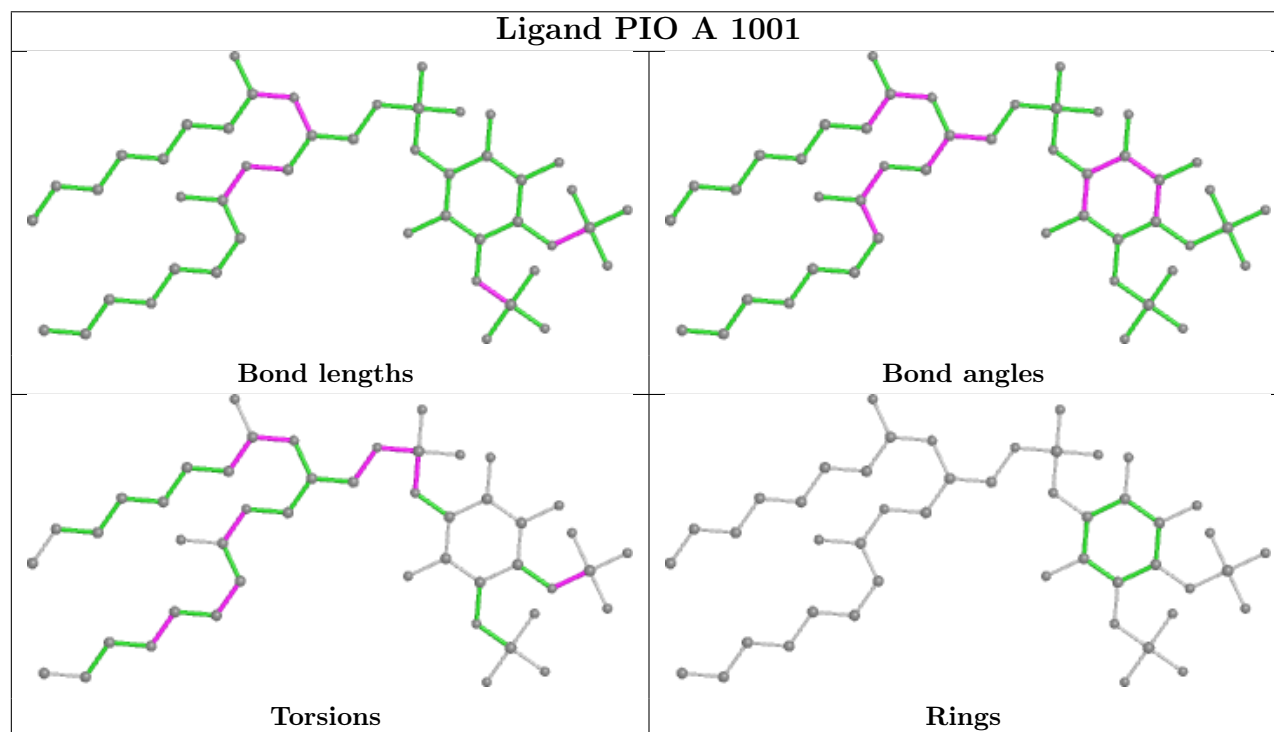
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1001	PIO	2	0
3	A	1002	PCW	2	0
4	A	1003	PIK	1	0

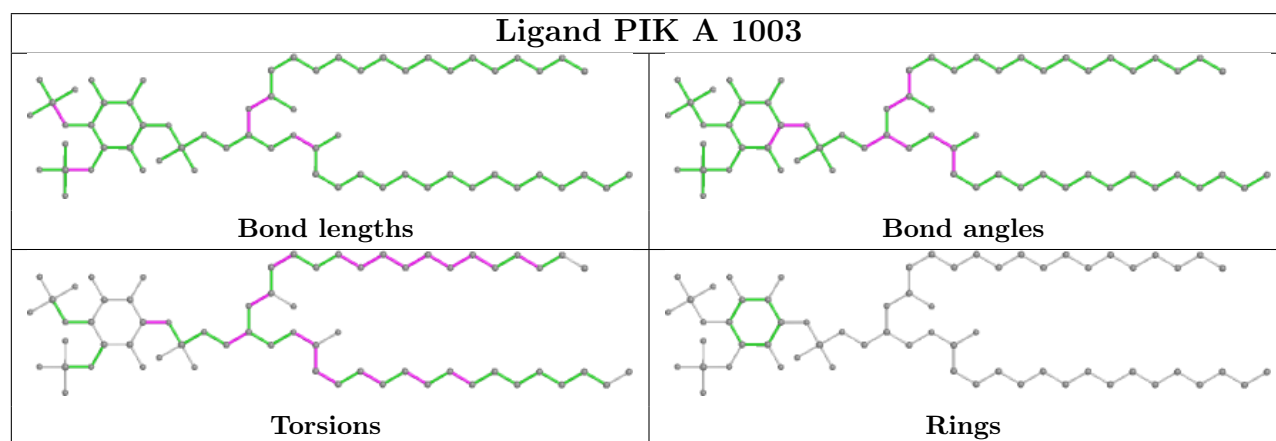
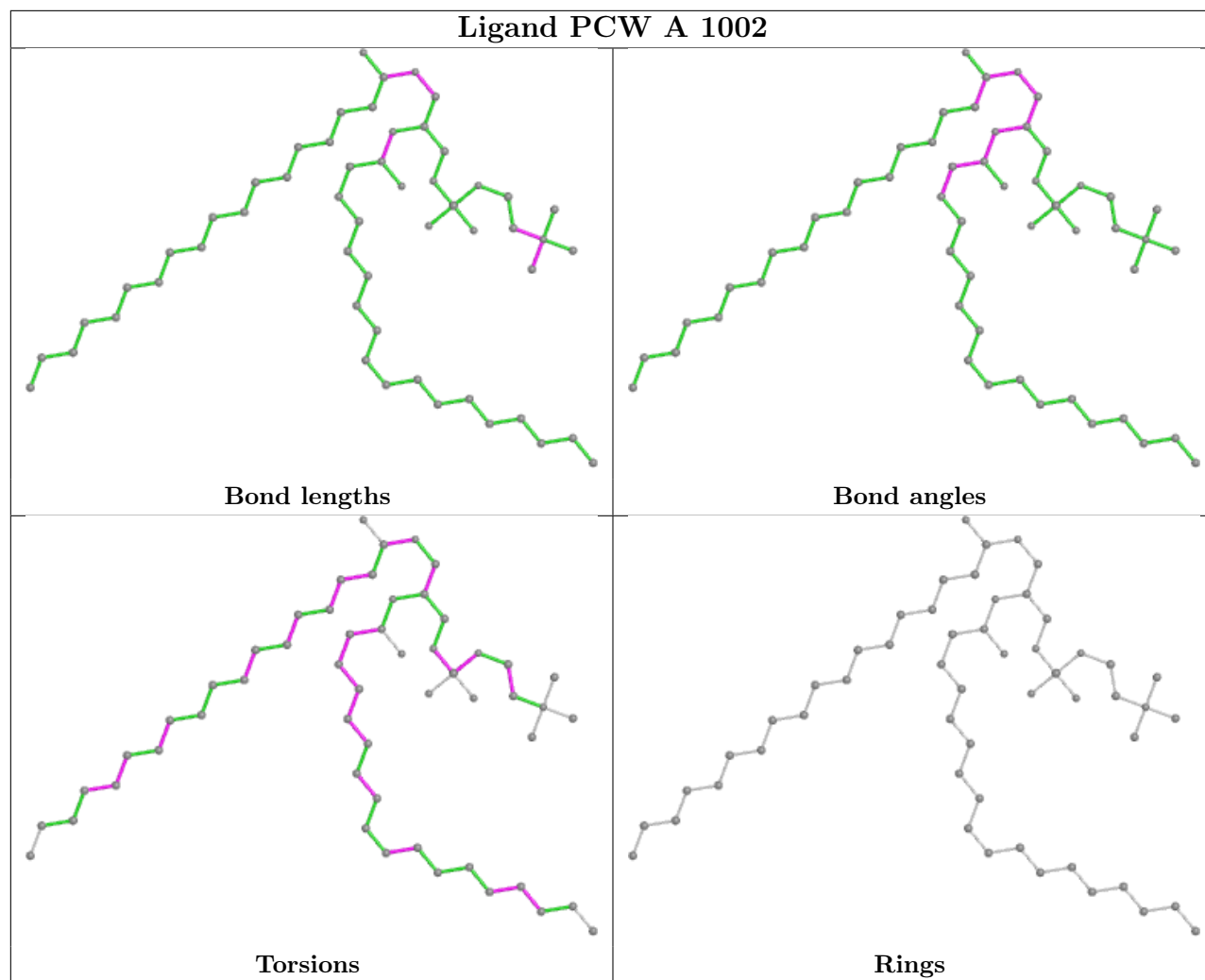
Continued on next page...

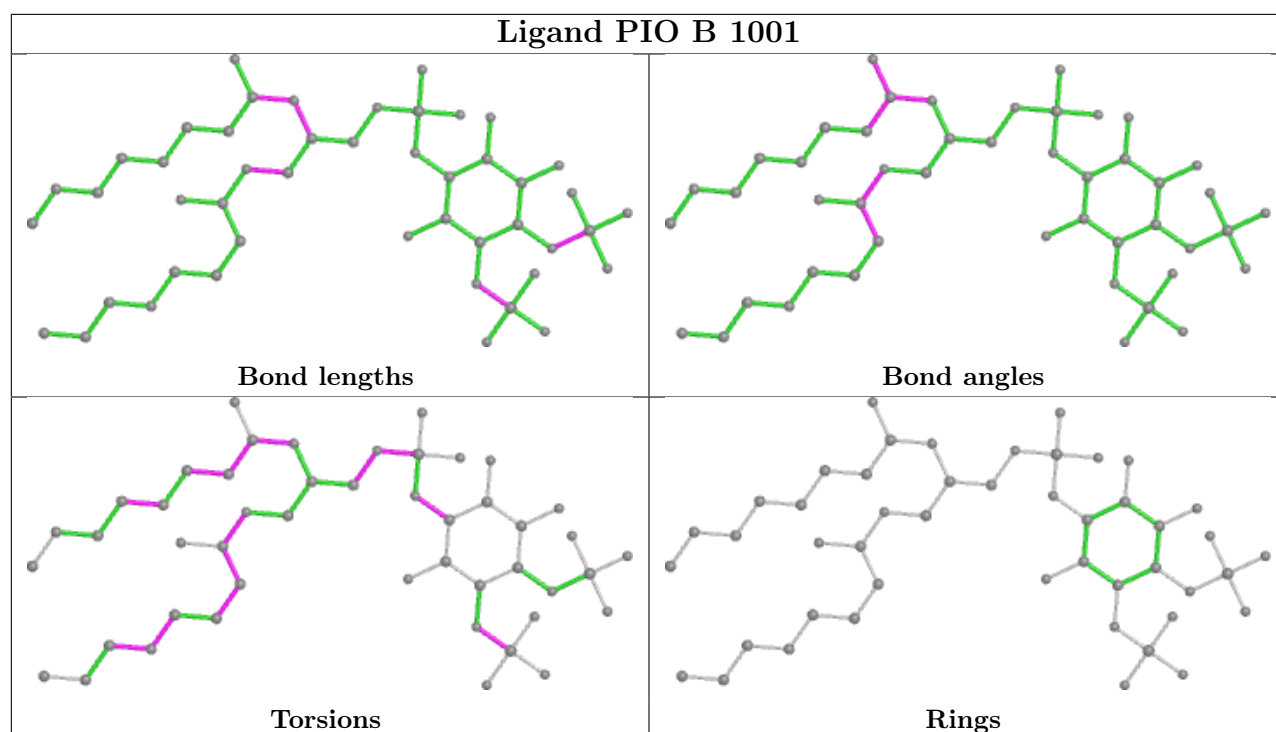
Continued from previous page...

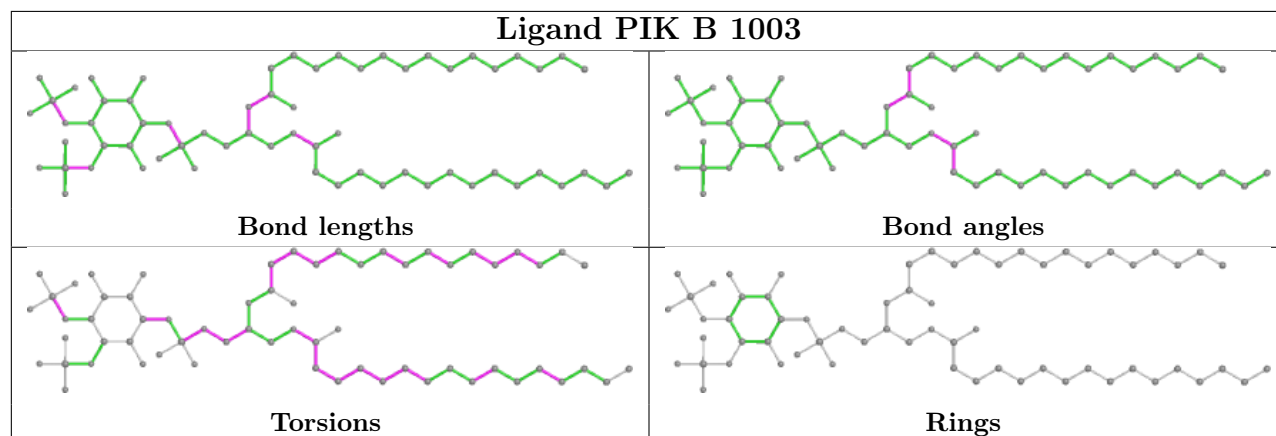
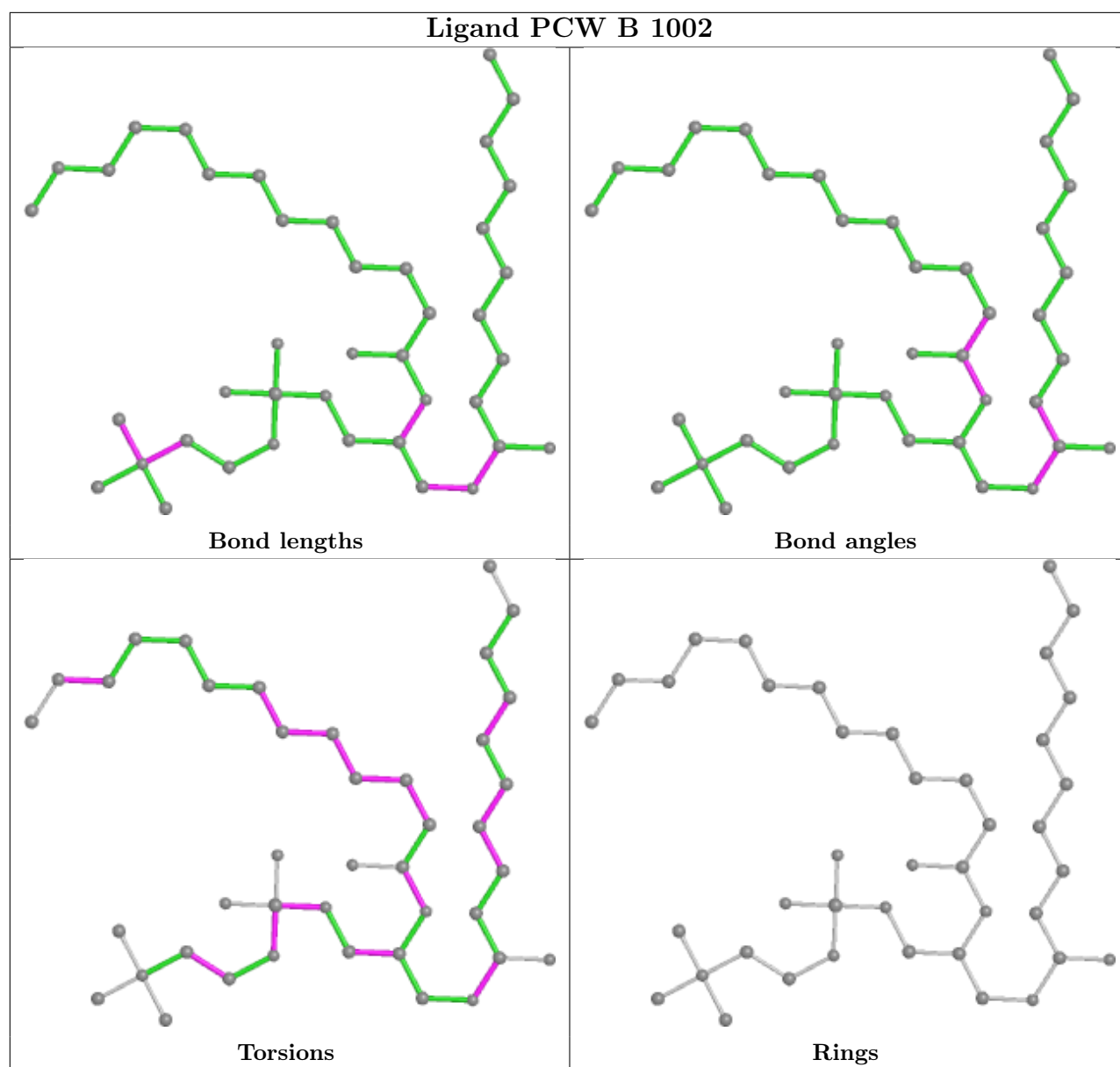
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1001	PIO	2	0
3	B	1002	PCW	3	0
4	B	1003	PIK	1	0
2	C	1001	PIO	1	0
3	C	1002	PCW	2	0
2	D	1001	PIO	2	0
3	D	1002	PCW	3	0
4	D	1003	PIK	1	0

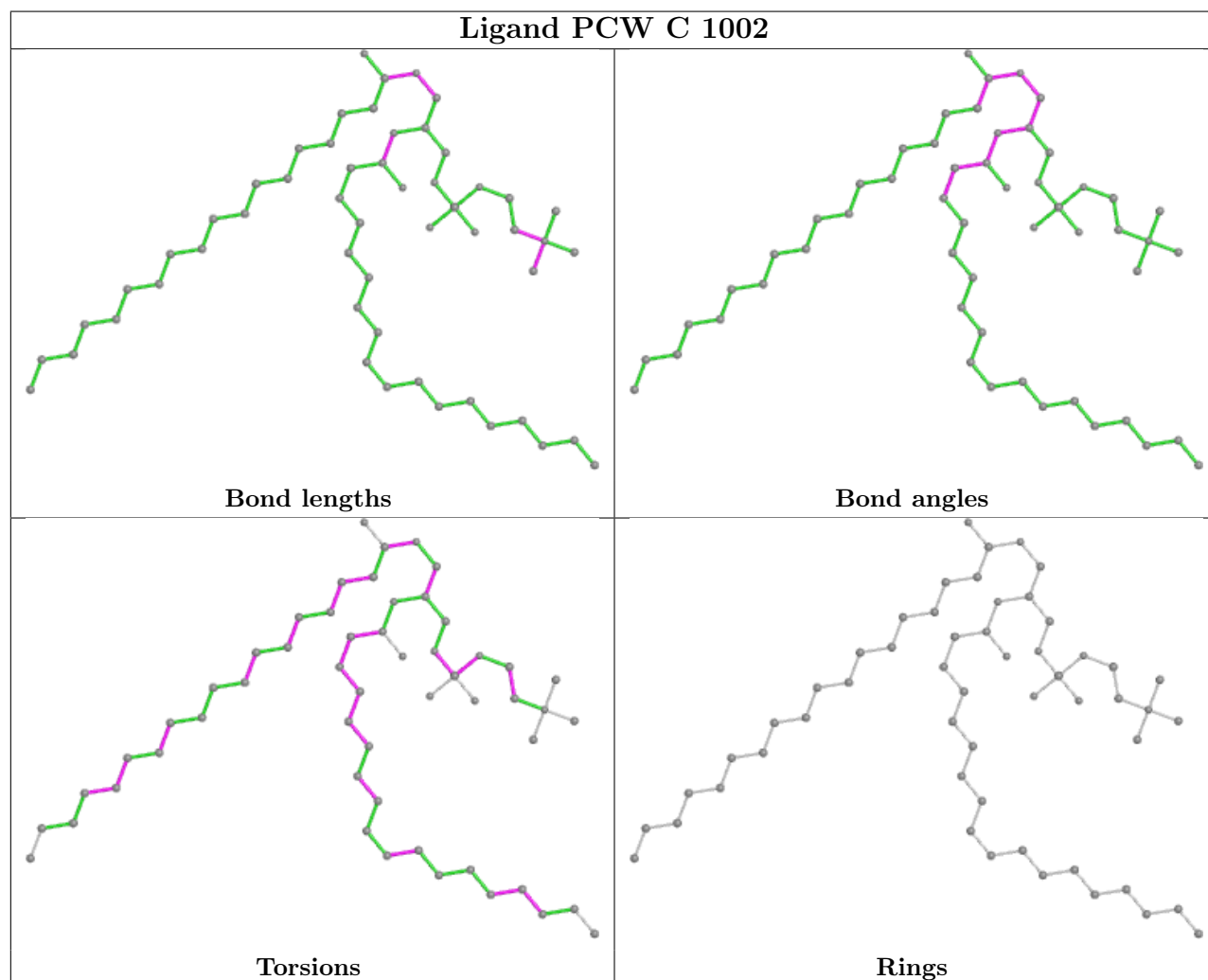
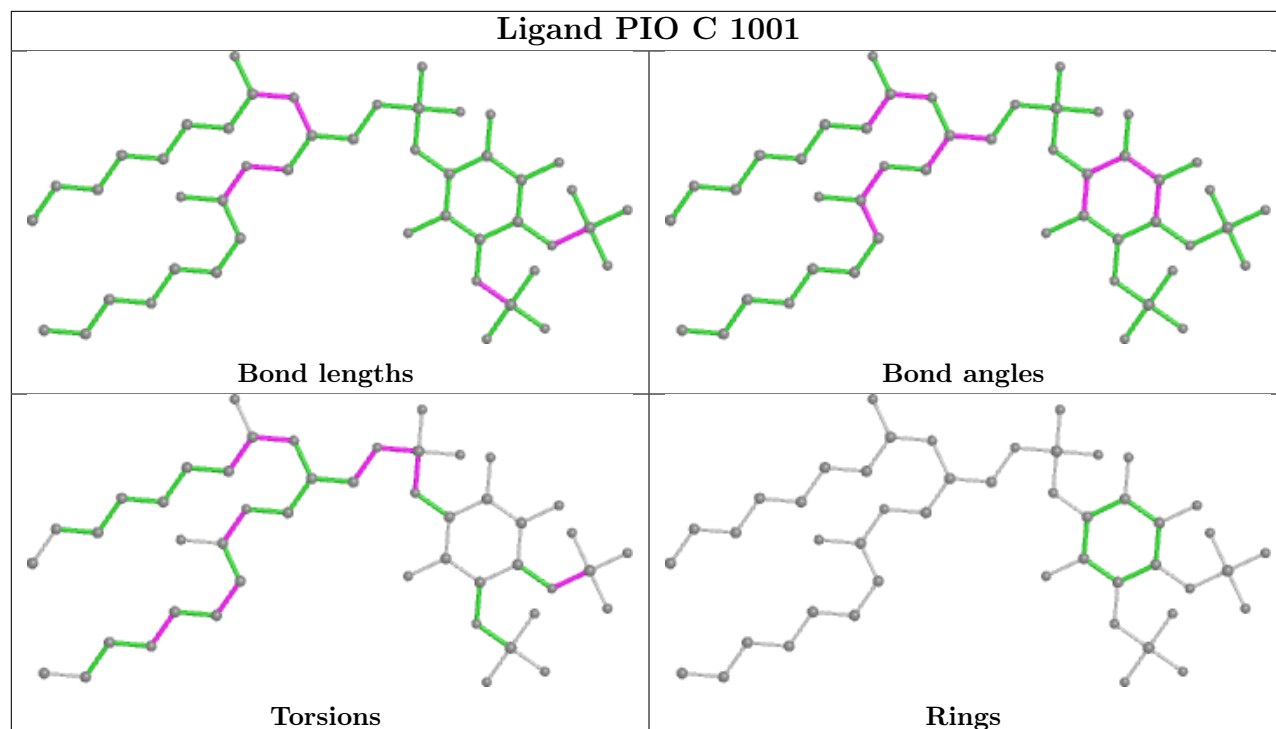
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

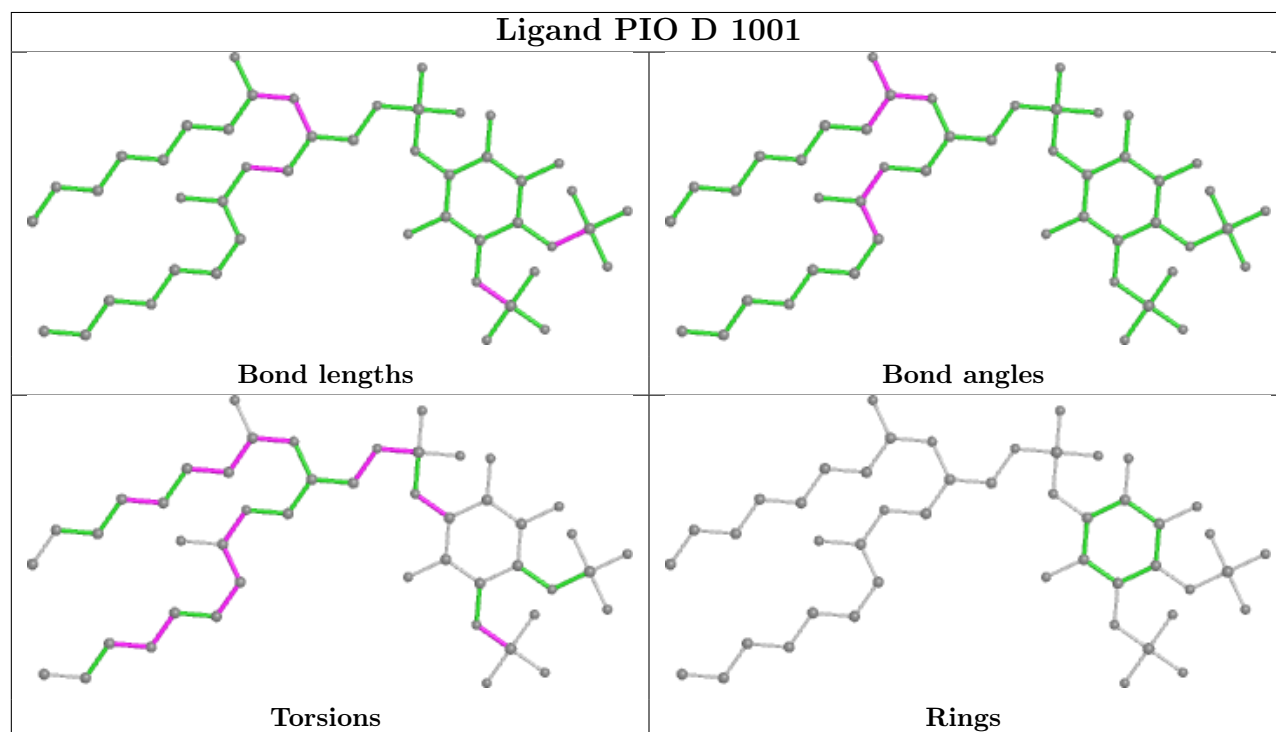
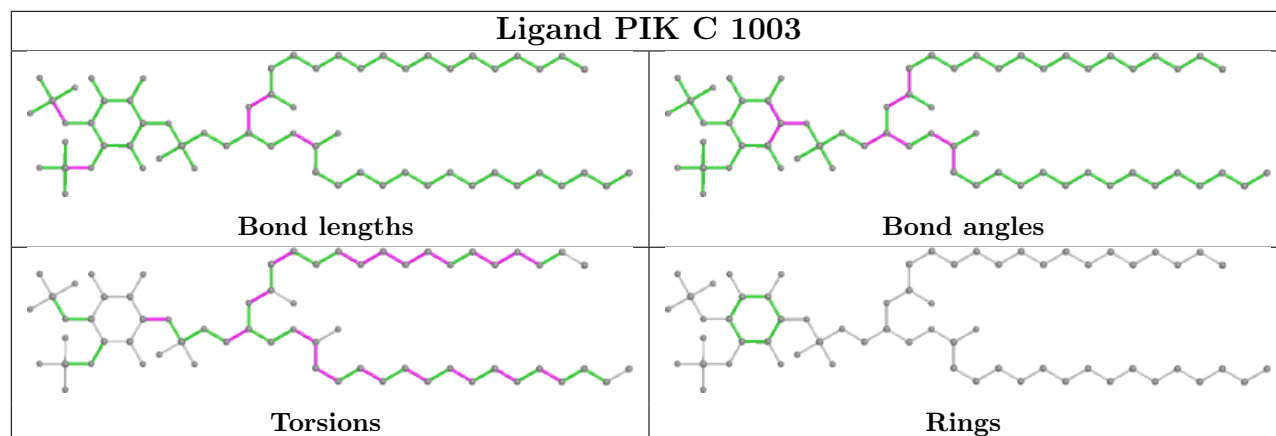


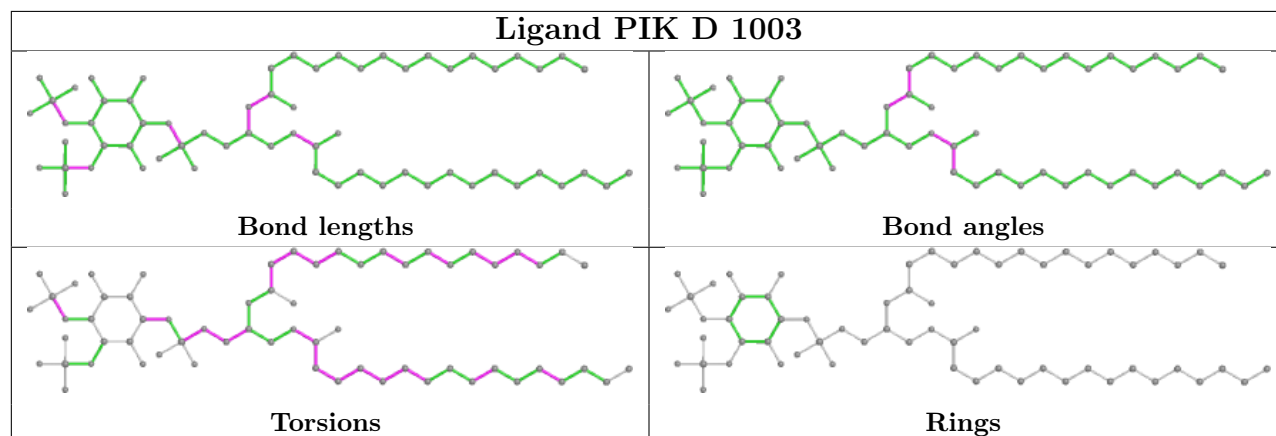
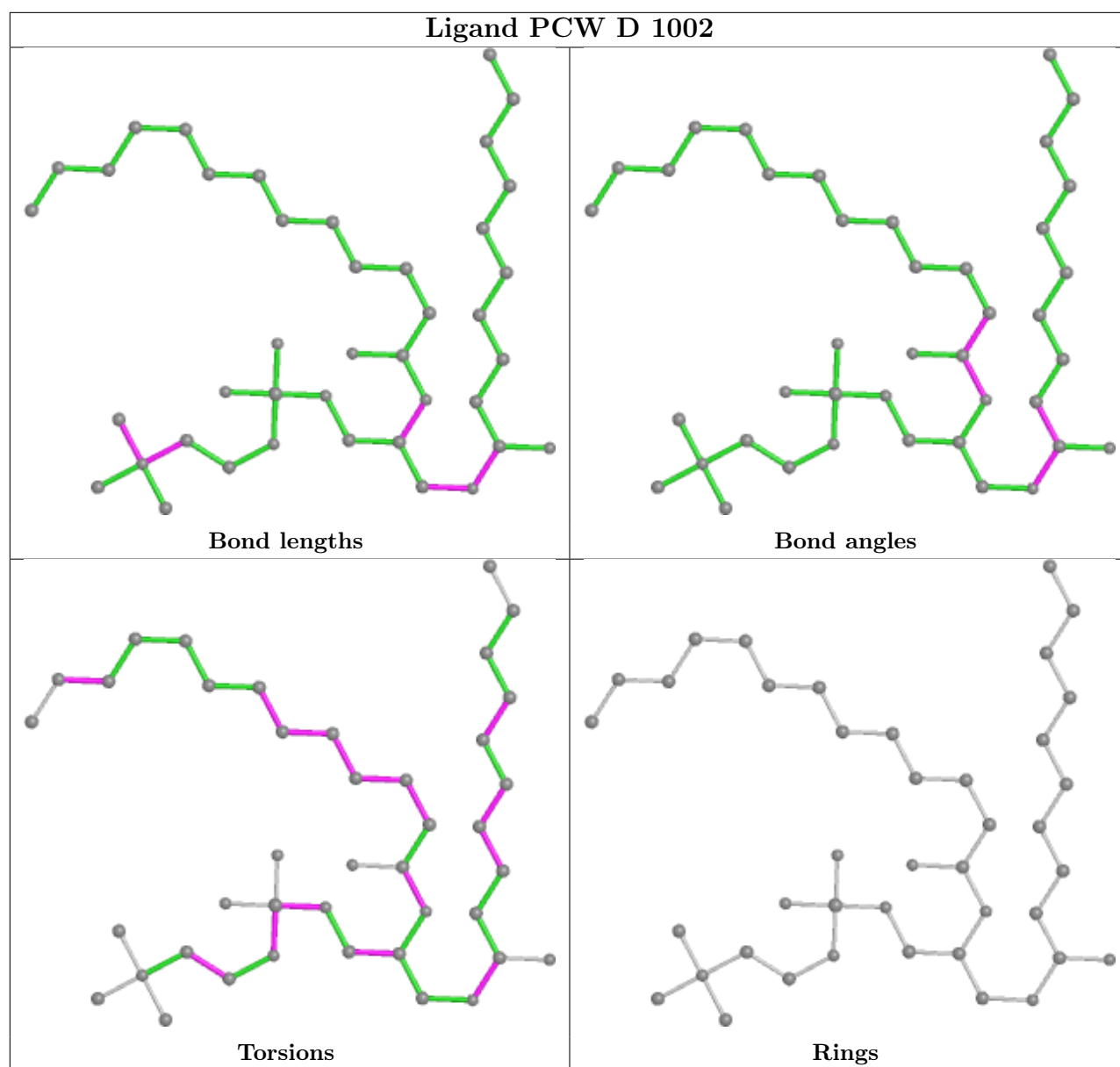












5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

There are no chain breaks in this entry.