WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB EM Validation Report ⓘ

Jan 26, 2025 – 02:17 PM JST

PDB ID	:	9ITE
EMDB ID	:	EMD-60859
Title	:	LPA-bound LPAR6 in complex with miniG13
Authors	:	He, Y.; Duan, Y.
Deposited on	:	2024-07-19
Resolution	:	3.06 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*
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.

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

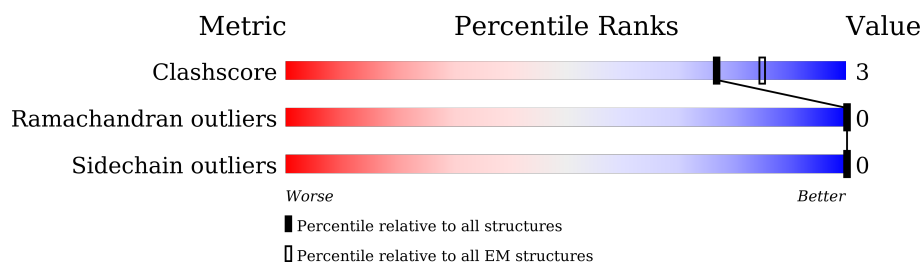|		
EMDB validation analysis	:	FAILED
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4.02b-467
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	FAILED
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.40

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 3.06 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	Percentile Ranks	Value
Clashscore		3
Ramachandran outliers		0
Sidechain outliers		0

Worse   *Better*

▌ Percentile relative to all structures
▯ Percentile relative to all EM structures

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 >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5%

Mol	Chain	Length	Quality of chain
1	A	230	90% • 7%
2	B	345	96% • •
3	E	247	89% • 6%
4	G	71	77% • 20%
5	R	301	90% 6% •

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2 Entry composition ⓘ

There are 8 unique types of molecules in this entry. The entry contains 8798 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 engineered miniGa13.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	214	Total 1676	C 1071	N 285	O 313	S 7	0	0

- Molecule 2 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	338	Total 2540	C 1571	N 452	O 496	S 21	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	MET	-	initiating methionine	UNP P62873
B	-3	GLY	-	expression tag	UNP P62873
B	-2	SER	-	expression tag	UNP P62873
B	-1	LEU	-	expression tag	UNP P62873
B	0	LEU	-	expression tag	UNP P62873
B	1	GLN	-	expression tag	UNP P62873

- Molecule 3 is a protein called scFv16.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	E	232	Total 1759	C 1117	N 294	O 338	S 10	0	0

- Molecule 4 is a protein called Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	G	57	Total 413	C 257	N 73	O 80	S 3	0	0

- Molecule 5 is a protein called Lysophosphatidic acid receptor 6.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	R	289	Total 2279	C 1515	N 354	O 388	S 22	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
R	43	ALA	ILE	conflict	UNP P43657
R	166	ARG	GLU	conflict	UNP P43657

- Molecule 6 is (2R)-2-hydroxy-3-(phosphonooxy)propyl (9E)-octadec-9-enoate (three-letter code: NKP) (formula: $C_{21}H_{41}O_7P$).

NKP
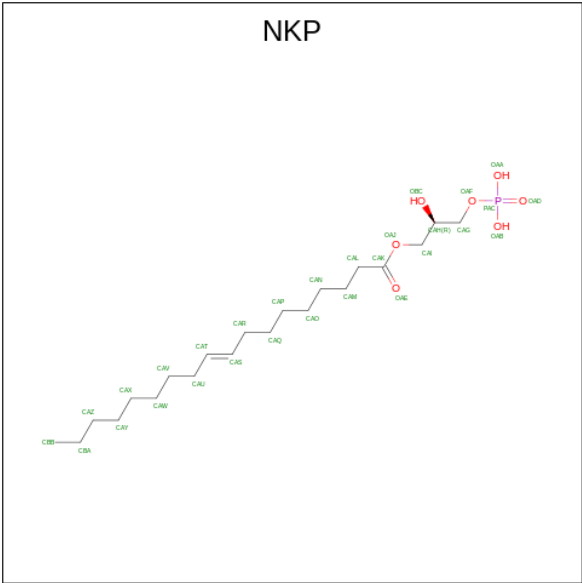
Mol	Chain	Residues	Atoms				AltConf
6	R	1	Total 29	C 21	O 7	P 1	0

- Molecule 7 is CHOLESTEROL (three-letter code: CLR) (formula: $C_{27}H_{46}O$).

CLR

Mol	Chain	Residues	Atoms			AltConf
7	R	1	Total 28	C 27	O 1	0
7	R	1	Total 28	C 27	O 1	0
7	R	1	Total 28	C 27	O 1	0

- Molecule 8 is PALMITIC ACID (three-letter code: PLM) (formula: $C_{16}H_{32}O_2$).

PLM
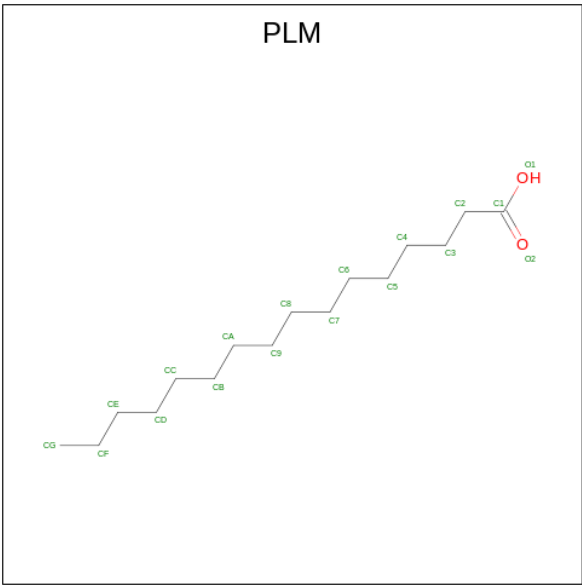
Mol	Chain	Residues	Atoms			AltConf
8	R	1	Total 18	C 16	O 2	0

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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. 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.
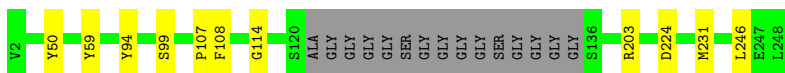
- Molecule 1: engineered miniGa13

Chain A:
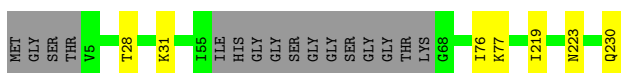
- Molecule 2: Guanine nucleotide-binding protein G(I)/G(S)/G(T) subunit beta-1

Chain B:

- Molecule 3: scFv16

Chain E:

- Molecule 4: Guanine nucleotide-binding protein G(I)/G(S)/G(O) subunit gamma-2

Chain G:

- Molecule 5: Lysophosphatidic acid receptor 6

Chain R:

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	213708	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TECNAI F30	Depositor
Voltage (kV)	300	Depositor
Electron dose $(e^-/Å^2)$	60	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	Not provided	
Image detector	GATAN K2 SUMMIT (4k x 4k)	Depositor

5   Model quality ⓘ

5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CLR, NKP, PLM

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	0.27	0/1703	0.48	0/2297
2	B	0.27	0/2587	0.53	0/3514
3	E	0.32	0/1803	0.53	0/2446
4	G	0.25	0/419	0.43	0/571
5	R	0.29	0/2335	0.47	0/3181
All	All	0.28	0/8847	0.50	0/12009

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 ⓘ

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	1676	0	1613	6	0
2	B	2540	0	2403	4	0
3	E	1759	0	1682	6	0
4	G	413	0	396	1	0
5	R	2279	0	2319	28	0
6	R	29	0	39	1	0
7	R	84	0	138	24	0
8	R	18	0	31	4	0
All	All	8798	0	8621	49	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 3.

All (49) 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)
5:R:61:MET:HE1	7:R:701:CLR:H21	1.42	0.99
5:R:143:THR:HG21	8:R:801:PLM:HG2	1.63	0.81
5:R:136:VAL:HG21	7:R:601:CLR:H191	1.62	0.80
5:R:61:MET:CE	7:R:701:CLR:H21	2.13	0.79
5:R:61:MET:HE1	7:R:701:CLR:C2	2.15	0.74
5:R:61:MET:HE3	7:R:701:CLR:C1	2.19	0.72
5:R:61:MET:CE	7:R:701:CLR:C1	2.69	0.70
5:R:218:SER:HB2	5:R:221:LYS:HB2	1.73	0.70
3:E:94:TYR:O	3:E:114:GLY:HA2	1.90	0.70
1:A:76:ILE:HG22	1:A:77:LYS:H	1.57	0.69
1:A:28:THR:HA	1:A:31:LYS:HE2	1.77	0.67
5:R:61:MET:CE	7:R:701:CLR:H11	2.26	0.66
7:R:601:CLR:H261	8:R:801:PLM:HG3	1.76	0.66
5:R:112:VAL:HG11	7:R:501:CLR:H211	1.79	0.63
1:A:230:GLN:HE22	5:R:222:ILE:HB	1.67	0.59
5:R:61:MET:CE	7:R:701:CLR:C2	2.77	0.58
3:E:203:ARG:NH2	3:E:224:ASP:OD2	2.37	0.58
5:R:65:LEU:CD1	7:R:701:CLR:H213	2.33	0.58
7:R:501:CLR:H162	7:R:501:CLR:H231	1.85	0.58
2:B:294:CYS:HB2	2:B:308:LEU:HB2	1.86	0.57
5:R:112:VAL:HG11	7:R:501:CLR:C21	2.36	0.56
2:B:292:PHE:HD1	2:B:313:ASN:O	1.89	0.55
1:A:223:ASN:ND2	5:R:117:ALA:O	2.39	0.55
7:R:601:CLR:C26	8:R:801:PLM:HG3	2.36	0.54
5:R:61:MET:SD	7:R:701:CLR:H11	2.47	0.54
5:R:217:LEU:HG	5:R:218:SER:H	1.73	0.54
5:R:55:TYR:OH	7:R:601:CLR:H22	2.08	0.53
5:R:61:MET:HE3	7:R:701:CLR:H12	1.91	0.52
3:E:50:TYR:HD2	3:E:59:TYR:HD2	1.58	0.51
5:R:58:ASN:HD21	7:R:701:CLR:H3	1.74	0.51
5:R:65:LEU:HD11	7:R:701:CLR:H213	1.92	0.50
5:R:191:VAL:HG13	6:R:401:NKP:HBB	1.95	0.49
3:E:108:PHE:HE2	3:E:231:MET:HE1	1.78	0.48
3:E:99:SER:HA	3:E:107:PRO:O	2.13	0.48
5:R:65:LEU:HD11	7:R:701:CLR:C21	2.43	0.48
5:R:276:THR:O	5:R:277:LEU:HB3	2.14	0.48
1:A:76:ILE:O	1:A:77:LYS:C	2.53	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:70:LEU:O	2:B:81:ILE:HA	2.16	0.45
3:E:224:ASP:O	3:E:246:LEU:HD22	2.18	0.44
2:B:333:ASP:O	2:B:334:SER:OG	2.33	0.43
5:R:82:TRP:CD1	5:R:82:TRP:O	2.71	0.43
7:R:601:CLR:H193	7:R:601:CLR:H111	1.75	0.43
7:R:701:CLR:H211	7:R:701:CLR:H232	1.72	0.43
5:R:298:ILE:HG22	5:R:298:ILE:O	2.18	0.43
7:R:501:CLR:H231	7:R:501:CLR:C16	2.47	0.42
8:R:801:PLM:HC1	8:R:801:PLM:H92	1.90	0.42
1:A:219:ILE:HD12	5:R:122:PHE:CE1	2.54	0.42
5:R:112:VAL:CG1	7:R:501:CLR:C21	2.98	0.41
4:G:60:PRO:HD2	4:G:61:PHE:H	1.86	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	210/230 (91%)	199 (95%)	11 (5%)	0	100	100
2	B	336/345 (97%)	325 (97%)	11 (3%)	0	100	100
3	E	228/247 (92%)	219 (96%)	9 (4%)	0	100	100
4	G	55/71 (78%)	54 (98%)	1 (2%)	0	100	100
5	R	285/301 (95%)	264 (93%)	21 (7%)	0	100	100
All	All	1114/1194 (93%)	1061 (95%)	53 (5%)	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 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	177/210 (84%)	177 (100%)	0	100	100
2	B	266/287 (93%)	266 (100%)	0	100	100
3	E	189/198 (96%)	189 (100%)	0	100	100
4	G	40/58 (69%)	40 (100%)	0	100	100
5	R	258/279 (92%)	258 (100%)	0	100	100
All	All	930/1032 (90%)	930 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

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 ⓘ

5 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	$\#|Z| > 2$
6	NKP	R	401	-	28,28,28	1.52	2 (7%)	31,32,32	1.25	3 (9%)
7	CLR	R	601	-	31,31,31	0.84	1 (3%)	48,48,48	1.29	4 (8%)
7	CLR	R	701	-	31,31,31	0.58	0	48,48,48	1.13	3 (6%)
8	PLM	R	801	-	17,17,17	0.53	0	17,17,17	0.49	0
7	CLR	R	501	-	31,31,31	0.28	0	48,48,48	0.33	0

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

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	NKP	R	401	-	-	15/28/28/28	-
7	CLR	R	601	-	-	2/10/68/68	0/4/4/4
7	CLR	R	701	-	-	6/10/68/68	0/4/4/4
8	PLM	R	801	-	-	10/15/15/15	-
7	CLR	R	501	-	-	2/10/68/68	0/4/4/4

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	R	401	NKP	PAC-OAF	6.88	1.82	1.60
6	R	401	NKP	OAF-CAG	-2.63	1.34	1.44
7	R	601	CLR	C10-C9	-2.32	1.52	1.56

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
7	R	601	CLR	C10-C9-C8	-3.71	107.17	112.73
6	R	401	NKP	OAF-PAC-OAD	-3.51	96.63	106.47
7	R	601	CLR	C11-C9-C10	-2.98	109.16	113.08
6	R	401	NKP	OAB-PAC-OAA	2.83	118.46	107.64
7	R	701	CLR	C13-C17-C20	-2.56	115.47	119.49
7	R	601	CLR	C19-C10-C9	-2.40	108.82	111.68
7	R	601	CLR	C13-C14-C8	-2.31	110.97	114.38
7	R	701	CLR	C11-C12-C13	-2.19	109.02	112.78

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
6	R	401	NKP	OAB-PAC-OAF	-2.14	101.05	106.73
7	R	701	CLR	C10-C9-C8	-2.12	109.55	112.73

There are no chirality outliers.
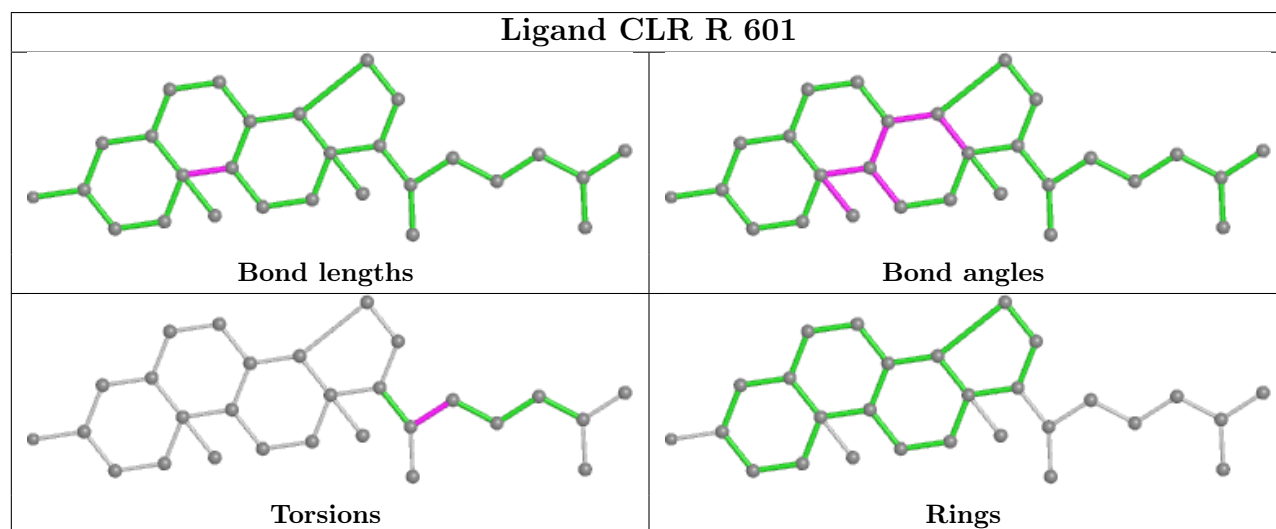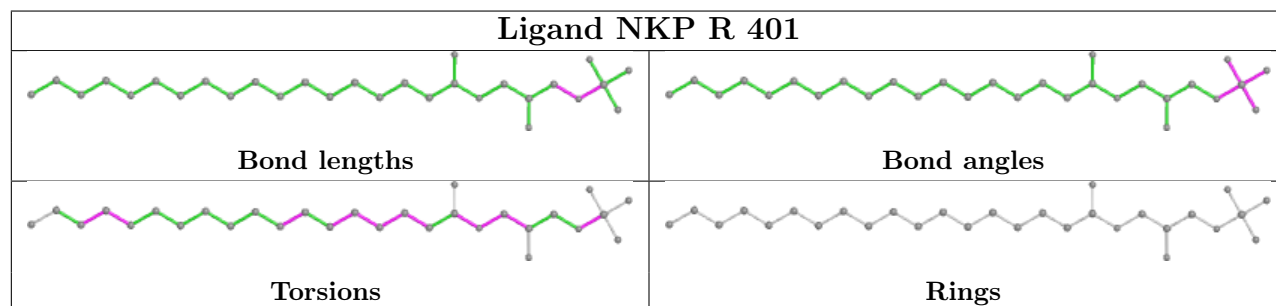
All (35) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	R	401	NKP	CAG-OAF-PAC-OAA
6	R	401	NKP	CAG-OAF-PAC-OAB
6	R	401	NKP	CAG-CAH-CAI-OAJ
6	R	401	NKP	OBC-CAH-CAI-OAJ
6	R	401	NKP	OAE-CAK-OAJ-CAI
6	R	401	NKP	CAL-CAK-OAJ-CAI
8	R	801	PLM	C3-C4-C5-C6
7	R	701	CLR	C21-C20-C22-C23
7	R	501	CLR	C17-C20-C22-C23
7	R	501	CLR	C21-C20-C22-C23
6	R	401	NKP	CAK-CAL-CAM-CAN
7	R	701	CLR	C22-C23-C24-C25
8	R	801	PLM	C2-C3-C4-C5
8	R	801	PLM	C5-C6-C7-C8
6	R	401	NKP	CAX-CAY-CAZ-CBA
6	R	401	NKP	CAM-CAN-CAO-CAP
8	R	801	PLM	C7-C8-C9-CA
6	R	401	NKP	CAP-CAQ-CAR-CAS
6	R	401	NKP	CAL-CAM-CAN-CAO
6	R	401	NKP	CAG-OAF-PAC-OAD
7	R	601	CLR	C21-C20-C22-C23
8	R	801	PLM	CC-CD-CE-CF
7	R	601	CLR	C17-C20-C22-C23
6	R	401	NKP	CAW-CAX-CAY-CAZ
8	R	801	PLM	C1-C2-C3-C4
8	R	801	PLM	C4-C5-C6-C7
8	R	801	PLM	C9-CA-CB-CC
6	R	401	NKP	CAH-CAI-OAJ-CAK
6	R	401	NKP	CAN-CAO-CAP-CAQ
7	R	701	CLR	C13-C17-C20-C21
8	R	801	PLM	CB-CC-CD-CE
7	R	701	CLR	C23-C24-C25-C27
7	R	701	CLR	C23-C24-C25-C26
7	R	701	CLR	C13-C17-C20-C22
8	R	801	PLM	C8-C9-CA-CB

There are no ring outliers.

5 monomers are involved in 27 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	R	401	NKP	1	0
7	R	601	CLR	5	0
7	R	701	CLR	14	0
8	R	801	PLM	4	0
7	R	501	CLR	5	0

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

Ligand NKP R 401

Bond lengths — Bond angles — Torsions — Rings

Ligand CLR R 601

Bond lengths — Bond angles — Torsions — Rings

Ligand CLR R 701

Bond lengths

Bond angles

Torsions

Rings

Ligand PLM R 801

Bond lengths

Bond angles

Torsions

Rings

Ligand CLR R 501

Bond lengths

Bond angles

Torsions

Rings
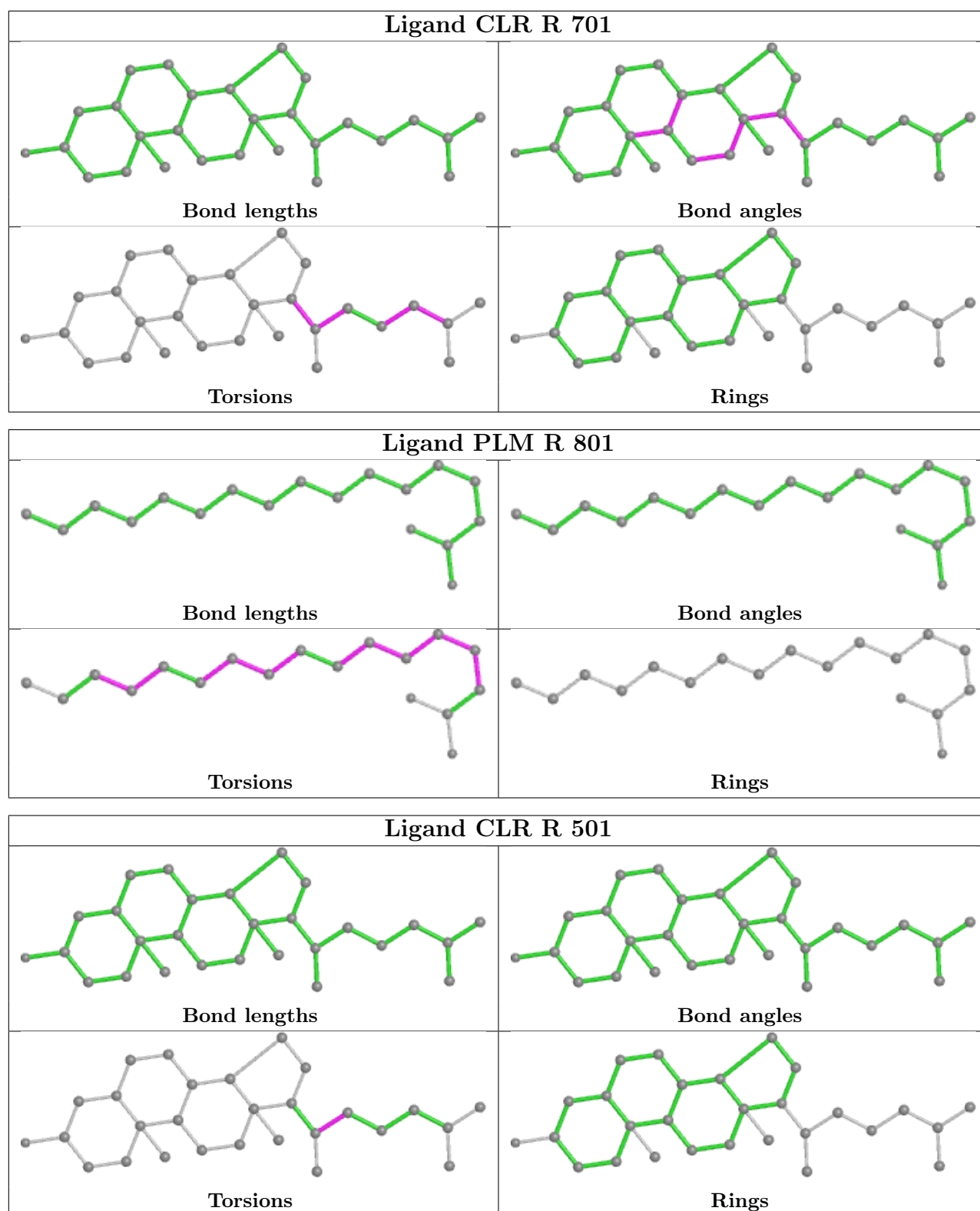
5.7　Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

There are no chain breaks in this entry.