



Full wwPDB EM Validation Report ⓘ

Jul 15, 2025 – 08:40 PM JST

PDB ID : 8Y2N / pdb_00008y2n
EMDB ID : EMD-38858
Title : Cryo-EM structure of the apo Lac1-Lip1 complex
Authors : Xie, T.; Zhang, Z.; Fang, Q.; Gong, X.
Deposited on : 2024-01-26
Resolution : 3.19 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 : 4-5-2 with Phenix2.0rc1
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) : 2.44

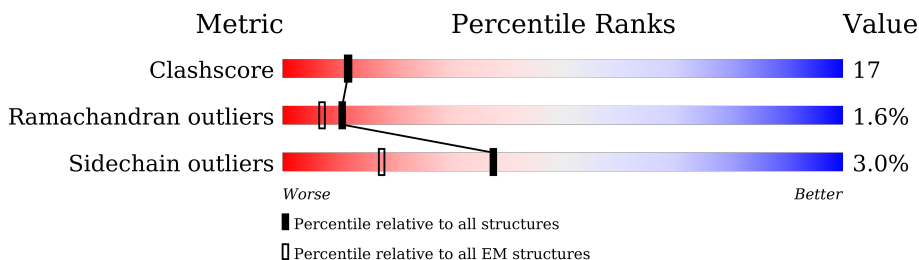
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.19 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 ≥ 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	428	43% 28% .. 26%
1	C	428	43% 27% .. 26%
2	B	150	71% 17% . 11%
2	D	150	71% 17% . 11%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 7714 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 Ceramide synthase LAC1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	315	Total	C	N	O	S	0	0
			2674	1811	424	426	13		
1	C	315	Total	C	N	O	S	0	0
			2674	1811	424	426	13		

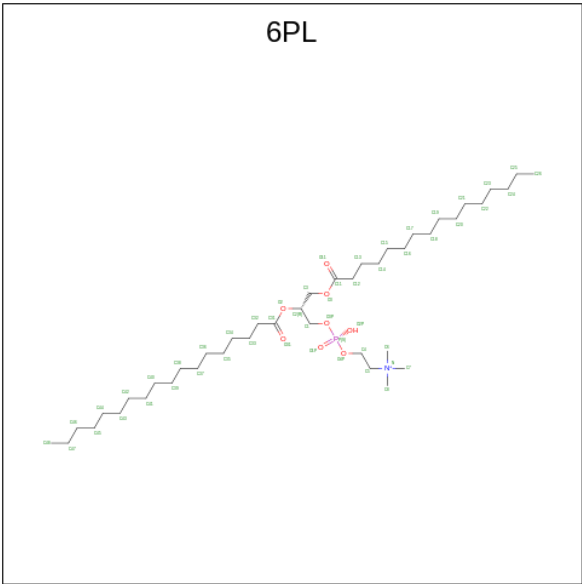
There are 20 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	419	LEU	-	expression tag	UNP P28496
A	420	GLU	-	expression tag	UNP P28496
A	421	ASP	-	expression tag	UNP P28496
A	422	TYR	-	expression tag	UNP P28496
A	423	LYS	-	expression tag	UNP P28496
A	424	ASP	-	expression tag	UNP P28496
A	425	ASP	-	expression tag	UNP P28496
A	426	ASP	-	expression tag	UNP P28496
A	427	ASP	-	expression tag	UNP P28496
A	428	LYS	-	expression tag	UNP P28496
C	419	LEU	-	expression tag	UNP P28496
C	420	GLU	-	expression tag	UNP P28496
C	421	ASP	-	expression tag	UNP P28496
C	422	TYR	-	expression tag	UNP P28496
C	423	LYS	-	expression tag	UNP P28496
C	424	ASP	-	expression tag	UNP P28496
C	425	ASP	-	expression tag	UNP P28496
C	426	ASP	-	expression tag	UNP P28496
C	427	ASP	-	expression tag	UNP P28496
C	428	LYS	-	expression tag	UNP P28496

- Molecule 2 is a protein called Ceramide synthase subunit LIP1.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	133	Total	C	N	O	S	0	0
			1089	703	178	202	6		
2	D	133	Total	C	N	O	S	0	0
			1089	703	178	202	6		

- Molecule 3 is (4S,7R)-4-HYDROXY-N,N,N-TRIMETHYL-9-OXO-7-[(PALMITOYLOXY)METHYL]-3,5,8-TRIOXA-4-PHOSPHAHEXACOSAN-1-AMINIUM 4-OXIDE (CCD ID: 6PL) (formula: C₄₂H₈₅NO₈P).



Mol	Chain	Residues	Atoms				AltConf
3	A	1	Total	C			0
			18	18			
3	A	1	Total	C			0
			18	18			
3	B	1	Total	C	O	P	0
			40	31	8	1	
3	B	1	Total	C			0
			18	18			
3	C	1	Total	C			0
			18	18			
3	C	1	Total	C			0
			18	18			
3	D	1	Total	C	O	P	0
			40	31	8	1	
3	D	1	Total	C			0
			18	18			

LEU
GLU
ASP
TYR
LYS
ASP
ASP
ASP
LYS

● Molecule 2: Ceramide synthase subunit LIP1



● Molecule 2: Ceramide synthase subunit LIP1



4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	159061	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	1000	Depositor
Maximum defocus (nm)	2000	Depositor
Magnification	Not provided	
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: 6PL

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	0.56	8/2768 (0.3%)	0.75	5/3765 (0.1%)
1	C	0.56	8/2768 (0.3%)	0.75	5/3765 (0.1%)
2	B	0.39	0/1122	0.52	0/1523
2	D	0.39	0/1122	0.52	0/1523
All	All	0.52	16/7780 (0.2%)	0.69	10/10576 (0.1%)

All (16) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	202	PHE	CA-C	-8.10	1.44	1.53
1	A	202	PHE	CA-C	-8.05	1.44	1.53
1	A	203	ASN	CA-C	-7.96	1.42	1.53
1	C	203	ASN	CA-C	-7.96	1.42	1.53
1	C	201	PHE	CA-C	-6.87	1.44	1.53
1	A	201	PHE	CA-C	-6.79	1.44	1.53
1	A	203	ASN	C-O	-6.64	1.15	1.23
1	C	203	ASN	C-O	-6.59	1.15	1.23
1	A	201	PHE	CA-CB	-6.02	1.43	1.53
1	C	201	PHE	CA-CB	-6.02	1.43	1.53
1	A	203	ASN	N-CA	-5.22	1.39	1.46
1	A	202	PHE	CA-CB	-5.19	1.46	1.53
1	C	202	PHE	CA-CB	-5.19	1.46	1.53
1	C	203	ASN	N-CA	-5.19	1.39	1.46
1	A	201	PHE	C-O	-5.07	1.17	1.23
1	C	201	PHE	C-O	-5.07	1.17	1.23

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	162	LEU	N-CA-C	-9.50	102.26	114.04

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	162	LEU	N-CA-C	-9.43	102.34	114.04
1	C	201	PHE	N-CA-C	8.95	123.75	111.39
1	A	201	PHE	N-CA-C	8.94	123.73	111.39
1	A	166	SER	N-CA-C	-5.67	98.72	110.80
1	C	166	SER	N-CA-C	-5.64	98.78	110.80
1	A	201	PHE	CA-CB-CG	-5.56	108.24	113.80
1	C	201	PHE	CA-CB-CG	-5.52	108.28	113.80
1	C	329	VAL	N-CA-C	-5.48	105.03	110.62
1	A	329	VAL	N-CA-C	-5.45	105.07	110.62

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	2674	0	2671	119	0
1	C	2674	0	2671	118	0
2	B	1089	0	1045	17	0
2	D	1089	0	1045	17	0
3	A	36	0	70	4	0
3	B	58	0	91	3	0
3	C	36	0	70	4	0
3	D	58	0	91	3	0
All	All	7714	0	7754	269	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 17.

All (269) 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:329:VAL:O	1:A:333:PHE:HB2	1.47	1.14
1:C:329:VAL:O	1:C:333:PHE:HB2	1.47	1.13
1:C:157:PRO:O	1:C:161:ARG:HB2	1.59	1.02

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:157:PRO:O	1:A:161:ARG:HB2	1.59	1.00
1:C:372:LEU:O	1:C:375:ILE:HG22	1.62	1.00
1:A:372:LEU:O	1:A:375:ILE:HG22	1.62	0.96
1:A:204:THR:O	1:A:206:ALA:N	2.00	0.94
1:C:204:THR:O	1:C:206:ALA:N	2.00	0.93
1:A:166:SER:HB2	1:A:169:ARG:HB3	1.49	0.92
1:C:166:SER:HB2	1:C:169:ARG:HB3	1.49	0.92
1:A:372:LEU:HD12	1:A:375:ILE:CG2	2.07	0.85
1:C:372:LEU:HD12	1:C:375:ILE:CG2	2.07	0.84
1:A:372:LEU:HD12	1:A:375:ILE:HG21	1.58	0.84
1:C:375:ILE:O	1:C:375:ILE:HD13	1.79	0.83
1:C:372:LEU:HD12	1:C:375:ILE:HG21	1.58	0.82
1:A:375:ILE:HD13	1:A:375:ILE:O	1.79	0.81
1:A:329:VAL:O	1:A:333:PHE:CB	2.28	0.81
1:C:329:VAL:O	1:C:333:PHE:CB	2.28	0.80
1:A:166:SER:HB2	1:A:169:ARG:CB	2.14	0.78
1:C:166:SER:HB2	1:C:169:ARG:CB	2.14	0.77
1:A:179:ALA:HA	1:A:182:TYR:CE1	2.21	0.76
1:A:155:ILE:HG21	1:A:174:MET:HA	1.68	0.76
1:C:179:ALA:HA	1:C:182:TYR:CE1	2.21	0.75
1:C:155:ILE:HG21	1:C:174:MET:HA	1.68	0.75
1:A:109:VAL:HG23	1:A:110:LEU:HD12	1.68	0.75
1:C:224:TYR:HH	1:C:266:SER:HG	1.27	0.75
1:C:109:VAL:HG23	1:C:110:LEU:HD12	1.68	0.74
1:C:204:THR:C	1:C:206:ALA:H	1.95	0.74
1:A:204:THR:C	1:A:206:ALA:H	1.95	0.74
1:C:367:VAL:CG1	1:C:371:TRP:CZ3	2.71	0.74
2:B:38:GLU:OE1	2:B:38:GLU:HA	1.89	0.73
1:A:367:VAL:CG1	1:A:371:TRP:CZ3	2.71	0.73
1:A:367:VAL:CG1	1:A:371:TRP:HZ3	2.03	0.72
2:D:38:GLU:HA	2:D:38:GLU:OE1	1.89	0.72
1:A:204:THR:C	1:A:206:ALA:N	2.47	0.72
1:A:152:ASP:OD1	1:A:153:VAL:N	2.24	0.71
1:C:189:PHE:HE2	1:C:223:PHE:HB2	1.56	0.71
1:C:367:VAL:CG1	1:C:371:TRP:HZ3	2.03	0.71
1:C:167:LYS:O	1:C:170:ILE:HG22	1.92	0.70
1:A:167:LYS:O	1:A:170:ILE:HG22	1.92	0.69
1:C:152:ASP:OD1	1:C:153:VAL:N	2.24	0.69
1:C:204:THR:C	1:C:206:ALA:N	2.47	0.69
1:C:261:LEU:O	1:C:265:SER:OG	2.09	0.68
1:A:189:PHE:HE2	1:A:223:PHE:HB2	1.56	0.68

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:261:LEU:O	1:A:265:SER:OG	2.09	0.68
1:A:372:LEU:C	1:A:375:ILE:HG22	2.19	0.67
1:C:372:LEU:C	1:C:375:ILE:HG22	2.19	0.67
1:A:72:TRP:HD1	1:A:73:PHE:CD1	2.14	0.65
1:C:367:VAL:HG12	1:C:371:TRP:CE3	2.32	0.65
1:C:72:TRP:HD1	1:C:73:PHE:CD1	2.14	0.64
1:A:367:VAL:HG12	1:A:371:TRP:CE3	2.32	0.64
1:A:238:LEU:HD11	1:A:253:THR:HG22	1.81	0.62
1:C:238:LEU:HD11	1:C:253:THR:HG22	1.81	0.62
1:C:375:ILE:HD13	1:C:375:ILE:C	2.24	0.62
1:C:263:ILE:HG12	1:C:279:TYR:OH	2.01	0.61
1:C:241:GLN:HE22	1:C:249:HIS:CE1	2.19	0.61
1:A:241:GLN:HE22	1:A:249:HIS:CE1	2.19	0.61
1:A:375:ILE:HD13	1:A:375:ILE:C	2.25	0.61
1:A:263:ILE:HG12	1:A:279:TYR:OH	2.01	0.61
1:A:204:THR:O	1:A:205:LYS:C	2.44	0.61
1:C:97:ALA:O	1:C:101:SER:OG	2.18	0.61
1:A:107:THR:OG1	1:A:108:ASN:N	2.34	0.60
1:C:205:LYS:O	1:C:205:LYS:HD3	2.02	0.60
1:C:341:LEU:HD23	2:D:52:HIS:HE1	1.67	0.60
1:A:341:LEU:HD23	2:B:52:HIS:HE1	1.67	0.60
1:A:205:LYS:O	1:A:205:LYS:HD3	2.01	0.59
1:C:72:TRP:HD1	1:C:73:PHE:HD1	1.50	0.59
1:C:204:THR:O	1:C:205:LYS:C	2.44	0.59
1:A:97:ALA:O	1:A:101:SER:OG	2.18	0.59
1:C:169:ARG:O	1:C:173:ILE:HG12	2.03	0.59
1:A:169:ARG:O	1:A:173:ILE:HG12	2.03	0.59
1:C:189:PHE:CE2	1:C:223:PHE:HB2	2.37	0.59
1:A:166:SER:CB	1:A:169:ARG:CB	2.81	0.59
1:C:166:SER:CB	1:C:169:ARG:CB	2.81	0.58
1:C:198:ASP:OD2	1:C:209:ARG:NH2	2.37	0.58
1:A:198:ASP:OD2	1:A:209:ARG:NH2	2.37	0.58
1:C:166:SER:OG	1:C:169:ARG:HD2	2.04	0.57
1:C:107:THR:OG1	1:C:108:ASN:N	2.34	0.57
1:C:372:LEU:O	1:C:375:ILE:CG2	2.46	0.57
1:A:166:SER:OG	1:A:169:ARG:HD2	2.04	0.57
1:C:326:LEU:O	1:C:329:VAL:HG22	2.05	0.57
1:A:155:ILE:O	1:A:159:ALA:N	2.33	0.57
1:A:167:LYS:HG3	1:A:168:HIS:N	2.20	0.57
1:A:326:LEU:O	1:A:329:VAL:HG22	2.05	0.57
1:A:372:LEU:HA	1:A:375:ILE:HG22	1.86	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:189:PHE:CE2	1:A:223:PHE:HB2	2.37	0.57
2:D:99:LEU:HD23	2:D:99:LEU:H	1.70	0.57
1:C:155:ILE:O	1:C:159:ALA:N	2.33	0.56
1:C:372:LEU:HA	1:C:375:ILE:HG22	1.86	0.56
1:A:72:TRP:HD1	1:A:73:PHE:HD1	1.50	0.56
1:A:372:LEU:O	1:A:375:ILE:CG2	2.46	0.56
1:C:167:LYS:HG3	1:C:168:HIS:N	2.20	0.56
2:B:99:LEU:H	2:B:99:LEU:HD23	1.70	0.56
1:C:361:ILE:HD11	3:C:502:6PL:H462	1.88	0.56
1:A:361:ILE:HD11	3:A:502:6PL:H462	1.88	0.56
1:C:151:MET:HA	1:C:155:ILE:HD13	1.88	0.56
1:A:166:SER:CB	1:A:169:ARG:HB2	2.36	0.56
1:A:202:PHE:CE1	1:A:277:PRO:HB3	2.41	0.55
1:A:151:MET:HA	1:A:155:ILE:HD13	1.88	0.55
1:C:202:PHE:CE1	1:C:277:PRO:HB3	2.41	0.55
1:C:204:THR:O	1:C:207:MET:N	2.33	0.55
1:A:150:LEU:HD23	1:A:178:TYR:HD2	1.72	0.55
1:A:238:LEU:HD21	1:A:253:THR:HG22	1.88	0.54
1:C:166:SER:CB	1:C:169:ARG:HB2	2.36	0.54
1:C:367:VAL:HG11	1:C:371:TRP:HZ3	1.73	0.54
1:C:238:LEU:HD21	1:C:253:THR:HG22	1.88	0.53
1:C:109:VAL:HG12	1:C:112:ARG:HH12	1.73	0.53
1:C:204:THR:HG22	1:C:207:MET:HE2	1.90	0.53
1:A:204:THR:O	1:A:207:MET:N	2.33	0.53
1:A:226:GLY:HA3	3:A:501:6PL:H441	1.91	0.53
1:A:87:PRO:HB2	1:A:145:PHE:HB2	1.91	0.53
1:A:107:THR:O	1:A:108:ASN:CB	2.56	0.52
1:A:109:VAL:HG12	1:A:112:ARG:HH12	1.73	0.52
1:A:204:THR:HG22	1:A:207:MET:HE2	1.90	0.52
1:C:107:THR:O	1:C:108:ASN:CB	2.56	0.52
1:C:150:LEU:HD23	1:C:178:TYR:HD2	1.72	0.52
1:C:81:ARG:O	1:C:82:HIS:ND1	2.42	0.52
1:C:87:PRO:HB2	1:C:145:PHE:HB2	1.91	0.52
1:A:81:ARG:O	1:A:82:HIS:ND1	2.42	0.52
1:A:367:VAL:HG12	1:A:371:TRP:CZ3	2.45	0.52
1:C:226:GLY:HA3	3:C:501:6PL:H441	1.91	0.52
1:A:367:VAL:HG11	1:A:371:TRP:HZ3	1.73	0.52
1:C:274:MET:HE1	3:C:502:6PL:H442	1.92	0.51
2:D:93:GLU:OE2	2:D:95:ASN:ND2	2.30	0.51
1:C:367:VAL:CG1	1:C:371:TRP:CE3	2.94	0.51
1:A:136:VAL:O	1:A:140:MET:HG3	2.11	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:75:PHE:O	1:A:78:ILE:HG22	2.11	0.51
1:C:75:PHE:O	1:C:78:ILE:HG22	2.11	0.51
1:C:84:TRP:HB3	1:C:148:GLU:HB2	1.92	0.51
1:C:171:LYS:HA	1:C:174:MET:HE2	1.92	0.51
1:A:171:LYS:HA	1:A:174:MET:HE2	1.92	0.51
1:C:367:VAL:HG12	1:C:371:TRP:CZ3	2.45	0.51
2:B:93:GLU:OE2	2:B:95:ASN:ND2	2.30	0.50
1:C:295:LEU:O	1:C:299:ASP:HA	2.12	0.50
1:C:372:LEU:CA	1:C:375:ILE:HG22	2.41	0.50
1:C:136:VAL:O	1:C:140:MET:HG3	2.11	0.50
1:A:84:TRP:HB3	1:A:148:GLU:HB2	1.92	0.50
1:C:372:LEU:HA	1:C:375:ILE:CG2	2.41	0.50
1:A:274:MET:HE1	3:A:502:6PL:H442	1.92	0.50
1:A:295:LEU:O	1:A:299:ASP:HA	2.11	0.50
1:A:317:LEU:O	1:A:321:ILE:HB	2.11	0.50
1:A:221:LYS:NZ	1:A:267:TYR:OH	2.45	0.50
1:A:249:HIS:O	1:A:253:THR:HG23	2.11	0.50
1:C:249:HIS:O	1:C:253:THR:HG23	2.11	0.50
1:C:72:TRP:CD1	1:C:73:PHE:H	2.30	0.49
1:A:262:LEU:HB3	3:A:502:6PL:H482	1.94	0.49
1:A:372:LEU:CA	1:A:375:ILE:HG22	2.41	0.49
2:B:99:LEU:HB2	2:B:130:GLY:O	2.12	0.49
1:C:317:LEU:O	1:C:321:ILE:HB	2.11	0.49
1:A:72:TRP:CD1	1:A:73:PHE:H	2.30	0.49
2:B:47:ASN:ND2	2:B:47:ASN:O	2.44	0.49
1:C:221:LYS:NZ	1:C:267:TYR:OH	2.45	0.49
1:A:367:VAL:CG1	1:A:371:TRP:CE3	2.94	0.49
1:A:372:LEU:HA	1:A:375:ILE:CG2	2.41	0.49
2:B:66:LYS:HD2	2:B:128:TYR:CZ	2.48	0.49
2:B:80:GLU:OE2	2:B:113:HIS:NE2	2.43	0.49
1:C:109:VAL:O	1:C:112:ARG:HG2	2.12	0.49
2:D:66:LYS:HD2	2:D:128:TYR:CZ	2.47	0.49
2:D:99:LEU:HB2	2:D:130:GLY:O	2.12	0.49
1:C:118:TYR:CE2	1:C:131:ASN:HB2	2.48	0.49
1:A:109:VAL:O	1:A:112:ARG:HG2	2.12	0.49
1:A:367:VAL:HG12	1:A:371:TRP:HE3	1.75	0.49
2:D:101:PHE:HB3	2:D:129:VAL:HG23	1.95	0.49
1:A:118:TYR:CE2	1:A:131:ASN:HB2	2.48	0.48
2:D:92:TYR:HD1	2:D:131:TYR:CE1	2.32	0.48
1:C:367:VAL:HG12	1:C:371:TRP:HE3	1.75	0.48
2:D:80:GLU:OE2	2:D:113:HIS:NE2	2.43	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:47:ASN:ND2	2:D:47:ASN:O	2.45	0.47
2:D:57:LYS:NZ	2:D:91:ASP:OD2	2.43	0.47
1:A:156:ARG:O	1:A:160:ILE:HG12	2.14	0.47
2:B:92:TYR:HD1	2:B:131:TYR:CE1	2.32	0.47
1:C:196:HIS:O	1:C:196:HIS:ND1	2.48	0.47
1:C:262:LEU:HB3	3:C:502:6PL:H482	1.95	0.47
1:A:196:HIS:O	1:A:196:HIS:ND1	2.48	0.47
2:B:101:PHE:HB3	2:B:129:VAL:HG23	1.95	0.47
1:C:224:TYR:OH	1:C:266:SER:OG	2.04	0.47
2:B:57:LYS:NZ	2:B:91:ASP:OD2	2.43	0.47
1:C:156:ARG:O	1:C:160:ILE:HG12	2.14	0.47
1:A:72:TRP:CD1	1:A:73:PHE:HD1	2.31	0.46
1:C:246:ARG:HB3	1:C:247:LYS:H	1.51	0.46
1:A:187:GLY:O	1:A:191:ILE:HD12	2.15	0.46
2:B:76:ASP:O	2:B:80:GLU:HG3	2.16	0.46
1:C:319:HIS:NE2	1:C:369:LEU:HD23	2.31	0.46
1:A:205:LYS:C	1:A:205:LYS:HD3	2.41	0.46
1:C:205:LYS:HD3	1:C:205:LYS:C	2.41	0.46
1:C:366:LEU:HD13	1:C:369:LEU:HD12	1.98	0.46
1:A:366:LEU:HD13	1:A:369:LEU:HD12	1.98	0.46
1:A:375:ILE:C	1:A:375:ILE:CD1	2.89	0.46
1:A:95:TYR:HE1	1:A:138:TYR:HE2	1.64	0.46
1:C:347:GLN:NE2	1:C:349:LYS:HB3	2.32	0.45
1:A:77:GLU:O	1:A:80:TYR:HB3	2.16	0.45
1:C:72:TRP:CD1	1:C:73:PHE:HD1	2.31	0.45
1:C:187:GLY:O	1:C:191:ILE:HD12	2.15	0.45
1:C:95:TYR:HE1	1:C:138:TYR:HE2	1.64	0.45
1:C:341:LEU:HD12	1:C:350:CYS:SG	2.56	0.45
2:D:69:ALA:HB2	2:D:83:THR:HG21	1.98	0.45
1:A:110:LEU:O	1:A:114:VAL:HG22	2.17	0.45
1:C:375:ILE:C	1:C:375:ILE:CD1	2.89	0.45
2:D:76:ASP:O	2:D:80:GLU:HG3	2.16	0.45
1:A:341:LEU:HD12	1:A:350:CYS:SG	2.56	0.45
2:B:69:ALA:HB2	2:B:83:THR:HG21	1.98	0.45
1:C:110:LEU:O	1:C:114:VAL:HG22	2.17	0.45
1:C:173:ILE:O	1:C:177:MET:HG2	2.17	0.45
1:C:276:LEU:HB3	1:C:277:PRO:HD3	1.99	0.45
1:A:91:LEU:HD21	1:A:142:PHE:HA	1.99	0.45
1:A:319:HIS:NE2	1:A:369:LEU:HD23	2.31	0.45
1:C:91:LEU:HD21	1:C:142:PHE:HA	1.99	0.45
1:C:77:GLU:O	1:C:80:TYR:HB3	2.16	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:210:THR:HG23	1:C:210:THR:O	2.17	0.44
1:C:76:ARG:O	1:C:79:SER:OG	2.25	0.44
1:A:326:LEU:HD21	1:A:361:ILE:HB	1.99	0.44
1:A:210:THR:O	1:A:210:THR:HG23	2.17	0.44
1:A:254:PHE:HE2	1:A:367:VAL:HG21	1.83	0.44
1:A:347:GLN:NE2	1:A:349:LYS:HB3	2.32	0.44
1:A:311:VAL:O	1:A:315:ILE:HG12	2.18	0.44
1:C:338:ASN:HD22	1:C:347:GLN:HG3	1.83	0.44
1:A:212:PRO:O	1:A:270:HIS:HB3	2.18	0.43
1:C:311:VAL:O	1:C:315:ILE:HG12	2.18	0.43
1:C:326:LEU:HD21	1:C:361:ILE:HB	1.99	0.43
1:A:162:LEU:O	1:A:163:HIS:CB	2.66	0.43
1:C:277:PRO:O	1:C:281:THR:HG23	2.18	0.43
1:A:173:ILE:O	1:A:177:MET:HG2	2.17	0.43
1:A:276:LEU:HB3	1:A:277:PRO:HD3	1.99	0.43
1:A:277:PRO:O	1:A:281:THR:HG23	2.18	0.43
1:A:336:GLU:HG3	1:A:336:GLU:O	2.18	0.43
1:A:338:ASN:HD22	1:A:347:GLN:HG3	1.83	0.43
1:C:336:GLU:HG3	1:C:336:GLU:O	2.18	0.43
1:C:274:MET:O	1:C:274:MET:HG2	2.19	0.43
1:C:325:ILE:O	1:C:328:SER:OG	2.23	0.43
2:B:58:GLU:OE1	2:B:60:GLN:NE2	2.51	0.43
3:B:201:6PL:H191	3:B:201:6PL:H162	1.54	0.43
1:C:254:PHE:HE2	1:C:367:VAL:HG21	1.83	0.43
1:C:325:ILE:O	1:C:329:VAL:HG13	2.19	0.42
2:B:64:VAL:HA	2:B:129:VAL:O	2.19	0.42
1:C:212:PRO:O	1:C:270:HIS:HB3	2.18	0.42
3:D:201:6PL:H162	3:D:201:6PL:H191	1.54	0.42
1:C:375:ILE:HG23	1:C:376:PHE:N	2.35	0.42
2:D:64:VAL:HA	2:D:129:VAL:O	2.19	0.42
1:C:207:MET:SD	1:C:274:MET:HA	2.60	0.42
1:C:264:TRP:HB2	3:D:202:6PL:H431	2.02	0.42
1:C:162:LEU:O	1:C:163:HIS:CB	2.66	0.42
1:A:325:ILE:O	1:A:329:VAL:HG13	2.19	0.42
1:A:264:TRP:HB2	3:B:202:6PL:H431	2.02	0.41
1:A:354:LEU:HB3	1:A:355:PRO:HD3	2.02	0.41
1:A:207:MET:SD	1:A:274:MET:HA	2.60	0.41
1:A:172:ARG:HD3	1:A:172:ARG:HA	1.87	0.41
1:C:123:THR:HG22	1:C:124:ASN:N	2.35	0.41
1:A:123:THR:HG22	1:A:124:ASN:N	2.35	0.41
1:A:316:TYR:O	1:A:320:TYR:HB3	2.21	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:239:VAL:HG21	2:D:26:VAL:HG11	2.03	0.41
1:C:316:TYR:O	1:C:320:TYR:HB3	2.21	0.41
1:C:354:LEU:HB3	1:C:355:PRO:HD3	2.03	0.41
1:A:274:MET:O	1:A:274:MET:HG2	2.19	0.41
1:A:375:ILE:HG23	1:A:376:PHE:N	2.34	0.41
2:B:34:ILE:HD11	3:B:202:6PL:H442	2.03	0.41
2:D:58:GLU:OE1	2:D:60:GLN:NE2	2.51	0.41
1:A:162:LEU:O	1:A:163:HIS:HB3	2.20	0.41
1:A:239:VAL:HG21	2:B:26:VAL:HG11	2.03	0.41
1:A:80:TYR:CD1	1:A:80:TYR:C	2.99	0.41
1:A:246:ARG:HB3	1:A:247:LYS:H	1.51	0.41
1:C:162:LEU:O	1:C:163:HIS:HB3	2.20	0.41
1:A:71:ILE:HB	1:A:74:SER:HB2	2.03	0.40
1:A:130:ILE:HD12	1:A:133:LEU:HD12	2.03	0.40
1:A:224:TYR:OH	1:A:266:SER:OG	2.04	0.40
1:A:147:ARG:O	1:A:151:MET:HB2	2.22	0.40
1:A:298:LEU:O	1:A:298:LEU:HD23	2.21	0.40
1:C:80:TYR:CD1	1:C:80:TYR:C	2.99	0.40
2:D:34:ILE:HD11	3:D:202:6PL:H442	2.03	0.40
1:C:172:ARG:HA	1:C:172:ARG:HD3	1.87	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	313/428 (73%)	284 (91%)	22 (7%)	7 (2%)	5	30
1	C	313/428 (73%)	284 (91%)	22 (7%)	7 (2%)	5	30
2	B	131/150 (87%)	123 (94%)	8 (6%)	0	100	100
2	D	131/150 (87%)	123 (94%)	8 (6%)	0	100	100
All	All	888/1156 (77%)	814 (92%)	60 (7%)	14 (2%)	10	37

All (14) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	205	LYS
1	A	246	ARG
1	C	205	LYS
1	C	246	ARG
1	A	108	ASN
1	C	108	ASN
1	A	166	SER
1	A	167	LYS
1	C	166	SER
1	C	167	LYS
1	A	164	VAL
1	C	164	VAL
1	A	163	HIS
1	C	163	HIS

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	285/391 (73%)	276 (97%)	9 (3%)	34	65
1	C	285/391 (73%)	276 (97%)	9 (3%)	34	65
2	B	120/135 (89%)	117 (98%)	3 (2%)	42	71
2	D	120/135 (89%)	117 (98%)	3 (2%)	42	71
All	All	810/1052 (77%)	786 (97%)	24 (3%)	37	66

All (24) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	77	GLU
1	A	81	ARG
1	A	108	ASN
1	A	162	LEU
1	A	163	HIS
1	A	164	VAL

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Mol	Chain	Res	Type
1	A	165	THR
1	A	371	TRP
1	A	375	ILE
2	B	38	GLU
2	B	70	ARG
2	B	136	GLU
1	C	77	GLU
1	C	81	ARG
1	C	108	ASN
1	C	162	LEU
1	C	163	HIS
1	C	164	VAL
1	C	165	THR
1	C	371	TRP
1	C	375	ILE
2	D	38	GLU
2	D	70	ARG
2	D	136	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	108	ASN
1	A	241	GLN
1	A	249	HIS
1	A	256	HIS
1	A	338	ASN
1	A	365	GLN
1	C	108	ASN
1	C	241	GLN
1	C	249	HIS
1	C	256	HIS
1	C	332	GLN
1	C	338	ASN
1	C	365	GLN

5.3.3 RNA ⓘ

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](#)

8 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	6PL	C	501	-	17,17,51	0.64	0	16,16,59	0.87	0
3	6PL	B	201	-	39,39,51	1.34	4 (10%)	43,44,59	1.21	2 (4%)
3	6PL	D	202	-	17,17,51	0.65	0	16,16,59	0.85	0
3	6PL	B	202	-	17,17,51	0.65	0	16,16,59	0.85	0
3	6PL	D	201	-	39,39,51	1.33	5 (12%)	43,44,59	1.21	3 (6%)
3	6PL	C	502	-	17,17,51	0.59	0	16,16,59	0.98	0
3	6PL	A	502	-	17,17,51	0.60	0	16,16,59	0.98	0
3	6PL	A	501	-	17,17,51	0.64	0	16,16,59	0.87	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
3	6PL	C	501	-	-	5/15/15/55	-
3	6PL	B	201	-	-	17/41/41/55	-
3	6PL	D	202	-	-	7/15/15/55	-
3	6PL	B	202	-	-	7/15/15/55	-
3	6PL	D	201	-	-	17/41/41/55	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	6PL	C	502	-	-	6/15/15/55	-
3	6PL	A	502	-	-	6/15/15/55	-
3	6PL	A	501	-	-	5/15/15/55	-

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	201	6PL	O3-C11	3.99	1.45	1.33
3	D	201	6PL	O3-C11	3.95	1.44	1.33
3	B	201	6PL	O2-C2	-3.08	1.38	1.46
3	D	201	6PL	O2-C2	-3.06	1.38	1.46
3	B	201	6PL	P-O4P	2.92	1.66	1.54
3	D	201	6PL	P-O4P	2.91	1.66	1.54
3	B	201	6PL	O2-C31	2.89	1.42	1.34
3	D	201	6PL	O2-C31	2.88	1.42	1.34
3	D	201	6PL	P-O3P	2.01	1.66	1.60

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	201	6PL	O2-C31-C32	4.25	120.65	111.50
3	D	201	6PL	O2-C31-C32	4.24	120.64	111.50
3	D	201	6PL	O3-C11-C12	2.61	120.10	111.91
3	B	201	6PL	O3-C11-C12	2.58	120.00	111.91
3	D	201	6PL	C2-O2-C31	-2.00	112.87	117.79

There are no chirality outliers.

All (70) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	201	6PL	C32-C31-O2-C2
3	D	201	6PL	C32-C31-O2-C2
3	B	201	6PL	O31-C31-O2-C2
3	D	201	6PL	O31-C31-O2-C2
3	B	201	6PL	C11-C12-C13-C14
3	D	201	6PL	C11-C12-C13-C14
3	B	201	6PL	C34-C35-C36-C37
3	D	201	6PL	C34-C35-C36-C37
3	B	201	6PL	C13-C14-C15-C16
3	D	201	6PL	C13-C14-C15-C16

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Mol	Chain	Res	Type	Atoms
3	B	202	6PL	C34-C35-C36-C37
3	D	202	6PL	C34-C35-C36-C37
3	B	202	6PL	C42-C43-C44-C45
3	D	202	6PL	C42-C43-C44-C45
3	B	201	6PL	C14-C15-C16-C17
3	D	201	6PL	C14-C15-C16-C17
3	B	201	6PL	C20-C21-C22-C23
3	D	201	6PL	C20-C21-C22-C23
3	A	501	6PL	C44-C45-C46-C47
3	C	501	6PL	C44-C45-C46-C47
3	B	201	6PL	O3P-C1-C2-C3
3	D	201	6PL	O3P-C1-C2-C3
3	C	502	6PL	C38-C39-C40-C41
3	A	502	6PL	C38-C39-C40-C41
3	C	501	6PL	C39-C40-C41-C42
3	A	501	6PL	C39-C40-C41-C42
3	A	502	6PL	C31-C32-C33-C34
3	C	502	6PL	C31-C32-C33-C34
3	C	501	6PL	C31-C32-C33-C34
3	A	501	6PL	C31-C32-C33-C34
3	B	201	6PL	C37-C38-C39-C40
3	D	201	6PL	C37-C38-C39-C40
3	A	501	6PL	C37-C38-C39-C40
3	C	501	6PL	C37-C38-C39-C40
3	A	502	6PL	C44-C45-C46-C47
3	C	502	6PL	C44-C45-C46-C47
3	A	502	6PL	C37-C38-C39-C40
3	B	201	6PL	C15-C16-C17-C18
3	C	502	6PL	C37-C38-C39-C40
3	D	201	6PL	C15-C16-C17-C18
3	D	202	6PL	C39-C40-C41-C42
3	B	202	6PL	C39-C40-C41-C42
3	A	501	6PL	C43-C44-C45-C46
3	C	501	6PL	C43-C44-C45-C46
3	B	201	6PL	C33-C34-C35-C36
3	D	201	6PL	C33-C34-C35-C36
3	C	502	6PL	C45-C46-C47-C48
3	B	201	6PL	O3P-C1-C2-O2
3	D	201	6PL	O3P-C1-C2-O2
3	A	502	6PL	C45-C46-C47-C48
3	B	201	6PL	C16-C17-C18-C19
3	D	201	6PL	C16-C17-C18-C19

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Mol	Chain	Res	Type	Atoms
3	B	201	6PL	C32-C33-C34-C35
3	D	201	6PL	C32-C33-C34-C35
3	D	201	6PL	C35-C36-C37-C38
3	B	201	6PL	C35-C36-C37-C38
3	B	202	6PL	C33-C34-C35-C36
3	D	202	6PL	C33-C34-C35-C36
3	B	202	6PL	C43-C44-C45-C46
3	D	202	6PL	C43-C44-C45-C46
3	B	201	6PL	O2-C2-C3-O3
3	D	202	6PL	C41-C42-C43-C44
3	B	202	6PL	C41-C42-C43-C44
3	B	202	6PL	C36-C37-C38-C39
3	D	202	6PL	C36-C37-C38-C39
3	D	201	6PL	O2-C2-C3-O3
3	C	502	6PL	C40-C41-C42-C43
3	D	201	6PL	C36-C37-C38-C39
3	A	502	6PL	C40-C41-C42-C43
3	B	201	6PL	C36-C37-C38-C39

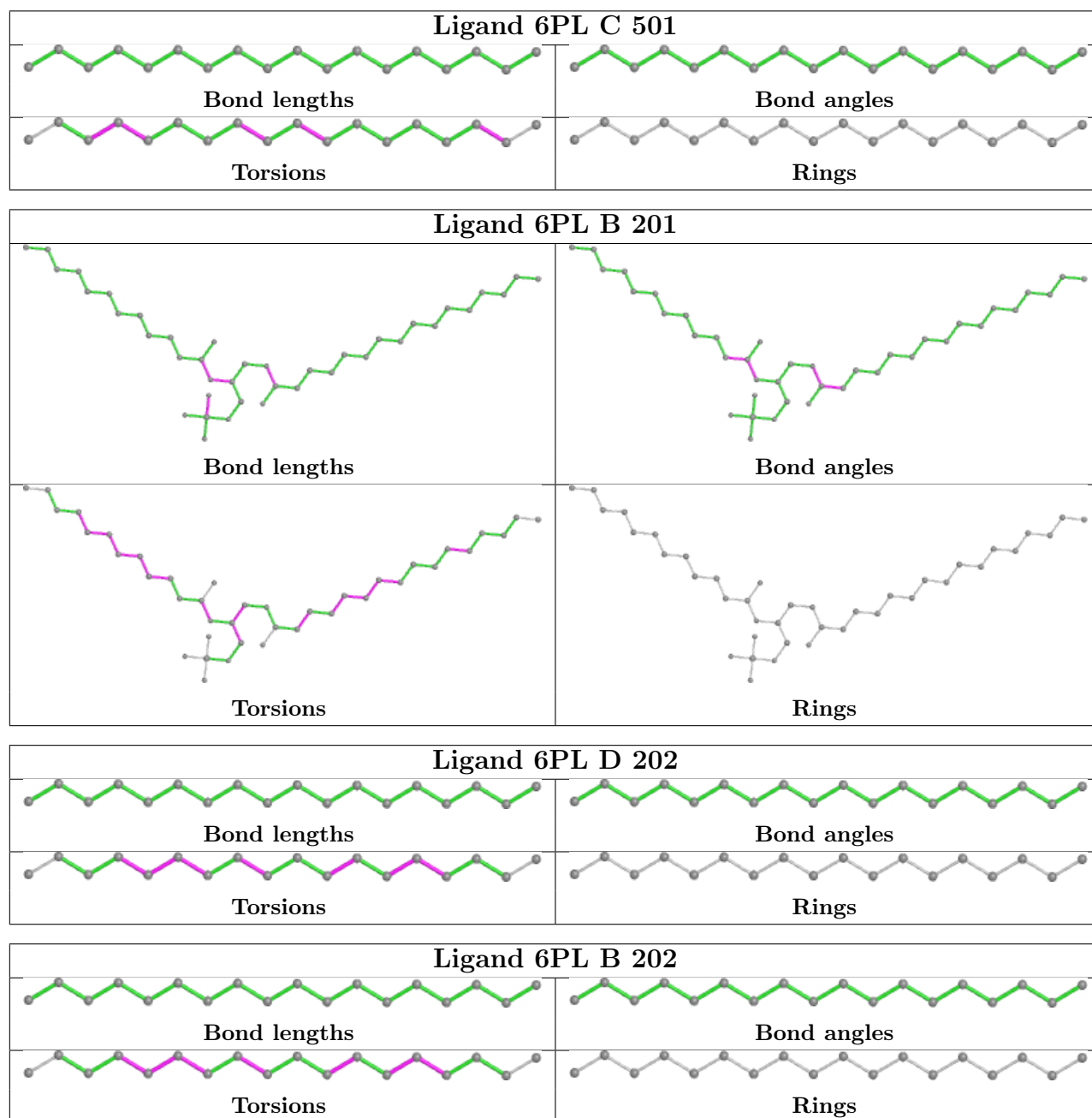
There are no ring outliers.

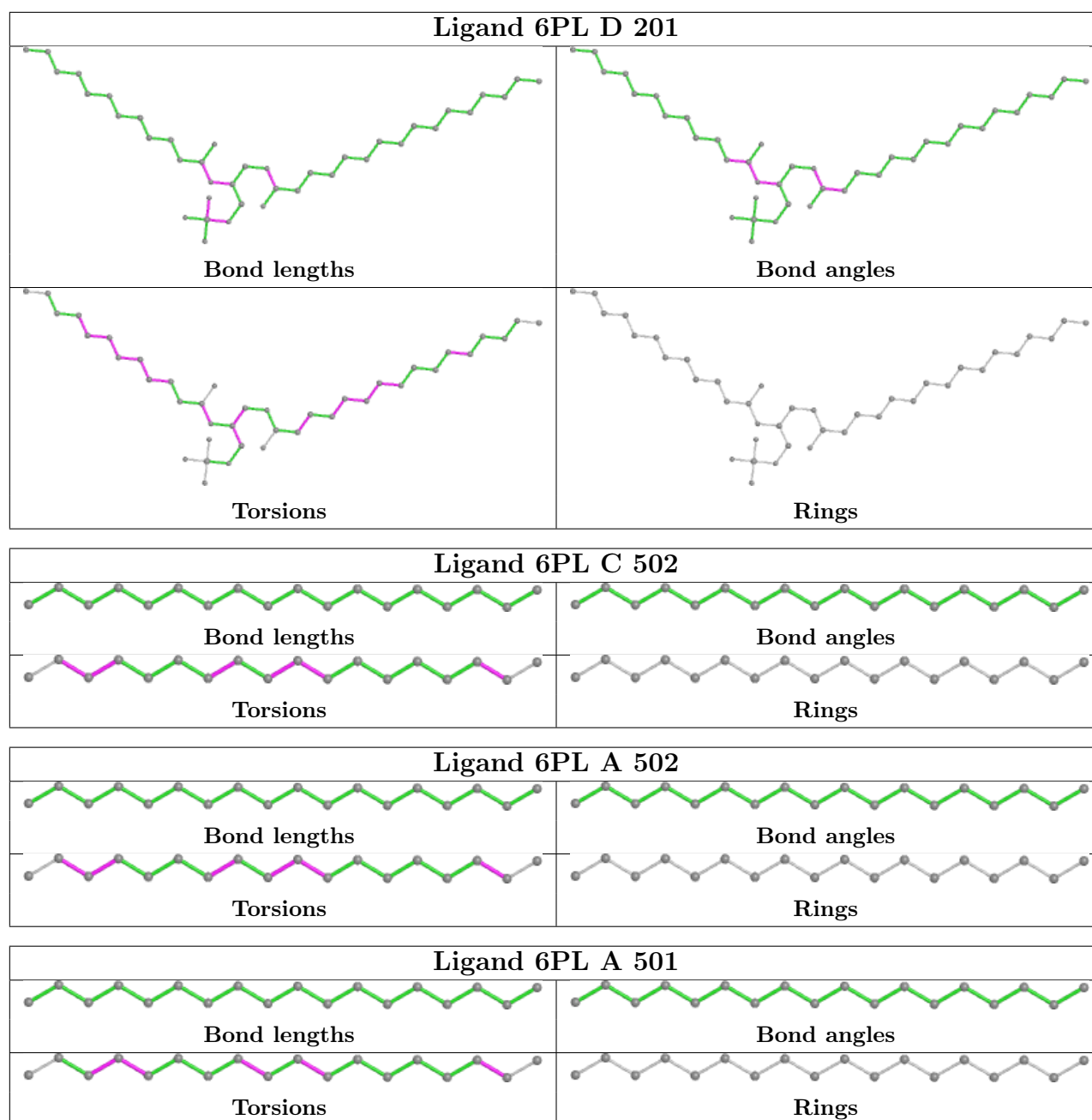
8 monomers are involved in 14 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	501	6PL	1	0
3	B	201	6PL	1	0
3	D	202	6PL	2	0
3	B	202	6PL	2	0
3	D	201	6PL	1	0
3	C	502	6PL	3	0
3	A	502	6PL	3	0
3	A	501	6PL	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 [i](#)

There are no chain breaks in this entry.