wwPDB EM Validation Summary Report

Jul 15, 2025 – 09:01 PM JST

PDB ID	:	9INE / pdb_00009ine
EMDB ID	:	EMD-60704
Title	:	Cryo-EM structure of human XPR1 in closed state in the presence of KIDINS220-1-432
Authors	:	Zuo, P.; Liang, L.; Yin, Y.
Deposited on	:	2024-07-06
Resolution	:	3.32 Å(reported)

This is a wwPDB EM Validation Summary 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:

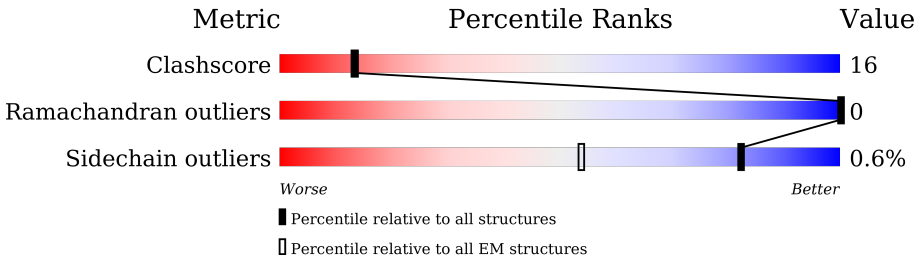
EMDB validation analysis	:	FAILED
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4-5-2 with Phenix2.0rc1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	FAILED
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.44

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
ELECTRON MICROSCOPY

The reported resolution of this entry is 3.32 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 <=5%

Mol	Chain	Length	Quality of chain
1	A	704	37% 20% 43%
1	B	704	38% 18% 43%

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 7520 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.

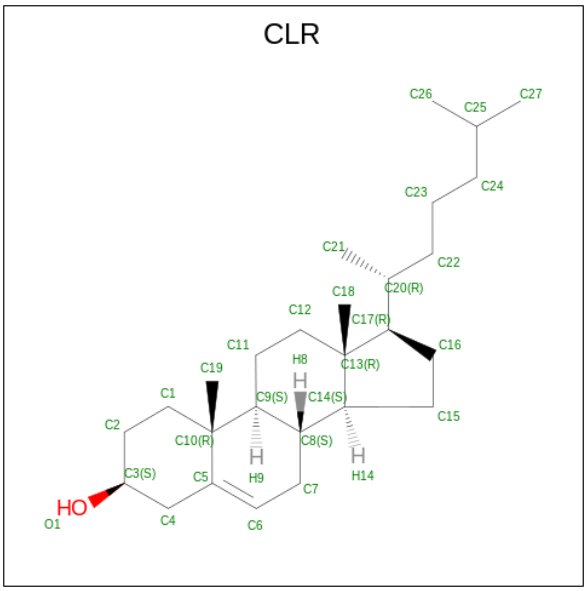
- Molecule 1 is a protein called Solute carrier family 53 member 1.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	B	401	Total	C	N	O	S	0	0
			3333	2233	535	549	16		
1	A	401	Total	C	N	O	S	0	0
			3333	2233	535	549	16		

There are 16 discrepancies between the modelled and reference sequences:

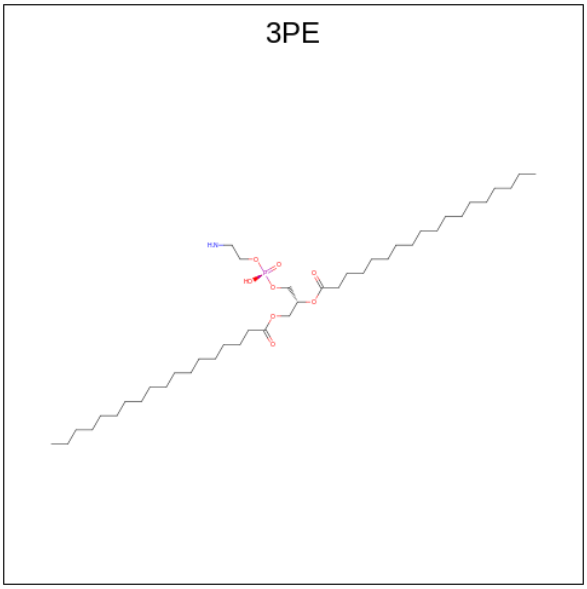
Chain	Residue	Modelled	Actual	Comment	Reference
B	697	SER	-	expression tag	UNP Q9UBH6
B	698	ARG	-	expression tag	UNP Q9UBH6
B	699	GLU	-	expression tag	UNP Q9UBH6
B	700	ASN	-	expression tag	UNP Q9UBH6
B	701	LEU	-	expression tag	UNP Q9UBH6
B	702	TYR	-	expression tag	UNP Q9UBH6
B	703	PHE	-	expression tag	UNP Q9UBH6
B	704	GLN	-	expression tag	UNP Q9UBH6
A	697	SER	-	expression tag	UNP Q9UBH6
A	698	ARG	-	expression tag	UNP Q9UBH6
A	699	GLU	-	expression tag	UNP Q9UBH6
A	700	ASN	-	expression tag	UNP Q9UBH6
A	701	LEU	-	expression tag	UNP Q9UBH6
A	702	TYR	-	expression tag	UNP Q9UBH6
A	703	PHE	-	expression tag	UNP Q9UBH6
A	704	GLN	-	expression tag	UNP Q9UBH6

- Molecule 2 is CHOLESTEROL (CCD ID: CLR) (formula: $C_{27}H_{46}O$) (labeled as "Ligand of Interest" by depositor).



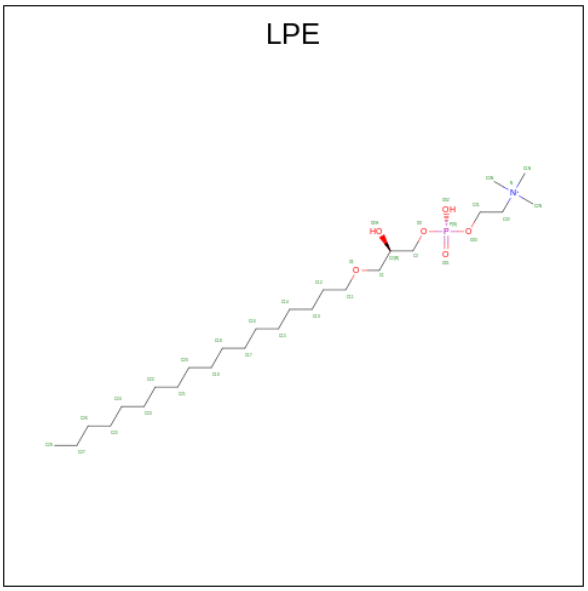
Mol	Chain	Residues	Atoms	AltConf
2	B	1	Total C O 28 27 1	0
2	B	1	Total C O 28 27 1	0
2	B	1	Total C O 28 27 1	0
2	B	1	Total C O 28 27 1	0
2	B	1	Total C O 28 27 1	0
2	B	1	Total C O 28 27 1	0
2	B	1	Total C O 28 27 1	0
2	A	1	Total C O 28 27 1	0
2	A	1	Total C O 28 27 1	0
2	A	1	Total C O 28 27 1	0
2	A	1	Total C O 28 27 1	0
2	A	1	Total C O 28 27 1	0
2	A	1	Total C O 28 27 1	0
2	A	1	Total C O 28 27 1	0

- Molecule 3 is 1,2-Distearoyl-sn-glycerophosphoethanolamine (CCD ID: 3PE) (formula: $C_{41}H_{82}NO_8P$) (labeled as "Ligand of Interest" by depositor).



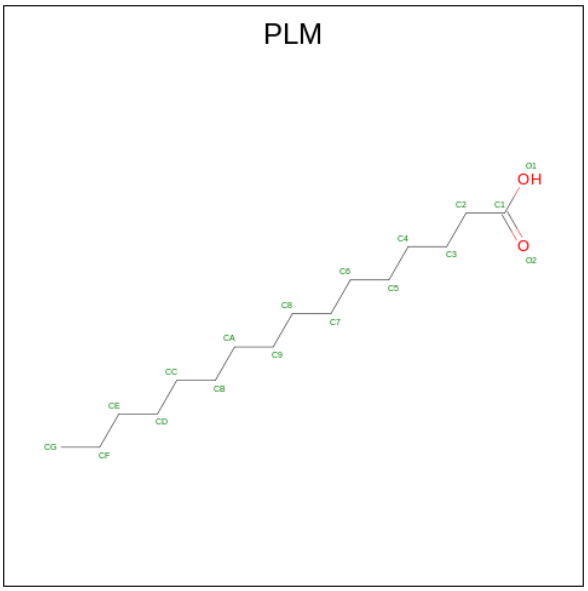
Mol	Chain	Residues	Atoms					AltConf
3	B	1	Total	C	N	O	P	0
			51	41	1	8	1	
3	B	1	Total	C	N	O	P	0
			51	41	1	8	1	
3	B	1	Total	C	N	O	P	0
			51	41	1	8	1	
3	B	1	Total	C	N	O	P	0
			51	41	1	8	1	
3	A	1	Total	C	N	O	P	0
			51	41	1	8	1	
3	A	1	Total	C	N	O	P	0
			51	41	1	8	1	

- Molecule 4 is 1-O-OCTADECYL-SN-GLYCERO-3-PHOSPHOCHOLINE (CCD ID: LPE) (formula: $C_{26}H_{57}NO_6P$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					AltConf
4	B	1	Total	C	N	O	P	0
			34	26	1	6	1	
4	A	1	Total	C	N	O	P	0
			34	26	1	6	1	

- Molecule 5 is PALMITIC ACID (CCD ID: PLM) (formula: $C_{16}H_{32}O_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			AltConf
5	B	1	Total	C	O	0
			18	16	2	

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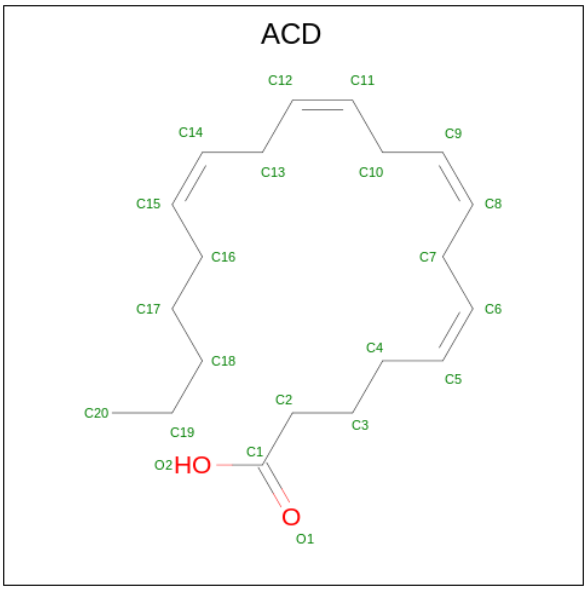
Mol	Chain	Residues	Atoms	AltConf
5	A	1	Total C O 18 16 2	0

- Molecule 6 is ARACHIDONIC ACID (CCD ID: ACD) (formula: $C_{20}H_{32}O_2$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	AltConf
6	B	1	Total C O 22 20 2	0
6	A	1	Total C O 22 20 2	0

- Molecule 7 is water.

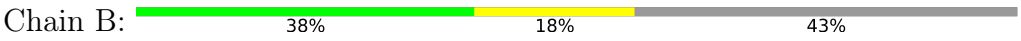
Mol	Chain	Residues	Atoms	AltConf
7	B	4	Total O 4 4	0
7	A	4	Total O 4 4	0

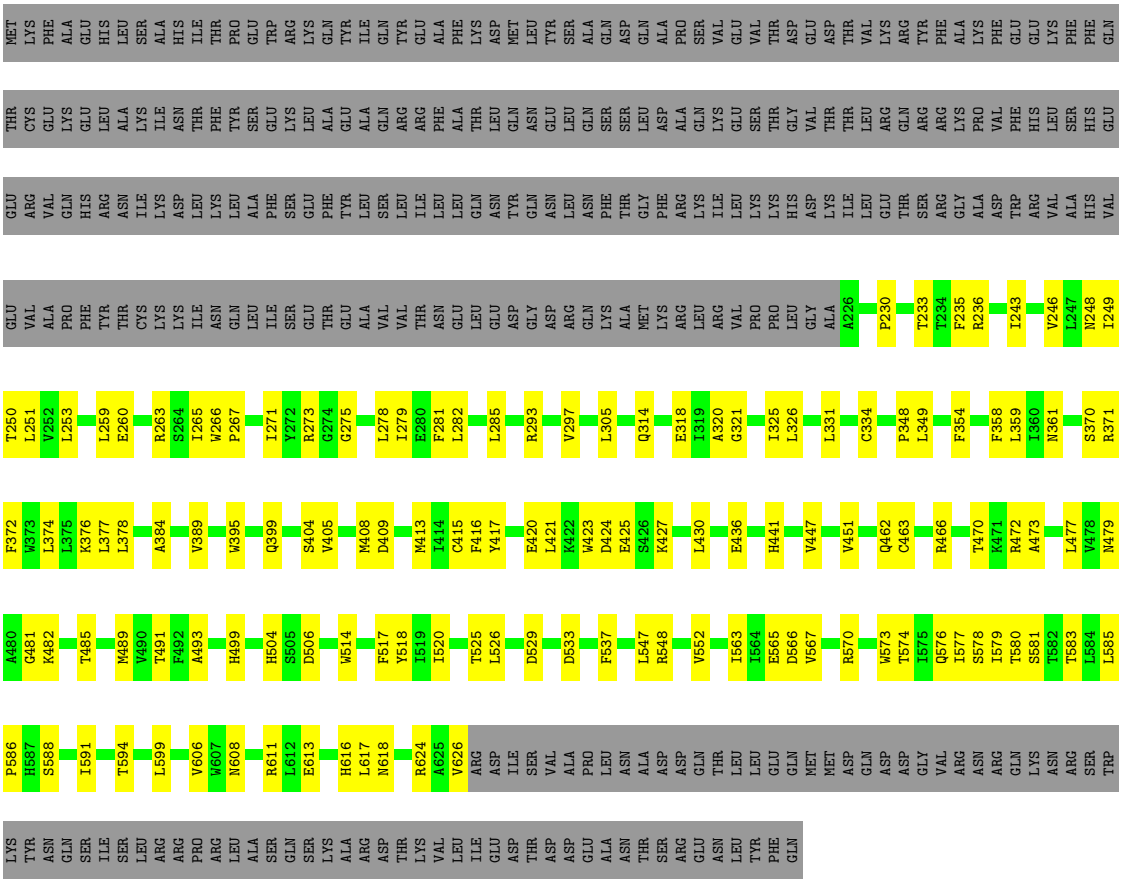
3 Residue-property plots (i)

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: Solute carrier family 53 member 1

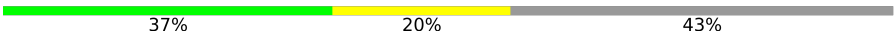
Chain B:

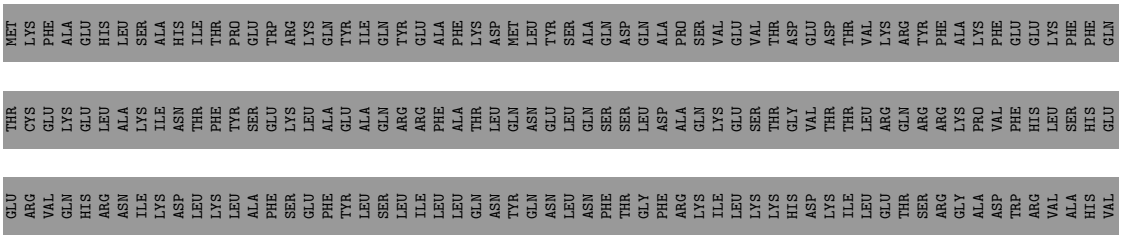


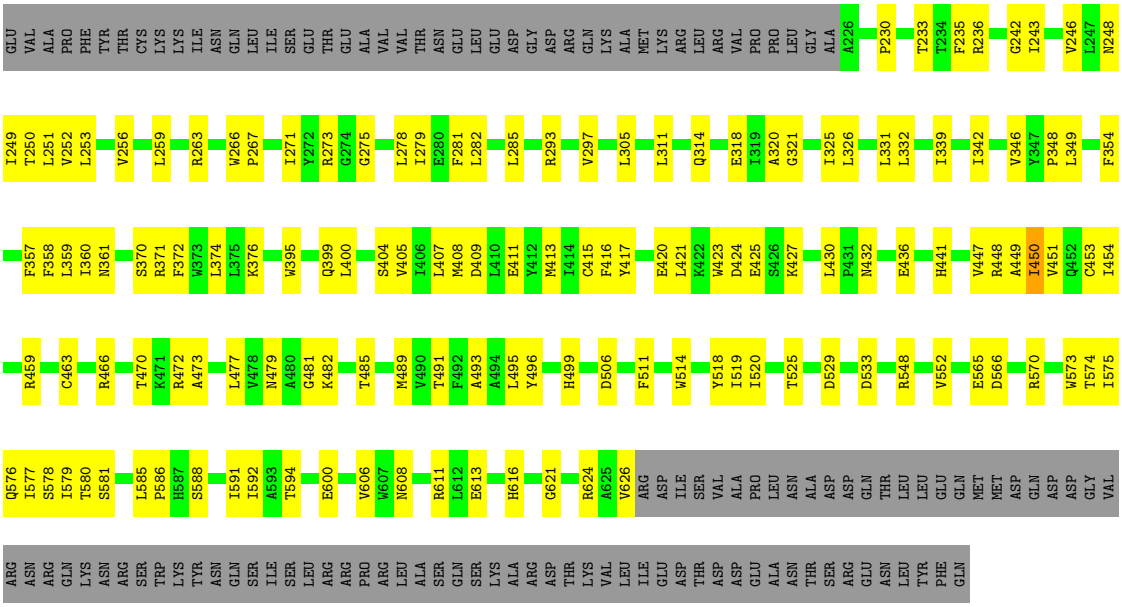


- Molecule 1: Solute carrier family 53 member 1

Chain A:






GLU VAL ALA PRO PHE TYR THR CYS LYS LYS ILE ASN GLN LEU ILE SER GLU THR GLU ALA VAL VAL THR ASN GLU LEU GLU ASP GLY ASP ARG GLN LYS ALA MET LYS ARG LEU ARG VAL PRO PRO LEU GLY ALA A226 P230 T233 T234 F235 R236 G242 I243 V246 L247 N248
I249 T250 L251 V252 L253 V256 L259 R263 W266 P267 I271 Y272 R273 G274 G275 L278 I279 E280 F281 L282 L285 R293 V297 L305 L311 Q314 E318 I319 A320 G321 I325 L326 L331 L332 I339 I342 V346 Y347 P348 L349 F354
F357 F358 L359 I360 N361 S370 R371 F372 W373 L374 L375 K376 W395 Q399 L400 S404 V405 I406 L407 M408 D409 L410 E411 Y412 M413 I414 C415 F416 Y417 E420 L421 K422 W423 D424 E425 S426 K427 L430 P431 N432 E436 H441 V447 R448 A449 I450 V451 Q452 C453 I454
R459 C463 R466 T470 K471 R472 A473 L477 V478 N479 A480 G481 K482 T485 M489 V490 T491 F492 A493 A494 L495 Y496 H499 D506 F511 W514 Y518 I519 I520 T525 D529 D533 R548 V552 E565 D566 R570 W573 T574 I575
Q576 I577 S578 I579 T580 S581 L585 P586 H587 S588 I591 I592 A593 T594 E600 V606 W607 N608 R611 L612 E613 H616 G621 R624 A625 V626 ARG ASP ILE SER VAL ALA PRO LEU ASN ALA ASP ASP GLN THR LEU LEU GLU GLN MET MET ASP GLN ASP ASP GLY VAL
ARG ASN ARG GLN LYS ASN ARG SER TRP LYS TYR ASN GLN SER ILE SER LEU ARG ARG PRO ARG LEU ALA SER GLN SER LYS ALA ARG ASP THR LYS VAL LEU ILE GLU ASP THR ASP ASP GLU ALA ASN THR SER ARG GLU ASN LEU TYR PHE GLN

4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	187463	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	PHASE FLIPPING AND AMPLITUDE CORRECTION	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/Å^2$)	50	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2000	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, PLM, 3PE, ACD, LPE

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	0.17	0/3444	0.35	0/4688
1	B	0.16	0/3444	0.34	0/4688
All	All	0.17	0/6888	0.35	0/9376

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	3333	0	3317	118	0
1	B	3333	0	3317	104	0
2	A	196	0	322	18	0
2	B	196	0	322	19	0
3	A	102	0	164	10	0
3	B	204	0	328	23	0
4	A	34	0	56	2	0
4	B	34	0	56	2	0
5	A	18	0	31	3	0
5	B	18	0	31	3	0
6	A	22	0	31	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	B	22	0	31	0	0
7	A	4	0	0	3	0
7	B	4	0	0	3	0
All	All	7520	0	8006	247	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 16.

The worst 5 of 247 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:566:ASP:O	1:A:570:ARG:HB2	1.82	0.80
1:A:405:VAL:HG22	1:A:577:ILE:HG12	1.63	0.79
1:B:566:ASP:O	1:B:570:ARG:HB2	1.87	0.75
1:B:405:VAL:HG22	1:B:577:ILE:HG12	1.68	0.74
1:B:466:ARG:CD	7:B:901:HOH:O	2.34	0.74

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	399/704 (57%)	382 (96%)	17 (4%)	0	100	100
1	B	399/704 (57%)	381 (96%)	18 (4%)	0	100	100
All	All	798/1408 (57%)	763 (96%)	35 (4%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

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

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	A	355/629 (56%)	353 (99%)	2 (1%)	84 90
1	B	355/629 (56%)	353 (99%)	2 (1%)	84 90
All	All	710/1258 (56%)	706 (99%)	4 (1%)	82 90

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	599	LEU
1	B	618	ASN
1	A	432	ASN
1	A	450	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 7 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	314	GLN
1	A	452	GLN
1	A	614	ASN
1	A	499	HIS
1	B	499	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 oligosaccharides in this entry.

5.6 Ligand geometry (i)

26 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	CLR	B	808	-	31,31,31	0.36	0	48,48,48	0.60	0
3	3PE	B	802	-	50,50,50	0.51	0	53,55,55	0.59	2 (3%)
5	PLM	B	811	-	17,17,17	0.91	1 (5%)	17,17,17	0.75	2 (11%)
2	CLR	B	809	-	31,31,31	0.38	0	48,48,48	0.62	0
2	CLR	B	801	-	31,31,31	0.37	0	48,48,48	0.58	0
6	ACD	A	812	-	21,21,21	0.57	0	21,21,21	0.56	0
2	CLR	A	803	-	31,31,31	0.42	0	48,48,48	0.61	0
2	CLR	A	807	-	31,31,31	0.36	0	48,48,48	0.60	0
2	CLR	A	808	-	31,31,31	0.39	0	48,48,48	0.62	0
2	CLR	A	811	-	31,31,31	0.38	0	48,48,48	0.49	0
3	3PE	A	802	-	50,50,50	0.50	0	53,55,55	0.60	2 (3%)
3	3PE	B	807	-	50,50,50	0.51	0	53,55,55	0.55	1 (1%)
6	ACD	B	813	-	21,21,21	0.57	0	21,21,21	0.57	0
3	3PE	A	806	-	50,50,50	0.51	0	53,55,55	0.55	1 (1%)
4	LPE	B	810	-	33,33,33	0.90	0	37,39,39	0.91	2 (5%)
2	CLR	A	805	-	31,31,31	0.40	0	48,48,48	0.70	1 (2%)
3	3PE	B	814	-	50,50,50	0.51	0	53,55,55	0.54	1 (1%)
2	CLR	A	801	-	31,31,31	0.38	0	48,48,48	0.58	0
4	LPE	A	809	-	33,33,33	0.90	0	37,39,39	0.91	2 (5%)
2	CLR	B	806	-	31,31,31	0.39	0	48,48,48	0.70	0
5	PLM	A	810	-	17,17,17	0.90	1 (5%)	17,17,17	0.75	2 (11%)
2	CLR	A	804	-	31,31,31	0.35	0	48,48,48	0.50	0
2	CLR	B	805	-	31,31,31	0.36	0	48,48,48	0.49	0
2	CLR	B	812	-	31,31,31	0.38	0	48,48,48	0.49	0
3	3PE	B	803	-	50,50,50	0.51	0	53,55,55	0.54	1 (1%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
2	CLR	B	804	-	31,31,31	0.41	0	48,48,48	0.61	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
2	CLR	B	808	-	-	8/10/68/68	0/4/4/4
3	3PE	B	802	-	-	24/54/54/54	-
5	PLM	B	811	-	-	8/15/15/15	-
2	CLR	B	809	-	-	8/10/68/68	0/4/4/4
2	CLR	B	801	-	-	4/10/68/68	0/4/4/4
6	ACD	A	812	-	-	3/19/19/19	-
2	CLR	A	803	-	-	2/10/68/68	0/4/4/4
2	CLR	A	807	-	-	8/10/68/68	0/4/4/4
2	CLR	A	808	-	-	8/10/68/68	0/4/4/4
2	CLR	A	811	-	-	8/10/68/68	0/4/4/4
3	3PE	A	802	-	-	24/54/54/54	-
3	3PE	B	807	-	-	25/54/54/54	-
6	ACD	B	813	-	-	5/19/19/19	-
3	3PE	A	806	-	-	24/54/54/54	-
4	LPE	B	810	-	-	16/34/34/34	-
2	CLR	A	805	-	-	7/10/68/68	0/4/4/4
3	3PE	B	814	-	-	25/54/54/54	-
2	CLR	A	801	-	-	4/10/68/68	0/4/4/4
4	LPE	A	809	-	-	16/34/34/34	-
2	CLR	B	806	-	-	7/10/68/68	0/4/4/4
5	PLM	A	810	-	-	8/15/15/15	-
2	CLR	A	804	-	-	9/10/68/68	0/4/4/4
2	CLR	B	805	-	-	9/10/68/68	0/4/4/4
2	CLR	B	812	-	-	8/10/68/68	0/4/4/4
3	3PE	B	803	-	-	24/54/54/54	-
2	CLR	B	804	-	-	2/10/68/68	0/4/4/4

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	811	PLM	C2-C1	2.91	1.57	1.50
5	A	810	PLM	C2-C1	2.86	1.57	1.50

The worst 5 of 17 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	A	809	LPE	C2N-N-C1N	3.89	118.98	108.97
4	B	810	LPE	C2N-N-C1N	3.88	118.95	108.97
3	B	814	3PE	O12-P-O14	2.35	123.87	112.24
3	A	806	3PE	O12-P-O14	2.35	123.86	112.24
3	B	803	3PE	O12-P-O14	2.35	123.85	112.24

There are no chirality outliers.

5 of 294 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	802	3PE	C1-O11-P-O14
3	B	802	3PE	C11-O13-P-O12
3	B	802	3PE	C12-C11-O13-P
3	B	802	3PE	O13-C11-C12-N
3	B	802	3PE	O22-C21-O21-C2

There are no ring outliers.

24 monomers are involved in 76 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	808	CLR	3	0
3	B	802	3PE	7	0
5	B	811	PLM	3	0
2	B	809	CLR	5	0
2	B	801	CLR	3	0
2	A	803	CLR	2	0
2	A	807	CLR	4	0
2	A	808	CLR	2	0
2	A	811	CLR	2	0
3	A	802	3PE	7	0
3	B	807	3PE	3	0
3	A	806	3PE	3	0
4	B	810	LPE	2	0
2	A	805	CLR	2	0
3	B	814	3PE	6	0
2	A	801	CLR	2	0

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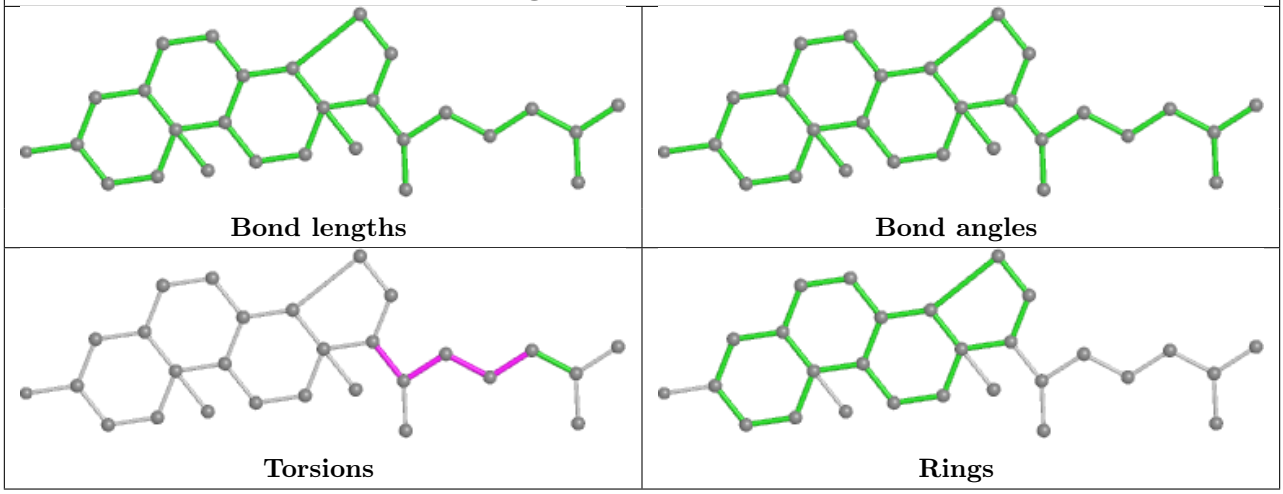
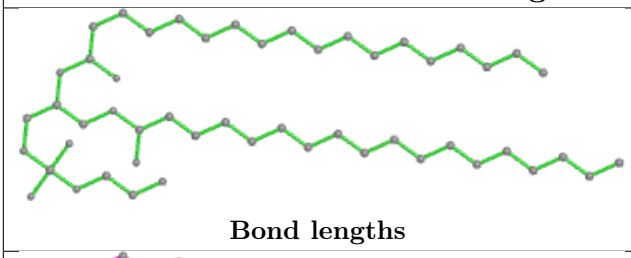
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	809	LPE	2	0
2	B	806	CLR	1	0
5	A	810	PLM	3	0
2	A	804	CLR	4	0
2	B	805	CLR	4	0
2	B	812	CLR	1	0
3	B	803	3PE	7	0
2	B	804	CLR	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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 CLR B 808



Ligand 3PE B 802



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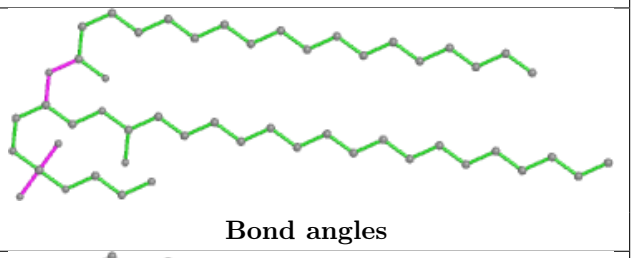
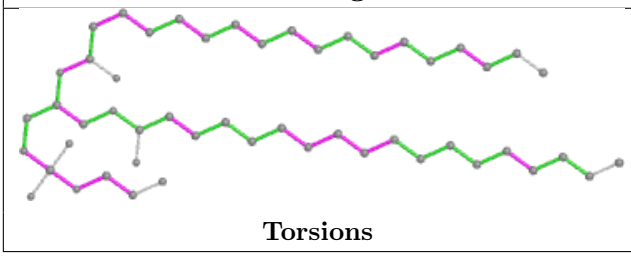
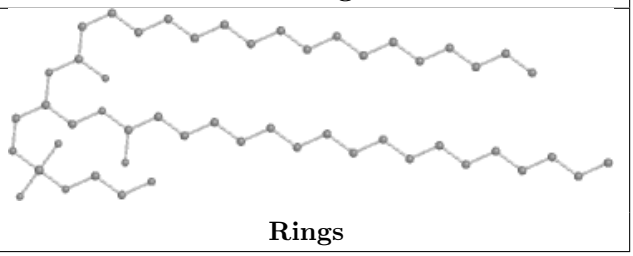


Bond angles

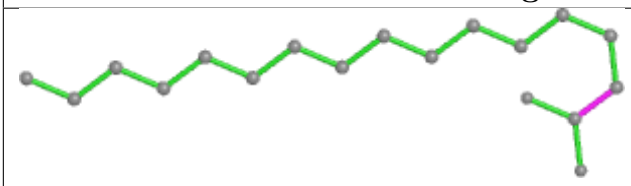


Torsions



Rings

Ligand PLM B 811



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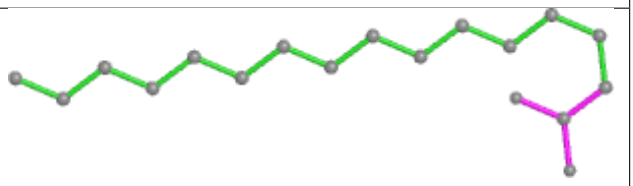
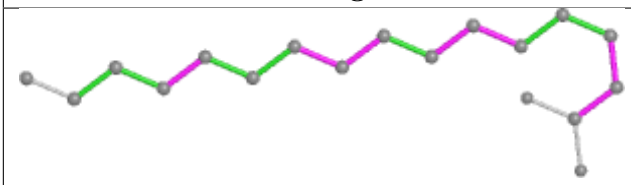


Bond angles



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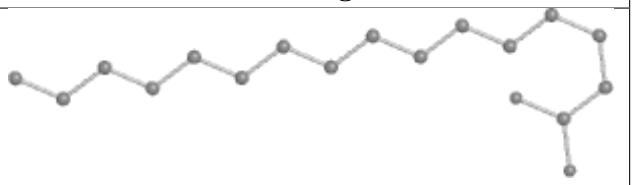
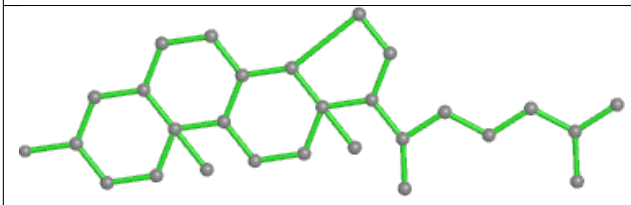


Rings

Ligand CLR B 809



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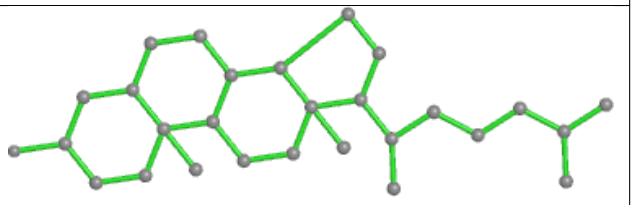

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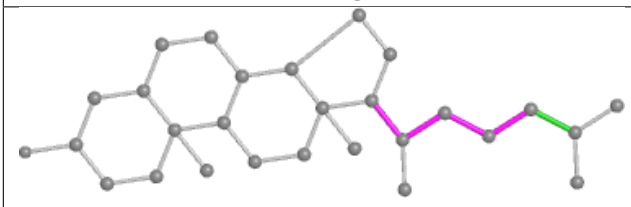
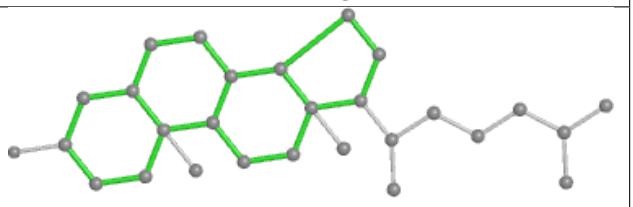


Torsions



Rings

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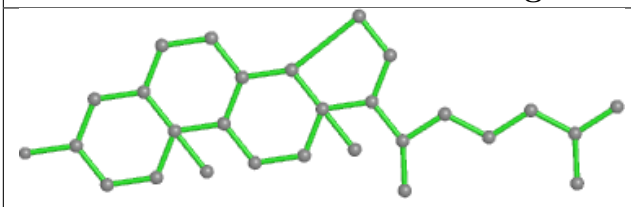

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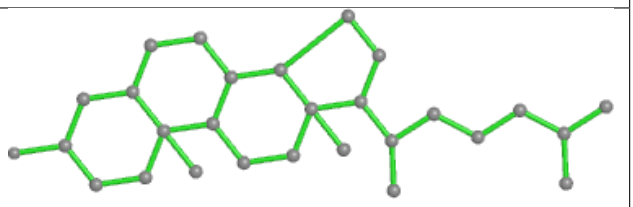

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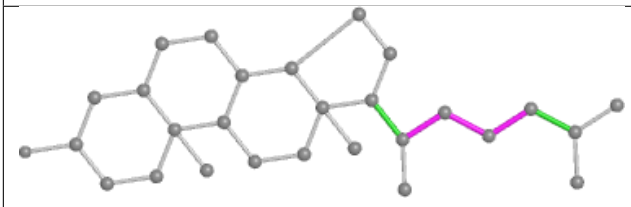

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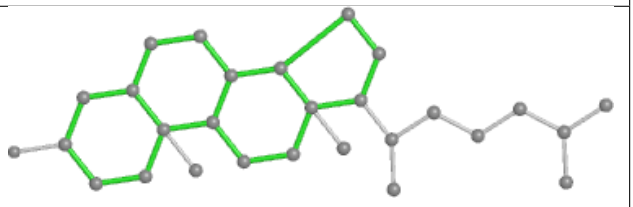
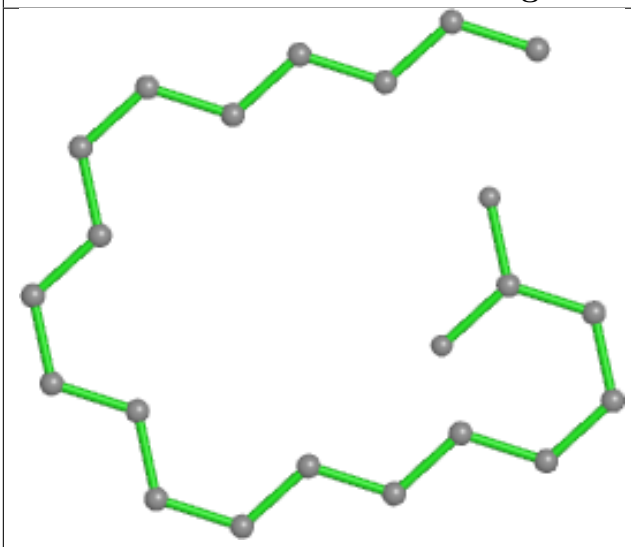


Rings

Ligand ACD A 812



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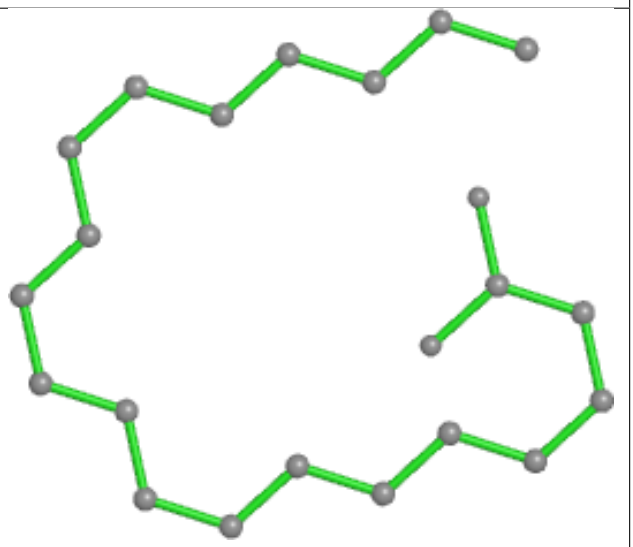

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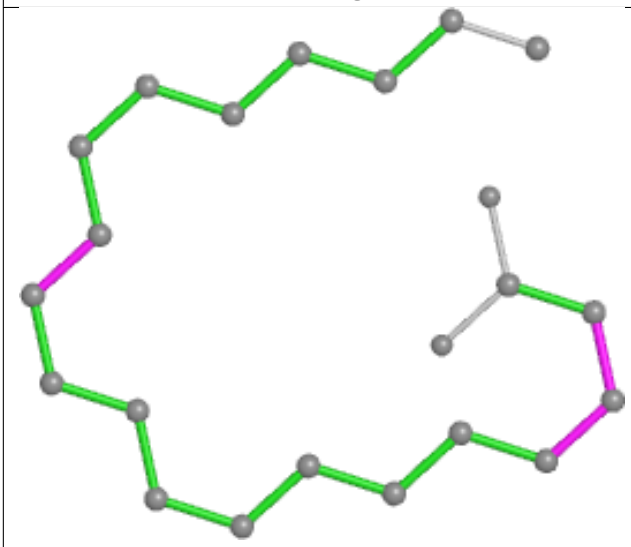

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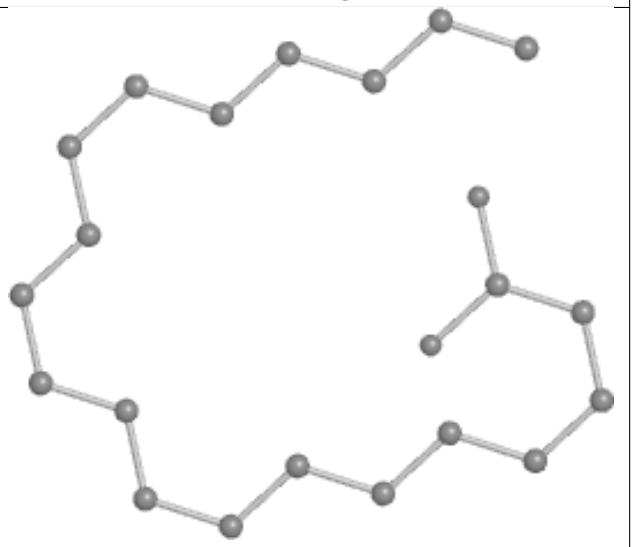
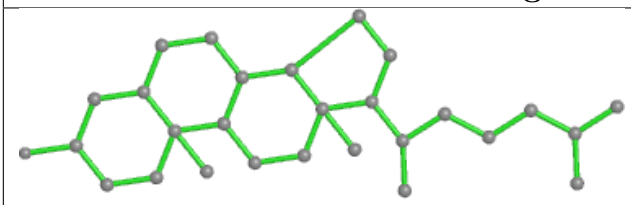


Rings

Ligand CLR A 803



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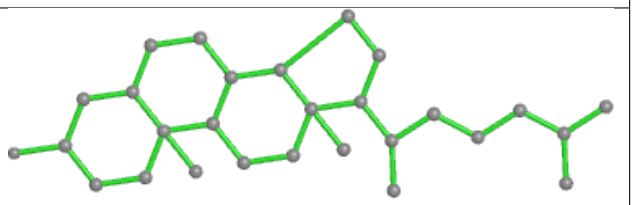

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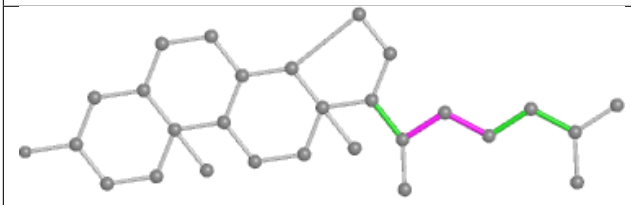

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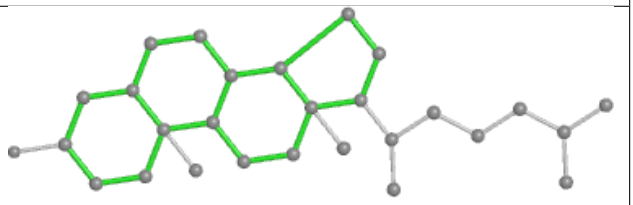
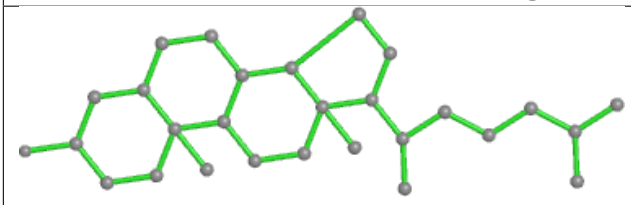


Rings

Ligand CLR A 807



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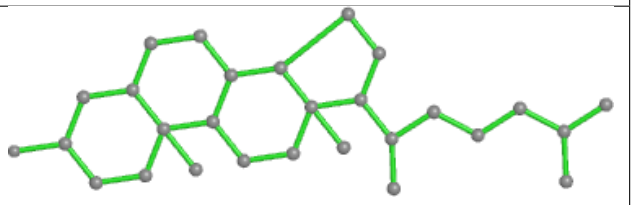

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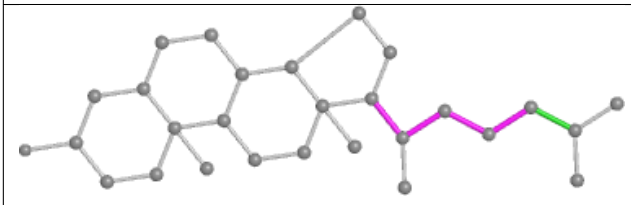

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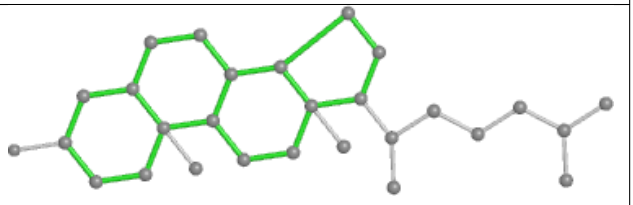
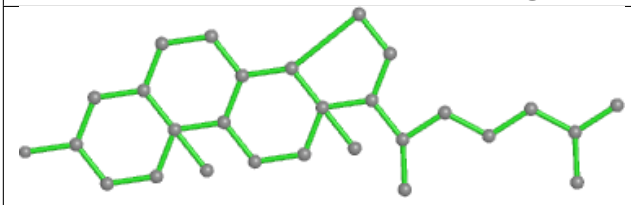


Rings

Ligand CLR A 808



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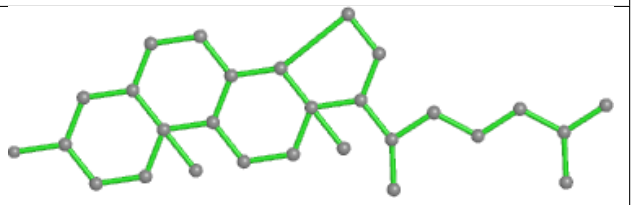

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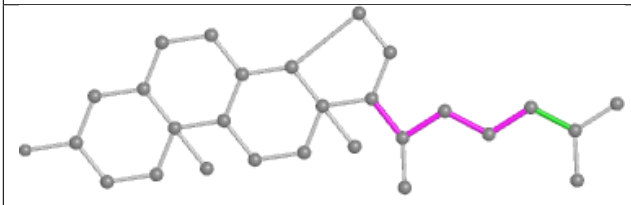

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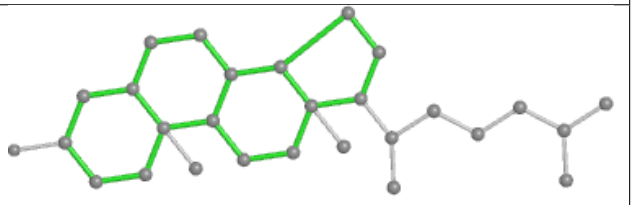
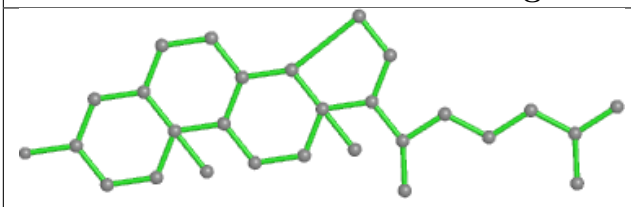


Rings

Ligand CLR A 811



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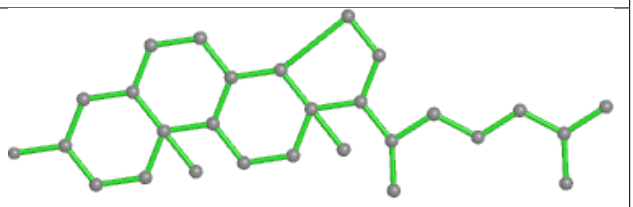

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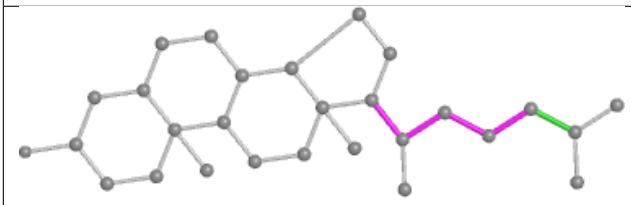

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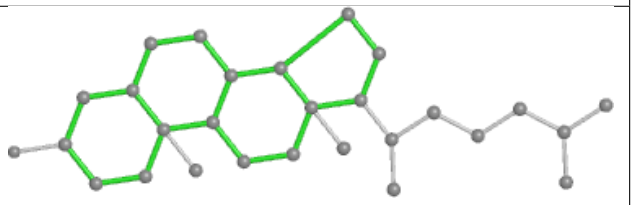
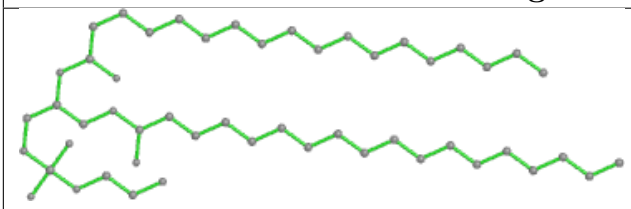


Rings

Ligand 3PE A 802



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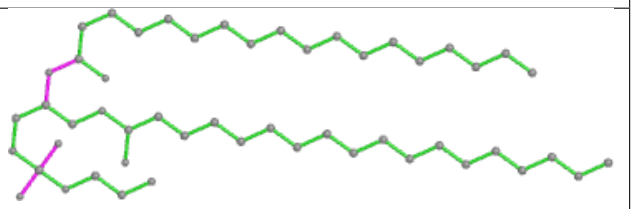

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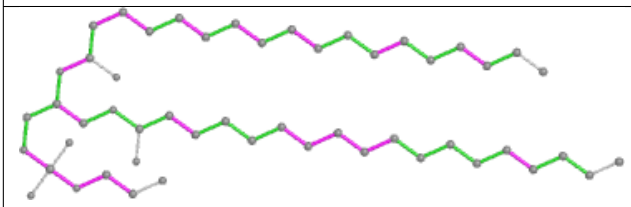

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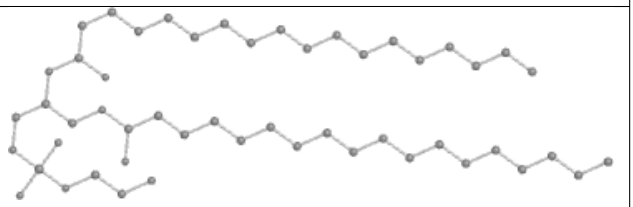
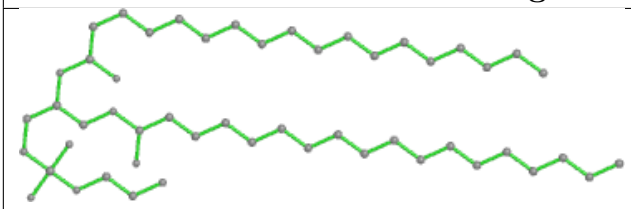


Rings

Ligand 3PE B 807



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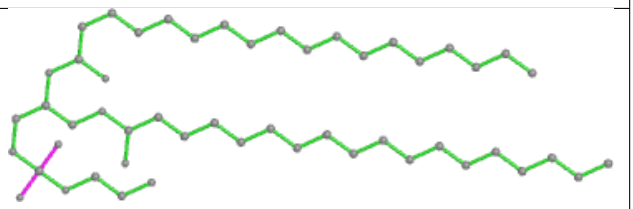
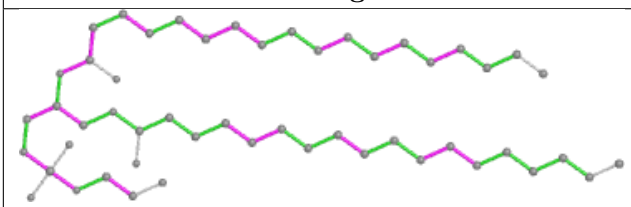


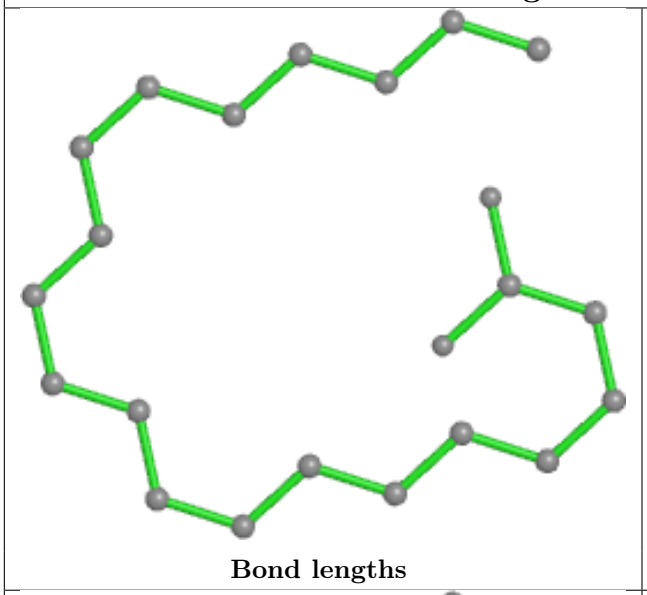
Bond angles



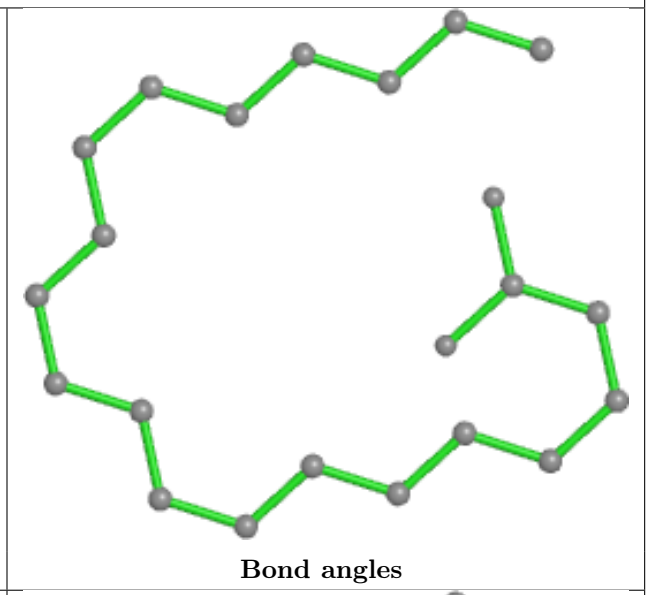
Torsions

Rings

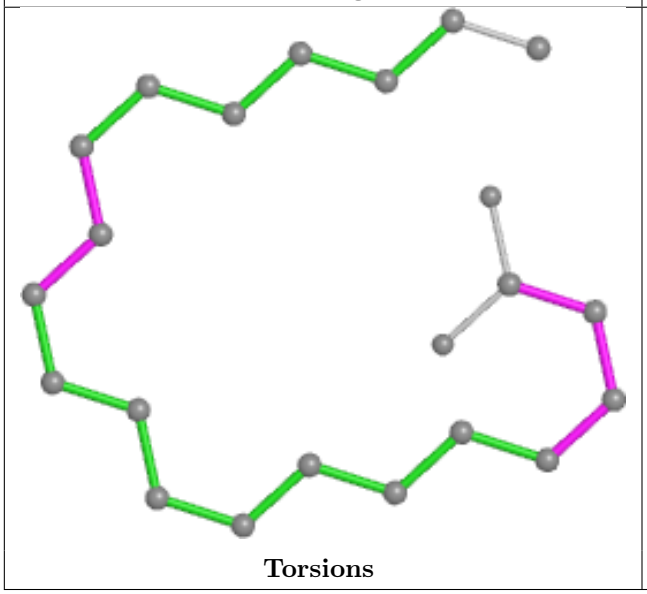
Ligand ACD B 813



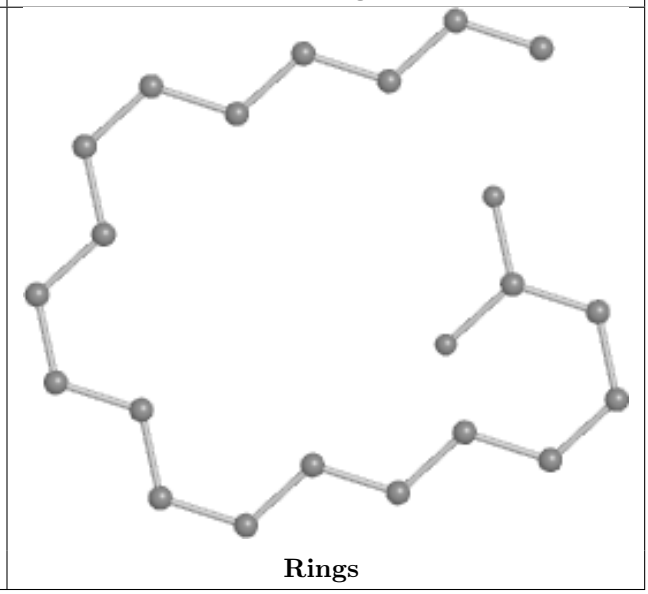
Bond lengths



Bond angles

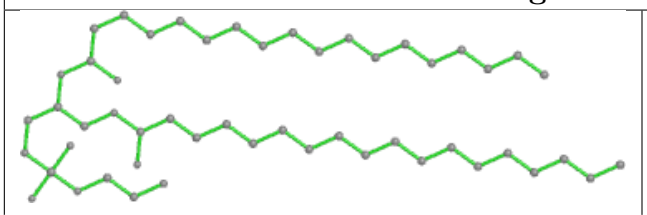


Torsions

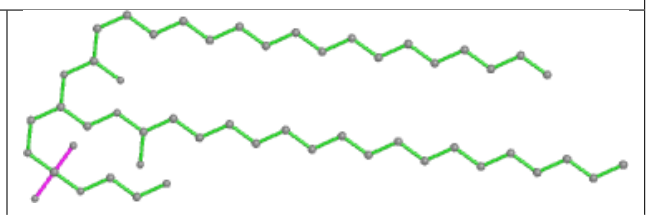


Rings

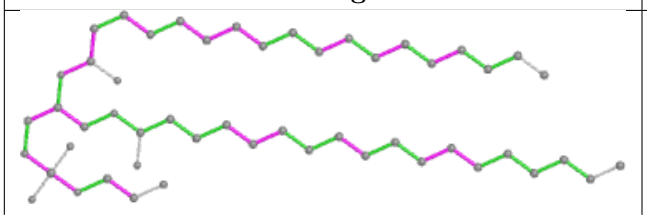
Ligand 3PE A 806



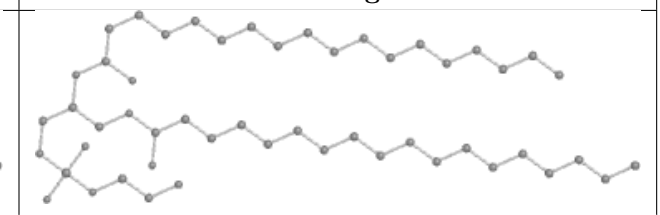
Bond lengths



Bond angles

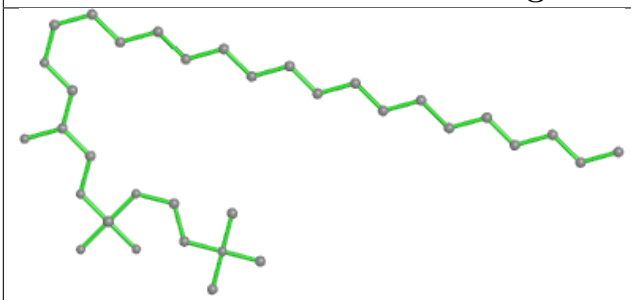


Torsions



Rings

Ligand LPE B 810



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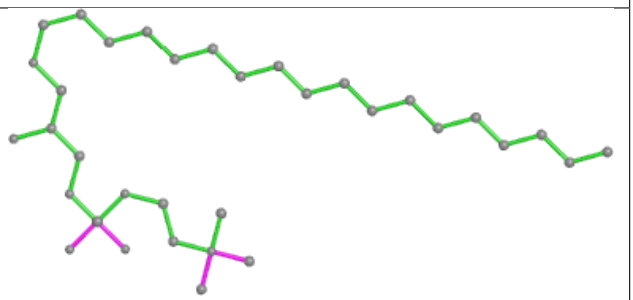
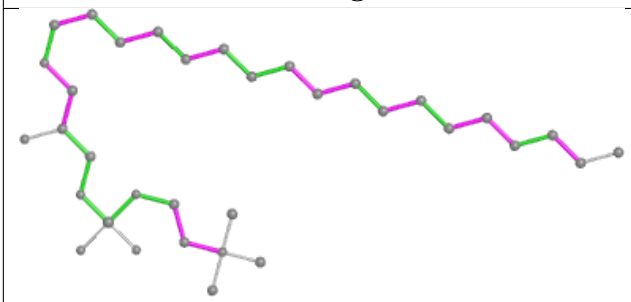
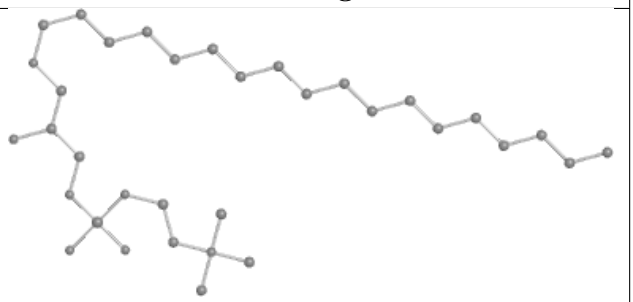


Bond angles

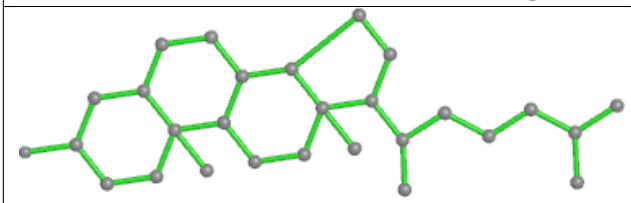


Torsions



Rings

Ligand CLR A 805



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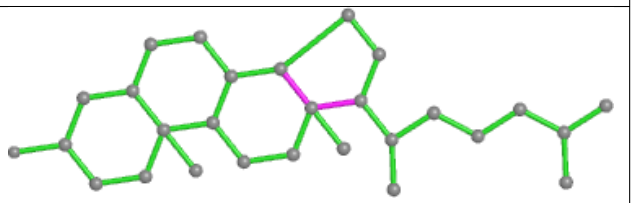
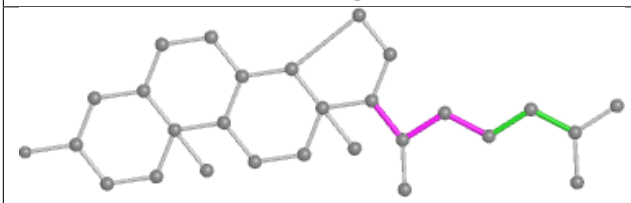


Bond angles



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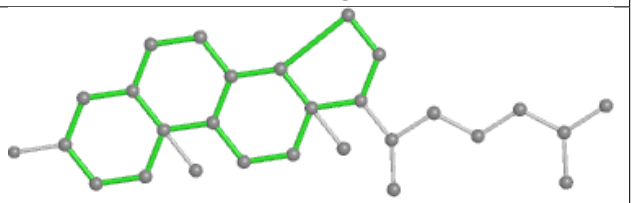
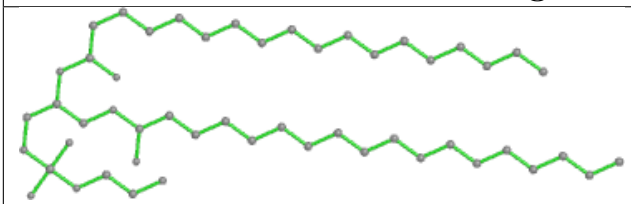
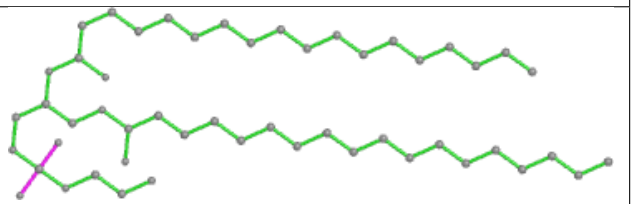


Rings

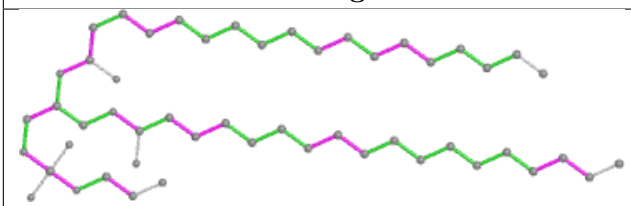
Ligand 3PE B 814



Bond lengths



Bond angles



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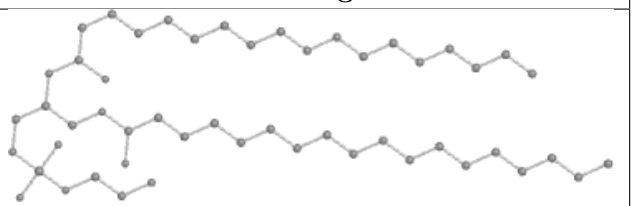
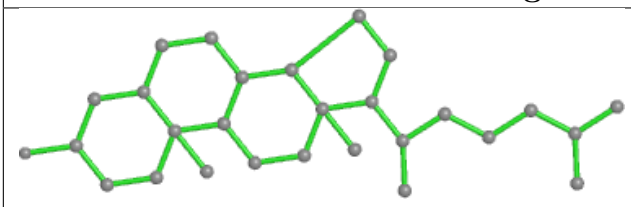


Rings

Ligand CLR A 801



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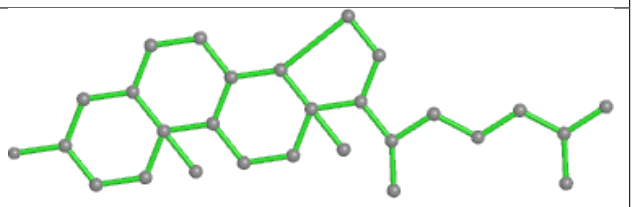
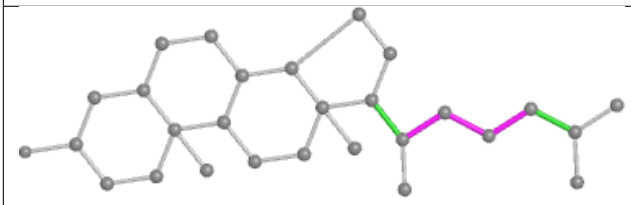
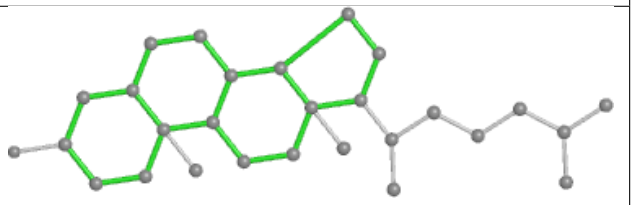


Bond angles

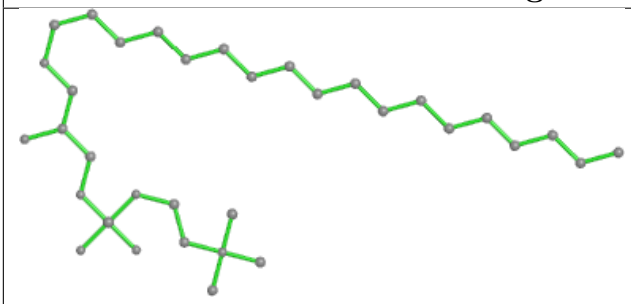


Torsions



Rings

Ligand LPE A 809



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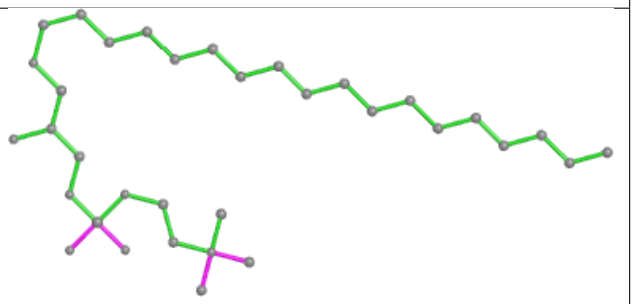
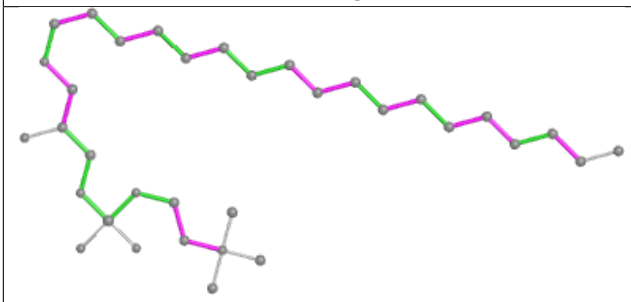
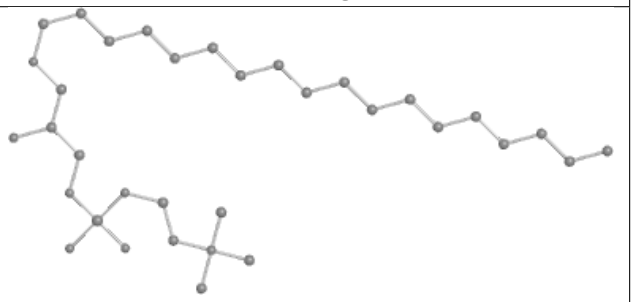


Bond angles

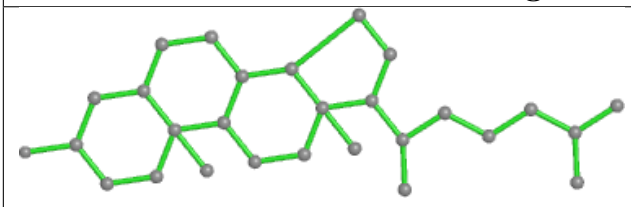


Torsions

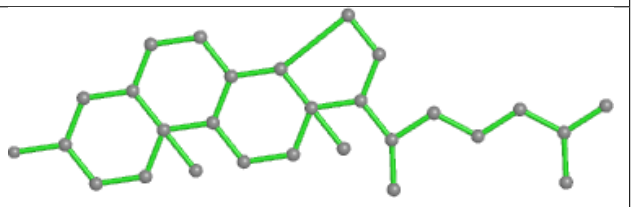


Rings

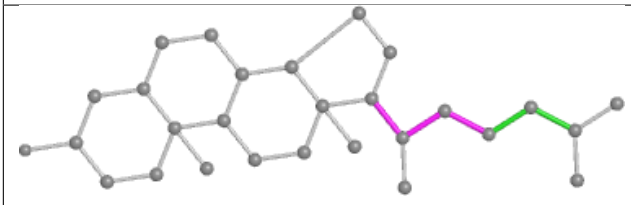
Ligand CLR B 806



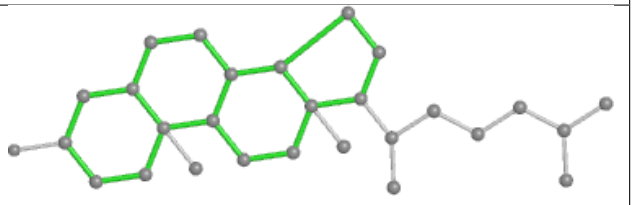
Bond lengths



Bond angles

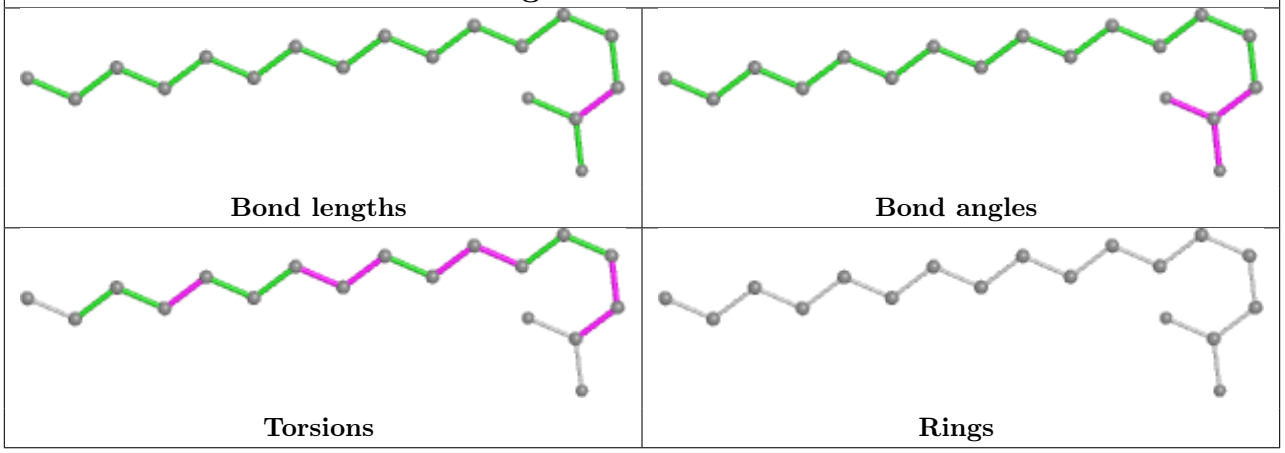


Torsions

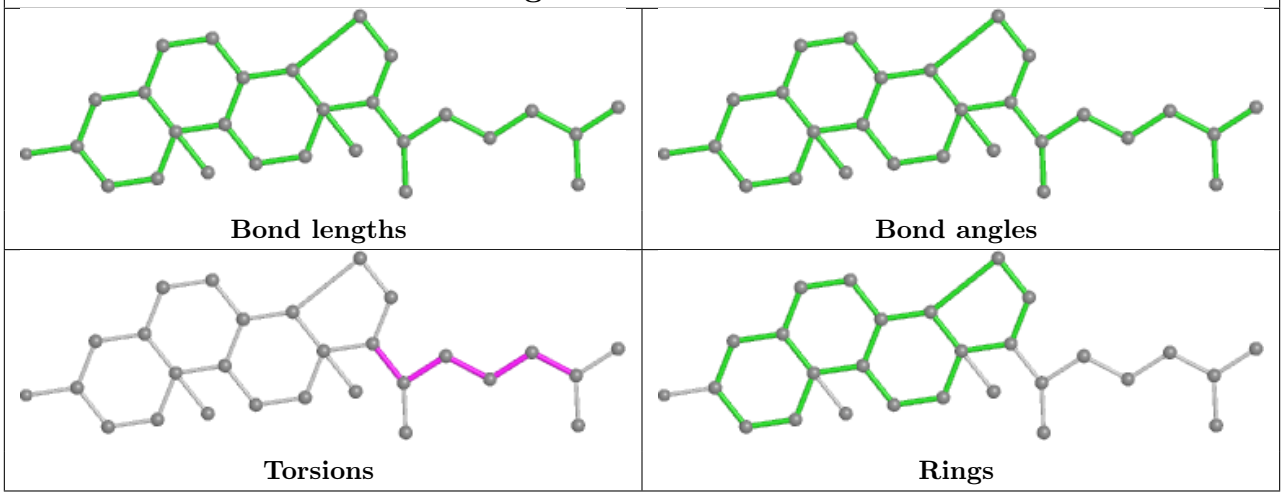


Rings

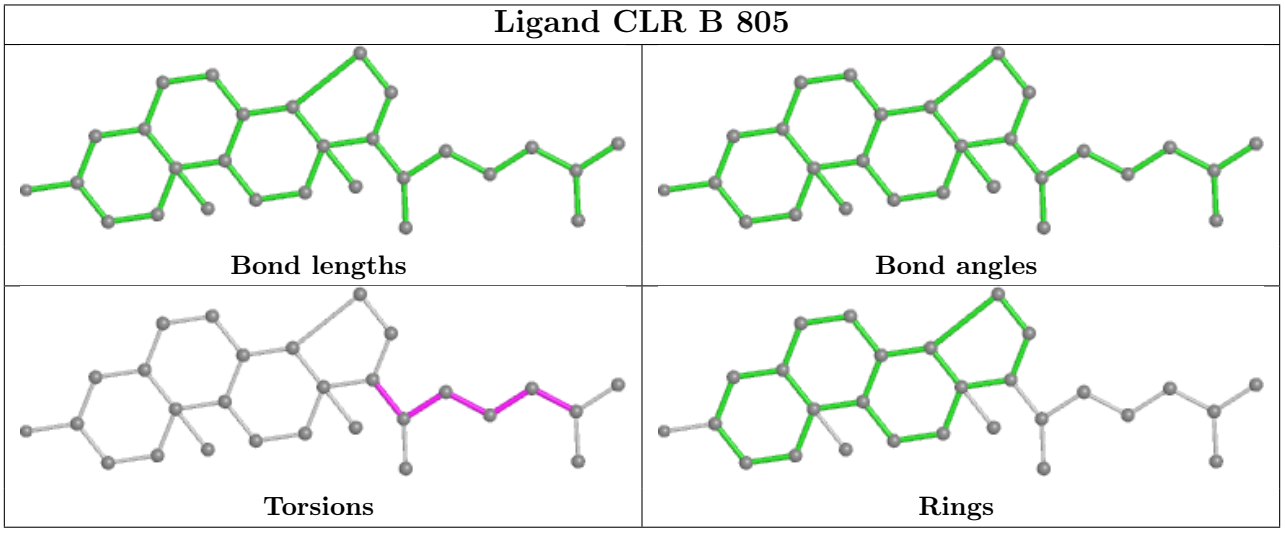
Ligand PLM A 810



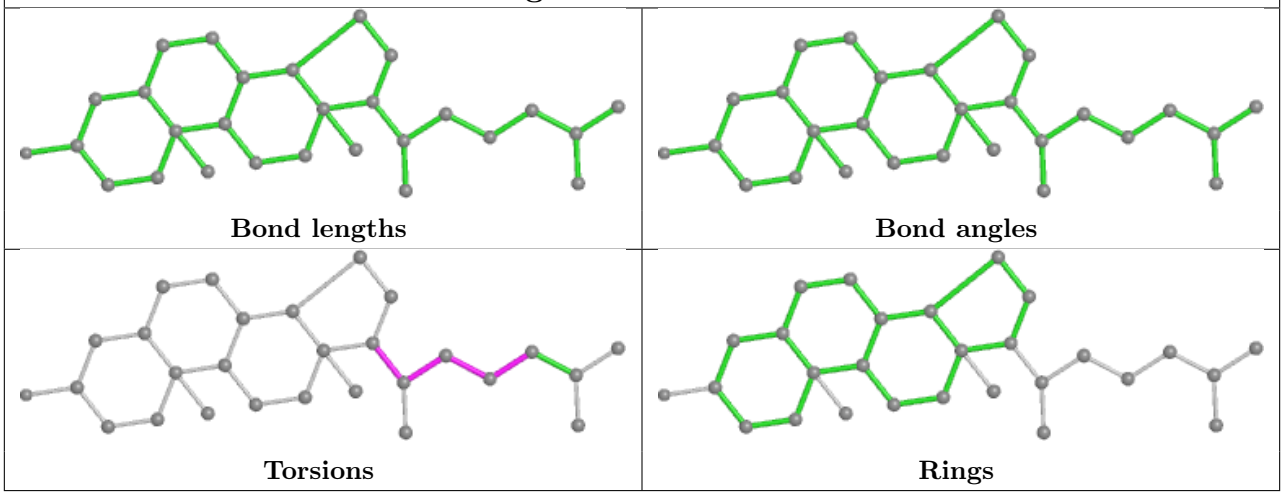
Ligand CLR A 804



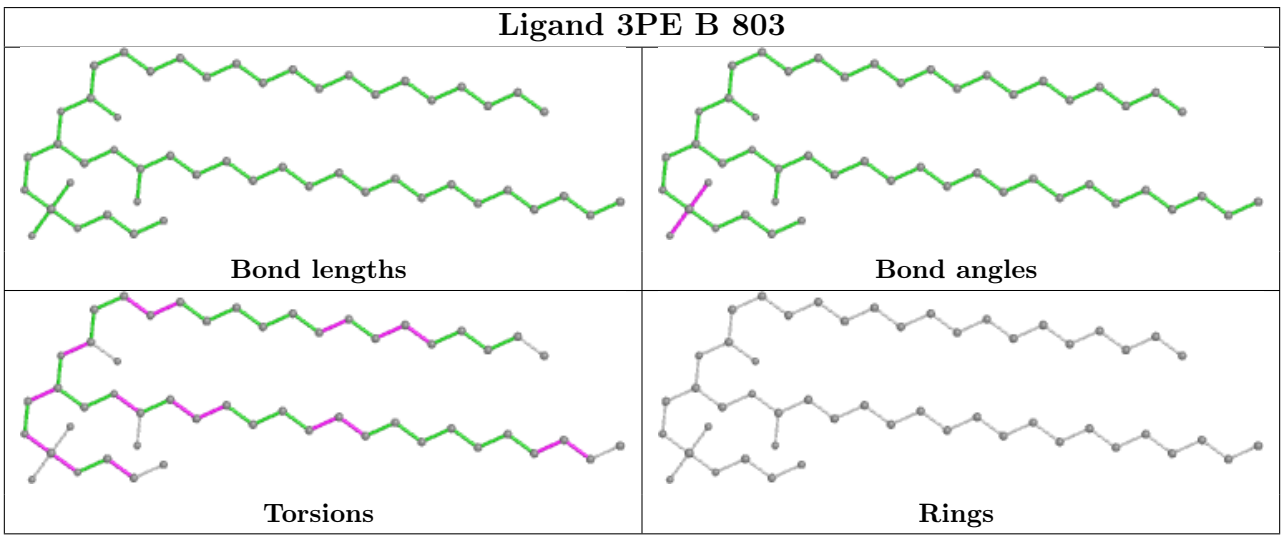
Ligand CLR B 805



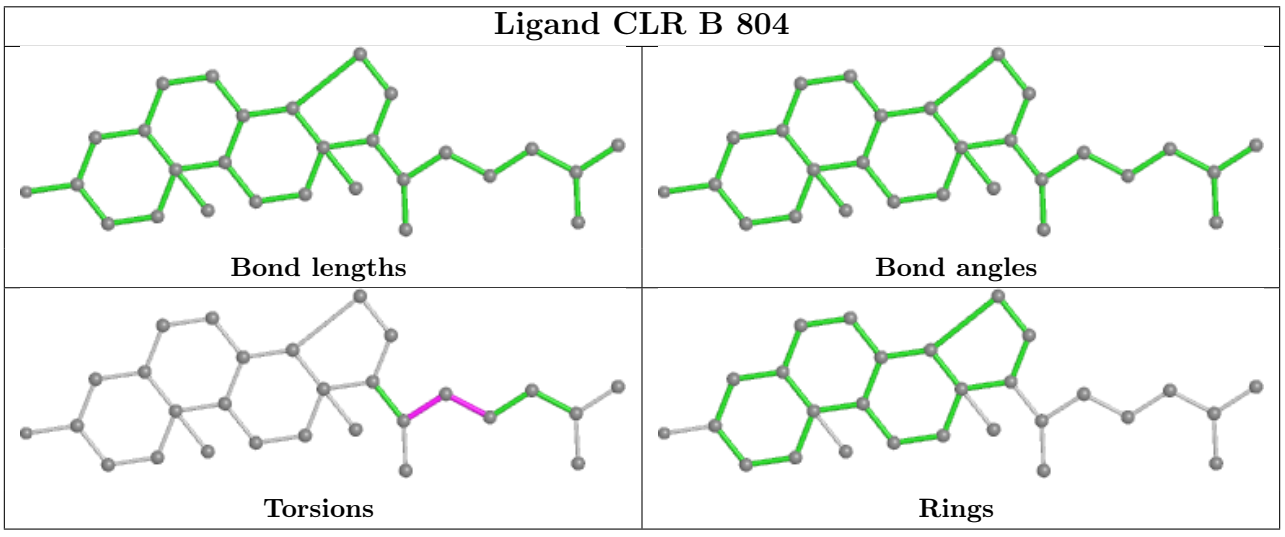
Ligand CLR B 812



Ligand 3PE B 803



Ligand CLR B 804



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.