wwPDB EM Validation Summary Report

Jul 16, 2025 – 02:15 AM JST

PDB ID	:	8ZOW / pdb_00008zow
EMDB ID	:	EMD-60320
Title	:	Cryo-EM structure of Metyltetraprole-bound porcine bc1 complex
Authors	:	Wang, Y.X.; Sun, J.Y.; Cui, G.R.; Yang, G.F.
Deposited on	:	2024-05-29
Resolution	:	2.53 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:

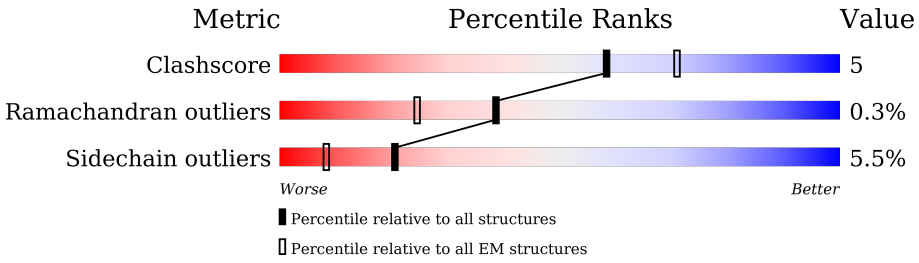
EMDB validation analysis	:	FAILED
Mogul	:	1.8.5 (274361), CSD as541be (2020)
MolProbity	:	4-5-2 with Phenix2.0rc1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ	:	FAILED
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal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

1 Overall quality at a glance

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

The reported resolution of this entry is 2.53 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	378	90% 9% •
1	a	378	92% 7% •
2	B	241	89% 10% •
2	b	241	82% 14% • •
3	C	196	74% 20% • • •
3	c	196	72% 20% 7% •
4	D	446	93% 6% •
4	d	446	93% 6% •
5	E	418	90% 9%

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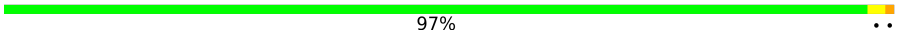
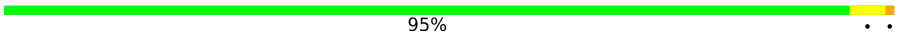
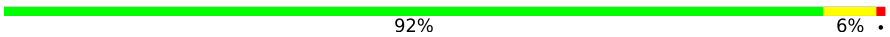
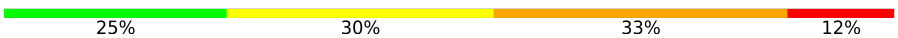
Mol	Chain	Length	Quality of chain
5	e	418	
6	F	64	
6	f	64	
7	G	106	
7	g	106	
8	H	79	
8	h	79	
9	I	62	
9	i	62	
10	J	52	
10	j	52	
11	K	57	
11	k	57	

2 Entry composition (i)

There are 17 unique types of molecules in this entry. The entry contains 33477 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 Cytochrome b.

Mol	Chain	Residues	Atoms					AltConf	Trace
1	A	378	Total	C	N	O	S	0	0
			3017	2026	470	501	20		
1	a	378	Total	C	N	O	S	0	0
			3017	2026	470	501	20		

- Molecule 2 is a protein called Cytochrome c1, heme protein, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
2	B	241	Total	C	N	O	S	0	0
			1920	1225	330	349	16		
2	b	239	Total	C	N	O	S	0	0
			1904	1214	327	347	16		

- Molecule 3 is a protein called Cytochrome b-c1 complex subunit Rieske, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
3	C	194	Total	C	N	O	S	0	0
			1502	946	261	288	7		
3	c	196	Total	C	N	O	S	0	0
			1518	955	265	291	7		

- Molecule 4 is a protein called Cytochrome b-c1 complex subunit 1, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
4	D	445	Total	C	N	O	S	0	0
			3452	2157	604	672	19		
4	d	446	Total	C	N	O	S	0	0
			3459	2161	605	674	19		

- Molecule 5 is a protein called Cytochrome b-c1 complex subunit 2, mitochondrial.

Mol	Chain	Residues	Atoms					AltConf	Trace
5	E	418	Total	C	N	O	S	0	0
			3134	1962	556	607	9		
5	e	418	Total	C	N	O	S	0	0
			3134	1962	556	607	9		

- Molecule 6 is a protein called Cytochrome b-c1 complex subunit 6.

Mol	Chain	Residues	Atoms					AltConf	Trace
6	F	64	Total	C	N	O	S	0	0
			528	320	97	106	5		
6	f	64	Total	C	N	O	S	0	0
			528	320	97	106	5		

- Molecule 7 is a protein called Cytochrome b-c1 complex subunit 7.

Mol	Chain	Residues	Atoms					AltConf	Trace
7	G	106	Total	C	N	O	S	0	0
			921	589	162	168	2		
7	g	106	Total	C	N	O	S	0	0
			921	589	162	168	2		

- Molecule 8 is a protein called Cytochrome b-c1 complex subunit 8.

Mol	Chain	Residues	Atoms					AltConf	Trace
8	H	71	Total	C	N	O	S	0	0
			608	399	112	95	2		
8	h	79	Total	C	N	O	S	0	0
			666	434	122	108	2		

- Molecule 9 is a protein called Complex III subunit 9.

Mol	Chain	Residues	Atoms				AltConf	Trace
9	I	62	Total	C	N	O	0	0
			507	331	90	86		
9	i	62	Total	C	N	O	0	0
			507	331	90	86		

- Molecule 10 is a protein called Cytochrome b-c1 complex subunit 10.

Mol	Chain	Residues	Atoms					AltConf	Trace
10	J	49	Total	C	N	O	S	0	0
			405	269	71	63	2		

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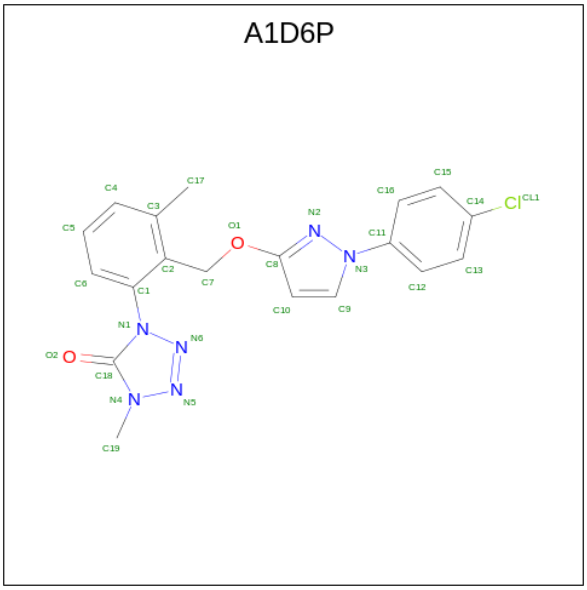
Mol	Chain	Residues	Atoms					AltConf	Trace
10	j	51	Total	C	N	O	S	0	0
			421	281	74	65	1		

- Molecule 11 is a protein called Cytochrome b-c1 complex subunit Rieske, mitochondrial.

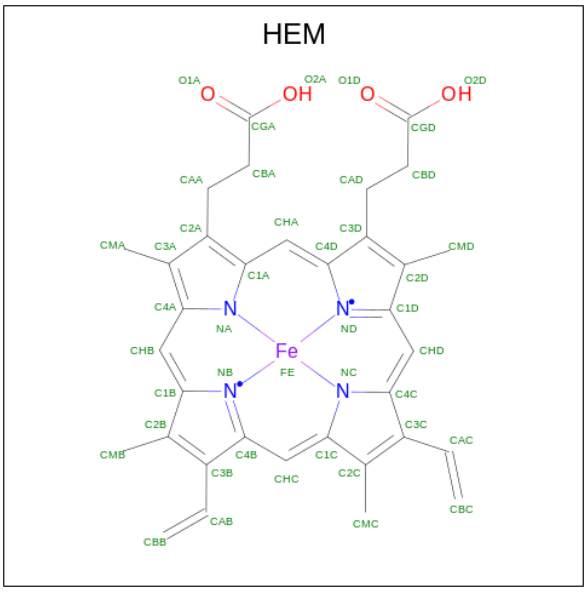
Mol	Chain	Residues	Atoms					AltConf	Trace
11	K	57	Total	C	N	O	S	0	0
			404	252	74	76	2		
11	k	57	Total	C	N	O	S	0	0
			404	252	74	76	2		

- Molecule 12 is 1-[2-[[1-(4-chlorophenyl)pyrazol-3-yl]oxymethyl]-3-methyl-phenyl]-4-methyl -1,2,3,4-tetrazol-5-one (CCD ID: A1D6P) (formula: $C_{19}H_{17}ClN_6O_2$) (labeled as "Ligand of Interest" by depositor).



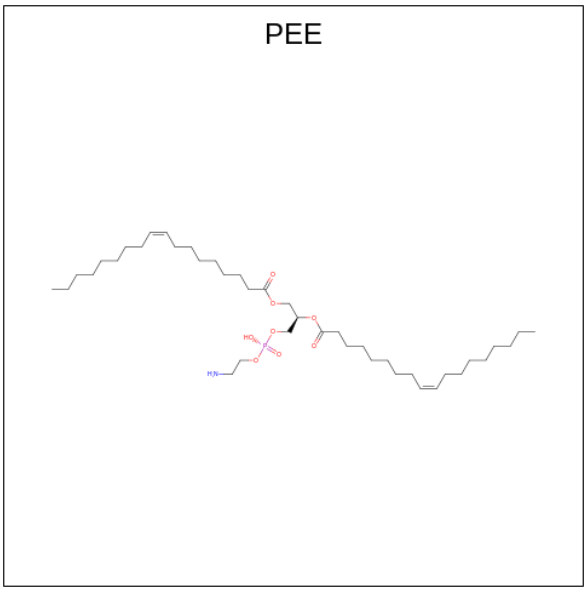
Mol	Chain	Residues	Atoms					AltConf
12	A	1	Total	C	Cl	N	O	0
			28	19	1	6	2	
12	A	1	Total	C	Cl	N	O	0
			28	19	1	6	2	
12	a	1	Total	C	Cl	N	O	0
			28	19	1	6	2	
12	a	1	Total	C	Cl	N	O	0
			28	19	1	6	2	

- Molecule 13 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



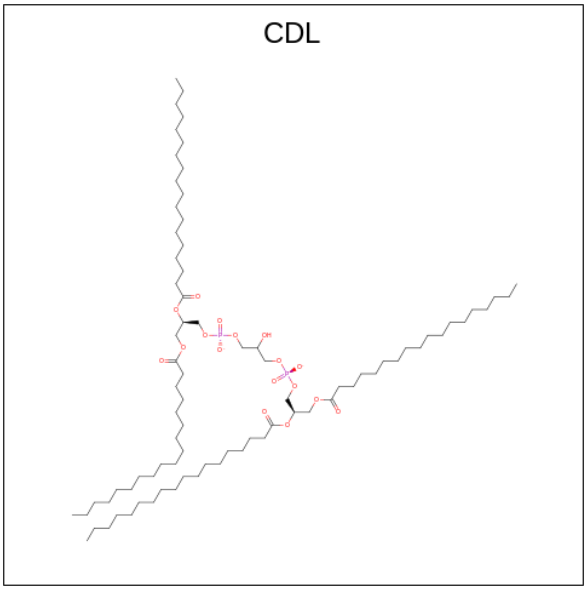
Mol	Chain	Residues	Atoms					AltConf
13	A	1	Total	C	Fe	N	O	0
			43	34	1	4	4	
13	A	1	Total	C	Fe	N	O	0
			43	34	1	4	4	
13	a	1	Total	C	Fe	N	O	0
			43	34	1	4	4	
13	a	1	Total	C	Fe	N	O	0
			43	34	1	4	4	

- Molecule 14 is 1,2-dioleoyl-sn-glycero-3-phosphoethanolamine (CCD ID: PEE) (formula: $C_{41}H_{78}NO_8P$).



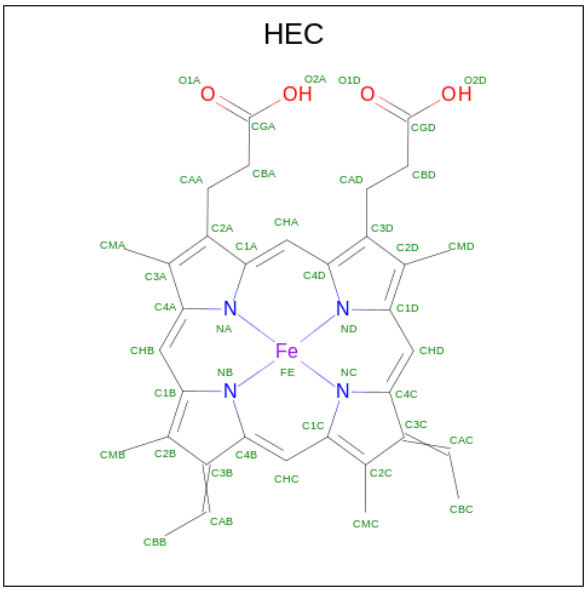
Mol	Chain	Residues	Atoms					AltConf
14	A	1	Total	C	N	O	P	0
			45	35	1	8	1	
14	a	1	Total	C	N	O	P	0
			49	39	1	8	1	

- Molecule 15 is CARDIOLIPIN (CCD ID: CDL) (formula: $C_{81}H_{156}O_{17}P_2$) (labeled as "Ligand of Interest" by depositor).



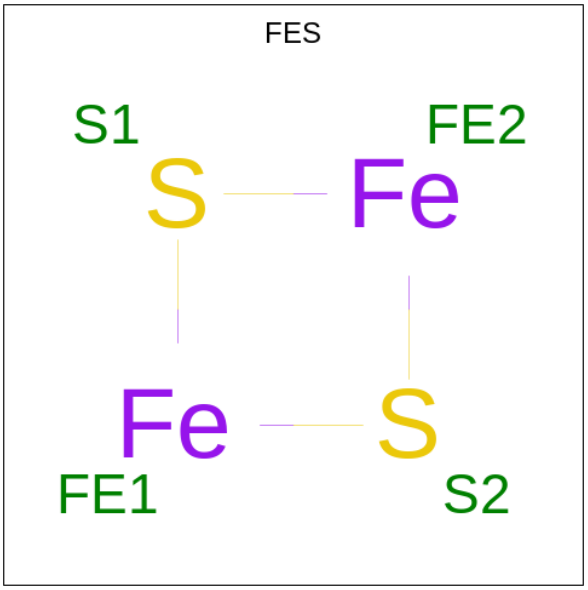
Mol	Chain	Residues	Atoms				AltConf
15	A	1	Total	C	O	P	0
			64	45	17	2	
15	a	1	Total	C	O	P	0
			64	45	17	2	

- Molecule 16 is HEME C (CCD ID: HEC) (formula: $C_{34}H_{34}FeN_4O_4$).



Mol	Chain	Residues	Atoms					AltConf
16	B	1	Total	C	Fe	N	O	0
			43	34	1	4	4	
16	b	1	Total	C	Fe	N	O	0
			43	34	1	4	4	

- Molecule 17 is FE2/S2 (INORGANIC) CLUSTER (CCD ID: FES) (formula: Fe_2S_2).



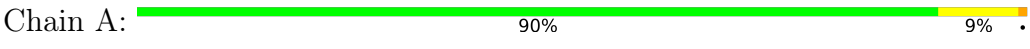
Mol	Chain	Residues	Atoms				AltConf
17	C	1	Total	Fe	S		0
			4	2	2		
17	c	1	Total	Fe	S		0
			4	2	2		

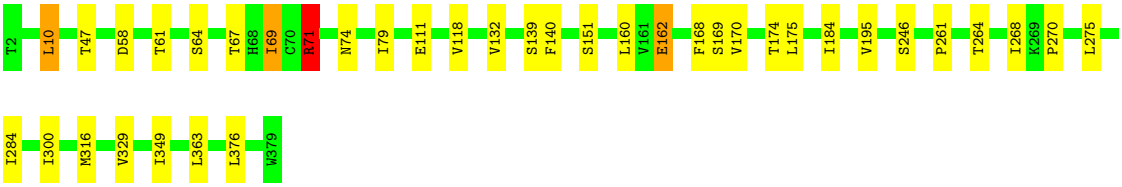
3 Residue-property plots (i)

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: Cytochrome b

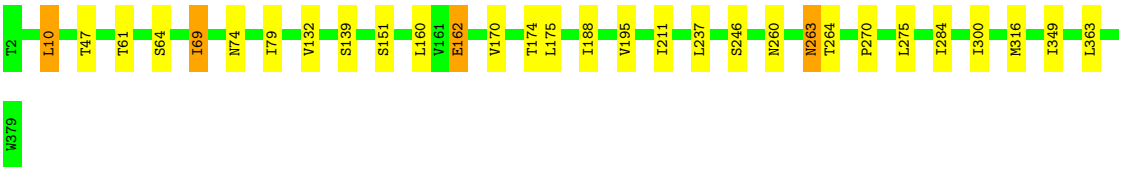
Chain A:





• Molecule 1: Cytochrome b

Chain a:

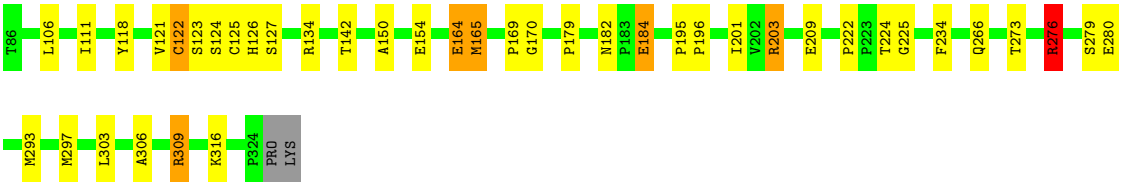


• Molecule 2: Cytochrome c1, heme protein, mitochondrial

Chain B:

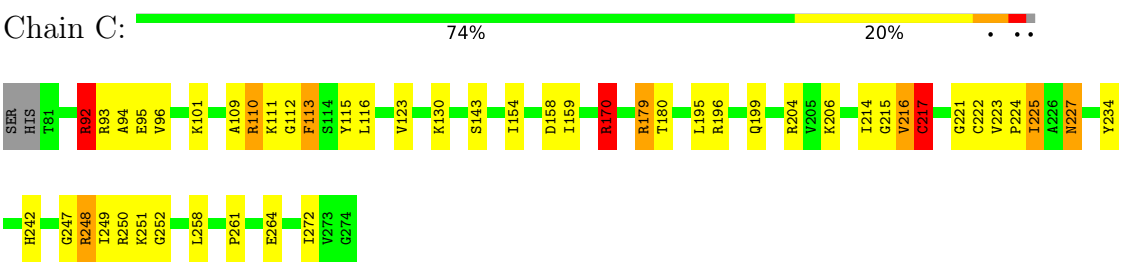
• Molecule 2: Cytochrome c1, heme protein, mitochondrial

Chain b:



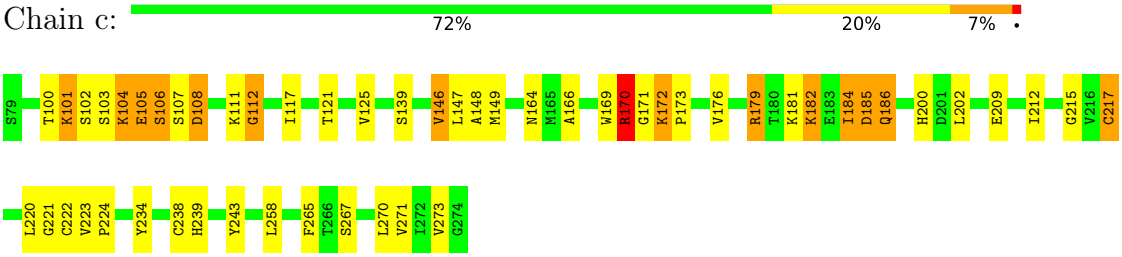
• Molecule 3: Cytochrome b-c1 complex subunit Rieske, mitochondrial

Chain C:



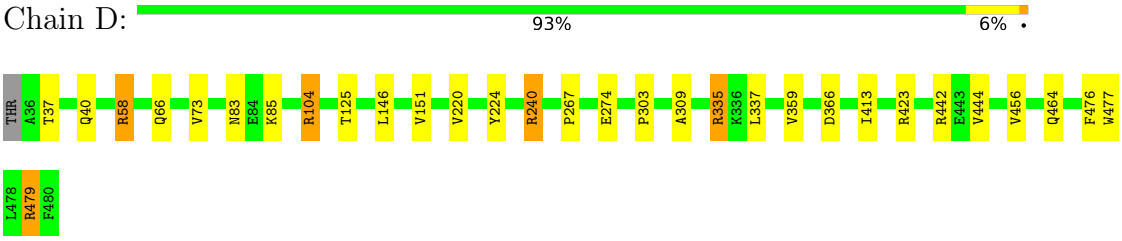
• Molecule 3: Cytochrome b-c1 complex subunit Rieske, mitochondrial

Chain c:



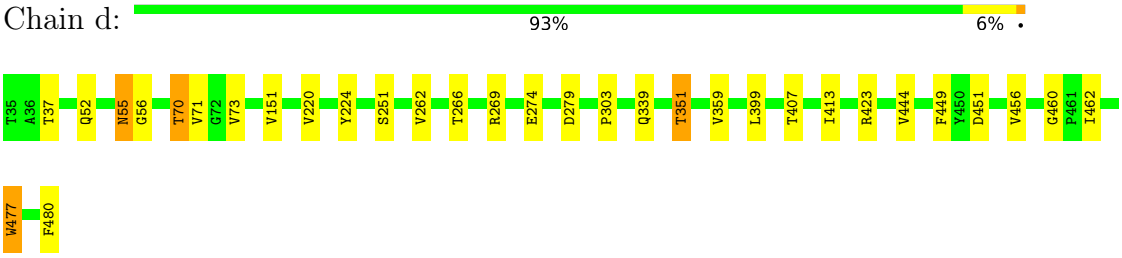
• Molecule 4: Cytochrome b-c1 complex subunit 1, mitochondrial

Chain D:



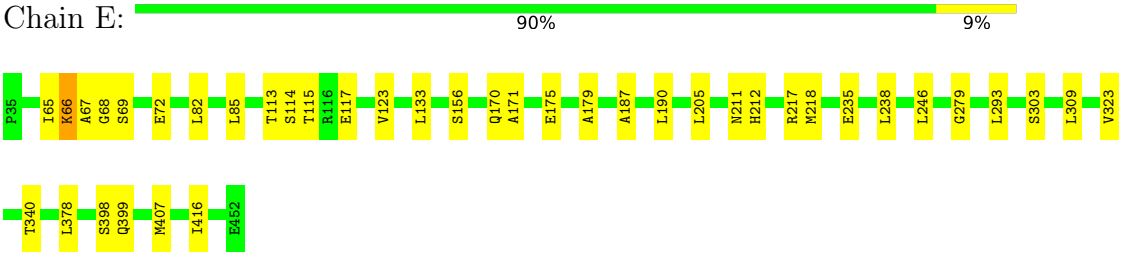
• Molecule 4: Cytochrome b-c1 complex subunit 1, mitochondrial

Chain d:



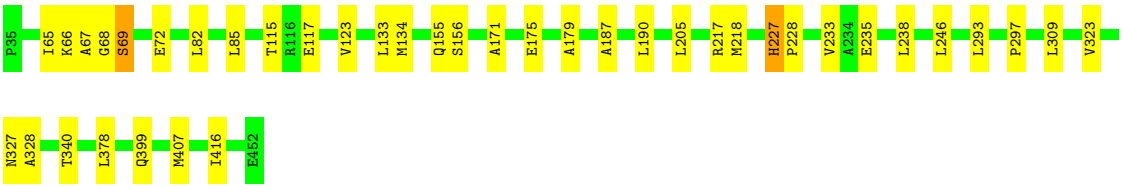
• Molecule 5: Cytochrome b-c1 complex subunit 2, mitochondrial

Chain E:



• Molecule 5: Cytochrome b-c1 complex subunit 2, mitochondrial

Chain e:

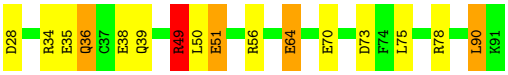


• Molecule 6: Cytochrome b-c1 complex subunit 6

Chain F:

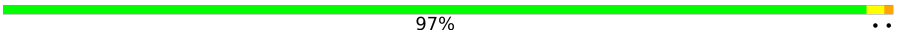
• Molecule 6: Cytochrome b-c1 complex subunit 6

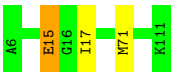
Chain f:



• Molecule 7: Cytochrome b-c1 complex subunit 7

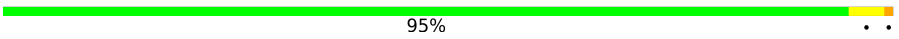
Chain G:

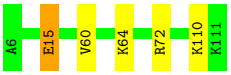




• Molecule 7: Cytochrome b-c1 complex subunit 7

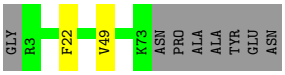
Chain g:





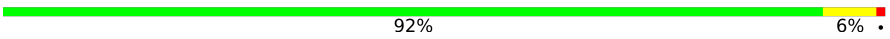
• Molecule 8: Cytochrome b-c1 complex subunit 8

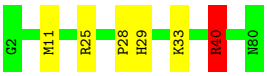
Chain H:



• Molecule 8: Cytochrome b-c1 complex subunit 8

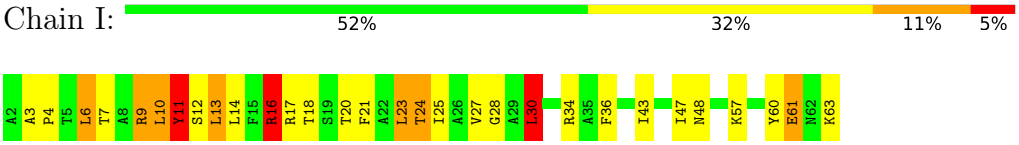
Chain h:





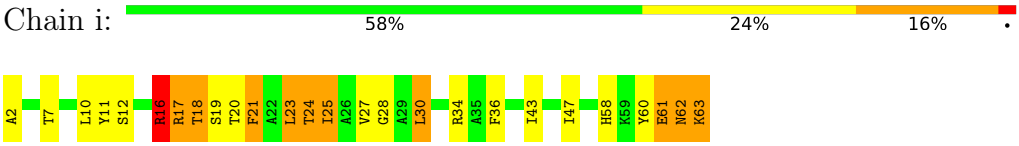
• Molecule 9: Complex III subunit 9

Chain I:



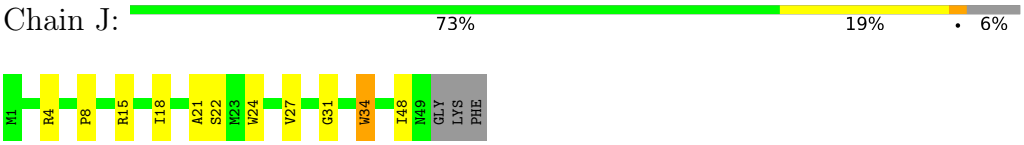
• Molecule 9: Complex III subunit 9

Chain i:



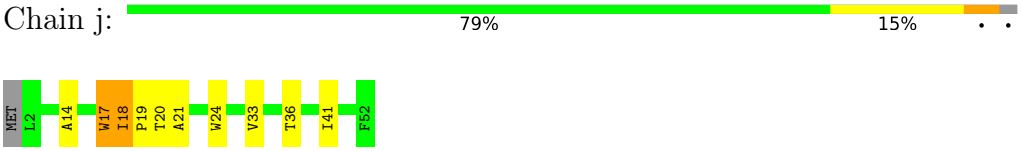
• Molecule 10: Cytochrome b-c1 complex subunit 10

Chain J:



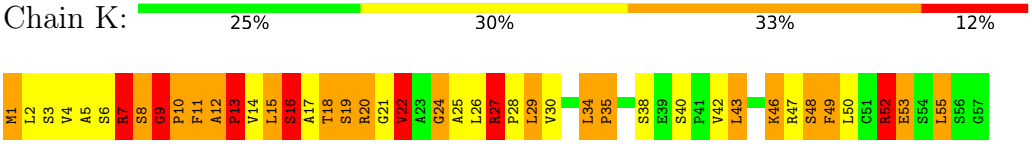
• Molecule 10: Cytochrome b-c1 complex subunit 10

Chain j:



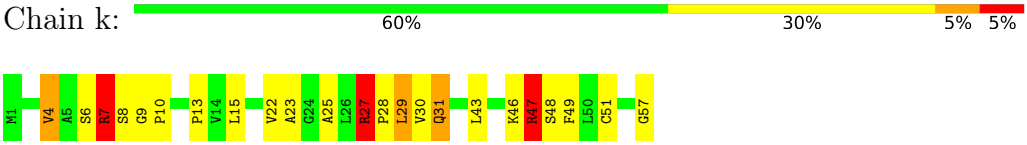
• Molecule 11: Cytochrome b-c1 complex subunit Rieske, mitochondrial

Chain K:



• Molecule 11: Cytochrome b-c1 complex subunit Rieske, mitochondrial

Chain k:



4 Experimental information (i)

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	411418	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 ($e^-/Å^2$)	49.72	Depositor
Minimum defocus (nm)	1600	Depositor
Maximum defocus (nm)	1800	Depositor
Magnification	Not provided	
Image detector	FEI FALCON IV (4k 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: FES, PEE, HEM, A1D6P, CDL, HEC

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	0.43	0/3115	0.66	3/4259 (0.1%)
1	a	0.42	0/3115	0.64	2/4259 (0.0%)
2	B	0.48	0/1978	0.79	6/2684 (0.2%)
2	b	0.55	1/1961 (0.1%)	0.89	8/2661 (0.3%)
3	C	0.59	1/1534 (0.1%)	0.88	6/2075 (0.3%)
3	c	0.51	1/1551 (0.1%)	0.90	2/2098 (0.1%)
4	D	0.42	0/3524	0.63	0/4783
4	d	0.48	2/3531 (0.1%)	0.72	6/4793 (0.1%)
5	E	0.45	2/3187 (0.1%)	0.63	1/4314 (0.0%)
5	e	0.48	2/3187 (0.1%)	0.67	4/4314 (0.1%)
6	F	0.35	0/534	0.91	6/714 (0.8%)
6	f	0.38	0/534	0.90	6/714 (0.8%)
7	G	0.39	0/941	0.64	1/1262 (0.1%)
7	g	0.39	0/941	0.64	1/1262 (0.1%)
8	H	0.38	0/628	0.71	0/848
8	h	0.34	0/688	0.75	0/931
9	I	0.66	0/520	1.17	3/701 (0.4%)
9	i	0.49	0/520	1.15	3/701 (0.4%)
10	J	0.40	0/420	0.87	1/576 (0.2%)
10	j	0.49	0/437	1.03	4/598 (0.7%)
11	K	1.42	4/410 (1.0%)	1.87	10/556 (1.8%)
11	k	0.73	0/410	1.34	3/556 (0.5%)
All	All	0.49	13/33666 (0.0%)	0.78	76/45659 (0.2%)

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

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

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Mol	Chain	#Chirality outliers	#Planarity outliers
2	B	0	2
2	b	0	4
3	C	0	6
3	c	0	1
4	D	0	5
6	F	0	1
6	f	0	1
8	h	0	1
9	I	0	4
9	i	0	3
10	J	0	1
11	K	0	3
11	k	0	4
All	All	0	37

The worst 5 of 13 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	217	CYS	C-N	13.54	1.52	1.33
2	b	121	VAL	C-N	9.97	1.49	1.33
4	d	351	THR	C-O	-9.46	1.13	1.23
5	e	67	ALA	C-O	-8.54	1.14	1.23
5	E	67	ALA	C-N	-8.49	1.25	1.32

The worst 5 of 76 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
11	K	4	VAL	N-CA-CB	-11.65	99.39	112.21
9	i	19	SER	N-CA-C	-11.05	99.93	113.41
10	j	17	TRP	N-CA-C	-10.00	96.09	110.59
4	d	451	ASP	CA-CB-CG	9.42	122.02	112.60
11	K	16	SER	N-CA-C	9.21	124.14	108.02

There are no chirality outliers.

5 of 37 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	71	ARG	Sidechain
2	B	180	TYR	Peptide
2	B	187	ARG	Sidechain
3	C	110	ARG	Peptide

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Mol	Chain	Res	Type	Group
3	C	92	ARG	Sidechain

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3017	0	3078	22	0
1	a	3017	0	3078	14	0
2	B	1920	0	1869	17	0
2	b	1904	0	1849	24	0
3	C	1502	0	1490	30	0
3	c	1518	0	1501	43	0
4	D	3452	0	3343	16	0
4	d	3459	0	3350	16	0
5	E	3134	0	3112	25	0
5	e	3134	0	3112	21	0
6	F	528	0	510	8	0
6	f	528	0	510	5	0
7	G	921	0	917	2	0
7	g	921	0	917	5	0
8	H	608	0	616	2	0
8	h	666	0	663	5	0
9	I	507	0	509	11	0
9	i	507	0	509	12	0
10	J	405	0	405	9	0
10	j	421	0	418	4	0
11	K	404	0	425	48	0
11	k	404	0	425	19	0
12	A	56	0	0	0	0
12	a	56	0	0	0	0
13	A	86	0	60	0	0
13	a	86	0	60	0	0
14	A	45	0	67	4	0
14	a	49	0	75	3	0
15	A	64	0	72	2	0
15	a	64	0	72	2	0
16	B	43	0	32	5	0
16	b	43	0	32	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
17	C	4	0	0	0	0
17	c	4	0	0	0	0
All	All	33477	0	33076	300	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 5.

The worst 5 of 300 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:125:CYS:SG	16:B:401:HEC:HBC3	1.86	1.16
1:A:169:SER:HB2	3:c:171:GLY:HA3	1.45	0.95
2:b:125:CYS:SG	16:b:401:HEC:CAC	2.55	0.95
5:e:328:ALA:HA	11:k:8:SER:HB2	1.46	0.94
2:B:125:CYS:SG	16:B:401:HEC:CBC	2.54	0.94

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	376/378 (100%)	362 (96%)	14 (4%)	0	100	100
1	a	376/378 (100%)	363 (96%)	13 (4%)	0	100	100
2	B	239/241 (99%)	225 (94%)	13 (5%)	1 (0%)	30	48
2	b	237/241 (98%)	213 (90%)	24 (10%)	0	100	100
3	C	192/196 (98%)	163 (85%)	29 (15%)	0	100	100
3	c	194/196 (99%)	153 (79%)	41 (21%)	0	100	100
4	D	443/446 (99%)	423 (96%)	20 (4%)	0	100	100
4	d	444/446 (100%)	421 (95%)	23 (5%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
5	E	416/418 (100%)	399 (96%)	17 (4%)	0	100	100
5	e	416/418 (100%)	398 (96%)	18 (4%)	0	100	100
6	F	62/64 (97%)	60 (97%)	2 (3%)	0	100	100
6	f	62/64 (97%)	60 (97%)	2 (3%)	0	100	100
7	G	104/106 (98%)	99 (95%)	5 (5%)	0	100	100
7	g	104/106 (98%)	99 (95%)	5 (5%)	0	100	100
8	H	69/79 (87%)	61 (88%)	8 (12%)	0	100	100
8	h	77/79 (98%)	67 (87%)	10 (13%)	0	100	100
9	I	60/62 (97%)	47 (78%)	13 (22%)	0	100	100
9	i	60/62 (97%)	49 (82%)	11 (18%)	0	100	100
10	J	47/52 (90%)	42 (89%)	5 (11%)	0	100	100
10	j	49/52 (94%)	42 (86%)	6 (12%)	1 (2%)	6	10
11	K	55/57 (96%)	37 (67%)	10 (18%)	8 (14%)	0	0
11	k	55/57 (96%)	43 (78%)	10 (18%)	2 (4%)	3	3
All	All	4137/4198 (98%)	3826 (92%)	299 (7%)	12 (0%)	38	54

5 of 12 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
11	K	7	ARG
11	K	8	SER
10	j	18	ILE
11	k	27	ARG
11	K	9	GLY

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	331/331 (100%)	319 (96%)	12 (4%)	30	53
1	a	331/331 (100%)	318 (96%)	13 (4%)	27	50

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
2	B	206/206 (100%)	201 (98%)	5 (2%)	44 68
2	b	204/206 (99%)	191 (94%)	13 (6%)	14 28
3	C	164/166 (99%)	151 (92%)	13 (8%)	10 19
3	c	166/166 (100%)	144 (87%)	22 (13%)	3 5
4	D	371/372 (100%)	365 (98%)	6 (2%)	58 79
4	d	372/372 (100%)	366 (98%)	6 (2%)	58 79
5	E	327/328 (100%)	323 (99%)	4 (1%)	67 85
5	e	327/328 (100%)	322 (98%)	5 (2%)	60 80
6	F	61/61 (100%)	52 (85%)	9 (15%)	2 4
6	f	61/61 (100%)	51 (84%)	10 (16%)	2 3
7	G	95/95 (100%)	94 (99%)	1 (1%)	70 86
7	g	95/95 (100%)	94 (99%)	1 (1%)	70 86
8	H	65/70 (93%)	65 (100%)	0	100 100
8	h	70/70 (100%)	69 (99%)	1 (1%)	62 82
9	I	50/50 (100%)	29 (58%)	21 (42%)	0 0
9	i	50/50 (100%)	33 (66%)	17 (34%)	0 0
10	J	40/42 (95%)	39 (98%)	1 (2%)	42 67
10	j	41/42 (98%)	39 (95%)	2 (5%)	21 40
11	K	44/44 (100%)	18 (41%)	26 (59%)	0 0
11	k	44/44 (100%)	38 (86%)	6 (14%)	3 5
All	All	3515/3530 (100%)	3321 (94%)	194 (6%)	20 34

5 of 194 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	b	165	MET
3	c	238	CYS
2	b	224	THR
3	c	146	VAL
4	d	351	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 57 such sidechains are listed below:

Mol	Chain	Res	Type
1	a	148	ASN
8	h	65	GLN
3	c	239	HIS
6	f	62	GLN
5	e	227	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)

16 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	$\#\|Z\| > 2$
12	A1D6P	A	402	-	30,31,31	1.41	5 (16%)	32,44,44	1.47	5 (15%)
16	HEC	b	401	2	32,50,50	2.37	12 (37%)	24,82,82	2.15	5 (20%)
13	HEM	A	403	1	41,50,50	1.51	7 (17%)	45,82,82	1.59	11 (24%)
14	PEE	A	405	-	44,44,50	1.54	5 (11%)	46,49,55	1.38	5 (10%)
15	CDL	A	406	-	63,63,99	1.08	8 (12%)	69,75,111	1.14	4 (5%)
14	PEE	a	405	-	48,48,50	1.49	5 (10%)	51,53,55	1.31	4 (7%)
12	A1D6P	A	401	-	30,31,31	1.36	4 (13%)	32,44,44	1.48	5 (15%)
13	HEM	a	403	1	41,50,50	1.56	6 (14%)	45,82,82	1.87	13 (28%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
16	HEC	B	401	2	32,50,50	2.22	13 (40%)	24,82,82	2.85	9 (37%)
17	FES	c	301	3	0,4,4	-	-	-		
12	A1D6P	a	402	-	30,31,31	1.40	5 (16%)	32,44,44	1.48	5 (15%)
13	HEM	a	404	1	41,50,50	1.49	6 (14%)	45,82,82	1.63	9 (20%)
15	CDL	a	406	-	63,63,99	1.10	8 (12%)	69,75,111	1.17	4 (5%)
12	A1D6P	a	401	-	30,31,31	1.35	3 (10%)	32,44,44	1.48	5 (15%)
17	FES	C	301	-	0,4,4	-	-	-		
13	HEM	A	404	1	41,50,50	1.61	7 (17%)	45,82,82	2.23	17 (37%)

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
12	A1D6P	A	402	-	-	3/11/13/13	0/4/4/4
16	HEC	b	401	2	-	3/10/54/54	-
13	HEM	A	403	1	-	2/12/54/54	-
14	PEE	A	405	-	-	28/48/48/54	-
15	CDL	A	406	-	-	44/74/74/110	-
14	PEE	a	405	-	-	26/52/52/54	-
12	A1D6P	A	401	-	-	2/11/13/13	0/4/4/4
13	HEM	a	403	1	-	6/12/54/54	-
16	HEC	B	401	2	-	4/10/54/54	-
17	FES	c	301	3	-	-	0/1/1/1
12	A1D6P	a	402	-	-	3/11/13/13	0/4/4/4
13	HEM	a	404	1	-	2/12/54/54	-
15	CDL	a	406	-	-	37/74/74/110	-
12	A1D6P	a	401	-	-	2/11/13/13	0/4/4/4
17	FES	C	301	-	-	-	0/1/1/1
13	HEM	A	404	1	-	4/12/54/54	-

The worst 5 of 94 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
16	b	401	HEC	C3C-C2C	7.31	1.48	1.40
16	B	401	HEC	C2B-C3B	6.36	1.47	1.40
16	B	401	HEC	C3C-C2C	5.93	1.46	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
16	b	401	HEC	C2B-C3B	5.80	1.46	1.40
14	a	405	PEE	C39-C38	4.40	1.57	1.31

The worst 5 of 101 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
16	B	401	HEC	C1D-C2D-C3D	-7.06	102.08	107.00
16	b	401	HEC	C1D-C2D-C3D	-5.85	102.92	107.00
13	A	404	HEM	CAD-C3D-C4D	5.85	134.88	124.66
16	B	401	HEC	CBD-CAD-C3D	-5.84	102.65	112.62
16	B	401	HEC	CMB-C2B-C3B	5.80	132.64	125.82

There are no chirality outliers.

5 of 166 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
12	A	401	A1D6P	C12-C11-N3-C9
12	A	401	A1D6P	C16-C11-N3-C9
12	A	402	A1D6P	C16-C11-N3-C9
12	a	401	A1D6P	C12-C11-N3-C9
12	a	401	A1D6P	C16-C11-N3-C9

There are no ring outliers.

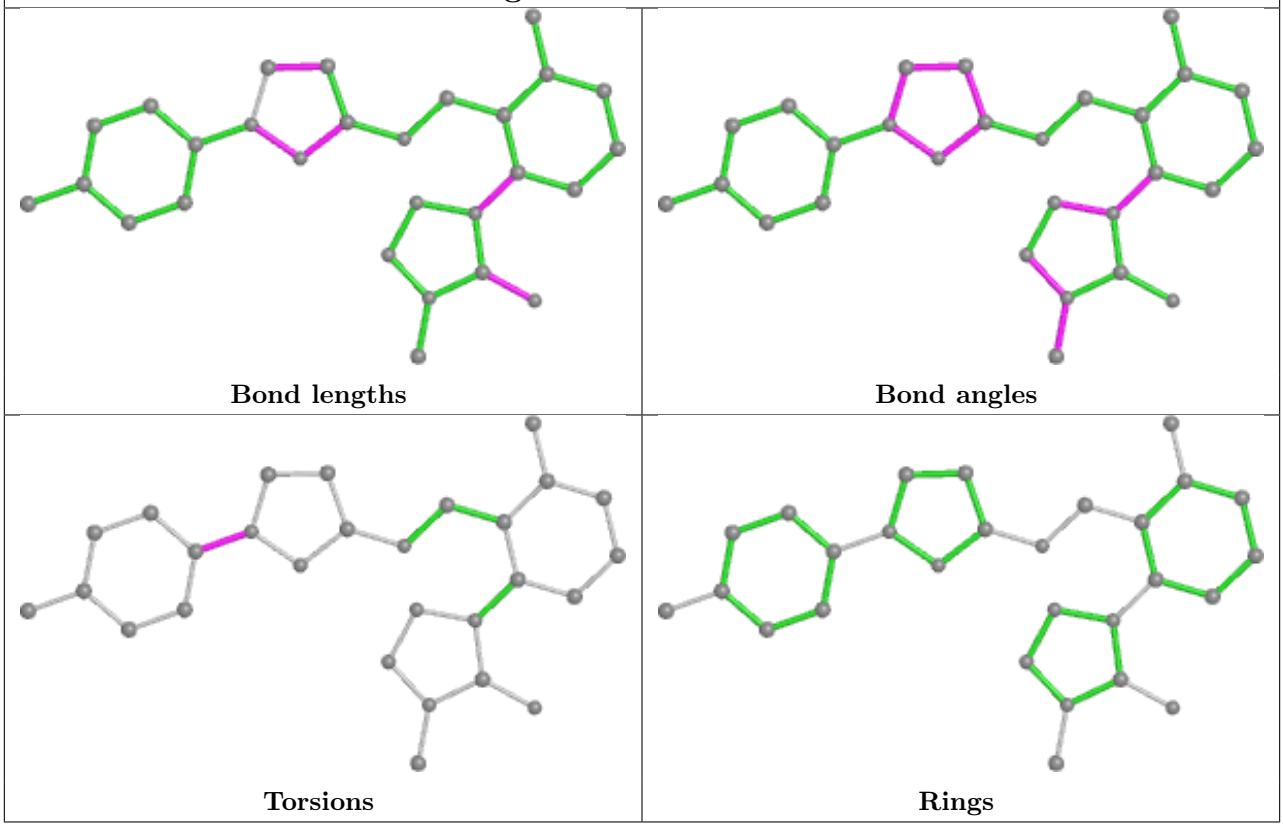
6 monomers are involved in 20 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
16	b	401	HEC	4	0
14	A	405	PEE	4	0
15	A	406	CDL	2	0
14	a	405	PEE	3	0
16	B	401	HEC	5	0
15	a	406	CDL	2	0

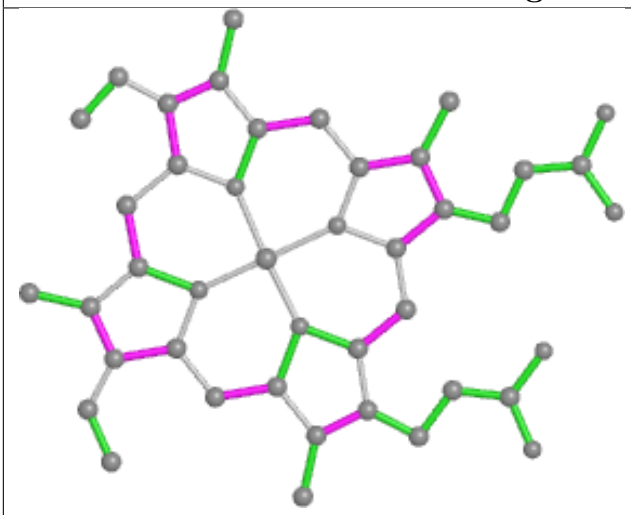
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

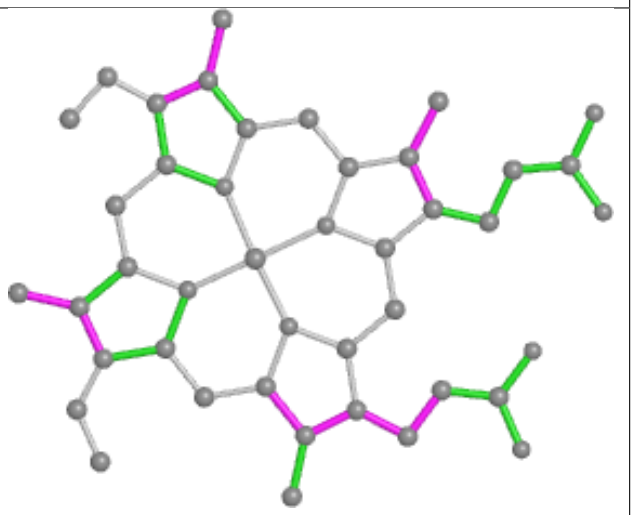
Ligand A1D6P A 402



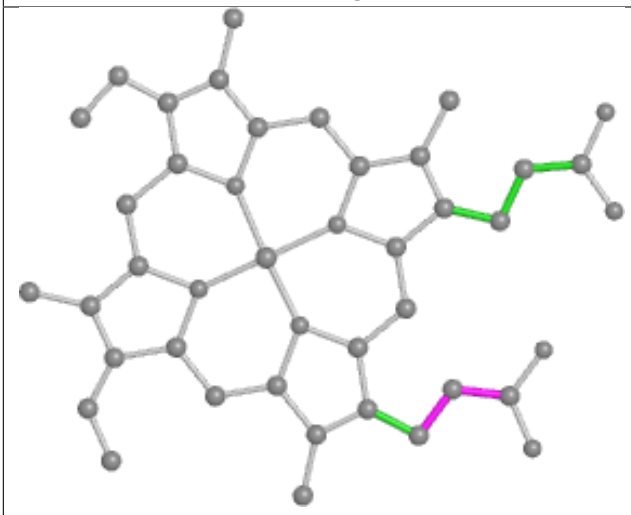
Ligand HEC b 401



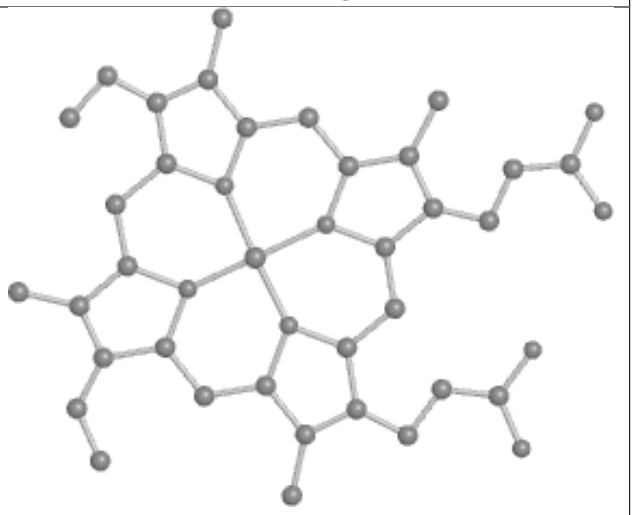
Bond lengths



Bond angles

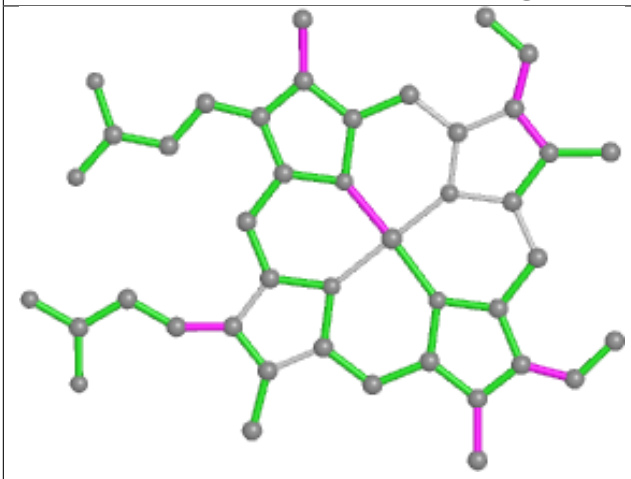


Torsions

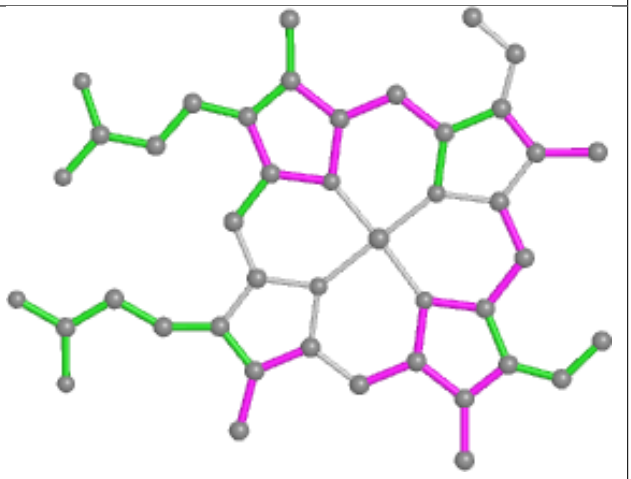


Rings

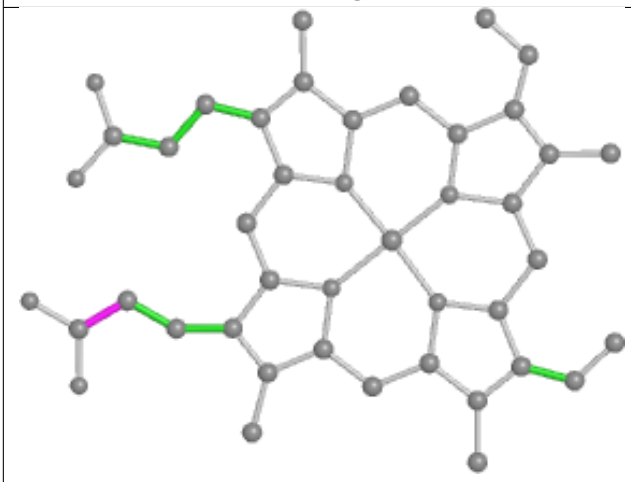
Ligand HEM A 403



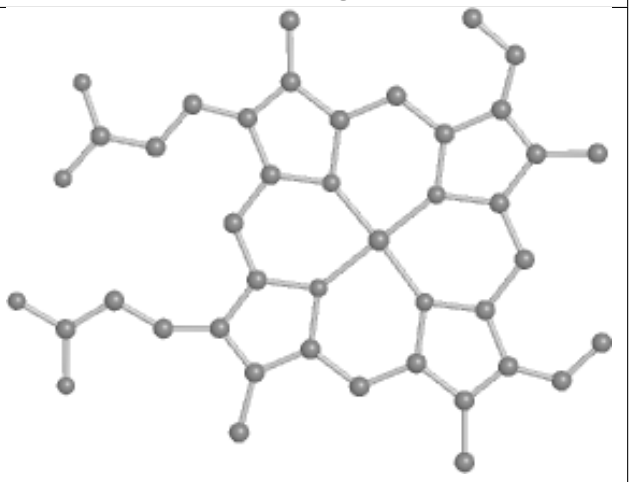
Bond lengths



Bond angles

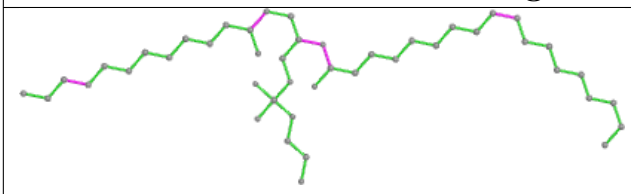


Torsions

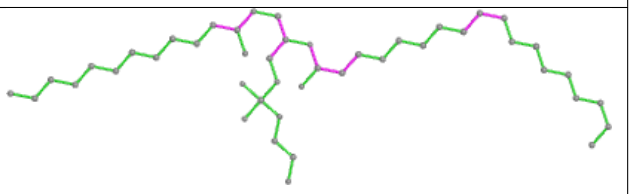


Rings

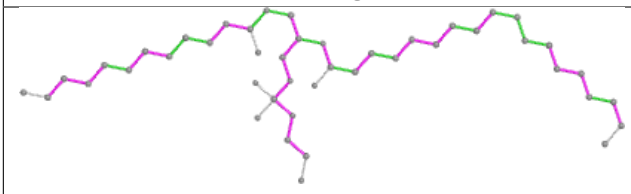
Ligand PEE A 405



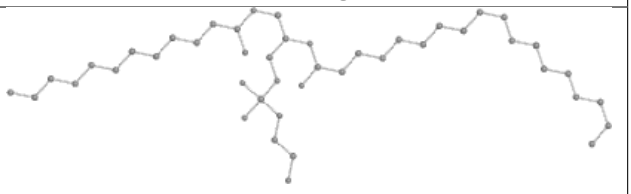
Bond lengths



Bond angles

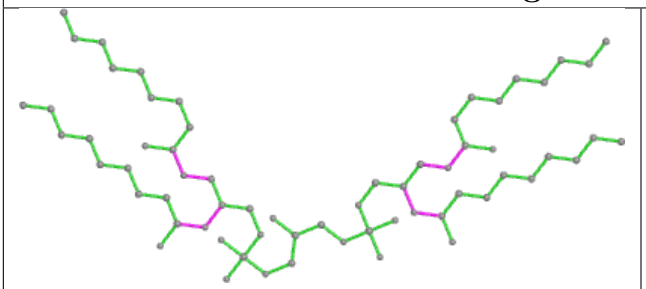


Torsions



Rings

Ligand CDL A 406



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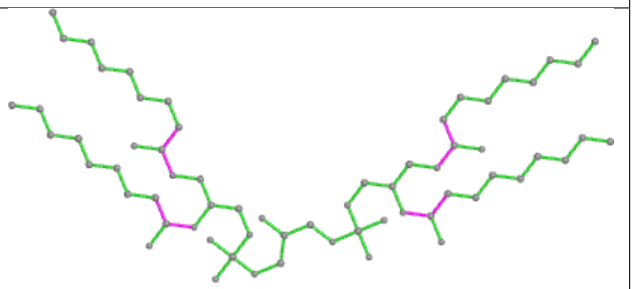
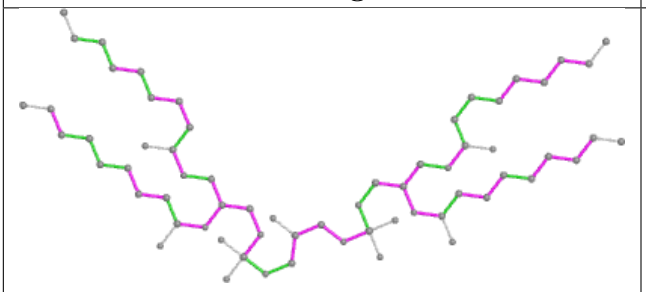


Bond angles



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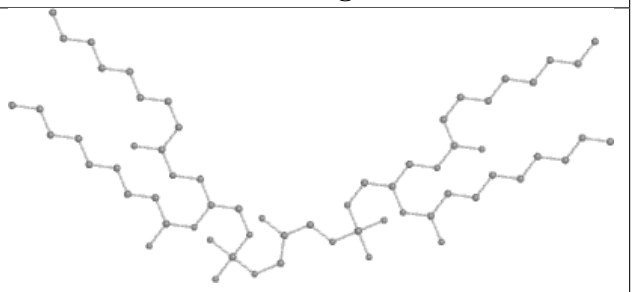
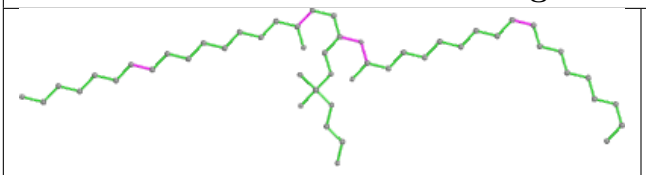


Rings

Ligand PEE a 405



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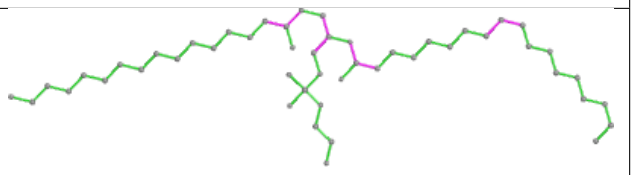
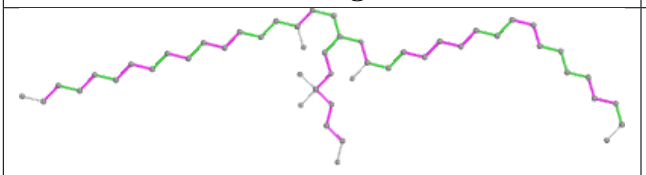


Bond angles



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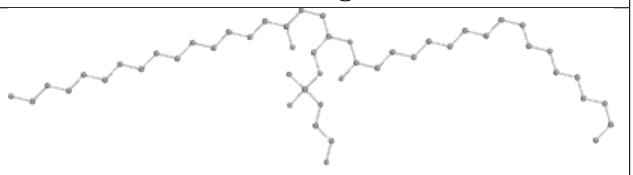
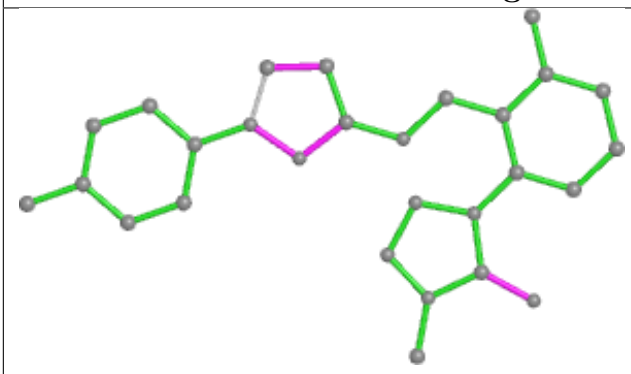


Rings

Ligand A1D6P A 401



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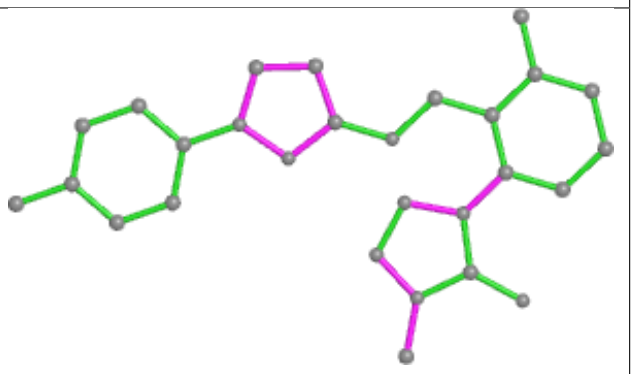
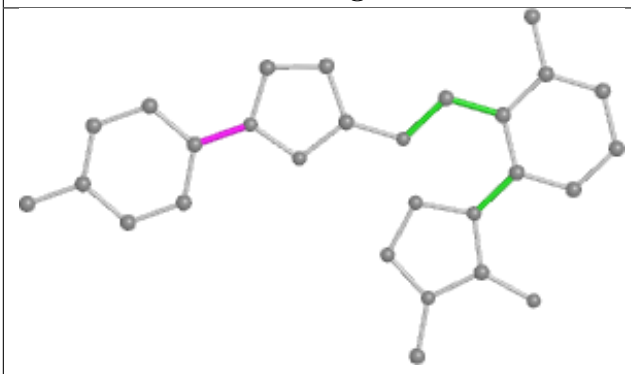


Bond angles



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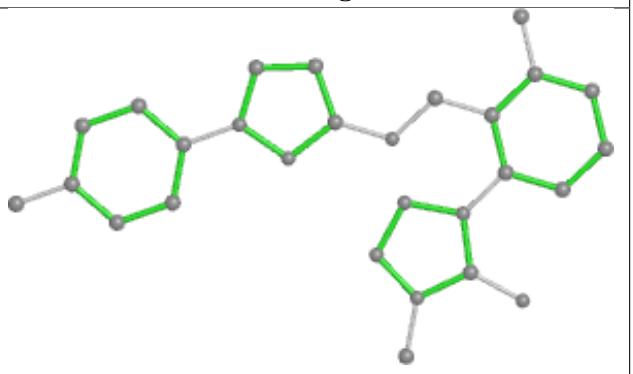
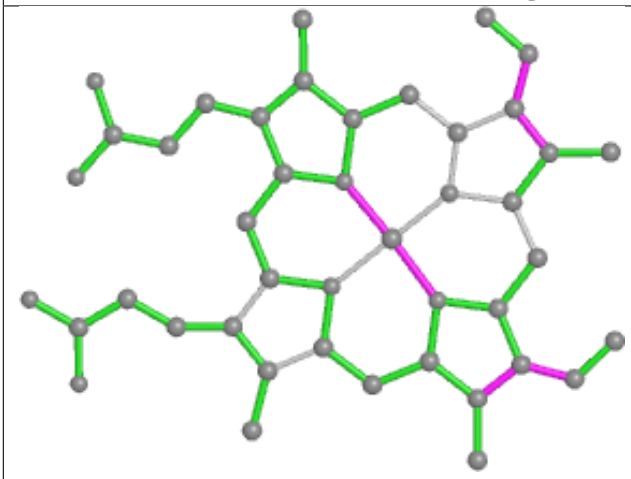


Rings

Ligand HEM a 403



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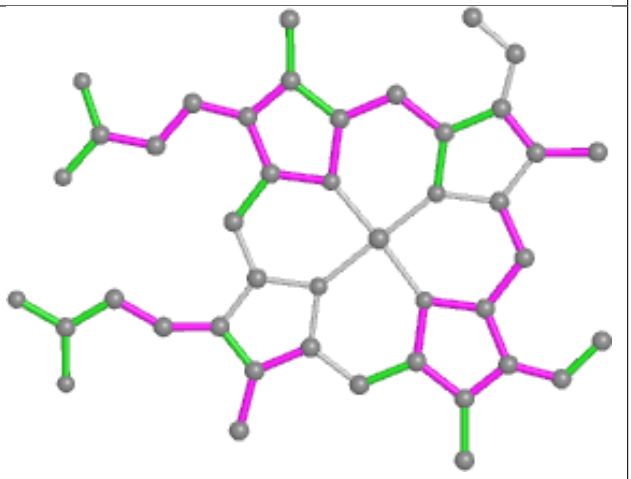
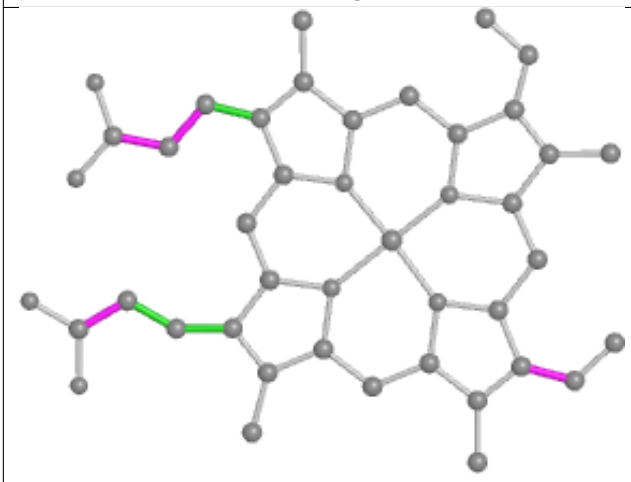


Bond angles



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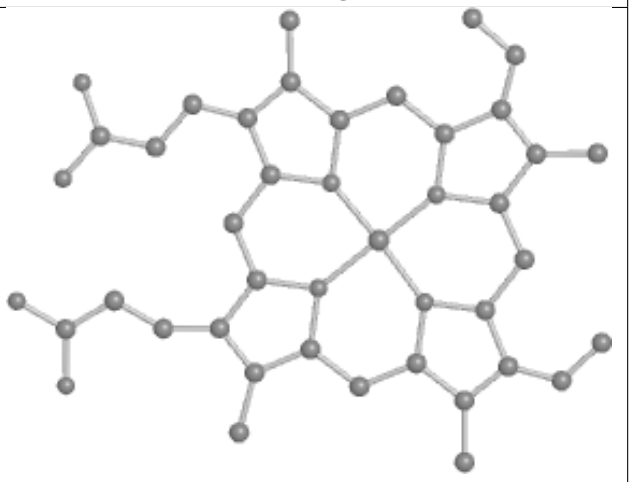
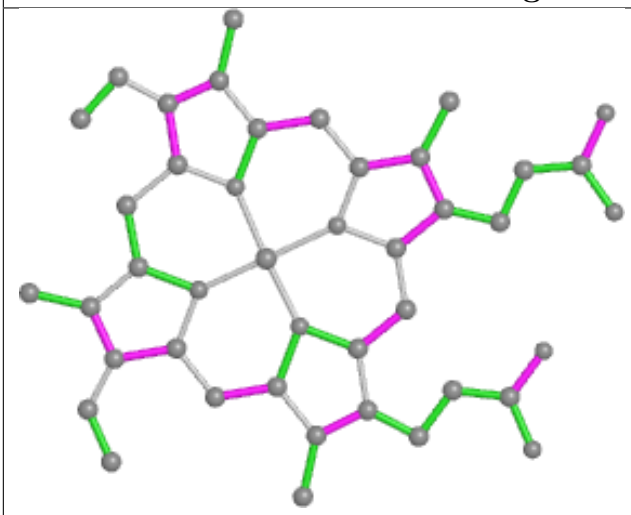
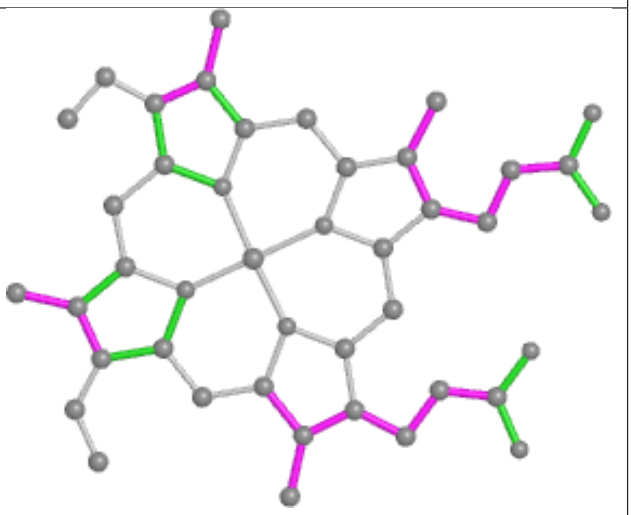


Rings

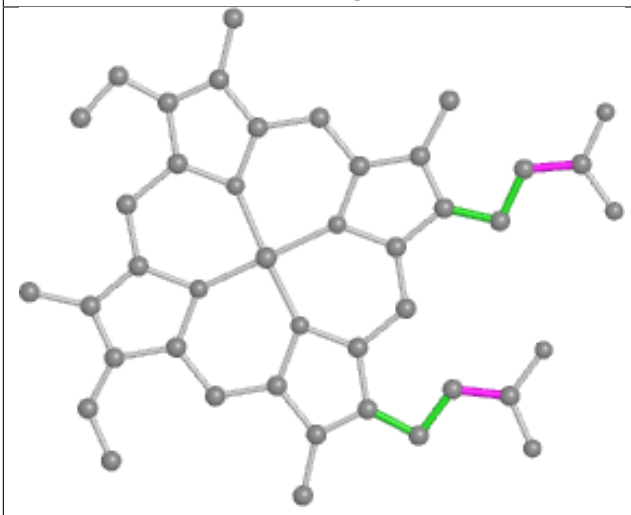
Ligand HEC B 401



Bond lengths



Bond angles



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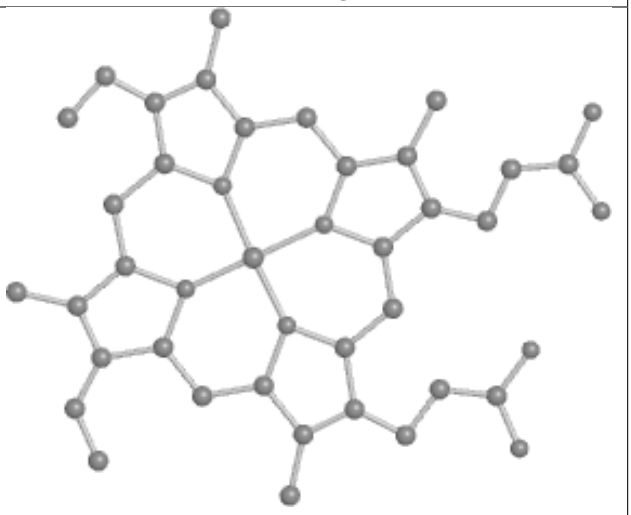
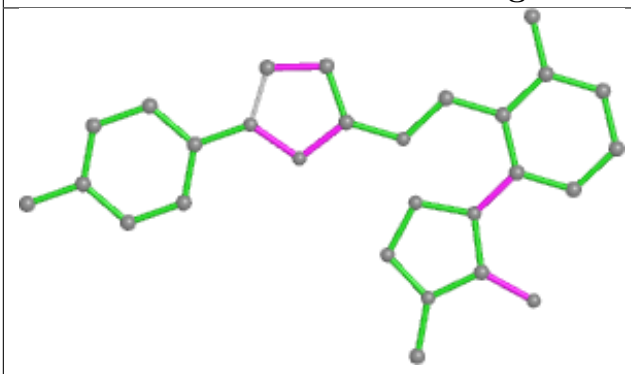
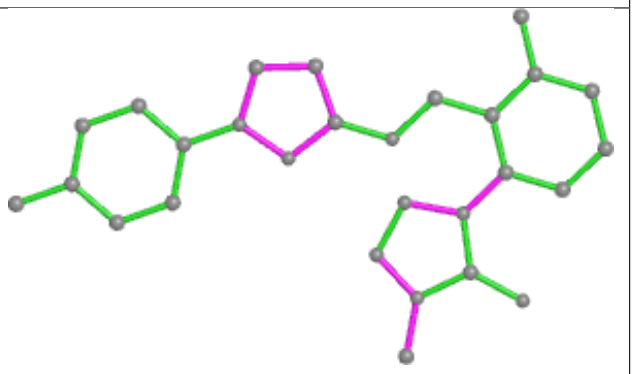


Rings

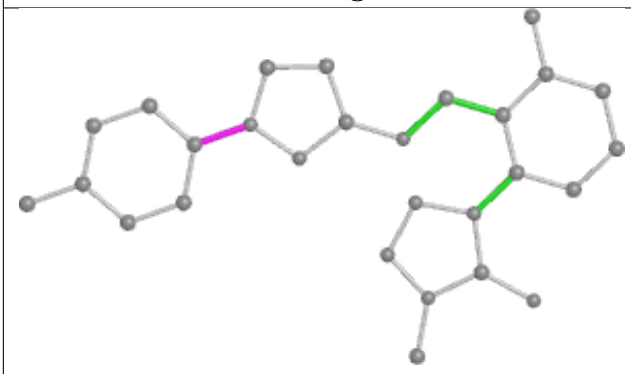
Ligand A1D6P a 402



Bond lengths



Bond angles



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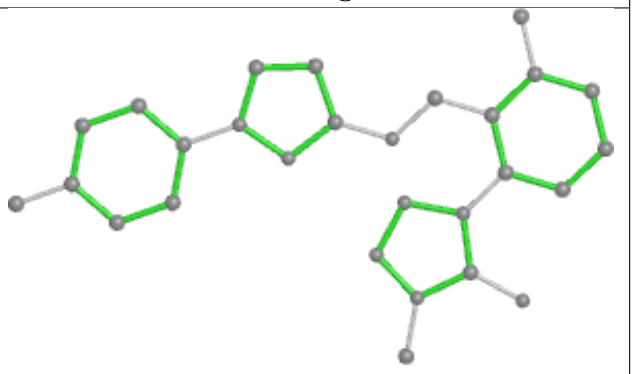
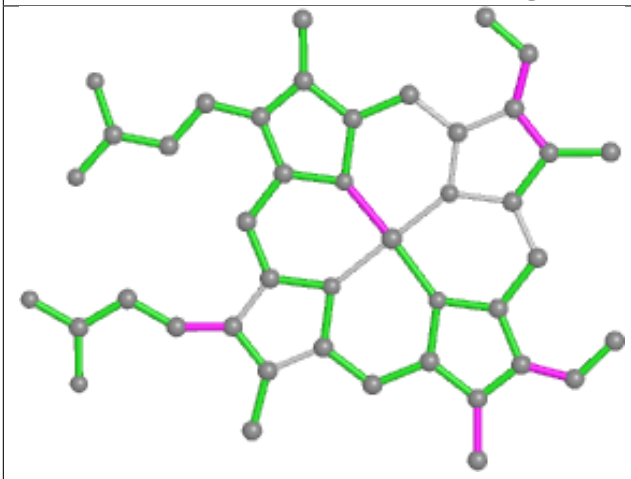
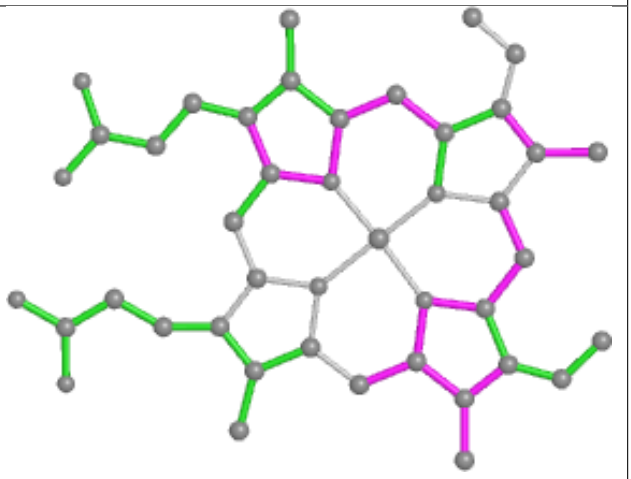


Rings

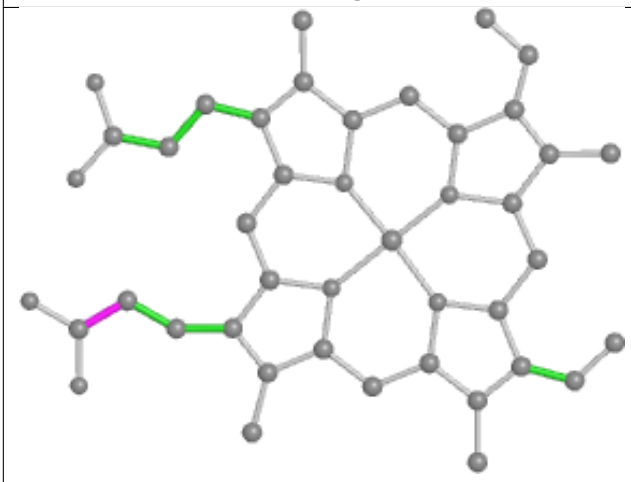
Ligand HEM a 404



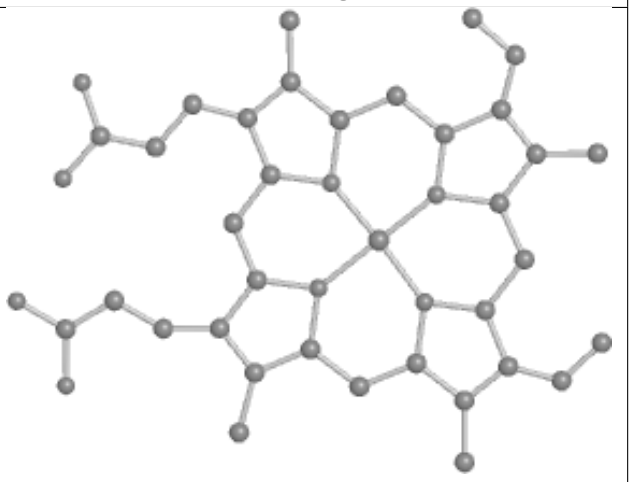
Bond lengths



Bond angles

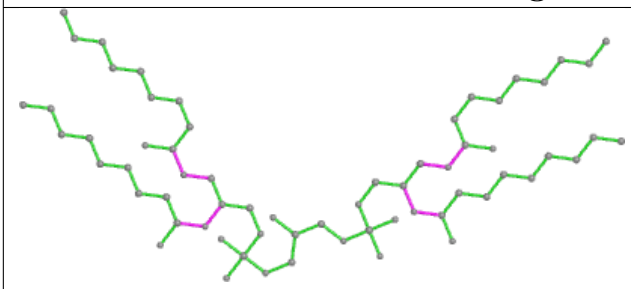


Torsions

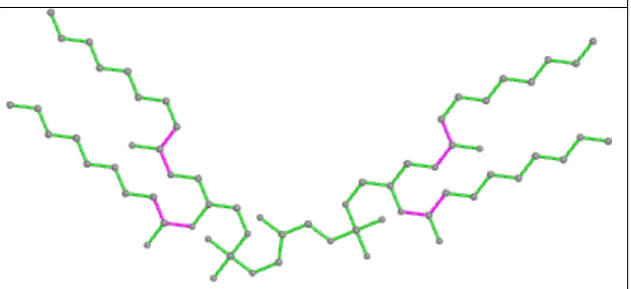


Rings

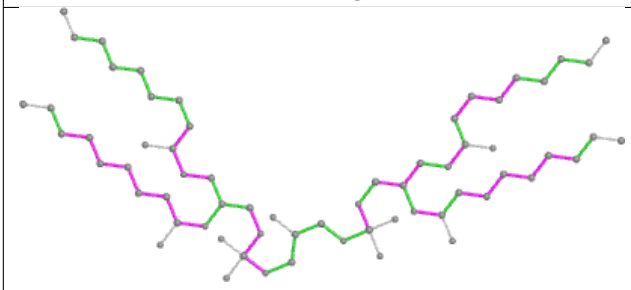
Ligand CDL a 406



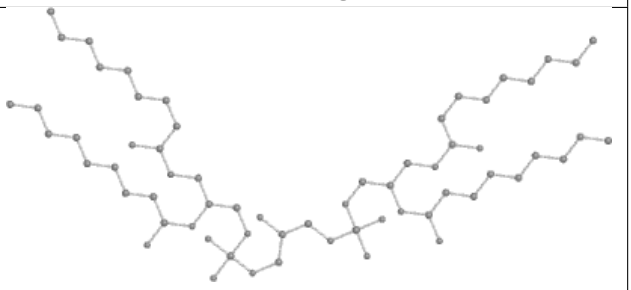
Bond lengths



Bond angles

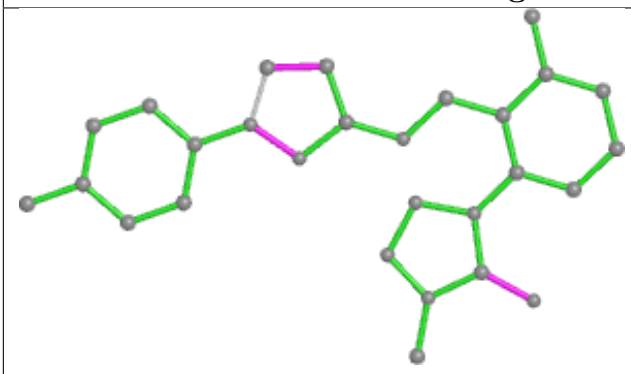


Torsions

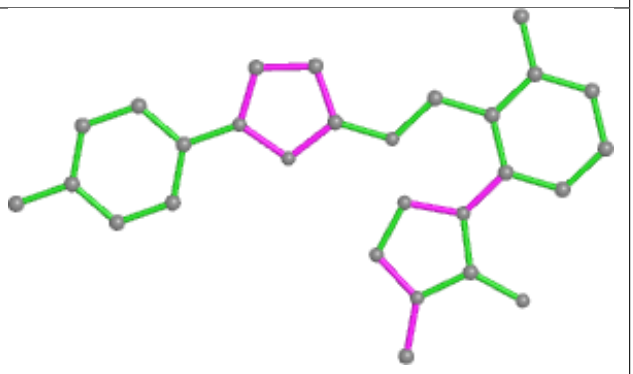


Rings

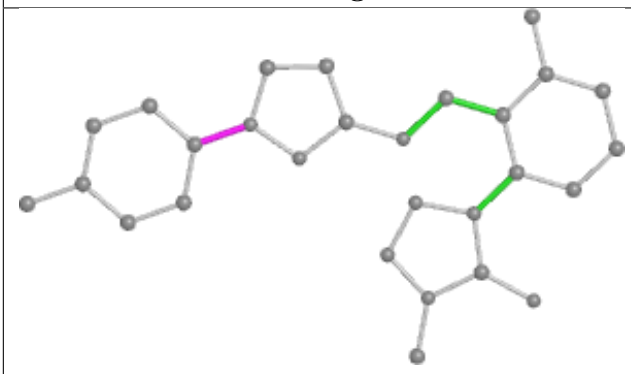
Ligand A1D6P a 401



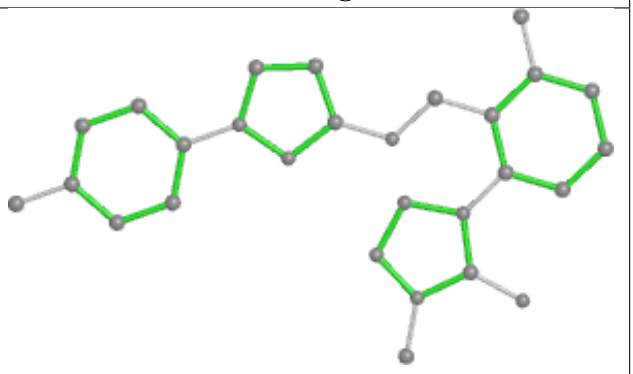
Bond lengths



Bond angles

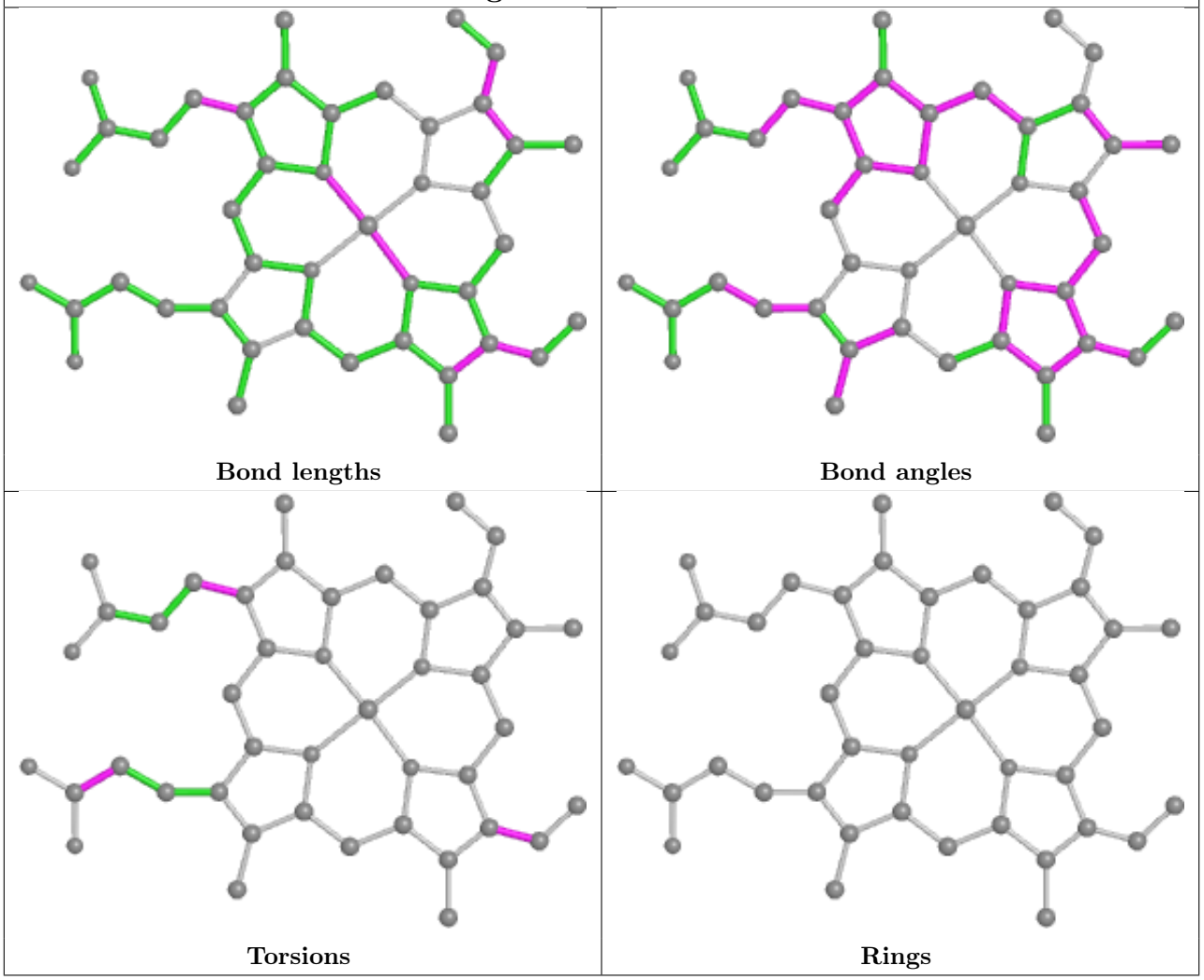


Torsions



Rings

Ligand HEM A 404



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.