wwPDB X-ray Structure Validation Summary Report (i)

Sep 25, 2023 – 12:01 PM EDT

PDB ID	:	5WBG
Title	:	Crystal Structure of human Cytochrome P450 2B6 (Y226H/K262R) in complex with an analog of a drug Efavirenz
Authors	:	Shah, M.B.; Halpert, J.R.
Deposited on	:	2017-06-29
Resolution	:	2.99 Å(reported)

This is a wwPDB X-ray Structure 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/XrayValidationReportHelp
with specific help available everywhere you see the (i) 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 (i)) were used in the production of this report:

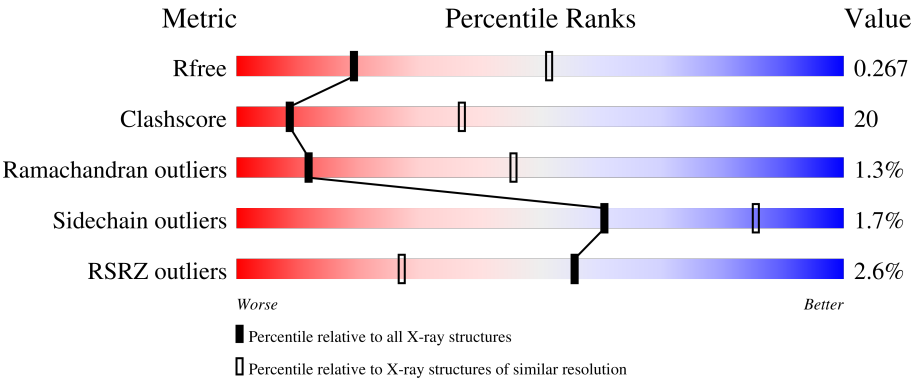
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.35.1
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.35.1

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.99 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)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	2092 (3.00-3.00)
Clashscore	141614	2416 (3.00-3.00)
Ramachandran outliers	138981	2333 (3.00-3.00)
Sidechain outliers	138945	2336 (3.00-3.00)
RSRZ outliers	127900	1990 (3.00-3.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower 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% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	476	2% 72% 23%
1	B	476	% 69% 26%
1	C	476	2% 71% 23%
1	D	476	3% 73% 23%
1	E	476	3% 74% 21%

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Mol	Chain	Length	Quality of chain
1	F	476	4% 71% 23%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	HEM	D	501	-	-	X	-
3	9ZJ	A	502	-	-	X	-
3	9ZJ	B	502	-	-	X	-
3	9ZJ	C	502	-	-	X	X
3	9ZJ	D	502	-	-	-	X
3	9ZJ	E	502	-	-	X	-
3	9ZJ	F	503	-	-	X	-
4	ZAZ	A	503	-	-	-	X
5	CM5	B	503	-	-	-	X
5	CM5	C	503	-	-	-	X
5	CM5	F	502	-	-	X	X

2 Entry composition (i)

There are 6 unique types of molecules in this entry. The entry contains 22570 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, 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 P450 2B6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	463	Total	C	N	O	S	0	0	0
			3637	2362	614	645	16			
1	B	464	Total	C	N	O	S	0	0	0
			3650	2370	614	650	16			
1	C	464	Total	C	N	O	S	0	0	0
			3655	2373	616	650	16			
1	D	464	Total	C	N	O	S	0	0	0
			3631	2360	612	643	16			
1	E	463	Total	C	N	O	S	0	0	0
			3643	2366	614	647	16			
1	F	464	Total	C	N	O	S	0	0	0
			3633	2362	613	642	16			

There are 96 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	20	MET	-	initiating methionine	UNP P20813
A	21	ALA	GLN	engineered mutation	UNP P20813
A	22	LYS	ARG	engineered mutation	UNP P20813
A	23	LYS	HIS	engineered mutation	UNP P20813
A	24	THR	PRO	engineered mutation	UNP P20813
A	25	SER	ASN	engineered mutation	UNP P20813
A	26	SER	THR	engineered mutation	UNP P20813
A	27	LYS	HIS	engineered mutation	UNP P20813
A	28	GLY	ASP	engineered mutation	UNP P20813
A	29	LYS	ARG	engineered mutation	UNP P20813
A	226	HIS	TYR	engineered mutation	UNP P20813
A	262	ARG	LYS	engineered mutation	UNP P20813
A	492	HIS	-	expression tag	UNP P20813
A	493	HIS	-	expression tag	UNP P20813
A	494	HIS	-	expression tag	UNP P20813
A	495	HIS	-	expression tag	UNP P20813
B	20	MET	-	initiating methionine	UNP P20813

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Chain	Residue	Modelled	Actual	Comment	Reference
B	21	ALA	GLN	engineered mutation	UNP P20813
B	22	LYS	ARG	engineered mutation	UNP P20813
B	23	LYS	HIS	engineered mutation	UNP P20813
B	24	THR	PRO	engineered mutation	UNP P20813
B	25	SER	ASN	engineered mutation	UNP P20813
B	26	SER	THR	engineered mutation	UNP P20813
B	27	LYS	HIS	engineered mutation	UNP P20813
B	28	GLY	ASP	engineered mutation	UNP P20813
B	29	LYS	ARG	engineered mutation	UNP P20813
B	226	HIS	TYR	engineered mutation	UNP P20813
B	262	ARG	LYS	engineered mutation	UNP P20813
B	492	HIS	-	expression tag	UNP P20813
B	493	HIS	-	expression tag	UNP P20813
B	494	HIS	-	expression tag	UNP P20813
B	495	HIS	-	expression tag	UNP P20813
C	20	MET	-	initiating methionine	UNP P20813
C	21	ALA	GLN	engineered mutation	UNP P20813
C	22	LYS	ARG	engineered mutation	UNP P20813
C	23	LYS	HIS	engineered mutation	UNP P20813
C	24	THR	PRO	engineered mutation	UNP P20813
C	25	SER	ASN	engineered mutation	UNP P20813
C	26	SER	THR	engineered mutation	UNP P20813
C	27	LYS	HIS	engineered mutation	UNP P20813
C	28	GLY	ASP	engineered mutation	UNP P20813
C	29	LYS	ARG	engineered mutation	UNP P20813
C	226	HIS	TYR	engineered mutation	UNP P20813
C	262	ARG	LYS	engineered mutation	UNP P20813
C	492	HIS	-	expression tag	UNP P20813
C	493	HIS	-	expression tag	UNP P20813
C	494	HIS	-	expression tag	UNP P20813
C	495	HIS	-	expression tag	UNP P20813
D	20	MET	-	initiating methionine	UNP P20813
D	21	ALA	GLN	engineered mutation	UNP P20813
D	22	LYS	ARG	engineered mutation	UNP P20813
D	23	LYS	HIS	engineered mutation	UNP P20813
D	24	THR	PRO	engineered mutation	UNP P20813
D	25	SER	ASN	engineered mutation	UNP P20813
D	26	SER	THR	engineered mutation	UNP P20813
D	27	LYS	HIS	engineered mutation	UNP P20813
D	28	GLY	ASP	engineered mutation	UNP P20813
D	29	LYS	ARG	engineered mutation	UNP P20813
D	226	HIS	TYR	engineered mutation	UNP P20813

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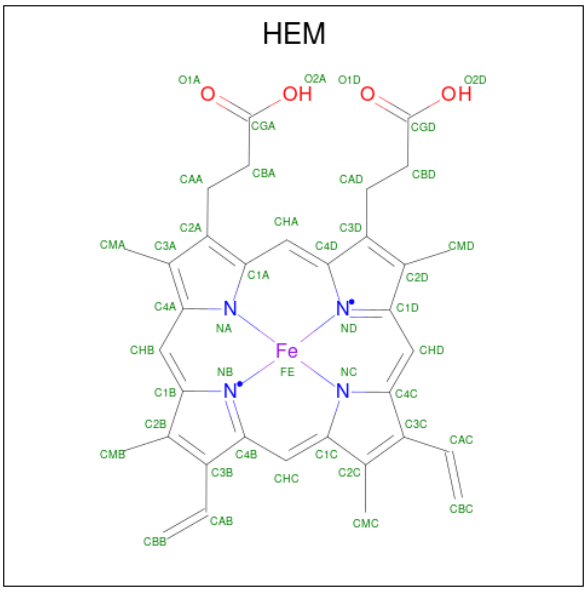
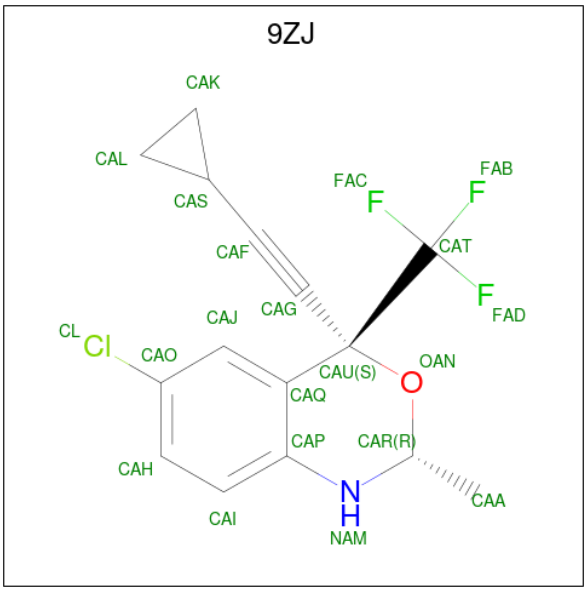
Chain	Residue	Modelled	Actual	Comment	Reference
D	262	ARG	LYS	engineered mutation	UNP P20813
D	492	HIS	-	expression tag	UNP P20813
D	493	HIS	-	expression tag	UNP P20813
D	494	HIS	-	expression tag	UNP P20813
D	495	HIS	-	expression tag	UNP P20813
E	20	MET	-	initiating methionine	UNP P20813
E	21	ALA	GLN	engineered mutation	UNP P20813
E	22	LYS	ARG	engineered mutation	UNP P20813
E	23	LYS	HIS	engineered mutation	UNP P20813
E	24	THR	PRO	engineered mutation	UNP P20813
E	25	SER	ASN	engineered mutation	UNP P20813
E	26	SER	THR	engineered mutation	UNP P20813
E	27	LYS	HIS	engineered mutation	UNP P20813
E	28	GLY	ASP	engineered mutation	UNP P20813
E	29	LYS	ARG	engineered mutation	UNP P20813
E	226	HIS	TYR	engineered mutation	UNP P20813
E	262	ARG	LYS	engineered mutation	UNP P20813
E	492	HIS	-	expression tag	UNP P20813
E	493	HIS	-	expression tag	UNP P20813
E	494	HIS	-	expression tag	UNP P20813
E	495	HIS	-	expression tag	UNP P20813
F	20	MET	-	initiating methionine	UNP P20813
F	21	ALA	GLN	engineered mutation	UNP P20813
F	22	LYS	ARG	engineered mutation	UNP P20813
F	23	LYS	HIS	engineered mutation	UNP P20813
F	24	THR	PRO	engineered mutation	UNP P20813
F	25	SER	ASN	engineered mutation	UNP P20813
F	26	SER	THR	engineered mutation	UNP P20813
F	27	LYS	HIS	engineered mutation	UNP P20813
F	28	GLY	ASP	engineered mutation	UNP P20813
F	29	LYS	ARG	engineered mutation	UNP P20813
F	226	HIS	TYR	engineered mutation	UNP P20813
F	262	ARG	LYS	engineered mutation	UNP P20813
F	492	HIS	-	expression tag	UNP P20813
F	493	HIS	-	expression tag	UNP P20813
F	494	HIS	-	expression tag	UNP P20813
F	495	HIS	-	expression tag	UNP P20813

- Molecule 2 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



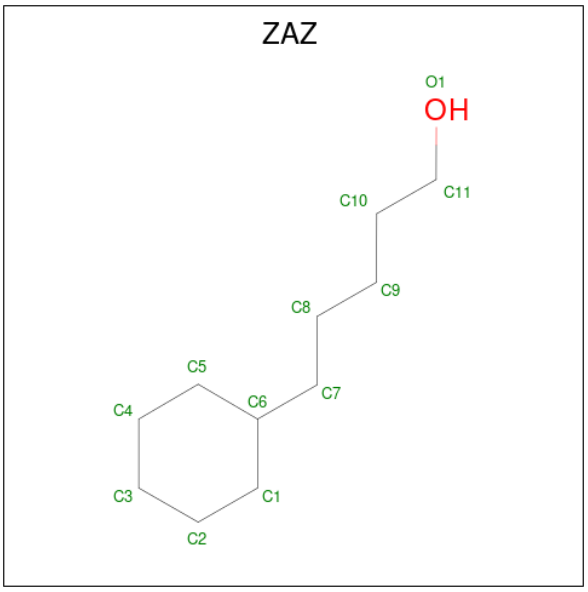
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	C	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	D	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	E	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	F	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

- Molecule 3 is (2R,4S)-6-chloro-4-(cyclopropylethynyl)-2-methyl-4-(trifluoromethyl)-1,4-dihydro-2H-3,1-benzoxazine (three-letter code: 9ZJ) (formula: $C_{15}H_{13}ClF_3NO$).



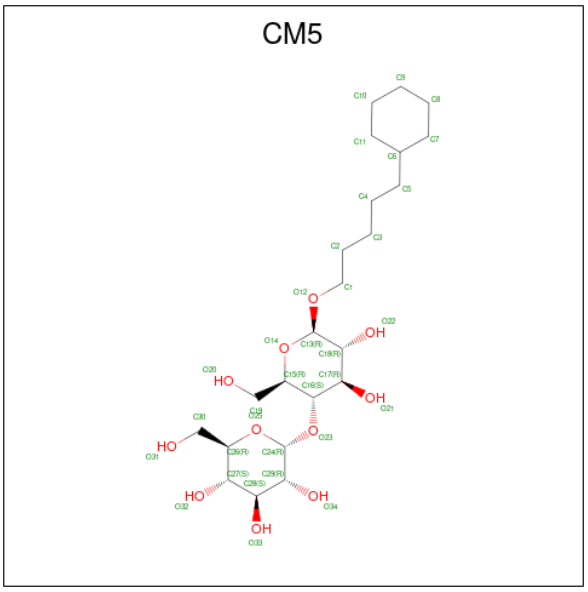
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total	C	Cl	F	N	O	0	0
			21	15	1	3	1	1		
3	B	1	Total	C	Cl	F	N	O	0	0
			21	15	1	3	1	1		
3	C	1	Total	C	Cl	F	N	O	0	0
			21	15	1	3	1	1		
3	D	1	Total	C	Cl	F	N	O	0	0
			21	15	1	3	1	1		
3	E	1	Total	C	Cl	F	N	O	0	0
			21	15	1	3	1	1		
3	F	1	Total	C	Cl	F	N	O	0	0
			21	15	1	3	1	1		

- Molecule 4 is 5-cyclohexylpentan-1-ol (three-letter code: ZAZ) (formula: $C_{11}H_{22}O$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 12 11 1	0	0

- Molecule 5 is 5-CYCLOHEXYL-1-PENTYL-BETA-D-MALTOSIDE (three-letter code: CM5) (formula: $C_{23}H_{42}O_{11}$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	B	1	Total C O 34 23 11	0	0
5	C	1	Total C O 34 23 11	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	D	1	Total C O 34 23 11	0	0
5	E	1	Total C O 34 23 11	0	0
5	F	1	Total C O 34 23 11	0	0

- Molecule 6 is water.

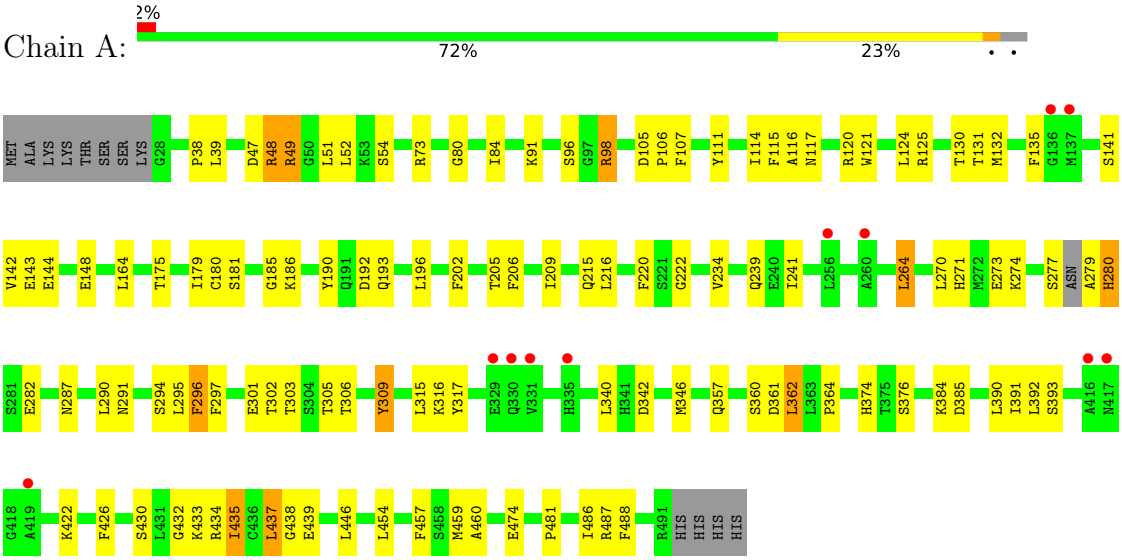
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	36	Total O 36 36	0	0
6	B	39	Total O 39 39	0	0
6	C	25	Total O 25 25	0	0
6	D	26	Total O 26 26	0	0
6	E	17	Total O 17 17	0	0
6	F	12	Total O 12 12	0	0

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 and electron density. 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. A red dot above a residue indicates a poor fit to the electron density (RSRZ > 2). 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.

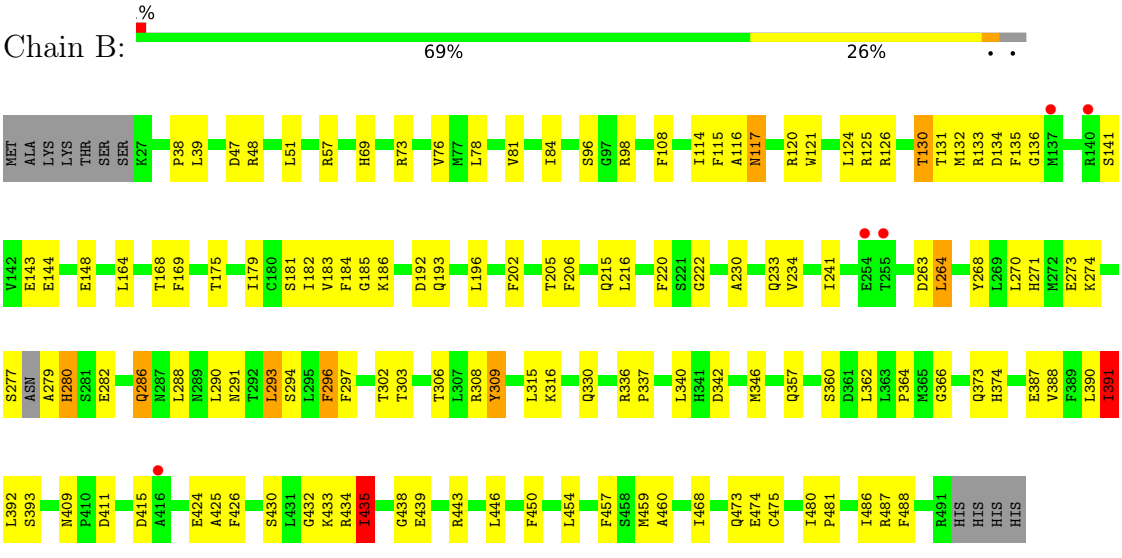
• Molecule 1: Cytochrome P450 2B6

Chain A:



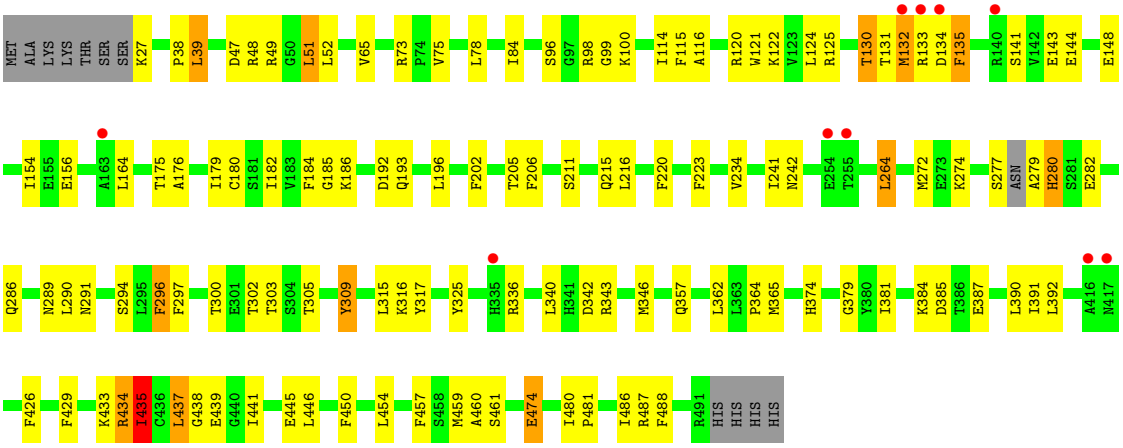
• Molecule 1: Cytochrome P450 2B6

Chain B:



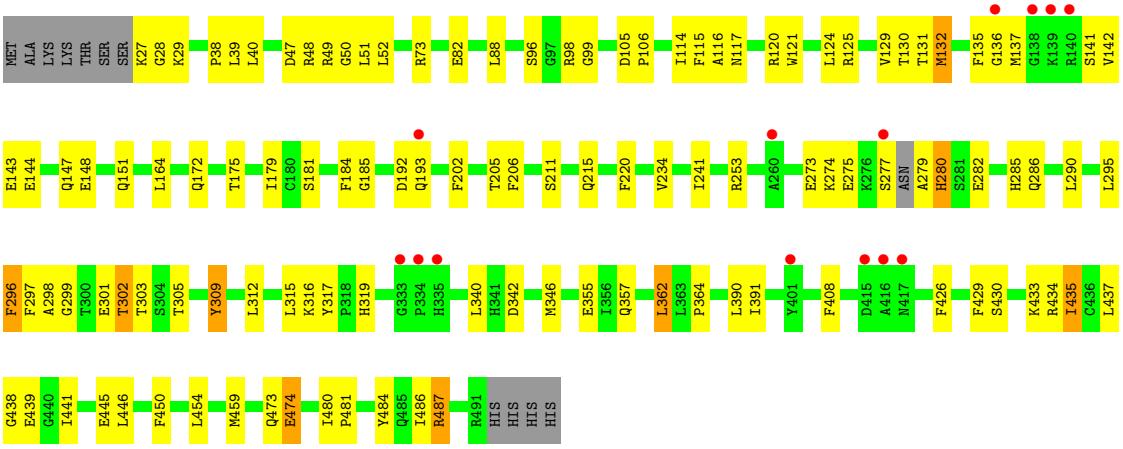
• Molecule 1: Cytochrome P450 2B6

Chain C:



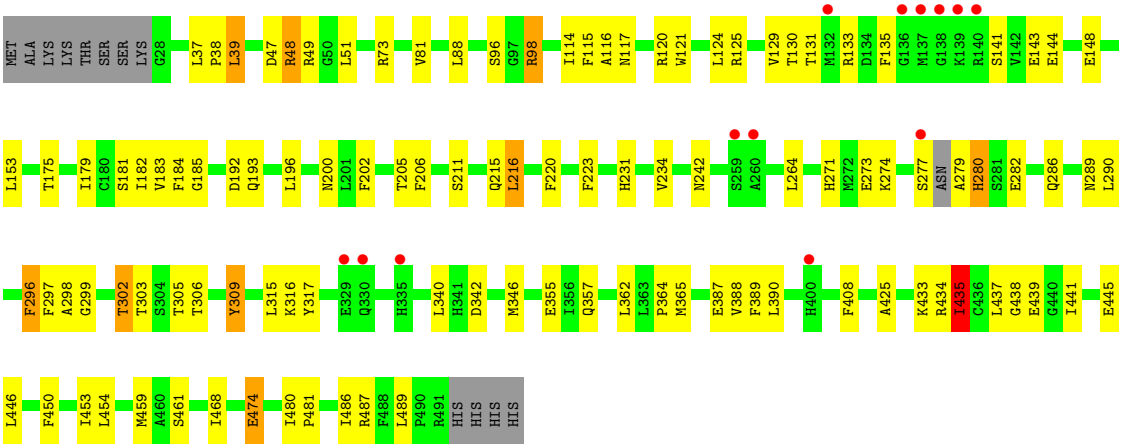
• Molecule 1: Cytochrome P450 2B6

Chain D:



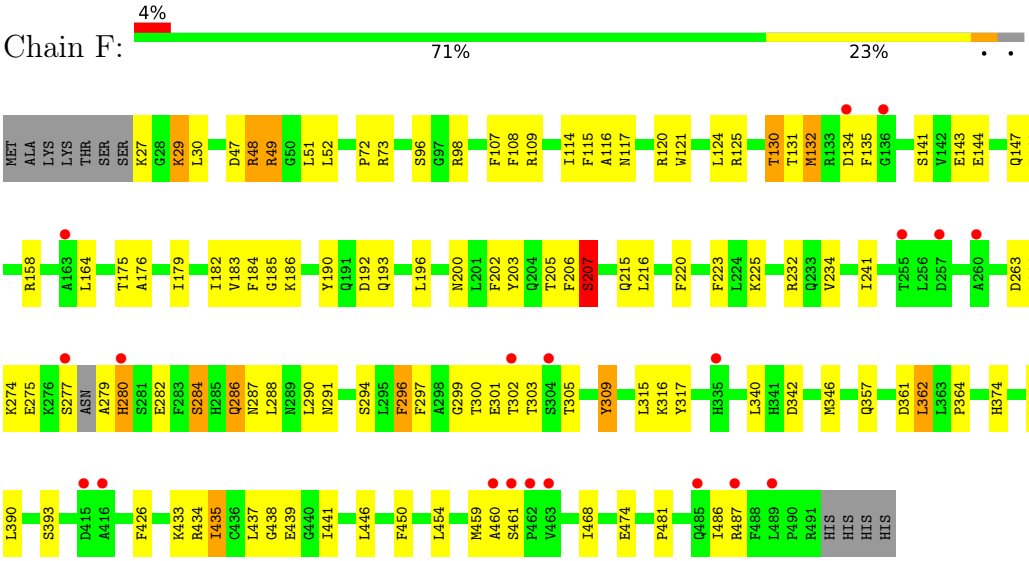
• Molecule 1: Cytochrome P450 2B6

Chain E:



• Molecule 1: Cytochrome P450 2B6

Chain F:


4%
71%
23%
MET ALA LYS LYS THR SER SER K27 G28 K29 L30 D47 R48 R49 G50 L51 L52 P72 R73 S96 G97 R98 F107 F108 R109 I114 F115 A116 N117 R120 W121 L124 R125 T130 T131 M132 R133 D134 F135 G136 S141 V142 E143 E144 Q147 E148 Q151 I154
R158 A163 L164 T175 A176 I179 I182 V183 F184 G185 K186 Y190 Q191 D192 Q193 L196 N200 L201 F202 Y203 Q204 T205 F206 S207 Q215 L216 F220 F223 L224 K225 R232 Q233 V234 I241 T255 L256 D257 A260 D263 L264 Y268 E273
K274 E275 K276 S277 ASN A279 H280 S281 E282 F283 S284 H285 Q286 N287 L288 N289 L290 N291 S294 L295 F296 F297 A298 G299 T300 E301 T302 T303 S304 T305 Y309 L315 K316 Y317 H335 L340 H341 D342 M346 Q357 D361 L362 L363 P364 H374 Y380 K384 D385
L390 S393 D415 A416 F426 K433 R434 I435 C436 L437 G438 E439 G440 I441 L446 F450 L454 M459 A460 S461 P462 V463 I468 E474 P481 Q485 I486 R487 F488 L489 P490 R491 HIS HIS HIS HIS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	103.29Å 197.79Å 119.22Å 90.00° 98.51° 90.00°	Depositor
Resolution (Å)	50.00 – 2.99 39.65 – 2.99	Depositor EDS
% Data completeness (in resolution range)	99.2 (50.00-2.99) 99.2 (39.65-2.99)	Depositor EDS
R_{merge}	0.19	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.94 (at 3.01Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.227 , 0.262 0.236 , 0.267	Depositor DCC
R_{free} test set	4745 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å^2)	64.6	Xtriage
Anisotropy	0.156	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 60.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.45$, $< L^2 > = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.91	EDS
Total number of atoms	22570	wwPDB-VP
Average B, all atoms (Å^2)	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.01% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CM5, HEM, 9ZJ, ZAZ

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	0.64	0/3737	0.74	4/5074 (0.1%)
1	B	0.67	0/3749	0.75	3/5088 (0.1%)
1	C	0.63	0/3755	0.75	6/5096 (0.1%)
1	D	0.62	0/3731	0.71	3/5066 (0.1%)
1	E	0.61	0/3743	0.72	3/5081 (0.1%)
1	F	0.59	0/3733	0.71	4/5069 (0.1%)
All	All	0.63	0/22448	0.73	23/30474 (0.1%)

There are no bond length outliers.

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

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	437	LEU	CB-CG-CD1	-8.87	95.93	111.00
1	C	435	ILE	CB-CA-C	-8.08	95.45	111.60
1	F	435	ILE	CB-CA-C	-8.05	95.50	111.60
1	B	435	ILE	CB-CA-C	-7.66	96.28	111.60
1	A	132	MET	N-CA-C	-6.98	92.15	111.00

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	3637	0	3515	125	0
1	B	3650	0	3533	153	0
1	C	3655	0	3538	164	0
1	D	3631	0	3502	138	0
1	E	3643	0	3524	156	0
1	F	3633	0	3511	141	0
2	A	43	0	30	5	0
2	B	43	0	30	4	0
2	C	43	0	30	11	0
2	D	43	0	30	22	0
2	E	43	0	30	15	0
2	F	43	0	30	1	0
3	A	21	0	0	10	0
3	B	21	0	0	8	0
3	C	21	0	0	7	0
3	D	21	0	0	6	0
3	E	21	0	0	7	0
3	F	21	0	0	10	0
4	A	12	0	0	0	0
5	B	34	0	42	7	0
5	C	34	0	42	20	0
5	D	34	0	42	13	0
5	E	34	0	42	18	0
5	F	34	0	42	24	0
6	A	36	0	0	8	0
6	B	39	0	0	10	0
6	C	25	0	0	8	0
6	D	26	0	0	5	0
6	E	17	0	0	5	0
6	F	12	0	0	3	0
All	All	22570	0	21513	900	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 20.

The worst 5 of 900 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:E:131:THR:HG21	1:E:264:LEU:CD2	1.17	1.59
1:A:135:PHE:CE2	1:A:142:VAL:CG2	2.05	1.39
1:A:135:PHE:CE2	1:A:142:VAL:HG22	1.57	1.38
1:A:135:PHE:HE2	1:A:142:VAL:CG2	1.41	1.31

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:220:PHE:CD2	5:E:503:CM5:H101	1.67	1.30

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 X-ray entries followed by that with respect to entries of similar resolution.

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	459/476 (96%)	420 (92%)	32 (7%)	7 (2%)	10	42
1	B	460/476 (97%)	419 (91%)	34 (7%)	7 (2%)	10	42
1	C	460/476 (97%)	414 (90%)	41 (9%)	5 (1%)	14	50
1	D	460/476 (97%)	414 (90%)	38 (8%)	8 (2%)	9	39
1	E	459/476 (96%)	417 (91%)	37 (8%)	5 (1%)	14	50
1	F	460/476 (97%)	416 (90%)	40 (9%)	4 (1%)	17	55
All	All	2758/2856 (97%)	2500 (91%)	222 (8%)	36 (1%)	12	45

5 of 36 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	280	HIS
1	B	280	HIS
1	C	280	HIS
1	D	28	GLY
1	D	280	HIS

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 X-ray entries followed by that with respect to entries of similar resolution.

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	376/418 (90%)	371 (99%)	5 (1%)	69	89
1	B	378/418 (90%)	370 (98%)	8 (2%)	53	82
1	C	379/418 (91%)	373 (98%)	6 (2%)	62	86
1	D	373/418 (89%)	368 (99%)	5 (1%)	69	89
1	E	377/418 (90%)	372 (99%)	5 (1%)	69	89
1	F	374/418 (90%)	364 (97%)	10 (3%)	44	77
All	All	2257/2508 (90%)	2218 (98%)	39 (2%)	60	85

5 of 39 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	309	TYR
1	F	286	GLN
1	F	30	LEU
1	F	200	ASN
1	F	309	TYR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 monosaccharides in this entry.

5.6 Ligand geometry (i)

18 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	9ZJ	A	502	-	22,23,23	2.14	1 (4%)	34,36,36	4.38	7 (20%)
5	CM5	C	503	-	36,36,36	0.41	0	49,49,49	0.70	1 (2%)
4	ZAZ	A	503	-	12,12,12	0.78	0	13,13,13	0.77	0
2	HEM	A	501	1	41,50,50	1.80	4 (9%)	45,82,82	1.52	7 (15%)
5	CM5	E	503	-	36,36,36	0.40	0	49,49,49	0.70	1 (2%)
5	CM5	B	503	-	36,36,36	0.40	0	49,49,49	0.70	1 (2%)
3	9ZJ	D	502	-	22,23,23	2.43	2 (9%)	34,36,36	4.14	7 (20%)
3	9ZJ	B	502	-	22,23,23	2.95	4 (18%)	34,36,36	5.32	6 (17%)
2	HEM	D	501	1	41,50,50	1.93	6 (14%)	45,82,82	1.90	15 (33%)
3	9ZJ	E	502	-	22,23,23	2.40	3 (13%)	34,36,36	4.75	8 (23%)
2	HEM	B	501	1	41,50,50	1.83	5 (12%)	45,82,82	1.79	10 (22%)
5	CM5	D	503	-	36,36,36	0.40	0	49,49,49	0.70	1 (2%)
2	HEM	F	501	1	41,50,50	1.99	7 (17%)	45,82,82	1.98	14 (31%)
2	HEM	E	501	1	41,50,50	1.86	4 (9%)	45,82,82	1.89	13 (28%)
3	9ZJ	C	502	-	22,23,23	2.31	3 (13%)	34,36,36	4.40	7 (20%)
3	9ZJ	F	503	-	22,23,23	2.27	2 (9%)	34,36,36	4.30	7 (20%)
5	CM5	F	502	-	36,36,36	0.40	0	49,49,49	0.70	1 (2%)
2	HEM	C	501	1	41,50,50	2.02	6 (14%)	45,82,82	1.52	9 (20%)

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	9ZJ	A	502	-	-	10/10/32/32	0/3/3/3
5	CM5	C	503	-	-	14/17/65/65	0/3/3/3
4	ZAZ	A	503	-	-	1/6/14/14	0/1/1/1
2	HEM	A	501	1	-	2/12/54/54	-
5	CM5	E	503	-	-	14/17/65/65	0/3/3/3

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	CM5	B	503	-	-	14/17/65/65	0/3/3/3
3	9ZJ	D	502	-	-	10/10/32/32	0/3/3/3
3	9ZJ	B	502	-	-	10/10/32/32	0/3/3/3
2	HEM	D	501	1	-	6/12/54/54	-
3	9ZJ	E	502	-	-	10/10/32/32	0/3/3/3
2	HEM	B	501	1	-	4/12/54/54	-
5	CM5	D	503	-	-	14/17/65/65	0/3/3/3
2	HEM	F	501	1	-	6/12/54/54	-
2	HEM	E	501	1	-	4/12/54/54	-
3	9ZJ	C	502	-	-	10/10/32/32	0/3/3/3
3	9ZJ	F	503	-	-	10/10/32/32	0/3/3/3
5	CM5	F	502	-	-	14/17/65/65	0/3/3/3
2	HEM	C	501	1	-	4/12/54/54	-

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	502	9ZJ	CAU-CAQ	-9.57	1.39	1.51
3	C	502	9ZJ	CAU-CAQ	-9.53	1.39	1.51
3	D	502	9ZJ	CAU-CAQ	-9.51	1.39	1.51
3	A	502	9ZJ	CAU-CAQ	-9.51	1.39	1.51
3	F	503	9ZJ	CAU-CAQ	-9.51	1.39	1.51

The worst 5 of 115 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	B	502	9ZJ	OAN-CAU-CAQ	20.31	125.99	111.64
3	C	502	9ZJ	OAN-CAU-CAQ	16.82	123.53	111.64
3	B	502	9ZJ	CAA-CAR-NAM	16.55	127.55	109.64
3	E	502	9ZJ	OAN-CAU-CAG	-13.62	77.13	108.39
3	A	502	9ZJ	OAN-CAU-CAQ	12.33	120.35	111.64

There are no chirality outliers.

5 of 157 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	F	501	HEM	C2B-C3B-CAB-CBB
3	A	502	9ZJ	FAC-CAT-CAU-CAG

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Mol	Chain	Res	Type	Atoms
3	A	502	9ZJ	FAD-CAT-CAU-CAG
3	A	502	9ZJ	FAB-CAT-CAU-CAG
3	A	502	9ZJ	FAC-CAT-CAU-OAN

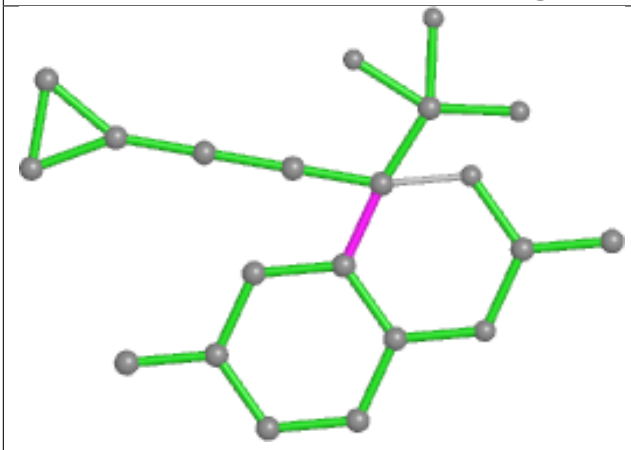
There are no ring outliers.

17 monomers are involved in 188 short contacts:

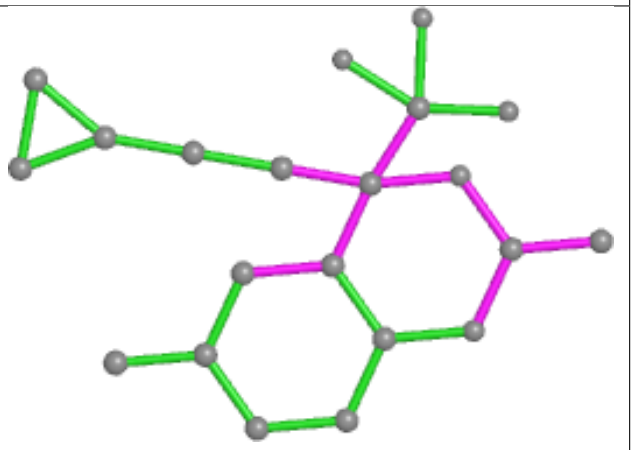
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	502	9ZJ	10	0
5	C	503	CM5	20	0
2	A	501	HEM	5	0
5	E	503	CM5	18	0
5	B	503	CM5	7	0
3	D	502	9ZJ	6	0
3	B	502	9ZJ	8	0
2	D	501	HEM	22	0
3	E	502	9ZJ	7	0
2	B	501	HEM	4	0
5	D	503	CM5	13	0
2	F	501	HEM	1	0
2	E	501	HEM	15	0
3	C	502	9ZJ	7	0
3	F	503	9ZJ	10	0
5	F	502	CM5	24	0
2	C	501	HEM	11	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.

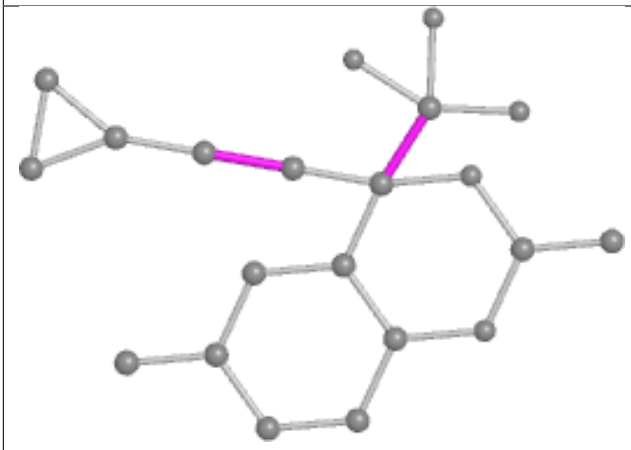
Ligand 9ZJ A 502



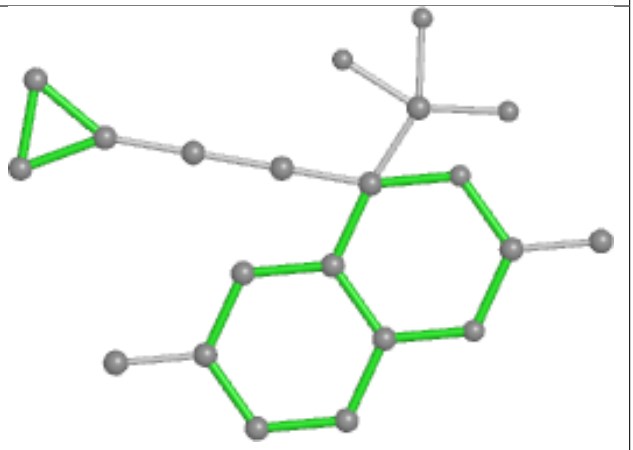
Bond lengths



Bond angles

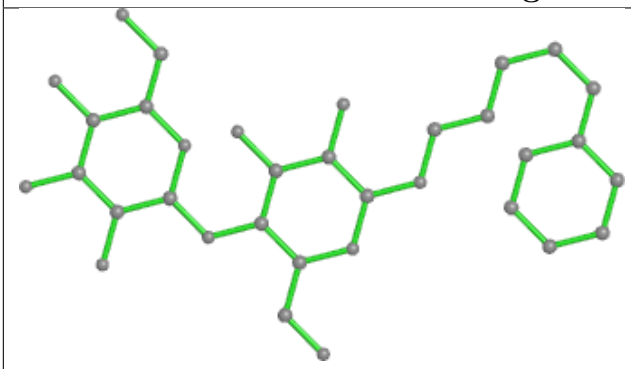


Torsions



Rings

Ligand CM5 C 503



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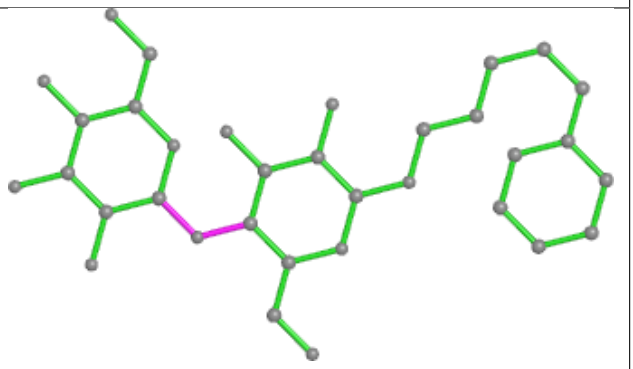

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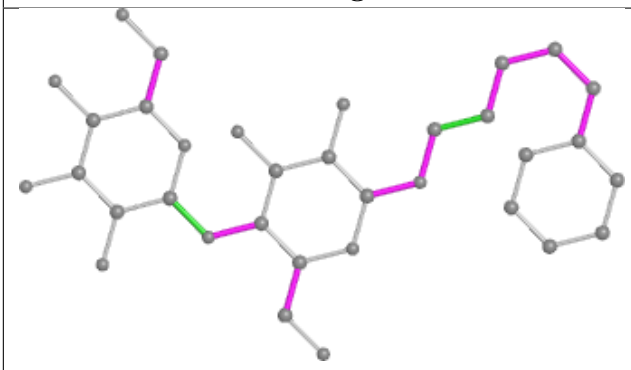

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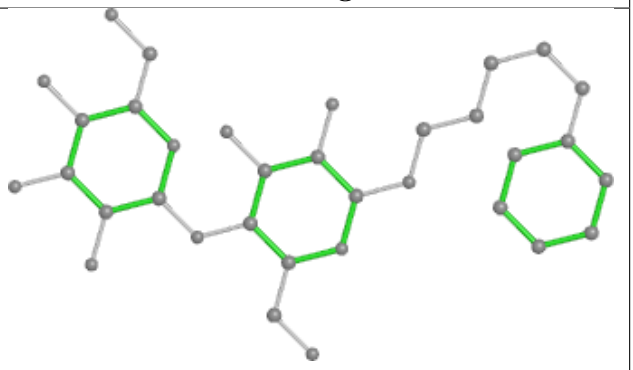
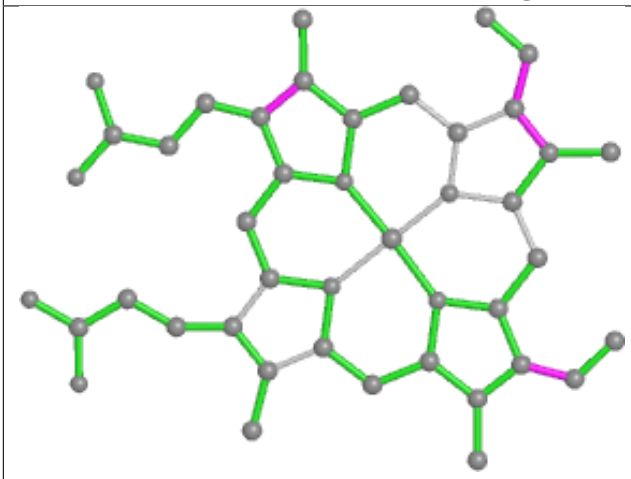


Rings

Ligand HEM A 501



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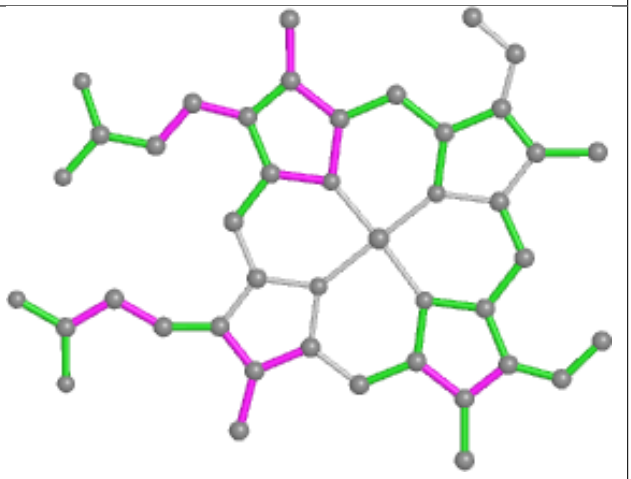

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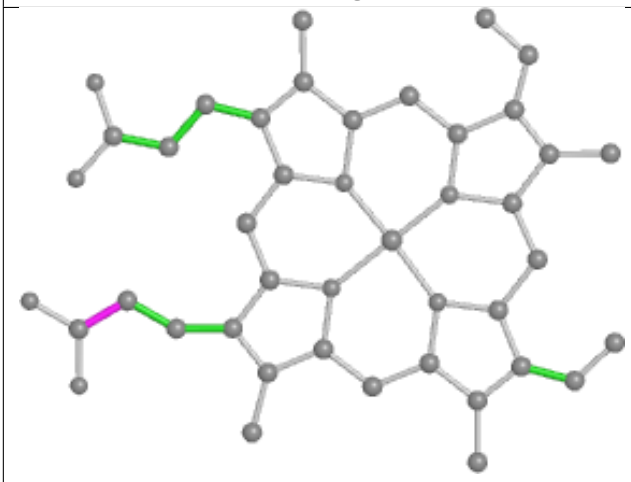

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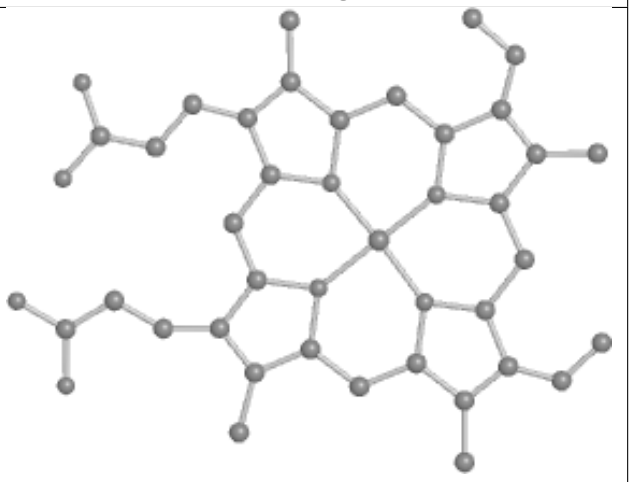
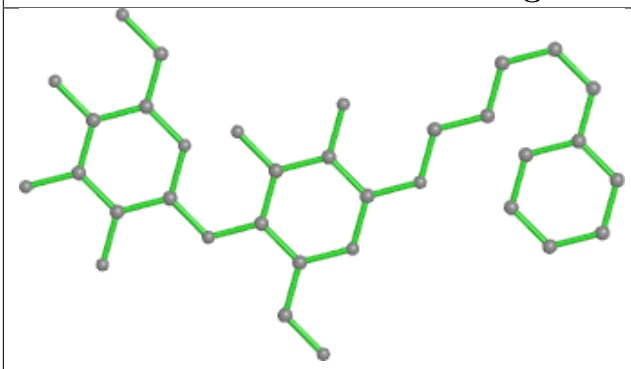


Rings

Ligand CM5 E 503



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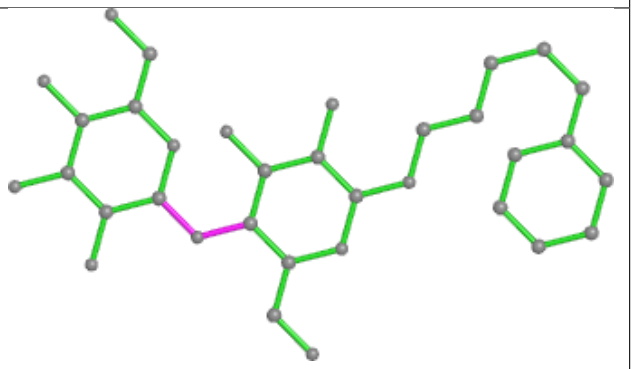

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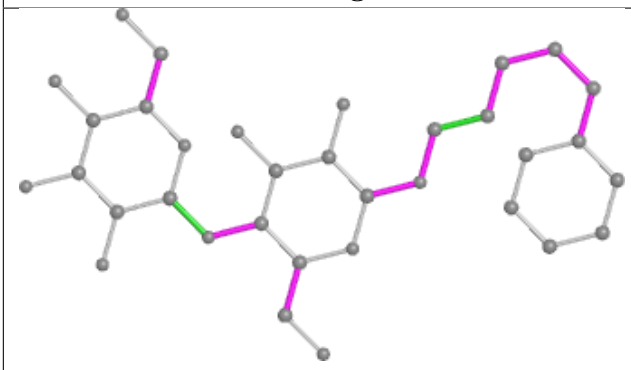

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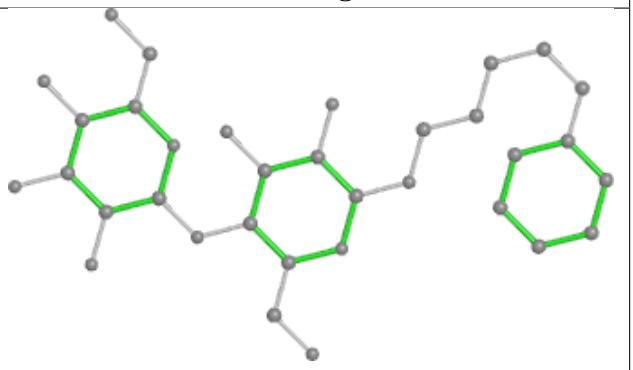
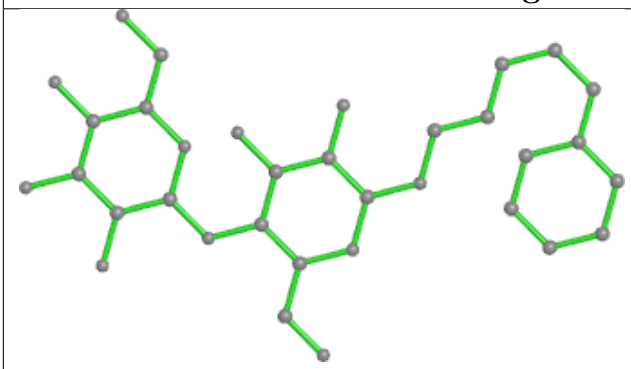


Rings

Ligand CM5 B 503



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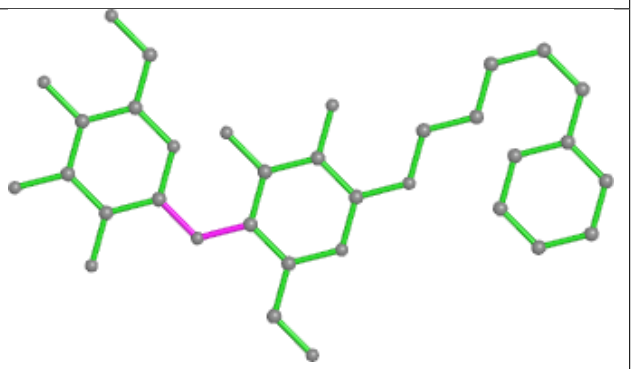

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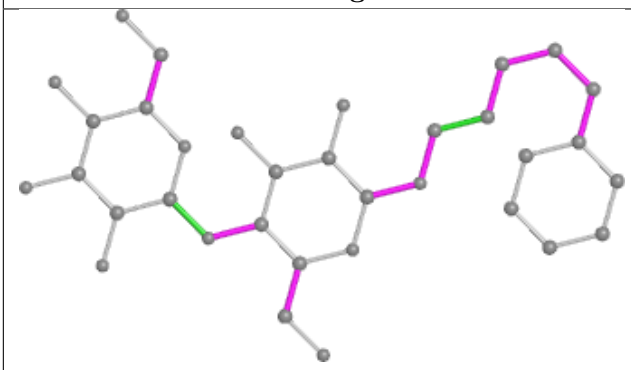

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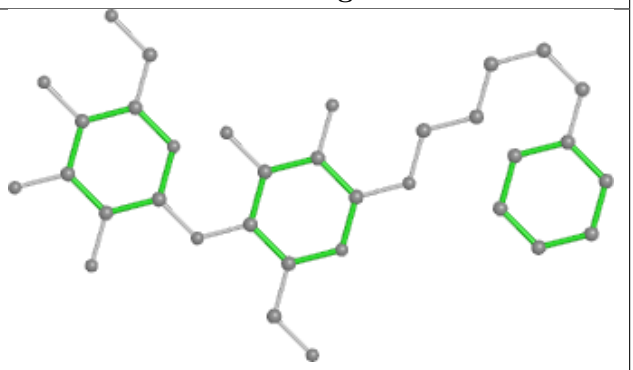
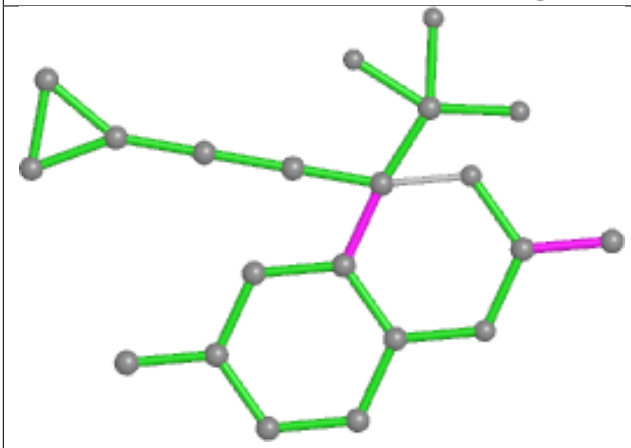


Rings

Ligand 9ZJ D 502



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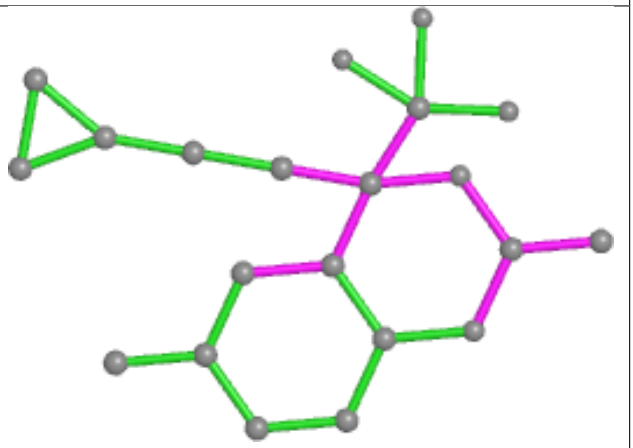

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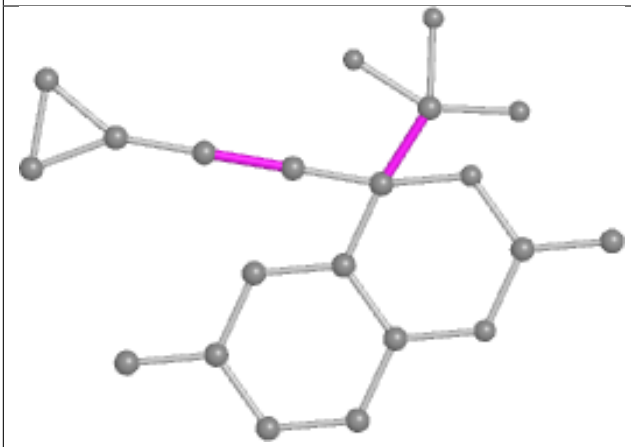

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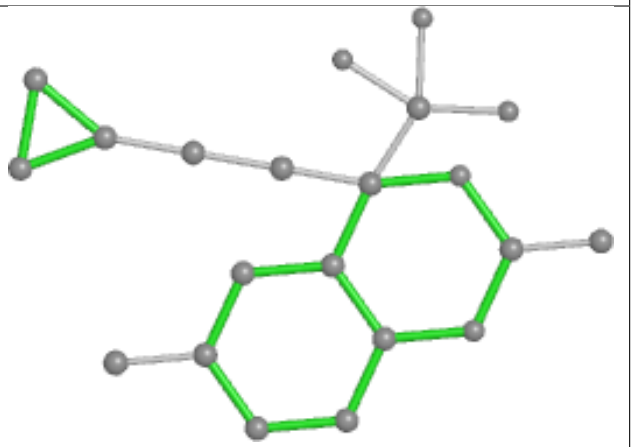
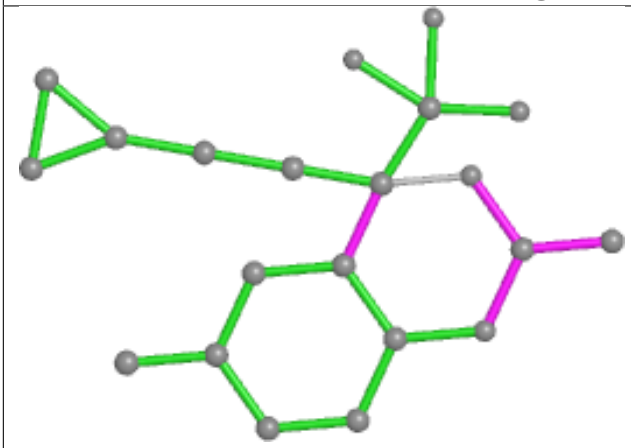


Rings

Ligand 9ZJ B 502



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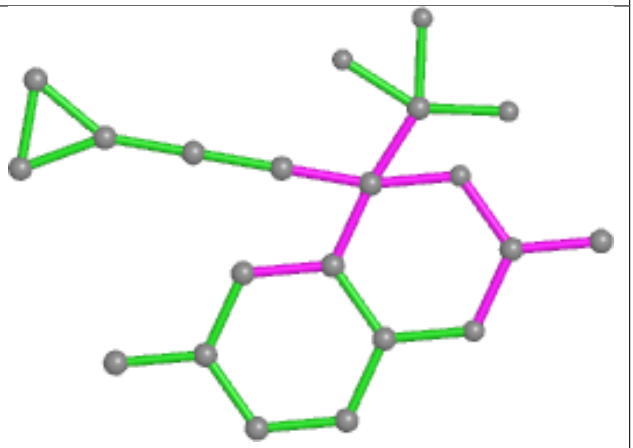
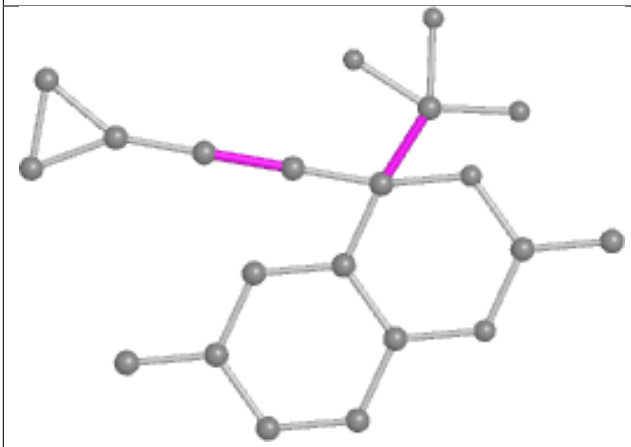


Bond angles



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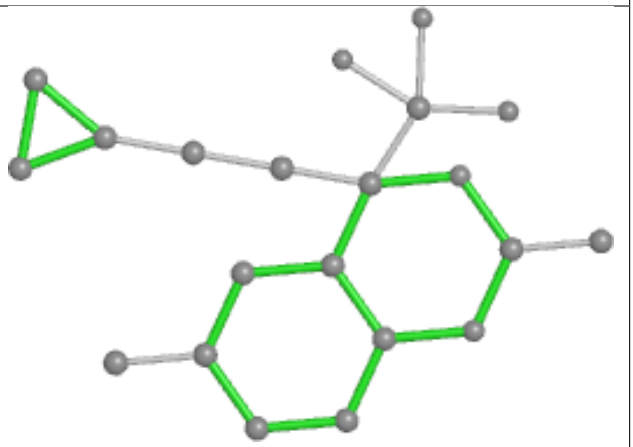
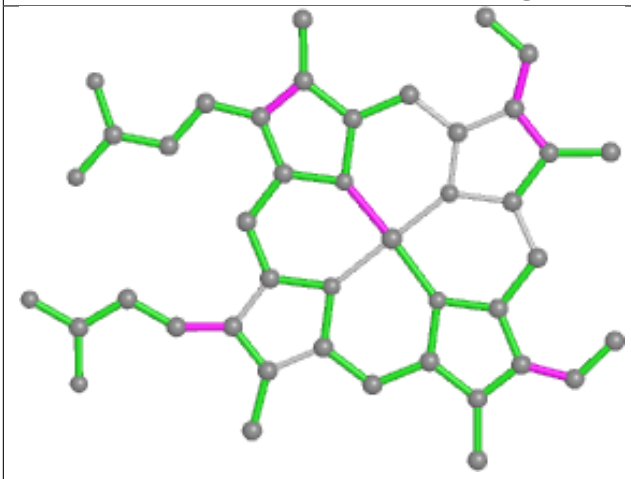
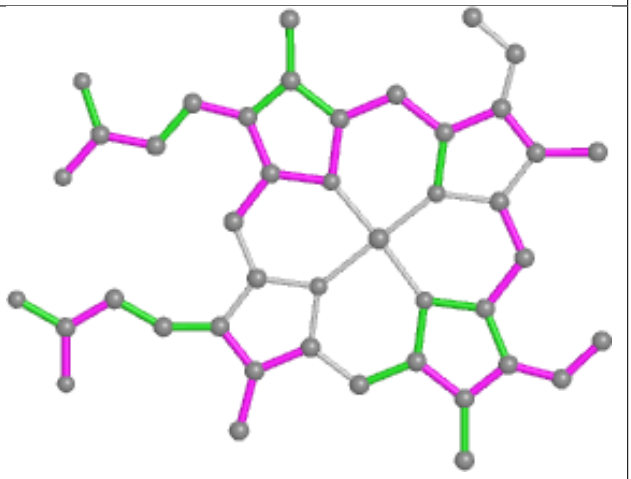


Rings

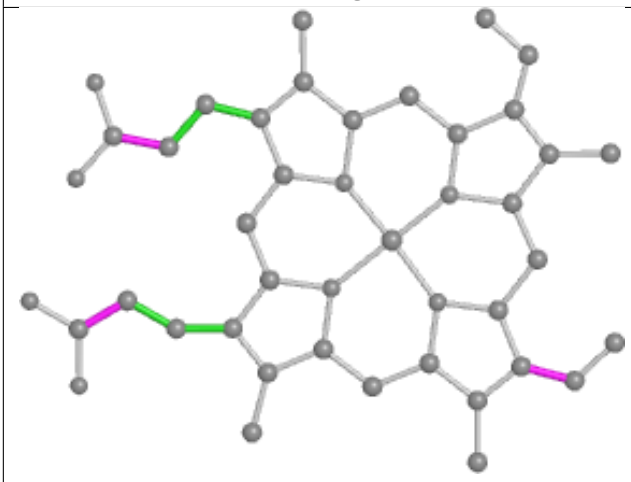
Ligand HEM D 501



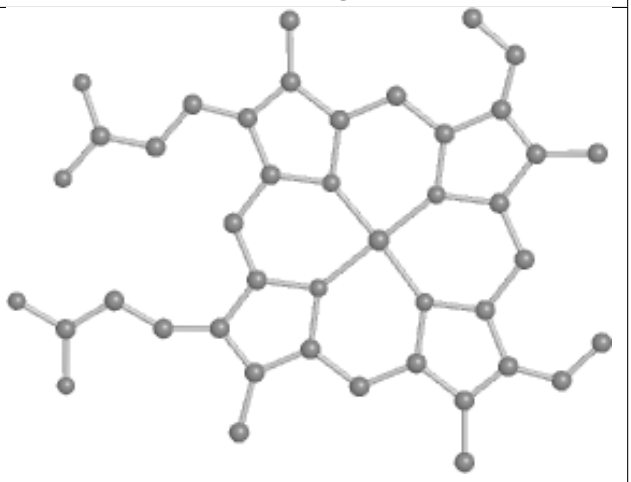
Bond lengths



Bond angles

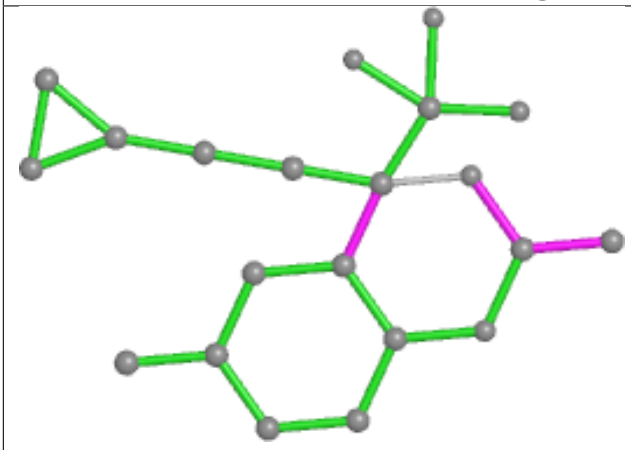


Torsions

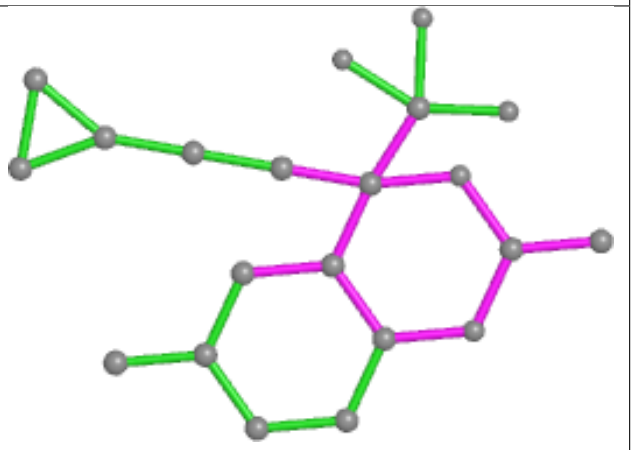


Rings

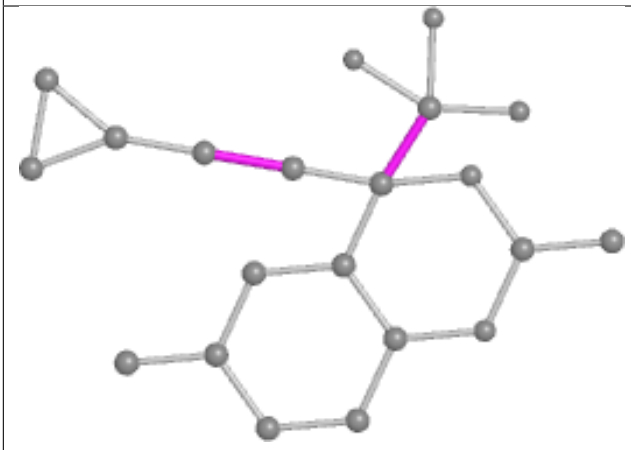
Ligand 9ZJ E 502



Bond lengths



Bond angles



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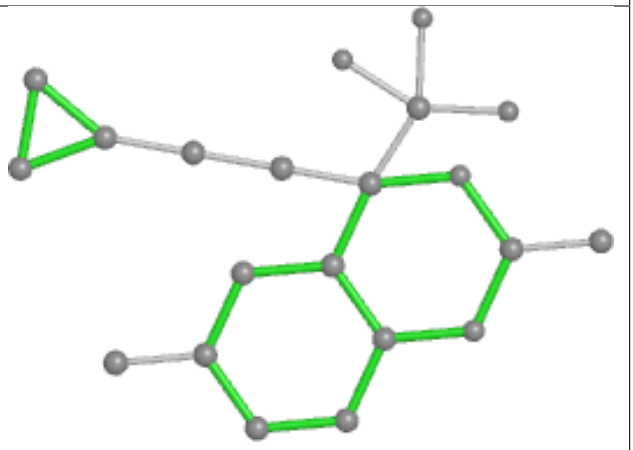
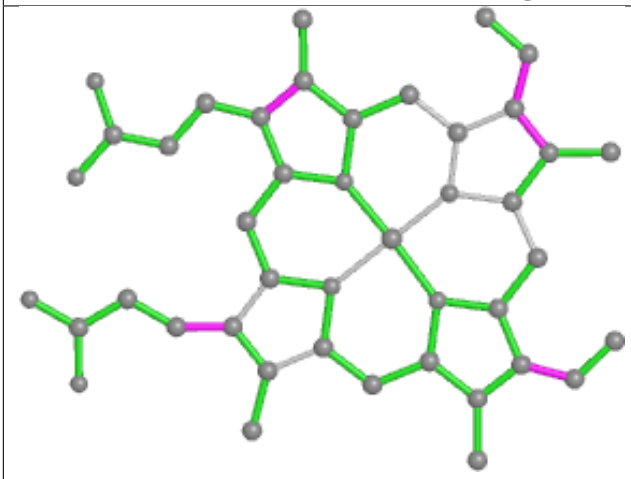
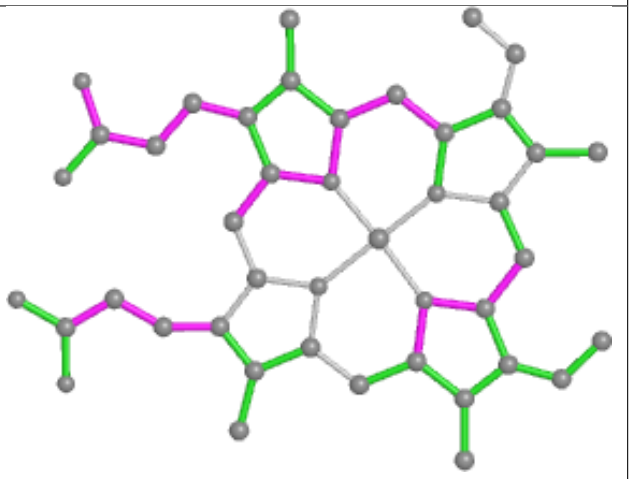


Rings

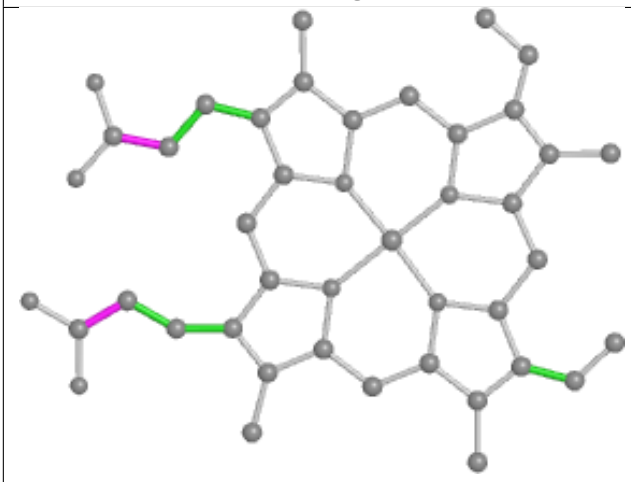
Ligand HEM B 501



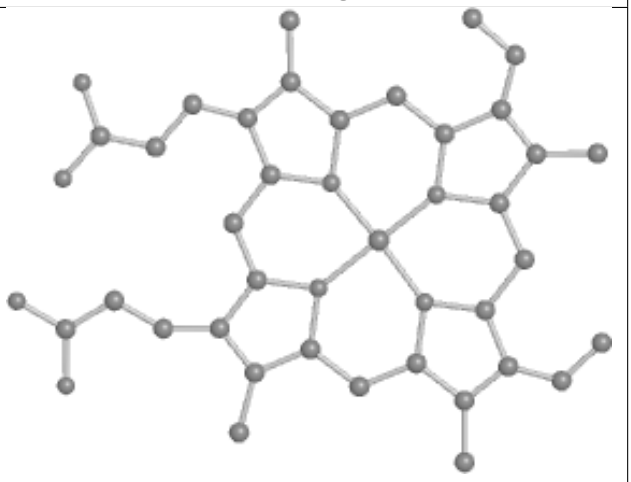
Bond lengths



Bond angles

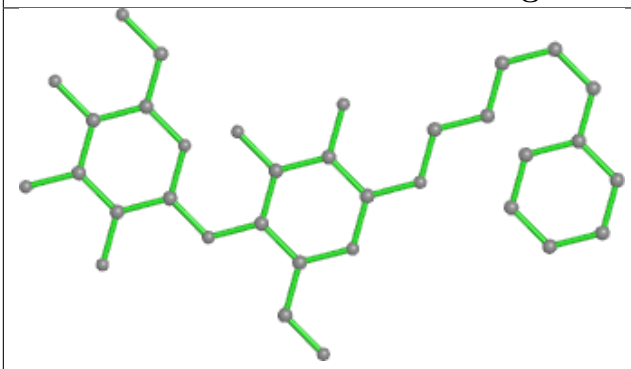


Torsions

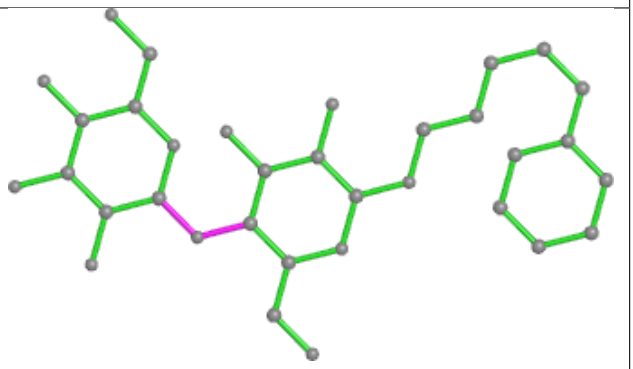


Rings

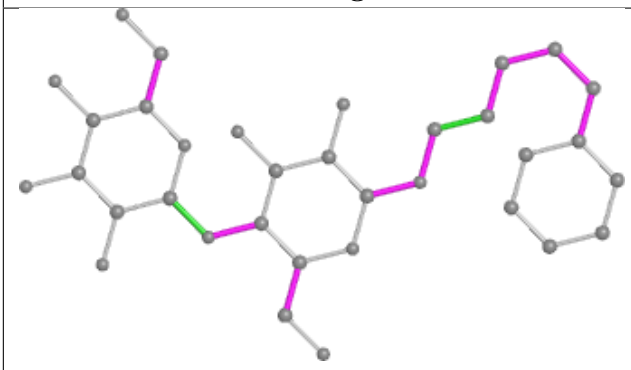
Ligand CM5 D 503



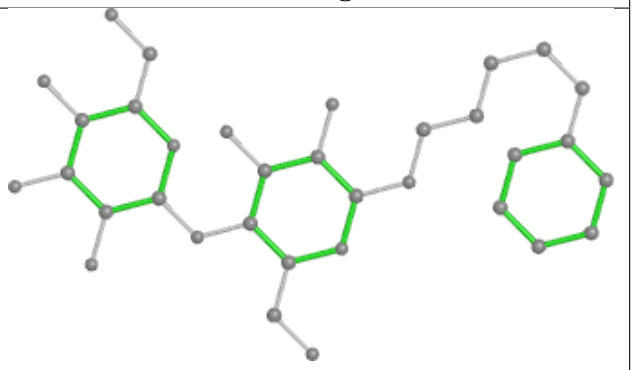
Bond lengths



Bond angles

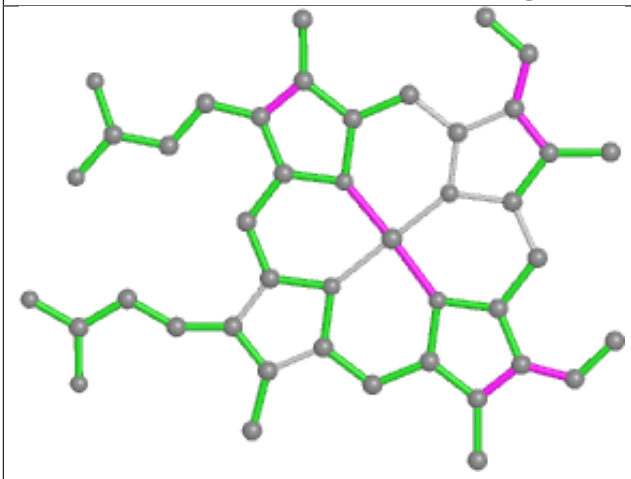


Torsions

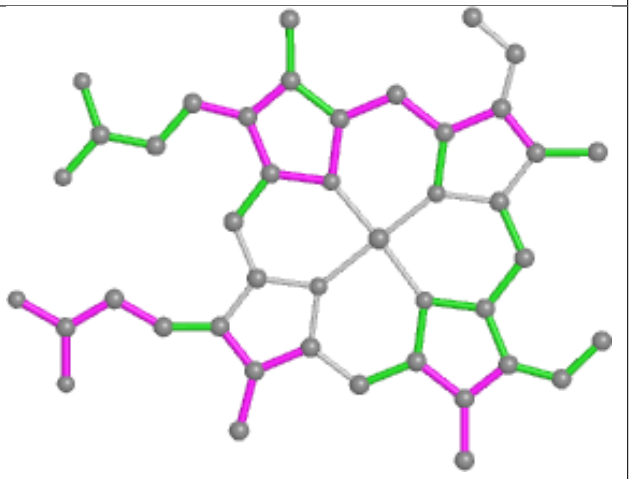


Rings

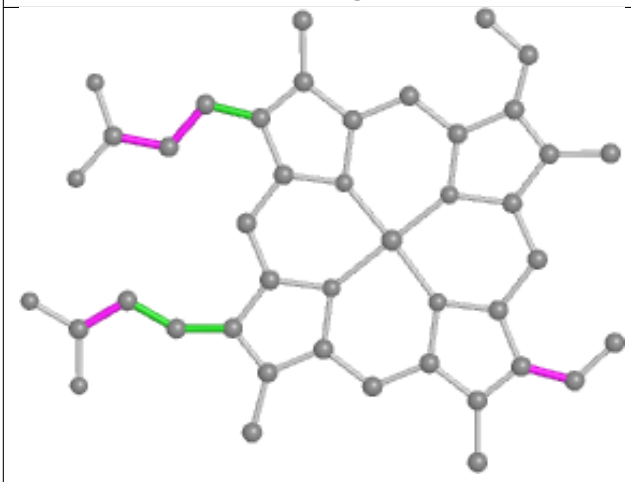
Ligand HEM F 501



Bond lengths



Bond angles



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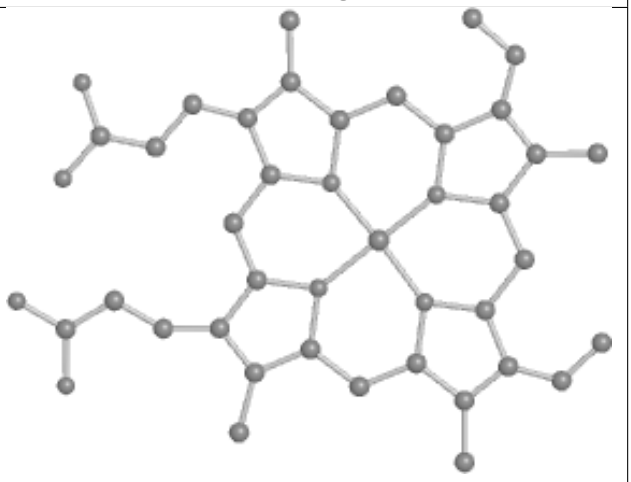
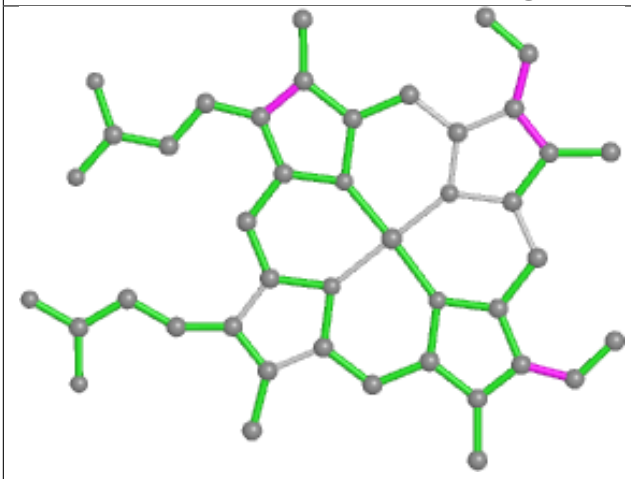
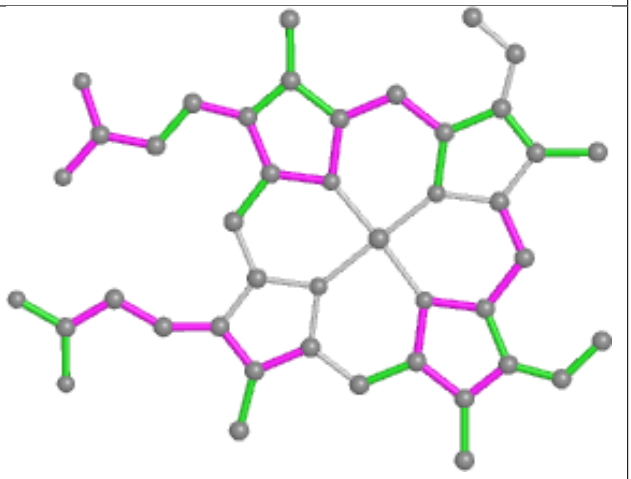


Rings

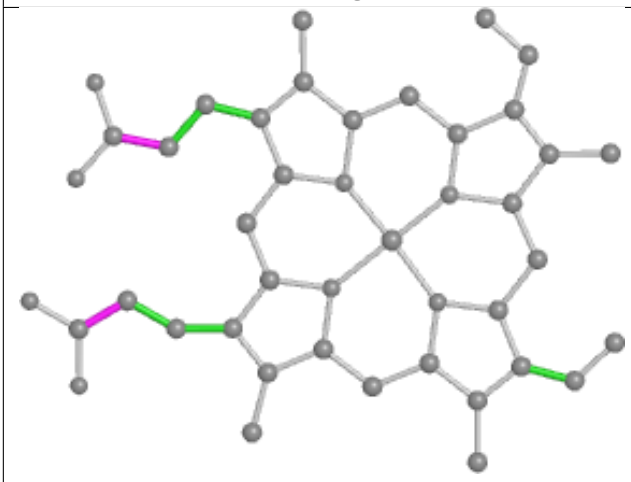
Ligand HEM E 501



Bond lengths



Bond angles



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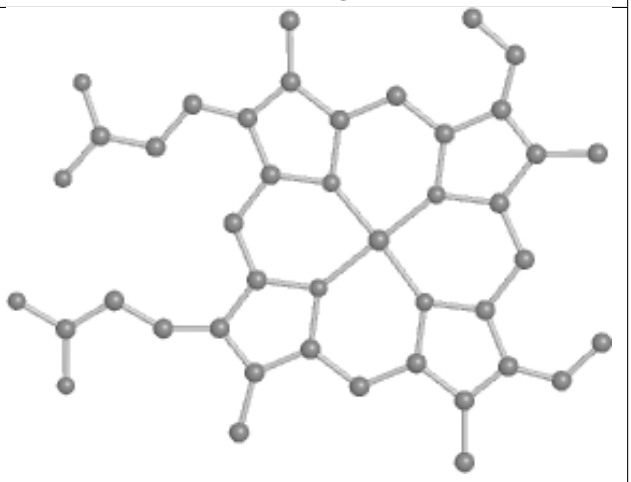
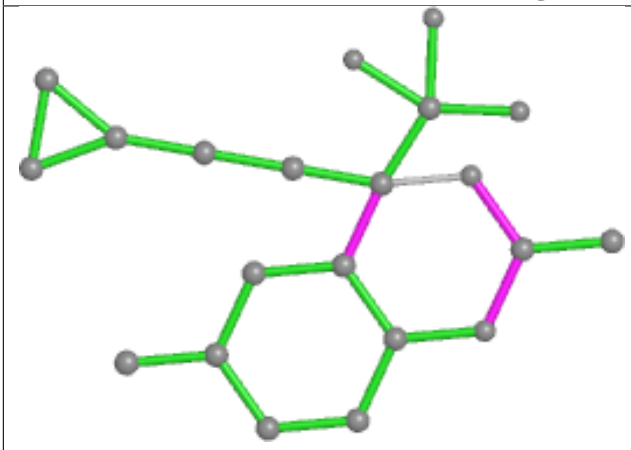
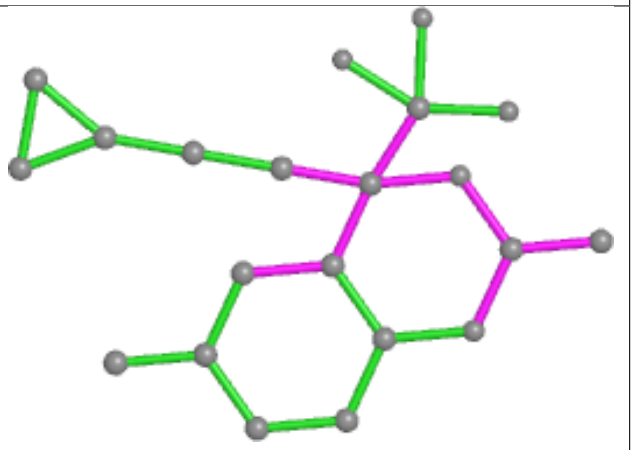


Rings

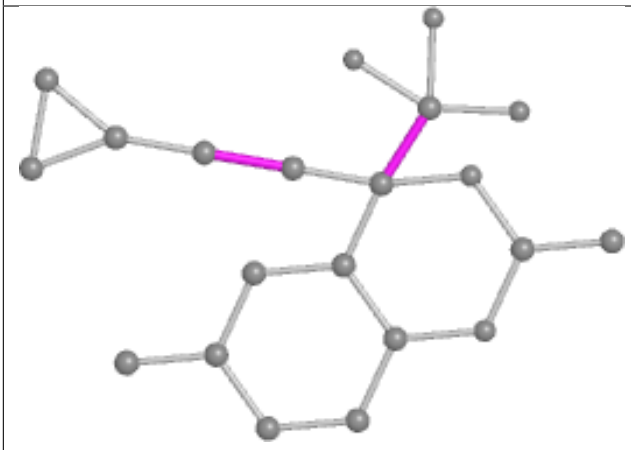
Ligand 9ZJ C 502



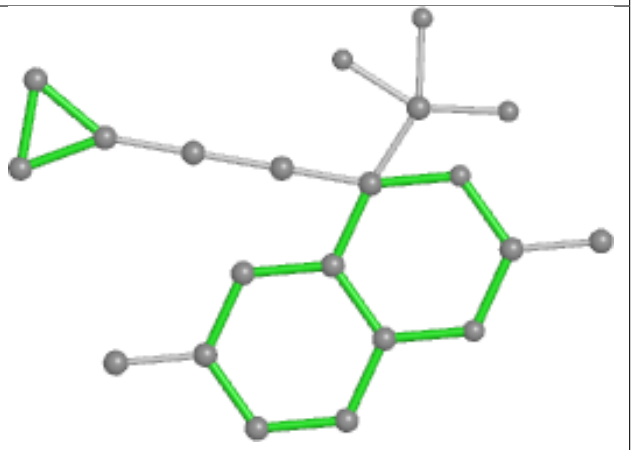
Bond lengths



Bond angles

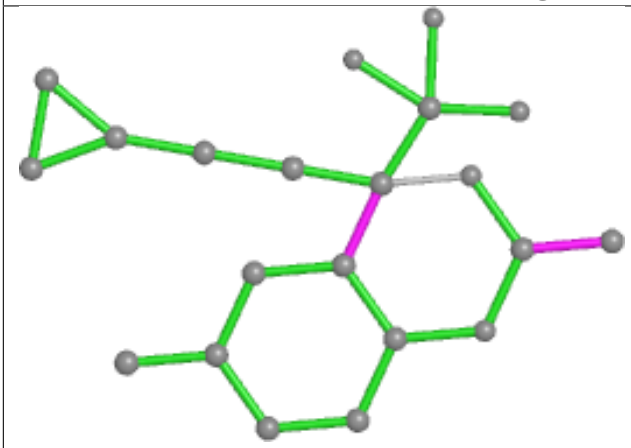


Torsions

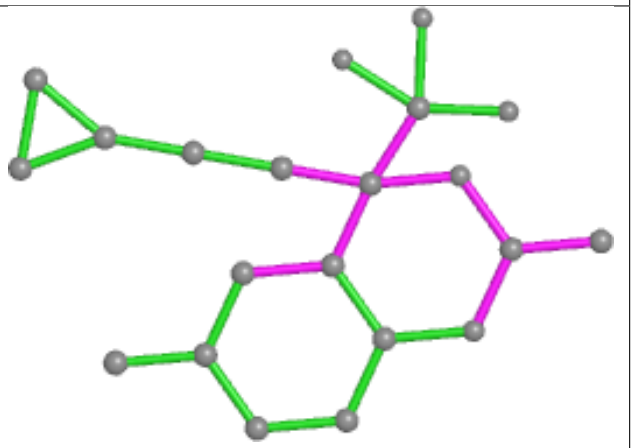


Rings

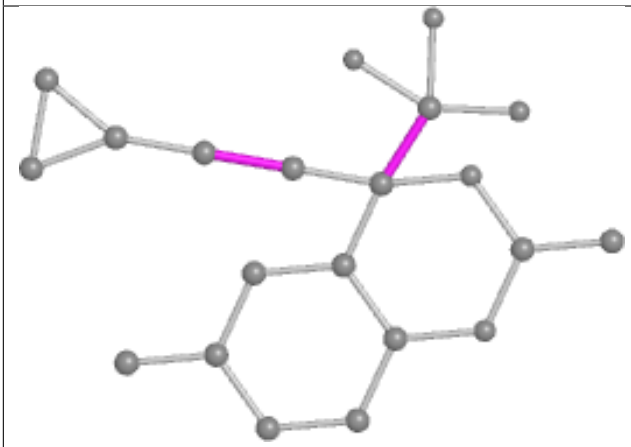
Ligand 9ZJ F 503



Bond lengths



Bond angles



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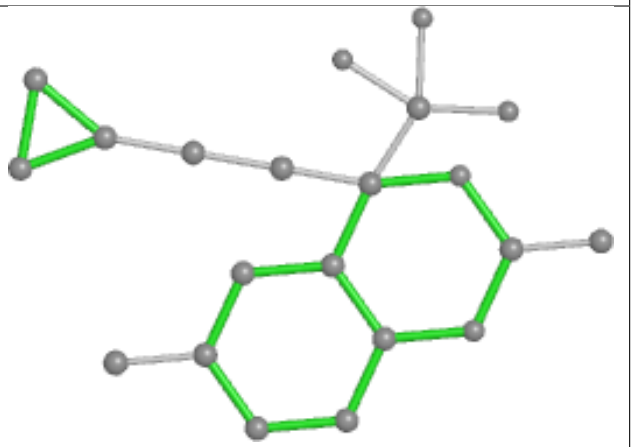
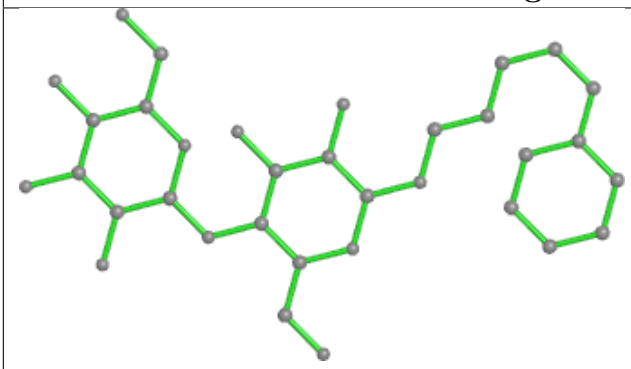
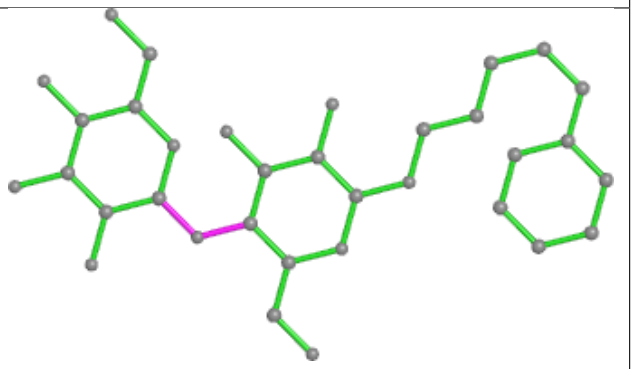


Rings

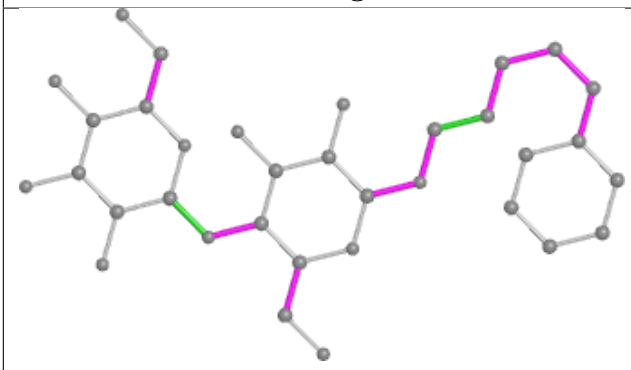
Ligand CM5 F 502



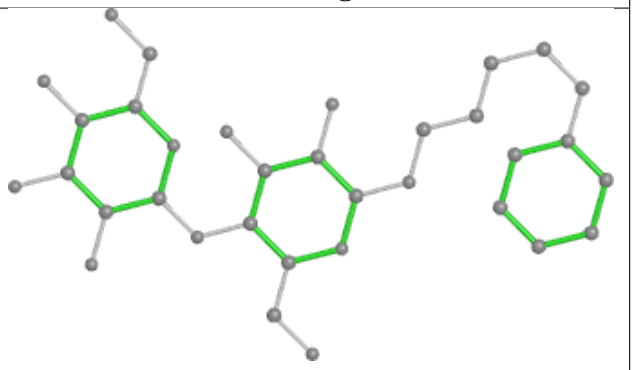
Bond lengths



Bond angles

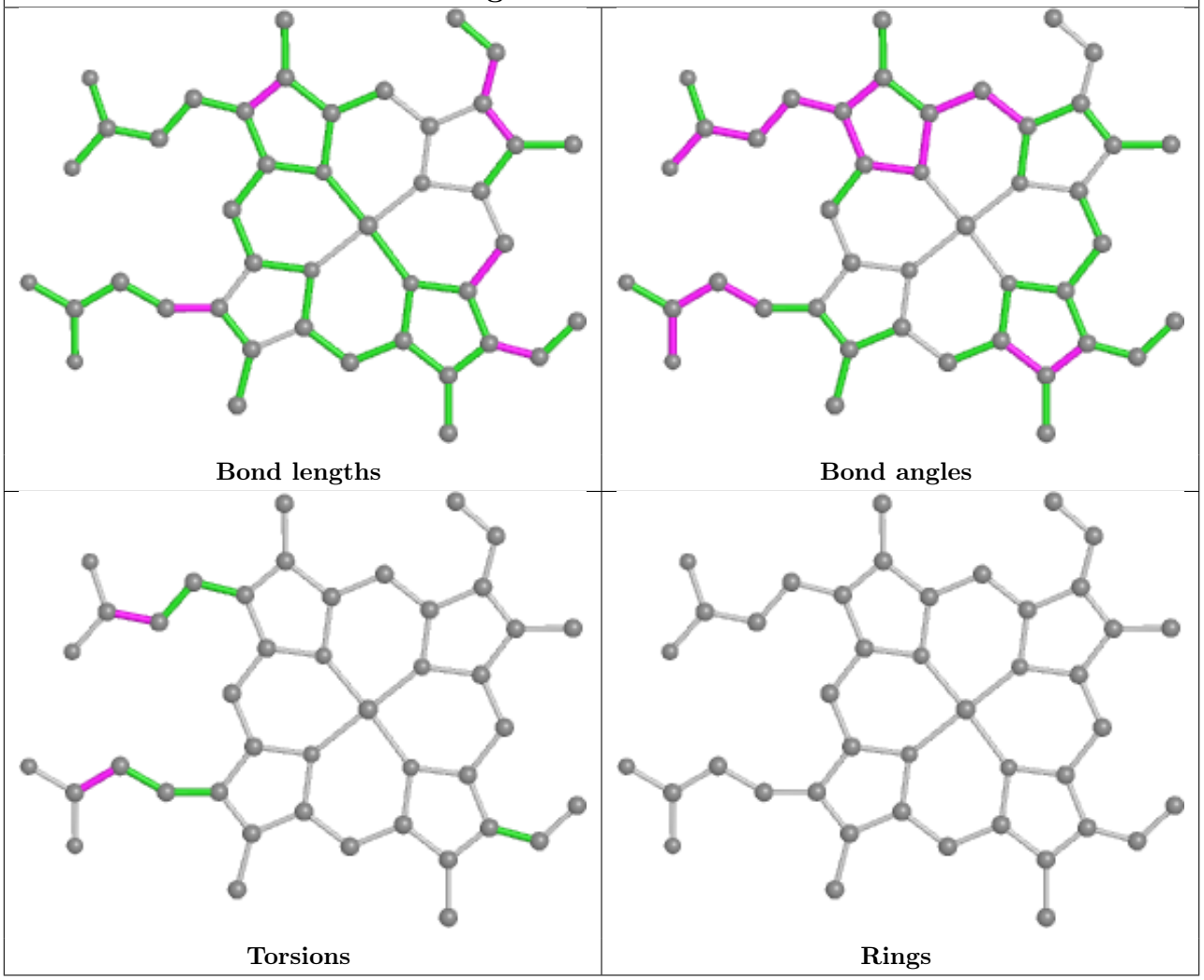


Torsions



Rings

Ligand HEM C 501



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.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled 'Q< 0.9' lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	463/476 (97%)	-0.04	11 (2%)	59	30	18, 45, 71, 106	0
1	B	464/476 (97%)	-0.10	5 (1%)	80	56	17, 41, 66, 93	0
1	C	464/476 (97%)	0.03	10 (2%)	62	33	24, 48, 72, 98	0
1	D	464/476 (97%)	0.03	14 (3%)	50	22	26, 49, 73, 115	0
1	E	463/476 (97%)	-0.05	13 (2%)	53	25	22, 46, 72, 108	0
1	F	464/476 (97%)	0.17	20 (4%)	35	13	27, 56, 84, 114	0
All	All	2782/2856 (97%)	0.01	73 (2%)	56	27	17, 47, 77, 115	0

The worst 5 of 73 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	335	HIS	5.0
1	D	335	HIS	4.6
1	D	140	ARG	4.5
1	A	335	HIS	4.3
1	A	417	ASN	4.1

6.2 Non-standard residues in protein, DNA, RNA chains

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands (i)

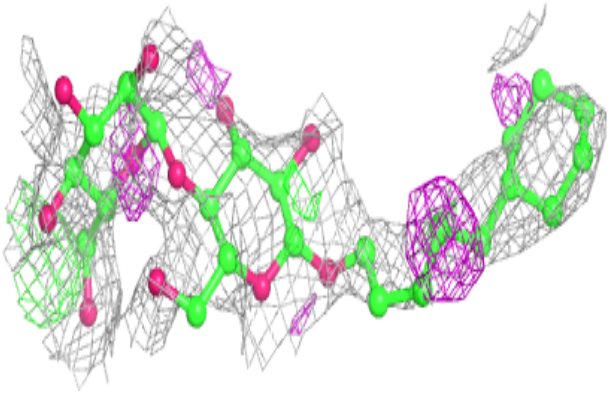
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

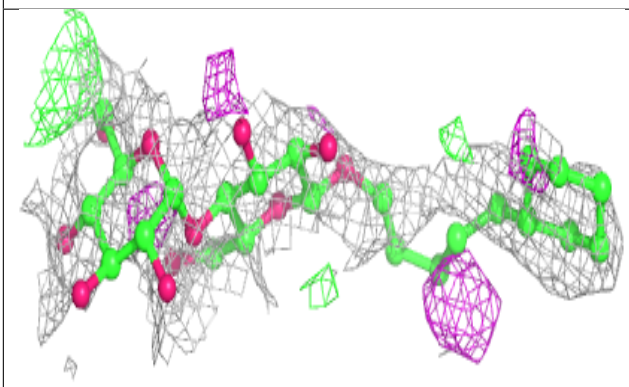
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
5	CM5	F	502	34/34	0.47	0.53	60,134,145,147	0
5	CM5	D	503	34/34	0.58	0.35	55,121,146,146	0
5	CM5	C	503	34/34	0.65	0.60	87,133,152,157	0
5	CM5	E	503	34/34	0.66	0.39	53,128,136,140	0
5	CM5	B	503	34/34	0.69	0.46	70,142,149,150	0
3	9ZJ	D	502	21/21	0.75	0.44	79,97,110,127	0
4	ZAZ	A	503	12/12	0.77	0.78	62,69,82,83	0
3	9ZJ	C	502	21/21	0.79	0.41	73,87,94,99	0
3	9ZJ	F	503	21/21	0.81	0.42	71,86,95,98	0
3	9ZJ	E	502	21/21	0.84	0.38	75,95,114,116	0
3	9ZJ	B	502	21/21	0.85	0.40	94,103,109,116	0
3	9ZJ	A	502	21/21	0.86	0.40	89,105,121,129	0
2	HEM	A	501	43/43	0.98	0.21	25,45,58,64	0
2	HEM	B	501	43/43	0.98	0.19	24,34,42,53	0
2	HEM	C	501	43/43	0.98	0.20	14,38,46,49	0
2	HEM	D	501	43/43	0.98	0.22	22,46,55,61	0
2	HEM	E	501	43/43	0.98	0.19	22,38,47,51	0
2	HEM	F	501	43/43	0.98	0.20	24,46,52,57	0

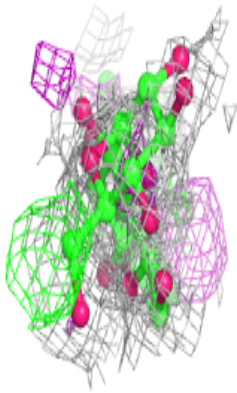
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around CM5 F 502:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

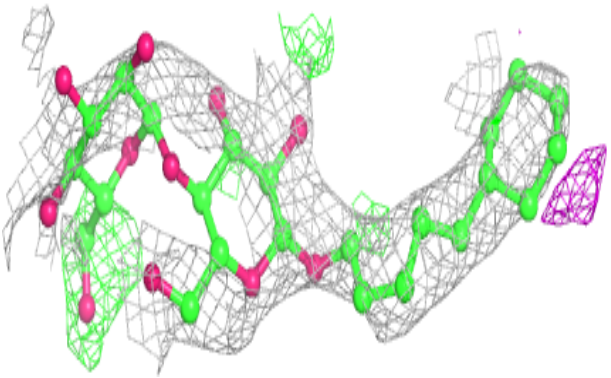


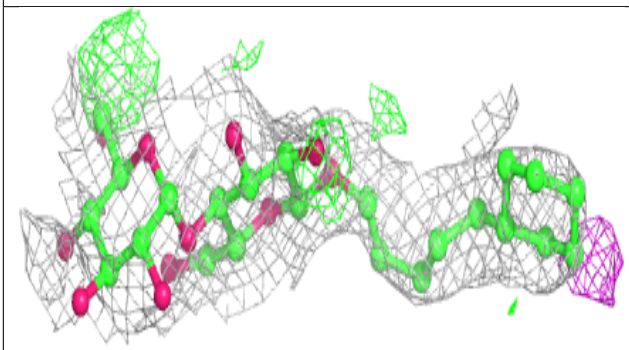


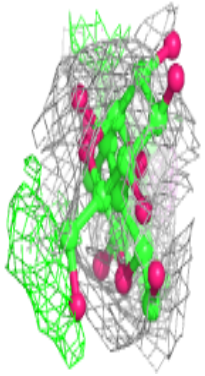


Electron density around CM5 D 503:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

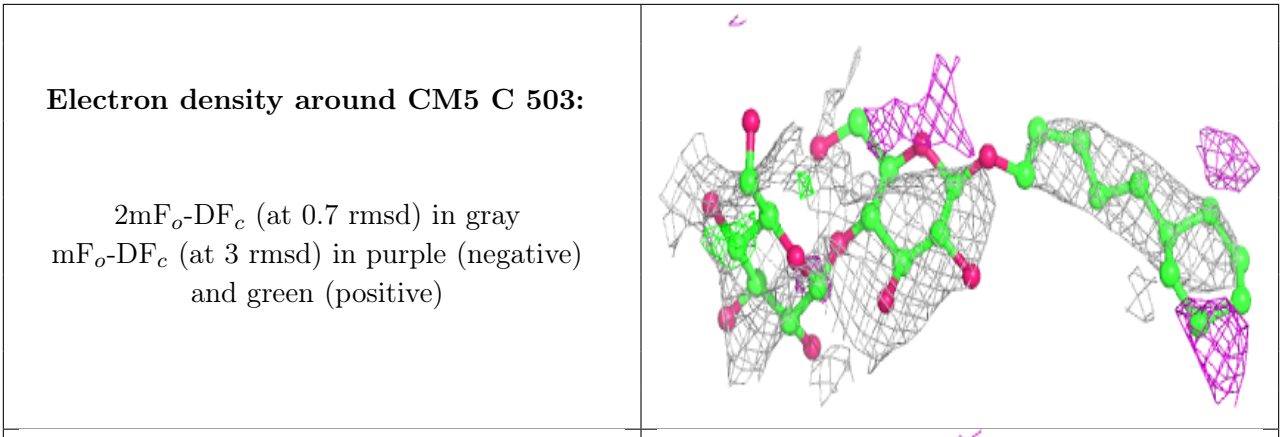






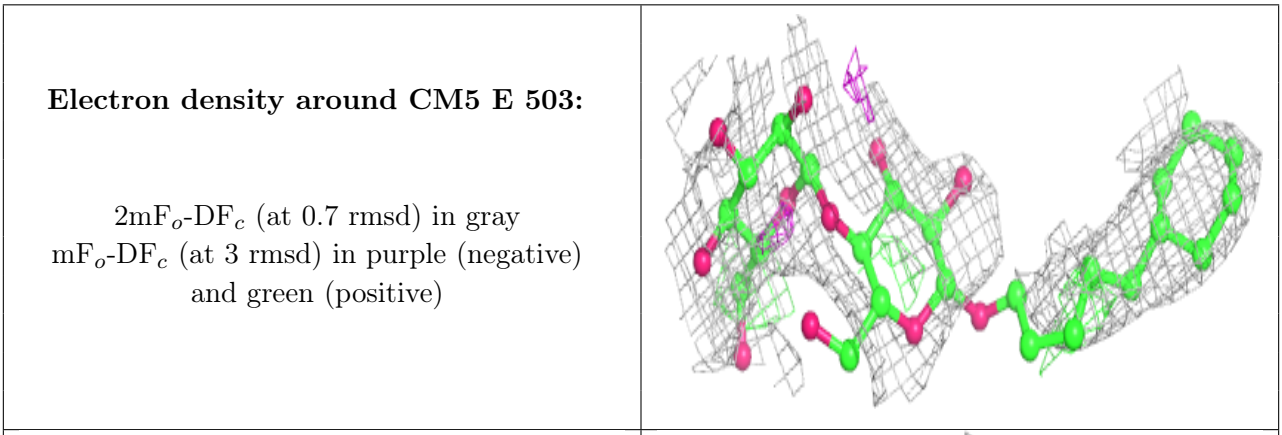
Electron density around CM5 C 503:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



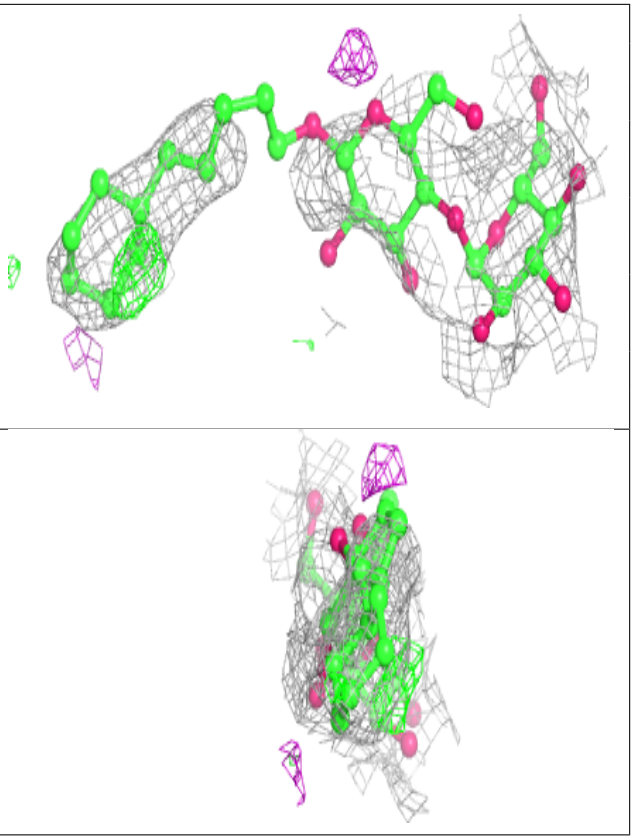
Electron density around CM5 E 503:

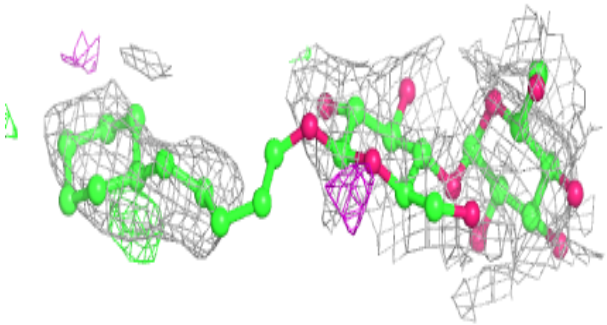
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



Electron density around CM5 B 503:

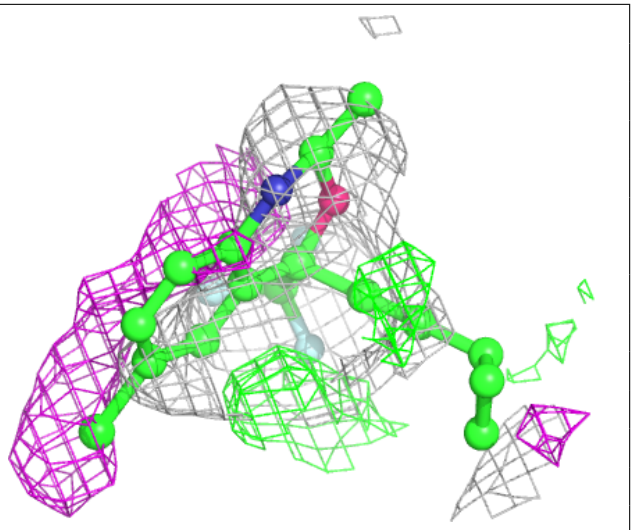
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

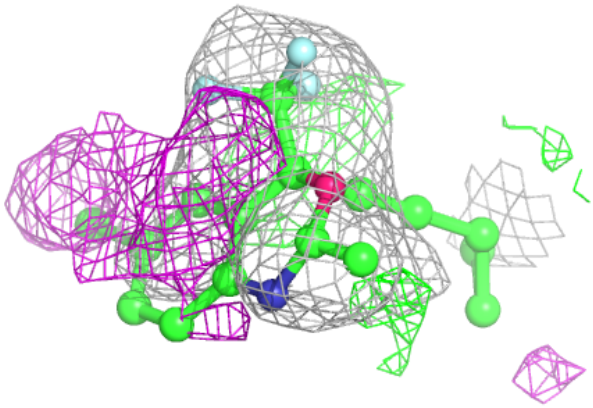


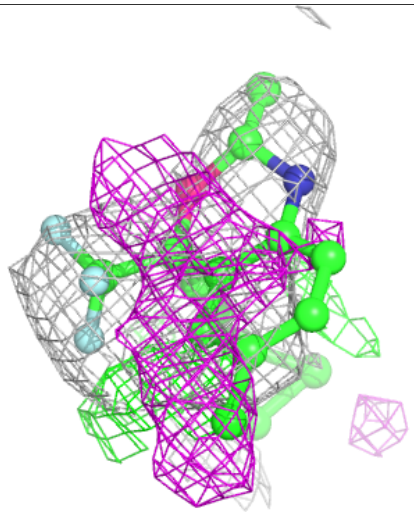


Electron density around 9ZJ D 502:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

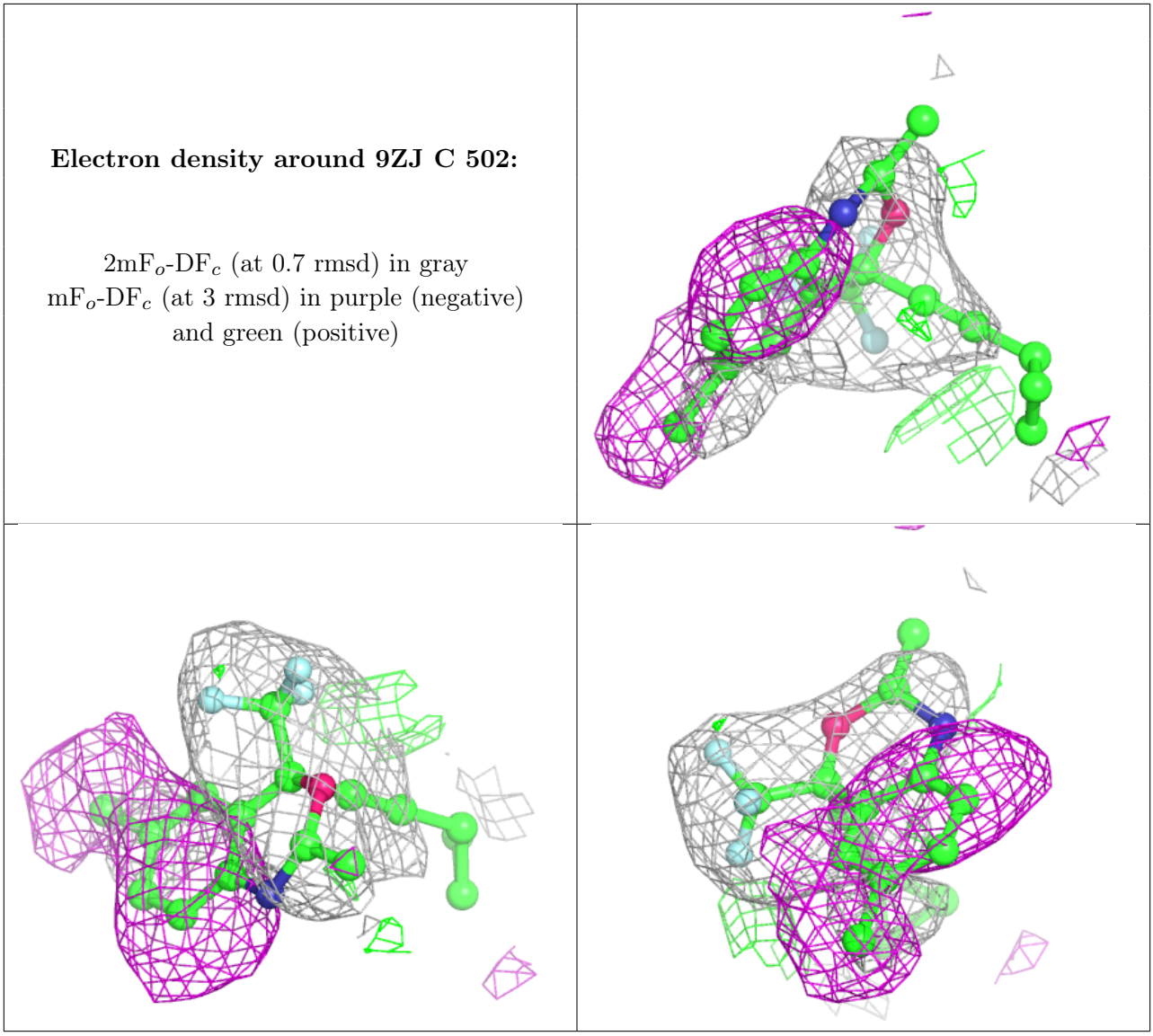






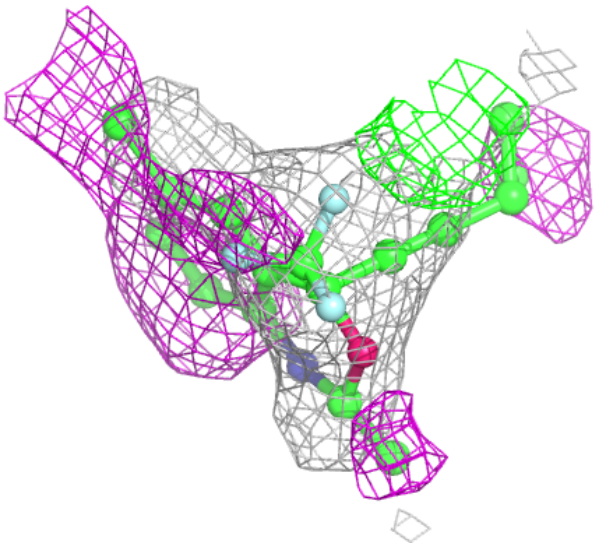
Electron density around 9ZJ C 502:

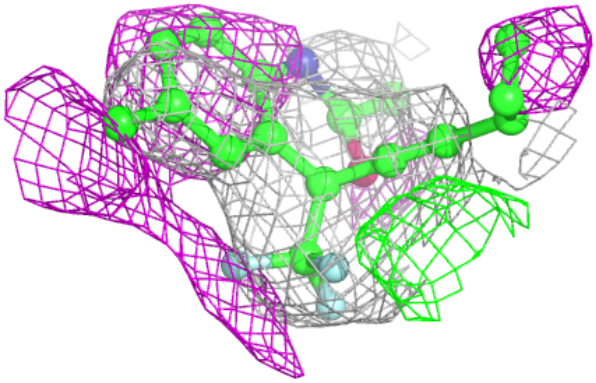
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

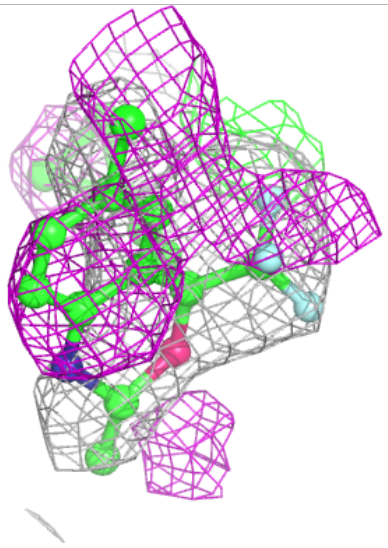


Electron density around 9ZJ F 503:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

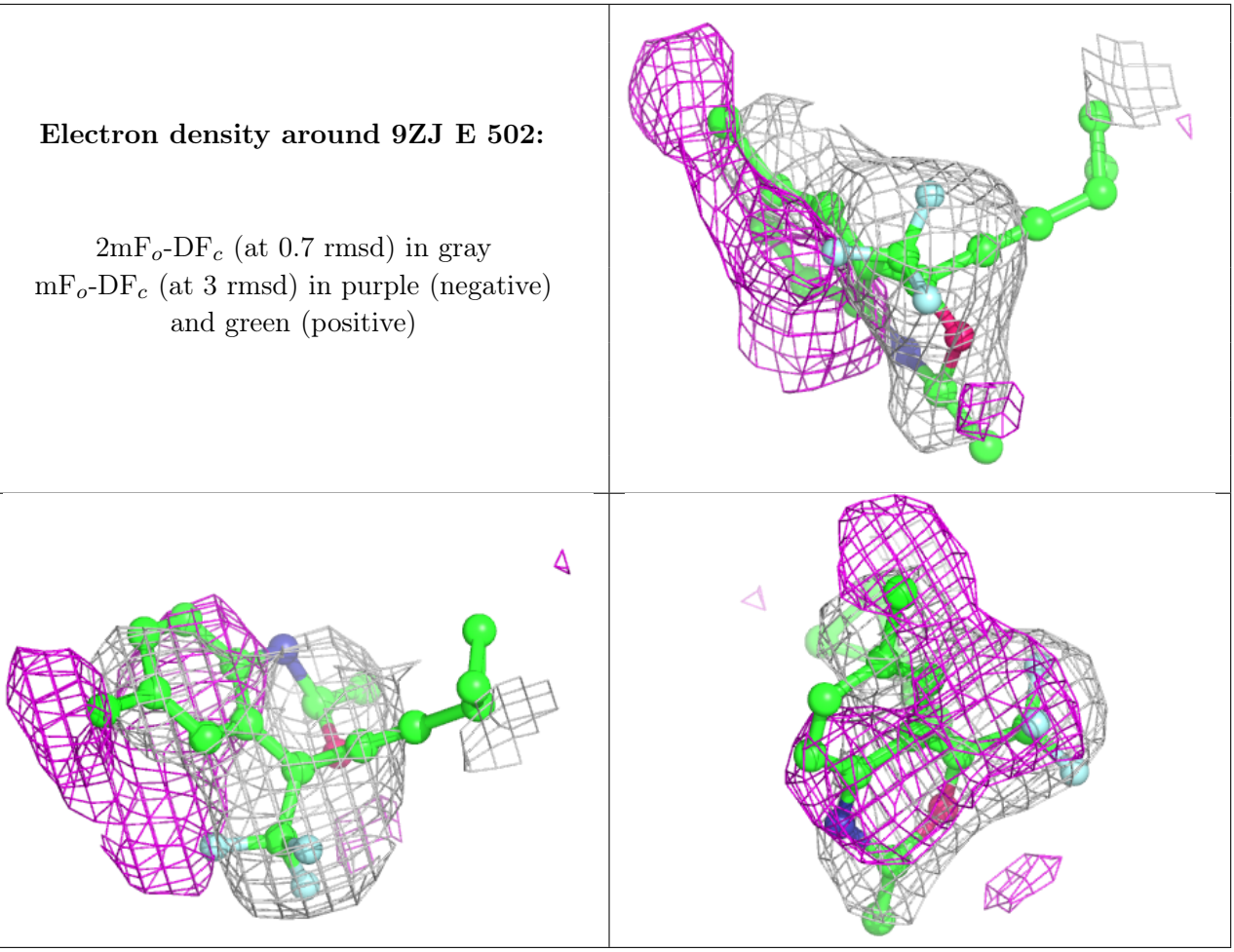






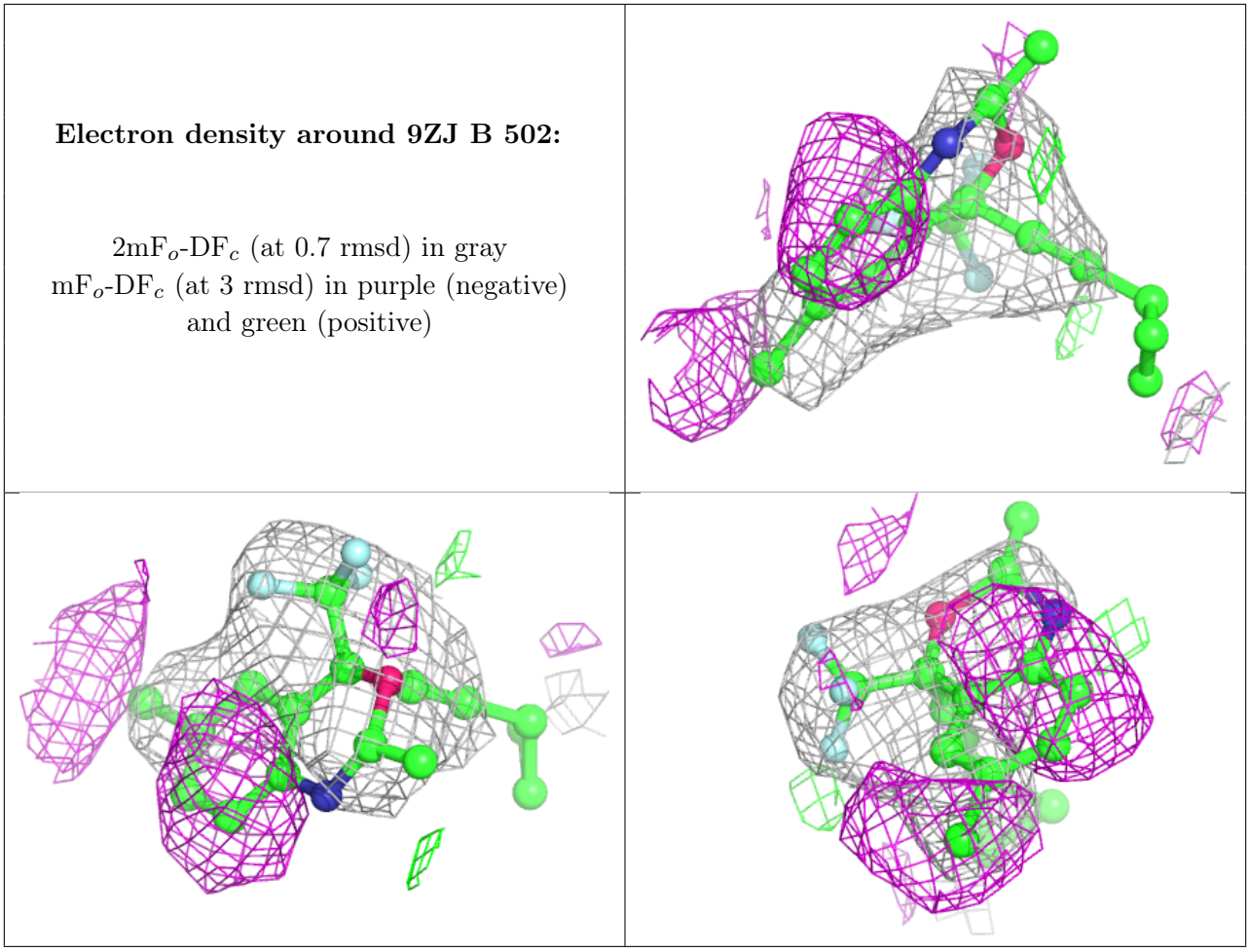
Electron density around 9ZJ E 502:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



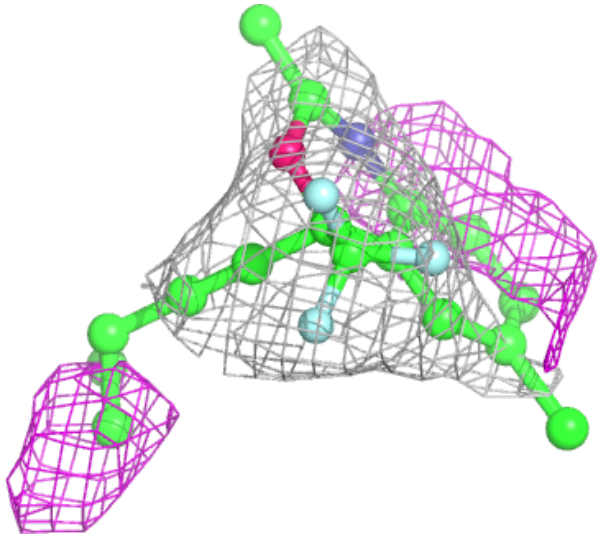
Electron density around 9ZJ B 502:

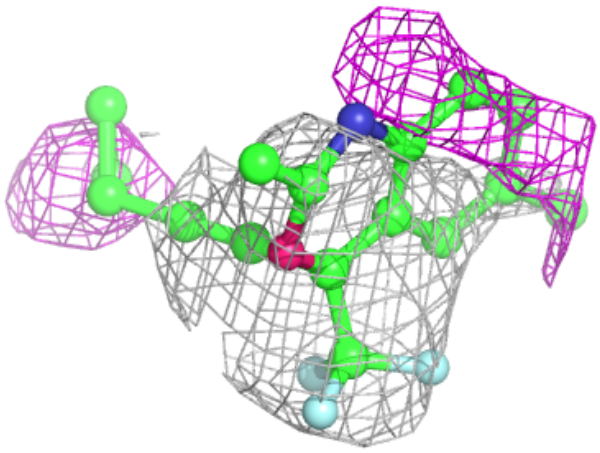
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

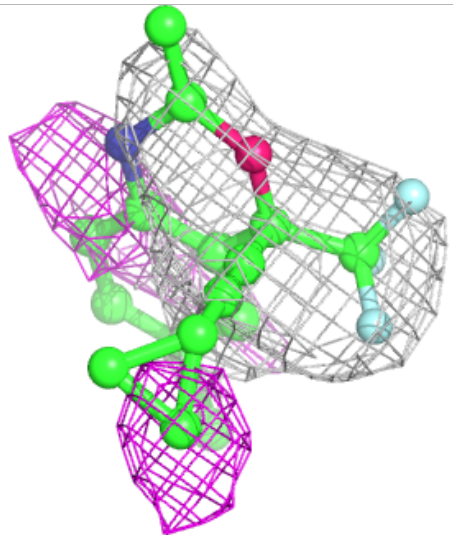


Electron density around 9ZJ A 502:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

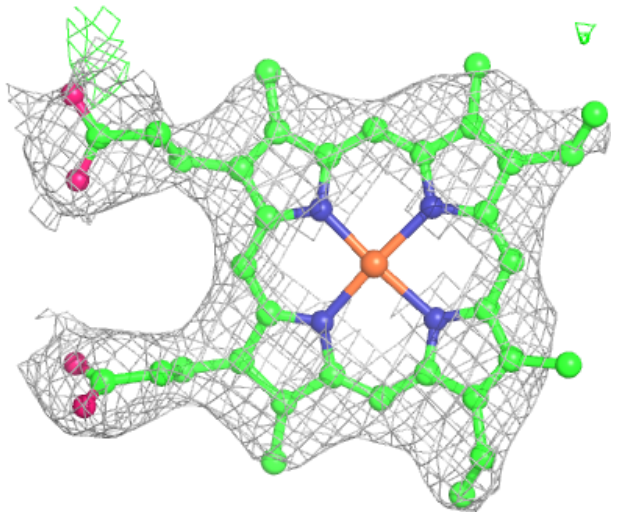


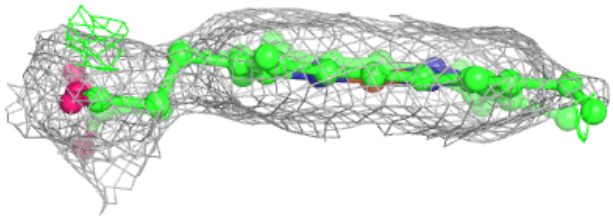


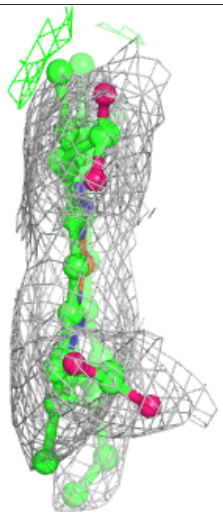


Electron density around HEM A 501:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

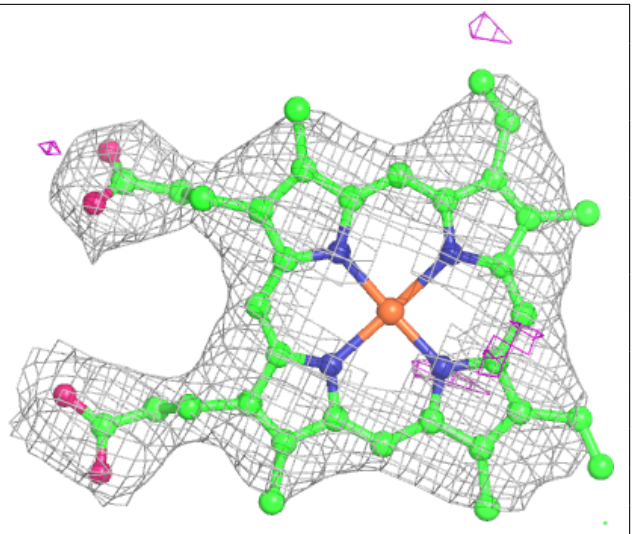


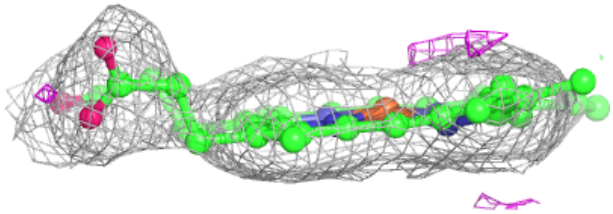


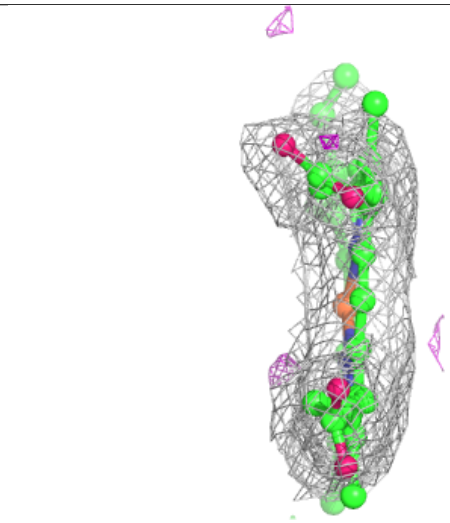


Electron density around HEM B 501:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

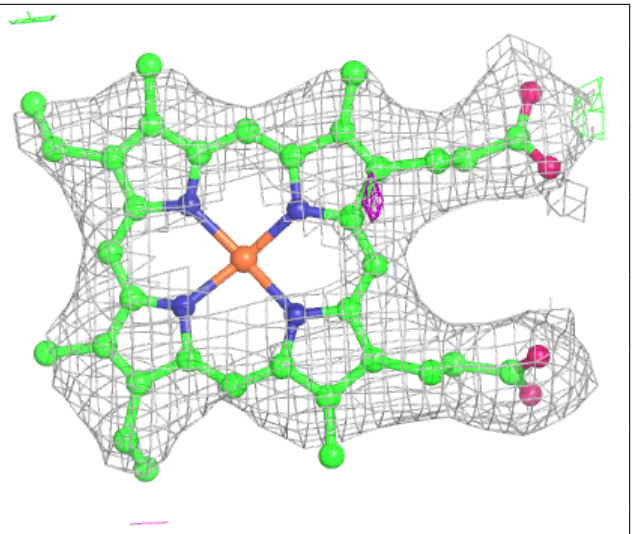


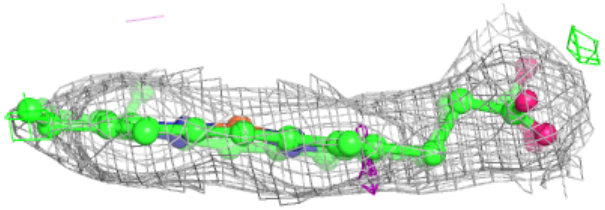


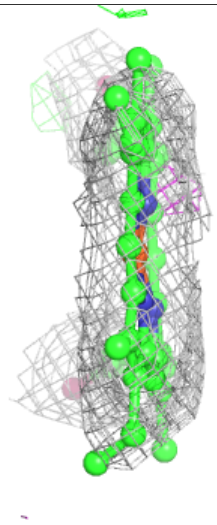


Electron density around HEM C 501:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

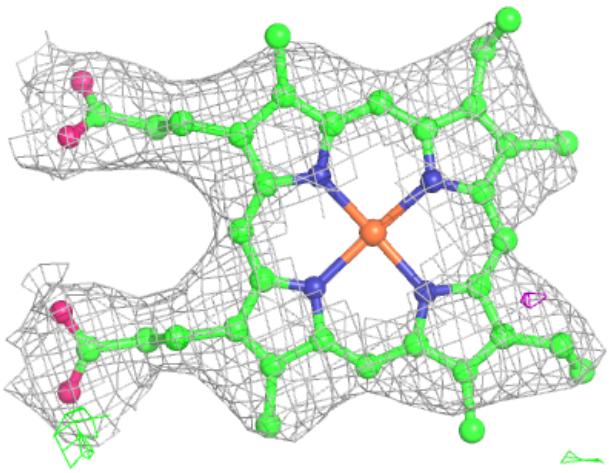


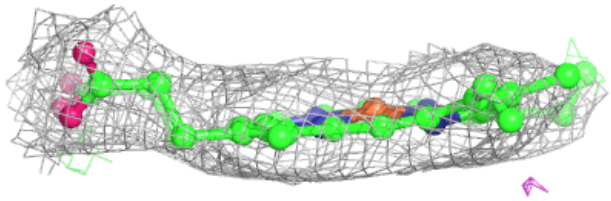


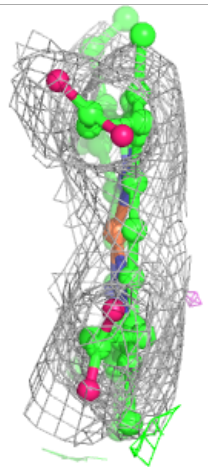


Electron density around HEM D 501:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

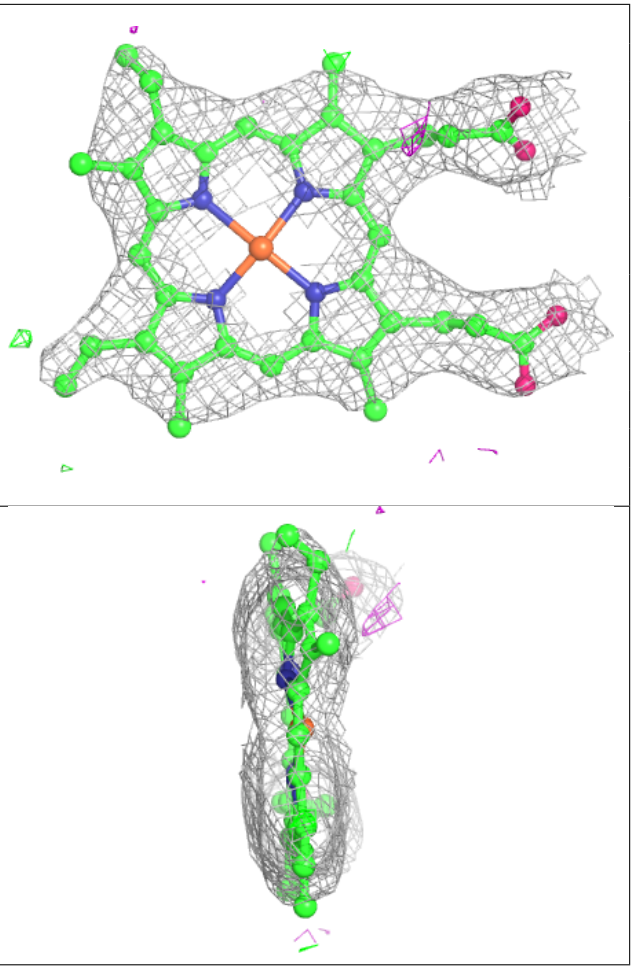


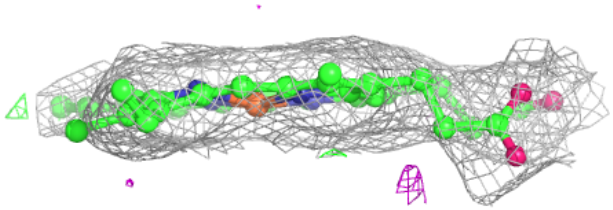




Electron density around HEM E 501:

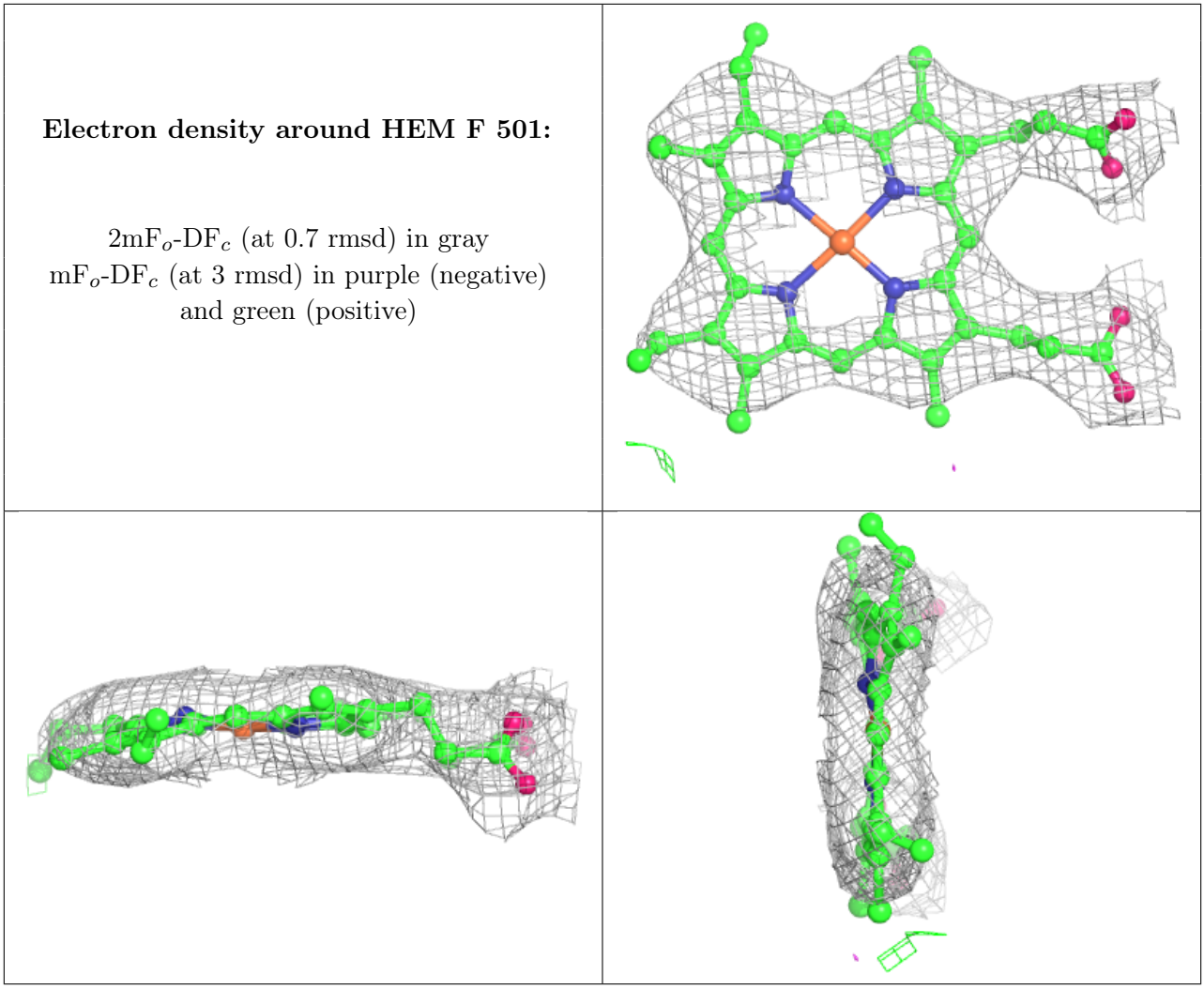
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)





Electron density around HEM F 501:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)



6.5 Other polymers (i)

There are no such residues in this entry.