



# wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 22, 2020 – 03:55 PM BST

PDB ID : 4EJG  
Title : Human Cytochrome P450 2A13 in complex with Nicotine  
Authors : DeVore, N.M.; Scott, E.E.  
Deposited on : 2012-04-06  
Resolution : 2.50 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](mailto: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 ⓘ symbol.

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The following versions of software and data (see [references ⓘ](#)) 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 : 2.13.1  
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) : 2.13.1

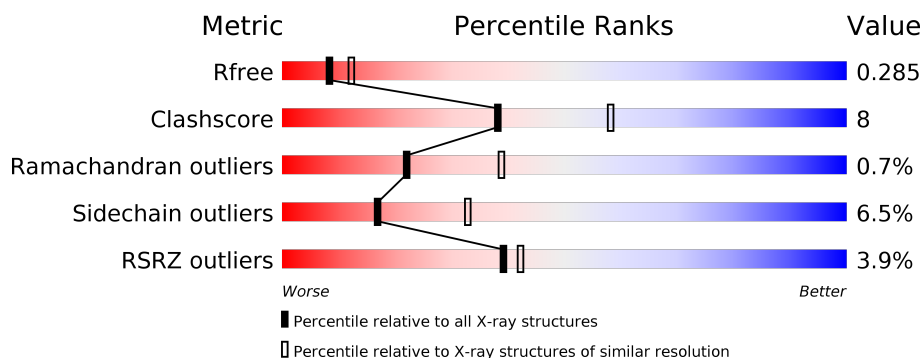
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions  $\leq 5\%$ . 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	<div> <div>80%</div> <div>17%</div> <div>• •</div> </div>
1	B	476	<div> <div>81%</div> <div>16%</div> <div>•</div> </div>
1	C	476	<div> <div>75%</div> <div>22%</div> <div>• •</div> </div>
1	D	476	<div> <div>75%</div> <div>20%</div> <div>• •</div> </div>
1	E	476	<div> <div>2%</div> <div>79%</div> <div>17%</div> <div>• •</div> </div>
1	F	476	<div> <div>8%</div> <div>72%</div> <div>24%</div> <div>• •</div> </div>

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Mol	Chain	Length	Quality of chain
1	G	476	
1	H	476	

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
4	GOL	H	502	-	X	-	-

## 2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 30618 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 2A13.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	464	Total	C	N	O	S	0	1	0
			3772	2426	652	676	18			
1	B	464	Total	C	N	O	S	0	5	0
			3812	2448	663	683	18			
1	C	464	Total	C	N	O	S	0	4	0
			3798	2441	659	680	18			
1	D	465	Total	C	N	O	S	0	3	0
			3797	2441	658	680	18			
1	E	465	Total	C	N	O	S	0	3	0
			3798	2443	659	678	18			
1	F	465	Total	C	N	O	S	0	0	0
			3772	2427	652	675	18			
1	G	463	Total	C	N	O	S	0	0	0
			3735	2403	643	671	18			
1	H	458	Total	C	N	O	S	0	0	0
			3687	2365	638	666	18			

There are 96 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	23	MET	-	EXPRESSION TAG	UNP Q16696
A	24	ALA	-	EXPRESSION TAG	UNP Q16696
A	25	LYS	-	EXPRESSION TAG	UNP Q16696
A	26	LYS	-	EXPRESSION TAG	UNP Q16696
A	27	THR	-	EXPRESSION TAG	UNP Q16696
A	28	SER	-	EXPRESSION TAG	UNP Q16696
A	29	SER	-	EXPRESSION TAG	UNP Q16696
A	30	LYS	-	EXPRESSION TAG	UNP Q16696
A	495	HIS	-	EXPRESSION TAG	UNP Q16696
A	496	HIS	-	EXPRESSION TAG	UNP Q16696
A	497	HIS	-	EXPRESSION TAG	UNP Q16696
A	498	HIS	-	EXPRESSION TAG	UNP Q16696
B	23	MET	-	EXPRESSION TAG	UNP Q16696

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Chain	Residue	Modelled	Actual	Comment	Reference
B	24	ALA	-	EXPRESSION TAG	UNP Q16696
B	25	LYS	-	EXPRESSION TAG	UNP Q16696
B	26	LYS	-	EXPRESSION TAG	UNP Q16696
B	27	THR	-	EXPRESSION TAG	UNP Q16696
B	28	SER	-	EXPRESSION TAG	UNP Q16696
B	29	SER	-	EXPRESSION TAG	UNP Q16696
B	30	LYS	-	EXPRESSION TAG	UNP Q16696
B	495	HIS	-	EXPRESSION TAG	UNP Q16696
B	496	HIS	-	EXPRESSION TAG	UNP Q16696
B	497	HIS	-	EXPRESSION TAG	UNP Q16696
B	498	HIS	-	EXPRESSION TAG	UNP Q16696
C	23	MET	-	EXPRESSION TAG	UNP Q16696
C	24	ALA	-	EXPRESSION TAG	UNP Q16696
C	25	LYS	-	EXPRESSION TAG	UNP Q16696
C	26	LYS	-	EXPRESSION TAG	UNP Q16696
C	27	THR	-	EXPRESSION TAG	UNP Q16696
C	28	SER	-	EXPRESSION TAG	UNP Q16696
C	29	SER	-	EXPRESSION TAG	UNP Q16696
C	30	LYS	-	EXPRESSION TAG	UNP Q16696
C	495	HIS	-	EXPRESSION TAG	UNP Q16696
C	496	HIS	-	EXPRESSION TAG	UNP Q16696
C	497	HIS	-	EXPRESSION TAG	UNP Q16696
C	498	HIS	-	EXPRESSION TAG	UNP Q16696
D	23	MET	-	EXPRESSION TAG	UNP Q16696
D	24	ALA	-	EXPRESSION TAG	UNP Q16696
D	25	LYS	-	EXPRESSION TAG	UNP Q16696
D	26	LYS	-	EXPRESSION TAG	UNP Q16696
D	27	THR	-	EXPRESSION TAG	UNP Q16696
D	28	SER	-	EXPRESSION TAG	UNP Q16696
D	29	SER	-	EXPRESSION TAG	UNP Q16696
D	30	LYS	-	EXPRESSION TAG	UNP Q16696
D	495	HIS	-	EXPRESSION TAG	UNP Q16696
D	496	HIS	-	EXPRESSION TAG	UNP Q16696
D	497	HIS	-	EXPRESSION TAG	UNP Q16696
D	498	HIS	-	EXPRESSION TAG	UNP Q16696
E	23	MET	-	EXPRESSION TAG	UNP Q16696
E	24	ALA	-	EXPRESSION TAG	UNP Q16696
E	25	LYS	-	EXPRESSION TAG	UNP Q16696
E	26	LYS	-	EXPRESSION TAG	UNP Q16696
E	27	THR	-	EXPRESSION TAG	UNP Q16696
E	28	SER	-	EXPRESSION TAG	UNP Q16696
E	29	SER	-	EXPRESSION TAG	UNP Q16696

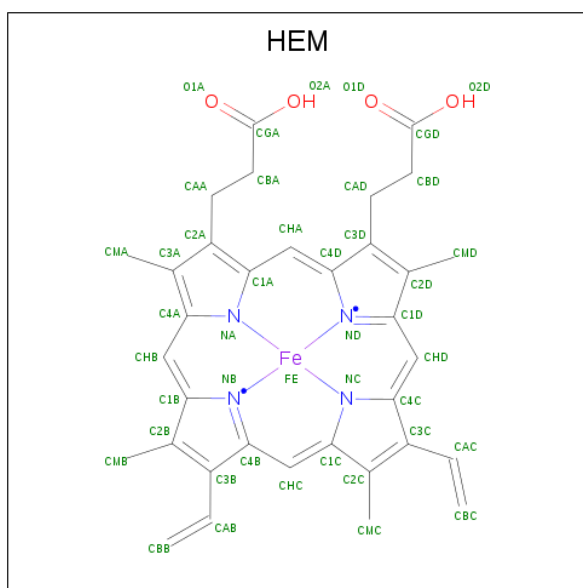
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Chain	Residue	Modelled	Actual	Comment	Reference
E	30	LYS	-	EXPRESSION TAG	UNP Q16696
E	495	HIS	-	EXPRESSION TAG	UNP Q16696
E	496	HIS	-	EXPRESSION TAG	UNP Q16696
E	497	HIS	-	EXPRESSION TAG	UNP Q16696
E	498	HIS	-	EXPRESSION TAG	UNP Q16696
F	23	MET	-	EXPRESSION TAG	UNP Q16696
F	24	ALA	-	EXPRESSION TAG	UNP Q16696
F	25	LYS	-	EXPRESSION TAG	UNP Q16696
F	26	LYS	-	EXPRESSION TAG	UNP Q16696
F	27	THR	-	EXPRESSION TAG	UNP Q16696
F	28	SER	-	EXPRESSION TAG	UNP Q16696
F	29	SER	-	EXPRESSION TAG	UNP Q16696
F	30	LYS	-	EXPRESSION TAG	UNP Q16696
F	495	HIS	-	EXPRESSION TAG	UNP Q16696
F	496	HIS	-	EXPRESSION TAG	UNP Q16696
F	497	HIS	-	EXPRESSION TAG	UNP Q16696
F	498	HIS	-	EXPRESSION TAG	UNP Q16696
G	23	MET	-	EXPRESSION TAG	UNP Q16696
G	24	ALA	-	EXPRESSION TAG	UNP Q16696
G	25	LYS	-	EXPRESSION TAG	UNP Q16696
G	26	LYS	-	EXPRESSION TAG	UNP Q16696
G	27	THR	-	EXPRESSION TAG	UNP Q16696
G	28	SER	-	EXPRESSION TAG	UNP Q16696
G	29	SER	-	EXPRESSION TAG	UNP Q16696
G	30	LYS	-	EXPRESSION TAG	UNP Q16696
G	495	HIS	-	EXPRESSION TAG	UNP Q16696
G	496	HIS	-	EXPRESSION TAG	UNP Q16696
G	497	HIS	-	EXPRESSION TAG	UNP Q16696
G	498	HIS	-	EXPRESSION TAG	UNP Q16696
H	23	MET	-	EXPRESSION TAG	UNP Q16696
H	24	ALA	-	EXPRESSION TAG	UNP Q16696
H	25	LYS	-	EXPRESSION TAG	UNP Q16696
H	26	LYS	-	EXPRESSION TAG	UNP Q16696
H	27	THR	-	EXPRESSION TAG	UNP Q16696
H	28	SER	-	EXPRESSION TAG	UNP Q16696
H	29	SER	-	EXPRESSION TAG	UNP Q16696
H	30	LYS	-	EXPRESSION TAG	UNP Q16696
H	495	HIS	-	EXPRESSION TAG	UNP Q16696
H	496	HIS	-	EXPRESSION TAG	UNP Q16696
H	497	HIS	-	EXPRESSION TAG	UNP Q16696
H	498	HIS	-	EXPRESSION TAG	UNP Q16696

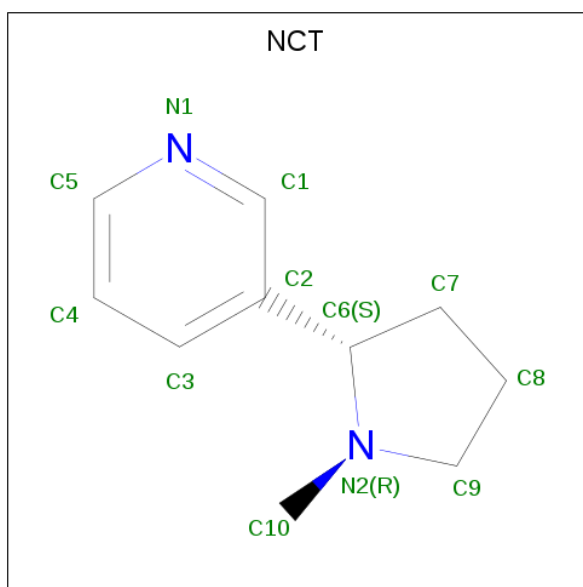
- Molecule 2 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (for-

mula:  $C_{34}H_{32}FeN_4O_4$ ).



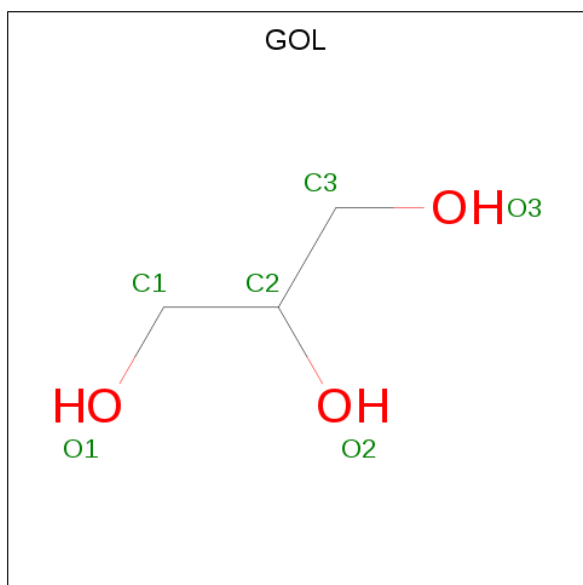
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	B	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	C	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	D	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	E	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	F	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	G	1	Total 43	C 34	Fe 1	N 4	O 4	0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

- Molecule 3 is (S)-3-(1-METHYLPYRROLIDIN-2-YL)PYRIDINE (three-letter code: NCT) (formula:  $C_{10}H_{14}N_2$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	N	0	0
			12	10	2		
3	B	1	Total	C	N	0	0
			12	10	2		
3	C	1	Total	C	N	0	0
			12	10	2		
3	D	1	Total	C	N	0	0
			12	10	2		

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula:  $C_3H_8O_3$ ).





Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	H	1	Total	C	O	0	0
			6	3	3		

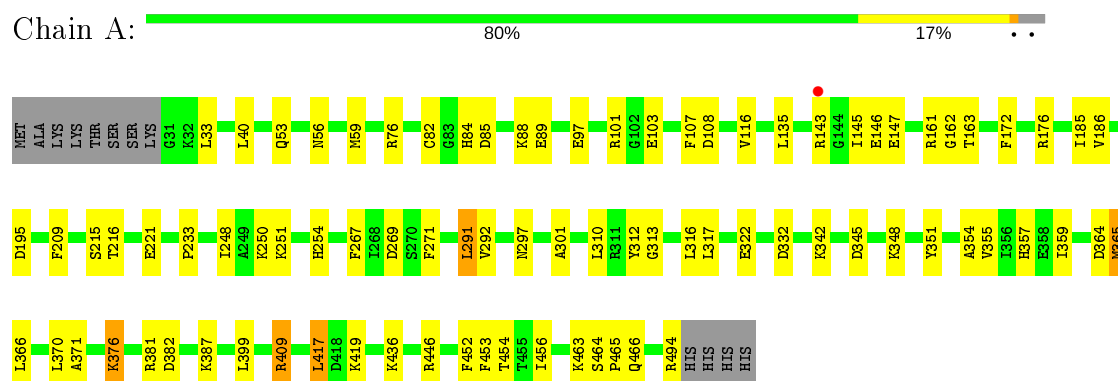
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	9	Total	O	0	0
			9	9		
5	B	5	Total	O	0	0
			5	5		
5	C	6	Total	O	0	0
			6	6		
5	D	14	Total	O	0	0
			14	14		
5	E	2	Total	O	0	0
			2	2		
5	F	2	Total	O	0	0
			2	2		
5	G	9	Total	O	0	0
			9	9		
5	H	2	Total	O	0	0
			2	2		

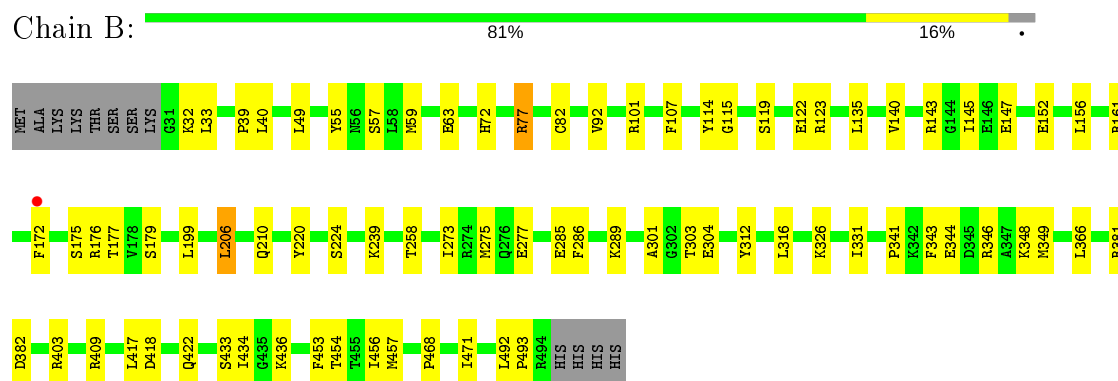
### 3 Residue-property plots [i](#)

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 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.

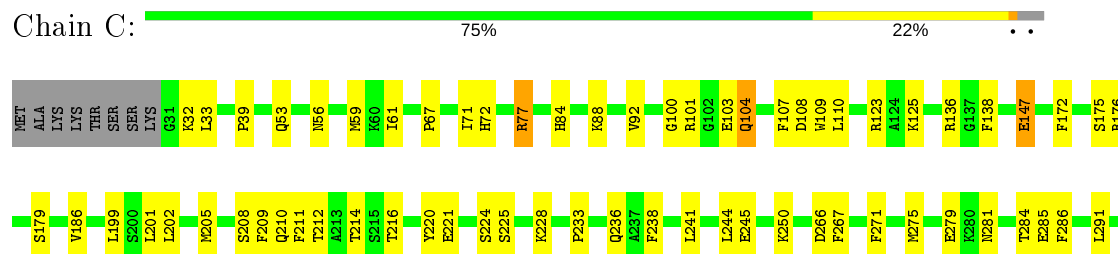
#### • Molecule 1: Cytochrome P450 2A13

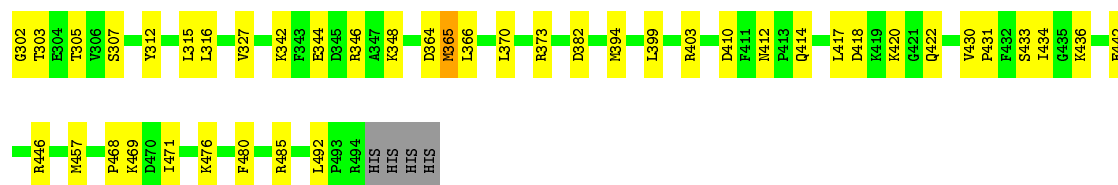


#### • Molecule 1: Cytochrome P450 2A13



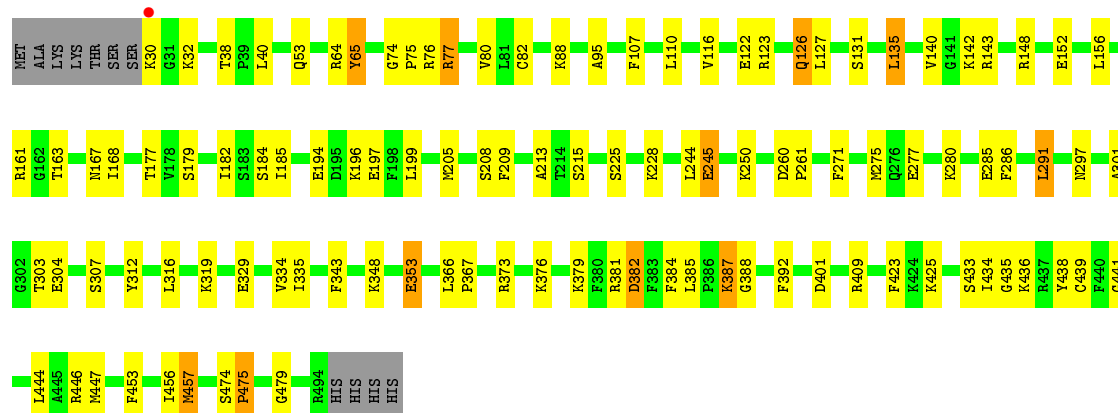
#### • Molecule 1: Cytochrome P450 2A13





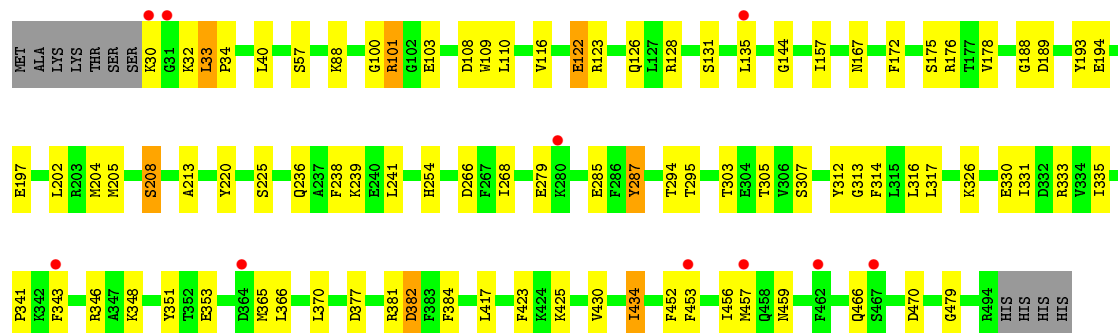
• Molecule 1: Cytochrome P450 2A13

Chain D: 75% 20% • •



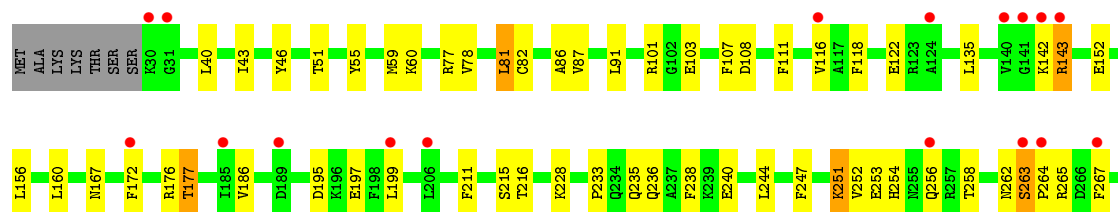
• Molecule 1: Cytochrome P450 2A13

Chain E: 79% 17% • •

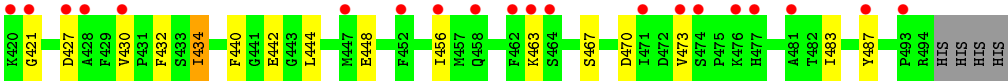


• Molecule 1: Cytochrome P450 2A13

Chain F: 72% 24% • •







## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	71.66Å 120.32Å 153.73Å 100.62° 101.82° 93.73°	Depositor
Resolution (Å)	102.58 – 2.50 102.59 – 2.50	Depositor EDS
% Data completeness (in resolution range)	96.7 (102.58-2.50) 96.7 (102.59-2.50)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	0.09	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.93 (at 2.52Å)	Xtriage
Refinement program	REFMAC 6.1.13	Depositor
R, $R_{free}$	0.224 , 0.285 0.222 , 0.285	Depositor DCC
$R_{free}$ test set	8224 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	46.3	Xtriage
Anisotropy	0.055	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.33 , 49.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	30618	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.65% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  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: GOL, NCT, HEM

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	0.98	1/3869 (0.0%)	0.88	2/5210 (0.0%)
1	B	0.97	0/3909	0.88	0/5262
1	C	0.95	1/3898 (0.0%)	0.85	1/5248 (0.0%)
1	D	0.96	4/3897 (0.1%)	0.87	6/5246 (0.1%)
1	E	0.84	3/3898 (0.1%)	0.79	0/5246
1	F	0.78	1/3869 (0.0%)	0.77	0/5209
1	G	0.73	0/3832	0.76	0/5166
1	H	0.70	0/3780	0.72	0/5094
All	All	0.87	10/30952 (0.0%)	0.82	9/41681 (0.0%)

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	65	TYR	CD2-CE2	-5.98	1.30	1.39
1	F	46	TYR	CD1-CE1	-5.93	1.30	1.39
1	E	100	GLY	C-N	-5.86	1.20	1.34
1	D	475	PRO	N-CD	5.67	1.55	1.47
1	E	101	ARG	C-N	-5.61	1.23	1.33

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	316	LEU	CA-CB-CG	5.70	128.41	115.30
1	D	401	ASP	CB-CG-OD1	5.46	123.22	118.30
1	A	195	ASP	CB-CG-OD1	5.35	123.12	118.30
1	D	387	LYS	CD-CE-NZ	-5.32	99.47	111.70
1	C	315	LEU	CB-CG-CD2	-5.24	102.10	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	3772	0	3735	53	0
1	B	3812	0	3771	45	0
1	C	3798	0	3762	57	0
1	D	3797	0	3764	56	0
1	E	3798	0	3772	44	0
1	F	3772	0	3741	71	0
1	G	3735	0	3670	77	0
1	H	3687	0	3614	54	0
2	A	43	0	30	2	0
2	B	43	0	30	1	0
2	C	43	0	30	2	0
2	D	43	0	30	3	0
2	E	43	0	30	2	0
2	F	43	0	30	3	0
2	G	43	0	30	0	0
2	H	43	0	30	2	0
3	A	12	0	14	3	0
3	B	12	0	14	3	0
3	C	12	0	14	3	0
3	D	12	0	14	3	0
4	H	6	0	8	1	0
5	A	9	0	0	0	0
5	B	5	0	0	1	0
5	C	6	0	0	0	0
5	D	14	0	0	1	0
5	E	2	0	0	0	0
5	F	2	0	0	0	0
5	G	9	0	0	1	0
5	H	2	0	0	0	0
All	All	30618	0	30133	459	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 8.

The worst 5 of 459 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:C:32:LYS:HD2	1:C:33:LEU:H	1.19	1.07
1:D:77:ARG:HH11	1:D:77:ARG:HG2	1.23	1.03
1:B:32:LYS:HD2	1:B:33:LEU:H	1.25	0.96
1:C:32:LYS:HD2	1:C:33:LEU:N	1.81	0.95
1:H:352:THR:O	1:H:356:ILE:HD13	1.72	0.90

There are no symmetry-related clashes.

## 5.3 Torsion angles

### 5.3.1 Protein backbone

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all 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	463/476 (97%)	441 (95%)	21 (4%)	1 (0%)	47	68
1	B	467/476 (98%)	433 (93%)	33 (7%)	1 (0%)	47	68
1	C	466/476 (98%)	438 (94%)	26 (6%)	2 (0%)	34	54
1	D	466/476 (98%)	445 (96%)	21 (4%)	0	100	100
1	E	466/476 (98%)	448 (96%)	16 (3%)	2 (0%)	34	54
1	F	463/476 (97%)	413 (89%)	44 (10%)	6 (1%)	12	21
1	G	461/476 (97%)	404 (88%)	52 (11%)	5 (1%)	14	26
1	H	454/476 (95%)	396 (87%)	49 (11%)	9 (2%)	7	12
All	All	3706/3808 (97%)	3418 (92%)	262 (7%)	26 (1%)	22	39

5 of 26 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	F	262	ASN
1	F	338	ASN
1	H	95	ALA
1	H	408	PRO
1	F	345	ASP

### 5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all 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	409/419 (98%)	392 (96%)	17 (4%)	30	54
1	B	413/419 (99%)	397 (96%)	16 (4%)	32	57
1	C	412/419 (98%)	393 (95%)	19 (5%)	27	50
1	D	412/419 (98%)	386 (94%)	26 (6%)	18	34
1	E	412/419 (98%)	382 (93%)	30 (7%)	14	27
1	F	409/419 (98%)	376 (92%)	33 (8%)	11	23
1	G	402/419 (96%)	371 (92%)	31 (8%)	13	25
1	H	396/419 (94%)	356 (90%)	40 (10%)	7	14
All	All	3265/3352 (97%)	3053 (94%)	212 (6%)	17	33

5 of 212 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	E	254	HIS
1	F	228	LYS
1	H	318	MET
1	E	312	TYR
1	E	470	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	297	ASN
1	F	375	ASN
1	G	486	ASN
1	E	255	ASN
1	G	340	GLN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

## 5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

## 5.6 Ligand geometry ⓘ

13 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	NCT	B	501	-	13,13,13	1.20	1 (7%)	17,17,17	2.30	6 (35%)
3	NCT	A	501	-	13,13,13	0.82	0	17,17,17	2.18	7 (41%)
4	GOL	H	502	-	5,5,5	0.97	0	5,5,5	2.05	3 (60%)
2	HEM	A	500	1	27,50,50	2.30	8 (29%)	17,82,82	1.44	5 (29%)
2	HEM	H	501	1	27,50,50	2.18	9 (33%)	17,82,82	1.70	4 (23%)
2	HEM	F	500	1	27,50,50	2.28	7 (25%)	17,82,82	1.35	3 (17%)
2	HEM	D	500	1	27,50,50	2.17	9 (33%)	17,82,82	1.54	4 (23%)
2	HEM	G	500	1	27,50,50	2.33	7 (25%)	17,82,82	1.79	4 (23%)
2	HEM	B	500	1	27,50,50	2.19	8 (29%)	17,82,82	1.57	5 (29%)
2	HEM	E	500	1	27,50,50	2.24	7 (25%)	17,82,82	2.02	7 (41%)
2	HEM	C	500	1	27,50,50	2.33	8 (29%)	17,82,82	1.85	5 (29%)
3	NCT	D	501	-	13,13,13	0.76	1 (7%)	17,17,17	1.88	6 (35%)
3	NCT	C	501	-	13,13,13	1.15	1 (7%)	17,17,17	2.35	6 (35%)

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	NCT	B	501	-	-	0/4/14/14	0/2/2/2
3	NCT	A	501	-	-	0/4/14/14	0/2/2/2
4	GOL	H	502	-	-	4/4/4/4	-
2	HEM	A	500	1	-	0/6/54/54	-
2	HEM	H	501	1	-	1/6/54/54	-
2	HEM	F	500	1	-	3/6/54/54	-
2	HEM	D	500	1	-	0/6/54/54	-
2	HEM	G	500	1	-	0/6/54/54	-
2	HEM	B	500	1	-	0/6/54/54	-
2	HEM	E	500	1	-	0/6/54/54	-
2	HEM	C	500	1	-	0/6/54/54	-
3	NCT	D	501	-	-	0/4/14/14	0/2/2/2
3	NCT	C	501	-	-	0/4/14/14	0/2/2/2

The worst 5 of 66 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	G	500	HEM	C3D-C2D	5.94	1.55	1.37
2	F	500	HEM	C3D-C2D	5.68	1.54	1.37
2	C	500	HEM	C3C-C2C	-5.61	1.32	1.40
2	C	500	HEM	C3D-C2D	5.45	1.53	1.37
2	G	500	HEM	C3C-C2C	-5.40	1.32	1.40

The worst 5 of 65 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	501	NCT	C10-N2-C6	5.82	130.53	112.83
3	B	501	NCT	C10-N2-C6	5.68	130.09	112.83
3	A	501	NCT	C10-N2-C6	5.11	128.37	112.83
2	G	500	HEM	CAA-CBA-CGA	-4.68	104.83	112.67
3	D	501	NCT	C10-N2-C6	4.43	126.29	112.83

There are no chirality outliers.

5 of 8 torsion outliers are listed below:

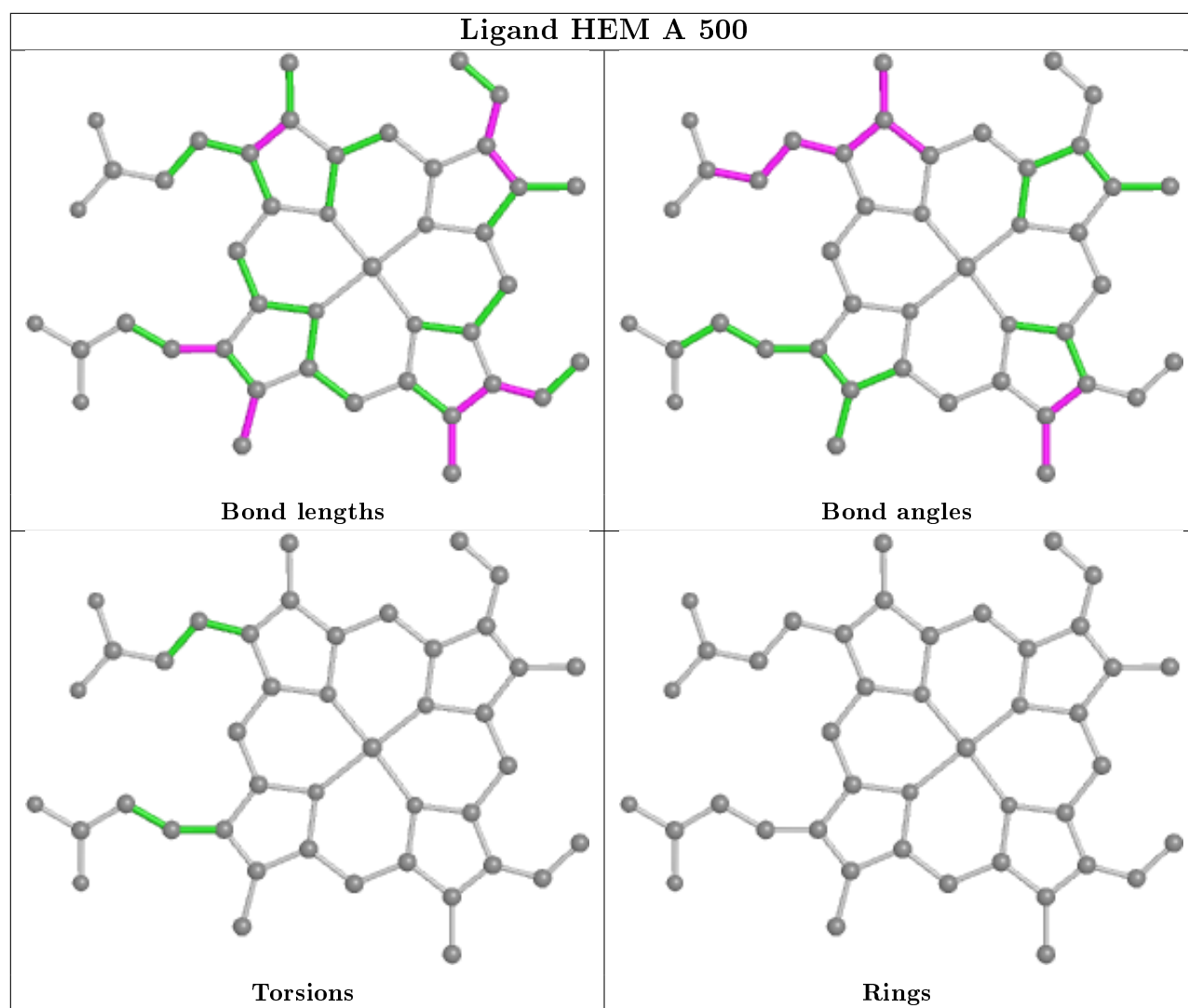
Mol	Chain	Res	Type	Atoms
4	H	502	GOL	O1-C1-C2-C3
4	H	502	GOL	C1-C2-C3-O3
2	H	501	HEM	C3D-CAD-CBD-CGD
2	F	500	HEM	C2D-C3D-CAD-CBD
2	F	500	HEM	C4D-C3D-CAD-CBD

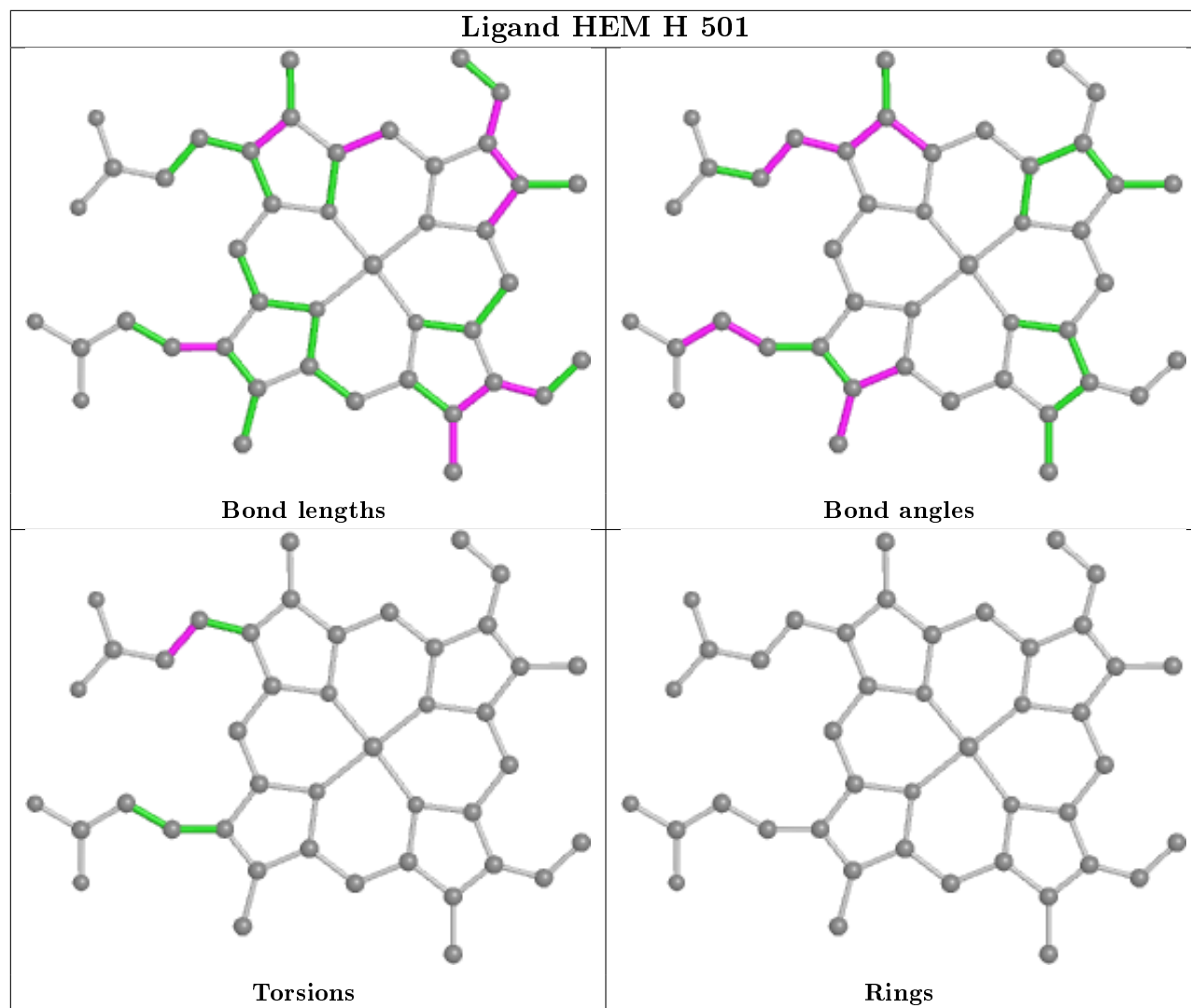
There are no ring outliers.

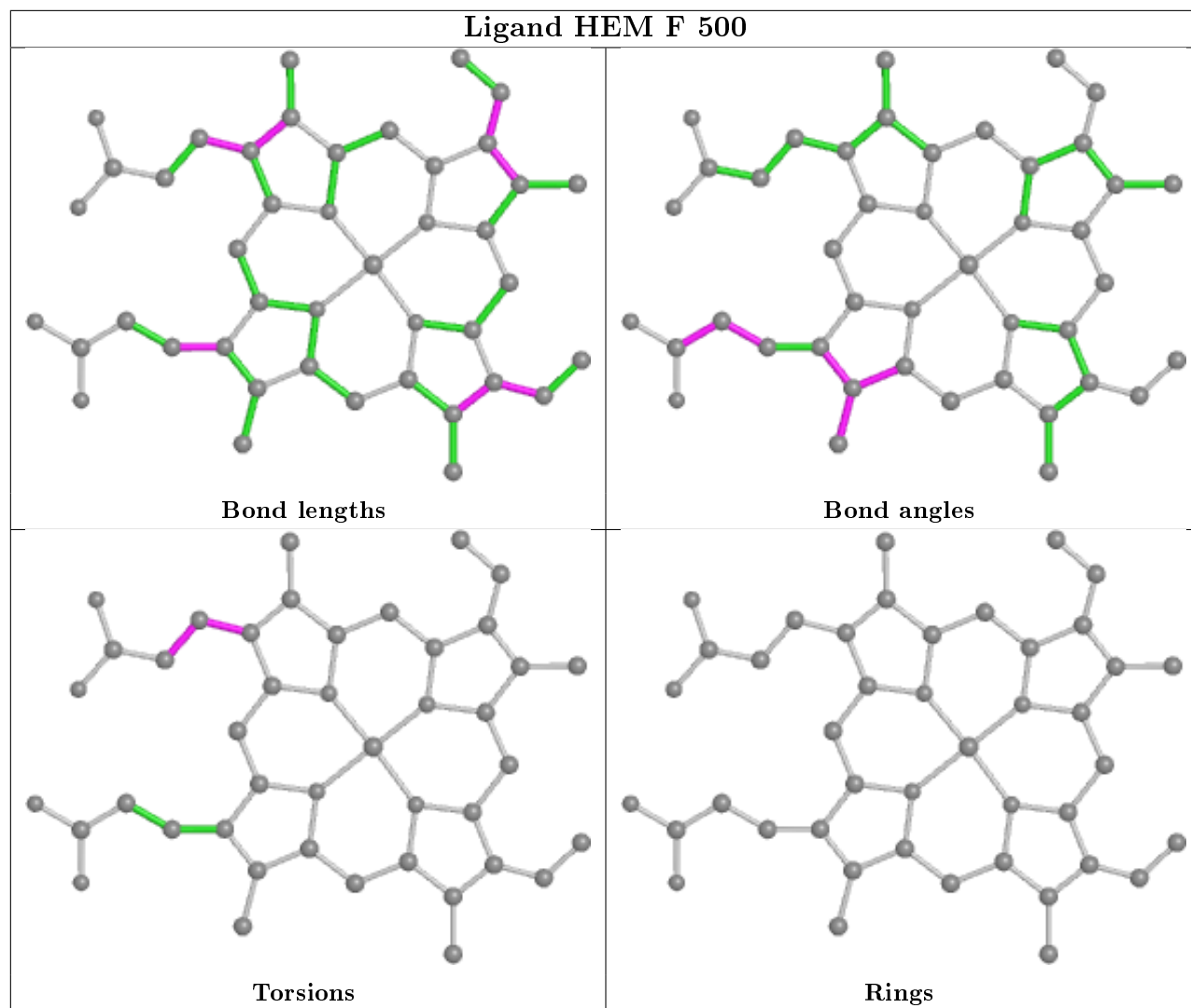
12 monomers are involved in 28 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	501	NCT	3	0
3	A	501	NCT	3	0
4	H	502	GOL	1	0
2	A	500	HEM	2	0
2	H	501	HEM	2	0
2	F	500	HEM	3	0
2	D	500	HEM	3	0
2	B	500	HEM	1	0
2	E	500	HEM	2	0
2	C	500	HEM	2	0
3	D	501	NCT	3	0
3	C	501	NCT	3	0

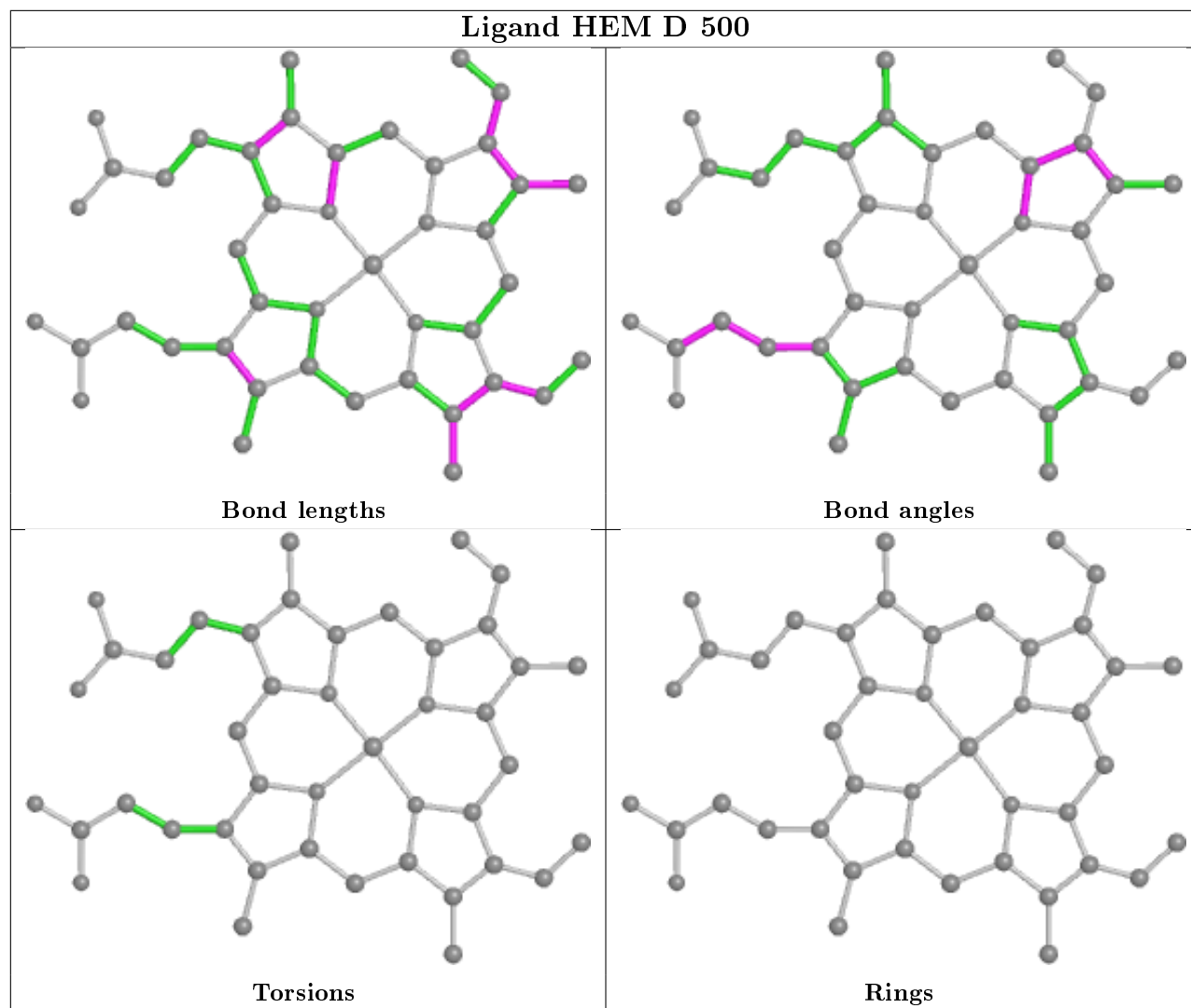
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

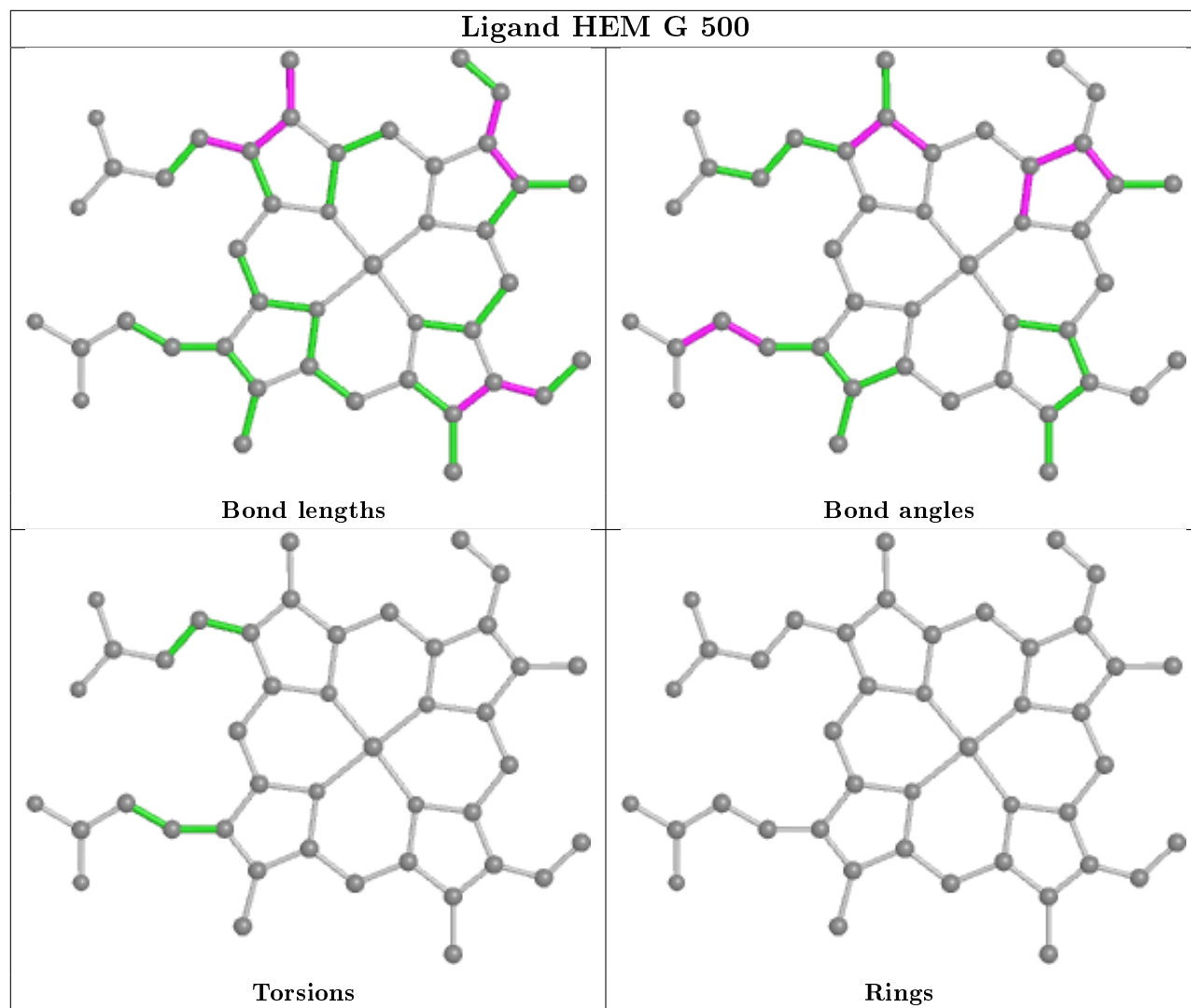


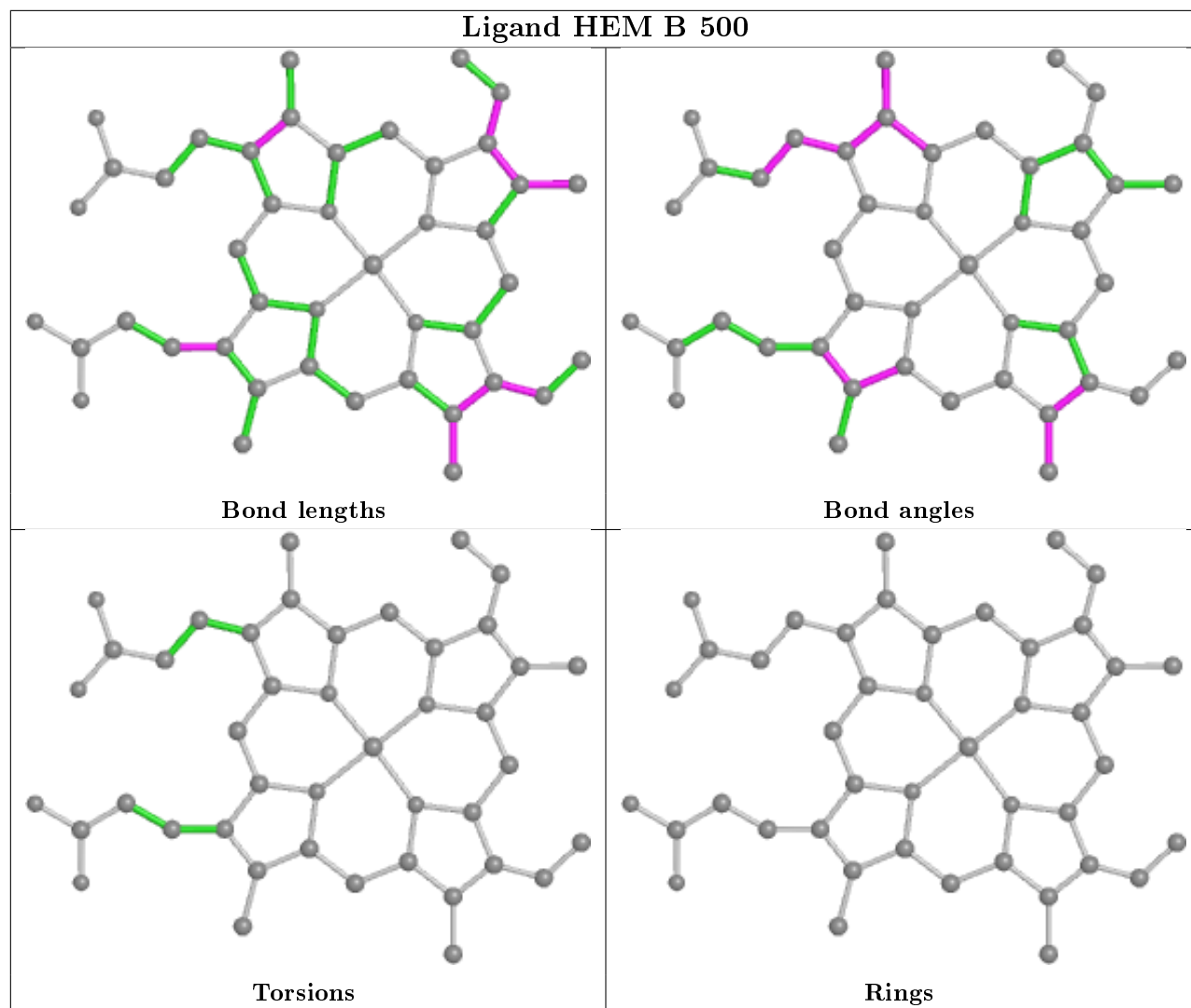


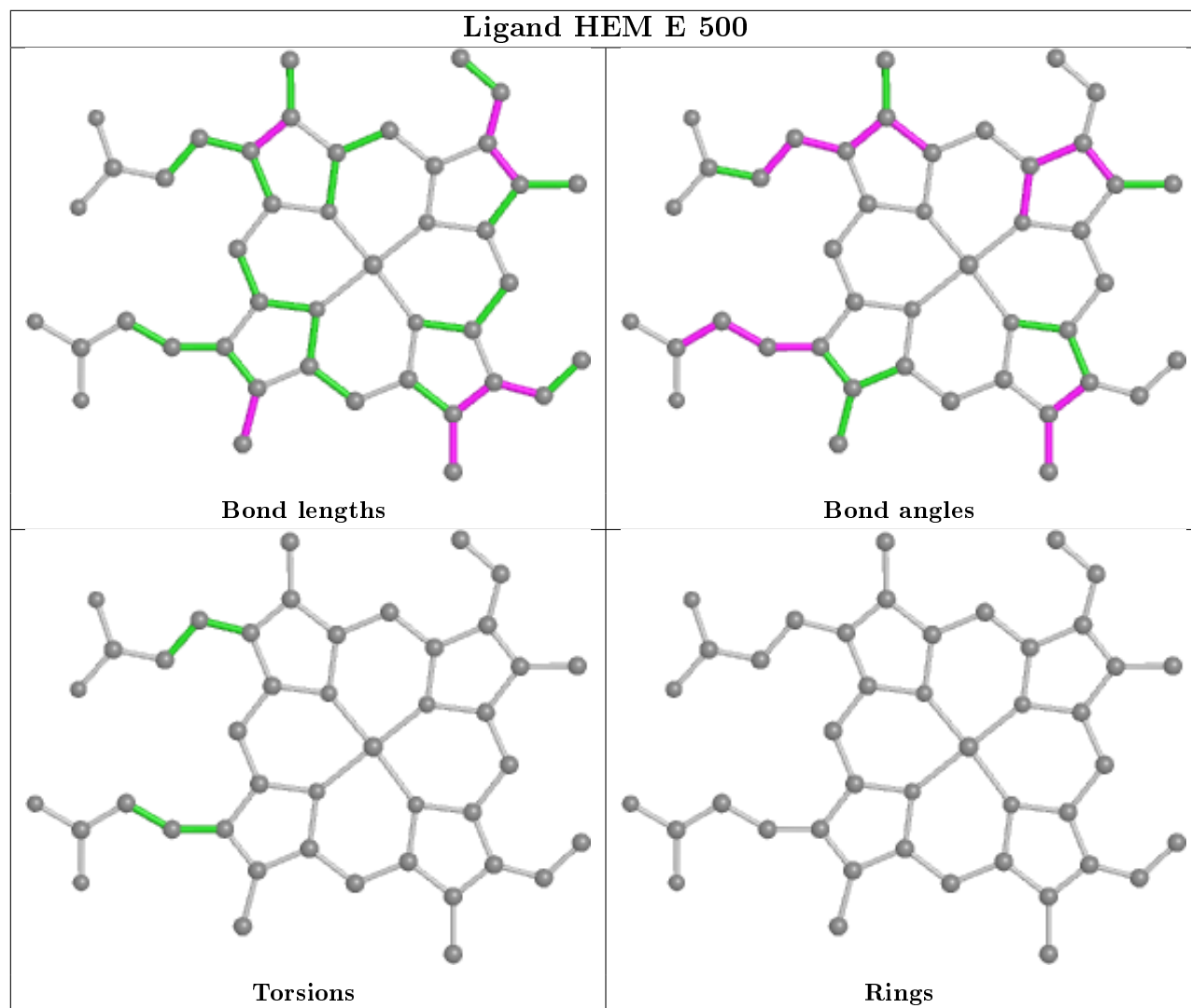


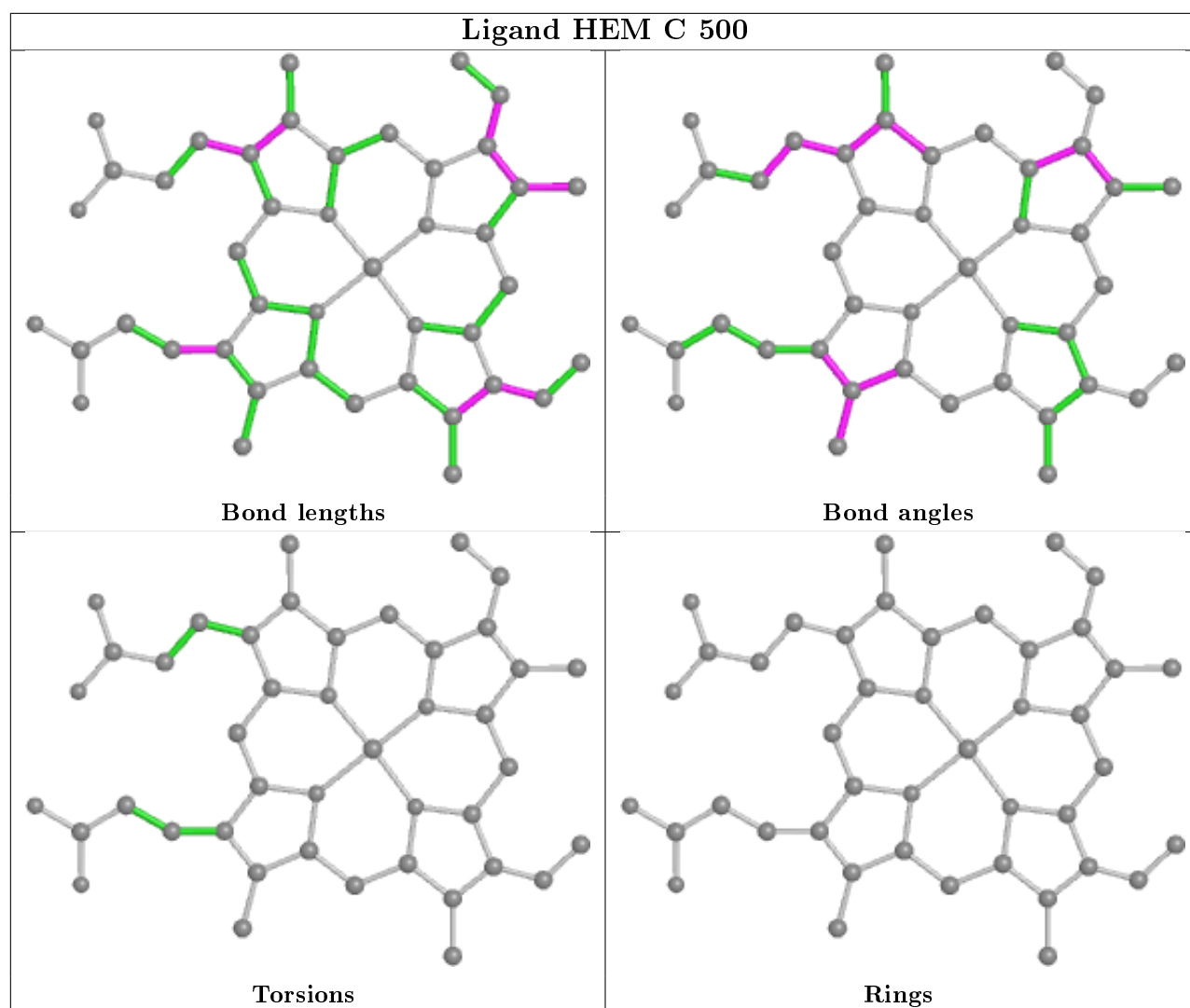












## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	464/476 (97%)	0.15	1 (0%) 95 95	17, 33, 53, 58	0
1	B	464/476 (97%)	0.11	1 (0%) 95 95	18, 33, 52, 61	0
1	C	464/476 (97%)	0.09	0 100 100	17, 33, 49, 58	0
1	D	465/476 (97%)	0.16	1 (0%) 95 95	19, 34, 52, 59	0
1	E	465/476 (97%)	0.20	10 (2%) 62 65	22, 48, 66, 74	0
1	F	465/476 (97%)	0.60	37 (7%) 12 12	23, 61, 83, 90	0
1	G	463/476 (97%)	0.63	36 (7%) 13 13	29, 65, 85, 95	0
1	H	458/476 (96%)	0.83	57 (12%) 4 3	23, 75, 94, 99	0
All	All	3708/3808 (97%)	0.34	143 (3%) 39 42	17, 45, 85, 99	0

The worst 5 of 143 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	F	141	GLY	7.7
1	H	133	ALA	6.0
1	H	282	PRO	5.4
1	G	157	ILE	5.4
1	G	491	PHE	5.0

### 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

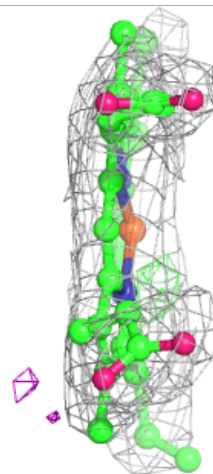
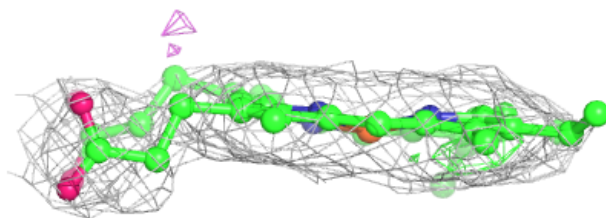
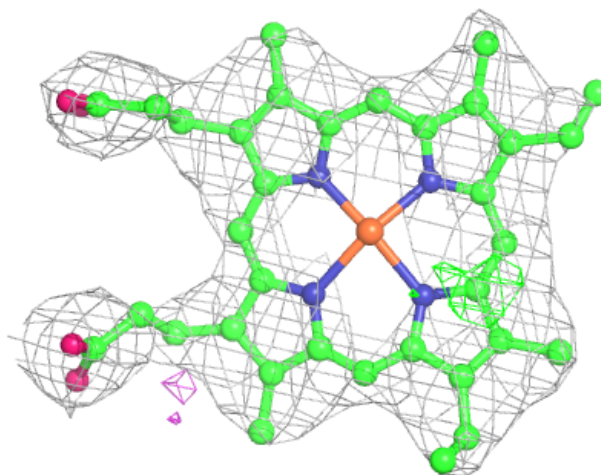
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	NCT	D	501	12/12	0.88	0.35	80,81,82,82	0
4	GOL	H	502	6/6	0.89	0.27	28,32,35,37	0
3	NCT	A	501	12/12	0.91	0.23	50,52,53,54	0
3	NCT	C	501	12/12	0.91	0.31	61,62,67,68	0
3	NCT	B	501	12/12	0.92	0.23	40,43,44,47	0
2	HEM	H	501	43/43	0.93	0.22	58,61,67,68	0
2	HEM	G	500	43/43	0.97	0.16	32,38,43,49	0
2	HEM	E	500	43/43	0.97	0.16	26,33,35,35	0
2	HEM	F	500	43/43	0.97	0.18	44,48,50,51	0
2	HEM	D	500	43/43	0.97	0.19	16,26,28,28	0
2	HEM	C	500	43/43	0.98	0.17	15,23,27,29	0
2	HEM	B	500	43/43	0.98	0.16	13,23,25,28	0
2	HEM	A	500	43/43	0.98	0.19	16,23,27,31	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 HEM H 501:**

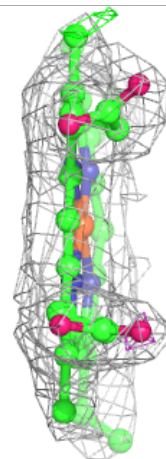
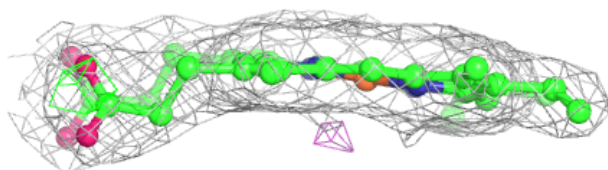
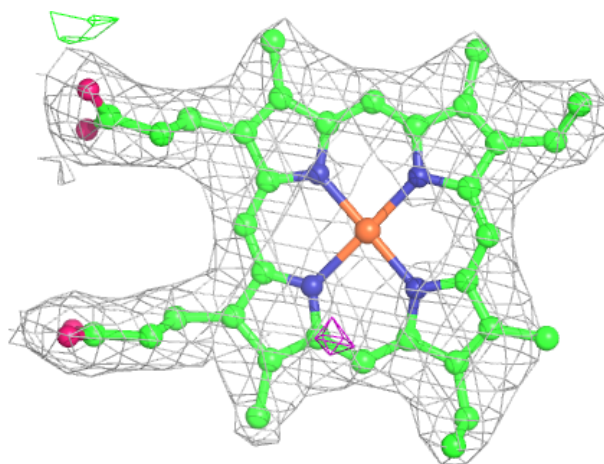
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)





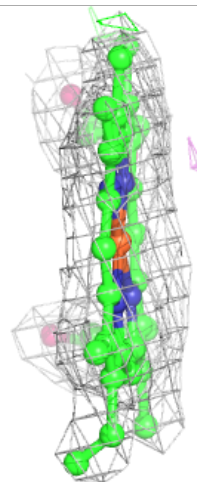
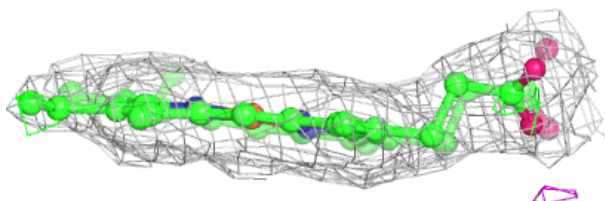
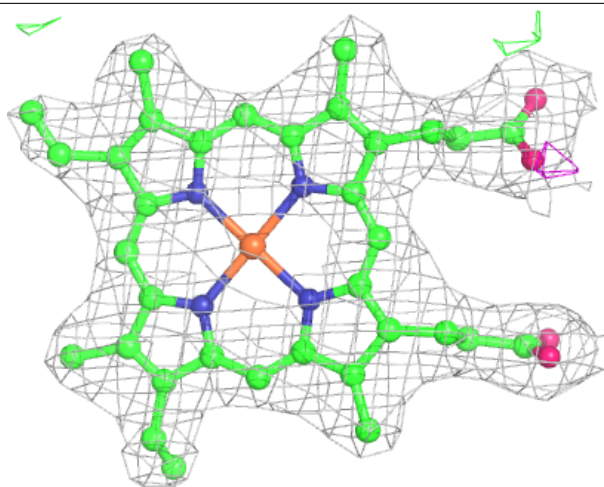
**Electron density around HEM G 500:**

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



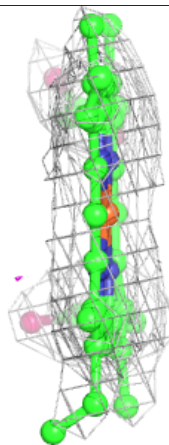
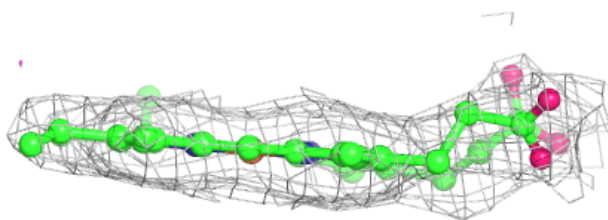
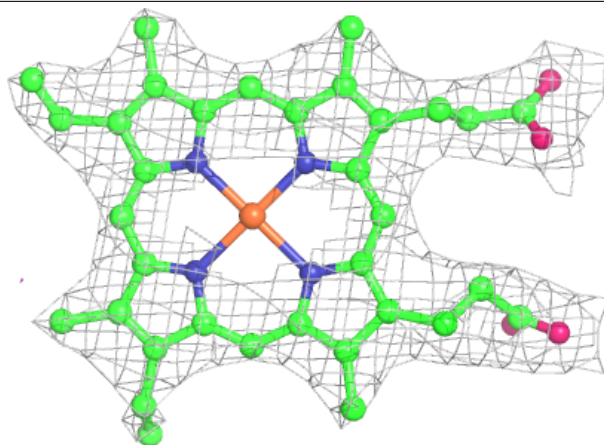
**Electron density around HEM E 500:**

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



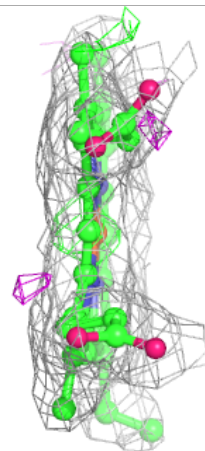
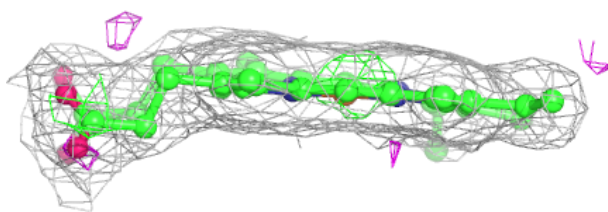
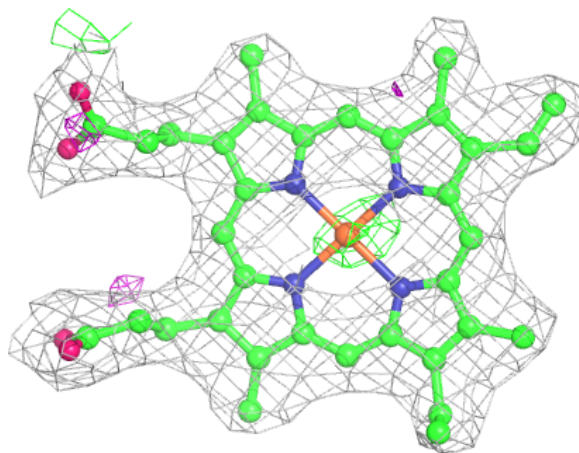
**Electron density around HEM F 500:**

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



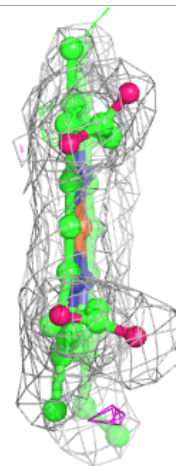
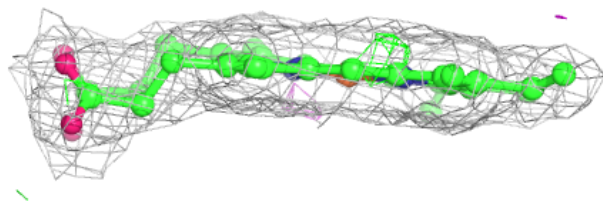
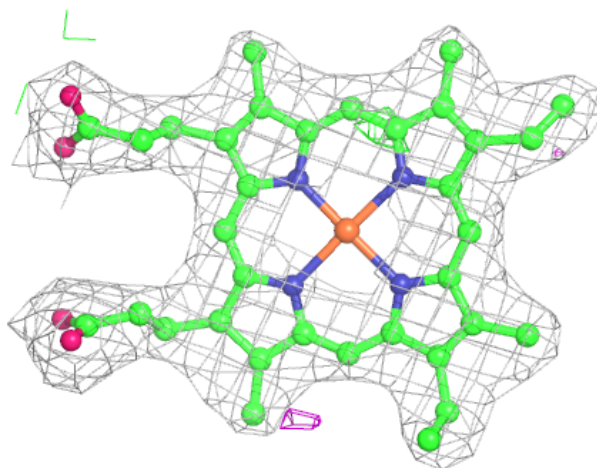
**Electron density around HEM D 500:**

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



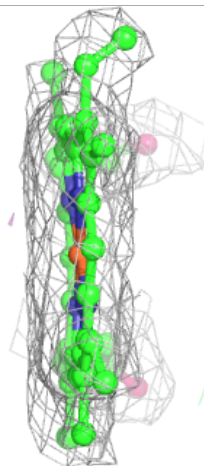
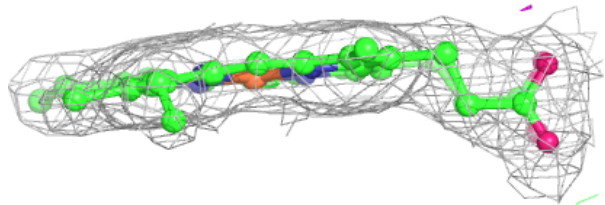
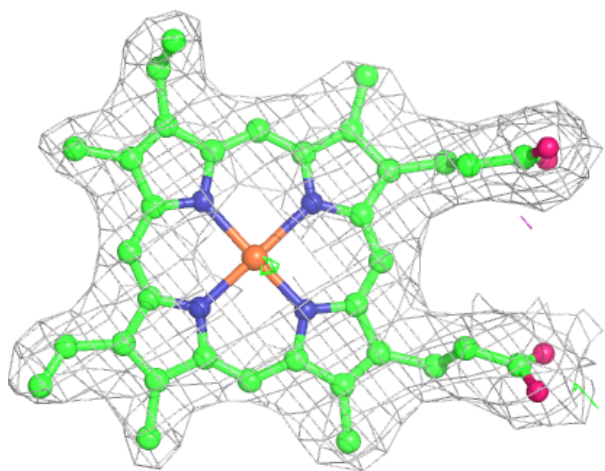
**Electron density around HEM C 500:**

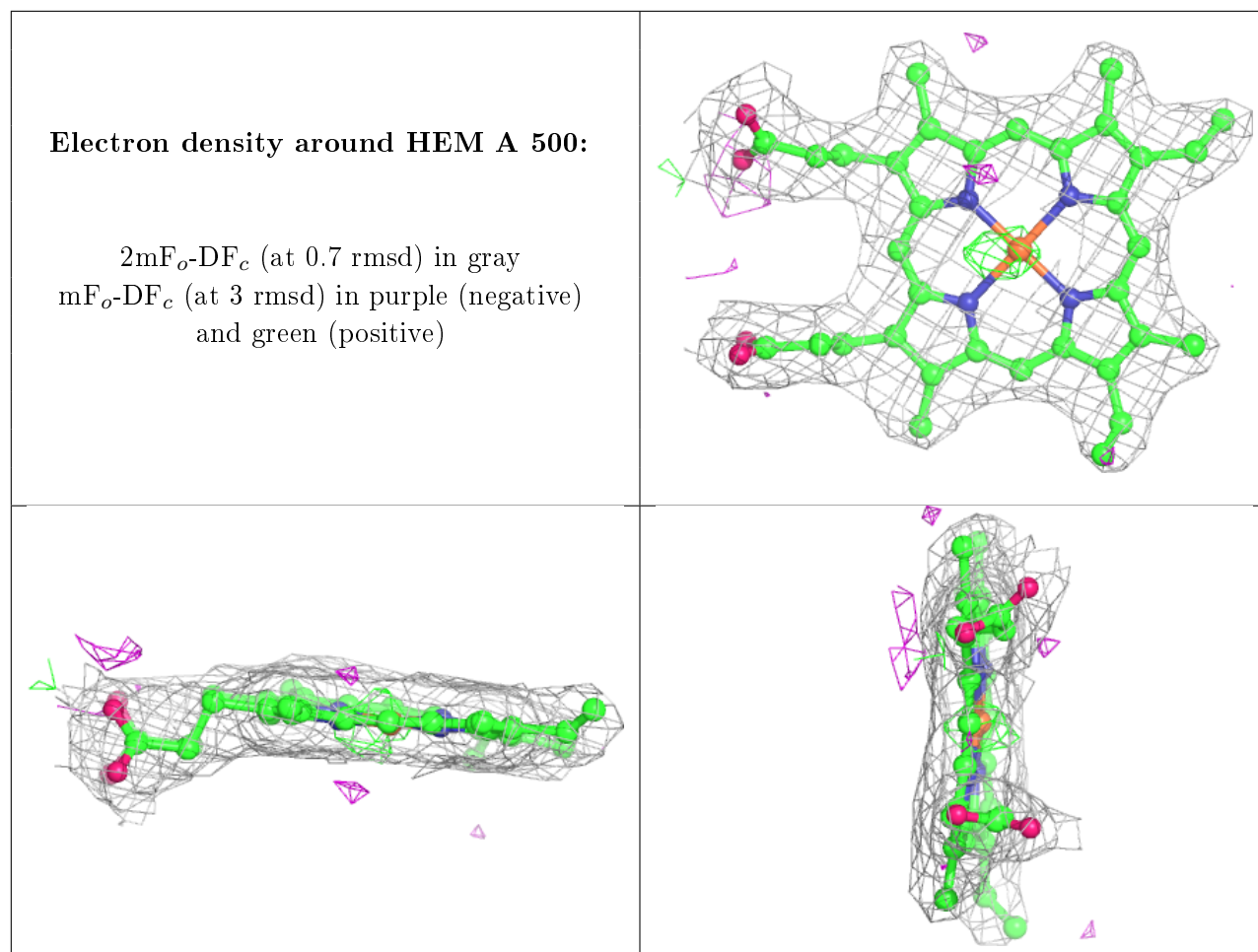
$2mF_o-DF_c$  (at 0.7 rmsd) in gray  
 $mF_o-DF_c$  (at 3 rmsd) in purple (negative)  
and green (positive)



**Electron density around HEM B 500:**

$2mF_o-DF_c$  (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.