



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 20, 2023 – 12:47 PM EDT

PDB ID : 2NOX
Title : Crystal structure of tryptophan 2,3-dioxygenase from *Ralstonia metallidurans*
Authors : Zhang, Y.; Kang, S.A.; Mukherjee, T.; Bale, S.; Crane, B.R.; Begley, T.P.; Ealick, S.E.
Deposited on : 2006-10-26
Resolution : 2.40 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 ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.35
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

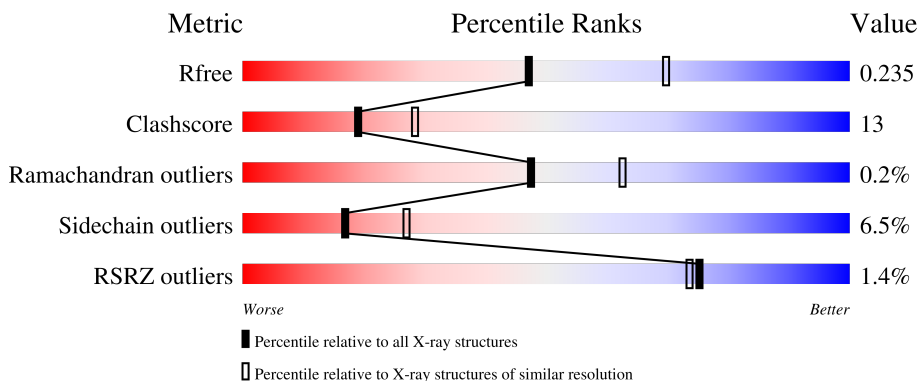
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)

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 $\leq 5\%$. 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	281	70% 21% • 7%
1	B	281	71% 21% •• 5%
1	C	281	70% 18% • 9%
1	D	281	70% 19% • 8%
1	E	281	71% 18% • 9%

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Mol	Chain	Length	Quality of chain
1	F	281	<p>% 66% 23% • 7%</p>
1	G	281	<p>3% 62% 27% • 8%</p>
1	H	281	<p>70% 19% • 8%</p>
1	I	281	<p>% 62% 27% • 8%</p>
1	J	281	<p>4% 67% 22% • 9%</p>
1	K	281	<p>3% 71% 17% • 9%</p>
1	L	281	<p>% 64% 25% • 7%</p>
1	M	281	<p>69% 18% •• 9%</p>
1	N	281	<p>2% 69% 21% • 7%</p>
1	O	281	<p>% 68% 19% • 9%</p>
1	P	281	<p>68% 22% • 8%</p>

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 36423 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 Tryptophan 2,3-dioxygenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	261	Total 2160	C 1375	N 382	O 390	S 13	0	1	0
1	B	266	Total 2192	C 1400	N 384	O 395	S 13	0	0	0
1	C	255	Total 2106	C 1344	N 368	O 382	S 12	0	0	0
1	D	259	Total 2133	C 1360	N 376	O 385	S 12	0	0	0
1	E	256	Total 2126	C 1356	N 376	O 382	S 12	0	0	0
1	F	260	Total 2152	C 1371	N 380	O 388	S 13	0	0	0
1	G	259	Total 2137	C 1362	N 376	O 387	S 12	0	0	0
1	H	259	Total 2147	C 1368	N 380	O 387	S 12	0	2	0
1	I	259	Total 2133	C 1360	N 376	O 385	S 12	0	0	0
1	J	257	Total 2126	C 1356	N 374	O 384	S 12	0	0	0
1	K	255	Total 2119	C 1352	N 372	O 383	S 12	0	1	0
1	L	260	Total 2141	C 1364	N 377	O 388	S 12	0	0	0
1	M	255	Total 2111	C 1349	N 370	O 380	S 12	0	1	0
1	N	260	Total 2150	C 1370	N 379	O 389	S 12	0	1	0
1	O	257	Total 2126	C 1356	N 374	O 384	S 12	0	0	0
1	P	259	Total 2133	C 1360	N 376	O 385	S 12	0	0	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
2	M	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	N	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	O	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	P	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

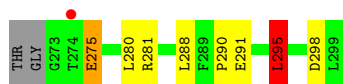
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	130	Total	O	0	0
			130	130		
3	B	126	Total	O	0	0
			126	126		
3	C	107	Total	O	0	0
			107	107		
3	D	158	Total	O	0	0
			158	158		
3	E	107	Total	O	0	0
			107	107		
3	F	72	Total	O	0	0
			72	72		
3	G	56	Total	O	0	0
			56	56		
3	H	114	Total	O	0	0
			114	114		
3	I	85	Total	O	0	0
			85	85		
3	J	82	Total	O	0	0
			82	82		
3	K	74	Total	O	0	0
			74	74		
3	L	81	Total	O	0	0
			81	81		
3	M	116	Total	O	0	0
			116	116		
3	N	66	Total	O	0	0
			66	66		
3	O	61	Total	O	0	0
			61	61		

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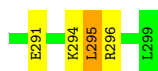
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	P	108	Total 108	O 108	0	0



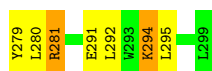
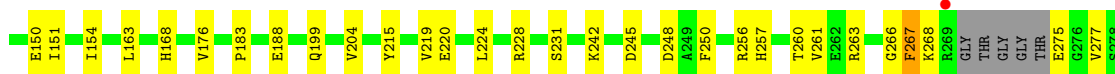
- Molecule 1: Tryptophan 2,3-dioxygenase

Chain D: 70% 19% 8%



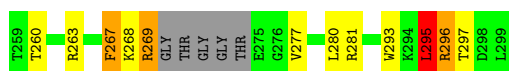
- Molecule 1: Tryptophan 2,3-dioxygenase

Chain E: 71% 18% 9%



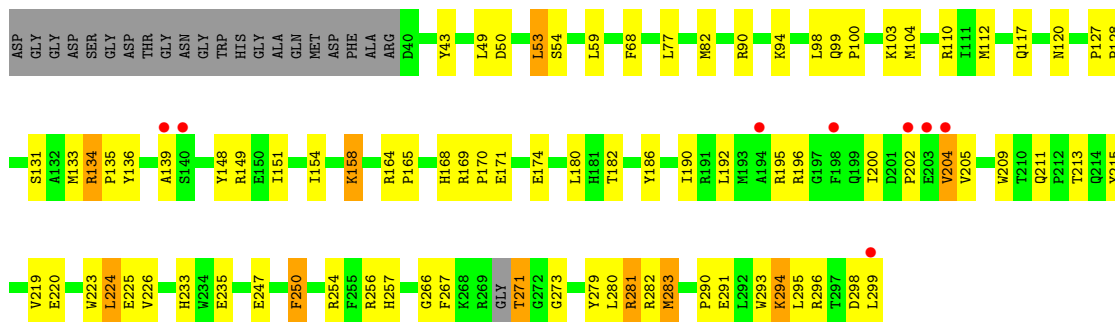
- Molecule 1: Tryptophan 2,3-dioxygenase

Chain F: 66% 23% 7%

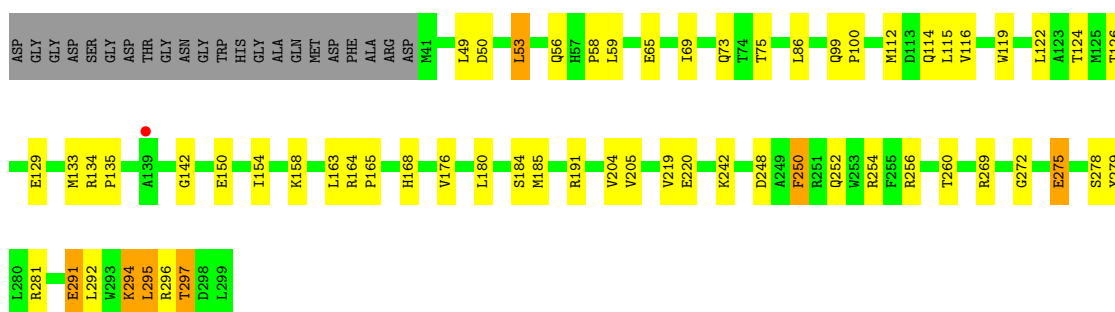


- Molecule 1: Tryptophan 2,3-dioxygenase

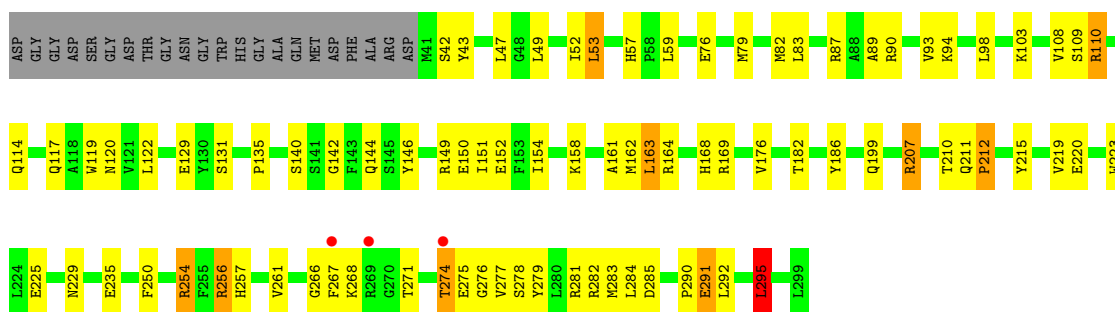
Chain G: 62% 27% 8%



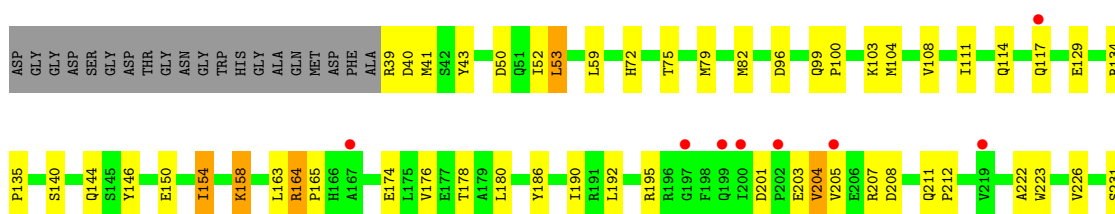
• Molecule 1: Tryptophan 2,3-dioxygenase



• Molecule 1: Tryptophan 2,3-dioxygenase



• Molecule 1: Tryptophan 2,3-dioxygenase

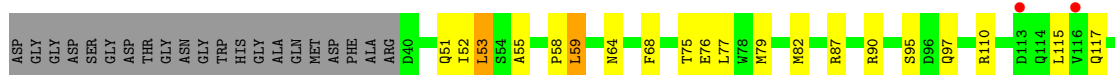




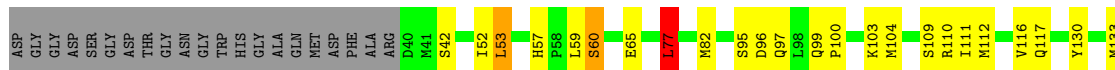
- Molecule 1: Tryptophan 2,3-dioxygenase



- Molecule 1: Tryptophan 2,3-dioxygenase



- Molecule 1: Tryptophan 2,3-dioxygenase

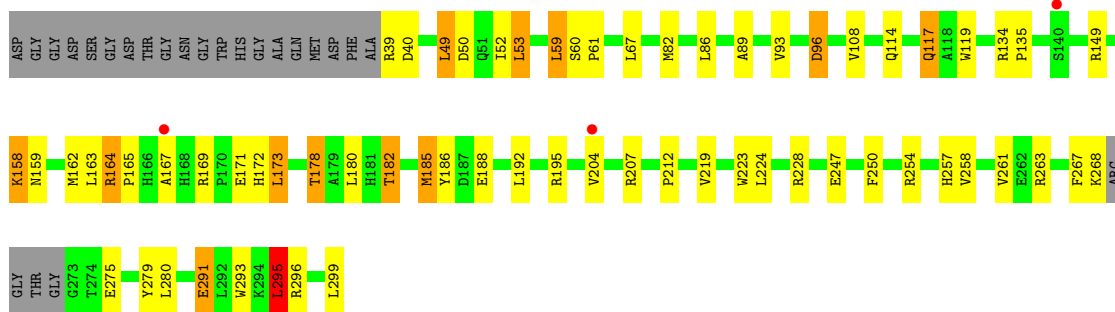


- Molecule 1: Tryptophan 2,3-dioxygenase

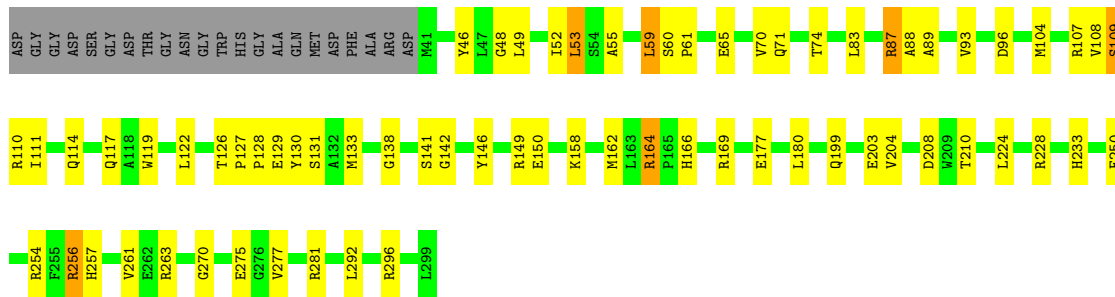




● Molecule 1: Tryptophan 2,3-dioxygenase



● Molecule 1: Tryptophan 2,3-dioxygenase



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	72.54Å 132.12Å 139.95Å 66.97° 85.06° 89.89°	Depositor
Resolution (Å)	50.12 – 2.40 50.09 – 2.22	Depositor EDS
% Data completeness (in resolution range)	93.5 (50.12-2.40) 86.1 (50.09-2.22)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.46 (at 2.22Å)	Xtrriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.210 , 0.270 0.163 , 0.235	Depositor DCC
R_{free} test set	11190 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	38.1	Xtrriage
Anisotropy	0.109	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 51.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	36423	wwPDB-VP
Average B, all atoms (Å ²)	45.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.97% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: 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	0.68	0/2217	0.80	3/3004 (0.1%)
1	B	0.64	0/2252	0.78	5/3053 (0.2%)
1	C	0.65	0/2162	0.76	2/2932 (0.1%)
1	D	0.68	0/2190	0.80	1/2969 (0.0%)
1	E	0.61	0/2182	0.68	1/2956 (0.0%)
1	F	0.58	0/2208	0.71	1/2991 (0.0%)
1	G	0.57	0/2193	0.66	0/2972
1	H	0.60	0/2207	0.73	1/2992 (0.0%)
1	I	0.57	0/2190	0.69	1/2969 (0.0%)
1	J	0.54	0/2182	0.69	1/2957 (0.0%)
1	K	0.51	0/2178	0.68	0/2953
1	L	0.54	0/2198	0.68	0/2980
1	M	0.64	0/2167	0.75	2/2938 (0.1%)
1	N	0.54	0/2207	0.67	0/2991
1	O	0.57	0/2182	0.68	1/2957 (0.0%)
1	P	0.61	0/2190	0.73	2/2969 (0.1%)
All	All	0.60	0/35105	0.72	21/47583 (0.0%)

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

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

There are no bond length outliers.

The worst 5 of 21 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	295	LEU	CA-CB-CG	9.07	136.17	115.30
1	M	295	LEU	CA-CB-CG	8.72	135.36	115.30
1	B	296	ARG	NE-CZ-NH2	-8.70	115.95	120.30
1	H	295	LEU	CA-CB-CG	7.93	133.53	115.30
1	B	296	ARG	NE-CZ-NH1	7.75	124.17	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	L	139	ALA	Peptide

5.2 Too-close contacts [i](#)

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

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2160	0	2108	65	0
1	B	2192	0	2117	50	0
1	C	2106	0	2047	51	0
1	D	2133	0	2083	49	0
1	E	2126	0	2076	51	0
1	F	2152	0	2096	64	0
1	G	2137	0	2083	75	0
1	H	2147	0	2101	34	0
1	I	2133	0	2083	87	0
1	J	2126	0	2073	56	0
1	K	2119	0	2065	53	0
1	L	2141	0	2087	78	0
1	M	2111	0	2051	46	0
1	N	2150	0	2099	60	0
1	O	2126	0	2073	58	0
1	P	2133	0	2083	62	0
2	A	43	0	30	6	0
2	B	43	0	30	0	0
2	C	43	0	30	2	0
2	D	43	0	30	2	0
2	E	43	0	30	7	0
2	F	43	0	30	3	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	G	43	0	30	3	0
2	H	43	0	30	2	0
2	I	43	0	30	9	0
2	J	43	0	30	1	0
2	K	43	0	30	4	0
2	L	43	0	30	5	0
2	M	43	0	30	2	0
2	N	43	0	30	1	0
2	O	43	0	30	4	0
2	P	43	0	30	7	0
3	A	130	0	0	10	0
3	B	126	0	0	6	0
3	C	107	0	0	7	0
3	D	158	0	0	4	0
3	E	107	0	0	4	0
3	F	72	0	0	6	0
3	G	56	0	0	8	0
3	H	114	0	0	3	0
3	I	85	0	0	8	0
3	J	82	0	0	6	0
3	K	74	0	0	7	0
3	L	81	0	0	10	0
3	M	116	0	0	5	0
3	N	66	0	0	1	0
3	O	61	0	0	4	0
3	P	108	0	0	5	0
All	All	36423	0	33805	893	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 13.

The worst 5 of 893 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:N:109:SER:HB3	1:N:110:ARG:NH1	1.56	1.17
1:G:283:MET:HE2	1:G:283:MET:HA	1.18	1.15
1:P:65:GLU:HG3	1:P:133:MET:CE	1.77	1.15
1:G:82:MET:HE2	1:G:112:MET:HG2	1.31	1.11
1:C:219:VAL:HG12	1:C:291:GLU:HG3	1.31	1.09

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	260/281 (92%)	254 (98%)	6 (2%)	0	100	100
1	B	262/281 (93%)	254 (97%)	8 (3%)	0	100	100
1	C	251/281 (89%)	244 (97%)	7 (3%)	0	100	100
1	D	257/281 (92%)	248 (96%)	8 (3%)	1 (0%)	34	48
1	E	252/281 (90%)	241 (96%)	9 (4%)	2 (1%)	19	29
1	F	256/281 (91%)	249 (97%)	6 (2%)	1 (0%)	34	48
1	G	255/281 (91%)	242 (95%)	12 (5%)	1 (0%)	34	48
1	H	259/281 (92%)	254 (98%)	5 (2%)	0	100	100
1	I	257/281 (92%)	249 (97%)	7 (3%)	1 (0%)	34	48
1	J	253/281 (90%)	244 (96%)	9 (4%)	0	100	100
1	K	252/281 (90%)	246 (98%)	5 (2%)	1 (0%)	34	48
1	L	258/281 (92%)	250 (97%)	6 (2%)	2 (1%)	19	29
1	M	252/281 (90%)	244 (97%)	7 (3%)	1 (0%)	34	48
1	N	259/281 (92%)	250 (96%)	9 (4%)	0	100	100
1	O	253/281 (90%)	238 (94%)	15 (6%)	0	100	100
1	P	257/281 (92%)	249 (97%)	8 (3%)	0	100	100
All	All	4093/4496 (91%)	3956 (97%)	127 (3%)	10 (0%)	47	62

5 of 10 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	140	SER
1	E	268	LYS
1	I	212	PRO
1	M	268	LYS
1	E	141	SER

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	229/240 (95%)	217 (95%)	12 (5%)	23	38
1	B	230/240 (96%)	214 (93%)	16 (7%)	15	24
1	C	224/240 (93%)	210 (94%)	14 (6%)	18	28
1	D	226/240 (94%)	211 (93%)	15 (7%)	16	26
1	E	226/240 (94%)	212 (94%)	14 (6%)	18	29
1	F	228/240 (95%)	213 (93%)	15 (7%)	16	26
1	G	227/240 (95%)	213 (94%)	14 (6%)	18	29
1	H	228/240 (95%)	214 (94%)	14 (6%)	18	30
1	I	226/240 (94%)	213 (94%)	13 (6%)	20	32
1	J	226/240 (94%)	209 (92%)	17 (8%)	13	21
1	K	226/240 (94%)	213 (94%)	13 (6%)	20	32
1	L	227/240 (95%)	215 (95%)	12 (5%)	22	37
1	M	223/240 (93%)	204 (92%)	19 (8%)	10	16
1	N	228/240 (95%)	213 (93%)	15 (7%)	16	26
1	O	226/240 (94%)	207 (92%)	19 (8%)	11	16
1	P	226/240 (94%)	213 (94%)	13 (6%)	20	32
All	All	3626/3840 (94%)	3391 (94%)	235 (6%)	17	27

5 of 235 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	I	59	LEU
1	O	296	ARG
1	J	295	LEU
1	O	291	GLU
1	N	265	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 23 such sidechains are listed below:

Mol	Chain	Res	Type
1	K	144	GLN
1	L	114	GLN
1	L	51	GLN
1	M	252	GLN
1	D	252	GLN

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](#)

16 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	HEM	D	500	3,1	41,50,50	2.15	10 (24%)	45,82,82	1.86	8 (17%)
2	HEM	H	500	1	41,50,50	2.06	8 (19%)	45,82,82	1.92	12 (26%)
2	HEM	F	500	1	41,50,50	1.95	6 (14%)	45,82,82	1.69	10 (22%)
2	HEM	O	500	1	41,50,50	2.00	7 (17%)	45,82,82	1.77	9 (20%)
2	HEM	P	500	3,1	41,50,50	2.00	7 (17%)	45,82,82	1.79	8 (17%)
2	HEM	G	500	1	41,50,50	2.11	9 (21%)	45,82,82	1.85	8 (17%)
2	HEM	J	500	1	41,50,50	2.01	6 (14%)	45,82,82	1.59	7 (15%)
2	HEM	E	500	3,1	41,50,50	1.93	8 (19%)	45,82,82	1.79	9 (20%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	HEM	C	500	1	41,50,50	2.01	6 (14%)	45,82,82	1.81	10 (22%)
2	HEM	K	500	1	41,50,50	1.88	6 (14%)	45,82,82	1.71	5 (11%)
2	HEM	B	500	1	41,50,50	2.14	8 (19%)	45,82,82	1.78	9 (20%)
2	HEM	L	500	1	41,50,50	1.87	7 (17%)	45,82,82	1.72	9 (20%)
2	HEM	M	500	1	41,50,50	2.05	10 (24%)	45,82,82	1.72	8 (17%)
2	HEM	N	500	1	41,50,50	1.96	6 (14%)	45,82,82	1.83	8 (17%)
2	HEM	I	500	1	41,50,50	1.94	7 (17%)	45,82,82	1.66	8 (17%)
2	HEM	A	500	3,1	41,50,50	2.02	8 (19%)	45,82,82	1.92	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
2	HEM	D	500	3,1	-	4/12/54/54	-
2	HEM	H	500	1	-	2/12/54/54	-
2	HEM	F	500	1	-	2/12/54/54	-
2	HEM	O	500	1	-	0/12/54/54	-
2	HEM	P	500	3,1	-	4/12/54/54	-
2	HEM	G	500	1	-	5/12/54/54	-
2	HEM	J	500	1	-	7/12/54/54	-
2	HEM	E	500	3,1	-	4/12/54/54	-
2	HEM	C	500	1	-	4/12/54/54	-
2	HEM	K	500	1	-	4/12/54/54	-
2	HEM	B	500	1	-	2/12/54/54	-
2	HEM	L	500	1	-	1/12/54/54	-
2	HEM	M	500	1	-	2/12/54/54	-
2	HEM	N	500	1	-	3/12/54/54	-
2	HEM	I	500	1	-	2/12/54/54	-
2	HEM	A	500	3,1	-	4/12/54/54	-

The worst 5 of 119 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	500	HEM	C3D-C2D	8.48	1.54	1.36
2	G	500	HEM	C3D-C2D	8.32	1.54	1.36

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	I	500	HEM	C3D-C2D	8.26	1.54	1.36
2	C	500	HEM	C3D-C2D	8.19	1.54	1.36
2	J	500	HEM	C3D-C2D	8.16	1.54	1.36

The worst 5 of 137 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	500	HEM	C4D-ND-C1D	7.52	112.84	105.07
2	G	500	HEM	C4D-ND-C1D	6.88	112.18	105.07
2	A	500	HEM	C4D-ND-C1D	6.77	112.06	105.07
2	P	500	HEM	C4D-ND-C1D	6.46	111.75	105.07
2	N	500	HEM	C4D-ND-C1D	6.40	111.69	105.07

There are no chirality outliers.

5 of 50 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	500	HEM	C2B-C3B-CAB-CBB
2	A	500	HEM	C4B-C3B-CAB-CBB
2	J	500	HEM	C4D-C3D-CAD-CBD
2	J	500	HEM	C3D-CAD-CBD-CGD
2	M	500	HEM	CAA-CBA-CGA-O2A

There are no ring outliers.

15 monomers are involved in 58 short contacts:

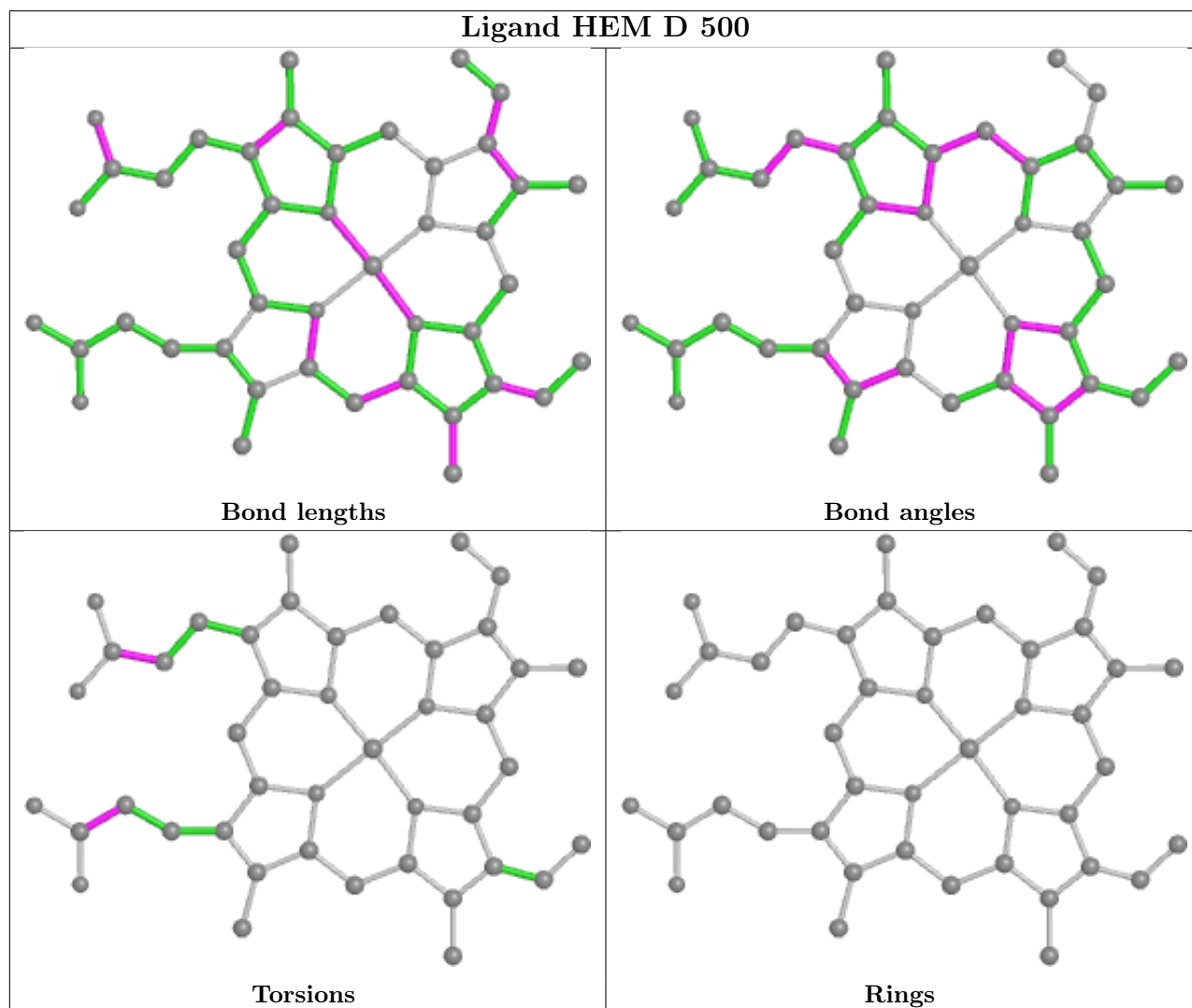
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	D	500	HEM	2	0
2	H	500	HEM	2	0
2	F	500	HEM	3	0
2	O	500	HEM	4	0
2	P	500	HEM	7	0
2	G	500	HEM	3	0
2	J	500	HEM	1	0
2	E	500	HEM	7	0
2	C	500	HEM	2	0
2	K	500	HEM	4	0
2	L	500	HEM	5	0
2	M	500	HEM	2	0
2	N	500	HEM	1	0
2	I	500	HEM	9	0

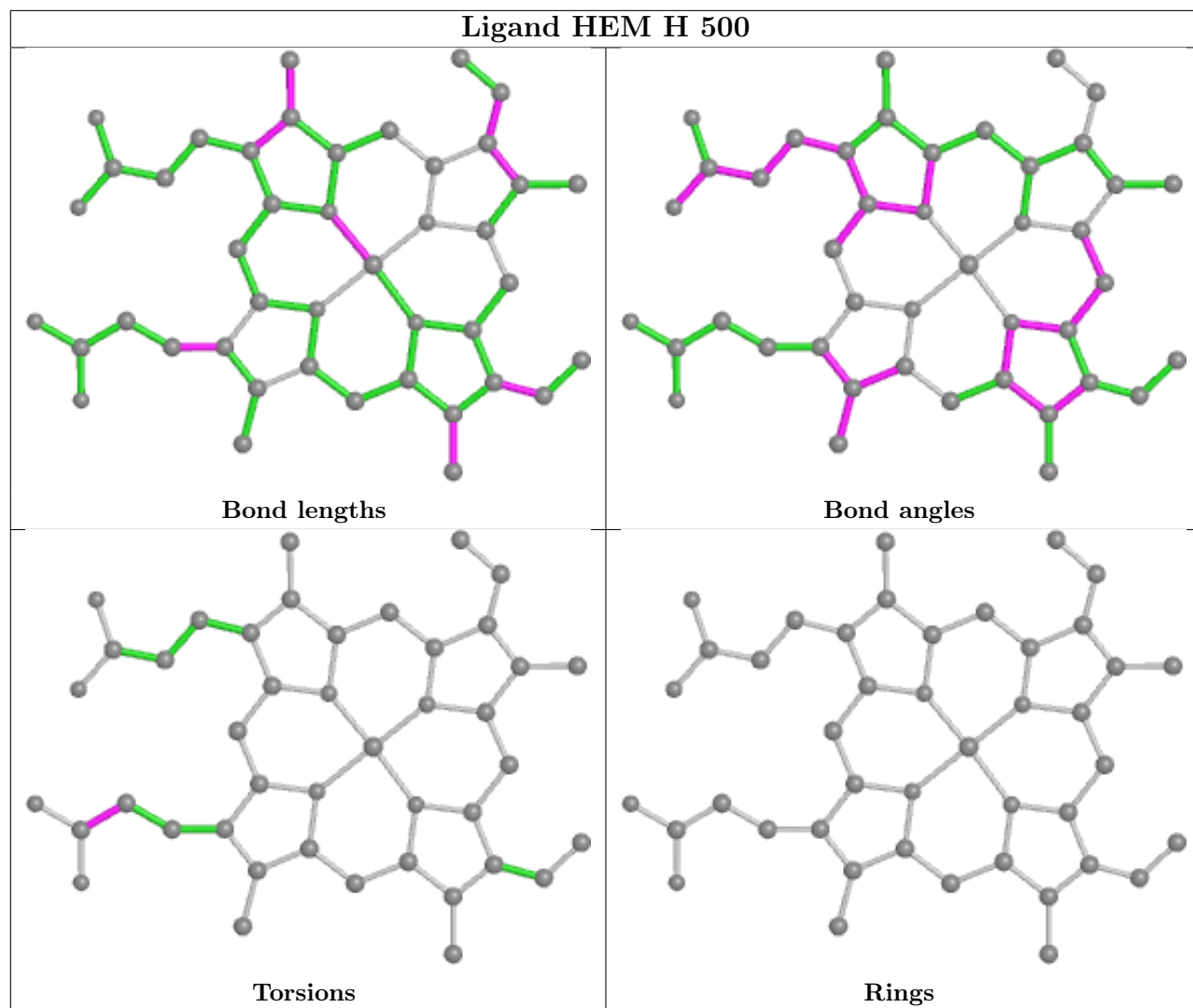
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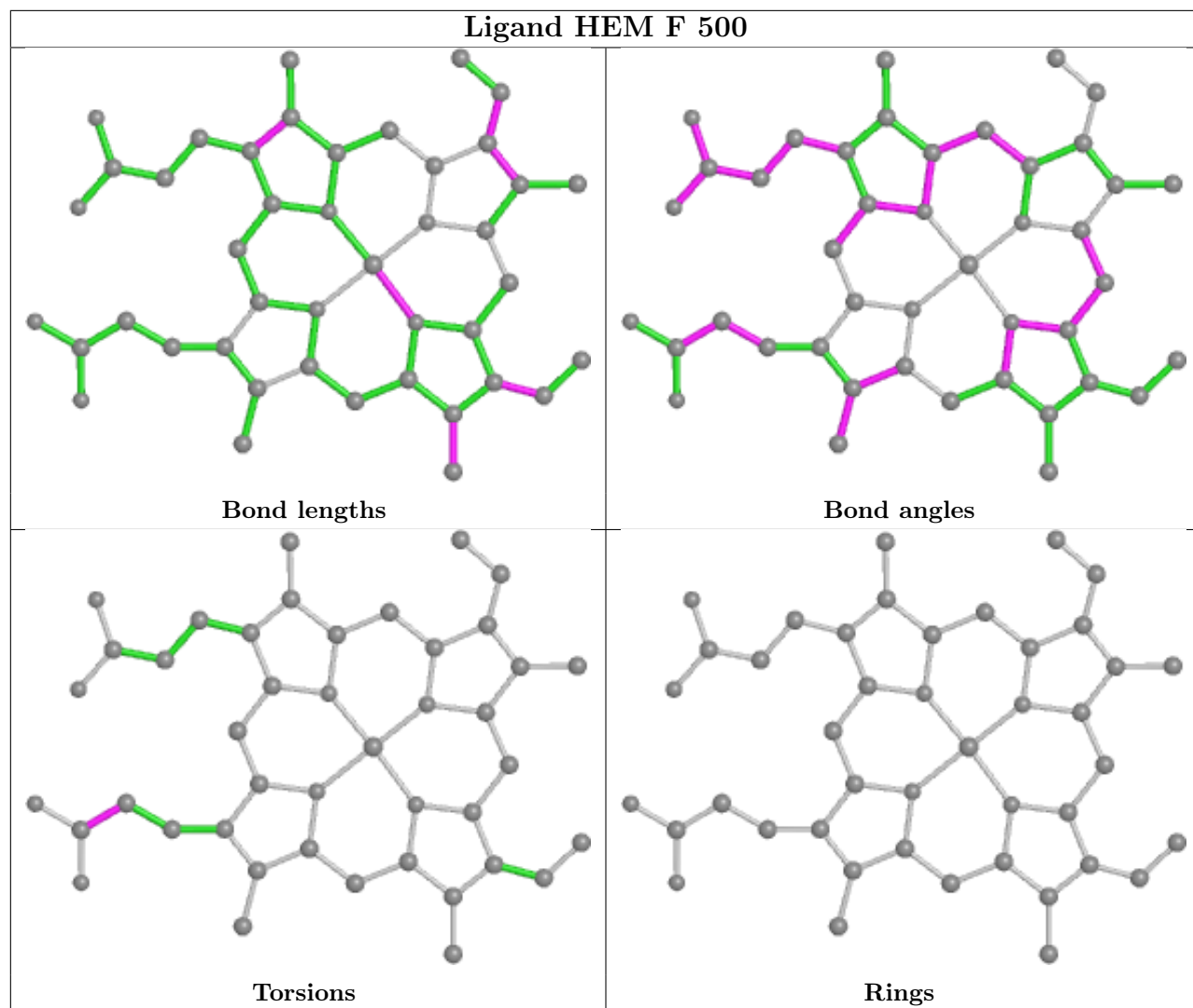
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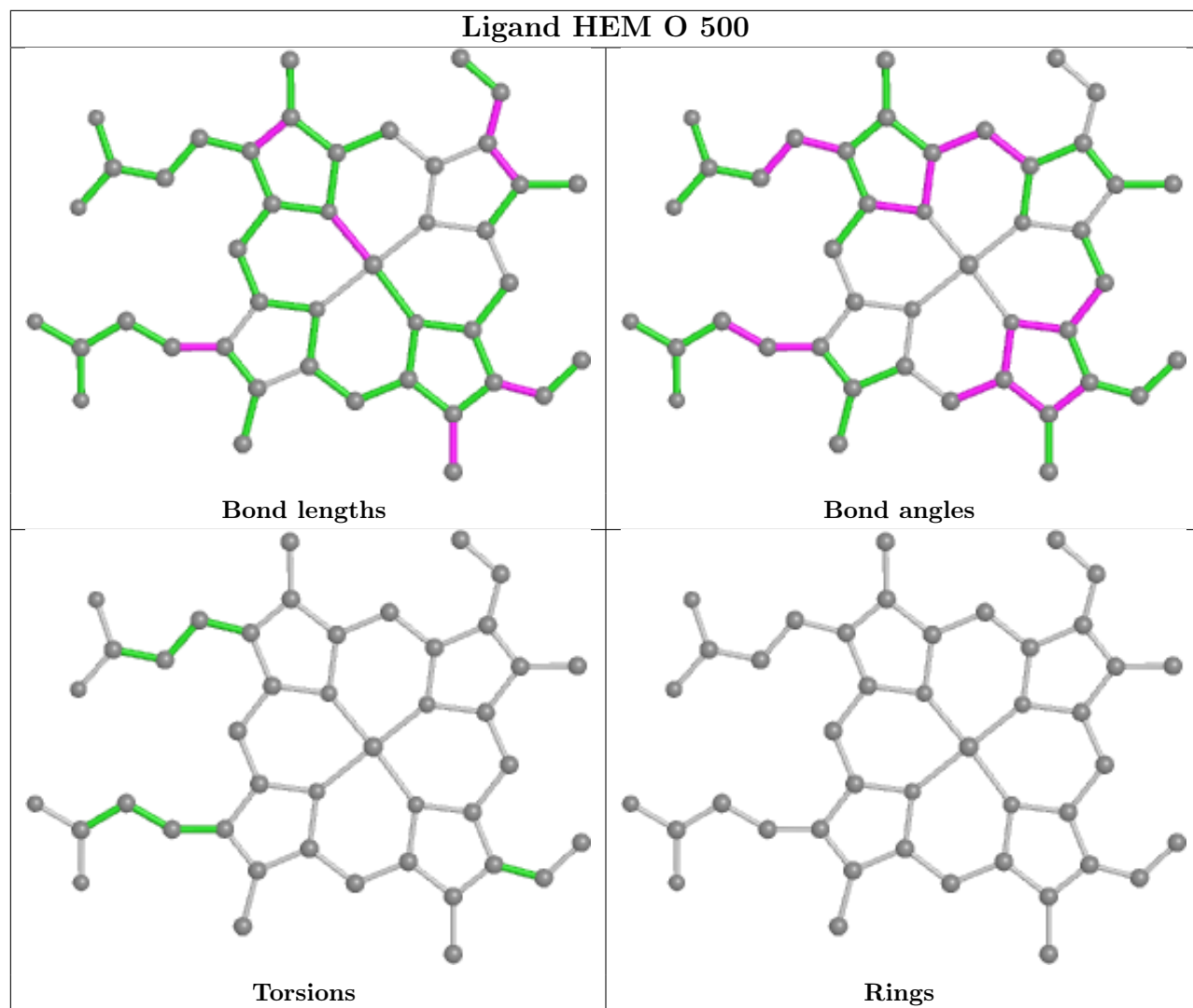
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	500	HEM	6	0

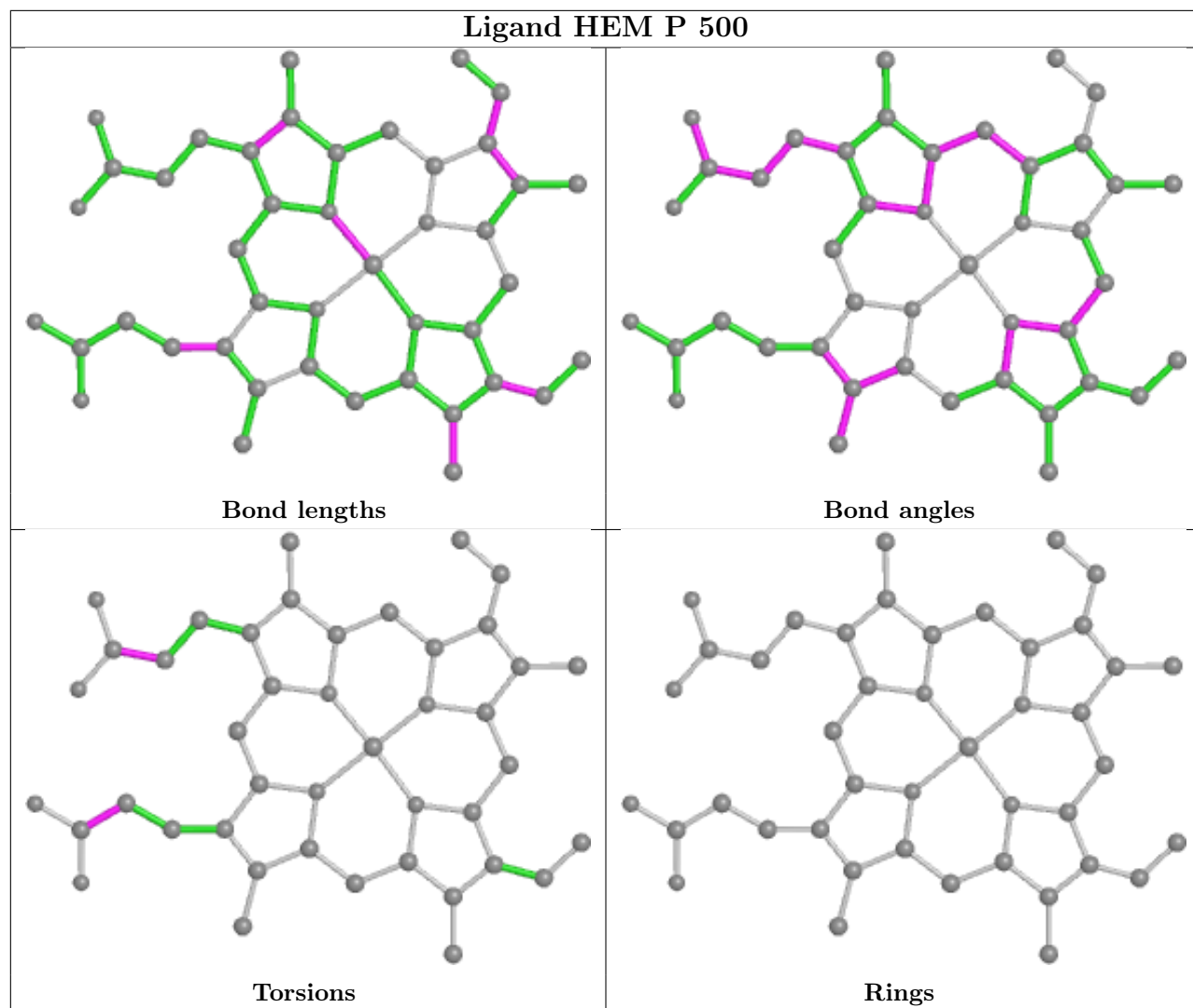
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

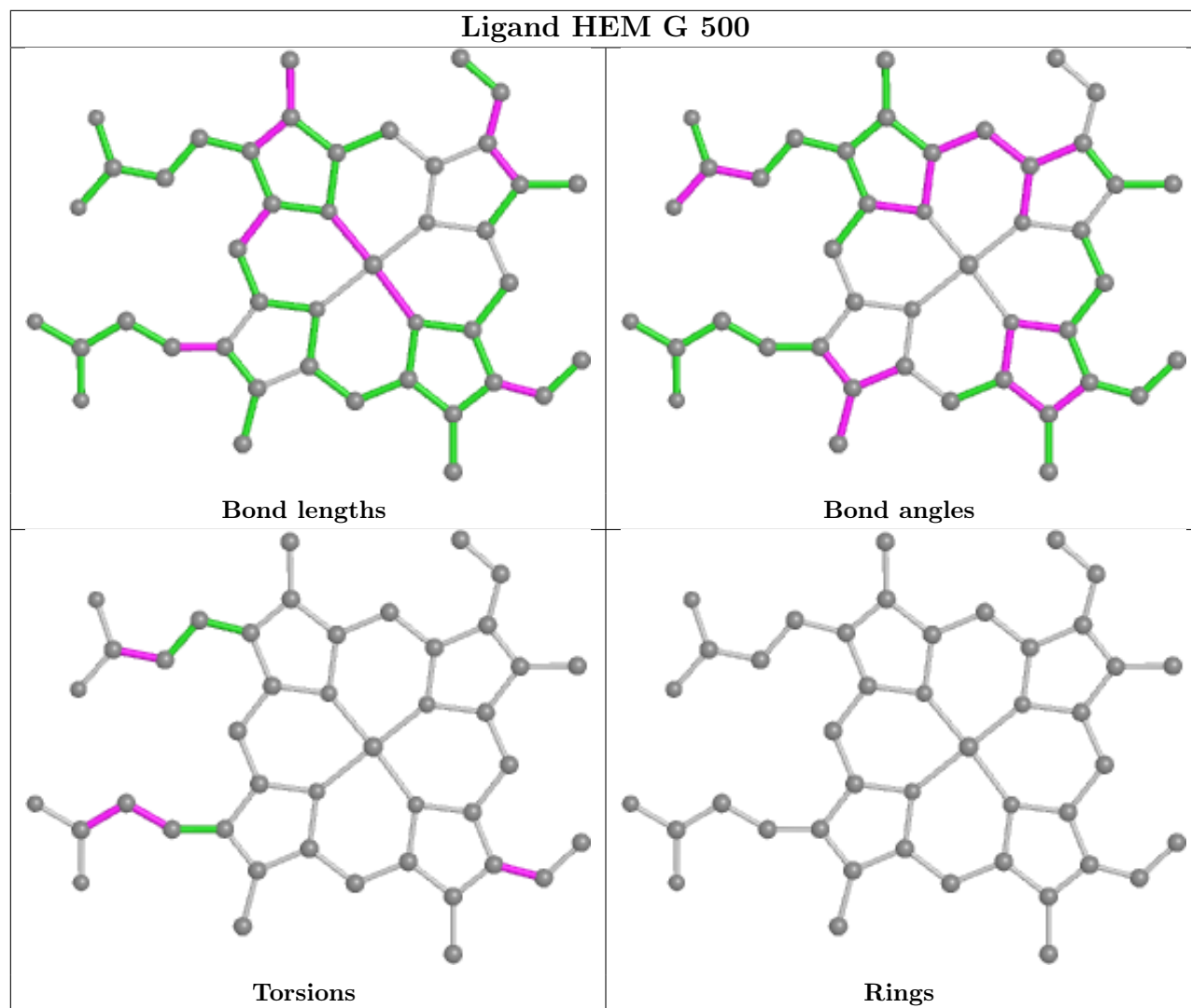


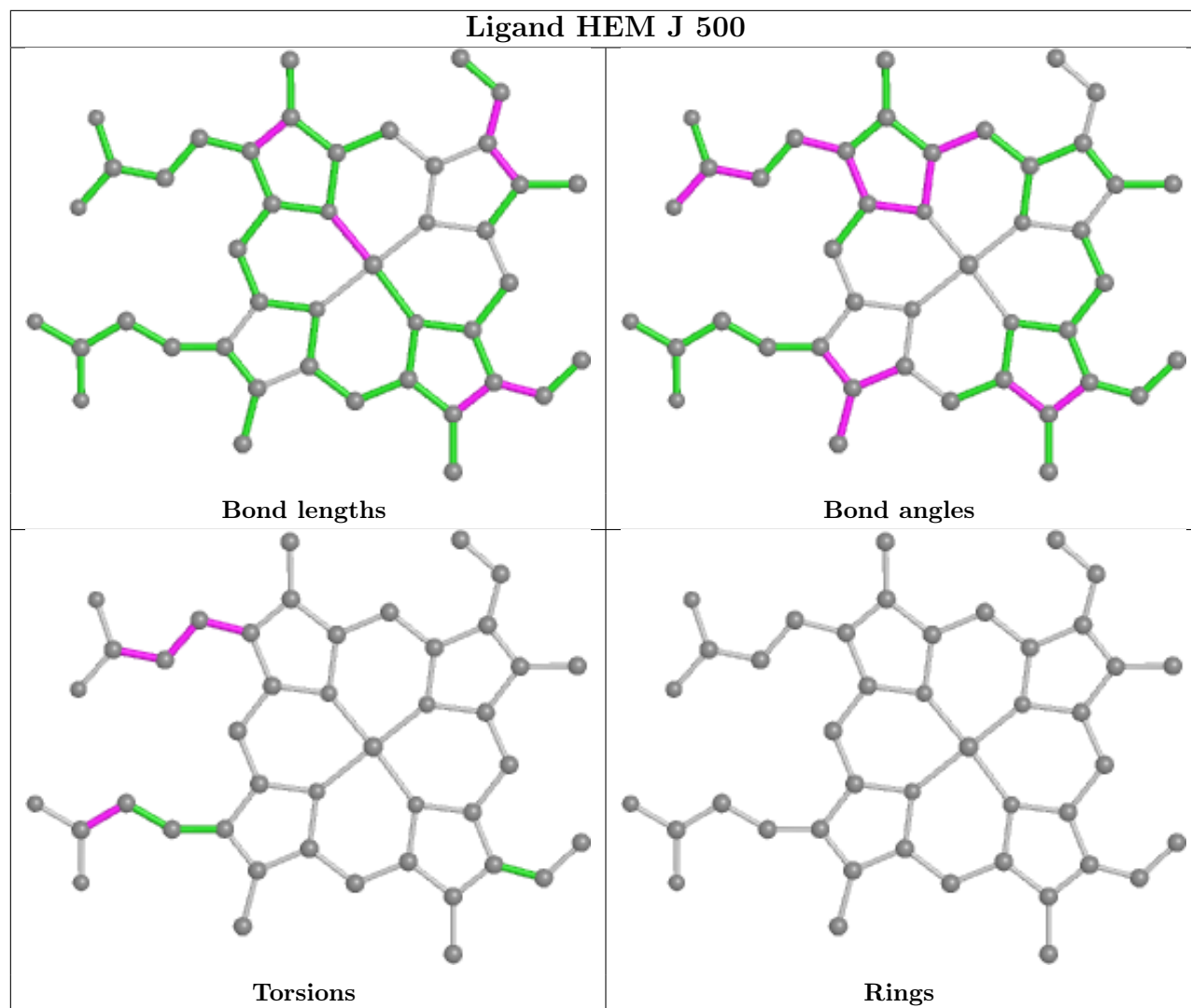


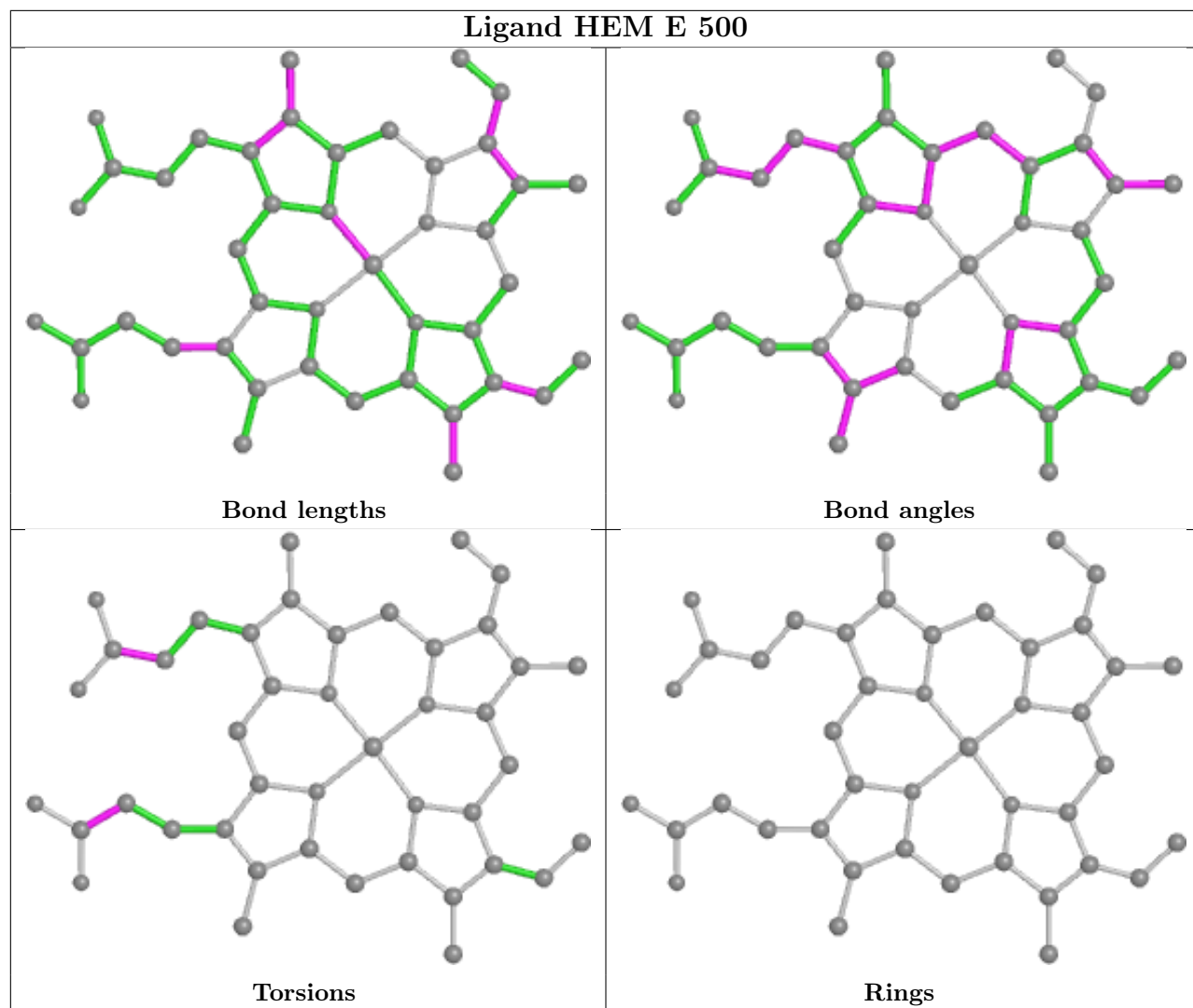


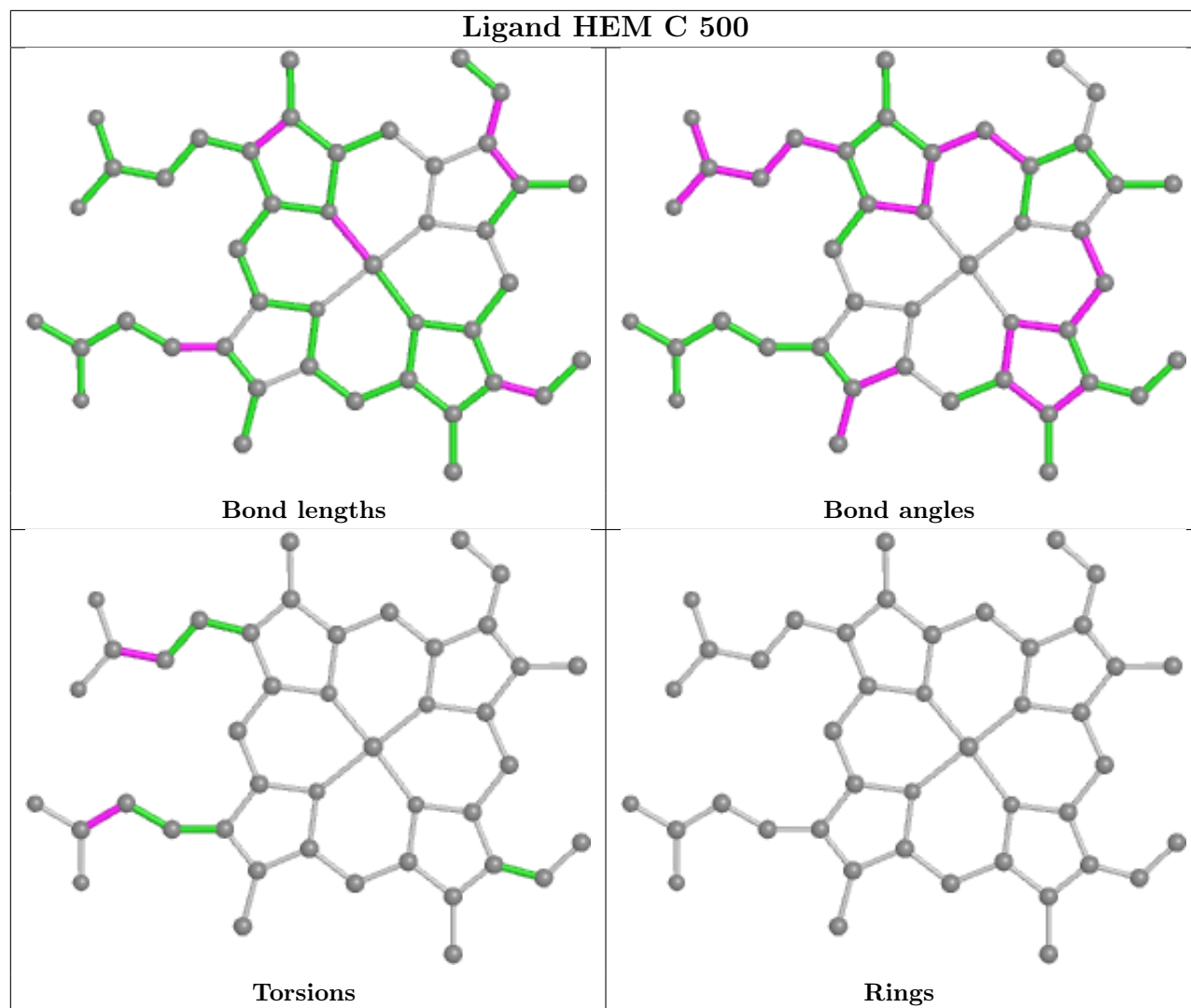


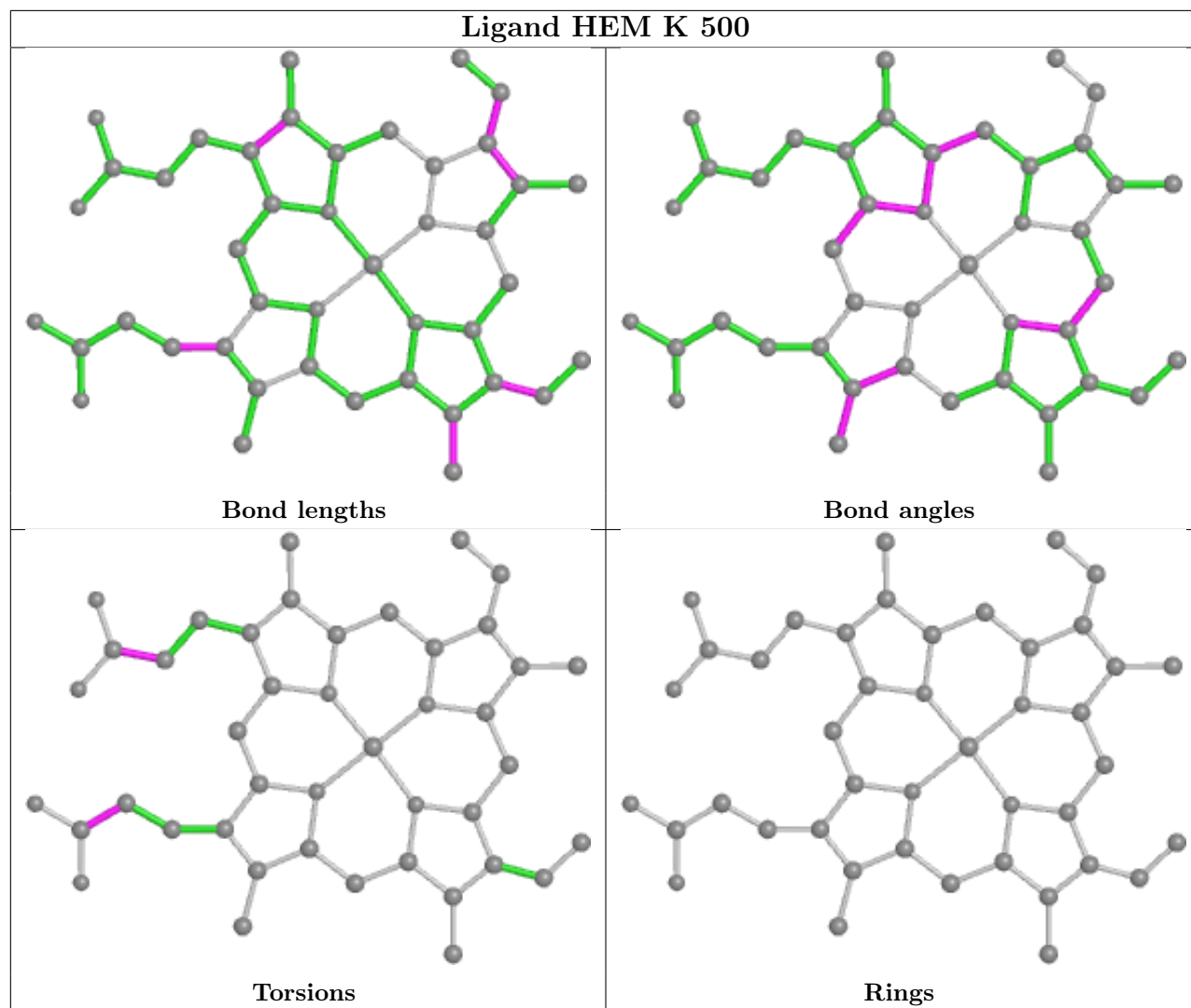


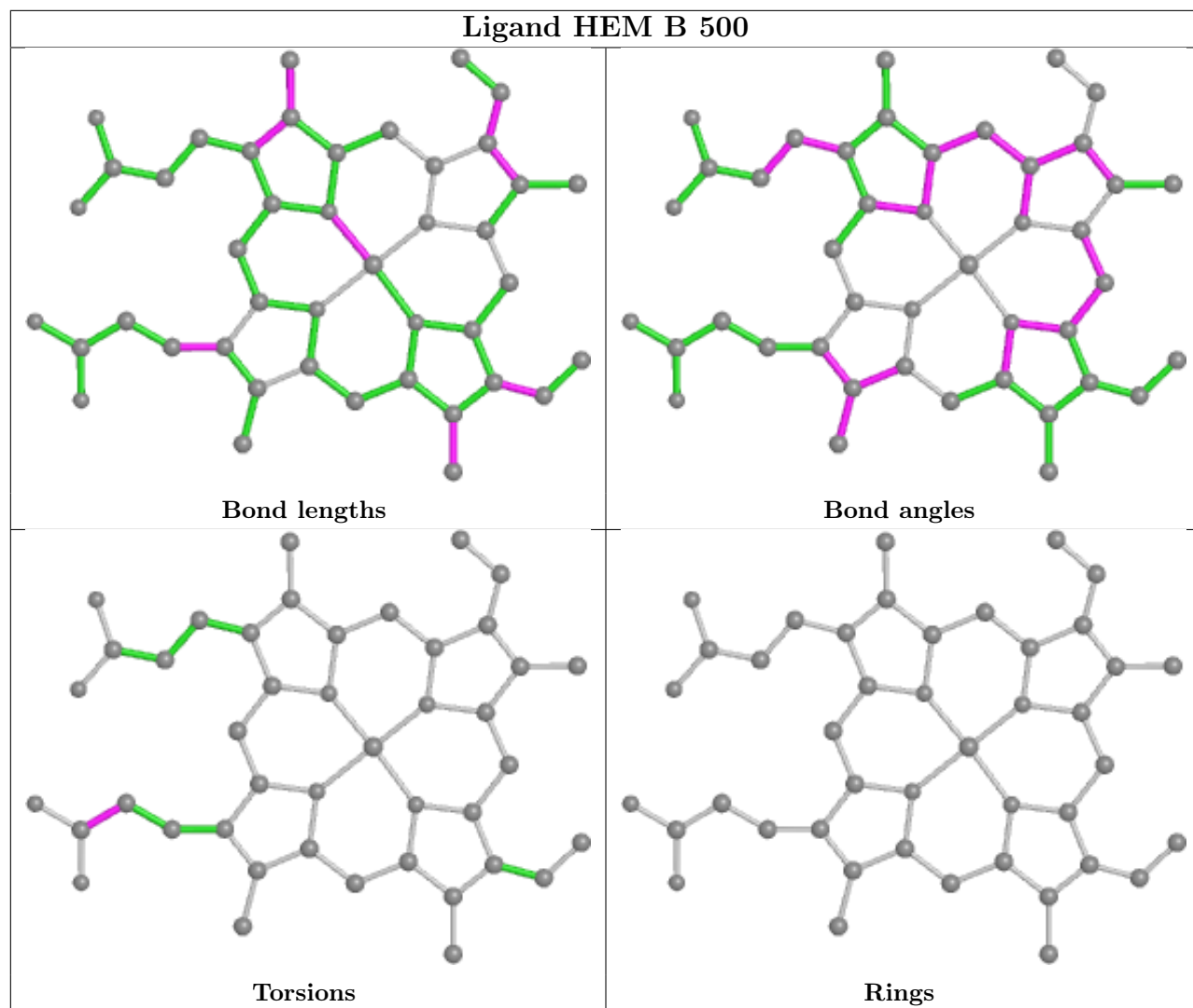


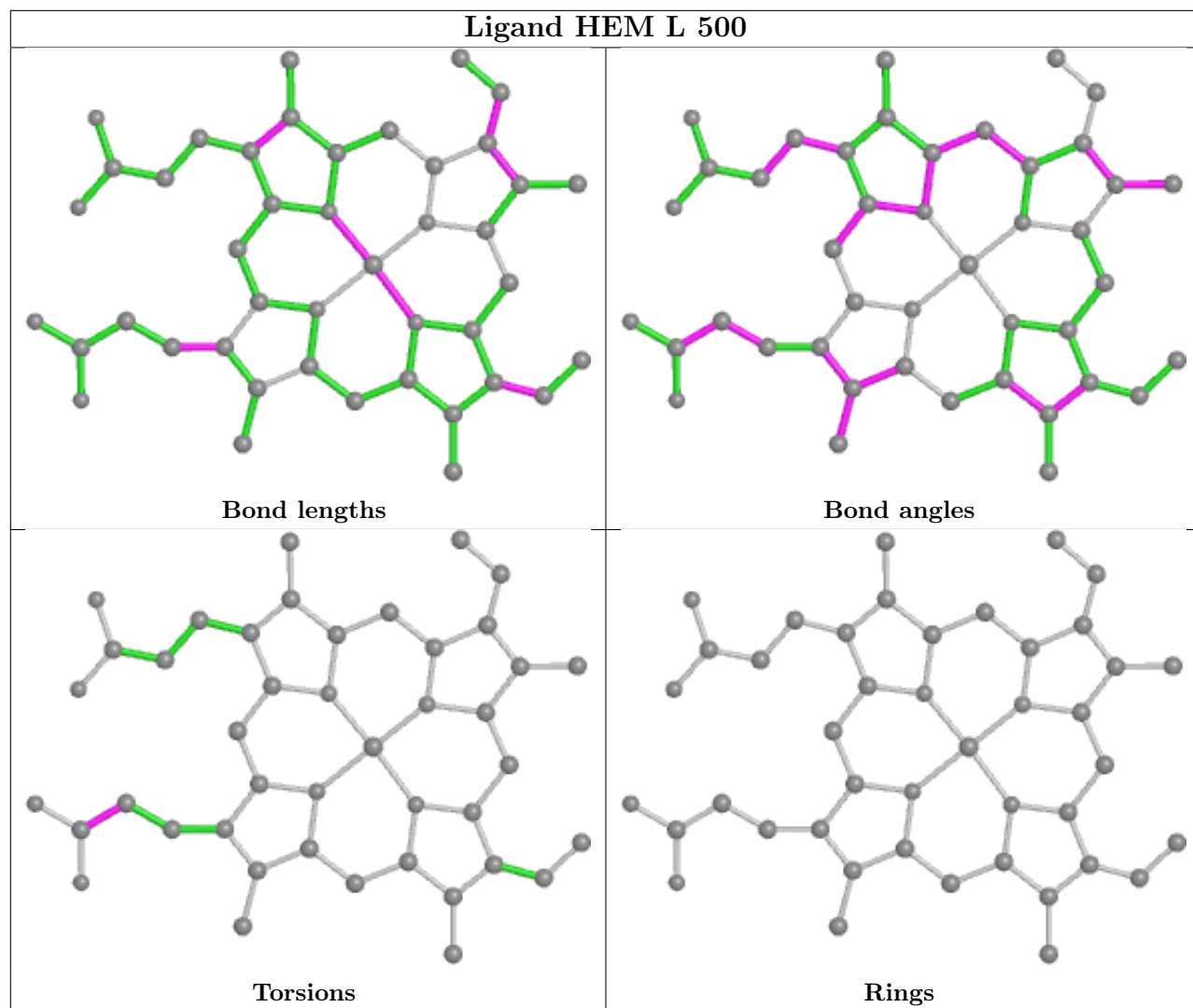


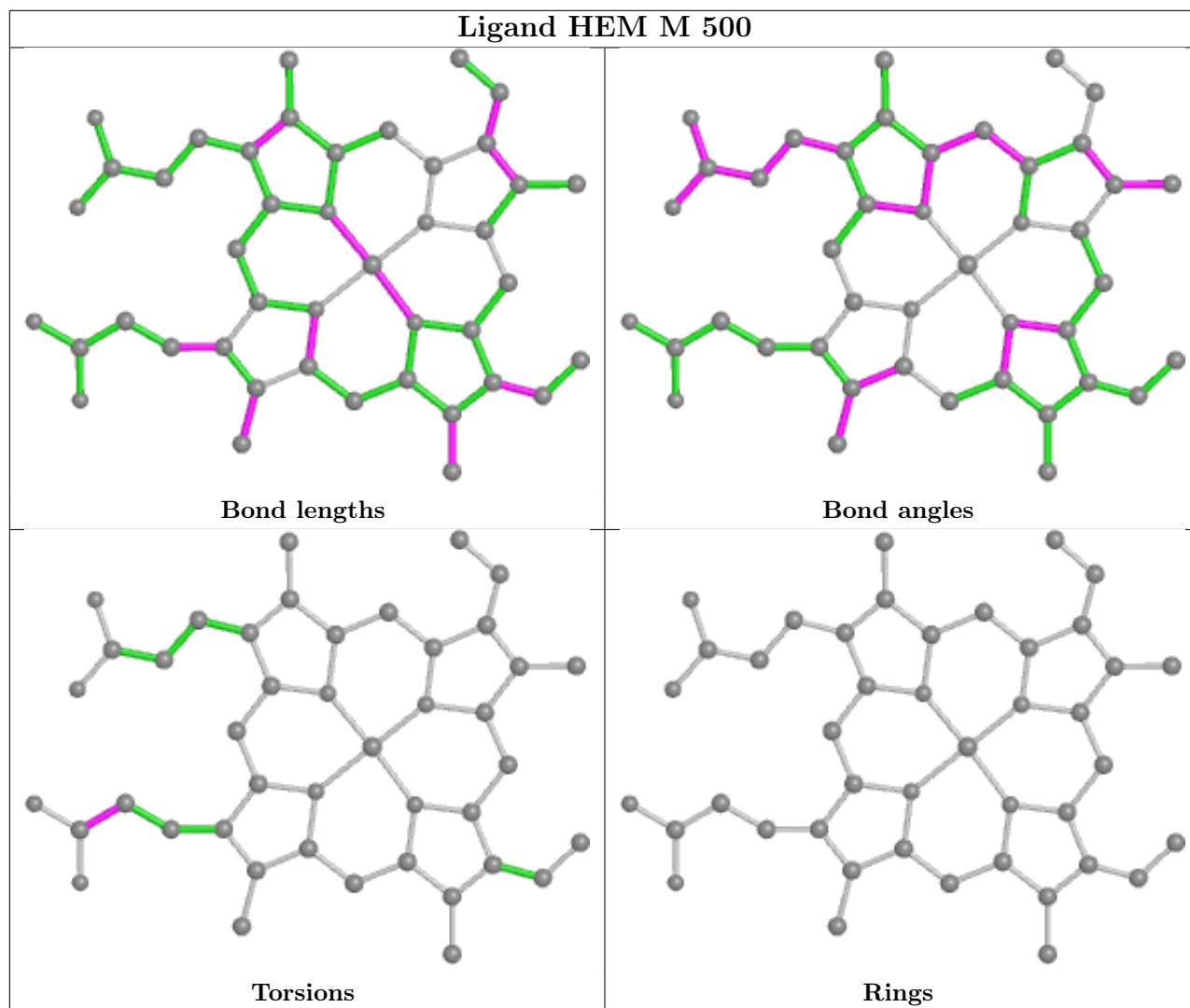


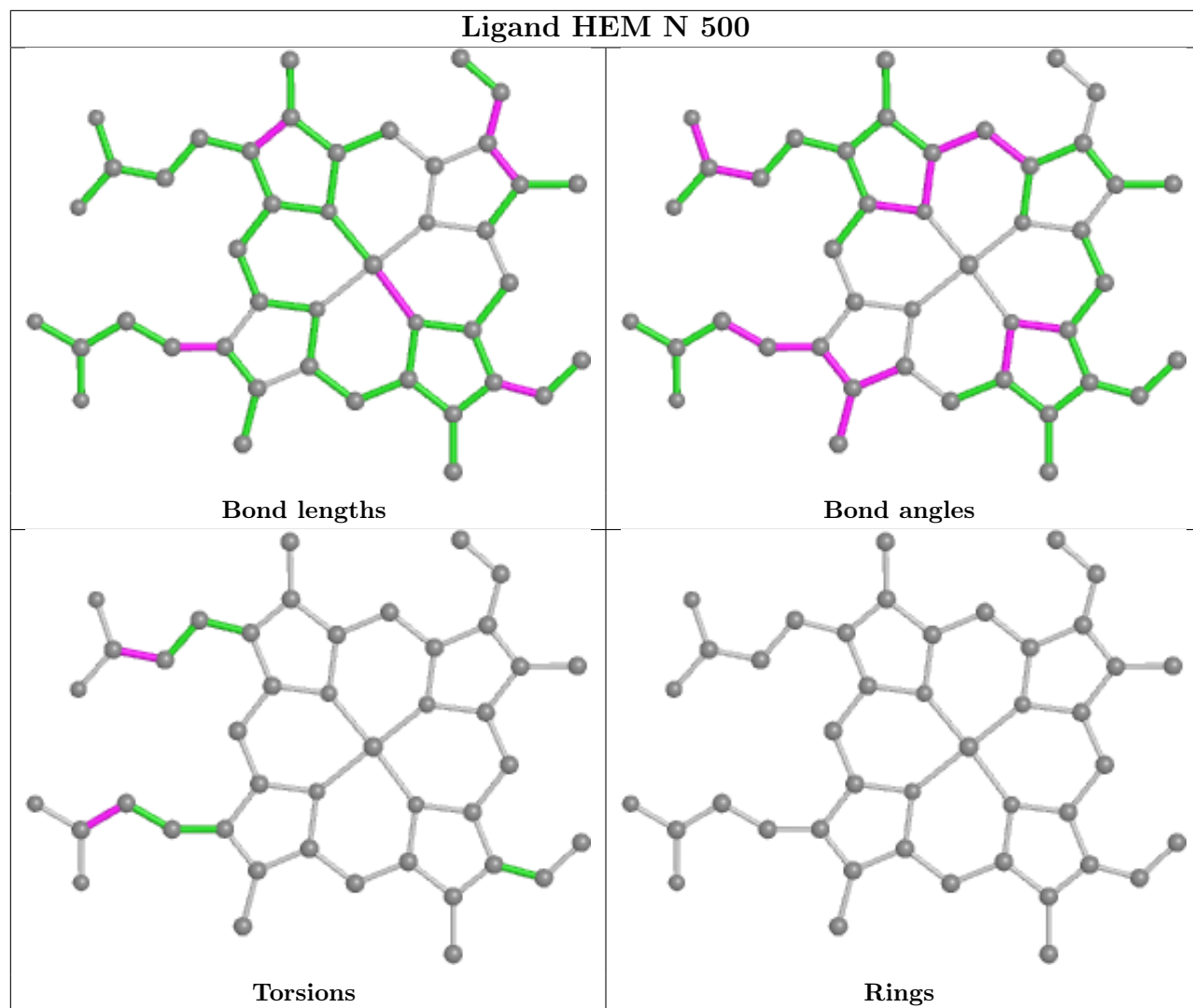


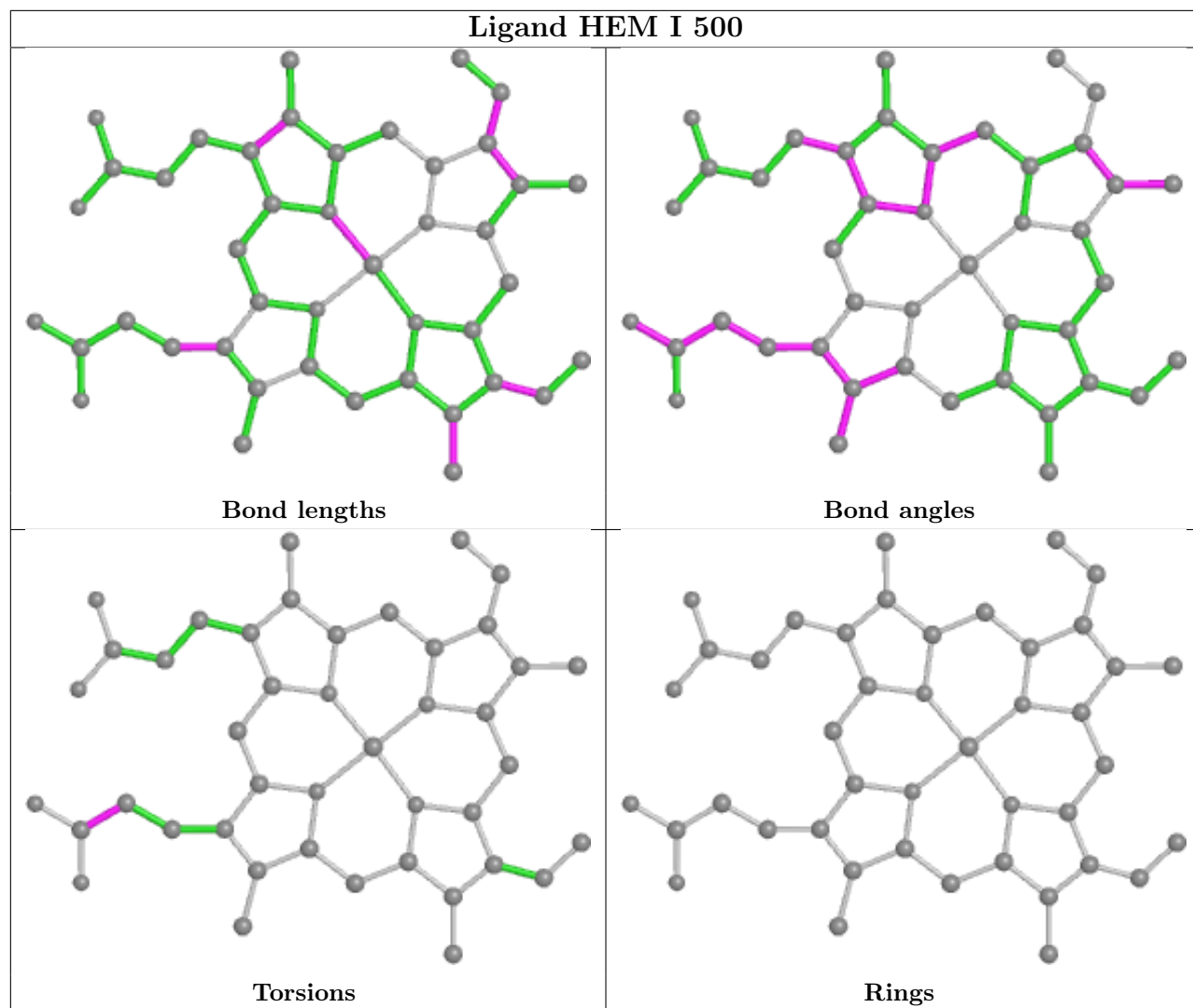


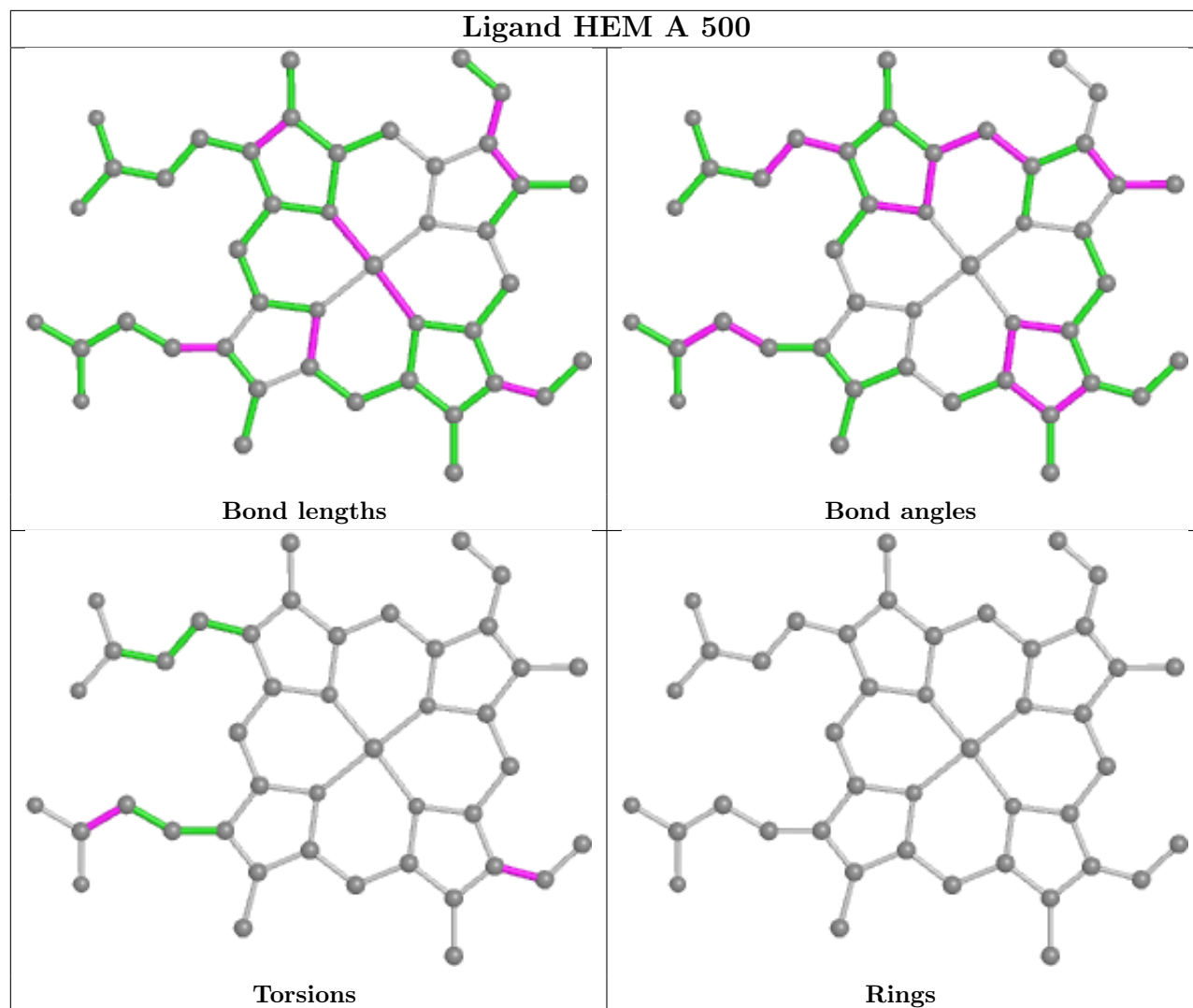












5.7 Other polymers [i](#)

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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, 95th 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	261/281 (92%)	-0.42	2 (0%) 86 84	27, 41, 65, 121	0
1	B	266/281 (94%)	-0.34	5 (1%) 66 64	30, 43, 70, 102	0
1	C	255/281 (90%)	-0.33	5 (1%) 65 63	29, 43, 70, 101	0
1	D	259/281 (92%)	-0.45	0 100 100	27, 40, 64, 92	0
1	E	256/281 (91%)	-0.49	2 (0%) 86 84	26, 42, 70, 120	0
1	F	260/281 (92%)	-0.34	2 (0%) 86 84	29, 44, 80, 106	0
1	G	259/281 (92%)	-0.21	8 (3%) 49 47	29, 45, 76, 106	0
1	H	259/281 (92%)	-0.47	1 (0%) 92 91	27, 41, 63, 92	0
1	I	259/281 (92%)	-0.36	3 (1%) 79 77	29, 44, 68, 83	0
1	J	257/281 (91%)	-0.10	10 (3%) 39 38	28, 43, 71, 109	0
1	K	255/281 (90%)	-0.05	8 (3%) 49 47	28, 41, 66, 99	0
1	L	260/281 (92%)	-0.33	3 (1%) 79 77	28, 43, 66, 91	0
1	M	255/281 (90%)	-0.47	0 100 100	27, 42, 70, 97	0
1	N	260/281 (92%)	-0.16	6 (2%) 60 58	29, 44, 74, 105	0
1	O	257/281 (91%)	-0.22	3 (1%) 79 77	28, 44, 74, 116	0
1	P	259/281 (92%)	-0.48	0 100 100	27, 43, 65, 93	0
All	All	4137/4496 (92%)	-0.33	58 (1%) 75 73	26, 43, 70, 121	0

The worst 5 of 58 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	N	139	ALA	4.5
1	B	270	GLY	4.4
1	B	139	ALA	4.2
1	A	39	ARG	3.8
1	K	275	GLU	3.6

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

6.4 Ligands [i](#)

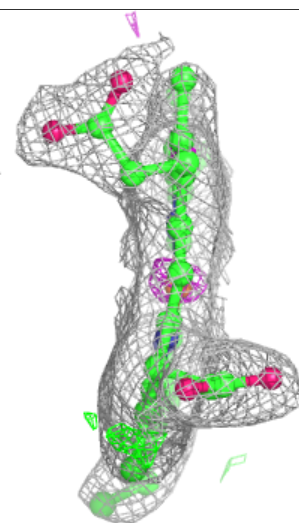
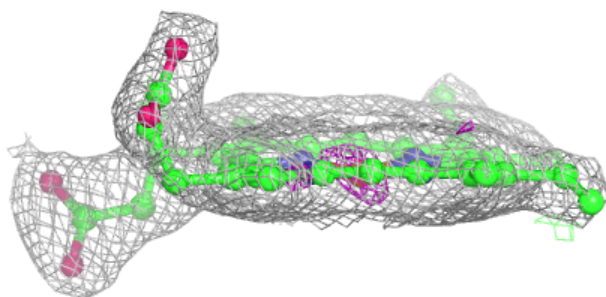
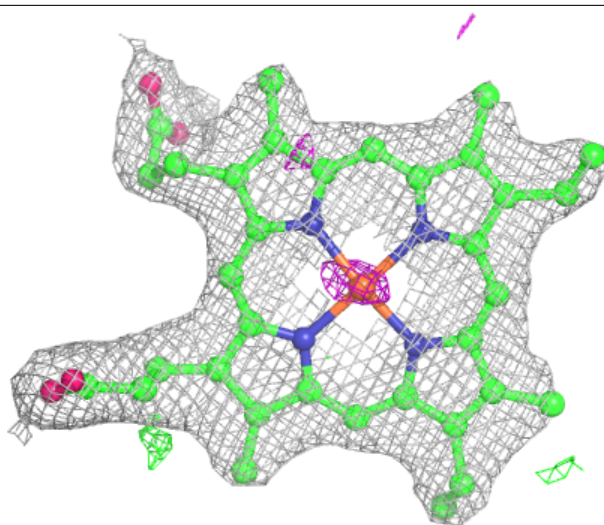
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
2	HEM	F	500	43/43	0.97	0.11	39,47,58,74	0
2	HEM	G	500	43/43	0.97	0.10	43,52,63,70	0
2	HEM	I	500	43/43	0.97	0.10	24,37,57,60	0
2	HEM	J	500	43/43	0.97	0.10	27,42,57,67	0
2	HEM	O	500	43/43	0.97	0.11	48,58,68,80	0
2	HEM	A	500	43/43	0.98	0.09	18,28,39,57	0
2	HEM	B	500	43/43	0.98	0.10	32,43,56,62	0
2	HEM	H	500	43/43	0.98	0.09	16,29,37,43	0
2	HEM	C	500	43/43	0.98	0.09	28,42,62,68	0
2	HEM	D	500	43/43	0.98	0.10	18,29,37,44	0
2	HEM	K	500	43/43	0.98	0.10	28,43,61,71	0
2	HEM	L	500	43/43	0.98	0.10	20,34,53,63	0
2	HEM	M	500	43/43	0.98	0.10	25,37,48,52	0
2	HEM	N	500	43/43	0.98	0.10	37,56,65,74	0
2	HEM	E	500	43/43	0.98	0.09	21,32,48,58	0
2	HEM	P	500	43/43	0.99	0.08	20,31,42,54	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.

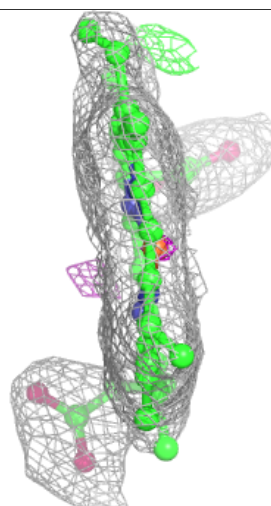
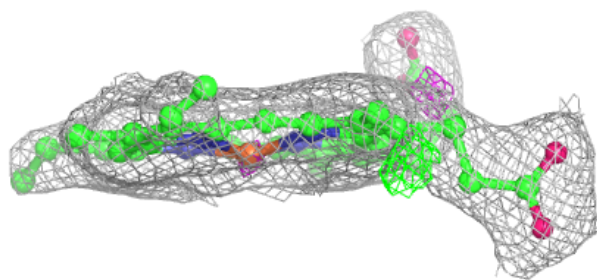
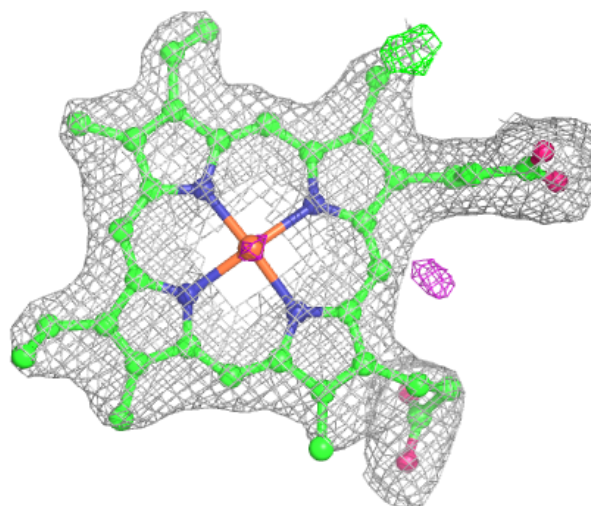
Electron density around HEM F 500:

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



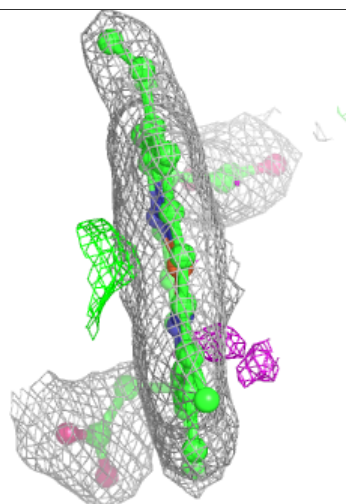
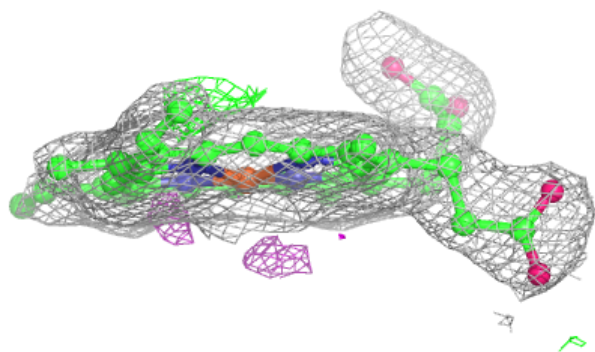
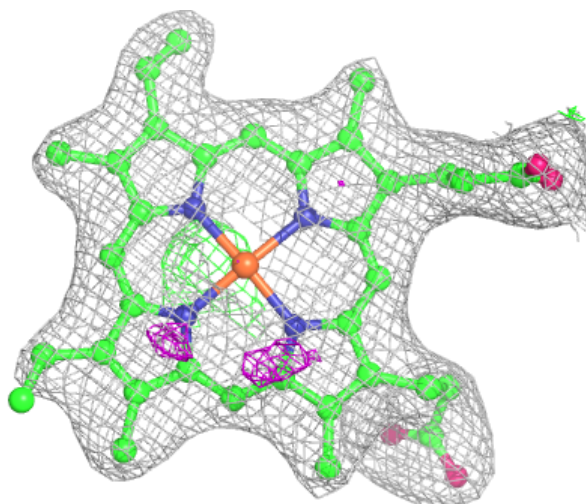
Electron density around HEM G 500:

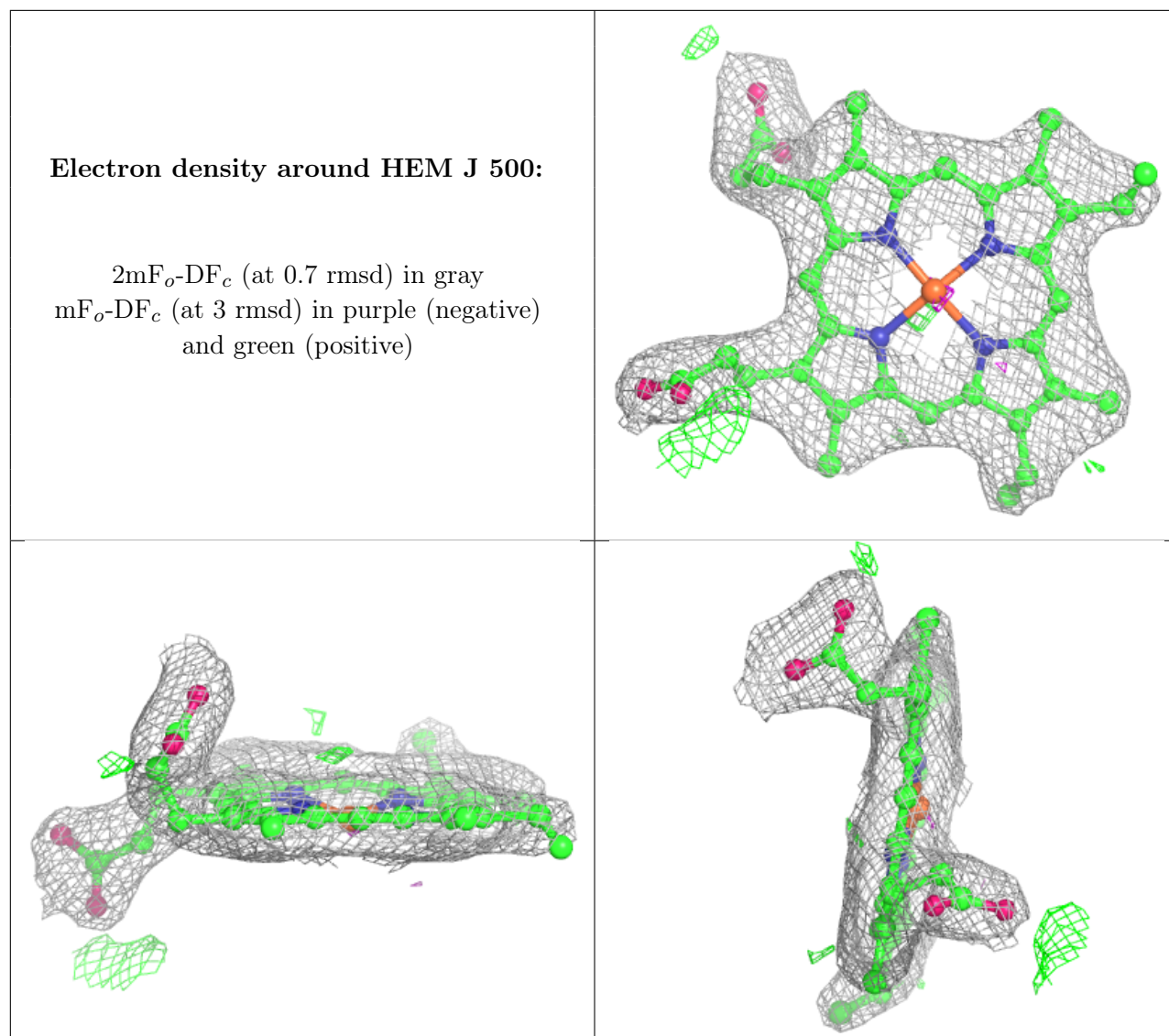
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around HEM I 500:

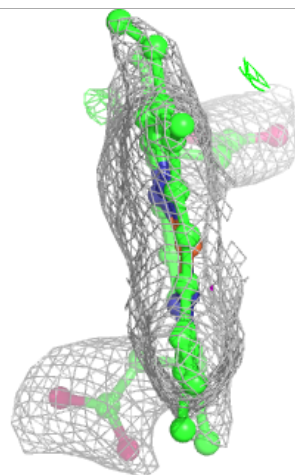
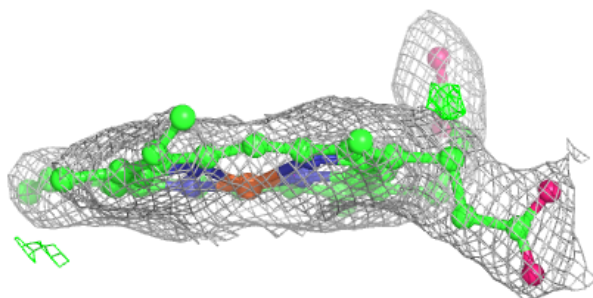
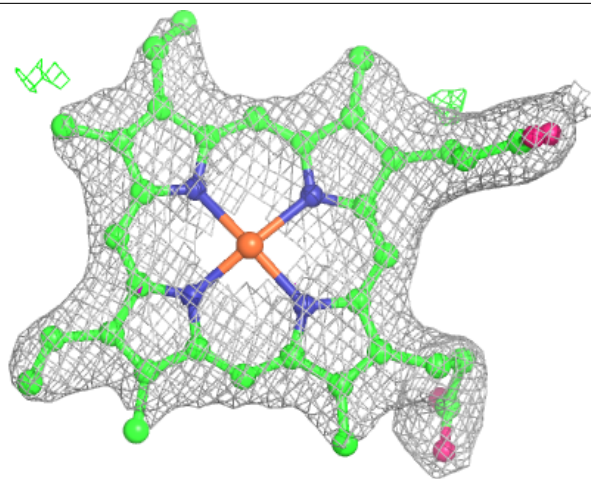
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





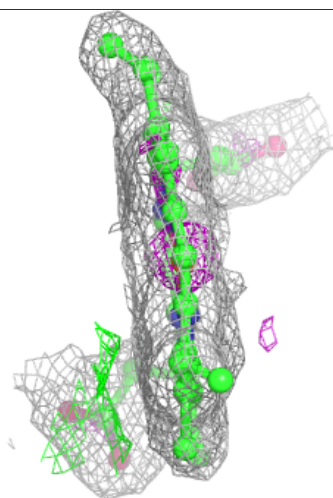
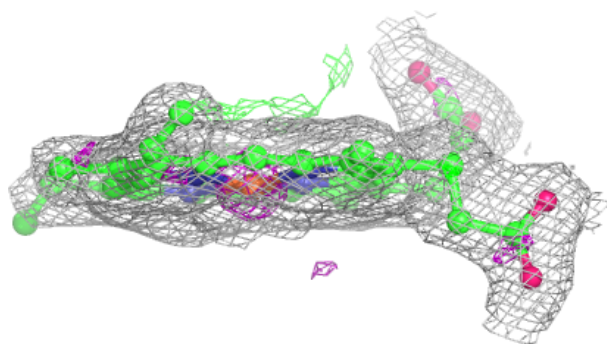
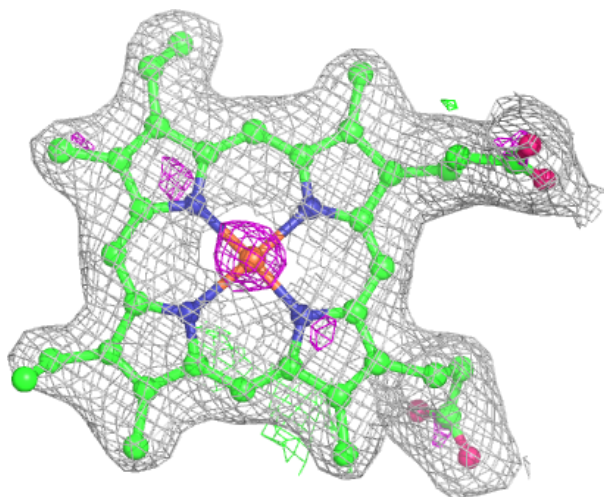
Electron density around HEM O 500:

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



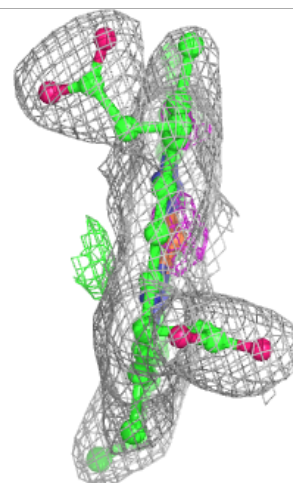
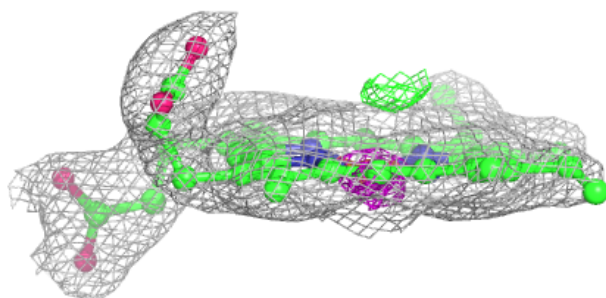
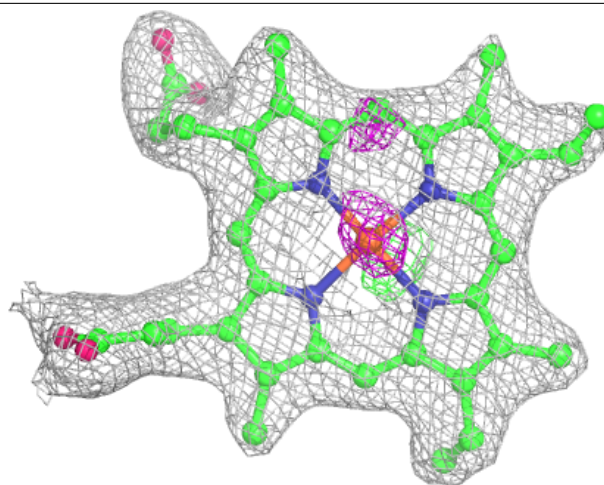
Electron density around HEM A 500:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



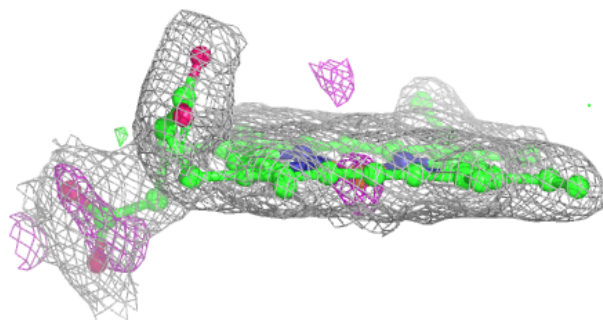
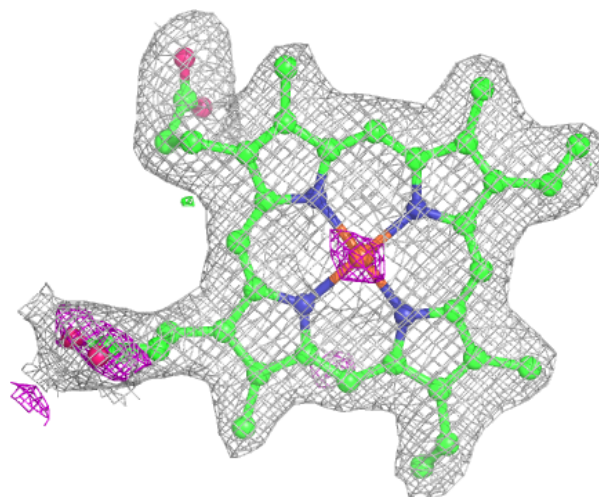
Electron density around HEM B 500:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



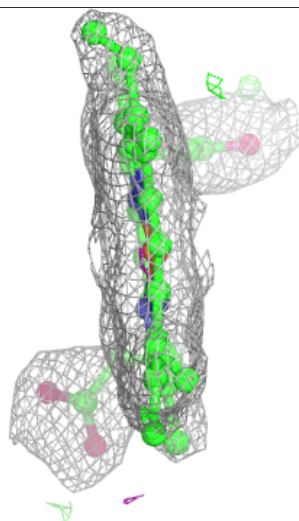
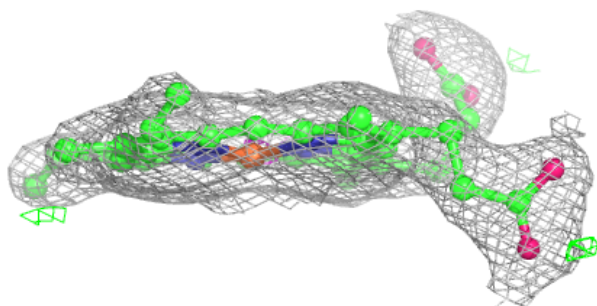
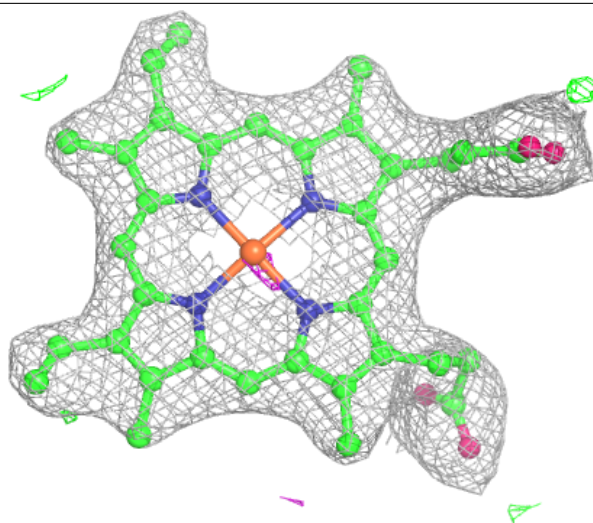
Electron density around HEM H 500:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



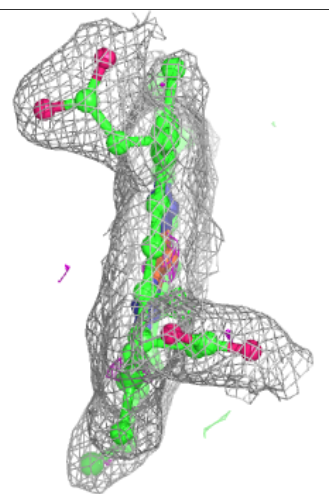
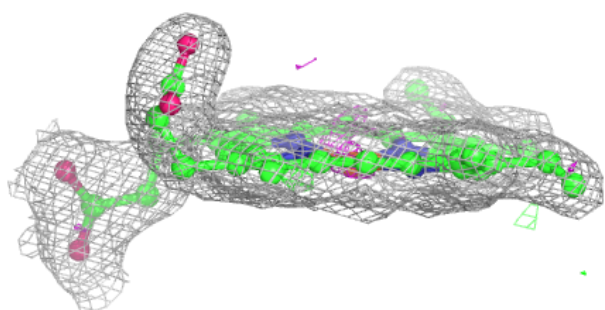
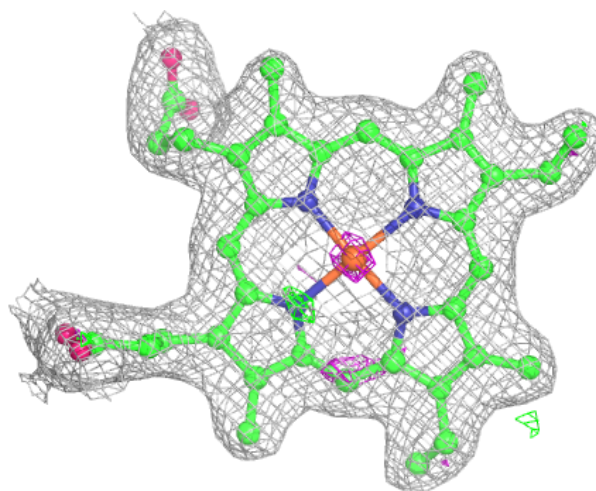
Electron density around HEM C 500:

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



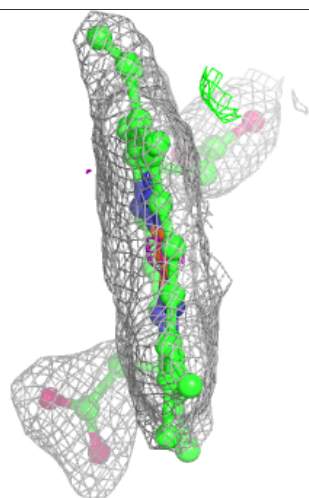
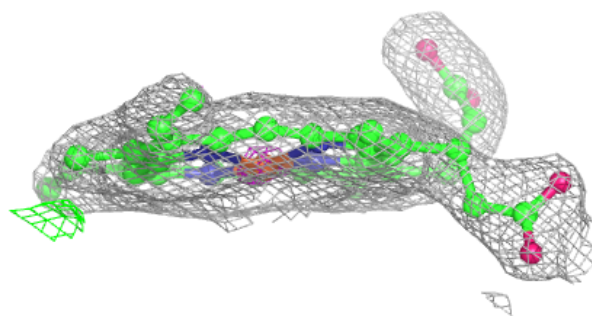
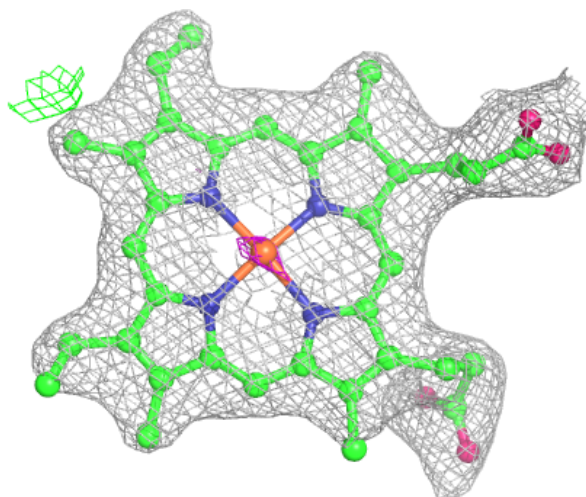
Electron density around HEM D 500:

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



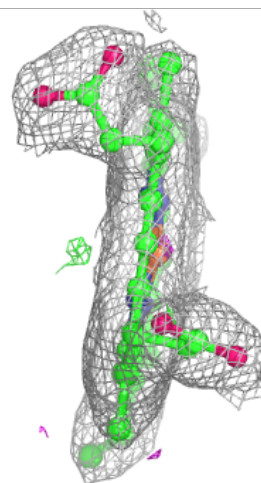
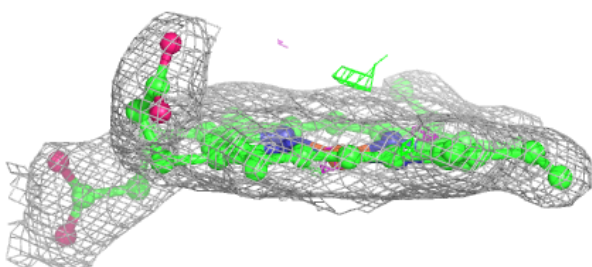
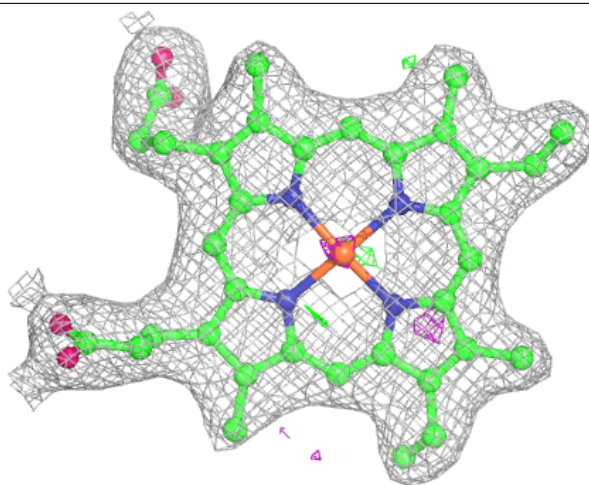
Electron density around HEM K 500:

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



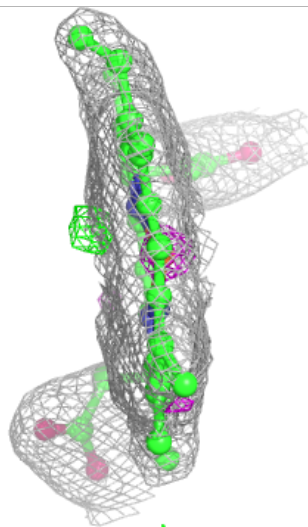
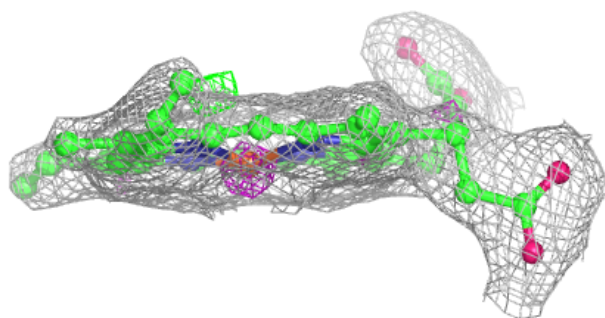
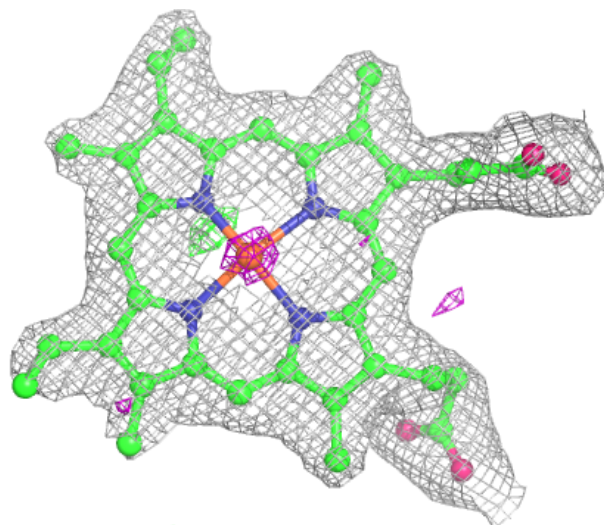
Electron density around HEM L 500:

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



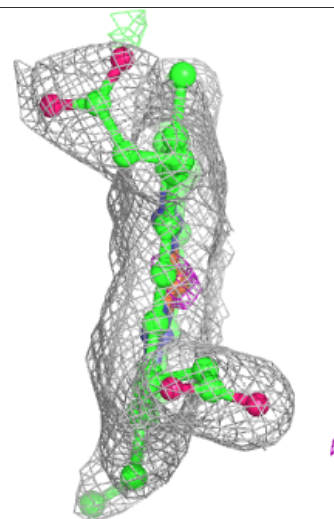
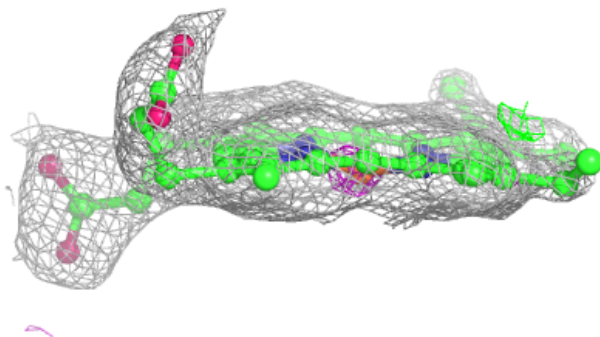
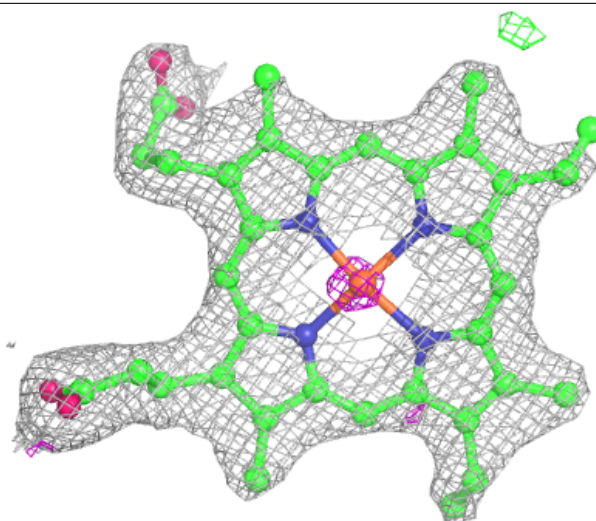
Electron density around HEM M 500:

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



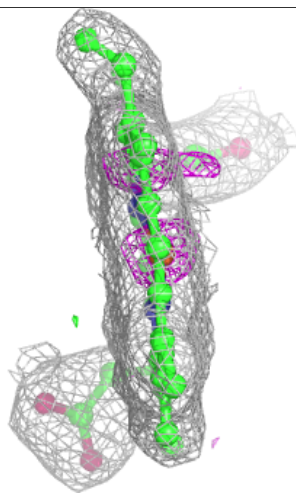
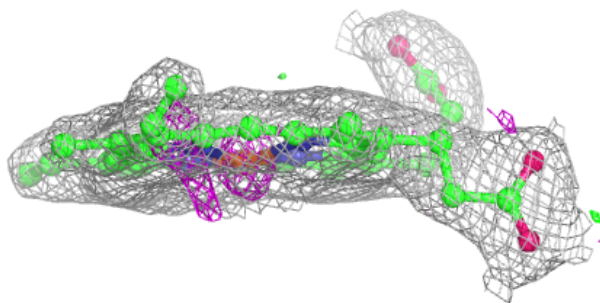
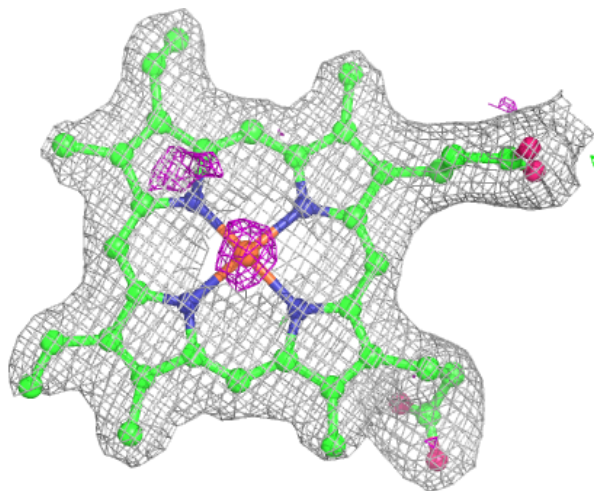
Electron density around HEM N 500:

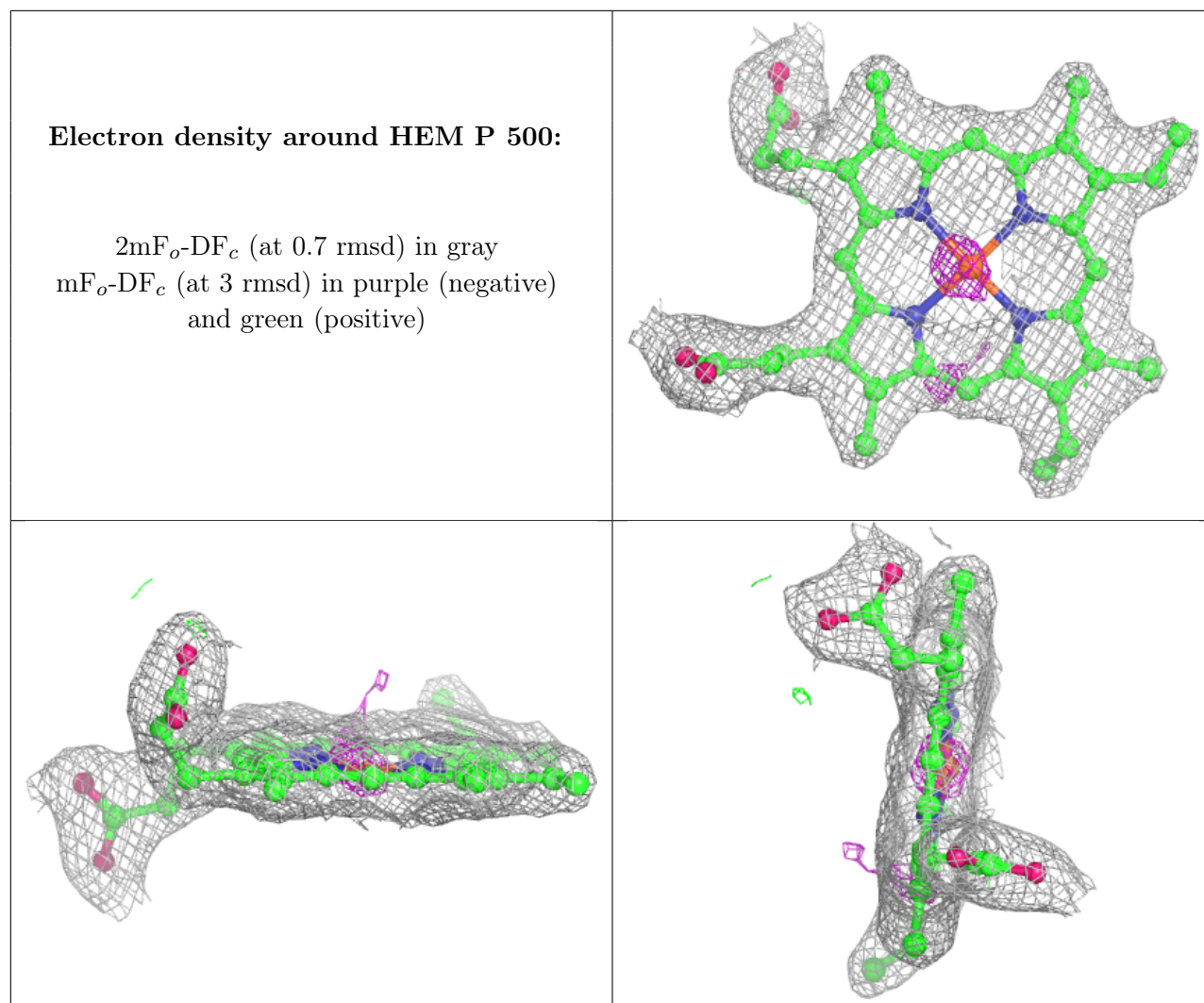
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



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)





6.5 Other polymers [i](#)

There are no such residues in this entry.