



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 4, 2026 – 08:33 AM EDT

PDB ID : 1FGJ / pdb_00001fgj
Title : X-RAY STRUCTURE OF HYDROXYLAMINE OXIDOREDUCTASE
Authors : Tanaka, N.; Igarashi, N.; Moriyama, H.
Deposited on : 1997-03-03
Resolution : 2.80 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

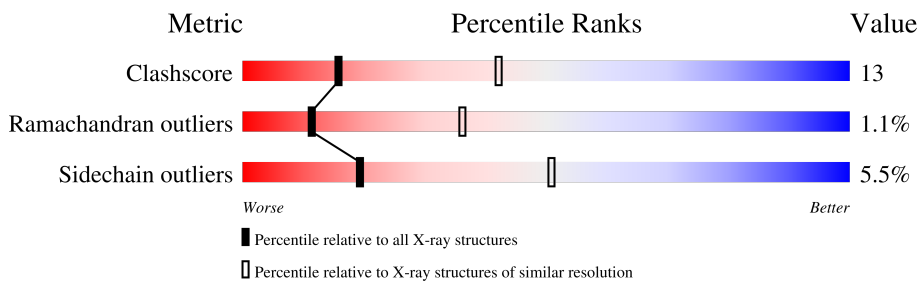
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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))
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	546	
1	B	546	

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
3	HEC	A	550	X	-	-	-
3	HEC	B	550	X	-	-	-

2 Entry composition [i](#)

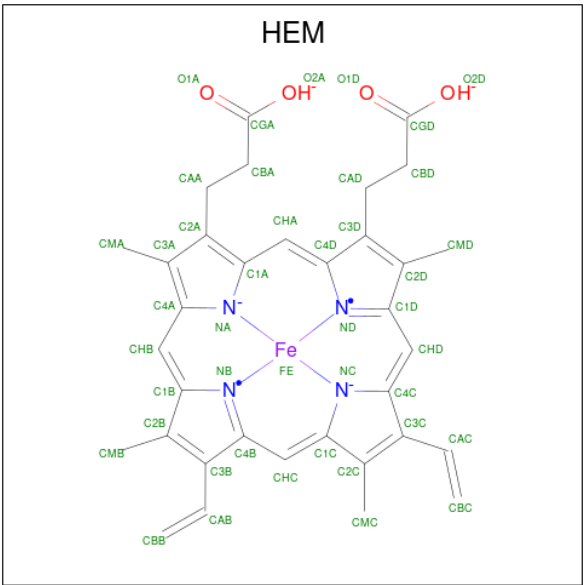
There are 3 unique types of molecules in this entry. The entry contains 8648 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 HYDROXYLAMINE OXIDOREDUCTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	499	Total	C	N	O	S	0	0	0
			3980	2474	706	768	32			
1	B	499	Total	C	N	O	S	0	0	0
			3980	2474	706	768	32			

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



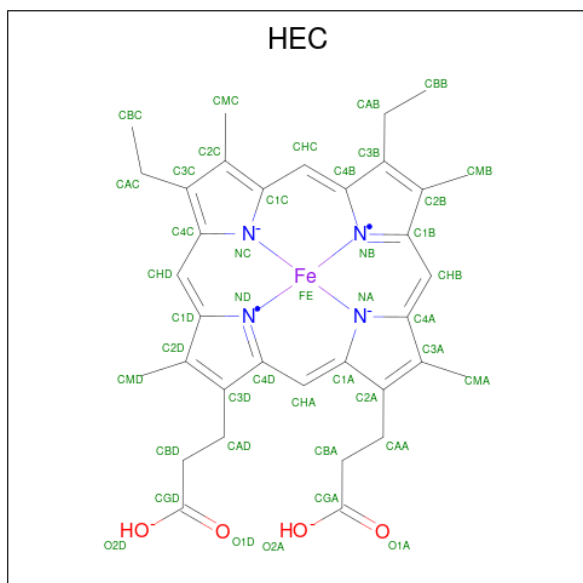
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

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[illegible]

- Molecule 3 is HEME C (CCD ID: HEC) (formula: $\text{C}_{34}\text{H}_{36}\text{FeN}_4\text{O}_4$).



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

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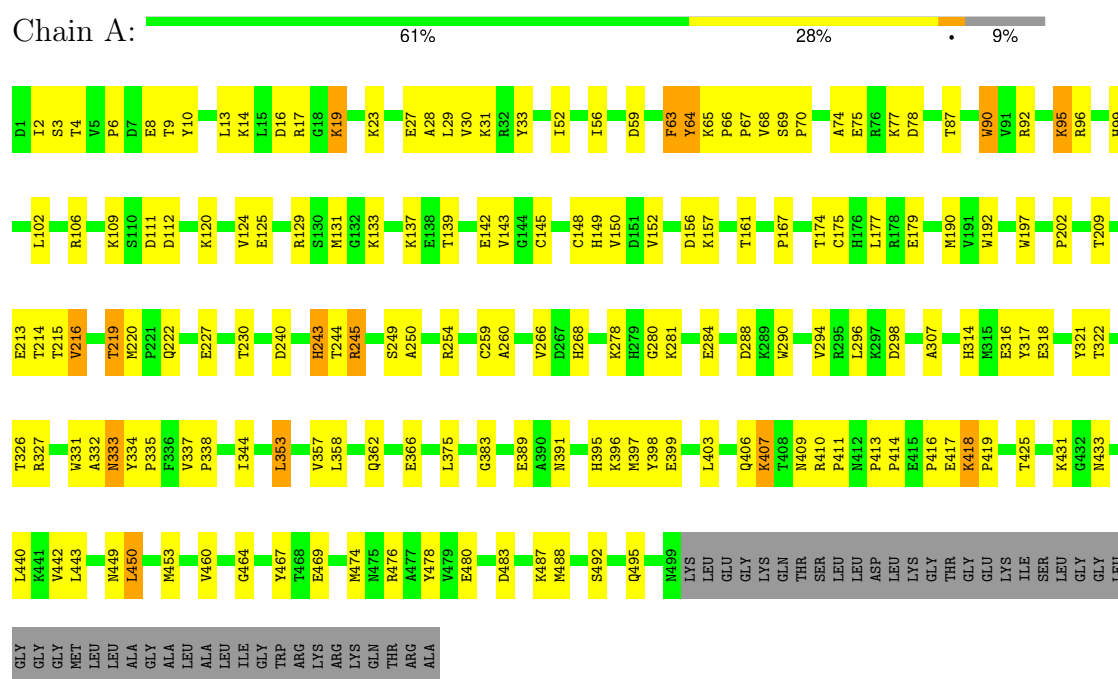
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Fe	N	O		
3	B	1	43	34	1	4	4	0	0

3 Residue-property plots

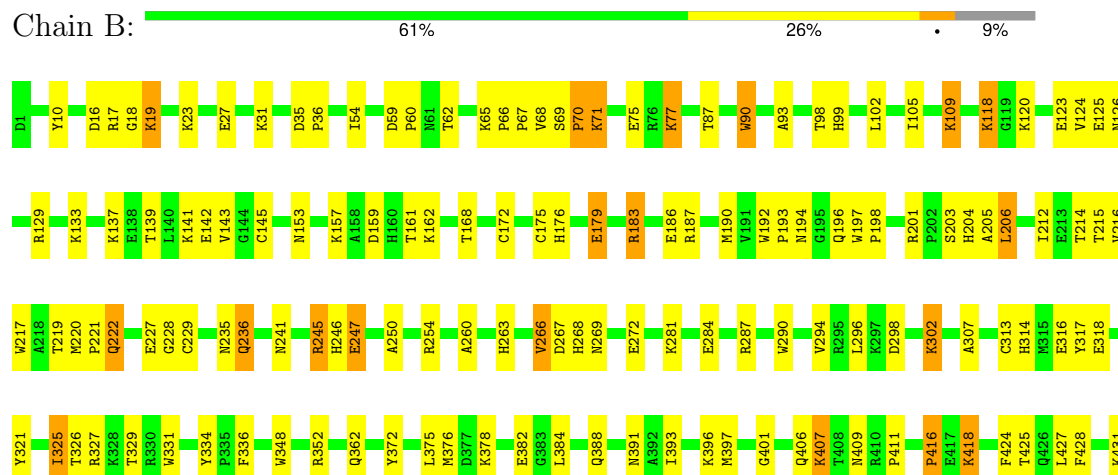
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

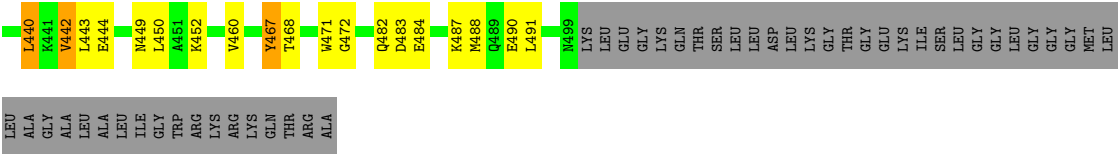
Note EDS was not executed.

• Molecule 1: HYDROXYLAMINE OXIDOREDUCTASE



• Molecule 1: HYDROXYLAMINE OXIDOREDUCTASE





LEU
ALA
GLY
ALA
LEU
ALA
LEU
ILE
GLY
TRP
ARG
LYS
ARG
LYS
GLN
THR
ARG
ALA

4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 63	Depositor
Cell constants a, b, c, α , β , γ	96.20Å 96.20Å 265.70Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	8.00 – 2.80	Depositor
% Data completeness (in resolution range)	99.2 (8.00-2.80)	Depositor
R_{merge}	0.79	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.230 , 0.309	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	8648	wwPDB-VP
Average B, all atoms (Å ²)	13.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: HEC, 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	0.50	0/4083	1.05	18/5534 (0.3%)
1	B	0.49	0/4083	1.03	14/5534 (0.3%)
All	All	0.49	0/8166	1.04	32/11068 (0.3%)

There are no bond length outliers.

The worst 5 of 32 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	266	VAL	N-CA-C	10.36	120.27	110.53
1	B	260	ALA	N-CA-C	8.48	121.29	111.11
1	B	266	VAL	N-CA-C	8.34	121.47	111.05
1	A	244	THR	N-CA-C	8.20	121.18	110.43
1	B	449	ASN	N-CA-C	7.81	119.79	111.28

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	3980	0	3779	102	2
1	B	3980	0	3779	121	2
2	A	301	0	210	5	0
2	B	301	0	210	7	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	A	43	0	30	2	2
3	B	43	0	30	3	2
All	All	8648	0	8038	222	4

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 222 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:219:THR:HG22	1:A:416:PRO:HD2	1.51	0.92
1:B:69:SER:HB2	1:B:70:PRO:HD3	1.51	0.91
1:A:202:PRO:HB2	2:A:552:HEM:HBA1	1.54	0.89
1:B:219:THR:HG22	1:B:416:PRO:HD2	1.66	0.78
1:A:69:SER:HB2	1:A:70:PRO:HD3	1.68	0.76

All (4) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:467:TYR:CE1	3:A:550:HEC:CHC[2_655]	1.79	0.41
1:B:467:TYR:CE1	3:B:550:HEC:CHC[3_665]	1.95	0.25
1:A:467:TYR:OH	3:A:550:HEC:C3B[2_655]	2.00	0.20
1:B:467:TYR:OH	3:B:550:HEC:C4B[3_665]	2.11	0.09

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	497/546 (91%)	455 (92%)	35 (7%)	7 (1%)	9 30
1	B	497/546 (91%)	450 (90%)	43 (9%)	4 (1%)	16 44

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	994/1092 (91%)	905 (91%)	78 (8%)	11 (1%)	11	36

5 of 11 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	3	SER
1	A	327	ARG
1	B	247	GLU
1	B	268	HIS
1	A	150	VAL

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	427/460 (93%)	405 (95%)	22 (5%)	21	53
1	B	427/460 (93%)	402 (94%)	25 (6%)	18	48
All	All	854/920 (93%)	807 (94%)	47 (6%)	19	51

5 of 47 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	145	CYS
1	B	302	LYS
1	B	179	GLU
1	B	222	GLN
1	B	407	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 28 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	153	ASN
1	B	499	ASN
1	B	233	HIS

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Mol	Chain	Res	Type
1	B	454	HIS
1	B	211	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

16 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	HEM	B	554	1	50,50,50	1.45	4 (8%)	67,82,82	1.15	6 (8%)
2	HEM	B	548	1	50,50,50	1.33	4 (8%)	67,82,82	1.27	8 (11%)
2	HEM	A	552	1	50,50,50	1.47	5 (10%)	67,82,82	1.64	8 (11%)
2	HEM	A	554	1	50,50,50	1.39	3 (6%)	67,82,82	1.15	5 (7%)
2	HEM	B	551	1	50,50,50	1.39	6 (12%)	67,82,82	1.34	6 (8%)
2	HEM	B	553	1	50,50,50	1.41	5 (10%)	67,82,82	1.10	4 (5%)
2	HEM	B	549	1	50,50,50	1.48	5 (10%)	67,82,82	1.27	11 (16%)
3	HEC	B	550	1	50,50,50	1.75	6 (12%)	68,82,82	1.38	8 (11%)
2	HEM	A	548	1	50,50,50	1.37	5 (10%)	67,82,82	1.15	4 (5%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	HEM	A	547	1	50,50,50	1.32	4 (8%)	67,82,82	1.14	4 (5%)
2	HEM	A	553	1	50,50,50	1.29	4 (8%)	67,82,82	1.26	4 (5%)
2	HEM	A	551	1	50,50,50	1.35	4 (8%)	67,82,82	1.20	6 (8%)
2	HEM	B	547	1	50,50,50	1.29	3 (6%)	67,82,82	0.97	3 (4%)
3	HEC	A	550	1	50,50,50	1.39	4 (8%)	68,82,82	1.27	6 (8%)
2	HEM	A	549	1	50,50,50	1.29	4 (8%)	67,82,82	1.09	4 (5%)
2	HEM	B	552	1	50,50,50	1.35	5 (10%)	67,82,82	1.39	11 (16%)

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	B	554	1	-	9/14/54/54	-
2	HEM	B	548	1	-	8/14/54/54	-
2	HEM	A	552	1	-	12/14/54/54	-
2	HEM	A	554	1	-	4/14/54/54	-
2	HEM	B	551	1	-	6/14/54/54	-
2	HEM	B	553	1	-	8/14/54/54	-
3	HEC	A	550	1	1/1/3/7	7/14/54/54	-
2	HEM	B	549	1	-	8/14/54/54	-
2	HEM	A	548	1	-	7/14/54/54	-
2	HEM	A	547	1	-	5/14/54/54	-
2	HEM	A	553	1	-	8/14/54/54	-
2	HEM	A	551	1	-	6/14/54/54	-
2	HEM	B	547	1	-	7/14/54/54	-
3	HEC	B	550	1	1/1/3/7	4/14/54/54	-
2	HEM	A	549	1	-	8/14/54/54	-
2	HEM	B	552	1	-	9/14/54/54	-

The worst 5 of 71 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	550	HEC	CHB-C4A	7.25	1.52	1.38
3	B	550	HEC	CHC-C4B	5.02	1.48	1.38
3	A	550	HEC	CHC-C4B	4.94	1.48	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	551	HEM	CBC-CAC	4.89	1.53	1.30
2	A	552	HEM	CBB-CAB	4.80	1.53	1.30

The worst 5 of 98 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	552	HEM	CAD-C3D-C2D	-5.82	116.96	127.87
2	A	552	HEM	CAD-C3D-C4D	5.77	134.75	124.70
2	A	552	HEM	CBD-CAD-C3D	4.79	125.78	112.53
2	B	551	HEM	C3B-C4B-NB	4.33	112.58	109.47
3	B	550	HEC	C4A-CHB-C1B	-4.17	117.16	126.02

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	A	550	HEC	NA
3	B	550	HEC	NA

5 of 116 torsion outliers are listed below:

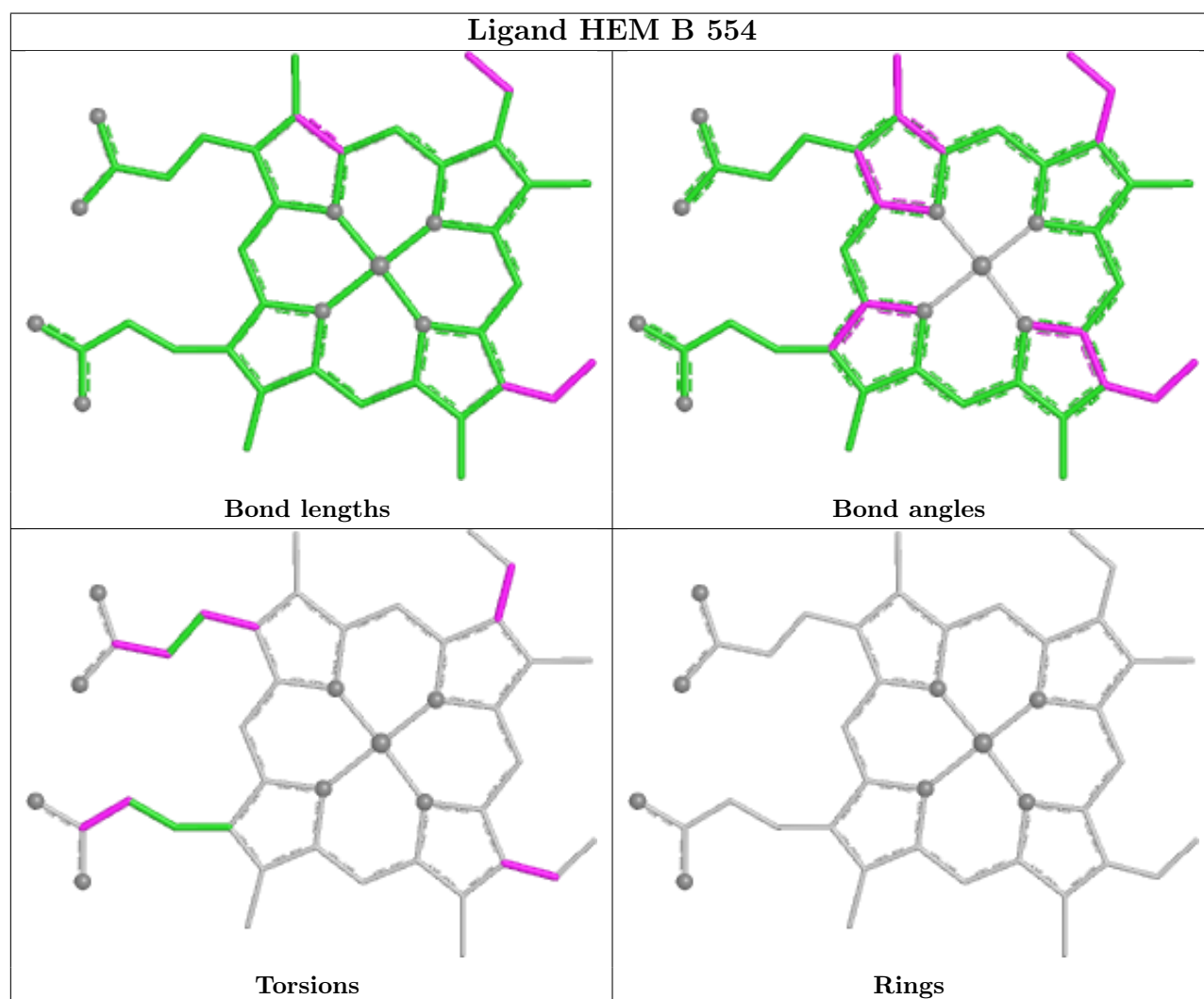
Mol	Chain	Res	Type	Atoms
2	A	548	HEM	C2C-C3C-CAC-CBC
2	A	549	HEM	C2B-C3B-CAB-CBB
2	A	549	HEM	C4B-C3B-CAB-CBB
2	A	549	HEM	C2C-C3C-CAC-CBC
2	A	551	HEM	C2B-C3B-CAB-CBB

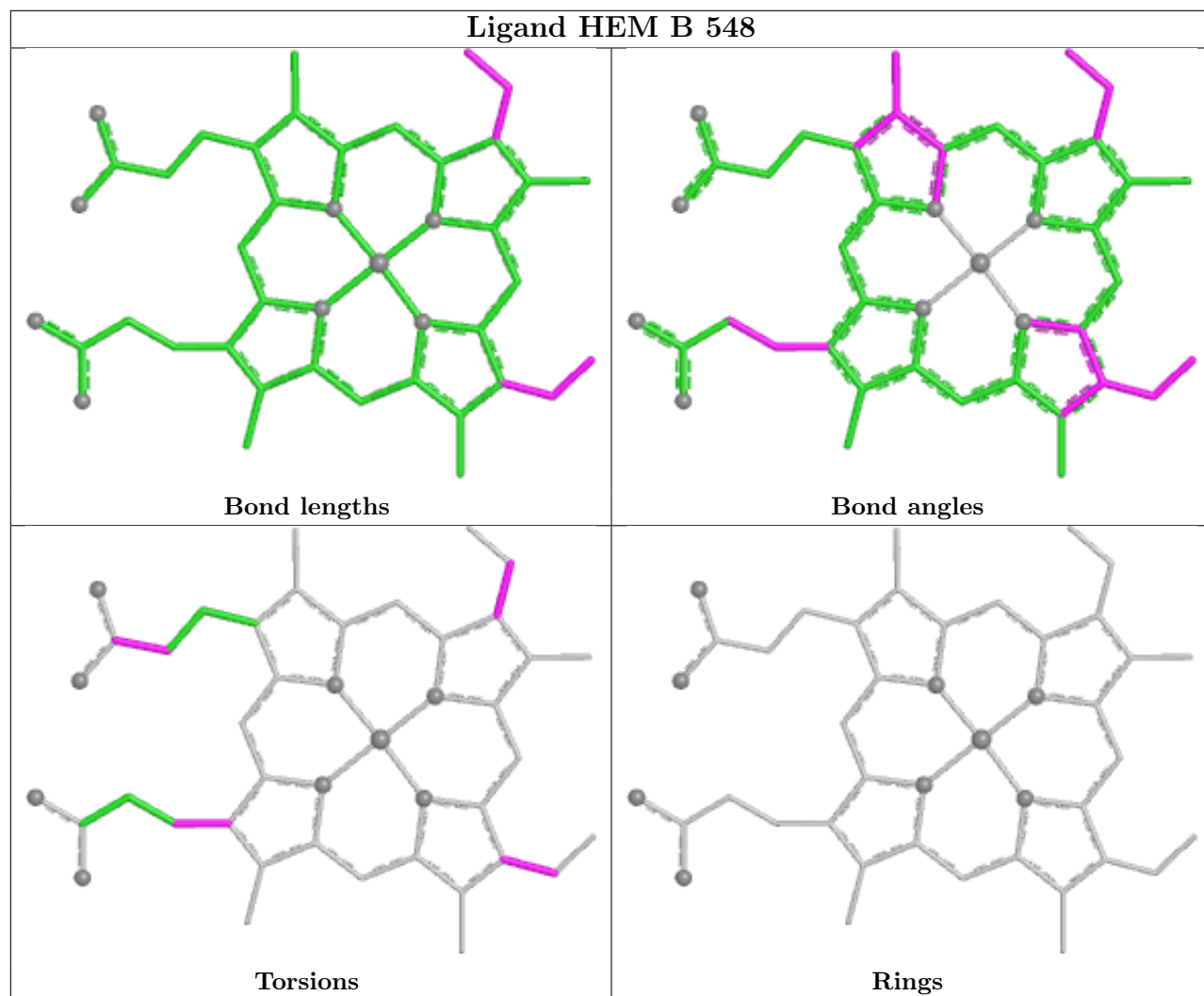
There are no ring outliers.

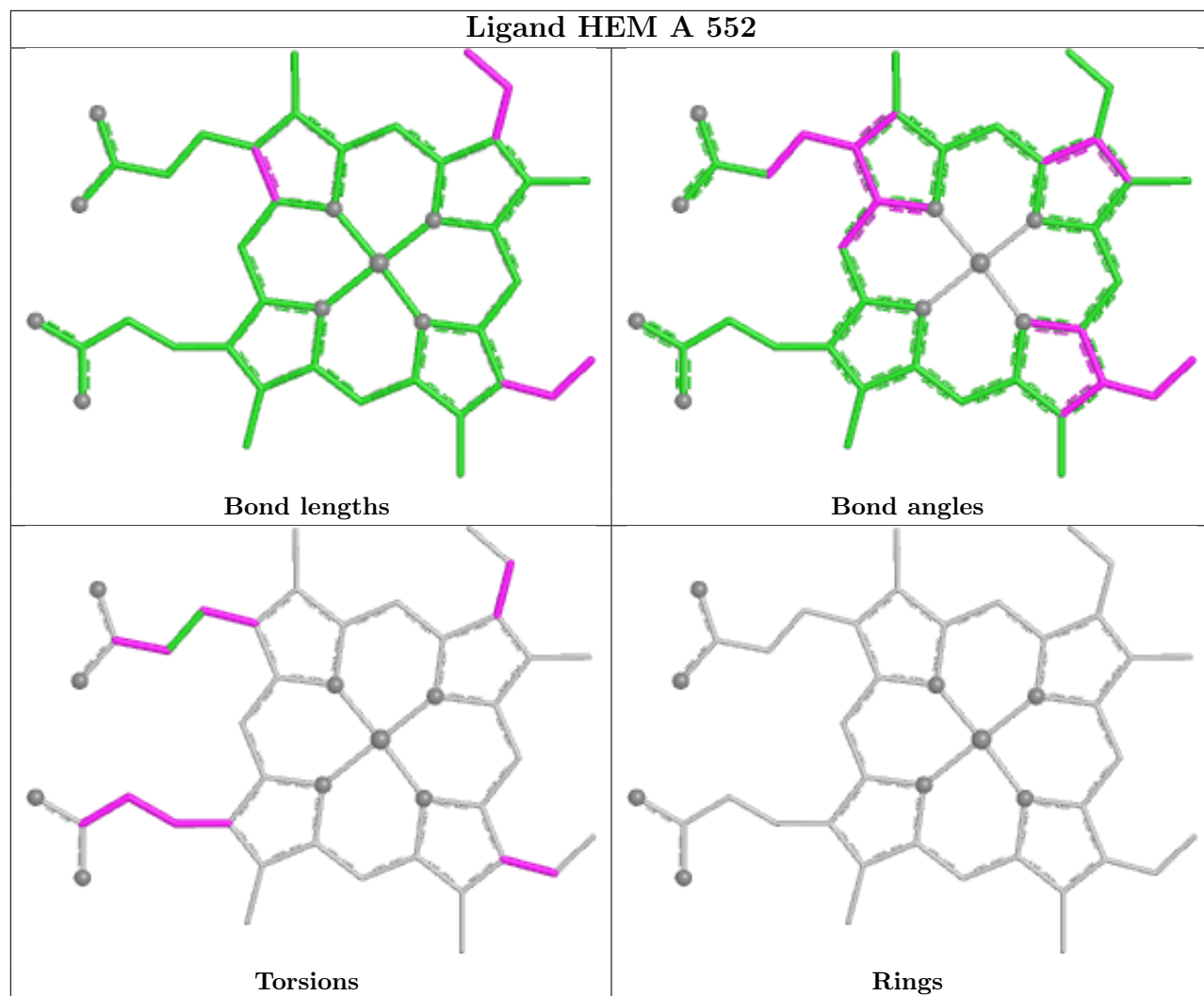
10 monomers are involved in 20 short contacts:

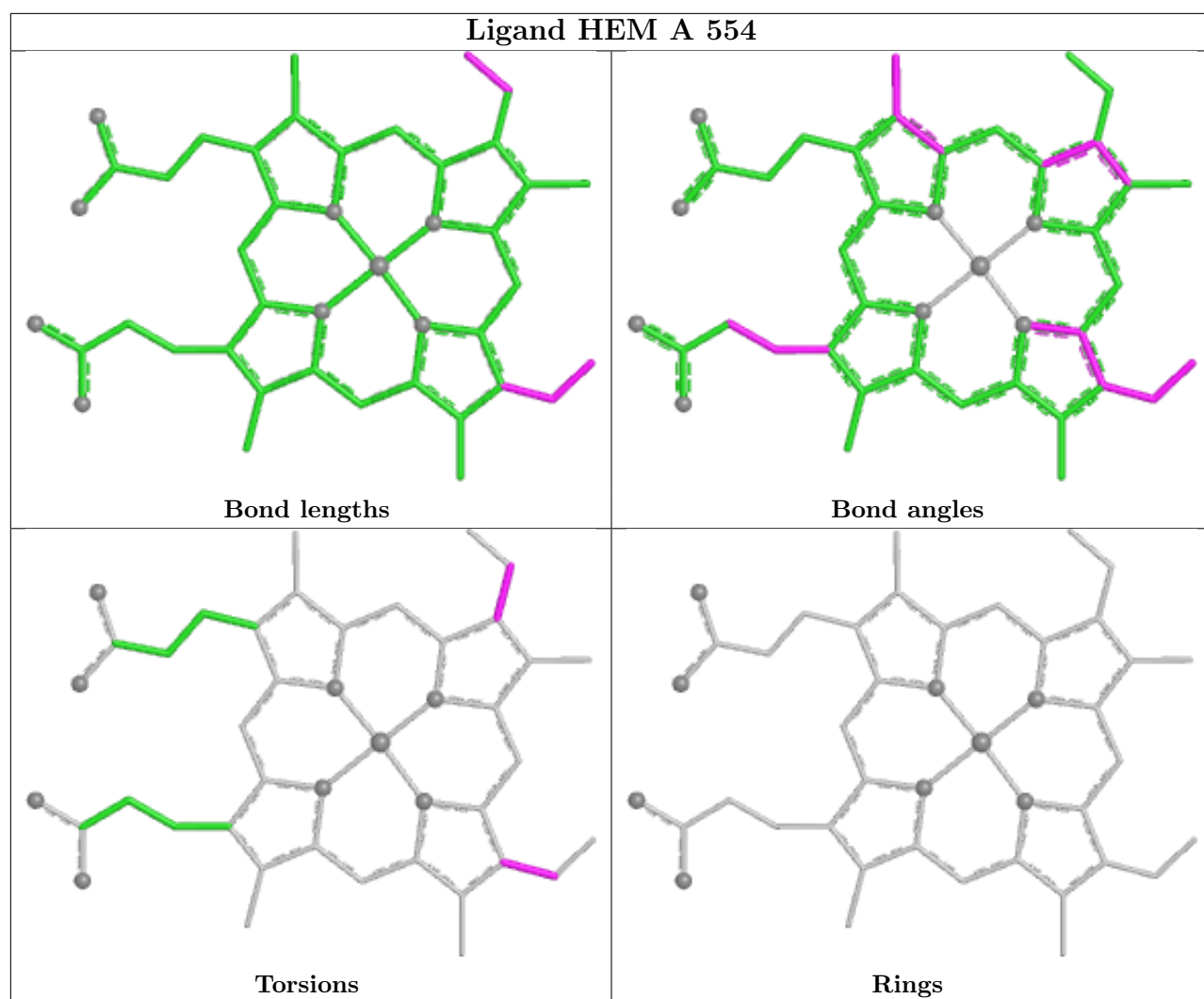
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	552	HEM	2	0
2	B	551	HEM	2	0
2	B	553	HEM	1	0
2	B	549	HEM	1	0
3	B	550	HEC	3	2
2	A	548	HEM	1	0
2	A	547	HEM	1	0
2	A	551	HEM	1	0
3	A	550	HEC	2	2
2	B	552	HEM	3	0

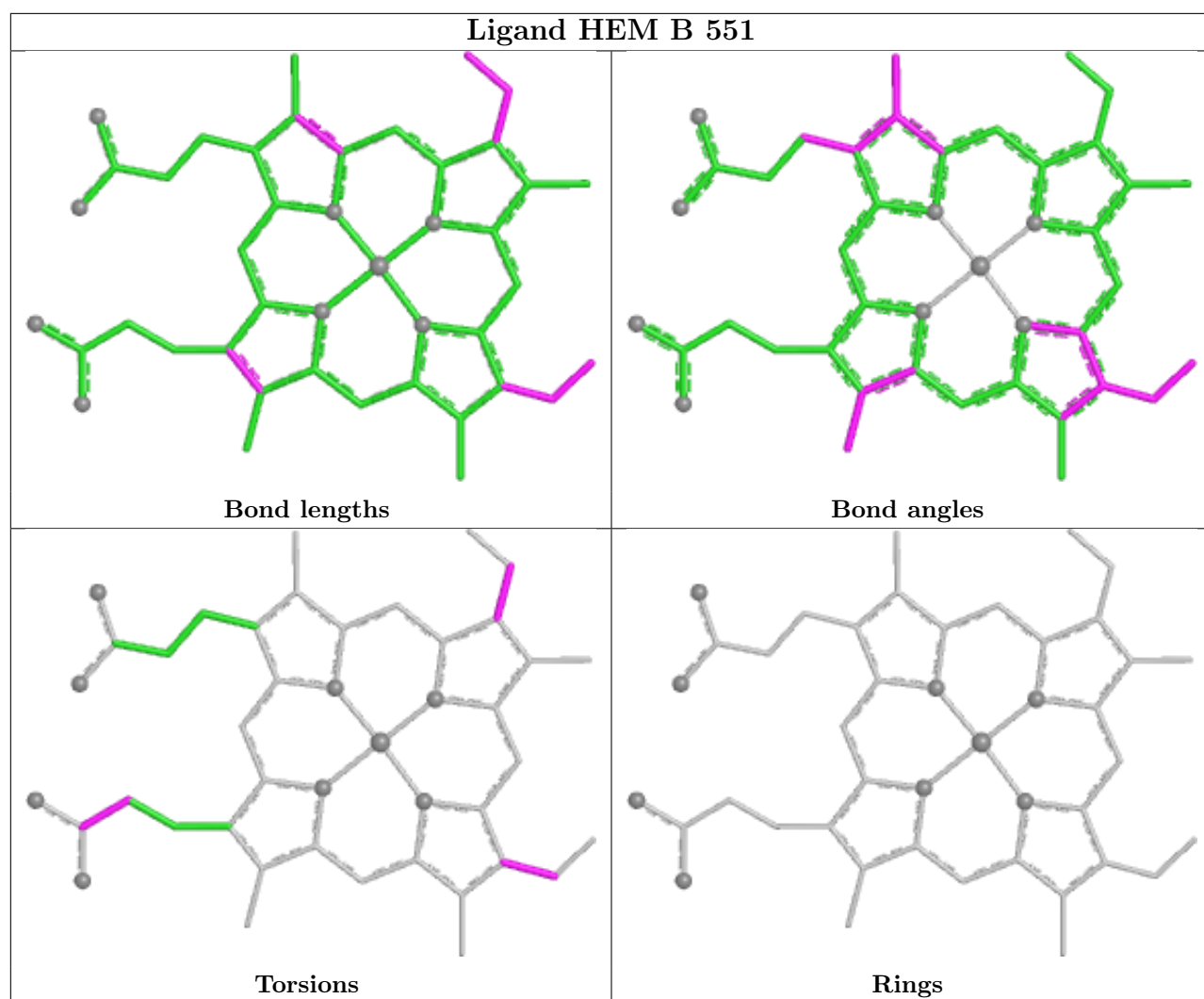
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

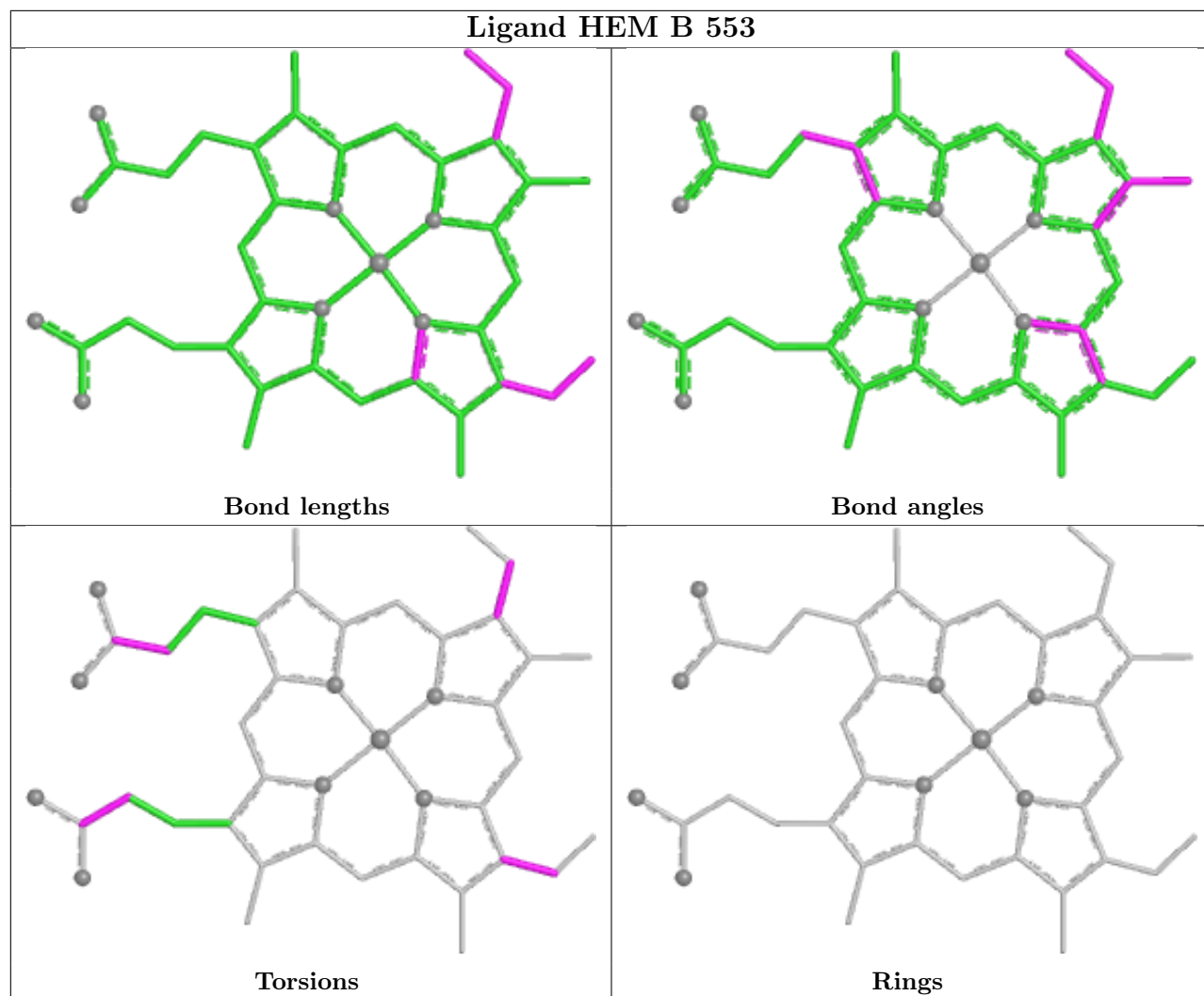


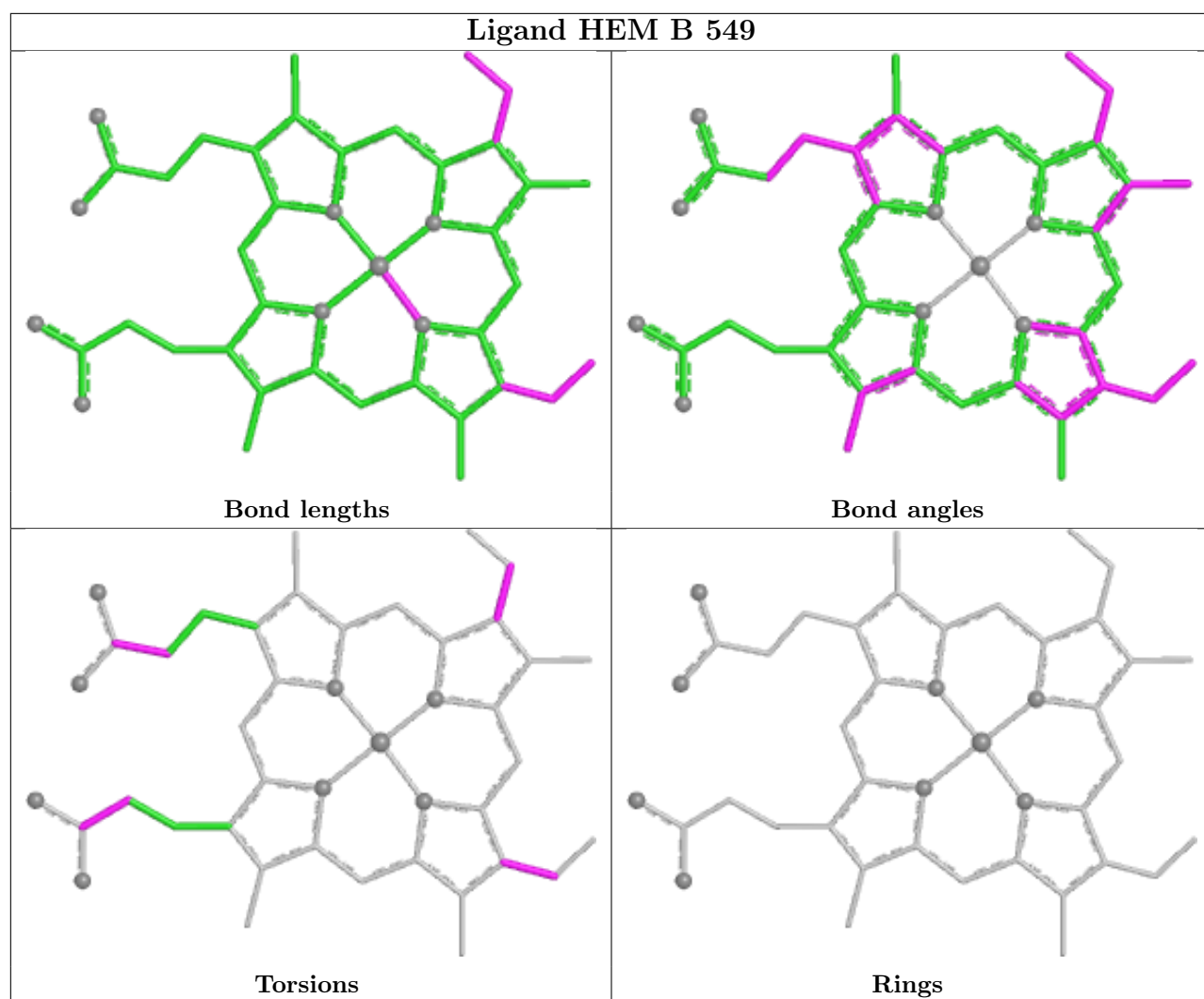




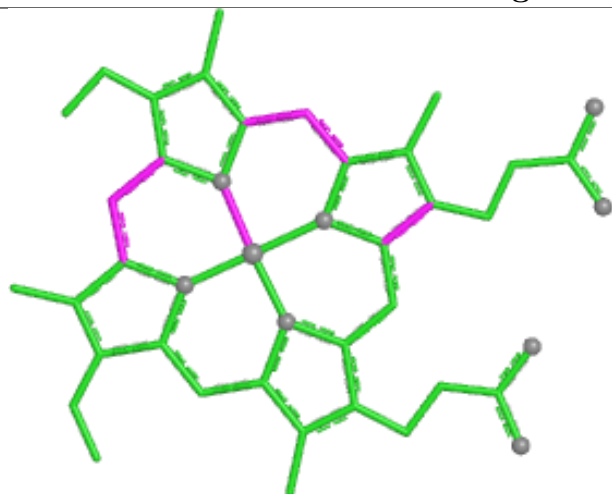




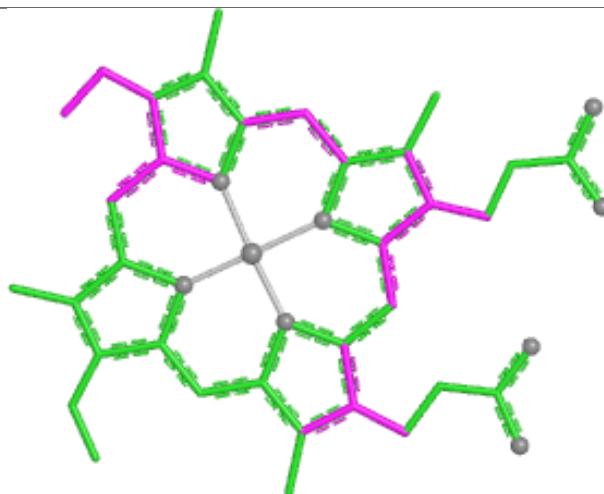




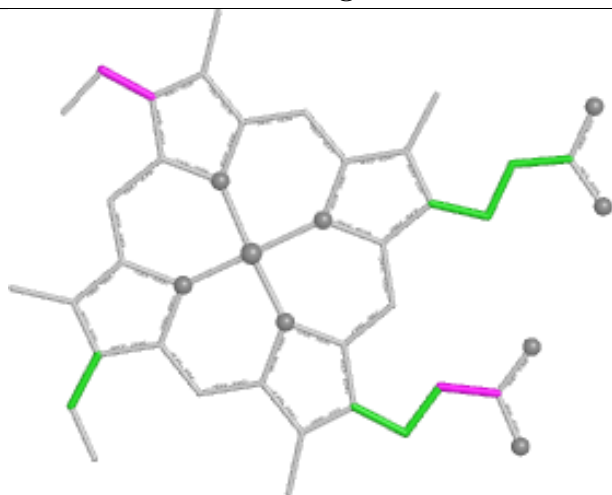
Ligand HEC B 550



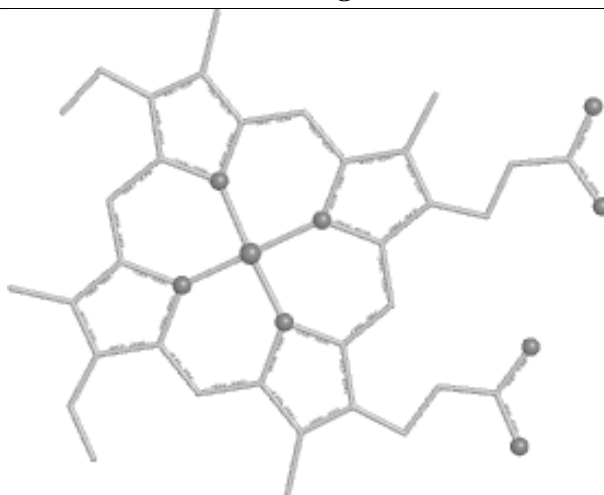
Bond lengths



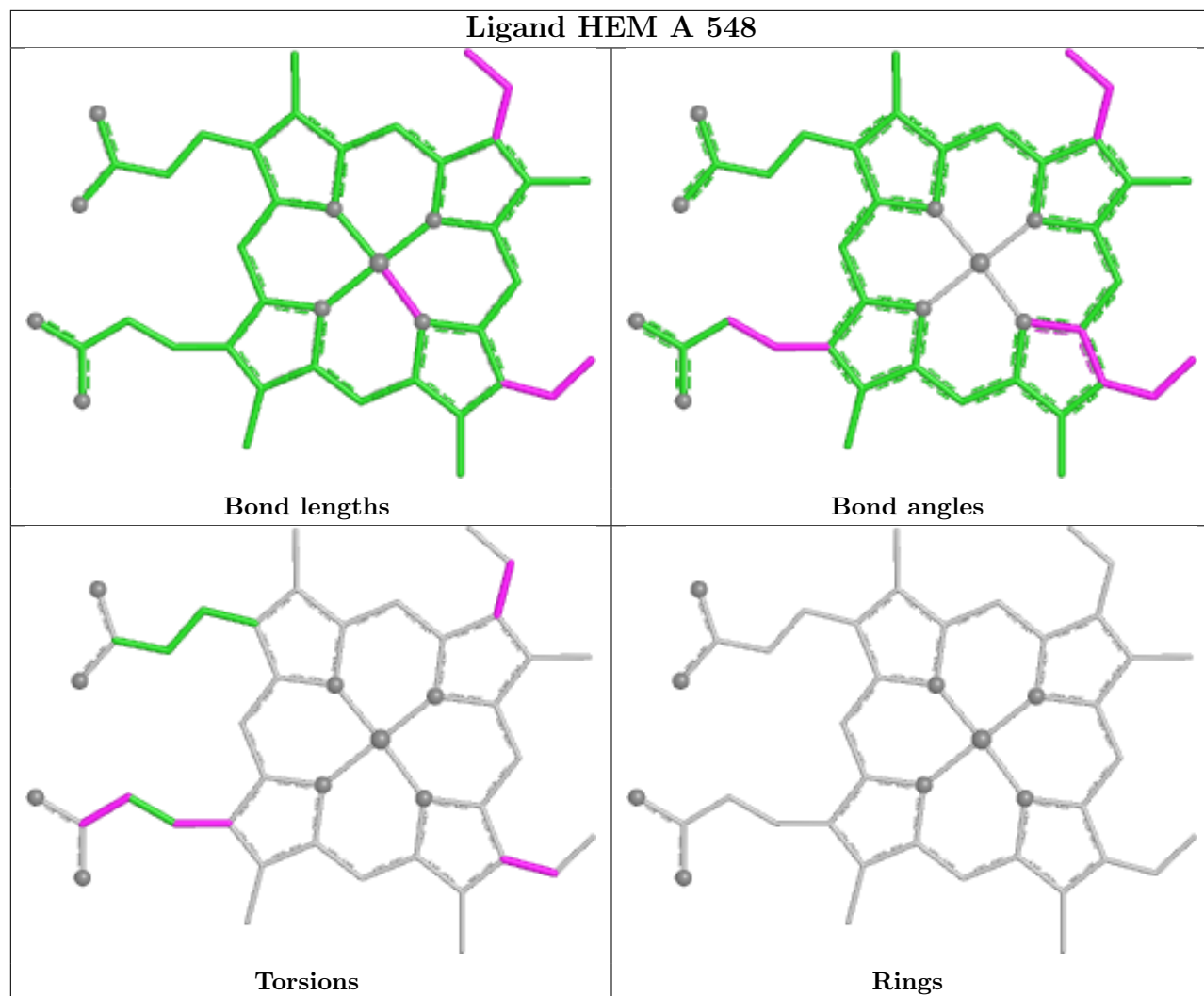
Bond angles

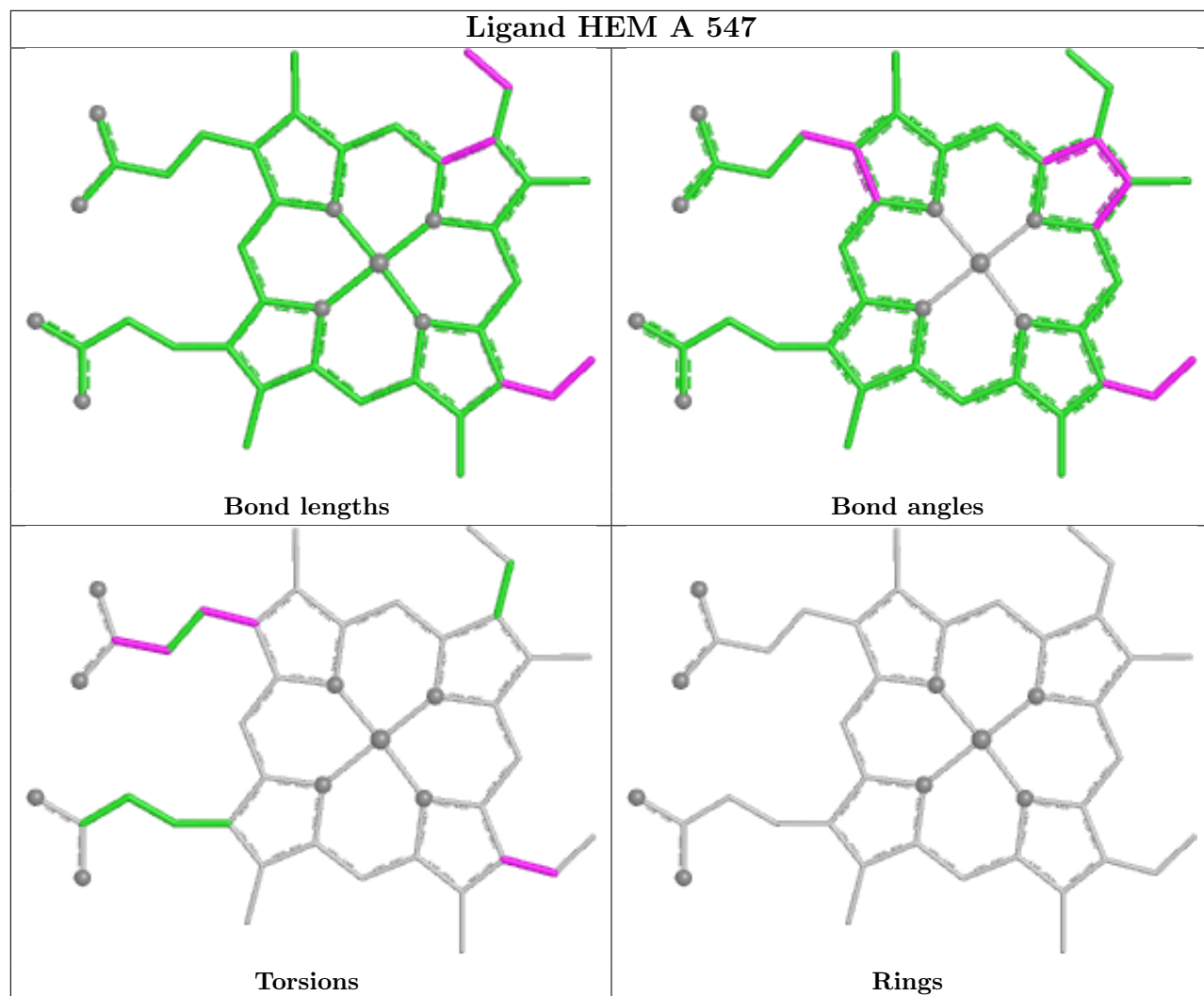


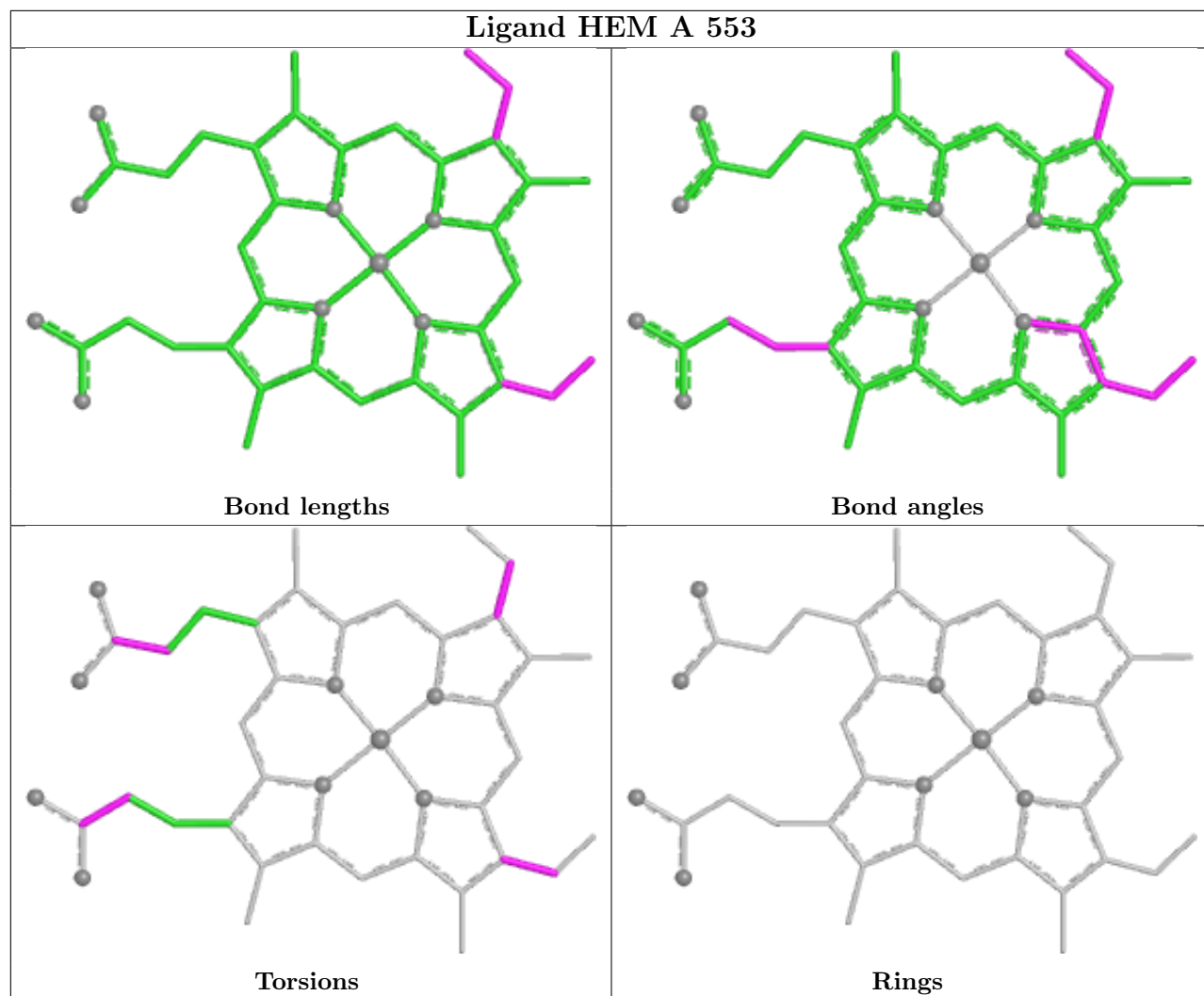
Torsions

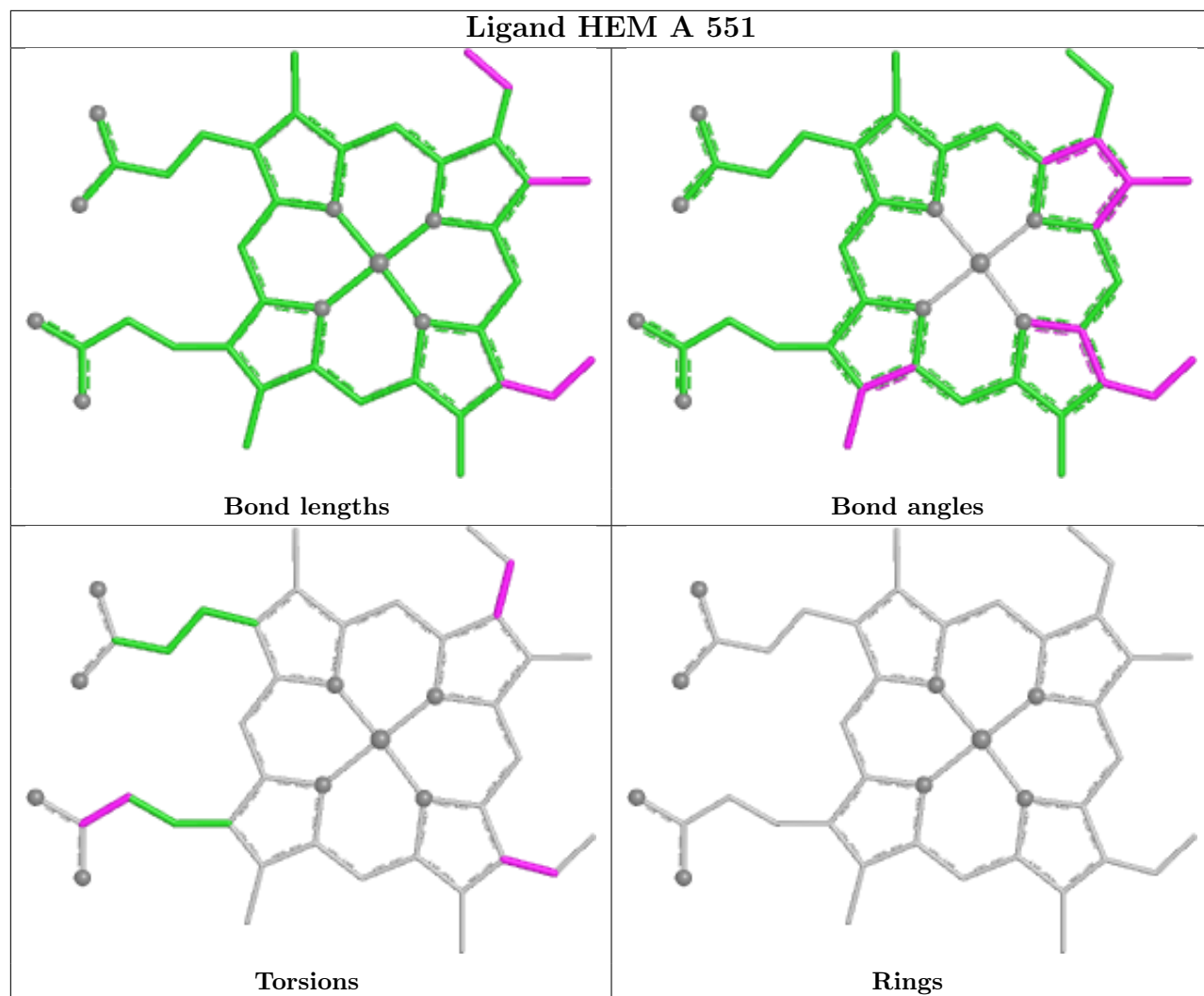


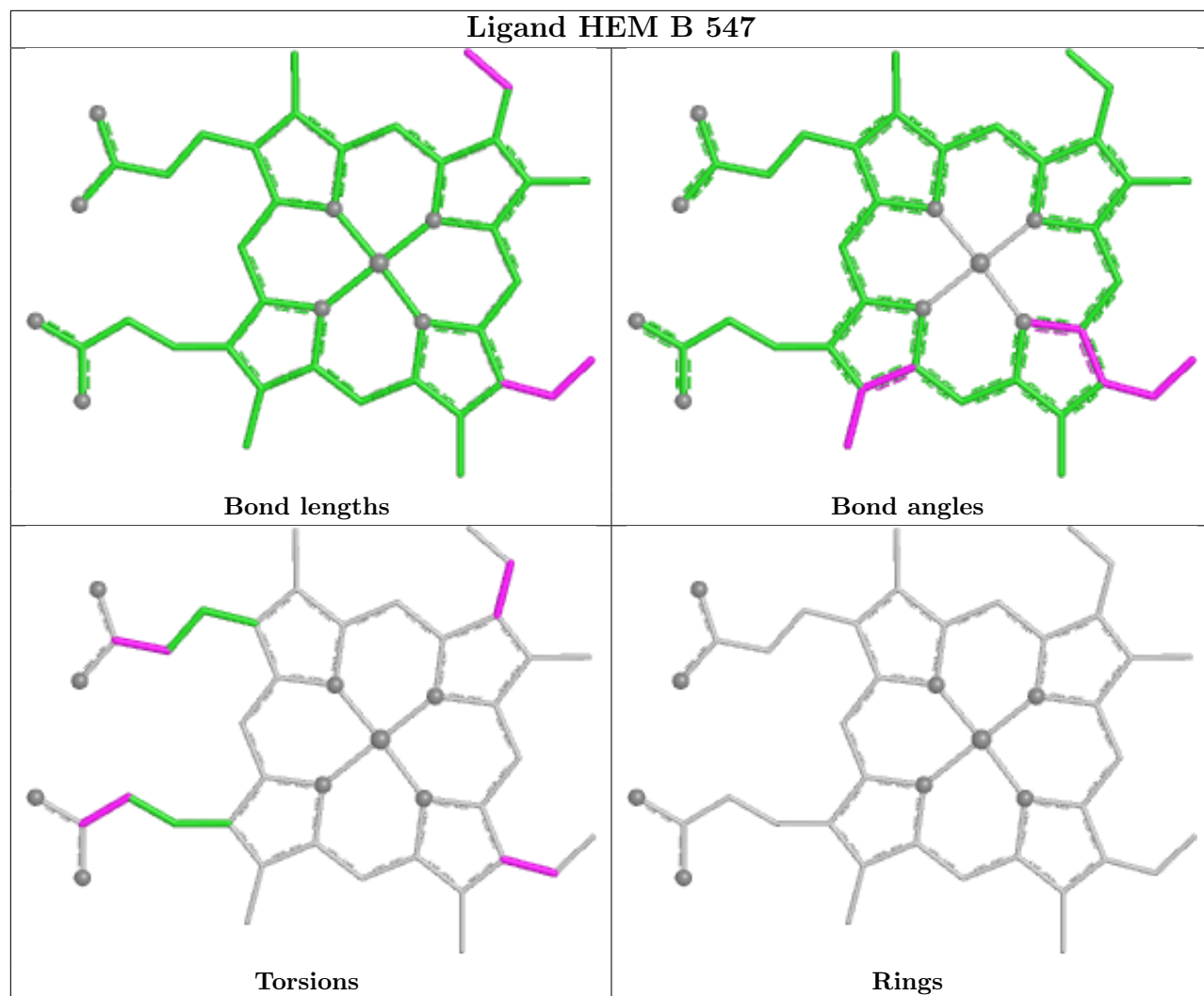
Rings

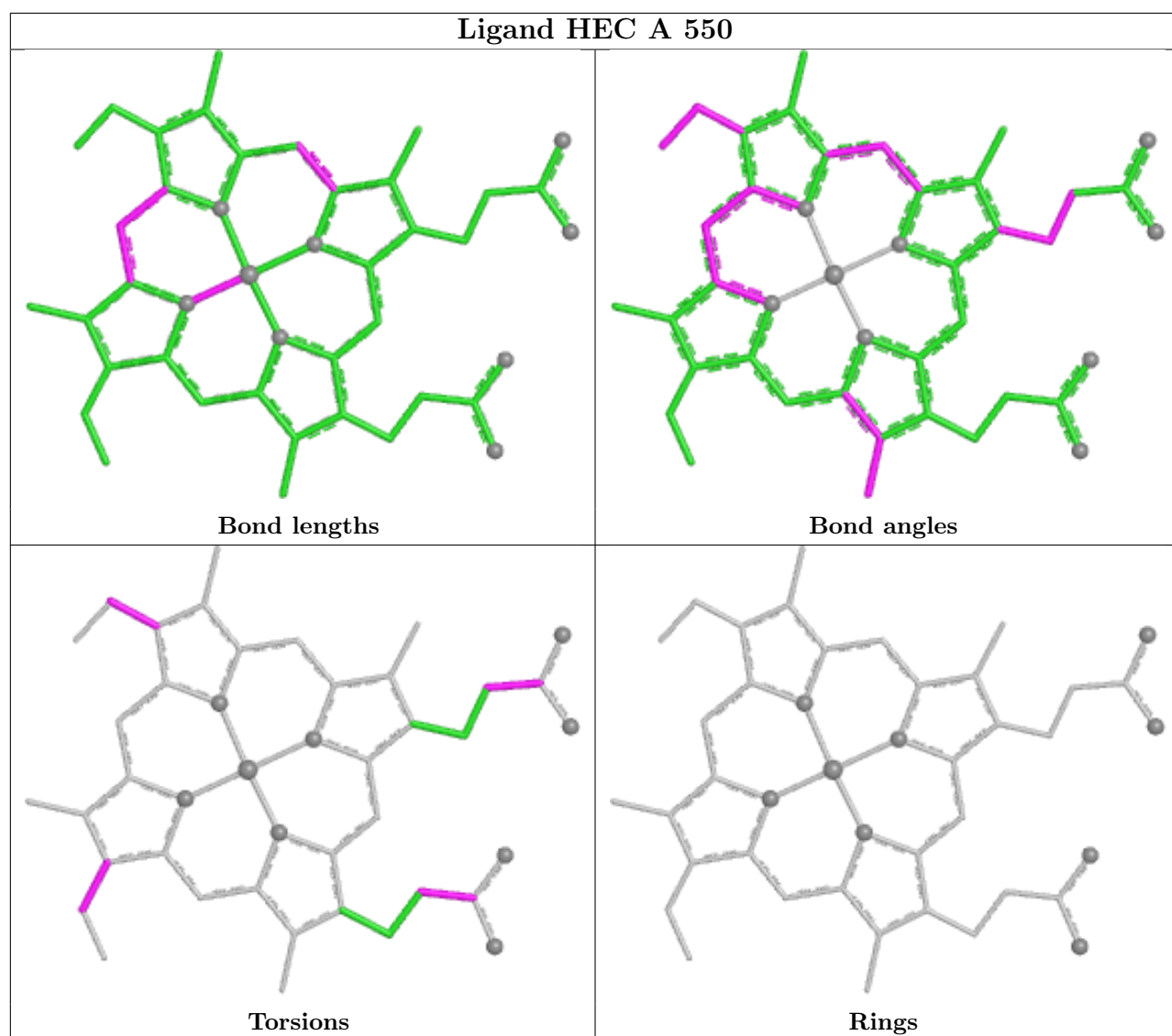




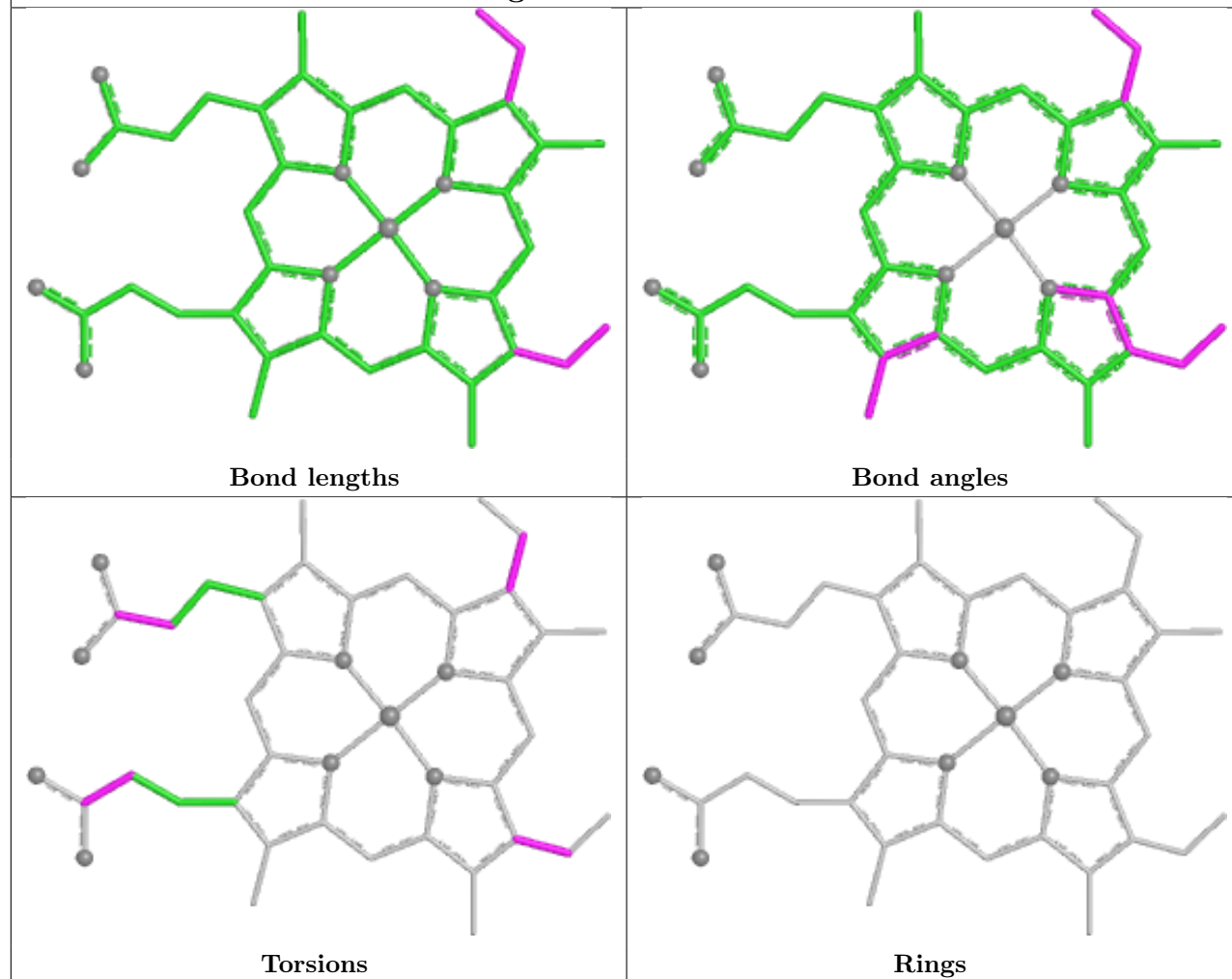


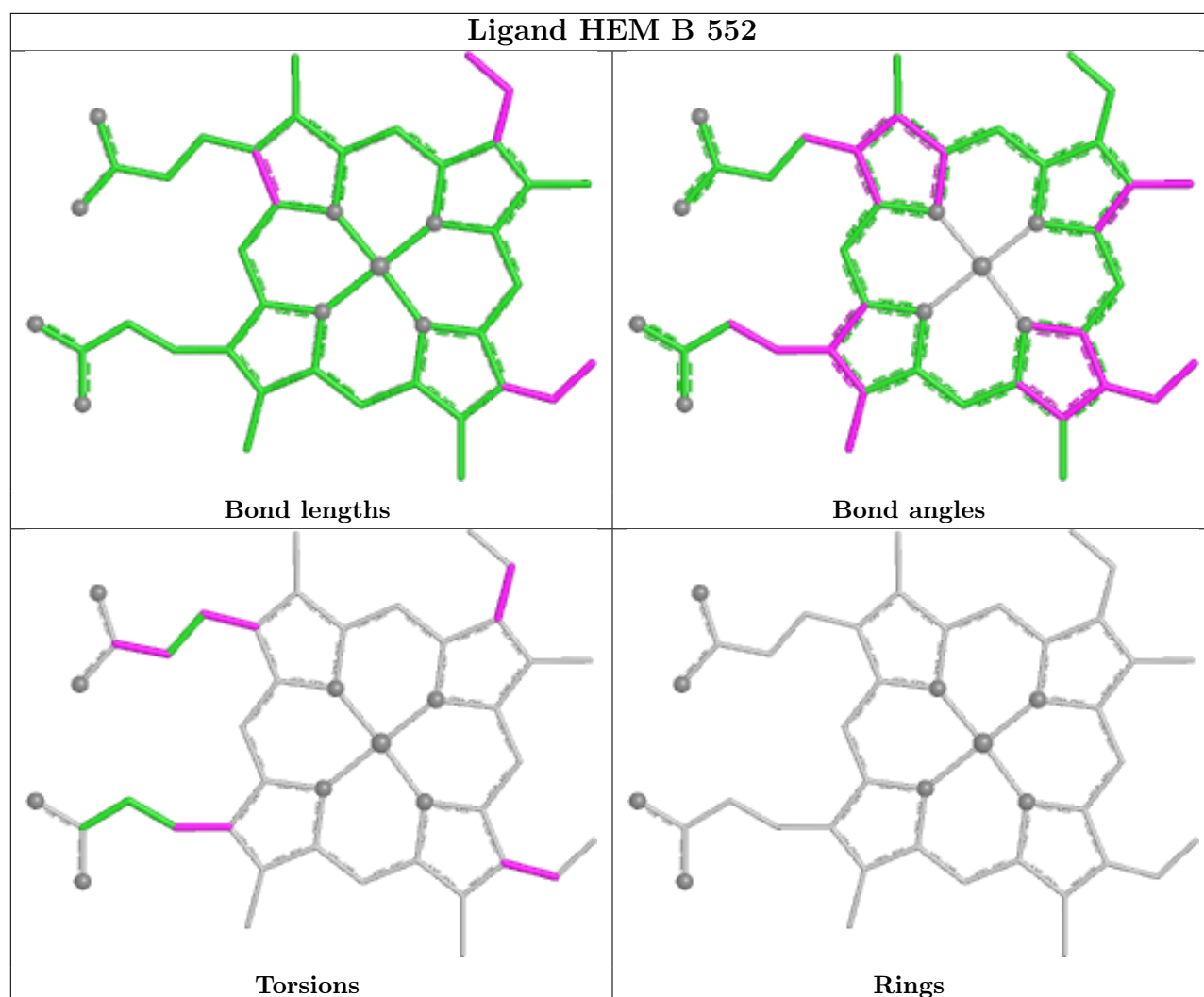






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5.7 Other polymers [i](#)

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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.