



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 02:30 AM UTC

PDB ID : 6IAO / pdb_00006iao
Title : Structure of Cytochrome P450 BM3 M11 mutant in complex with DTT at resolution 2.16Å
Authors : Mirza, O.; Rafiq, M.; Frydenvang, K.
Deposited on : 2018-11-27
Resolution : 2.16 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

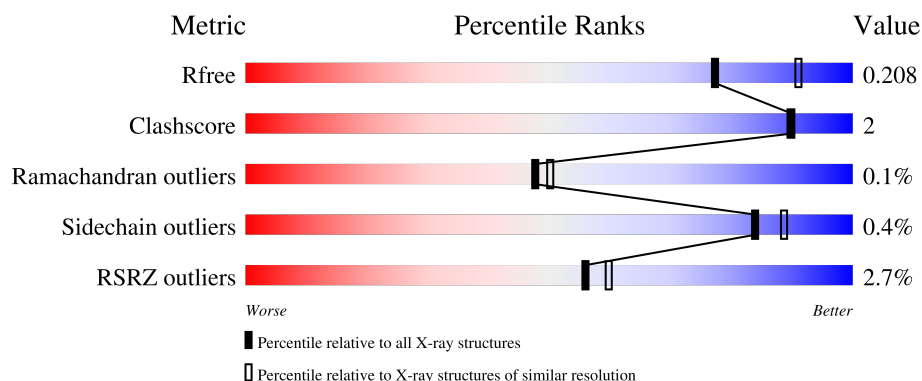
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.16 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}	180053	2057 (2.16-2.16)
Clashscore	190562	2159 (2.16-2.16)
Ramachandran outliers	187476	2134 (2.16-2.16)
Sidechain outliers	187428	2133 (2.16-2.16)
RSRZ outliers	180081	2059 (2.16-2.16)

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	507	2% 86% • 10%
1	B	507	% 86% • 11%
1	C	507	4% 84% 5% 11%
1	D	507	2% 84% 5% 11%

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 16073 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 Bifunctional cytochrome P450/NADPH-P450 reductase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	455	Total	C	N	O	S	0	5	0
			3670	2346	625	680	19			
1	B	452	Total	C	N	O	S	0	5	0
			3653	2332	624	679	18			
1	C	450	Total	C	N	O	S	0	5	0
			3625	2319	617	669	20			
1	D	450	Total	C	N	O	S	0	0	0
			3599	2300	608	673	18			

There are 176 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-34	MET	-	initiating methionine	UNP P14779
A	-33	GLY	-	expression tag	UNP P14779
A	-32	SER	-	expression tag	UNP P14779
A	-31	SER	-	expression tag	UNP P14779
A	-30	HIS	-	expression tag	UNP P14779
A	-29	HIS	-	expression tag	UNP P14779
A	-28	HIS	-	expression tag	UNP P14779
A	-27	HIS	-	expression tag	UNP P14779
A	-26	HIS	-	expression tag	UNP P14779
A	-25	HIS	-	expression tag	UNP P14779
A	-24	SER	-	expression tag	UNP P14779
A	-23	SER	-	expression tag	UNP P14779
A	-22	GLY	-	expression tag	UNP P14779
A	-21	LEU	-	expression tag	UNP P14779
A	-20	VAL	-	expression tag	UNP P14779
A	-19	PRO	-	expression tag	UNP P14779
A	-18	ARG	-	expression tag	UNP P14779
A	-17	GLY	-	expression tag	UNP P14779
A	-16	SER	-	expression tag	UNP P14779
A	-15	HIS	-	expression tag	UNP P14779
A	-14	MET	-	expression tag	UNP P14779

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Chain	Residue	Modelled	Actual	Comment	Reference
A	-13	ALA	-	expression tag	UNP P14779
A	-12	SER	-	expression tag	UNP P14779
A	-11	MET	-	expression tag	UNP P14779
A	-10	THR	-	expression tag	UNP P14779
A	-9	GLY	-	expression tag	UNP P14779
A	-8	GLY	-	expression tag	UNP P14779
A	-7	GLN	-	expression tag	UNP P14779
A	-6	GLN	-	expression tag	UNP P14779
A	-5	MET	-	expression tag	UNP P14779
A	-4	GLY	-	expression tag	UNP P14779
A	-3	ARG	-	expression tag	UNP P14779
A	-2	GLY	-	expression tag	UNP P14779
A	-1	SER	-	expression tag	UNP P14779
A	47	LEU	ARG	engineered mutation	UNP P14779
A	64	GLY	GLU	engineered mutation	UNP P14779
A	81	ILE	PHE	engineered mutation	UNP P14779
A	87	VAL	PHE	engineered mutation	UNP P14779
A	143	GLY	GLU	engineered mutation	UNP P14779
A	188	GLN	LEU	engineered mutation	UNP P14779
A	198	CYS	TYR	engineered mutation	UNP P14779
A	267	VAL	GLU	engineered mutation	UNP P14779
A	285	TYR	HIS	engineered mutation	UNP P14779
A	415	SER	GLY	engineered mutation	UNP P14779
B	-34	MET	-	initiating methionine	UNP P14779
B	-33	GLY	-	expression tag	UNP P14779
B	-32	SER	-	expression tag	UNP P14779
B	-31	SER	-	expression tag	UNP P14779
B	-30	HIS	-	expression tag	UNP P14779
B	-29	HIS	-	expression tag	UNP P14779
B	-28	HIS	-	expression tag	UNP P14779
B	-27	HIS	-	expression tag	UNP P14779
B	-26	HIS	-	expression tag	UNP P14779
B	-25	HIS	-	expression tag	UNP P14779
B	-24	SER	-	expression tag	UNP P14779
B	-23	SER	-	expression tag	UNP P14779
B	-22	GLY	-	expression tag	UNP P14779
B	-21	LEU	-	expression tag	UNP P14779
B	-20	VAL	-	expression tag	UNP P14779
B	-19	PRO	-	expression tag	UNP P14779
B	-18	ARG	-	expression tag	UNP P14779
B	-17	GLY	-	expression tag	UNP P14779
B	-16	SER	-	expression tag	UNP P14779

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-15	HIS	-	expression tag	UNP P14779
B	-14	MET	-	expression tag	UNP P14779
B	-13	ALA	-	expression tag	UNP P14779
B	-12	SER	-	expression tag	UNP P14779
B	-11	MET	-	expression tag	UNP P14779
B	-10	THR	-	expression tag	UNP P14779
B	-9	GLY	-	expression tag	UNP P14779
B	-8	GLY	-	expression tag	UNP P14779
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B	-1	SER	-	expression tag	UNP P14779
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B	64	GLY	GLU	engineered mutation	UNP P14779
B	81	ILE	PHE	engineered mutation	UNP P14779
B	87	VAL	PHE	engineered mutation	UNP P14779
B	143	GLY	GLU	engineered mutation	UNP P14779
B	188	GLN	LEU	engineered mutation	UNP P14779
B	198	CYS	TYR	engineered mutation	UNP P14779
B	267	VAL	GLU	engineered mutation	UNP P14779
B	285	TYR	HIS	engineered mutation	UNP P14779
B	415	SER	GLY	engineered mutation	UNP P14779
C	-34	MET	-	initiating methionine	UNP P14779
C	-33	GLY	-	expression tag	UNP P14779
C	-32	SER	-	expression tag	UNP P14779
C	-31	SER	-	expression tag	UNP P14779
C	-30	HIS	-	expression tag	UNP P14779
C	-29	HIS	-	expression tag	UNP P14779
C	-28	HIS	-	expression tag	UNP P14779
C	-27	HIS	-	expression tag	UNP P14779
C	-26	HIS	-	expression tag	UNP P14779
C	-25	HIS	-	expression tag	UNP P14779
C	-24	SER	-	expression tag	UNP P14779
C	-23	SER	-	expression tag	UNP P14779
C	-22	GLY	-	expression tag	UNP P14779
C	-21	LEU	-	expression tag	UNP P14779
C	-20	VAL	-	expression tag	UNP P14779
C	-19	PRO	-	expression tag	UNP P14779
C	-18	ARG	-	expression tag	UNP P14779

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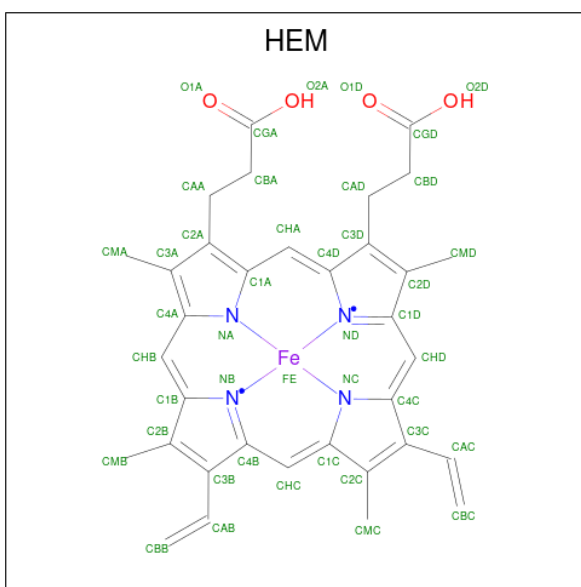
Chain	Residue	Modelled	Actual	Comment	Reference
C	-17	GLY	-	expression tag	UNP P14779
C	-16	SER	-	expression tag	UNP P14779
C	-15	HIS	-	expression tag	UNP P14779
C	-14	MET	-	expression tag	UNP P14779
C	-13	ALA	-	expression tag	UNP P14779
C	-12	SER	-	expression tag	UNP P14779
C	-11	MET	-	expression tag	UNP P14779
C	-10	THR	-	expression tag	UNP P14779
C	-9	GLY	-	expression tag	UNP P14779
C	-8	GLY	-	expression tag	UNP P14779
C	-7	GLN	-	expression tag	UNP P14779
C	-6	GLN	-	expression tag	UNP P14779
C	-5	MET	-	expression tag	UNP P14779
C	-4	GLY	-	expression tag	UNP P14779
C	-3	ARG	-	expression tag	UNP P14779
C	-2	GLY	-	expression tag	UNP P14779
C	-1	SER	-	expression tag	UNP P14779
C	47	LEU	ARG	engineered mutation	UNP P14779
C	64	GLY	GLU	engineered mutation	UNP P14779
C	81	ILE	PHE	engineered mutation	UNP P14779
C	87	VAL	PHE	engineered mutation	UNP P14779
C	143	GLY	GLU	engineered mutation	UNP P14779
C	188	GLN	LEU	engineered mutation	UNP P14779
C	198	CYS	TYR	engineered mutation	UNP P14779
C	267	VAL	GLU	engineered mutation	UNP P14779
C	285	TYR	HIS	engineered mutation	UNP P14779
C	415	SER	GLY	engineered mutation	UNP P14779
D	-34	MET	-	initiating methionine	UNP P14779
D	-33	GLY	-	expression tag	UNP P14779
D	-32	SER	-	expression tag	UNP P14779
D	-31	SER	-	expression tag	UNP P14779
D	-30	HIS	-	expression tag	UNP P14779
D	-29	HIS	-	expression tag	UNP P14779
D	-28	HIS	-	expression tag	UNP P14779
D	-27	HIS	-	expression tag	UNP P14779
D	-26	HIS	-	expression tag	UNP P14779
D	-25	HIS	-	expression tag	UNP P14779
D	-24	SER	-	expression tag	UNP P14779
D	-23	SER	-	expression tag	UNP P14779
D	-22	GLY	-	expression tag	UNP P14779
D	-21	LEU	-	expression tag	UNP P14779
D	-20	VAL	-	expression tag	UNP P14779

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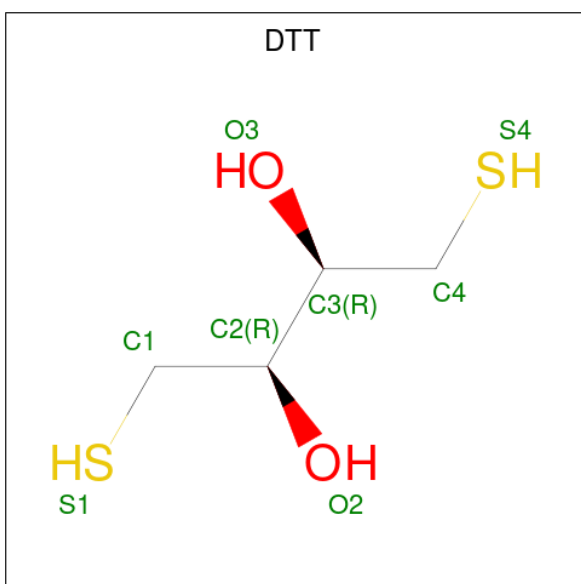
Chain	Residue	Modelled	Actual	Comment	Reference
D	-19	PRO	-	expression tag	UNP P14779
D	-18	ARG	-	expression tag	UNP P14779
D	-17	GLY	-	expression tag	UNP P14779
D	-16	SER	-	expression tag	UNP P14779
D	-15	HIS	-	expression tag	UNP P14779
D	-14	MET	-	expression tag	UNP P14779
D	-13	ALA	-	expression tag	UNP P14779
D	-12	SER	-	expression tag	UNP P14779
D	-11	MET	-	expression tag	UNP P14779
D	-10	THR	-	expression tag	UNP P14779
D	-9	GLY	-	expression tag	UNP P14779
D	-8	GLY	-	expression tag	UNP P14779
D	-7	GLN	-	expression tag	UNP P14779
D	-6	GLN	-	expression tag	UNP P14779
D	-5	MET	-	expression tag	UNP P14779
D	-4	GLY	-	expression tag	UNP P14779
D	-3	ARG	-	expression tag	UNP P14779
D	-2	GLY	-	expression tag	UNP P14779
D	-1	SER	-	expression tag	UNP P14779
D	47	LEU	ARG	engineered mutation	UNP P14779
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D	81	ILE	PHE	engineered mutation	UNP P14779
D	87	VAL	PHE	engineered mutation	UNP P14779
D	143	GLY	GLU	engineered mutation	UNP P14779
D	188	GLN	LEU	engineered mutation	UNP P14779
D	198	CYS	TYR	engineered mutation	UNP P14779
D	267	VAL	GLU	engineered mutation	UNP P14779
D	285	TYR	HIS	engineered mutation	UNP P14779
D	415	SER	GLY	engineered mutation	UNP P14779

- 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 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

- Molecule 3 is 2,3-DIHYDROXY-1,4-DITHIOBUTANE (CCD ID: DTT) (formula: $C_4H_{10}O_2S_2$).

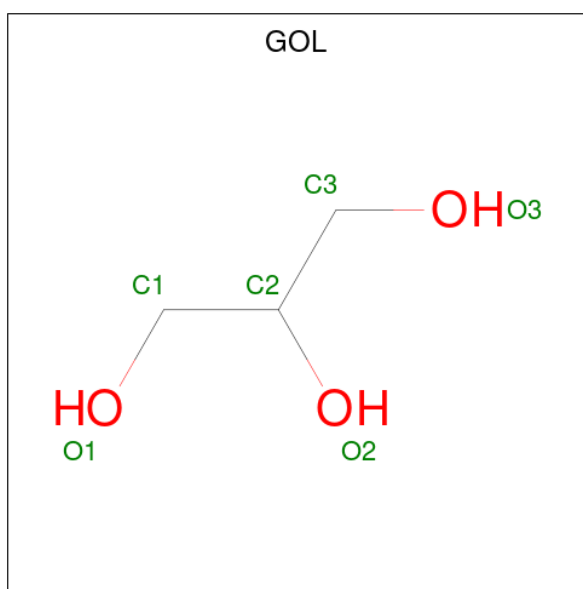


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	O	S	0	0
			8	4	2	2		
3	A	1	Total	C	O	S	0	0
			8	4	2	2		
3	B	1	Total	C	O	S	0	0
			8	4	2	2		
3	C	1	Total	C	O	S	0	0
			8	4	2	2		
3	D	1	Total	C	O	S	0	0
			8	4	2	2		

- Molecule 4 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	6	Total	Cl	0	0
			6	6		
4	B	5	Total	Cl	0	0
			5	5		
4	C	4	Total	Cl	0	0
			4	4		
4	D	5	Total	Cl	0	0
			5	5		

- Molecule 5 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



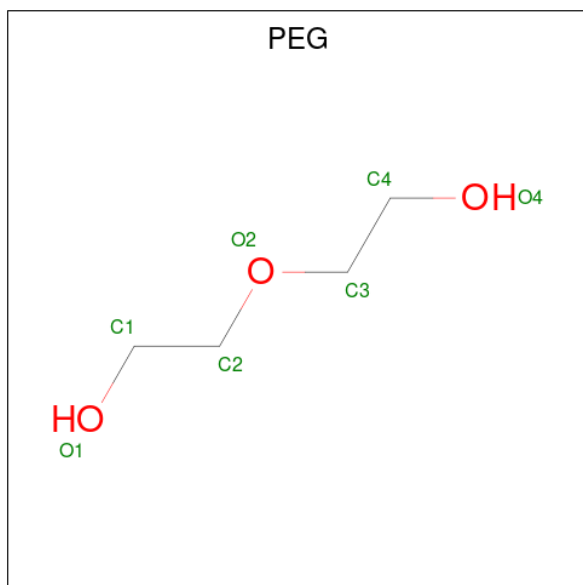
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			6	3	3		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	O	0	0
			6	3	3		
5	B	1	Total	C	O	0	0
			6	3	3		
5	C	1	Total	C	O	0	0
			6	3	3		

- Molecule 6 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: $C_4H_{10}O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			7	4	3		
6	C	1	Total	C	O	0	0
			7	4	3		

- Molecule 7 is water.

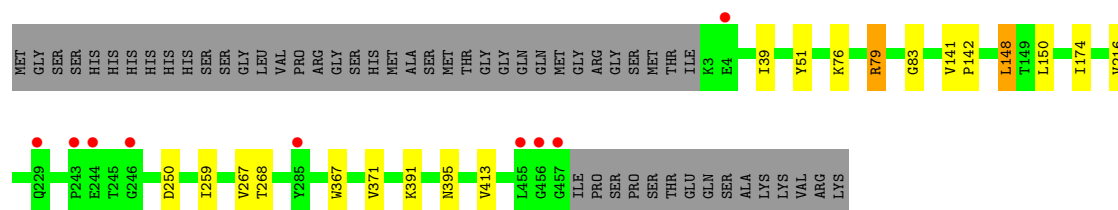
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	392	Total	O	0	2
			394	394		
7	B	344	Total	O	0	6
			350	350		
7	C	241	Total	O	0	2
			243	243		
7	D	268	Total	O	0	1
			269	269		

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.

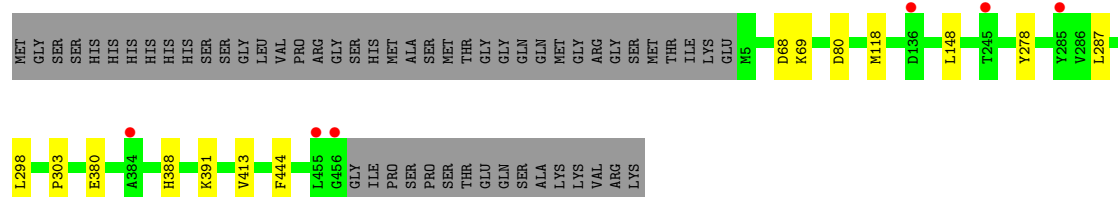
- Molecule 1: Bifunctional cytochrome P450/NADPH-P450 reductase

Chain A: 



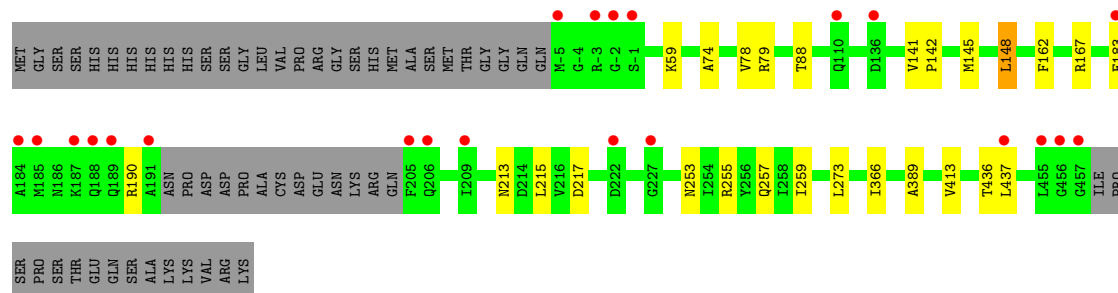
- Molecule 1: Bifunctional cytochrome P450/NADPH-P450 reductase

Chain B: 



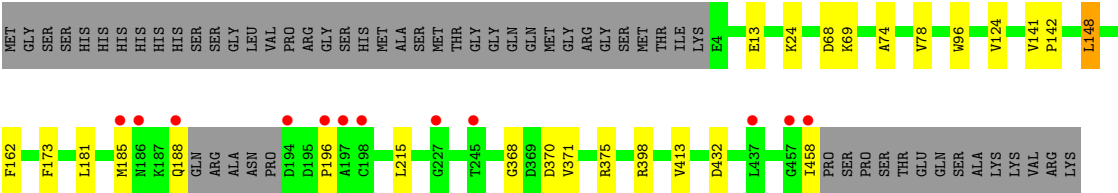
- Molecule 1: Bifunctional cytochrome P450/NADPH-P450 reductase

Chain C: 



- Molecule 1: Bifunctional cytochrome P450/NADPH-P450 reductase

Chain D: 



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	377.93Å 59.94Å 95.46Å 90.00° 95.74° 90.00°	Depositor
Resolution (Å)	47.18 – 2.16 47.18 – 2.16	Depositor EDS
% Data completeness (in resolution range)	99.6 (47.18-2.16) 99.6 (47.18-2.16)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.14	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.85 (at 2.16Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.159 , 0.202 0.168 , 0.208	Depositor DCC
R_{free} test set	5744 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	20.1	Xtriage
Anisotropy	0.434	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 47.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	16073	wwPDB-VP
Average B, all atoms (Å ²)	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.04% 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: CL, DTT, PEG, GOL, 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	0.21	0/3767	0.41	0/5094
1	B	0.21	0/3747	0.39	0/5067
1	C	0.21	0/3719	0.38	0/5021
1	D	0.20	0/3679	0.38	0/4974
All	All	0.21	0/14912	0.39	0/20156

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

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	3670	0	3678	12	0
1	B	3653	0	3649	8	0
1	C	3625	0	3645	15	0
1	D	3599	0	3582	14	0
2	A	43	0	30	1	0
2	B	43	0	30	1	0
2	C	43	0	30	2	0
2	D	43	0	30	1	0
3	A	16	0	17	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	8	0	9	0	0
3	C	8	0	9	0	0
3	D	8	0	9	0	0
4	A	6	0	0	0	0
4	B	5	0	0	0	0
4	C	4	0	0	0	0
4	D	5	0	0	0	0
5	A	12	0	16	1	0
5	B	6	0	8	0	0
5	C	6	0	8	0	0
6	A	7	0	10	0	0
6	C	7	0	10	0	0
7	A	394	0	0	1	0
7	B	350	0	0	2	0
7	C	243	0	0	1	0
7	D	269	0	0	1	0
All	All	16073	0	14770	54	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 2.

All (54) 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:D:181:LEU:O	1:D:185:MET:HE3	1.88	0.74
1:D:370:ASP:OD2	1:D:375:ARG:NH1	2.25	0.69
1:C:145[A]:MET:HE2	1:C:273:LEU:HB3	1.79	0.63
1:B:80:ASP:OD2	7:B:601:HOH:O	2.17	0.59
1:B:118:MET:HE1	7:B:687:HOH:O	2.02	0.58
1:C:217:ASP:OD1	1:C:255:ARG:NH1	2.35	0.57
1:C:59:LYS:NZ	7:C:603:HOH:O	2.37	0.57
1:D:148:LEU:HD21	1:D:413:VAL:HG21	1.89	0.54
1:B:68[A]:ASP:OD1	1:B:69:LYS:N	2.40	0.54
1:A:148:LEU:HD21	1:A:413:VAL:HG21	1.91	0.53
1:C:183:GLU:OE2	1:C:190:ARG:NH2	2.38	0.51
1:D:124:VAL:CG1	1:D:458:ILE:HD11	2.41	0.51
1:D:173:PHE:CD1	1:D:215:LEU:HD22	2.47	0.49
1:D:368:GLY:O	1:D:371:VAL:HG13	2.13	0.49
1:A:216:VAL:HG21	1:A:259:ILE:HG13	1.95	0.48
1:B:388:HIS:HA	1:B:391:LYS:HD3	1.94	0.48
1:D:375:ARG:NH2	7:D:615:HOH:O	2.46	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:501:HEM:CMB	2:C:501:HEM:HBB2	2.44	0.47
1:A:141:VAL:HB	1:A:142:PRO:HD3	1.96	0.47
1:D:68:ASP:OD1	1:D:69:LYS:N	2.48	0.46
1:C:141:VAL:HB	1:C:142:PRO:HD3	1.99	0.45
1:D:141:VAL:HB	1:D:142:PRO:HD3	1.99	0.45
1:A:83:GLY:HA2	5:A:510:GOL:H2	1.99	0.44
1:D:162:PHE:CE1	1:D:215:LEU:HD21	2.53	0.44
1:D:24:LYS:NZ	1:D:432:ASP:OD1	2.46	0.44
1:C:148:LEU:HD21	1:C:413:VAL:HG21	2.00	0.44
1:B:287:LEU:C	1:B:287:LEU:HD23	2.43	0.44
1:C:215:LEU:C	1:C:215:LEU:HD13	2.44	0.43
1:A:367:TRP:HB2	1:A:371:VAL:HG12	2.01	0.43
1:D:74:ALA:O	1:D:78:VAL:HG23	2.18	0.43
1:A:267[A]:VAL:HG13	1:A:268:THR:N	2.33	0.43
1:D:96:TRP:CZ2	1:D:398:ARG:HD2	2.53	0.43
1:C:213:ASN:OD1	1:C:259:ILE:HD11	2.18	0.43
1:B:278:TYR:HA	1:B:444:PHE:CZ	2.53	0.42
1:C:436:THR:O	1:C:437:LEU:HB2	2.19	0.42
1:A:250:ASP:OD2	7:A:601:HOH:O	2.21	0.42
1:A:76:LYS:O	1:A:79:ARG:HB2	2.20	0.42
1:B:298:LEU:HD22	1:B:303:PRO:HB3	2.00	0.42
1:C:145[A]:MET:HE3	1:C:273:LEU:HD13	2.01	0.42
1:C:253:ASN:O	1:C:257:GLN:HG2	2.20	0.42
1:A:216:VAL:HG21	1:A:259:ILE:CG1	2.50	0.42
1:A:39:ILE:HA	1:A:51:TYR:O	2.20	0.42
1:C:162:PHE:O	1:C:167[B]:ARG:NH1	2.53	0.41
1:C:366:ILE:HG21	1:C:389:ALA:HB1	2.01	0.41
2:B:501:HEM:CMC	2:B:501:HEM:HBC2	2.51	0.41
1:A:391:LYS:HE2	1:A:395:ASN:HB2	2.03	0.41
1:C:79:ARG:HG3	1:C:88:THR:HB	2.03	0.41
2:A:501:HEM:HBC2	2:A:501:HEM:CMC	2.51	0.40
2:C:501:HEM:HBB2	2:C:501:HEM:HMB2	2.03	0.40
2:D:501:HEM:CMB	2:D:501:HEM:HBB2	2.51	0.40
1:B:148:LEU:HD21	1:B:413:VAL:HG21	2.03	0.40
1:D:124:VAL:HG11	1:D:458:ILE:HD11	2.03	0.40
1:A:150:LEU:HD22	1:A:174:ILE:HD11	2.02	0.40
1:C:74:ALA:O	1:C:78:VAL:HG23	2.22	0.40

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	458/507 (90%)	444 (97%)	14 (3%)	0	100	100
1	B	455/507 (90%)	440 (97%)	15 (3%)	0	100	100
1	C	451/507 (89%)	439 (97%)	12 (3%)	0	100	100
1	D	446/507 (88%)	429 (96%)	16 (4%)	1 (0%)	43	44
All	All	1810/2028 (89%)	1752 (97%)	57 (3%)	1 (0%)	48	50

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	196	PRO

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	401/439 (91%)	399 (100%)	2 (0%)	81	87
1	B	399/439 (91%)	398 (100%)	1 (0%)	86	91
1	C	395/439 (90%)	394 (100%)	1 (0%)	86	91
1	D	392/439 (89%)	389 (99%)	3 (1%)	73	79
All	All	1587/1756 (90%)	1580 (100%)	7 (0%)	84	89

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	79	ARG
1	A	148	LEU
1	B	380	GLU
1	C	148	LEU
1	D	13	GLU
1	D	148	LEU
1	D	188	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	27	GLN
1	A	70	ASN
1	A	189	GLN
1	B	70	ASN
1	B	239	ASN
1	B	288	GLN
1	C	70	ASN
1	C	95	ASN
1	D	92	HIS
1	D	204	GLN
1	D	428	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](#)

Of 35 ligands modelled in this entry, 20 are monoatomic - leaving 15 for Mogul analysis.

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	$\# Z > 2$
5	GOL	C	507	-	5,5,5	1.02	0	5,5,5	1.02	0
3	DTT	A	502	2	7,7,7	0.37	0	4,8,8	0.90	0
3	DTT	C	502	2	7,7,7	0.42	0	4,8,8	0.58	0
5	GOL	A	510	-	5,5,5	1.12	0	5,5,5	0.90	0
5	GOL	A	511	-	5,5,5	0.97	0	5,5,5	1.01	0
3	DTT	D	502	2	7,7,7	0.52	0	4,8,8	0.80	0
2	HEM	A	501	1,3	50,50,50	1.37	6 (12%)	67,82,82	1.16	7 (10%)
2	HEM	C	501	1,3	50,50,50	1.37	8 (16%)	67,82,82	1.09	5 (7%)
5	GOL	B	508	-	5,5,5	0.87	0	5,5,5	1.05	0
2	HEM	B	501	1,3	50,50,50	1.37	8 (16%)	67,82,82	1.22	6 (8%)
6	PEG	A	512	-	6,6,6	0.39	0	5,5,5	1.01	0
6	PEG	C	508	-	6,6,6	0.45	0	5,5,5	0.29	0
3	DTT	A	503	1	7,7,7	0.39	0	4,8,8	0.68	0
2	HEM	D	501	1,3	50,50,50	1.29	5 (10%)	67,82,82	1.10	4 (5%)
3	DTT	B	502	2	7,7,7	0.41	0	4,8,8	0.63	0

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
5	GOL	C	507	-	-	1/4/4/4	-
3	DTT	A	502	2	-	3/8/8/8	-
3	DTT	C	502	2	-	3/8/8/8	-
5	GOL	A	510	-	-	2/4/4/4	-
5	GOL	A	511	-	-	3/4/4/4	-
3	DTT	D	502	2	-	5/8/8/8	-
2	HEM	A	501	1,3	-	4/14/54/54	-
2	HEM	C	501	1,3	-	4/14/54/54	-
5	GOL	B	508	-	-	1/4/4/4	-
2	HEM	B	501	1,3	-	2/14/54/54	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	PEG	A	512	-	-	2/4/4/4	-
6	PEG	C	508	-	-	4/4/4/4	-
3	DTT	A	503	1	-	1/8/8/8	-
2	HEM	D	501	1,3	-	3/14/54/54	-
3	DTT	B	502	2	-	4/8/8/8	-

All (27) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	501	HEM	FE-NB	3.87	2.06	1.94
2	C	501	HEM	FE-NA	3.63	2.07	1.95
2	B	501	HEM	FE-ND	3.29	2.05	1.94
2	B	501	HEM	FE-NA	3.25	2.05	1.95
2	A	501	HEM	FE-ND	3.03	2.04	1.94
2	C	501	HEM	FE-NC	3.02	2.05	1.95
2	C	501	HEM	CAC-C3C	3.01	1.55	1.47
2	D	501	HEM	CAB-C3B	2.95	1.55	1.47
2	A	501	HEM	CAC-C3C	2.94	1.55	1.47
2	D	501	HEM	FE-NB	2.90	2.03	1.94
2	A	501	HEM	CAB-C3B	2.87	1.55	1.47
2	B	501	HEM	CAC-C3C	2.78	1.54	1.47
2	D	501	HEM	FE-NC	2.74	2.04	1.95
2	D	501	HEM	CAC-C3C	2.74	1.54	1.47
2	C	501	HEM	CAB-C3B	2.69	1.54	1.47
2	B	501	HEM	FE-NB	2.69	2.03	1.94
2	B	501	HEM	CAB-C3B	2.61	1.54	1.47
2	C	501	HEM	FE-NB	2.45	2.02	1.94
2	A	501	HEM	FE-NA	2.43	2.03	1.95
2	B	501	HEM	FE-NC	2.42	2.03	1.95
2	C	501	HEM	CMB-C2B	2.40	1.55	1.50
2	D	501	HEM	FE-NA	2.30	2.02	1.95
2	B	501	HEM	CMC-C2C	2.21	1.55	1.50
2	A	501	HEM	CMA-C3A	2.12	1.55	1.50
2	C	501	HEM	CMA-C3A	2.09	1.55	1.50
2	C	501	HEM	FE-ND	2.08	2.01	1.94
2	B	501	HEM	CMD-C2D	2.08	1.55	1.50

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	501	HEM	C1B-NB-C4B	3.00	108.75	105.21

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	501	HEM	C1B-NB-C4B	2.69	108.39	105.21
2	A	501	HEM	C3B-C2B-C1B	2.64	108.40	106.41
2	A	501	HEM	C4D-ND-C1D	2.60	108.28	105.21
2	B	501	HEM	CBD-CAD-C3D	-2.57	105.44	112.53
2	B	501	HEM	C3D-C4D-ND	-2.55	107.38	110.17
2	B	501	HEM	C4D-ND-C1D	2.53	108.20	105.21
2	C	501	HEM	C3B-C4B-NB	-2.38	107.76	109.47
2	B	501	HEM	C3B-C4B-NB	-2.32	107.80	109.47
2	C	501	HEM	C1B-NB-C4B	2.25	107.88	105.21
2	D	501	HEM	C1B-NB-C4B	2.22	107.83	105.21
2	D	501	HEM	C2A-C1A-NA	-2.21	107.70	110.15
2	A	501	HEM	C2B-C1B-NB	-2.19	107.32	109.84
2	C	501	HEM	C4D-ND-C1D	2.18	107.78	105.21
2	A	501	HEM	C3B-C4B-NB	-2.16	107.91	109.47
2	D	501	HEM	C3D-C4D-ND	-2.14	107.82	110.17
2	D	501	HEM	C4D-ND-C1D	2.11	107.71	105.21
2	B	501	HEM	CHD-C1D-ND	2.11	126.69	124.42
2	C	501	HEM	CBD-CAD-C3D	-2.11	106.71	112.53
2	A	501	HEM	C3D-C4D-ND	-2.09	107.88	110.17
2	C	501	HEM	C3D-C4D-ND	-2.07	107.90	110.17
2	A	501	HEM	C2D-C1D-ND	-2.00	107.59	109.90

There are no chirality outliers.

All (42) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	502	DTT	C1-C2-C3-O3
3	A	502	DTT	O2-C2-C3-O3
3	A	502	DTT	O2-C2-C3-C4
3	A	503	DTT	C1-C2-C3-O3
3	B	502	DTT	C1-C2-C3-O3
3	B	502	DTT	O2-C2-C3-O3
3	B	502	DTT	O2-C2-C3-C4
3	C	502	DTT	C1-C2-C3-O3
3	C	502	DTT	O2-C2-C3-C4
3	D	502	DTT	C1-C2-C3-O3
3	D	502	DTT	C1-C2-C3-C4
3	D	502	DTT	O2-C2-C3-O3
3	D	502	DTT	O2-C2-C3-C4
3	D	502	DTT	O3-C3-C4-S4
5	A	510	GOL	O1-C1-C2-O2
6	A	512	PEG	O2-C3-C4-O4

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Mol	Chain	Res	Type	Atoms
6	C	508	PEG	O2-C3-C4-O4
5	A	510	GOL	O1-C1-C2-C3
5	A	511	GOL	C1-C2-C3-O3
5	A	511	GOL	O2-C2-C3-O3
6	C	508	PEG	O1-C1-C2-O2
3	C	502	DTT	O2-C2-C3-O3
5	A	511	GOL	O1-C1-C2-O2
5	C	507	GOL	O1-C1-C2-O2
6	C	508	PEG	C4-C3-O2-C2
6	A	512	PEG	C4-C3-O2-C2
5	B	508	GOL	O2-C2-C3-O3
2	B	501	HEM	CAD-CBD-CGD-O2D
2	D	501	HEM	CAD-CBD-CGD-O2D
2	C	501	HEM	CAA-CBA-CGA-O2A
2	B	501	HEM	CAD-CBD-CGD-O1D
2	C	501	HEM	CAD-CBD-CGD-O2D
2	D	501	HEM	CAD-CBD-CGD-O1D
2	C	501	HEM	CAD-CBD-CGD-O1D
2	A	501	HEM	CAD-CBD-CGD-O2D
3	B	502	DTT	C1-C2-C3-C4
6	C	508	PEG	C1-C2-O2-C3
2	A	501	HEM	CAD-CBD-CGD-O1D
2	A	501	HEM	CAA-CBA-CGA-O2A
2	C	501	HEM	CAA-CBA-CGA-O1A
2	D	501	HEM	CAA-CBA-CGA-O2A
2	A	501	HEM	CAA-CBA-CGA-O1A

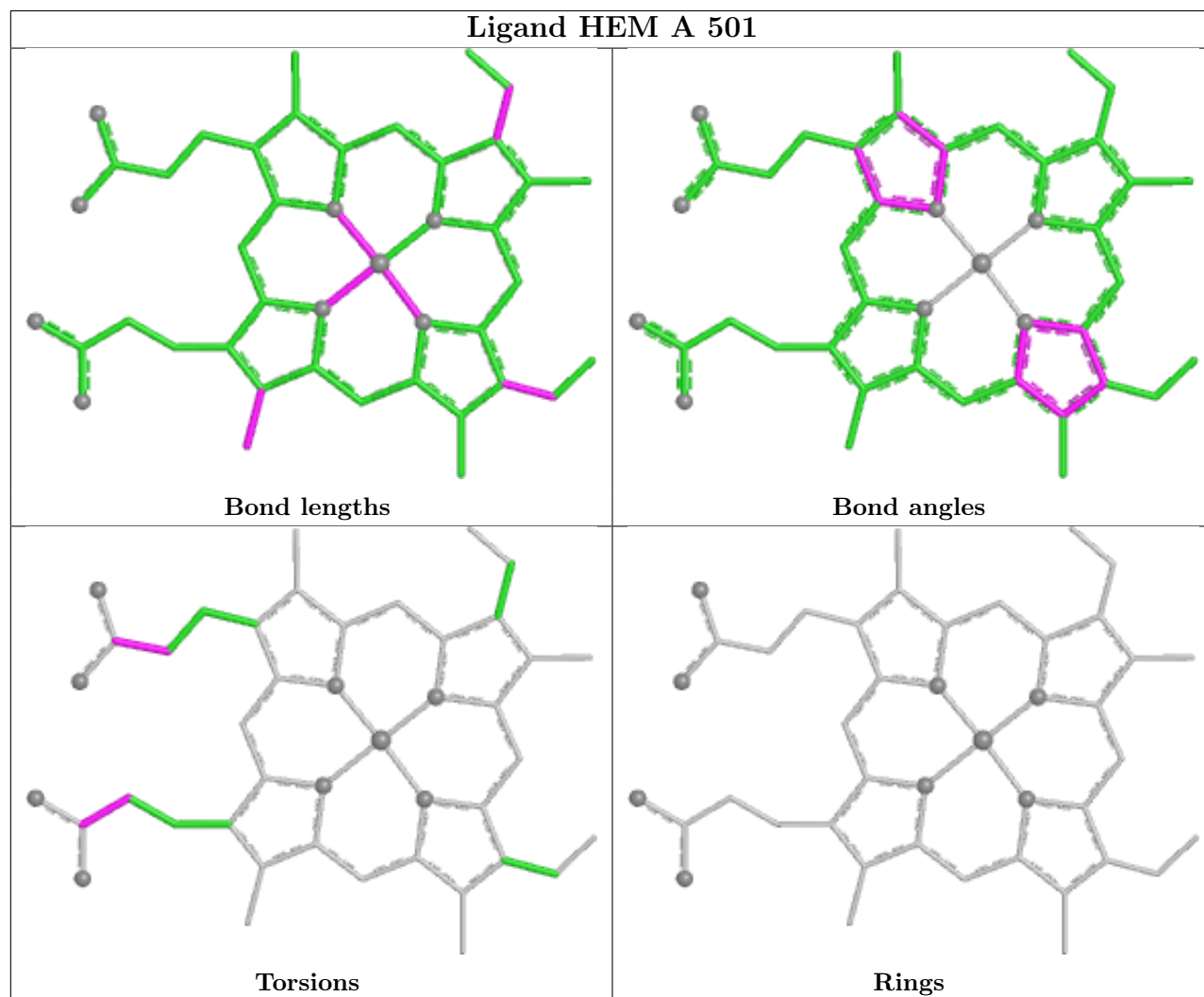
There are no ring outliers.

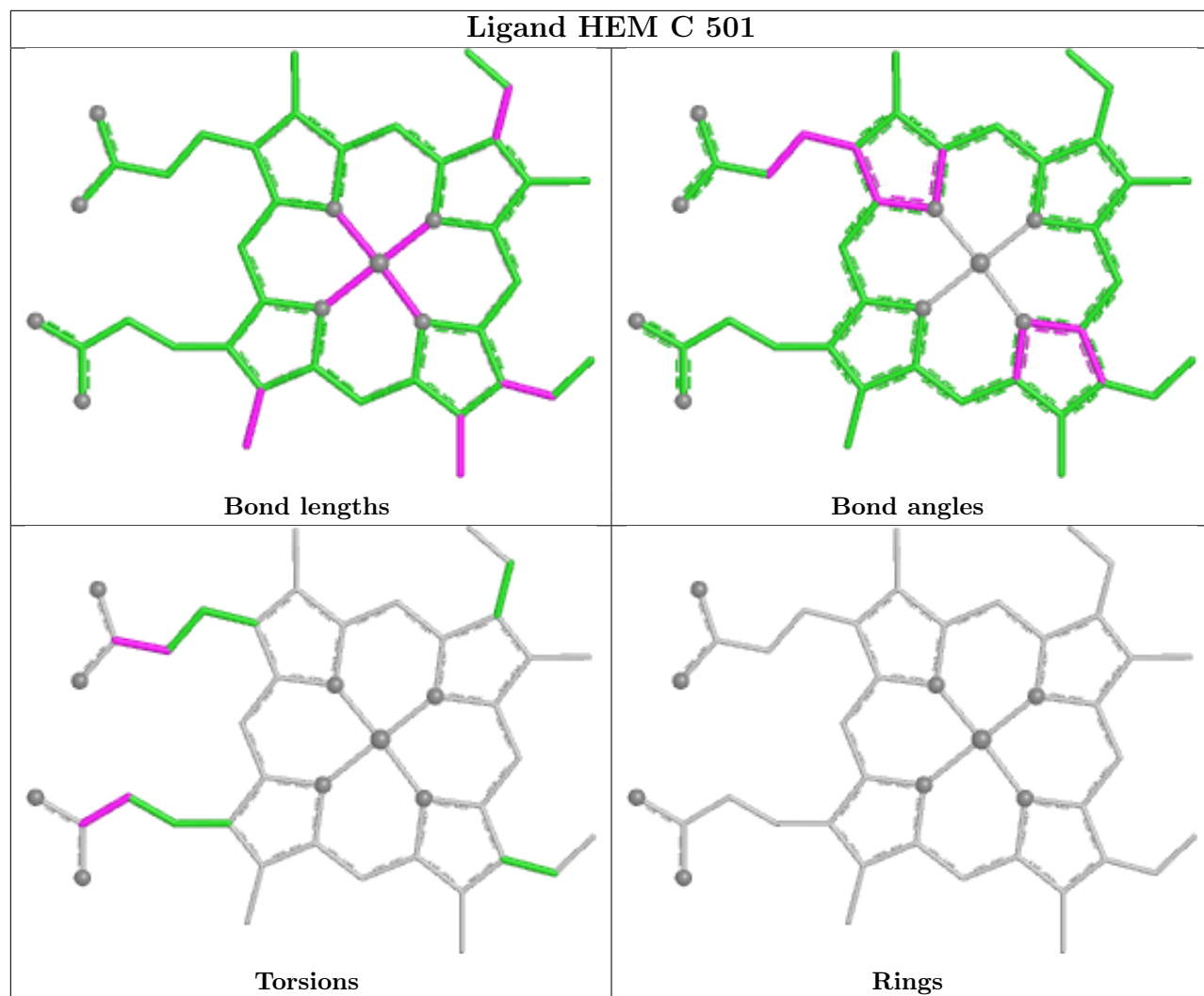
5 monomers are involved in 6 short contacts:

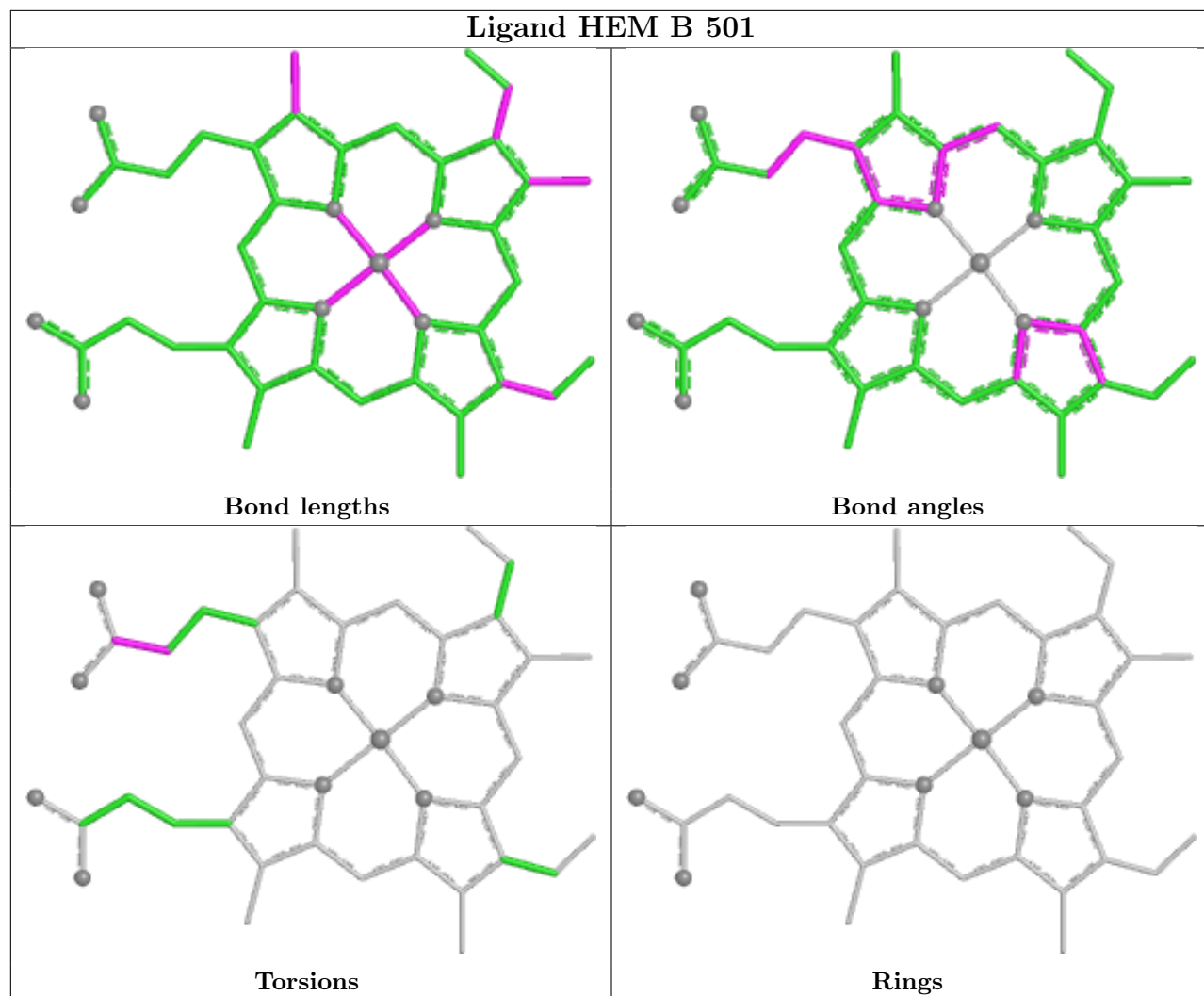
Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	510	GOL	1	0
2	A	501	HEM	1	0
2	C	501	HEM	2	0
2	B	501	HEM	1	0
2	D	501	HEM	1	0

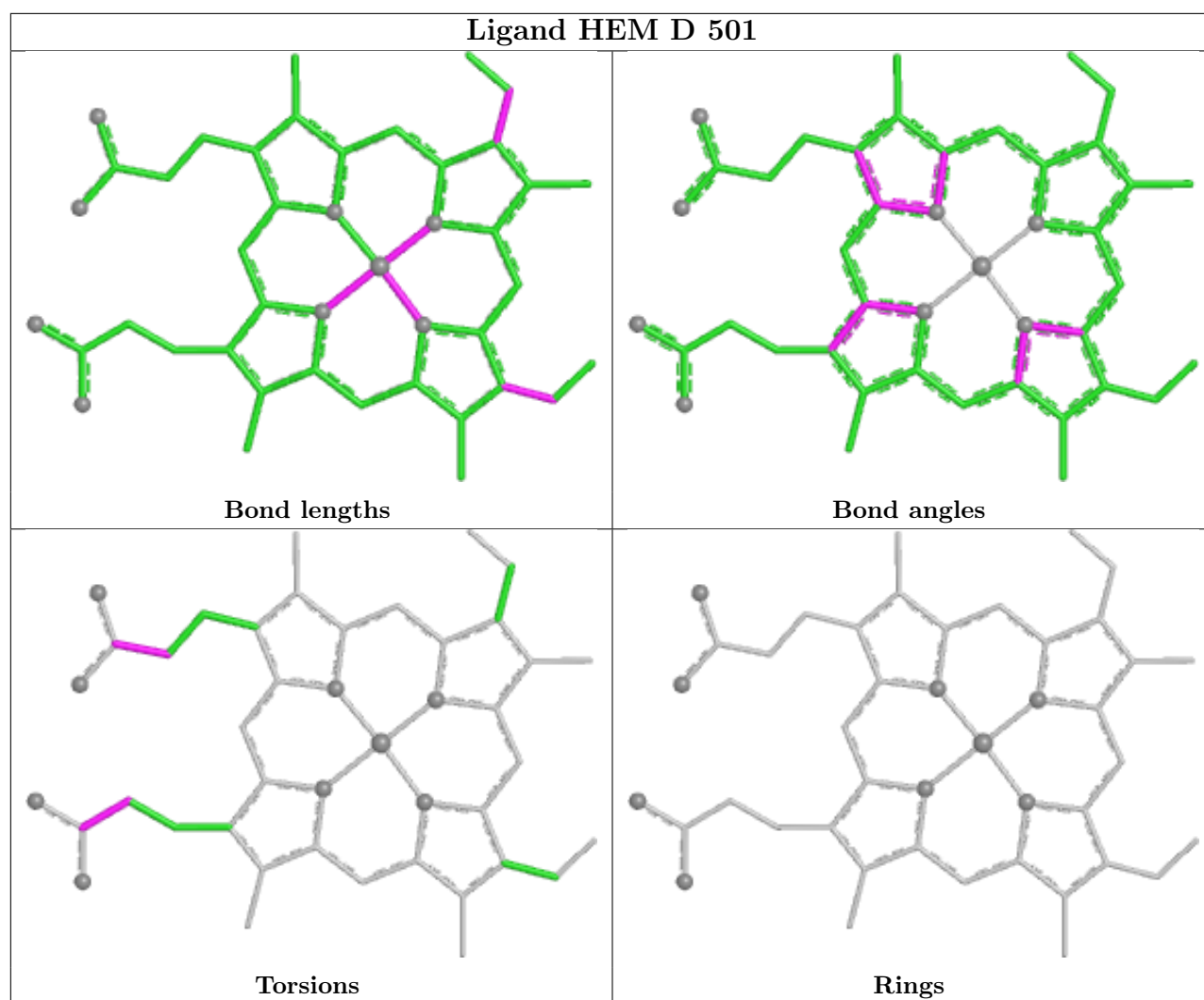
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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, 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	455/507 (89%)	-0.32	9 (1%) 65 69	10, 20, 44, 79	5 (1%)
1	B	452/507 (89%)	-0.29	6 (1%) 75 78	11, 21, 45, 72	5 (1%)
1	C	450/507 (88%)	-0.05	22 (4%) 35 39	11, 25, 59, 88	5 (1%)
1	D	450/507 (88%)	-0.02	12 (2%) 56 60	11, 25, 59, 86	0
All	All	1807/2028 (89%)	-0.17	49 (2%) 56 60	10, 23, 53, 88	15 (0%)

All (49) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	205	PHE	5.2
1	D	196	PRO	4.6
1	C	189	GLN	4.5
1	C	-5	MET	4.4
1	A	456	GLY	4.0
1	C	185	MET	3.9
1	D	188	GLN	3.6
1	D	437	LEU	3.5
1	C	-2	GLY	3.4
1	C	206	GLN	3.3
1	C	-3	ARG	3.2
1	B	455	LEU	3.1
1	C	227	GLY	3.1
1	D	227	GLY	3.1
1	B	136	ASP	3.0
1	C	457	GLY	3.0
1	B	245	THR	3.0
1	D	457	GLY	2.8
1	C	191	ALA	2.8
1	D	186	ASN	2.8
1	D	458	ILE	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	285	TYR	2.6
1	C	222	ASP	2.6
1	A	243	PRO	2.6
1	D	194	ASP	2.6
1	A	457	GLY	2.6
1	C	456	GLY	2.6
1	A	229	GLN	2.5
1	A	246	GLY	2.5
1	A	285	TYR	2.5
1	B	384	ALA	2.5
1	C	184	ALA	2.5
1	D	198	CYS	2.4
1	A	455	LEU	2.4
1	C	136	ASP	2.4
1	D	197	ALA	2.4
1	C	209	ILE	2.4
1	C	183	GLU	2.3
1	C	437	LEU	2.3
1	A	244	GLU	2.2
1	C	187	LYS	2.2
1	C	-1	SER	2.2
1	D	185	MET	2.2
1	B	456	GLY	2.2
1	C	110	GLN	2.1
1	C	188	GLN	2.1
1	A	4	GLU	2.0
1	C	455	LEU	2.0
1	D	245	THR	2.0

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 oligosaccharides 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,

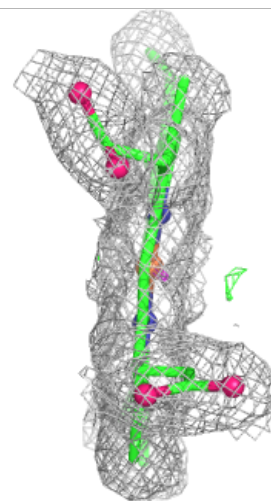
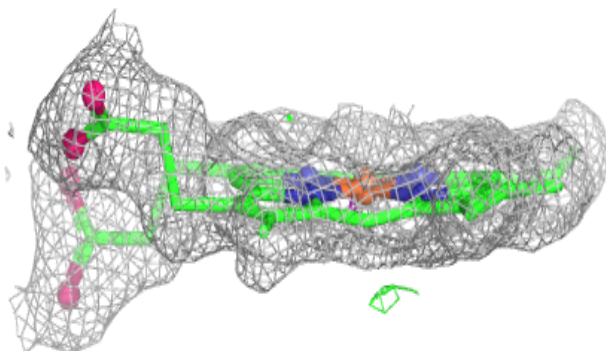
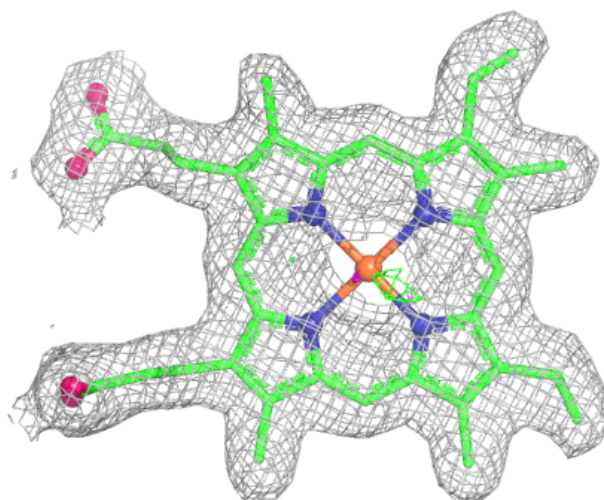
median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	GOL	A	511	6/6	0.68	0.22	64,66,67,68	0
5	GOL	B	508	6/6	0.78	0.20	52,54,54,57	0
6	PEG	C	508	7/7	0.81	0.22	65,69,72,73	0
5	GOL	C	507	6/6	0.83	0.19	56,58,61,62	0
6	PEG	A	512	7/7	0.86	0.30	72,73,76,77	0
3	DTT	C	502	8/8	0.86	0.17	48,55,63,68	0
3	DTT	A	502	8/8	0.87	0.15	50,55,60,64	0
3	DTT	B	502	8/8	0.87	0.16	50,54,59,63	0
3	DTT	D	502	8/8	0.89	0.15	54,59,64,68	0
5	GOL	A	510	6/6	0.90	0.12	36,46,49,50	0
3	DTT	A	503	8/8	0.91	0.14	34,44,49,54	0
4	CL	B	504	1/1	0.92	0.15	57,57,57,57	0
4	CL	A	507	1/1	0.93	0.18	56,56,56,56	0
4	CL	B	506	1/1	0.93	0.15	47,47,47,47	0
4	CL	C	503	1/1	0.93	0.12	54,54,54,54	0
4	CL	C	504	1/1	0.94	0.10	52,52,52,52	0
4	CL	A	504	1/1	0.95	0.17	52,52,52,52	0
4	CL	B	503	1/1	0.95	0.10	47,47,47,47	0
4	CL	D	506	1/1	0.96	0.11	45,45,45,45	0
4	CL	A	505	1/1	0.97	0.11	44,44,44,44	0
4	CL	D	504	1/1	0.97	0.06	38,38,38,38	0
4	CL	B	505	1/1	0.97	0.12	40,40,40,40	0
4	CL	B	507	1/1	0.98	0.06	27,27,27,27	0
2	HEM	C	501	43/43	0.98	0.05	12,15,18,22	0
4	CL	A	508	1/1	0.98	0.05	28,28,28,28	0
4	CL	C	505	1/1	0.98	0.06	44,44,44,44	0
4	CL	C	506	1/1	0.98	0.07	35,35,35,35	0
4	CL	D	503	1/1	0.98	0.09	36,36,36,36	0
2	HEM	B	501	43/43	0.98	0.06	9,13,20,24	0
2	HEM	A	501	43/43	0.99	0.05	7,11,13,14	0
4	CL	D	505	1/1	0.99	0.04	40,40,40,40	0
4	CL	A	509	1/1	0.99	0.12	42,42,42,42	0
4	CL	D	507	1/1	0.99	0.05	33,33,33,33	0
2	HEM	D	501	43/43	0.99	0.05	11,16,19,20	0
4	CL	A	506	1/1	1.00	0.07	29,29,29,29	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.

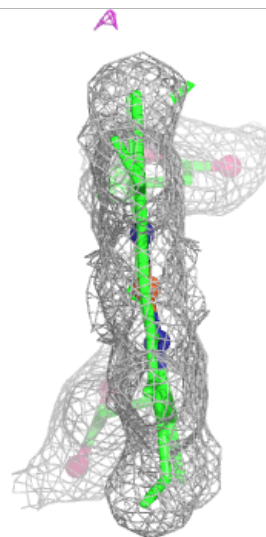
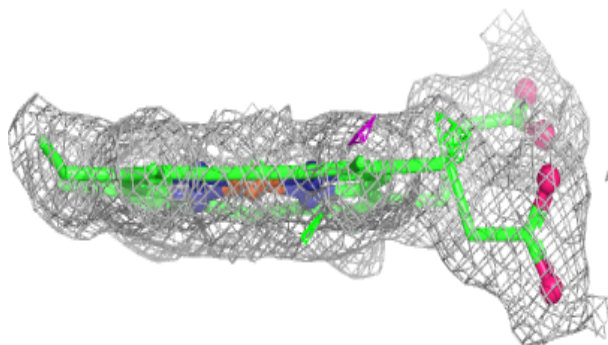
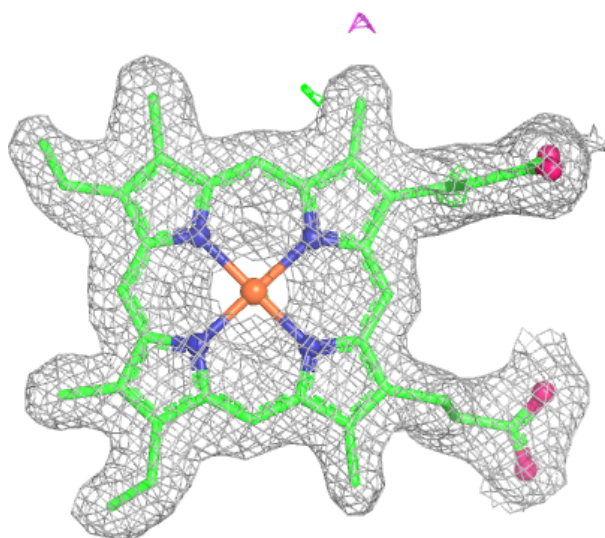
Electron density around HEM C 501:

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



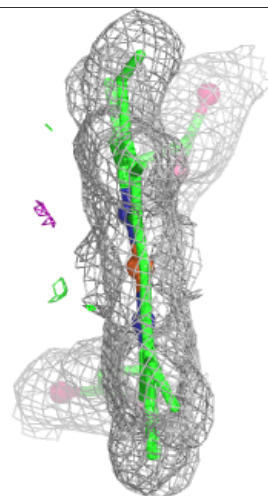
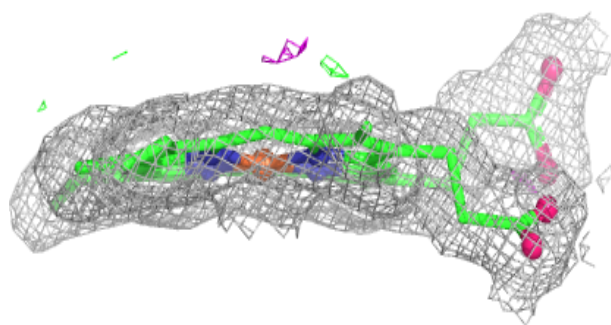
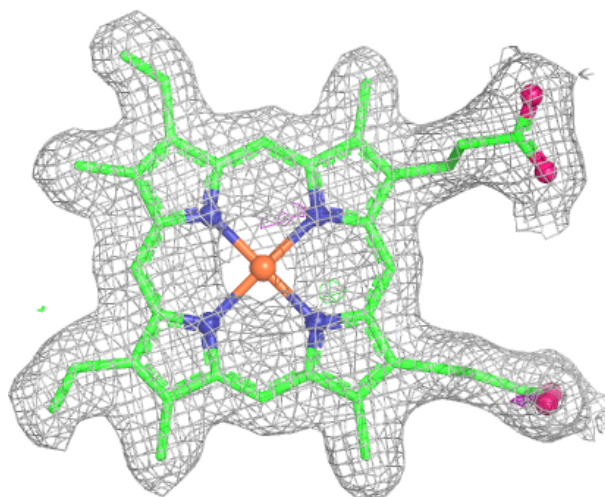
Electron density around HEM B 501:

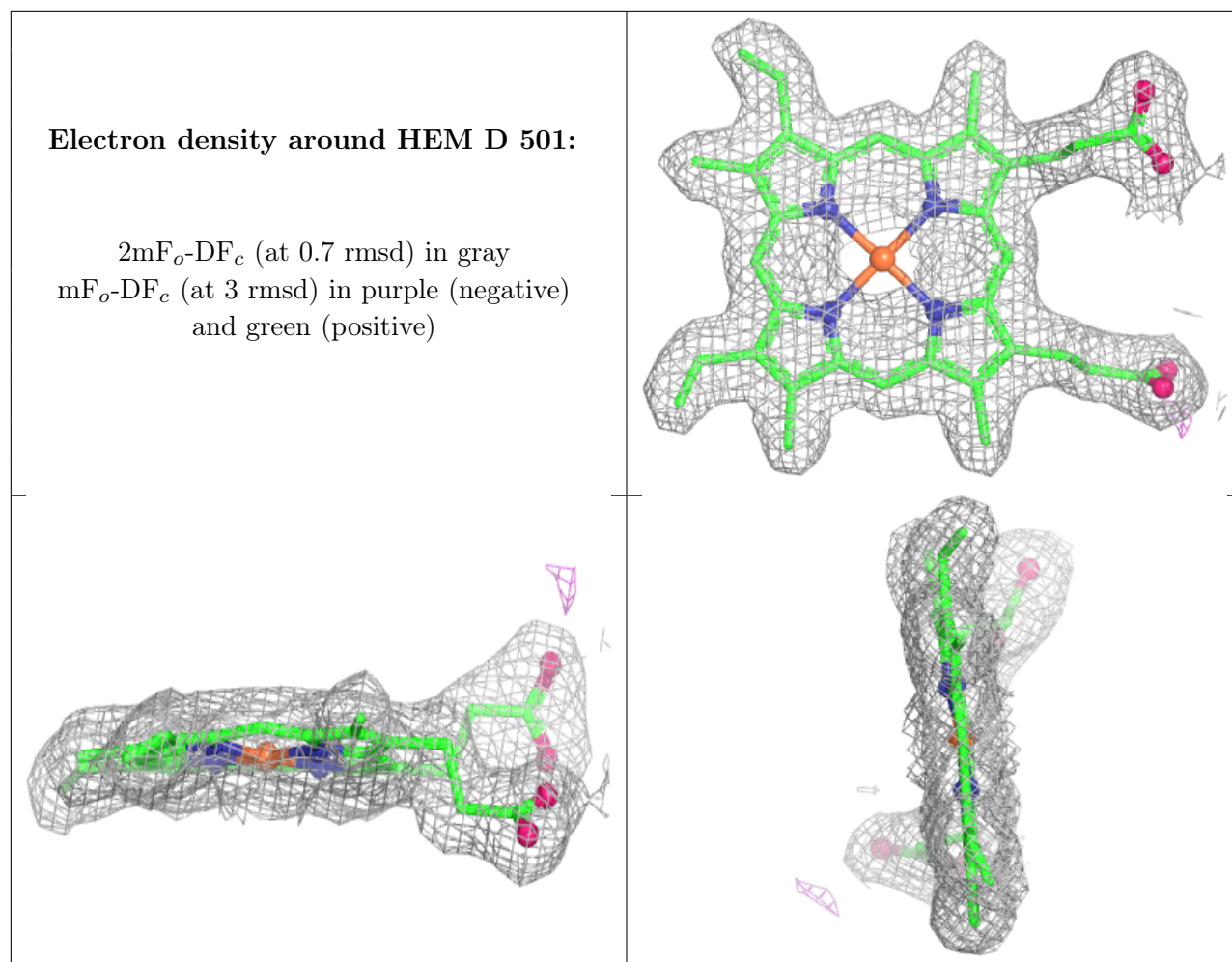
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around HEM A 501:

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





6.5 Other polymers [i](#)

There are no such residues in this entry.