



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 15, 2023 – 04:03 PM EDT

PDB ID : 8DSG
Title : P411-PFA carbene transferase
Authors : Maggiolo, A.O.; Porter, N.J.; Zhang, J.; Arnold, F.H.
Deposited on : 2022-07-22
Resolution : 1.87 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
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) : 2.36

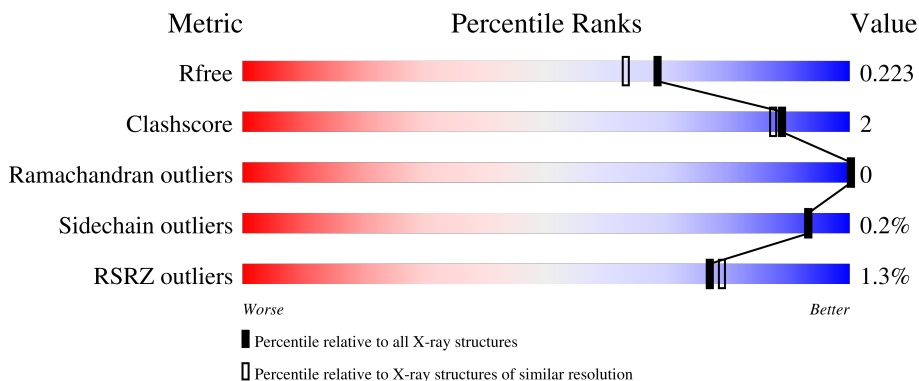
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.87 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	9470 (1.90-1.86)
Clashscore	141614	10282 (1.90-1.86)
Ramachandran outliers	138981	10152 (1.90-1.86)
Sidechain outliers	138945	10152 (1.90-1.86)
RSRZ outliers	127900	9303 (1.90-1.86)

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	472	 92% . 5%
1	B	472	 93% . .
1	C	472	 91% . 6%
1	D	472	 93% . 5%

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
5	BTB	A	506	-	-	-	X

2 Entry composition i

There are 6 unique types of molecules in this entry. The entry contains 15955 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Cytochrome P450-BM3 variant P411-PFA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	450	Total 3678	C 2355	N 624	O 682	S 17	0	7	0
1	B	451	Total 3695	C 2366	N 626	O 686	S 17	0	9	0
1	C	445	Total 3652	C 2340	N 620	O 676	S 16	0	8	0
1	D	449	Total 3679	C 2355	N 624	O 683	S 17	0	8	0

There are 136 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	70	THR	ASN	engineered mutation	UNP F2Q7T0
A	74	GLY	ALA	engineered mutation	UNP F2Q7T0
A	78	LEU	VAL	engineered mutation	UNP F2Q7T0
A	82	LEU	ALA	engineered mutation	UNP F2Q7T0
A	87	ALA	PHE	engineered mutation	UNP F2Q7T0
A	118	SER	MET	engineered mutation	UNP F2Q7T0
A	142	SER	PRO	engineered mutation	UNP F2Q7T0
A	175	ILE	THR	engineered mutation	UNP F2Q7T0
A	184	VAL	ALA	engineered mutation	UNP F2Q7T0
A	226	THR	SER	engineered mutation	UNP F2Q7T0
A	236	GLN	HIS	engineered mutation	UNP F2Q7T0
A	252	GLY	GLU	engineered mutation	UNP F2Q7T0
A	263	TYR	ILE	engineered mutation	UNP F2Q7T0
A	266	VAL	HIS	engineered mutation	UNP F2Q7T0
A	268	GLY	THR	engineered mutation	UNP F2Q7T0
A	290	VAL	ALA	engineered mutation	UNP F2Q7T0
A	327	VAL	THR	engineered mutation	UNP F2Q7T0
A	328	VAL	ALA	engineered mutation	UNP F2Q7T0
A	330	VAL	ALA	engineered mutation	UNP F2Q7T0
A	353	VAL	LEU	engineered mutation	UNP F2Q7T0
A	366	VAL	ILE	engineered mutation	UNP F2Q7T0

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Chain	Residue	Modelled	Actual	Comment	Reference
A	400	SER	CYS	engineered mutation	UNP F2Q7T0
A	401	PRO	ILE	engineered mutation	UNP F2Q7T0
A	436	LEU	THR	engineered mutation	UNP F2Q7T0
A	437	GLN	LEU	engineered mutation	UNP F2Q7T0
A	442	LYS	GLU	engineered mutation	UNP F2Q7T0
A	464	LEU	-	expression tag	UNP F2Q7T0
A	465	GLU	-	expression tag	UNP F2Q7T0
A	466	HIS	-	expression tag	UNP F2Q7T0
A	467	HIS	-	expression tag	UNP F2Q7T0
A	468	HIS	-	expression tag	UNP F2Q7T0
A	469	HIS	-	expression tag	UNP F2Q7T0
A	470	HIS	-	expression tag	UNP F2Q7T0
A	471	HIS	-	expression tag	UNP F2Q7T0
B	70	THR	ASN	engineered mutation	UNP F2Q7T0
B	74	GLY	ALA	engineered mutation	UNP F2Q7T0
B	78	LEU	VAL	engineered mutation	UNP F2Q7T0
B	82	LEU	ALA	engineered mutation	UNP F2Q7T0
B	87	ALA	PHE	engineered mutation	UNP F2Q7T0
B	118	SER	MET	engineered mutation	UNP F2Q7T0
B	142	SER	PRO	engineered mutation	UNP F2Q7T0
B	175	ILE	THR	engineered mutation	UNP F2Q7T0
B	184	VAL	ALA	engineered mutation	UNP F2Q7T0
B	226	THR	SER	engineered mutation	UNP F2Q7T0
B	236	GLN	HIS	engineered mutation	UNP F2Q7T0
B	252	GLY	GLU	engineered mutation	UNP F2Q7T0
B	263	TYR	ILE	engineered mutation	UNP F2Q7T0
B	266	VAL	HIS	engineered mutation	UNP F2Q7T0
B	268	GLY	THR	engineered mutation	UNP F2Q7T0
B	290	VAL	ALA	engineered mutation	UNP F2Q7T0
B	327	VAL	THR	engineered mutation	UNP F2Q7T0
B	328	VAL	ALA	engineered mutation	UNP F2Q7T0
B	330	VAL	ALA	engineered mutation	UNP F2Q7T0
B	353	VAL	LEU	engineered mutation	UNP F2Q7T0
B	366	VAL	ILE	engineered mutation	UNP F2Q7T0
B	400	SER	CYS	engineered mutation	UNP F2Q7T0
B	401	PRO	ILE	engineered mutation	UNP F2Q7T0
B	436	LEU	THR	engineered mutation	UNP F2Q7T0
B	437	GLN	LEU	engineered mutation	UNP F2Q7T0
B	442	LYS	GLU	engineered mutation	UNP F2Q7T0
B	464	LEU	-	expression tag	UNP F2Q7T0
B	465	GLU	-	expression tag	UNP F2Q7T0
B	466	HIS	-	expression tag	UNP F2Q7T0

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Chain	Residue	Modelled	Actual	Comment	Reference
B	467	HIS	-	expression tag	UNP F2Q7T0
B	468	HIS	-	expression tag	UNP F2Q7T0
B	469	HIS	-	expression tag	UNP F2Q7T0
B	470	HIS	-	expression tag	UNP F2Q7T0
B	471	HIS	-	expression tag	UNP F2Q7T0
C	70	THR	ASN	engineered mutation	UNP F2Q7T0
C	74	GLY	ALA	engineered mutation	UNP F2Q7T0
C	78	LEU	VAL	engineered mutation	UNP F2Q7T0
C	82	LEU	ALA	engineered mutation	UNP F2Q7T0
C	87	ALA	PHE	engineered mutation	UNP F2Q7T0
C	118	SER	MET	engineered mutation	UNP F2Q7T0
C	142	SER	PRO	engineered mutation	UNP F2Q7T0
C	175	ILE	THR	engineered mutation	UNP F2Q7T0
C	184	VAL	ALA	engineered mutation	UNP F2Q7T0
C	226	THR	SER	engineered mutation	UNP F2Q7T0
C	236	GLN	HIS	engineered mutation	UNP F2Q7T0
C	252	GLY	GLU	engineered mutation	UNP F2Q7T0
C	263	TYR	ILE	engineered mutation	UNP F2Q7T0
C	266	VAL	HIS	engineered mutation	UNP F2Q7T0
C	268	GLY	THR	engineered mutation	UNP F2Q7T0
C	290	VAL	ALA	engineered mutation	UNP F2Q7T0
C	327	VAL	THR	engineered mutation	UNP F2Q7T0
C	328	VAL	ALA	engineered mutation	UNP F2Q7T0
C	330	VAL	ALA	engineered mutation	UNP F2Q7T0
C	353	VAL	LEU	engineered mutation	UNP F2Q7T0
C	366	VAL	ILE	engineered mutation	UNP F2Q7T0
C	400	SER	CYS	engineered mutation	UNP F2Q7T0
C	401	PRO	ILE	engineered mutation	UNP F2Q7T0
C	436	LEU	THR	engineered mutation	UNP F2Q7T0
C	437	GLN	LEU	engineered mutation	UNP F2Q7T0
C	442	LYS	GLU	engineered mutation	UNP F2Q7T0
C	464	LEU	-	expression tag	UNP F2Q7T0
C	465	GLU	-	expression tag	UNP F2Q7T0
C	466	HIS	-	expression tag	UNP F2Q7T0
C	467	HIS	-	expression tag	UNP F2Q7T0
C	468	HIS	-	expression tag	UNP F2Q7T0
C	469	HIS	-	expression tag	UNP F2Q7T0
C	470	HIS	-	expression tag	UNP F2Q7T0
C	471	HIS	-	expression tag	UNP F2Q7T0
D	70	THR	ASN	engineered mutation	UNP F2Q7T0
D	74	GLY	ALA	engineered mutation	UNP F2Q7T0
D	78	LEU	VAL	engineered mutation	UNP F2Q7T0

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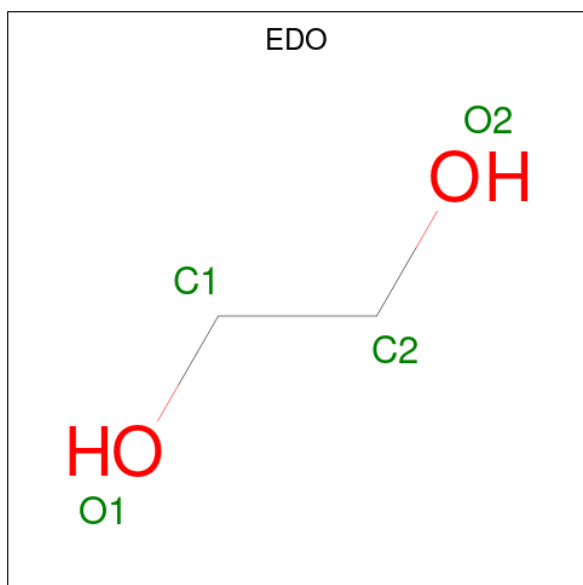
Chain	Residue	Modelled	Actual	Comment	Reference
D	82	LEU	ALA	engineered mutation	UNP F2Q7T0
D	87	ALA	PHE	engineered mutation	UNP F2Q7T0
D	118	SER	MET	engineered mutation	UNP F2Q7T0
D	142	SER	PRO	engineered mutation	UNP F2Q7T0
D	175	ILE	THR	engineered mutation	UNP F2Q7T0
D	184	VAL	ALA	engineered mutation	UNP F2Q7T0
D	226	THR	SER	engineered mutation	UNP F2Q7T0
D	236	GLN	HIS	engineered mutation	UNP F2Q7T0
D	252	GLY	GLU	engineered mutation	UNP F2Q7T0
D	263	TYR	ILE	engineered mutation	UNP F2Q7T0
D	266	VAL	HIS	engineered mutation	UNP F2Q7T0
D	268	GLY	THR	engineered mutation	UNP F2Q7T0
D	290	VAL	ALA	engineered mutation	UNP F2Q7T0
D	327	VAL	THR	engineered mutation	UNP F2Q7T0
D	328	VAL	ALA	engineered mutation	UNP F2Q7T0
D	330	VAL	ALA	engineered mutation	UNP F2Q7T0
D	353	VAL	LEU	engineered mutation	UNP F2Q7T0
D	366	VAL	ILE	engineered mutation	UNP F2Q7T0
D	400	SER	CYS	engineered mutation	UNP F2Q7T0
D	401	PRO	ILE	engineered mutation	UNP F2Q7T0
D	436	LEU	THR	engineered mutation	UNP F2Q7T0
D	437	GLN	LEU	engineered mutation	UNP F2Q7T0
D	442	LYS	GLU	engineered mutation	UNP F2Q7T0
D	464	LEU	-	expression tag	UNP F2Q7T0
D	465	GLU	-	expression tag	UNP F2Q7T0
D	466	HIS	-	expression tag	UNP F2Q7T0
D	467	HIS	-	expression tag	UNP F2Q7T0
D	468	HIS	-	expression tag	UNP F2Q7T0
D	469	HIS	-	expression tag	UNP F2Q7T0
D	470	HIS	-	expression tag	UNP F2Q7T0
D	471	HIS	-	expression tag	UNP F2Q7T0

- Molecule 2 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: C₃₄H₃₂FeN₄O₄) (labeled as "Ligand of Interest" by depositor).



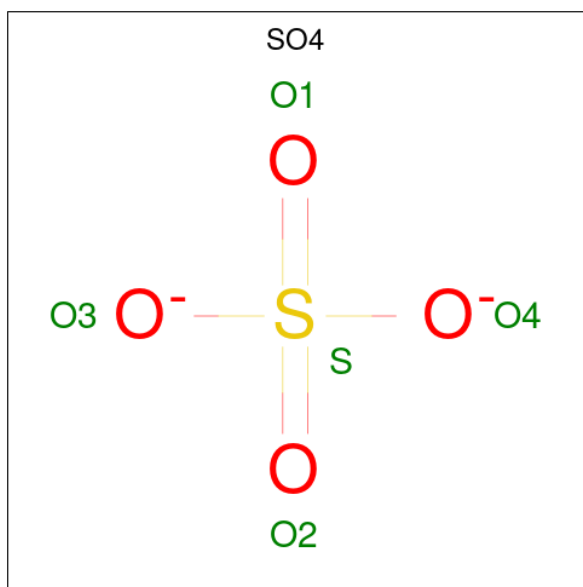
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Fe	N			O
2	A	1	43	34	1	4	4	0	0
2	B	1	43	34	1	4	4	0	0
2	C	1	43	34	1	4	4	0	0
2	D	1	43	34	1	4	4	0	0

- Molecule 3 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: $C_2H_6O_2$).



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

- Molecule 4 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



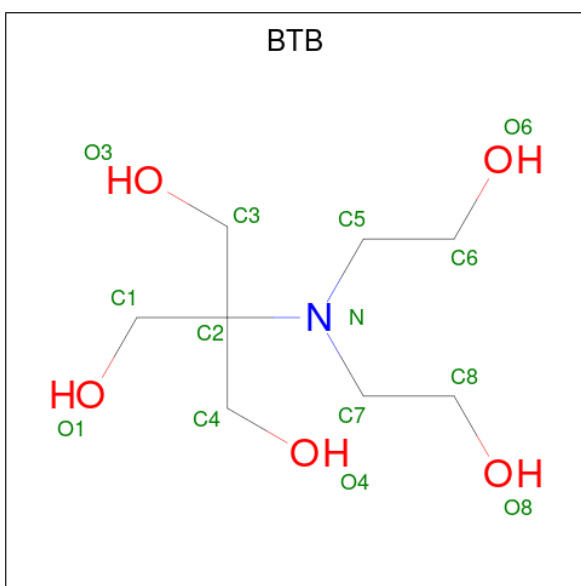
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total O S 5 4 1	0	0
4	A	1	Total O S 5 4 1	0	0
4	B	1	Total O S 5 4 1	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	C	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is 2-[BIS-(2-HYDROXY-ETHYL)-AMINO]-2-HYDROXYMETHYL-PROPAN E-1,3-DIOL (three-letter code: BTB) (formula: C₈H₁₉NO₅).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		

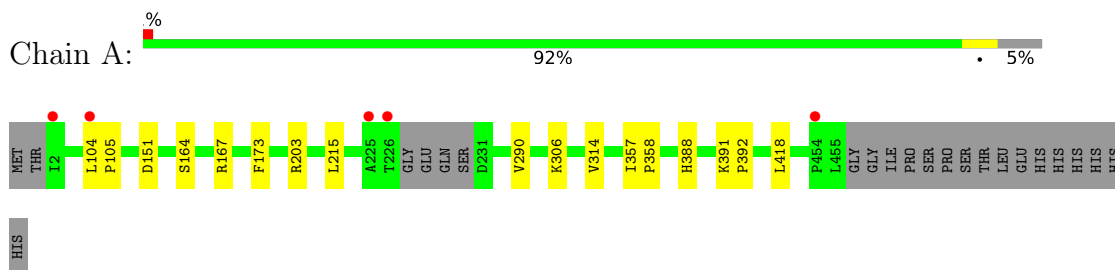
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	262	Total	O	0	0
			262	262		
6	B	260	Total	O	0	0
			260	260		
6	C	175	Total	O	0	0
			175	175		
6	D	288	Total	O	0	0
			288	288		

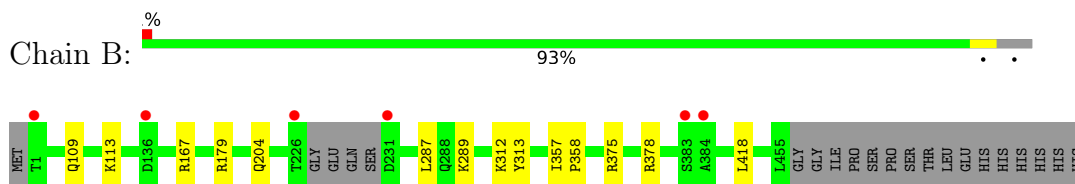
3 Residue-property plots [i](#)

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

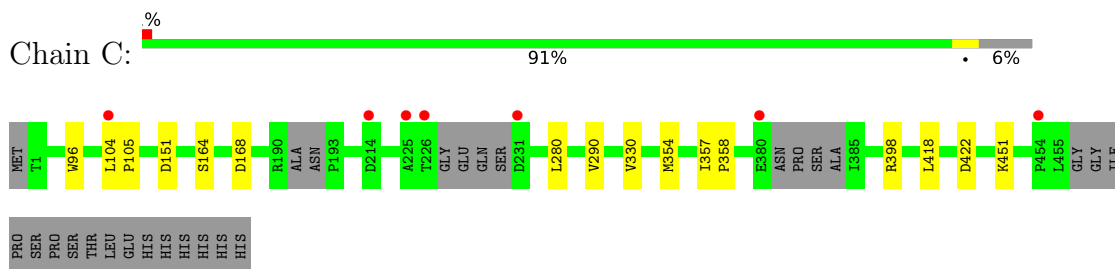
- Molecule 1: Cytochrome P450-BM3 variant P411-PFA



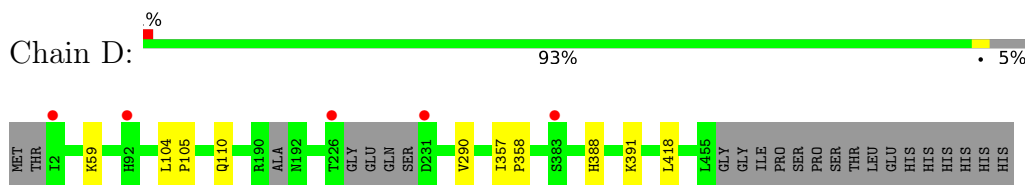
- Molecule 1: Cytochrome P450-BM3 variant P411-PFA



- Molecule 1: Cytochrome P450-BM3 variant P411-PFA



- Molecule 1: Cytochrome P450-BM3 variant P411-PFA



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	105.25Å 172.46Å 225.62Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.60 – 1.87 38.57 – 1.87	Depositor EDS
% Data completeness (in resolution range)	91.8 (38.60-1.87) 91.8 (38.57-1.87)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.90 (at 1.87Å)	Xtrriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.187 , 0.218 0.195 , 0.223	Depositor DCC
R_{free} test set	7853 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å ²)	19.7	Xtrriage
Anisotropy	0.135	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 44.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.013 for 1/2*h-1/2*k,-3/2*h-1/2*k,-l 0.022 for 1/2*h+1/2*k,3/2*h-1/2*k,-l	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	15955	wwPDB-VP
Average B, all atoms (Å ²)	22.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.42% 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: EDO, SO4, HEM, BTB

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	0.63	0/3763	0.68	0/5084
1	B	0.63	0/3783	0.69	0/5112
1	C	0.64	0/3737	0.69	0/5043
1	D	0.63	0/3763	0.68	0/5082
All	All	0.63	0/15046	0.68	0/20321

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	3678	0	3676	16	0
1	B	3695	0	3699	13	0
1	C	3652	0	3660	15	0
1	D	3679	0	3674	5	0
2	A	43	0	30	2	0
2	B	43	0	30	3	0
2	C	43	0	30	3	0
2	D	43	0	30	2	0
3	A	8	0	12	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	12	0	18	0	0
3	C	8	0	12	0	0
3	D	8	0	12	0	0
4	A	10	0	0	0	0
4	B	5	0	0	0	0
4	C	5	0	0	0	0
4	D	10	0	0	0	0
5	A	14	0	19	2	0
5	B	14	0	19	0	0
6	A	262	0	0	0	0
6	B	260	0	0	0	0
6	C	175	0	0	0	0
6	D	288	0	0	1	0
All	All	15955	0	14921	57	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 (57) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:330[A]:VAL:HG11	1:C:354:MET:CE	2.01	0.90
1:C:330[A]:VAL:HG11	1:C:354:MET:HE2	1.52	0.89
1:B:287:LEU:HD21	1:B:418:LEU:HD11	1.60	0.83
1:B:287:LEU:CD2	1:B:418:LEU:HD11	2.12	0.80
1:A:203:ARG:NH2	1:B:179:ARG:NH2	2.37	0.72
1:B:179:ARG:HH21	1:B:204:GLN:CD	1.92	0.72
1:C:422:ASP:OD1	1:C:451:LYS:HE3	1.92	0.70
1:A:290:VAL:CG1	1:A:418:LEU:HD13	2.26	0.65
1:C:330[A]:VAL:CG1	1:C:354:MET:CE	2.74	0.65
1:B:167[A]:ARG:HG2	1:C:168:ASP:HB2	1.80	0.64
1:C:422:ASP:OD1	1:C:451:LYS:CE	2.47	0.62
2:C:1102:HEM:HBC2	2:C:1102:HEM:HMC2	1.84	0.60
1:B:109:GLN:HG3	1:B:113:LYS:HE2	1.86	0.57
1:C:290:VAL:CG1	1:C:418:LEU:HD13	2.36	0.55
1:A:203:ARG:HH21	1:B:179:ARG:NH2	2.04	0.55
2:C:1102:HEM:HMB2	2:C:1102:HEM:HBB2	1.89	0.55
2:B:501:HEM:HBC2	2:B:501:HEM:HMC2	1.89	0.54
1:C:151:ASP:OD2	1:C:164[B]:SER:OG	2.27	0.53
1:D:290:VAL:HG13	1:D:418:LEU:HD13	1.89	0.53
1:C:330[A]:VAL:CG1	1:C:354:MET:HE3	2.38	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:290:VAL:HG11	1:A:418:LEU:HD13	1.90	0.51
1:B:375:ARG:O	1:B:378:ARG:HB2	2.11	0.51
2:A:501:HEM:HBB2	2:A:501:HEM:HMB2	1.93	0.51
1:A:151:ASP:CG	1:A:164[B]:SER:OG	2.50	0.50
1:C:330[A]:VAL:CG1	1:C:354:MET:HE2	2.35	0.50
1:B:287:LEU:CD2	1:B:418:LEU:CD1	2.89	0.49
1:B:287:LEU:HD21	1:B:418:LEU:CD1	2.35	0.49
2:D:501:HEM:HBB2	2:D:501:HEM:HMB2	1.95	0.49
1:A:173:PHE:CD1	1:A:215:LEU:HD22	2.48	0.48
2:B:501:HEM:HMB2	2:B:501:HEM:HBB2	1.96	0.48
1:A:290:VAL:HG13	1:A:314:VAL:HG22	1.96	0.47
5:A:506:BTB:H71	5:A:506:BTB:O3	2.15	0.47
1:A:151:ASP:OD1	1:A:164[B]:SER:OG	2.32	0.47
1:A:167[A]:ARG:HH11	1:A:167[A]:ARG:HG3	1.80	0.47
2:D:501:HEM:HMC2	2:D:501:HEM:HBC2	1.98	0.46
2:A:501:HEM:HMC2	2:A:501:HEM:HBC2	1.98	0.46
1:D:59:LYS:NZ	6:D:604:HOH:O	2.47	0.45
1:A:290:VAL:HG12	1:A:418:LEU:HD13	1.98	0.45
1:B:289:LYS:HD2	1:B:313:TYR:CZ	2.52	0.45
1:C:290:VAL:HG11	1:C:418:LEU:HD13	1.99	0.44
5:A:506:BTB:O3	5:A:506:BTB:C7	2.66	0.43
1:A:167[A]:ARG:HG3	1:A:167[A]:ARG:NH1	2.34	0.43
1:D:104:LEU:N	1:D:105:PRO:HD2	2.33	0.43
1:A:388:HIS:HA	1:A:391:LYS:HD3	1.99	0.43
1:A:203:ARG:HH21	1:B:179:ARG:HH22	1.65	0.43
1:C:104:LEU:N	1:C:105:PRO:CD	2.81	0.43
1:C:280:LEU:HD13	1:C:418:LEU:HD11	2.00	0.42
1:B:357:ILE:N	1:B:358:PRO:CD	2.82	0.42
2:C:1102:HEM:HBC2	2:C:1102:HEM:CMC	2.49	0.42
1:D:388:HIS:HA	1:D:391:LYS:HD3	2.00	0.42
1:C:357:ILE:N	1:C:358:PRO:CD	2.83	0.42
1:A:104:LEU:N	1:A:105:PRO:HD2	2.34	0.42
1:D:357:ILE:N	1:D:358:PRO:CD	2.83	0.42
1:A:391:LYS:N	1:A:392:PRO:CD	2.84	0.41
2:B:501:HEM:HBC2	2:B:501:HEM:CMC	2.50	0.41
1:C:96:TRP:CZ2	1:C:398:ARG:HD2	2.56	0.41
1:A:357:ILE:N	1:A:358:PRO:CD	2.84	0.40

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	453/472 (96%)	443 (98%)	10 (2%)	0	100	100
1	B	456/472 (97%)	445 (98%)	11 (2%)	0	100	100
1	C	445/472 (94%)	431 (97%)	14 (3%)	0	100	100
1	D	451/472 (96%)	442 (98%)	9 (2%)	0	100	100
All	All	1805/1888 (96%)	1761 (98%)	44 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	404/416 (97%)	403 (100%)	1 (0%)	93	93
1	B	407/416 (98%)	406 (100%)	1 (0%)	93	93
1	C	402/416 (97%)	402 (100%)	0	100	100
1	D	405/416 (97%)	404 (100%)	1 (0%)	93	93
All	All	1618/1664 (97%)	1615 (100%)	3 (0%)	93	93

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	306	LYS
1	B	312	LYS
1	D	110	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	288	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](#)

21 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
4	SO4	B	506	-	4,4,4	0.40	0	6,6,6	0.07	0
3	EDO	D	502	-	3,3,3	0.08	0	2,2,2	0.25	0
2	HEM	C	1102	1	41,50,50	1.34	5 (12%)	45,82,82	1.74	12 (26%)
3	EDO	C	1104	-	3,3,3	0.11	0	2,2,2	0.33	0
3	EDO	C	1103	-	3,3,3	0.09	0	2,2,2	0.17	0
5	BTB	A	506	-	13,13,13	0.62	0	7,16,16	0.13	0
2	HEM	D	501	1	41,50,50	1.29	5 (12%)	45,82,82	1.75	10 (22%)
3	EDO	B	503	-	3,3,3	0.07	0	2,2,2	0.21	0
2	HEM	A	501	1	41,50,50	1.29	5 (12%)	45,82,82	1.71	10 (22%)
4	SO4	D	504	-	4,4,4	0.38	0	6,6,6	0.05	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	EDO	D	503	-	3,3,3	0.09	0	2,2,2	0.27	0
4	SO4	A	505	-	4,4,4	0.40	0	6,6,6	0.07	0
3	EDO	B	502	-	3,3,3	0.08	0	2,2,2	0.23	0
4	SO4	A	504	-	4,4,4	0.39	0	6,6,6	0.05	0
2	HEM	B	501	1	41,50,50	1.29	4 (9%)	45,82,82	1.80	12 (26%)
4	SO4	C	1101	-	4,4,4	0.40	0	6,6,6	0.05	0
3	EDO	A	503	-	3,3,3	0.10	0	2,2,2	0.24	0
3	EDO	A	502	-	3,3,3	0.10	0	2,2,2	0.26	0
3	EDO	B	504	-	3,3,3	0.06	0	2,2,2	0.25	0
4	SO4	D	505	-	4,4,4	0.39	0	6,6,6	0.05	0
5	BTB	B	505	-	13,13,13	0.98	1 (7%)	7,16,16	0.12	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
2	HEM	C	1102	1	-	2/12/54/54	-
5	BTB	B	505	-	-	0/21/21/21	-
2	HEM	B	501	1	-	2/12/54/54	-
2	HEM	A	501	1	-	2/12/54/54	-
3	EDO	C	1104	-	-	1/1/1/1	-
3	EDO	C	1103	-	-	0/1/1/1	-
3	EDO	A	503	-	-	0/1/1/1	-
3	EDO	D	503	-	-	1/1/1/1	-
3	EDO	A	502	-	-	0/1/1/1	-
3	EDO	B	504	-	-	0/1/1/1	-
5	BTB	A	506	-	-	4/21/21/21	-
3	EDO	D	502	-	-	0/1/1/1	-
3	EDO	B	502	-	-	1/1/1/1	-
2	HEM	D	501	1	-	2/12/54/54	-
3	EDO	B	503	-	-	1/1/1/1	-

All (20) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	1102	HEM	C1B-NB	-3.45	1.34	1.40
2	B	501	HEM	C1B-NB	-3.39	1.34	1.40
2	A	501	HEM	C1B-NB	-3.18	1.34	1.40
2	D	501	HEM	C1B-NB	-3.10	1.35	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	1102	HEM	FE-NB	3.05	2.11	1.96
2	A	501	HEM	FE-NB	2.93	2.11	1.96
2	B	501	HEM	FE-NB	2.86	2.11	1.96
2	D	501	HEM	FE-NB	2.78	2.10	1.96
2	C	1102	HEM	C4D-ND	-2.66	1.35	1.40
2	D	501	HEM	C4D-ND	-2.65	1.35	1.40
2	A	501	HEM	C4D-ND	-2.59	1.35	1.40
2	B	501	HEM	CHB-C1B	2.43	1.41	1.35
2	C	1102	HEM	CHB-C1B	2.41	1.41	1.35
2	B	501	HEM	C4D-ND	-2.40	1.36	1.40
5	B	505	BTB	C2-N	2.38	1.53	1.48
2	A	501	HEM	CHB-C1B	2.32	1.40	1.35
2	D	501	HEM	C4B-NB	-2.28	1.34	1.38
2	D	501	HEM	CHB-C1B	2.24	1.40	1.35
2	A	501	HEM	C4B-NB	-2.11	1.34	1.38
2	C	1102	HEM	C1D-ND	-2.00	1.34	1.38

All (44) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	501	HEM	CHC-C4B-NB	4.81	129.66	124.43
2	B	501	HEM	CHC-C4B-NB	4.76	129.60	124.43
2	C	1102	HEM	CHC-C4B-NB	4.58	129.41	124.43
2	B	501	HEM	C1B-NB-C4B	4.43	109.65	105.07
2	A	501	HEM	CHC-C4B-NB	4.26	129.06	124.43
2	D	501	HEM	C1B-NB-C4B	4.18	109.39	105.07
2	C	1102	HEM	C1B-NB-C4B	4.10	109.30	105.07
2	A	501	HEM	C1B-NB-C4B	4.01	109.21	105.07
2	A	501	HEM	CHD-C1D-ND	3.73	128.48	124.43
2	D	501	HEM	CHD-C1D-ND	3.54	128.27	124.43
2	C	1102	HEM	CHD-C1D-ND	3.34	128.06	124.43
2	D	501	HEM	CHA-C4D-ND	3.29	128.44	124.38
2	B	501	HEM	CHD-C1D-ND	3.24	127.95	124.43
2	B	501	HEM	CHA-C4D-ND	3.13	128.25	124.38
2	A	501	HEM	CHA-C4D-ND	2.91	127.98	124.38
2	C	1102	HEM	CHA-C4D-ND	2.90	127.97	124.38
2	C	1102	HEM	C4B-C3B-C2B	-2.87	104.84	107.11
2	B	501	HEM	C4B-C3B-C2B	-2.86	104.84	107.11
2	B	501	HEM	CHB-C1B-NB	2.77	127.81	124.38
2	A	501	HEM	CHD-C1D-C2D	-2.66	120.83	124.98
2	A	501	HEM	CHB-C1B-NB	2.61	127.61	124.38
2	D	501	HEM	CHB-C1B-NB	2.58	127.56	124.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	501	HEM	CHD-C1D-C2D	-2.56	120.98	124.98
2	D	501	HEM	C4B-C3B-C2B	-2.53	105.11	107.11
2	B	501	HEM	CMD-C2D-C1D	2.51	128.86	125.04
2	C	1102	HEM	CHB-C1B-NB	2.50	127.47	124.38
2	C	1102	HEM	CHD-C1D-C2D	-2.48	121.11	124.98
2	A	501	HEM	O2D-CGD-CBD	2.46	121.92	114.03
2	B	501	HEM	CHD-C1D-C2D	-2.45	121.15	124.98
2	C	1102	HEM	CMD-C2D-C1D	2.44	128.76	125.04
2	A	501	HEM	C4B-C3B-C2B	-2.43	105.18	107.11
2	B	501	HEM	CHA-C4D-C3D	-2.36	120.89	125.33
2	D	501	HEM	CHA-C4D-C3D	-2.34	120.93	125.33
2	A	501	HEM	CBD-CAD-C3D	-2.29	106.26	112.63
2	B	501	HEM	CAD-C3D-C4D	2.29	128.66	124.66
2	C	1102	HEM	CBD-CAD-C3D	-2.25	106.37	112.63
2	B	501	HEM	CBD-CAD-C3D	-2.22	106.46	112.63
2	B	501	HEM	O2D-CGD-CBD	2.20	121.09	114.03
2	C	1102	HEM	CHA-C4D-C3D	-2.18	121.24	125.33
2	C	1102	HEM	O2D-CGD-CBD	2.17	121.00	114.03
2	C	1102	HEM	CAD-C3D-C4D	2.16	128.43	124.66
2	D	501	HEM	CBD-CAD-C3D	-2.15	106.65	112.63
2	D	501	HEM	O2D-CGD-CBD	2.14	120.90	114.03
2	A	501	HEM	CHA-C4D-C3D	-2.09	121.40	125.33

There are no chirality outliers.

All (16) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	506	BTB	C1-C2-C4-O4
5	A	506	BTB	C3-C2-C4-O4
5	A	506	BTB	N-C2-C4-O4
5	A	506	BTB	N-C7-C8-O8
3	C	1104	EDO	O1-C1-C2-O2
2	A	501	HEM	CAD-CBD-CGD-O1D
2	B	501	HEM	CAD-CBD-CGD-O1D
2	D	501	HEM	CAD-CBD-CGD-O1D
2	C	1102	HEM	CAD-CBD-CGD-O1D
2	A	501	HEM	CAD-CBD-CGD-O2D
2	B	501	HEM	CAD-CBD-CGD-O2D
2	C	1102	HEM	CAD-CBD-CGD-O2D
2	D	501	HEM	CAD-CBD-CGD-O2D
3	B	502	EDO	O1-C1-C2-O2
3	B	503	EDO	O1-C1-C2-O2

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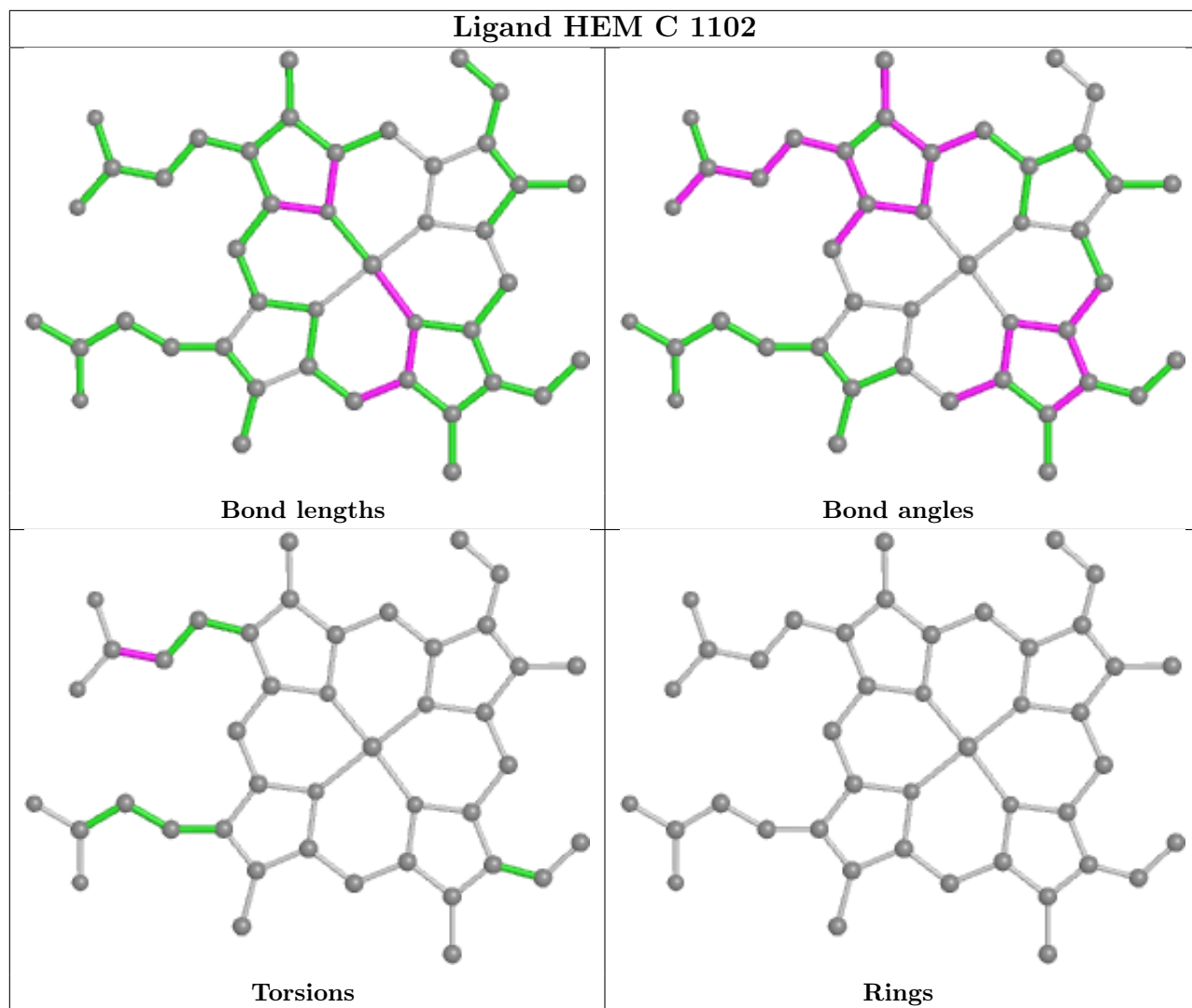
Mol	Chain	Res	Type	Atoms
3	D	503	EDO	O1-C1-C2-O2

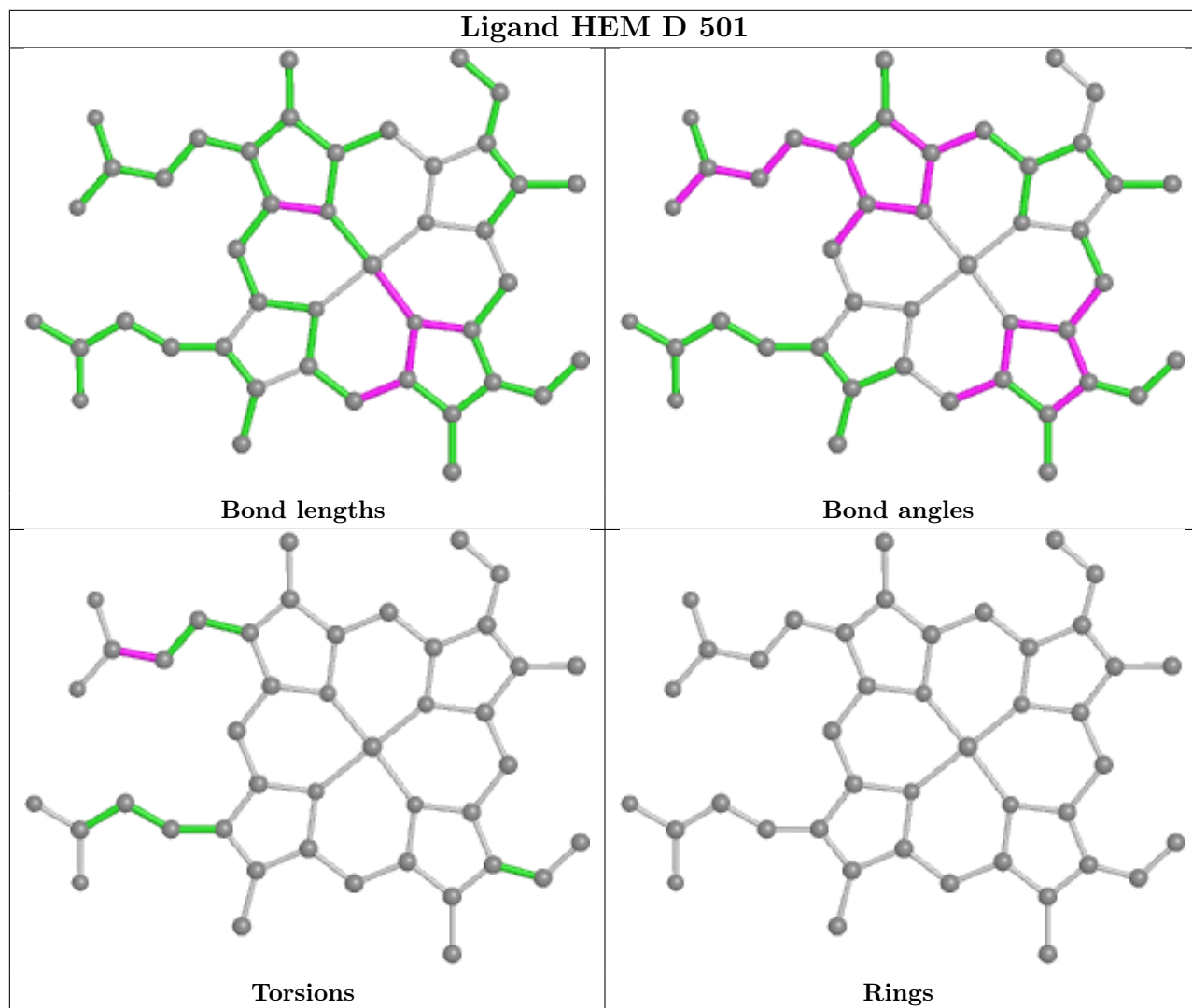
There are no ring outliers.

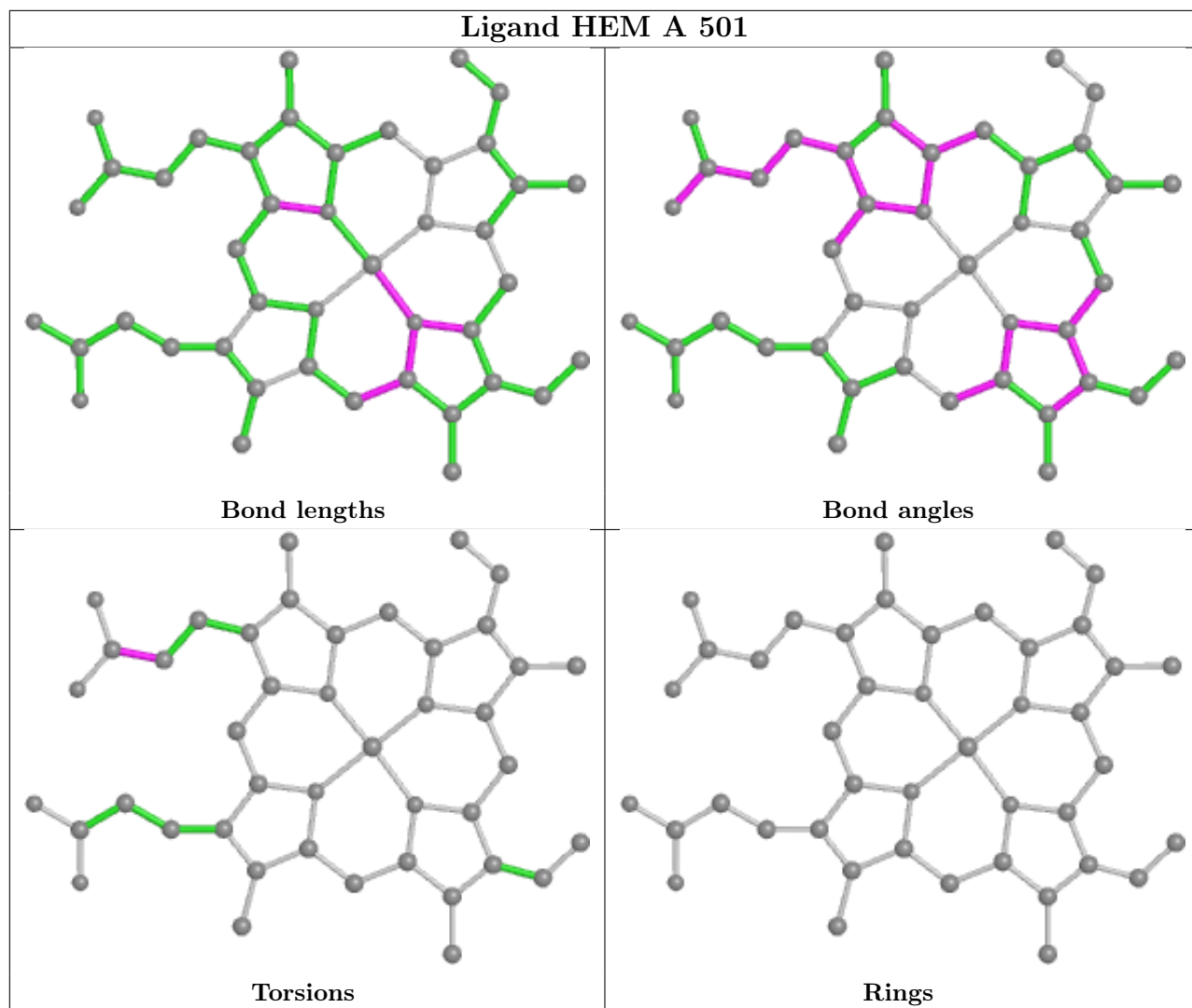
5 monomers are involved in 12 short contacts:

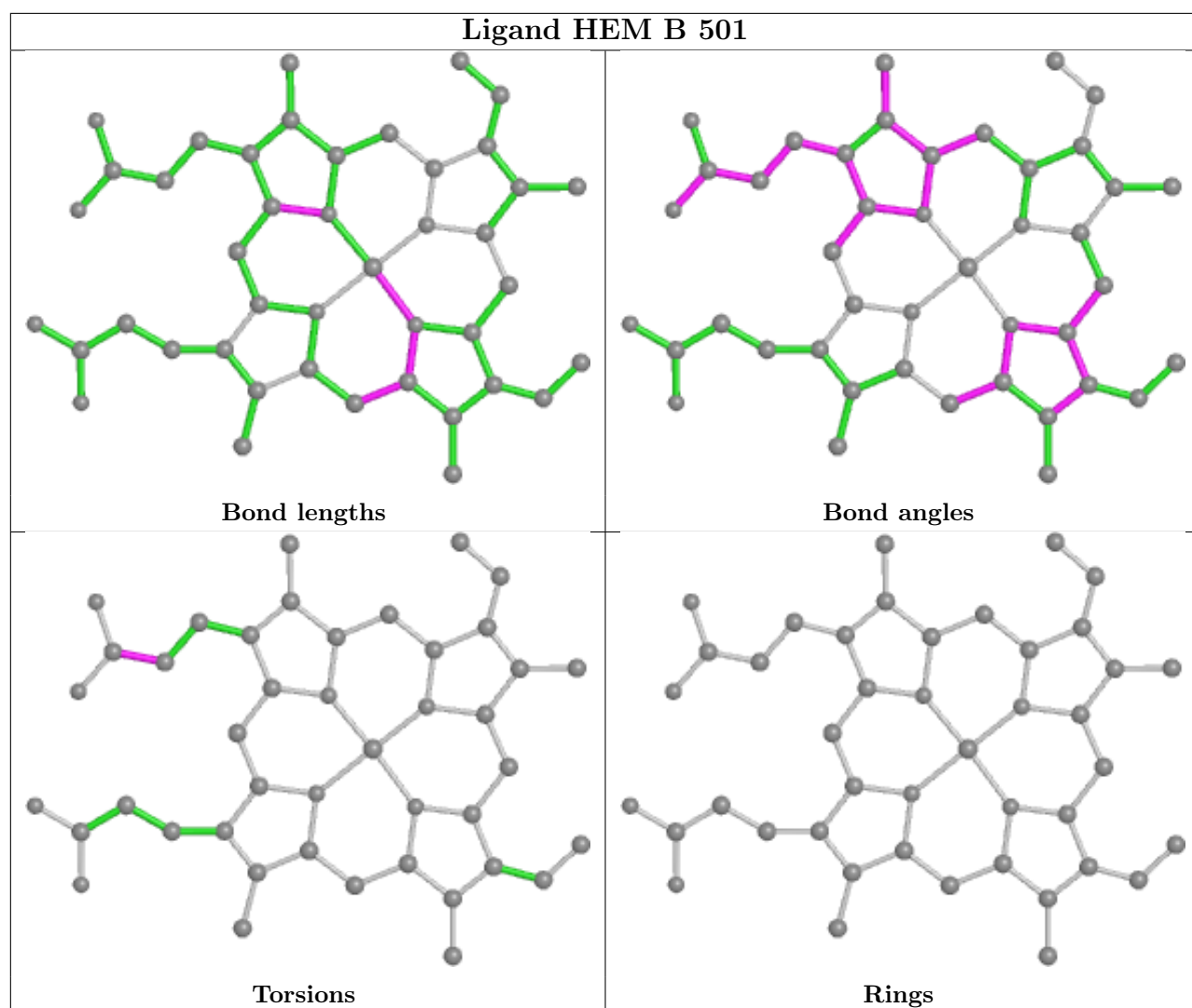
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	1102	HEM	3	0
5	A	506	BTB	2	0
2	D	501	HEM	2	0
2	A	501	HEM	2	0
2	B	501	HEM	3	0

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.









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	450/472 (95%)	0.02	5 (1%) 80 82	11, 20, 33, 53	59 (13%)
1	B	451/472 (95%)	0.03	6 (1%) 77 79	11, 20, 34, 49	62 (13%)
1	C	445/472 (94%)	0.26	7 (1%) 72 74	16, 26, 41, 57	53 (11%)
1	D	449/472 (95%)	0.04	5 (1%) 80 82	11, 19, 32, 45	49 (10%)
All	All	1795/1888 (95%)	0.09	23 (1%) 77 79	11, 21, 36, 57	223 (12%)

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	231	ASP	4.6
1	C	104	LEU	4.5
1	A	225	ALA	3.7
1	C	231	ASP	3.6
1	B	383	SER	3.5
1	C	214	ASP	3.0
1	B	136	ASP	3.0
1	D	231	ASP	3.0
1	B	226	THR	2.9
1	C	454	PRO	2.8
1	C	225	ALA	2.8
1	C	380	GLU	2.6
1	B	1	THR	2.6
1	D	2	ILE	2.6
1	A	454	PRO	2.5
1	C	226	THR	2.5
1	A	2	ILE	2.4
1	A	104	LEU	2.2
1	D	226	THR	2.2
1	B	384	ALA	2.2
1	D	92	HIS	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	226	THR	2.1
1	D	383	SER	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](#)

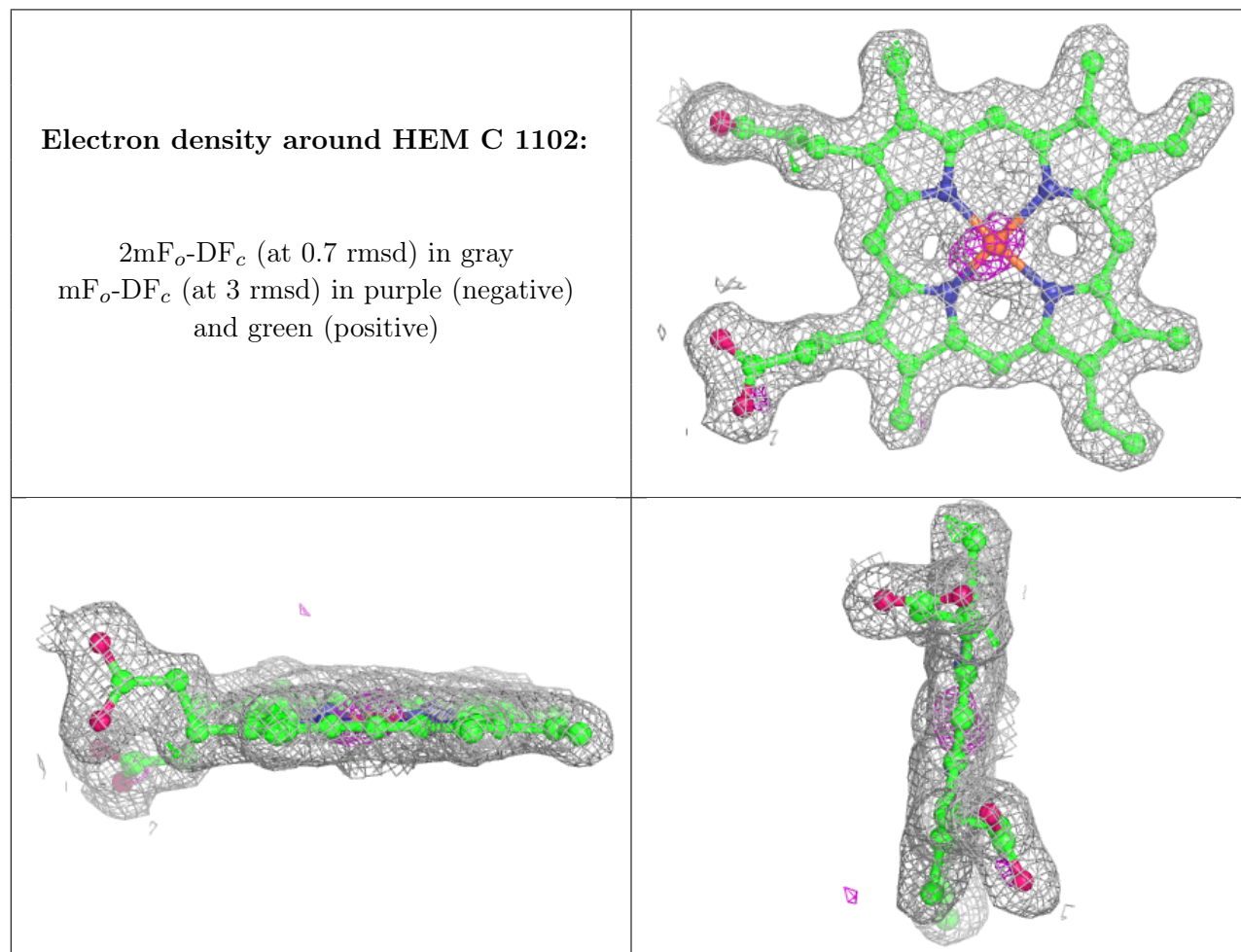
There are no monosaccharides in this entry.

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.

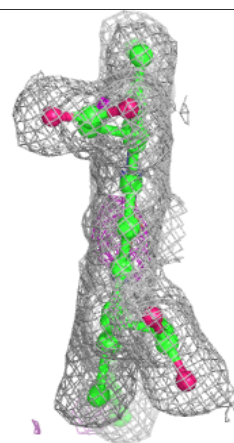
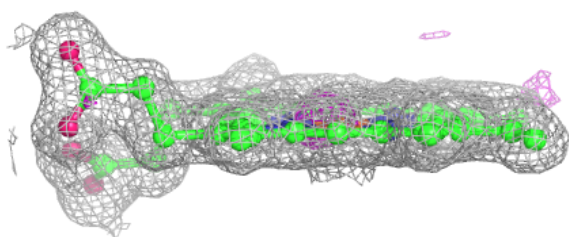
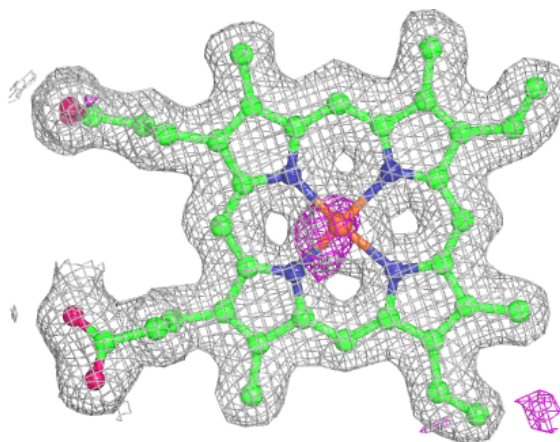
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	BTB	A	506	14/14	0.58	0.44	28,29,30,30	14
5	BTB	B	505	14/14	0.74	0.23	39,40,40,41	0
3	EDO	B	503	4/4	0.75	0.25	48,48,48,50	0
3	EDO	D	502	4/4	0.84	0.22	38,39,39,39	0
3	EDO	B	504	4/4	0.85	0.14	33,35,35,35	0
4	SO4	D	505	5/5	0.85	0.23	67,68,70,70	0
3	EDO	D	503	4/4	0.88	0.18	30,32,32,34	0
3	EDO	C	1104	4/4	0.88	0.17	38,39,39,40	0
3	EDO	A	503	4/4	0.89	0.21	33,33,34,34	0
4	SO4	D	504	5/5	0.90	0.26	63,63,63,64	0
3	EDO	B	502	4/4	0.91	0.23	29,30,30,31	0
4	SO4	C	1101	5/5	0.93	0.15	63,63,63,65	0
3	EDO	A	502	4/4	0.94	0.14	22,23,23,23	0
2	HEM	C	1102	43/43	0.95	0.12	17,19,21,22	0
4	SO4	A	505	5/5	0.96	0.14	45,45,47,47	0
2	HEM	D	501	43/43	0.97	0.11	12,13,14,14	0
2	HEM	B	501	43/43	0.97	0.11	11,13,13,15	0
2	HEM	A	501	43/43	0.97	0.12	13,14,15,16	0
4	SO4	A	504	5/5	0.97	0.14	49,49,50,50	0
3	EDO	C	1103	4/4	0.97	0.09	28,29,29,30	0
4	SO4	B	506	5/5	0.98	0.10	34,35,37,37	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.



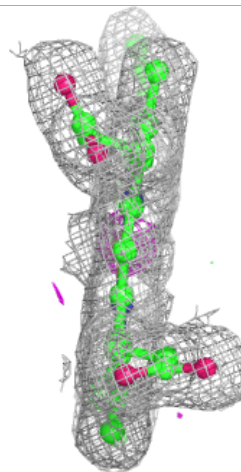
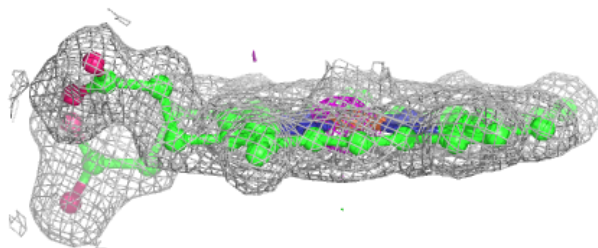
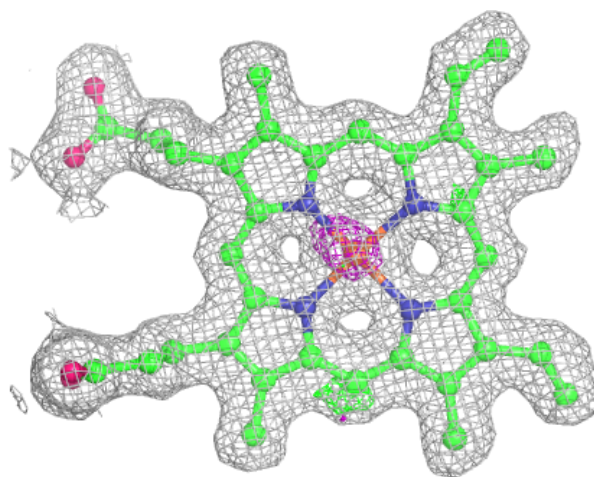
Electron density around HEM D 501:

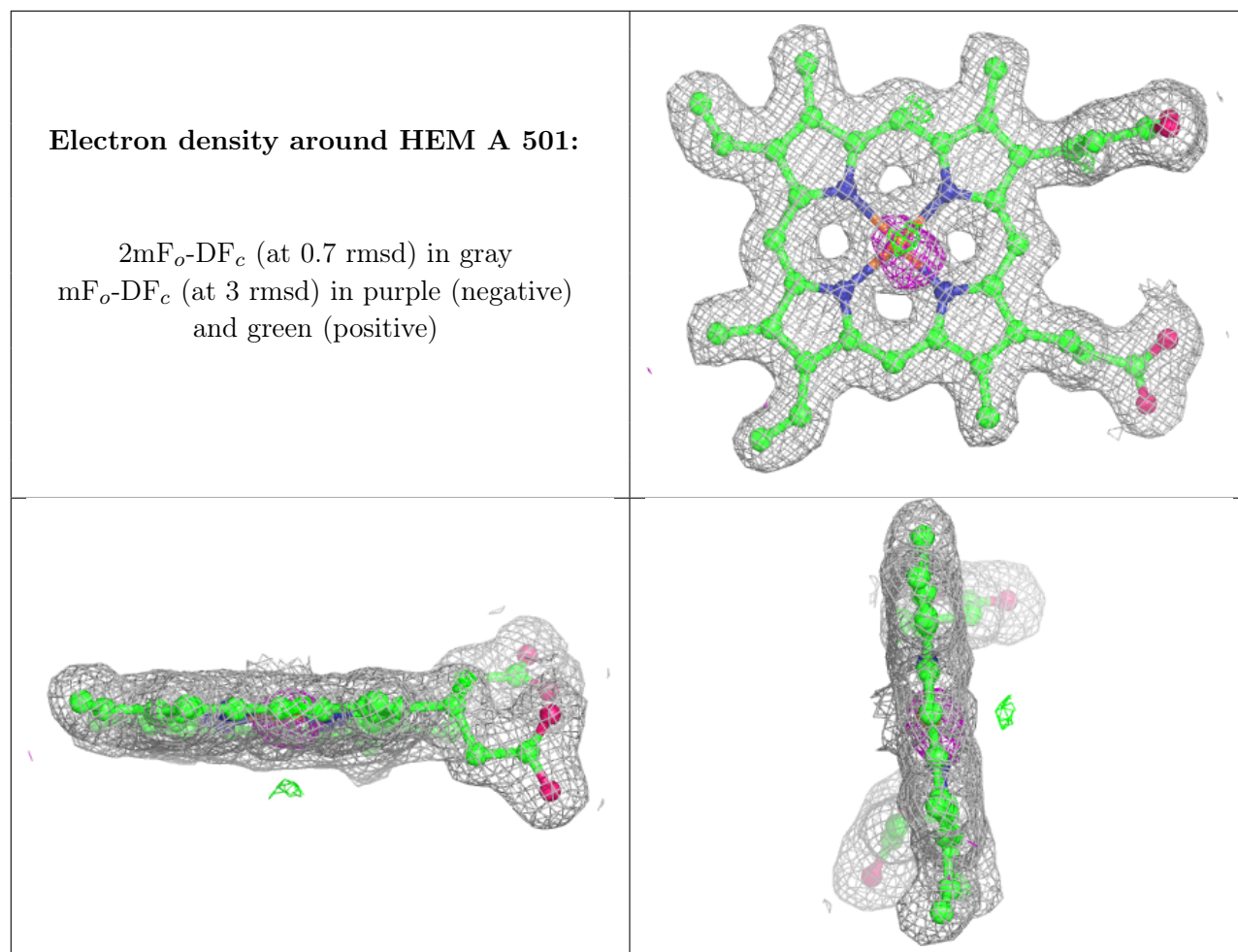
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around HEM 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)





6.5 Other polymers [i](#)

There are no such residues in this entry.