wwPDB X-ray Structure Validation Summary Report (i)

Nov 5, 2023 – 10:01 pm GMT

PDB ID	:	2BS2
Title	:	QUINOL:FUMARATE REDUCTASE FROM WOLINELLA SUCCINOGENES
Authors	:	Lancaster, C.R.D.
Deposited on	:	2005-05-14
Resolution	:	1.78 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 (i) 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 (i)) were used in the production of this report:

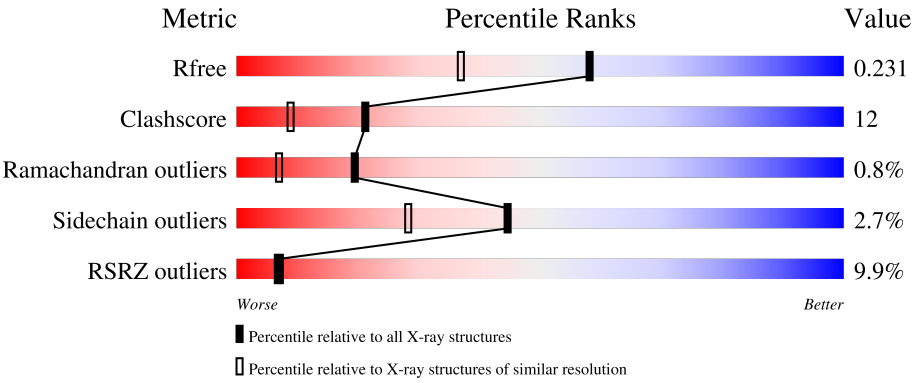
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.78 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	9185 (1.80-1.76)
Clashscore	141614	10184 (1.80-1.76)
Ramachandran outliers	138981	10051 (1.80-1.76)
Sidechain outliers	138945	10050 (1.80-1.76)
RSRZ outliers	127900	9032 (1.80-1.76)

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 <=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	660	8% 76% 21%
1	D	660	10% 75% 22%
2	B	241	6% 81% 15%
2	E	241	5% 80% 17%
3	C	256	18% 75% 23%

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Mol	Chain	Length	Quality of chain
3	F	256	

2 Entry composition (i)

There are 12 unique types of molecules in this entry. The entry contains 19666 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 QUINOL-FUMARATE REDUCTASE FLAVOPROTEIN SUBUNIT A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	656	Total	C	N	O	S	27	5	1
			5145	3219	927	967	32			
1	D	656	Total	C	N	O	S	32	3	1
			5125	3207	921	965	32			

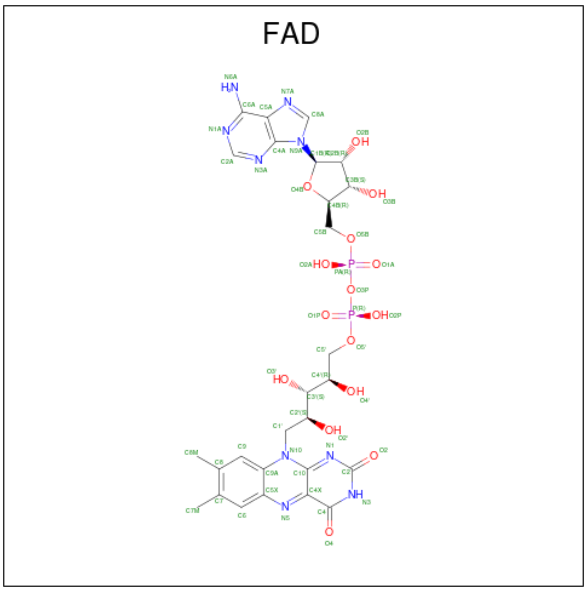
- Molecule 2 is a protein called QUINOL-FUMARATE REDUCTASE IRON-SULFUR SUBUNIT B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	240	Total	C	N	O	S	6	1	1
			1902	1199	324	355	24			
2	E	240	Total	C	N	O	S	6	1	1
			1902	1199	324	355	24			

- Molecule 3 is a protein called QUINOL-FUMARATE REDUCTASE DIHEME CYTOCHROME B SUBUNIT C.

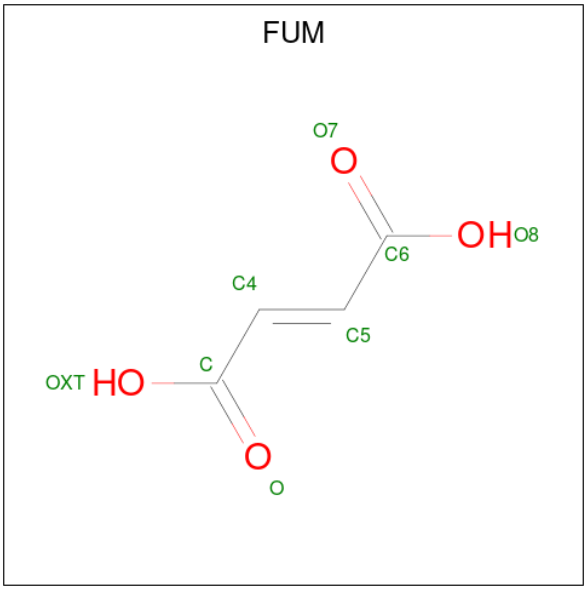
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	255	Total	C	N	O	S	16	2	1
			2099	1398	336	351	14			
3	F	255	Total	C	N	O	S	12	2	1
			2099	1398	336	351	14			

- Molecule 4 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	N	O	P	0	0
			53	27	9	15	2		
4	D	1	Total	C	N	O	P	0	0
			53	27	9	15	2		

- Molecule 5 is FUMARIC ACID (three-letter code: FUM) (formula: $C_4H_4O_4$).

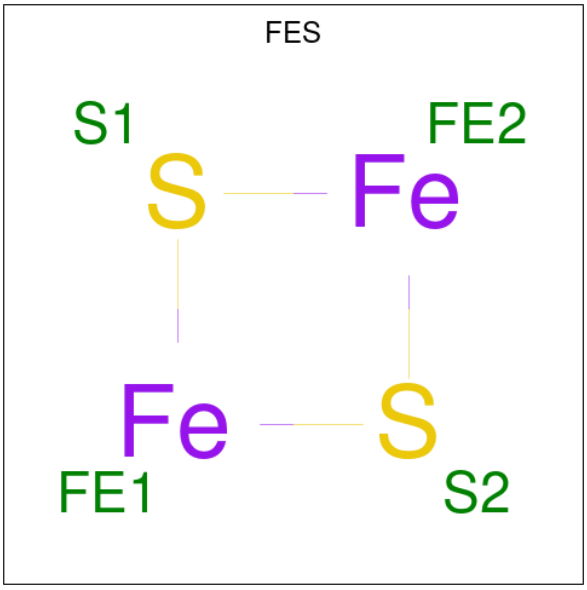


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	O		0	0
			8	4	4			
5	D	1	Total	C	O		0	0
			8	4	4			

- Molecule 6 is SODIUM ION (three-letter code: NA) (formula: Na).

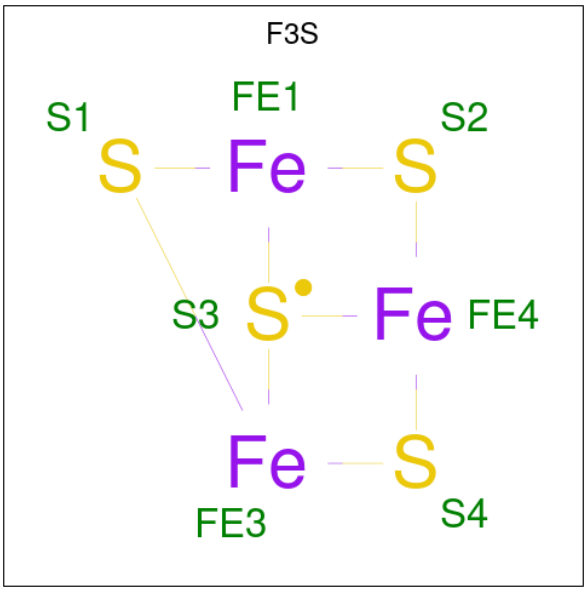
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	A	1	Total Na 1 1	0	0
6	D	1	Total Na 1 1	0	0

- Molecule 7 is FE2/S2 (INORGANIC) CLUSTER (three-letter code: FES) (formula: Fe_2S_2).



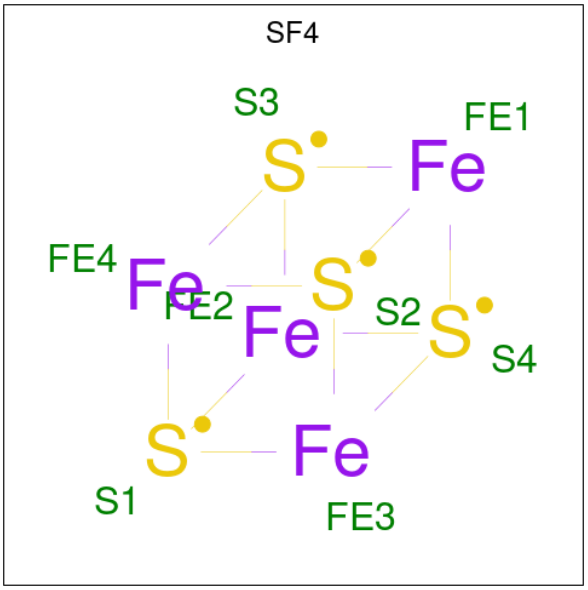
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	B	1	Total Fe S 4 2 2	0	0
7	E	1	Total Fe S 4 2 2	0	0

- Molecule 8 is FE3-S4 CLUSTER (three-letter code: F3S) (formula: Fe_3S_4).



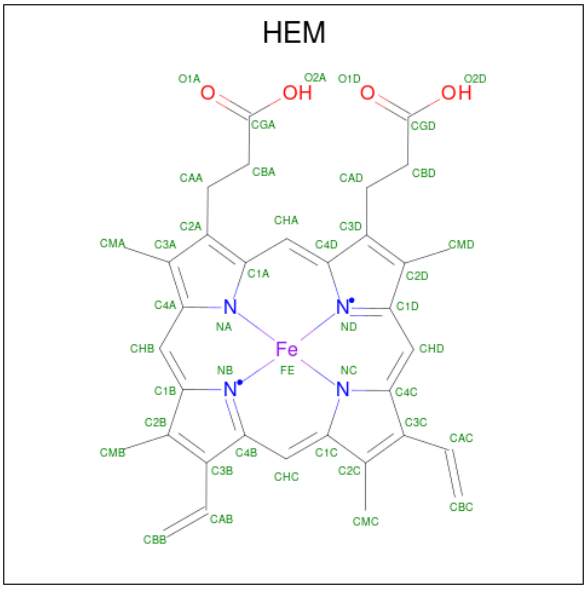
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	B	1	Total Fe S 7 3 4	0	0
8	E	1	Total Fe S 7 3 4	0	0

- Molecule 9 is IRON/SULFUR CLUSTER (three-letter code: SF4) (formula: Fe_4S_4).



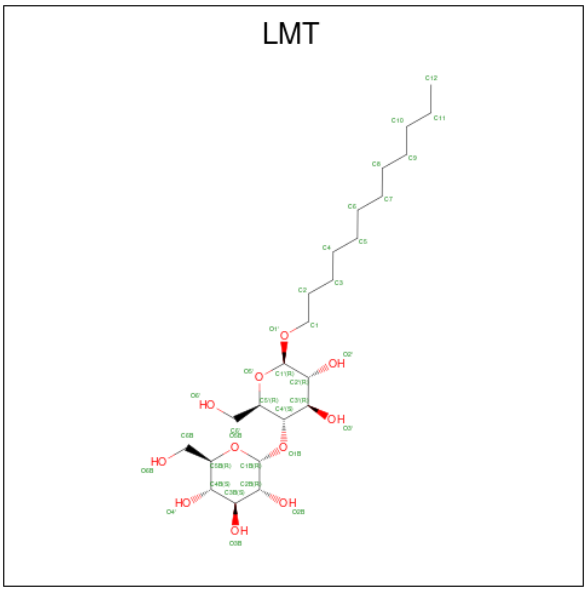
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
9	B	1	Total Fe S 8 4 4	0	0
9	E	1	Total Fe S 8 4 4	0	0

- Molecule 10 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



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

- Molecule 11 is DODECYL-BETA-D-MALTOSIDE (three-letter code: LMT) (formula: $C_{24}H_{46}O_{11}$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
11	C	1	Total C O 35 24 11	16	0
11	F	1	Total C O 35 24 11	16	0

- Molecule 12 is water.

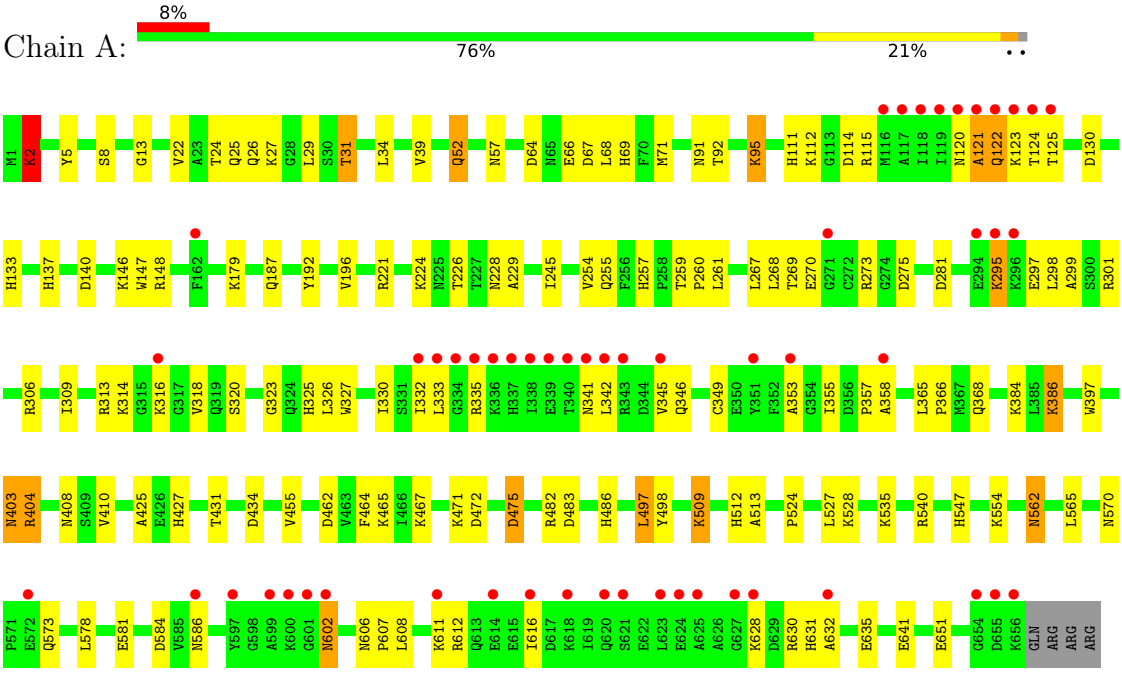
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
12	A	273	Total O 273 273	1	0
12	B	155	Total O 155 155	0	0
12	C	55	Total O 55 55	0	0
12	D	287	Total O 287 287	4	0
12	E	164	Total O 164 164	0	0
12	F	56	Total O 56 56	0	0

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.

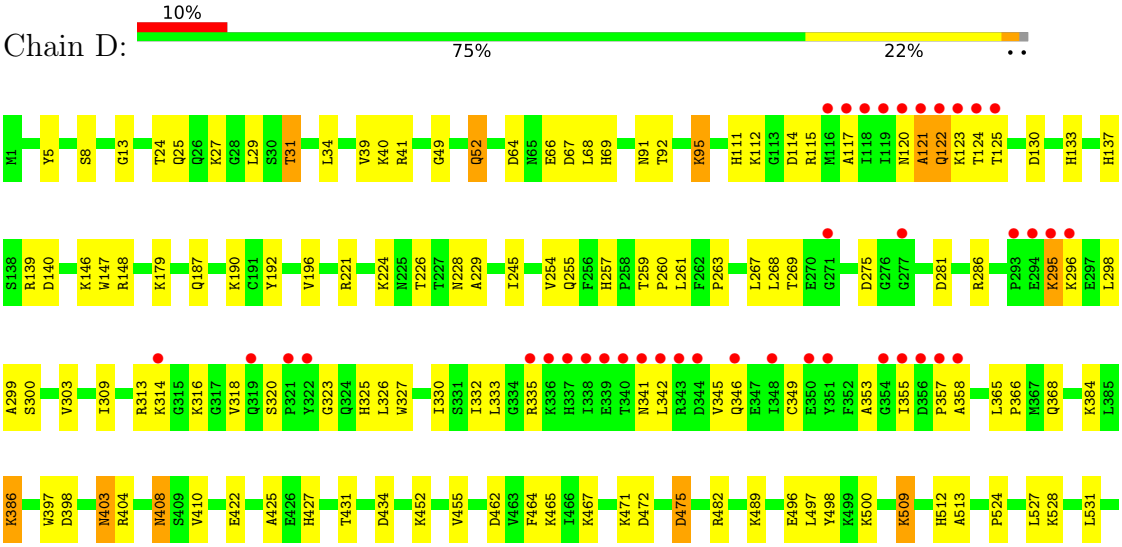
• Molecule 1: QUINOL-FUMARATE REDUCTASE FLAVOPROTEIN SUBUNIT A

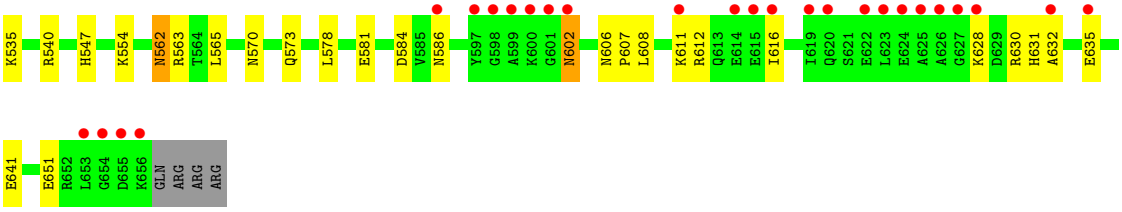
Chain A:



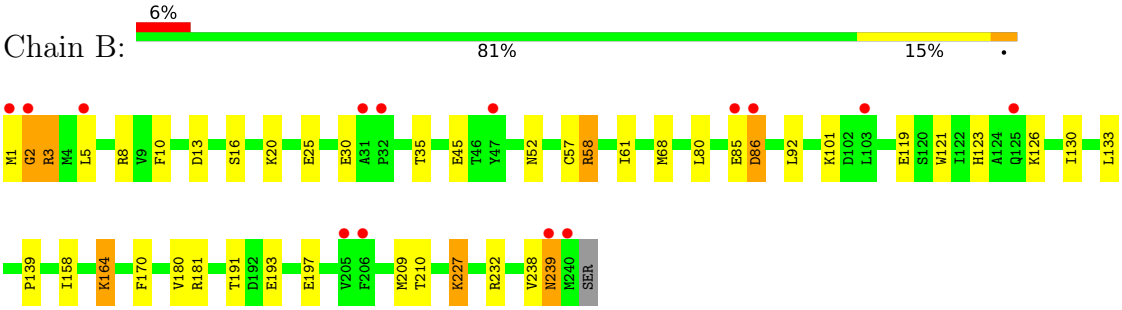
• Molecule 1: QUINOL-FUMARATE REDUCTASE FLAVOPROTEIN SUBUNIT A

Chain D:

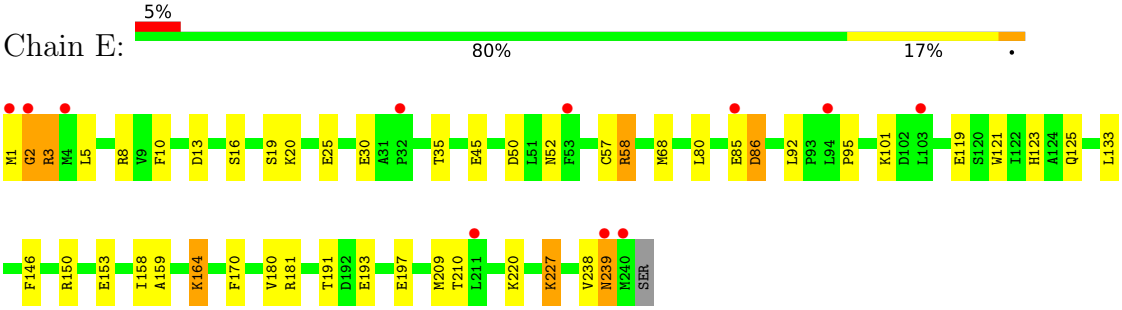




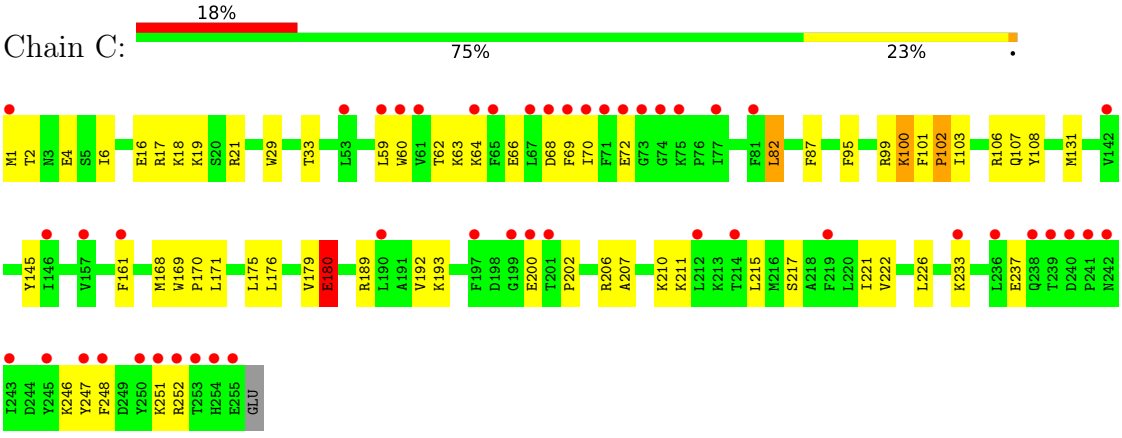
• Molecule 2: QUINOL-FUMARATE REDUCTASE IRON-SULFUR SUBUNIT B



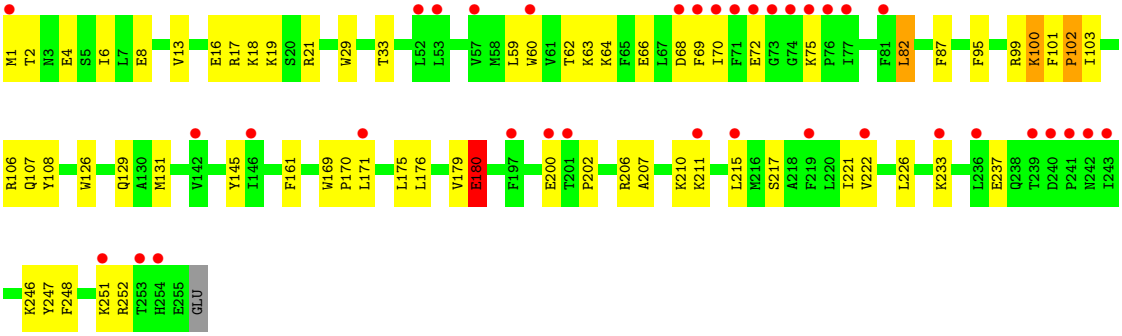
• Molecule 2: QUINOL-FUMARATE REDUCTASE IRON-SULFUR SUBUNIT B



• Molecule 3: QUINOL-FUMARATE REDUCTASE DIHEME CYTOCHROME B SUBUNIT C



• Molecule 3: QUINOL-FUMARATE REDUCTASE DIHEME CYTOCHROME B SUBUNIT C


M1 T2 N3 E4 S5 I6 L7 E8 V13 E16 R17 K18 K19 S20 R21 W29 T33 L52 L53 V57 M58 L59 W60 V61 T62 K63 K64 F65 E66 L67 D68 F69 I70 F71 E72 G73 G74 K75 P76 I77 F81 L82 F87 F95 R99 K100 F101 P102 I103
R106 Q107 Y108 W126 Q129 A130 M131 V142 Y145 I146 F161 W169 P170 L171 L175 L176 V179 E180 F197 E200 T201 P202 R206 A207 K210 K211 L215 M216 S217 A218 P219 L220 I221 V222 L226 K233 L236 E237 Q238 T239 D240 P241 N242 I243
K246 Y247 F248 K251 R252 T253 H254 E255 GLU

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	85.10Å 188.77Å 117.82Å 90.00° 104.47° 90.00°	Depositor
Resolution (Å)	28.70 – 1.78 28.70 – 1.78	Depositor EDS
% Data completeness (in resolution range)	92.5 (28.70-1.78) 92.3 (28.70-1.78)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.25 (at 1.78Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.229 , 0.237 0.224 , 0.231	Depositor DCC
R_{free} test set	4488 reflections (1.41%)	wwPDB-VP
Wilson B-factor (Å^2)	26.2	Xtriage
Anisotropy	0.185	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 59.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.43$, $< L^2 > = 0.26$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	19666	wwPDB-VP
Average B, all atoms (Å^2)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 12.55% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: NA, FAD, LMT, F3S, HEM, SF4, FUM, FES

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	2.00	2/5241 (0.0%)	0.61	3/7063 (0.0%)
1	D	0.32	0/5221	0.59	1/7038 (0.0%)
2	B	0.34	0/1939	0.59	0/2616
2	E	0.35	0/1939	0.59	0/2616
3	C	2.35	2/2165 (0.1%)	2.34	3/2930 (0.1%)
3	F	7.27	6/2165 (0.3%)	2.64	9/2930 (0.3%)
All	All	2.82	10/18670 (0.1%)	1.31	16/25193 (0.1%)

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

Mol	Chain	#Chirality outliers	#Planarity outliers
3	C	0	1
3	F	0	1
All	All	0	2

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	F	180[A]	GLU	CD-OE2	220.23	3.67	1.25
3	F	180[B]	GLU	CD-OE2	220.23	3.67	1.25
1	A	2[A]	LYS	CE-NZ	101.15	4.01	1.49
1	A	2[B]	LYS	CE-NZ	101.15	4.01	1.49
3	F	180[A]	GLU	CG-CD	83.46	2.77	1.51

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	C	180[A]	GLU	OE1-CD-OE2	-87.28	18.56	123.30
3	C	180[B]	GLU	OE1-CD-OE2	-87.28	18.56	123.30
3	F	180[A]	GLU	OE1-CD-OE2	-84.43	21.99	123.30
3	F	180[B]	GLU	OE1-CD-OE2	-84.43	21.99	123.30
3	F	180[A]	GLU	CG-CD-OE2	-38.95	40.40	118.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
3	C	180[A]	GLU	Sidechain
3	F	180[A]	GLU	Sidechain

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	5145	0	5124	126	0
1	D	5125	0	5100	128	0
2	B	1902	0	1869	44	0
2	E	1902	0	1869	49	0
3	C	2099	0	2111	56	0
3	F	2099	0	2111	67	0
4	A	53	0	29	3	0
4	D	53	0	29	3	0
5	A	8	0	1	0	0
5	D	8	0	1	0	0
6	A	1	0	0	0	0
6	D	1	0	0	0	0
7	B	4	0	0	0	0
7	E	4	0	0	0	0
8	B	7	0	0	0	0
8	E	7	0	0	0	0
9	B	8	0	0	0	0
9	E	8	0	0	0	0
10	C	86	0	60	1	0
10	F	86	0	60	1	0
11	C	35	0	46	8	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
11	F	35	0	46	9	0
12	A	273	0	0	9	0
12	B	155	0	0	3	0
12	C	55	0	0	1	0
12	D	287	0	0	5	0
12	E	164	0	0	2	0
12	F	56	0	0	1	0
All	All	19666	0	18456	444	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 12.

The worst 5 of 444 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)
3:F:180[B]:GLU:CD	3:F:180[B]:GLU:CG	1.80	1.47
3:F:180[A]:GLU:OE1	3:F:180[A]:GLU:CD	1.70	1.31
3:F:180[B]:GLU:OE1	3:F:180[B]:GLU:HG2	1.47	1.11
2:B:1:MET:HG2	2:B:2:GLY:H	1.24	1.01
2:E:1:MET:HG2	2:E:2:GLY:H	1.24	0.98

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	659/660 (100%)	634 (96%)	21 (3%)	4 (1%)	25 11
1	D	657/660 (100%)	631 (96%)	22 (3%)	4 (1%)	25 11
2	B	239/241 (99%)	227 (95%)	8 (3%)	4 (2%)	9 2
2	E	239/241 (99%)	227 (95%)	8 (3%)	4 (2%)	9 2

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
3	C	255/256 (100%)	247 (97%)	7 (3%)	1 (0%)	34 19
3	F	255/256 (100%)	247 (97%)	7 (3%)	1 (0%)	34 19
All	All	2304/2314 (100%)	2213 (96%)	73 (3%)	18 (1%)	19 7

5 of 18 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	121	ALA
2	B	86	ASP
3	C	72	GLU
1	D	121	ALA
2	E	86	ASP

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	537/537 (100%)	519 (97%)	18 (3%)	37 20
1	D	535/537 (100%)	518 (97%)	17 (3%)	39 22
2	B	212/213 (100%)	208 (98%)	4 (2%)	57 43
2	E	212/213 (100%)	208 (98%)	4 (2%)	57 43
3	C	223/223 (100%)	218 (98%)	5 (2%)	52 36
3	F	223/223 (100%)	218 (98%)	5 (2%)	52 36
All	All	1942/1946 (100%)	1889 (97%)	53 (3%)	44 28

5 of 53 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	52	GLN
1	D	403	ASN
3	F	82	LEU
1	D	95	LYS
1	D	275	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 42 such sidechains are listed below:

Mol	Chain	Res	Type
1	D	257	HIS
1	D	562	ASN
1	D	325	HIS
1	D	430	ASN
1	D	602	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 18 ligands modelled in this entry, 2 are monoatomic - leaving 16 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	$\#\|Z\| > 2$
10	HEM	F	1255	3	41,50,50	1.38	6 (14%)	45,82,82	0.88	2 (4%)
4	FAD	A	1656	1	53,58,58	1.80	14 (26%)	68,89,89	1.32	8 (11%)
9	SF4	E	1242	2	0,12,12	-	-	-		
11	LMT	C	1257	-	36,36,36	1.11	2 (5%)	47,47,47	1.27	4 (8%)
5	FUM	D	1657	-	7,7,7	1.16	0	8,8,8	0.70	0
7	FES	B	1240	2	0,4,4	-	-	-		

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
11	LMT	F	1257	-	36,36,36	1.11	2 (5%)	47,47,47	1.27	4 (8%)
10	HEM	C	1256	3	41,50,50	1.36	6 (14%)	45,82,82	1.33	5 (11%)
7	FES	E	1240	2	0,4,4	-	-	-		
10	HEM	F	1256	3	41,50,50	1.35	5 (12%)	45,82,82	1.33	5 (11%)
8	F3S	E	1241	2	0,9,9	-	-	-		
8	F3S	B	1241	2	0,9,9	-	-	-		
9	SF4	B	1242	2	0,12,12	-	-	-		
4	FAD	D	1656	1	53,58,58	1.71	10 (18%)	68,89,89	1.32	7 (10%)
10	HEM	C	1255	3	41,50,50	1.37	5 (12%)	45,82,82	0.87	2 (4%)
5	FUM	A	1657	-	7,7,7	1.17	0	8,8,8	0.71	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
10	HEM	F	1255	3	-	0/12/54/54	-
4	FAD	A	1656	1	-	4/30/50/50	0/6/6/6
11	LMT	C	1257	-	-	11/21/61/61	0/2/2/2
11	LMT	F	1257	-	-	11/21/61/61	0/2/2/2
5	FUM	D	1657	-	-	0/5/5/5	-
7	FES	B	1240	2	-	-	0/1/1/1
9	SF4	E	1242	2	-	-	0/6/5/5
10	HEM	C	1256	3	-	2/12/54/54	-
10	HEM	F	1256	3	-	2/12/54/54	-
7	FES	E	1240	2	-	-	0/1/1/1
8	F3S	E	1241	2	-	-	0/3/3/3
8	F3S	B	1241	2	-	-	0/3/3/3
9	SF4	B	1242	2	-	-	0/6/5/5
4	FAD	D	1656	1	-	4/30/50/50	0/6/6/6
10	HEM	C	1255	3	-	0/12/54/54	-
5	FUM	A	1657	-	-	0/5/5/5	-

The worst 5 of 50 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	1656	FAD	O4B-C1B	4.55	1.47	1.41
4	D	1656	FAD	O4B-C1B	4.38	1.47	1.41
4	D	1656	FAD	C1'-C2'	3.96	1.58	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	1656	FAD	PA-O2A	-3.83	1.37	1.55
4	A	1656	FAD	C1'-C2'	3.82	1.58	1.52

The worst 5 of 37 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
11	F	1257	LMT	C1-O1'-C1'	4.99	122.11	113.84
4	D	1656	FAD	C1'-N10-C9A	-4.97	112.23	120.51
4	A	1656	FAD	C1'-N10-C9A	-4.94	112.27	120.51
11	C	1257	LMT	C1-O1'-C1'	4.93	122.02	113.84
10	C	1256	HEM	CBA-CAA-C2A	3.75	119.01	112.62

There are no chirality outliers.

5 of 34 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	1656	FAD	PA-O3P-P-O5'
4	D	1656	FAD	PA-O3P-P-O5'
11	C	1257	LMT	C2'-C1'-O1'-C1
11	F	1257	LMT	C2'-C1'-O1'-C1
11	C	1257	LMT	O5'-C1'-O1'-C1

There are no ring outliers.

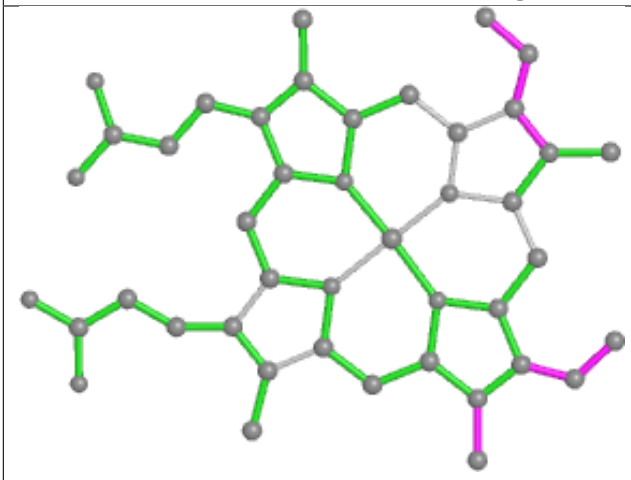
6 monomers are involved in 25 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	1656	FAD	3	0
11	C	1257	LMT	8	0
11	F	1257	LMT	9	0
10	C	1256	HEM	1	0
10	F	1256	HEM	1	0
4	D	1656	FAD	3	0

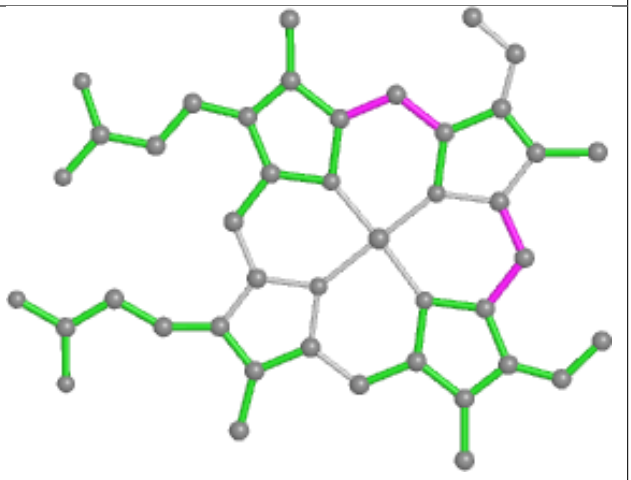
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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

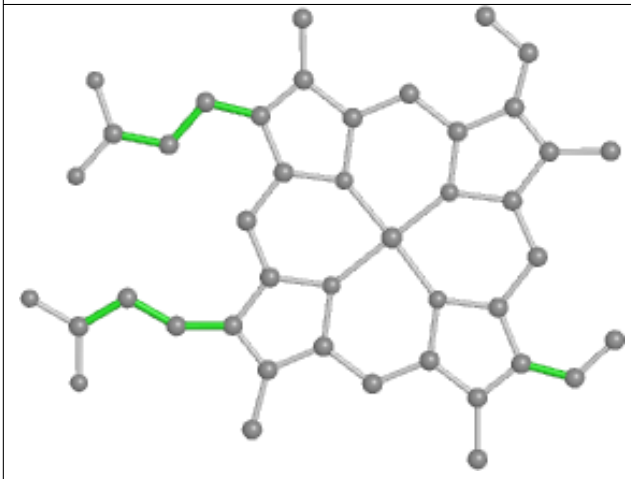
Ligand HEM F 1255



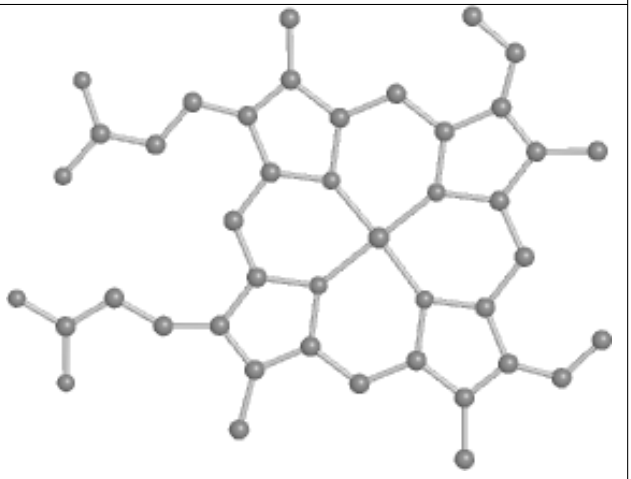
Bond lengths



Bond angles

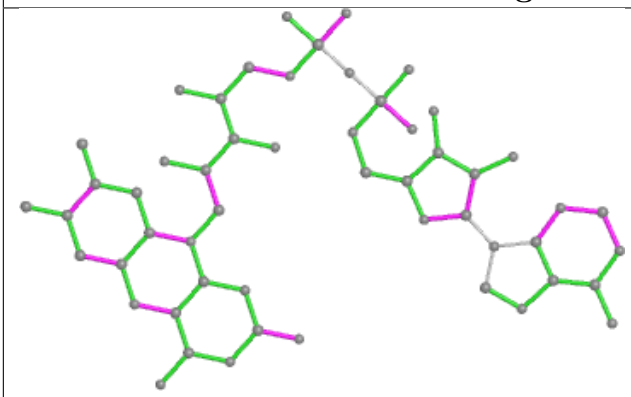


Torsions

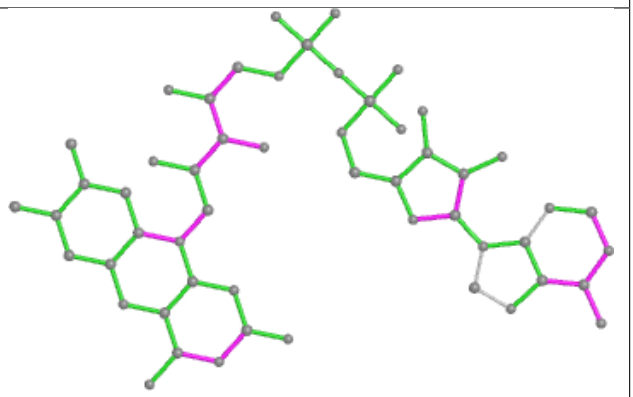


Rings

Ligand FAD A 1656



Bond lengths



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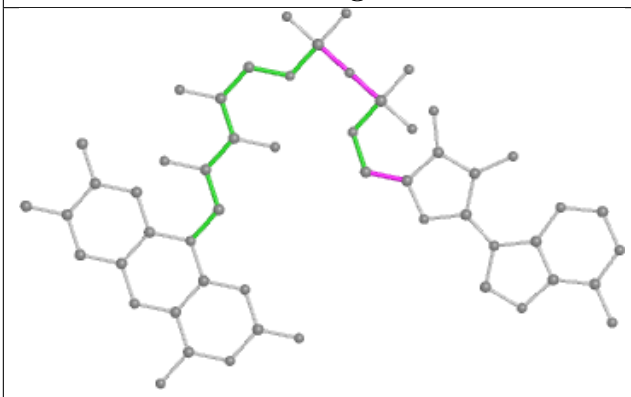
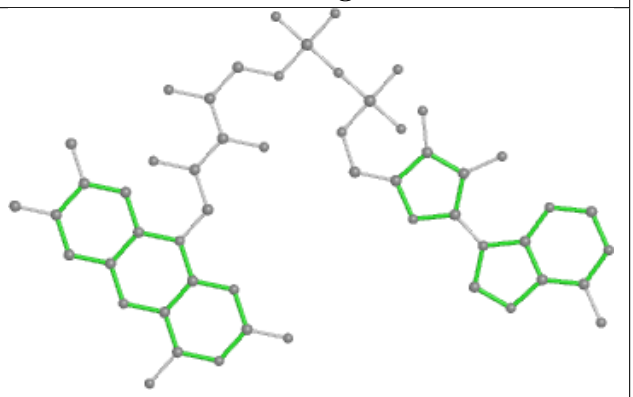
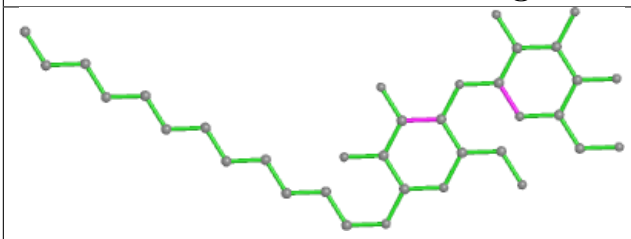


Torsions

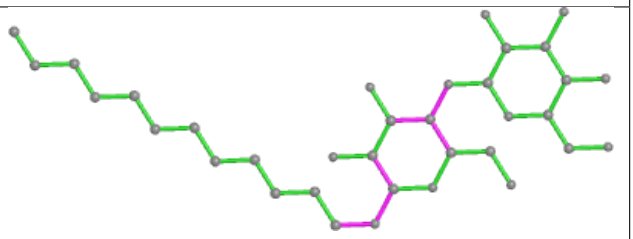


Rings

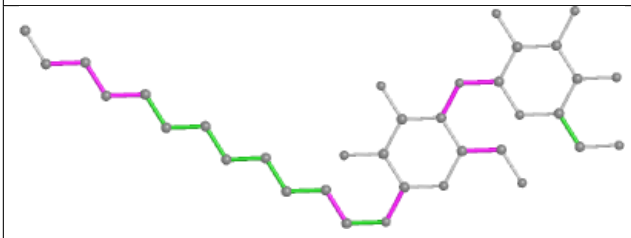
Ligand LMT C 1257



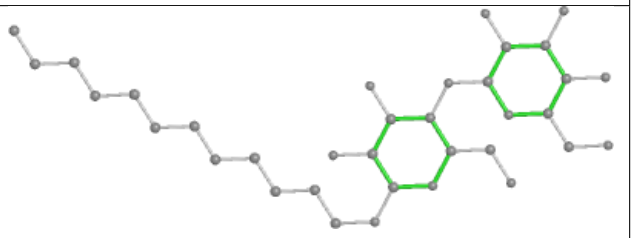
Bond lengths



Bond angles

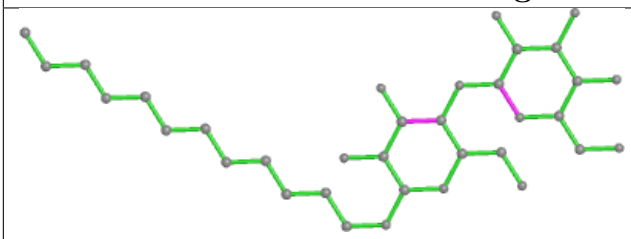


Torsions

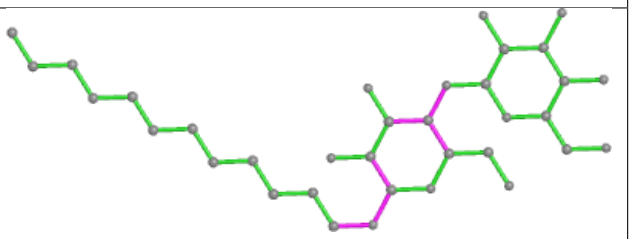


Rings

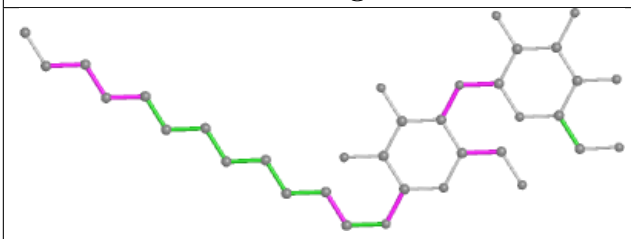
Ligand LMT F 1257



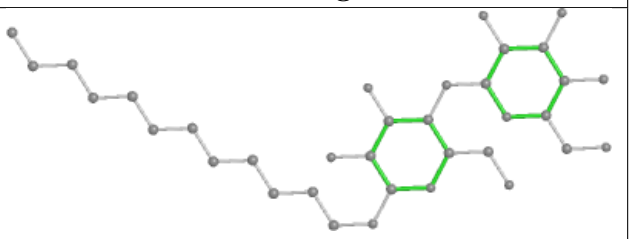
Bond lengths



Bond angles

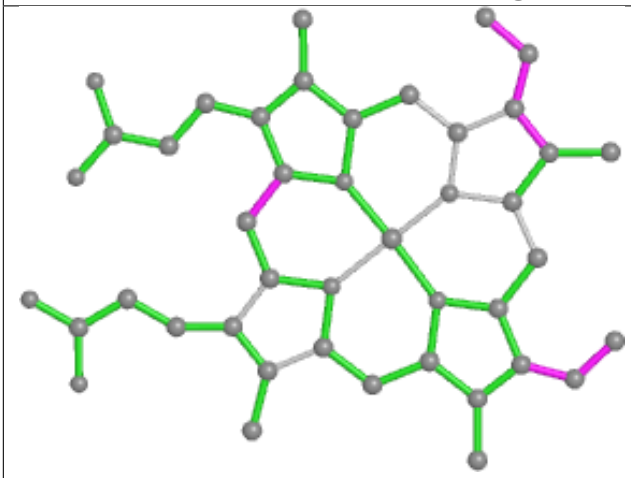


Torsions

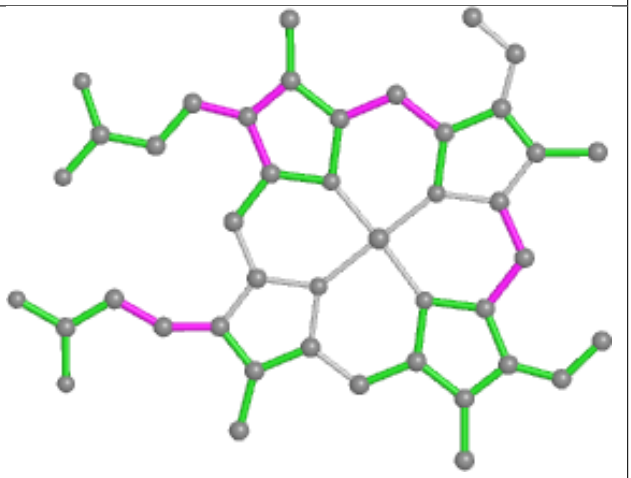


Rings

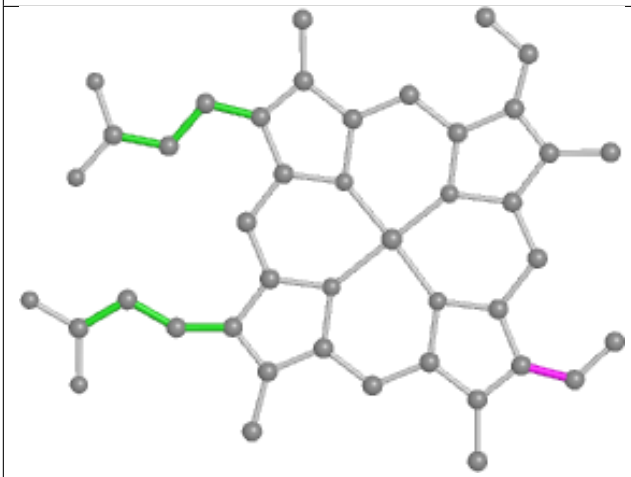
Ligand HEM C 1256



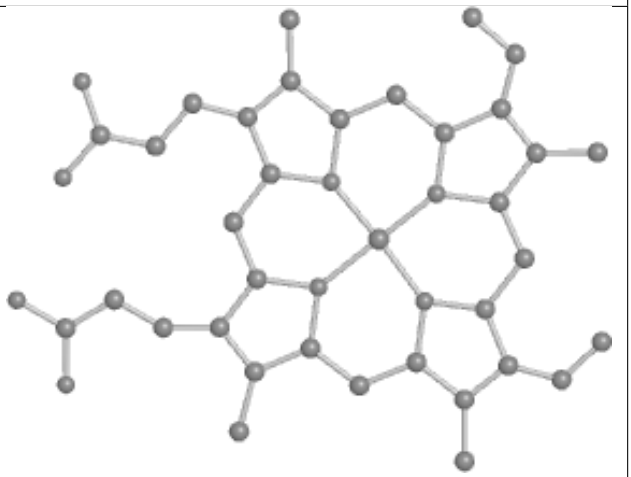
Bond lengths



Bond angles

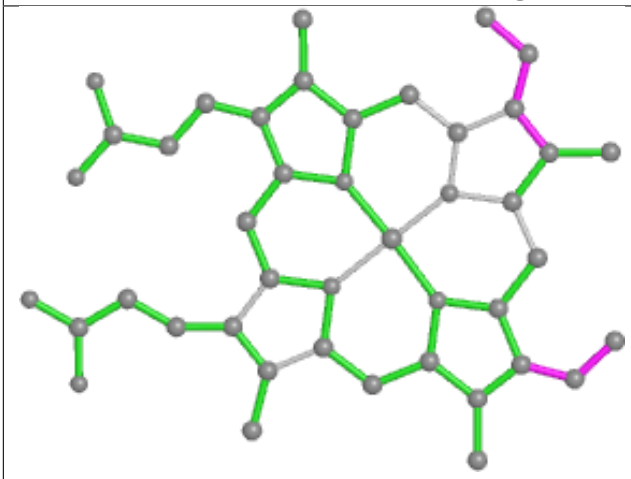


Torsions

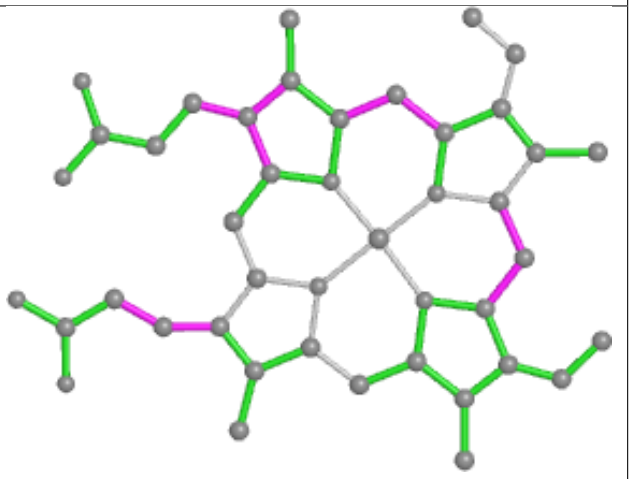


Rings

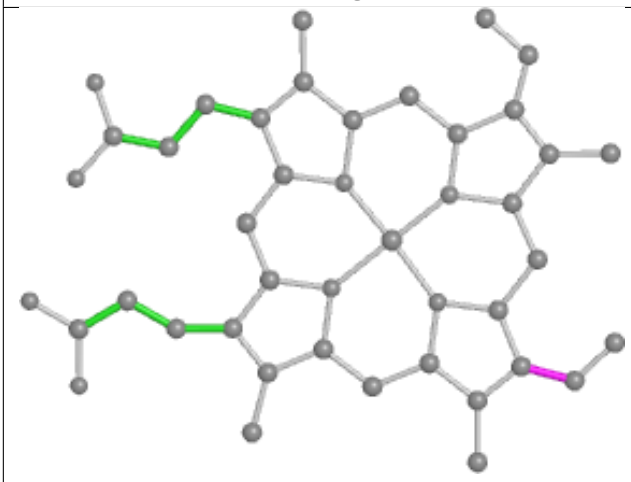
Ligand HEM F 1256



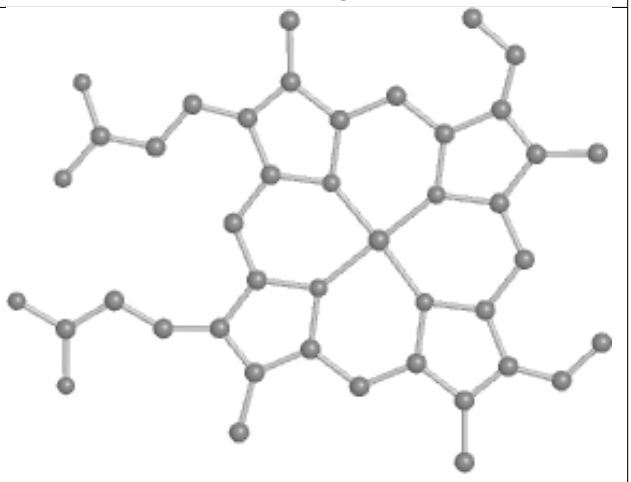
Bond lengths



Bond angles

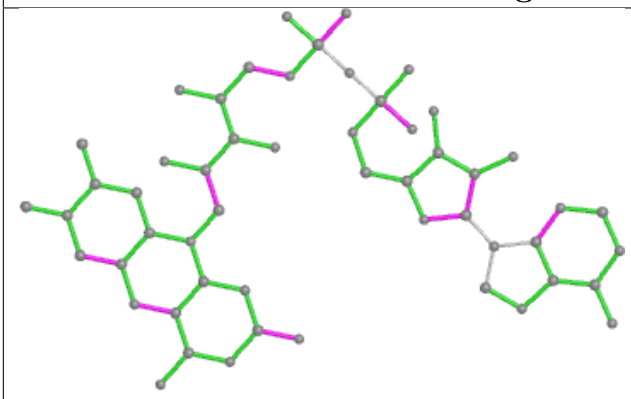


Torsions

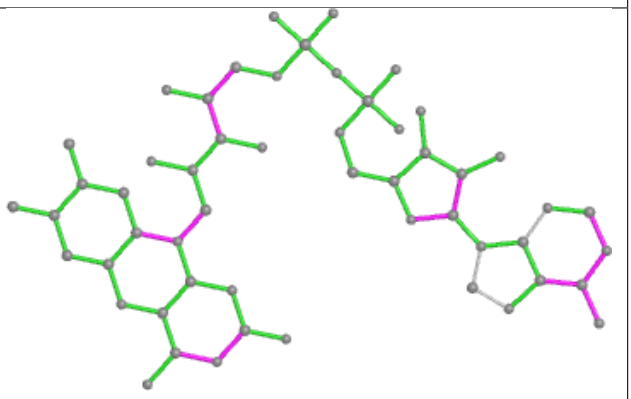


Rings

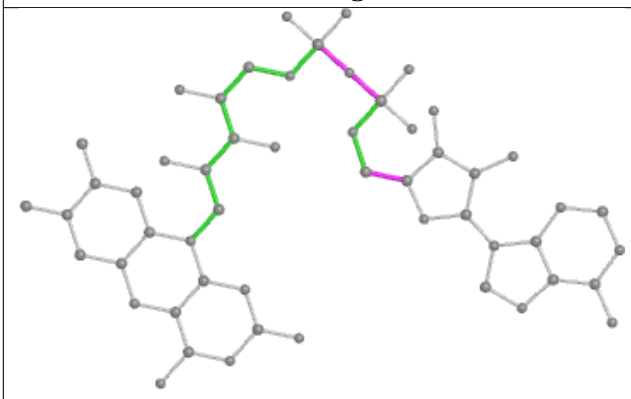
Ligand FAD D 1656



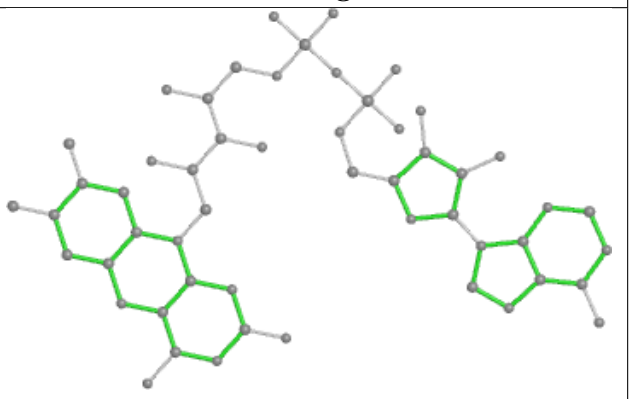
Bond lengths



Bond angles

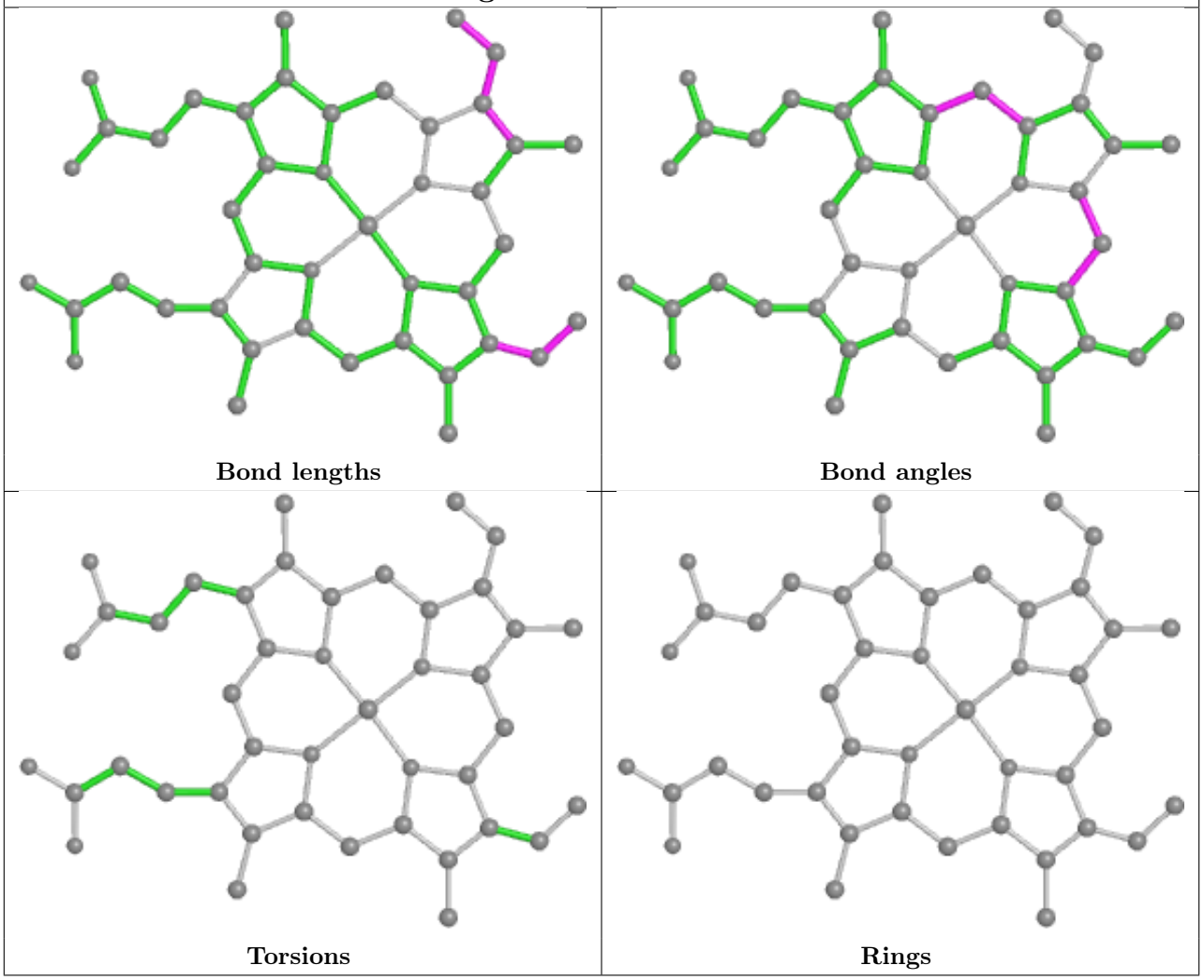


Torsions



Rings

Ligand HEM C 1255



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data

6.1 Protein, DNA and RNA chains

In the following table, the column labelled '#RSRZ> 2' contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95^{th} 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	656/660 (99%)	0.49	54 (8%)	11	11	19, 33, 69, 80	14 (2%)
1	D	656/660 (99%)	0.57	65 (9%)	7	7	19, 33, 69, 80	16 (2%)
2	B	240/241 (99%)	0.33	14 (5%)	23	22	21, 29, 50, 74	2 (0%)
2	E	240/241 (99%)	0.37	11 (4%)	32	31	20, 28, 51, 74	2 (0%)
3	C	255/256 (99%)	1.02	47 (18%)	1	1	26, 44, 77, 91	11 (4%)
3	F	255/256 (99%)	0.86	36 (14%)	2	2	25, 43, 76, 90	10 (3%)
All	All	2302/2314 (99%)	0.58	227 (9%)	7	7	19, 34, 70, 91	55 (2%)

The worst 5 of 227 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	121	ALA	13.8
2	B	1	MET	11.8
3	C	254	HIS	11.1
1	A	121	ALA	10.3
1	D	122	GLN	10.2

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

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

6.3 Carbohydrates

There are no monosaccharides in this entry.

6.4 Ligands (i)

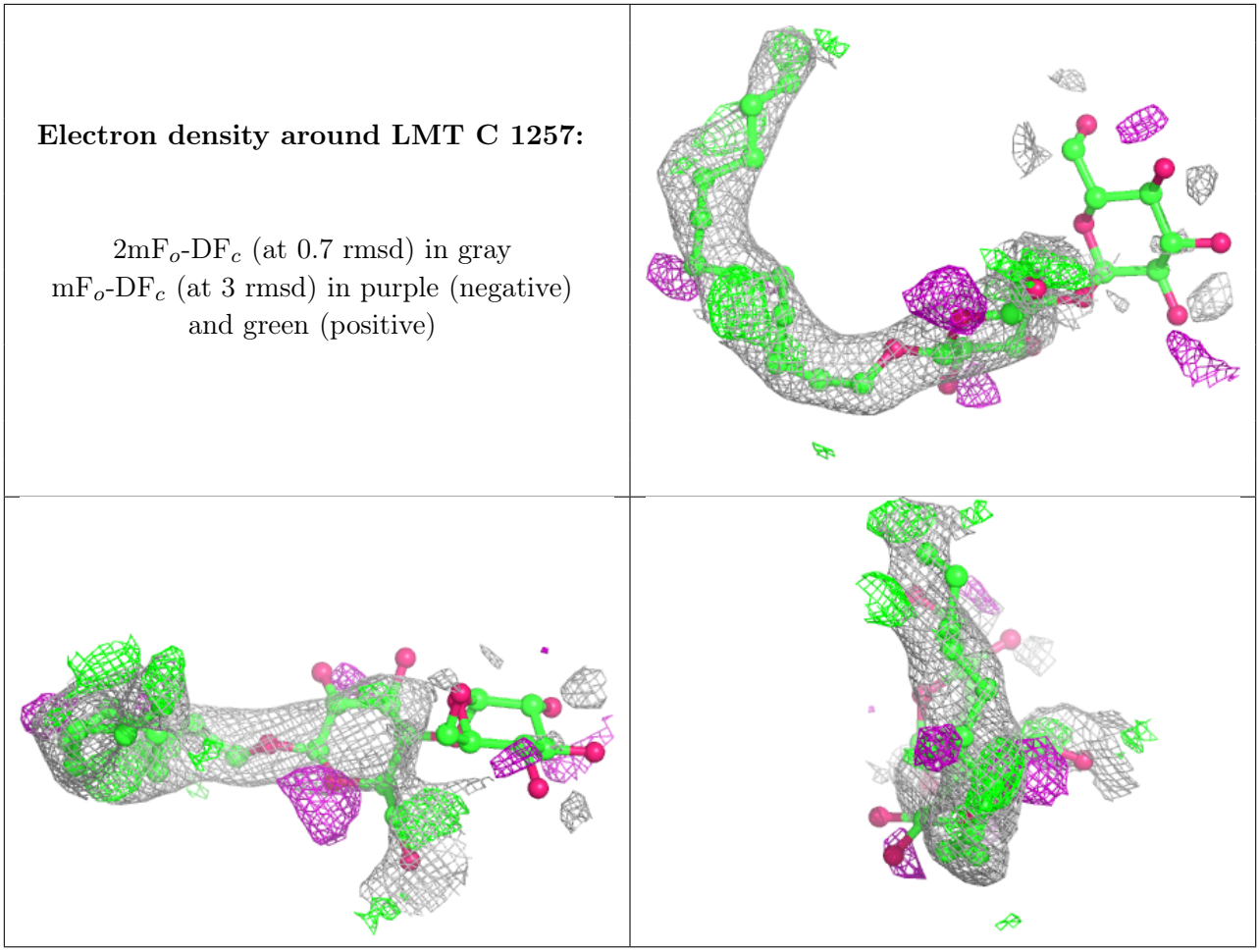
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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
11	LMT	C	1257	35/35	0.55	0.33	59,63,68,69	16
11	LMT	F	1257	35/35	0.73	0.25	59,63,69,69	16
5	FUM	A	1657	8/8	0.76	0.17	42,46,48,50	0
5	FUM	D	1657	8/8	0.79	0.18	43,46,47,48	0
10	HEM	C	1256	43/43	0.96	0.13	38,40,43,45	0
10	HEM	F	1256	43/43	0.96	0.13	36,40,43,45	0
6	NA	D	1658	1/1	0.96	0.08	26,26,26,26	0
10	HEM	C	1255	43/43	0.96	0.10	26,31,34,38	0
10	HEM	F	1255	43/43	0.97	0.10	26,32,35,38	0
4	FAD	D	1656	53/53	0.97	0.09	18,22,25,25	0
4	FAD	A	1656	53/53	0.98	0.08	16,22,25,27	0
9	SF4	E	1242	8/8	0.99	0.06	21,23,23,24	0
6	NA	A	1658	1/1	0.99	0.03	26,26,26,26	0
7	FES	B	1240	4/4	0.99	0.06	22,22,23,24	0
7	FES	E	1240	4/4	0.99	0.06	21,21,21,23	0
8	F3S	B	1241	7/7	0.99	0.07	24,25,26,27	0
8	F3S	E	1241	7/7	0.99	0.09	23,24,25,25	0
9	SF4	B	1242	8/8	0.99	0.05	22,24,25,25	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.

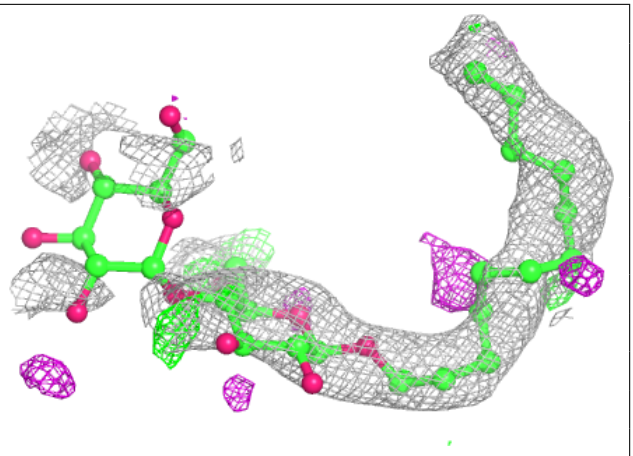
Electron density around LMT C 1257:

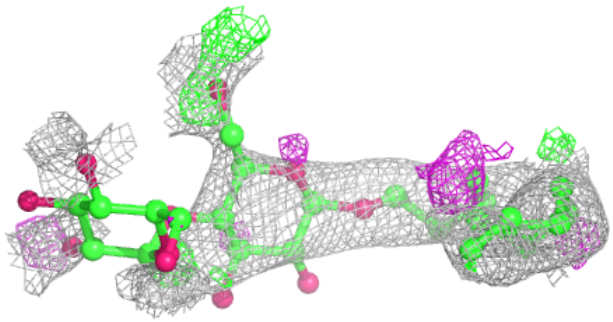
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

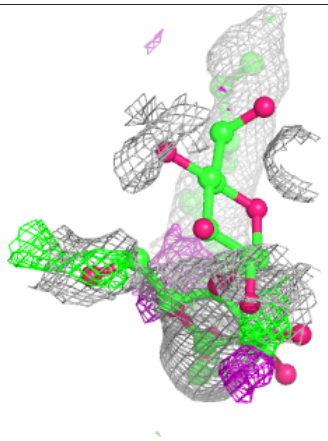


Electron density around LMT F 1257:

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

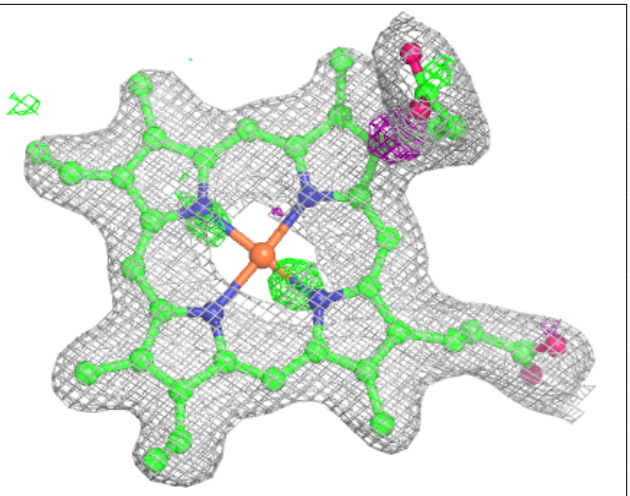


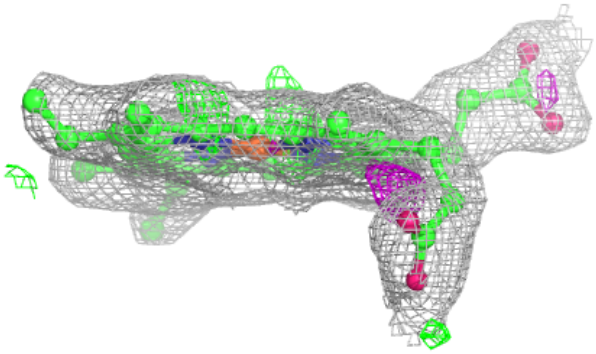


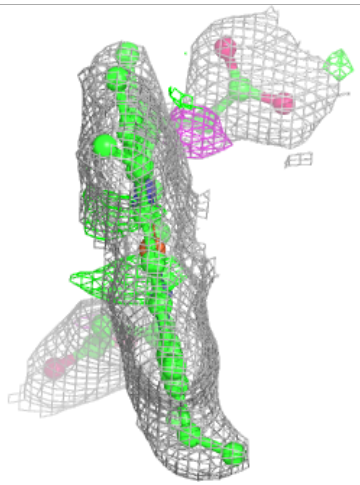


Electron density around HEM C 1256:

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

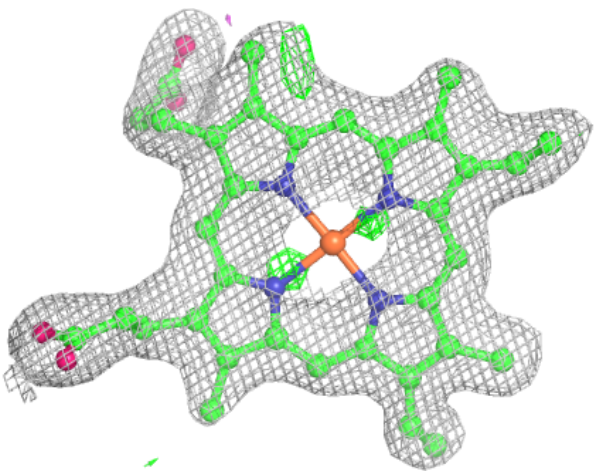


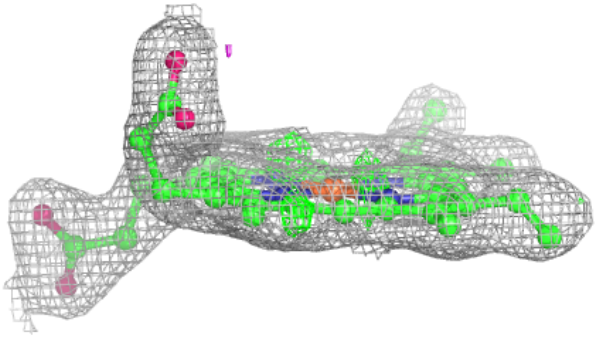


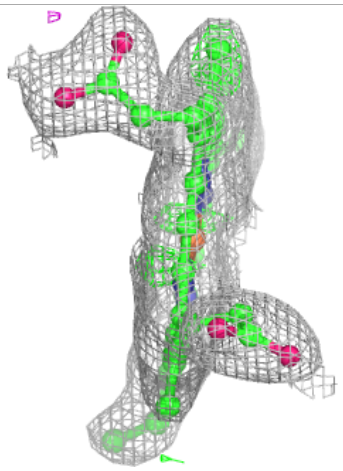


Electron density around HEM F 1256:

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

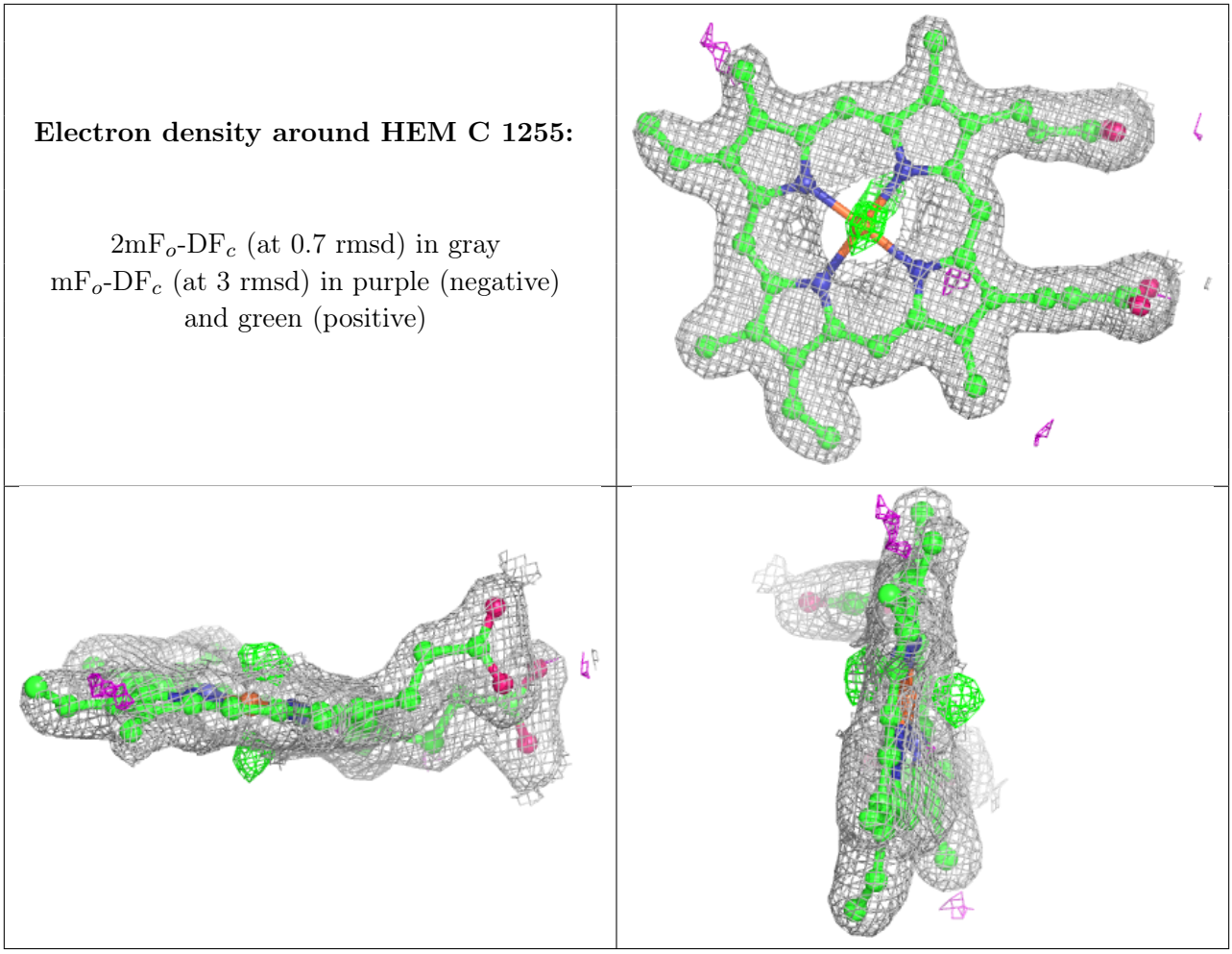






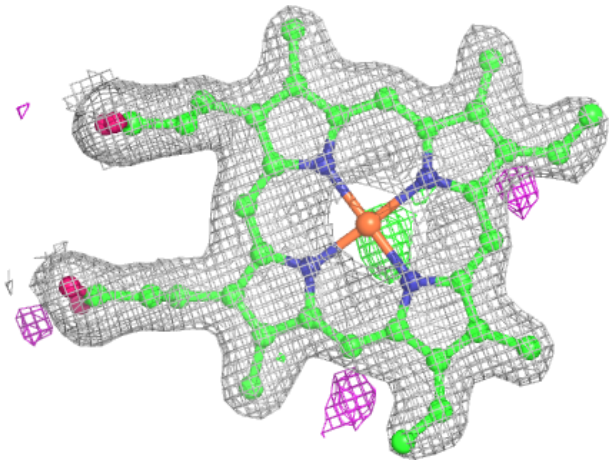
Electron density around HEM C 1255:

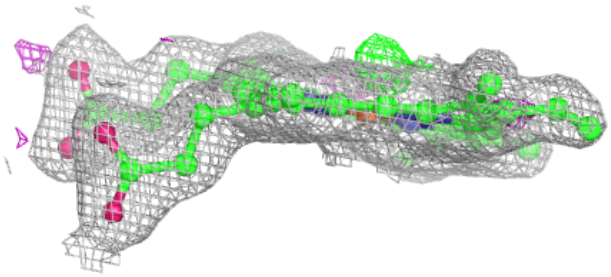
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative) and green (positive)

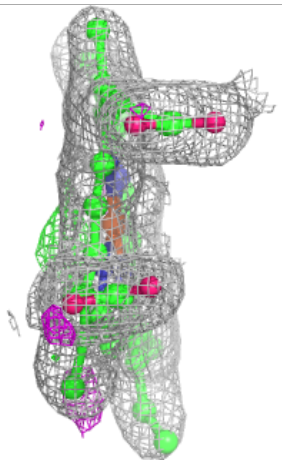


Electron density around HEM F 1255:

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

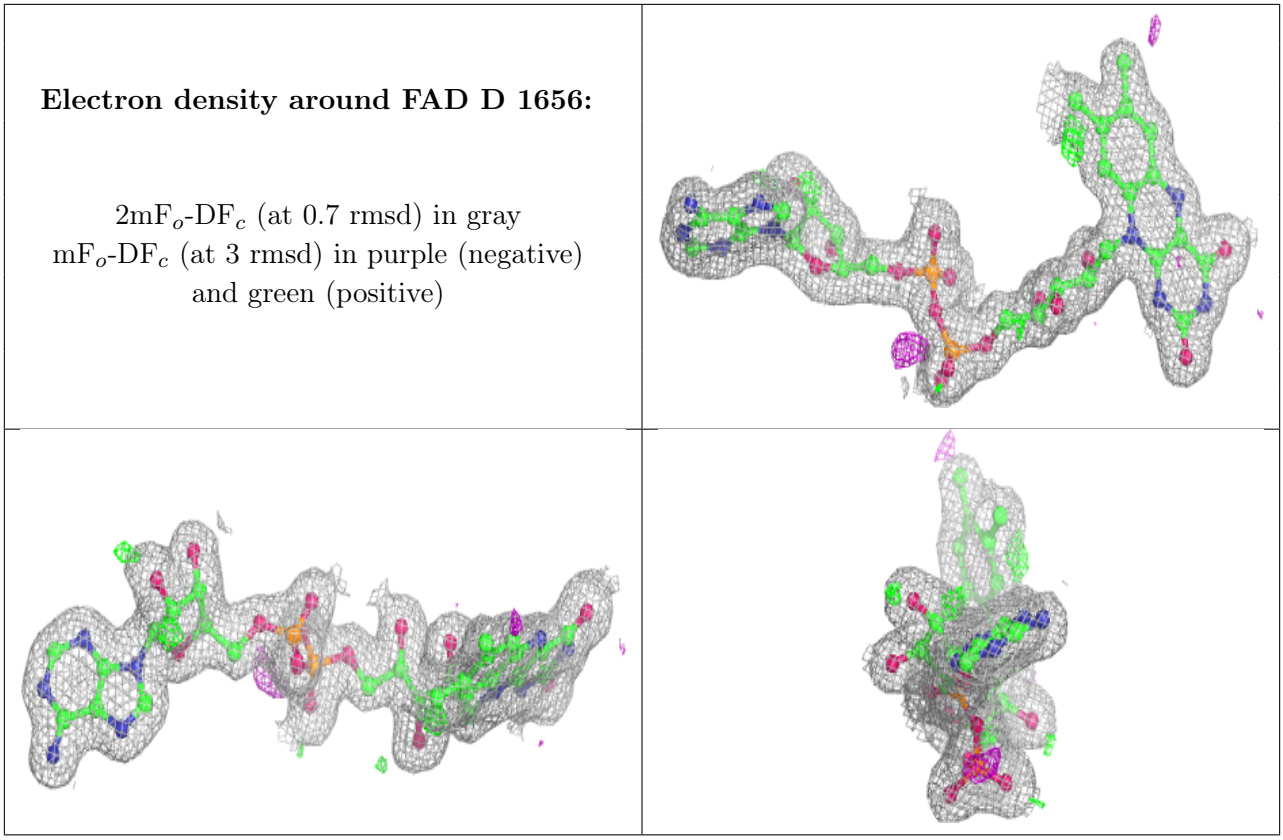






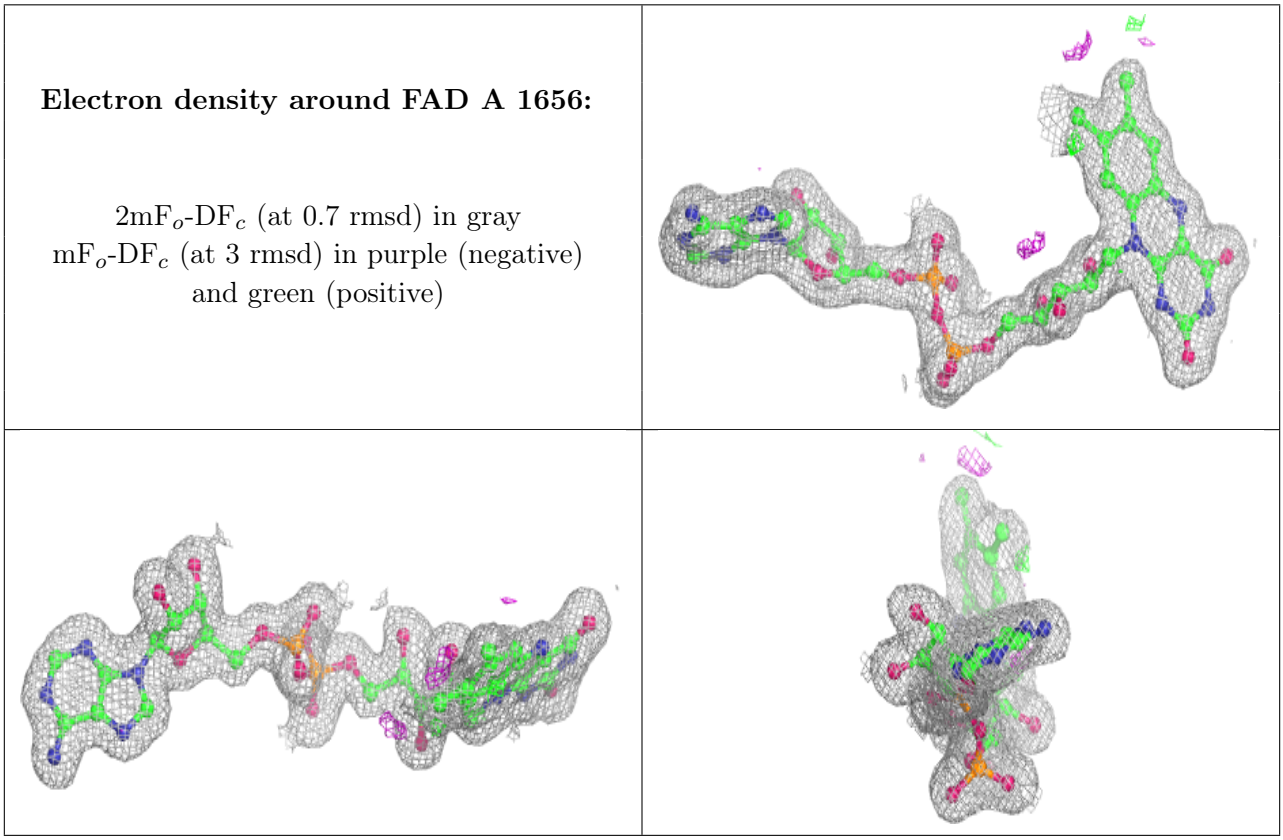
Electron density around FAD D 1656:

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



Electron density around FAD A 1656:

$2mF_o$-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.