



wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 3, 2024 – 01:51 am GMT

PDB ID : 2WDR
Title : E. coli succinate:quinone oxidoreductase (SQR) with pentachlorophenol bound
Authors : Ruprecht, J.; Yankovskaya, V.; Maklashina, E.; Iwata, S.; Cecchini, G.
Deposited on : 2009-03-25
Resolution : 3.20 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity : 4.02b-467
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 3.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.003 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.39

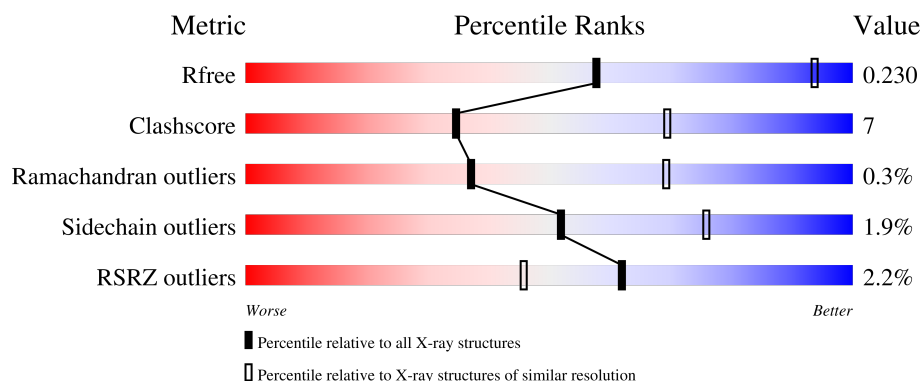
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.20 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}	164625	1370 (3.20-3.20)
Clashscore	180529	1497 (3.20-3.20)
Ramachandran outliers	177936	1479 (3.20-3.20)
Sidechain outliers	177891	1478 (3.20-3.20)
RSRZ outliers	164620	1371 (3.20-3.20)

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	588	<div> <div>0%</div> <div>82%</div> <div>18%</div> </div>
1	E	588	<div> <div>0%</div> <div>80%</div> <div>20%</div> </div>
1	I	588	<div> <div>4%</div> <div>82%</div> <div>18%</div> </div>
2	B	238	<div> <div>0%</div> <div>82%</div> <div>17%</div> </div>
2	F	238	<div> <div>2%</div> <div>81%</div> <div>18%</div> </div>

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Mol	Chain	Length	Quality of chain
2	J	238	
3	C	129	
3	G	129	
3	K	129	
4	D	115	
4	H	115	
4	L	115	

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
10	F3S	J	304	-	-	X	-
12	PCI	G	1131	-	X	-	-
6	TEO	A	1589	-	-	X	-

2 Entry composition

There are 12 unique types of molecules in this entry. The entry contains 24936 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 SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUB-UNIT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	588	Total	C	N	O	S	0	0	0
			4522	2812	821	861	28			
1	E	588	Total	C	N	O	S	0	0	0
			4522	2812	821	861	28			
1	I	588	Total	C	N	O	S	0	0	0
			4522	2812	821	861	28			

- Molecule 2 is a protein called SUCCINATE DEHYDROGENASE IRON-SULFUR SUB-UNIT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	238	Total	C	N	O	S	0	0	0
			1869	1172	329	348	20			
2	F	238	Total	C	N	O	S	0	0	0
			1869	1172	329	348	20			
2	J	238	Total	C	N	O	S	0	0	0
			1869	1172	329	348	20			

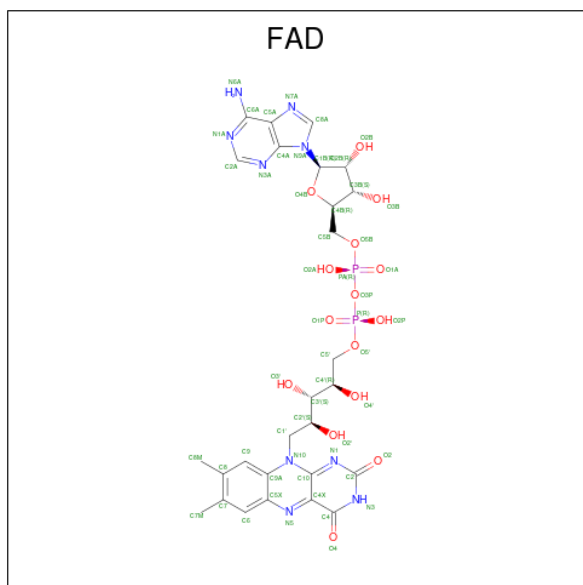
- Molecule 3 is a protein called SUCCINATE DEHYDROGENASE CYTOCHROME B556 SUBUNIT.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	122	Total	C	N	O	S	0	0	0
			948	630	153	160	5			
3	G	122	Total	C	N	O	S	0	0	0
			948	630	153	160	5			
3	K	122	Total	C	N	O	S	0	0	0
			948	630	153	160	5			

- Molecule 4 is a protein called SUCCINATE DEHYDROGENASE HYDROPHOBIC MEMBRANE ANCHOR SUBUNIT.

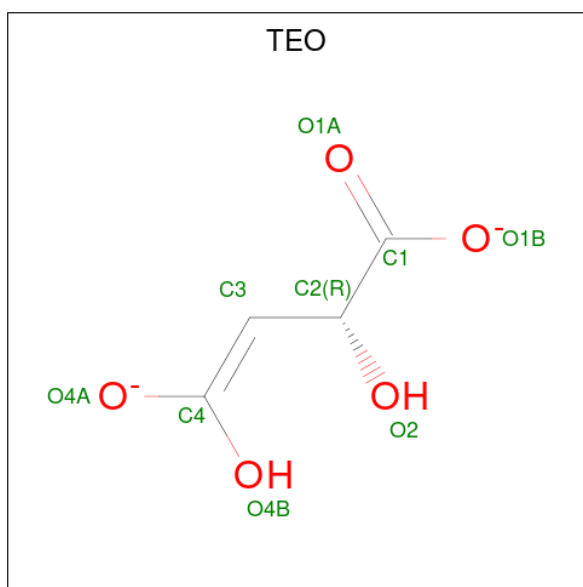
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	105	Total 836	C 577	N 123	O 133	S 3	0	0	0
4	H	105	Total 836	C 577	N 123	O 133	S 3	0	0	0
4	L	105	Total 836	C 577	N 123	O 133	S 3	0	0	0

- Molecule 5 is FLAVIN-ADENINE DINUCLEOTIDE (three-letter code: FAD) (formula: $\text{C}_{27}\text{H}_{33}\text{N}_9\text{O}_{15}\text{P}_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total 53	C 27	N 9	O 15	P 2	0	0
5	E	1	Total 53	C 27	N 9	O 15	P 2	0	0
5	I	1	Total 53	C 27	N 9	O 15	P 2	0	0

- Molecule 6 is MALATE LIKE INTERMEDIATE (three-letter code: TEO) (formula: $C_4H_4O_5$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			9	4	5		
6	E	1	Total	C	O	0	0
			9	4	5		
6	I	1	Total	C	O	0	0
			9	4	5		

- Molecule 7 is SODIUM ION (three-letter code: NA) (formula: Na).

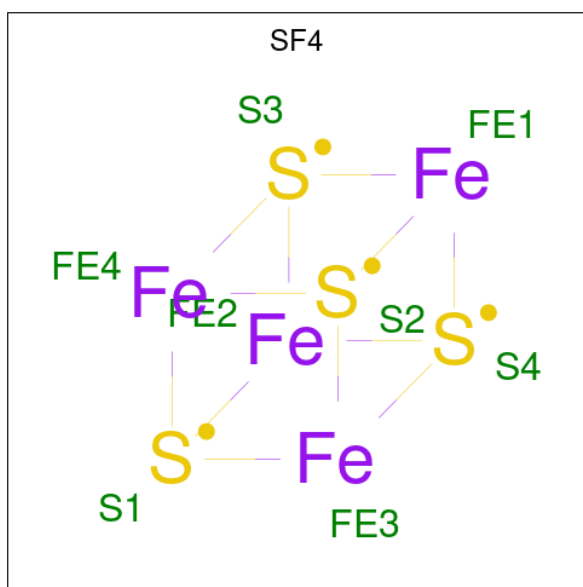
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	1	Total	Na	0	0
			1	1		
7	E	1	Total	Na	0	0
			1	1		
7	I	1	Total	Na	0	0
			1	1		

- Molecule 8 is FE2/S2 (INORGANIC) CLUSTER (three-letter code: FES) (formula: Fe₂S₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
8	B	1	Total	Fe	S	0	0
			4	2	2		
8	F	1	Total	Fe	S	0	0
			4	2	2		
8	J	1	Total	Fe	S	0	0
			4	2	2		

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



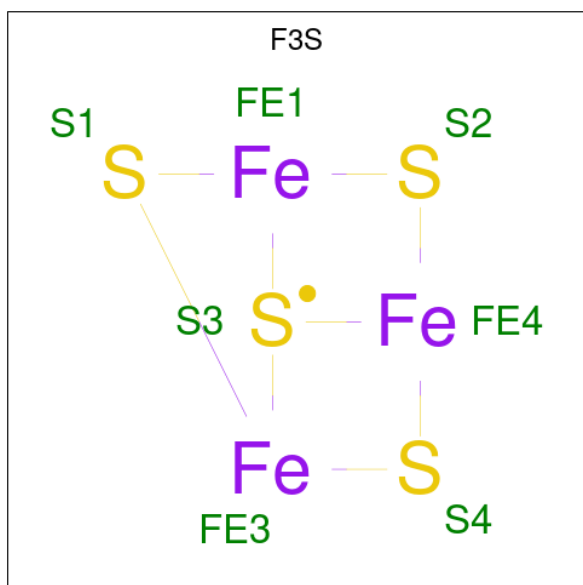
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	B	1	Total	Fe	S	0	0
			8	4	4		

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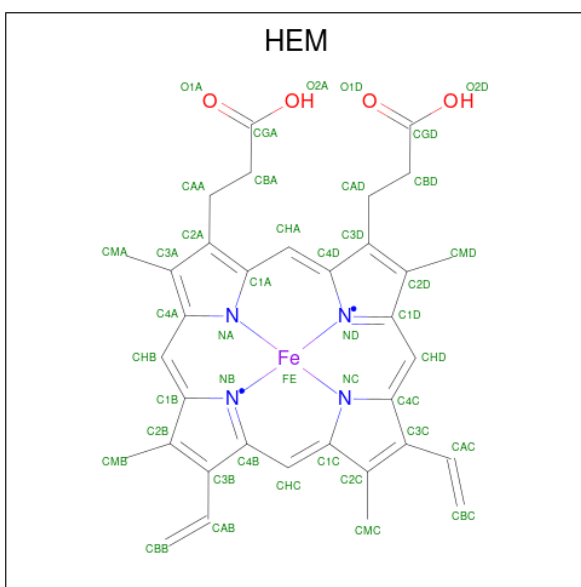
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	F	1	Total	Fe	S	0	0
			8	4	4		
9	J	1	Total	Fe	S	0	0
			8	4	4		

- Molecule 10 is FE3-S4 CLUSTER (three-letter code: F3S) (formula: Fe_3S_4).



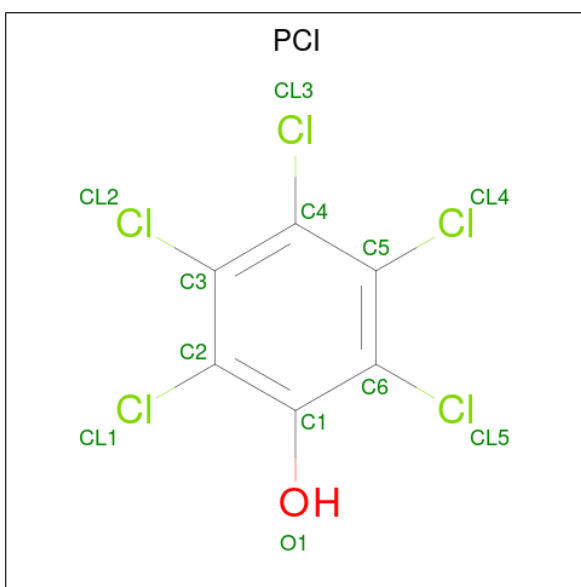
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
10	B	1	Total	Fe	S	0	0
			7	3	4		
10	F	1	Total	Fe	S	0	0
			7	3	4		
10	J	1	Total	Fe	S	0	0
			7	3	4		

- Molecule 11 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $\text{C}_{34}\text{H}_{32}\text{FeN}_4\text{O}_4$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
11	C	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
11	G	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
11	K	1	Total 43	C 34	Fe 1	N 4	O 4	0	0

- Molecule 12 is PENTACHLOROPHENOL (three-letter code: PCI) (formula: C_6HCl_5O).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
12	C	1	Total	C	Cl	O	0	0
			12	6	5	1		

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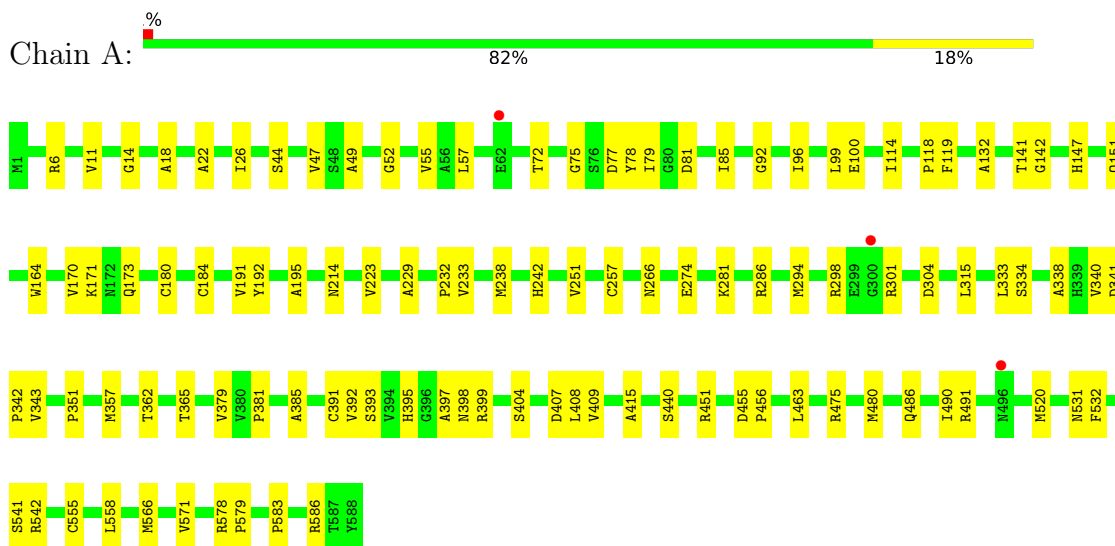
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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
12	G	1	Total	C	Cl	O	0	0
			12	6	5	1		
12	K	1	Total	C	Cl	O	0	0
			12	6	5	1		

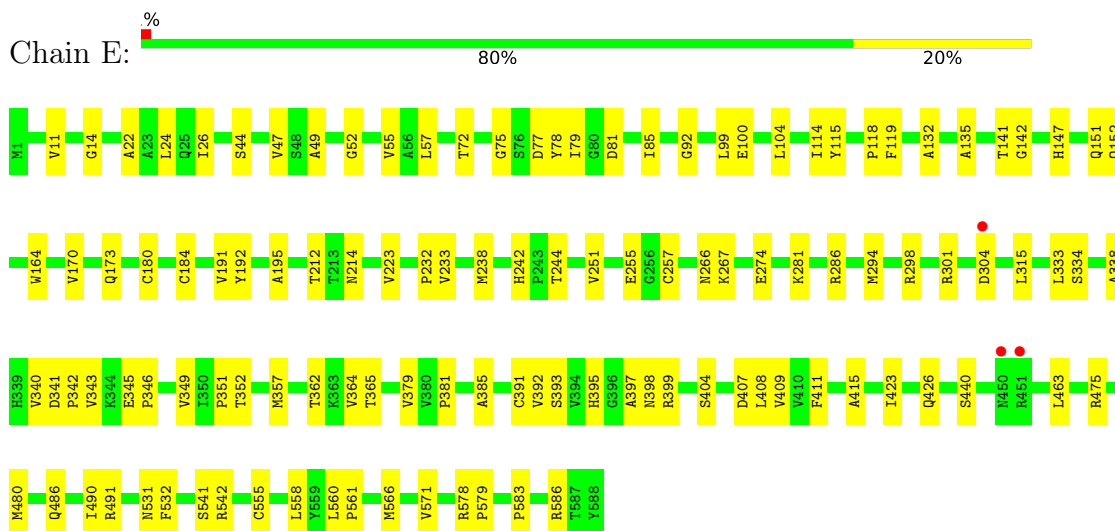
3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry 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.

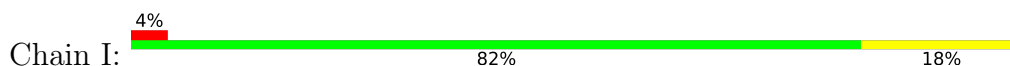
• Molecule 1: SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUBUNIT

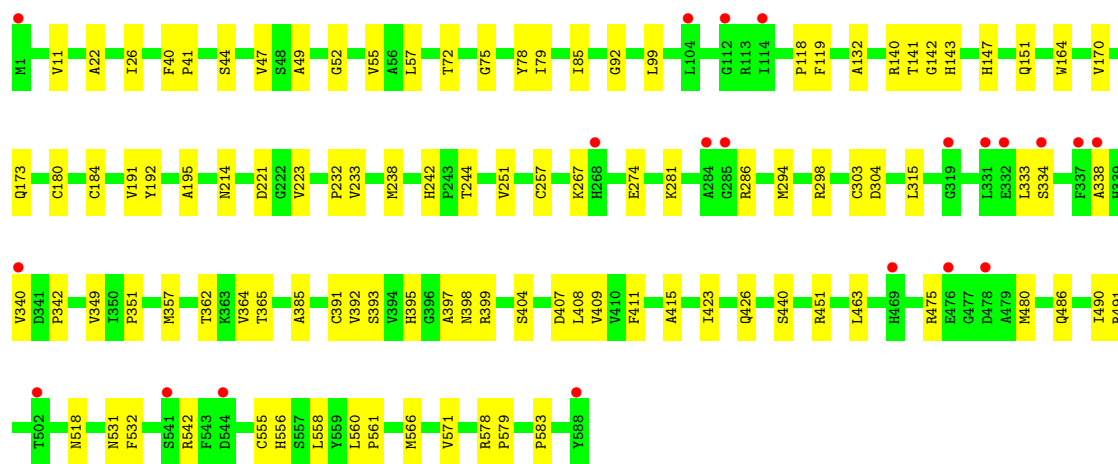


• Molecule 1: SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUBUNIT

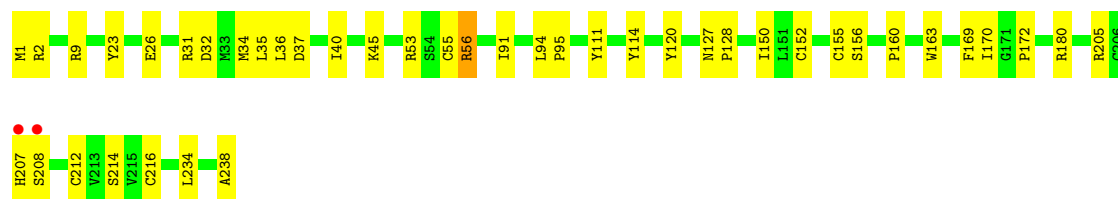
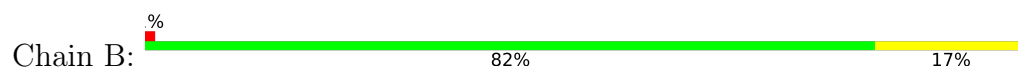


• Molecule 1: SUCCINATE DEHYDROGENASE FLAVOPROTEIN SUBUNIT

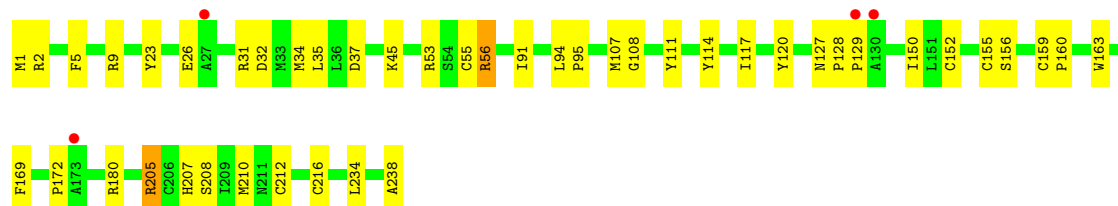
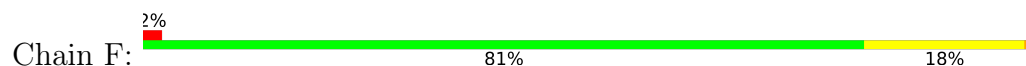




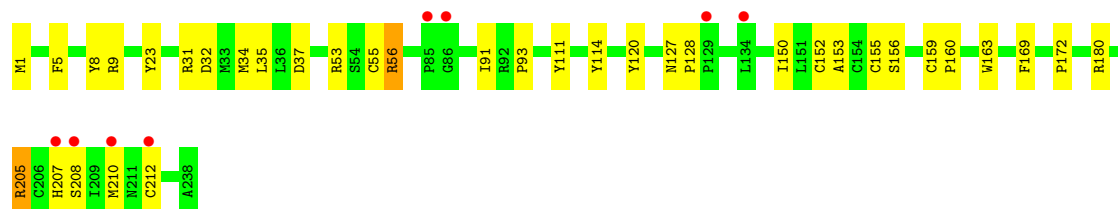
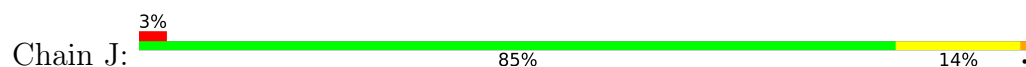
• Molecule 2: SUCCINATE DEHYDROGENASE IRON-SULFUR SUBUNIT



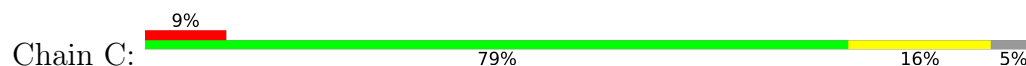
• Molecule 2: SUCCINATE DEHYDROGENASE IRON-SULFUR SUBUNIT



• Molecule 2: SUCCINATE DEHYDROGENASE IRON-SULFUR SUBUNIT

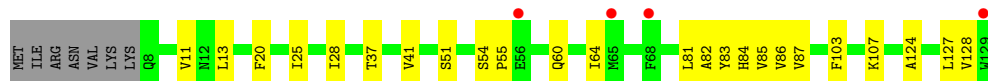
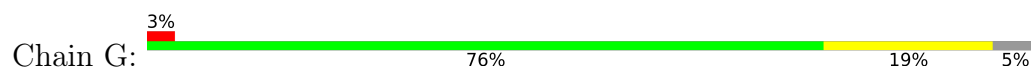


• Molecule 3: SUCCINATE DEHYDROGENASE CYTOCHROME B556 SUBUNIT

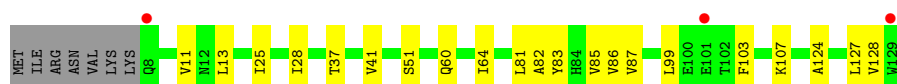
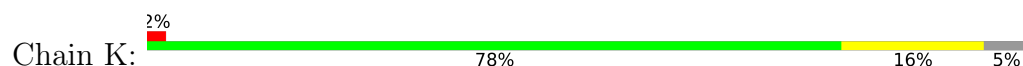




• Molecule 3: SUCCINATE DEHYDROGENASE CYTOCHROME B556 SUBUNIT



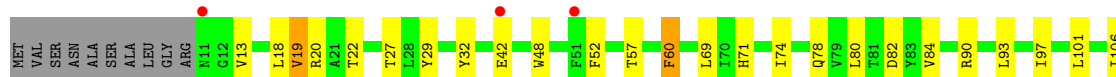
• Molecule 3: SUCCINATE DEHYDROGENASE CYTOCHROME B556 SUBUNIT



• Molecule 4: SUCCINATE DEHYDROGENASE HYDROPHOBIC MEMBRANE ANCHOR SUBUNIT



• Molecule 4: SUCCINATE DEHYDROGENASE HYDROPHOBIC MEMBRANE ANCHOR SUBUNIT



• Molecule 4: SUCCINATE DEHYDROGENASE HYDROPHOBIC MEMBRANE ANCHOR SUBUNIT



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	119.95Å 186.13Å 204.03Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.52 – 3.20 46.52 – 3.20	Depositor EDS
% Data completeness (in resolution range)	99.3 (46.52-3.20) 99.2 (46.52-3.20)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.11 (at 3.19Å)	Xtriage
Refinement program	REFMAC 5.4.0067	Depositor
R, R_{free}	0.197 , 0.228 0.200 , 0.230	Depositor DCC
R_{free} test set	3828 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å ²)	59.2	Xtriage
Anisotropy	0.356	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 91.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	24936	wwPDB-VP
Average B, all atoms (Å ²)	48.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.41% 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: NA, SF4, FAD, FES, HEM, PCI, TEO, F3S

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	0.51	0/4611	0.56	0/6237
1	E	0.44	0/4611	0.53	0/6237
1	I	0.38	0/4611	0.50	0/6237
2	B	0.54	0/1908	0.60	0/2578
2	F	0.51	0/1908	0.58	0/2578
2	J	0.44	0/1908	0.55	0/2578
3	C	0.52	0/970	0.55	0/1316
3	G	0.47	0/970	0.54	0/1316
3	K	0.42	0/970	0.49	0/1316
4	D	0.46	0/859	0.50	0/1175
4	H	0.42	0/859	0.48	0/1175
4	L	0.42	0/859	0.47	0/1175
All	All	0.46	0/25044	0.54	0/33918

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	4522	0	4426	64	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	E	4522	0	4426	67	0
1	I	4522	0	4426	63	0
2	B	1869	0	1850	24	0
2	F	1869	0	1850	30	0
2	J	1869	0	1850	24	0
3	C	948	0	989	13	0
3	G	948	0	989	14	0
3	K	948	0	989	12	0
4	D	836	0	875	12	0
4	H	836	0	875	19	0
4	L	836	0	875	14	0
5	A	53	0	29	7	0
5	E	53	0	30	5	0
5	I	53	0	29	6	0
6	A	9	0	3	4	0
6	E	9	0	3	2	0
6	I	9	0	3	2	0
7	A	1	0	0	0	0
7	E	1	0	0	0	0
7	I	1	0	0	0	0
8	B	4	0	0	0	0
8	F	4	0	0	0	0
8	J	4	0	0	0	0
9	B	8	0	0	1	0
9	F	8	0	0	1	0
9	J	8	0	0	1	0
10	B	7	0	0	1	0
10	F	7	0	0	1	0
10	J	7	0	0	2	0
11	C	43	0	30	7	0
11	G	43	0	30	7	0
11	K	43	0	30	4	0
12	C	12	0	1	0	0
12	G	12	0	0	1	0
12	K	12	0	0	0	0
All	All	24936	0	24608	368	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 7.

The worst 5 of 368 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)
11:C:1130:HEM:HBB2	11:C:1130:HEM:HHC	1.50	0.92
11:G:1130:HEM:HHC	11:G:1130:HEM:HBB2	1.55	0.87
2:F:55:CYS:O	2:F:56:ARG:HD3	1.75	0.86
1:E:555:CYS:HA	1:E:571:VAL:HG23	1.61	0.83
2:B:55:CYS:O	2:B:56:ARG:HD3	1.78	0.82

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	586/588 (100%)	558 (95%)	27 (5%)	1 (0%)	44	75
1	E	586/588 (100%)	558 (95%)	27 (5%)	1 (0%)	44	75
1	I	586/588 (100%)	557 (95%)	28 (5%)	1 (0%)	44	75
2	B	236/238 (99%)	221 (94%)	15 (6%)	0	100	100
2	F	236/238 (99%)	221 (94%)	14 (6%)	1 (0%)	30	64
2	J	236/238 (99%)	221 (94%)	15 (6%)	0	100	100
3	C	120/129 (93%)	116 (97%)	3 (2%)	1 (1%)	16	51
3	G	120/129 (93%)	116 (97%)	3 (2%)	1 (1%)	16	51
3	K	120/129 (93%)	116 (97%)	3 (2%)	1 (1%)	16	51
4	D	103/115 (90%)	96 (93%)	6 (6%)	1 (1%)	13	47
4	H	103/115 (90%)	95 (92%)	7 (7%)	1 (1%)	13	47
4	L	103/115 (90%)	97 (94%)	5 (5%)	1 (1%)	13	47
All	All	3135/3210 (98%)	2972 (95%)	153 (5%)	10 (0%)	37	69

5 of 10 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	92	GLY

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Mol	Chain	Res	Type
1	E	92	GLY
1	I	92	GLY
4	D	42	GLU
4	H	42	GLU

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	473/473 (100%)	467 (99%)	6 (1%)	65	83
1	E	473/473 (100%)	467 (99%)	6 (1%)	65	83
1	I	473/473 (100%)	468 (99%)	5 (1%)	70	86
2	B	208/208 (100%)	201 (97%)	7 (3%)	32	63
2	F	208/208 (100%)	200 (96%)	8 (4%)	28	60
2	J	208/208 (100%)	201 (97%)	7 (3%)	32	63
3	C	102/109 (94%)	102 (100%)	0	100	100
3	G	102/109 (94%)	101 (99%)	1 (1%)	73	87
3	K	102/109 (94%)	101 (99%)	1 (1%)	73	87
4	D	88/96 (92%)	85 (97%)	3 (3%)	32	63
4	H	88/96 (92%)	85 (97%)	3 (3%)	32	63
4	L	88/96 (92%)	85 (97%)	3 (3%)	32	63
All	All	2613/2658 (98%)	2563 (98%)	50 (2%)	52	76

5 of 50 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	F	205	ARG
1	I	173	GLN
4	L	109	PHE
2	F	212	CYS
4	H	60	PHE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 24 ligands modelled in this entry, 3 are monoatomic - leaving 21 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	$\# Z > 2$
11	HEM	G	1130	4,3	41,50,50	1.97	8 (19%)	45,82,82	1.94	10 (22%)
12	PCI	C	1131	-	12,12,12	2.00	4 (33%)	18,18,18	1.22	1 (5%)
8	FES	F	302	2	0,4,4	-	-	-		
9	SF4	F	303	2	0,12,12	-	-	-		
10	F3S	F	304	2	0,9,9	-	-	-		
5	FAD	A	601	1	53,58,58	1.24	4 (7%)	68,89,89	1.39	10 (14%)
6	TEO	I	1589	-	6,8,8	1.04	0	4,10,10	1.59	1 (25%)
5	FAD	I	601	1	53,58,58	1.23	4 (7%)	68,89,89	1.39	10 (14%)
9	SF4	B	303	2	0,12,12	-	-	-		
12	PCI	K	1131	-	12,12,12	2.14	5 (41%)	18,18,18	1.14	2 (11%)
10	F3S	B	304	2	0,9,9	-	-	-		
12	PCI	G	1131	-	12,12,12	2.21	6 (50%)	18,18,18	2.03	7 (38%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
8	FES	B	302	2	0,4,4	-	-	-		
11	HEM	C	1130	4,3	41,50,50	1.89	7 (17%)	45,82,82	1.98	14 (31%)
6	TEO	E	1589	-	6,8,8	0.93	0	4,10,10	1.72	2 (50%)
8	FES	J	302	2	0,4,4	-	-	-		
9	SF4	J	303	2	0,12,12	-	-	-		
5	FAD	E	601	1	53,58,58	1.24	3 (5%)	68,89,89	1.56	15 (22%)
10	F3S	J	304	2	0,9,9	-	-	-		
6	TEO	A	1589	-	6,8,8	1.17	0	4,10,10	1.70	1 (25%)
11	HEM	K	1130	4,3	41,50,50	2.04	8 (19%)	45,82,82	2.00	9 (20%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
11	HEM	G	1130	4,3	-	9/12/54/54	-
12	PCI	C	1131	-	-	-	0/1/1/1
8	FES	F	302	2	-	-	0/1/1/1
9	SF4	F	303	2	-	-	0/6/5/5
10	F3S	F	304	2	-	-	0/3/3/3
5	FAD	A	601	1	-	4/30/50/50	0/6/6/6
6	TEO	I	1589	-	-	4/6/8/8	-
5	FAD	I	601	1	-	9/30/50/50	0/6/6/6
9	SF4	B	303	2	-	-	0/6/5/5
12	PCI	K	1131	-	-	-	0/1/1/1
10	F3S	B	304	2	-	-	0/3/3/3
12	PCI	G	1131	-	-	-	0/1/1/1
8	FES	B	302	2	-	-	0/1/1/1
11	HEM	C	1130	4,3	-	6/12/54/54	-
6	TEO	E	1589	-	-	5/6/8/8	-
8	FES	J	302	2	-	-	0/1/1/1
9	SF4	J	303	2	-	-	0/6/5/5
5	FAD	E	601	1	-	5/30/50/50	0/6/6/6
10	F3S	J	304	2	-	-	0/3/3/3
6	TEO	A	1589	-	-	5/6/8/8	-
11	HEM	K	1130	4,3	-	7/12/54/54	-

The worst 5 of 49 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
11	K	1130	HEM	C3D-C2D	7.88	1.53	1.36
11	G	1130	HEM	C3D-C2D	7.56	1.52	1.36
11	C	1130	HEM	C3D-C2D	7.29	1.52	1.36
11	G	1130	HEM	C3C-C2C	-5.49	1.32	1.40
5	E	601	FAD	C4X-N5	5.03	1.40	1.30

The worst 5 of 82 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
11	K	1130	HEM	C4D-ND-C1D	6.29	111.57	105.07
11	C	1130	HEM	C4D-ND-C1D	5.79	111.05	105.07
11	G	1130	HEM	C4D-ND-C1D	5.54	110.80	105.07
5	A	601	FAD	N3A-C2A-N1A	-5.32	120.36	128.68
12	G	1131	PCI	C1-C6-CL5	5.29	124.02	118.08

There are no chirality outliers.

5 of 54 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	601	FAD	O4B-C4B-C5B-O5B
5	E	601	FAD	PA-O3P-P-O5'
5	I	601	FAD	N10-C1'-C2'-O2'
5	I	601	FAD	N10-C1'-C2'-C3'
5	I	601	FAD	C2'-C3'-C4'-O4'

There are no ring outliers.

16 monomers are involved in 49 short contacts:

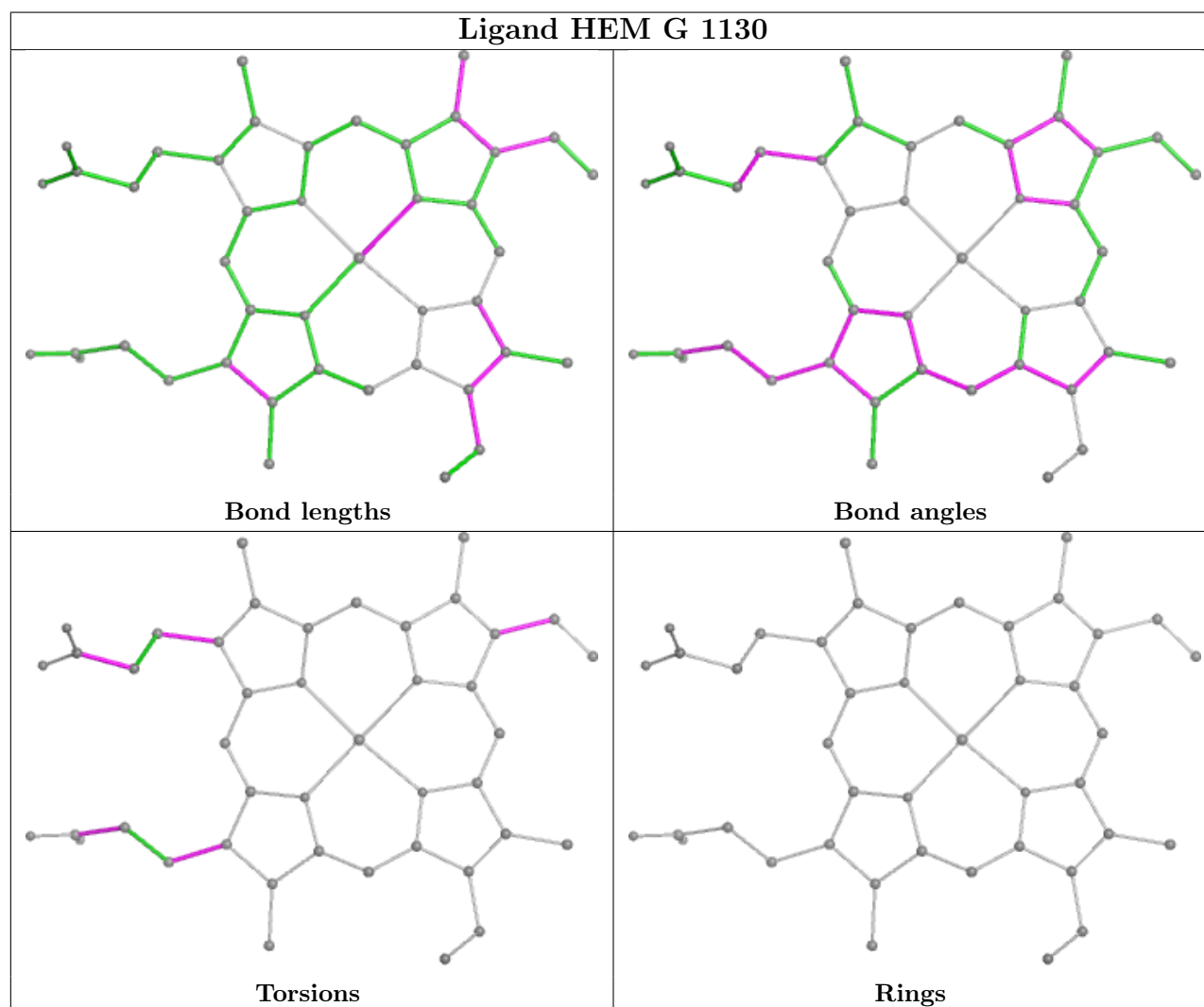
Mol	Chain	Res	Type	Clashes	Symm-Clashes
11	G	1130	HEM	7	0
9	F	303	SF4	1	0
10	F	304	F3S	1	0
5	A	601	FAD	7	0
6	I	1589	TEO	2	0
5	I	601	FAD	6	0
9	B	303	SF4	1	0
10	B	304	F3S	1	0
12	G	1131	PCI	1	0
11	C	1130	HEM	7	0
6	E	1589	TEO	2	0
9	J	303	SF4	1	0
5	E	601	FAD	5	0

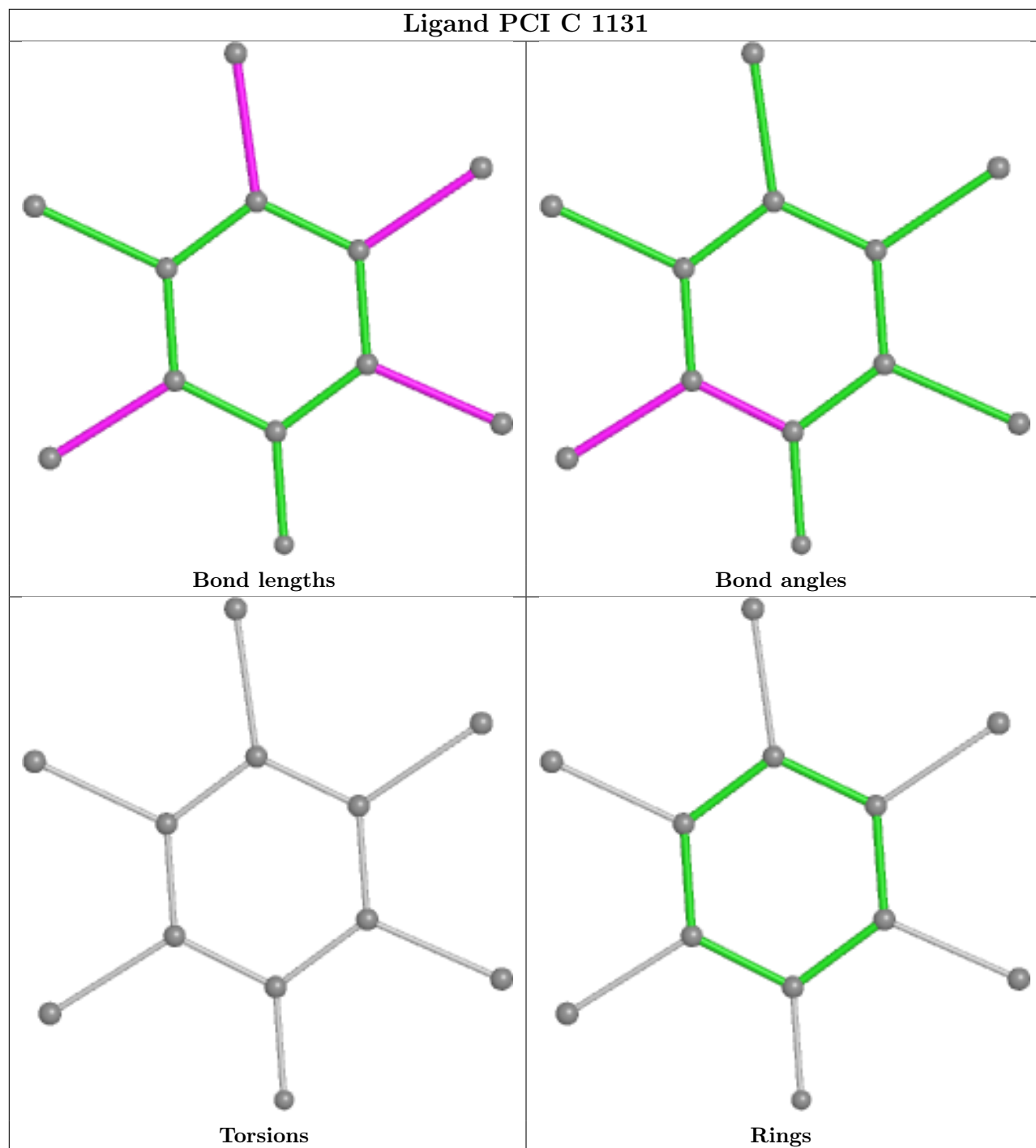
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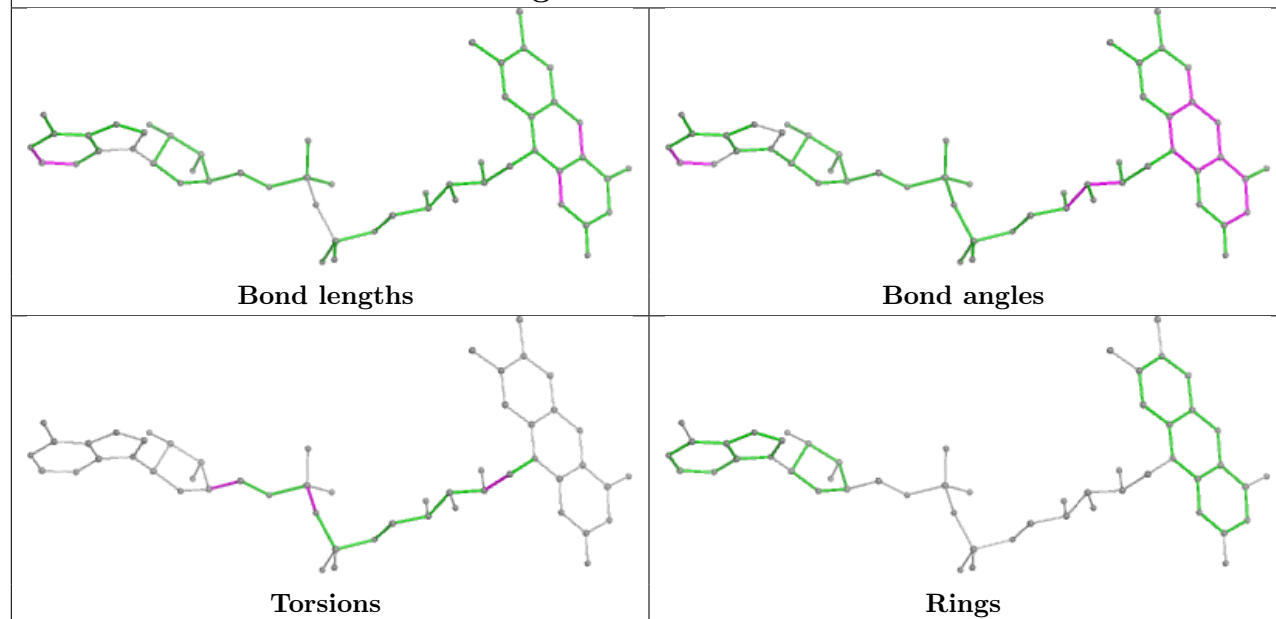
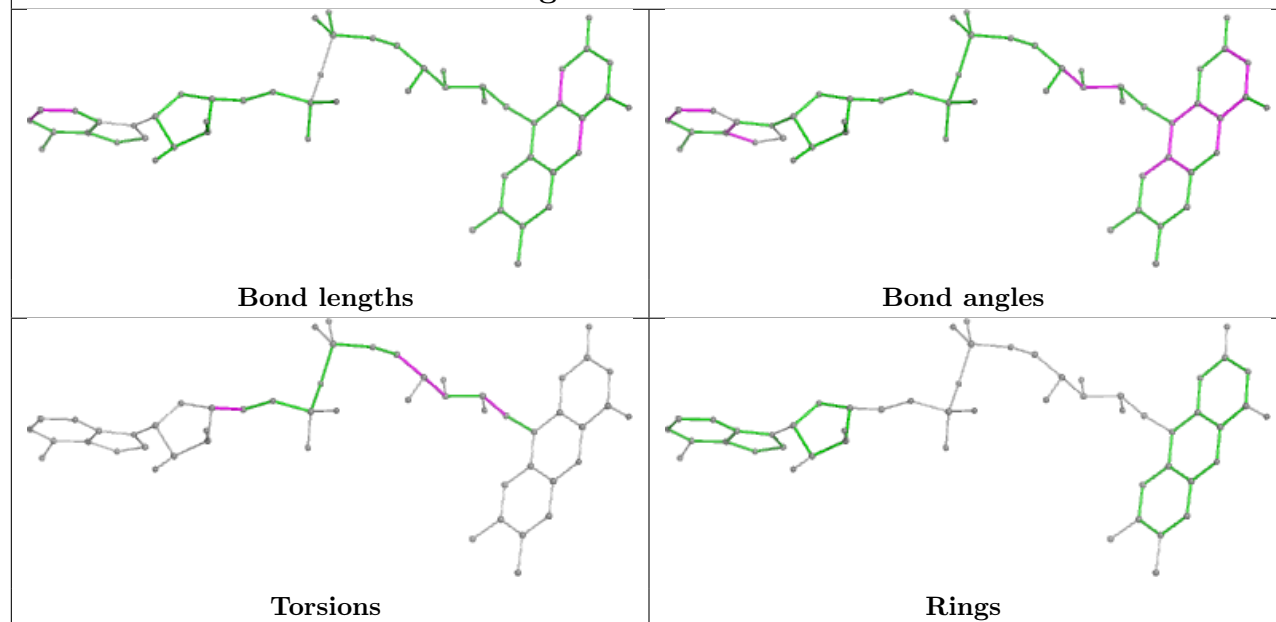
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Mol	Chain	Res	Type	Clashes	Symm-Clashes
10	J	304	F3S	2	0
6	A	1589	TEO	4	0
11	K	1130	HEM	4	0

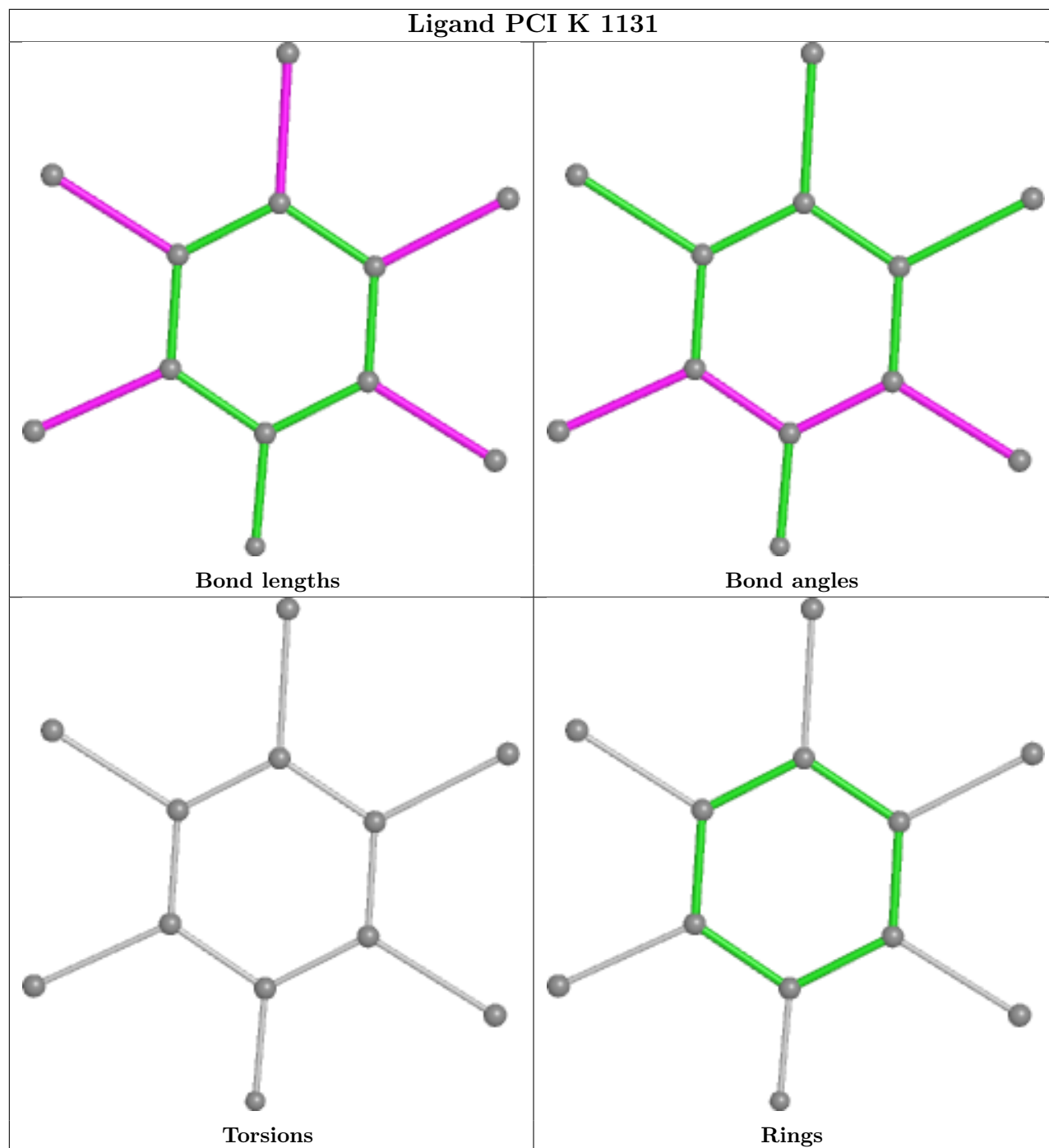
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

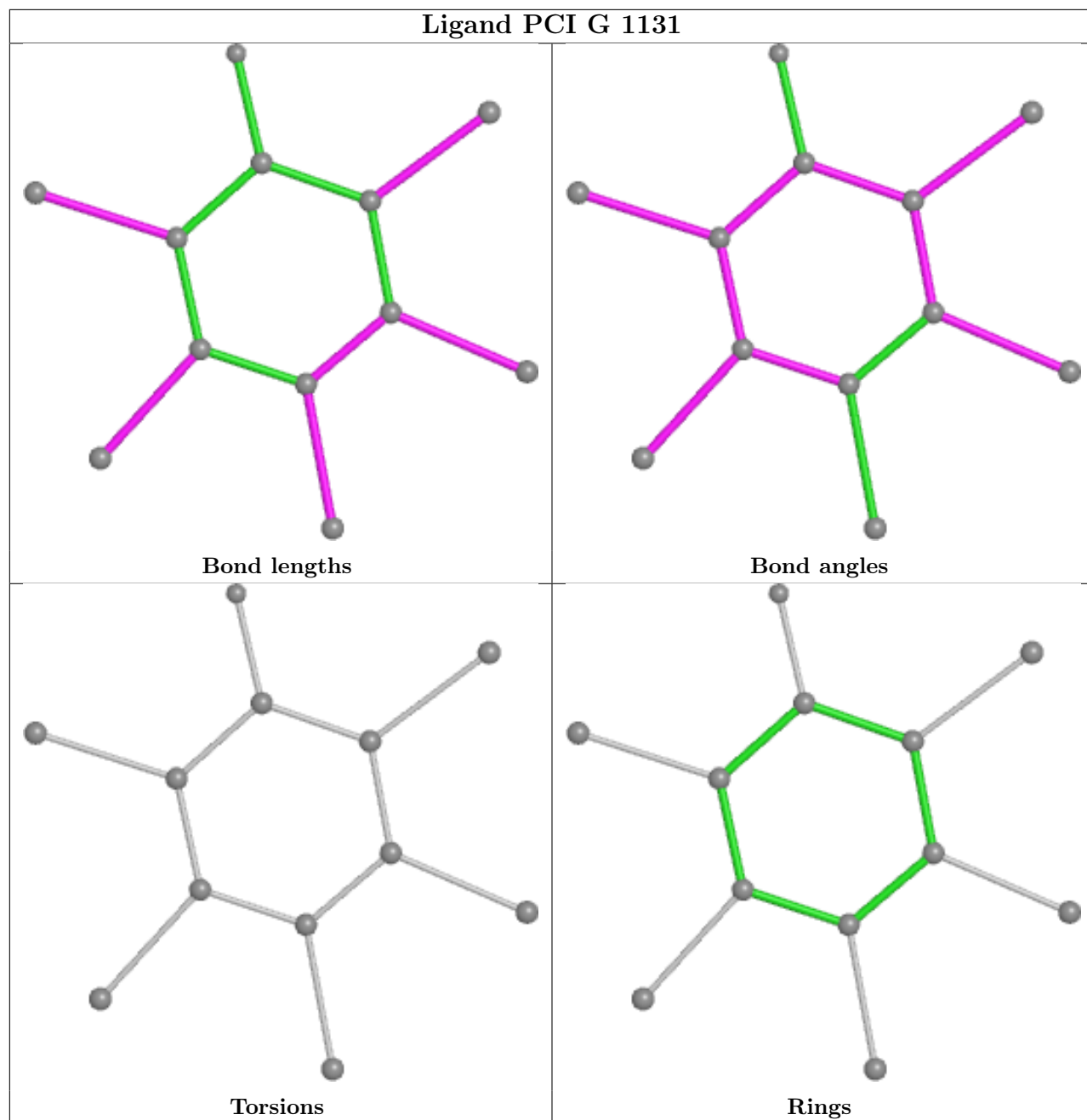




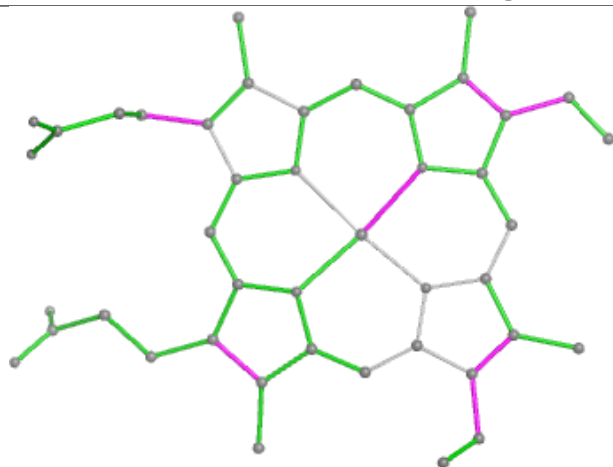
Ligand FAD A 601**Ligand FAD I 601**

Ligand PCI K 1131

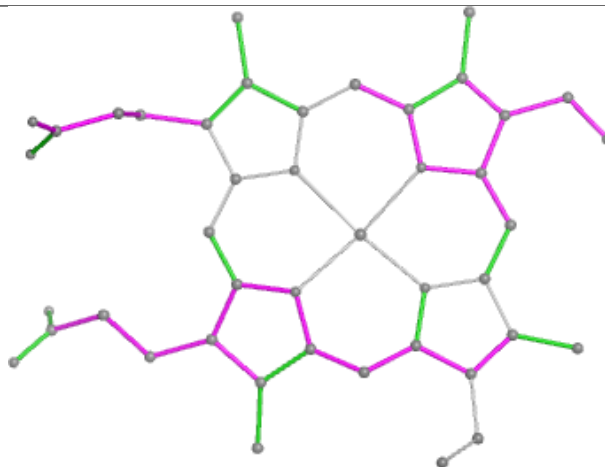




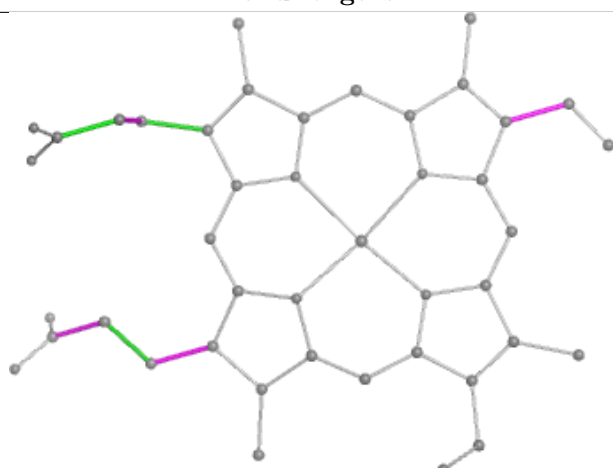
Ligand HEM C 1130



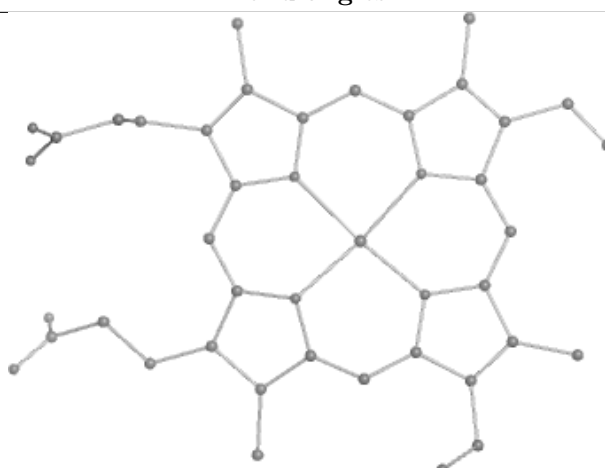
Bond lengths



Bond angles

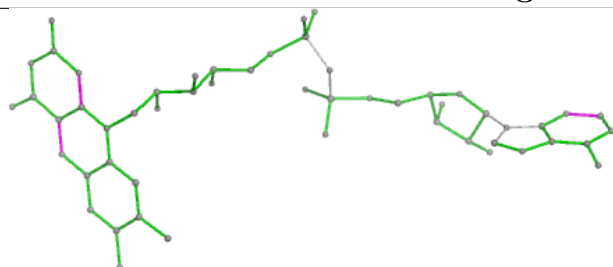


Torsions

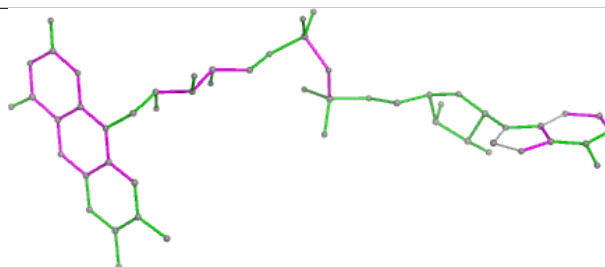


Rings

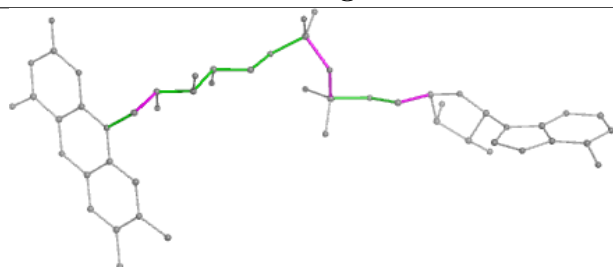
Ligand FAD E 601



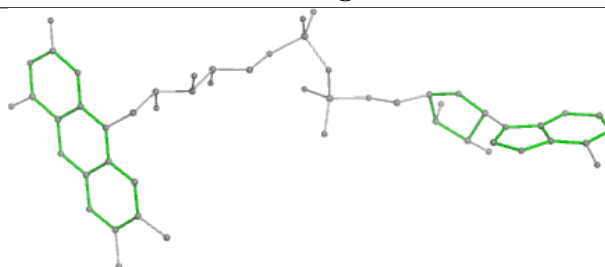
Bond lengths



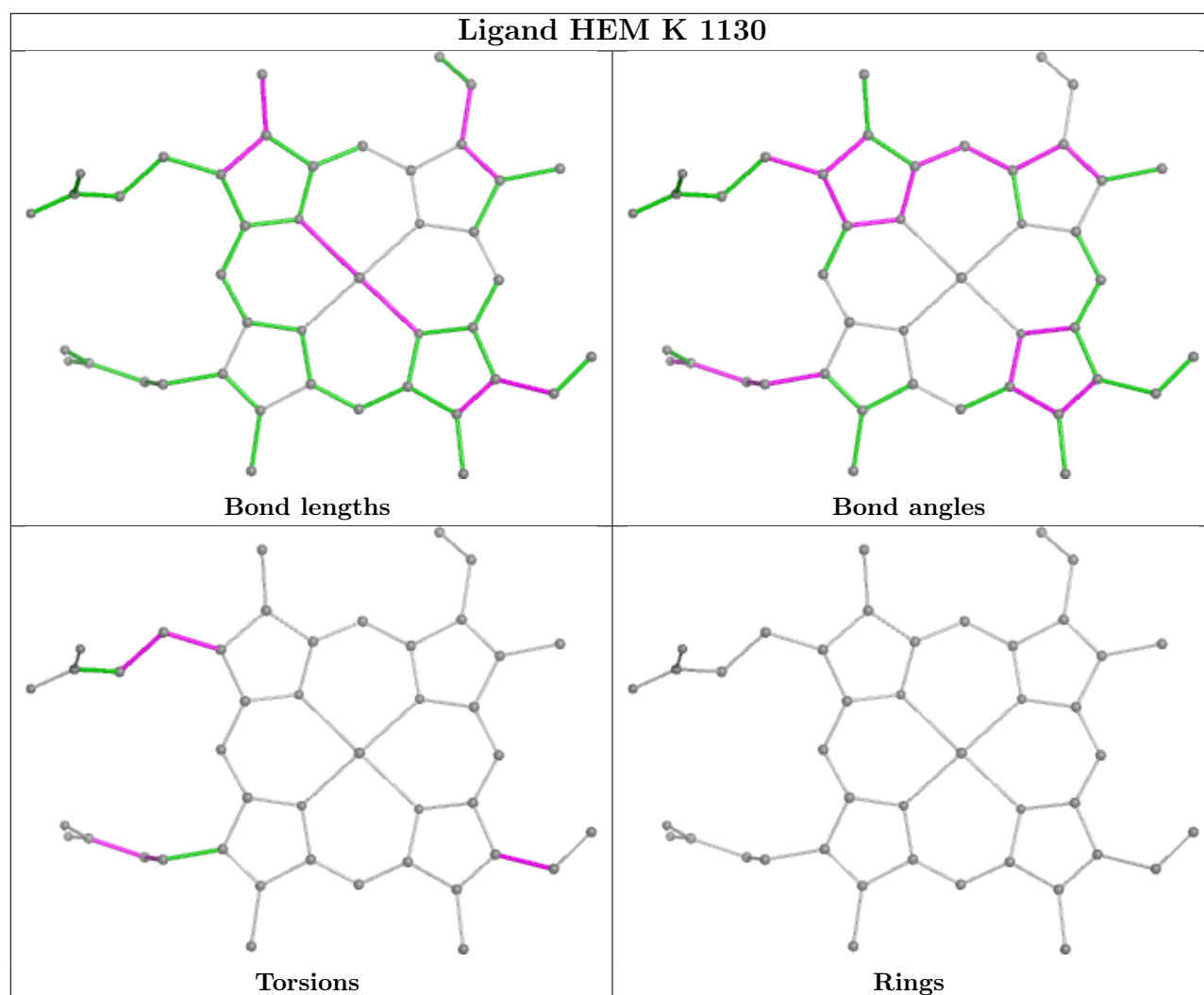
Bond angles



Torsions



Rings



5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

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

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	588/588 (100%)	-0.22	3 (0%) 87 78	47, 48, 49, 51	0
1	E	588/588 (100%)	0.06	3 (0%) 87 78	47, 48, 49, 51	0
1	I	588/588 (100%)	0.55	21 (3%) 46 32	47, 48, 49, 51	0
2	B	238/238 (100%)	-0.06	2 (0%) 82 70	47, 48, 49, 50	0
2	F	238/238 (100%)	0.13	4 (1%) 69 53	47, 48, 49, 50	0
2	J	238/238 (100%)	0.44	8 (3%) 48 34	47, 48, 49, 50	0
3	C	122/129 (94%)	0.57	11 (9%) 17 11	47, 48, 49, 49	0
3	G	122/129 (94%)	0.50	4 (3%) 49 34	47, 48, 49, 49	0
3	K	122/129 (94%)	0.40	3 (2%) 58 42	47, 48, 49, 49	0
4	D	105/115 (91%)	0.32	1 (0%) 79 66	47, 48, 49, 50	0
4	H	105/115 (91%)	0.64	3 (2%) 54 38	47, 48, 49, 50	0
4	L	105/115 (91%)	0.44	5 (4%) 36 25	47, 48, 49, 49	0
All	All	3159/3210 (98%)	0.22	68 (2%) 62 46	47, 48, 49, 51	0

The worst 5 of 68 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	G	68	PHE	5.9
3	C	10	PRO	4.9
1	I	1	MET	4.5
1	I	334	SER	4.5
2	B	207	HIS	4.0

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 ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

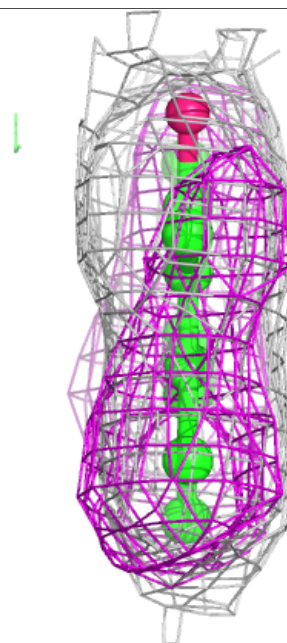
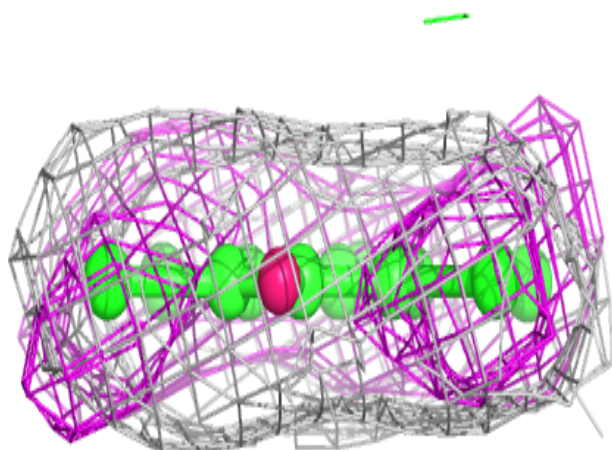
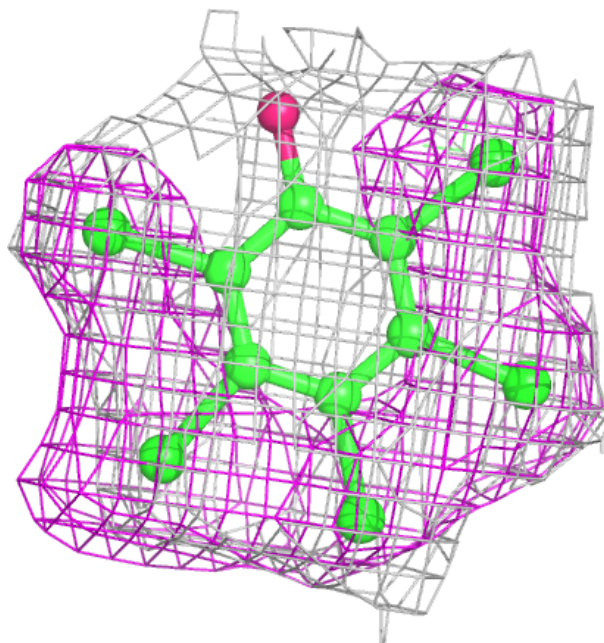
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
6	TEO	I	1589	9/9	0.83	0.20	67,70,71,71	0
6	TEO	E	1589	9/9	0.89	0.22	38,39,39,41	0
12	PCI	G	1131	12/12	0.90	0.20	46,48,50,51	0
12	PCI	K	1131	12/12	0.91	0.17	56,58,60,61	0
5	FAD	I	601	53/53	0.92	0.12	42,50,57,58	0
12	PCI	C	1131	12/12	0.92	0.20	40,42,44,48	0
11	HEM	K	1130	43/43	0.94	0.13	46,48,59,61	0
5	FAD	E	601	53/53	0.94	0.12	26,38,42,44	0
6	TEO	A	1589	9/9	0.94	0.14	26,27,30,32	0
11	HEM	G	1130	43/43	0.94	0.14	43,47,53,56	0
5	FAD	A	601	53/53	0.95	0.11	20,24,34,39	0
11	HEM	C	1130	43/43	0.96	0.10	37,41,46,48	0
7	NA	I	1590	1/1	0.97	0.13	21,21,21,21	0
10	F3S	J	304	7/7	0.97	0.12	47,50,53,56	0
10	F3S	F	304	7/7	0.98	0.10	43,46,48,51	0
7	NA	E	1590	1/1	0.98	0.19	12,12,12,12	0
8	FES	F	302	4/4	0.99	0.07	38,39,42,44	0
8	FES	J	302	4/4	0.99	0.10	55,56,58,58	0
9	SF4	B	303	8/8	0.99	0.04	27,29,31,31	0
9	SF4	F	303	8/8	0.99	0.07	35,36,38,38	0
9	SF4	J	303	8/8	0.99	0.08	46,48,50,50	0
10	F3S	B	304	7/7	0.99	0.10	39,39,41,41	0
8	FES	B	302	4/4	0.99	0.07	31,32,33,36	0
7	NA	A	1590	1/1	1.00	0.18	2,2,2,2	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.

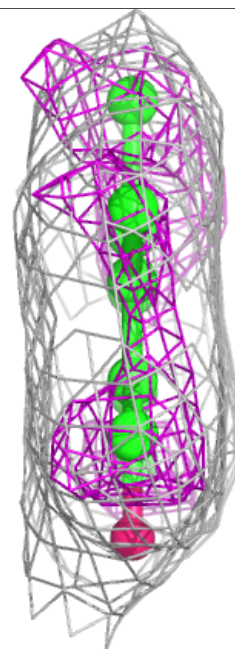
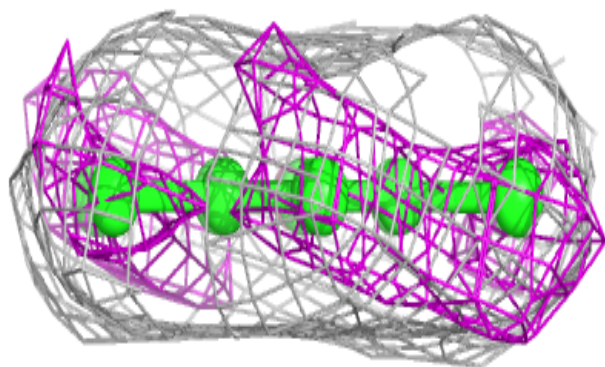
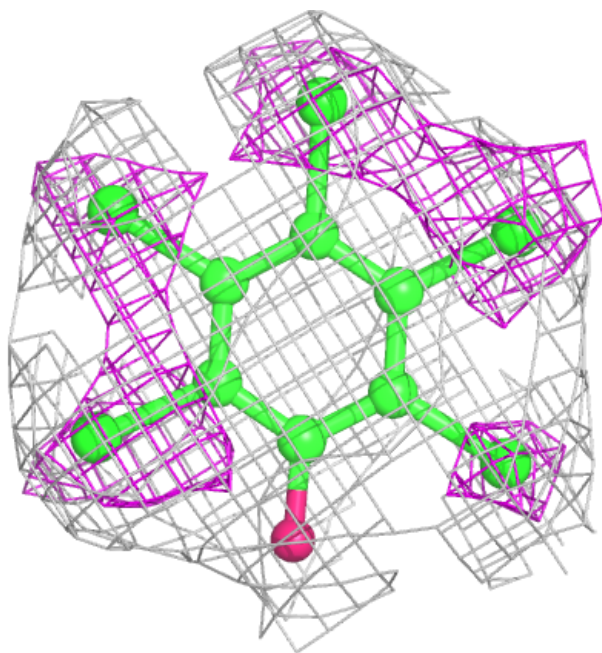
Electron density around PCI G 1131:

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



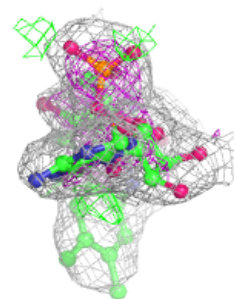
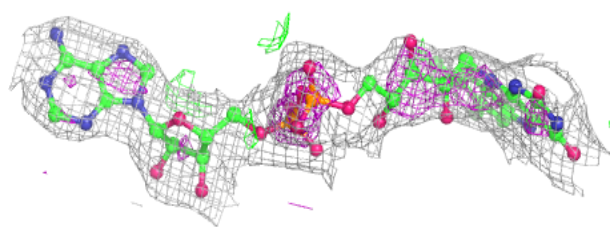
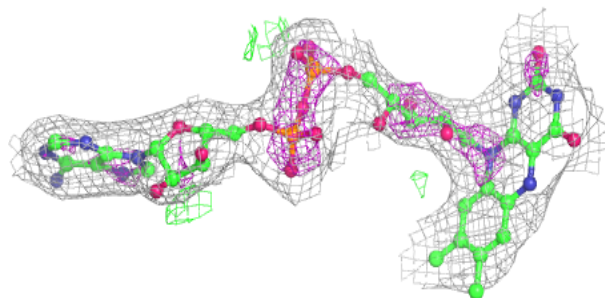
Electron density around PCI K 1131:

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



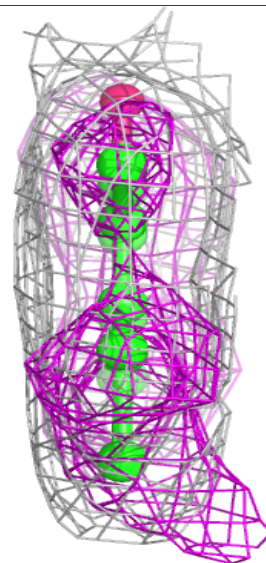
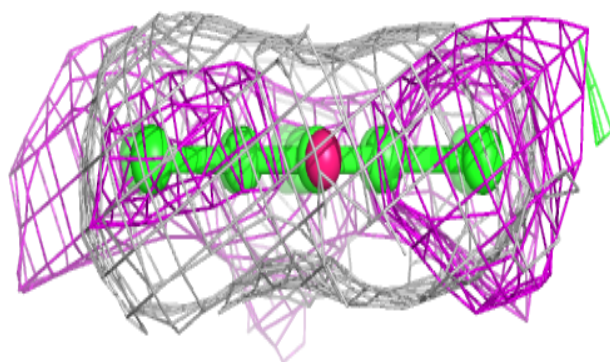
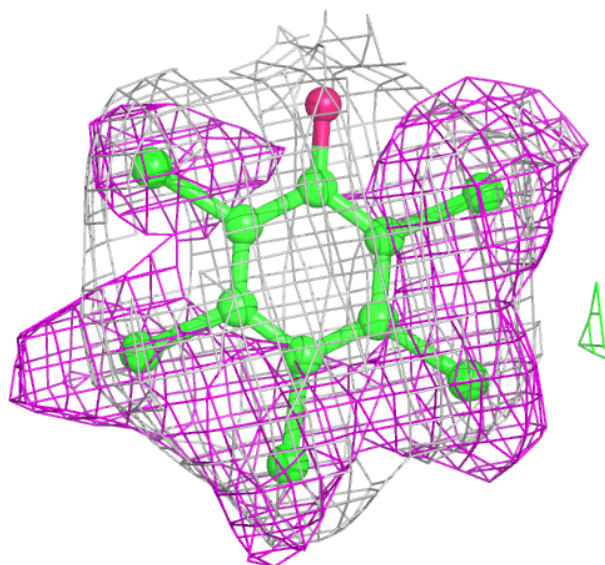
Electron density around FAD I 601:

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



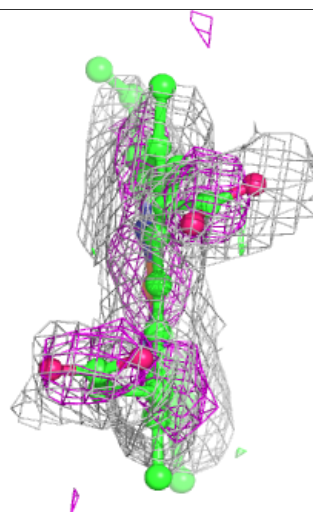
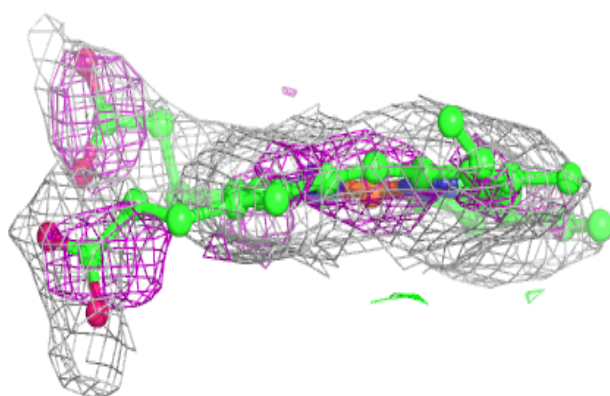
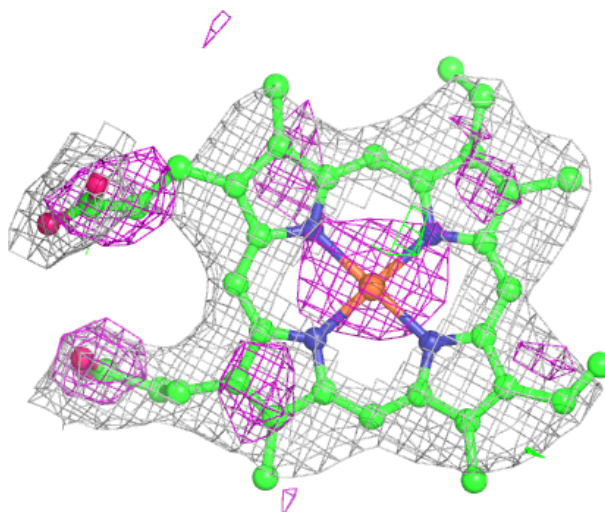
Electron density around PCI C 1131:

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



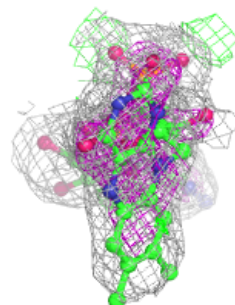
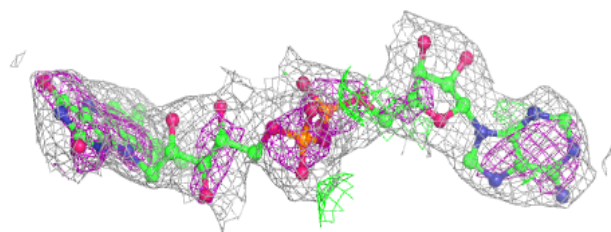
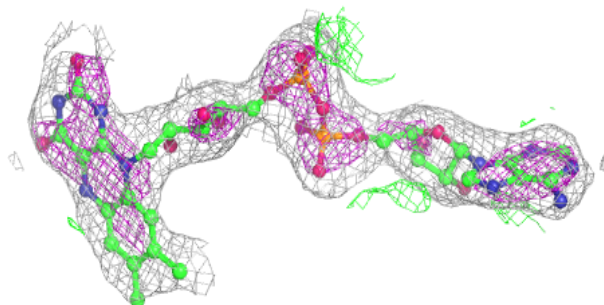
Electron density around HEM K 1130:

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

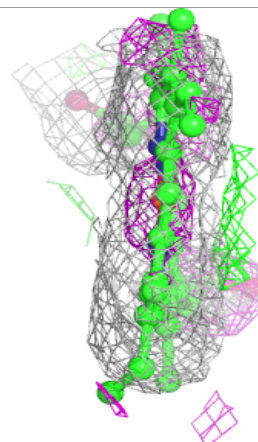
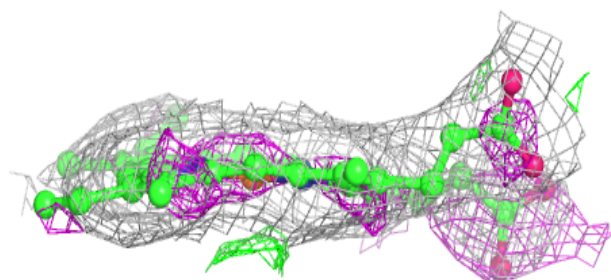
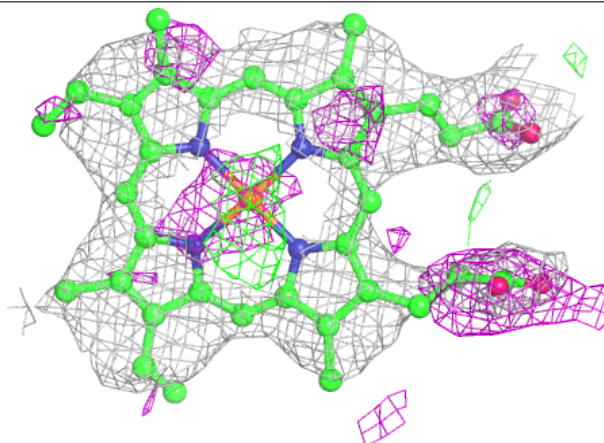


Electron density around FAD E 601:

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

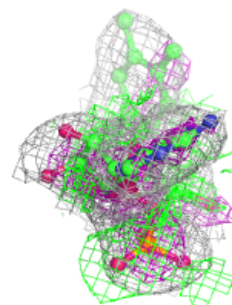
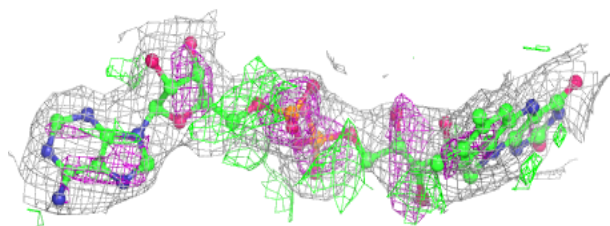
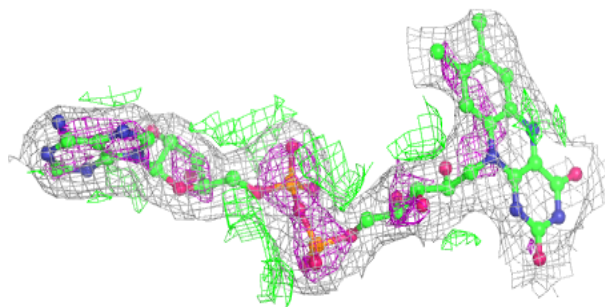
**Electron density around HEM G 1130:**

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

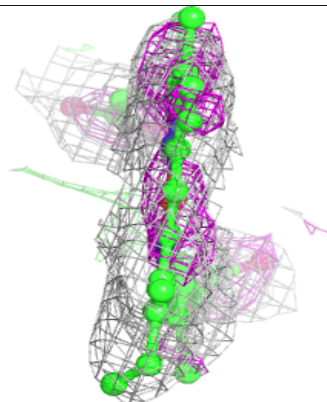
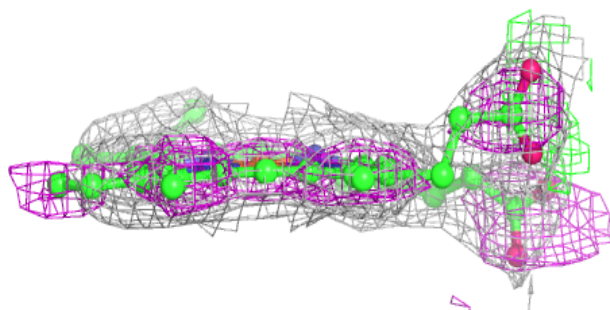
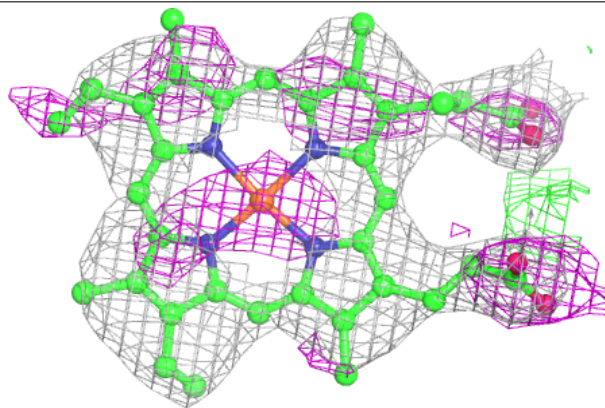


Electron density around FAD A 601:

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

**Electron density around HEM C 1130:**

$2mF_o-DF_c$ (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.