W O R L D W I D E
wwPDB
PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report ⓘ

Dec 7, 2023 – 10:18 am GMT

PDB ID	:	6ZI4
Title	:	Ultrafast Structural Response to Charge Redistribution Within a Photosynthetic Reaction Centre - 5 ps (a) structure
Authors	:	Baath, P.; Dods, R.; Braenden, G.; Neutze, R.
Deposited on	:	2020-06-24
Resolution	:	2.80 Å(reported)

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

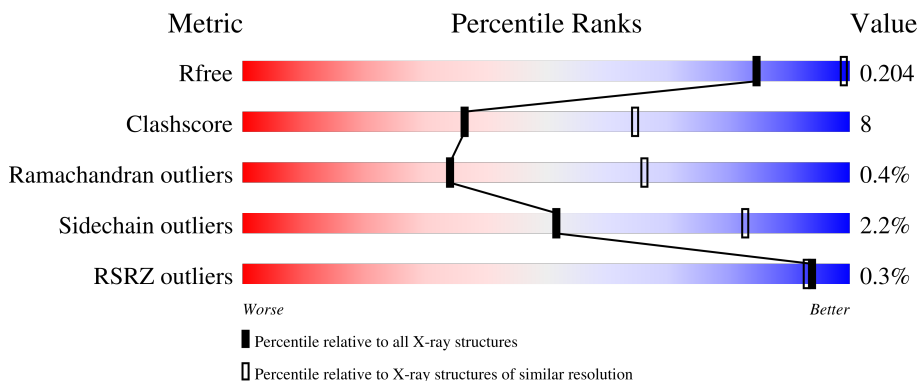|		
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (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 2.80 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.

Metric	Percentile Ranks	Value
Rfree		0.204
Clashscore		8
Ramachandran outliers		0.4%
Sidechain outliers		2.2%
RSRZ outliers		0.3%

Worse *Better*

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=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	C	336	83% 15% ••
2	H	258	% 83% 15% •
3	L	273	79% 21%
4	M	323	88% 11%

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	BCB	L	301[A]	X	-	-	-
10	BCB	L	301[B]	X	-	-	-
10	BCB	L	302[A]	X	-	-	-
10	BCB	L	302[B]	X	-	-	-
10	BCB	L	304	X	-	-	-
10	BCB	M	403[A]	X	-	-	-
10	BCB	M	403[B]	X	-	-	-
6	DGA	C	405	-	-	-	X
7	SO4	M	412	-	-	-	X
9	HTO	L	306	-	-	-	X

2 Entry composition ⓘ

There are 15 unique types of molecules in this entry. The entry contains 11266 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 Photosynthetic reaction center cytochrome c subunit.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	C	332	Total	C	N	O	S	0	0	0
			2602	1640	466	478	18			

- Molecule 2 is a protein called Reaction center protein H chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	H	258	Total	C	N	O	S	0	0	0
			2018	1292	344	380	2			

- Molecule 3 is a protein called Reaction center protein L chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	L	273	Total	C	N	O	S	0	41	0
			2508	1678	409	413	8			

- Molecule 4 is a protein called Reaction center protein M chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	M	323	Total	C	N	O	S	0	51	0
			2977	1983	491	490	13			

- Molecule 5 is HEME C (three-letter code: HEC) (formula: $C_{34}H_{34}FeN_4O_4$) (labeled as "Ligand of Interest" by depositor).

HEC

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

- Molecule 6 is DIACYL GLYCEROL (three-letter code: DGA) (formula: $C_{39}H_{76}O_5$).

DGA

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	C	1	Total 37	C 33	O 4	0	0

• Molecule 7 is SULFATE ION (three-letter code: SO4) (formula: O_4S).
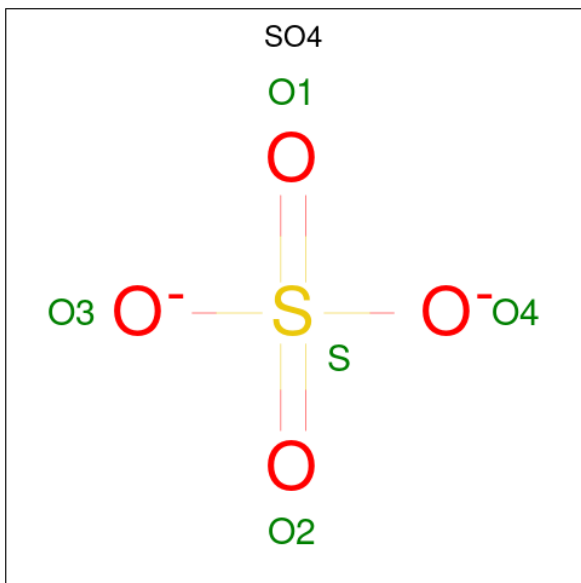
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	C	1	Total 5	O 4	S 1	0	0
7	H	1	Total 5	O 4	S 1	0	0
7	H	1	Total 5	O 4	S 1	0	0
7	H	1	Total 5	O 4	S 1	0	0
7	H	1	Total 5	O 4	S 1	0	0
7	M	1	Total 5	O 4	S 1	0	0
7	M	1	Total 5	O 4	S 1	0	0
7	M	1	Total 5	O 4	S 1	0	0
7	M	1	Total 5	O 4	S 1	0	0
7	M	1	Total 5	O 4	S 1	0	0
7	M	1	Total 5	O 4	S 1	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	M	1	Total O S 5 4 1			0	0

- Molecule 8 is LAURYL DIMETHYLAMINE-N-OXIDE (three-letter code: LDA) (formula: $C_{14}H_{31}NO$).
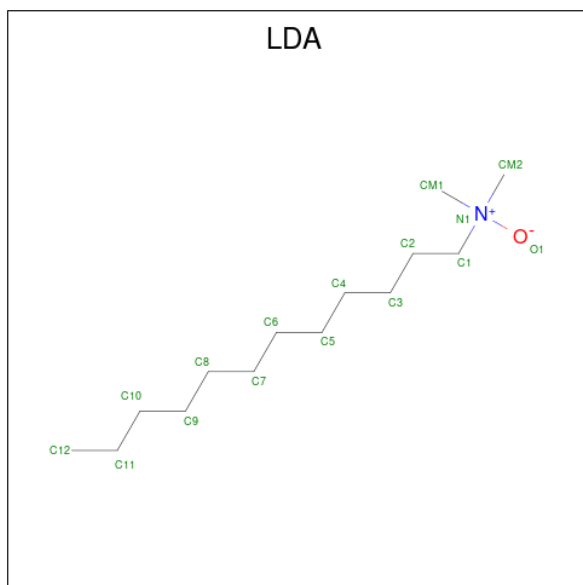
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	H	1	Total 16	C 14	N 1	O 1	0	0
8	H	1	Total 16	C 14	N 1	O 1	0	0
8	H	1	Total 16	C 14	N 1	O 1	0	0
8	L	1	Total 16	C 14	N 1	O 1	0	0

- Molecule 9 is HEPTANE-1,2,3-TRIOL (three-letter code: HTO) (formula: $C_7H_{16}O_3$).

HTO
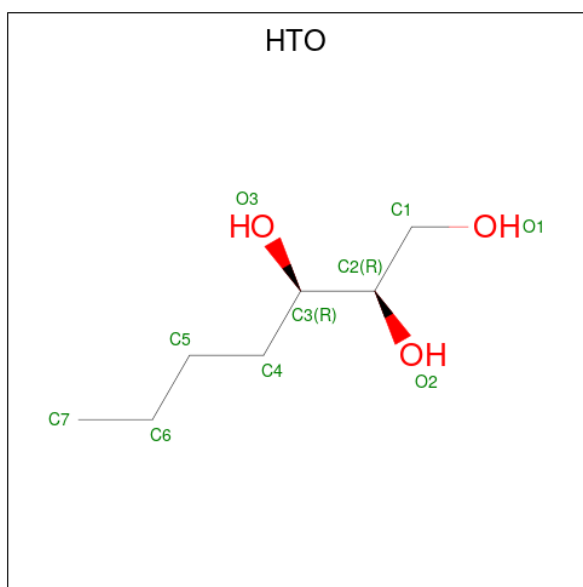
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
9	H	1	Total 10	C 7	O 3	0	0
9	L	1	Total 10	C 7	O 3	0	0

- Molecule 10 is BACTERIOCHLOROPHYLL B (three-letter code: BCB) (formula: $C_{55}H_{72}MgN_4O_6$) (labeled as "Ligand of Interest" by depositor).


BCB

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
10	L	1	Total 132	C 110	Mg 2	N 8	O 12	0	1

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
10	L	1	Total 132	C 110	Mg 2	N 8	O 12	0	1
10	L	1	Total 66	C 55	Mg 1	N 4	O 6	0	0
10	M	1	Total 132	C 110	Mg 2	N 8	O 12	0	1

- Molecule 11 is BACTERIOPHEOPHYTIN B (three-letter code: BPB) (formula: $C_{55}H_{74}N_4O_6$) (labeled as "Ligand of Interest" by depositor).

BPB
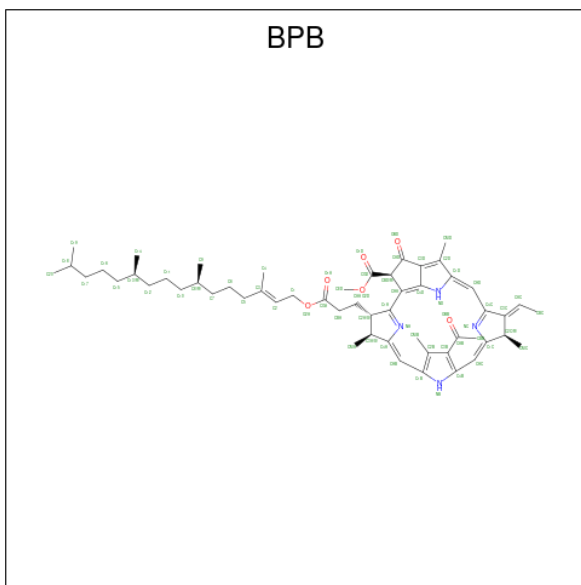
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
11	L	1	Total 130	C 110	N 8	O 12	0	1
11	M	1	Total 65	C 55	N 4	O 6	0	0

- Molecule 12 is FE (III) ION (three-letter code: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
12	M	1	Total 2	Fe 2	0	1

- Molecule 13 is MENAQUINONE-7 (three-letter code: MQ7) (formula: $C_{46}H_{64}O_2$) (labeled as "Ligand of Interest" by depositor).

MQ7
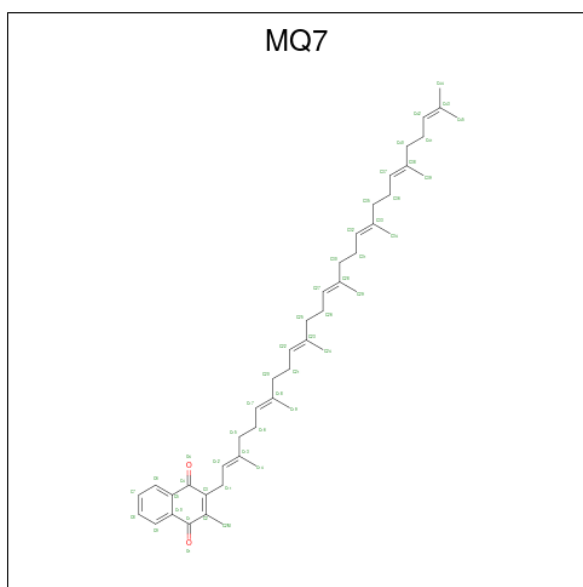
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
13	M	1	Total	C	O	0	1
			96	92	4		

- Molecule 14 is 15-cis-1,2-dihydroneurosporene (three-letter code: NS5) (formula: $C_{40}H_{60}$).

NS5
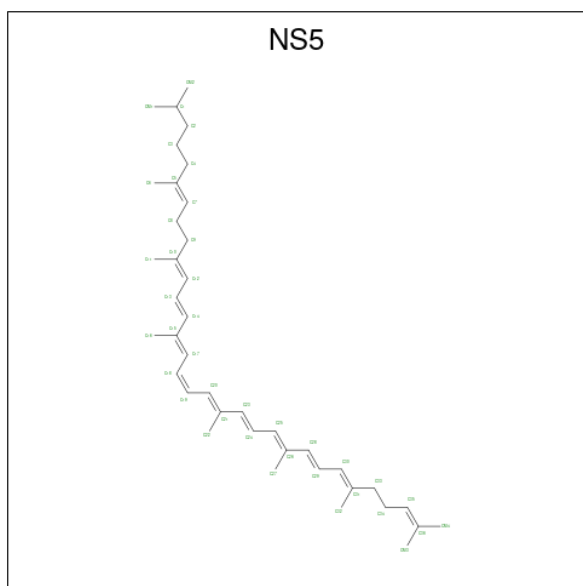
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
14	M	1	Total	C	0	0
			40	40		

- Molecule 15 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
15	C	3	Total 3	O 3	0	0
15	H	2	Total 2	O 2	0	0
15	L	4	Total 4	O 4	0	0
15	M	4	Total 4	O 4	0	0

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry 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: Photosynthetic reaction center cytochrome c subunit
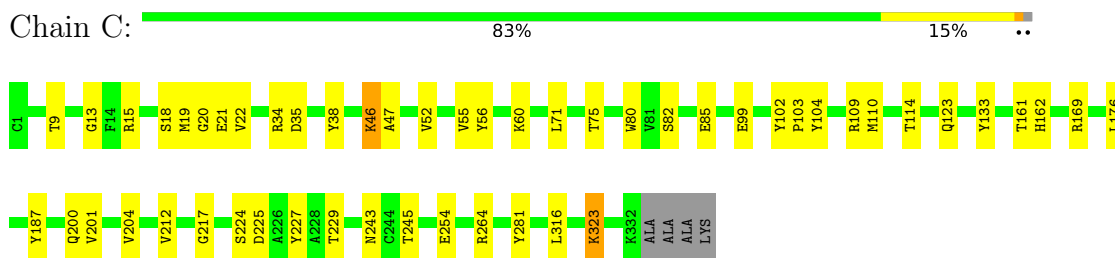
- Molecule 2: Reaction center protein H chain
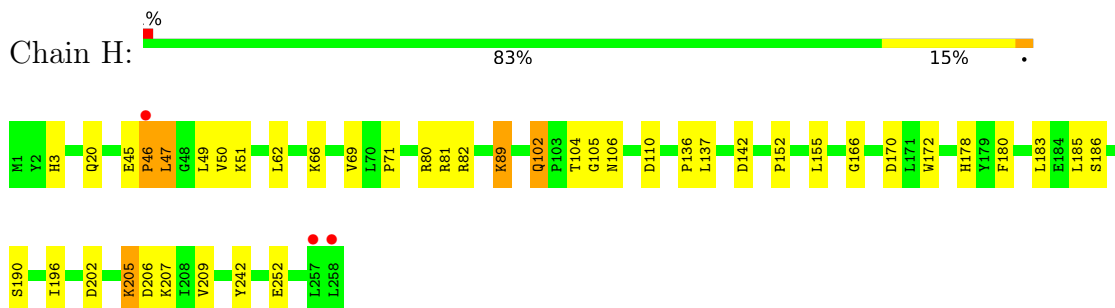
- Molecule 3: Reaction center protein L chain
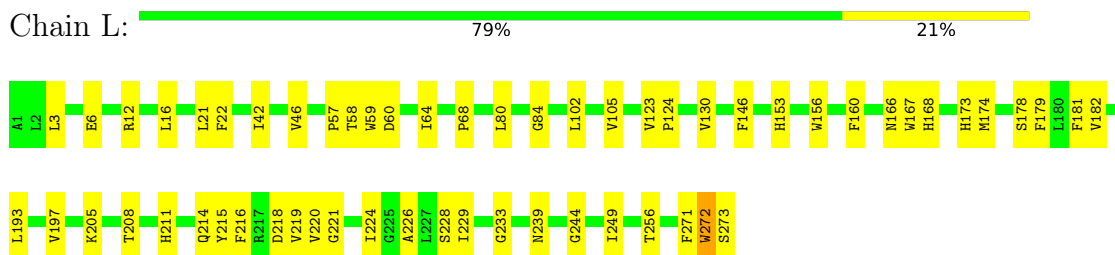
- Molecule 4: Reaction center protein M chain
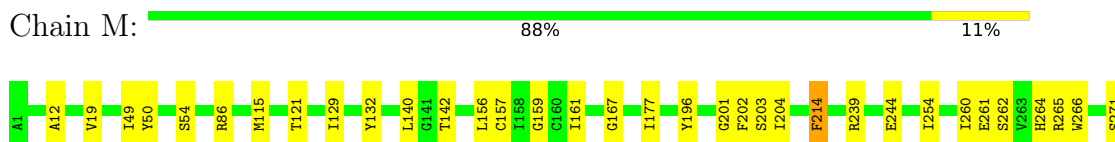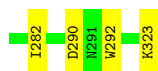
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α, β, γ	226.40Å　226.40Å　113.70Å 90.00°　　90.00°　　90.00°	Depositor
Resolution (Å)	36.88　–　2.80 36.88　–　2.46	Depositor EDS
% Data completeness (in resolution range)	100.0 (36.88-2.80) 86.3 (36.88-2.46)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.04 (at 2.45Å)	Xtriage
Refinement program	REFMAC 5.8.0158, PHENIX 1.17.1_3660	Depositor
R, R_{free}	0.176　,　0.201 0.180　,　0.204	Depositor DCC
R_{free} test set	4542 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å^2)	75.4	Xtriage
Anisotropy	0.171	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.29 , 63.5	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	11266	wwPDB-VP
Average B, all atoms (Å^2)	85.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 1.74% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, LDA, BPB, HEC, MQ7, FME, HTO, BCB, DGA, FE, NS5

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	C	0.44	0/2669	0.61	0/3637
2	H	0.41	0/2055	0.60	0/2807
3	L	0.43	0/2612	0.60	0/3568
4	M	0.47	0/3101	0.56	0/4242
All	All	0.44	0/10437	0.59	0/14254

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 ⓘ

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	C	2602	0	2578	57	0
2	H	2018	0	2020	40	0
3	L	2508	0	2390	51	0
4	M	2977	0	2832	29	0
5	C	172	0	120	8	0
6	C	37	0	58	0	0
7	C	5	0	0	0	0
7	H	20	0	0	0	0
7	M	35	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
8	H	48	0	93	2	0
8	L	16	0	31	1	0
9	H	10	0	16	0	0
9	L	10	0	16	0	0
10	L	330	0	360	14	0
10	M	132	0	144	5	0
11	L	130	0	148	8	0
11	M	65	0	74	5	0
12	M	2	0	0	0	0
13	M	96	0	128	2	0
14	M	40	0	60	3	0
15	C	3	0	0	0	0
15	H	2	0	0	0	0
15	L	4	0	0	0	0
15	M	4	0	0	0	0
All	All	11266	0	11068	176	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 8.

The worst 5 of 176 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)
2:H:89:LYS:HE2	2:H:110:ASP:CB	1.96	0.95
1:C:13:GLY:HA3	1:C:19:MET:CE	2.05	0.87
2:H:89:LYS:HE2	2:H:110:ASP:HB2	1.55	0.86
1:C:13:GLY:CA	1:C:19:MET:HE2	2.07	0.85
1:C:13:GLY:HA3	1:C:19:MET:HE2	1.60	0.82

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	C	330/336 (98%)	319 (97%)	11 (3%)	0	100	100
2	H	256/258 (99%)	245 (96%)	8 (3%)	3 (1%)	13	39
3	L	312/273 (114%)	298 (96%)	13 (4%)	1 (0%)	41	72
4	M	372/323 (115%)	358 (96%)	13 (4%)	1 (0%)	41	72
All	All	1270/1190 (107%)	1220 (96%)	45 (4%)	5 (0%)	34	66

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	H	47	LEU
2	H	50	VAL
2	H	46	PRO
4	M	177	ILE
3	L	57	PRO

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	C	281/282 (100%)	276 (98%)	5 (2%)	59	86
2	H	212/212 (100%)	205 (97%)	7 (3%)	38	72
3	L	253/218 (116%)	249 (98%)	4 (2%)	62	88
4	M	288/249 (116%)	280 (97%)	8 (3%)	43	77
All	All	1034/961 (108%)	1010 (98%)	24 (2%)	52	82

5 of 24 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	L	271	PHE
4	M	203[A]	SER
4	M	115	MET
4	M	203[B]	SER
2	H	89	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
2	H	220	ASN
2	H	106	ASN
2	H	8	GLN
1	C	310	GLN
2	H	102	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

1 non-standard protein/DNA/RNA residue is modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
2	FME	H	1	2	8,9,10	1.01	0	7,9,11	0.94	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	FME	H	1	2	-	1/7/9/11	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	H	1	FME	CB-CG-SD-CE

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 38 ligands modelled in this entry, 2 are monoatomic - leaving 36 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	#$|Z| > 2$
7	SO4	H	702	-	4,4,4	0.21	0	6,6,6	0.28	0
5	HEC	C	401	1	32,50,50	1.54	4 (12%)	24,82,82	2.20	7 (29%)
10	BCB	L	302[A]	-	63,74,74	1.86	14 (22%)	74,115,115	3.01	25 (33%)
10	BCB	M	403[B]	-	63,74,74	1.92	14 (22%)	74,115,115	3.21	26 (35%)
10	BCB	M	403[A]	-	63,74,74	1.94	14 (22%)	74,115,115	3.21	24 (32%)
7	SO4	M	407	-	4,4,4	0.11	0	6,6,6	0.14	0
8	LDA	L	305	-	12,15,15	0.37	0	14,17,17	0.73	0
6	DGA	C	405	1	36,36,43	1.17	3 (8%)	38,38,45	1.22	4 (10%)
10	BCB	L	304	-	63,74,74	1.87	14 (22%)	74,115,115	3.21	22 (29%)
7	SO4	M	409	-	4,4,4	0.26	0	6,6,6	0.21	0
11	BPB	L	303[B]	-	49,70,70	2.12	9 (18%)	47,101,101	2.12	13 (27%)
11	BPB	M	404	-	49,70,70	2.17	9 (18%)	47,101,101	2.28	14 (29%)
7	SO4	H	704	-	4,4,4	0.12	0	6,6,6	0.14	0
7	SO4	H	705	-	4,4,4	0.15	0	6,6,6	0.15	0
7	SO4	M	408	-	4,4,4	0.20	0	6,6,6	0.26	0
11	BPB	L	303[A]	-	49,70,70	2.07	9 (18%)	47,101,101	2.23	14 (29%)
8	LDA	H	701	-	12,15,15	0.36	0	14,17,17	0.68	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
5	HEC	C	402	1	32,50,50	1.43	3 (9%)	24,82,82	1.96	7 (29%)
10	BCB	L	301[B]	-	63,74,74	1.94	14 (22%)	74,115,115	3.08	24 (32%)
8	LDA	H	707	-	12,15,15	0.31	0	14,17,17	1.17	1 (7%)
8	LDA	H	706	-	12,15,15	0.38	0	14,17,17	0.79	0
10	BCB	L	301[A]	-	63,74,74	1.94	14 (22%)	74,115,115	3.16	26 (35%)
13	MQ7	M	402[B]	-	49,49,49	1.46	2 (4%)	60,63,63	1.38	10 (16%)
7	SO4	C	406	-	4,4,4	0.24	0	6,6,6	0.18	0
9	HTO	L	306	-	9,9,9	0.75	0	10,10,10	0.89	1 (10%)
13	MQ7	M	402[A]	-	49,49,49	1.54	2 (4%)	60,63,63	1.49	10 (16%)
7	SO4	H	703	-	4,4,4	0.22	0	6,6,6	0.19	0
7	SO4	M	410	-	4,4,4	0.27	0	6,6,6	0.24	0
5	HEC	C	404	1	32,50,50	1.56	4 (12%)	24,82,82	1.97	8 (33%)
9	HTO	H	708	-	9,9,9	0.79	0	10,10,10	0.79	0
7	SO4	M	411	-	4,4,4	0.32	0	6,6,6	0.33	0
7	SO4	M	406	-	4,4,4	0.13	0	6,6,6	0.41	0
7	SO4	M	412	-	4,4,4	0.22	0	6,6,6	0.14	0
5	HEC	C	403	1	32,50,50	1.56	5 (15%)	24,82,82	1.94	11 (45%)
10	BCB	L	302[B]	-	63,74,74	1.91	16 (25%)	74,115,115	2.90	24 (32%)
14	NS5	M	405	-	39,39,39	1.38	1 (2%)	44,46,46	2.04	12 (27%)

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	BCB	L	302[A]	-	2/2/21/26	6/37/137/137	-
5	HEC	C	401	1	-	3/10/54/54	-
10	BCB	M	403[B]	-	3/3/21/26	8/37/137/137	-
10	BCB	M	403[A]	-	3/3/21/26	13/37/137/137	-
8	LDA	L	305	-	-	6/13/13/13	-
6	DGA	C	405	1	-	15/37/37/45	-
10	BCB	L	304	-	3/3/21/26	14/37/137/137	-
11	BPB	L	303[B]	-	-	7/37/105/105	0/5/6/6
11	BPB	M	404	-	-	8/37/105/105	0/5/6/6
11	BPB	L	303[A]	-	-	8/37/105/105	0/5/6/6
8	LDA	H	701	-	-	4/13/13/13	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	HEC	C	402	1	-	3/10/54/54	-
10	BCB	L	301[B]	-	3/3/21/26	11/37/137/137	-
8	LDA	H	707	-	-	11/13/13/13	-
8	LDA	H	706	-	-	6/13/13/13	-
10	BCB	L	301[A]	-	3/3/21/26	7/37/137/137	-
13	MQ7	M	402[B]	-	-	2/41/61/61	0/2/2/2
9	HTO	L	306	-	-	4/10/10/10	-
13	MQ7	M	402[A]	-	-	0/41/61/61	0/2/2/2
5	HEC	C	404	1	-	5/10/54/54	-
9	HTO	H	708	-	-	1/10/10/10	-
5	HEC	C	403	1	-	0/10/54/54	-
10	BCB	L	302[B]	-	2/2/21/26	11/37/137/137	-
14	NS5	M	405	-	-	10/43/43/43	-

The worst 5 of 151 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
13	M	402[B]	MQ7	C3-C2	8.26	1.50	1.35
13	M	402[A]	MQ7	C3-C2	8.08	1.50	1.35
11	M	404	BPB	CAC-C3C	7.34	1.52	1.33
14	M	405	NS5	C35-C36	7.33	1.53	1.32
11	L	303[A]	BPB	CAC-C3C	7.31	1.52	1.33

The worst 5 of 283 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
10	L	304	BCB	C1C-NC-C4C	-20.38	97.55	106.71
10	M	403[A]	BCB	C1C-NC-C4C	-19.33	98.01	106.71
10	L	301[A]	BCB	C1C-NC-C4C	-19.17	98.09	106.71
10	L	301[B]	BCB	C1C-NC-C4C	-18.59	98.35	106.71
10	M	403[B]	BCB	C1C-NC-C4C	-18.47	98.40	106.71

5 of 19 chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
10	L	301[A]	BCB	NA
10	L	301[A]	BCB	NC
10	L	301[A]	BCB	ND
10	L	301[B]	BCB	NA
10	L	301[B]	BCB	NC

5 of 163 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	C	405	DGA	OG1-CG1-CG2-OG2
6	C	405	DGA	OG1-CG1-CG2-CG3
8	H	706	LDA	C2-C1-N1-O1
8	H	706	LDA	C2-C1-N1-CM1
8	H	706	LDA	C2-C1-N1-CM2

There are no ring outliers.

20 monomers are involved in 44 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	C	401	HEC	1	0
10	L	302[A]	BCB	1	0
10	M	403[B]	BCB	4	0
10	M	403[A]	BCB	1	0
8	L	305	LDA	1	0
10	L	304	BCB	4	0
11	L	303[B]	BPB	4	0
11	M	404	BPB	5	0
7	M	408	SO4	1	0
11	L	303[A]	BPB	4	0
8	H	701	LDA	1	0
5	C	402	HEC	4	0
10	L	301[B]	BCB	5	0
8	H	707	LDA	1	0
10	L	301[A]	BCB	2	0
13	M	402[A]	MQ7	2	0
5	C	404	HEC	2	0
5	C	403	HEC	2	0
10	L	302[B]	BCB	2	0
14	M	405	NS5	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 HEC C 401

Bond lengths

Bond angles

Torsions

Rings

Ligand BCB L 302 (A)

Bond lengths

Bond angles

Torsions

Rings

Ligand BCB M 403 (B)

Bond lengths

Bond angles

Torsions

Rings

Ligand BCB M 403 (A)

Bond lengths

Bond angles

Torsions

Rings

Ligand DGA C 405

Bond lengths

Bond angles

Torsions

Rings

Ligand BCB L 304

Bond lengths

Bond angles

Torsions

Rings

Ligand BPB L 303 (B)

Bond lengths

Bond angles

Torsions

Rings

Ligand BPB M 404

Bond lengths

Bond angles

Torsions

Rings

Ligand BPB L 303 (A)

Bond lengths

Bond angles

Torsions

Rings

Ligand HEC C 402

Bond lengths

Bond angles

Torsions

Rings

Ligand BCB L 301 (B)

Bond lengths

Bond angles

Torsions

Rings

Ligand BCB L 301 (A)

Bond lengths

Bond angles

Torsions

Rings

Ligand MQ7 M 402 (B)

Bond lengths

Bond angles

Torsions

Rings

Ligand MQ7 M 402 (A)

Bond lengths

Bond angles

Torsions

Rings

Ligand HEC C 404

Bond lengths

Bond angles

Torsions

Rings

Ligand HEC C 403

Bond lengths

Bond angles

Torsions

Rings

Ligand BCB L 302 (B)

Bond lengths

Bond angles

Torsions

Rings

Ligand NS5 M 405

Bond lengths

Bond angles

Torsions

Rings

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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(Å²)	Q<0.9
1	C	332/336 (98%)	-0.77	0	100	100	64, 83, 110, 135	0
2	H	257/258 (99%)	-0.59	3 (1%)	79	73	71, 93, 133, 185	0
3	L	273/273 (100%)	-0.81	0	100	100	66, 80, 105, 122	0
4	M	323/323 (100%)	-0.60	0	100	100	66, 80, 106, 134	0
All	All	1185/1190 (99%)	-0.69	3 (0%)	94	93	64, 84, 114, 185	0

All (3) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	H	46	PRO	2.7
2	H	258	LEU	2.2
2	H	257	LEU	2.1

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

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(Å²)	Q<0.9
2	FME	H	1	10/11	0.97	0.13	81,93,103,118	0

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(Å^2)	Q<0.9
6	DGA	C	405	37/44	0.67	0.55	88,122,155,160	0
7	SO4	M	412	5/5	0.72	0.50	140,155,161,174	0
9	HTO	L	306	10/10	0.79	0.53	86,109,119,121	0
7	SO4	M	409	5/5	0.80	0.31	122,128,141,155	0
8	LDA	L	305	16/16	0.81	0.29	94,116,141,145	0
8	LDA	H	706	16/16	0.81	0.42	75,91,159,160	0
7	SO4	M	410	5/5	0.83	0.30	122,148,161,167	0
14	NS5	M	405	40/40	0.87	0.21	69,84,125,127	0
9	HTO	H	708	10/10	0.88	0.23	95,107,121,123	0
7	SO4	M	411	5/5	0.89	0.44	119,121,146,173	0
7	SO4	H	704	5/5	0.90	0.48	89,93,107,107	5
7	SO4	C	406	5/5	0.91	0.27	121,135,142,155	0
13	MQ7	M	402[B]	48/48	0.93	0.21	67,75,112,135	48
13	MQ7	M	402[A]	48/48	0.93	0.21	67,75,113,135	48
10	BCB	L	304	66/66	0.95	0.21	65,74,156,167	0
7	SO4	H	705	5/5	0.95	0.06	97,98,110,110	5
7	SO4	H	703	5/5	0.95	0.45	143,146,151,163	0
8	LDA	H	707	16/16	0.95	0.35	89,107,124,127	0
7	SO4	M	407	5/5	0.96	0.07	106,107,116,138	0
8	LDA	H	701	16/16	0.96	0.18	72,86,101,101	0
11	BPB	M	404	65/65	0.96	0.17	69,82,163,171	0
5	HEC	C	403	43/43	0.97	0.17	63,73,83,87	0
10	BCB	L	302[B]	66/66	0.98	0.21	62,70,102,105	66
7	SO4	M	406	5/5	0.98	0.06	90,104,114,115	0
10	BCB	M	403[A]	66/66	0.98	0.18	52,66,97,103	66
10	BCB	M	403[B]	66/66	0.98	0.18	52,66,97,103	66
11	BPB	L	303[A]	65/65	0.98	0.21	67,73,82,87	65
11	BPB	L	303[B]	65/65	0.98	0.21	67,73,82,87	65
5	HEC	C	401	43/43	0.98	0.14	80,88,103,117	0
10	BCB	L	301[A]	66/66	0.98	0.20	56,66,82,99	66
10	BCB	L	301[B]	66/66	0.98	0.20	56,66,82,99	66
10	BCB	L	302[A]	66/66	0.98	0.21	62,70,102,105	66
7	SO4	M	408	5/5	0.99	0.08	78,86,92,93	0
12	FE	M	401[A]	1/1	0.99	0.09	78,78,78,78	1
12	FE	M	401[B]	1/1	0.99	0.09	78,78,78,78	1
7	SO4	H	702	5/5	0.99	0.06	94,104,112,115	0
5	HEC	C	402	43/43	0.99	0.13	71,82,93,119	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($Å^2$)	Q<0.9
5	HEC	C	404	43/43	0.99	0.12	65,74,91,113	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 DGA C 405:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)
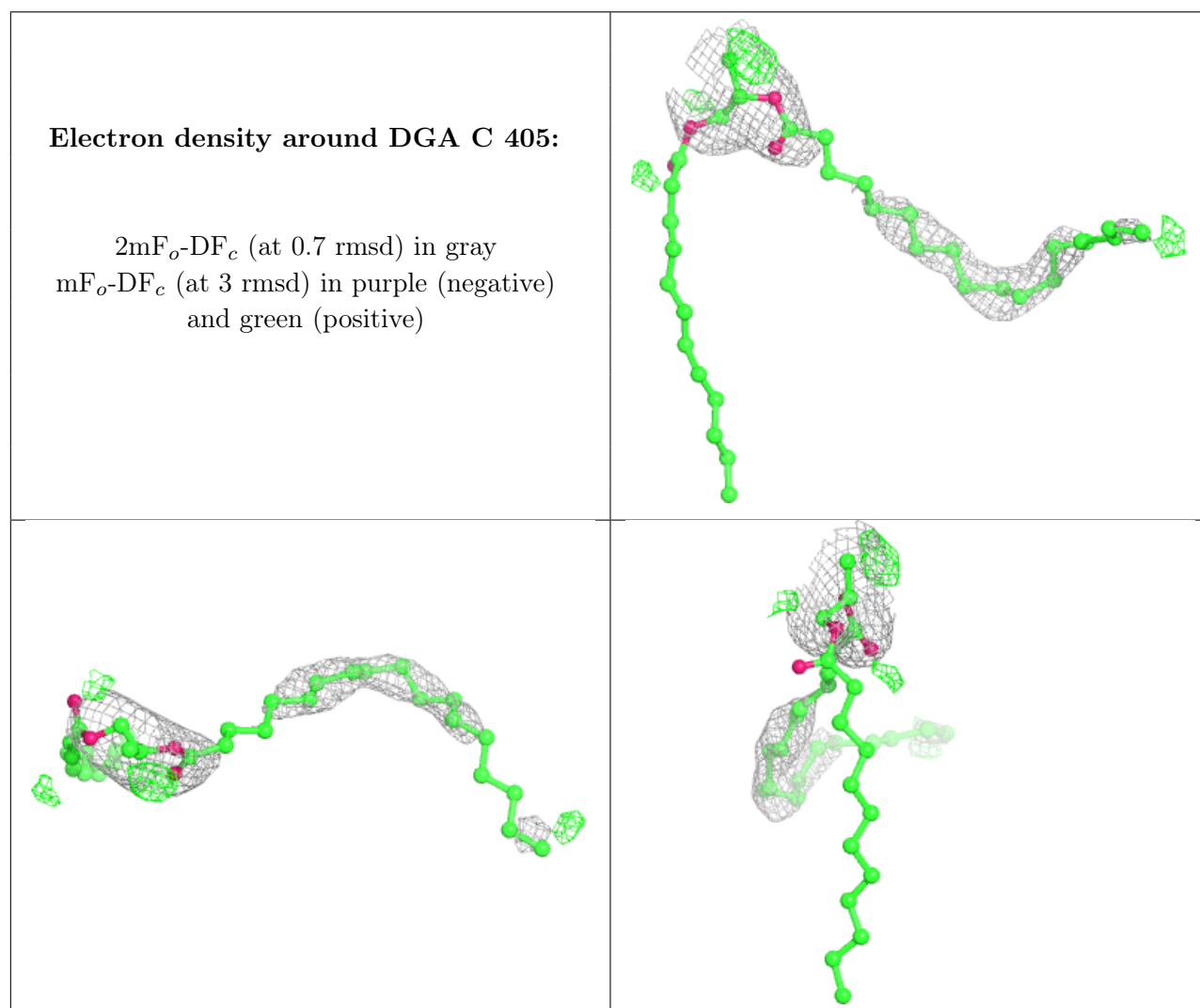
Electron density around NS5 M 405:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
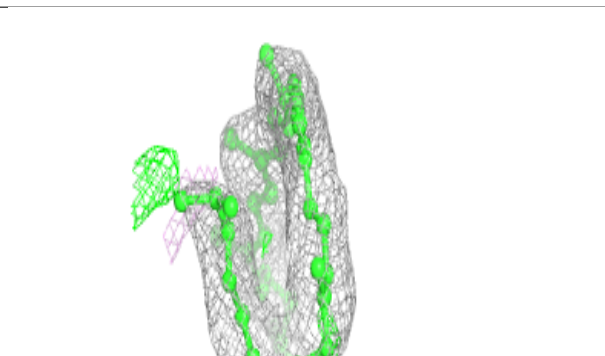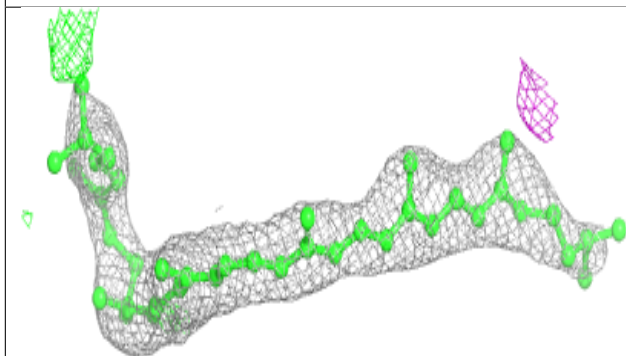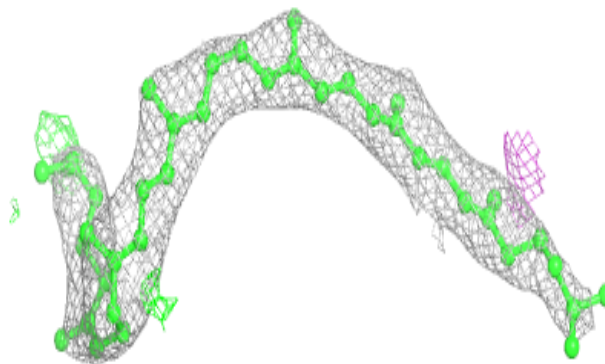
Electron density around MQ7 M 402 (B):

$2mF_o$-DF_c (at 0.7 rmsd) in gray
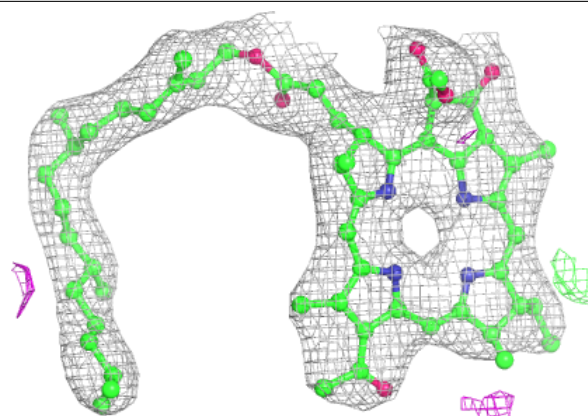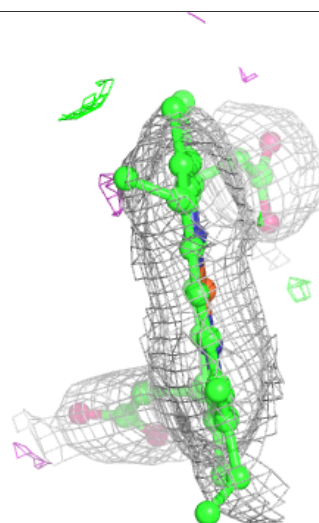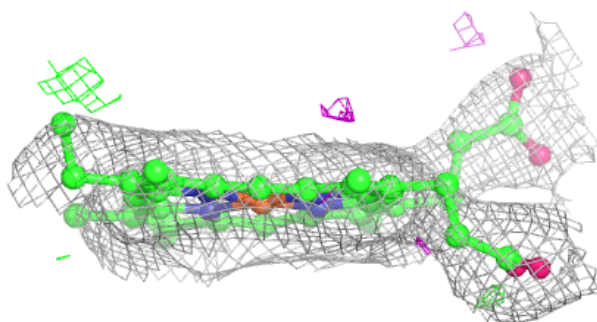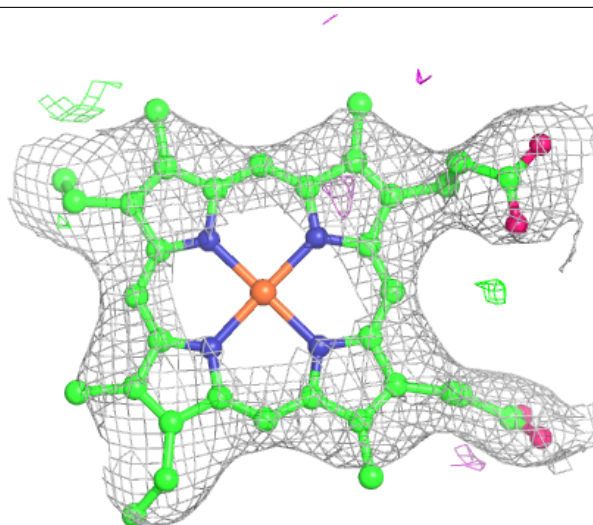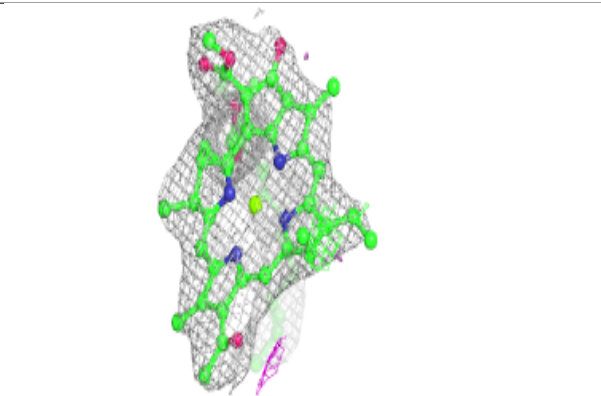mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
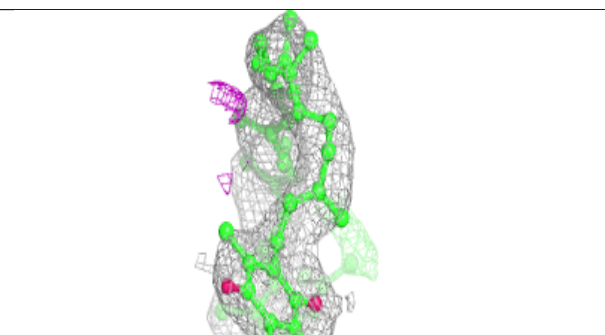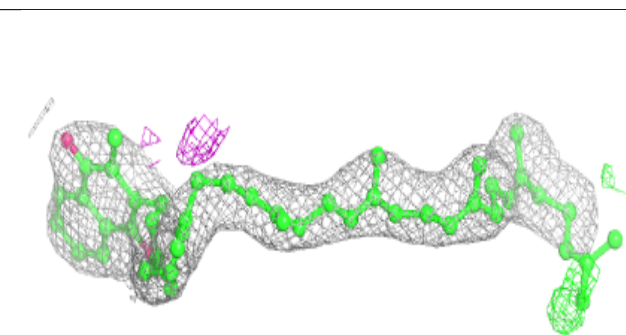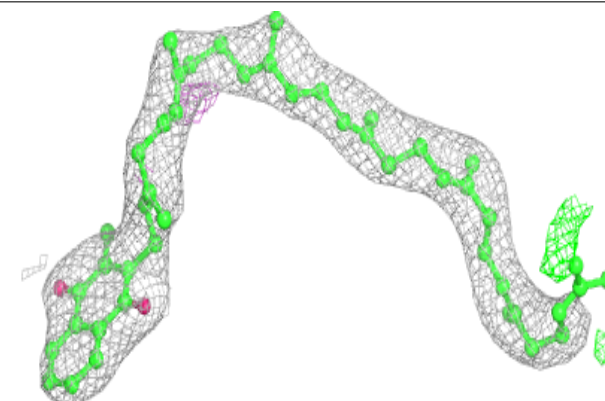
Electron density around MQ7 M 402 (A):

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
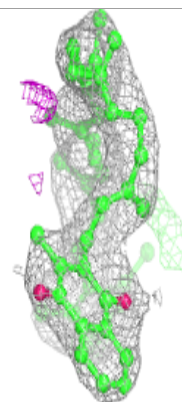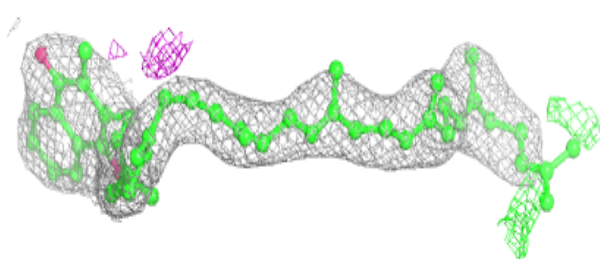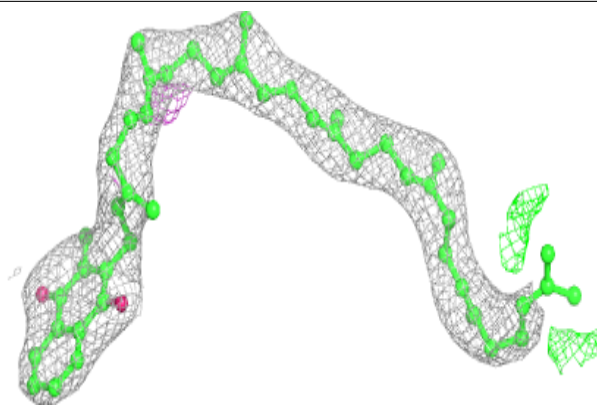
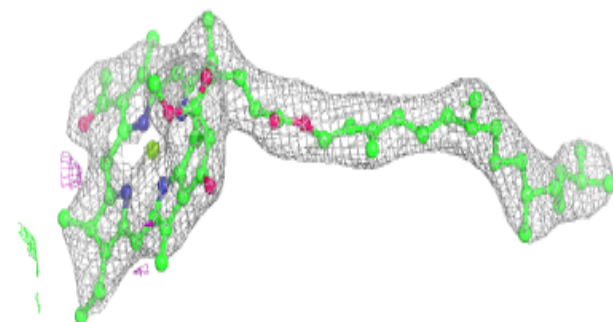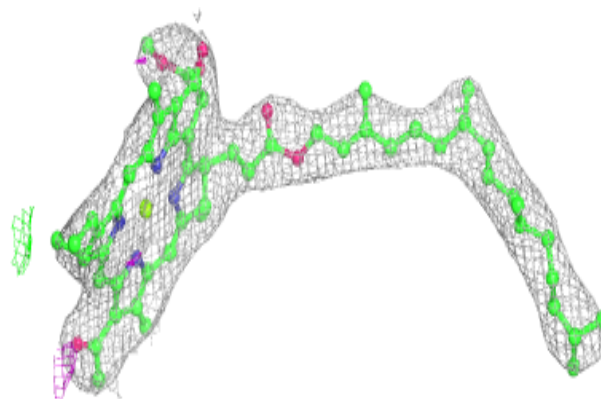**Electron density around BCB L 304:**

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
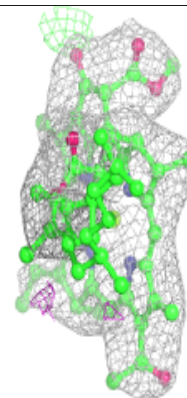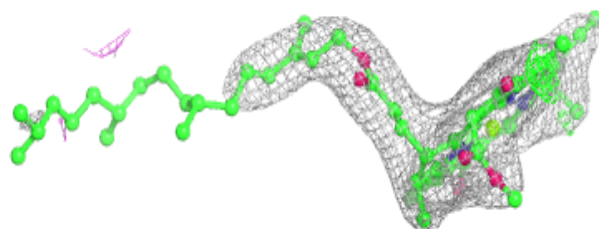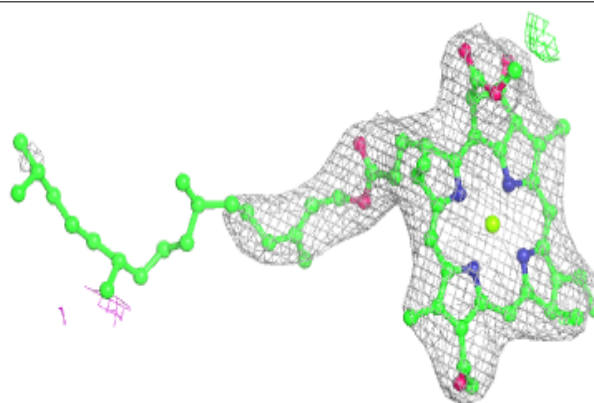
Electron density around BPB M 404:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
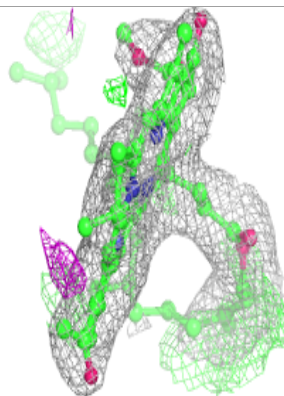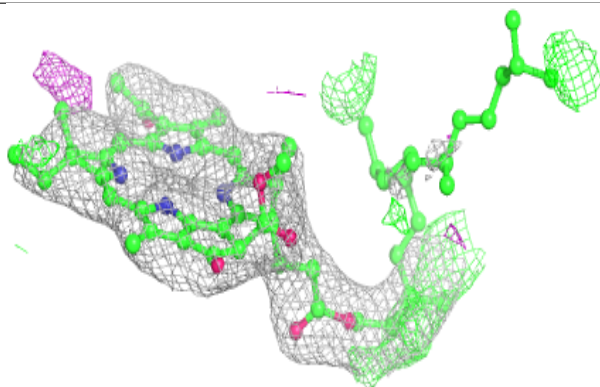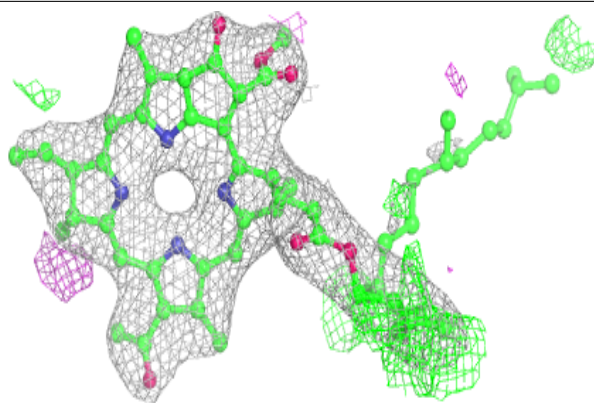
Electron density around HEC C 403:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
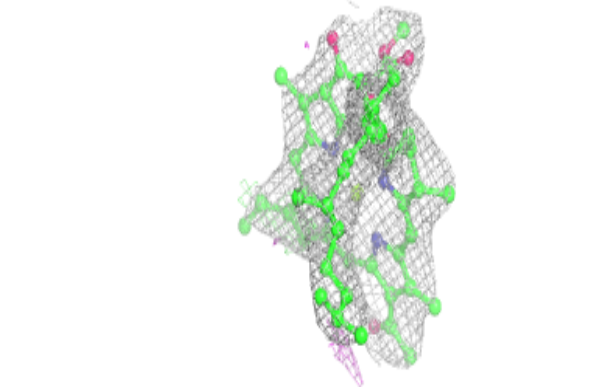$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
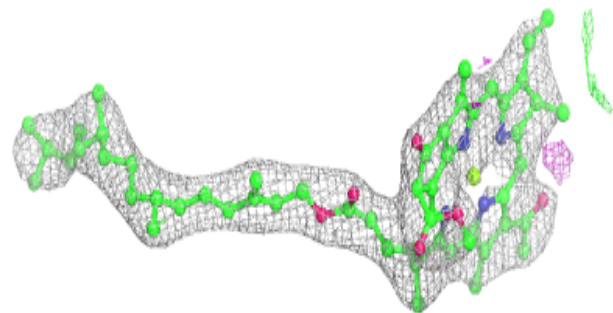and green (positive)
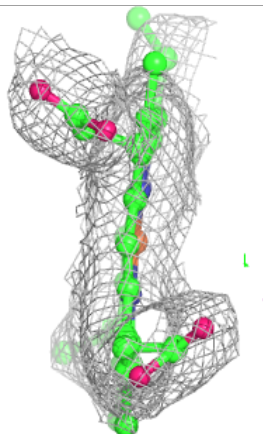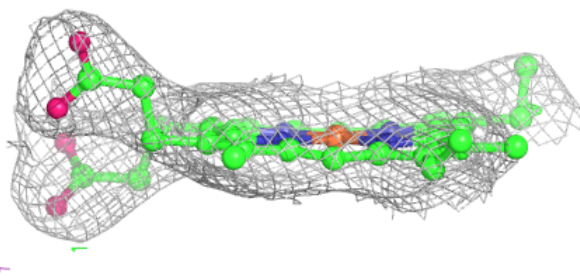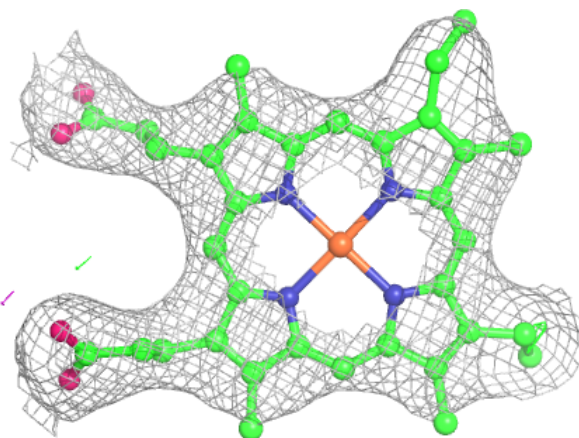
Electron density around BCB L 302 (B):

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
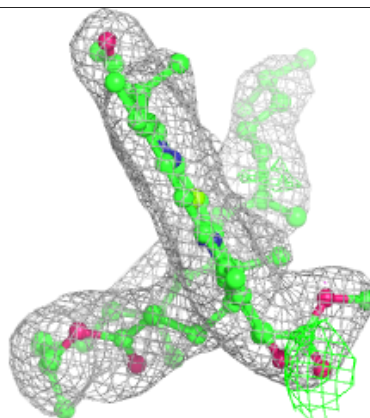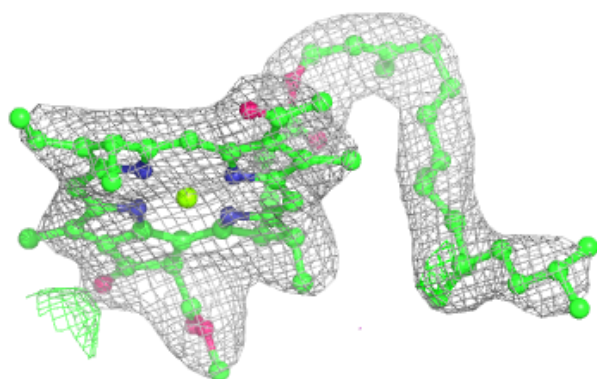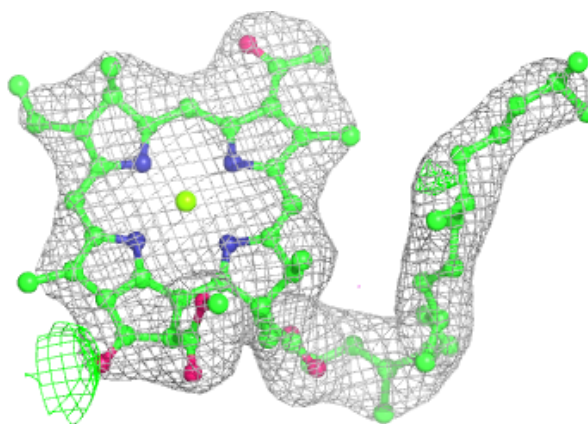
Electron density around BCB M 403 (A):

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
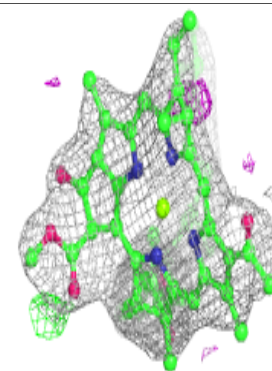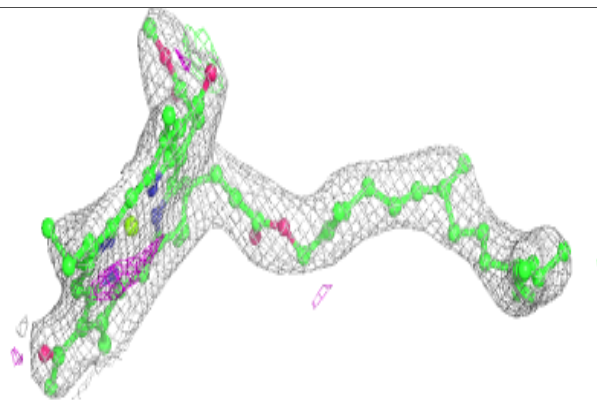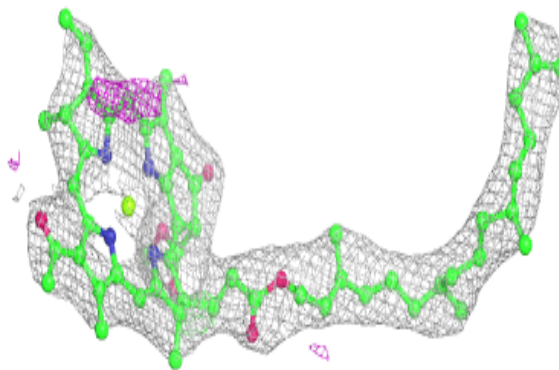
Electron density around BCB M 403 (B):

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
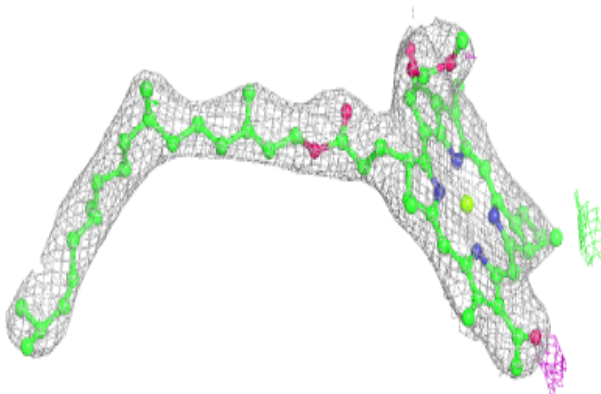and green (positive)
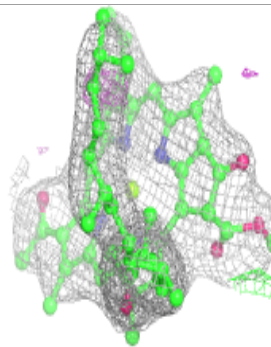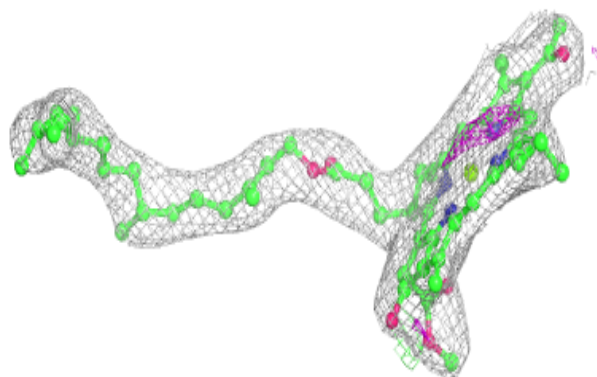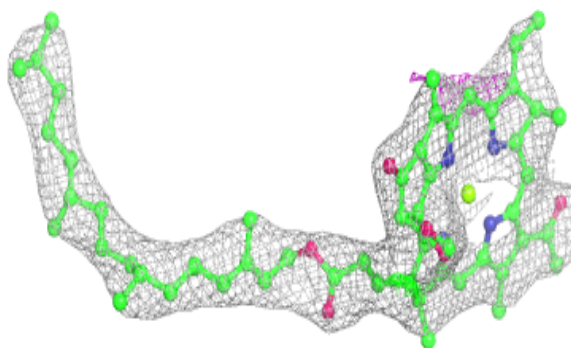
Electron density around BPB L 303 (A):

$2mF_o$-DF_c (at 0.7 rmsd) in gray
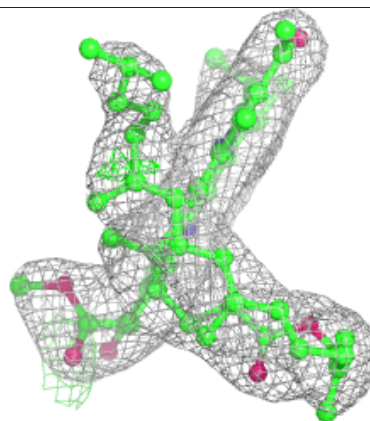mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
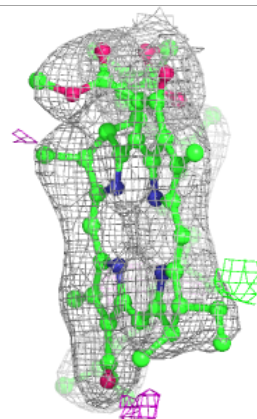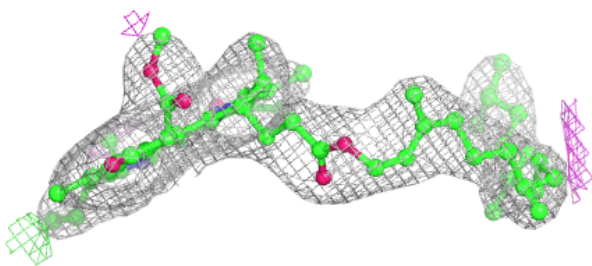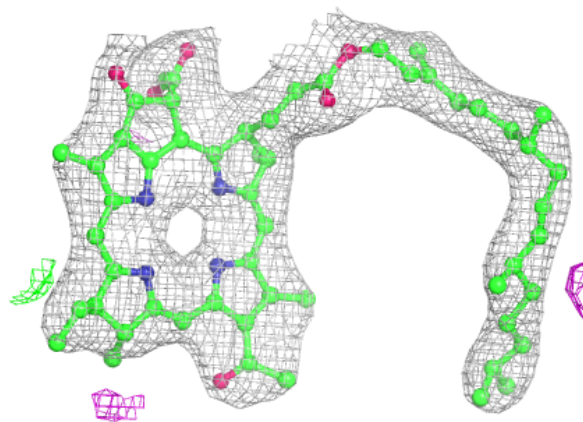
Electron density around BPB L 303 (B):

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
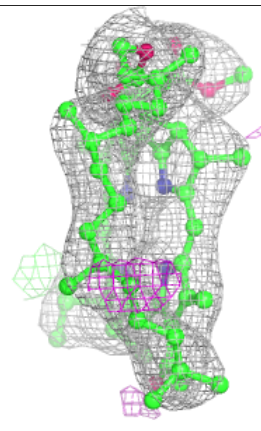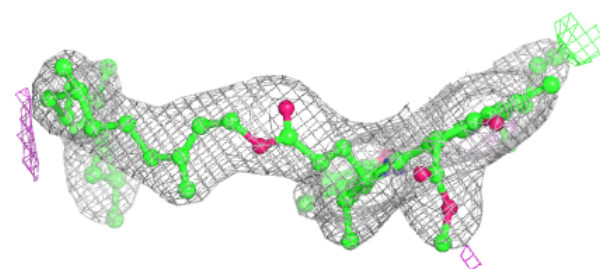
Electron density around HEC C 401:

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

Electron density around BCB L 301 (A):

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
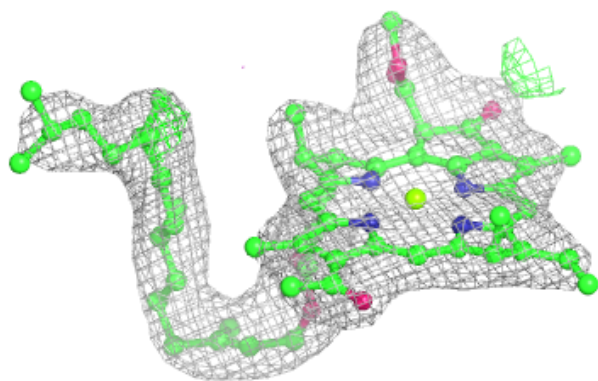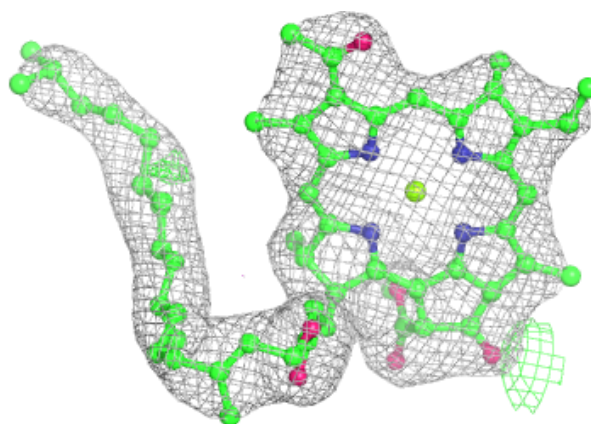and green (positive)
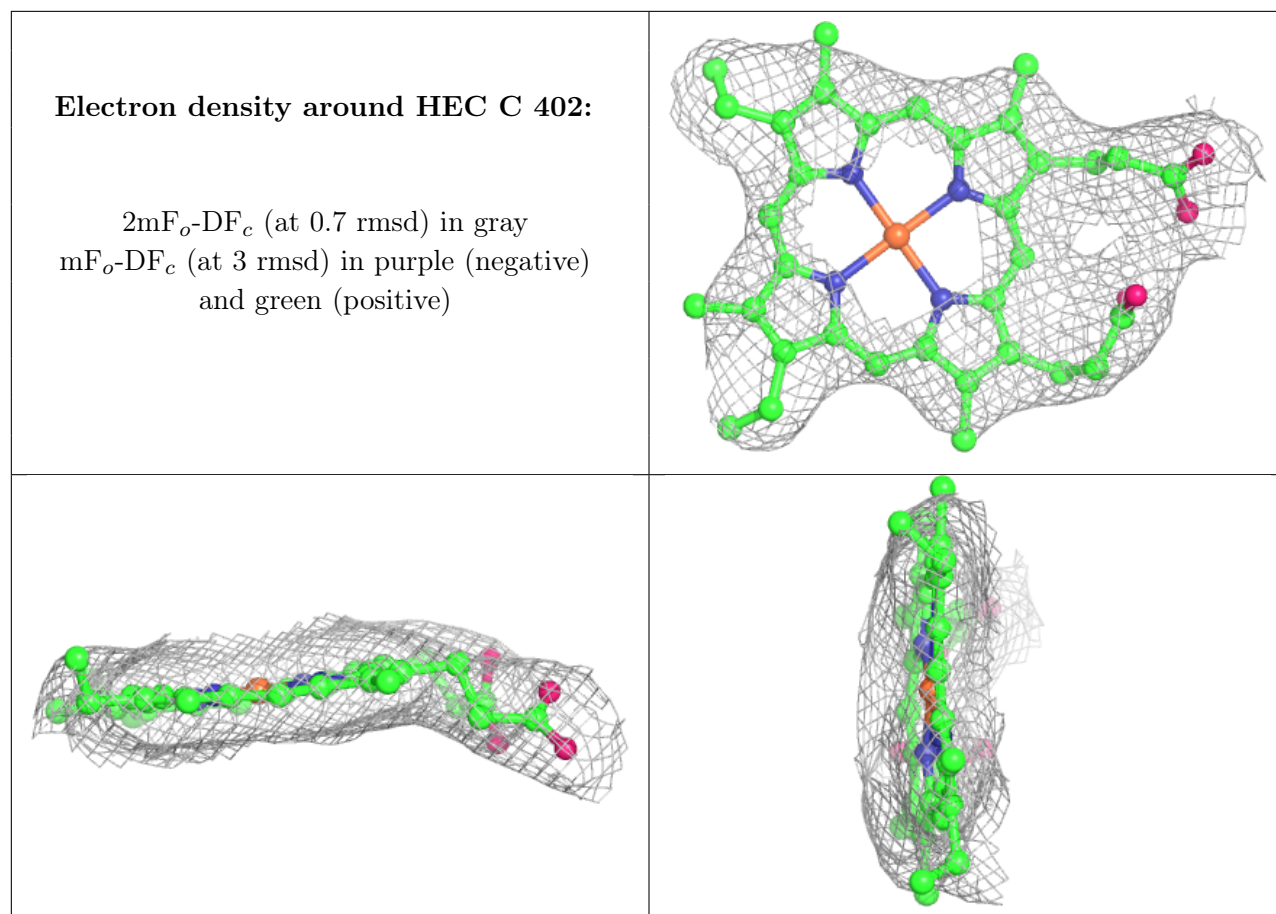
Electron density around BCB L 301 (B):

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
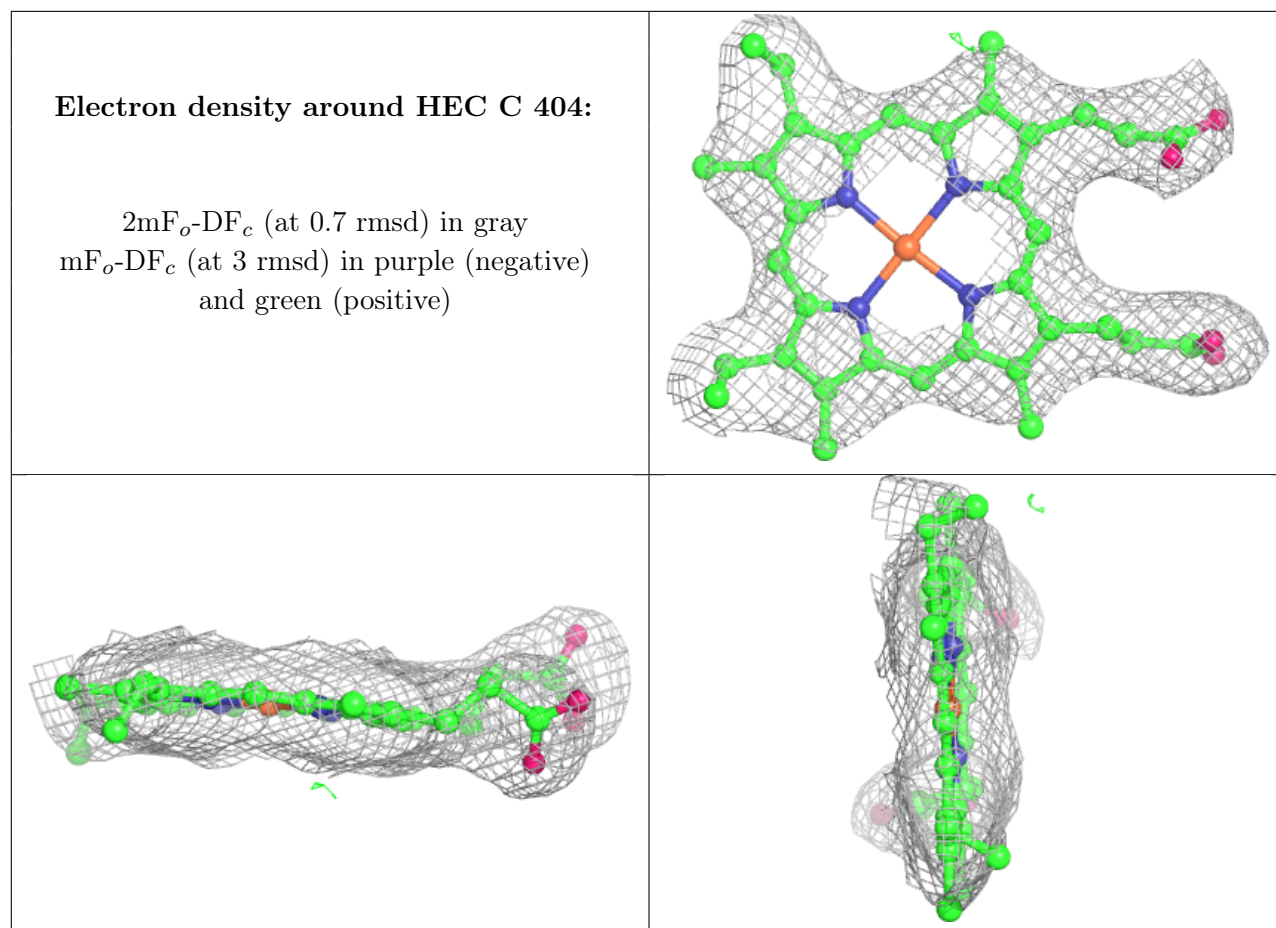mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)

Electron density around BCB L 302 (A):

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

Electron density around HEC C 402:

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

Electron density around HEC C 404:

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

6.5 Other polymers ⓘ

There are no such residues in this entry.