WORLDWIDE PDB

PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report (i)

Nov 20, 2023 – 12:43 AM JST

PDB ID	:	7C90
Title	:	Crystal structure of Cytochrome CL from the marine methylotrophic bacterium Methylophaga aminisulfidivorans MPT (Ma-CytcL)
Authors	:	Ghosh, S.; Dhanasingh, I.; Lee, S.H.
Deposited on	:	2020-06-04
Resolution	:	2.13 Å(reported)

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

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (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:

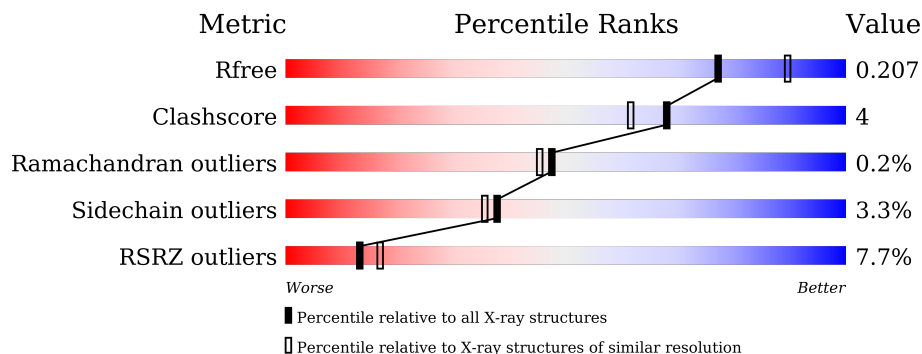|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance ⓘ

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

The reported resolution of this entry is 2.13 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		0.207
Clashscore		4
Ramachandran outliers		0.2%
Sidechain outliers		3.3%
RSRZ outliers		7.7%

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	2523 (2.16-2.12)
Clashscore	141614	2653 (2.16-2.12)
Ramachandran outliers	138981	2618 (2.16-2.12)
Sidechain outliers	138945	2617 (2.16-2.12)
RSRZ outliers	127900	2485 (2.16-2.12)

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	194	6% / 71% / 7% · 22%
1	B	194	3% / 72% / 6% 22%
1	C	194	9% / 66% / 8% 25%
1	D	194	6% / 69% / 8% · 23%

2 Entry composition ⓘ

There are 8 unique types of molecules in this entry. The entry contains 5321 atoms, of which 0 are hydrogens and 0 are deuteriums.

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

- Molecule 1 is a protein called Cytochrome c, mono-and diheme variant.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	151	Total	C	N	O	S	0	0	0
			1185	748	197	234	6			
1	B	151	Total	C	N	O	S	0	0	0
			1185	748	197	234	6			
1	C	145	Total	C	N	O	S	0	0	0
			1137	717	188	226	6			
1	D	150	Total	C	N	O	S	0	0	0
			1176	742	195	233	6			

- Molecule 2 is HEME C (three-letter code: HEC) (formula: $C_{34}H_{34}FeN_4O_4$) (labeled as "Ligand of Interest" by depositor).

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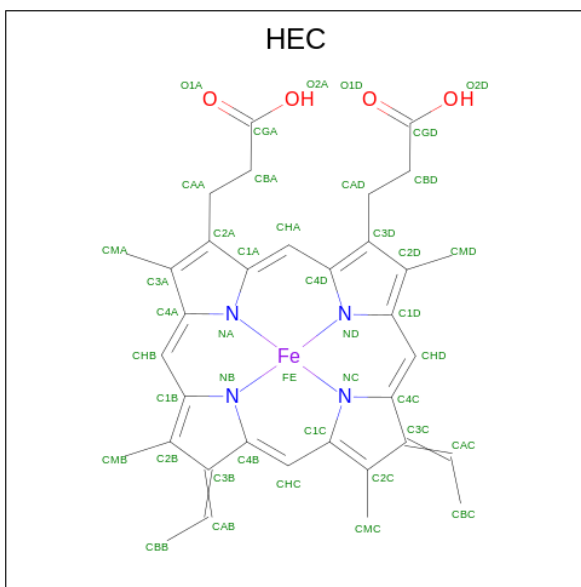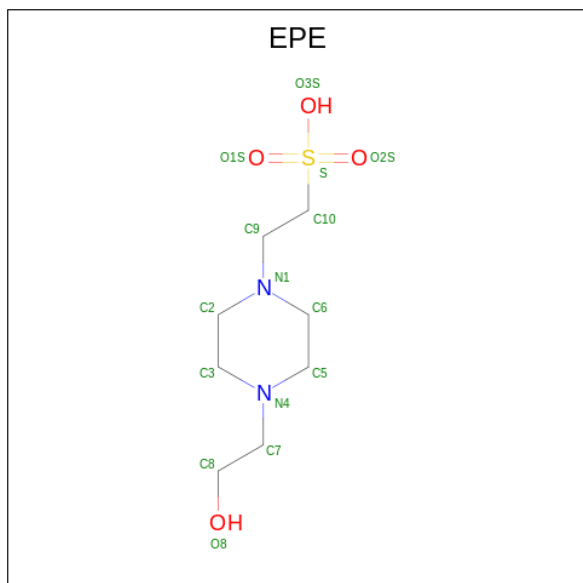
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4			
2	B	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4			

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

- Molecule 3 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (three-letter code: EPE) (formula: $C_8H_{18}N_2O_4S$).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	S	0	0
			15	8	2	4	1		
3	B	1	Total	C	N	O	S	0	0
			15	8	2	4	1		
3	B	1	Total	C	N	O	S	0	0
			15	8	2	4	1		
3	C	1	Total	C	N	O	S	0	0
			15	8	2	4	1		

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).

GOL

C3

OH O3

C1   C2

HO

O1

OH

O2

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

- Molecule 5 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total 1	Ca 1	0	0
5	B	1	Total 1	Ca 1	0	0
5	C	1	Total 1	Ca 1	0	0
5	D	1	Total 1	Ca 1	0	0

- Molecule 6 is FE (III) ION (three-letter code: FE) (formula: Fe).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	1	Total 1	Fe 1	0	0
6	B	1	Total 1	Fe 1	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
6	C	1	Total Fe 1 1	0	0
6	D	1	Total Fe 1 1	0	0

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

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	2	Total Na 2 2	0	0
7	B	2	Total Na 2 2	0	0
7	C	2	Total Na 2 2	0	0
7	D	2	Total Na 2 2	0	0

- Molecule 8 is water.

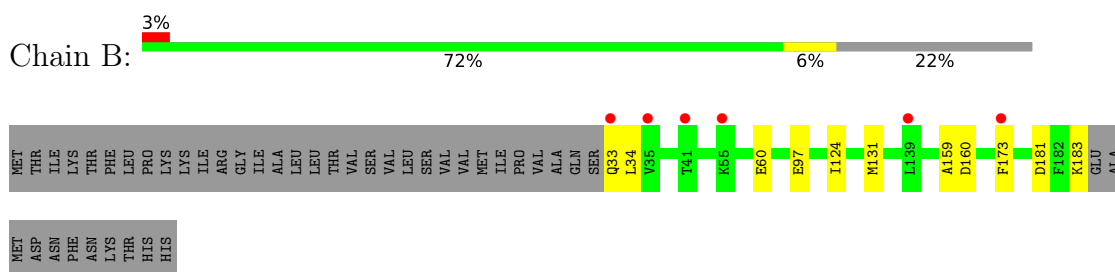| Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	108	Total O 108 108	0	0
8	B	90	Total O 90 90	0	0
8	C	83	Total O 83 83	0	0
8	D	91	Total O 91 91	0	0

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.
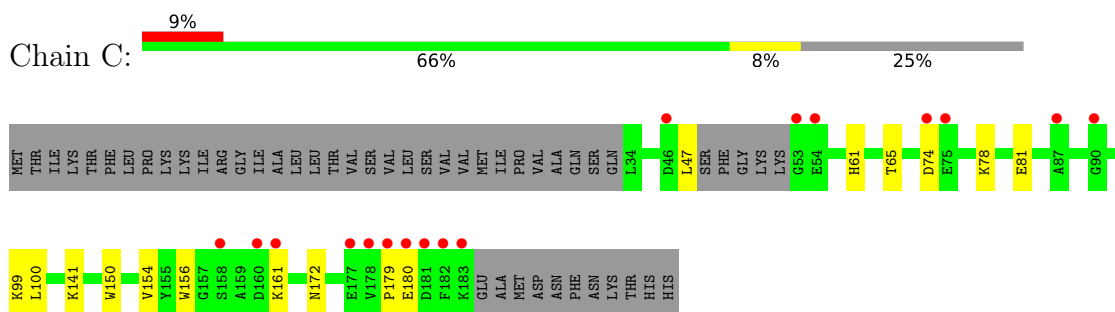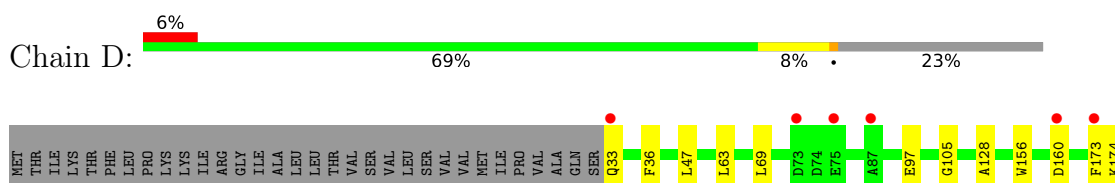
• Molecule 1: Cytochrome c, mono-and diheme variant
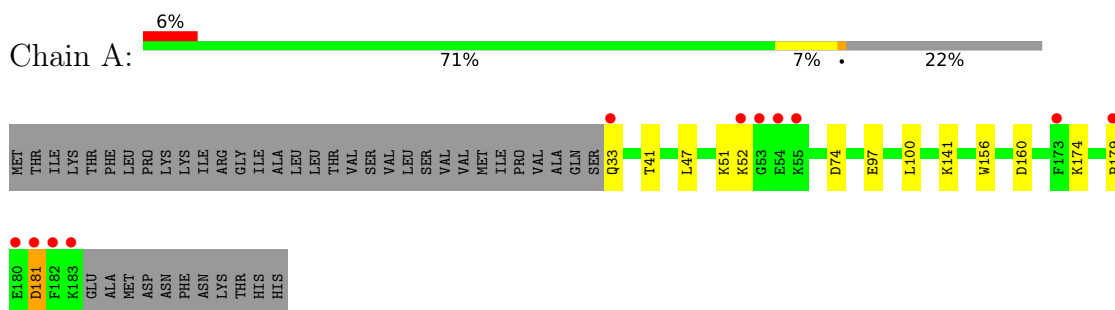
Chain A:

• Molecule 1: Cytochrome c, mono-and diheme variant

Chain B:

• Molecule 1: Cytochrome c, mono-and diheme variant

Chain C:

• Molecule 1: Cytochrome c, mono-and diheme variant

Chain D:

P175 A176 E177 V178 P179 E180 D181 F182 LYS GLU ALA MET ASP ASN PHE ASN LYS THR HIS HIS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	61.76Å 76.06Å 66.44Å 90.00° 106.85° 90.00°	Depositor
Resolution (Å)	30.58 – 2.13 30.56 – 2.13	Depositor EDS
% Data completeness (in resolution range)	97.4 (30.58-2.13) 97.4 (30.56-2.13)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	6.14 (at 2.14Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.148 , 0.200 0.158 , 0.207	Depositor DCC
R_{free} test set	1953 reflections (6.07%)	wwPDB-VP
Wilson B-factor (Å^2)	31.7	Xtriage
Anisotropy	0.038	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.40 , 55.7	EDS
L-test for twinning[2]	$< |L| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5321	wwPDB-VP
Average B, all atoms (Å^2)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.18% 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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: EPE, CA, GOL, FE, HEC, NA

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	0.71	0/1214	0.81	0/1641
1	B	0.70	0/1214	0.78	0/1641
1	C	0.69	0/1164	0.78	0/1575
1	D	0.74	1/1205 (0.1%)	0.79	0/1630
All	All	0.71	1/4797 (0.0%)	0.79	0/6487

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	128	ALA	C-N	-5.42	1.21	1.34

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	1185	0	1113	7	0
1	B	1185	0	1113	9	0
1	C	1137	0	1061	8	0
1	D	1176	0	1099	12	0
2	A	43	0	30	1	0
2	B	43	0	30	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	43	0	30	0	0
2	D	43	0	30	1	0
3	A	15	0	18	0	0
3	B	30	0	35	0	0
3	C	15	0	18	0	0
4	A	12	0	16	0	0
4	B	6	0	8	0	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
5	C	1	0	0	0	0
5	D	1	0	0	0	0
6	A	1	0	0	0	0
6	B	1	0	0	0	0
6	C	1	0	0	0	0
6	D	1	0	0	0	0
7	A	2	0	0	0	0
7	B	2	0	0	0	0
7	C	2	0	0	0	0
7	D	2	0	0	0	0
8	A	108	0	0	2	0
8	B	90	0	0	2	0
8	C	83	0	0	1	0
8	D	91	0	0	1	0
All	All	5321	0	4601	36	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 4.

All (36) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:177:GLU:H	1:D:177:GLU:CD	1.91	0.73
1:D:97:GLU:HG3	1:D:181:ASP:HB2	1.72	0.72
1:D:97:GLU:HB2	1:D:182:PHE:HB3	1.75	0.67
1:A:33:GLN:O	1:A:33:GLN:HG3	1.97	0.65
1:A:51:LYS:HE2	8:A:375:HOH:O	2.02	0.59
1:C:74:ASP:O	1:C:78:LYS:HG2	2.04	0.58
1:C:172:ASN:ND2	8:C:302:HOH:O	2.37	0.57
1:D:174:LYS:NZ	8:D:303:HOH:O	2.38	0.56
1:C:47:LEU:O	1:C:141:LYS:NZ	2.32	0.51
1:C:81:GLU:HG3	1:C:150:TRP:NE1	2.27	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:182:PHE:C	1:D:182:PHE:CD1	2.85	0.49
1:B:97:GLU:HG3	1:B:181:ASP:HB2	1.95	0.48
2:A:201:HEC:HMC1	2:A:201:HEC:HBC3	1.94	0.48
1:D:47:LEU:HD13	1:D:63:LEU:HD22	1.96	0.47
1:D:97:GLU:HB2	1:D:182:PHE:CB	2.42	0.47
1:A:156:TRP:CE3	1:A:179:PRO:HD3	2.51	0.46
1:D:36:PHE:CD1	1:D:47:LEU:HD11	2.51	0.44
1:D:181:ASP:OD1	1:D:181:ASP:N	2.50	0.44
1:D:173:PHE:CD1	1:D:173:PHE:C	2.91	0.43
1:B:183:LYS:CG	8:B:383:HOH:O	2.66	0.43
1:B:159:ALA:HB2	1:B:173:PHE:CD2	2.54	0.43
1:D:105:GLY:HA3	1:D:156:TRP:CZ3	2.54	0.43
1:A:97:GLU:HG3	1:A:181:ASP:HB2	2.00	0.42
1:C:61:HIS:CE1	1:C:65:THR:HG21	2.54	0.42
2:D:201:HEC:HBC3	2:D:201:HEC:HMC1	2.01	0.42
1:B:34:LEU:HD12	1:B:34:LEU:HA	1.93	0.42
1:A:47:LEU:O	1:A:141:LYS:NZ	2.46	0.41
1:A:52:LYS:HG2	8:A:311:HOH:O	2.20	0.41
1:D:173:PHE:HE1	1:D:175:PRO:HG3	1.85	0.41
1:B:183:LYS:CD	8:B:383:HOH:O	2.68	0.41
1:C:156:TRP:CE3	1:C:179:PRO:HD3	2.57	0.40
1:A:41:THR:HG22	1:B:183:LYS:HD2	2.02	0.40
1:B:124:ILE:CD1	2:B:201:HEC:HMB2	2.51	0.40
1:B:124:ILE:HG12	2:B:201:HEC:HMB2	2.04	0.40
1:B:131:MET:CE	1:C:100:LEU:HB2	2.51	0.40
1:C:150:TRP:CZ2	1:C:154:VAL:HG11	2.56	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	149/194 (77%)	145 (97%)	4 (3%)	0	100	100
1	B	149/194 (77%)	145 (97%)	4 (3%)	0	100	100
1	C	141/194 (73%)	136 (96%)	4 (3%)	1 (1%)	22	14
1	D	148/194 (76%)	144 (97%)	4 (3%)	0	100	100
All	All	587/776 (76%)	570 (97%)	16 (3%)	1 (0%)	47	45

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	99	LYS

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	123/162 (76%)	118 (96%)	5 (4%)	30	27
1	B	123/162 (76%)	120 (98%)	3 (2%)	49	49
1	C	118/162 (73%)	116 (98%)	2 (2%)	60	63
1	D	122/162 (75%)	116 (95%)	6 (5%)	25	20
All	All	486/648 (75%)	470 (97%)	16 (3%)	38	35

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	74	ASP
1	A	100	LEU
1	A	160	ASP
1	A	174	LYS
1	A	181	ASP
1	B	33	GLN
1	B	60	GLU
1	B	160	ASP
1	C	161	LYS
1	C	180	GLU

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Mol	Chain	Res	Type
1	D	33	GLN
1	D	69	LEU
1	D	160	ASP
1	D	180	GLU
1	D	181	ASP
1	D	182	PHE

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

Mol	Chain	Res	Type
1	B	33	GLN

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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 27 ligands modelled in this entry, 16 are monoatomic - leaving 11 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	$\#|Z| > 2$
2	HEC	C	201	1	32,50,50	1.86	9 (28%)	24,82,82	2.72	9 (37%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
3	EPE	B	203	-	15,15,15	1.80	1 (6%)	18,20,20	1.49	2 (11%)
4	GOL	B	204	-	5,5,5	0.14	0	5,5,5	0.36	0
4	GOL	A	204	-	5,5,5	0.12	0	5,5,5	0.48	0
2	HEC	B	201	1	32,50,50	1.92	9 (28%)	24,82,82	3.11	7 (29%)
2	HEC	A	201	1	32,50,50	2.12	10 (31%)	24,82,82	2.81	8 (33%)
3	EPE	C	202	-	15,15,15	1.98	1 (6%)	18,20,20	2.26	4 (22%)
4	GOL	A	203	-	5,5,5	0.11	0	5,5,5	0.39	0
2	HEC	D	201	1	32,50,50	1.94	9 (28%)	24,82,82	2.52	8 (33%)
3	EPE	A	202	-	15,15,15	1.80	1 (6%)	18,20,20	1.67	1 (5%)
3	EPE	B	202	-	15,15,15	1.74	1 (6%)	18,20,20	1.14	3 (16%)

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	HEC	C	201	1	-	1/10/54/54	-
3	EPE	B	203	-	-	4/9/19/19	0/1/1/1
4	GOL	B	204	-	-	2/4/4/4	-
4	GOL	A	204	-	-	4/4/4/4	-
2	HEC	B	201	1	-	2/10/54/54	-
2	HEC	A	201	1	-	0/10/54/54	-
3	EPE	C	202	-	-	6/9/19/19	0/1/1/1
4	GOL	A	203	-	-	4/4/4/4	-
2	HEC	D	201	1	-	1/10/54/54	-
3	EPE	A	202	-	-	7/9/19/19	0/1/1/1
3	EPE	B	202	-	-	2/9/19/19	0/1/1/1

All (41) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	202	EPE	C10-S	-7.20	1.67	1.77
3	B	202	EPE	C10-S	-6.58	1.68	1.77
3	B	203	EPE	C10-S	-6.52	1.68	1.77
3	A	202	EPE	C10-S	-6.38	1.68	1.77
2	A	201	HEC	C3C-C2C	6.21	1.47	1.40
2	A	201	HEC	C2B-C3B	5.40	1.46	1.40
2	B	201	HEC	C3C-C2C	5.31	1.46	1.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	201	HEC	C3C-C2C	5.13	1.46	1.40
2	C	201	HEC	C2B-C3B	5.10	1.46	1.40
2	D	201	HEC	C2B-C3B	4.19	1.45	1.40
2	B	201	HEC	C2B-C3B	3.76	1.44	1.40
2	C	201	HEC	C2A-C1A	3.41	1.50	1.42
2	D	201	HEC	C3D-C2D	3.40	1.47	1.37
2	D	201	HEC	C3C-C4C	3.34	1.49	1.43
2	C	201	HEC	C3C-C2C	3.29	1.44	1.40
2	B	201	HEC	CAD-C3D	-3.03	1.47	1.52
2	B	201	HEC	C3C-C4C	2.95	1.48	1.43
2	C	201	HEC	C3A-C4A	2.93	1.49	1.42
2	A	201	HEC	CAD-C3D	-2.93	1.47	1.52
2	C	201	HEC	C3C-C4C	2.93	1.48	1.43
2	D	201	HEC	C2A-C1A	2.87	1.49	1.42
2	C	201	HEC	C2A-C3A	2.75	1.45	1.37
2	A	201	HEC	C2A-C3A	2.71	1.45	1.37
2	B	201	HEC	C2A-C3A	2.65	1.45	1.37
2	A	201	HEC	C3A-C4A	2.63	1.48	1.42
2	A	201	HEC	C1B-NB	-2.54	1.30	1.36
2	C	201	HEC	C4B-C3B	2.53	1.47	1.43
2	D	201	HEC	C2A-C3A	2.51	1.45	1.37
2	A	201	HEC	C2A-C1A	2.49	1.48	1.42
2	D	201	HEC	C3A-C4A	2.47	1.48	1.42
2	B	201	HEC	C3D-C2D	2.46	1.45	1.37
2	B	201	HEC	C4D-ND	-2.43	1.31	1.36
2	B	201	HEC	C2A-C1A	2.41	1.48	1.42
2	A	201	HEC	C3D-C2D	2.41	1.44	1.37
2	B	201	HEC	C4B-C3B	2.30	1.47	1.43
2	C	201	HEC	C1C-NC	-2.29	1.31	1.36
2	D	201	HEC	C4B-C3B	2.22	1.47	1.43
2	C	201	HEC	C3D-C2D	2.17	1.44	1.37
2	D	201	HEC	C4D-CHA	2.15	1.47	1.41
2	A	201	HEC	C1D-CHD	2.03	1.46	1.41
2	A	201	HEC	CAA-C2A	-2.01	1.48	1.52

All (42) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	201	HEC	C1D-C2D-C3D	-9.91	100.10	107.00
2	C	201	HEC	CMC-C2C-C3C	7.60	134.76	125.82
2	B	201	HEC	CBD-CAD-C3D	-7.34	100.10	112.62
2	C	201	HEC	CBD-CAD-C3D	-7.00	100.68	112.62

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	201	HEC	CMC-C2C-C3C	6.91	133.95	125.82
2	D	201	HEC	C1D-C2D-C3D	-6.88	102.21	107.00
3	C	202	EPE	O2S-S-C10	5.73	113.81	106.92
2	A	201	HEC	CBD-CAD-C3D	-5.47	103.28	112.62
2	A	201	HEC	CBA-CAA-C2A	-5.43	103.45	112.60
2	D	201	HEC	CMC-C2C-C3C	5.35	132.11	125.82
3	A	202	EPE	O3S-S-C10	5.07	113.97	105.77
3	C	202	EPE	O3S-S-C10	4.91	113.70	105.77
2	C	201	HEC	C1D-C2D-C3D	-4.70	103.72	107.00
2	A	201	HEC	C1D-C2D-C3D	-4.69	103.73	107.00
3	C	202	EPE	O1S-S-C10	-4.58	101.40	106.92
2	D	201	HEC	CBD-CAD-C3D	-4.41	105.10	112.62
2	B	201	HEC	CMB-C2B-C3B	4.22	130.79	125.82
2	B	201	HEC	CMC-C2C-C3C	4.22	130.78	125.82
3	B	203	EPE	O2S-S-C10	4.03	111.77	106.92
2	A	201	HEC	CMB-C2B-C3B	3.61	130.07	125.82
2	D	201	HEC	CBA-CAA-C2A	-3.59	106.56	112.60
2	B	201	HEC	CBA-CAA-C2A	-3.55	106.63	112.60
2	A	201	HEC	CMA-C3A-C2A	3.40	131.35	124.94
3	B	203	EPE	O1S-S-C10	3.20	110.77	106.92
2	A	201	HEC	C2B-C3B-C4B	-3.12	102.98	106.35
2	C	201	HEC	CBA-CAA-C2A	-3.03	107.50	112.60
2	D	201	HEC	CMB-C2B-C3B	2.69	128.98	125.82
2	B	201	HEC	CMA-C3A-C2A	2.62	129.88	124.94
2	D	201	HEC	CMA-C3A-C2A	2.52	129.70	124.94
2	C	201	HEC	CMA-C3A-C2A	2.52	129.70	124.94
2	A	201	HEC	CMD-C2D-C3D	2.49	129.64	124.94
2	C	201	HEC	CMC-C2C-C1C	-2.37	124.82	128.46
2	C	201	HEC	O1A-CGA-CBA	-2.34	115.56	123.08
3	B	202	EPE	C9-N1-C2	-2.10	105.85	111.23
2	D	201	HEC	CMD-C2D-C3D	2.09	128.88	124.94
2	D	201	HEC	O2A-CGA-CBA	2.08	120.71	114.03
2	C	201	HEC	CMB-C2B-C1B	2.07	131.65	128.46
3	B	202	EPE	O3S-S-C10	2.06	109.10	105.77
3	B	202	EPE	O2S-S-C10	2.03	109.36	106.92
2	B	201	HEC	CMD-C2D-C3D	2.02	128.76	124.94
2	C	201	HEC	CMB-C2B-C3B	2.01	128.18	125.82
3	C	202	EPE	C5-C6-N1	-2.00	106.53	110.64

There are no chirality outliers.

All (33) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	202	EPE	S-C10-C9-N1
3	A	202	EPE	C9-C10-S-O2S
3	B	203	EPE	C8-C7-N4-C5
3	C	202	EPE	C9-C10-S-O1S
4	A	203	GOL	C1-C2-C3-O3
4	B	204	GOL	O1-C1-C2-O2
4	B	204	GOL	O1-C1-C2-C3
3	C	202	EPE	N4-C7-C8-O8
3	A	202	EPE	C9-C10-S-O3S
3	A	202	EPE	N4-C7-C8-O8
4	A	203	GOL	O1-C1-C2-C3
4	A	204	GOL	O1-C1-C2-C3
4	A	204	GOL	C1-C2-C3-O3
4	A	203	GOL	O2-C2-C3-O3
3	C	202	EPE	C9-C10-S-O3S
3	B	203	EPE	N4-C7-C8-O8
4	A	203	GOL	O1-C1-C2-O2
3	C	202	EPE	C10-C9-N1-C2
3	C	202	EPE	C10-C9-N1-C6
4	A	204	GOL	O1-C1-C2-O2
3	A	202	EPE	C9-C10-S-O1S
3	C	202	EPE	C9-C10-S-O2S
3	A	202	EPE	C8-C7-N4-C3
2	C	201	HEC	C3D-CAD-CBD-CGD
4	A	204	GOL	O2-C2-C3-O3
3	B	202	EPE	C10-C9-N1-C6
3	B	203	EPE	C10-C9-N1-C6
3	A	202	EPE	C8-C7-N4-C5
2	D	201	HEC	CAA-CBA-CGA-O1A
2	B	201	HEC	CAD-CBD-CGD-O2D
3	B	202	EPE	C9-C10-S-O1S
2	B	201	HEC	CAA-CBA-CGA-O1A
3	B	203	EPE	C10-C9-N1-C2

There are no ring outliers.
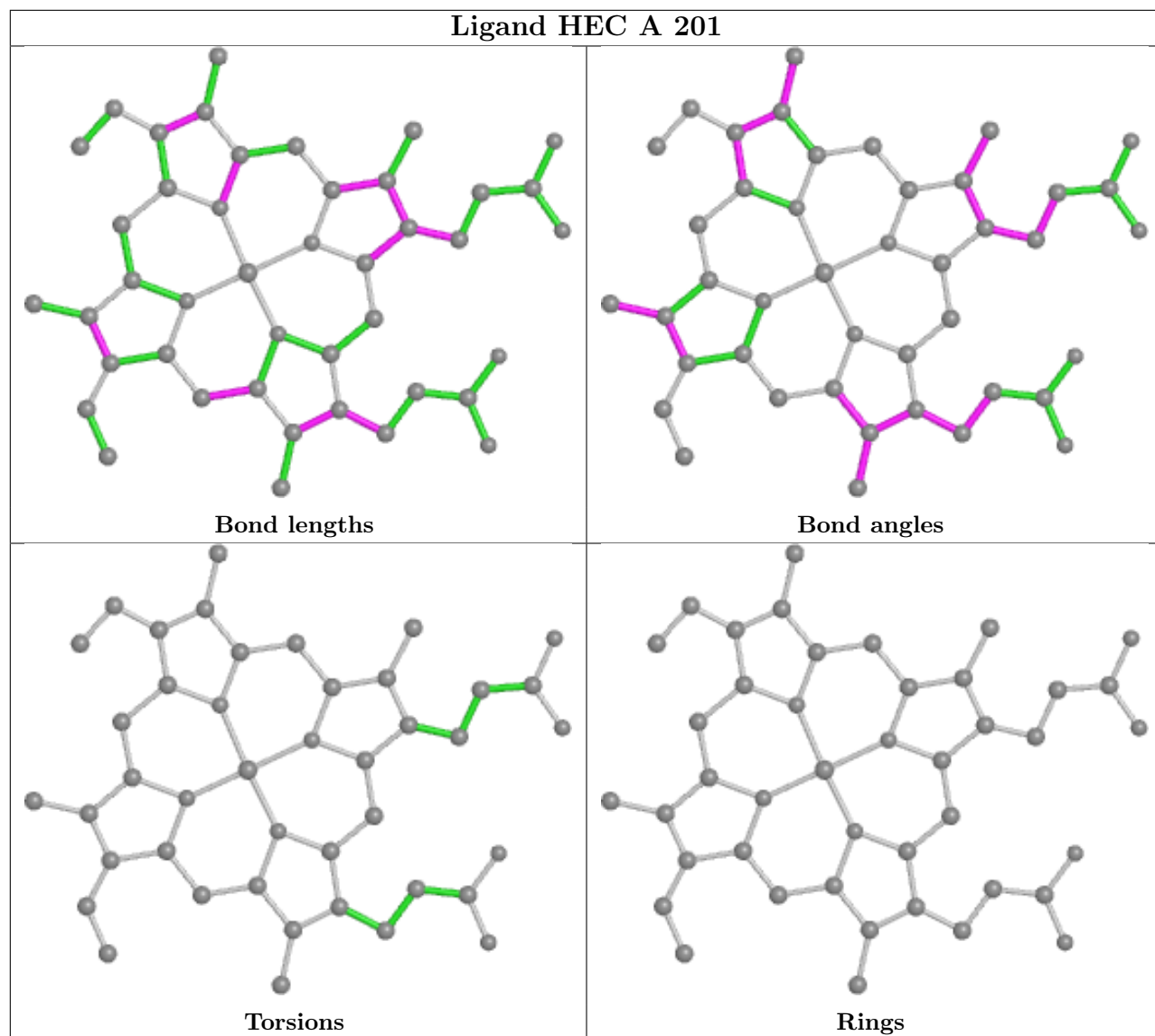
3 monomers are involved in 4 short contacts:

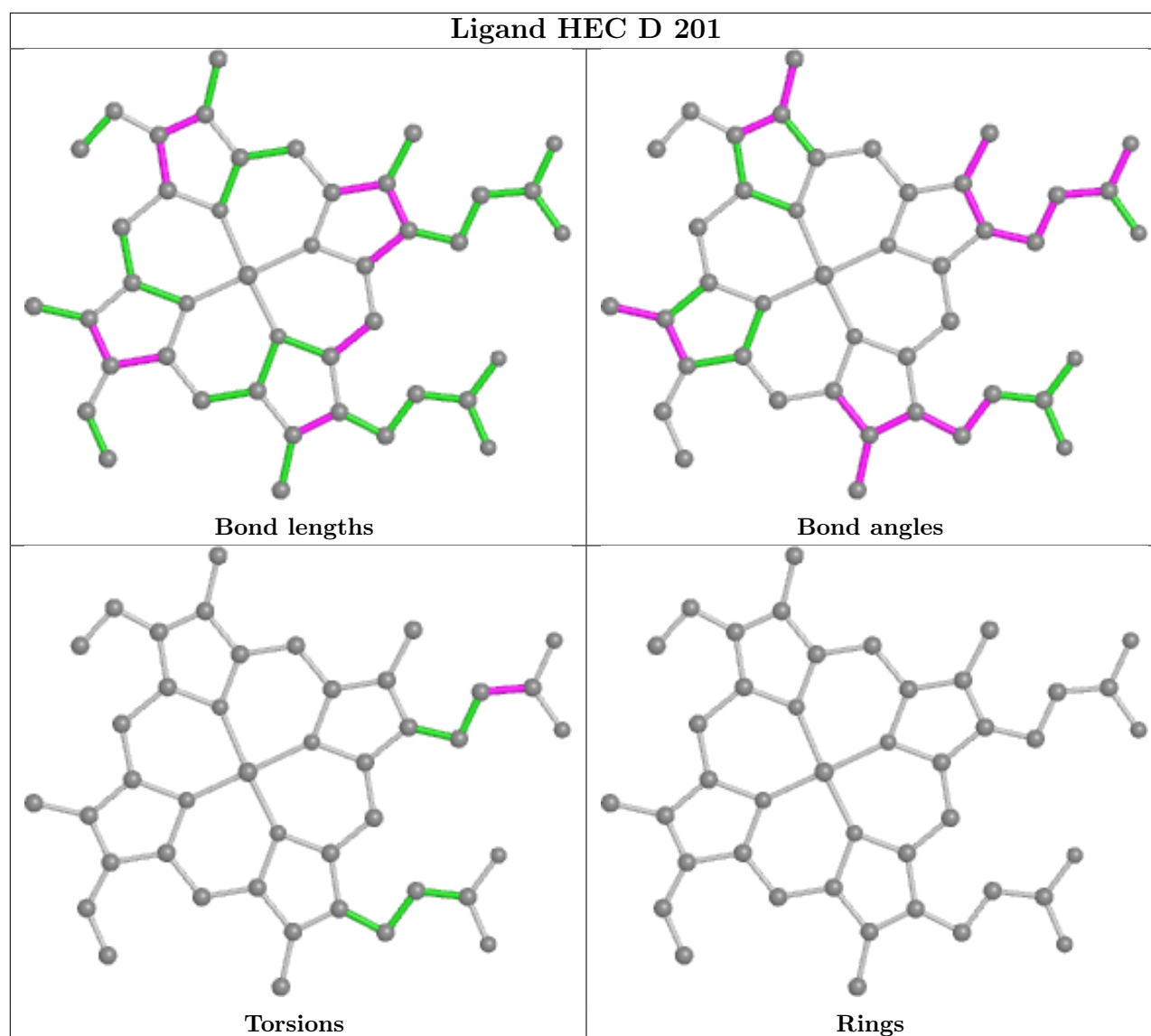| Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	201	HEC	2	0
2	A	201	HEC	1	0
2	D	201	HEC	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths,

bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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 201

Bond lengths

Bond angles

Torsions

Rings

Ligand HEC B 201

Bond lengths

Bond angles

Torsions

Rings

Ligand HEC A 201

Bond lengths

Bond angles

Torsions

Rings

Ligand HEC D 201

Bond lengths

Bond angles

Torsions

Rings
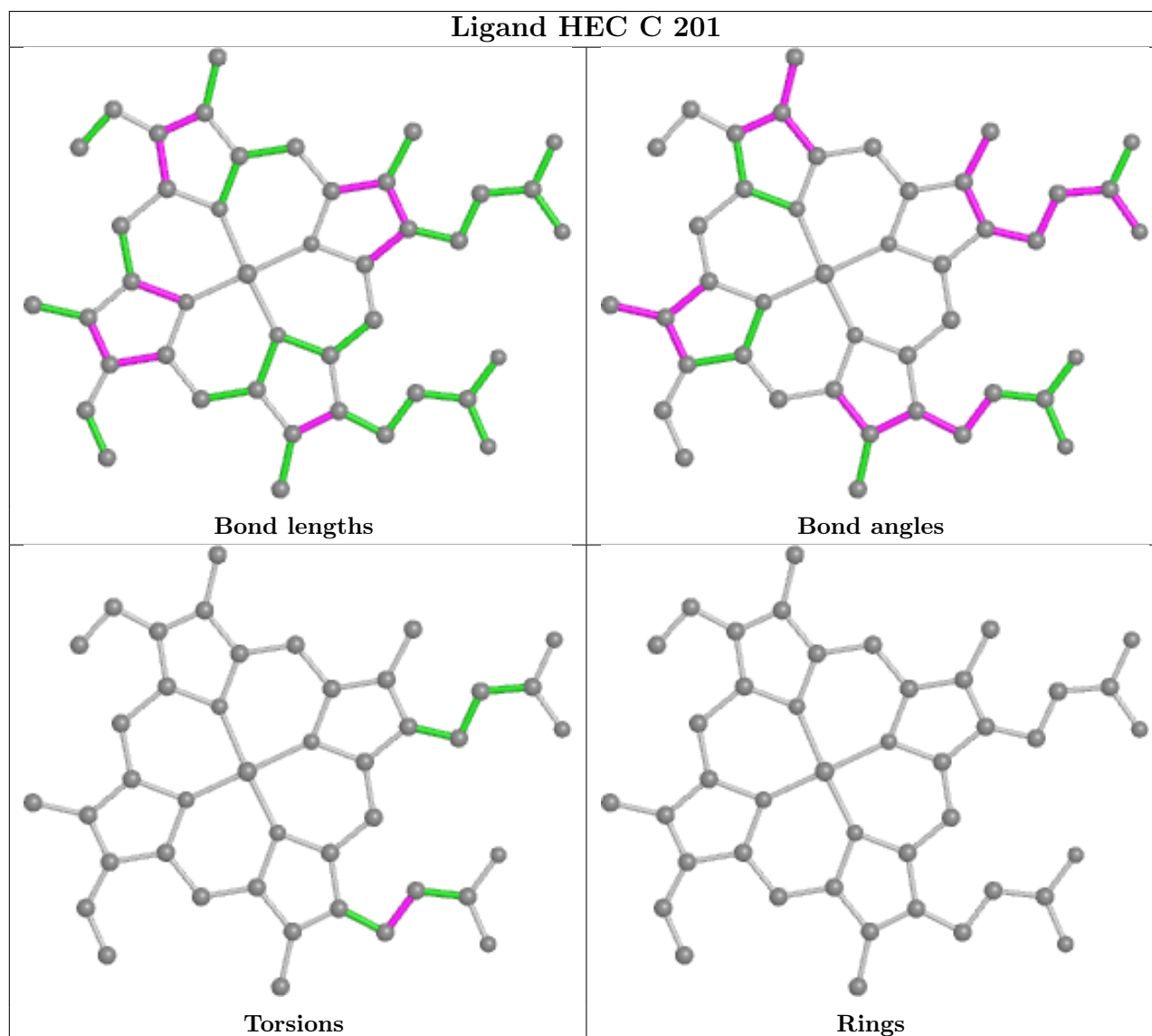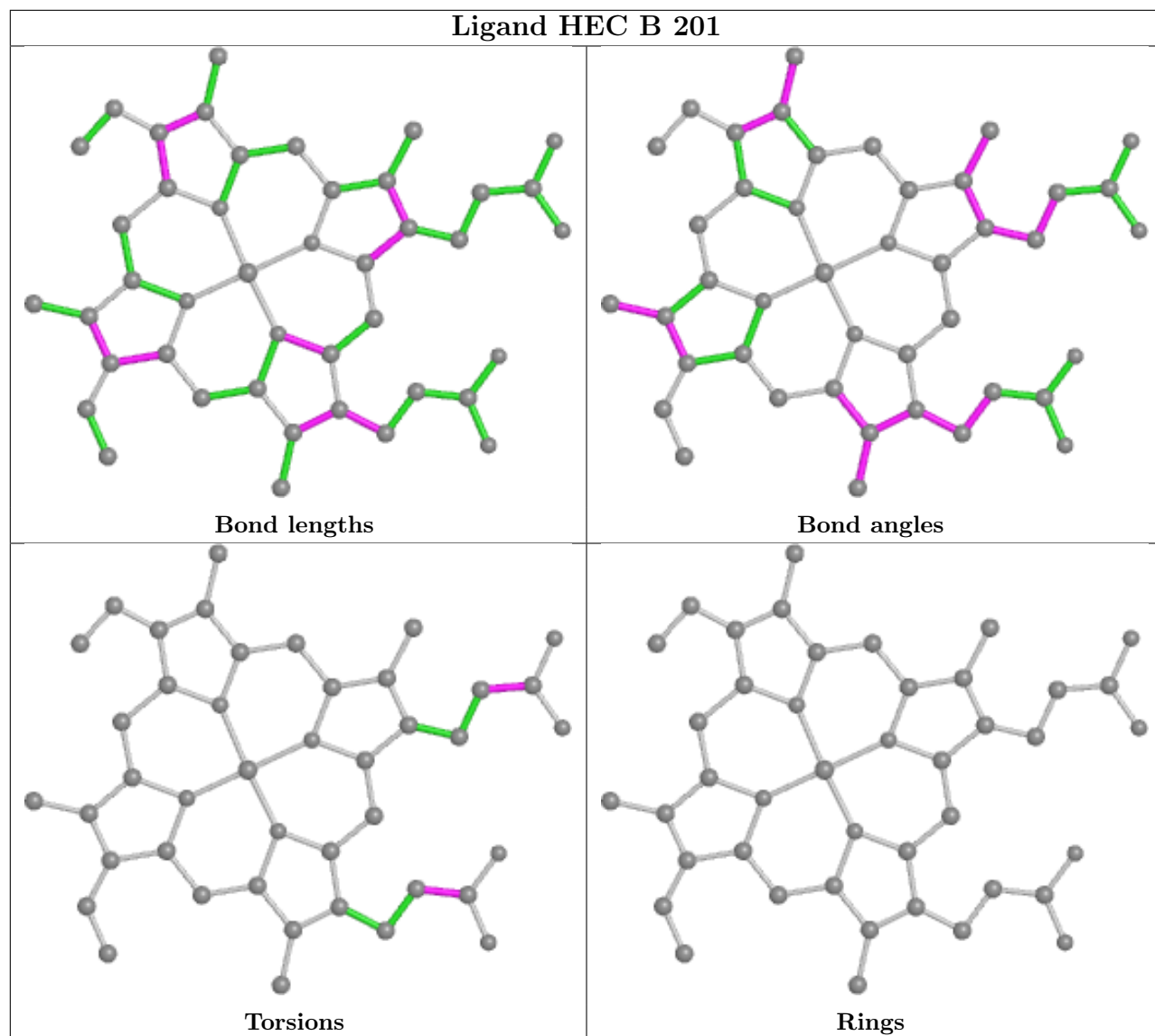
5.7 Other polymers ⓘ

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	A	151/194 (77%)	0.24	11 (7%)	15	19	20, 35, 72, 98	0
1	B	151/194 (77%)	0.25	6 (3%)	38	46	21, 33, 62, 85	0
1	C	145/194 (74%)	0.53	17 (11%)	4	5	25, 36, 68, 103	0
1	D	150/194 (77%)	0.24	12 (8%)	12	15	23, 35, 69, 94	0
All	All	597/776 (76%)	0.31	46 (7%)	13	17	20, 35, 69, 103	0

All (46) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	182	PHE	6.3
1	A	180	GLU	5.9
1	C	53	GLY	5.2
1	C	54	GLU	4.4
1	A	53	GLY	4.3
1	D	181	ASP	4.3
1	A	54	GLU	4.2
1	C	183	LYS	3.6
1	B	33	GLN	3.3
1	B	41	THR	3.3
1	A	182	PHE	3.2
1	C	180	GLU	3.2
1	C	181	ASP	3.1
1	D	173	PHE	2.9
1	D	180	GLU	2.8
1	D	178	VAL	2.7
1	A	181	ASP	2.7
1	D	175	PRO	2.6
1	D	87	ALA	2.6
1	D	179	PRO	2.6
1	C	182	PHE	2.6

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Mol	Chain	Res	Type	RSRZ
1	C	179	PRO	2.5
1	D	33	GLN	2.5
1	C	178	VAL	2.5
1	C	177	GLU	2.5
1	C	87	ALA	2.4
1	C	160	ASP	2.4
1	A	173	PHE	2.3
1	D	75	GLU	2.3
1	C	75	GLU	2.3
1	B	55	LYS	2.2
1	A	52	LYS	2.2
1	B	35	VAL	2.2
1	C	90	GLY	2.2
1	A	33	GLN	2.1
1	C	158	SER	2.1
1	D	160	ASP	2.1
1	B	173	PHE	2.1
1	C	46	ASP	2.1
1	B	139	LEU	2.1
1	D	73	ASP	2.1
1	C	161	LYS	2.1
1	A	179	PRO	2.1
1	C	74	ASP	2.1
1	A	55	LYS	2.0
1	A	183	LYS	2.0

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 ⓘ

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
4	GOL	B	204	6/6	0.74	0.26	74,80,82,83	0
4	GOL	A	203	6/6	0.77	0.27	72,73,77,78	0
3	EPE	B	203	15/15	0.77	0.22	85,97,108,109	0
3	EPE	A	202	15/15	0.85	0.15	64,68,87,88	0
4	GOL	A	204	6/6	0.86	0.27	64,71,75,85	0
3	EPE	C	202	15/15	0.89	0.24	60,89,116,117	0
5	CA	D	202	1/1	0.92	0.04	66,66,66,66	0
6	FE	C	204	1/1	0.94	0.11	82,82,82,82	0
7	NA	C	206	1/1	0.94	0.08	31,31,31,31	0
6	FE	D	203	1/1	0.95	0.05	92,92,92,92	0
5	CA	A	205	1/1	0.95	0.06	61,61,61,61	0
5	CA	B	205	1/1	0.96	0.06	64,64,64,64	0
7	NA	D	205	1/1	0.96	0.10	24,24,24,24	0
5	CA	C	203	1/1	0.97	0.05	66,66,66,66	0
3	EPE	B	202	15/15	0.97	0.18	38,62,85,88	0
7	NA	A	207	1/1	0.97	0.13	23,23,23,23	0
6	FE	A	206	1/1	0.97	0.15	80,80,80,80	0
6	FE	B	206	1/1	0.97	0.06	90,90,90,90	0
2	HEC	C	201	43/43	0.98	0.16	21,23,33,41	0
2	HEC	D	201	43/43	0.98	0.13	20,22,28,31	0
7	NA	A	208	1/1	0.98	0.10	31,31,31,31	0
2	HEC	A	201	43/43	0.98	0.15	19,21,28,33	0
2	HEC	B	201	43/43	0.98	0.14	18,21,28,30	0
7	NA	B	208	1/1	0.99	0.10	17,17,17,17	0
7	NA	D	204	1/1	0.99	0.11	21,21,21,21	0
7	NA	C	205	1/1	0.99	0.07	28,28,28,28	0
7	NA	B	207	1/1	1.00	0.12	18,18,18,18	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.
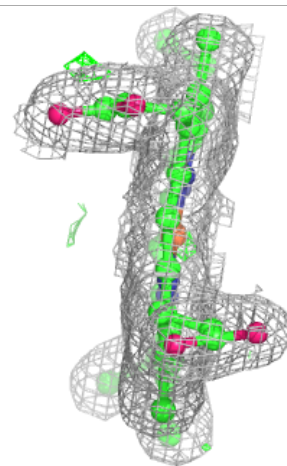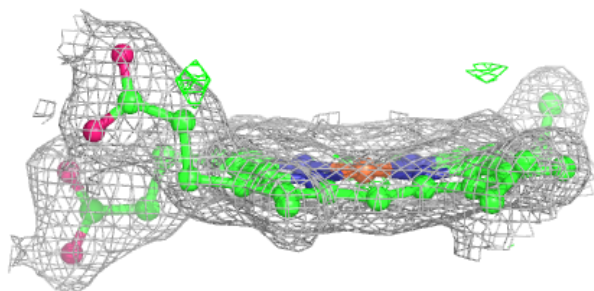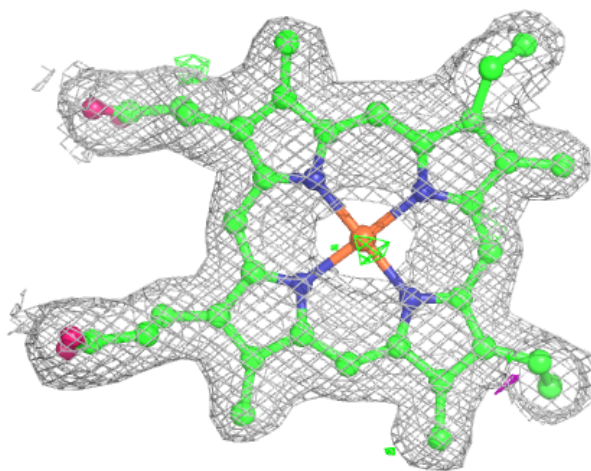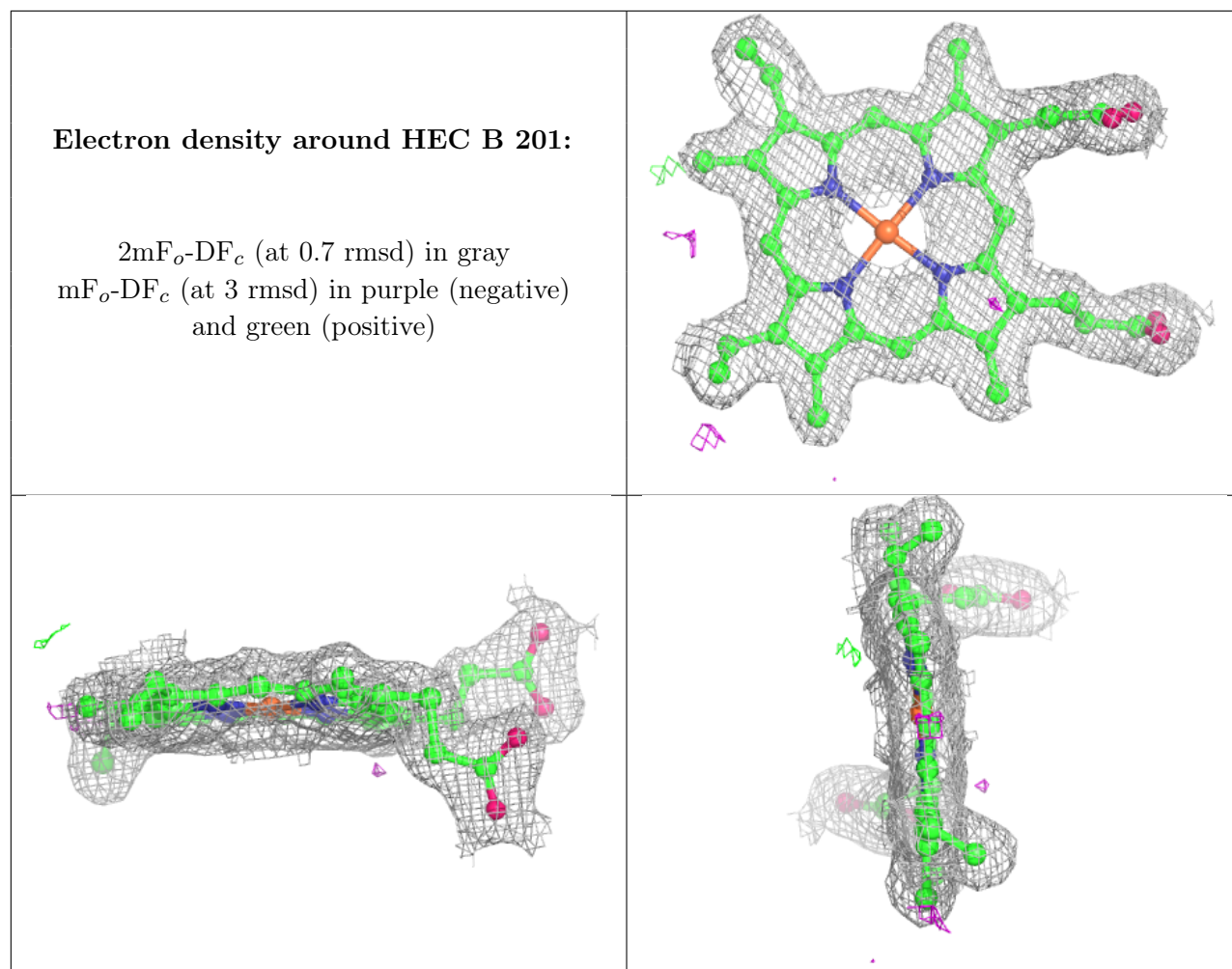
Electron density around HEC C 201:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
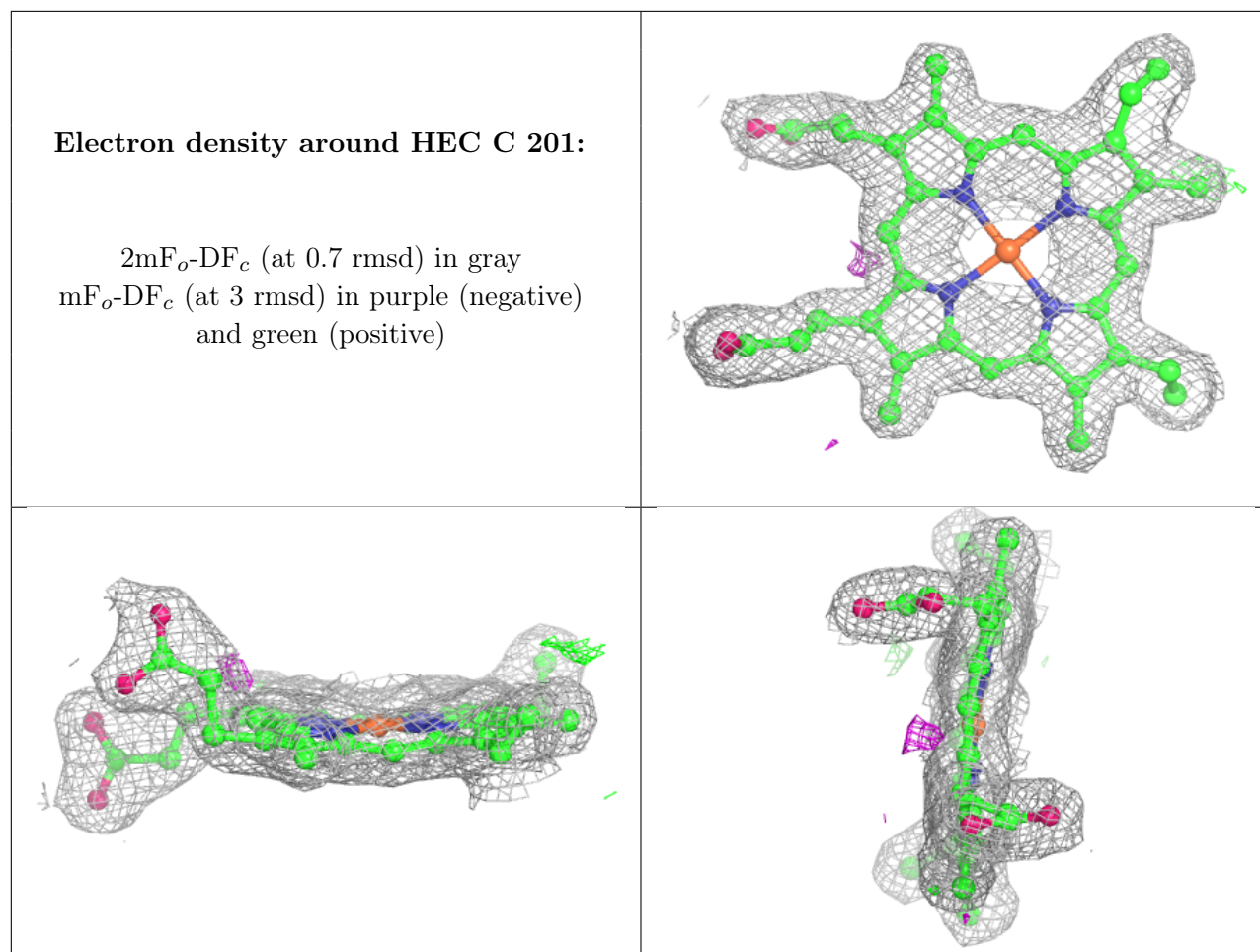
Electron density around HEC D 201:

2mF$_o$-DF$_c$ (at 0.7 rmsd) in gray
mF$_o$-DF$_c$ (at 3 rmsd) in purple (negative)
and green (positive)
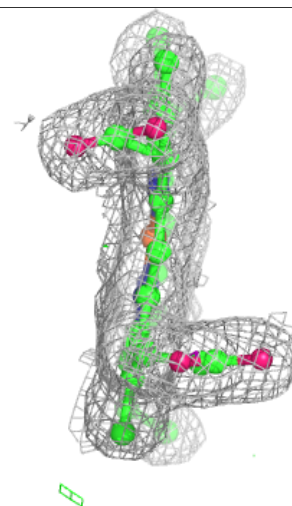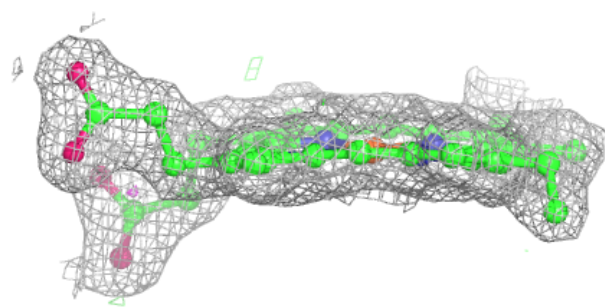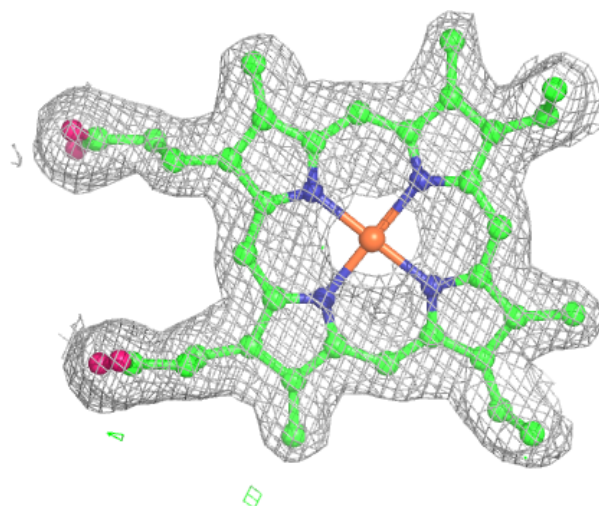
Electron density around HEC A 201:

$2mF_o$-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 B 201:

$2mF_o$-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 ⓘ

There are no such residues in this entry.