



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:52 PM UTC

PDB ID : 1H9X / pdb_00001h9x
Title : Cytochrome cd1 Nitrite Reductase, reduced form
Authors : Sjogren, T.; Hajdu, J.
Deposited on : 2001-03-23
Resolution : 2.10 Å(reported)

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

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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

MolProbity : 4-5-2 with Phenix2.0
Mogul : 2022.3.0, CSD as543be (2022)
Xtriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4 : 9.0.010 (Gargrove)
Density-Fitness : 1.0.12
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

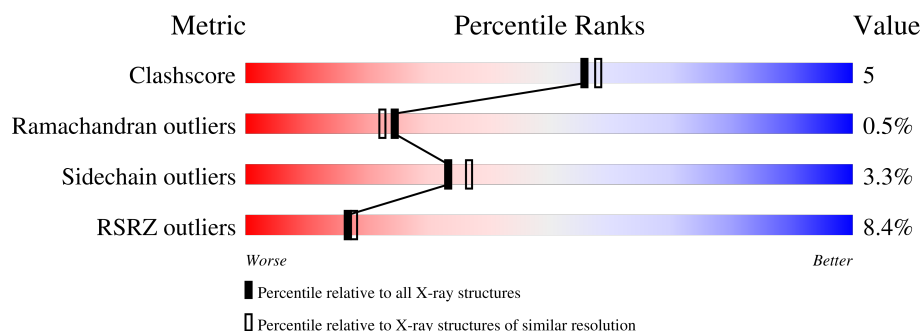
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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))
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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.

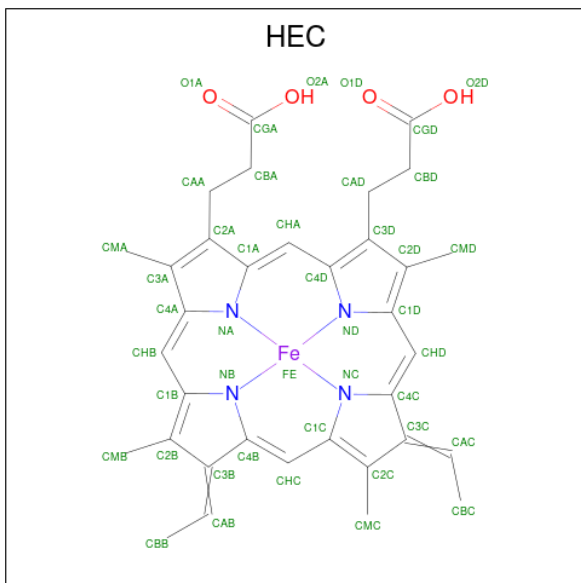
Mol	Chain	Length	Quality of chain
1	A	567	5% 82% 9% •• 7%
1	B	567	10% 78% 12% • 7%

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 CD1 NITRITE REDUCTASE.

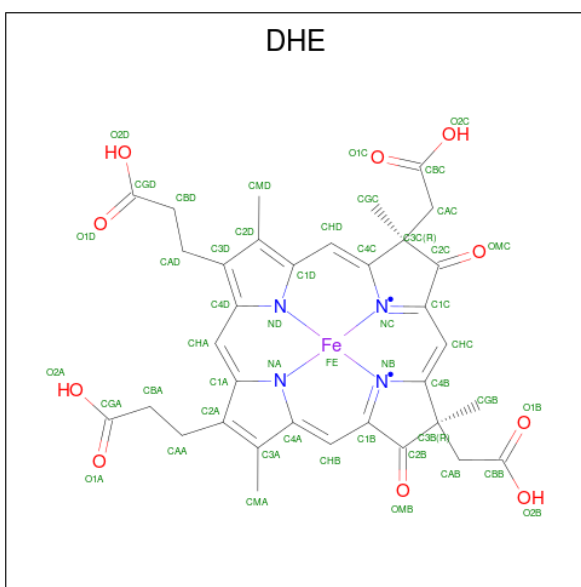
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	526	Total 4094	C 2593	N 682	O 805	S 14	0	0	0
1	B	529	Total 4110	C 2603	N 685	O 808	S 14	0	0	0

- Molecule 2 is HEME C (CCD ID: HEC) (formula: $\text{C}_{34}\text{H}_{34}\text{FeN}_4\text{O}_4$).



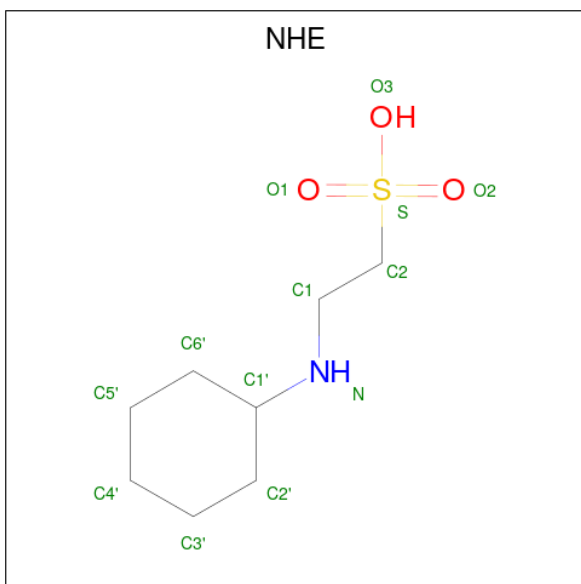
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	B	1	Total 43	C 34	Fe 1	N 4	O 4	0	0

- Molecule 3 is HEME D (CCD ID: DHE) (formula: $\text{C}_{34}\text{H}_{32}\text{FeN}_4\text{O}_{10}$).



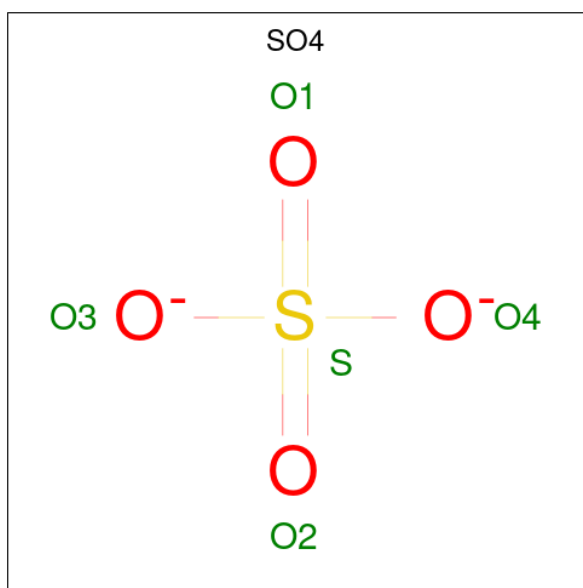
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total 49	C 34	Fe 1	N 4	O 10	0	0
3	B	1	Total 49	C 34	Fe 1	N 4	O 10	0	0

- Molecule 4 is 2-[N-CYCLOHEXYLAMINO]ETHANE SULFONIC ACID (CCD ID: NHE) (formula: $C_8H_{17}NO_3S$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	B	1	Total	C	N	O	S	0	0
			13	8	1	3	1		

- Molecule 5 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

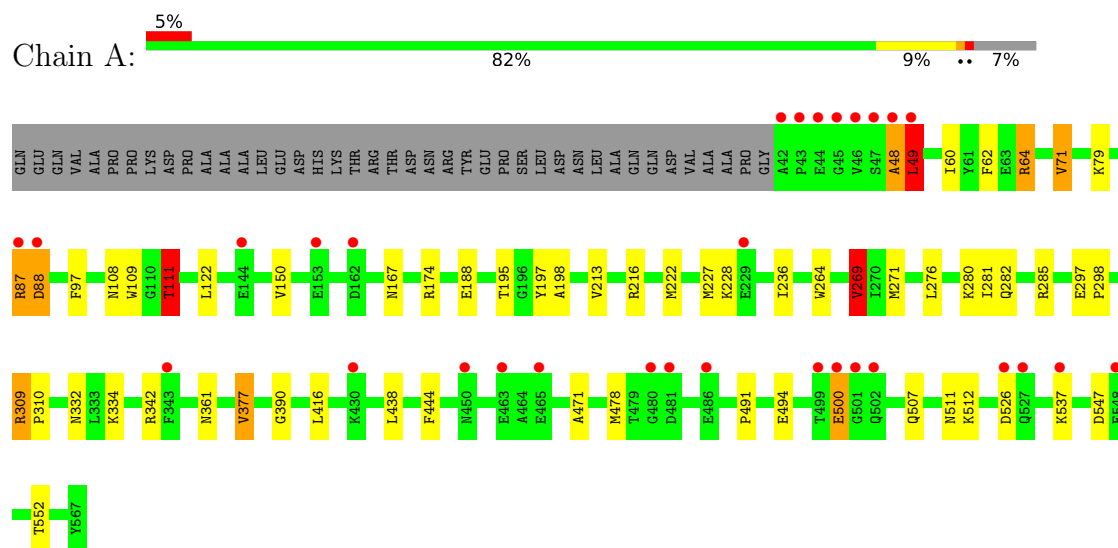
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	317	Total	O	0	0
			317	317		
6	B	318	Total	O	0	0
			318	318		

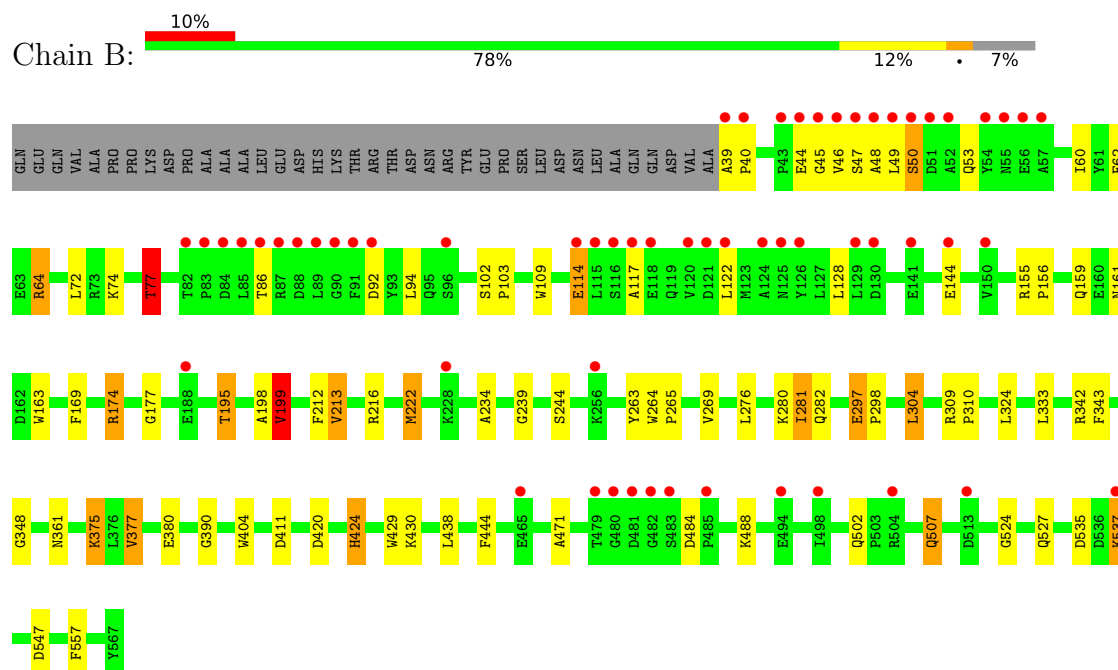
3 Residue-property plots [i](#)

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

• Molecule 1: CYTOCHROME CD1 NITRITE REDUCTASE



• Molecule 1: CYTOCHROME CD1 NITRITE REDUCTASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	127.97Å 127.97Å 264.13Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.10 30.00 – 2.10	Depositor EDS
% Data completeness (in resolution range)	99.7 (30.00-2.10) 99.3 (30.00-2.10)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$	-	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.216 , 0.241 0.197 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å ²)	26.5	Xtriage
Anisotropy	0.264	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 38.3	EDS
L-test for twinning ¹	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	9051	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.24% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Theoretical 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NHE, SO4, HEC, DHE

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	0.59	0/4195	1.38	20/5705 (0.4%)
1	B	0.62	0/4212	1.41	36/5729 (0.6%)
All	All	0.60	0/8407	1.40	56/11434 (0.5%)

There are no bond length outliers.

All (56) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	174	ARG	NE-CZ-NH2	12.99	130.89	119.20
1	B	199	VAL	CB-CA-C	-10.19	94.57	111.29
1	A	269	VAL	CB-CA-C	-9.43	96.57	110.33
1	B	377	VAL	N-CA-CB	-8.46	100.69	112.12
1	A	97	PHE	CA-CB-CG	-8.33	105.47	113.80
1	B	92	ASP	CA-CB-CG	-8.31	104.29	112.60
1	B	377	VAL	CB-CA-C	8.29	118.78	110.65
1	B	48	ALA	CA-C-O	8.20	131.49	121.81
1	A	361	ASN	N-CA-C	7.90	120.59	111.11
1	B	169	PHE	CA-CB-CG	7.88	121.68	113.80
1	A	342	ARG	CD-NE-CZ	7.77	135.28	124.40
1	B	72	LEU	CA-C-O	7.37	128.19	119.56
1	A	377	VAL	CB-CA-C	7.31	117.81	110.65
1	B	361	ASN	N-CA-C	7.00	118.56	111.07
1	A	62	PHE	CA-CB-CG	-6.98	106.82	113.80
1	B	45	GLY	N-CA-C	6.69	129.04	113.18
1	A	390	GLY	N-CA-C	-6.68	99.97	111.47
1	A	174	ARG	N-CA-C	6.63	119.11	111.02
1	B	50	SER	N-CA-C	-6.63	102.26	110.41
1	A	309	ARG	CD-NE-CZ	6.57	133.59	124.40
1	B	62	PHE	CA-CB-CG	-6.40	107.40	113.80
1	B	44	GLU	CA-C-N	6.38	133.91	121.41

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	44	GLU	C-N-CA	6.38	133.91	121.41
1	B	49	LEU	N-CA-C	-6.14	99.89	109.72
1	A	195	THR	N-CA-C	-6.09	104.93	112.72
1	B	390	GLY	N-CA-C	-5.98	99.86	110.86
1	B	547	ASP	CA-CB-CG	5.90	118.50	112.60
1	B	244	SER	N-CA-C	5.89	119.31	109.95
1	A	111	THR	N-CA-CB	-5.80	100.76	110.39
1	B	404	TRP	CA-CB-CG	5.69	124.42	113.60
1	B	239	GLY	CA-C-O	-5.68	115.38	121.35
1	A	552	THR	CB-CA-C	-5.42	107.35	111.20
1	B	507	GLN	N-CA-C	5.42	122.34	110.80
1	B	281	ILE	N-CA-CB	5.40	117.47	110.99
1	B	333	LEU	N-CA-C	5.40	117.51	109.25
1	B	117	ALA	O-C-N	-5.39	116.49	122.09
1	B	424	HIS	CA-CB-CG	5.39	119.19	113.80
1	B	77	THR	N-CA-C	-5.37	105.46	112.23
1	A	377	VAL	N-CA-CB	-5.36	104.88	112.12
1	B	174	ARG	NH1-CZ-NH2	-5.34	112.36	119.30
1	A	88	ASP	CA-CB-CG	-5.34	107.26	112.60
1	B	46	VAL	CA-C-O	5.32	126.89	120.67
1	A	188	GLU	CB-CG-CD	5.24	121.52	112.60
1	A	500	GLU	CB-CG-CD	5.24	121.51	112.60
1	A	547	ASP	CA-CB-CG	5.22	117.82	112.60
1	B	44	GLU	O-C-N	-5.22	115.26	122.46
1	B	411	ASP	CA-CB-CG	5.20	117.80	112.60
1	B	77	THR	N-CA-CB	-5.18	102.32	110.30
1	A	332	ASN	N-CA-C	-5.14	101.82	109.11
1	B	263	TYR	N-CA-C	-5.13	105.37	111.69
1	A	285	ARG	NE-CZ-NH2	-5.13	114.58	119.20
1	A	71	VAL	N-CA-CB	-5.09	100.36	111.05
1	B	557	PHE	CA-CB-CG	-5.07	108.73	113.80
1	B	195	THR	N-CA-C	-5.05	106.25	112.72
1	B	212	PHE	CA-C-N	-5.00	116.16	123.06
1	B	212	PHE	C-N-CA	-5.00	116.16	123.06

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	A	4094	0	3948	34	0
1	B	4110	0	3963	42	0
2	A	43	0	30	1	0
2	B	43	0	30	1	0
3	A	49	0	28	2	0
3	B	49	0	28	2	0
4	B	13	0	17	0	0
5	B	15	0	0	1	0
6	A	317	0	0	6	0
6	B	318	0	0	4	0
All	All	9051	0	8044	78	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 5.

All (78) 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:A:108:ASN:HD22	1:A:111:THR:HG22	1.18	1.05
1:B:222:MET:HE3	1:B:234:ALA:HB3	1.45	0.98
1:B:222:MET:HE2	1:B:276:LEU:HG	1.45	0.94
1:A:271:MET:HE2	1:A:276:LEU:HD22	1.54	0.89
1:A:416:LEU:HD11	1:A:478:MET:HE1	1.67	0.75
1:A:108:ASN:ND2	1:A:111:THR:HG22	1.99	0.74
1:A:271:MET:CE	1:A:276:LEU:HD22	2.16	0.73
1:B:161:ASN:HD22	1:B:163:TRP:H	1.36	0.73
1:A:264:TRP:HZ3	1:A:297:GLU:HG2	1.54	0.71
1:B:222:MET:CE	1:B:276:LEU:HG	2.21	0.70
1:A:108:ASN:HD22	1:A:111:THR:CG2	2.03	0.69
1:A:438:LEU:HG	1:A:471:ALA:HB2	1.78	0.66
1:A:167:ASN:HD21	1:A:511:ASN:HB2	1.61	0.65
1:A:167:ASN:ND2	1:A:512:LYS:H	1.95	0.65
1:B:109:TRP:CE2	2:B:601:HEC:HBB2	2.34	0.63
1:B:159:GLN:HE21	1:B:161:ASN:ND2	1.97	0.62
1:B:86:THR:HG22	1:B:128:LEU:HD23	1.83	0.61
1:A:111:THR:HG21	6:A:2044:HOH:O	2.00	0.60
1:A:236:ILE:HG21	1:A:271:MET:HE3	1.84	0.60
1:A:87:ARG:HB3	1:A:87:ARG:HH11	1.66	0.59
1:B:438:LEU:HG	1:B:471:ALA:HB2	1.85	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:222:MET:HE3	1:A:276:LEU:CD2	2.33	0.58
1:A:48:ALA:O	1:A:49:LEU:HB2	2.02	0.58
1:A:280:LYS:HE3	1:A:282:GLN:NE2	2.19	0.57
1:A:269:VAL:HG13	1:A:281:ILE:HG12	1.88	0.56
1:B:304:LEU:HD11	1:B:348:GLY:HA2	1.87	0.56
1:B:177:GLY:HA2	1:B:199:VAL:HG22	1.88	0.55
1:A:109:TRP:CE2	2:A:601:HEC:HBB2	2.42	0.54
1:A:150:VAL:HG21	1:A:227:MET:HE1	1.89	0.53
1:A:271:MET:HE2	1:A:276:LEU:CD2	2.34	0.52
1:B:502:GLN:NE2	6:B:2261:HOH:O	2.36	0.52
1:A:478:MET:HE2	6:A:2255:HOH:O	2.09	0.52
1:B:537:LYS:HE3	1:B:537:LYS:H	1.76	0.51
3:B:602:DHE:HMD3	3:B:602:DHE:HBD2	1.92	0.51
1:B:102:SER:HB2	1:B:103:PRO:HD2	1.92	0.50
1:B:39:ALA:N	1:B:40:PRO:CD	2.74	0.49
1:A:491:PRO:HB2	1:A:494:GLU:HB3	1.94	0.49
1:A:60:ILE:HG23	1:A:64:ARG:HG3	1.95	0.49
1:B:444:PHE:CE1	3:B:602:DHE:HBD1	2.48	0.48
1:B:375:LYS:HB3	1:B:375:LYS:NZ	2.29	0.48
1:B:537:LYS:HE3	1:B:537:LYS:N	2.29	0.48
1:B:109:TRP:HE3	1:B:114:GLU:HB3	1.77	0.48
1:B:198:ALA:HB1	1:B:216:ARG:HB2	1.96	0.48
1:B:50:SER:H	1:B:53:GLN:HE21	1.62	0.47
1:B:342:ARG:O	1:B:343:PHE:HB2	2.13	0.47
1:B:488:LYS:NZ	6:B:2248:HOH:O	2.46	0.47
1:A:444:PHE:CE1	3:A:602:DHE:HBD1	2.49	0.47
1:B:86:THR:HG23	1:B:94:LEU:HD21	1.96	0.47
3:A:602:DHE:HMD3	3:A:602:DHE:HBD2	1.97	0.47
1:A:167:ASN:HD22	1:A:512:LYS:H	1.61	0.46
1:B:86:THR:CG2	1:B:94:LEU:HD11	2.45	0.46
1:B:155:ARG:HB3	1:B:156:PRO:HD2	1.98	0.45
1:B:280:LYS:HE3	1:B:282:GLN:NE2	2.32	0.45
1:B:535:ASP:OD1	1:B:537:LYS:NZ	2.49	0.45
1:B:420:ASP:OD2	1:B:424:HIS:HD2	2.00	0.45
1:B:60:ILE:HG23	1:B:64:ARG:HD3	1.99	0.45
1:B:380:GLU:HG3	1:B:429:TRP:O	2.16	0.44
1:B:524:GLY:H	1:B:527:GLN:HE21	1.65	0.44
1:B:53:GLN:HB3	1:B:122:LEU:HD21	1.99	0.44
1:A:334:LYS:HD2	6:A:2082:HOH:O	2.17	0.44
1:A:309:ARG:HB3	1:A:310:PRO:HD2	2.00	0.43
1:B:264:TRP:HA	1:B:265:PRO:C	2.42	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:197:TYR:O	1:A:198:ALA:HB3	2.17	0.43
1:A:297:GLU:N	1:A:298:PRO:HD3	2.32	0.43
1:B:77:THR:HG23	6:B:2014:HOH:O	2.18	0.43
1:B:484:ASP:HB3	6:B:2246:HOH:O	2.17	0.43
1:A:216:ARG:HD3	6:A:2015:HOH:O	2.19	0.43
1:A:264:TRP:CZ3	1:A:297:GLU:HG2	2.42	0.42
1:B:297:GLU:N	1:B:298:PRO:HD3	2.34	0.42
1:B:74:LYS:HD2	5:B:622:SO4:O4	2.19	0.42
1:A:222:MET:HE3	1:A:276:LEU:HG	2.02	0.42
1:B:309:ARG:NH2	1:B:324:LEU:HD13	2.34	0.42
1:A:79:LYS:NZ	6:A:2029:HOH:O	2.47	0.42
1:B:195:THR:HG21	1:B:213:VAL:HG21	2.02	0.41
1:B:195:THR:OG1	1:B:199:VAL:HG13	2.20	0.41
1:B:264:TRP:CD2	1:B:265:PRO:HA	2.55	0.41
1:A:526:ASP:HB2	6:A:2288:HOH:O	2.21	0.41
1:B:309:ARG:HB3	1:B:310:PRO:HD2	2.03	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	524/567 (92%)	497 (95%)	24 (5%)	3 (1%)	21	18
1	B	527/567 (93%)	503 (95%)	22 (4%)	2 (0%)	30	28
All	All	1051/1134 (93%)	1000 (95%)	46 (4%)	5 (0%)	24	22

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	48	ALA
1	B	507	GLN

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Mol	Chain	Res	Type
1	A	49	LEU
1	A	507	GLN
1	B	47	SER

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	436/469 (93%)	423 (97%)	13 (3%)	36	41
1	B	437/469 (93%)	421 (96%)	16 (4%)	30	33
All	All	873/938 (93%)	844 (97%)	29 (3%)	33	37

All (29) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	49	LEU
1	A	64	ARG
1	A	71	VAL
1	A	87	ARG
1	A	88	ASP
1	A	111	THR
1	A	122	LEU
1	A	213	VAL
1	A	228	LYS
1	A	269	VAL
1	A	377	VAL
1	A	500	GLU
1	A	537	LYS
1	B	64	ARG
1	B	77	THR
1	B	114	GLU
1	B	144	GLU
1	B	174	ARG
1	B	199	VAL
1	B	213	VAL

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Mol	Chain	Res	Type
1	B	222	MET
1	B	269	VAL
1	B	281	ILE
1	B	297	GLU
1	B	304	LEU
1	B	375	LYS
1	B	377	VAL
1	B	430	LYS
1	B	537	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	108	ASN
1	A	167	ASN
1	A	282	GLN
1	A	385	GLN
1	A	450	ASN
1	A	452	GLN
1	A	527	GLN
1	A	561	ASN
1	B	53	GLN
1	B	161	ASN
1	B	221	ASN
1	B	282	GLN
1	B	424	HIS
1	B	527	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 oligosaccharides in this entry.

5.6 Ligand geometry

8 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	SO4	B	621	-	4,4,4	0.76	0	6,6,6	0.44	0
2	HEC	A	601	1	46,50,50	2.01	12 (26%)	58,82,82	1.63	5 (8%)
5	SO4	B	622	-	4,4,4	0.72	0	6,6,6	0.43	0
3	DHE	B	602	1	52,56,56	4.39	13 (25%)	68,94,94	2.53	11 (16%)
3	DHE	A	602	1	52,56,56	4.37	12 (23%)	68,94,94	2.63	17 (25%)
4	NHE	B	611	-	13,13,13	1.92	2 (15%)	16,17,17	2.63	6 (37%)
2	HEC	B	601	1	46,50,50	1.93	10 (21%)	58,82,82	1.62	3 (5%)
5	SO4	B	623	-	4,4,4	0.74	0	6,6,6	0.18	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	HEC	A	601	1	-	4/14/54/54	-
3	DHE	B	602	1	-	7/20/108/108	-
3	DHE	A	602	1	-	6/20/108/108	-
4	NHE	B	611	-	-	3/7/15/15	0/1/1/1
2	HEC	B	601	1	-	6/14/54/54	-

All (49) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	602	DHE	OMB-C2B	17.97	1.53	1.22
3	B	602	DHE	OMC-C2C	17.81	1.53	1.22
3	B	602	DHE	OMB-C2B	17.69	1.53	1.22
3	A	602	DHE	OMC-C2C	17.55	1.52	1.22
3	B	602	DHE	C3C-C2C	-10.40	1.34	1.52

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	602	DHE	C3C-C2C	-10.21	1.35	1.52
3	B	602	DHE	C3B-C2B	-10.17	1.35	1.52
3	A	602	DHE	C3B-C2B	-9.79	1.35	1.52
2	A	601	HEC	CAC-C3C	7.11	1.58	1.35
2	B	601	HEC	CAC-C3C	7.05	1.57	1.35
2	A	601	HEC	CAB-C3B	7.02	1.57	1.35
2	B	601	HEC	CAB-C3B	7.01	1.57	1.35
4	B	611	NHE	O3-S	6.22	1.70	1.47
3	A	602	DHE	CAB-CBB	-5.95	1.32	1.50
3	B	602	DHE	CAB-CBB	-5.94	1.32	1.50
3	A	602	DHE	CAC-CBC	-5.90	1.32	1.50
3	B	602	DHE	CAC-CBC	-5.75	1.33	1.50
3	B	602	DHE	FE-NB	3.75	2.06	1.94
3	A	602	DHE	FE-NA	3.69	2.07	1.95
3	A	602	DHE	FE-NC	3.35	2.05	1.94
3	B	602	DHE	FE-NC	3.31	2.05	1.94
2	B	601	HEC	CBB-CAB	-3.08	1.38	1.49
2	A	601	HEC	CBC-CAC	-3.04	1.38	1.49
2	B	601	HEC	CBC-CAC	-2.99	1.38	1.49
3	A	602	DHE	FE-ND	2.93	2.04	1.95
3	A	602	DHE	FE-NB	2.82	2.03	1.94
3	B	602	DHE	FE-NA	2.76	2.04	1.95
3	B	602	DHE	FE-ND	2.75	2.04	1.95
2	A	601	HEC	CMD-C2D	2.62	1.56	1.50
2	A	601	HEC	CAD-C3D	2.46	1.57	1.51
2	A	601	HEC	CMC-C2C	2.44	1.55	1.50
2	A	601	HEC	CBB-CAB	-2.39	1.40	1.49
2	A	601	HEC	CMB-C2B	2.37	1.55	1.50
2	B	601	HEC	CMB-C2B	2.34	1.55	1.50
3	B	602	DHE	CMA-C3A	2.33	1.55	1.50
3	A	602	DHE	C1B-C2B	-2.31	1.44	1.47
2	B	601	HEC	C3C-C2C	-2.31	1.33	1.41
3	A	602	DHE	CMA-C3A	2.31	1.55	1.50
2	A	601	HEC	C3C-C2C	-2.28	1.33	1.41
2	B	601	HEC	CMD-C2D	2.24	1.55	1.50
2	B	601	HEC	CMC-C2C	2.20	1.55	1.50
2	A	601	HEC	CMA-C3A	2.18	1.55	1.50
2	A	601	HEC	C3B-C2B	-2.18	1.33	1.41
2	B	601	HEC	CMA-C3A	2.11	1.55	1.50
2	B	601	HEC	C3B-C2B	-2.10	1.34	1.41
2	A	601	HEC	C3D-C2D	-2.05	1.33	1.38
3	B	602	DHE	CAA-C2A	2.04	1.56	1.51

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	B	611	NHE	C1-N	2.03	1.51	1.47
3	B	602	DHE	O1C-CBC	2.01	1.28	1.22

All (42) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	602	DHE	C2B-C3B-C4B	12.56	107.01	100.35
3	B	602	DHE	C2C-C3C-C4C	12.20	106.82	100.35
3	B	602	DHE	C2B-C3B-C4B	11.92	106.67	100.35
3	A	602	DHE	C2C-C3C-C4C	11.08	106.23	100.35
2	A	601	HEC	CBB-CAB-C3B	-8.91	109.63	127.43
4	B	611	NHE	O2-S-C2	7.31	117.78	106.73
2	B	601	HEC	CBC-CAC-C3C	-6.88	113.68	127.43
2	B	601	HEC	CBB-CAB-C3B	-6.24	114.97	127.43
2	A	601	HEC	CBC-CAC-C3C	-4.50	118.44	127.43
3	B	602	DHE	O2B-CBB-O1B	-4.41	111.99	123.33
4	B	611	NHE	O3-S-O1	-4.24	100.78	111.40
3	A	602	DHE	O2B-CBB-CAB	4.21	127.69	114.35
4	B	611	NHE	O3-S-C2	-4.07	98.04	106.00
3	A	602	DHE	O2B-CBB-O1B	-3.98	113.10	123.33
3	A	602	DHE	OMC-C2C-C1C	-3.64	122.57	126.49
3	B	602	DHE	C3B-C4B-CHC	3.62	125.66	122.44
3	A	602	DHE	OMB-C2B-C1B	-3.53	122.69	126.49
3	B	602	DHE	O2B-CBB-CAB	3.36	124.99	114.35
3	A	602	DHE	OMC-C2C-C3C	3.31	129.83	125.93
3	B	602	DHE	O2C-CBC-O1C	-3.31	114.81	123.33
3	A	602	DHE	C3B-C4B-CHC	3.31	125.38	122.44
3	A	602	DHE	OMB-C2B-C3B	3.29	129.81	125.93
2	B	601	HEC	O1D-CGD-CBD	-2.83	114.12	123.09
3	B	602	DHE	O2C-CBC-CAC	2.76	123.10	114.35
3	B	602	DHE	OMB-C2B-C3B	2.75	129.17	125.93
4	B	611	NHE	O2-S-O1	2.68	122.53	113.82
3	B	602	DHE	OMB-C2B-C1B	-2.67	123.62	126.49
3	B	602	DHE	C1D-CHD-C4C	-2.65	120.98	125.87
3	A	602	DHE	O2C-CBC-O1C	-2.65	116.52	123.33
3	A	602	DHE	CGC-C3C-C2C	-2.52	103.20	109.38
3	A	602	DHE	O1A-CGA-CBA	-2.45	115.32	123.09
3	B	602	DHE	CGC-C3C-C2C	-2.44	103.38	109.38
2	A	601	HEC	CHA-C1A-NA	2.41	127.08	124.45
3	A	602	DHE	CAA-CBA-CGA	2.37	119.95	113.67
3	A	602	DHE	O2C-CBC-CAC	2.33	121.74	114.35
3	A	602	DHE	CHB-C1B-NB	2.29	126.89	124.42

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	601	HEC	C2A-C1A-NA	-2.29	108.11	110.32
2	A	601	HEC	O1D-CGD-CBD	-2.21	116.10	123.09
3	A	602	DHE	CBD-CAD-C3D	2.17	118.54	112.53
3	A	602	DHE	CHC-C1C-NC	2.10	126.69	124.42
4	B	611	NHE	O3-S-O2	-2.04	106.28	111.40
4	B	611	NHE	C1-N-C1'	-2.02	110.30	114.18

There are no chirality outliers.

All (26) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	601	HEC	C2B-C3B-CAB-CBB
2	A	601	HEC	C4B-C3B-CAB-CBB
2	A	601	HEC	C2C-C3C-CAC-CBC
2	A	601	HEC	C4C-C3C-CAC-CBC
2	B	601	HEC	C2C-C3C-CAC-CBC
2	B	601	HEC	C4C-C3C-CAC-CBC
3	A	602	DHE	C2D-C3D-CAD-CBD
3	A	602	DHE	C4D-C3D-CAD-CBD
3	B	602	DHE	C2D-C3D-CAD-CBD
3	B	602	DHE	C4D-C3D-CAD-CBD
4	B	611	NHE	C1-C2-S-O3
4	B	611	NHE	C1-C2-S-O2
2	B	601	HEC	C4B-C3B-CAB-CBB
2	B	601	HEC	C2B-C3B-CAB-CBB
3	B	602	DHE	C3C-CAC-CBC-O2C
3	B	602	DHE	C3C-CAC-CBC-O1C
3	A	602	DHE	C3B-CAB-CBB-O1B
3	A	602	DHE	C3B-CAB-CBB-O2B
3	A	602	DHE	C3C-CAC-CBC-O1C
3	A	602	DHE	C3C-CAC-CBC-O2C
3	B	602	DHE	C3B-CAB-CBB-O1B
2	B	601	HEC	CAD-CBD-CGD-O2D
4	B	611	NHE	C1-C2-S-O1
2	B	601	HEC	CAD-CBD-CGD-O1D
3	B	602	DHE	C3B-CAB-CBB-O2B
3	B	602	DHE	CAD-CBD-CGD-O2D

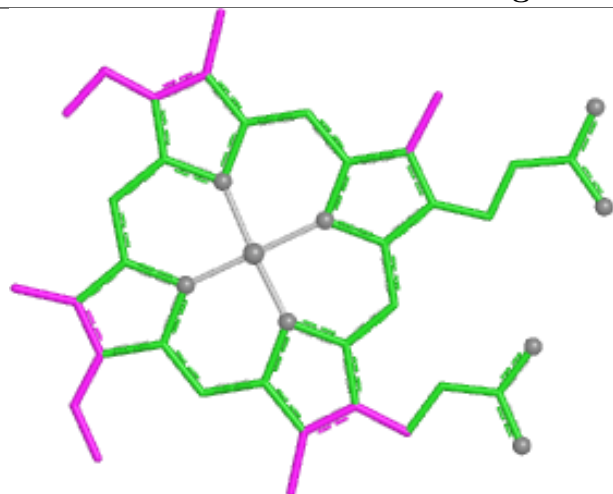
There are no ring outliers.

5 monomers are involved in 7 short contacts:

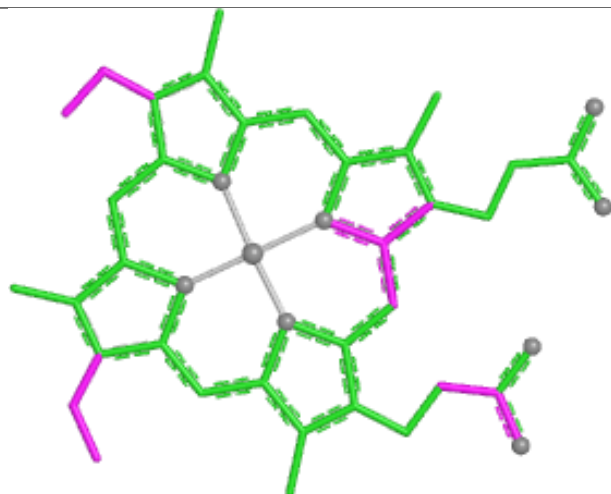
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	601	HEC	1	0
5	B	622	SO4	1	0
3	B	602	DHE	2	0
3	A	602	DHE	2	0
2	B	601	HEC	1	0

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 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.

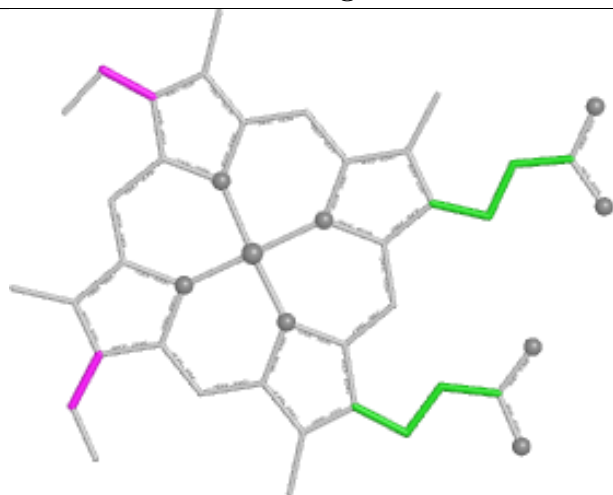
Ligand HEC A 601



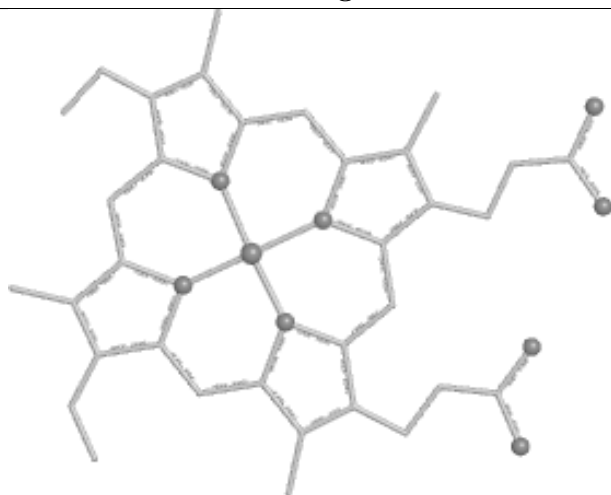
Bond lengths



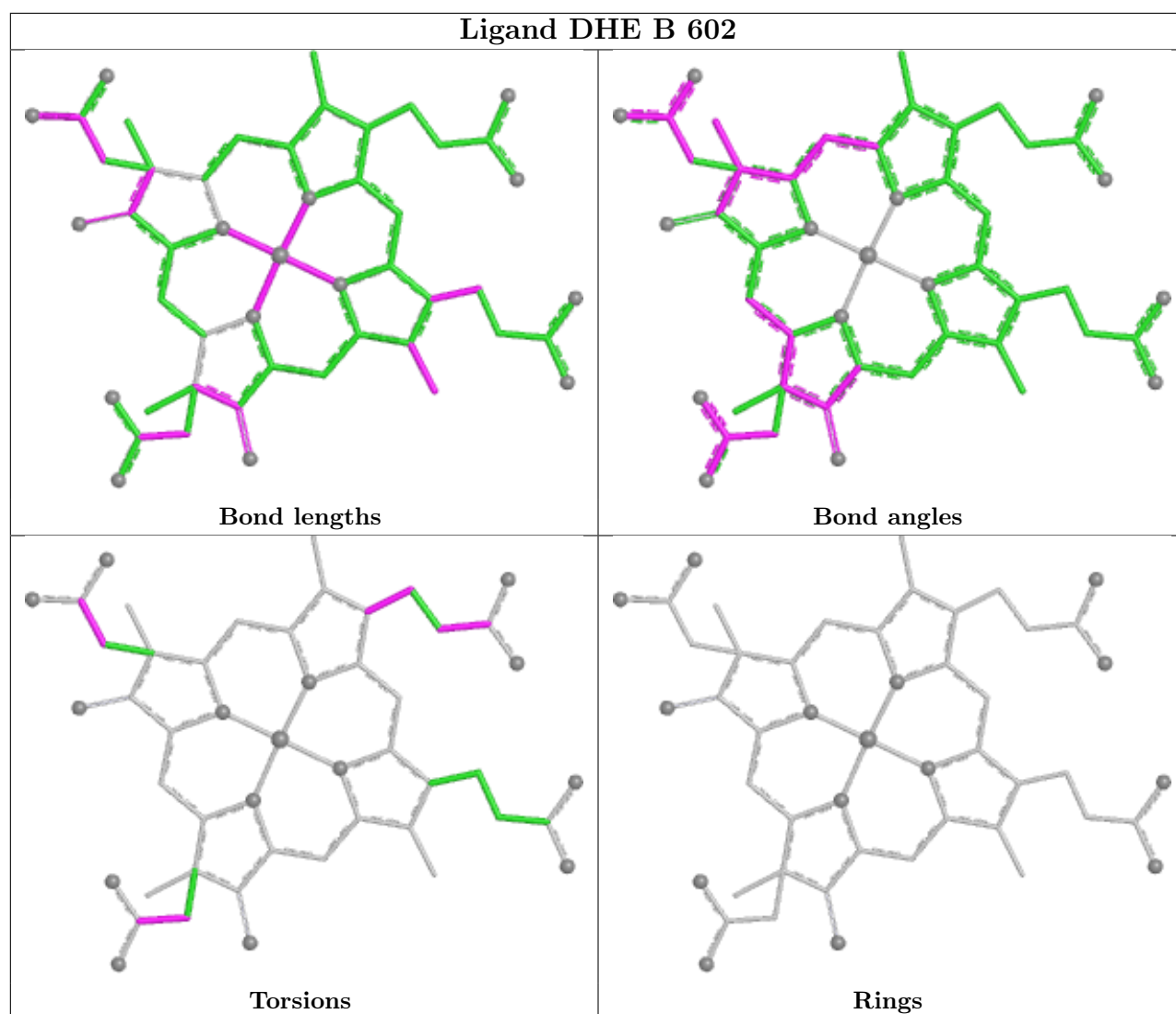
Bond angles

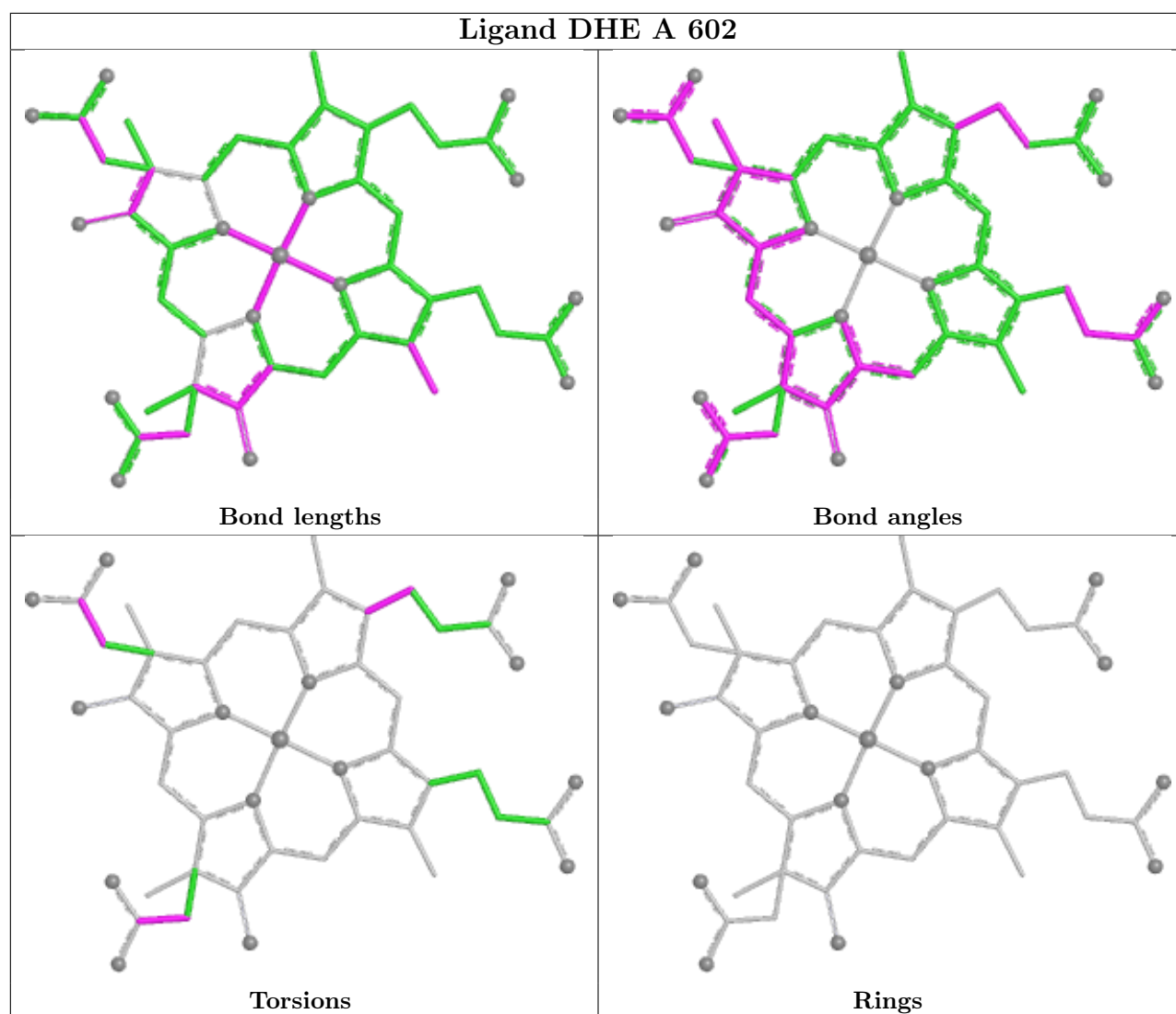


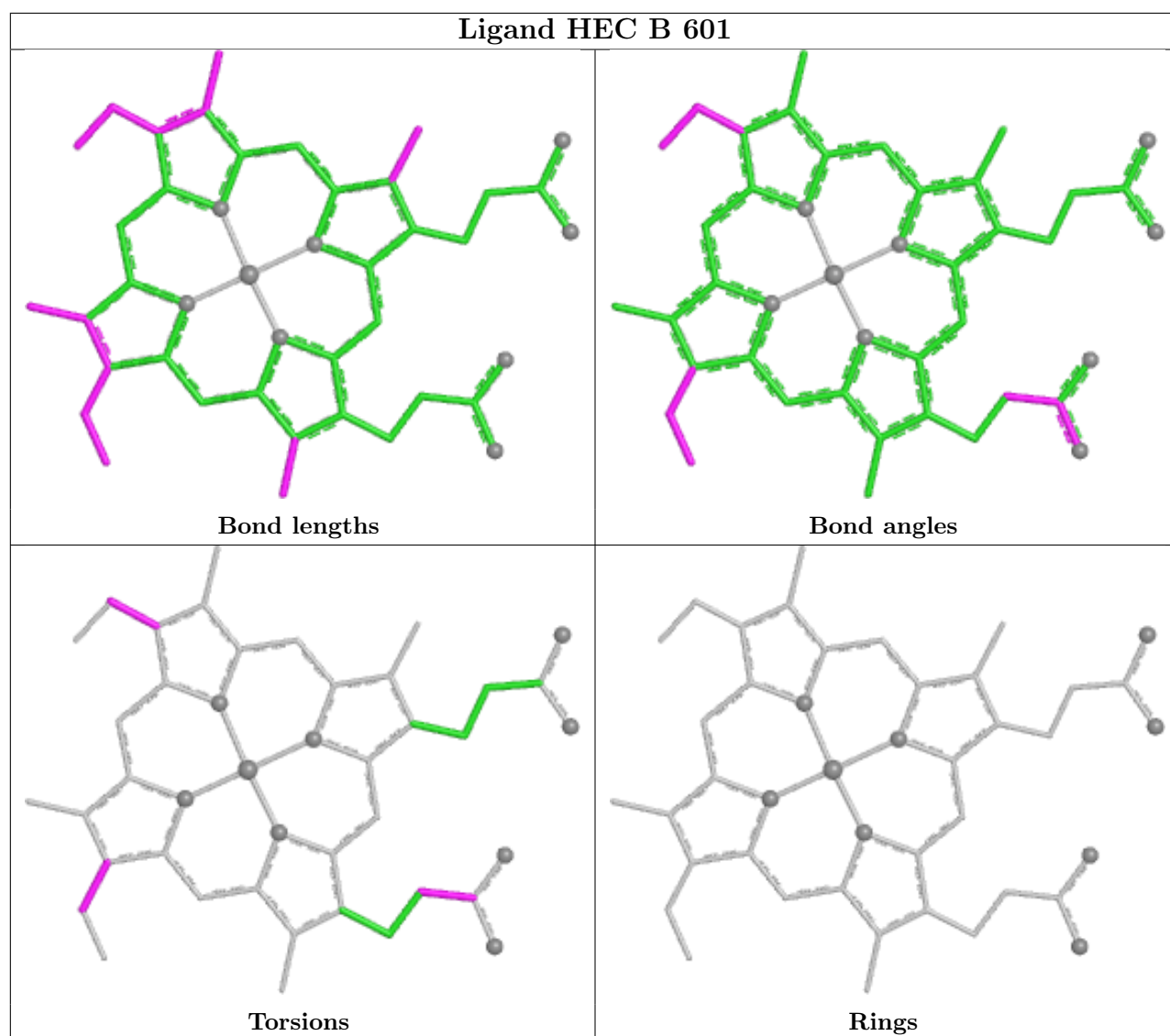
Torsions



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

6.1 Protein, DNA and RNA chains

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	526/567 (92%)	0.29	30 (5%) 29 31	17, 26, 43, 75	0
1	B	529/567 (93%)	0.44	59 (11%) 10 10	17, 26, 46, 66	0
All	All	1055/1134 (93%)	0.37	89 (8%) 17 18	17, 26, 44, 75	0

All (89) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	42	ALA	8.1
1	B	47	SER	7.7
1	B	482	GLY	6.9
1	B	39	ALA	6.4
1	A	47	SER	6.4
1	A	46	VAL	6.1
1	B	44	GLU	6.0
1	B	45	GLY	5.7
1	A	45	GLY	5.4
1	B	52	ALA	5.3
1	B	48	ALA	5.0
1	A	500	GLU	4.8
1	B	46	VAL	4.8
1	A	502	GLN	4.8
1	A	48	ALA	4.8
1	A	43	PRO	4.6
1	B	49	LEU	4.6
1	B	117	ALA	4.2
1	B	54	TYR	4.1
1	B	57	ALA	4.1
1	B	50	SER	4.1
1	B	92	ASP	4.0
1	B	116	SER	4.0
1	B	90	GLY	3.9

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Mol	Chain	Res	Type	RSRZ
1	A	44	GLU	3.9
1	B	483	SER	3.8
1	A	87	ARG	3.7
1	A	499	THR	3.7
1	B	86	THR	3.7
1	B	87	ARG	3.6
1	A	153	GLU	3.6
1	B	51	ASP	3.5
1	A	548	GLU	3.4
1	B	91	PHE	3.4
1	B	84	ASP	3.4
1	A	480	GLY	3.3
1	B	129	LEU	3.3
1	B	43	PRO	3.3
1	B	144	GLU	3.2
1	B	122	LEU	3.2
1	B	55	ASN	3.2
1	B	114	GLU	3.2
1	B	89	LEU	3.1
1	A	49	LEU	3.0
1	B	130	ASP	3.0
1	A	229	GLU	2.9
1	A	463	GLU	2.9
1	B	480	GLY	2.9
1	B	96	SER	2.8
1	B	115	LEU	2.8
1	B	537	LYS	2.8
1	B	40	PRO	2.8
1	B	83	PRO	2.7
1	B	504	ARG	2.7
1	A	144	GLU	2.6
1	B	126	TYR	2.6
1	A	501	GLY	2.6
1	A	430	LYS	2.6
1	B	88	ASP	2.5
1	A	162	ASP	2.5
1	B	513	ASP	2.5
1	B	498	ILE	2.5
1	B	125	ASN	2.4
1	B	120	VAL	2.4
1	B	479	THR	2.4
1	B	118	GLU	2.4

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Mol	Chain	Res	Type	RSRZ
1	B	465	GLU	2.3
1	A	527	GLN	2.3
1	B	141	GLU	2.3
1	B	188	GLU	2.3
1	A	537	LYS	2.3
1	B	56	GLU	2.3
1	A	450	ASN	2.2
1	A	88	ASP	2.2
1	A	526	ASP	2.2
1	A	465	GLU	2.2
1	A	486	GLU	2.2
1	B	481	ASP	2.2
1	B	121	ASP	2.2
1	B	228	LYS	2.1
1	B	485	PRO	2.1
1	B	124	ALA	2.1
1	A	481	ASP	2.1
1	B	82	THR	2.1
1	B	256	LYS	2.1
1	B	150	VAL	2.1
1	B	494	GLU	2.0
1	A	343	PHE	2.0
1	B	85	LEU	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

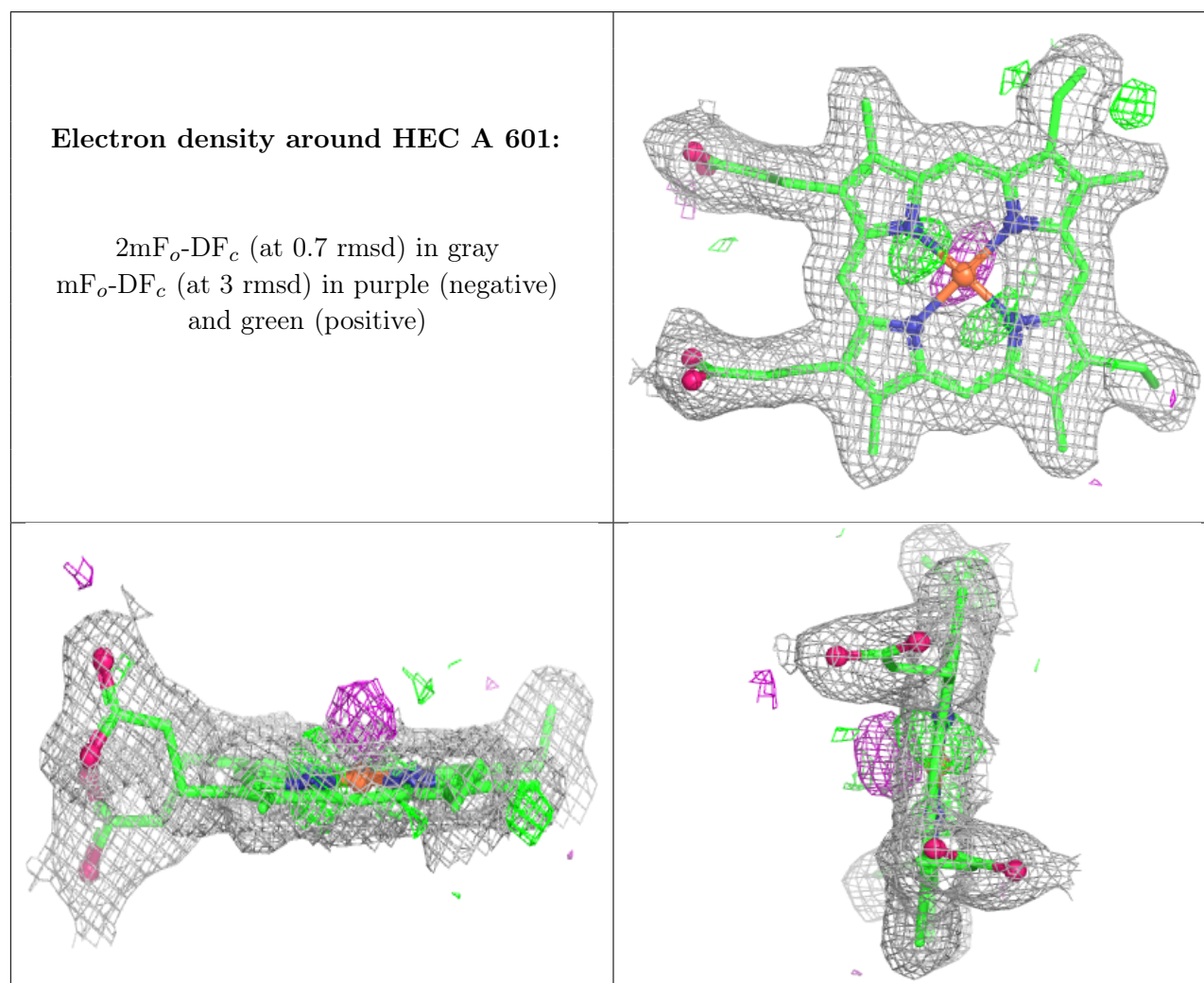
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

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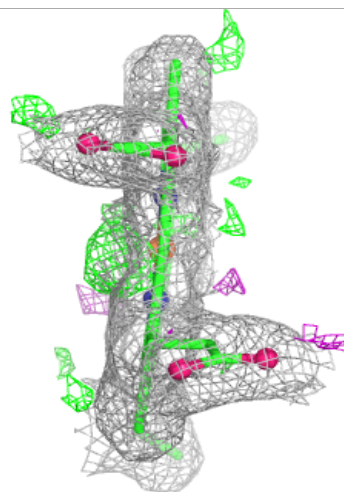
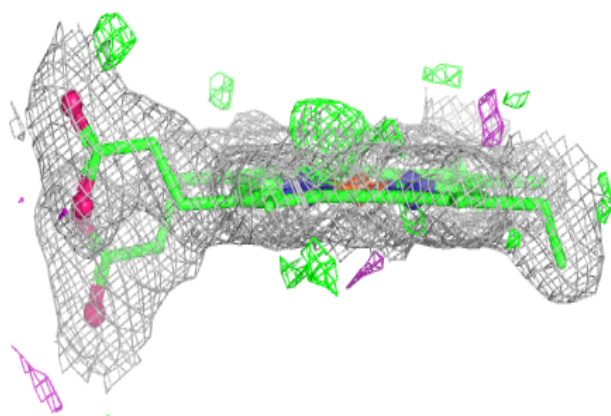
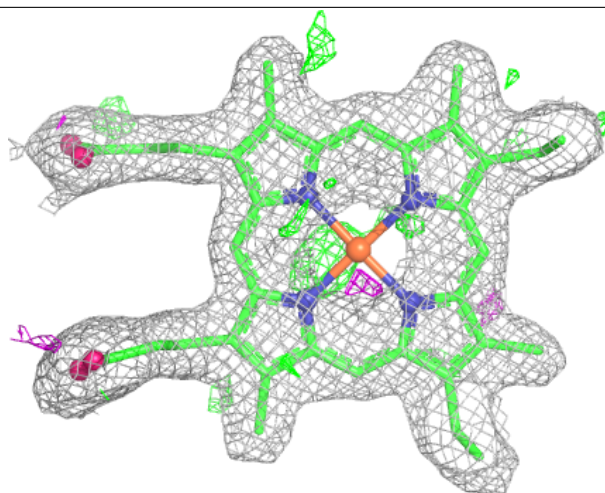
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	NHE	B	611	13/13	0.72	0.20	24,26,33,34	0
5	SO4	B	622	5/5	0.87	0.28	55,56,58,58	0
5	SO4	B	621	5/5	0.93	0.11	39,39,40,40	0
5	SO4	B	623	5/5	0.93	0.14	56,56,56,57	0
2	HEC	A	601	43/43	0.97	0.07	14,17,21,23	0
2	HEC	B	601	43/43	0.97	0.08	21,23,26,28	0
3	DHE	A	602	49/49	0.97	0.07	17,21,24,25	0
3	DHE	B	602	49/49	0.97	0.07	17,20,24,26	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.



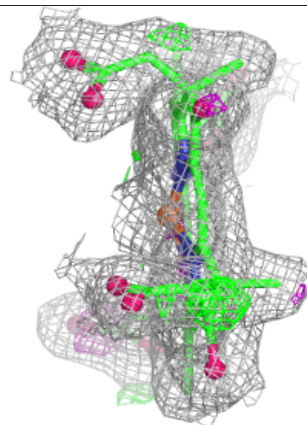
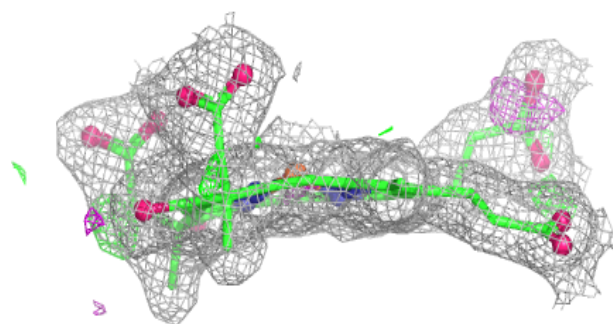
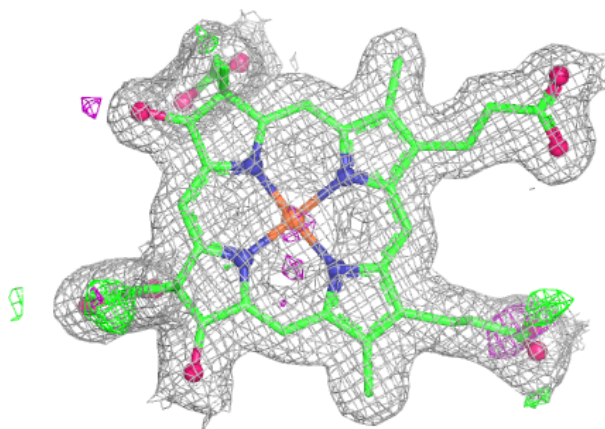
Electron density around HEC B 601:

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



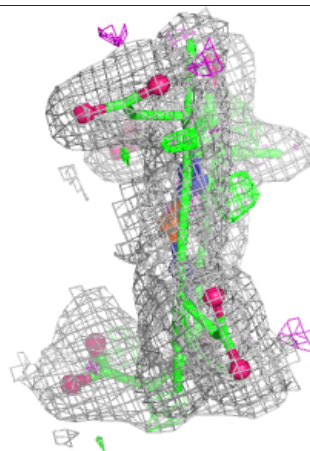
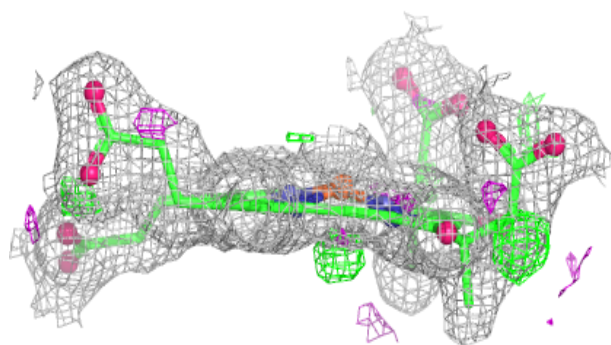
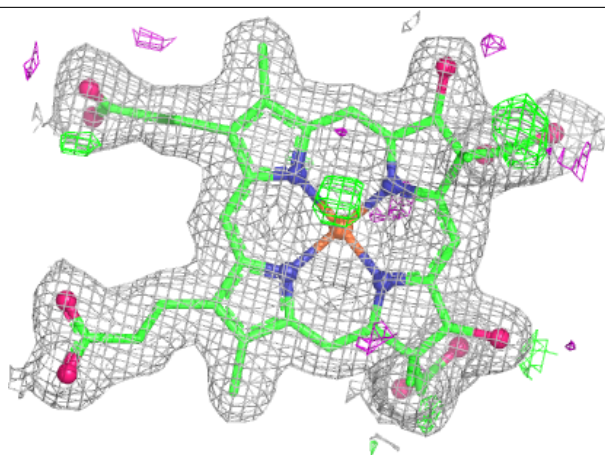
Electron density around DHE A 602:

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



Electron density around DHE B 602:

$2mF_o-DF_c$ (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.