Full wwPDB X-ray Structure Validation Report (i)

Aug 25, 2026 – 01:35 am BST

PDB ID	:	6RTD / pdb_00006rtd
Title	:	Dihydro-heme d1 dehydrogenase NirN in complex with DHE
Authors	:	Kluenemann, T.; Preuss, A.; Layer, G.; Blankenfeldt, W.
Deposited on	:	2019-05-23
Resolution	:	2.36 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:

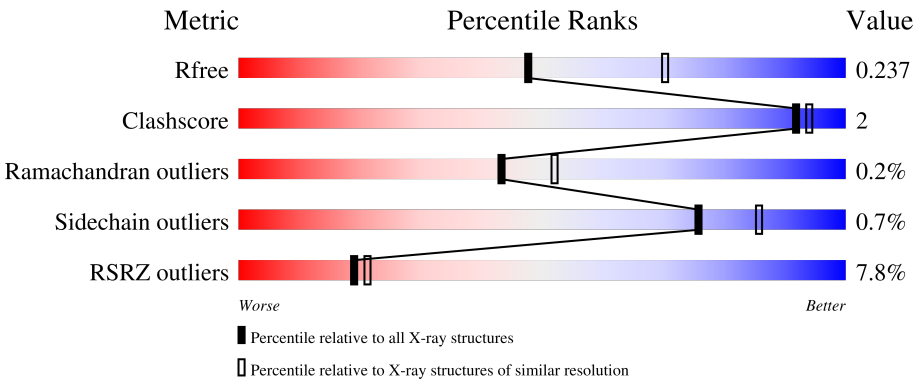
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.36 Å.

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



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1596 (2.36-2.36)
Clashscore	190562	1663 (2.36-2.36)
Ramachandran outliers	187476	1646 (2.36-2.36)
Sidechain outliers	187428	1646 (2.36-2.36)
RSRZ outliers	180081	1598 (2.36-2.36)

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	509	7% 86% 5% 9%
1	B	509	7% 89% • 8%

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
3	DHE	A	502	X	-	-	-
3	DHE	B	501	X	-	-	-
4	HEC	A	503	X	-	-	-
4	HEC	B	502	X	-	-	-

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 15086 atoms, of which 7252 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.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	465	7209	2326	3559	654	665	5	0	15	0
1	B	466	7243	2339	3569	658	672	5	0	17	0

There are 72 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-33	MET	-	initiating methionine	UNP A0A0C7D2F2
A	-32	LYS	-	expression tag	UNP A0A0C7D2F2
A	-31	TYR	-	expression tag	UNP A0A0C7D2F2
A	-30	LEU	-	expression tag	UNP A0A0C7D2F2
A	-29	LEU	-	expression tag	UNP A0A0C7D2F2
A	-28	PRO	-	expression tag	UNP A0A0C7D2F2
A	-27	THR	-	expression tag	UNP A0A0C7D2F2
A	-26	ALA	-	expression tag	UNP A0A0C7D2F2
A	-25	ALA	-	expression tag	UNP A0A0C7D2F2
A	-24	ALA	-	expression tag	UNP A0A0C7D2F2
A	-23	GLY	-	expression tag	UNP A0A0C7D2F2
A	-22	LEU	-	expression tag	UNP A0A0C7D2F2
A	-21	LEU	-	expression tag	UNP A0A0C7D2F2
A	-20	LEU	-	expression tag	UNP A0A0C7D2F2
A	-19	LEU	-	expression tag	UNP A0A0C7D2F2
A	-18	ALA	-	expression tag	UNP A0A0C7D2F2
A	-17	ALA	-	expression tag	UNP A0A0C7D2F2
A	-16	GLN	-	expression tag	UNP A0A0C7D2F2
A	-15	PRO	-	expression tag	UNP A0A0C7D2F2
A	-14	ALA	-	expression tag	UNP A0A0C7D2F2
A	-13	MET	-	expression tag	UNP A0A0C7D2F2
A	-12	ALA	-	expression tag	UNP A0A0C7D2F2
A	-11	MET	-	expression tag	UNP A0A0C7D2F2
A	-10	GLY	-	expression tag	UNP A0A0C7D2F2
A	-9	TRP	-	expression tag	UNP A0A0C7D2F2

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Chain	Residue	Modelled	Actual	Comment	Reference
A	-8	SER	-	expression tag	UNP A0A0C7D2F2
A	-7	HIS	-	expression tag	UNP A0A0C7D2F2
A	-6	PRO	-	expression tag	UNP A0A0C7D2F2
A	-5	GLN	-	expression tag	UNP A0A0C7D2F2
A	-4	PHE	-	expression tag	UNP A0A0C7D2F2
A	-3	GLU	-	expression tag	UNP A0A0C7D2F2
A	-2	LYS	-	expression tag	UNP A0A0C7D2F2
A	-1	ALA	-	expression tag	UNP A0A0C7D2F2
A	0	SER	-	expression tag	UNP A0A0C7D2F2
A	1	GLY	-	expression tag	UNP A0A0C7D2F2
A	2	GLU	-	expression tag	UNP A0A0C7D2F2
B	-33	MET	-	initiating methionine	UNP A0A0C7D2F2
B	-32	LYS	-	expression tag	UNP A0A0C7D2F2
B	-31	TYR	-	expression tag	UNP A0A0C7D2F2
B	-30	LEU	-	expression tag	UNP A0A0C7D2F2
B	-29	LEU	-	expression tag	UNP A0A0C7D2F2
B	-28	PRO	-	expression tag	UNP A0A0C7D2F2
B	-27	THR	-	expression tag	UNP A0A0C7D2F2
B	-26	ALA	-	expression tag	UNP A0A0C7D2F2
B	-25	ALA	-	expression tag	UNP A0A0C7D2F2
B	-24	ALA	-	expression tag	UNP A0A0C7D2F2
B	-23	GLY	-	expression tag	UNP A0A0C7D2F2
B	-22	LEU	-	expression tag	UNP A0A0C7D2F2
B	-21	LEU	-	expression tag	UNP A0A0C7D2F2
B	-20	LEU	-	expression tag	UNP A0A0C7D2F2
B	-19	LEU	-	expression tag	UNP A0A0C7D2F2
B	-18	ALA	-	expression tag	UNP A0A0C7D2F2
B	-17	ALA	-	expression tag	UNP A0A0C7D2F2
B	-16	GLN	-	expression tag	UNP A0A0C7D2F2
B	-15	PRO	-	expression tag	UNP A0A0C7D2F2
B	-14	ALA	-	expression tag	UNP A0A0C7D2F2
B	-13	MET	-	expression tag	UNP A0A0C7D2F2
B	-12	ALA	-	expression tag	UNP A0A0C7D2F2
B	-11	MET	-	expression tag	UNP A0A0C7D2F2
B	-10	GLY	-	expression tag	UNP A0A0C7D2F2
B	-9	TRP	-	expression tag	UNP A0A0C7D2F2
B	-8	SER	-	expression tag	UNP A0A0C7D2F2
B	-7	HIS	-	expression tag	UNP A0A0C7D2F2
B	-6	PRO	-	expression tag	UNP A0A0C7D2F2
B	-5	GLN	-	expression tag	UNP A0A0C7D2F2
B	-4	PHE	-	expression tag	UNP A0A0C7D2F2
B	-3	GLU	-	expression tag	UNP A0A0C7D2F2

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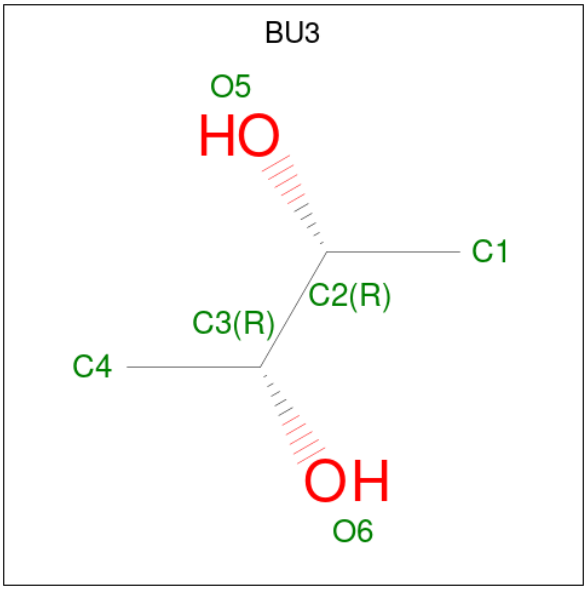
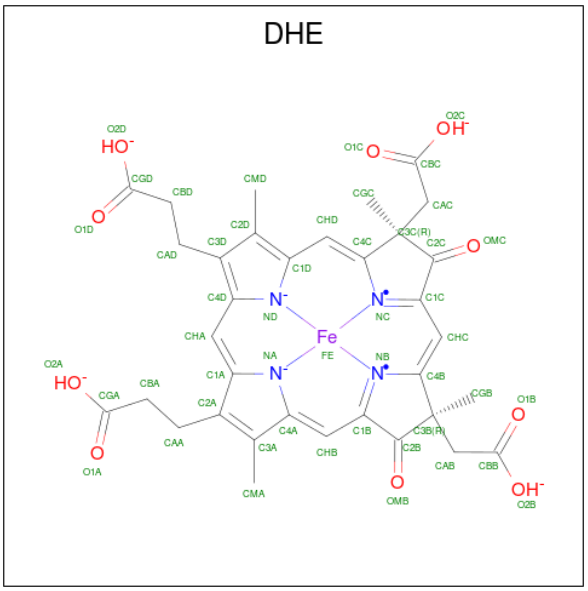
Chain	Residue	Modelled	Actual	Comment	Reference
B	-2	LYS	-	expression tag	UNP A0A0C7D2F2
B	-1	ALA	-	expression tag	UNP A0A0C7D2F2
B	0	SER	-	expression tag	UNP A0A0C7D2F2
B	1	GLY	-	expression tag	UNP A0A0C7D2F2
B	2	GLU	-	expression tag	UNP A0A0C7D2F2

- Molecule 2 is (R,R)-2,3-BUTANEDIOL (CCD ID: BU3) (formula: $C_4H_{10}O_2$).



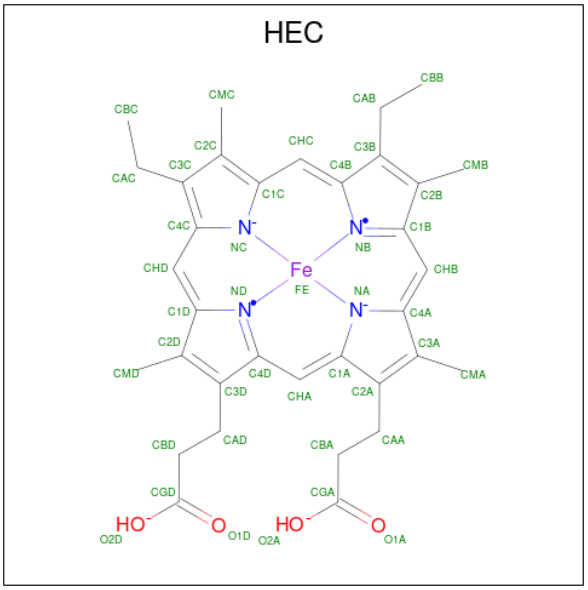
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	H	O		
2	A	1	16	4	10	2	0	0

- Molecule 3 is HEME D (CCD ID: DHE) (formula: $C_{34}H_{32}FeN_4O_{10}$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	Fe	H	N	O		
3	A	1	75	34	1	26	4	10	0	0
			Total	C	Fe	H	N	O		
3	B	1	73	34	1	24	4	10	0	0

- Molecule 4 is HEME C (CCD ID: HEC) (formula: $C_{34}H_{36}FeN_4O_4$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	Fe	H	N	O		
4	A	1	75	34	1	32	4	4	0	0
			Total	C	Fe	H	N	O		
4	B	1	75	34	1	32	4	4	0	0

- Molecule 5 is water.

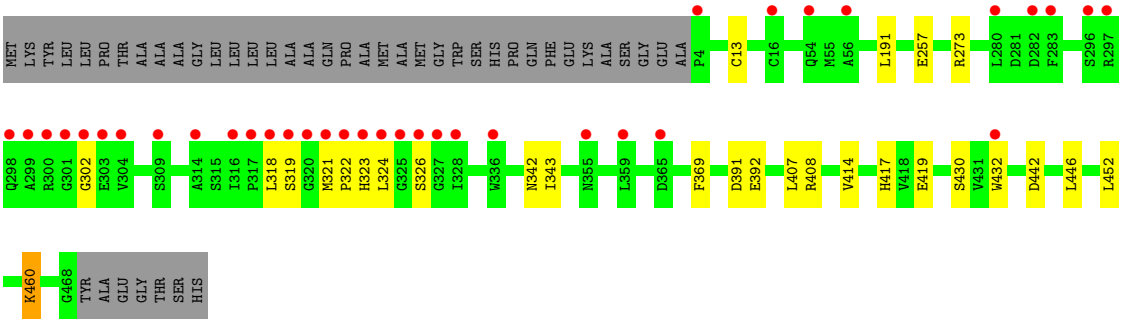
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	142	142	142	0	0
			Total	O		
5	B	178	178	178	0	0

3 Residue-property plots (i)

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

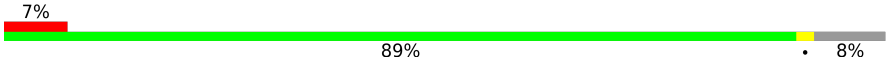
• Molecule 1: Cytochrome c

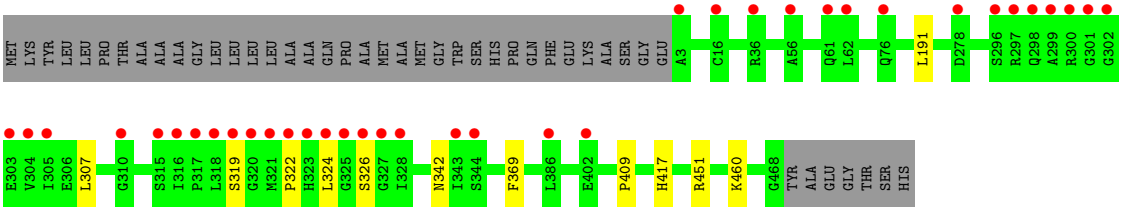
Chain A:



• Molecule 1: Cytochrome c

Chain B:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	191.38Å 54.59Å 132.13Å 90.00° 131.94° 90.00°	Depositor
Resolution (Å)	45.09 – 2.36 45.09 – 2.36	Depositor EDS
% Data completeness (in resolution range)	99.9 (45.09-2.36) 93.8 (45.09-2.36)	Depositor EDS
R_{merge}	0.13	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.18 (at 2.37Å)	Xtriage
Refinement program	PHENIX dev_3112	Depositor
R, R_{free}	0.192 , 0.235 0.194 , 0.237	Depositor DCC
R_{free} test set	2152 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å^2)	36.0	Xtriage
Anisotropy	0.497	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 49.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.011 for -h-2*l,-k,l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	15086	wwPDB-VP
Average B, all atoms (Å^2)	59.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.22% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: DHE, BU3, HEC

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	0.11	0/3786	0.30	0/5164
1	B	0.11	0/3801	0.29	0/5187
All	All	0.11	0/7587	0.30	0/10351

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts (i)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	3650	3559	3531	18	0
1	B	3674	3569	3550	6	0
2	A	6	10	10	0	0
3	A	49	26	24	0	0
3	B	49	24	24	0	0
4	A	43	32	30	1	0
4	B	43	32	30	0	0
5	A	142	0	0	1	0
5	B	178	0	0	2	0
All	All	7834	7252	7199	24	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 2.

All (24) 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:318[B]:LEU:HD13	1:A:322[B]:PRO:HG3	1.71	0.72
1:A:322[A]:PRO:HG2	1:A:324[A]:LEU:HD13	1.74	0.70
1:A:326[A]:SER:OG	5:A:601:HOH:O	2.11	0.66
1:A:322[A]:PRO:CG	1:A:324[A]:LEU:HD13	2.28	0.64
1:B:319[A]:SER:O	1:B:342:ASN:ND2	2.27	0.60
1:A:319[B]:SER:O	1:A:342:ASN:ND2	2.35	0.60
1:A:302:GLY:N	1:A:318[B]:LEU:HD12	2.18	0.59
1:B:409:PRO:O	1:B:451:ARG:NH2	2.38	0.57
1:B:326[A]:SER:OG	5:B:601:HOH:O	2.18	0.57
1:B:322[A]:PRO:HG2	1:B:324[A]:LEU:HG	1.86	0.57
1:A:391:ASP:OD2	1:A:408:ARG:NE	2.38	0.53
1:A:430:SER:OG	1:A:460:LYS:NZ	2.29	0.52
1:A:419:GLU:HB3	1:A:460:LYS:HG2	1.93	0.49
1:B:191:LEU:C	1:B:191:LEU:HD12	2.37	0.48
1:B:307:LEU:O	5:B:602:HOH:O	2.20	0.47
1:A:321[A]:MET:O	1:A:343:ILE:HG22	2.14	0.47
1:A:191:LEU:C	1:A:191:LEU:HD12	2.42	0.45
1:A:257:GLU:OE1	1:A:273:ARG:NH1	2.46	0.45
1:A:414:VAL:HG13	1:A:432:TRP:HB2	1.98	0.44
1:A:452:LEU:HD12	1:A:452:LEU:N	2.35	0.42
1:A:442:ASP:O	1:A:446:LEU:N	2.48	0.42
1:A:392:GLU:HA	1:A:407:LEU:O	2.19	0.41
1:A:13:CYS:SG	4:A:503:HEC:HMB1	2.61	0.41

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	478/509 (94%)	451 (94%)	26 (5%)	1 (0%)	43	52
1	B	481/509 (94%)	465 (97%)	15 (3%)	1 (0%)	43	52
All	All	959/1018 (94%)	916 (96%)	41 (4%)	2 (0%)	43	52

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	417	HIS
1	A	417	HIS

5.3.2 Protein sidechains (i)

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

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

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	378/408 (93%)	374 (99%)	4 (1%)	65	79
1	B	379/408 (93%)	377 (100%)	2 (0%)	81	89
All	All	757/816 (93%)	751 (99%)	6 (1%)	76	84

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	323[A]	HIS
1	A	323[B]	HIS
1	A	369	PHE
1	A	460	LYS
1	B	369	PHE
1	B	460	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	95	GLN
1	A	390	HIS
1	B	97	HIS

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Mol	Chain	Res	Type
1	B	246	HIS

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

5 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	$\#\|Z\| > 2$
3	DHE	A	502	1	52,56,56	1.95	8 (15%)	53,94,94	1.98	10 (18%)
4	HEC	B	502	1	50,50,50	1.63	7 (14%)	68,82,82	1.69	16 (23%)
3	DHE	B	501	1	52,56,56	1.95	8 (15%)	53,94,94	1.93	11 (20%)
4	HEC	A	503	1	50,50,50	1.64	8 (16%)	68,82,82	1.67	19 (27%)
2	BU3	A	501	-	4,5,5	0.75	0	6,6,6	0.32	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
3	DHE	A	502	1	1/1/19/19	7/20/108/108	-
4	HEC	B	502	1	1/1/7/7	2/14/54/54	-
3	DHE	B	501	1	1/1/19/19	10/20/108/108	-
4	HEC	A	503	1	1/1/7/7	2/14/54/54	-
2	BU3	A	501	-	-	0/4/4/4	-

All (31) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	501	DHE	CBD-CAD	-7.38	1.28	1.52
3	A	502	DHE	CBD-CAD	-7.32	1.28	1.52
4	A	503	HEC	FE-NB	5.08	2.10	1.94
4	B	502	HEC	FE-NB	5.06	2.10	1.94
3	A	502	DHE	FE-NB	4.25	2.08	1.94
3	A	502	DHE	FE-ND	4.24	2.09	1.95
3	B	501	DHE	FE-NB	4.21	2.07	1.94
3	A	502	DHE	FE-NC	4.16	2.07	1.94
3	B	501	DHE	FE-NC	4.14	2.07	1.94
3	B	501	DHE	FE-ND	4.11	2.09	1.95
4	A	503	HEC	FE-NC	4.08	2.09	1.95
4	B	502	HEC	FE-NC	4.05	2.08	1.95
3	B	501	DHE	CGC-C3C	3.89	1.61	1.54
3	B	501	DHE	FE-NA	3.83	2.08	1.95
3	A	502	DHE	FE-NA	3.79	2.08	1.95
3	A	502	DHE	CGC-C3C	3.77	1.61	1.54
4	B	502	HEC	C1D-ND	-3.69	1.34	1.40
4	A	503	HEC	C1D-ND	-3.66	1.34	1.40
4	A	503	HEC	C4B-NB	-3.62	1.34	1.40
4	B	502	HEC	C4B-NB	-3.56	1.34	1.40
3	B	501	DHE	CGB-C3B	3.53	1.61	1.54
3	A	502	DHE	CGB-C3B	3.41	1.60	1.54
4	A	503	HEC	C1B-NB	-2.71	1.33	1.38
4	B	502	HEC	C1A-C2A	-2.69	1.40	1.45
4	B	502	HEC	C1B-NB	-2.68	1.33	1.38
4	A	503	HEC	C1A-C2A	-2.31	1.41	1.45
4	A	503	HEC	FE-ND	-2.28	1.87	1.94
4	B	502	HEC	FE-ND	-2.22	1.87	1.94
4	A	503	HEC	C4A-C3A	-2.21	1.41	1.45
3	B	501	DHE	O2A-CGA	-2.10	1.23	1.30
3	A	502	DHE	O2A-CGA	-2.10	1.23	1.30

All (56) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	502	DHE	CAD-CBD-CGD	7.17	129.02	113.60
3	B	501	DHE	CAD-CBD-CGD	6.41	127.39	113.60
3	A	502	DHE	C4B-NB-C1B	5.18	110.42	105.07
3	B	501	DHE	C4B-NB-C1B	5.06	110.30	105.07
4	B	502	HEC	C4B-NB-C1B	4.66	109.89	105.07
3	B	501	DHE	C1C-NC-C4C	4.51	109.73	105.07
4	A	503	HEC	C4B-NB-C1B	4.47	109.69	105.07
4	B	502	HEC	CHC-C4B-NB	4.42	129.83	124.37
3	A	502	DHE	C1C-NC-C4C	4.33	109.54	105.07
4	A	503	HEC	CHC-C4B-NB	4.22	129.58	124.37
3	B	501	DHE	CBD-CAD-C3D	3.87	123.38	112.63
3	A	502	DHE	CBD-CAD-C3D	3.62	122.70	112.63
3	A	502	DHE	C4A-NA-C1A	3.45	108.73	105.35
4	A	503	HEC	CHD-C1D-ND	3.35	128.50	124.37
3	A	502	DHE	C1C-CHC-C4B	3.23	129.90	124.98
4	B	502	HEC	CBB-CAB-C3B	-3.20	103.60	112.43
4	B	502	HEC	C4C-NC-C1C	3.17	108.45	105.35
3	B	501	DHE	C4A-NA-C1A	3.14	108.42	105.35
3	B	501	DHE	C4D-ND-C1D	3.13	108.41	105.35
4	B	502	HEC	CHA-C1A-NA	3.11	127.80	124.44
4	B	502	HEC	CHD-C1D-ND	3.09	128.18	124.37
3	A	502	DHE	C4D-ND-C1D	3.07	108.35	105.35
3	B	501	DHE	C1C-CHC-C4B	3.05	129.62	124.98
4	B	502	HEC	CHA-C4D-ND	3.03	127.71	124.42
4	A	503	HEC	C4C-NC-C1C	3.02	108.31	105.35
3	B	501	DHE	CAA-CBA-CGA	2.86	119.75	113.60
4	A	503	HEC	CHA-C4D-ND	2.85	127.52	124.42
3	A	502	DHE	CAA-CBA-CGA	2.83	119.70	113.60
4	A	503	HEC	C4A-NA-C1A	2.77	108.06	105.35
4	A	503	HEC	CHA-C1A-NA	2.71	127.37	124.44
4	B	502	HEC	C4A-NA-C1A	2.65	107.95	105.35
4	A	503	HEC	CAC-C3C-C2C	2.65	131.10	126.86
4	A	503	HEC	CHB-C1B-NB	2.61	127.26	124.42
4	B	502	HEC	CHB-C1B-NB	2.53	127.17	124.42
4	B	502	HEC	CHA-C4D-C3D	-2.52	121.14	124.84
3	A	502	DHE	C2A-C1A-NA	-2.49	107.90	110.32
4	B	502	HEC	C1A-CHA-C4D	-2.48	120.72	126.06
4	A	503	HEC	CBC-CAC-C3C	-2.43	105.73	112.43
4	A	503	HEC	C1A-CHA-C4D	-2.42	120.83	126.06
3	B	501	DHE	CHB-C1B-NB	2.40	127.03	124.42
4	A	503	HEC	CHD-C1D-C2D	-2.34	120.24	126.73
4	B	502	HEC	CAB-C3B-C2B	2.28	131.43	127.53
3	B	501	DHE	C2A-C1A-NA	-2.27	108.12	110.32

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	A	503	HEC	CAD-C3D-C4D	2.24	128.57	124.66
4	B	502	HEC	CAC-C3C-C2C	2.20	130.39	126.86
3	B	501	DHE	CHC-C1C-NC	2.17	126.77	124.42
4	B	502	HEC	O2D-CGD-CBD	2.11	120.80	114.03
4	A	503	HEC	CBB-CAB-C3B	-2.10	106.63	112.43
4	A	503	HEC	CHA-C4D-C3D	-2.09	121.77	124.84
4	A	503	HEC	C2A-C1A-NA	-2.09	108.29	110.32
4	A	503	HEC	CAB-C3B-C2B	2.07	131.08	127.53
4	B	502	HEC	CAD-C3D-C4D	2.06	128.25	124.66
4	B	502	HEC	CHD-C1D-C2D	-2.05	121.04	126.73
4	A	503	HEC	O2D-CGD-CBD	2.05	120.61	114.03
4	A	503	HEC	O2A-CGA-CBA	2.01	120.50	114.03
3	A	502	DHE	CHB-C1B-NB	2.01	126.60	124.42

All (4) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	A	502	DHE	NA
3	B	501	DHE	NA
4	A	503	HEC	NA
4	B	502	HEC	NA

All (21) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	501	DHE	C3D-CAD-CBD-CGD
3	B	501	DHE	C3C-CAC-CBC-O1C
3	B	501	DHE	C2D-C3D-CAD-CBD
3	B	501	DHE	C3C-CAC-CBC-O2C
3	A	502	DHE	C3B-CAB-CBB-O2B
3	A	502	DHE	C3C-CAC-CBC-O2C
3	B	501	DHE	C3B-CAB-CBB-O1B
3	B	501	DHE	C3B-CAB-CBB-O2B
3	A	502	DHE	C3C-CAC-CBC-O1C
3	A	502	DHE	C3B-CAB-CBB-O1B
3	A	502	DHE	CAA-CBA-CGA-O1A
3	A	502	DHE	CAA-CBA-CGA-O2A
4	A	503	HEC	CAD-CBD-CGD-O2D
3	B	501	DHE	CAA-CBA-CGA-O2A
4	A	503	HEC	CAD-CBD-CGD-O1D
4	B	502	HEC	CAD-CBD-CGD-O2D
3	B	501	DHE	CAA-CBA-CGA-O1A

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Mol	Chain	Res	Type	Atoms
4	B	502	HEC	CAD-CBD-CGD-O1D
3	B	501	DHE	C4D-C3D-CAD-CBD
3	A	502	DHE	CAD-CBD-CGD-O2D
3	B	501	DHE	CAD-CBD-CGD-O2D

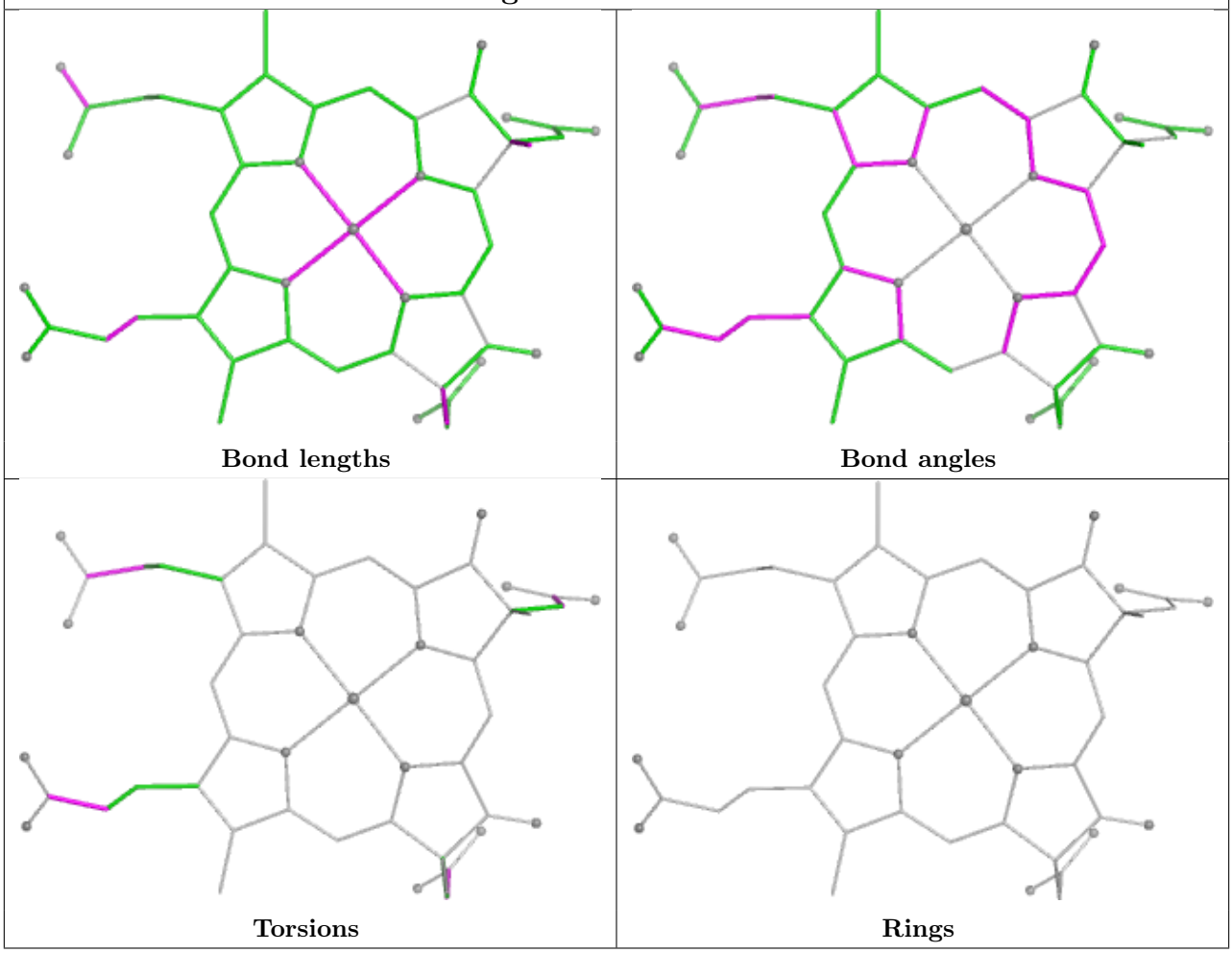
There are no ring outliers.

1 monomer is involved in 1 short contact:

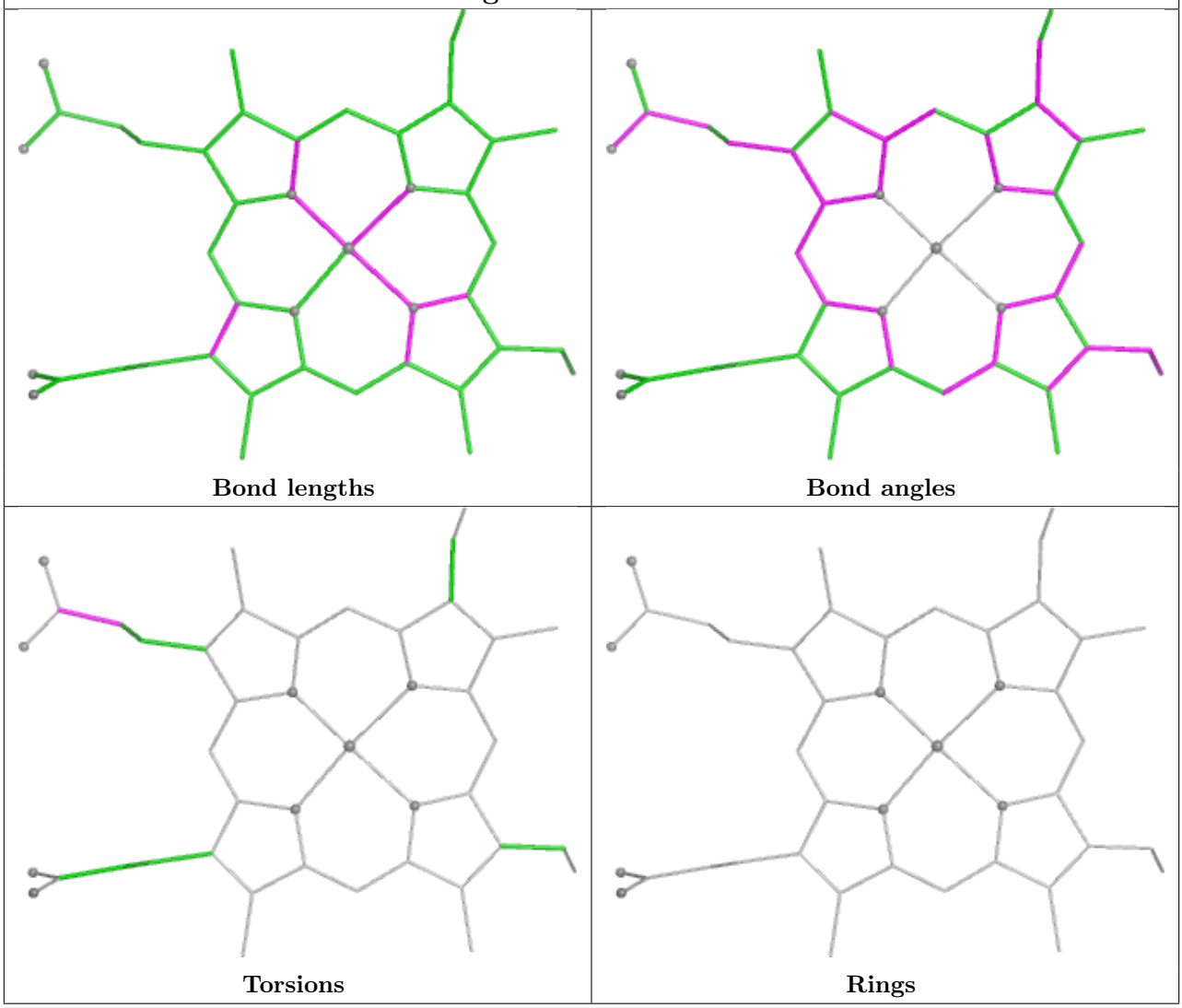
Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	503	HEC	1	0

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.

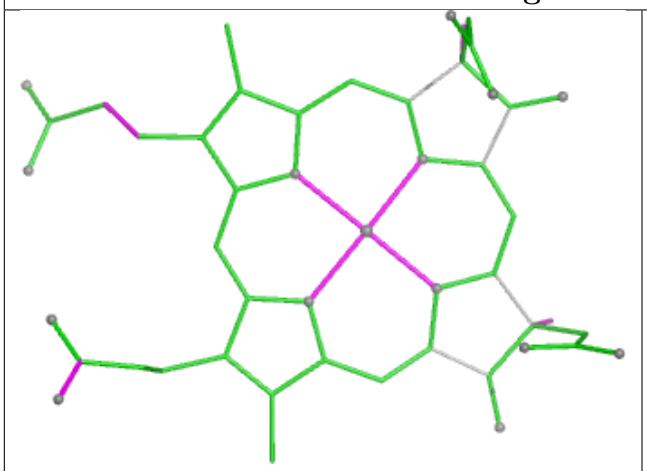
Ligand DHE A 502



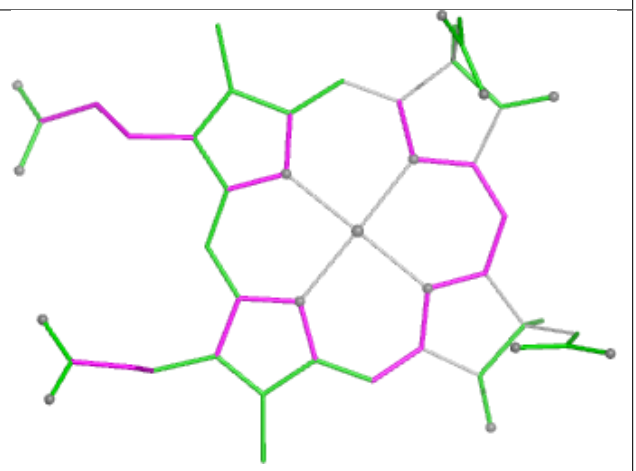
Ligand HEC B 502



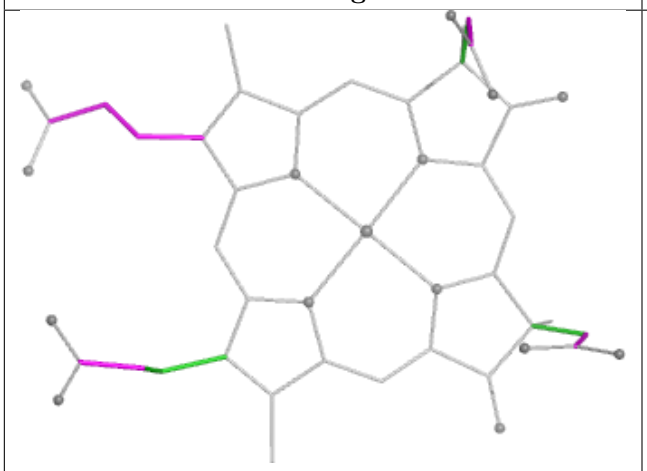
Ligand DHE B 501



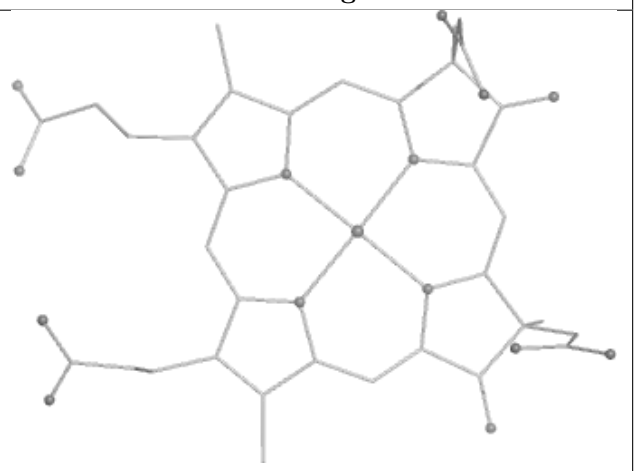
Bond lengths



Bond angles

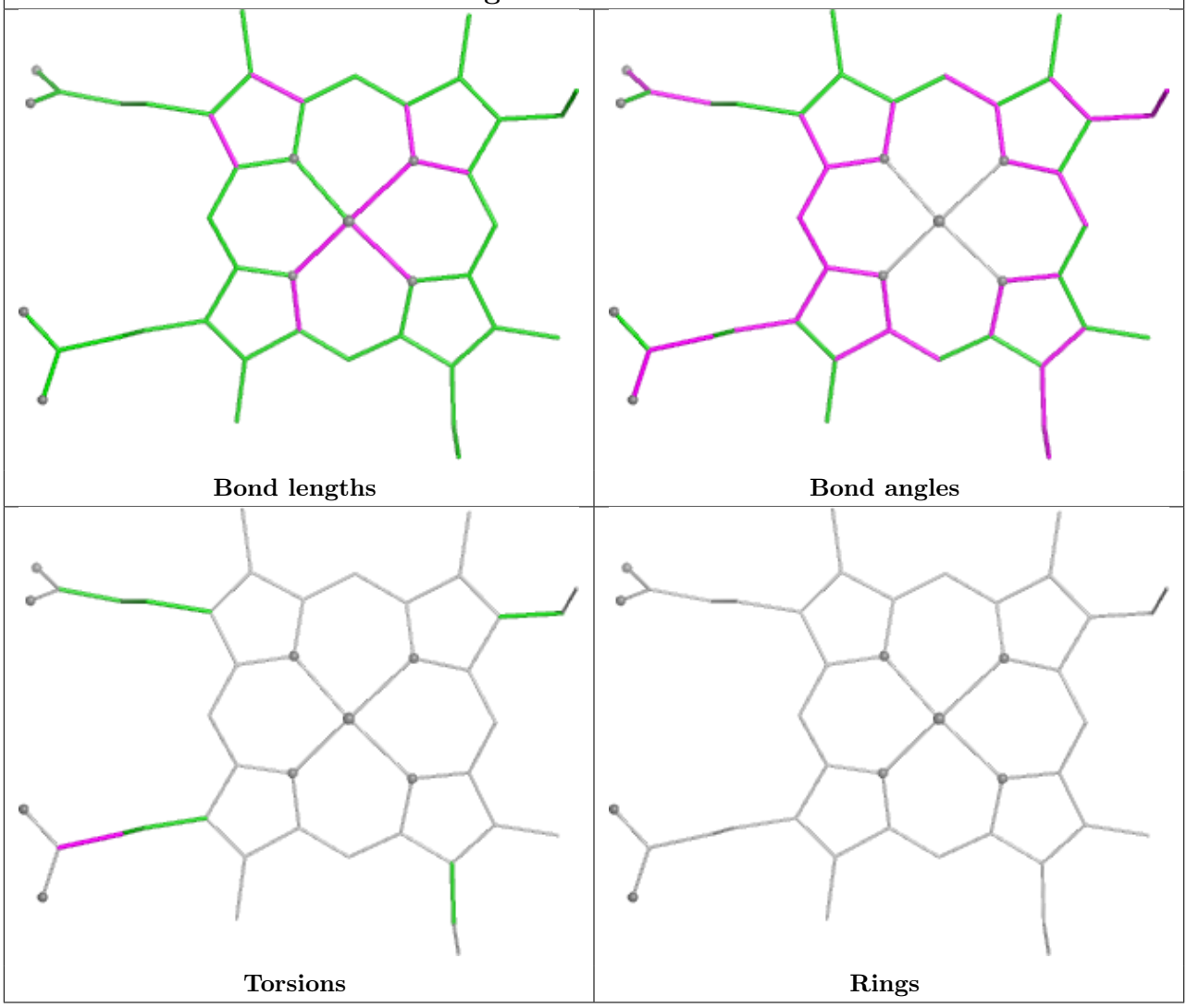


Torsions



Rings

Ligand HEC A 503



5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2			OWAB(Å^2)	Q<0.9
1	A	465/509 (91%)	0.62	36 (7%)	19	22	28, 59, 103, 195	11 (2%)
1	B	466/509 (91%)	0.42	37 (7%)	18	21	21, 51, 86, 170	14 (3%)
All	All	931/1018 (91%)	0.52	73 (7%)	19	21	21, 55, 96, 195	25 (2%)

All (73) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	321[A]	MET	11.0
1	B	326[A]	SER	9.9
1	B	323[A]	HIS	9.7
1	A	323[A]	HIS	9.7
1	B	325[A]	GLY	8.8
1	B	321[A]	MET	8.5
1	A	326[A]	SER	8.1
1	B	322[A]	PRO	8.0
1	A	325[A]	GLY	8.0
1	B	327[A]	GLY	6.6
1	B	324[A]	LEU	6.4
1	B	320[A]	GLY	5.9
1	A	322[A]	PRO	5.4
1	B	298	GLN	5.4
1	A	298	GLN	5.0
1	B	318[A]	LEU	5.0
1	A	327[A]	GLY	4.9
1	B	319[A]	SER	4.9
1	A	324[A]	LEU	4.5
1	A	300	ARG	4.4
1	B	328[A]	ILE	4.3
1	A	320[A]	GLY	4.3
1	B	297	ARG	4.1
1	B	317	PRO	3.9

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Mol	Chain	Res	Type	RSRZ
1	B	299	ALA	3.5
1	A	283	PHE	3.5
1	A	299	ALA	3.5
1	A	297	ARG	3.4
1	A	301	GLY	3.4
1	B	300	ARG	3.3
1	B	316	ILE	3.3
1	A	355	ASN	3.2
1	A	318[A]	LEU	3.1
1	B	56	ALA	2.9
1	A	304	VAL	2.9
1	A	317	PRO	2.8
1	A	316	ILE	2.8
1	A	432	TRP	2.7
1	A	328[A]	ILE	2.7
1	B	278	ASP	2.7
1	A	303	GLU	2.7
1	B	343	ILE	2.7
1	A	4	PRO	2.6
1	B	296	SER	2.6
1	A	365	ASP	2.6
1	A	319[A]	SER	2.5
1	A	302	GLY	2.5
1	A	282	ASP	2.4
1	B	61	GLN	2.3
1	B	386	LEU	2.3
1	B	16	CYS	2.3
1	A	54	GLN	2.3
1	B	62	LEU	2.2
1	A	56	ALA	2.2
1	B	344	SER	2.2
1	B	310	GLY	2.2
1	B	303	GLU	2.2
1	B	3	ALA	2.2
1	A	280	LEU	2.2
1	B	301	GLY	2.1
1	B	302	GLY	2.1
1	A	16	CYS	2.1
1	A	309	SER	2.1
1	A	314	ALA	2.1
1	B	304	VAL	2.1
1	B	315	SER	2.1

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Mol	Chain	Res	Type	RSRZ
1	B	402	GLU	2.1
1	A	359	LEU	2.1
1	B	305	ILE	2.1
1	A	296	SER	2.0
1	B	76	GLN	2.0
1	B	36[A]	ARG	2.0
1	A	336	TRP	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)

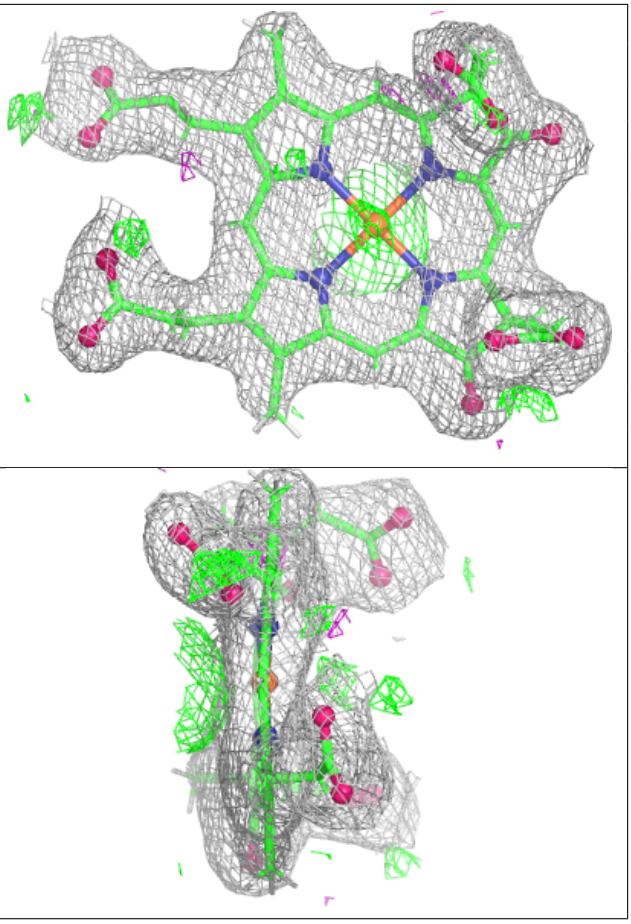
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	BU3	A	501	6/6	0.91	0.10	34,41,42,43	0
3	DHE	A	502	49/49	0.95	0.09	42,47,55,57	0
4	HEC	A	503	43/43	0.95	0.09	41,50,60,60	0
3	DHE	B	501	49/49	0.96	0.09	37,43,52,53	0
4	HEC	B	502	43/43	0.96	0.08	32,43,52,54	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.

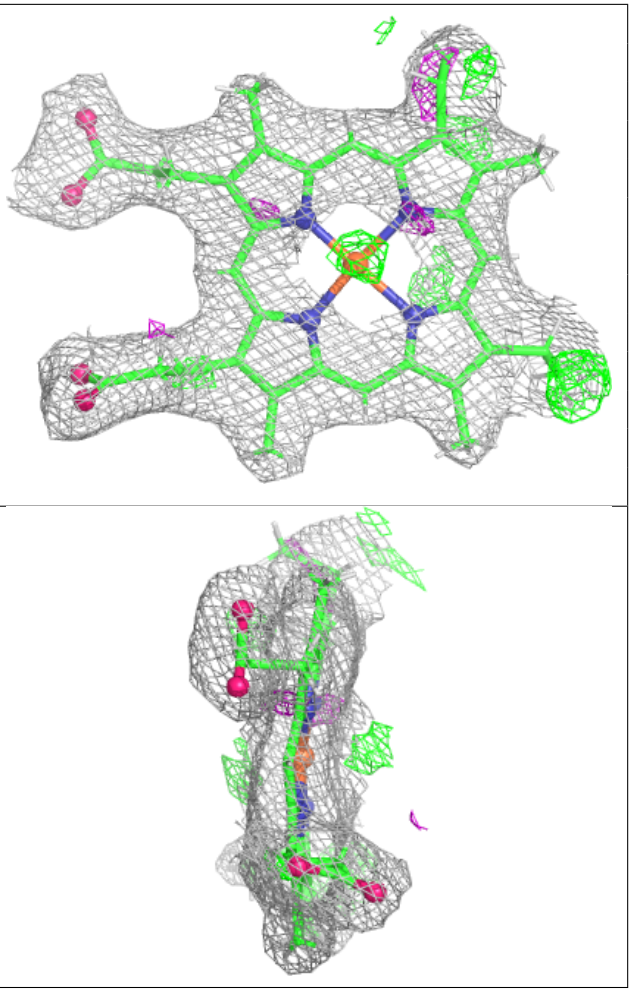
Electron density around DHE A 502:

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



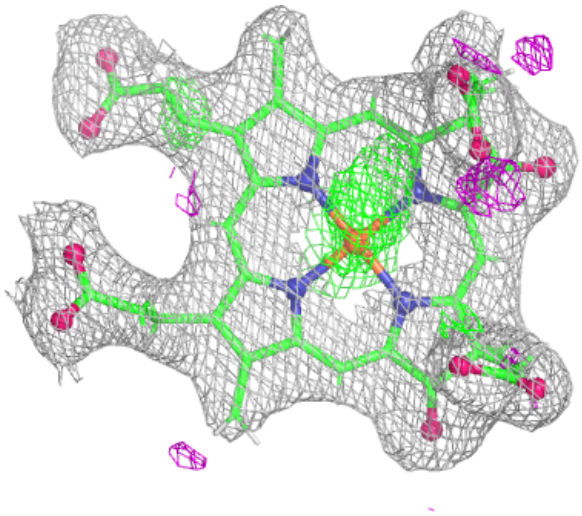
Electron density around HEC A 503:

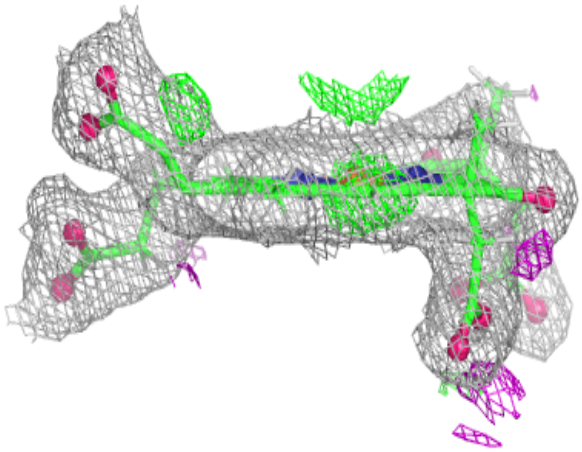
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

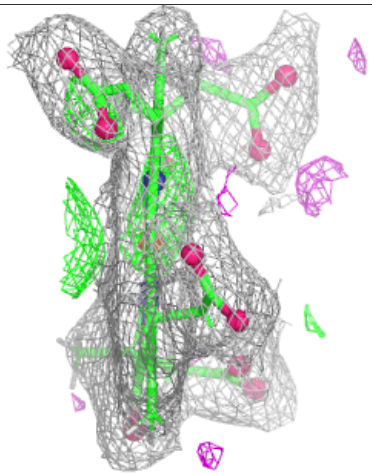


Electron density around DHE B 501:

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

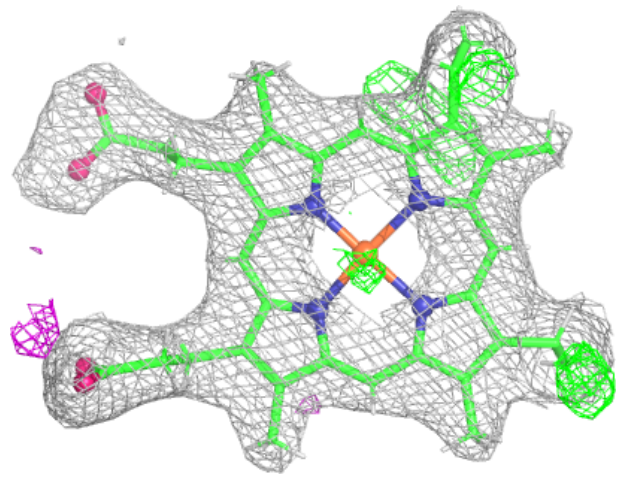


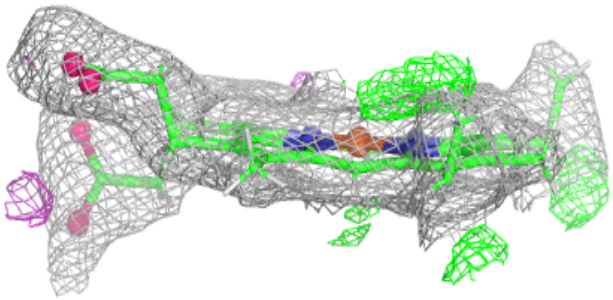


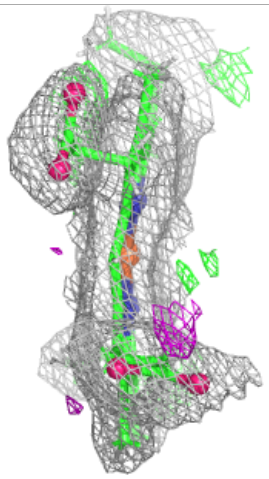


Electron density around HEC B 502:

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.