



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 18, 2026 – 06:04 AM UTC

PDB ID : 8GUE / pdb_00008gue
Title : Crystal Structure of narbomycin-bound cytochrome P450 PikC with the unnatural amino acid p-Acetyl-L-Phenylalanine incorporated at position 238
Authors : Li, G.B.; Pan, Y.J.; Li, S.Y.; Gao, X.
Deposited on : 2022-09-11
Resolution : 1.90 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

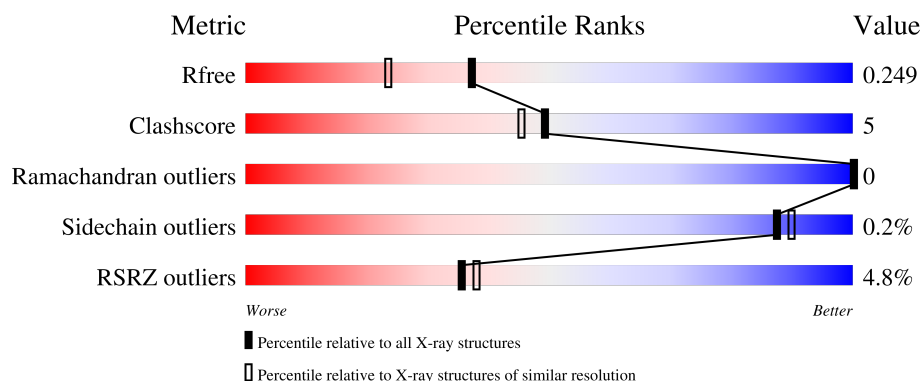
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.90 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	7789 (1.90-1.90)
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)
RSRZ outliers	180081	7790 (1.90-1.90)

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	424	
1	B	424	

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
6	PEG	A	511	-	-	X	-

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 6672 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.

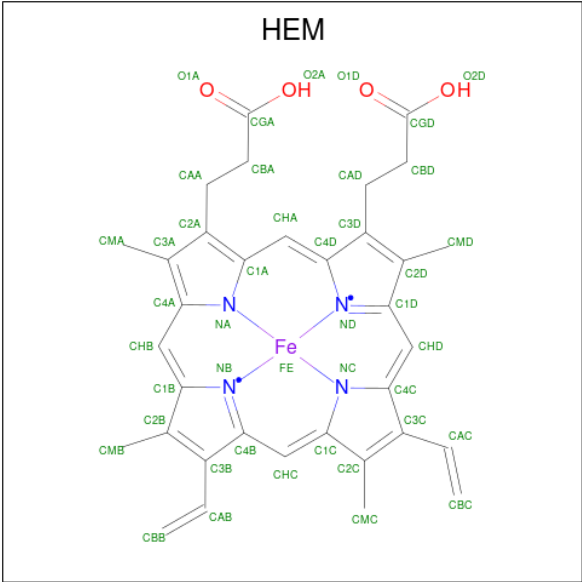
- Molecule 1 is a protein called Cytochrome P450 monooxygenase PikC.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	394	Total	C	N	O	S	0	0	0
			3071	1941	547	570	13			
1	B	392	Total	C	N	O	S	0	0	0
			3057	1931	545	568	13			

There are 18 discrepancies between the modelled and reference sequences:

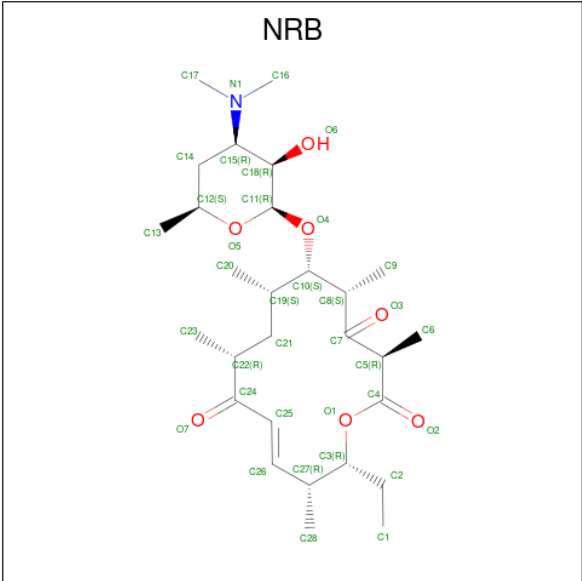
Chain	Residue	Modelled	Actual	Comment	Reference
A	238	4AF	HIS	conflict	UNP O87605
A	417	LEU	-	expression tag	UNP O87605
A	418	GLU	-	expression tag	UNP O87605
A	419	HIS	-	expression tag	UNP O87605
A	420	HIS	-	expression tag	UNP O87605
A	421	HIS	-	expression tag	UNP O87605
A	422	HIS	-	expression tag	UNP O87605
A	423	HIS	-	expression tag	UNP O87605
A	424	HIS	-	expression tag	UNP O87605
B	238	4AF	HIS	conflict	UNP O87605
B	417	LEU	-	expression tag	UNP O87605
B	418	GLU	-	expression tag	UNP O87605
B	419	HIS	-	expression tag	UNP O87605
B	420	HIS	-	expression tag	UNP O87605
B	421	HIS	-	expression tag	UNP O87605
B	422	HIS	-	expression tag	UNP O87605
B	423	HIS	-	expression tag	UNP O87605
B	424	HIS	-	expression tag	UNP O87605

- Molecule 2 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: $C_{34}H_{32}FeN_4O_4$) (labeled as "Ligand of Interest" by depositor).



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 NARBOMYCIN (CCD ID: NRB) (formula: C₂₈H₄₇NO₇) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			36	28	1	7		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	B	1	Total	C	N	O	0	0
			36	28	1	7		

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



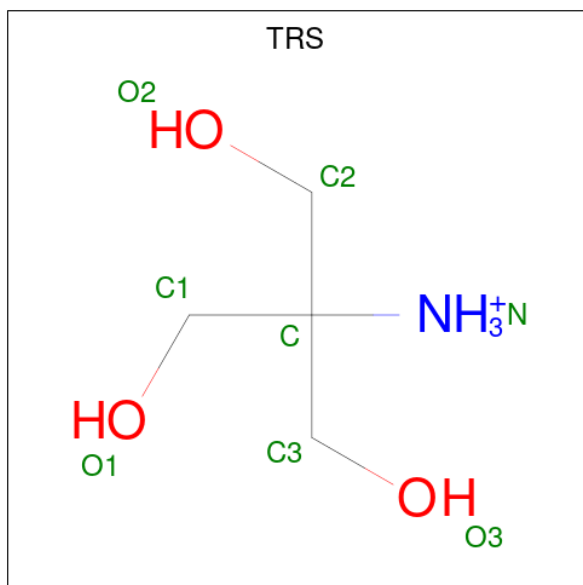
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total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

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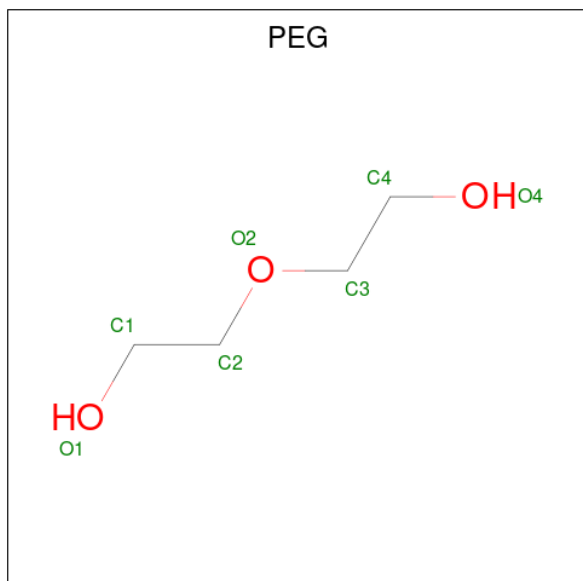
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	B	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (CCD ID: TRS) (formula: $C_4H_{12}NO_3$).



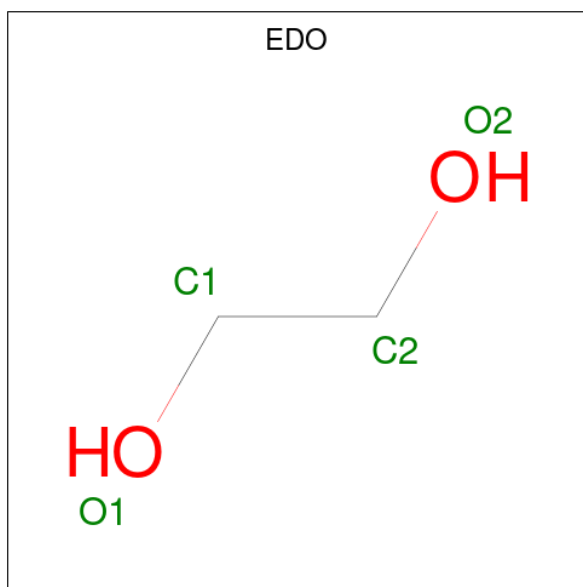
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	N	O	0	0
			8	4	1	3		

- Molecule 6 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: $C_4H_{10}O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			7	4	3		
6	B	1	Total	C	O	0	0
			7	4	3		

- Molecule 7 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	B	1	Total	C	O	0	0
			4	2	2		
7	B	1	Total	C	O	0	0
			4	2	2		

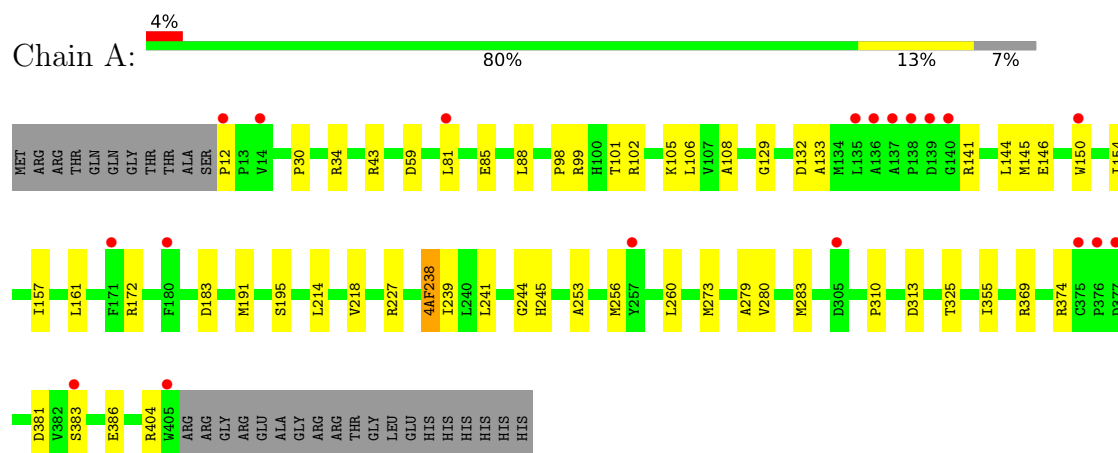
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	153	Total	O	0	0
			153	153		
8	B	148	Total	O	0	0
			148	148		

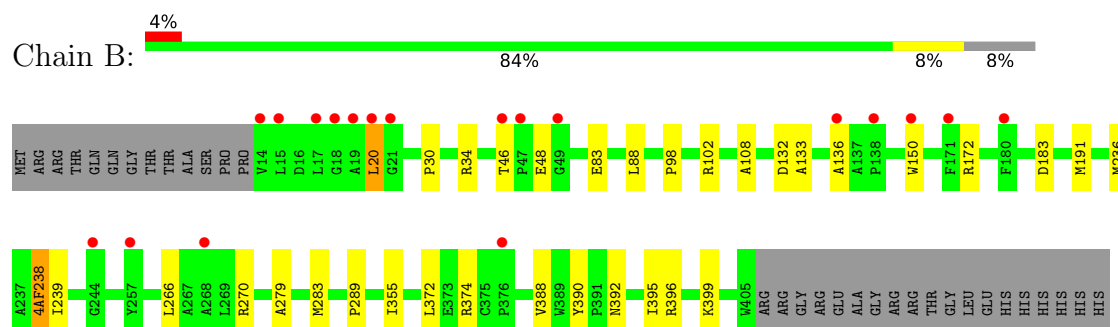
3 Residue-property plots

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 P450 monooxygenase PikC



• Molecule 1: Cytochrome P450 monooxygenase PikC



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	59.47Å 97.82Å 141.07Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	37.77 – 1.90 37.77 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.6 (37.77-1.90) 99.6 (37.77-1.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.61 (at 1.89Å)	Xtrriage
Refinement program	PHENIX 1.19.2_4158	Depositor
R, R_{free}	0.201 , 0.250 0.202 , 0.249	Depositor DCC
R_{free} test set	2000 reflections (3.05%)	wwPDB-VP
Wilson B-factor (Å ²)	33.2	Xtrriage
Anisotropy	0.237	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 36.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	6672	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 45.12 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.3828e-04. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: TRS, EDO, HEM, PEG, 4AF, SO4, NRB

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	0.20	0/3128	0.41	0/4266
1	B	0.20	0/3112	0.39	0/4243
All	All	0.20	0/6240	0.40	0/8509

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	3071	0	3041	45	0
1	B	3057	0	3026	24	0
2	A	43	0	30	1	0
2	B	43	0	30	1	0
3	A	36	0	47	1	0
3	B	36	0	47	1	0
4	A	35	0	0	1	0
4	B	20	0	0	0	0
5	A	8	0	12	5	0
6	A	7	0	10	4	0
6	B	7	0	10	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
7	B	8	0	12	1	0
8	A	153	0	0	1	0
8	B	148	0	0	0	0
All	All	6672	0	6265	68	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 (68) 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:B:270:ARG:NH1	1:B:372:LEU:O	2.22	0.73
1:A:141:ARG:HG3	1:A:141:ARG:HH11	1.53	0.72
1:B:88:LEU:HD12	1:B:191:MET:HE2	1.78	0.66
1:B:132:ASP:OD1	1:B:374:ARG:NH2	2.31	0.61
1:A:30:PRO:O	1:A:34:ARG:HG3	2.02	0.59
1:A:99:ARG:NH1	4:A:509:SO4:O1	2.35	0.59
1:A:132:ASP:OD1	1:A:374:ARG:NH2	2.35	0.59
1:A:88:LEU:HD21	1:A:195:SER:HB2	1.86	0.58
1:B:30:PRO:O	1:B:34:ARG:HG3	2.04	0.57
1:B:150:TRP:HE3	1:B:172:ARG:HH21	1.52	0.55
1:A:161:LEU:HD13	1:A:241:LEU:HG	1.88	0.54
1:A:85:GLU:HG2	1:A:191:MET:HE1	1.90	0.53
1:B:388:VAL:HG13	1:B:399:LYS:HB2	1.91	0.53
1:A:239:ILE:HD12	3:A:502:NRB:H6C1	1.90	0.52
1:B:46:THR:C	1:B:48:GLU:H	2.19	0.51
1:A:256:MET:O	1:A:260:LEU:HG	2.10	0.51
1:B:390:TYR:CZ	1:B:399:LYS:HG2	2.46	0.50
1:A:101:THR:O	1:A:105:LYS:HG3	2.12	0.50
1:A:108:ALA:HA	1:A:355:ILE:HD11	1.94	0.50
1:B:83:GLU:H	7:B:508:EDO:H21	1.76	0.49
1:A:157:ILE:HG13	1:A:161:LEU:HD12	1.95	0.49
1:A:381:ASP:HA	1:A:404:ARG:HE	1.78	0.48
1:B:108:ALA:HA	1:B:355:ILE:HD11	1.96	0.48
1:B:279:ALA:O	1:B:283:MET:HG3	2.14	0.47
1:A:102:ARG:HE	6:A:511:PEG:H21	1.79	0.47
1:B:98:PRO:HB2	6:B:509:PEG:H22	1.97	0.47
1:B:238:4AF:H112	3:B:502:NRB:H203	1.97	0.46
1:A:59:ASP:CG	5:A:510:TRS:H31	2.40	0.46
1:A:146:GLU:OE2	1:A:172:ARG:NH1	2.48	0.46
1:A:383:SER:OG	1:A:386:GLU:HG3	2.16	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:266:LEU:HD21	1:B:270:ARG:HE	1.80	0.45
1:A:81:LEU:HD22	1:A:85:GLU:HB3	1.97	0.45
1:B:289:PRO:HG2	2:B:501:HEM:HAC	1.98	0.45
1:A:227:ARG:HH11	1:A:227:ARG:HG2	1.79	0.45
5:A:510:TRS:H12	8:A:660:HOH:O	2.16	0.45
1:A:141:ARG:HG3	1:A:141:ARG:NH1	2.28	0.44
1:A:244:GLY:HA2	2:A:501:HEM:C3B	2.52	0.44
1:B:392:ASN:HB3	1:B:395:ILE:HG13	1.98	0.44
1:A:129:GLY:O	1:B:136:ALA:HB1	2.17	0.44
1:B:388:VAL:CG2	1:B:399:LYS:HE3	2.47	0.44
1:A:102:ARG:HE	6:A:511:PEG:C2	2.30	0.44
1:A:144:LEU:HD12	1:A:144:LEU:HA	1.87	0.44
1:A:98:PRO:HG2	6:A:511:PEG:H31	1.99	0.44
1:A:227:ARG:HG2	1:A:227:ARG:NH1	2.33	0.44
1:A:273:MET:HG2	1:A:369:ARG:NH1	2.34	0.43
1:A:154:ILE:HD13	1:A:245:HIS:CE1	2.53	0.43
1:A:59:ASP:OD2	5:A:510:TRS:H31	2.19	0.43
1:A:106:LEU:HD21	1:A:227:ARG:HD2	2.01	0.42
1:B:20:LEU:H	1:B:20:LEU:HG	1.41	0.42
1:A:325:THR:HG21	5:A:510:TRS:O3	2.19	0.42
1:A:133:ALA:HA	1:B:133:ALA:HA	2.01	0.42
1:B:102:ARG:HH21	6:B:509:PEG:H41	1.84	0.42
1:A:279:ALA:O	1:A:283:MET:HG3	2.19	0.42
1:A:145:MET:SD	1:A:150:TRP:CD1	3.12	0.42
1:B:183:ASP:OD2	1:B:183:ASP:N	2.48	0.42
1:A:280:VAL:O	1:A:283:MET:HB2	2.19	0.42
1:B:396:ARG:HH11	1:B:396:ARG:HG2	1.85	0.42
1:A:227:ARG:HA	1:A:227:ARG:HD3	1.86	0.42
1:A:238:4AF:H9	1:A:238:4AF:H111	1.85	0.41
1:B:236:MET:HA	1:B:239:ILE:HG22	2.02	0.41
1:A:145:MET:HE1	1:A:253:ALA:CB	2.50	0.41
1:A:183:ASP:N	1:A:183:ASP:OD1	2.52	0.41
1:A:12:PRO:HG2	1:A:43:ARG:CZ	2.50	0.41
1:A:98:PRO:HB2	6:A:511:PEG:H22	2.02	0.41
1:A:214:LEU:O	1:A:218:VAL:HG23	2.20	0.41
1:A:310:PRO:HG2	1:A:313:ASP:CG	2.46	0.40
1:A:325:THR:HG21	5:A:510:TRS:HO3	1.86	0.40
1:A:150:TRP:HZ3	1:A:245:HIS:CE1	2.40	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	391/424 (92%)	379 (97%)	12 (3%)	0	100	100
1	B	389/424 (92%)	380 (98%)	9 (2%)	0	100	100
All	All	780/848 (92%)	759 (97%)	21 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	321/345 (93%)	321 (100%)	0	100	100
1	B	319/345 (92%)	318 (100%)	1 (0%)	86	88
All	All	640/690 (93%)	639 (100%)	1 (0%)	87	90

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	20	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	89	ASN
1	B	89	ASN

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Mol	Chain	Res	Type
1	B	186	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues 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$
1	4AF	B	238	1	13,14,15	1.33	2 (15%)	13,18,20	0.99	0
1	4AF	A	238	1	13,14,15	1.41	3 (23%)	13,18,20	0.96	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
1	4AF	B	238	1	-	0/9/10/12	0/1/1/1
1	4AF	A	238	1	-	0/9/10/12	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	238	4AF	C3-C4	2.53	1.57	1.51
1	B	238	4AF	C7-C8	2.25	1.54	1.49
1	A	238	4AF	C7-C8	2.17	1.53	1.49
1	A	238	4AF	O-C	2.10	1.27	1.20
1	B	238	4AF	C3-C4	2.09	1.56	1.51

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	B	238	4AF	1	0
1	A	238	4AF	1	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

20 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
2	HEM	A	501	1	50,50,50	1.36	7 (14%)	67,82,82	0.88	1 (1%)
4	SO4	A	509	-	4,4,4	0.23	0	6,6,6	0.11	0
4	SO4	A	507	-	4,4,4	0.26	0	6,6,6	0.11	0
6	PEG	B	509	-	6,6,6	0.11	0	5,5,5	0.10	0
4	SO4	A	503	-	4,4,4	0.25	0	6,6,6	0.12	0
5	TRS	A	510	-	7,7,7	0.46	0	9,9,9	0.57	0
4	SO4	A	506	-	4,4,4	0.27	0	6,6,6	0.12	0
6	PEG	A	511	-	6,6,6	0.09	0	5,5,5	0.14	0
4	SO4	B	507	-	4,4,4	0.23	0	6,6,6	0.07	0
4	SO4	B	503	-	4,4,4	0.29	0	6,6,6	0.09	0
7	EDO	B	508	-	3,3,3	0.43	0	2,2,2	0.45	0
3	NRB	B	502	-	37,37,37	1.28	5 (13%)	46,53,53	2.31	17 (36%)
4	SO4	B	505	-	4,4,4	0.25	0	6,6,6	0.12	0
4	SO4	B	504	-	4,4,4	0.30	0	6,6,6	0.15	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
7	EDO	B	506	-	3,3,3	0.45	0	2,2,2	0.31	0
3	NRB	A	502	-	37,37,37	1.39	7 (18%)	46,53,53	2.37	17 (36%)
2	HEM	B	501	1	50,50,50	1.39	7 (14%)	67,82,82	0.86	1 (1%)
4	SO4	A	505	-	4,4,4	0.25	0	6,6,6	0.07	0
4	SO4	A	504	-	4,4,4	0.29	0	6,6,6	0.06	0
4	SO4	A	508	-	4,4,4	0.25	0	6,6,6	0.10	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
6	PEG	B	509	-	-	2/4/4/4	-
5	TRS	A	510	-	-	5/9/9/9	-
2	HEM	A	501	1	-	4/14/54/54	-
6	PEG	A	511	-	-	2/4/4/4	-
7	EDO	B	506	-	-	1/1/1/1	-
3	NRB	A	502	-	-	9/51/67/67	0/1/2/2
2	HEM	B	501	1	-	2/14/54/54	-
3	NRB	B	502	-	-	11/51/67/67	0/1/2/2
7	EDO	B	508	-	-	0/1/1/1	-

All (26) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	501	HEM	FE-NB	4.24	2.08	1.94
2	A	501	HEM	FE-NB	3.98	2.07	1.94
3	B	502	NRB	O3-C7	3.67	1.27	1.21
3	A	502	NRB	O3-C7	3.63	1.27	1.21
2	B	501	HEM	FE-NC	3.22	2.05	1.95
2	A	501	HEM	FE-NC	3.06	2.05	1.95
3	B	502	NRB	C8-C7	-3.02	1.47	1.52
3	B	502	NRB	C19-C10	3.00	1.58	1.53
2	A	501	HEM	C4C-NC	-3.00	1.34	1.39
3	A	502	NRB	C5-C7	-2.92	1.48	1.52
3	A	502	NRB	C19-C10	2.76	1.58	1.53
2	B	501	HEM	C4C-NC	-2.68	1.34	1.39
3	A	502	NRB	C8-C7	-2.67	1.48	1.52
2	A	501	HEM	FE-NA	2.64	2.03	1.95

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	502	NRB	O1-C3	-2.62	1.41	1.46
2	B	501	HEM	FE-ND	2.58	2.02	1.94
3	A	502	NRB	C15-N1	2.55	1.53	1.47
3	A	502	NRB	C18-C15	2.49	1.58	1.53
2	B	501	HEM	FE-NA	2.48	2.03	1.95
2	B	501	HEM	C4D-ND	-2.43	1.36	1.40
3	B	502	NRB	C5-C7	-2.43	1.49	1.52
2	A	501	HEM	C4D-ND	-2.32	1.36	1.40
3	B	502	NRB	O1-C3	-2.21	1.42	1.46
2	A	501	HEM	FE-ND	2.20	2.01	1.94
2	B	501	HEM	C1B-NB	-2.18	1.36	1.40
2	A	501	HEM	C1B-NB	-2.03	1.36	1.40

All (36) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	502	NRB	O1-C4-C5	9.48	120.29	110.93
3	A	502	NRB	O1-C4-C5	8.93	119.74	110.93
3	B	502	NRB	C11-O5-C12	-4.79	105.53	112.91
3	A	502	NRB	C11-O5-C12	-4.64	105.75	112.91
3	A	502	NRB	C22-C21-C19	4.04	122.34	115.09
3	B	502	NRB	O2-C4-C5	-3.54	120.06	124.65
3	A	502	NRB	C18-C15-N1	3.52	121.08	110.94
3	A	502	NRB	C12-C14-C15	-3.48	104.52	110.46
3	A	502	NRB	O2-C4-C5	-3.44	120.19	124.65
3	A	502	NRB	O3-C7-C5	-3.31	114.58	120.71
3	B	502	NRB	O1-C3-C2	3.26	112.08	106.90
3	B	502	NRB	C22-C21-C19	3.24	120.90	115.09
3	A	502	NRB	C3-O1-C4	3.11	122.56	117.85
3	B	502	NRB	O3-C7-C5	-3.04	115.08	120.71
3	A	502	NRB	O1-C3-C2	2.92	111.54	106.90
3	B	502	NRB	C3-O1-C4	2.62	121.81	117.85
3	A	502	NRB	O5-C12-C13	2.48	111.53	106.88
3	A	502	NRB	O7-C24-C22	-2.45	117.24	121.40
3	B	502	NRB	O1-C4-O2	-2.41	119.61	123.95
3	A	502	NRB	C11-C18-C15	-2.40	105.30	109.15
3	A	502	NRB	C20-C19-C10	-2.38	107.25	111.14
3	B	502	NRB	C14-C15-N1	-2.29	109.16	115.59
3	B	502	NRB	C8-C10-C19	2.18	118.00	114.19
3	A	502	NRB	O1-C4-O2	-2.17	120.03	123.95
3	A	502	NRB	C8-C10-C19	2.17	117.97	114.19
3	B	502	NRB	C10-C8-C7	2.13	117.70	110.91

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	502	NRB	C6-C5-C4	-2.13	106.17	110.34
3	B	502	NRB	C18-C15-N1	2.07	116.91	110.94
3	B	502	NRB	O5-C12-C13	2.04	110.71	106.88
3	B	502	NRB	C23-C22-C21	2.04	115.54	111.52
3	B	502	NRB	O7-C24-C22	-2.03	117.94	121.40
2	A	501	HEM	C3B-C2B-C1B	-2.03	104.89	106.41
3	B	502	NRB	C6-C5-C4	-2.02	106.38	110.34
2	B	501	HEM	CMC-C2C-C1C	2.02	128.28	124.73
3	B	502	NRB	C20-C19-C10	-2.01	107.87	111.14
3	A	502	NRB	C10-C8-C7	2.00	117.29	110.91

There are no chirality outliers.

All (36) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	501	HEM	C2C-C3C-CAC-CBC
3	A	502	NRB	C5-C7-C8-C9
3	A	502	NRB	O3-C7-C8-C9
3	A	502	NRB	C8-C10-C19-C20
3	A	502	NRB	C8-C10-C19-C21
3	A	502	NRB	O4-C10-C19-C20
3	A	502	NRB	O4-C10-C19-C21
3	B	502	NRB	C5-C7-C8-C9
3	B	502	NRB	O3-C7-C8-C9
3	B	502	NRB	C8-C10-C19-C20
3	B	502	NRB	C8-C10-C19-C21
3	B	502	NRB	O4-C10-C19-C20
3	B	502	NRB	O4-C10-C19-C21
3	B	502	NRB	O5-C11-O4-C10
3	A	502	NRB	O5-C11-O4-C10
6	B	509	PEG	O2-C3-C4-O4
6	A	511	PEG	C1-C2-O2-C3
2	A	501	HEM	C2B-C3B-CAB-CBB
2	B	501	HEM	C4C-C3C-CAC-CBC
5	A	510	TRS	C2-C-C1-O1
5	A	510	TRS	C3-C-C1-O1
3	B	502	NRB	C18-C15-N1-C16
2	A	501	HEM	C2C-C3C-CAC-CBC
6	B	509	PEG	O1-C1-C2-O2
6	A	511	PEG	O1-C1-C2-O2
3	A	502	NRB	C19-C10-C8-C7
5	A	510	TRS	C1-C-C2-O2

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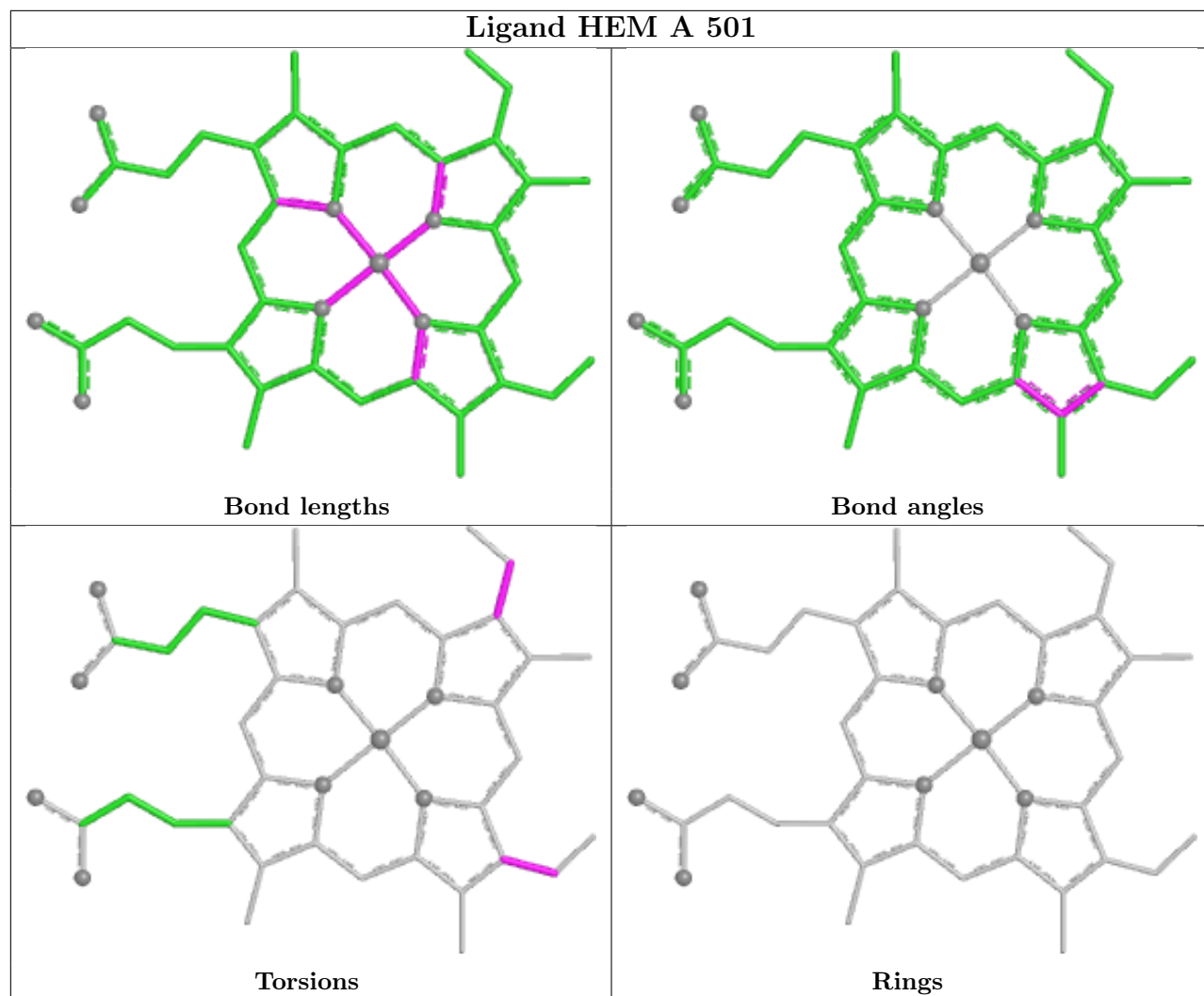
Mol	Chain	Res	Type	Atoms
2	A	501	HEM	C4B-C3B-CAB-CBB
5	A	510	TRS	N-C-C1-O1
3	B	502	NRB	C5-C4-O1-C3
3	A	502	NRB	C25-C26-C27-C28
5	A	510	TRS	C3-C-C2-O2
2	A	501	HEM	C4C-C3C-CAC-CBC
7	B	506	EDO	O1-C1-C2-O2
3	B	502	NRB	C25-C26-C27-C28
3	B	502	NRB	C19-C10-C8-C9

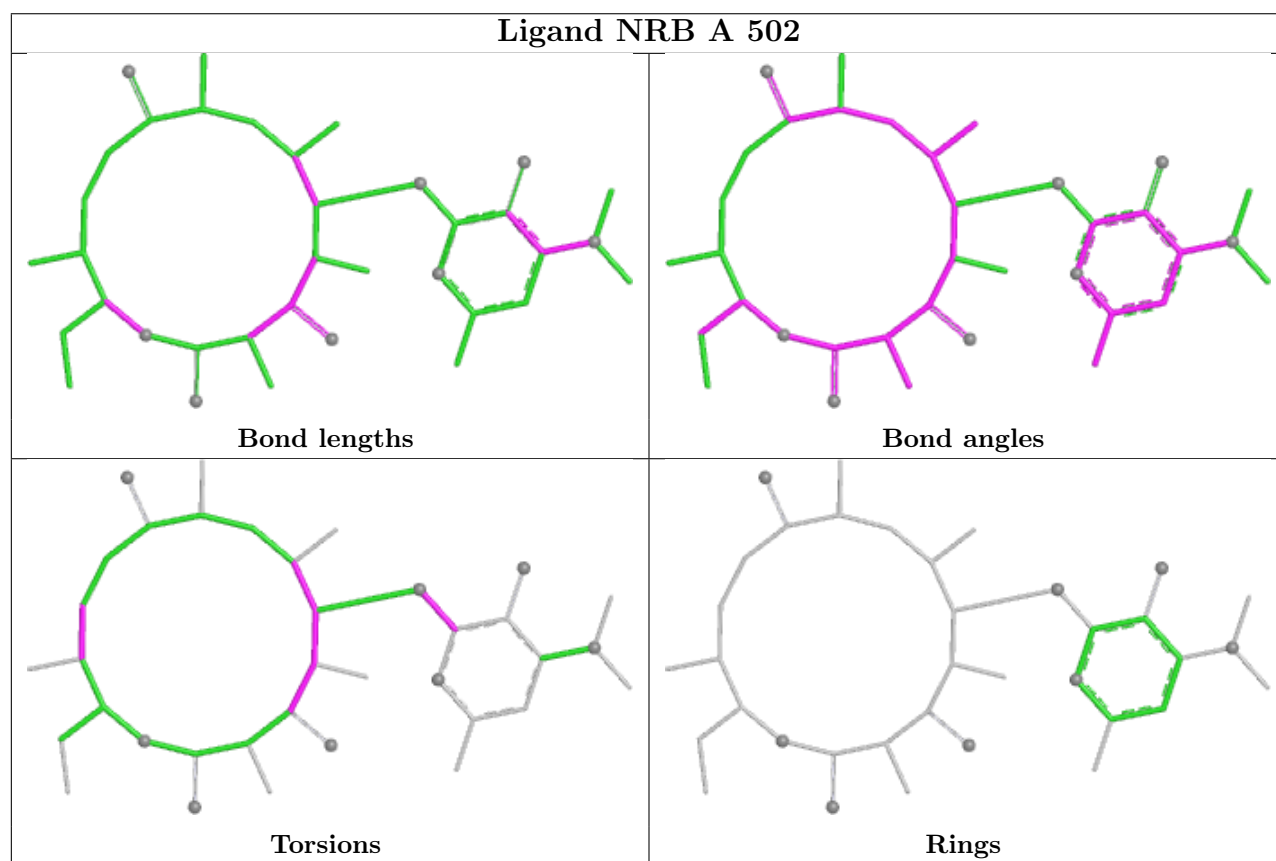
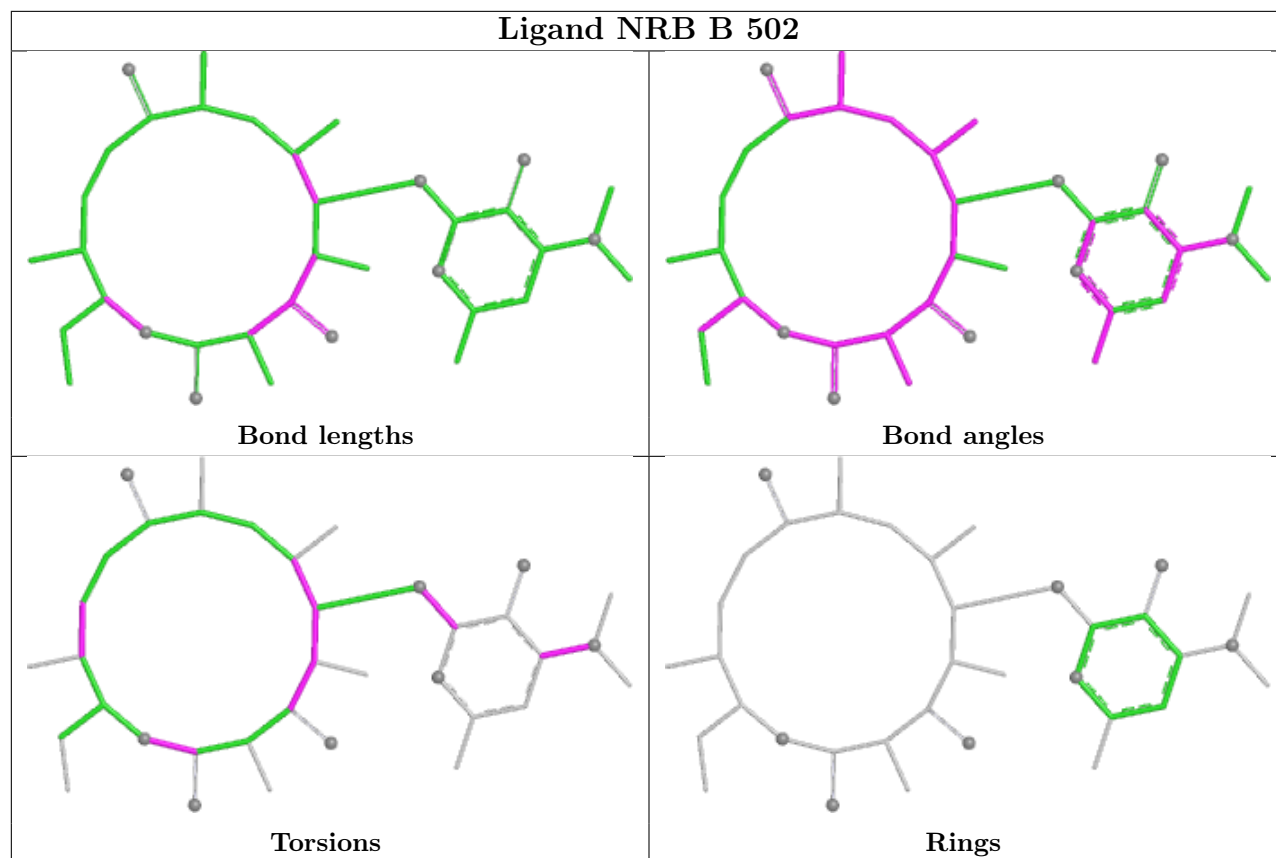
There are no ring outliers.

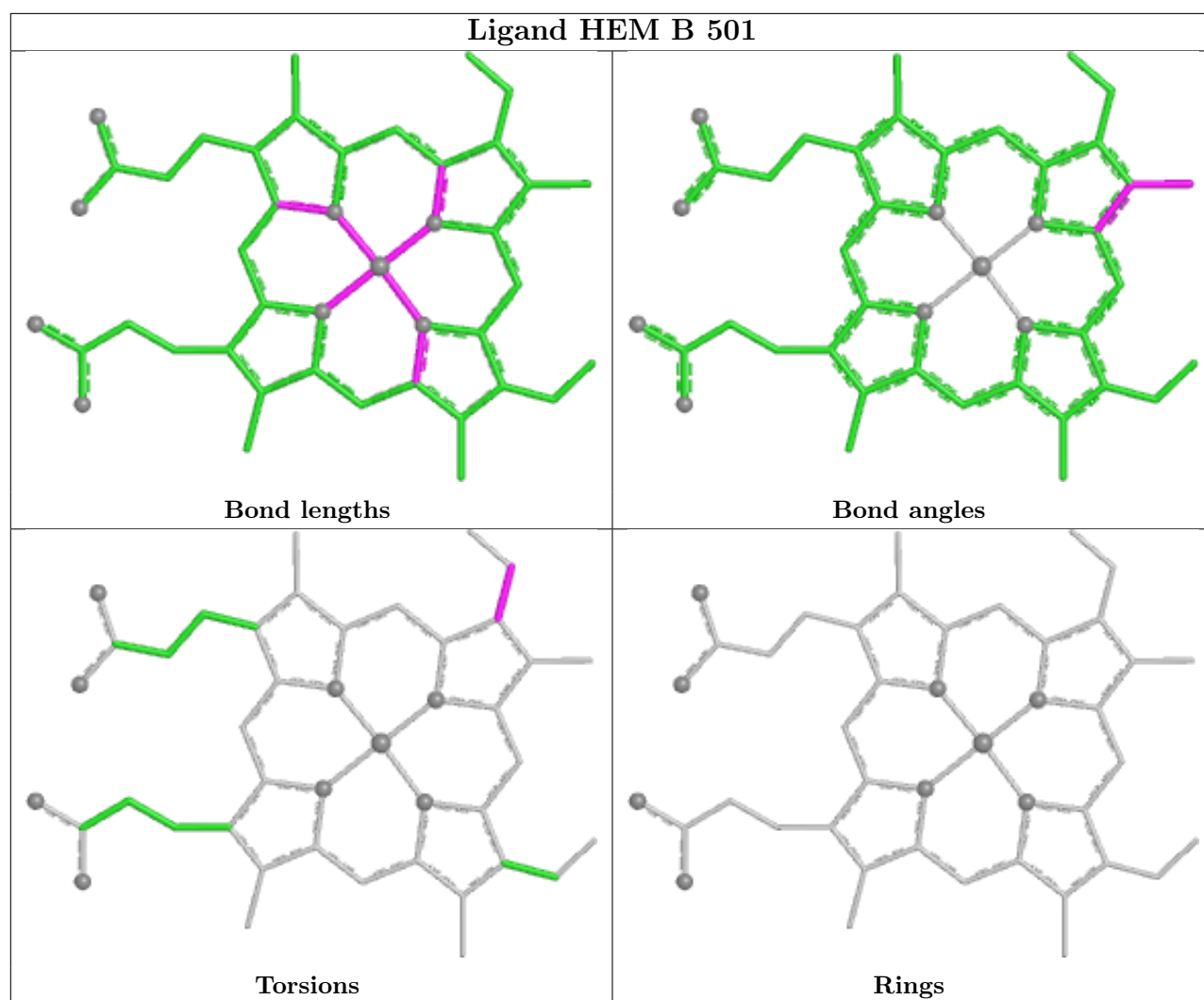
9 monomers are involved in 17 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	501	HEM	1	0
4	A	509	SO4	1	0
6	B	509	PEG	2	0
5	A	510	TRS	5	0
6	A	511	PEG	4	0
7	B	508	EDO	1	0
3	B	502	NRB	1	0
3	A	502	NRB	1	0
2	B	501	HEM	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.







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	393/424 (92%)	0.20	19 (4%) 35 38	21, 34, 57, 80	0
1	B	391/424 (92%)	0.25	19 (4%) 35 37	22, 35, 59, 82	0
All	All	784/848 (92%)	0.23	38 (4%) 35 38	21, 35, 58, 82	0

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	47	PRO	5.5
1	B	150	TRP	4.9
1	A	140	GLY	4.4
1	B	180	PHE	4.2
1	A	150	TRP	4.2
1	A	180	PHE	3.8
1	A	137	ALA	3.3
1	B	17	LEU	3.3
1	A	12	PRO	3.3
1	A	376	PRO	3.1
1	A	138	PRO	3.0
1	B	14	VAL	2.9
1	B	268	ALA	2.9
1	B	19	ALA	2.9
1	B	136	ALA	2.8
1	B	15	LEU	2.8
1	B	376	PRO	2.7
1	A	405	TRP	2.6
1	A	14	VAL	2.6
1	B	46	THR	2.6
1	A	375	CYS	2.5
1	A	139	ASP	2.5
1	B	138	PRO	2.5
1	A	377	ASP	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	135	LEU	2.4
1	B	20	LEU	2.3
1	B	49	GLY	2.3
1	A	81	LEU	2.2
1	B	21	GLY	2.1
1	B	171	PHE	2.1
1	A	305	ASP	2.1
1	A	257	TYR	2.1
1	B	18	GLY	2.1
1	A	171	PHE	2.0
1	A	383	SER	2.0
1	B	244	GLY	2.0
1	A	136	ALA	2.0
1	B	257	TYR	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [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
1	4AF	B	238	14/15	0.94	0.09	21,34,41,47	0
1	4AF	A	238	14/15	0.96	0.07	24,29,40,45	0

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
4	SO4	A	508	5/5	0.61	0.11	66,73,81,92	0
7	EDO	B	508	4/4	0.64	0.17	44,54,57,57	0

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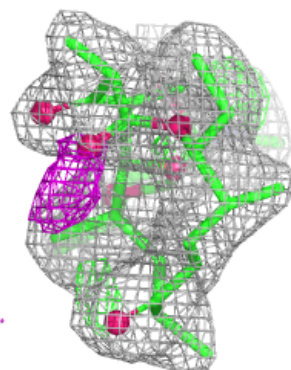
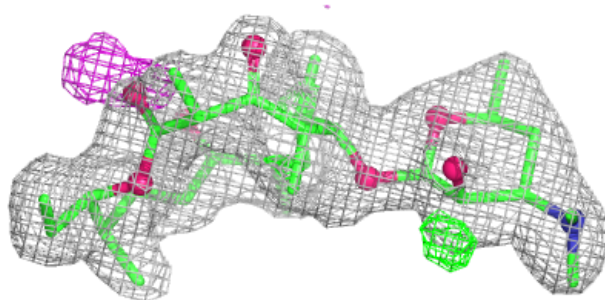
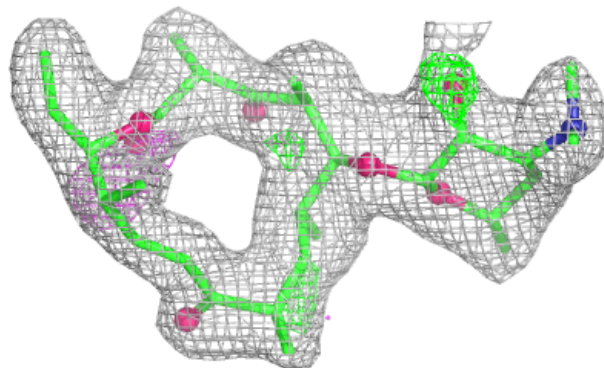
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	SO4	B	505	5/5	0.71	0.11	64,66,67,80	0
4	SO4	A	509	5/5	0.71	0.12	54,64,70,75	0
4	SO4	A	506	5/5	0.73	0.11	48,63,73,78	0
4	SO4	A	507	5/5	0.74	0.09	62,69,72,91	0
4	SO4	A	504	5/5	0.76	0.10	53,53,65,82	0
4	SO4	A	505	5/5	0.77	0.09	65,67,72,75	0
5	TRS	A	510	8/8	0.80	0.13	34,42,50,61	0
7	EDO	B	506	4/4	0.82	0.13	46,48,55,55	0
4	SO4	B	507	5/5	0.82	0.09	60,63,71,72	0
4	SO4	A	503	5/5	0.84	0.10	45,48,61,64	0
6	PEG	B	509	7/7	0.84	0.12	41,43,51,51	0
4	SO4	B	504	5/5	0.86	0.09	37,41,63,67	0
4	SO4	B	503	5/5	0.87	0.09	46,47,50,61	0
6	PEG	A	511	7/7	0.88	0.10	32,42,48,52	0
3	NRB	A	502	36/36	0.88	0.12	29,41,49,64	0
3	NRB	B	502	36/36	0.89	0.11	26,42,56,63	0
2	HEM	A	501	43/43	0.97	0.07	19,24,28,40	0
2	HEM	B	501	43/43	0.97	0.07	19,24,26,40	0

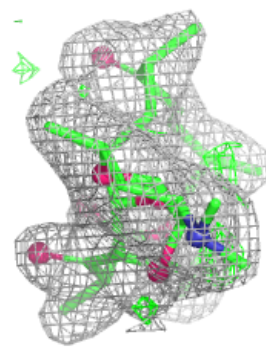
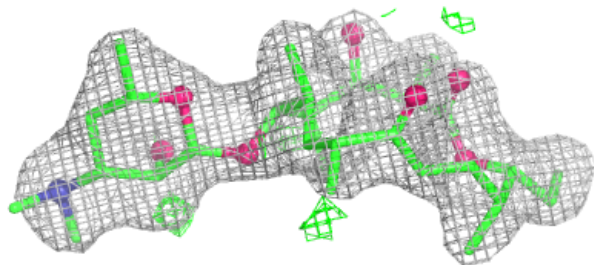
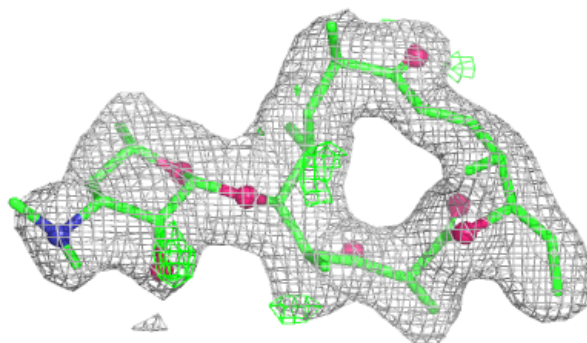
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

Electron density around NRB 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)

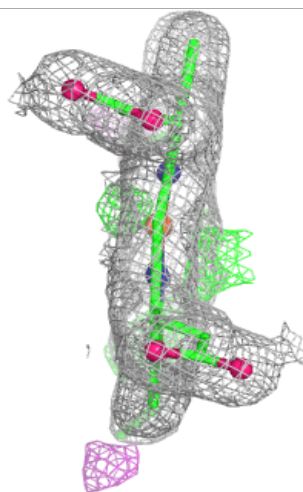
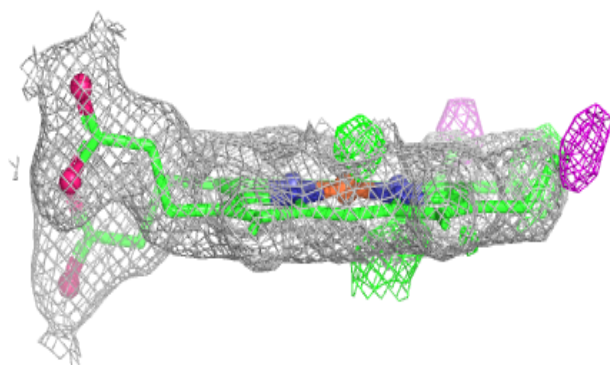
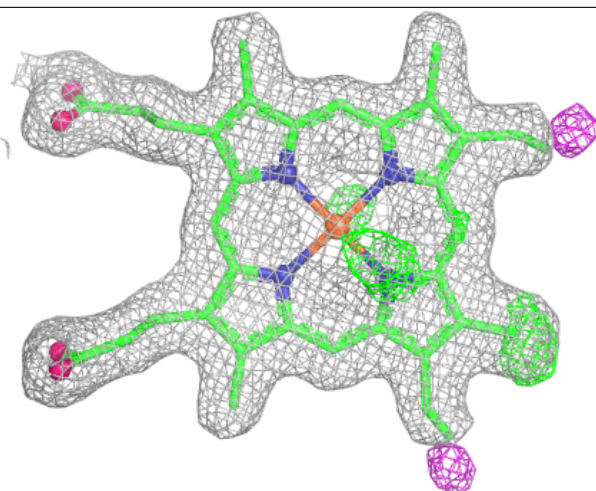
**Electron density around NRB B 502:**

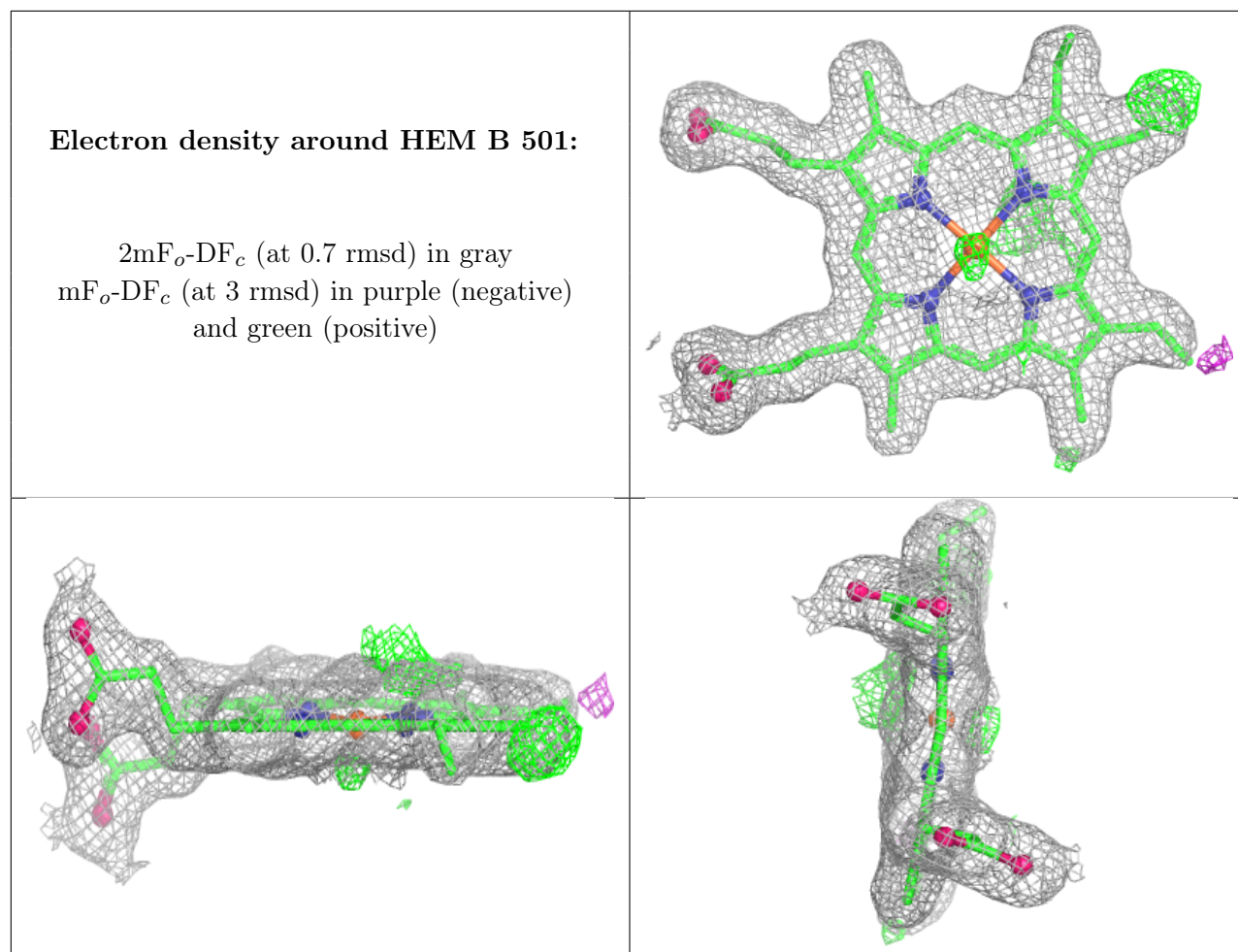
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around HEM A 501:

$2mF_o-DF_c$ (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.