



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 01:47 PM UTC

PDB ID : 5SYU / pdb_00005syu
Title : Crystal structure of Burkholderia pseudomallei KatG E242Q variant
Authors : Loewen, P.C.
Deposited on : 2016-08-12
Resolution : 1.80 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

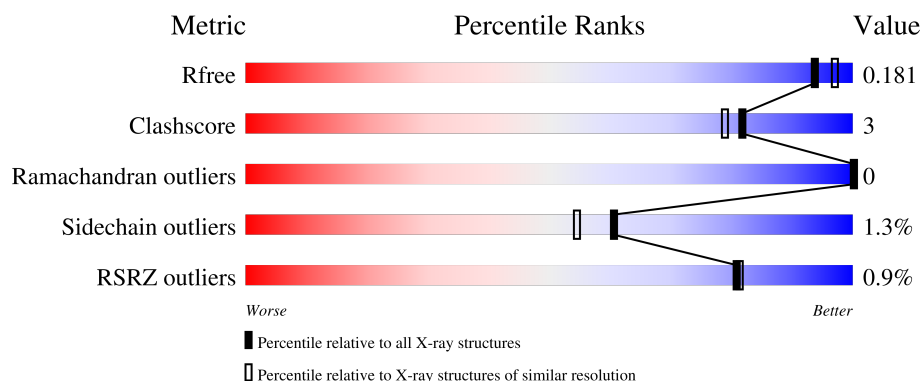
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

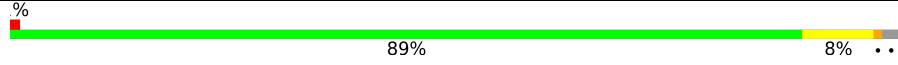
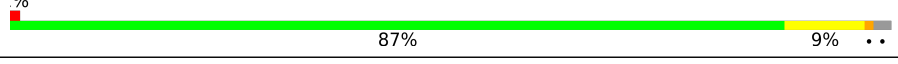
The reported resolution of this entry is 1.80 Å.

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



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	7662 (1.80-1.80)
Clashscore	190562	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)
RSRZ outliers	180081	7663 (1.80-1.80)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. 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	728	
1	B	728	

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	MPD	B	806	-	-	X	-

2 Entry composition i

There are 8 unique types of molecules in this entry. The entry contains 12746 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.

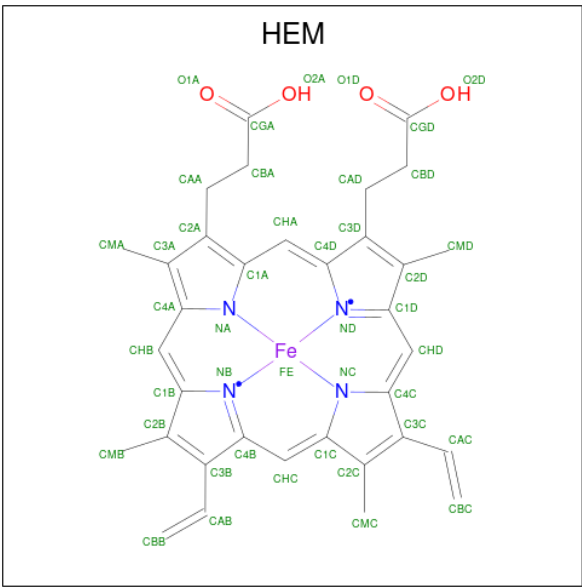
- Molecule 1 is a protein called Catalase-peroxidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	713	Total	C	N	O	S	0	6	0
			5540	3498	988	1040	14			
1	B	713	Total	C	N	O	S	0	10	0
			5560	3513	994	1039	14			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	242	GLN	GLU	engineered mutation	UNP Q3JNW6
B	242	GLN	GLU	engineered mutation	UNP Q3JNW6

- Molecule 2 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: C₃₄H₃₂FeN₄O₄).



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

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

- Molecule 3 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	1	Total	Na		
			1	1	0	0
3	B	1	Total	Na		
			1	1	0	0

- Molecule 4 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

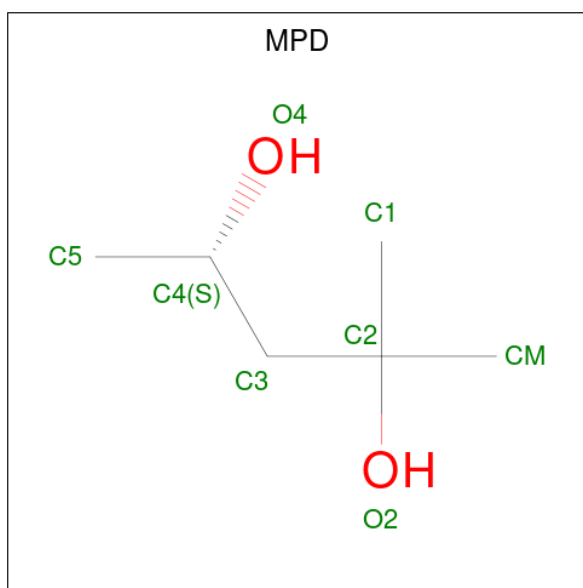
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Cl		
			1	1	0	0
4	B	1	Total	Cl		
			1	1	0	0

- Molecule 5 is OXYGEN MOLECULE (CCD ID: OXY) (formula: O₂).



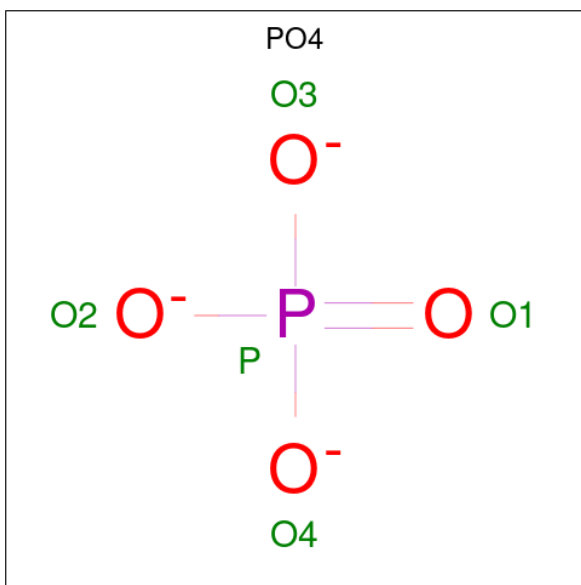
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	O		
			2	2	0	0
5	B	1	Total	O		
			2	2	0	0

- Molecule 6 is (4S)-2-METHYL-2,4-PENTANEDIOL (CCD ID: MPD) (formula: C₆H₁₄O₂).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			8	6	2		
6	A	1	Total	C	O	0	0
			8	6	2		
6	B	1	Total	C	O	0	0
			8	6	2		
6	B	1	Total	C	O	0	0
			8	6	2		
6	B	1	Total	C	O	0	0
			8	6	2		

- Molecule 7 is PHOSPHATE ION (CCD ID: PO4) (formula: O₄P).



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

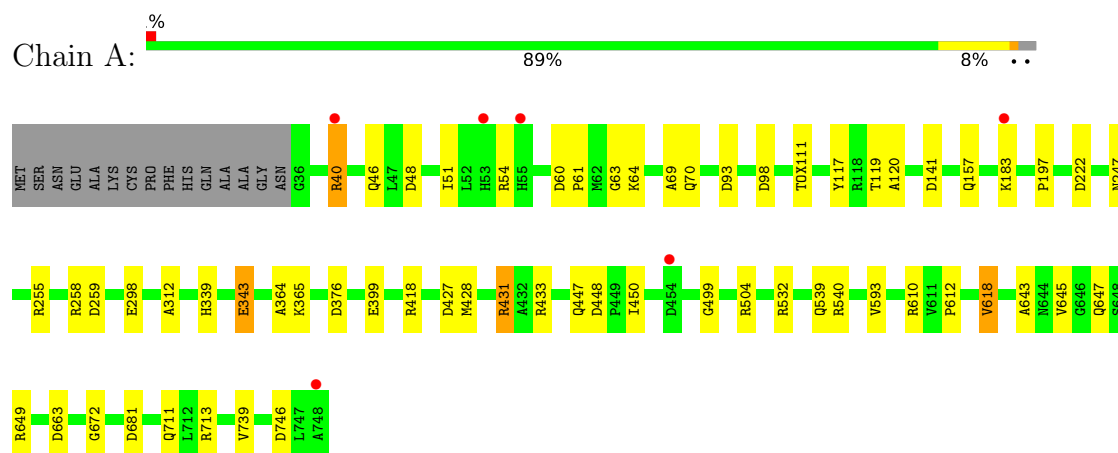
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	774	Total	O	0	0
			774	774		
8	B	733	Total	O	0	0
			733	733		

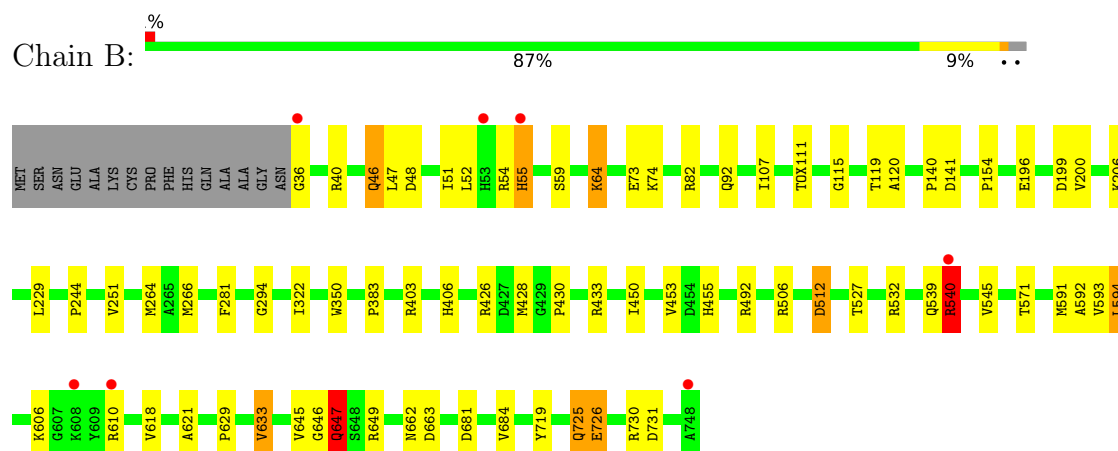
3 Residue-property plots

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: Catalase-peroxidase



• Molecule 1: Catalase-peroxidase



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	101.00Å 113.67Å 174.79Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.65 – 1.80 47.65 – 1.80	Depositor EDS
% Data completeness (in resolution range)	89.1 (47.65-1.80) 89.1 (47.65-1.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.82 (at 1.79Å)	Xtriage
Refinement program	REFMAC 5.8.0151	Depositor
R, R_{free}	0.139 , 0.172 0.152 , 0.181	Depositor DCC
R_{free} test set	8195 reflections (4.40%)	wwPDB-VP
Wilson B-factor (Å ²)	19.3	Xtriage
Anisotropy	0.364	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 38.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	12746	wwPDB-VP
Average B, all atoms (Å ²)	22.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.21% of the height of the origin peak. No significant pseudotranslation is detected.*

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: TOX, HEM, NA, OXY, PO4, CL, MPD

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	1.64	36/5677 (0.6%)	1.29	13/7714 (0.2%)
1	B	1.67	40/5711 (0.7%)	1.29	16/7759 (0.2%)
All	All	1.66	76/11388 (0.7%)	1.29	29/15473 (0.2%)

All (76) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	512	ASP	CG-OD2	10.99	1.46	1.25
1	A	645	VAL	CA-CB	-9.62	1.44	1.54
1	B	54	ARG	CA-C	-9.57	1.40	1.53
1	A	532	ARG	NE-CZ	-8.91	1.23	1.33
1	B	36	GLY	N-CA	8.19	1.58	1.45
1	B	512	ASP	CB-CG	7.65	1.71	1.52
1	B	540	ARG	C-O	7.49	1.32	1.23
1	B	453	VAL	C-O	-7.30	1.16	1.24
1	B	199	ASP	C-O	7.19	1.32	1.24
1	B	645	VAL	CA-CB	-6.86	1.47	1.54
1	B	430	PRO	CA-CB	-6.72	1.44	1.53
1	A	499	GLY	C-O	6.64	1.30	1.23
1	B	281	PHE	C-O	-6.64	1.15	1.23
1	A	197	PRO	CA-C	-6.60	1.44	1.52
1	B	726	GLU	CD-OE1	6.58	1.37	1.25
1	A	739	VAL	C-O	6.52	1.31	1.24
1	A	376	ASP	N-CA	6.52	1.54	1.46
1	A	364	ALA	CA-C	6.49	1.60	1.52
1	B	450	ILE	N-CA	6.41	1.51	1.46
1	A	612	PRO	CA-C	6.41	1.60	1.52
1	B	52	LEU	C-O	6.29	1.32	1.24
1	B	322	ILE	N-CA	-6.25	1.38	1.46
1	A	618	VAL	CA-CB	6.24	1.62	1.54
1	B	455	HIS	N-CA	6.24	1.51	1.45

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	294	GLY	C-O	6.12	1.29	1.23
1	B	647	GLN	CA-C	6.10	1.61	1.53
1	A	399	GLU	C-O	-6.06	1.17	1.24
1	B	592	ALA	CA-C	-6.04	1.44	1.52
1	B	681	ASP	CA-C	6.03	1.59	1.52
1	B	725	GLN	CD-OE1	5.99	1.34	1.23
1	A	681	ASP	CA-C	5.96	1.59	1.52
1	A	672	GLY	C-O	5.94	1.32	1.24
1	A	746	ASP	N-CA	5.86	1.53	1.46
1	B	383	PRO	C-O	5.84	1.30	1.23
1	B	244	PRO	C-O	5.83	1.30	1.23
1	A	448	ASP	C-O	5.82	1.26	1.23
1	B	532	ARG	C-O	-5.79	1.17	1.24
1	A	713	ARG	CA-C	5.77	1.60	1.52
1	A	54	ARG	CA-C	-5.67	1.45	1.53
1	B	92	GLN	CD-NE2	-5.67	1.21	1.33
1	A	711	GLN	CD-NE2	-5.63	1.21	1.33
1	A	63	GLY	N-CA	5.61	1.52	1.45
1	A	222	ASP	CA-C	5.59	1.59	1.53
1	B	200	VAL	N-CA	5.57	1.52	1.46
1	A	120	ALA	N-CA	5.57	1.53	1.46
1	B	82	ARG	CZ-NH2	-5.53	1.26	1.33
1	A	98	ASP	CA-C	-5.51	1.45	1.52
1	A	258	ARG	N-CA	-5.50	1.39	1.46
1	B	107	ILE	N-CA	5.47	1.53	1.46
1	A	298	GLU	C-O	5.46	1.31	1.24
1	A	418	ARG	CZ-NH2	-5.43	1.26	1.33
1	A	40	ARG	C-O	5.43	1.30	1.24
1	A	427	ASP	C-O	5.39	1.31	1.24
1	B	731	ASP	N-CA	-5.39	1.39	1.46
1	A	40	ARG	N-CA	5.36	1.53	1.46
1	A	247	ASN	CG-ND2	-5.36	1.22	1.33
1	B	47	LEU	CA-C	5.32	1.59	1.52
1	A	69	ALA	N-CA	5.31	1.52	1.46
1	B	621	ALA	CA-C	5.30	1.59	1.52
1	B	154	PRO	CA-C	5.29	1.59	1.52
1	B	527	THR	N-CA	-5.25	1.40	1.46
1	A	312	ALA	C-O	5.25	1.30	1.24
1	B	59	SER	N-CA	-5.17	1.39	1.46
1	A	647	GLN	CA-C	5.17	1.60	1.53
1	B	350	TRP	C-O	-5.15	1.17	1.24
1	B	684	VAL	CA-CB	-5.15	1.48	1.54

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	492	ARG	CZ-NH2	5.14	1.40	1.33
1	A	365	LYS	N-CA	5.12	1.52	1.46
1	B	594	LEU	CA-C	5.11	1.59	1.52
1	B	545	VAL	C-O	5.08	1.29	1.24
1	A	61	PRO	N-CA	-5.08	1.40	1.47
1	B	120	ALA	N-CA	5.08	1.52	1.46
1	B	229	LEU	C-O	5.07	1.30	1.23
1	A	60	ASP	C-O	-5.04	1.18	1.24
1	A	259	ASP	CA-C	5.03	1.59	1.52
1	A	157	GLN	N-CA	-5.02	1.40	1.46

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	46	GLN	CB-CG-CD	7.63	125.58	112.60
1	B	571	THR	CA-C-O	7.47	128.43	120.36
1	B	48	ASP	N-CA-C	6.81	119.85	108.20
1	B	571	THR	O-C-N	-6.22	115.90	123.30
1	B	539	GLN	O-C-N	6.21	129.93	122.85
1	B	196	GLU	N-CA-CB	-6.12	103.58	111.35
1	A	532	ARG	NE-CZ-NH2	-5.95	113.84	119.20
1	A	48	ASP	N-CA-C	5.89	118.28	108.20
1	A	431	ARG	NE-CZ-NH2	5.77	124.40	119.20
1	A	539	GLN	O-C-N	5.70	129.34	122.85
1	A	46	GLN	CB-CG-CD	5.67	122.23	112.60
1	B	663	ASP	N-CA-C	5.63	118.15	111.33
1	A	539	GLN	CA-C-N	5.46	130.79	122.65
1	A	539	GLN	C-N-CA	5.46	130.79	122.65
1	B	251	VAL	N-CA-C	5.39	115.60	110.53
1	A	663	ASP	N-CA-C	5.29	117.74	111.33
1	A	643	ALA	N-CA-C	5.24	119.51	113.18
1	B	54	ARG	N-CA-C	-5.22	103.50	110.55
1	A	93	ASP	N-CA-C	5.21	117.70	111.71
1	B	64	LYS	CB-CA-C	-5.19	101.85	110.68
1	A	450	ILE	CB-CA-C	-5.17	104.84	110.37
1	B	539	GLN	CA-C-N	5.08	130.22	122.65
1	B	539	GLN	C-N-CA	5.08	130.22	122.65
1	B	206	LYS	CG-CD-CE	5.08	122.98	111.30
1	A	117	TYR	N-CA-C	5.07	117.39	110.24
1	B	55	HIS	CB-CA-C	5.05	119.22	111.39
1	B	606	LYS	CA-C-O	-5.03	115.08	120.42
1	A	70	GLN	CA-CB-CG	5.02	124.15	114.10

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	196	GLU	N-CA-C	5.02	113.92	108.14

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	5540	0	5358	12	0
1	B	5560	0	5399	33	0
2	A	43	0	30	0	0
2	B	43	0	30	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	2	0	0	0	0
5	B	2	0	0	0	0
6	A	16	0	28	3	0
6	B	24	0	42	12	0
7	B	5	0	0	0	0
8	A	774	0	0	5	0
8	B	733	0	0	10	0
All	All	12746	0	10887	56	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 3.

All (56) 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:506:ARG:HE	6:B:806:MPD:H12	1.30	0.95
1:B:730[A]:ARG:HD2	8:B:1503:HOH:O	1.67	0.93
6:B:808:MPD:H53	6:B:808:MPD:C1	2.06	0.83
1:A:119[B]:THR:HG21	8:A:1104:HOH:O	1.78	0.83

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:119[B]:THR:HG23	8:B:1065:HOH:O	1.81	0.81
6:B:806:MPD:H51	8:B:1285:HOH:O	1.81	0.80
6:B:808:MPD:H53	6:B:808:MPD:H12	1.62	0.80
1:A:119[B]:THR:HG23	1:A:593:VAL:HG11	1.65	0.78
1:A:593:VAL:HG13	8:A:995:HOH:O	1.87	0.74
6:A:806:MPD:O4	6:A:806:MPD:O2	2.04	0.74
1:B:540:ARG:CZ	1:B:540:ARG:HA	2.23	0.68
1:B:55:HIS:HD2	8:B:1209:HOH:O	1.77	0.67
1:B:73:GLU:OE2	8:B:902:HOH:O	2.11	0.67
1:B:540:ARG:HA	1:B:540:ARG:NH1	2.09	0.67
1:A:339:HIS:O	1:A:343[B]:GLU:HG3	1.96	0.66
1:B:512:ASP:OD1	8:B:904:HOH:O	2.15	0.65
6:B:806:MPD:H52	6:B:806:MPD:H11	1.79	0.65
1:B:119[B]:THR:HG22	1:B:593:VAL:HG21	1.80	0.64
1:B:633[A]:VAL:HG22	1:B:719:TYR:CZ	2.33	0.63
1:B:633[A]:VAL:HG22	1:B:719:TYR:CE2	2.32	0.63
6:B:807:MPD:HM2	6:B:807:MPD:H53	1.80	0.62
6:B:806:MPD:H13	8:B:1524:HOH:O	1.99	0.61
6:A:805:MPD:H11	6:A:805:MPD:C5	2.32	0.60
1:B:506:ARG:NE	6:B:806:MPD:H12	2.10	0.58
1:B:629:PRO:O	1:B:633[A]:VAL:HG23	2.04	0.58
1:B:633[A]:VAL:CG2	1:B:719:TYR:CZ	2.87	0.57
1:A:51:ILE:HD11	1:A:618:VAL:HG12	1.87	0.56
6:B:806:MPD:H52	6:B:806:MPD:C1	2.35	0.56
1:B:506:ARG:HE	6:B:806:MPD:C1	2.12	0.55
1:B:55:HIS:CD2	8:B:1209:HOH:O	2.57	0.54
1:B:512:ASP:HB2	8:B:1070:HOH:O	2.07	0.54
1:B:74:LYS:HE2	1:B:74:LYS:HA	1.89	0.54
1:A:540:ARG:HA	1:A:540:ARG:NE	2.25	0.51
1:B:662:ASN:H	1:B:725:GLN:HE22	1.59	0.51
1:B:646:GLY:C	1:B:647:GLN:HG2	2.36	0.50
1:B:426[A]:ARG:NE	8:B:903:HOH:O	2.13	0.49
1:B:647:GLN:H	1:B:647:GLN:HE21	1.60	0.49
1:B:647:GLN:HE21	1:B:647:GLN:N	2.11	0.49
1:A:428:MET:O	1:A:433:ARG:HD3	2.13	0.48
1:B:591:MET:SD	1:B:594:LEU:HD12	2.53	0.48
1:A:504:ARG:HD2	8:A:999:HOH:O	2.14	0.48
6:B:808:MPD:H53	6:B:808:MPD:H11	1.92	0.48
1:A:119[B]:THR:CG2	1:A:593:VAL:HG11	2.40	0.47
1:B:428:MET:O	1:B:433:ARG:HD3	2.15	0.47
1:B:726:GLU:H	1:B:726:GLU:CD	2.23	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
6:A:805:MPD:H11	6:A:805:MPD:H52	1.98	0.45
1:B:51:ILE:HD11	1:B:618:VAL:HG12	1.99	0.45
1:B:140:PRO:HB3	6:B:808:MPD:H4	1.98	0.45
1:B:403[B]:ARG:HH12	1:B:406:HIS:HD2	1.62	0.45
1:B:649[A]:ARG:HA	1:B:649[A]:ARG:HD3	1.64	0.44
1:A:255[A]:ARG:HG3	8:A:1112:HOH:O	2.18	0.43
1:B:115:GLY:O	1:B:264:MET:HE1	2.19	0.41
1:B:426[B]:ARG:HA	1:B:426[B]:ARG:HD2	1.84	0.41
1:A:431:ARG:HD2	1:A:447:GLN:OE1	2.21	0.40
1:A:649:ARG:NH1	8:A:933:HOH:O	2.54	0.40
1:B:266:MET:HE2	1:B:426[A]:ARG:HH11	1.86	0.40

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	715/728 (98%)	703 (98%)	12 (2%)	0	100	100
1	B	719/728 (99%)	712 (99%)	7 (1%)	0	100	100
All	All	1434/1456 (98%)	1415 (99%)	19 (1%)	0	100	100

There are no Ramachandran outliers to report.

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	554/560 (99%)	547 (99%)	7 (1%)	61	54
1	B	558/560 (100%)	549 (98%)	9 (2%)	55	47
All	All	1112/1120 (99%)	1096 (99%)	16 (1%)	61	52

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

Mol	Chain	Res	Type
1	A	40	ARG
1	A	64	LYS
1	A	141	ASP
1	A	183	LYS
1	A	343[A]	GLU
1	A	343[B]	GLU
1	A	610	ARG
1	B	40	ARG
1	B	46	GLN
1	B	64	LYS
1	B	141	ASP
1	B	540	ARG
1	B	610	ARG
1	B	633[A]	VAL
1	B	633[B]	VAL
1	B	647	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	70	GLN
1	A	227	ASN
1	A	647	GLN
1	A	737	ASN
1	A	741	ASN
1	B	55	HIS
1	B	227	ASN
1	B	406	HIS
1	B	647	GLN
1	B	650	HIS
1	B	725	GLN
1	B	741	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

4 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	TOX	B	111[B]	-	14,17,18	1.51	3 (21%)	12,23,25	2.16	4 (33%)
1	TOX	A	111[B]	-	14,17,18	2.45	8 (57%)	12,23,25	3.08	6 (50%)
1	TOX	B	111[A]	2	14,17,18	1.51	3 (21%)	12,23,25	2.16	4 (33%)
1	TOX	A	111[A]	2	14,17,18	2.45	8 (57%)	12,23,25	3.08	6 (50%)

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	TOX	B	111[B]	-	-	2/5/8/10	0/2/2/2
1	TOX	A	111[B]	-	-	2/5/8/10	0/2/2/2
1	TOX	B	111[A]	2	-	2/5/8/10	0/2/2/2
1	TOX	A	111[A]	2	-	2/5/8/10	0/2/2/2

All (22) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	111[A]	TOX	CE2-NE1	-4.16	1.32	1.39
1	A	111[B]	TOX	CE2-NE1	-4.16	1.32	1.39
1	A	111[A]	TOX	O1-NE1	3.50	1.43	1.39
1	A	111[B]	TOX	O1-NE1	3.50	1.43	1.39
1	A	111[A]	TOX	CD2-CG	3.39	1.49	1.44
1	A	111[B]	TOX	CD2-CG	3.39	1.49	1.44

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	111[A]	TOX	O-C	3.29	1.32	1.20
1	A	111[B]	TOX	O-C	3.29	1.32	1.20
1	A	111[A]	TOX	CE3-CD2	-3.15	1.35	1.39
1	A	111[B]	TOX	CE3-CD2	-3.15	1.35	1.39
1	B	111[A]	TOX	O-C	3.09	1.31	1.20
1	B	111[B]	TOX	O-C	3.09	1.31	1.20
1	B	111[A]	TOX	CZ3-CE3	-2.51	1.34	1.38
1	B	111[B]	TOX	CZ3-CE3	-2.51	1.34	1.38
1	B	111[A]	TOX	CD2-CE2	2.29	1.44	1.41
1	B	111[B]	TOX	CD2-CE2	2.29	1.44	1.41
1	A	111[A]	TOX	CD1-CG	2.21	1.41	1.36
1	A	111[B]	TOX	CD1-CG	2.21	1.41	1.36
1	A	111[A]	TOX	CD2-CE2	2.16	1.43	1.41
1	A	111[B]	TOX	CD2-CE2	2.16	1.43	1.41
1	A	111[A]	TOX	CB-CG	-2.02	1.46	1.50
1	A	111[B]	TOX	CB-CG	-2.02	1.46	1.50

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	111[A]	TOX	CZ2-CE2-CD2	-5.65	115.65	121.95
1	A	111[B]	TOX	CZ2-CE2-CD2	-5.65	115.65	121.95
1	B	111[A]	TOX	CH2-CZ3-CE3	4.86	126.24	120.24
1	B	111[B]	TOX	CH2-CZ3-CE3	4.86	126.24	120.24
1	A	111[A]	TOX	CZ3-CH2-CZ2	4.20	125.42	120.24
1	A	111[B]	TOX	CZ3-CH2-CZ2	4.20	125.42	120.24
1	A	111[A]	TOX	CE3-CD2-CE2	3.94	123.78	119.24
1	A	111[B]	TOX	CE3-CD2-CE2	3.94	123.78	119.24
1	A	111[A]	TOX	CZ2-CE2-NE1	3.88	135.54	129.37
1	A	111[B]	TOX	CZ2-CE2-NE1	3.88	135.54	129.37
1	A	111[A]	TOX	CH2-CZ3-CE3	-3.83	115.51	120.24
1	A	111[B]	TOX	CH2-CZ3-CE3	-3.83	115.51	120.24
1	B	111[A]	TOX	CZ2-CE2-NE1	3.39	134.78	129.37
1	B	111[B]	TOX	CZ2-CE2-NE1	3.39	134.78	129.37
1	A	111[A]	TOX	CE2-CD2-CG	-3.06	104.57	107.39
1	A	111[B]	TOX	CE2-CD2-CG	-3.06	104.57	107.39
1	B	111[A]	TOX	CZ3-CH2-CZ2	-2.33	117.37	120.24
1	B	111[B]	TOX	CZ3-CH2-CZ2	-2.33	117.37	120.24
1	B	111[A]	TOX	CB-CG-CD2	2.29	131.09	126.70
1	B	111[B]	TOX	CB-CG-CD2	2.29	131.09	126.70

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	111[A]	TOX	N-CA-CB-CG
1	A	111[A]	TOX	C-CA-CB-CG
1	A	111[B]	TOX	N-CA-CB-CG
1	A	111[B]	TOX	C-CA-CB-CG
1	B	111[A]	TOX	N-CA-CB-CG
1	B	111[A]	TOX	C-CA-CB-CG
1	B	111[B]	TOX	N-CA-CB-CG
1	B	111[B]	TOX	C-CA-CB-CG

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 14 ligands modelled in this entry, 4 are monoatomic - leaving 10 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
6	MPD	A	806	-	7,7,7	0.87	0	9,10,10	0.78	0
7	PO4	B	805	-	4,4,4	0.81	0	6,6,6	2.96	2 (33%)
2	HEM	A	801	1	50,50,50	2.35	12 (24%)	67,82,82	1.86	20 (29%)
2	HEM	B	801	1	50,50,50	1.78	8 (16%)	67,82,82	1.41	9 (13%)
5	OXY	A	804	-	1,1,1	0.21	0	-	-	-
6	MPD	B	807	-	7,7,7	0.73	0	9,10,10	2.07	2 (22%)
6	MPD	B	808	-	7,7,7	1.05	0	9,10,10	1.60	4 (44%)
6	MPD	A	805	-	7,7,7	0.99	0	9,10,10	1.11	1 (11%)
6	MPD	B	806	-	7,7,7	1.12	0	9,10,10	1.39	2 (22%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	OXY	B	804	-	1,1,1	0.83	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	MPD	A	806	-	-	3/5/5/5	-
2	HEM	A	801	1	-	2/14/54/54	-
2	HEM	B	801	1	-	3/14/54/54	-
6	MPD	B	807	-	-	2/5/5/5	-
6	MPD	B	808	-	-	3/5/5/5	-
6	MPD	A	805	-	-	4/5/5/5	-
6	MPD	B	806	-	-	3/5/5/5	-

All (20) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	801	HEM	C4D-ND	-8.20	1.26	1.40
2	A	801	HEM	C1B-NB	-7.35	1.27	1.40
2	B	801	HEM	C1B-NB	-5.75	1.30	1.40
2	A	801	HEM	C1C-NC	-4.38	1.31	1.39
2	A	801	HEM	C4A-NA	-4.29	1.31	1.39
2	B	801	HEM	C4A-NA	-4.29	1.31	1.39
2	B	801	HEM	C4C-NC	4.03	1.47	1.39
2	A	801	HEM	FE-NB	3.80	2.06	1.94
2	A	801	HEM	C1A-NA	3.73	1.46	1.39
2	B	801	HEM	FE-NB	3.59	2.06	1.94
2	B	801	HEM	C1C-NC	-3.51	1.33	1.39
2	A	801	HEM	CHC-C1C	3.19	1.44	1.38
2	A	801	HEM	CBA-CGA	3.16	1.57	1.50
2	B	801	HEM	CMA-C3A	2.96	1.56	1.50
2	B	801	HEM	C4D-ND	-2.82	1.35	1.40
2	A	801	HEM	C4C-NC	2.72	1.44	1.39
2	A	801	HEM	O1A-CGA	2.71	1.31	1.22
2	B	801	HEM	FE-NA	2.58	2.03	1.95
2	A	801	HEM	FE-NC	2.50	2.03	1.95
2	A	801	HEM	O1D-CGD	2.46	1.30	1.22

All (40) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	801	HEM	C3C-C2C-C1C	-5.26	102.07	107.05
7	B	805	PO4	O2-P-O1	-5.14	92.77	110.95
6	B	807	MPD	O4-C4-C5	-5.03	87.81	109.45
7	B	805	PO4	O3-P-O2	4.91	123.20	107.91
2	B	801	HEM	C4B-C3B-C2B	-4.59	103.06	107.28
2	A	801	HEM	C4B-C3B-C2B	-3.96	103.64	107.28
2	A	801	HEM	O2A-CGA-CBA	3.62	125.45	114.00
2	B	801	HEM	C2A-C1A-NA	-3.53	106.23	110.15
2	A	801	HEM	C2C-C1C-NC	3.51	116.13	109.64
2	B	801	HEM	C3B-C4B-NB	3.51	111.99	109.47
2	A	801	HEM	CAA-CBA-CGA	-3.30	104.91	113.67
2	A	801	HEM	C3D-C4D-ND	3.14	113.62	110.17
6	B	807	MPD	C5-C4-C3	2.87	125.02	111.67
2	A	801	HEM	C3A-C4A-NA	2.74	114.54	110.14
2	B	801	HEM	O2D-CGD-CBD	2.71	122.57	114.00
2	A	801	HEM	O1A-CGA-CBA	-2.70	114.53	123.09
2	B	801	HEM	O1D-CGD-CBD	-2.69	114.57	123.09
6	B	808	MPD	O2-C2-C3	-2.56	99.68	109.27
2	A	801	HEM	C4A-C3A-C2A	-2.56	103.89	106.82
2	A	801	HEM	CHD-C1D-ND	2.55	127.16	124.42
2	A	801	HEM	CAA-C2A-C3A	-2.48	121.51	127.07
2	A	801	HEM	C2A-C1A-NA	-2.44	107.44	110.15
2	A	801	HEM	CHC-C1C-C2C	-2.41	120.47	125.49
2	A	801	HEM	CHC-C1C-NC	-2.40	121.84	124.45
6	B	806	MPD	CM-C2-C1	-2.38	105.31	110.63
6	B	808	MPD	CM-C2-C1	2.38	115.94	110.63
6	A	805	MPD	C5-C4-C3	2.36	122.64	111.67
6	B	806	MPD	C1-C2-C3	2.27	119.99	110.20
2	A	801	HEM	C4C-C3C-C2C	2.26	108.77	106.81
2	A	801	HEM	C1D-C2D-C3D	-2.20	104.67	106.98
2	A	801	HEM	CHB-C1B-NB	2.17	127.05	124.37
2	A	801	HEM	CHA-C4D-C3D	-2.17	121.23	125.23
2	B	801	HEM	CAA-CBA-CGA	-2.17	107.92	113.67
2	A	801	HEM	CMC-C2C-C3C	2.16	133.65	128.43
6	B	808	MPD	C1-C2-C3	2.15	119.48	110.20
2	A	801	HEM	CAA-C2A-C1A	2.12	129.07	124.94
2	B	801	HEM	CHA-C1A-NA	2.11	127.69	123.86
6	B	808	MPD	O2-C2-CM	-2.01	101.73	107.99
2	B	801	HEM	C2B-C1B-NB	2.00	112.14	109.84
2	B	801	HEM	CAC-C3C-C4C	-2.00	120.04	124.82

There are no chirality outliers.

All (20) torsion outliers are listed below:

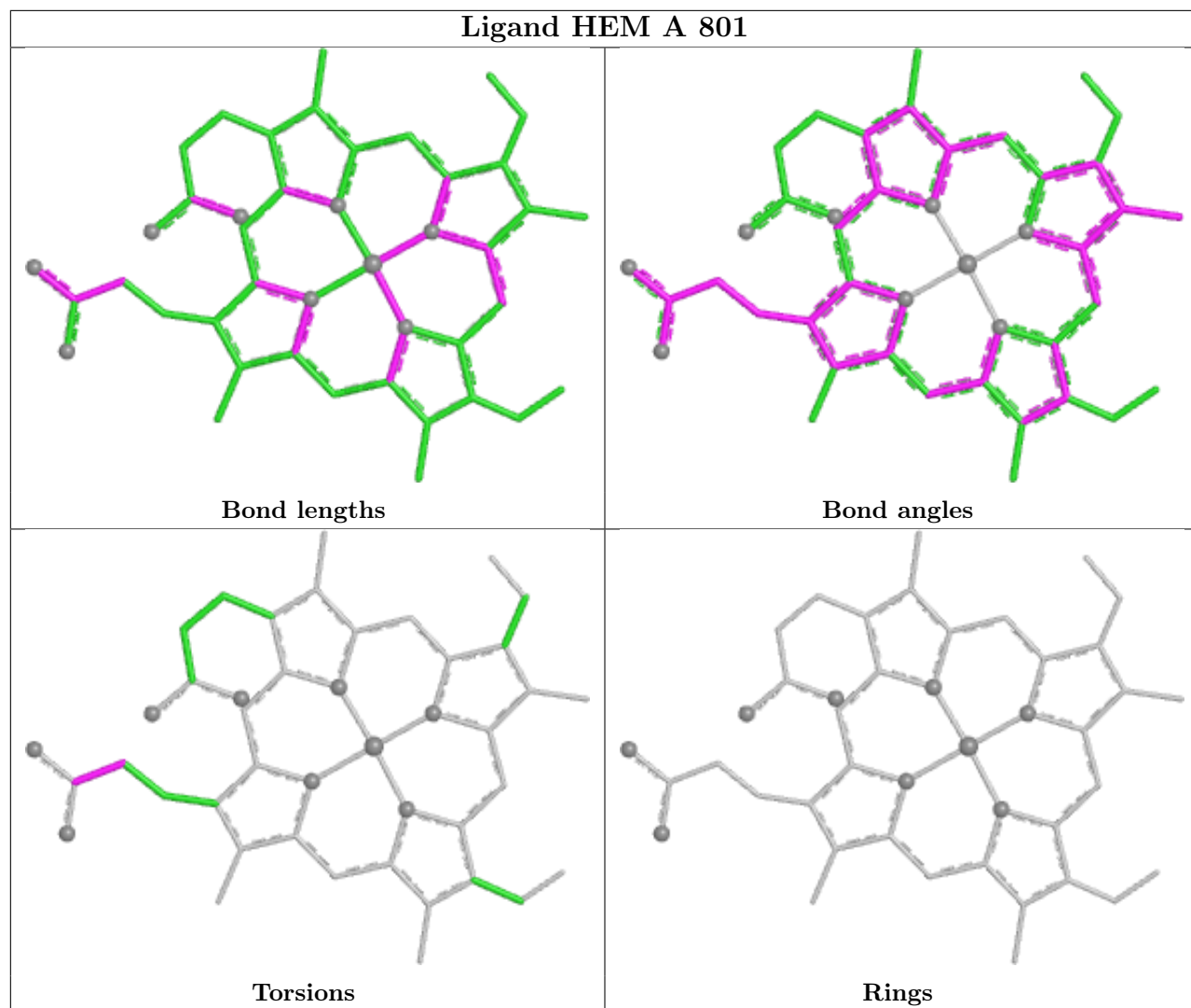
Mol	Chain	Res	Type	Atoms
6	A	805	MPD	C2-C3-C4-C5
6	B	806	MPD	C1-C2-C3-C4
6	B	806	MPD	O2-C2-C3-C4
6	B	807	MPD	C2-C3-C4-C5
6	B	808	MPD	C2-C3-C4-C5
6	A	805	MPD	O2-C2-C3-C4
6	A	805	MPD	C2-C3-C4-O4
6	A	806	MPD	C1-C2-C3-C4
6	A	806	MPD	CM-C2-C3-C4
6	B	808	MPD	CM-C2-C3-C4
2	A	801	HEM	CAA-CBA-CGA-O2A
2	B	801	HEM	CAA-CBA-CGA-O2A
2	B	801	HEM	CAA-CBA-CGA-O1A
2	A	801	HEM	CAA-CBA-CGA-O1A
6	A	806	MPD	O2-C2-C3-C4
6	B	807	MPD	O2-C2-C3-C4
6	A	805	MPD	CM-C2-C3-C4
6	B	806	MPD	CM-C2-C3-C4
6	B	808	MPD	C1-C2-C3-C4
2	B	801	HEM	CAD-CBD-CGD-O2D

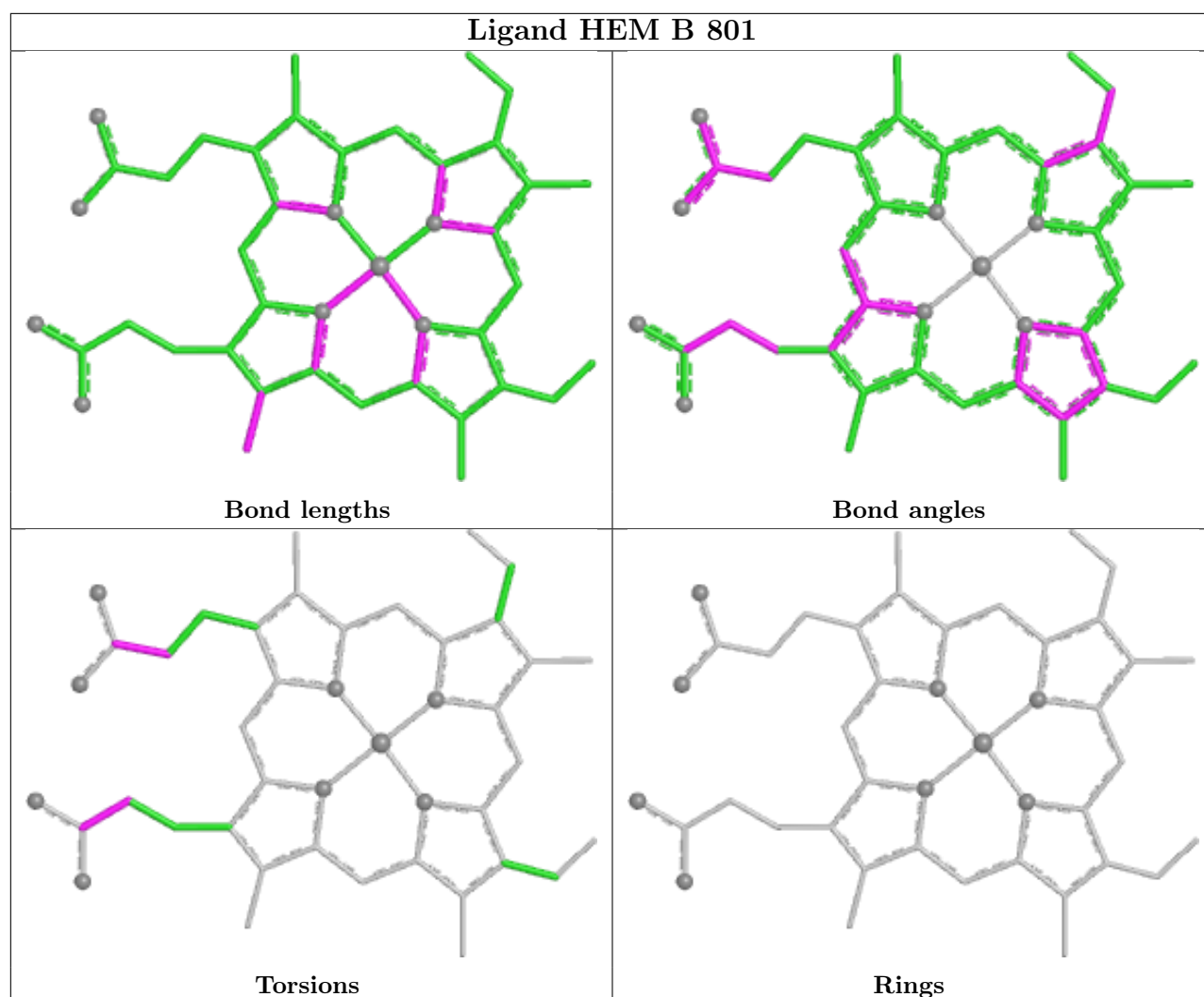
There are no ring outliers.

5 monomers are involved in 15 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	A	806	MPD	1	0
6	B	807	MPD	1	0
6	B	808	MPD	4	0
6	A	805	MPD	2	0
6	B	806	MPD	7	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	712/728 (97%)	-0.46	6 (0%) 82 83	10, 19, 37, 79	5 (0%)
1	B	712/728 (97%)	-0.47	7 (0%) 79 80	10, 19, 36, 83	9 (1%)
All	All	1424/1456 (97%)	-0.46	13 (0%) 81 81	10, 19, 37, 83	14 (0%)

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	748	ALA	5.4
1	B	748	ALA	5.0
1	A	53	HIS	2.6
1	A	183	LYS	2.4
1	B	610	ARG	2.3
1	A	55	HIS	2.3
1	A	454	ASP	2.3
1	B	53	HIS	2.2
1	A	40	ARG	2.2
1	B	55	HIS	2.1
1	B	36	GLY	2.1
1	B	608	LYS	2.1
1	B	540	ARG	2.0

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

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
1	TOX	A	111[A]	16/17	0.98	0.04	13,13,17,19	2

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
1	TOX	A	111[B]	16/17	0.98	0.04	13,13,15,19	2
1	TOX	B	111[A]	16/17	0.98	0.04	12,14,19,21	2
1	TOX	B	111[B]	16/17	0.98	0.04	12,14,17,21	2

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

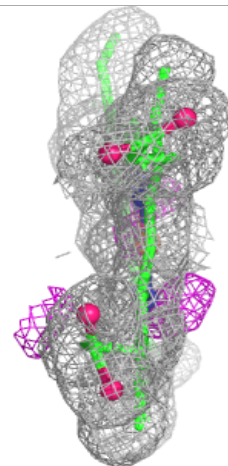
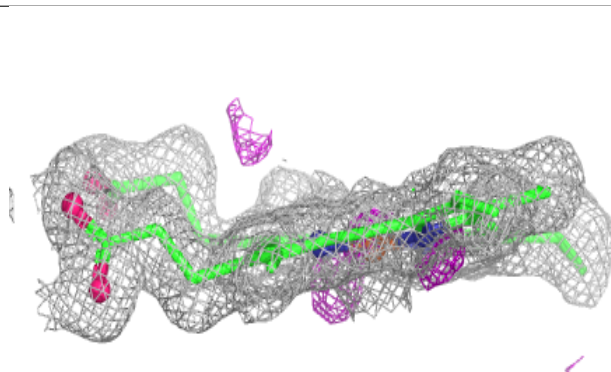
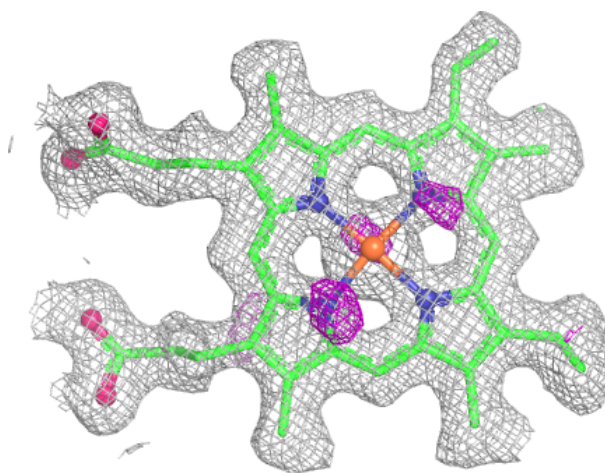
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
6	MPD	B	808	8/8	0.84	0.19	44,56,66,73	0
6	MPD	B	806	8/8	0.89	0.14	38,46,47,47	0
6	MPD	A	806	8/8	0.90	0.20	55,66,73,75	0
6	MPD	B	807	8/8	0.91	0.12	27,35,43,48	0
5	OXY	B	804	2/2	0.91	0.19	28,28,28,36	0
5	OXY	A	804	2/2	0.92	0.17	33,33,33,34	0
6	MPD	A	805	8/8	0.93	0.13	35,40,49,51	0
7	PO4	B	805	5/5	0.95	0.08	37,50,51,53	0
4	CL	A	803	1/1	0.97	0.07	33,33,33,33	0
4	CL	B	803	1/1	0.98	0.06	32,32,32,32	0
2	HEM	A	801	43/43	0.99	0.05	12,14,15,17	0
2	HEM	B	801	43/43	0.99	0.05	13,15,17,18	0
3	NA	A	802	1/1	1.00	0.03	16,16,16,16	0
3	NA	B	802	1/1	1.00	0.03	15,15,15,15	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.

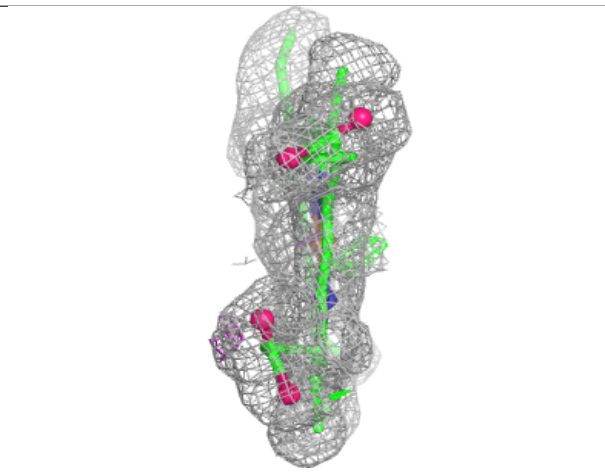
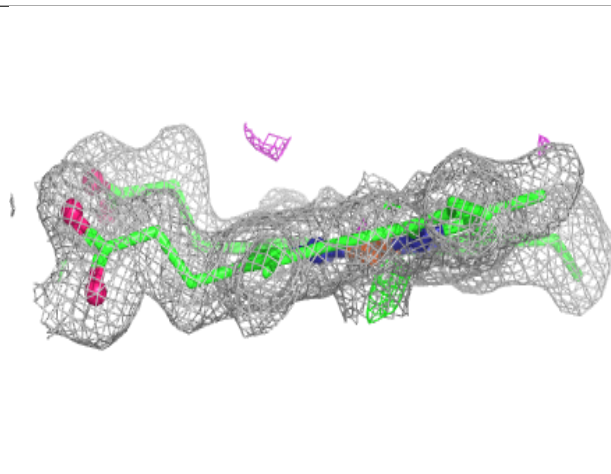
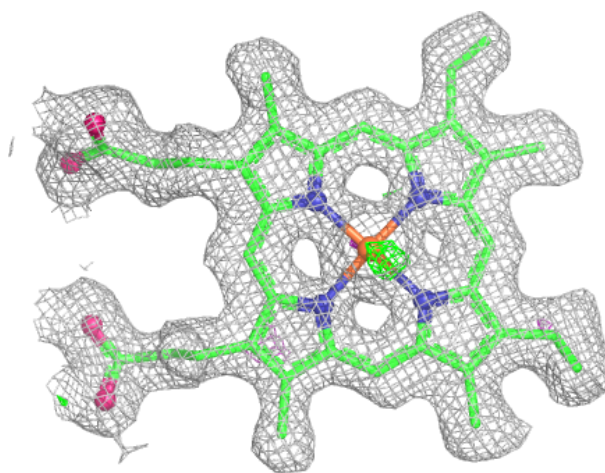
Electron density around HEM A 801:

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



Electron density around HEM B 801:

$2mF_o-DF_c$ (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.