



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 11, 2021 – 04:28 AM EDT

PDB ID : 2QPE
Title : An unexpected outcome of surface-engineering an integral membrane protein: Improved crystallization of cytochrome ba3 oxidase from *Thermus thermophilus*
Authors : Liu, B.; Luna, V.M.; Chen, Y.; Stout, C.D.; Fee, J.A.
Deposited on : 2007-07-23
Resolution : 2.90 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.23.2
buster-report : 1.1.7 (2018)
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.23.2

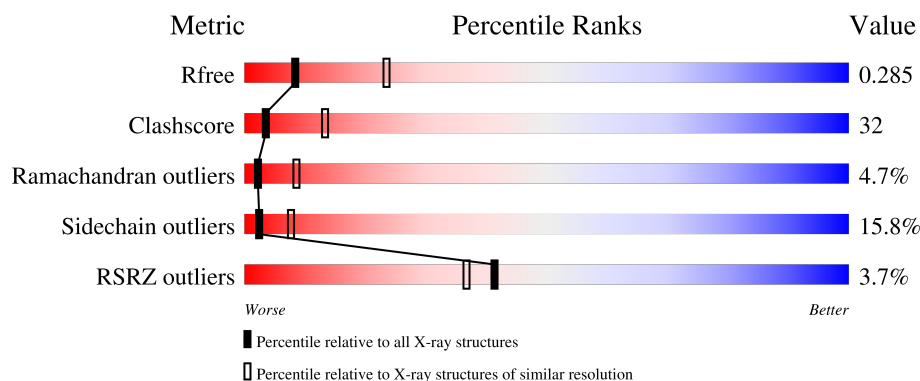
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


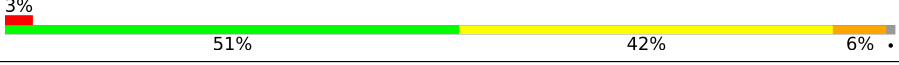

The reported resolution of this entry is 2.90 Å.

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}	130704	1957 (2.90-2.90)
Clashscore	141614	2172 (2.90-2.90)
Ramachandran outliers	138981	2115 (2.90-2.90)
Sidechain outliers	138945	2117 (2.90-2.90)
RSRZ outliers	127900	1906 (2.90-2.90)

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	568	
2	B	168	
3	C	34	

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 6077 atoms, of which 0 are hydrogens and 0 are deuteriums.

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

- Molecule 1 is a protein called Cytochrome c oxidase subunit 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	557	4409	2985	709	699	16	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	MET	-	expression tag	UNP Q5SJ79
A	-4	HIS	-	expression tag	UNP Q5SJ79
A	-3	HIS	-	expression tag	UNP Q5SJ79
A	-2	HIS	-	expression tag	UNP Q5SJ79
A	-1	HIS	-	expression tag	UNP Q5SJ79
A	0	HIS	-	expression tag	UNP Q5SJ79
A	1	HIS	-	expression tag	UNP Q5SJ79
A	258	ARG	LYS	engineered mutation	UNP Q5SJ79

- Molecule 2 is a protein called Cytochrome c oxidase subunit 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	166	1298	844	217	233	4	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	4	GLN	GLU	engineered mutation	UNP Q5SJ80

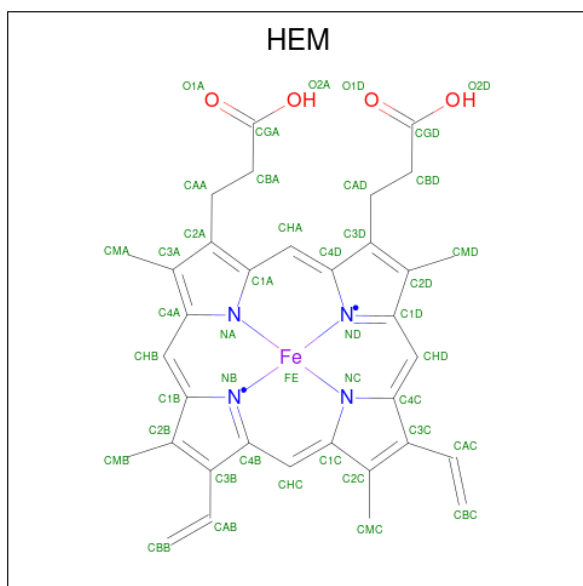
- Molecule 3 is a protein called Cytochrome c oxidase polypeptide 2A.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
3	C	33	259	179	39	41	0	0	0

- Molecule 4 is COPPER (I) ION (three-letter code: CU1) (formula: Cu).

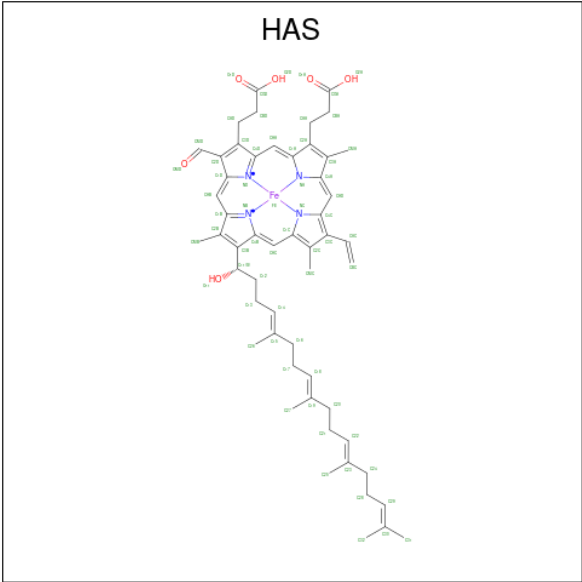
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Cu	0	0
			1	1		

- Molecule 5 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



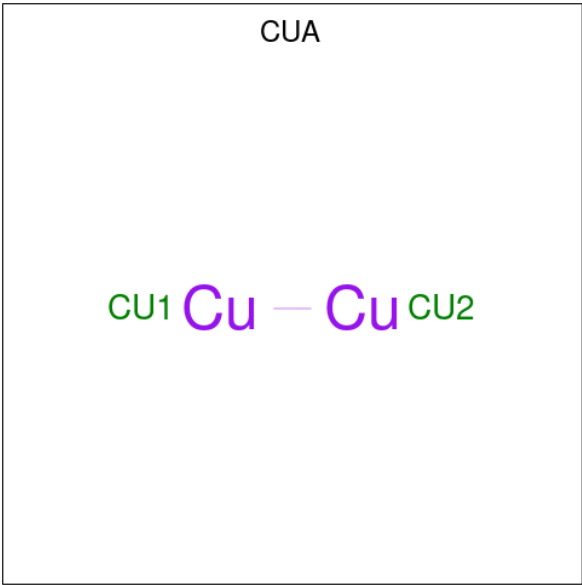
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	Fe	N	O	0	0
			43	34	1	4	4		

- Molecule 6 is HEME-AS (three-letter code: HAS) (formula: $C_{54}H_{64}FeN_4O_6$).

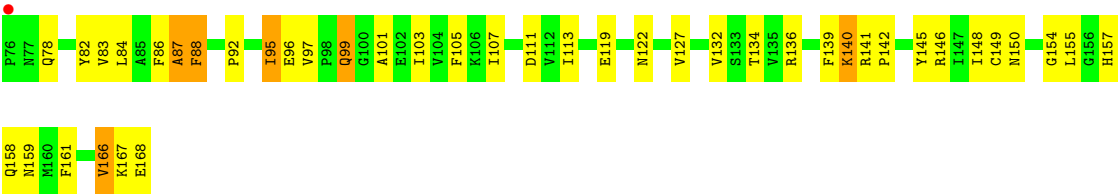


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	A	1	Total	C	Fe	N	O	0	0
			65	54	1	4	6		

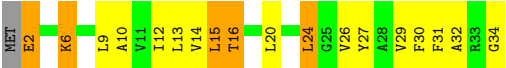
- Molecule 7 is DINUCLEAR COPPER ION (three-letter code: CUA) (formula: Cu₂).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Cu		
7	B	1	2	2	0	0



• Molecule 3: Cytochrome c oxidase polypeptide 2A



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	114.64Å 114.64Å 148.57Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	19.99 – 2.90 19.99 – 2.90	Depositor EDS
% Data completeness (in resolution range)	95.1 (19.99-2.90) 95.1 (19.99-2.90)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.33 (at 2.88Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.234 , 0.302 0.196 , 0.285	Depositor DCC
R_{free} test set	1083 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	93.1	Xtriage
Anisotropy	0.073	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 78.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	6077	wwPDB-VP
Average B, all atoms (Å ²)	92.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.84% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: CUA, HEM, HAS, CU1

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	0.95	2/4566 (0.0%)	1.05	13/6266 (0.2%)
2	B	0.92	1/1335 (0.1%)	1.03	1/1822 (0.1%)
3	C	1.08	0/265	1.03	0/359
All	All	0.95	3/6166 (0.0%)	1.04	14/8447 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
2	B	0	1
All	All	0	2

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	170	TRP	CB-CG	5.94	1.60	1.50
2	B	16	LYS	CE-NZ	5.44	1.62	1.49
1	A	203	GLU	CB-CG	5.21	1.62	1.52

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	25	LEU	CB-CG-CD1	-10.17	93.71	111.00
1	A	493	LEU	CA-CB-CG	6.52	130.29	115.30
1	A	215	LEU	CA-CB-CG	6.22	129.61	115.30
2	B	37	LEU	CA-CB-CG	5.96	129.01	115.30
1	A	520	LEU	CA-CB-CG	5.76	128.54	115.30

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	25	LEU	CA-CB-CG	5.74	128.49	115.30
1	A	75	LEU	CA-CB-CG	5.67	128.34	115.30
1	A	354	LEU	CB-CG-CD1	5.34	120.07	111.00
1	A	192	MET	CG-SD-CE	5.31	108.70	100.20
1	A	218	GLY	N-CA-C	5.21	126.12	113.10
1	A	371	LEU	CB-CG-CD2	-5.20	102.16	111.00
1	A	472	LEU	CB-CG-CD1	-5.17	102.21	111.00
1	A	58	LEU	CB-CG-CD1	5.15	119.76	111.00
1	A	122	LEU	CA-CB-CG	5.12	127.08	115.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	8	ILE	Peptide
2	B	87	ALA	Peptide

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	4409	0	4515	339	0
2	B	1298	0	1282	61	0
3	C	259	0	279	11	0
4	A	1	0	0	0	0
5	A	43	0	30	7	0
6	A	65	0	61	15	0
7	B	2	0	0	0	0
All	All	6077	0	6167	392	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 32.

All (392) 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:233:HIS:NE2	1:A:237:TYR:CE2	1.71	1.53
1:A:233:HIS:NE2	1:A:237:TYR:HE2	0.79	1.27
1:A:385:PHE:CB	6:A:801:HAS:HMA2	1.73	1.18
1:A:385:PHE:CG	6:A:801:HAS:HMA2	1.81	1.16
1:A:410:GLY:CA	1:A:502:ALA:HB2	1.74	1.16
1:A:182:VAL:HG21	1:A:508:PHE:HE2	1.08	1.12
1:A:518:ARG:HH21	1:A:518:ARG:HG3	1.08	1.11
1:A:7:GLU:HB3	1:A:10:ARG:HA	1.30	1.08
1:A:182:VAL:HG21	1:A:508:PHE:CE2	1.91	1.04
1:A:410:GLY:HA2	1:A:502:ALA:CB	1.90	1.01
2:B:142:PRO:HA	2:B:166:VAL:CG2	1.90	1.00
2:B:142:PRO:HA	2:B:166:VAL:HG22	1.48	0.95
1:A:506:LEU:H	1:A:506:LEU:HD23	1.32	0.94
1:A:385:PHE:HB2	6:A:801:HAS:CMA	1.98	0.93
1:A:410:GLY:HA2	1:A:502:ALA:HB2	0.94	0.93
1:A:430:LEU:O	1:A:434:ILE:HG13	1.70	0.91
1:A:562:TRP:HA	2:B:155:LEU:HD12	1.52	0.91
1:A:518:ARG:HG3	1:A:518:ARG:NH2	1.79	0.91
1:A:497:ARG:C	1:A:499:PRO:HD3	1.91	0.90
1:A:76:ASN:HB3	5:A:800:HEM:HBC2	1.53	0.89
1:A:233:HIS:CD2	1:A:237:TYR:CE2	2.61	0.89
1:A:233:HIS:CD2	1:A:237:TYR:HE2	1.91	0.88
1:A:385:PHE:HB2	6:A:801:HAS:HMA2	1.52	0.88
1:A:412:PRO:HB3	1:A:501:LEU:HD21	1.56	0.87
1:A:233:HIS:CE1	1:A:237:TYR:HE2	1.91	0.87
1:A:385:PHE:CB	6:A:801:HAS:CMA	2.53	0.87
1:A:12:TYR:CD1	1:A:19:LYS:HB2	2.10	0.86
1:A:449:ARG:HD2	1:A:450:ARG:HG3	1.58	0.85
1:A:45:ASN:ND2	1:A:65:TYR:CE1	2.47	0.83
1:A:385:PHE:CG	6:A:801:HAS:CMA	2.61	0.83
1:A:7:GLU:CB	1:A:10:ARG:HA	2.11	0.81
1:A:329:GLY:HA2	1:A:330:ARG:HE	1.43	0.81
1:A:374:VAL:HG12	1:A:375:VAL:HG13	1.63	0.80
1:A:454:ALA:O	1:A:457:PRO:HG3	1.80	0.80
1:A:277:THR:H	1:A:278:PRO:HD2	1.46	0.80
1:A:233:HIS:CE1	1:A:282:HIS:HE1	2.01	0.79
1:A:277:THR:N	1:A:278:PRO:HD2	1.98	0.78
1:A:321:GLU:HA	1:A:335:TRP:CE3	2.19	0.78
1:A:385:PHE:CD2	6:A:801:HAS:HMA2	2.19	0.78
1:A:162:ILE:O	1:A:165:ASP:HB3	1.84	0.77
1:A:307:VAL:HA	1:A:310:LEU:HD12	1.65	0.77
1:A:124:LEU:HD21	1:A:145:PHE:HD1	1.46	0.76

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:410:GLY:CA	1:A:502:ALA:CB	2.60	0.74
1:A:547:VAL:HG12	1:A:548:GLN:N	2.02	0.74
2:B:92:PRO:HD2	2:B:95:ILE:HD11	1.68	0.74
1:A:108:LEU:O	1:A:112:MET:HG3	1.87	0.74
1:A:124:LEU:HD21	1:A:145:PHE:CD1	2.21	0.74
1:A:518:ARG:HH21	1:A:518:ARG:CG	1.95	0.73
1:A:549:LEU:O	1:A:553:LEU:HD23	1.88	0.73
2:B:103:ILE:HD13	2:B:139:PHE:HD1	1.54	0.73
1:A:497:ARG:O	1:A:499:PRO:HD3	1.89	0.73
1:A:63:GLN:CG	1:A:127:ASN:HD22	2.02	0.73
1:A:10:ARG:O	1:A:12:TYR:N	2.22	0.72
1:A:233:HIS:HB3	1:A:234:PRO:CD	2.20	0.72
1:A:52:TYR:O	1:A:56:LYS:HB2	1.90	0.72
1:A:370:THR:HA	1:A:373:TYR:CE1	2.25	0.72
1:A:160:ILE:HD13	1:A:194:PHE:HB2	1.72	0.71
1:A:407:ASN:HD21	1:A:506:LEU:CD2	2.03	0.71
1:A:152:PHE:C	1:A:152:PHE:CD2	2.62	0.71
1:A:107:TRP:O	1:A:111:TRP:HD1	1.73	0.71
1:A:365:VAL:HG12	1:A:366:ASN:N	2.05	0.71
1:A:390:ALA:O	1:A:394:THR:HB	1.91	0.71
1:A:282:HIS:CD2	1:A:283:HIS:CD2	2.78	0.70
1:A:152:PHE:C	1:A:152:PHE:HD2	1.95	0.70
1:A:331:GLY:H	1:A:334:GLY:HA3	1.57	0.70
1:A:407:ASN:HD21	1:A:506:LEU:HD23	1.56	0.70
1:A:455:GLN:C	1:A:457:PRO:HD3	2.11	0.70
1:A:459:ALA:C	1:A:461:PRO:HD2	2.12	0.70
1:A:277:THR:N	1:A:278:PRO:CD	2.55	0.70
1:A:272:PHE:CZ	1:A:308:PRO:HB2	2.27	0.69
1:A:277:THR:H	1:A:278:PRO:CD	2.05	0.69
1:A:7:GLU:HB3	1:A:10:ARG:CA	2.15	0.69
1:A:220:ASP:OD2	2:B:52:ARG:NH1	2.26	0.69
1:A:76:ASN:HB3	5:A:800:HEM:CBC	2.21	0.69
1:A:27:LEU:HD23	1:A:83:LEU:CD2	2.23	0.68
1:A:233:HIS:CE1	1:A:282:HIS:CE1	2.80	0.68
1:A:329:GLY:HA2	1:A:330:ARG:NE	2.09	0.68
2:B:97:VAL:O	2:B:166:VAL:HA	1.93	0.68
1:A:27:LEU:HD23	1:A:83:LEU:HD22	1.74	0.68
1:A:294:TRP:CZ2	1:A:544:PRO:HG2	2.28	0.68
1:A:321:GLU:OE1	1:A:325:ARG:NH2	2.26	0.67
2:B:55:PRO:O	2:B:58:VAL:HG12	1.94	0.67
1:A:499:PRO:HB3	1:A:502:ALA:HB3	1.75	0.66

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:14:ALA:O	1:A:100:ARG:NH1	2.29	0.66
1:A:388:GLN:HB3	6:A:801:HAS:HMC3	1.76	0.66
1:A:294:TRP:HZ2	1:A:544:PRO:HG2	1.60	0.65
1:A:234:PRO:HG3	1:A:277:THR:HA	1.79	0.65
1:A:97:LEU:HD21	1:A:180:PRO:HG2	1.78	0.65
1:A:152:PHE:CD2	1:A:152:PHE:O	2.50	0.65
2:B:86:PHE:O	2:B:88:PHE:N	2.28	0.65
1:A:63:GLN:HG3	1:A:127:ASN:HD22	1.60	0.65
1:A:45:ASN:ND2	1:A:65:TYR:HE1	1.96	0.64
1:A:156:THR:O	1:A:160:ILE:HG13	1.98	0.64
1:A:330:ARG:HD2	1:A:330:ARG:N	2.12	0.64
1:A:332:LEU:HD23	1:A:333:PHE:CE2	2.33	0.64
1:A:59:LEU:HB2	1:A:61:PHE:HE1	1.62	0.64
1:A:414:SER:OG	1:A:417:GLN:HG3	1.97	0.63
1:A:506:LEU:H	1:A:506:LEU:CD2	2.02	0.63
1:A:435:MET:HG2	1:A:439:LEU:HD22	1.79	0.63
1:A:330:ARG:N	1:A:330:ARG:CD	2.61	0.63
1:A:107:TRP:O	1:A:111:TRP:CD1	2.52	0.62
1:A:213:PHE:HB3	1:A:215:LEU:HD22	1.80	0.62
1:A:120:ALA:O	1:A:123:PRO:HD2	2.00	0.62
1:A:342:ASP:HB2	1:A:418:ARG:HH22	1.64	0.62
1:A:28:GLY:O	1:A:31:ALA:HB3	1.99	0.62
1:A:233:HIS:ND1	1:A:282:HIS:HE1	1.94	0.61
1:A:78:ILE:HG22	1:A:79:VAL:N	2.14	0.61
1:A:233:HIS:CD2	1:A:237:TYR:CD2	2.89	0.61
1:A:366:ASN:HB3	6:A:801:HAS:CMD	2.31	0.61
1:A:366:ASN:HB3	6:A:801:HAS:HMD	1.81	0.61
1:A:477:LEU:HA	1:A:480:ALA:HB3	1.83	0.61
1:A:385:PHE:O	1:A:389:VAL:HG12	2.01	0.61
2:B:142:PRO:HA	2:B:166:VAL:HG21	1.81	0.60
1:A:477:LEU:HD13	5:A:800:HEM:HMB1	1.83	0.60
2:B:83:VAL:HG12	2:B:84:LEU:N	2.17	0.60
1:A:233:HIS:CD2	1:A:233:HIS:C	2.74	0.60
1:A:335:TRP:O	1:A:339:LEU:HD22	2.02	0.60
1:A:370:THR:HA	1:A:373:TYR:CD1	2.36	0.60
1:A:56:LYS:O	1:A:60:PRO:HA	2.01	0.60
1:A:539:VAL:O	1:A:543:GLY:HA3	2.03	0.59
1:A:102:ASN:OD1	1:A:102:ASN:O	2.21	0.59
1:A:307:VAL:HA	1:A:310:LEU:CD1	2.32	0.59
1:A:385:PHE:HB2	6:A:801:HAS:HMA1	1.84	0.59
1:A:50:ASP:O	1:A:53:PRO:HD2	2.03	0.58

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:388:GLN:N	1:A:388:GLN:HE21	2.00	0.58
1:A:52:TYR:N	1:A:53:PRO:HD2	2.19	0.58
1:A:342:ASP:O	1:A:418:ARG:NH2	2.36	0.58
2:B:92:PRO:HD2	2:B:95:ILE:CD1	2.32	0.58
1:A:233:HIS:HB3	1:A:234:PRO:HD2	1.84	0.58
1:A:547:VAL:CG1	1:A:548:GLN:N	2.67	0.58
1:A:137:PRO:HG2	1:A:224:ALA:CB	2.34	0.58
1:A:137:PRO:CG	1:A:224:ALA:HB1	2.33	0.58
1:A:59:LEU:HB2	1:A:61:PHE:CE1	2.37	0.58
1:A:420:LEU:HD12	1:A:424:VAL:HG23	1.84	0.58
1:A:186:ALA:O	1:A:190:TRP:HD1	1.86	0.57
1:A:186:ALA:O	1:A:190:TRP:CD1	2.57	0.57
1:A:400:SER:O	1:A:404:LEU:HB2	2.04	0.57
1:A:523:ALA:O	1:A:526:ARG:HG3	2.03	0.57
1:A:310:LEU:O	1:A:313:ALA:HB3	2.04	0.57
1:A:137:PRO:HG2	1:A:224:ALA:HB1	1.85	0.57
1:A:562:TRP:CA	2:B:155:LEU:HD12	2.30	0.57
1:A:98:ASN:ND2	1:A:98:ASN:O	2.38	0.57
1:A:446:ASN:OD1	2:B:119:GLU:HG3	2.04	0.57
1:A:146:TYR:CD2	1:A:208:LEU:HD13	2.41	0.56
1:A:211:TRP:HZ2	1:A:558:GLY:HA3	1.70	0.56
2:B:32:LEU:O	2:B:35:TYR:HB3	2.06	0.56
1:A:282:HIS:HA	1:A:285:PHE:CZ	2.41	0.56
1:A:261:SER:HB3	1:A:264:MET:HB2	1.87	0.56
1:A:63:GLN:CG	1:A:127:ASN:ND2	2.67	0.56
1:A:377:ASN:HB3	2:B:150:ASN:O	2.06	0.56
1:A:119:VAL:HG12	1:A:148:GLY:CA	2.35	0.56
1:A:459:ALA:O	2:B:146:ARG:NH1	2.34	0.56
1:A:220:ASP:HB3	1:A:223:VAL:HG22	1.87	0.55
1:A:91:TYR:CE1	1:A:95:ARG:HD2	2.42	0.55
1:A:191:LEU:HB3	1:A:531:PHE:CD2	2.41	0.55
1:A:410:GLY:HA3	1:A:499:PRO:HG3	1.88	0.55
1:A:20:ALA:HB3	1:A:106:MET:CE	2.38	0.54
1:A:314:PHE:CZ	2:B:14:TYR:HB3	2.43	0.54
1:A:330:ARG:H	1:A:334:GLY:HA3	1.73	0.54
1:A:391:SER:O	1:A:395:LEU:HD12	2.07	0.54
2:B:70:ALA:HB1	2:B:82:TYR:O	2.07	0.54
1:A:382:PRO:HA	1:A:385:PHE:CE2	2.41	0.54
1:A:274:LEU:N	1:A:274:LEU:CD1	2.70	0.54
1:A:388:GLN:NE2	1:A:388:GLN:CA	2.70	0.54
1:A:389:VAL:HG22	5:A:800:HEM:HAC	1.88	0.54

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:456:VAL:HG23	1:A:456:VAL:O	2.08	0.54
1:A:547:VAL:HG12	1:A:548:GLN:H	1.72	0.54
1:A:460:TYR:N	1:A:461:PRO:CD	2.70	0.54
1:A:551:GLY:C	1:A:552:HIS:ND1	2.61	0.54
2:B:96:GLU:HB3	2:B:167:LYS:NZ	2.22	0.54
2:B:157:HIS:O	2:B:159:ASN:N	2.40	0.54
1:A:152:PHE:HD2	1:A:152:PHE:O	1.90	0.53
1:A:344:PRO:HG3	1:A:422:LEU:HG	1.90	0.53
1:A:300:VAL:HG22	2:B:30:ILE:HD13	1.90	0.53
2:B:105:PHE:CZ	2:B:139:PHE:HE1	2.26	0.53
2:B:42:ALA:HB1	2:B:45:ILE:HD12	1.90	0.53
2:B:3:ASP:OD1	3:C:2:GLU:HB3	2.09	0.53
3:C:26:VAL:O	3:C:27:TYR:C	2.47	0.53
1:A:181:LEU:O	1:A:185:MET:HG3	2.09	0.53
1:A:135:PHE:O	1:A:137:PRO:HD3	2.08	0.53
1:A:388:GLN:NE2	1:A:388:GLN:HA	2.24	0.53
1:A:20:ALA:HB3	1:A:106:MET:HE1	1.90	0.52
1:A:106:MET:O	1:A:109:SER:HB3	2.08	0.52
1:A:423:ALA:O	1:A:427:LEU:HB2	2.10	0.52
1:A:391:SER:HB2	1:A:395:LEU:HD11	1.92	0.52
1:A:189:PHE:O	1:A:192:MET:N	2.41	0.52
1:A:274:LEU:N	1:A:274:LEU:HD12	2.22	0.52
2:B:105:PHE:HZ	2:B:139:PHE:HE1	1.58	0.52
1:A:426:TRP:O	1:A:430:LEU:HD22	2.11	0.51
3:C:10:ALA:O	3:C:14:VAL:HG23	2.10	0.51
1:A:36:SER:O	1:A:40:PRO:HD3	2.10	0.51
1:A:120:ALA:HB2	1:A:148:GLY:HA3	1.92	0.51
1:A:195:LEU:CD2	1:A:534:ALA:HB1	2.40	0.51
1:A:513:SER:O	2:B:5:HIS:CE1	2.63	0.51
1:A:240:LEU:HA	1:A:393:VAL:HG22	1.92	0.51
1:A:398:MET:HG2	1:A:484:PHE:CE1	2.46	0.51
1:A:52:TYR:N	1:A:53:PRO:CD	2.74	0.51
1:A:332:LEU:CD2	1:A:333:PHE:CE2	2.94	0.51
1:A:433:MET:O	1:A:436:ALA:HB3	2.11	0.51
1:A:7:GLU:O	1:A:10:ARG:HG3	2.11	0.51
1:A:56:LYS:CE	1:A:62:VAL:O	2.59	0.51
1:A:146:TYR:HD2	1:A:208:LEU:HD13	1.76	0.50
2:B:157:HIS:C	2:B:159:ASN:H	2.13	0.50
1:A:46:TYR:CE1	5:A:800:HEM:HBA2	2.46	0.50
1:A:465:VAL:O	1:A:468:VAL:HG23	2.10	0.50
1:A:95:ARG:HA	1:A:95:ARG:CZ	2.41	0.50

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:384:HIS:O	1:A:388:GLN:HG2	2.12	0.50
1:A:450:ARG:O	2:B:157:HIS:HD2	1.94	0.50
2:B:113:ILE:HA	2:B:127:VAL:O	2.11	0.50
1:A:101:PRO:HA	1:A:166:LEU:HD11	1.94	0.50
1:A:365:VAL:HG12	1:A:366:ASN:H	1.74	0.50
1:A:37:LEU:O	1:A:40:PRO:HD2	2.12	0.50
1:A:379:ALA:O	1:A:382:PRO:HD2	2.12	0.50
1:A:124:LEU:CD2	1:A:129:ALA:HB3	2.41	0.50
1:A:233:HIS:CE1	1:A:237:TYR:CE2	2.78	0.50
2:B:86:PHE:CD1	2:B:86:PHE:C	2.86	0.50
1:A:93:PRO:HB3	1:A:183:THR:HA	1.94	0.49
1:A:233:HIS:CB	1:A:234:PRO:CD	2.87	0.49
2:B:145:TYR:CE1	2:B:166:VAL:HG13	2.47	0.49
1:A:385:PHE:HB3	6:A:801:HAS:HMA2	1.82	0.49
1:A:410:GLY:O	1:A:501:LEU:CD1	2.61	0.49
1:A:410:GLY:O	1:A:501:LEU:HD11	2.12	0.49
2:B:99:GLN:HG3	2:B:99:GLN:O	2.10	0.49
1:A:63:GLN:HB2	1:A:127:ASN:ND2	2.28	0.49
1:A:182:VAL:CG2	1:A:508:PHE:HE2	2.00	0.49
1:A:192:MET:HG3	1:A:272:PHE:O	2.12	0.49
2:B:64:TRP:CD1	2:B:83:VAL:O	2.65	0.49
1:A:27:LEU:O	1:A:28:GLY:C	2.51	0.49
1:A:240:LEU:O	1:A:240:LEU:HG	2.12	0.49
1:A:101:PRO:HB3	1:A:166:LEU:HD11	1.94	0.49
2:B:47:ALA:HB2	2:B:134:THR:HB	1.95	0.49
1:A:459:ALA:O	1:A:461:PRO:HD2	2.12	0.48
1:A:498:LYS:N	1:A:499:PRO:HD3	2.27	0.48
1:A:119:VAL:HG12	1:A:148:GLY:HA2	1.95	0.48
2:B:27:PHE:HA	2:B:30:ILE:HG13	1.95	0.48
1:A:79:VAL:HG13	1:A:152:PHE:HE1	1.79	0.48
1:A:420:LEU:O	1:A:421:GLY:C	2.52	0.48
1:A:252:PRO:O	1:A:255:ALA:HB3	2.14	0.48
1:A:388:GLN:HE21	1:A:388:GLN:CA	2.26	0.48
1:A:63:GLN:CB	1:A:127:ASN:ND2	2.77	0.48
1:A:262:ASP:N	1:A:263:PRO:HD2	2.28	0.48
1:A:330:ARG:HD2	1:A:330:ARG:H	1.79	0.47
1:A:488:LEU:CD1	1:A:492:LEU:HD12	2.44	0.47
3:C:29:VAL:O	3:C:30:PHE:C	2.51	0.47
1:A:373:TYR:OH	2:B:45:ILE:HG12	2.13	0.47
1:A:101:PRO:O	1:A:103:MET:N	2.47	0.47
1:A:41:PHE:CE1	1:A:55:LEU:HD12	2.50	0.47

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:83:VAL:HG12	2:B:84:LEU:H	1.79	0.47
1:A:33:ILE:O	1:A:33:ILE:HG22	2.14	0.47
1:A:518:ARG:HA	1:A:518:ARG:HD2	1.69	0.47
2:B:142:PRO:CA	2:B:166:VAL:HG22	2.32	0.47
1:A:41:PHE:CD1	1:A:55:LEU:HD12	2.49	0.47
1:A:450:ARG:O	2:B:157:HIS:CD2	2.67	0.47
1:A:504:ALA:HA	1:A:505:PRO:HD3	1.84	0.47
2:B:63:PRO:HG2	2:B:82:TYR:CD2	2.50	0.47
1:A:193:TRP:CE3	1:A:193:TRP:HA	2.50	0.46
1:A:314:PHE:CD1	2:B:15:GLU:HG2	2.50	0.46
1:A:407:ASN:ND2	1:A:506:LEU:HD22	2.30	0.46
1:A:78:ILE:O	1:A:82:GLN:HB2	2.15	0.46
1:A:89:MET:HB2	1:A:190:TRP:CZ2	2.50	0.46
2:B:26:LEU:O	2:B:30:ILE:HG13	2.14	0.46
1:A:79:VAL:HG13	1:A:152:PHE:CE1	2.50	0.46
1:A:101:PRO:O	1:A:103:MET:HG2	2.15	0.46
1:A:192:MET:CG	1:A:273:LEU:HA	2.44	0.46
1:A:32:LEU:HA	1:A:76:ASN:ND2	2.30	0.46
1:A:360:GLY:O	1:A:364:ILE:HG13	2.16	0.46
1:A:374:VAL:HG21	3:C:30:PHE:HA	1.98	0.46
2:B:119:GLU:OE2	2:B:146:ARG:NH2	2.46	0.46
1:A:460:TYR:N	1:A:461:PRO:HD2	2.28	0.46
1:A:42:GLN:HG2	1:A:52:TYR:OH	2.16	0.46
1:A:518:ARG:NH2	1:A:518:ARG:CG	2.59	0.46
1:A:12:TYR:CE1	1:A:19:LYS:HB2	2.50	0.46
1:A:39:GLY:C	5:A:800:HEM:HMB3	2.36	0.46
1:A:56:LYS:NZ	1:A:62:VAL:O	2.49	0.46
1:A:79:VAL:HA	1:A:152:PHE:CZ	2.51	0.46
1:A:96:GLU:O	1:A:96:GLU:HG2	2.16	0.46
1:A:143:TRP:CE3	1:A:213:PHE:HE2	2.33	0.45
1:A:403:TRP:CZ3	1:A:404:LEU:HD22	2.51	0.45
1:A:372:ASP:OD1	1:A:376:HIS:HB2	2.17	0.45
3:C:12:ILE:HA	3:C:15:LEU:HB3	1.98	0.45
2:B:148:ILE:HG23	2:B:161:PHE:CE2	2.52	0.45
2:B:101:ALA:O	2:B:103:ILE:HD12	2.16	0.45
1:A:181:LEU:CD1	1:A:266:ARG:HG3	2.46	0.45
1:A:390:ALA:HB1	1:A:432:MET:HE1	1.99	0.45
1:A:407:ASN:ND2	1:A:506:LEU:CD2	2.77	0.45
1:A:427:LEU:HA	1:A:427:LEU:HD23	1.54	0.45
2:B:154:GLY:O	2:B:157:HIS:HB2	2.16	0.45
1:A:199:GLY:HA3	1:A:230:TRP:HB3	1.99	0.45

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:459:ALA:C	1:A:461:PRO:CD	2.84	0.45
1:A:207:PHE:CD1	1:A:219:VAL:HG13	2.52	0.45
1:A:363:GLY:O	1:A:366:ASN:HB2	2.17	0.45
1:A:390:ALA:HB1	1:A:432:MET:CE	2.47	0.45
3:C:31:PHE:O	3:C:34:GLY:N	2.44	0.45
1:A:404:LEU:O	1:A:408:LEU:HG	2.17	0.44
1:A:439:LEU:HD13	1:A:470:ASN:OD1	2.15	0.44
1:A:548:GLN:O	1:A:551:GLY:N	2.50	0.44
2:B:157:HIS:C	2:B:159:ASN:N	2.70	0.44
1:A:24:PHE:HZ	1:A:109:SER:OG	2.00	0.44
1:A:355:GLY:HA2	1:A:358:PRO:HD2	1.99	0.44
1:A:391:SER:C	1:A:395:LEU:HD12	2.38	0.44
1:A:119:VAL:CG1	1:A:148:GLY:HA2	2.48	0.44
1:A:264:MET:HA	1:A:264:MET:CE	2.48	0.44
1:A:381:VAL:HG12	1:A:385:PHE:CD2	2.52	0.44
1:A:499:PRO:HB3	1:A:502:ALA:CB	2.47	0.44
2:B:74:THR:HG23	2:B:78:GLN:HB3	1.99	0.44
1:A:488:LEU:HD11	1:A:492:LEU:HD12	1.99	0.44
1:A:41:PHE:HD2	1:A:51:ALA:HB3	1.82	0.44
1:A:146:TYR:CD2	1:A:208:LEU:HB3	2.53	0.44
1:A:10:ARG:O	1:A:11:VAL:C	2.56	0.44
1:A:262:ASP:O	1:A:263:PRO:C	2.56	0.44
1:A:69:LEU:HD23	1:A:132:LEU:HD22	2.00	0.43
3:C:6:LYS:HA	3:C:9:LEU:HD12	2.00	0.43
1:A:506:LEU:O	1:A:508:PHE:N	2.49	0.43
1:A:105:LEU:HD23	1:A:105:LEU:HA	1.57	0.43
1:A:365:VAL:O	1:A:366:ASN:C	2.57	0.43
1:A:374:VAL:HG23	2:B:122:ASN:ND2	2.34	0.43
1:A:184:TYR:CD1	1:A:527:ILE:HD11	2.53	0.43
1:A:142:HIS:ND1	1:A:144:ALA:HB3	2.33	0.43
1:A:310:LEU:HB3	2:B:18:TRP:CZ2	2.54	0.43
1:A:69:LEU:HD23	1:A:132:LEU:CD2	2.49	0.43
1:A:132:LEU:C	1:A:134:THR:H	2.22	0.43
1:A:195:LEU:HD12	1:A:195:LEU:HA	1.83	0.43
1:A:274:LEU:HD12	1:A:274:LEU:HA	1.80	0.43
1:A:486:TYR:O	1:A:490:SER:HB3	2.19	0.43
1:A:307:VAL:CA	1:A:310:LEU:HD12	2.42	0.42
1:A:324:GLY:HA3	1:A:335:TRP:HB2	2.01	0.42
1:A:401:LEU:O	1:A:405:LEU:HB2	2.19	0.42
1:A:420:LEU:HD12	1:A:420:LEU:O	2.19	0.42
1:A:522:LEU:HD12	1:A:522:LEU:HA	1.51	0.42

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:51:GLU:OE2	2:B:132:VAL:HB	2.18	0.42
2:B:107:ILE:HG21	2:B:127:VAL:HG21	2.00	0.42
1:A:449:ARG:HH12	6:A:801:HAS:CGA	2.31	0.42
1:A:239:TRP:O	1:A:242:PRO:HD2	2.20	0.42
1:A:378:THR:OG1	1:A:380:TRP:HB3	2.19	0.42
3:C:16:THR:O	3:C:20:LEU:HG	2.19	0.42
1:A:204:ALA:HA	1:A:208:LEU:HB2	2.01	0.42
1:A:347:VAL:HG12	1:A:351:LEU:HD12	2.00	0.42
2:B:96:GLU:HB3	2:B:167:LYS:HZ3	1.84	0.42
1:A:30:LEU:HD23	1:A:30:LEU:HA	2.00	0.42
1:A:188:VAL:O	1:A:189:PHE:O	2.37	0.42
1:A:325:ARG:NH1	1:A:331:GLY:O	2.53	0.42
2:B:105:PHE:HZ	2:B:139:PHE:CE1	2.36	0.42
1:A:84:PHE:CE1	1:A:397:ALA:HA	2.54	0.42
1:A:282:HIS:HA	1:A:285:PHE:CE2	2.54	0.42
1:A:511:VAL:HG12	1:A:512:ILE:C	2.39	0.42
1:A:130:THR:O	1:A:130:THR:HG22	2.19	0.42
1:A:342:ASP:HB2	1:A:418:ARG:NH2	2.34	0.42
2:B:24:ALA:O	2:B:28:VAL:HG23	2.20	0.42
1:A:27:LEU:HD23	1:A:83:LEU:HD21	2.01	0.42
1:A:61:PHE:H	1:A:61:PHE:HD1	1.68	0.42
1:A:229:TRP:HZ3	1:A:232:GLY:O	2.02	0.42
1:A:251:LEU:HA	1:A:254:GLN:CG	2.50	0.42
1:A:273:LEU:C	1:A:274:LEU:HD12	2.40	0.42
1:A:351:LEU:HD21	1:A:426:TRP:CH2	2.54	0.42
1:A:561:LEU:HD23	1:A:561:LEU:HA	1.72	0.42
1:A:56:LYS:HD3	1:A:62:VAL:O	2.20	0.41
1:A:82:GLN:HG2	1:A:238:PHE:CZ	2.55	0.41
1:A:178:VAL:HG22	1:A:522:LEU:CD1	2.50	0.41
1:A:340:PRO:C	1:A:342:ASP:H	2.23	0.41
1:A:387:LEU:HD23	1:A:387:LEU:HA	1.86	0.41
1:A:25:LEU:O	1:A:29:PHE:HD1	2.04	0.41
1:A:72:HIS:HE1	5:A:800:HEM:C4B	2.38	0.41
1:A:105:LEU:O	1:A:108:LEU:HB3	2.21	0.41
1:A:306:ALA:O	1:A:310:LEU:HD12	2.20	0.41
2:B:10:ALA:O	2:B:14:TYR:HD1	2.04	0.41
1:A:15:TYR:CZ	1:A:95:ARG:NH1	2.89	0.41
1:A:381:VAL:HB	1:A:382:PRO:HD3	2.03	0.41
1:A:82:GLN:NE2	1:A:156:THR:HG23	2.34	0.41
2:B:140:LYS:HB3	2:B:140:LYS:HE3	1.69	0.41
1:A:239:TRP:HE3	6:A:801:HAS:HBC2	1.85	0.41

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:259:LEU:HG	1:A:261:SER:H	1.85	0.41
1:A:374:VAL:HG11	3:C:26:VAL:HG13	2.02	0.41
1:A:411:LYS:HA	1:A:412:PRO:HD3	1.83	0.41
3:C:24:LEU:HD12	3:C:24:LEU:HA	1.97	0.41
1:A:38:PHE:HE2	1:A:62:VAL:HG21	1.86	0.41
1:A:132:LEU:O	1:A:134:THR:N	2.54	0.41
1:A:223:VAL:O	1:A:226:THR:N	2.53	0.41
1:A:466:PRO:O	1:A:469:PHE:N	2.54	0.41
2:B:40:HIS:CD2	2:B:41:THR:HG23	2.56	0.41
1:A:92:LEU:O	1:A:93:PRO:C	2.57	0.41
1:A:385:PHE:CD1	1:A:385:PHE:C	2.94	0.41
1:A:488:LEU:HD11	1:A:492:LEU:CD1	2.51	0.41
2:B:155:LEU:HD23	2:B:155:LEU:O	2.21	0.41
1:A:192:MET:HG2	1:A:273:LEU:HA	2.03	0.40
1:A:233:HIS:CD2	1:A:234:PRO:N	2.89	0.40
1:A:303:LEU:HD13	2:B:30:ILE:HG12	2.03	0.40
1:A:417:GLN:HE22	1:A:491:VAL:HA	1.86	0.40
1:A:9:SER:OG	1:A:11:VAL:HG23	2.22	0.40
1:A:369:PHE:HE2	1:A:373:TYR:HH	1.68	0.40
1:A:254:GLN:H	1:A:254:GLN:HG2	1.73	0.40
1:A:388:GLN:CB	6:A:801:HAS:HMC3	2.48	0.40
1:A:472:LEU:HD23	1:A:472:LEU:HA	1.91	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	555/568 (98%)	427 (77%)	100 (18%)	28 (5%)	2	7
2	B	164/168 (98%)	139 (85%)	21 (13%)	4 (2%)	6	22
3	C	31/34 (91%)	19 (61%)	9 (29%)	3 (10%)	0	1

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	750/770 (97%)	585 (78%)	130 (17%)	35 (5%)	2 8

All (35) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	11	VAL
1	A	58	LEU
1	A	102	ASN
1	A	189	PHE
1	A	366	ASN
2	B	87	ALA
2	B	88	PHE
3	C	32	ALA
1	A	190	TRP
1	A	365	VAL
1	A	379	ALA
1	A	496	GLU
1	A	526	ARG
2	B	158	GLN
3	C	15	LEU
3	C	16	THR
1	A	109	SER
1	A	341	TRP
1	A	504	ALA
1	A	517	ASP
1	A	461	PRO
1	A	57	ARG
1	A	89	MET
1	A	224	ALA
1	A	392	LEU
1	A	422	LEU
1	A	452	TYR
1	A	548	GLN
2	B	4	GLN
1	A	234	PRO
1	A	233	HIS
1	A	355	GLY
1	A	499	PRO
1	A	547	VAL
1	A	28	GLY

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	453/462 (98%)	382 (84%)	71 (16%)	2	8
2	B	136/138 (99%)	114 (84%)	22 (16%)	2	7
3	C	26/27 (96%)	22 (85%)	4 (15%)	2	8
All	All	615/627 (98%)	518 (84%)	97 (16%)	2	8

All (97) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	GLU
1	A	8	ILE
1	A	23	TYR
1	A	48	ASN
1	A	54	LEU
1	A	56	LYS
1	A	59	LEU
1	A	82	GLN
1	A	95	ARG
1	A	99	MET
1	A	103	MET
1	A	125	LEU
1	A	133	TYR
1	A	134	THR
1	A	147	LEU
1	A	150	SER
1	A	152	PHE
1	A	168	ARG
1	A	169	ARG
1	A	177	LYS
1	A	179	THR
1	A	195	LEU
1	A	213	PHE
1	A	215	LEU
1	A	216	VAL
1	A	230	TRP

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	238	PHE
1	A	253	LYS
1	A	254	GLN
1	A	261	SER
1	A	305	VAL
1	A	309	SER
1	A	315	THR
1	A	319	SER
1	A	326	LEU
1	A	327	ARG
1	A	330	ARG
1	A	339	LEU
1	A	354	LEU
1	A	369	PHE
1	A	374	VAL
1	A	385	PHE
1	A	388	GLN
1	A	391	SER
1	A	395	LEU
1	A	404	LEU
1	A	405	LEU
1	A	418	ARG
1	A	419	ARG
1	A	420	LEU
1	A	430	LEU
1	A	439	LEU
1	A	449	ARG
1	A	452	TYR
1	A	455	GLN
1	A	465	VAL
1	A	472	LEU
1	A	477	LEU
1	A	478	LEU
1	A	490	SER
1	A	496	GLU
1	A	500	GLU
1	A	501	LEU
1	A	506	LEU
1	A	518	ARG
1	A	520	LEU
1	A	533	VAL
1	A	536	ILE

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	547	VAL
1	A	548	GLN
1	A	560	ARG
2	B	6	LYS
2	B	9	LYS
2	B	12	LEU
2	B	16	LYS
2	B	19	LEU
2	B	23	LEU
2	B	26	LEU
2	B	30	ILE
2	B	39	THR
2	B	46	PRO
2	B	52	ARG
2	B	59	ARG
2	B	72	VAL
2	B	95	ILE
2	B	99	GLN
2	B	111	ASP
2	B	136	ARG
2	B	140	LYS
2	B	141	ARG
2	B	149	CYS
2	B	166	VAL
2	B	168	GLU
3	C	2	GLU
3	C	6	LYS
3	C	13	LEU
3	C	24	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	48	ASN
1	A	76	ASN
1	A	127	ASN
1	A	254	GLN
1	A	388	GLN
2	B	5	HIS
2	B	122	ASN

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 1 is monoatomic - leaving 3 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	$\# Z > 2$
7	CUA	B	802	2	0,1,1	-	-	-		
5	HEM	A	800	1	27,50,50	2.37	11 (40%)	17,82,82	3.53	9 (52%)
6	HAS	A	801	1	56,72,72	3.80	13 (23%)	50,109,109	5.52	25 (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
5	HEM	A	800	1	-	2/6/54/54	-
6	HAS	A	801	1	-	5/35/122/122	-

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	A	801	HAS	C4A-C3A	10.82	1.52	1.38
6	A	801	HAS	C1B-NB	-10.74	1.35	1.49
6	A	801	HAS	C4D-ND	-9.87	1.36	1.49
6	A	801	HAS	C1D-ND	-9.79	1.36	1.49
6	A	801	HAS	C4B-NB	-8.45	1.38	1.49
6	A	801	HAS	C1A-C2A	8.34	1.49	1.38
6	A	801	HAS	C3D-C2D	8.30	1.44	1.34
6	A	801	HAS	C1C-C2C	6.86	1.47	1.38
6	A	801	HAS	C3C-CAC	-6.80	1.34	1.47
5	A	800	HEM	C3D-C2D	5.80	1.54	1.37
5	A	800	HEM	C3C-C2C	-5.78	1.32	1.40
6	A	801	HAS	C2A-C3A	4.46	1.50	1.37
5	A	800	HEM	C3B-C2B	-4.39	1.34	1.40
6	A	801	HAS	C2B-C3B	3.65	1.37	1.34
5	A	800	HEM	C3B-CAB	3.55	1.55	1.47
6	A	801	HAS	CHD-C4C	-3.32	1.47	1.51
6	A	801	HAS	C3C-C2C	2.76	1.44	1.40
5	A	800	HEM	C1D-ND	2.60	1.41	1.36
5	A	800	HEM	CMA-C3A	2.53	1.56	1.51
5	A	800	HEM	CMB-C2B	2.32	1.57	1.51
5	A	800	HEM	C4A-CHB	-2.12	1.35	1.41
5	A	800	HEM	C1A-NA	2.12	1.40	1.36
5	A	800	HEM	C4D-C3D	2.05	1.47	1.42
5	A	800	HEM	C1B-C2B	2.02	1.47	1.42

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	A	801	HAS	CHB-C1D-ND	16.62	131.60	110.94
6	A	801	HAS	CHC-C1C-C2C	-13.26	106.50	129.45
6	A	801	HAS	CHB-C1B-NB	13.22	127.38	110.94
6	A	801	HAS	CHD-C4A-C3A	-11.43	110.42	129.53
6	A	801	HAS	CAA-C2A-C1A	-10.92	119.63	127.30
6	A	801	HAS	CHC-C4B-NB	9.90	129.43	110.75
6	A	801	HAS	C4C-C3C-C2C	9.42	118.87	104.41
6	A	801	HAS	OMD-CMD-C2D	-8.49	113.65	124.39
6	A	801	HAS	CBA-CAA-C2A	-8.22	97.32	112.49
6	A	801	HAS	CHA-C4D-ND	8.09	126.01	110.75
5	A	800	HEM	CAA-CBA-CGA	-7.63	99.88	112.67
6	A	801	HAS	C4A-C3A-C2A	-7.30	98.04	105.81
6	A	801	HAS	CMA-C3A-C2A	-6.42	112.84	124.94
5	A	800	HEM	CBA-CAA-C2A	6.22	123.95	112.49
6	A	801	HAS	CMC-C2C-C3C	-5.84	113.75	124.68

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	A	800	HEM	CAD-CBD-CGD	-5.82	102.91	112.67
6	A	801	HAS	C27-C19-C20	4.69	123.17	115.27
5	A	800	HEM	C4C-C3C-C2C	4.18	109.81	106.90
5	A	800	HEM	CMA-C3A-C4A	-4.04	122.26	128.46
5	A	800	HEM	CMA-C3A-C2A	4.03	132.54	124.94
6	A	801	HAS	C25-C23-C24	3.77	121.61	115.27
5	A	800	HEM	C1D-C2D-C3D	-3.53	104.54	107.00
6	A	801	HAS	CMB-C2B-C3B	-2.83	122.76	129.82
6	A	801	HAS	C31-C30-C29	-2.80	114.56	122.65
6	A	801	HAS	C20-C19-C18	-2.72	115.62	121.12
5	A	800	HEM	C4A-C3A-C2A	-2.59	105.19	107.00
6	A	801	HAS	CAA-C2A-C3A	-2.58	119.84	127.25
6	A	801	HAS	C24-C23-C22	-2.42	116.22	121.12
5	A	800	HEM	CAA-C2A-C3A	2.26	133.74	127.25
6	A	801	HAS	CHB-C1B-C2B	2.18	121.51	114.70
6	A	801	HAS	CAA-CBA-CGA	-2.17	109.03	112.67
6	A	801	HAS	CHD-C4C-C3C	-2.16	126.77	129.61
6	A	801	HAS	CBD-CAD-C3D	-2.16	110.53	114.35
6	A	801	HAS	C32-C30-C31	2.10	119.24	114.60

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	800	HEM	C1A-C2A-CAA-CBA
5	A	800	HEM	C3A-C2A-CAA-CBA
6	A	801	HAS	C1A-C2A-CAA-CBA
6	A	801	HAS	C1D-C2D-CMD-OMD
6	A	801	HAS	C3D-C2D-CMD-OMD
6	A	801	HAS	C2D-C3D-CAD-CBD
6	A	801	HAS	C11-C12-C13-C14

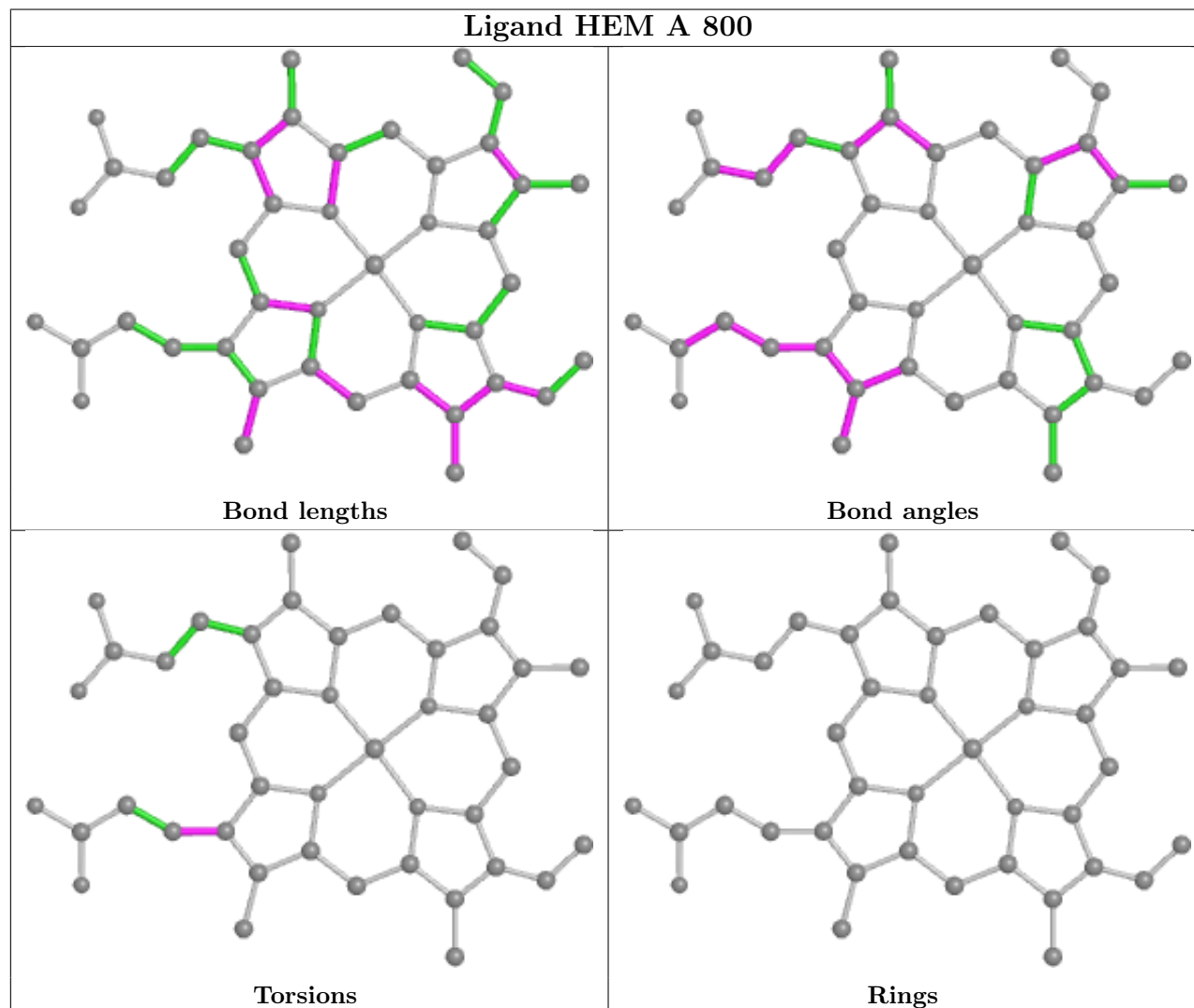
There are no ring outliers.

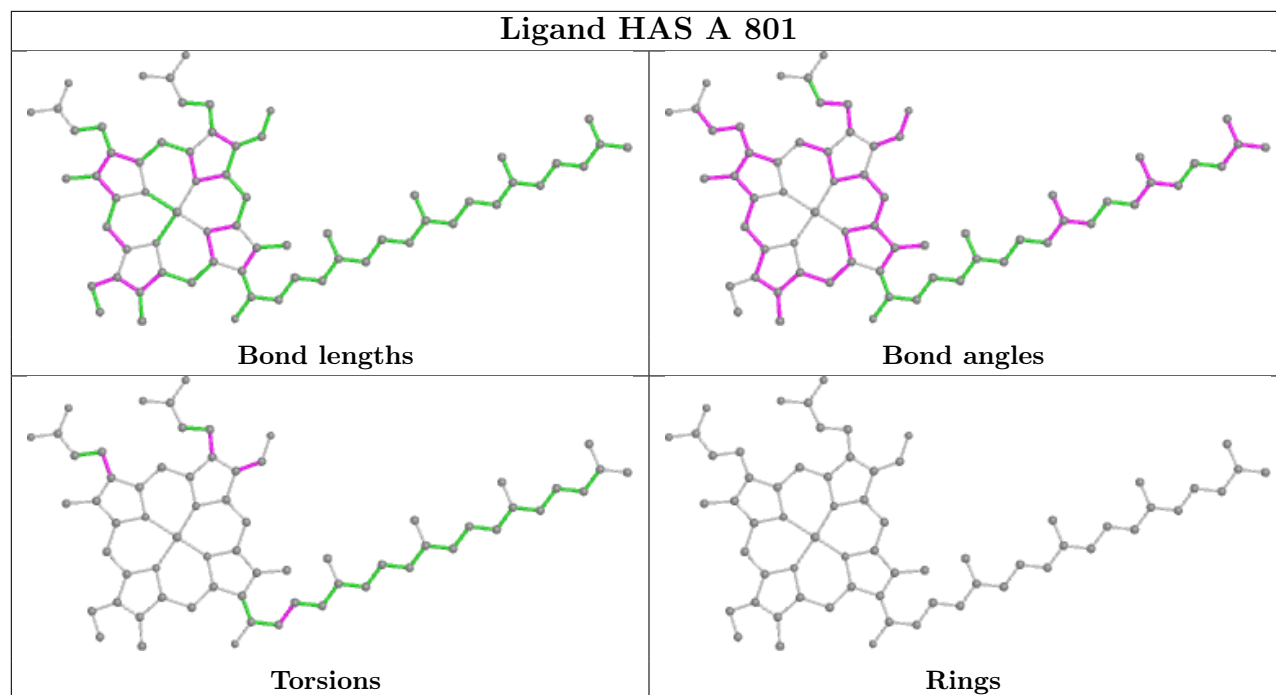
2 monomers are involved in 22 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	A	800	HEM	7	0
6	A	801	HAS	15	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	557/568 (98%)	-0.28	23 (4%) 37 32	64, 88, 129, 216	0
2	B	166/168 (98%)	-0.40	5 (3%) 50 45	71, 88, 124, 174	0
3	C	33/34 (97%)	-0.62	0 100 100	69, 79, 133, 154	0
All	All	756/770 (98%)	-0.32	28 (3%) 41 37	64, 88, 131, 216	0

All (28) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	6	SER	7.9
1	A	515	PRO	5.8
1	A	9	SER	5.7
1	A	173	ALA	5.1
1	A	10	ARG	4.5
1	A	495	ARG	4.3
1	A	493	LEU	4.2
1	A	12	TYR	3.6
2	B	76	PRO	3.5
1	A	217	GLU	3.3
1	A	501	LEU	3.3
2	B	4	GLN	3.2
1	A	218	GLY	3.1
1	A	8	ILE	3.1
2	B	52	ARG	2.8
1	A	215	LEU	2.7
1	A	104	GLY	2.7
1	A	516	GLU	2.7
2	B	73	GLN	2.7
1	A	510	GLU	2.6
1	A	174	ASN	2.5
2	B	72	VAL	2.4
1	A	13	GLU	2.3

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	502	ALA	2.2
1	A	177	LYS	2.2
1	A	494	SER	2.2
1	A	176	GLY	2.0
1	A	416	ALA	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 monosaccharides in this entry.

6.4 Ligands [i](#)

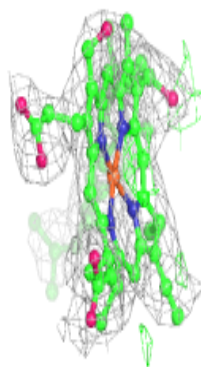
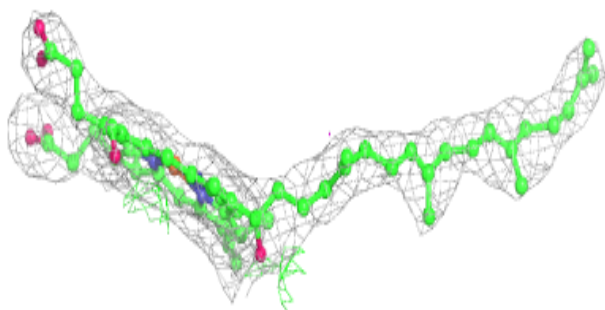
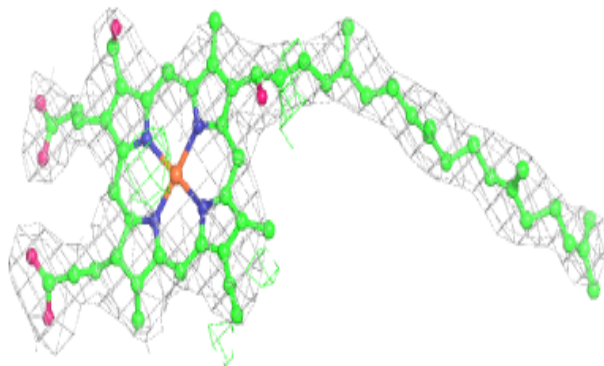
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	HAS	A	801	65/65	0.97	0.13	53,74,87,93	0
5	HEM	A	800	43/43	0.98	0.11	50,68,90,98	0
4	CU1	A	803	1/1	0.99	0.11	84,84,84,84	0
7	CUA	B	802	2/2	1.00	0.08	88,88,88,90	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.

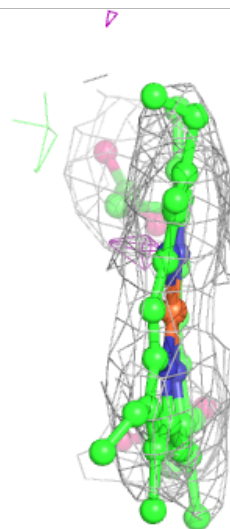
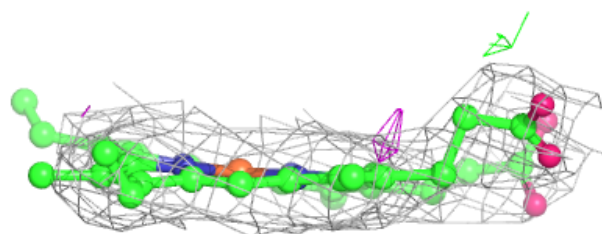
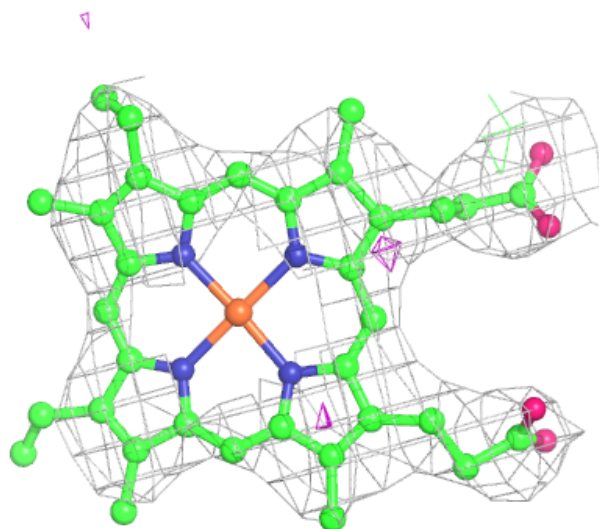
Electron density around HAS A 801:

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



Electron density around HEM A 800:

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



6.5 Other polymers ⓘ

There are no such residues in this entry.