Full wwPDB X-ray Structure Validation Report (i)

Aug 5, 2026 – 10:09 PM JST

PDB ID	:	7VE3 / pdb_00007ve3
Title	:	Structure of the complex of sheep lactoperoxidase with hypoiodite at 2.70 A resolution
Authors	:	Singh, P.K.; Yamini, S.; Singh, R.P.; Singh, A.K.; Sinha, M.; Kaur, P.; Sharma, S.; Singh, T.P.
Deposited on	:	2021-09-07
Resolution	:	2.70 Å(reported)

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

We welcome your comments at *validation@mail.wwpdb.org*
A user guide is available at
https://www.wwpdb.org/validation/2017/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The types of validation reports are described at
http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (1)) were used in the production of this report:

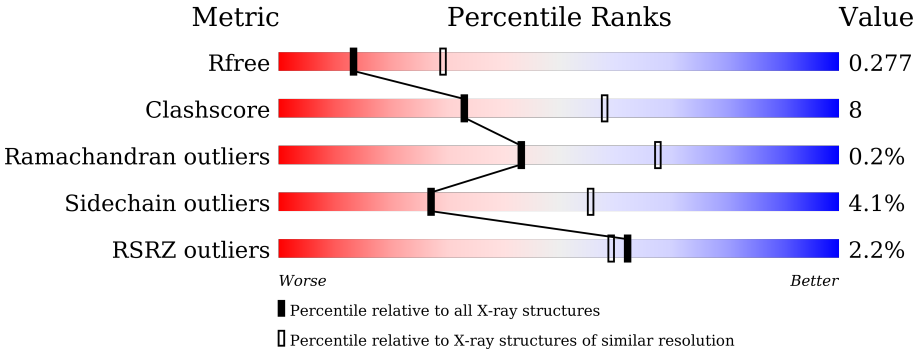
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.70 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	3538 (2.70-2.70)
Clashscore	190562	3843 (2.70-2.70)
Ramachandran outliers	187476	3778 (2.70-2.70)
Sidechain outliers	187428	3778 (2.70-2.70)
RSRZ outliers	180081	3538 (2.70-2.70)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions <=5% The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	595	2% 79% 20% •

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
7	61D	A	618	-	-	X	-
7	61D	A	621	-	-	X	-

2 Entry composition (i)

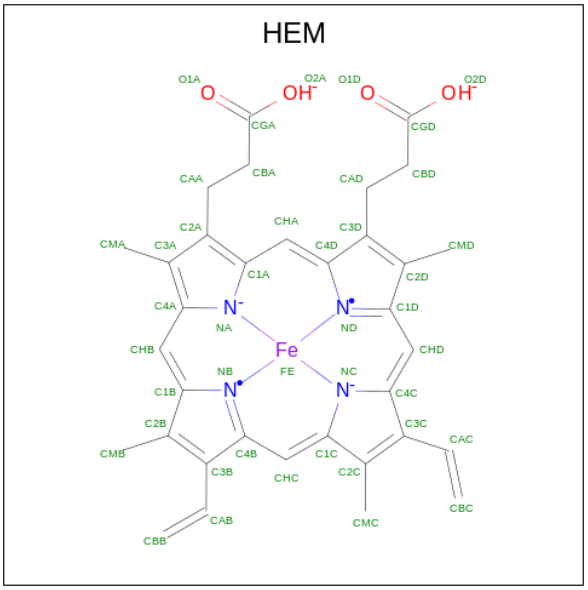
There are 8 unique types of molecules in this entry. The entry contains 5031 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Lactoperoxidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	595	4769	3027	854	862	26	0	1	0

- 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).

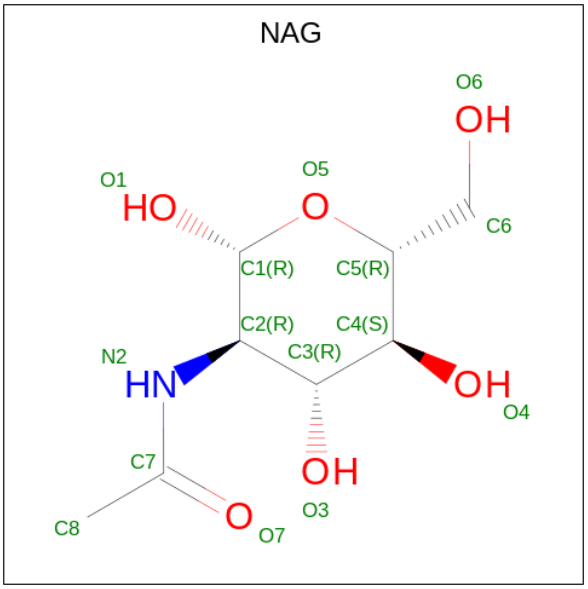


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Fe	N	O		
2	A	1	43	34	1	4	4	0	0

- Molecule 3 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Ca		
3	A	1	1	1	0	0

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$) (labeled as "Ligand of Interest" by depositor).

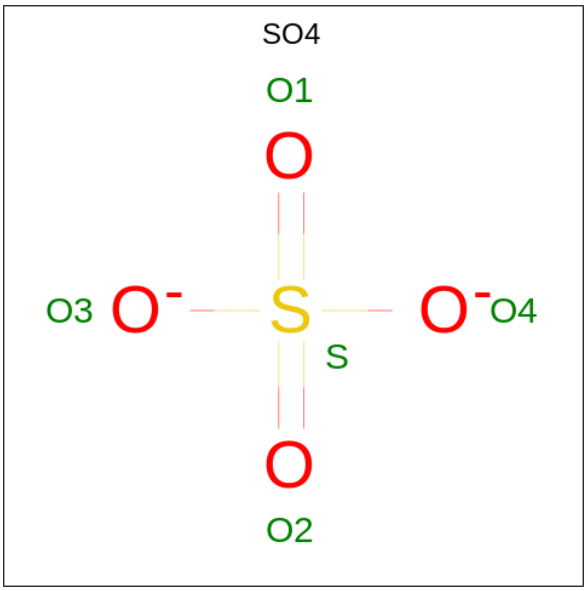


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
4	A	1	14	8	1	5	0	0
			Total	C	N	O		
4	A	1	14	8	1	5	0	0

- Molecule 5 is IODIDE ION (CCD ID: IOD) (formula: I).

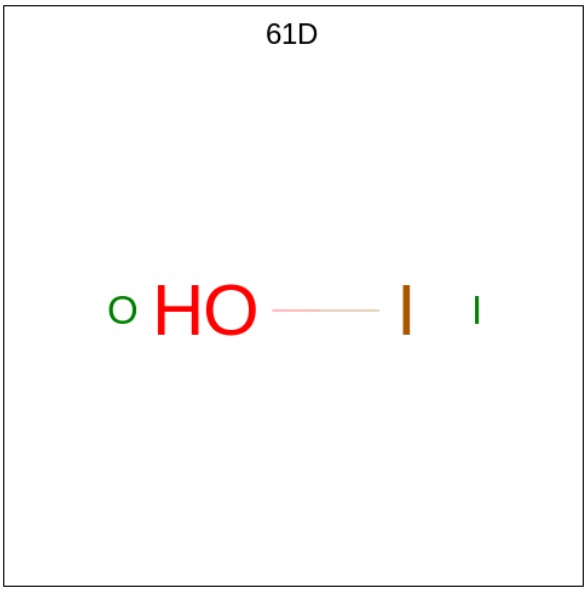
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	I		
5	A	6	6	6	0	0

- Molecule 6 is SULFATE ION (CCD ID: SO4) (formula: O_4S).



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

- Molecule 7 is hypoiodous acid (CCD ID: 61D) (formula: HIO) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total I O 2 1 1	0	0
7	A	1	Total I O 2 1 1	0	0

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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
7	A	1	Total I O 2 1 1	0	0
7	A	1	Total I O 2 1 1	0	0
7	A	1	Total I O 2 1 1	0	0
7	A	1	Total I O 2 1 1	0	0
7	A	1	Total I O 2 1 1	0	0
7	A	1	Total I O 2 1 1	0	0
7	A	1	Total I O 2 1 1	0	0
7	A	1	Total I O 2 1 1	0	0
7	A	1	Total I O 2 1 1	0	0

- Molecule 8 is water.

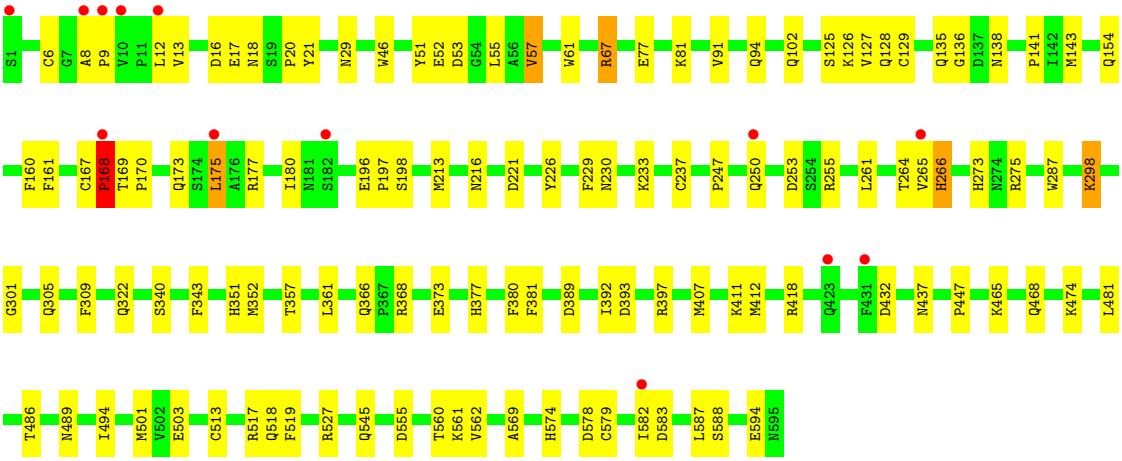
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
8	A	157	Total O 157 157	0	0

3 Residue-property plots (i)

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

- Molecule 1: Lactoperoxidase

Chain A:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	53.94Å 80.18Å 76.12Å 90.00° 102.86° 90.00°	Depositor
Resolution (Å)	43.97 – 2.70 43.97 – 2.70	Depositor EDS
% Data completeness (in resolution range)	97.6 (43.97-2.70) 97.6 (43.97-2.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.07	Depositor
$< I/\sigma(I) >$ [1]	11.72 (at 2.69Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.195 , 0.277 0.195 , 0.277	Depositor DCC
R_{free} test set	860 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å^2)	59.0	Xtriage
Anisotropy	0.031	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.26 , 37.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	5031	wwPDB-VP
Average B, all atoms (Å^2)	68.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.46% of the height of the origin peak. No significant pseudotranslation is detected.*

[1]Intensities estimated from amplitudes.

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

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: 61D, CA, HEM, SO4, NAG, IOD

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	0.52	0/4894	1.10	10/6637 (0.2%)

There are no bond length outliers.

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	170	PRO	N-CA-C	10.32	123.29	110.70
1	A	154	GLN	CB-CA-C	-8.54	91.94	111.83
1	A	168	PRO	N-CA-C	7.07	127.03	112.47
1	A	57	VAL	N-CA-CB	6.96	116.56	110.08
1	A	389	ASP	CA-CB-CG	6.67	119.27	112.60
1	A	16	ASP	CB-CA-C	6.43	119.92	109.90
1	A	17	GLU	N-CA-C	-5.69	106.51	113.50
1	A	16	ASP	N-CA-C	-5.66	101.66	110.10
1	A	233	LYS	CB-CA-C	5.25	116.28	108.87
1	A	127	VAL	N-CA-C	-5.01	107.84	111.90

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	4769	0	4687	72	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	43	0	30	2	0
3	A	1	0	0	0	0
4	A	28	0	26	0	0
5	A	6	0	0	1	0
6	A	5	0	0	0	0
7	A	22	0	0	7	0
8	A	157	0	0	8	0
All	All	5031	0	4743	75	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 8.

All (75) 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:6:CYS:O	1:A:167:CYS:SG	2.00	1.18
1:A:216:ASN:ND2	5:A:610:IOD:I	2.58	1.05
7:A:614:61D:I	8:A:849:HOH:O	2.68	0.81
2:A:601:HEM:HMB1	2:A:601:HEM:HBB2	1.64	0.79
1:A:351:HIS:HD1	1:A:437:ASN:HD21	1.29	0.79
1:A:52:GLU:HB3	1:A:57:VAL:HG23	1.66	0.79
1:A:51:TYR:CD2	1:A:55:LEU:O	2.37	0.78
1:A:230:ASN:HB2	1:A:250:GLN:OE1	1.91	0.71
1:A:418:ARG:O	1:A:432:ASP:HA	1.93	0.67
1:A:91:VAL:HG12	1:A:411:LYS:HD3	1.81	0.63
1:A:266:HIS:HE1	8:A:759:HOH:O	1.82	0.62
1:A:468:GLN:HG2	1:A:474:LYS:HA	1.83	0.61
1:A:264:THR:HG23	1:A:392:ILE:HB	1.86	0.58
1:A:322:GLN:HB2	8:A:798:HOH:O	2.04	0.58
1:A:125:SER:HA	1:A:128:GLN:HB2	1.86	0.57
1:A:197:PRO:HD2	7:A:621:61D:I	2.75	0.56
1:A:173:GLN:HG3	1:A:177:ARG:HA	1.88	0.56
1:A:61:TRP:HH2	1:A:136:GLY:O	1.89	0.56
1:A:418:ARG:O	1:A:432:ASP:CB	2.54	0.55
1:A:561:LYS:NZ	7:A:618:61D:I	3.10	0.55
1:A:393:ASP:HB2	8:A:760:HOH:O	2.05	0.55
1:A:351:HIS:HD1	1:A:437:ASN:ND2	2.04	0.55
1:A:562:VAL:CG2	1:A:582:ILE:CD1	2.86	0.54
1:A:418:ARG:O	1:A:432:ASP:CA	2.56	0.53
1:A:237:CYS:HA	1:A:381:PHE:O	2.09	0.53
1:A:230:ASN:CB	1:A:250:GLN:OE1	2.56	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:261:LEU:O	1:A:265:VAL:HG23	2.10	0.52
1:A:407:MET:HB3	1:A:501:MET:HE3	1.92	0.52
1:A:12:LEU:O	1:A:13:VAL:HG23	2.10	0.52
1:A:8:ALA:HB3	1:A:9:PRO:HD3	1.92	0.51
1:A:352:MET:HB3	1:A:412:MET:O	2.10	0.51
1:A:53:ASP:CG	1:A:57:VAL:HG22	2.36	0.51
1:A:229:PHE:HB3	1:A:247:PRO:HG2	1.92	0.51
1:A:196:GLU:HB3	7:A:621:61D:I	2.83	0.49
2:A:601:HEM:HMC2	2:A:601:HEM:HBC2	1.94	0.49
1:A:102:GLN:CG	1:A:265:VAL:HG21	2.42	0.49
1:A:213:MET:HG2	1:A:273:HIS:CD2	2.48	0.49
1:A:29:ASN:O	1:A:527:ARG:NH1	2.46	0.48
1:A:373:GLU:HB3	7:A:617:61D:I	2.83	0.48
1:A:397:ARG:NH1	7:A:618:61D:I	3.16	0.48
1:A:560:THR:HA	1:A:579:CYS:SG	2.54	0.48
1:A:46:TRP:CE2	1:A:340:SER:HB3	2.48	0.48
1:A:578:ASP:OD1	1:A:579:CYS:N	2.48	0.47
1:A:275:ARG:CD	1:A:555:ASP:HB3	2.44	0.47
1:A:407:MET:HG3	8:A:795:HOH:O	2.13	0.47
1:A:447:PRO:HD3	8:A:707:HOH:O	2.15	0.47
1:A:377:HIS:HA	1:A:380:PHE:CE2	2.50	0.46
1:A:102:GLN:HG3	1:A:265:VAL:HG21	1.97	0.46
1:A:135:GLN:HG3	1:A:141:PRO:HD2	1.98	0.45
1:A:141:PRO:HG2	1:A:143:MET:CE	2.46	0.45
1:A:309:PHE:HZ	1:A:519:PHE:O	1.99	0.45
1:A:343:PHE:CG	1:A:518:GLN:HG2	2.51	0.45
1:A:255:ARG:HD2	7:A:612:61D:I	2.87	0.45
1:A:175:LEU:HD13	1:A:175:LEU:HA	1.80	0.45
1:A:287:TRP:HA	8:A:784:HOH:O	2.18	0.44
1:A:77:GLU:OE2	1:A:81:LYS:NZ	2.40	0.44
1:A:61:TRP:CH2	1:A:136:GLY:O	2.70	0.44
1:A:298:LYS:HB2	1:A:298:LYS:HE2	1.67	0.43
1:A:138:ASN:O	1:A:161:PHE:HA	2.18	0.43
1:A:343:PHE:CD1	1:A:518:GLN:HG2	2.54	0.43
1:A:253:ASP:HA	8:A:780:HOH:O	2.18	0.43
1:A:221:ASP:HB2	1:A:226:TYR:CZ	2.54	0.42
1:A:67:ARG:HB3	1:A:489:ASN:ND2	2.34	0.42
1:A:301:GLY:O	1:A:305:GLN:HG3	2.20	0.42
1:A:494:ILE:HD12	1:A:494:ILE:HA	1.81	0.42
1:A:513:CYS:O	1:A:517:ARG:HG3	2.20	0.42
1:A:20:PRO:HG2	1:A:21:TYR:CE2	2.54	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:361:LEU:HA	1:A:366:GLN:O	2.20	0.41
1:A:574:HIS:HD1	1:A:574:HIS:C	2.28	0.41
1:A:229:PHE:CG	1:A:247:PRO:HG2	2.55	0.41
1:A:309:PHE:CZ	1:A:519:PHE:O	2.73	0.41
1:A:94:GLN:O	1:A:569:ALA:CB	2.68	0.41
1:A:160:PHE:O	1:A:161:PHE:CD1	2.73	0.41
1:A:129:CYS:SG	1:A:161:PHE:HE1	2.43	0.41
1:A:230:ASN:OD1	1:A:230:ASN:C	2.63	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	594/595 (100%)	577 (97%)	16 (3%)	1 (0%)	43 68

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	168	PRO

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	519/518 (100%)	497 (96%)	22 (4%)	26 55

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	18	ASN
1	A	67	ARG
1	A	126	LYS
1	A	168	PRO
1	A	169	THR
1	A	175	LEU
1	A	180	ILE
1	A	198[A]	SER
1	A	198[B]	SER
1	A	266	HIS
1	A	298	LYS
1	A	357	THR
1	A	368	ARG
1	A	465	LYS
1	A	481	LEU
1	A	486	THR
1	A	503	GLU
1	A	545	GLN
1	A	583	ASP
1	A	587	LEU
1	A	588	SER
1	A	594	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	68	ASN
1	A	135	GLN
1	A	173	GLN
1	A	329	GLN
1	A	429	HIS
1	A	468	GLN
1	A	489	ASN
1	A	570	ASN
1	A	571	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 oligosaccharides in this entry.

5.6 Ligand geometry (i)

Of 22 ligands modelled in this entry, 7 are monoatomic - leaving 15 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	$\#\|Z\| > 2$
2	HEM	A	601	1,8	50,50,50	1.66	12 (24%)	66,82,82	1.89	17 (25%)
4	NAG	A	603	1	14,14,15	0.64	0	17,19,21	1.47	2 (11%)
7	61D	A	621	1	0,1,1	-	-	-		
7	61D	A	612	-	0,1,1	-	-	-		
7	61D	A	613	-	0,1,1	-	-	-		
7	61D	A	618	-	0,1,1	-	-	-		
7	61D	A	615	-	0,1,1	-	-	-		
7	61D	A	617	-	0,1,1	-	-	-		
7	61D	A	614	-	0,1,1	-	-	-		
7	61D	A	619	-	0,1,1	-	-	-		
6	SO4	A	611	-	4,4,4	0.32	0	6,6,6	0.22	0
7	61D	A	622	-	0,1,1	-	-	-		
7	61D	A	620	-	0,1,1	-	-	-		
7	61D	A	616	-	0,1,1	-	-	-		
4	NAG	A	604	1	14,14,15	0.75	0	17,19,21	1.62	3 (17%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral

centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	HEM	A	601	1,8	-	4/14/54/54	-
4	NAG	A	603	1	-	4/6/23/26	0/1/1/1
4	NAG	A	604	1	-	0/6/23/26	0/1/1/1

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	601	HEM	FE-NC	4.28	2.09	1.95
2	A	601	HEM	FE-NB	4.26	2.08	1.94
2	A	601	HEM	C1B-NB	-3.95	1.33	1.40
2	A	601	HEM	C4D-ND	-2.89	1.35	1.40
2	A	601	HEM	FE-ND	-2.62	1.86	1.94
2	A	601	HEM	C3C-C4C	-2.50	1.41	1.46
2	A	601	HEM	C1C-C2C	-2.34	1.40	1.45
2	A	601	HEM	C4B-NB	-2.34	1.34	1.38
2	A	601	HEM	C1D-ND	-2.31	1.34	1.38
2	A	601	HEM	FE-NA	2.02	2.02	1.95
2	A	601	HEM	C4C-NC	-2.02	1.35	1.39
2	A	601	HEM	CHB-C1B	2.01	1.42	1.38

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	601	HEM	CHC-C4B-NB	5.77	130.69	124.42
2	A	601	HEM	CHD-C1D-ND	5.43	130.32	124.42
2	A	601	HEM	C1B-NB-C4B	4.69	109.92	105.07
2	A	601	HEM	CHA-C4D-ND	4.47	129.89	124.37
4	A	603	NAG	C1-O5-C5	3.78	117.31	112.19
2	A	601	HEM	CHD-C1D-C2D	-3.66	119.26	124.98
4	A	604	NAG	C1-O5-C5	3.63	117.11	112.19
2	A	601	HEM	C4B-C3B-C2B	-3.51	104.33	107.11
2	A	601	HEM	CHB-C1B-NB	3.21	128.33	124.37
4	A	603	NAG	O5-C5-C6	2.94	111.82	107.20
4	A	604	NAG	O4-C4-C3	2.91	117.08	110.35
2	A	601	HEM	CHA-C4D-C3D	-2.57	120.50	125.33
4	A	604	NAG	O3-C3-C2	-2.45	104.40	109.47
2	A	601	HEM	CAA-C2A-C1A	2.44	129.69	124.89
2	A	601	HEM	C4D-ND-C1D	2.39	107.54	105.07
2	A	601	HEM	C1A-CHA-C4D	-2.35	120.76	126.34

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	601	HEM	C3B-C2B-C1B	2.35	108.23	106.49
2	A	601	HEM	CBA-CAA-C2A	-2.34	106.13	112.63
2	A	601	HEM	CBD-CAD-C3D	-2.26	106.36	112.63
2	A	601	HEM	CMA-C3A-C4A	2.19	128.71	125.37
2	A	601	HEM	CHC-C4B-C3B	-2.18	120.45	125.13
2	A	601	HEM	O2D-CGD-CBD	2.01	120.48	114.03

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	603	NAG	O5-C5-C6-O6
4	A	603	NAG	C4-C5-C6-O6
4	A	603	NAG	C8-C7-N2-C2
4	A	603	NAG	O7-C7-N2-C2
2	A	601	HEM	CAD-CBD-CGD-O1D
2	A	601	HEM	CAD-CBD-CGD-O2D
2	A	601	HEM	CAA-CBA-CGA-O1A
2	A	601	HEM	CAA-CBA-CGA-O2A

There are no ring outliers.

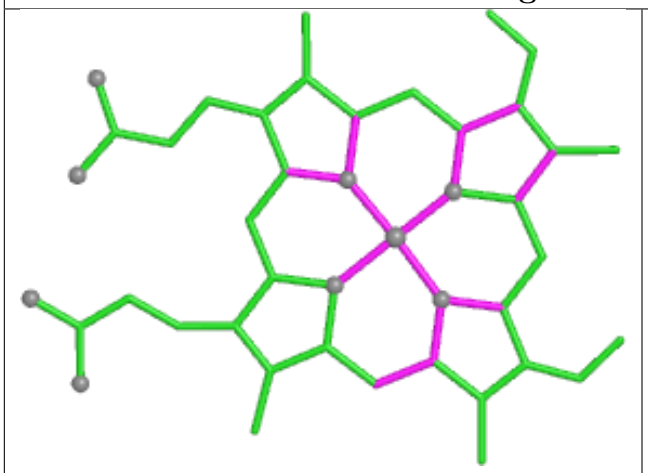
6 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	601	HEM	2	0
7	A	621	61D	2	0
7	A	612	61D	1	0
7	A	618	61D	2	0
7	A	617	61D	1	0
7	A	614	61D	1	0

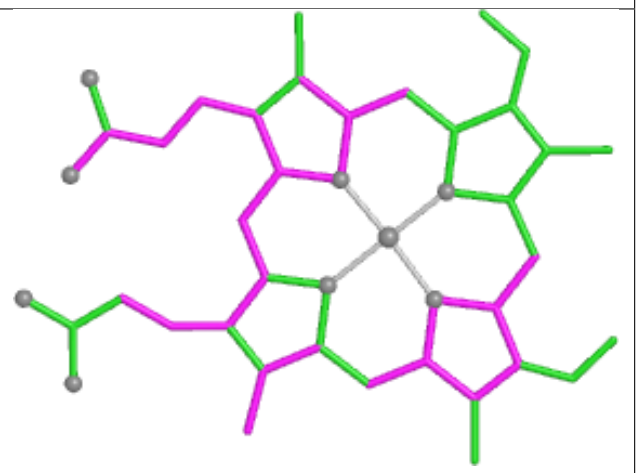
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient

equivalents in the CSD to analyse the geometry.

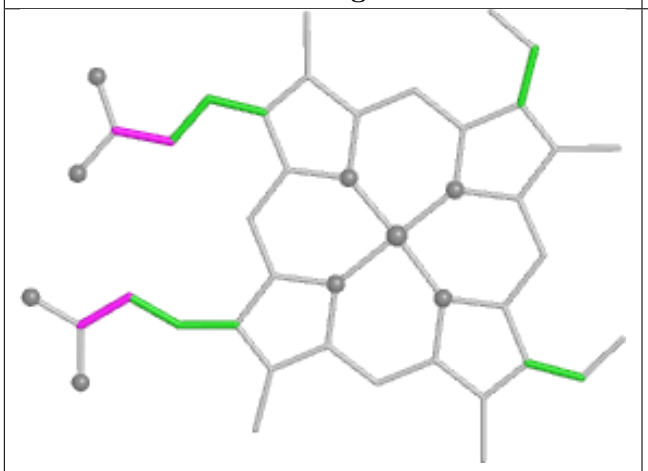
Ligand HEM A 601



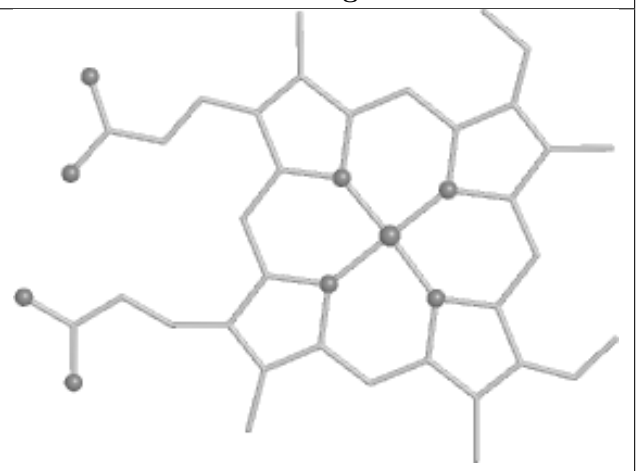
Bond lengths



Bond angles

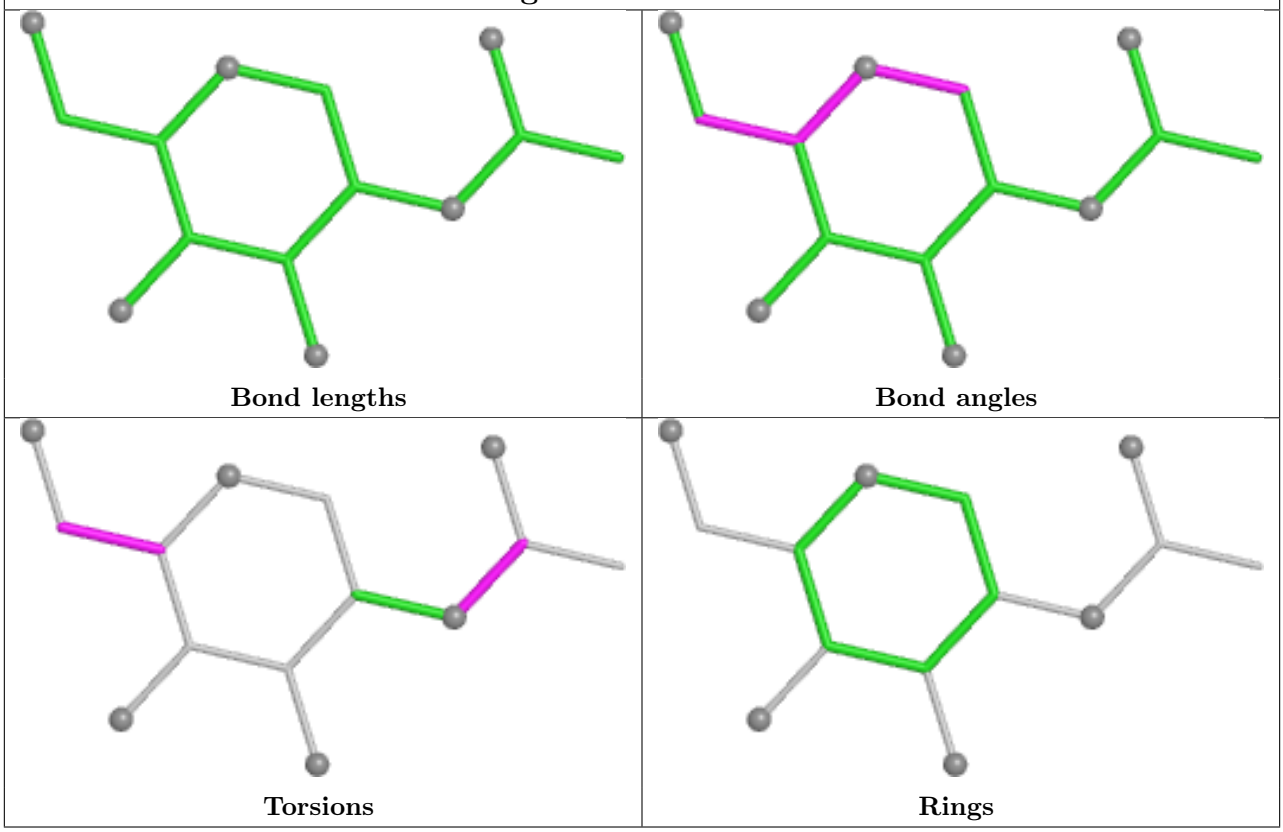


Torsions

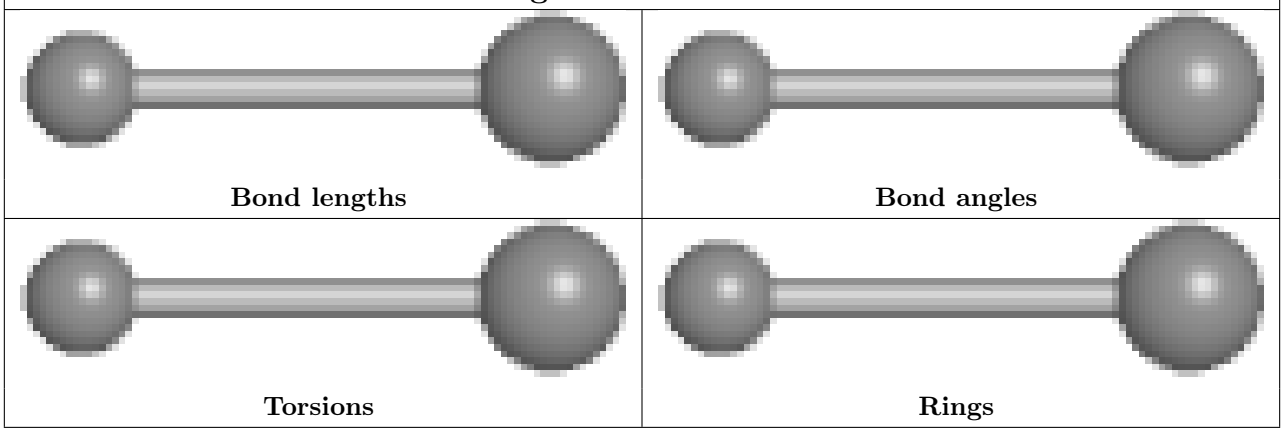


Rings

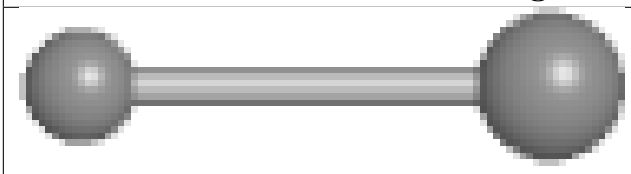
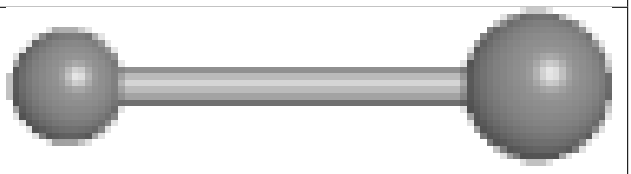
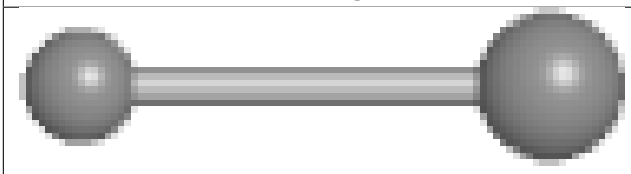
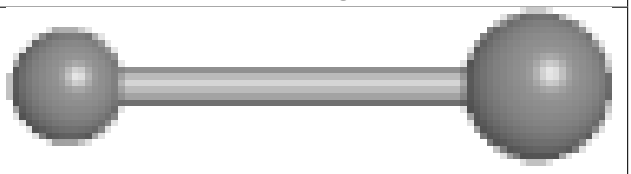
Ligand NAG A 603



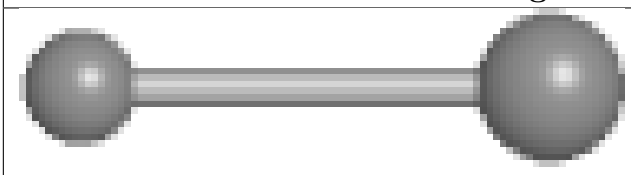
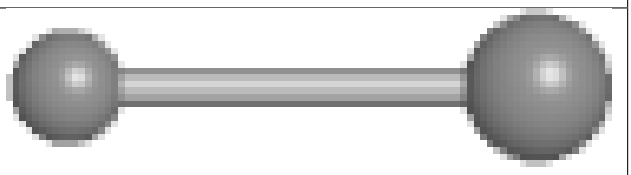
Ligand 61D A 621

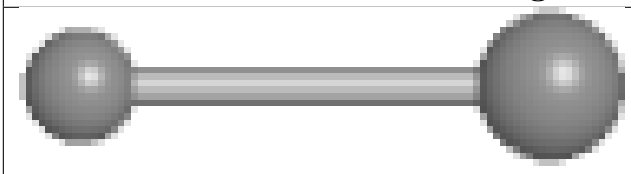
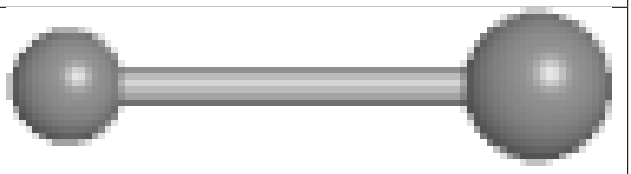
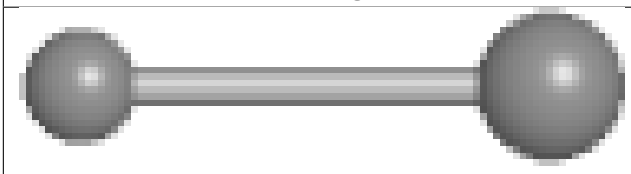
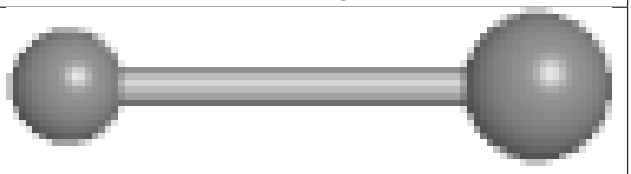


Ligand 61D A 612	
Bond lengths	Bond angles
Torsions	Rings

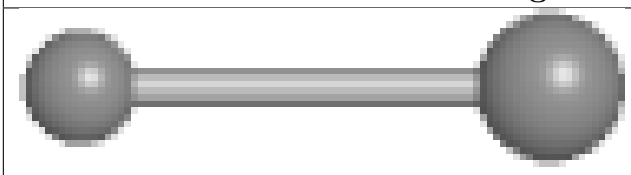
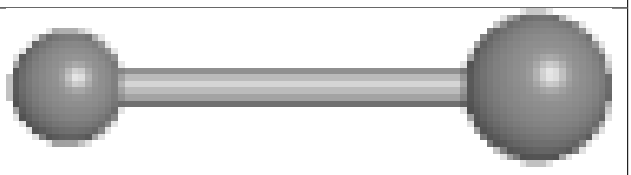
Ligand 61D A 613	
 Bond lengths	 Bond angles
 Torsions	 Rings

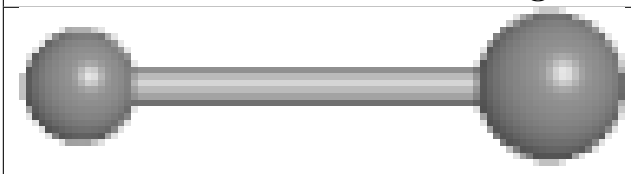
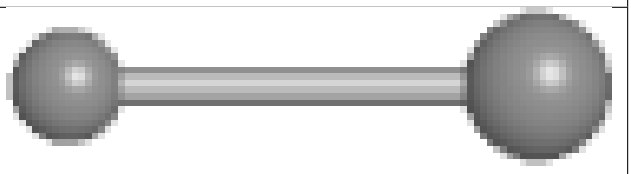
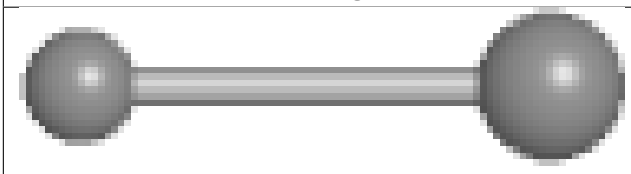
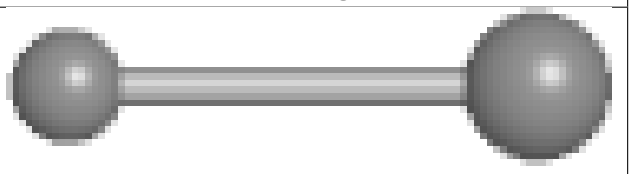
Ligand 61D A 618	
Bond lengths	Bond angles
Torsions	Rings

Ligand 61D A 615	
 Bond lengths	 Bond angles
Torsions	Rings

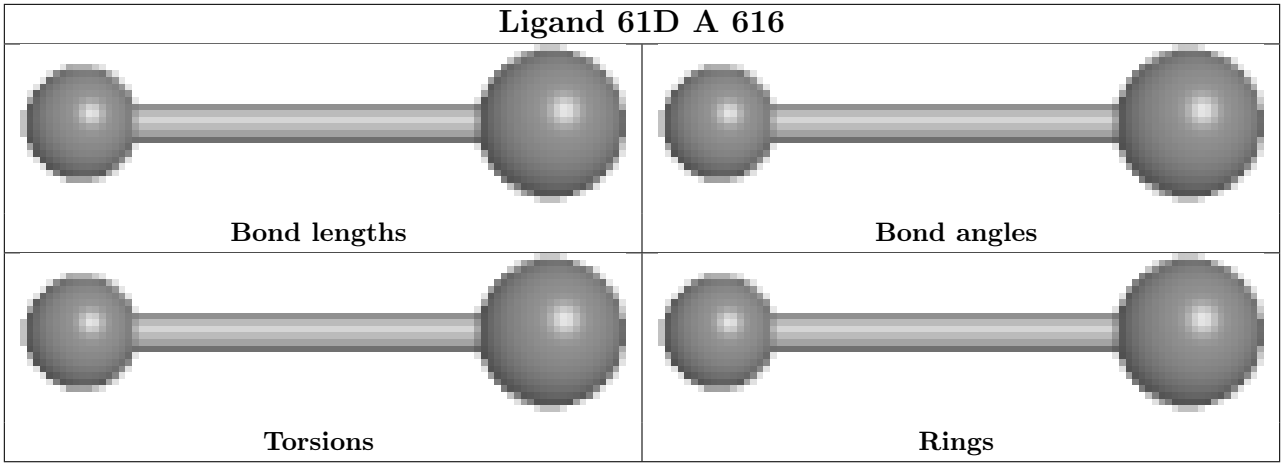
Ligand 61D A 617	
 Bond lengths	 Bond angles
 Torsions	 Rings

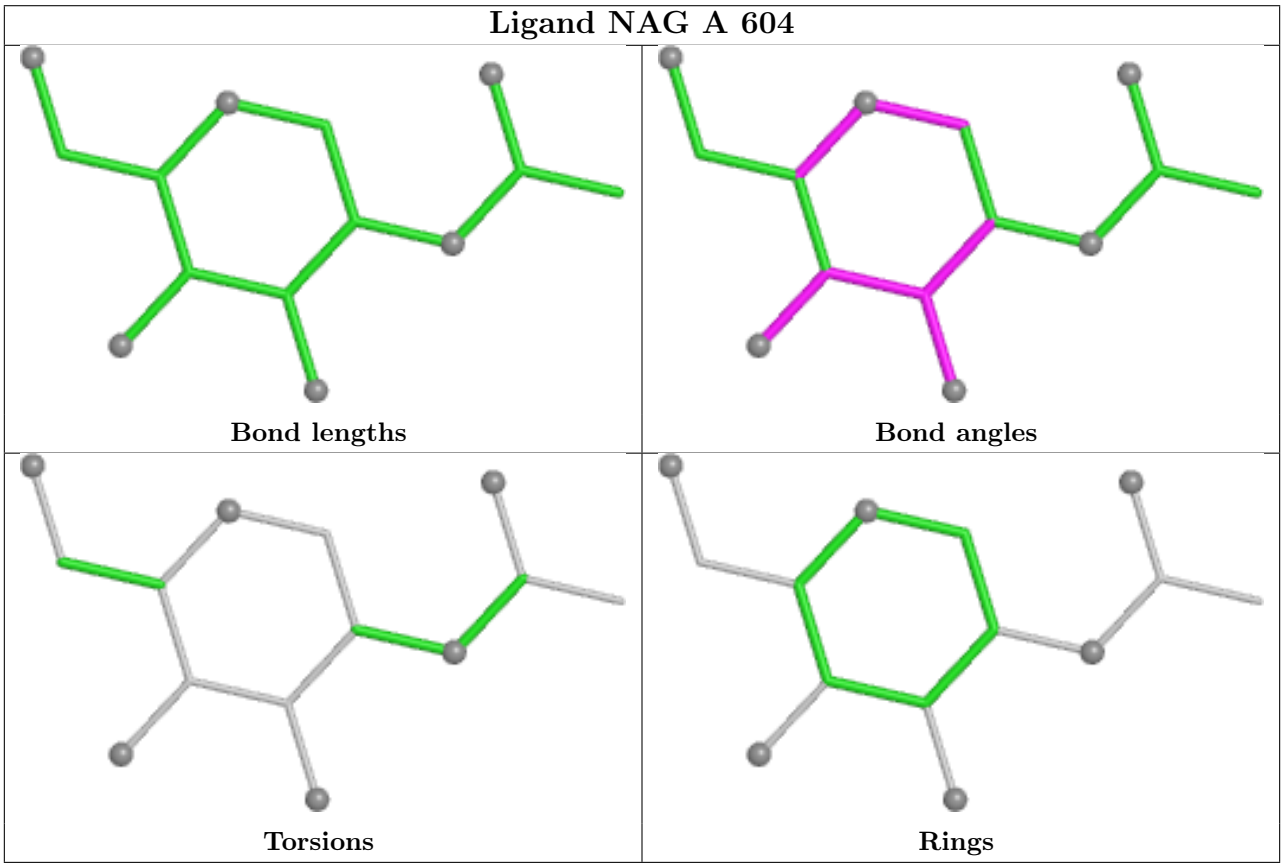
Ligand 61D A 614	
Bond lengths	Bond angles
Torsions	Rings

Ligand 61D A 619	
 Bond lengths	 Bond angles
Torsions	Rings

Ligand 61D A 622	
 Bond lengths	 Bond angles
 Torsions	 Rings

Ligand 61D A 620	
Bond lengths	Bond angles
Torsions	Rings





5.7 Other polymers (i)

There are no such residues in this entry.

5.8 Polymer linkage issues (i)

There are no chain breaks in this entry.

6 Fit of model and data (i)

6.1 Protein, DNA and RNA chains (i)

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å^2)	Q<0.9
1	A	595/595 (100%)	-0.16	13 (2%) 62 59	32, 60, 128, 233	1 (0%)

All (13) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	423	GLN	4.3
1	A	265	VAL	4.0
1	A	9	PRO	3.7
1	A	8	ALA	3.4
1	A	175	LEU	3.1
1	A	12	LEU	2.7
1	A	10	VAL	2.5
1	A	431	PHE	2.4
1	A	182	SER	2.2
1	A	168	PRO	2.2
1	A	250	GLN	2.2
1	A	1	SER	2.2
1	A	582	ILE	2.1

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

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

6.3 Carbohydrates (i)

There are no oligosaccharides in this entry.

6.4 Ligands (i)

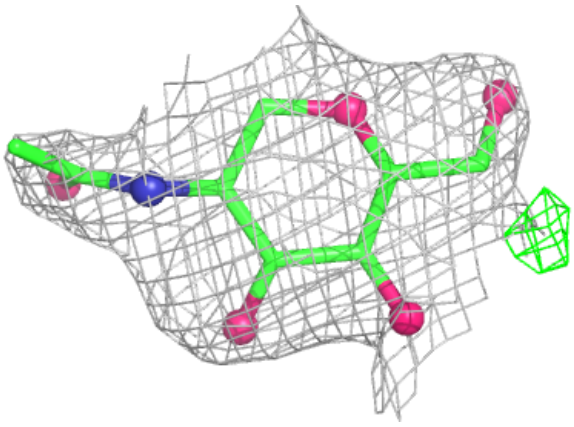
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

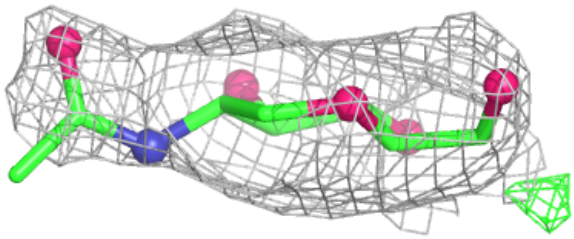
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
4	NAG	A	603	14/15	0.77	0.10	83,93,99,106	0
4	NAG	A	604	14/15	0.90	0.08	58,66,74,75	0
5	IOD	A	605	1/1	0.92	0.07	76,76,76,76	1
6	SO4	A	611	5/5	0.92	0.11	48,52,65,71	0
5	IOD	A	607	1/1	0.93	0.07	89,89,89,89	1
7	61D	A	620	2/2	0.93	0.12	74,74,74,98	2
7	61D	A	619	2/2	0.95	0.08	57,57,57,70	2
5	IOD	A	610	1/1	0.96	0.04	68,68,68,68	1
7	61D	A	617	2/2	0.96	0.07	85,85,85,104	2
7	61D	A	614	2/2	0.97	0.06	89,89,89,101	2
5	IOD	A	609	1/1	0.97	0.04	85,85,85,85	1
7	61D	A	612	2/2	0.97	0.07	55,55,55,67	2
7	61D	A	613	2/2	0.97	0.08	57,57,57,76	2
2	HEM	A	601	43/43	0.98	0.06	34,40,43,52	0
7	61D	A	618	2/2	0.98	0.06	66,66,66,81	2
7	61D	A	621	2/2	0.98	0.05	52,52,52,62	2
5	IOD	A	608	1/1	0.99	0.02	74,74,74,74	1
7	61D	A	615	2/2	0.99	0.04	60,60,60,68	2
7	61D	A	616	2/2	0.99	0.04	39,39,39,54	2
5	IOD	A	606	1/1	0.99	0.03	61,61,61,61	1
3	CA	A	602	1/1	1.00	0.02	49,49,49,49	0
7	61D	A	622	2/2	1.00	0.02	46,46,46,54	2

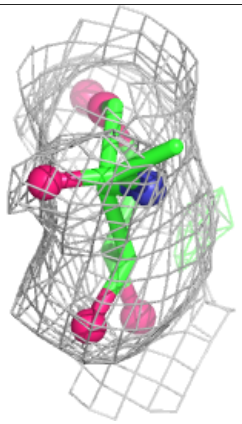
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around NAG A 603:

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

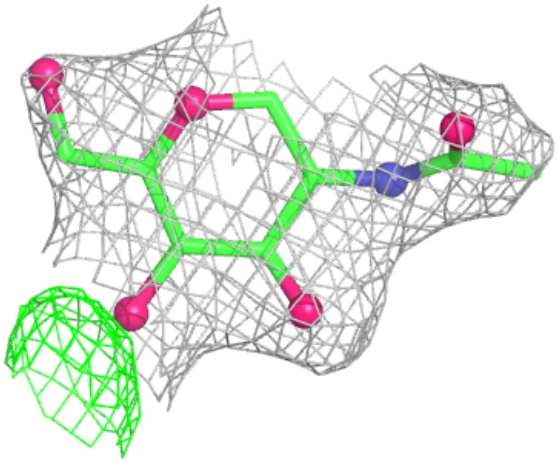


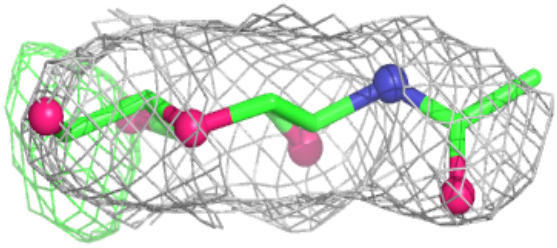


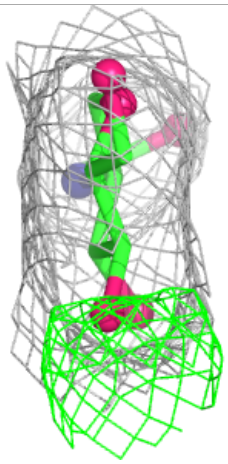


Electron density around NAG A 604:

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

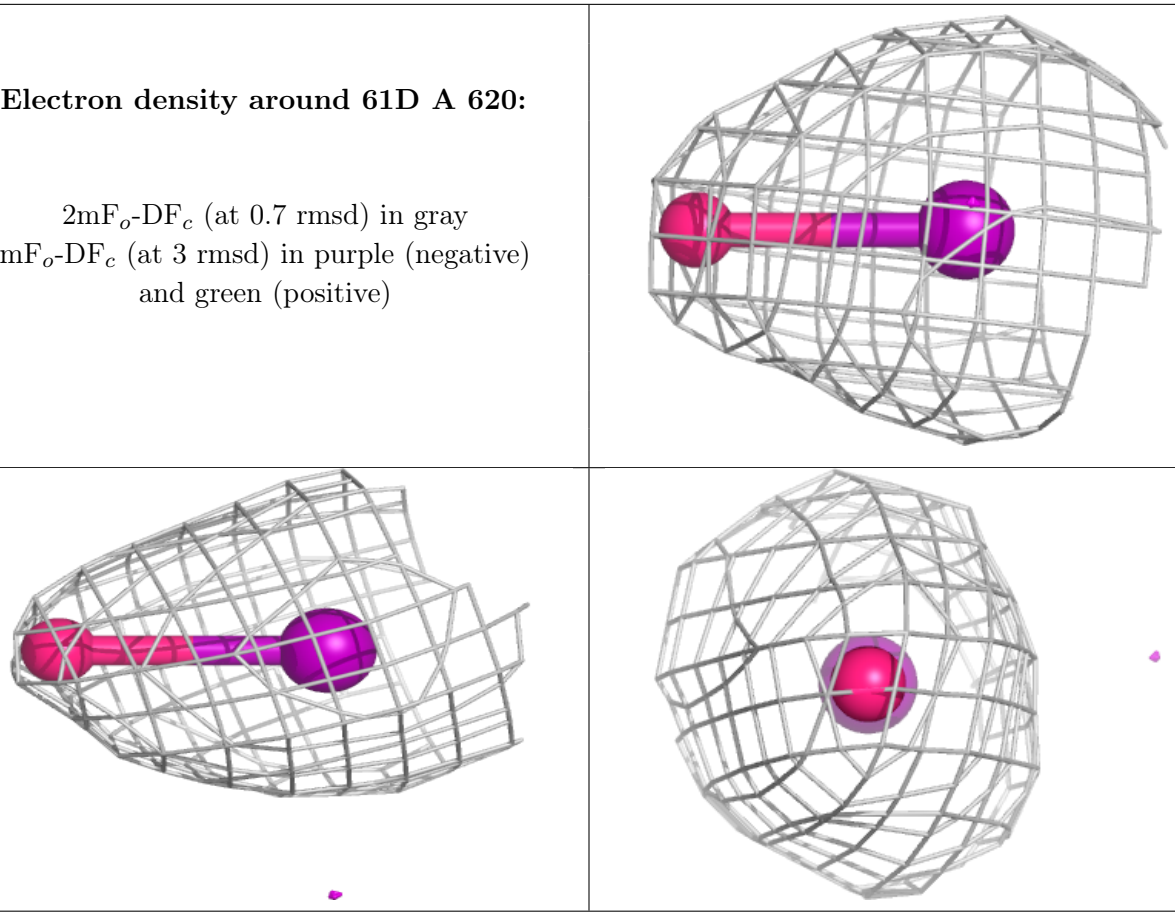






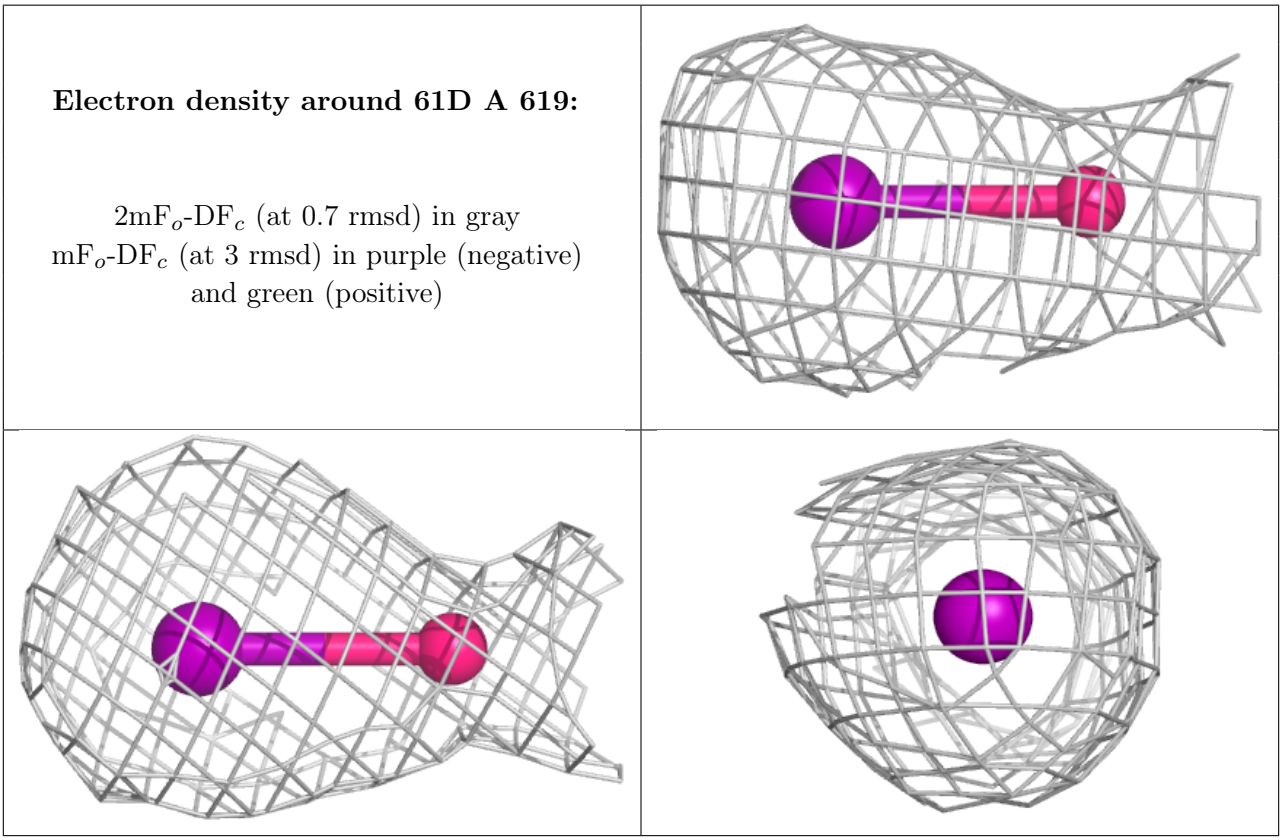
Electron density around 61D A 620:

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



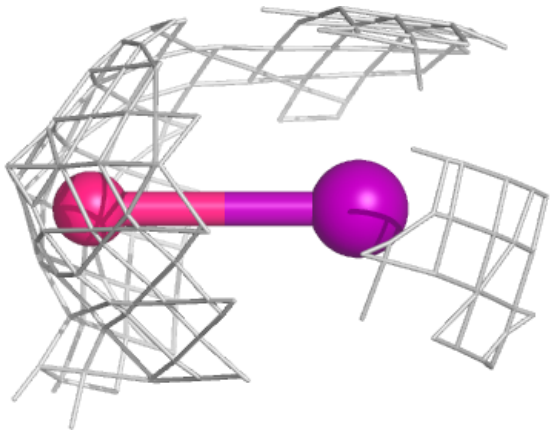
Electron density around 61D A 619:

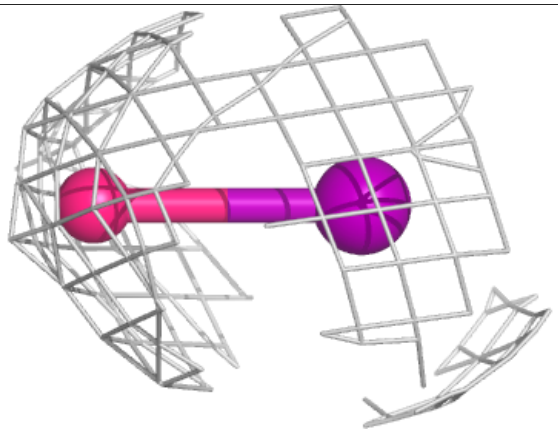
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

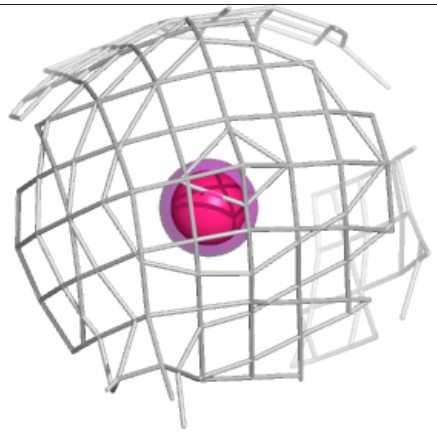


Electron density around 61D A 617:

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

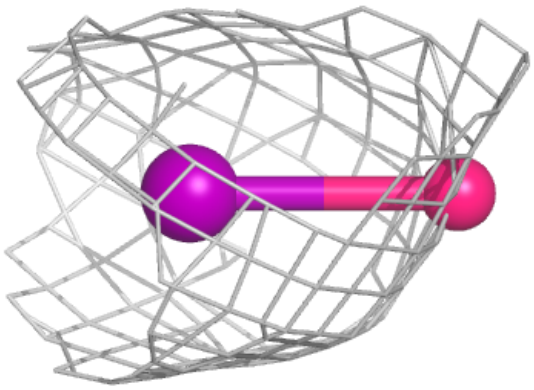


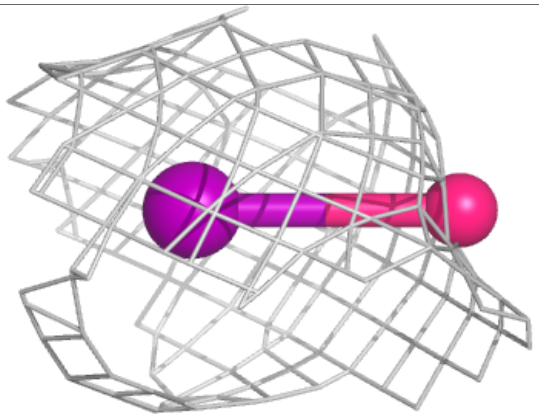


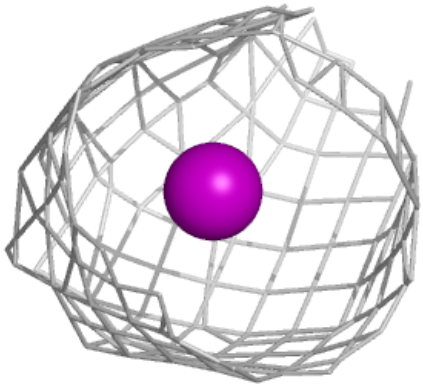


Electron density around 61D A 614:

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

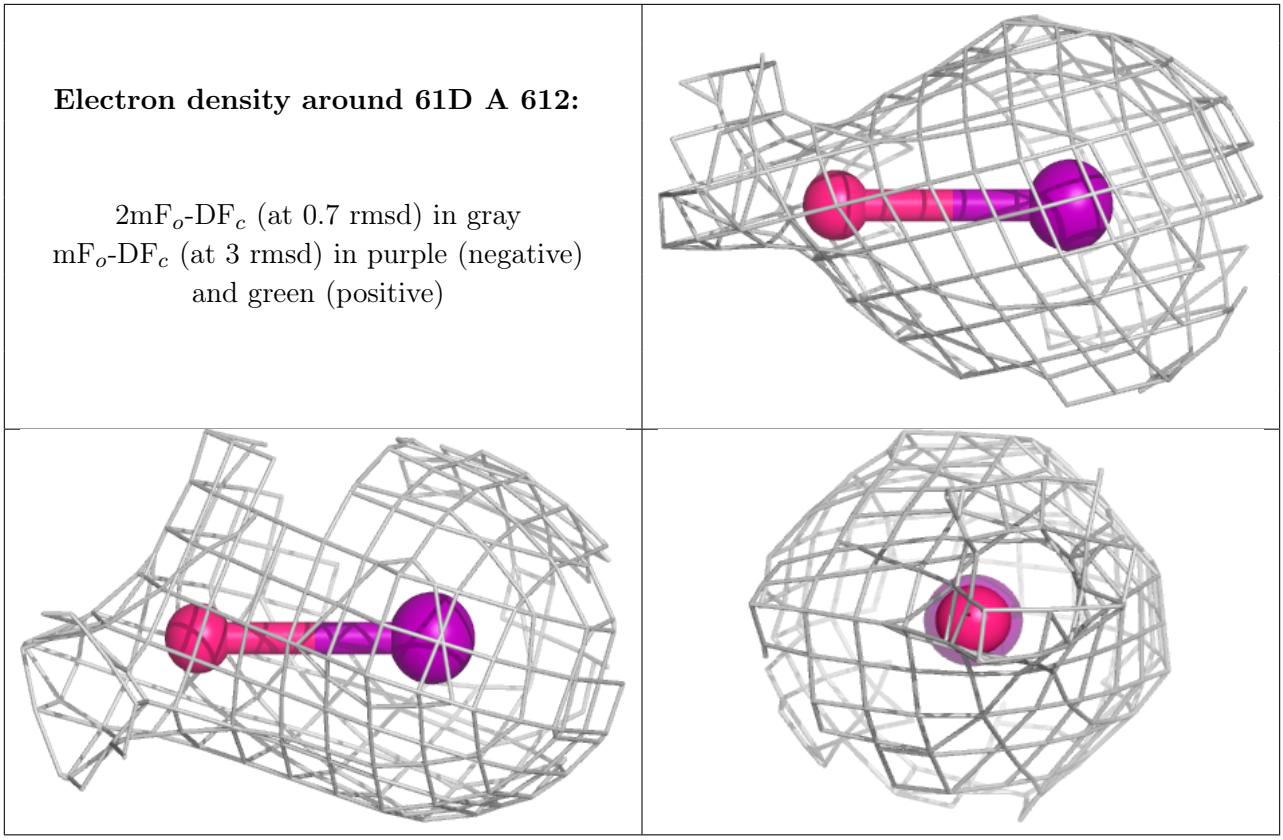






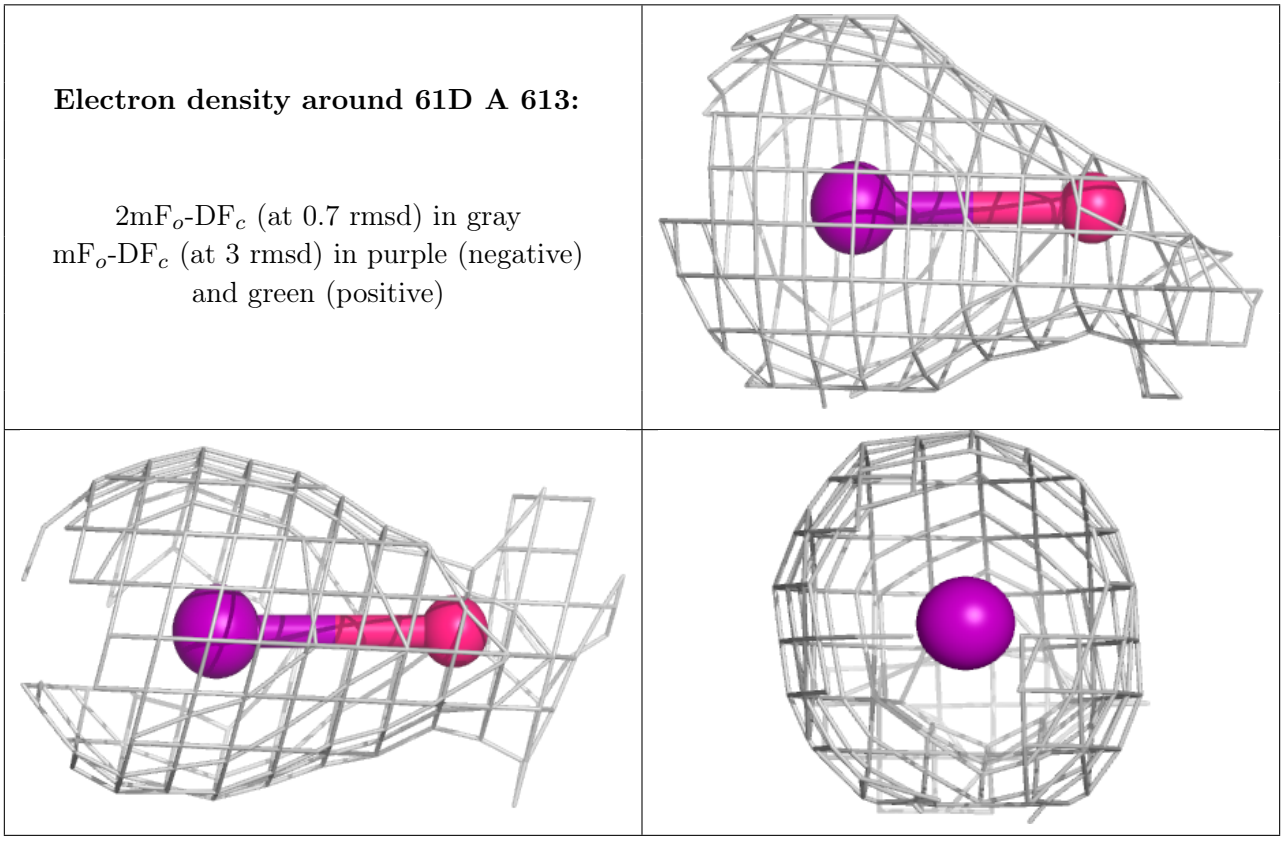
Electron density around 61D A 612:

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



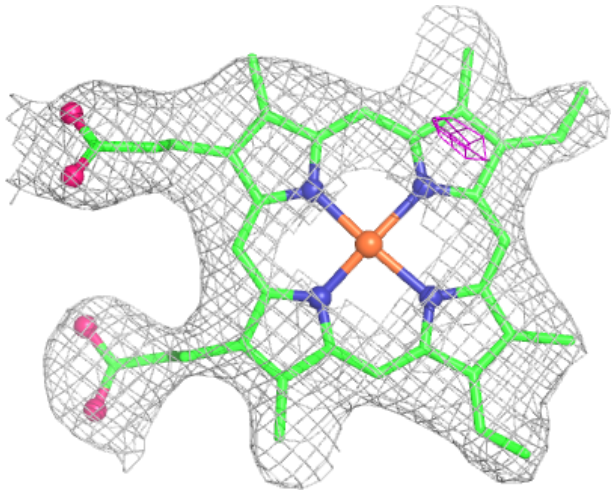
Electron density around 61D A 613:

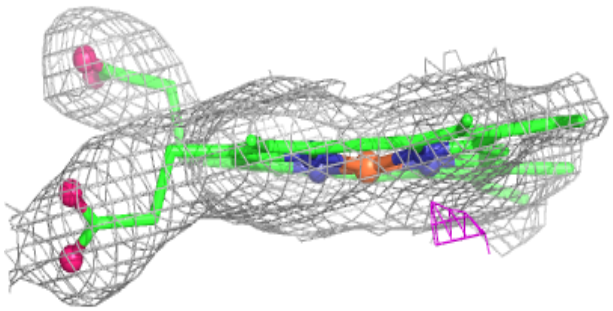
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

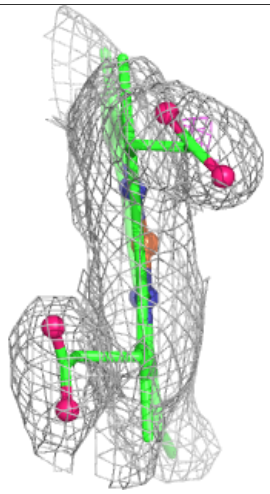


Electron density around HEM A 601:

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

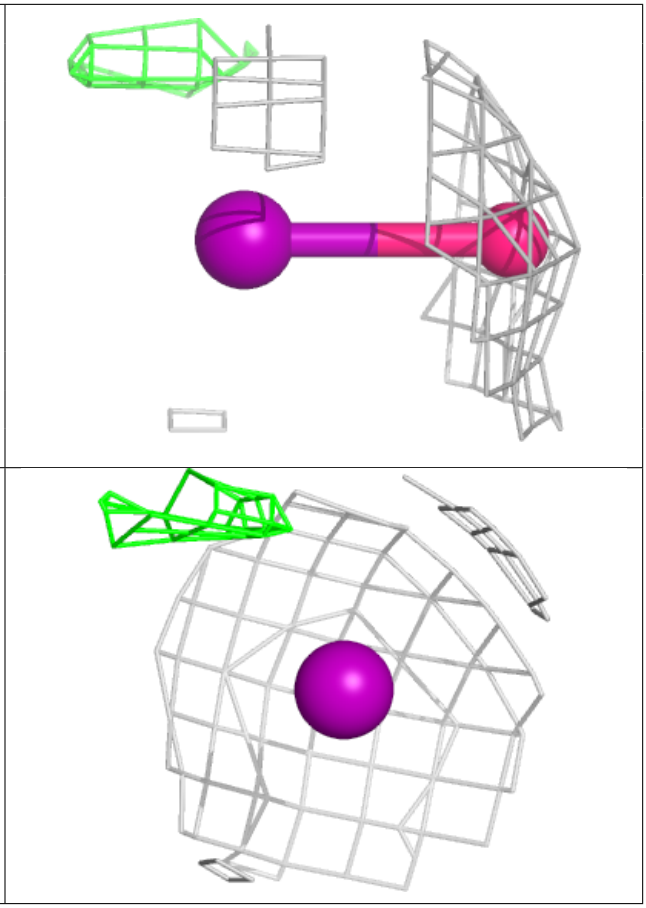






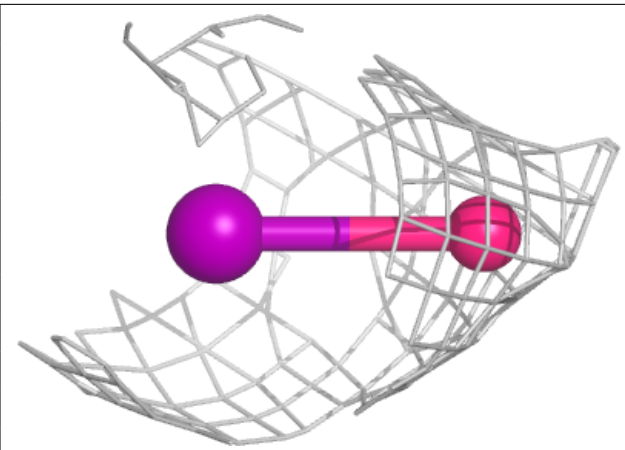
Electron density around 61D A 618:

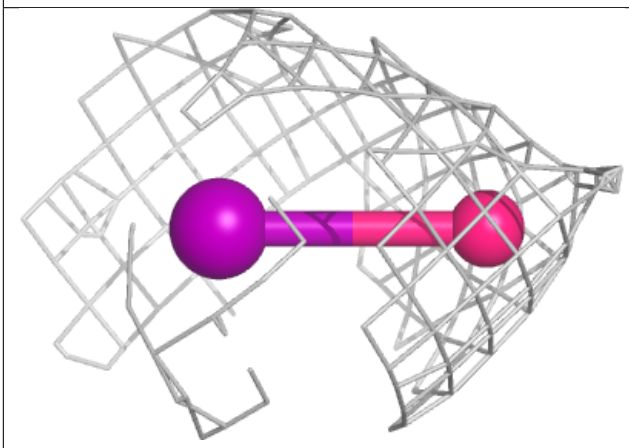
$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

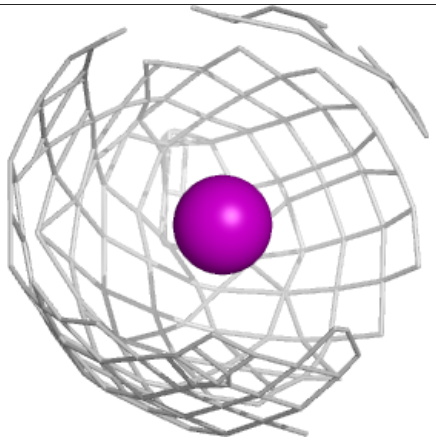


Electron density around 61D A 621:

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

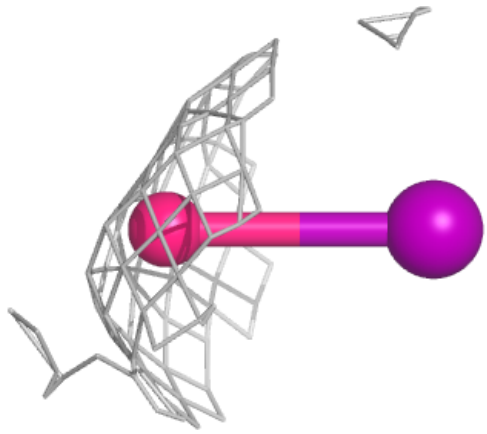


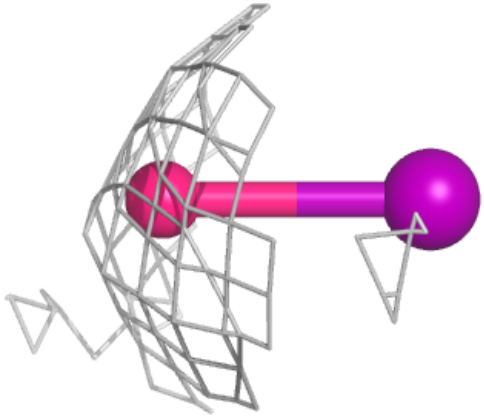


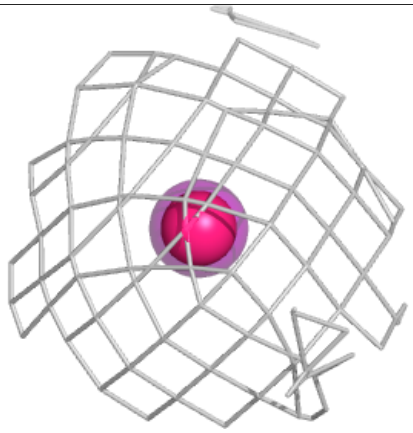


Electron density around 61D A 615:

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

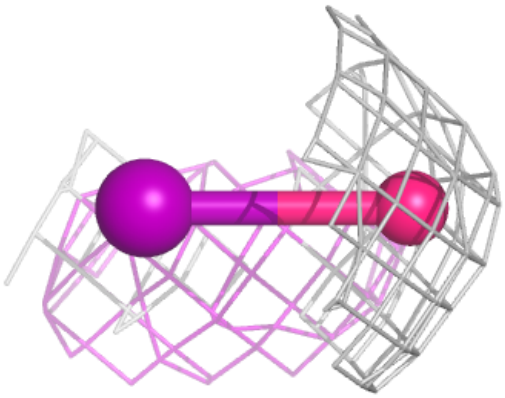


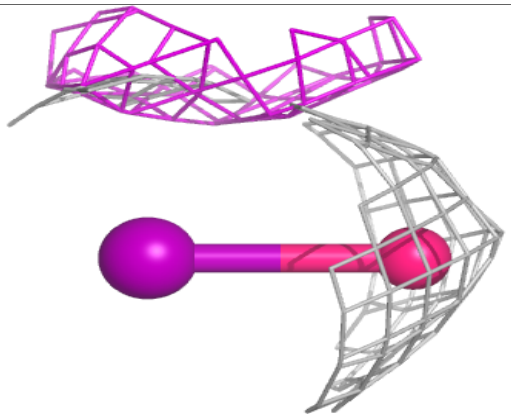


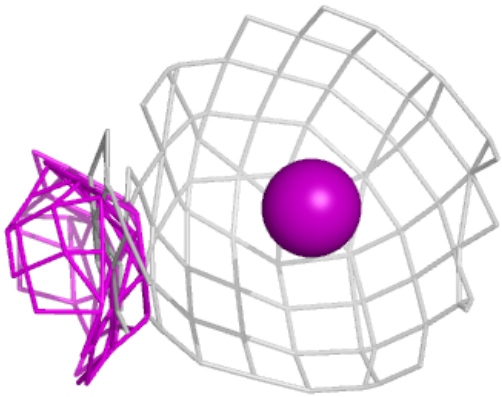


Electron density around 61D A 616:

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

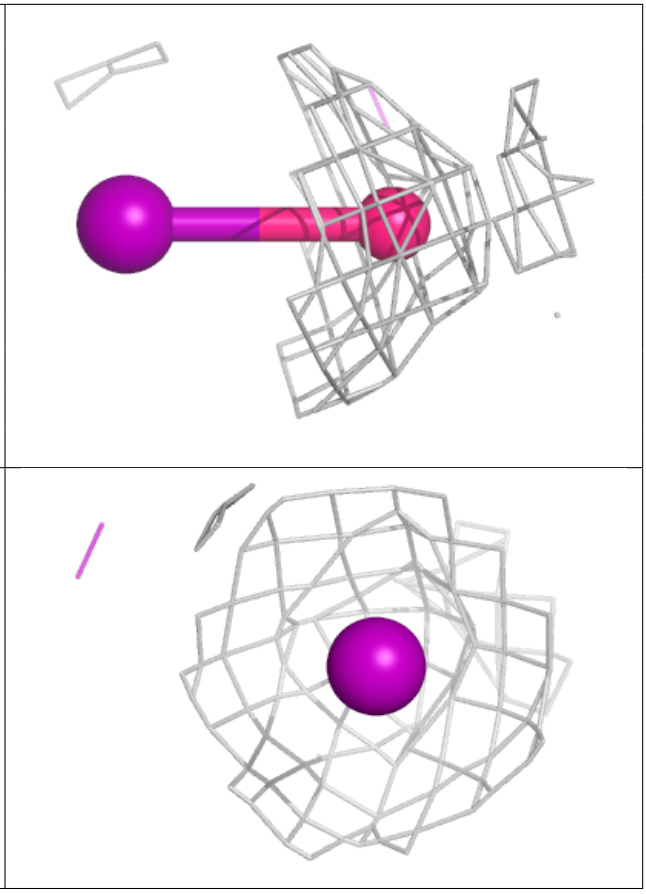






Electron density around 61D A 622:

$2mF_o$-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.