



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 12:18 AM UTC

PDB ID : 5TFU / pdb_00005tfu
Title : Structure of cytochrome P450 2D6 (CYP2D6) BACE1 inhibitor complex
Authors : Hsu, M.H.; Johnson, E.F.
Deposited on : 2016-09-26
Resolution : 2.75 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

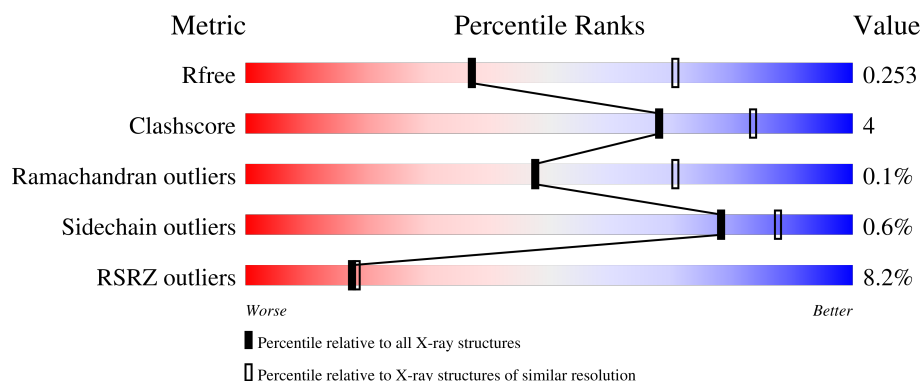
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.75 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	1009 (2.76-2.76)
Clashscore	190562	1044 (2.76-2.76)
Ramachandran outliers	187476	1024 (2.76-2.76)
Sidechain outliers	187428	1024 (2.76-2.76)
RSRZ outliers	180081	1009 (2.76-2.76)

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	479	9% 88% 6% 6%
1	B	479	6% 87% 7% 6%
1	C	479	8% 81% 12% 6%
1	D	479	9% 83% 11% 5%

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 14697 atoms, of which 0 are hydrogens and 0 are deuteriums.

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

- Molecule 1 is a protein called Cytochrome P450 2D6.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	451	Total	C	N	O	S	0	0	0
			3567	2286	633	634	14			
1	B	451	Total	C	N	O	S	0	0	0
			3574	2290	634	636	14			
1	C	450	Total	C	N	O	S	0	0	0
			3565	2284	632	635	14			
1	D	453	Total	C	N	O	S	0	0	0
			3586	2298	636	638	14			

There are 60 discrepancies between the modelled and reference sequences:

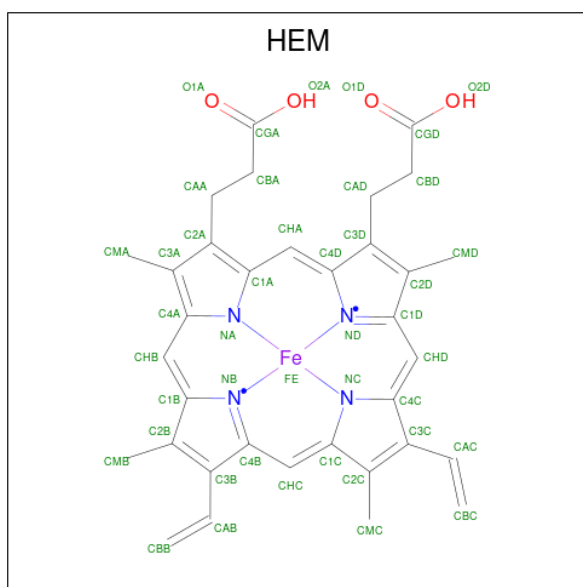
Chain	Residue	Modelled	Actual	Comment	Reference
A	23	MET	-	initiating methionine	UNP P10635
A	24	ALA	-	expression tag	UNP P10635
A	25	LYS	-	expression tag	UNP P10635
A	26	LYS	-	expression tag	UNP P10635
A	27	THR	-	expression tag	UNP P10635
A	28	SER	-	expression tag	UNP P10635
A	29	SER	-	expression tag	UNP P10635
A	30	LYS	-	expression tag	UNP P10635
A	31	GLY	-	expression tag	UNP P10635
A	32	LYS	-	expression tag	UNP P10635
A	33	LEU	-	expression tag	UNP P10635
A	498	HIS	-	expression tag	UNP P10635
A	499	HIS	-	expression tag	UNP P10635
A	500	HIS	-	expression tag	UNP P10635
A	501	HIS	-	expression tag	UNP P10635
B	23	MET	-	initiating methionine	UNP P10635
B	24	ALA	-	expression tag	UNP P10635
B	25	LYS	-	expression tag	UNP P10635
B	26	LYS	-	expression tag	UNP P10635
B	27	THR	-	expression tag	UNP P10635
B	28	SER	-	expression tag	UNP P10635

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Chain	Residue	Modelled	Actual	Comment	Reference
B	29	SER	-	expression tag	UNP P10635
B	30	LYS	-	expression tag	UNP P10635
B	31	GLY	-	expression tag	UNP P10635
B	32	LYS	-	expression tag	UNP P10635
B	33	LEU	-	expression tag	UNP P10635
B	498	HIS	-	expression tag	UNP P10635
B	499	HIS	-	expression tag	UNP P10635
B	500	HIS	-	expression tag	UNP P10635
B	501	HIS	-	expression tag	UNP P10635
C	23	MET	-	initiating methionine	UNP P10635
C	24	ALA	-	expression tag	UNP P10635
C	25	LYS	-	expression tag	UNP P10635
C	26	LYS	-	expression tag	UNP P10635
C	27	THR	-	expression tag	UNP P10635
C	28	SER	-	expression tag	UNP P10635
C	29	SER	-	expression tag	UNP P10635
C	30	LYS	-	expression tag	UNP P10635
C	31	GLY	-	expression tag	UNP P10635
C	32	LYS	-	expression tag	UNP P10635
C	33	LEU	-	expression tag	UNP P10635
C	498	HIS	-	expression tag	UNP P10635
C	499	HIS	-	expression tag	UNP P10635
C	500	HIS	-	expression tag	UNP P10635
C	501	HIS	-	expression tag	UNP P10635
D	23	MET	-	initiating methionine	UNP P10635
D	24	ALA	-	expression tag	UNP P10635
D	25	LYS	-	expression tag	UNP P10635
D	26	LYS	-	expression tag	UNP P10635
D	27	THR	-	expression tag	UNP P10635
D	28	SER	-	expression tag	UNP P10635
D	29	SER	-	expression tag	UNP P10635
D	30	LYS	-	expression tag	UNP P10635
D	31	GLY	-	expression tag	UNP P10635
D	32	LYS	-	expression tag	UNP P10635
D	33	LEU	-	expression tag	UNP P10635
D	498	HIS	-	expression tag	UNP P10635
D	499	HIS	-	expression tag	UNP P10635
D	500	HIS	-	expression tag	UNP P10635
D	501	HIS	-	expression tag	UNP P10635

- Molecule 2 is PROTOPORPHYRIN IX CONTAINING FE (CCD ID: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).

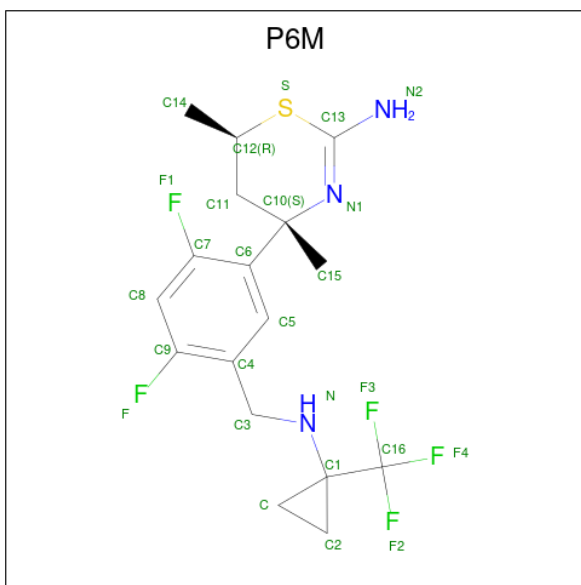


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	B	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	C	1	Total 43	C 34	Fe 1	N 4	O 4	0	0
2	D	1	Total 43	C 34	Fe 1	N 4	O 4	0	0

- Molecule 3 is ZINC ION (CCD ID: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Zn	0	0
			2	2		
3	B	1	Total	Zn	0	0
			1	1		
3	C	1	Total	Zn	0	0
			1	1		
3	D	1	Total	Zn	0	0
			1	1		

- Molecule 4 is (4S,6R)-4-[2,4-difluoro-5-({[1-(trifluoromethyl)cyclopropyl]amino}methyl)phenyl]-4,6-dimethyl-5,6-dihydro-4H-1,3-thiazin-2-amine (CCD ID: P6M) (formula: C₁₇H₂₀F₅N₃S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total	C	F	N	S	0	0
			26	17	5	3	1		
4	B	1	Total	C	F	N	S	0	0
			26	17	5	3	1		
4	C	1	Total	C	F	N	S	0	0
			26	17	5	3	1		
4	D	1	Total	C	F	N	S	0	0
			26	17	5	3	1		

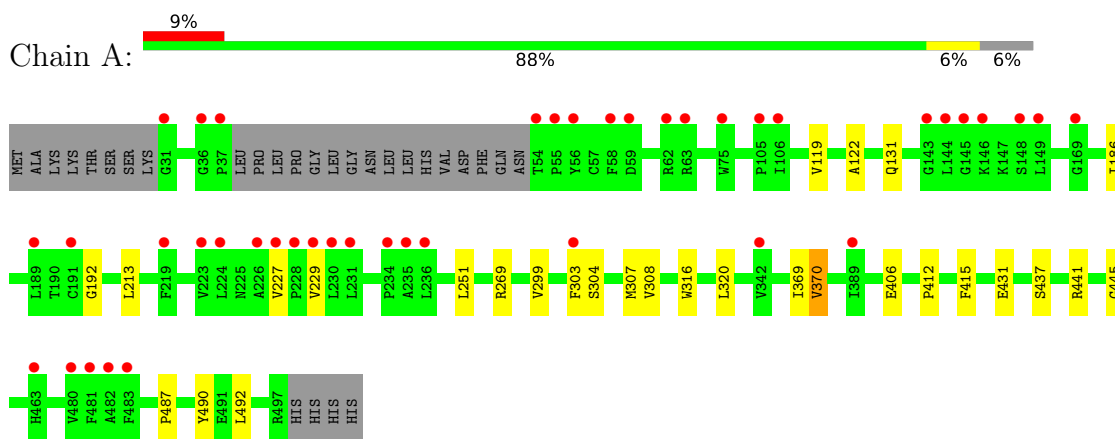
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	35	Total	O	0	0
			35	35		
5	B	29	Total	O	0	0
			29	29		
5	C	29	Total	O	0	0
			29	29		
5	D	31	Total	O	0	0
			31	31		

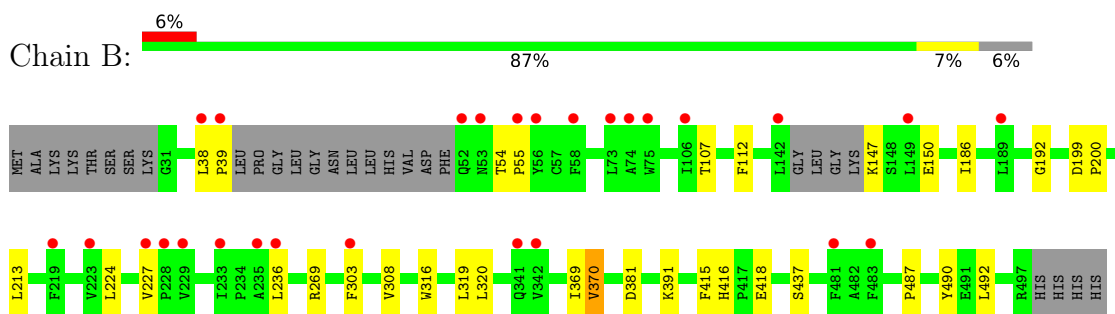
3 Residue-property plots [i](#)

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

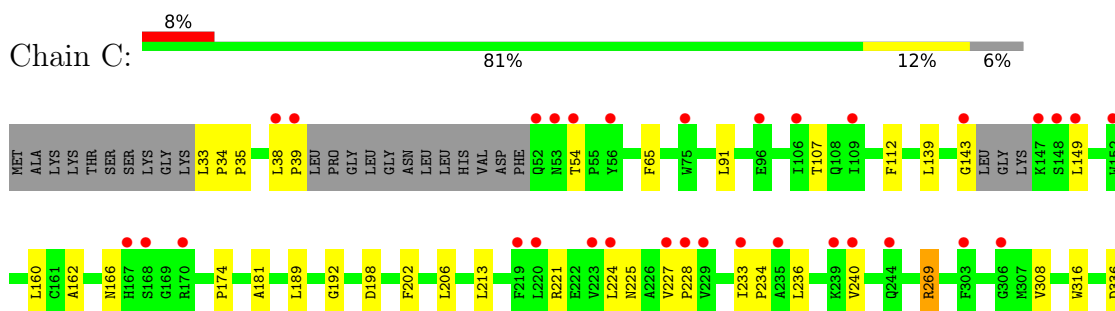
• Molecule 1: Cytochrome P450 2D6

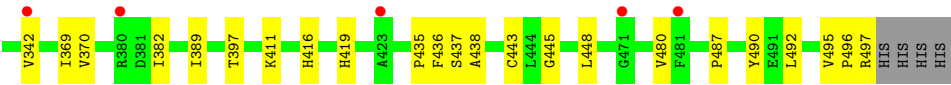


• Molecule 1: Cytochrome P450 2D6

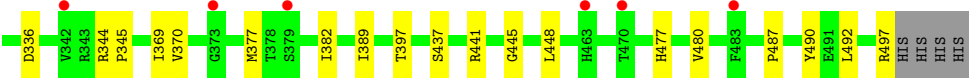
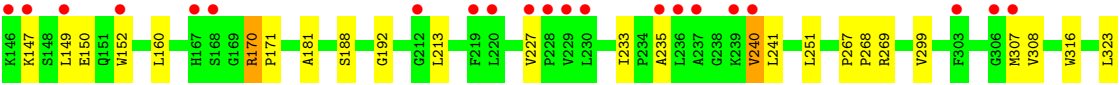
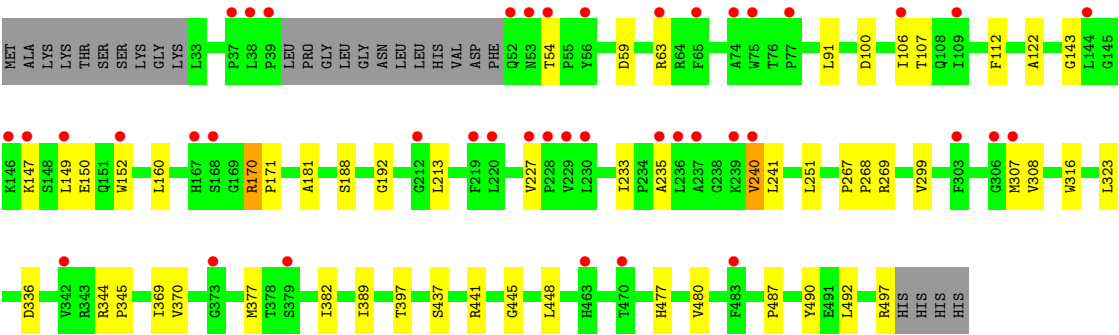
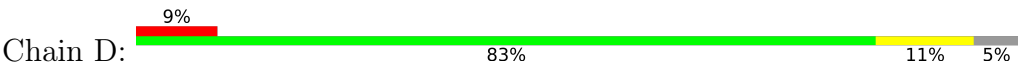


• Molecule 1: Cytochrome P450 2D6





● Molecule 1: Cytochrome P450 2D6



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	57.10Å 191.76Å 246.84Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	39.07 – 2.75 39.07 – 2.75	Depositor EDS
% Data completeness (in resolution range)	98.9 (39.07-2.75) 99.2 (39.07-2.75)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.06 (at 2.77Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.211 , 0.250 0.219 , 0.253	Depositor DCC
R_{free} test set	3532 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å ²)	45.6	Xtriage
Anisotropy	0.723	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 35.4	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	0.93	EDS
Total number of atoms	14697	wwPDB-VP
Average B, all atoms (Å ²)	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 23.99 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 4.1823e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

¹Intensities estimated from amplitudes.

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

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, P6M, HEM

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	0.27	0/3662	0.71	0/4977
1	B	0.28	0/3669	0.72	0/4988
1	C	0.28	0/3660	0.74	4/4977 (0.1%)
1	D	0.29	0/3682	0.73	1/5007 (0.0%)
All	All	0.28	0/14673	0.73	5/19949 (0.0%)

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	54	THR	CA-C-N	-7.35	111.40	119.19
1	C	54	THR	C-N-CA	-7.35	111.40	119.19
1	D	170	ARG	N-CA-C	6.17	115.40	108.25
1	C	411	LYS	CA-C-N	5.23	124.90	119.56
1	C	411	LYS	C-N-CA	5.23	124.90	119.56

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	3567	0	3554	15	0
1	B	3574	0	3555	17	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	3565	0	3542	33	0
1	D	3586	0	3570	30	0
2	A	43	0	30	4	0
2	B	43	0	30	3	0
2	C	43	0	30	6	0
2	D	43	0	30	7	0
3	A	2	0	0	0	0
3	B	1	0	0	0	0
3	C	1	0	0	0	0
3	D	1	0	0	0	0
4	A	26	0	0	0	0
4	B	26	0	0	0	0
4	C	26	0	0	0	0
4	D	26	0	0	0	0
5	A	35	0	0	0	0
5	B	29	0	0	0	0
5	C	29	0	0	0	0
5	D	31	0	0	0	0
All	All	14697	0	14341	103	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 4.

All (103) 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:186:ILE:HG21	1:A:303:PHE:HA	1.62	0.80
1:B:186:ILE:HG21	1:B:303:PHE:HA	1.65	0.79
1:D:122:ALA:O	1:D:441:ARG:NH2	2.23	0.71
1:A:122:ALA:O	1:A:441:ARG:NH2	2.19	0.70
1:B:147:LYS:HG2	1:B:150:GLU:HB3	1.73	0.70
1:B:192:GLY:O	1:B:269:ARG:NH2	2.26	0.68
1:D:441:ARG:NH1	2:D:601:HEM:O2D	2.30	0.65
1:D:213:LEU:HD13	1:D:308:VAL:HG21	1.80	0.64
1:D:369:ILE:HG13	1:D:370:VAL:HG23	1.81	0.63
1:C:369:ILE:HG13	1:C:370:VAL:HG23	1.82	0.61
1:A:369:ILE:HG13	1:A:370:VAL:HG23	1.83	0.61
1:A:227:VAL:HG12	1:A:229:VAL:HG22	1.86	0.58
1:D:170:ARG:HB2	1:D:171:PRO:HD2	1.87	0.56
1:D:240:VAL:HG22	1:D:241:LEU:HG	1.87	0.56
1:B:38:LEU:HD12	1:B:39:PRO:HD2	1.89	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:601:HEM:HBC2	2:C:601:HEM:HMC2	1.88	0.55
1:C:490:TYR:HE1	1:C:492:LEU:HD23	1.72	0.54
1:C:233:ILE:HD12	1:C:236:LEU:HD12	1.89	0.54
1:C:213:LEU:HD22	1:C:308:VAL:HG21	1.89	0.53
1:A:213:LEU:HD22	1:A:308:VAL:HG21	1.90	0.53
1:C:143:GLY:HA2	1:C:149:LEU:HB2	1.91	0.53
1:C:445:GLY:HA3	2:C:601:HEM:C3C	2.44	0.52
1:D:147:LYS:HG2	1:D:150:GLU:HB2	1.90	0.52
2:B:601:HEM:HBB2	2:B:601:HEM:HMB2	1.90	0.52
1:D:59:ASP:O	1:D:63:ARG:HG2	2.10	0.52
2:D:601:HEM:HMC2	2:D:601:HEM:HBC2	1.91	0.52
2:A:601:HEM:HBB2	2:A:601:HEM:HMB2	1.90	0.52
2:A:601:HEM:HMC2	2:A:601:HEM:HBC2	1.91	0.52
1:B:490:TYR:HE1	1:B:492:LEU:HD23	1.73	0.52
1:C:336:ASP:OD2	1:C:497:ARG:NH2	2.42	0.51
2:D:601:HEM:HMB2	2:D:601:HEM:HBB2	1.92	0.51
1:C:38:LEU:HD12	1:C:39:PRO:HD2	1.93	0.51
1:A:406:GLU:HA	1:A:412:PRO:HG3	1.92	0.50
1:A:490:TYR:HE1	1:A:492:LEU:HD23	1.76	0.50
1:B:213:LEU:HD22	1:B:308:VAL:HG21	1.92	0.50
1:C:35:PRO:HG2	1:C:65:PHE:HB3	1.93	0.50
1:A:192:GLY:O	1:A:269:ARG:NH2	2.44	0.50
2:B:601:HEM:HBC2	2:B:601:HEM:HMC2	1.94	0.50
1:C:192:GLY:O	1:C:269:ARG:NH2	2.45	0.50
1:D:448:LEU:HD23	2:D:601:HEM:HBC2	1.93	0.50
1:C:160:LEU:HD13	1:C:181:ALA:HB2	1.93	0.49
1:C:448:LEU:HD23	2:C:601:HEM:HBC2	1.94	0.49
1:D:251:LEU:HD21	1:D:299:VAL:HG12	1.94	0.49
1:D:445:GLY:HA3	2:D:601:HEM:C3C	2.47	0.49
1:C:91:LEU:HD11	1:C:397:THR:HG21	1.93	0.49
1:B:224:LEU:HD11	1:B:236:LEU:HD23	1.95	0.49
1:C:443:CYS:HB2	2:C:601:HEM:NA	2.27	0.48
1:C:436:PHE:HB3	1:C:443:CYS:HB3	1.95	0.48
1:D:152:TRP:CG	1:D:188:SER:HG	2.31	0.48
1:C:437:SER:OG	1:C:438:ALA:N	2.44	0.47
1:C:221:ARG:O	1:C:225:ASN:ND2	2.30	0.47
1:A:445:GLY:HA3	2:A:601:HEM:C3C	2.51	0.47
1:D:100:ASP:O	1:D:377:MET:N	2.47	0.47
1:D:192:GLY:O	1:D:269:ARG:NH2	2.48	0.47
1:C:224:LEU:HD11	1:C:240:VAL:HG11	1.96	0.46
1:D:143:GLY:HA3	1:D:149:LEU:HG	1.96	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:160:LEU:HD13	1:D:181:ALA:HB2	1.97	0.46
1:C:437:SER:HB3	2:C:601:HEM:HBA1	1.98	0.45
1:C:382:ILE:HG13	1:C:389:ILE:HB	1.98	0.45
1:D:369:ILE:HD11	2:D:601:HEM:HMB2	1.97	0.45
1:B:369:ILE:HG13	1:B:370:VAL:HG23	1.98	0.45
2:C:601:HEM:HMB2	2:C:601:HEM:HBB2	1.99	0.45
1:D:323:LEU:HD13	1:D:477:HIS:CE1	2.52	0.45
1:A:119:VAL:HG22	1:A:131:GLN:HB3	1.98	0.45
1:A:304:SER:HA	1:A:307:MET:HE2	1.99	0.44
1:B:437:SER:HB3	2:B:601:HEM:HBA1	2.00	0.44
1:D:106:ILE:HD12	1:D:241:LEU:HD11	1.99	0.44
1:D:336:ASP:OD2	1:D:497:ARG:NH2	2.46	0.44
1:D:490:TYR:HE1	1:D:492:LEU:HD23	1.82	0.44
1:C:174:PRO:HG3	1:C:492:LEU:HD21	1.99	0.44
1:D:107:THR:HB	1:D:112:PHE:CG	2.53	0.44
1:D:382:ILE:HG13	1:D:389:ILE:HB	1.99	0.44
1:C:316:TRP:CG	1:C:487:PRO:HG3	2.53	0.44
1:D:307:MET:HE2	1:D:307:MET:HB3	1.91	0.44
1:B:107:THR:HB	1:B:112:PHE:CG	2.53	0.43
1:B:381:ASP:OD1	1:B:391:LYS:N	2.51	0.43
1:C:162:ALA:O	1:C:166:ASN:ND2	2.44	0.43
1:B:316:TRP:CD2	1:B:487:PRO:HG3	2.53	0.43
1:B:416:HIS:NE2	1:B:418:GLU:HB2	2.33	0.43
1:D:437:SER:HB3	2:D:601:HEM:HBA1	2.01	0.43
1:A:437:SER:HB3	2:A:601:HEM:HBA1	2.01	0.43
1:A:316:TRP:CG	1:A:487:PRO:HG3	2.53	0.43
1:C:233:ILE:HA	1:C:234:PRO:HD3	1.92	0.42
1:D:344:ARG:HA	1:D:345:PRO:HD3	1.95	0.42
1:B:199:ASP:HA	1:B:200:PRO:HD3	1.94	0.42
1:B:319:LEU:HD22	1:B:487:PRO:HB3	2.00	0.42
1:C:33:LEU:HA	1:C:34:PRO:HD3	1.94	0.41
1:D:267:PRO:HA	1:D:268:PRO:HD3	1.91	0.41
1:D:316:TRP:CD2	1:D:487:PRO:HG3	2.55	0.41
1:A:251:LEU:HD21	1:A:299:VAL:HG12	2.03	0.41
1:D:233:ILE:HG22	1:D:235:ALA:H	1.85	0.41
1:C:139:LEU:HD22	1:C:189:LEU:HD13	2.02	0.41
1:C:495:VAL:HA	1:C:496:PRO:HD3	1.92	0.41
1:C:227:VAL:HA	1:C:228:PRO:HD3	1.77	0.41
1:B:320:LEU:HD13	1:B:415:PHE:CD1	2.55	0.41
1:C:107:THR:HB	1:C:112:PHE:CG	2.55	0.41
1:D:91:LEU:HD11	1:D:397:THR:HG21	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:202:PHE:O	1:C:206:LEU:HG	2.21	0.41
1:C:416:HIS:HB3	1:C:419:HIS:CE1	2.55	0.40
1:B:54:THR:N	1:B:55:PRO:HD2	2.36	0.40
1:A:320:LEU:HD13	1:A:415:PHE:CE1	2.56	0.40
1:C:198:ASP:OD1	1:C:198:ASP:N	2.52	0.40
1:C:435:PRO:HG2	1:C:436:PHE:CD1	2.57	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	447/479 (93%)	432 (97%)	15 (3%)	0	100	100
1	B	445/479 (93%)	434 (98%)	11 (2%)	0	100	100
1	C	444/479 (93%)	434 (98%)	10 (2%)	0	100	100
1	D	449/479 (94%)	432 (96%)	16 (4%)	1 (0%)	43	64
All	All	1785/1916 (93%)	1732 (97%)	52 (3%)	1 (0%)	48	71

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	54	THR

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	384/409 (94%)	382 (100%)	2 (0%)	81	89
1	B	386/409 (94%)	384 (100%)	2 (0%)	81	89
1	C	385/409 (94%)	382 (99%)	3 (1%)	73	84
1	D	387/409 (95%)	384 (99%)	3 (1%)	73	84
All	All	1542/1636 (94%)	1532 (99%)	10 (1%)	78	88

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	370	VAL
1	A	431	GLU
1	B	227	VAL
1	B	370	VAL
1	C	269	ARG
1	C	342	VAL
1	C	480	VAL
1	D	227	VAL
1	D	240	VAL
1	D	480	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	72	GLN
1	A	94	HIS
1	A	291	ASN
1	A	352	HIS
1	B	60	GLN
1	B	94	HIS
1	B	291	ASN
1	B	341	GLN
1	B	350	GLN
1	C	94	HIS
1	D	175	ASN
1	D	352	HIS
1	D	477	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 13 ligands modelled in this entry, 5 are monoatomic - leaving 8 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	50,50,50	1.35	6 (12%)	67,82,82	1.10	5 (7%)
2	HEM	B	601	1	50,50,50	1.30	6 (12%)	67,82,82	1.09	5 (7%)
4	P6M	A	604	-	26,28,28	0.25	0	26,45,45	0.43	0
2	HEM	C	601	1	50,50,50	1.33	6 (12%)	67,82,82	1.12	5 (7%)
4	P6M	C	603	-	26,28,28	0.25	0	26,45,45	0.39	0
4	P6M	B	603	-	26,28,28	0.28	0	26,45,45	0.42	0
2	HEM	D	601	1	50,50,50	1.30	6 (12%)	67,82,82	1.11	4 (5%)
4	P6M	D	603	-	26,28,28	0.27	0	26,45,45	0.40	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
2	HEM	A	601	1	-	2/14/54/54	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	HEM	B	601	1	-	2/14/54/54	-
4	P6M	A	604	-	-	2/15/39/39	0/3/3/3
2	HEM	C	601	1	-	0/14/54/54	-
4	P6M	C	603	-	-	2/15/39/39	0/3/3/3
4	P6M	B	603	-	-	0/15/39/39	0/3/3/3
2	HEM	D	601	1	-	0/14/54/54	-
4	P6M	D	603	-	-	4/15/39/39	0/3/3/3

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	601	HEM	FE-ND	4.10	2.07	1.94
2	B	601	HEM	FE-ND	3.87	2.06	1.94
2	C	601	HEM	FE-ND	3.82	2.06	1.94
2	A	601	HEM	FE-NC	3.64	2.07	1.95
2	C	601	HEM	FE-NC	3.53	2.06	1.95
2	D	601	HEM	FE-ND	3.47	2.05	1.94
2	C	601	HEM	FE-NB	3.30	2.05	1.94
2	A	601	HEM	CAC-C3C	3.23	1.56	1.47
2	D	601	HEM	FE-NC	3.23	2.05	1.95
2	C	601	HEM	CAC-C3C	3.16	1.55	1.47
2	D	601	HEM	CAC-C3C	3.14	1.55	1.47
2	B	601	HEM	FE-NC	3.14	2.05	1.95
2	D	601	HEM	FE-NB	3.13	2.04	1.94
2	D	601	HEM	CAB-C3B	3.11	1.55	1.47
2	B	601	HEM	CAC-C3C	3.11	1.55	1.47
2	B	601	HEM	CAB-C3B	3.11	1.55	1.47
2	A	601	HEM	CAB-C3B	3.08	1.55	1.47
2	C	601	HEM	CAB-C3B	3.08	1.55	1.47
2	B	601	HEM	FE-NA	2.85	2.04	1.95
2	A	601	HEM	FE-NB	2.79	2.03	1.94
2	A	601	HEM	FE-NA	2.78	2.04	1.95
2	D	601	HEM	FE-NA	2.78	2.04	1.95
2	B	601	HEM	FE-NB	2.69	2.03	1.94
2	C	601	HEM	FE-NA	2.58	2.03	1.95

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	601	HEM	C1B-NB-C4B	2.58	108.26	105.21
2	C	601	HEM	C1B-NB-C4B	2.51	108.18	105.21

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	601	HEM	C1B-NB-C4B	2.43	108.09	105.21
2	D	601	HEM	C4D-ND-C1D	2.40	108.05	105.21
2	C	601	HEM	C4D-ND-C1D	2.39	108.03	105.21
2	D	601	HEM	C1B-NB-C4B	2.39	108.03	105.21
2	A	601	HEM	C3B-C2B-C1B	2.36	108.18	106.41
2	A	601	HEM	C4D-ND-C1D	2.31	107.94	105.21
2	B	601	HEM	C4D-ND-C1D	2.27	107.90	105.21
2	D	601	HEM	C3D-C4D-ND	-2.21	107.74	110.17
2	C	601	HEM	C3B-C2B-C1B	2.21	108.07	106.41
2	C	601	HEM	C2A-C1A-NA	-2.17	107.74	110.15
2	B	601	HEM	C3B-C2B-C1B	2.16	108.03	106.41
2	D	601	HEM	C3B-C2B-C1B	2.14	108.02	106.41
2	C	601	HEM	C3D-C4D-ND	-2.10	107.87	110.17
2	A	601	HEM	C3D-C4D-ND	-2.04	107.94	110.17
2	B	601	HEM	C2A-C1A-NA	-2.03	107.90	110.15
2	A	601	HEM	C2A-C1A-NA	-2.03	107.90	110.15
2	B	601	HEM	C3D-C4D-ND	-2.00	107.97	110.17

There are no chirality outliers.

All (12) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	D	603	P6M	C-C1-C16-F4
4	C	603	P6M	N-C3-C4-C9
4	D	603	P6M	C-C1-C16-F2
4	A	604	P6M	N-C3-C4-C9
4	D	603	P6M	N-C3-C4-C9
4	A	604	P6M	N-C3-C4-C5
4	D	603	P6M	C-C1-C16-F3
2	A	601	HEM	CAD-CBD-CGD-O2D
2	B	601	HEM	CAA-CBA-CGA-O2A
4	C	603	P6M	N-C3-C4-C5
2	A	601	HEM	CAD-CBD-CGD-O1D
2	B	601	HEM	CAA-CBA-CGA-O1A

There are no ring outliers.

4 monomers are involved in 20 short contacts:

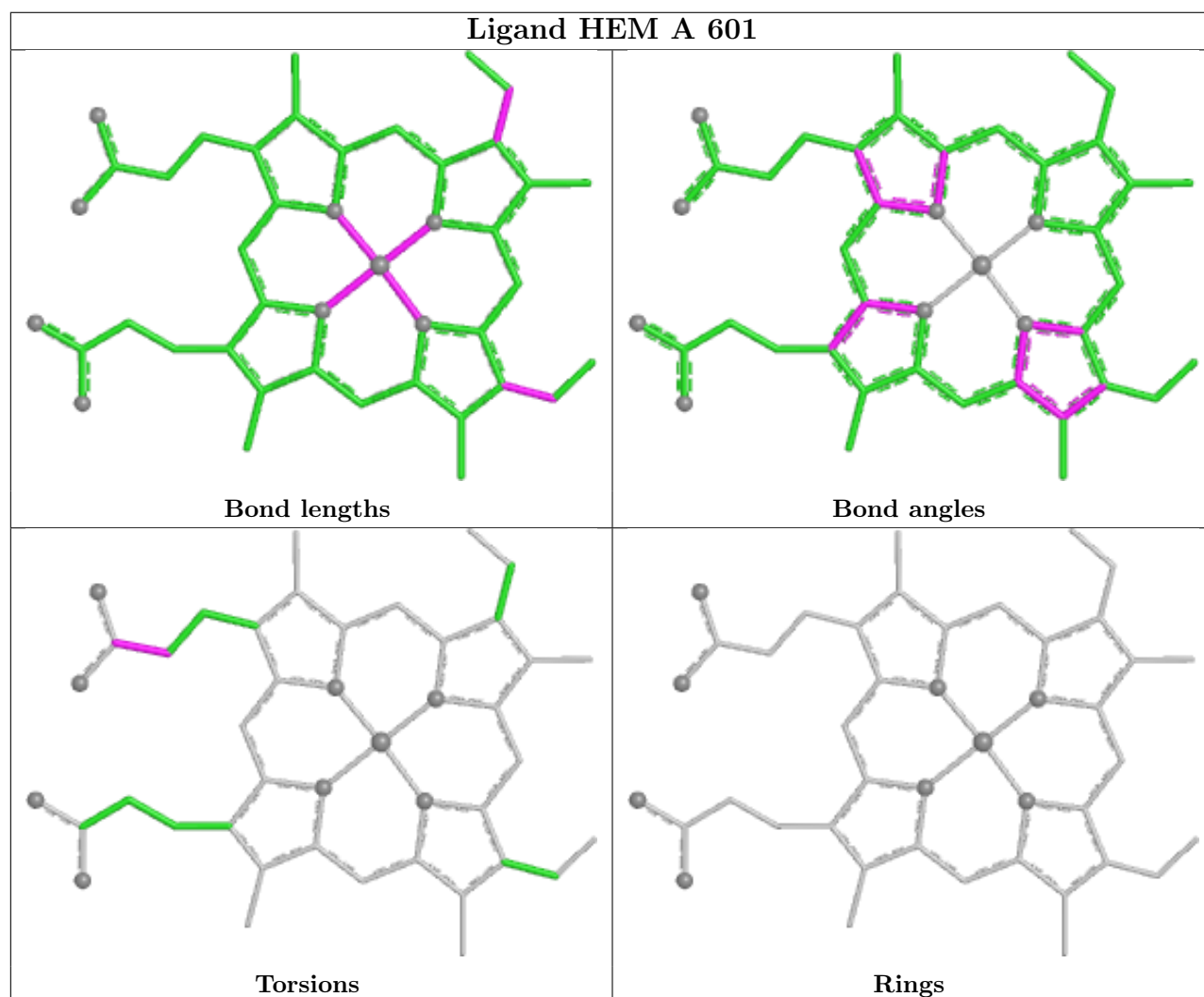
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	601	HEM	4	0
2	B	601	HEM	3	0

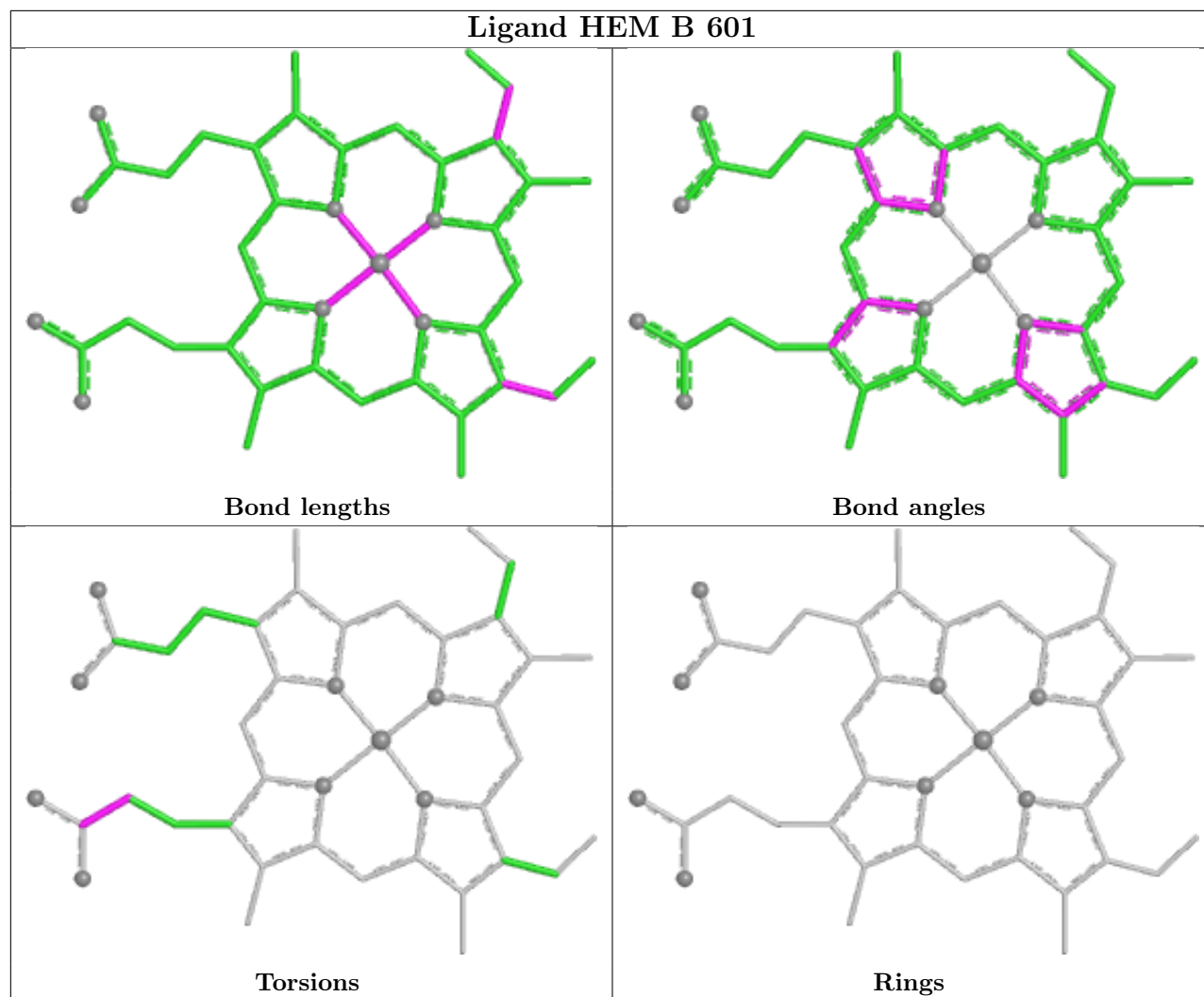
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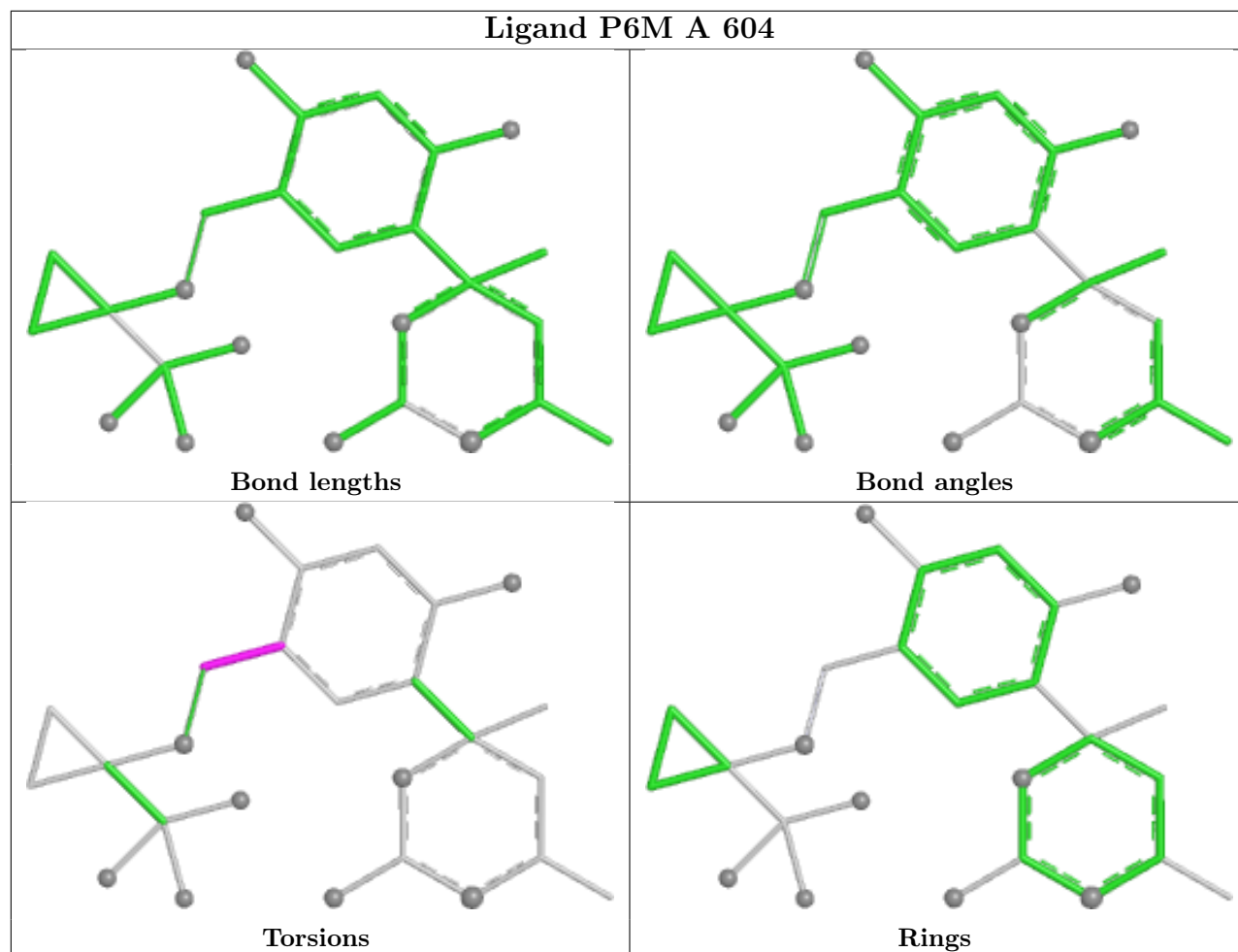
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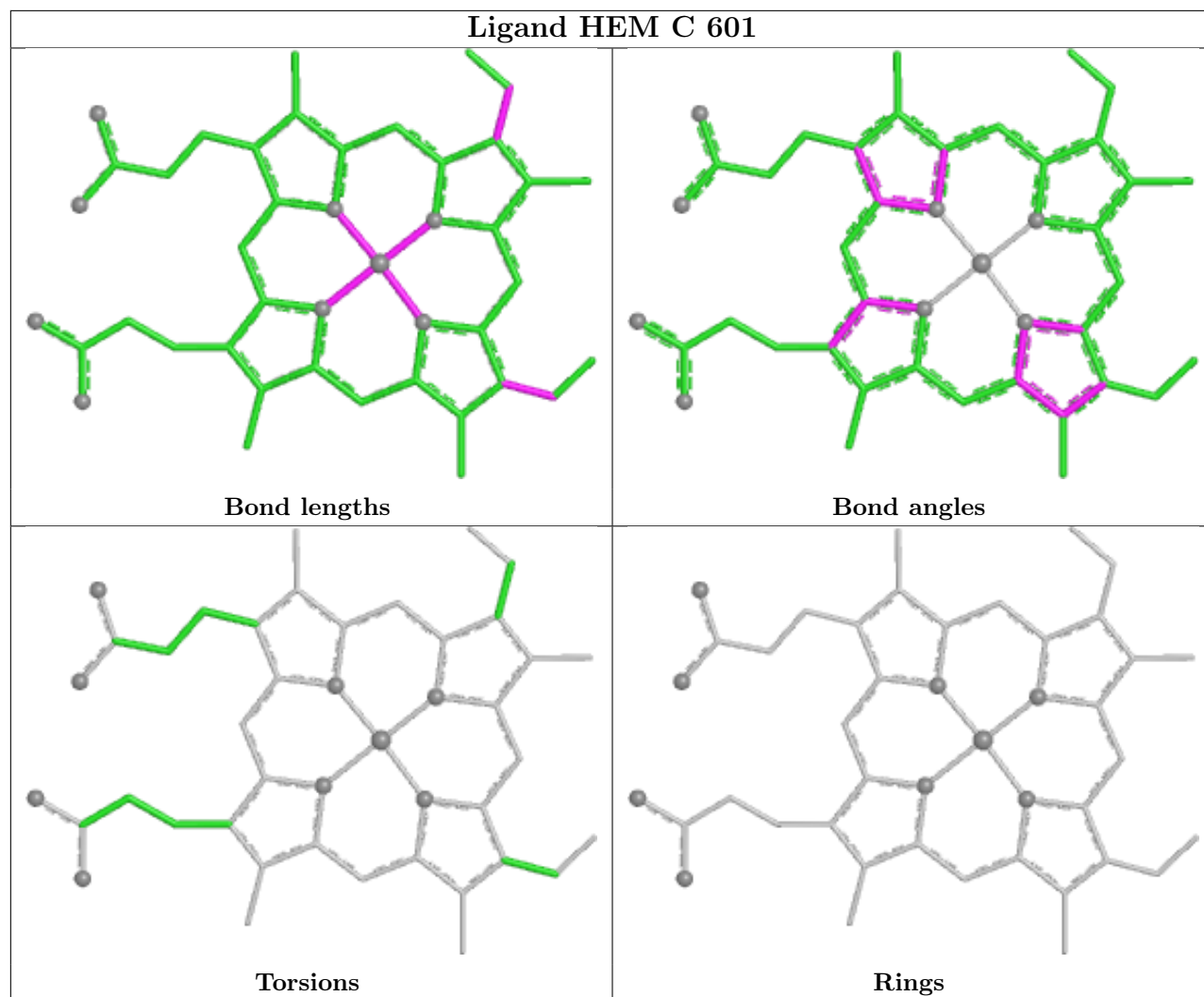
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	601	HEM	6	0
2	D	601	HEM	7	0

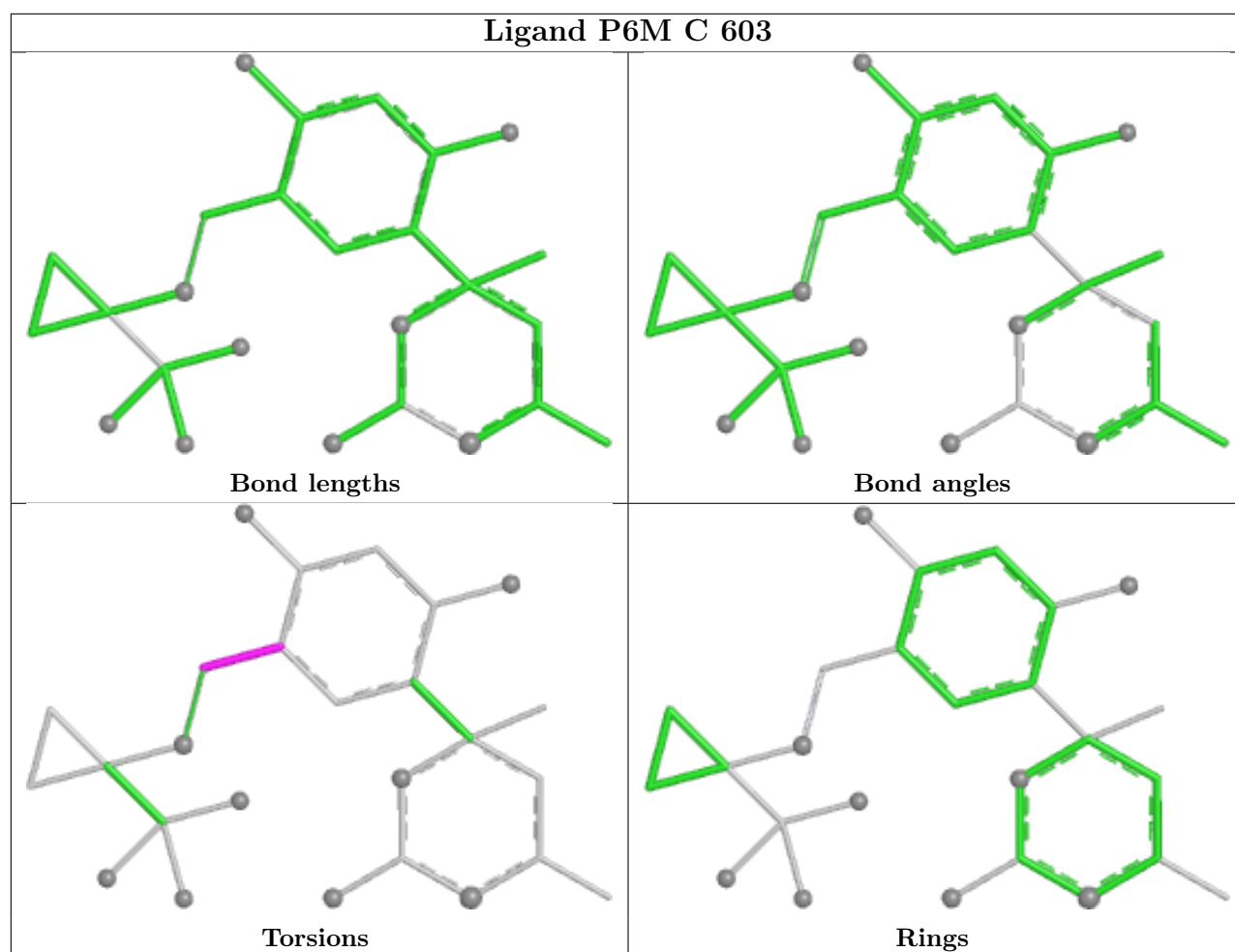
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

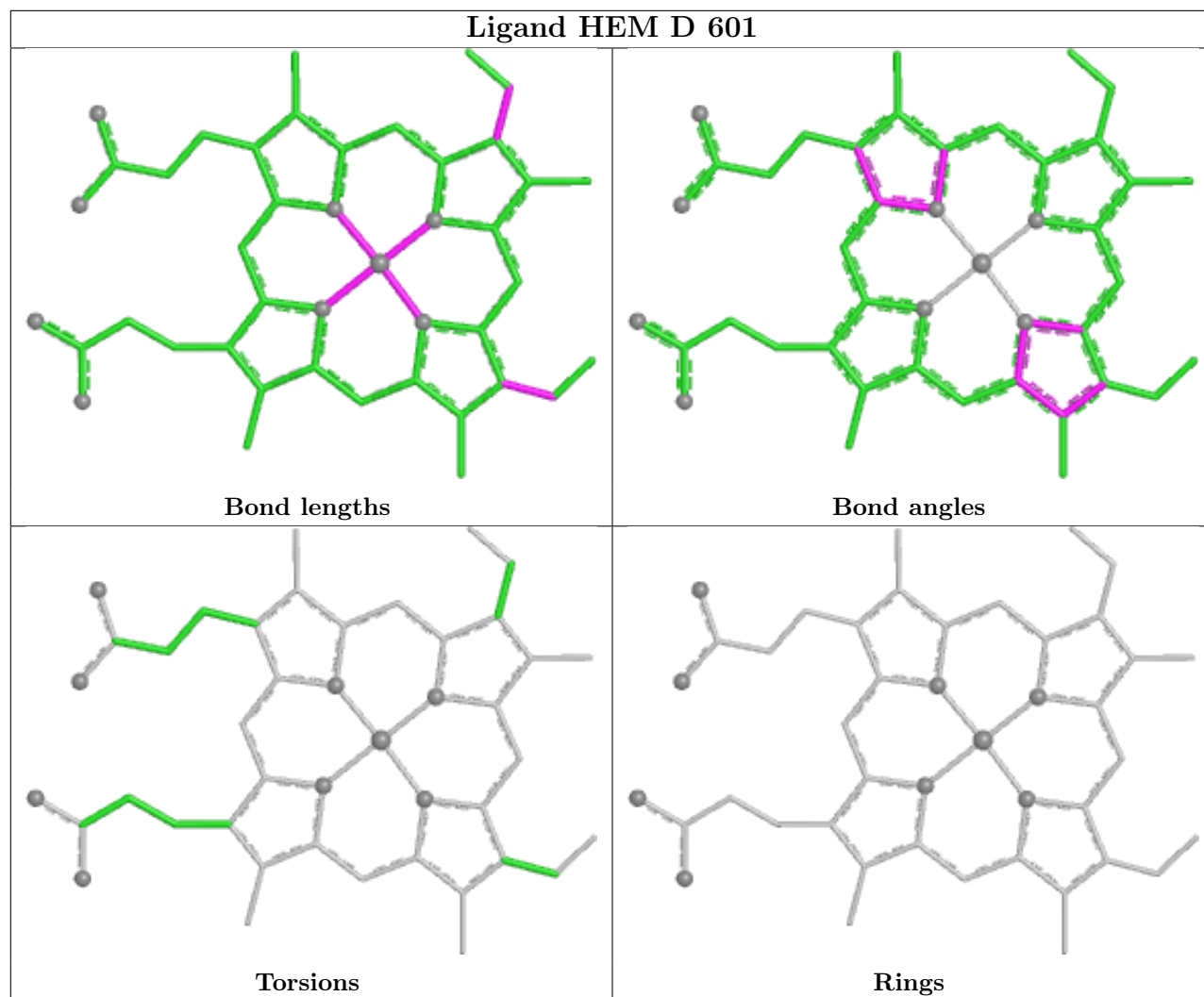


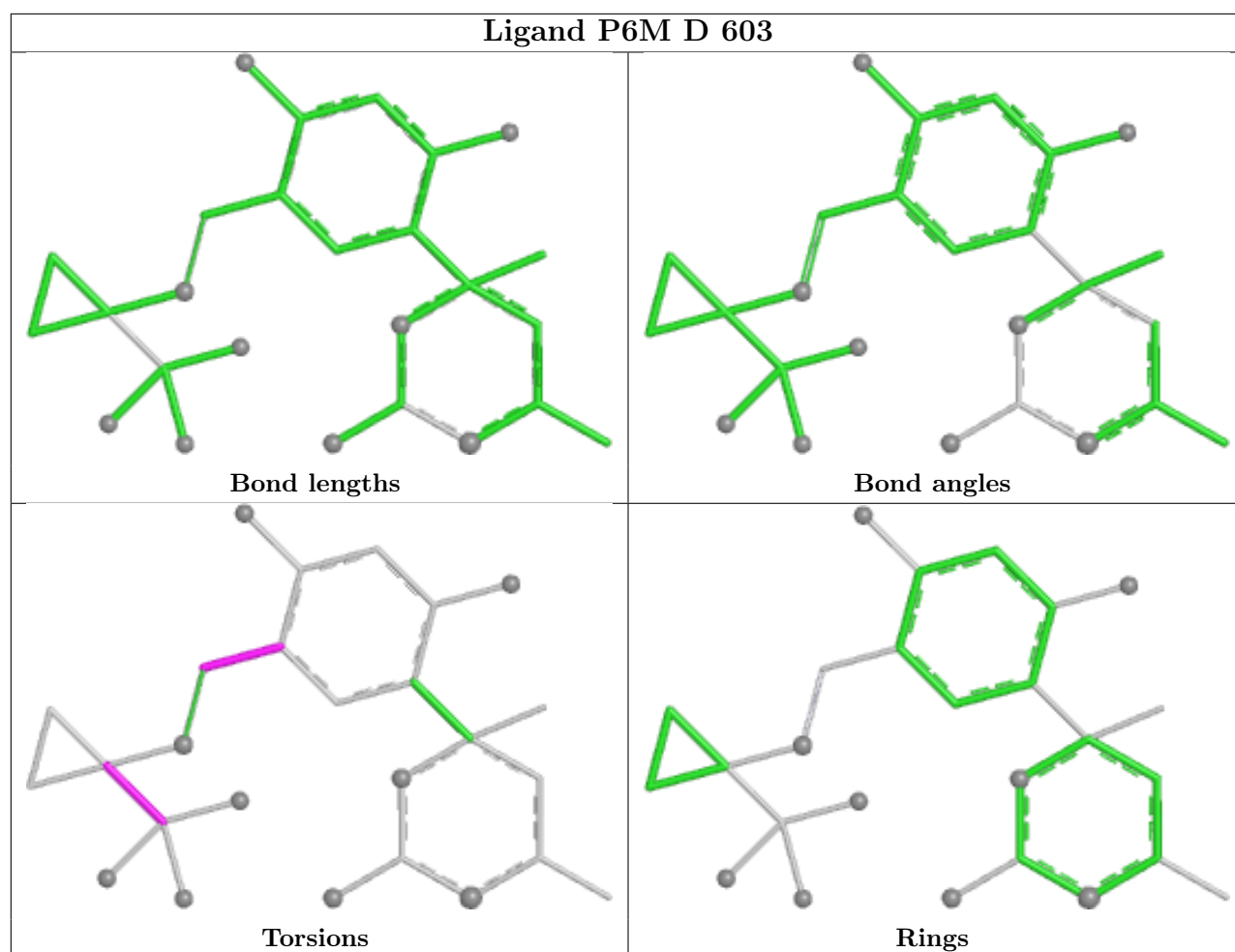












5.7 Other polymers [i](#)

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	451/479 (94%)	0.40	42 (9%) 14 14	24, 44, 94, 113	0
1	B	451/479 (94%)	0.36	27 (5%) 27 28	25, 42, 93, 110	0
1	C	450/479 (93%)	0.54	37 (8%) 17 18	28, 47, 96, 117	0
1	D	453/479 (94%)	0.61	42 (9%) 14 14	27, 50, 96, 115	0
All	All	1805/1916 (94%)	0.48	148 (8%) 17 18	24, 46, 95, 117	0

All (148) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	483	PHE	5.7
1	B	55	PRO	5.2
1	B	149	LEU	5.1
1	A	55	PRO	4.9
1	B	39	PRO	4.8
1	D	219	PHE	4.8
1	D	152	TRP	4.6
1	D	149	LEU	4.5
1	A	228	PRO	4.5
1	C	147	LYS	4.2
1	D	75	TRP	4.1
1	D	168	SER	4.0
1	C	143	GLY	3.9
1	C	219	PHE	3.8
1	C	152	TRP	3.8
1	C	240	VAL	3.7
1	C	38	LEU	3.7
1	B	56	TYR	3.7
1	A	483	PHE	3.7
1	A	235	ALA	3.6
1	D	229	VAL	3.6

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Mol	Chain	Res	Type	RSRZ
1	A	56	TYR	3.5
1	D	53	ASN	3.5
1	B	58	PHE	3.5
1	C	148	SER	3.4
1	B	53	ASN	3.4
1	C	220	LEU	3.4
1	D	373	GLY	3.4
1	D	54	THR	3.3
1	A	31	GLY	3.2
1	A	229	VAL	3.2
1	B	483	PHE	3.2
1	C	227	VAL	3.2
1	C	149	LEU	3.2
1	A	481	PHE	3.2
1	C	228	PRO	3.1
1	C	235	ALA	3.1
1	B	219	PHE	3.1
1	B	481	PHE	3.1
1	A	144	LEU	3.1
1	D	220	LEU	3.1
1	A	169	GLY	3.1
1	D	74	ALA	3.1
1	A	149	LEU	3.0
1	A	219	PHE	3.0
1	B	229	VAL	3.0
1	A	226	ALA	3.0
1	C	224	LEU	2.9
1	C	303	PHE	2.9
1	C	239	LYS	2.9
1	A	145	GLY	2.9
1	D	235	ALA	2.9
1	A	146	LYS	2.9
1	D	144	LEU	2.9
1	B	52	GLN	2.9
1	A	191	CYS	2.9
1	A	482	ALA	2.8
1	C	75	TRP	2.8
1	D	65	PHE	2.8
1	D	39	PRO	2.8
1	C	53	ASN	2.8
1	A	234	PRO	2.8
1	A	75	TRP	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	223	VAL	2.7
1	D	228	PRO	2.6
1	A	303	PHE	2.6
1	C	39	PRO	2.6
1	C	229	VAL	2.6
1	D	37	PRO	2.6
1	D	379	SER	2.6
1	D	146	LYS	2.6
1	C	223	VAL	2.5
1	B	75	TRP	2.5
1	B	233	ILE	2.5
1	B	228	PRO	2.5
1	A	106	ILE	2.5
1	C	167	HIS	2.5
1	A	58	PHE	2.5
1	D	38	LEU	2.5
1	C	56	TYR	2.5
1	D	52	GLN	2.5
1	D	303	PHE	2.5
1	C	106	ILE	2.4
1	C	168	SER	2.4
1	C	471	GLY	2.4
1	A	224	LEU	2.4
1	D	106	ILE	2.4
1	D	236	LEU	2.4
1	A	59	ASP	2.4
1	C	96	GLU	2.4
1	A	227	VAL	2.4
1	B	227	VAL	2.4
1	D	167	HIS	2.4
1	B	303	PHE	2.4
1	D	56	TYR	2.4
1	B	38	LEU	2.4
1	A	36	GLY	2.4
1	B	74	ALA	2.4
1	A	231	LEU	2.3
1	C	233	ILE	2.3
1	D	109	ILE	2.3
1	D	77	PRO	2.3
1	A	143	GLY	2.3
1	C	52	GLN	2.3
1	D	212	GLY	2.3

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Mol	Chain	Res	Type	RSRZ
1	C	170	ARG	2.3
1	A	480	VAL	2.3
1	A	389	ILE	2.3
1	C	54	THR	2.3
1	D	307	MET	2.3
1	A	236	LEU	2.3
1	B	189	LEU	2.3
1	D	342	VAL	2.3
1	A	189	LEU	2.3
1	B	106	ILE	2.3
1	D	470	THR	2.3
1	A	105	PRO	2.3
1	B	342	VAL	2.2
1	D	227	VAL	2.2
1	D	147	LYS	2.2
1	D	463	HIS	2.2
1	C	244	GLN	2.2
1	A	230	LEU	2.2
1	B	142	LEU	2.2
1	D	230	LEU	2.2
1	A	54	THR	2.2
1	D	239	LYS	2.2
1	D	240	VAL	2.2
1	C	481	PHE	2.2
1	C	423	ALA	2.1
1	B	73	LEU	2.1
1	A	63	ARG	2.1
1	D	306	GLY	2.1
1	A	463	HIS	2.1
1	A	342	VAL	2.1
1	D	237	ALA	2.1
1	A	62	ARG	2.1
1	C	342	VAL	2.1
1	A	148	SER	2.1
1	B	236	LEU	2.1
1	A	37	PRO	2.0
1	B	341	GLN	2.0
1	C	109	ILE	2.0
1	C	380	ARG	2.0
1	B	235	ALA	2.0
1	C	306	GLY	2.0
1	B	223	VAL	2.0

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Mol	Chain	Res	Type	RSRZ
1	D	63	ARG	2.0

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

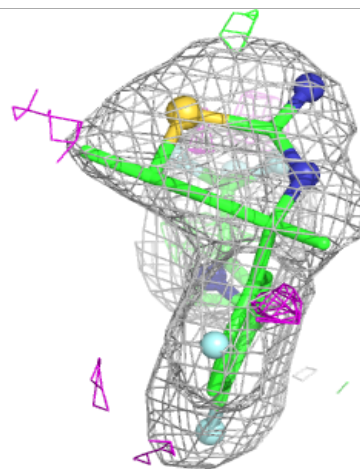
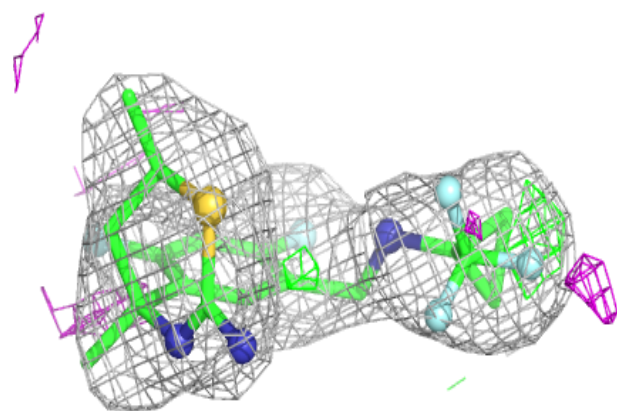
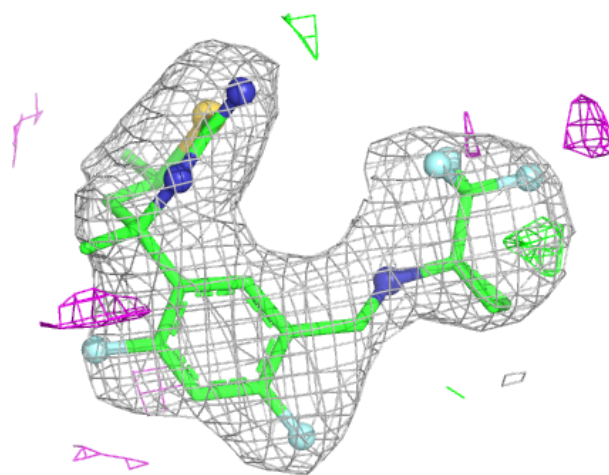
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	P6M	B	603	26/26	0.89	0.15	40,59,73,77	0
4	P6M	C	603	26/26	0.90	0.14	42,59,78,86	0
4	P6M	A	604	26/26	0.91	0.13	46,65,79,88	0
4	P6M	D	603	26/26	0.92	0.12	44,62,78,82	0
2	HEM	C	601	43/43	0.97	0.08	20,32,39,43	0
2	HEM	D	601	43/43	0.97	0.08	27,35,44,49	0
2	HEM	A	601	43/43	0.98	0.07	22,28,31,35	0
2	HEM	B	601	43/43	0.98	0.08	25,30,37,40	0
3	ZN	A	602	1/1	0.99	0.03	31,31,31,31	0
3	ZN	A	603	1/1	0.99	0.05	41,41,41,41	0
3	ZN	B	602	1/1	0.99	0.04	34,34,34,34	0
3	ZN	D	602	1/1	0.99	0.02	39,39,39,39	0
3	ZN	C	602	1/1	1.00	0.02	32,32,32,32	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.

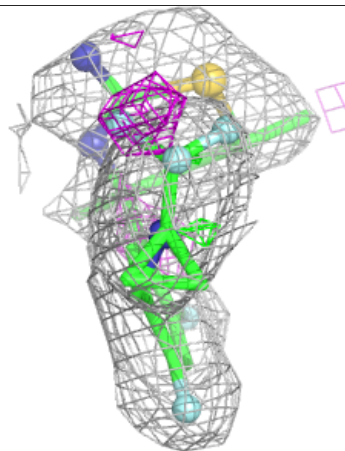
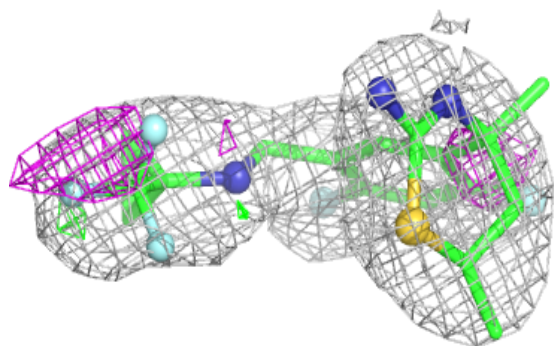
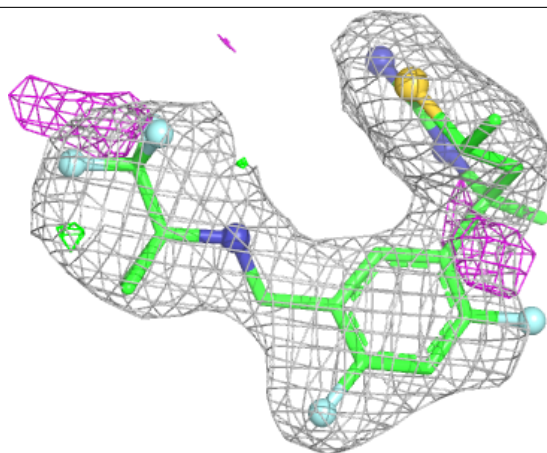
Electron density around P6M C 603:

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



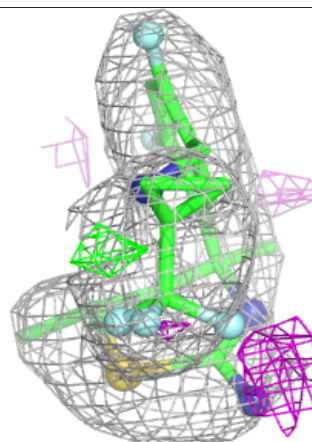
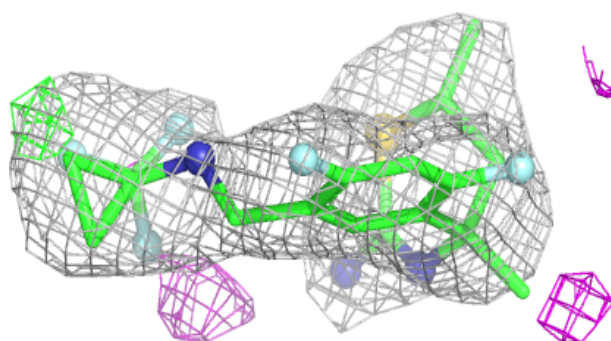
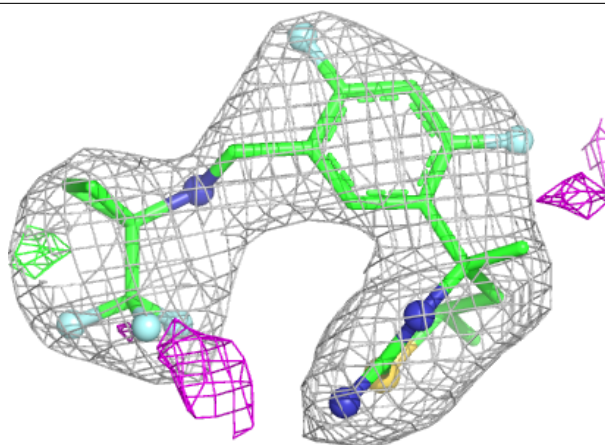
Electron density around P6M A 604:

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



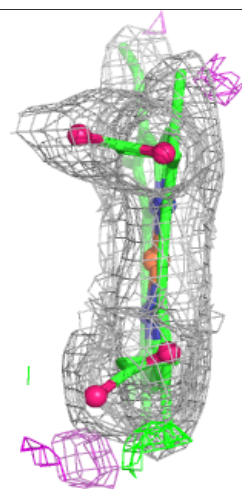
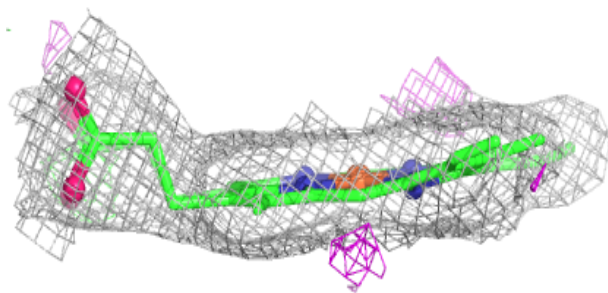
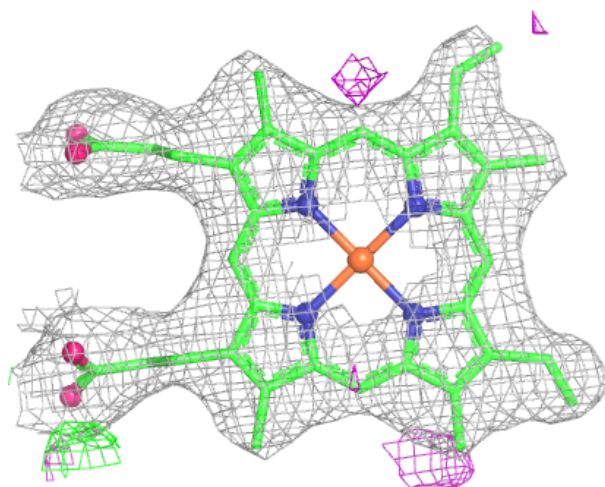
Electron density around P6M D 603:

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



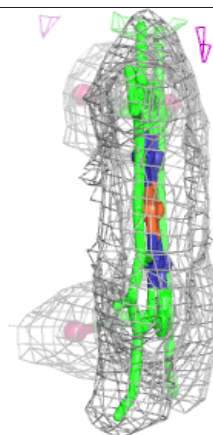
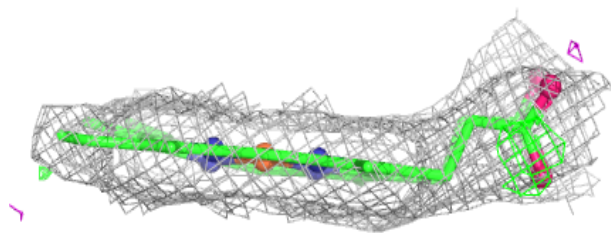
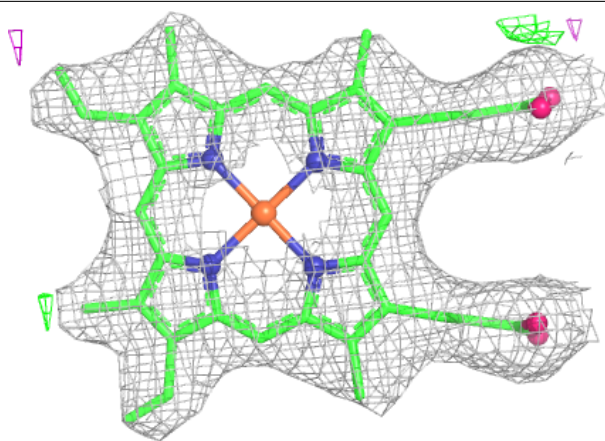
Electron density around HEM C 601:

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



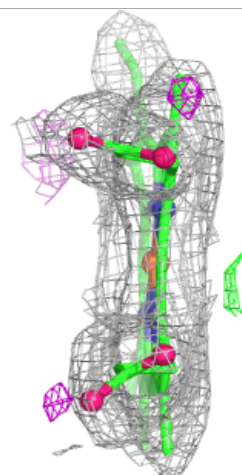
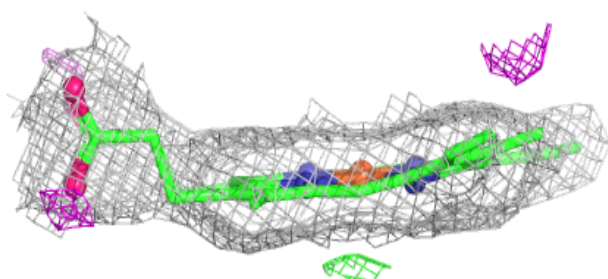
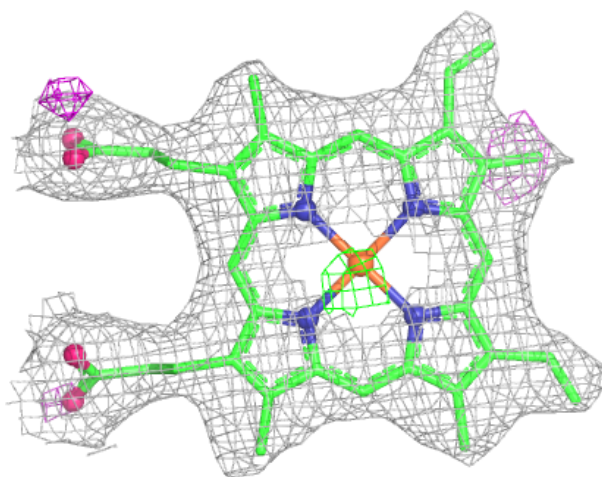
Electron density around HEM D 601:

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



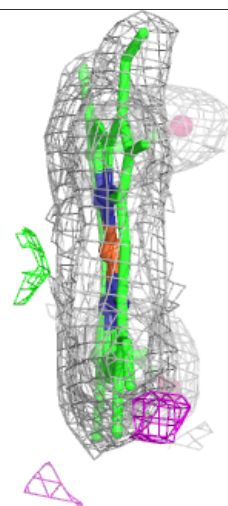
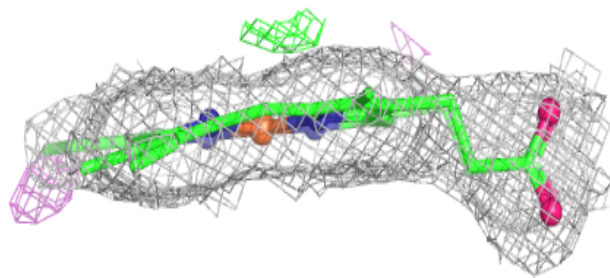
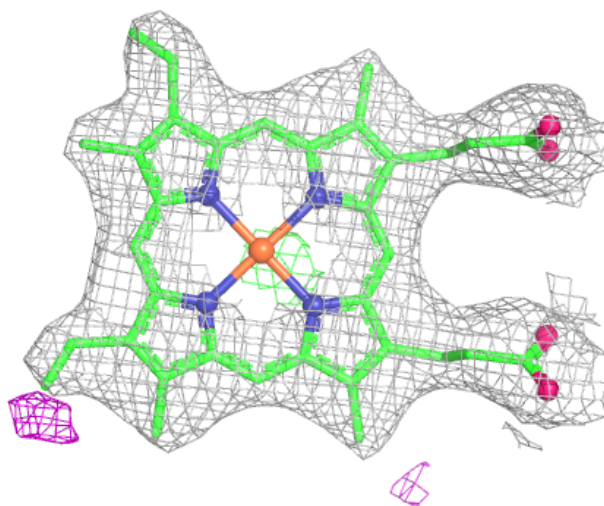
Electron density around HEM A 601:

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



Electron density around HEM B 601:

$2mF_o-DF_c$ (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.