



Full wwPDB X-ray Structure Validation Report ⓘ

Nov 13, 2023 – 05:46 PM JST

PDB ID : 5XXI
Title : Crystal structure of CYP2C9 in complex with multiple losartan molecules
Authors : Maekawa, K.; Adachi, M.; Shah, M.B.
Deposited on : 2017-07-04
Resolution : 2.30 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36
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) : 2.36

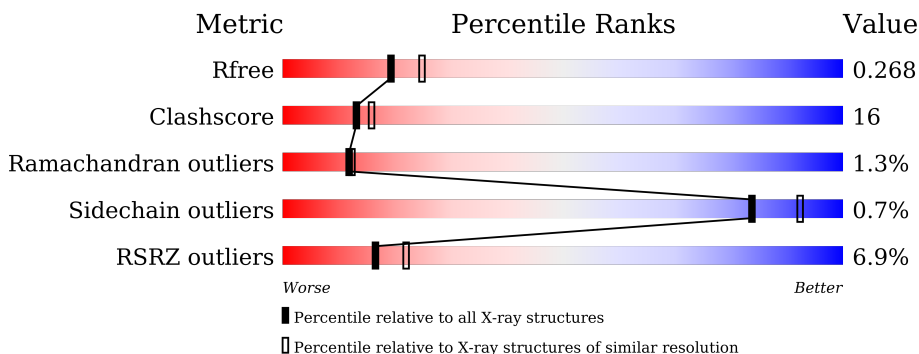
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	5042 (2.30-2.30)
Clashscore	141614	5643 (2.30-2.30)
Ramachandran outliers	138981	5575 (2.30-2.30)
Sidechain outliers	138945	5575 (2.30-2.30)
RSRZ outliers	127900	4938 (2.30-2.30)

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	463	

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
2	LSN	A	503[A]	-	X	X	X
2	LSN	A	503[B]	-	X	X	X

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 3922 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.

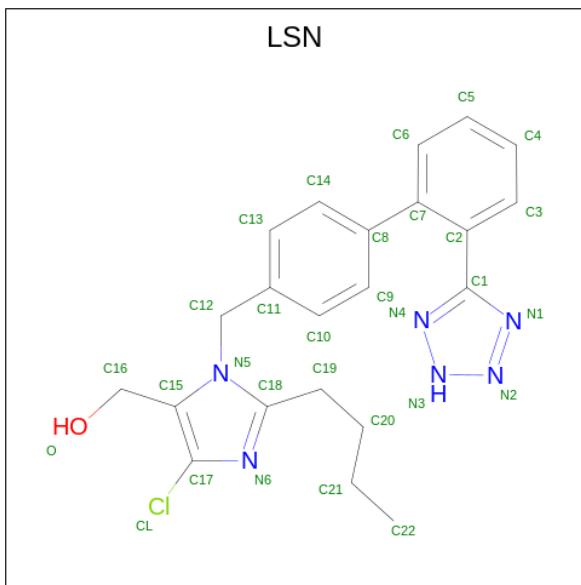
- Molecule 1 is a protein called Cytochrome P450 2C9.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	463	3655	2357	605	669	24	0	0	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	490	ILE	VAL	engineered mutation	UNP P11712

- Molecule 2 is [2-butyl-5-chloranyl-3-[[4-[2-(2H-1,2,3,4-tetrazol-5-yl)phenyl]phenyl]methyl]imidazol-4-yl]methanol (three-letter code: LSN) (formula: C₂₂H₂₃ClN₆O).



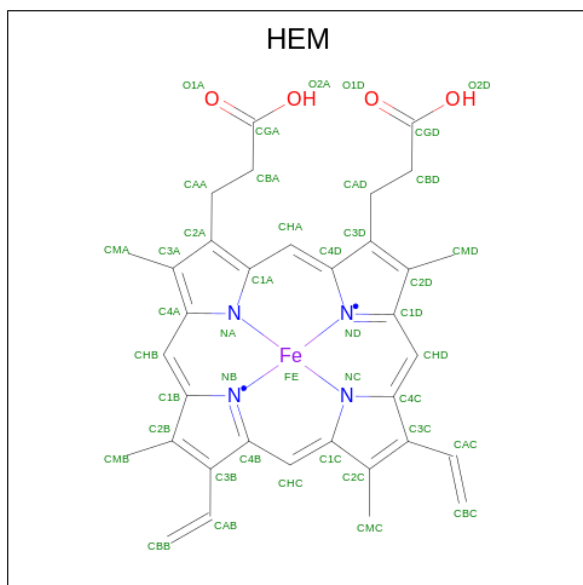
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	Cl	N	O		
2	A	1	30	22	1	6	1	0	0
2	A	1	30	22	1	6	1	0	0

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Cl	N			O
2	A	1	60	44	2	12	2	0	1

- Molecule 3 is PROTOPORPHYRIN IX CONTAINING FE (three-letter code: HEM) (formula: $C_{34}H_{32}FeN_4O_4$).



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

- Molecule 4 is POTASSIUM ION (three-letter code: K) (formula: K).

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

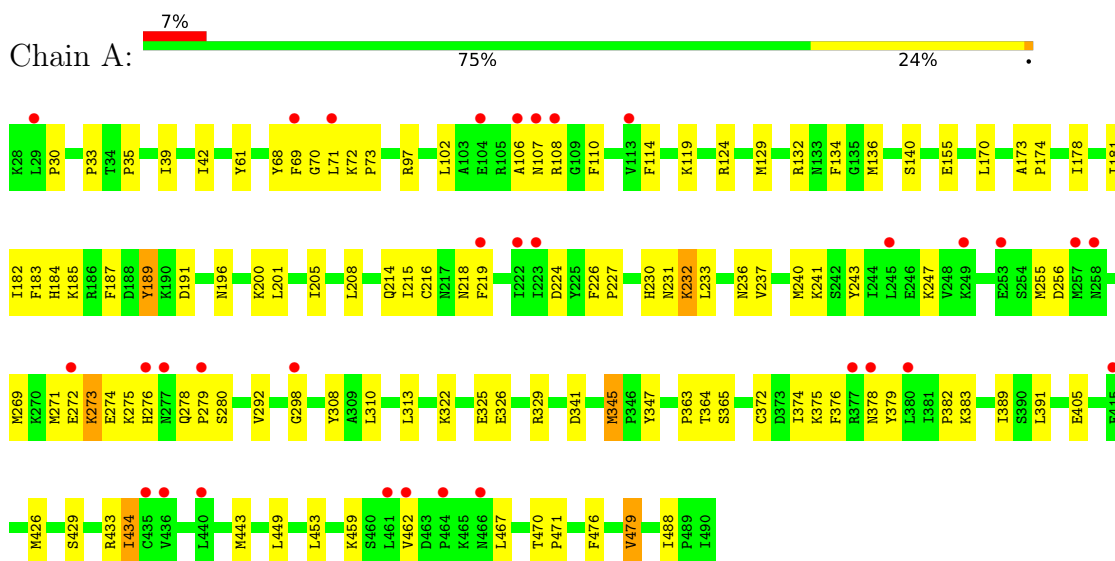
- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	103	Total 103 O 103	0	0

3 Residue-property plots

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

- Molecule 1: Cytochrome P450 2C9



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	74.57Å 142.96Å 161.42Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.63 – 2.30 43.63 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.4 (43.63-2.30) 99.4 (43.63-2.30)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.69 (at 2.29Å)	Xtrriage
Refinement program	REFMAC 5.8.0103	Depositor
R, R_{free}	0.204 , 0.269 0.208 , 0.268	Depositor DCC
R_{free} test set	1999 reflections (5.19%)	wwPDB-VP
Wilson B-factor (Å ²)	54.9	Xtrriage
Anisotropy	0.142	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 67.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	3922	wwPDB-VP
Average B, all atoms (Å ²)	67.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.80% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

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

5 Model quality [i](#)

5.1 Standard geometry [i](#)

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

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	0.93	0/3745	1.03	10/5080 (0.2%)

There are no bond length outliers.

All (10) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	124	ARG	NE-CZ-NH1	6.79	123.69	120.30
1	A	191	ASP	CB-CG-OD1	-6.26	112.67	118.30
1	A	345	MET	CG-SD-CE	-6.01	90.58	100.20
1	A	256	ASP	CB-CG-OD2	5.97	123.67	118.30
1	A	443	MET	CA-CB-CG	5.79	123.15	113.30
1	A	191	ASP	CB-CG-OD2	5.70	123.43	118.30
1	A	205	ILE	CG1-CB-CG2	-5.39	99.53	111.40
1	A	232	LYS	CD-CE-NZ	-5.28	99.55	111.70
1	A	467	LEU	CA-CB-CG	5.21	127.29	115.30
1	A	124	ARG	NE-CZ-NH2	-5.03	117.78	120.30

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	3655	0	3620	108	1

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	120	0	0	36	0
3	A	43	0	30	4	0
4	A	1	0	0	0	0
5	A	103	0	0	6	0
All	All	3922	0	3650	122	1

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 16.

All (122) 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)
2:A:503[A]:LSN:C13	5:A:609:HOH:O	1.71	1.31
2:A:503[B]:LSN:C10	5:A:609:HOH:O	1.69	1.29
1:A:214:GLN:O	2:A:503[A]:LSN:CL	2.05	1.10
1:A:476:PHE:HB3	2:A:503[B]:LSN:N4	1.69	1.06
2:A:503[A]:LSN:C19	2:A:503[A]:LSN:C10	2.34	1.06
1:A:218:ASN:ND2	2:A:503[A]:LSN:CL	2.28	1.01
2:A:503[B]:LSN:C15	2:A:503[B]:LSN:C13	2.41	0.98
1:A:155:GLU:HG3	1:A:189:TYR:CD1	2.02	0.94
1:A:476:PHE:O	2:A:503[B]:LSN:N4	2.01	0.93
1:A:476:PHE:HB3	2:A:503[A]:LSN:N4	1.83	0.91
1:A:476:PHE:O	2:A:503[A]:LSN:N4	2.03	0.91
2:A:503[B]:LSN:C13	2:A:503[B]:LSN:C16	2.48	0.91
1:A:108:ARG:O	1:A:114:PHE:HB2	1.71	0.91
2:A:503[A]:LSN:C10	2:A:503[A]:LSN:C18	2.52	0.87
1:A:274:GLU:HG2	1:A:280:SER:OG	1.75	0.85
2:A:503[B]:LSN:C1	2:A:503[B]:LSN:C9	2.56	0.83
1:A:155:GLU:HG3	1:A:189:TYR:HD1	1.40	0.83
2:A:503[A]:LSN:C14	2:A:503[A]:LSN:C1	2.57	0.83
1:A:102:LEU:HD23	2:A:503[B]:LSN:CL	2.16	0.82
1:A:375:LYS:HA	1:A:379:TYR:O	1.79	0.81
1:A:278:GLN:OE1	1:A:279:PRO:HA	1.83	0.78
1:A:39:ILE:O	1:A:42:ILE:HG12	1.84	0.77
3:A:504:HEM:HMB2	3:A:504:HEM:HBB2	1.68	0.75
1:A:108:ARG:NH2	1:A:114:PHE:CE1	2.55	0.74
1:A:214:GLN:O	2:A:503[A]:LSN:C17	2.36	0.73
1:A:185:LYS:NZ	1:A:247:LYS:HD2	2.04	0.73
1:A:201:LEU:HD12	2:A:501:LSN:C20	2.19	0.72
1:A:173:ALA:HB3	1:A:174:PRO:HD3	1.70	0.72
1:A:365:SER:O	2:A:503[A]:LSN:N1	2.22	0.71

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:232:LYS:HD3	2:A:502:LSN:CL	2.28	0.71
1:A:185:LYS:HZ2	1:A:247:LYS:HD2	1.56	0.70
1:A:114:PHE:CE2	2:A:503[A]:LSN:C21	2.75	0.69
1:A:155:GLU:HG3	1:A:189:TYR:CE1	2.28	0.68
1:A:208:LEU:O	1:A:214:GLN:HG2	1.94	0.67
1:A:108:ARG:HH21	1:A:114:PHE:HE1	1.43	0.65
2:A:503[A]:LSN:C14	2:A:503[A]:LSN:N1	2.59	0.65
1:A:183:PHE:O	1:A:184:HIS:HB3	1.98	0.63
1:A:365:SER:O	2:A:503[B]:LSN:N1	2.30	0.63
3:A:504:HEM:HBB2	3:A:504:HEM:CMB	2.27	0.63
1:A:476:PHE:CB	2:A:503[B]:LSN:N4	2.57	0.63
1:A:459:LYS:HB2	1:A:488:ILE:CD1	2.31	0.61
1:A:479:VAL:HG13	5:A:612:HOH:O	2.00	0.61
1:A:70:GLY:O	1:A:71:LEU:HB2	2.01	0.60
1:A:271:MET:O	1:A:273:LYS:N	2.34	0.59
1:A:218:ASN:ND2	2:A:503[B]:LSN:CL	2.73	0.59
1:A:215:ILE:HG22	1:A:216:CYS:N	2.17	0.58
1:A:69:PHE:CE1	1:A:219:PHE:HE2	2.22	0.58
1:A:240:MET:HG2	1:A:292:VAL:HG22	1.86	0.57
1:A:108:ARG:NE	2:A:501:LSN:O	2.37	0.57
2:A:503[B]:LSN:C9	2:A:503[B]:LSN:N1	2.67	0.56
1:A:476:PHE:CZ	2:A:503[B]:LSN:C19	2.88	0.56
1:A:476:PHE:CZ	2:A:503[A]:LSN:C16	2.92	0.53
1:A:69:PHE:CE1	1:A:219:PHE:CE2	2.97	0.52
1:A:313:LEU:HD13	1:A:453:LEU:HD11	1.91	0.52
1:A:102:LEU:HD12	1:A:102:LEU:O	2.09	0.52
1:A:214:GLN:OE1	2:A:503[A]:LSN:C10	2.59	0.51
1:A:372:CYS:HA	1:A:383:LYS:CB	2.40	0.51
1:A:226:PHE:N	1:A:227:PRO:CD	2.73	0.51
1:A:298:GLY:HA2	3:A:504:HEM:C2C	2.46	0.51
1:A:382:PRO:O	1:A:383:LYS:C	2.49	0.51
1:A:272:GLU:OE1	1:A:272:GLU:HA	2.11	0.51
1:A:374:ILE:HG13	1:A:375:LYS:O	2.11	0.50
1:A:185:LYS:HE2	1:A:187:PHE:CZ	2.46	0.50
1:A:372:CYS:HA	1:A:383:LYS:HB3	1.93	0.50
1:A:155:GLU:CG	1:A:189:TYR:CD1	2.87	0.49
1:A:214:GLN:OE1	2:A:503[B]:LSN:C13	2.60	0.49
1:A:214:GLN:O	2:A:503[B]:LSN:N6	2.44	0.49
1:A:237:VAL:HG12	1:A:241:LYS:HD2	1.94	0.49
1:A:129:MET:HE1	1:A:132:ARG:HH12	1.78	0.49
1:A:155:GLU:CG	1:A:189:TYR:HD1	2.18	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:376:PHE:O	1:A:378:ASN:N	2.38	0.48
1:A:97:ARG:HG2	1:A:114:PHE:HA	1.93	0.48
1:A:134:PHE:CE1	1:A:140:SER:HB3	2.48	0.48
1:A:215:ILE:HA	2:A:503[A]:LSN:CL	2.50	0.48
1:A:42:ILE:CD1	1:A:69:PHE:HA	2.45	0.47
1:A:184:HIS:CG	1:A:184:HIS:O	2.67	0.47
1:A:35:PRO:HG3	1:A:68:TYR:CD1	2.50	0.47
2:A:503[B]:LSN:C13	2:A:503[B]:LSN:O	2.63	0.47
1:A:271:MET:C	1:A:273:LYS:N	2.68	0.46
1:A:129:MET:CE	1:A:132:ARG:NH1	2.79	0.46
1:A:274:GLU:HG2	1:A:280:SER:CB	2.44	0.46
1:A:200:LYS:HD2	1:A:236:ASN:OD1	2.16	0.46
1:A:30:PRO:HA	1:A:379:TYR:CE2	2.51	0.45
1:A:69:PHE:O	1:A:69:PHE:CD2	2.70	0.45
1:A:33:PRO:HD3	1:A:61:TYR:CE2	2.52	0.45
1:A:363:PRO:HD2	2:A:503[A]:LSN:N4	2.31	0.45
1:A:129:MET:HE1	1:A:132:ARG:NH1	2.30	0.45
1:A:325:GLU:OE1	1:A:325:GLU:C	2.56	0.45
1:A:243:TYR:CZ	1:A:247:LYS:HE3	2.51	0.45
1:A:42:ILE:HD11	1:A:69:PHE:HA	1.99	0.44
1:A:274:GLU:O	1:A:276:HIS:N	2.50	0.44
1:A:106:ALA:HB3	1:A:108:ARG:HD2	1.99	0.44
1:A:433:ARG:HB2	5:A:606:HOH:O	2.17	0.44
1:A:426:MET:HA	5:A:623:HOH:O	2.17	0.44
1:A:365:SER:HB2	1:A:391:LEU:HD11	2.00	0.44
1:A:129:MET:HE3	1:A:132:ARG:NH2	2.33	0.44
1:A:107:ASN:HD21	1:A:110:PHE:HE2	1.64	0.43
1:A:364:THR:HA	1:A:389:ILE:O	2.18	0.43
1:A:274:GLU:HG2	1:A:280:SER:HG	1.79	0.43
1:A:233:LEU:HD23	1:A:233:LEU:HA	1.75	0.43
1:A:363:PRO:HD2	2:A:503[A]:LSN:N3	2.33	0.43
1:A:326:GLU:HB3	1:A:345:MET:HE3	2.01	0.43
3:A:504:HEM:HMB2	3:A:504:HEM:CBB	2.45	0.43
1:A:178:ILE:O	1:A:182:ILE:HG13	2.19	0.43
1:A:476:PHE:HZ	2:A:503[B]:LSN:C21	2.32	0.43
1:A:470:THR:HA	1:A:471:PRO:HD3	1.71	0.42
1:A:322:LYS:HB2	1:A:347:TYR:CE2	2.54	0.42
1:A:72:LYS:HA	1:A:73:PRO:HD3	1.92	0.42
1:A:255:MET:CE	1:A:269:MET:HG3	2.50	0.42
1:A:405:GLU:HG2	5:A:673:HOH:O	2.18	0.42
1:A:136:MET:CE	1:A:181:ILE:HG23	2.49	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:170:LEU:HD11	1:A:310:LEU:HD12	2.02	0.42
1:A:224:ASP:OD2	1:A:230:HIS:CD2	2.73	0.42
1:A:196:ASN:O	1:A:200:LYS:HG2	2.20	0.42
1:A:274:GLU:C	1:A:276:HIS:H	2.24	0.41
1:A:69:PHE:O	1:A:69:PHE:CG	2.73	0.41
1:A:433:ARG:O	1:A:434:ILE:C	2.58	0.41
1:A:449:LEU:HD23	1:A:449:LEU:HA	1.95	0.41
1:A:341:ASP:O	1:A:345:MET:HG3	2.21	0.41
1:A:110:PHE:HD1	1:A:119:LYS:HE2	1.86	0.41
1:A:30:PRO:HA	1:A:379:TYR:CD2	2.55	0.40
1:A:274:GLU:C	1:A:276:HIS:N	2.74	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:273:LYS:NZ	1:A:329:ARG:NH2[8_455]	1.98	0.22

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	461/463 (100%)	419 (91%)	36 (8%)	6 (1%)	12 12

All (6) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	273	LYS
1	A	189	TYR
1	A	275	LYS
1	A	429	SER
1	A	434	ILE

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Mol	Chain	Res	Type
1	A	462	VAL

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	407/419 (97%)	404 (99%)	3 (1%)	84 92

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	231	ASN
1	A	308	TYR
1	A	479	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	276	HIS

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 6 ligands modelled in this entry, 1 is monoatomic - leaving 5 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	LSN	A	501	-	28,33,33	5.41	18 (64%)	34,45,45	2.79	13 (38%)
2	LSN	A	503[A]	-	28,33,33	6.26	18 (64%)	34,45,45	2.42	14 (41%)
3	HEM	A	504	1,5	41,50,50	1.48	7 (17%)	45,82,82	2.26	11 (24%)
2	LSN	A	502	-	28,33,33	5.58	18 (64%)	34,45,45	2.73	14 (41%)
2	LSN	A	503[B]	-	28,33,33	6.03	18 (64%)	34,45,45	2.42	14 (41%)

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	LSN	A	501	-	-	7/16/18/18	0/4/4/4
2	LSN	A	503[A]	-	-	12/16/18/18	0/4/4/4
3	HEM	A	504	1,5	-	4/12/54/54	-
2	LSN	A	502	-	-	6/16/18/18	0/4/4/4
2	LSN	A	503[B]	-	-	11/16/18/18	0/4/4/4

All (79) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	502	LSN	C17-CL	-18.67	1.41	1.74
2	A	503[A]	LSN	C17-CL	-16.48	1.45	1.74
2	A	503[B]	LSN	C17-CL	-13.89	1.49	1.74
2	A	503[A]	LSN	C1-N1	9.99	1.45	1.33
2	A	503[B]	LSN	C1-N4	9.96	1.45	1.33
2	A	503[B]	LSN	C1-N1	9.92	1.45	1.33
2	A	503[A]	LSN	C1-N4	9.92	1.45	1.33
2	A	501	LSN	C1-N1	9.73	1.45	1.33

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	501	LSN	C1-N4	9.45	1.44	1.33
2	A	501	LSN	C3-C2	9.06	1.54	1.40
2	A	501	LSN	C9-C10	8.62	1.54	1.38
2	A	503[A]	LSN	C6-C7	8.01	1.52	1.40
2	A	503[B]	LSN	C6-C7	7.95	1.52	1.40
2	A	503[A]	LSN	C3-C2	7.94	1.52	1.40
2	A	503[B]	LSN	C3-C2	7.88	1.52	1.40
2	A	503[A]	LSN	C14-C13	7.76	1.52	1.38
2	A	503[B]	LSN	C9-C10	7.75	1.52	1.38
2	A	503[B]	LSN	C14-C13	7.72	1.52	1.38
2	A	503[A]	LSN	C9-C10	7.72	1.52	1.38
2	A	501	LSN	C10-C11	7.61	1.55	1.38
2	A	501	LSN	C6-C7	7.54	1.51	1.40
2	A	502	LSN	C9-C10	7.42	1.52	1.38
2	A	501	LSN	C9-C8	6.99	1.54	1.39
2	A	503[B]	LSN	C4-C3	6.82	1.53	1.38
2	A	503[A]	LSN	C5-C6	6.78	1.53	1.38
2	A	503[A]	LSN	C4-C3	6.78	1.53	1.38
2	A	503[B]	LSN	C5-C6	6.75	1.53	1.38
2	A	503[B]	LSN	C2-C7	6.66	1.52	1.41
2	A	503[A]	LSN	C2-C7	6.61	1.52	1.41
2	A	501	LSN	C14-C13	6.59	1.50	1.38
2	A	502	LSN	C1-N1	6.51	1.41	1.33
2	A	503[B]	LSN	C13-C11	6.49	1.52	1.38
2	A	503[A]	LSN	C13-C11	6.48	1.52	1.38
2	A	503[B]	LSN	C10-C11	6.46	1.52	1.38
2	A	503[A]	LSN	C10-C11	6.46	1.52	1.38
2	A	502	LSN	C14-C13	6.46	1.50	1.38
2	A	501	LSN	C4-C3	6.39	1.52	1.38
2	A	503[B]	LSN	C14-C8	6.38	1.52	1.39
2	A	503[A]	LSN	C9-C8	6.37	1.52	1.39
2	A	503[B]	LSN	C9-C8	6.37	1.52	1.39
2	A	503[A]	LSN	C14-C8	6.36	1.52	1.39
2	A	502	LSN	C1-N4	6.25	1.41	1.33
2	A	501	LSN	C14-C8	6.24	1.52	1.39
2	A	501	LSN	C2-C7	6.14	1.51	1.41
2	A	502	LSN	C3-C2	6.09	1.49	1.40
2	A	501	LSN	C13-C11	5.98	1.51	1.38
2	A	501	LSN	C5-C6	5.96	1.51	1.38
2	A	503[B]	LSN	C4-C5	5.89	1.53	1.38
2	A	503[A]	LSN	C4-C5	5.88	1.53	1.38
2	A	502	LSN	C13-C11	5.62	1.51	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	502	LSN	C9-C8	5.54	1.51	1.39
2	A	502	LSN	C4-C3	5.47	1.50	1.38
2	A	502	LSN	C10-C11	5.45	1.50	1.38
2	A	502	LSN	C5-C6	5.38	1.50	1.38
2	A	502	LSN	C6-C7	5.30	1.48	1.40
2	A	503[B]	LSN	C18-N6	5.21	1.45	1.35
2	A	503[A]	LSN	C18-N6	5.20	1.45	1.35
2	A	501	LSN	C18-N6	5.19	1.45	1.35
2	A	501	LSN	C4-C5	4.94	1.51	1.38
2	A	502	LSN	C14-C8	4.92	1.49	1.39
2	A	502	LSN	N4-N3	-4.67	1.28	1.34
2	A	502	LSN	C4-C5	4.66	1.50	1.38
2	A	502	LSN	N1-N2	-4.61	1.28	1.34
2	A	502	LSN	C2-C7	4.41	1.48	1.41
2	A	502	LSN	C18-N6	4.39	1.43	1.35
3	A	504	HEM	C1A-NA	3.20	1.42	1.36
3	A	504	HEM	C1A-CHA	-3.15	1.32	1.41
3	A	504	HEM	C1B-NB	-3.11	1.34	1.40
2	A	501	LSN	C7-C8	2.64	1.54	1.49
2	A	501	LSN	C17-CL	2.54	1.78	1.74
2	A	501	LSN	N1-N2	-2.46	1.31	1.34
3	A	504	HEM	C4B-NB	-2.34	1.34	1.38
3	A	504	HEM	C4D-ND	-2.30	1.36	1.40
3	A	504	HEM	CMB-C2B	2.26	1.55	1.50
3	A	504	HEM	FE-ND	-2.15	1.86	1.96
2	A	503[B]	LSN	N1-N2	-2.13	1.31	1.34
2	A	503[A]	LSN	N4-N3	-2.12	1.31	1.34
2	A	503[B]	LSN	N4-N3	-2.11	1.31	1.34
2	A	503[A]	LSN	N1-N2	-2.03	1.31	1.34

All (66) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	501	LSN	N4-N3-N2	8.49	115.08	109.53
2	A	502	LSN	N4-N3-N2	6.93	114.07	109.53
2	A	501	LSN	C1-N4-N3	-6.65	98.95	104.87
3	A	504	HEM	CHC-C4B-NB	6.61	131.61	124.43
2	A	502	LSN	N1-N2-N3	6.12	113.53	109.53
2	A	503[A]	LSN	N4-N3-N2	6.00	113.46	109.53
2	A	503[B]	LSN	N4-N3-N2	5.93	113.41	109.53
2	A	503[B]	LSN	N1-N2-N3	5.89	113.38	109.53
2	A	503[A]	LSN	N1-N2-N3	5.87	113.37	109.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	504	HEM	CHD-C1D-ND	5.32	130.21	124.43
2	A	502	LSN	C1-N4-N3	-5.22	100.22	104.87
2	A	502	LSN	C1-N1-N2	-5.04	100.39	104.87
3	A	504	HEM	CHA-C4D-ND	4.85	130.38	124.38
3	A	504	HEM	C1B-NB-C4B	4.77	110.00	105.07
2	A	501	LSN	C12-C11-C13	-4.72	111.44	120.40
2	A	501	LSN	N1-N2-N3	4.54	112.50	109.53
2	A	501	LSN	C1-N1-N2	-4.52	100.84	104.87
2	A	501	LSN	C17-C15-N5	-4.33	101.81	106.91
3	A	504	HEM	CHD-C1D-C2D	-4.23	118.37	124.98
2	A	502	LSN	C12-C11-C13	-4.16	112.50	120.40
2	A	503[B]	LSN	C13-C11-C10	3.96	124.40	118.17
2	A	503[A]	LSN	C13-C11-C10	3.93	124.34	118.17
3	A	504	HEM	CHA-C4D-C3D	-3.81	118.18	125.33
2	A	503[A]	LSN	C1-N1-N2	-3.73	101.55	104.87
2	A	503[B]	LSN	C1-N4-N3	-3.70	101.57	104.87
2	A	503[A]	LSN	C1-N4-N3	-3.69	101.59	104.87
2	A	503[B]	LSN	C1-N1-N2	-3.66	101.61	104.87
3	A	504	HEM	C4A-C3A-C2A	3.55	109.47	107.00
2	A	502	LSN	C3-C2-C7	3.42	122.07	118.67
2	A	502	LSN	C14-C8-C7	-3.38	115.44	120.91
3	A	504	HEM	C2C-C3C-C4C	-3.19	104.67	106.90
2	A	503[A]	LSN	C14-C8-C9	3.17	123.92	117.59
2	A	502	LSN	C9-C10-C11	-3.16	116.68	121.03
2	A	503[B]	LSN	C14-C8-C9	3.15	123.88	117.59
2	A	501	LSN	C14-C13-C11	-3.13	116.72	121.03
2	A	503[B]	LSN	C19-C18-N6	3.03	128.56	124.22
2	A	502	LSN	C13-C11-C10	3.02	122.91	118.17
2	A	503[B]	LSN	C3-C2-C7	3.01	121.66	118.67
2	A	503[A]	LSN	C19-C18-N6	2.98	128.49	124.22
2	A	503[A]	LSN	C3-C2-C7	2.97	121.62	118.67
2	A	502	LSN	C13-C14-C8	-2.96	116.87	121.13
2	A	503[A]	LSN	C6-C7-C2	2.96	121.61	118.67
2	A	503[B]	LSN	C6-C7-C2	2.91	121.56	118.67
2	A	502	LSN	C14-C8-C9	2.90	123.38	117.59
2	A	502	LSN	C16-C15-C17	-2.85	123.07	130.87
2	A	501	LSN	C15-N5-C18	2.80	112.21	109.76
2	A	502	LSN	C3-C2-C1	-2.74	114.34	118.55
2	A	501	LSN	C14-C8-C7	-2.73	116.50	120.91
3	A	504	HEM	O2D-CGD-CBD	2.62	122.46	114.03
2	A	501	LSN	C10-C9-C8	-2.62	117.36	121.13
3	A	504	HEM	C4C-CHD-C1D	-2.58	119.16	122.56

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	504	HEM	CHC-C4B-C3B	-2.52	120.70	124.57
2	A	503[B]	LSN	C9-C10-C11	-2.41	117.71	121.03
2	A	503[B]	LSN	C14-C13-C11	-2.40	117.73	121.03
2	A	503[A]	LSN	C14-C13-C11	-2.38	117.75	121.03
2	A	503[A]	LSN	C9-C10-C11	-2.37	117.77	121.03
2	A	503[B]	LSN	C2-C7-C8	-2.25	119.22	122.82
2	A	503[A]	LSN	C2-C7-C8	-2.24	119.25	122.82
2	A	501	LSN	C19-C18-N6	2.20	127.37	124.22
2	A	502	LSN	C12-C11-C10	2.20	124.59	120.40
2	A	501	LSN	C13-C11-C10	2.19	121.61	118.17
2	A	503[A]	LSN	C13-C14-C8	-2.11	118.10	121.13
2	A	503[A]	LSN	C10-C9-C8	-2.10	118.11	121.13
2	A	501	LSN	C2-C7-C8	-2.09	119.49	122.82
2	A	503[B]	LSN	C13-C14-C8	-2.08	118.14	121.13
2	A	503[B]	LSN	C10-C9-C8	-2.07	118.15	121.13

There are no chirality outliers.

All (40) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	501	LSN	N5-C18-C19-C20
2	A	501	LSN	N4-C1-C2-C3
2	A	503[A]	LSN	C18-C19-C20-C21
2	A	503[A]	LSN	N1-C1-C2-C3
2	A	503[A]	LSN	N4-C1-C2-C3
2	A	503[B]	LSN	C11-C12-N5-C15
2	A	503[B]	LSN	N1-C1-C2-C3
2	A	503[B]	LSN	N4-C1-C2-C3
2	A	503[B]	LSN	C2-C7-C8-C9
2	A	503[A]	LSN	C2-C7-C8-C14
2	A	501	LSN	C2-C7-C8-C14
2	A	503[B]	LSN	C2-C7-C8-C14
2	A	503[A]	LSN	C2-C7-C8-C9
2	A	503[B]	LSN	C6-C7-C8-C9
2	A	503[A]	LSN	C6-C7-C8-C14
2	A	503[B]	LSN	C6-C7-C8-C14
2	A	503[A]	LSN	C6-C7-C8-C9
2	A	501	LSN	N1-C1-C2-C3
2	A	502	LSN	N4-C1-C2-C3
2	A	503[A]	LSN	C19-C20-C21-C22
2	A	503[B]	LSN	C19-C20-C21-C22
2	A	502	LSN	C19-C20-C21-C22

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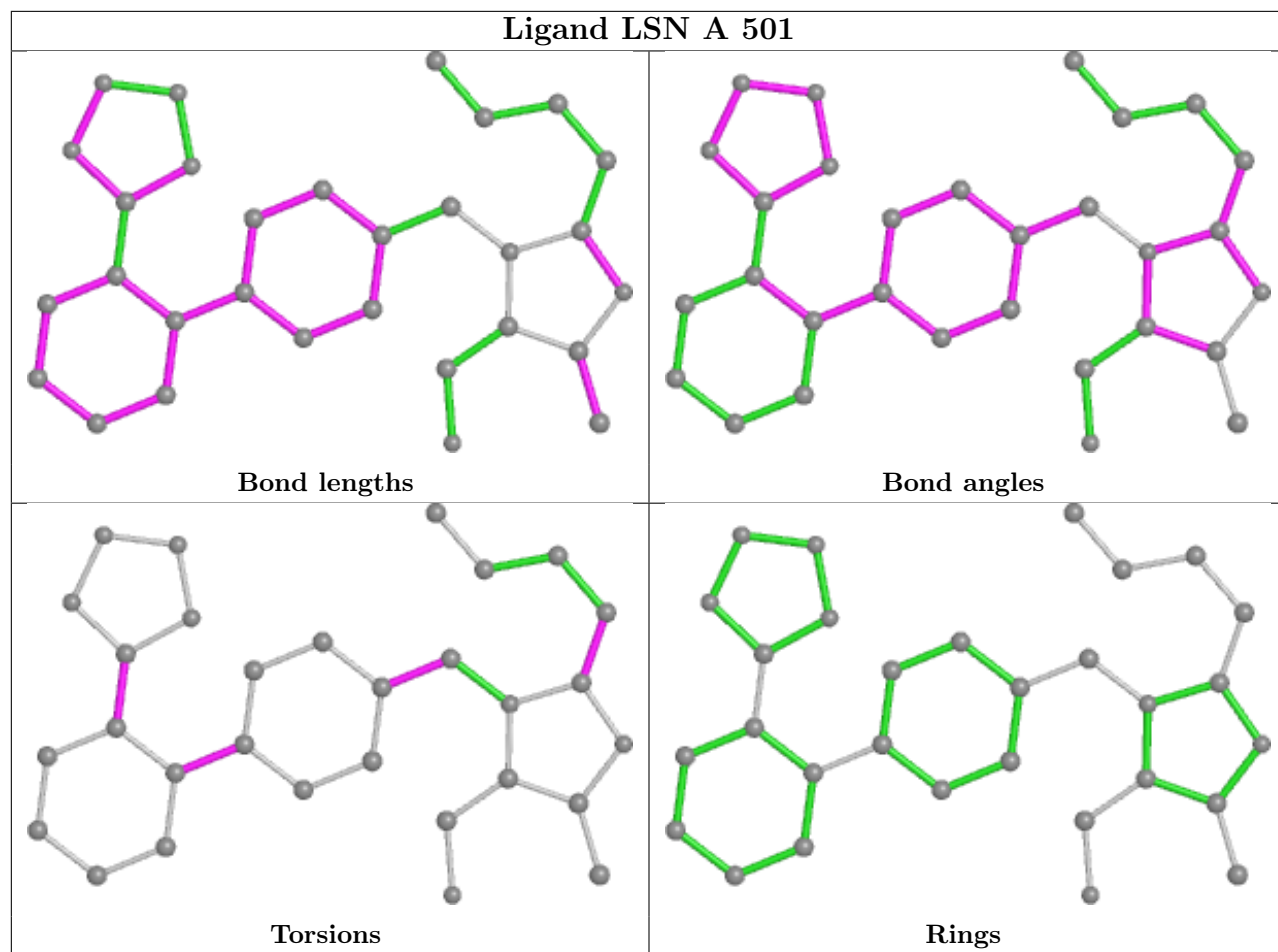
Mol	Chain	Res	Type	Atoms
2	A	503[A]	LSN	C10-C11-C12-N5
2	A	503[B]	LSN	C13-C11-C12-N5
2	A	502	LSN	C10-C11-C12-N5
2	A	503[B]	LSN	C10-C11-C12-N5
2	A	502	LSN	C13-C11-C12-N5
2	A	503[A]	LSN	C13-C11-C12-N5
2	A	501	LSN	C13-C11-C12-N5
2	A	503[A]	LSN	C11-C12-N5-C18
2	A	503[A]	LSN	N4-C1-C2-C7
3	A	504	HEM	CAA-CBA-CGA-O1A
2	A	502	LSN	N1-C1-C2-C3
3	A	504	HEM	CAA-CBA-CGA-O2A
2	A	501	LSN	C2-C7-C8-C9
2	A	501	LSN	C10-C11-C12-N5
2	A	502	LSN	N6-C18-C19-C20
2	A	503[B]	LSN	N6-C18-C19-C20
3	A	504	HEM	CAD-CBD-CGD-O2D
3	A	504	HEM	CAD-CBD-CGD-O1D

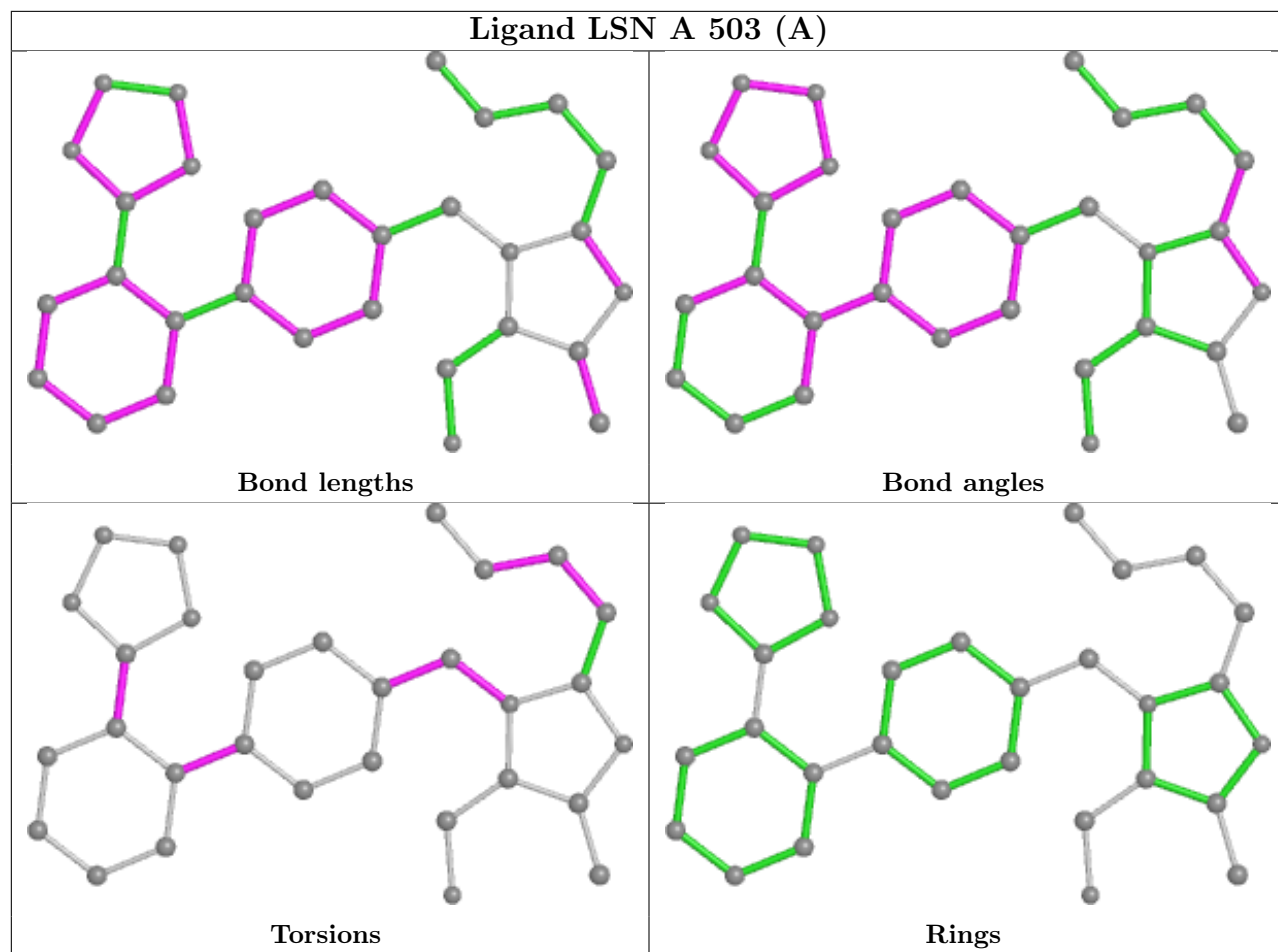
There are no ring outliers.

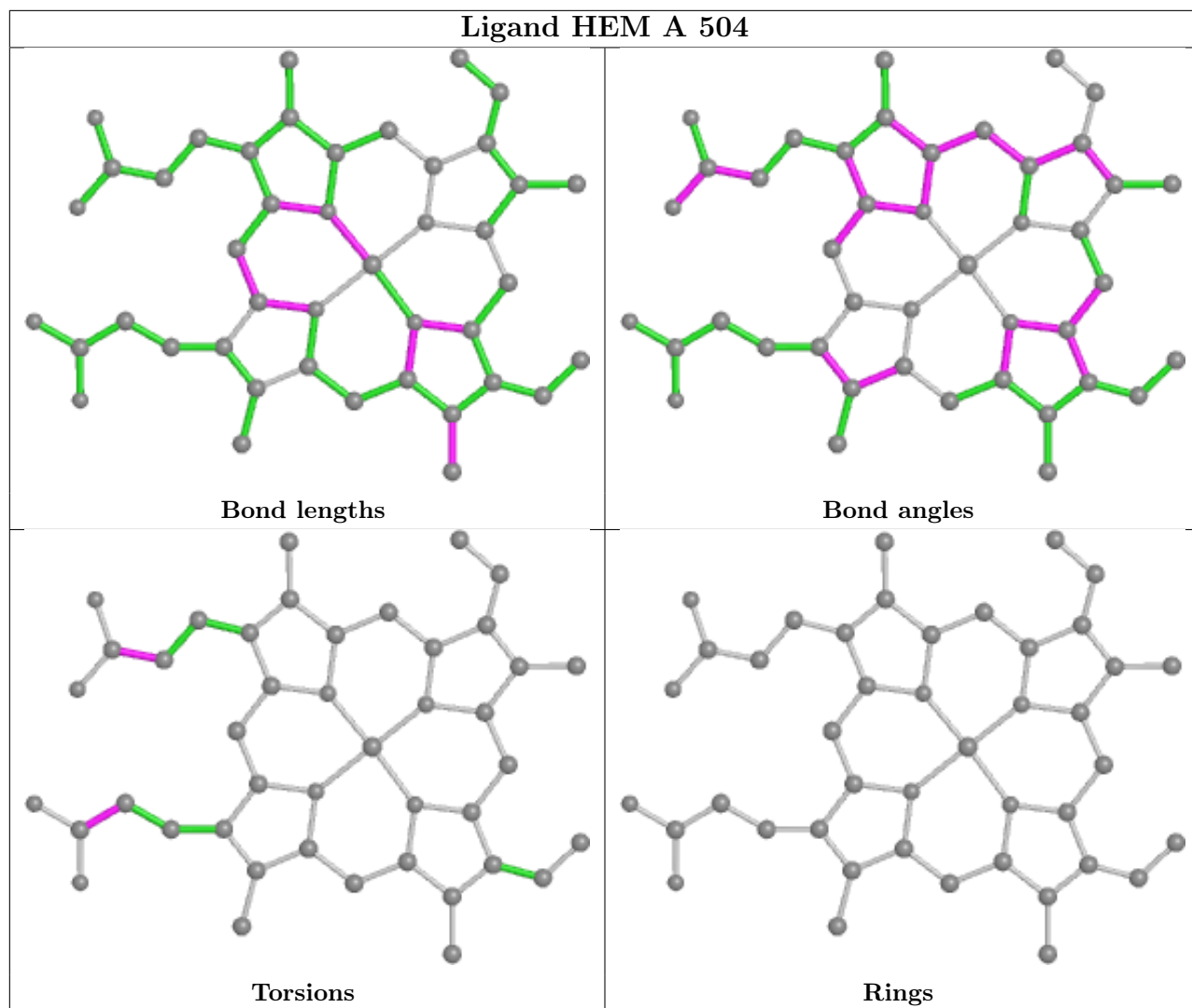
5 monomers are involved in 40 short contacts:

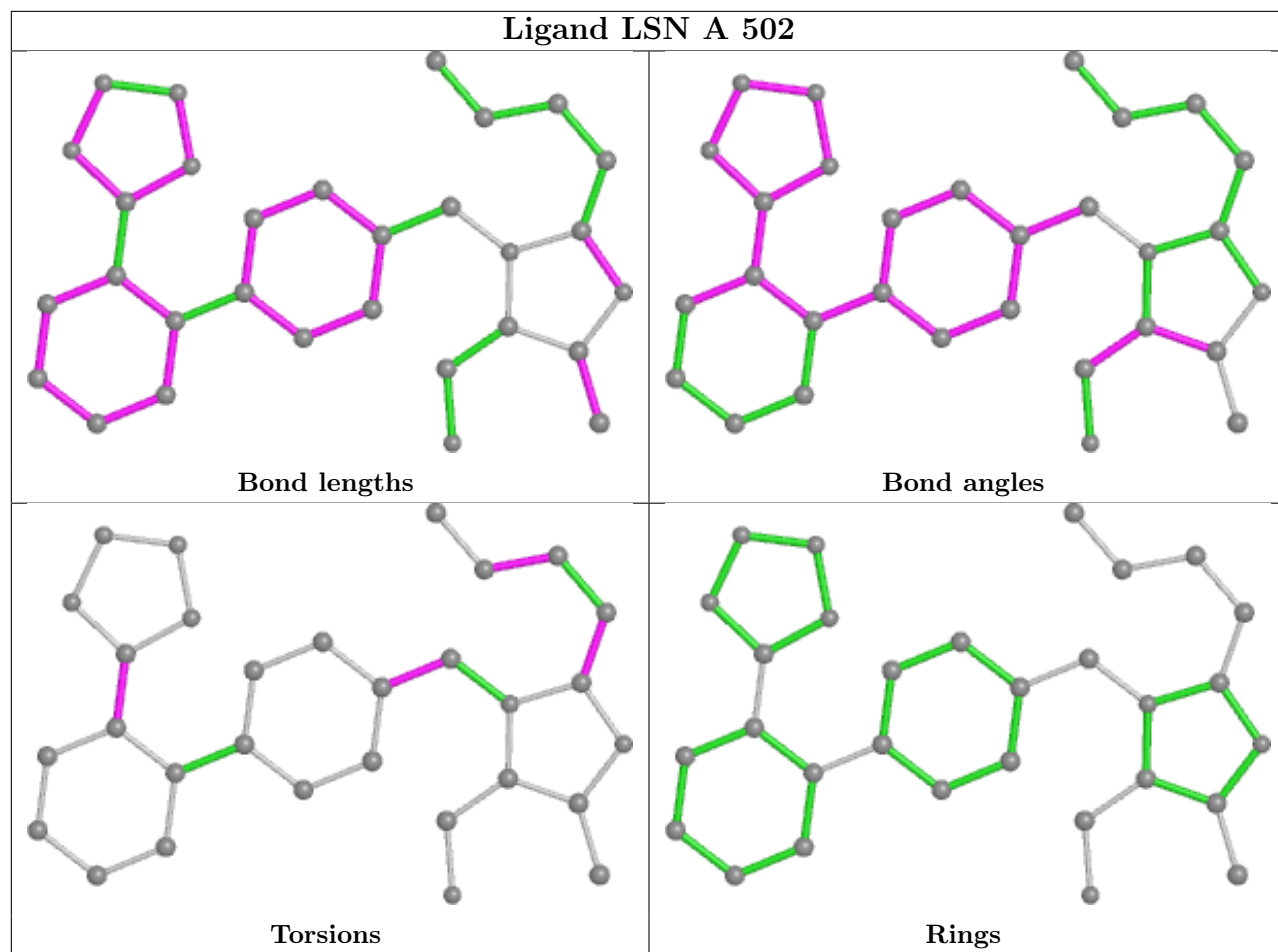
Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	501	LSN	2	0
2	A	503[A]	LSN	17	0
3	A	504	HEM	4	0
2	A	502	LSN	1	0
2	A	503[B]	LSN	16	0

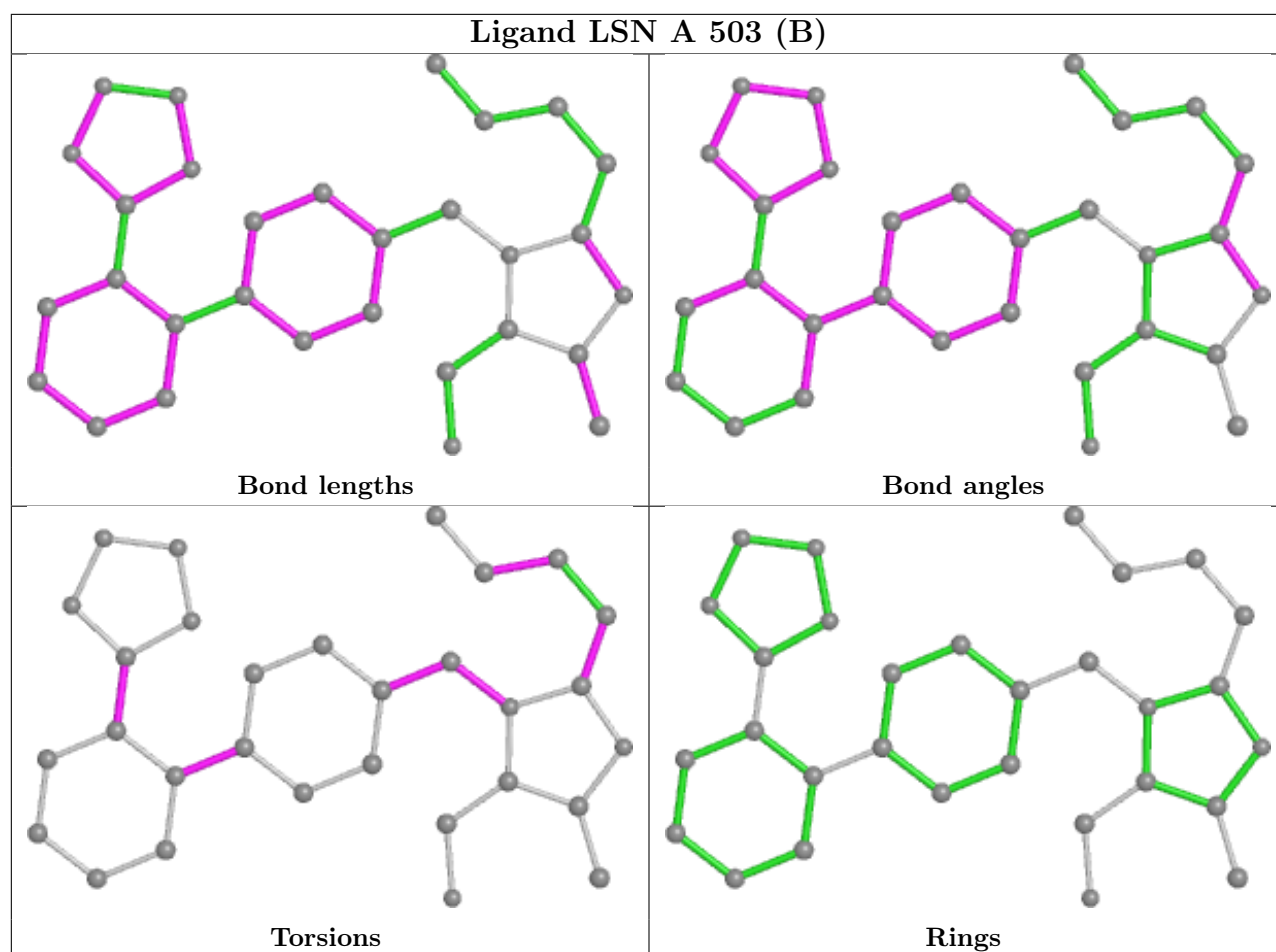
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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	463/463 (100%)	0.35	32 (6%) 16 22	40, 65, 96, 123	0

All (32) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	71	LEU	6.1
1	A	380	LEU	4.6
1	A	462	VAL	4.4
1	A	106	ALA	4.1
1	A	222	ILE	4.1
1	A	276	HIS	3.6
1	A	435	CYS	3.4
1	A	377	ARG	3.1
1	A	464	PRO	3.0
1	A	461	LEU	3.0
1	A	258	ASN	2.7
1	A	378	ASN	2.7
1	A	436	VAL	2.7
1	A	107	ASN	2.7
1	A	272	GLU	2.6
1	A	466	ASN	2.6
1	A	277	ASN	2.5
1	A	223	ILE	2.4
1	A	440	LEU	2.4
1	A	253	GLU	2.4
1	A	415	GLU	2.3
1	A	245	LEU	2.2
1	A	69	PHE	2.2
1	A	249	LYS	2.2
1	A	104	GLU	2.2
1	A	257	MET	2.2
1	A	219	PHE	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	29	LEU	2.1
1	A	298	GLY	2.1
1	A	279	PRO	2.1
1	A	113	VAL	2.0
1	A	108	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 monosaccharides in this entry.

6.4 Ligands [i](#)

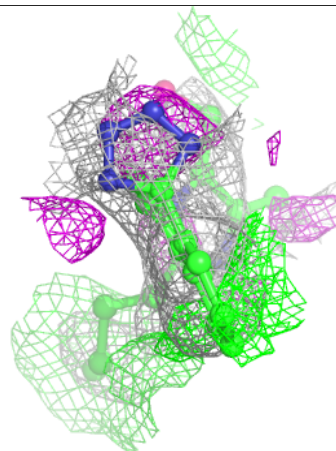
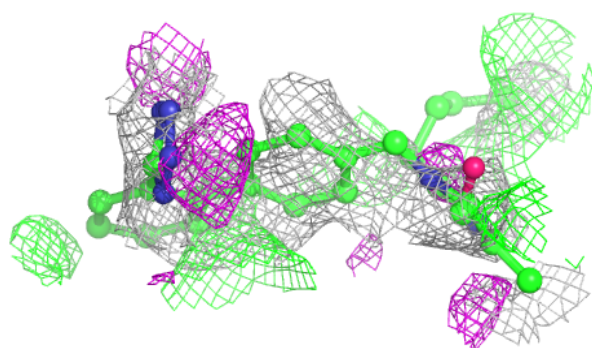
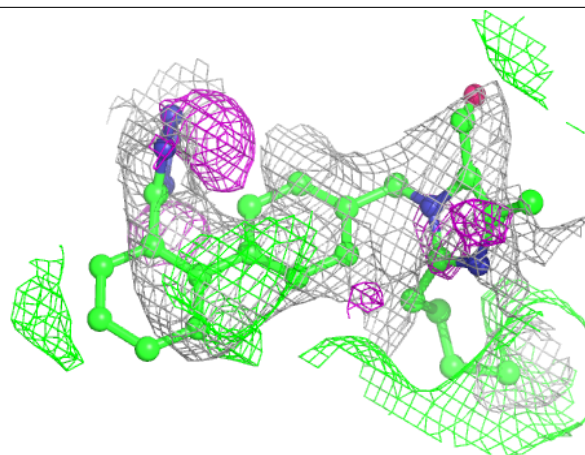
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	LSN	A	503[A]	30/30	0.62	0.42	67,157,185,191	30
2	LSN	A	503[B]	30/30	0.62	0.42	39,66,81,83	30
4	K	A	505	1/1	0.91	0.19	97,97,97,97	0
2	LSN	A	502	30/30	0.92	0.18	46,64,80,118	0
2	LSN	A	501	30/30	0.92	0.23	53,71,84,95	0
3	HEM	A	504	43/43	0.99	0.25	31,40,51,65	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.

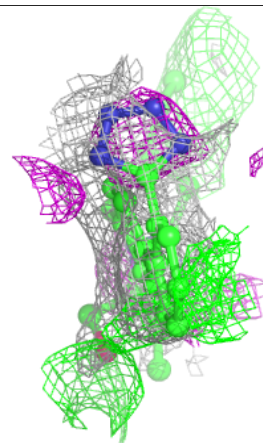
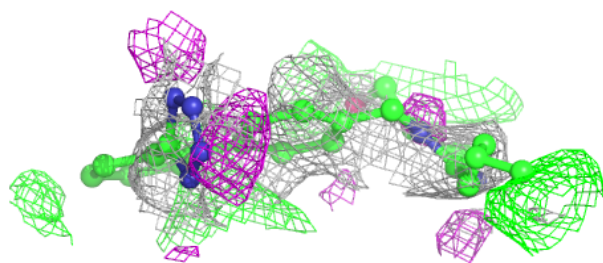
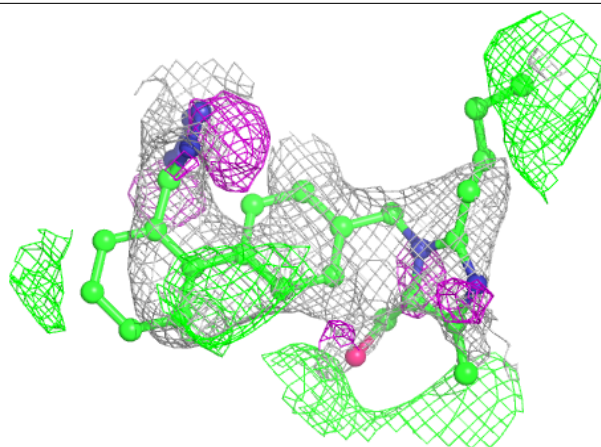
Electron density around LSN A 503 (A):

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



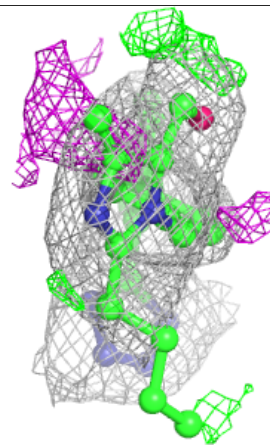
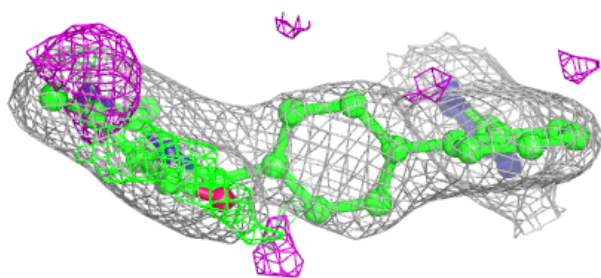
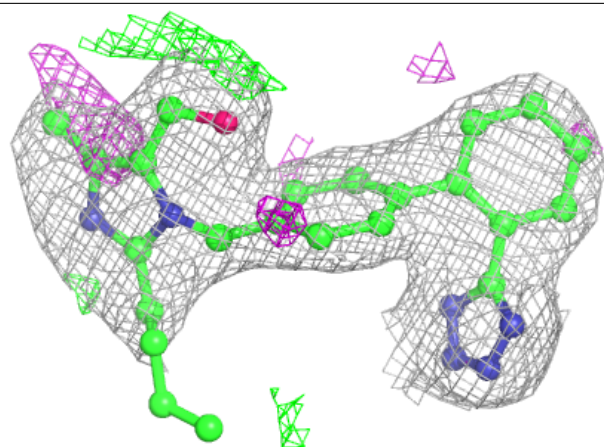
Electron density around LSN A 503 (B):

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

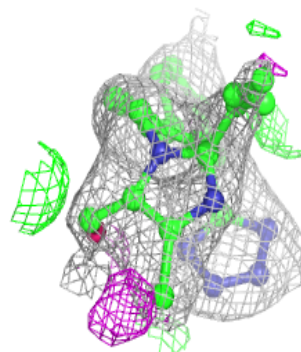
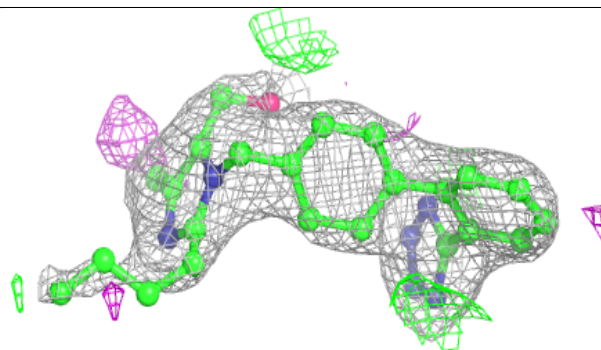
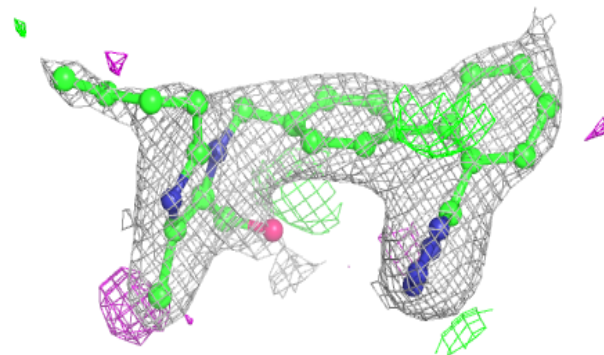


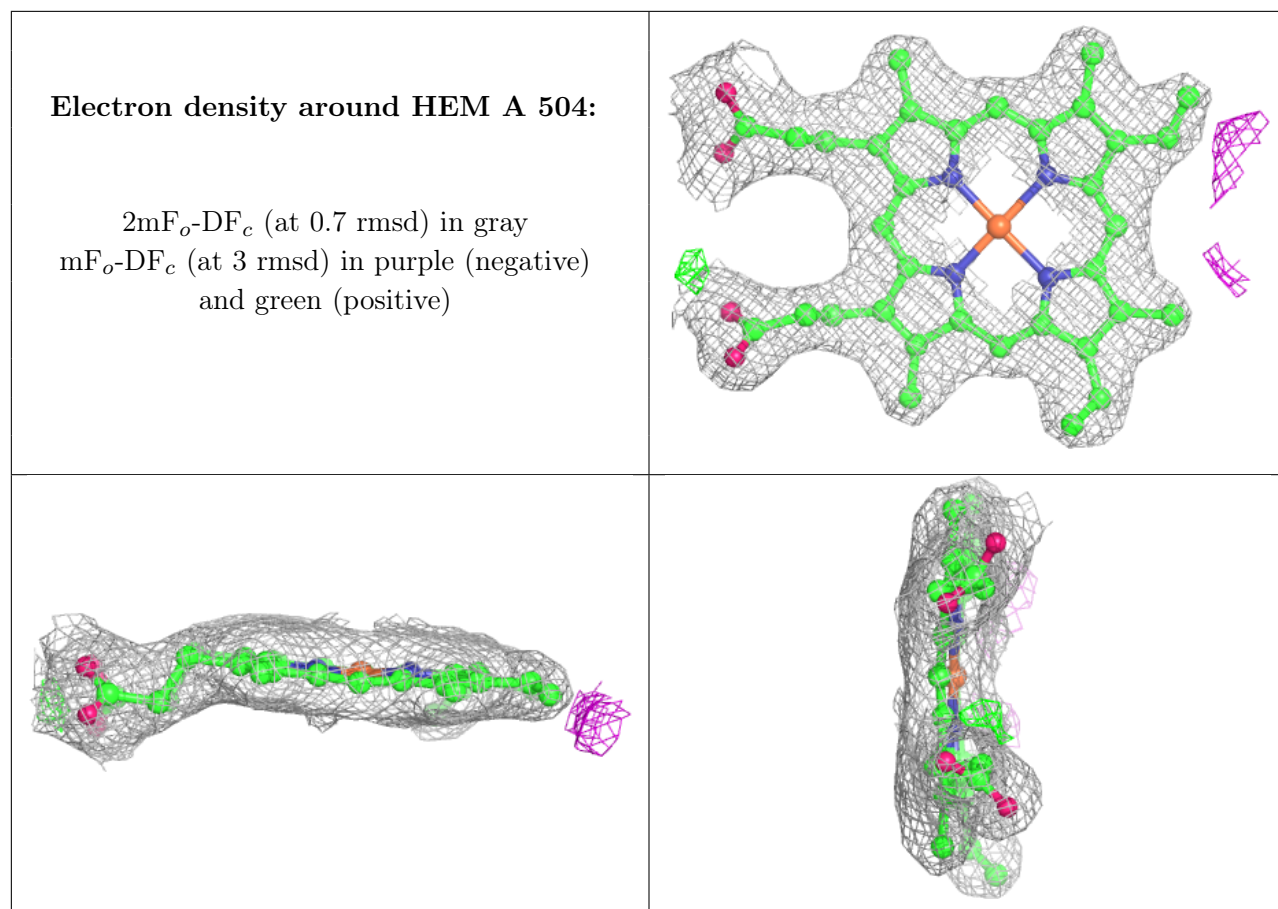
Electron density around LSN A 502:

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

**Electron density around LSN A 501:**

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





6.5 Other polymers [i](#)

There are no such residues in this entry.