WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

May 3, 2025 – 04:23 PM EDT

PDB ID	:	3AQI / pdb_00003aqi
Title	:	H240A variant of human ferrochelatase
Authors	:	Lanzilotta, W.N.; Medlock, A.E.; Dailey, T.A.; Dailey, H.A.
Deposited on	:	2010-11-03
Resolution	:	1.70 Å(reported)

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

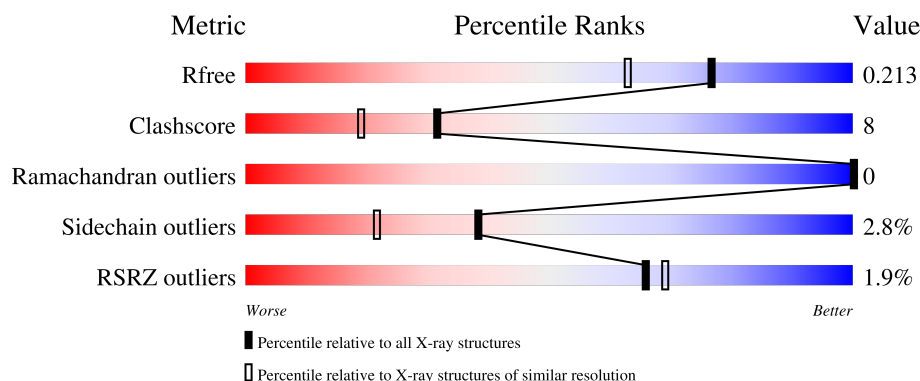|		
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.43.1

1 Overall quality at a glance ⓘ

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

The reported resolution of this entry is 1.70 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	Percentile Ranks	Value
Rfree		0.213
Clashscore		8
Ramachandran outliers		0
Sidechain outliers		2.8%
RSRZ outliers		1.9%

Worse *Better*

▌ Percentile relative to all X-ray structures
▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	5161 (1.70-1.70)
Clashscore	180529	5671 (1.70-1.70)
Ramachandran outliers	177936	5594 (1.70-1.70)
Sidechain outliers	177891	5594 (1.70-1.70)
RSRZ outliers	164620	5159 (1.70-1.70)

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	359	2% 84% 14% •
1	B	359	2% 81% 16% •

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
3	CHD	A	1	X	-	-	-
3	CHD	A	2	X	-	-	-
3	CHD	A	3	X	-	-	-
3	CHD	B	4	X	-	-	-
3	CHD	B	5	X	-	-	-
3	CHD	B	6	X	-	-	-

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 6814 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 Ferrochelatase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	359	Total	C	N	O	S	0	12	0
			2945	1881	506	538	20			
1	B	359	Total	C	N	O	S	0	14	0
			2952	1888	507	537	20			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	115	LEU	ARG	conflict	UNP P22830
A	240	ALA	HIS	engineered mutation	UNP P22830
B	615	LEU	ARG	conflict	UNP P22830
B	740	ALA	HIS	engineered mutation	UNP P22830

- Molecule 2 is FE2/S2 (INORGANIC) CLUSTER (CCD ID: FES) (formula: Fe_2S_2).
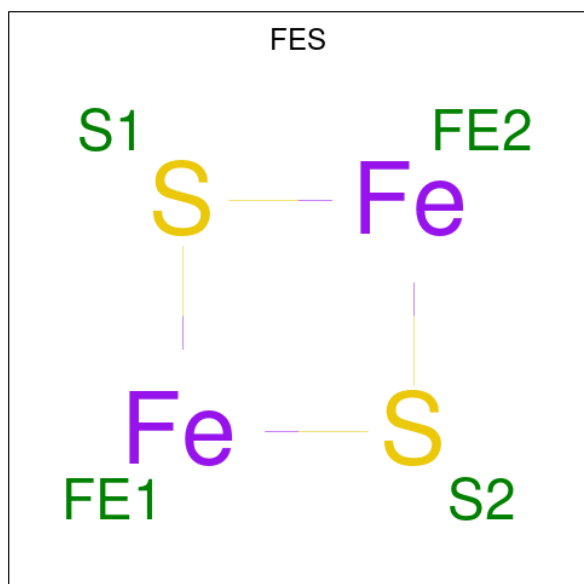
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total 4	Fe 2	S 2	0	0
2	B	1	Total 4	Fe 2	S 2	0	0

- Molecule 3 is CHOLIC ACID (CCD ID: CHD) (formula: $C_{24}H_{40}O_5$).
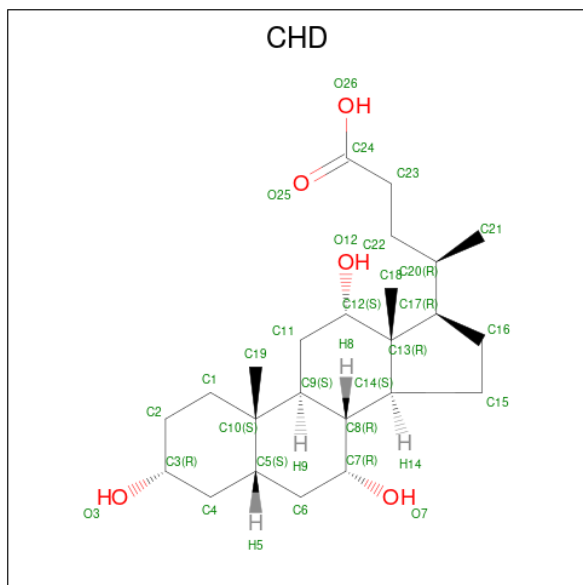
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total 29	C 24	O 5	0	0
3	A	1	Total 29	C 24	O 5	0	0
3	A	1	Total 29	C 24	O 5	0	0
3	B	1	Total 29	C 24	O 5	0	0
3	B	1	Total 29	C 24	O 5	0	0
3	B	1	Total 29	C 24	O 5	0	0

- Molecule 4 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).

GOL

C3

OH $O3$

C1 C2

HO

O1

OH

O2

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total 6	C 3	O 3	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	348	Total 348	O 348	0	0
5	B	381	Total 381	O 381	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: Ferrochelatase
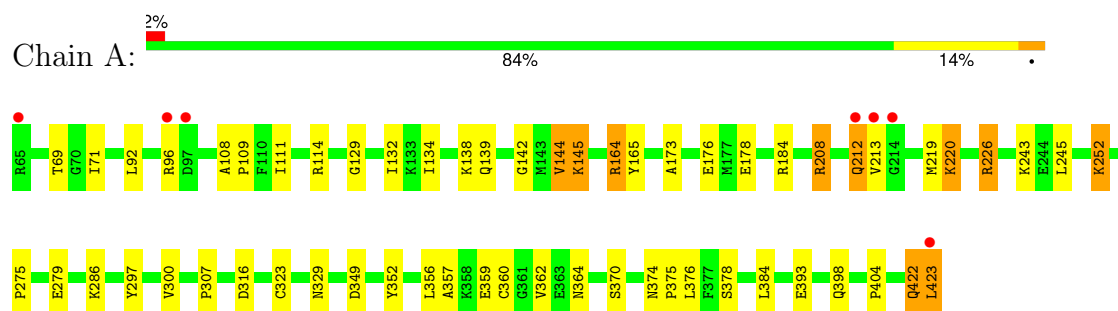
- Molecule 1: Ferrochelatase
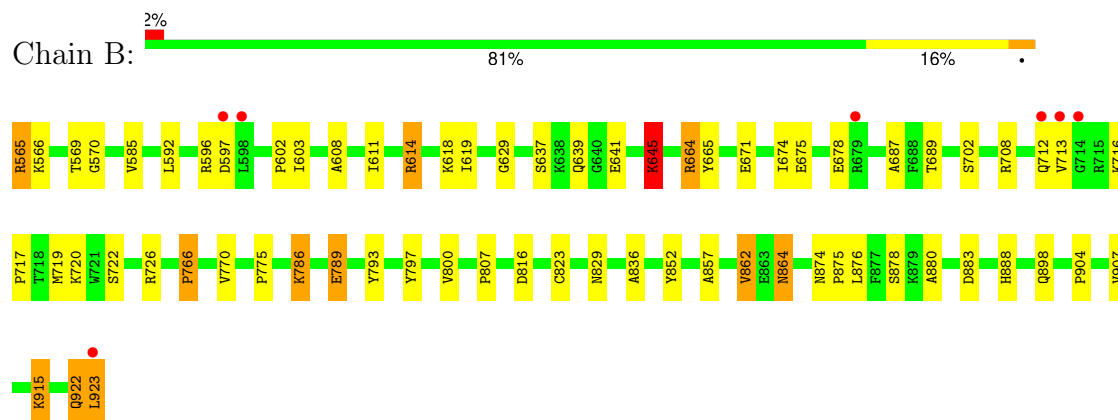
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	88.05Å 93.41Å 110.66Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	41.88 – 1.70 41.88 – 1.70	Depositor EDS
% Data completeness (in resolution range)	99.8 (41.88-1.70) 99.8 (41.88-1.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.06 (at 1.70Å)	Xtriage
Refinement program	REFMAC 5.5.0102	Depositor
R, R_{free}	0.172 , 0.214 0.171 , 0.213	Depositor DCC
R_{free} test set	5055 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	14.2	Xtriage
Anisotropy	0.075	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 42.6	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	6814	wwPDB-VP
Average B, all atoms (Å^2)	17.0	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 57.36 % 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 2.3930e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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[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 ⓘ

5.1   Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: CHD, GOL, FES

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	#$|Z|$ >5	RMSZ	#$|Z|$ >5
1	A	1.59	15/3050 (0.5%)	1.34	11/4129 (0.3%)
1	B	1.58	21/3063 (0.7%)	1.35	15/4146 (0.4%)
All	All	1.58	36/6113 (0.6%)	1.34	26/8275 (0.3%)

All (36) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	307	PRO	N-CA	-6.67	1.42	1.47
1	B	789[A]	GLU	C-O	6.31	1.31	1.24
1	B	789[B]	GLU	C-O	6.31	1.31	1.24
1	B	800	VAL	CA-CB	6.12	1.64	1.54
1	B	608	ALA	N-CA	6.08	1.52	1.46
1	B	619	ILE	N-CA	5.95	1.53	1.46
1	B	770	VAL	N-CA	5.88	1.53	1.46
1	B	836	ALA	CA-CB	5.87	1.62	1.53
1	B	726	ARG	CD-NE	-5.84	1.38	1.46
1	A	145	LYS	N-CA	5.83	1.53	1.46
1	A	245	LEU	N-CA	5.79	1.53	1.46
1	A	173	ALA	CA-CB	5.78	1.62	1.53
1	A	378	SER	CA-CB	5.72	1.62	1.53
1	A	139	GLN	CG-CD	5.57	1.66	1.52
1	A	129	GLY	N-CA	5.53	1.51	1.45
1	A	71	ILE	N-CA	5.53	1.53	1.46
1	B	629	GLY	N-CA	5.45	1.50	1.45
1	B	880	ALA	CA-CB	5.43	1.61	1.53
1	A	370	SER	C-O	5.41	1.30	1.23
1	B	678	GLU	N-CA	5.36	1.52	1.46
1	B	766	PRO	CA-CB	5.34	1.60	1.53
1	A	226	ARG	CZ-NH1	5.31	1.40	1.32
1	B	569	THR	N-CA	5.30	1.52	1.46
1	B	674	ILE	N-CA	5.29	1.52	1.46

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	300	VAL	N-CA	5.27	1.52	1.46
1	A	349	ASP	N-CA	5.25	1.53	1.46
1	A	134	ILE	CA-CB	5.24	1.60	1.54
1	B	689	THR	C-O	5.20	1.30	1.23
1	A	226	ARG	CD-NE	-5.20	1.39	1.46
1	A	111	ILE	CA-C	5.19	1.59	1.52
1	B	878	SER	N-CA	5.18	1.52	1.46
1	B	570	GLY	N-CA	5.16	1.52	1.45
1	B	639	GLN	CG-CD	5.14	1.64	1.52
1	B	687	ALA	CA-CB	5.12	1.59	1.52
1	B	726	ARG	N-CA	5.07	1.52	1.46
1	B	907	VAL	N-CA	5.03	1.51	1.46

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	726	ARG	NE-CZ-NH1	8.58	130.08	121.50
1	A	226	ARG	NE-CZ-NH2	-7.40	112.54	119.20
1	B	922	GLN	CA-C-N	7.17	134.60	121.70
1	B	922	GLN	C-N-CA	7.17	134.60	121.70
1	A	226	ARG	NE-CZ-NH1	7.11	128.61	121.50
1	B	664[A]	ARG	NE-CZ-NH1	-6.90	114.60	121.50
1	B	664[B]	ARG	NE-CZ-NH1	-6.90	114.60	121.50
1	A	176	GLU	N-CA-C	6.56	118.43	111.28
1	A	422	GLN	CA-C-N	6.23	132.91	121.70
1	A	422	GLN	C-N-CA	6.23	132.91	121.70
1	A	275	PRO	CB-CA-C	-6.17	102.12	111.44
1	B	726	ARG	NE-CZ-NH2	-5.93	113.86	119.20
1	A	384	LEU	N-CA-C	5.82	117.30	111.07
1	B	645	LYS	CD-CE-NZ	5.75	130.30	111.90
1	B	775	PRO	CB-CA-C	-5.65	102.91	111.44
1	B	864	ASN	CA-C-N	-5.59	115.22	122.99
1	B	864	ASN	C-N-CA	-5.59	115.22	122.99
1	A	144	VAL	N-CA-C	-5.42	105.24	110.72
1	B	596	ARG	N-CA-C	5.38	118.64	111.75
1	B	566	LYS	CA-C-N	-5.25	114.51	119.76
1	B	566	LYS	C-N-CA	-5.25	114.51	119.76
1	A	96	ARG	N-CA-C	5.22	119.27	113.01
1	A	164[A]	ARG	NE-CZ-NH1	-5.21	116.29	121.50
1	A	164[B]	ARG	NE-CZ-NH1	-5.21	116.29	121.50
1	B	585	VAL	N-CA-C	5.04	115.26	110.42
1	B	786	LYS	CD-CE-NZ	5.04	128.01	111.90

There are no chirality outliers.

There are no planarity outliers.

5.2   Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2945	0	2989	42	0
1	B	2952	0	3010	49	0
2	A	4	0	0	0	0
2	B	4	0	0	0	0
3	A	87	0	112	5	0
3	B	87	0	112	9	0
4	A	6	0	7	1	0
5	A	348	0	0	13	0
5	B	381	0	0	11	0
All	All	6814	0	6230	98	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 (98) 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:252[B]:LYS:HE2	5:A:637:HOH:O	1.43	1.18
1:B:883:ASP:HB2	5:B:461:HOH:O	1.60	1.02
1:B:823[B]:CYS:SG	1:B:862[B]:VAL:HG22	2.09	0.92
1:A:208:ARG:O	1:A:212:GLN:HG2	1.69	0.92
1:A:393[B]:GLU:CD	5:A:918:HOH:O	2.14	0.91
1:B:597:ASP:CG	1:B:708[B]:ARG:HH12	1.78	0.90
1:A:398:GLN:HE22	1:B:797:TYR:H	1.21	0.87
1:A:132[A]:ILE:CG2	5:A:663:HOH:O	2.23	0.86
1:B:611:ILE:HA	1:B:614:ARG:HG2	1.60	0.84
1:A:297:TYR:H	1:B:898:GLN:HE22	1.24	0.83
1:A:132[A]:ILE:HG23	5:A:663:HOH:O	1.78	0.82
1:B:664[B]:ARG:HG3	1:B:665:TYR:CE2	2.15	0.82
1:A:220:LYS:HG2	5:A:689:HOH:O	1.80	0.80
1:B:597:ASP:OD1	1:B:708[B]:ARG:NH1	2.15	0.78

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:220:LYS:CD	5:A:689:HOH:O	2.31	0.78
1:A:69:THR:HG23	1:A:184[B]:ARG:HG2	1.66	0.76
1:A:220:LYS:HD3	5:A:689:HOH:O	1.87	0.73
1:B:645:LYS:CE	5:B:434:HOH:O	2.38	0.71
3:B:6:CHD:C18	3:B:6:CHD:H222	2.20	0.71
1:B:720:LYS:HE2	1:B:923:LEU:HB2	1.74	0.70
1:A:142:GLY:O	1:A:145:LYS:HE3	1.90	0.70
1:A:357:ALA:HB1	1:A:362:VAL:HG11	1.74	0.69
1:A:138:LYS:NZ	5:A:449:HOH:O	2.25	0.69
3:A:1:CHD:H222	3:A:1:CHD:C18	2.22	0.69
1:B:722:SER:OG	1:B:888:HIS:HE1	1.76	0.69
1:A:69:THR:HG23	1:A:184[A]:ARG:HD2	1.76	0.68
1:B:565:ARG:HH11	1:B:565:ARG:HB2	1.61	0.66
1:B:637:SER:O	1:B:641[B]:GLU:HG3	1.95	0.65
3:B:6:CHD:H222	3:B:6:CHD:H181	1.79	0.64
1:A:220:LYS:CG	5:A:689:HOH:O	2.38	0.62
1:A:374:ASN:ND2	1:A:376:LEU:H	1.98	0.62
1:B:645:LYS:HE2	5:B:434:HOH:O	1.99	0.62
1:B:823[B]:CYS:SG	1:B:862[B]:VAL:CG2	2.87	0.61
1:B:671:GLU:O	1:B:675:GLU:HG3	2.01	0.60
1:A:142:GLY:O	1:A:145:LYS:HG3	2.01	0.59
1:B:645:LYS:HE3	5:B:434:HOH:O	2.00	0.59
1:A:252[A]:LYS:HE3	5:A:637:HOH:O	2.01	0.58
1:A:286:LYS:HD3	5:B:351:HOH:O	2.03	0.57
1:B:857:ALA:HB1	1:B:862[A]:VAL:HG11	1.85	0.57
1:B:888:HIS:HD2	5:B:1000:HOH:O	1.88	0.56
1:A:398:GLN:HE22	1:B:797:TYR:N	1.99	0.56
1:A:297:TYR:N	1:B:898:GLN:HE22	2.01	0.56
1:A:357:ALA:HB1	1:A:362:VAL:CG1	2.37	0.55
5:A:620:HOH:O	1:B:786:LYS:HD3	2.05	0.55
1:A:356:LEU:O	1:A:359:GLU:HG2	2.07	0.55
1:A:374:ASN:HD22	1:A:375:PRO:N	2.03	0.55
1:A:422:GLN:HG2	1:A:423:LEU:HD23	1.88	0.55
3:A:1:CHD:H222	3:A:1:CHD:H181	1.89	0.54
1:B:720:LYS:HE2	1:B:923:LEU:CB	2.38	0.54
4:A:424:GOL:H11	5:A:473:HOH:O	2.09	0.53
1:B:565:ARG:HH11	1:B:565:ARG:CB	2.21	0.53
1:B:565:ARG:HH11	1:B:565:ARG:CG	2.20	0.53
1:B:766:PRO:HG3	3:B:4:CHD:H11	1.90	0.53
1:B:874:ASN:HD22	1:B:875:PRO:N	2.07	0.53
3:B:6:CHD:H12	3:B:6:CHD:H212	1.92	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:178:GLU:HG2	1:A:219:MET:HE2	1.92	0.52
1:B:602:PRO:O	1:B:603:ILE:C	2.51	0.52
1:A:164[B]:ARG:HG3	1:A:165:TYR:CE2	2.46	0.51
1:A:374:ASN:HD22	1:A:374:ASN:C	2.19	0.50
1:A:108:ALA:HB3	1:A:109:PRO:HD3	1.93	0.50
1:A:92:LEU:C	1:A:92:LEU:HD23	2.37	0.50
1:B:883:ASP:CB	5:B:461:HOH:O	2.36	0.50
1:B:883:ASP:CG	5:B:461:HOH:O	2.56	0.48
1:A:374:ASN:HD22	1:A:375:PRO:CD	2.27	0.47
1:B:618[A]:LYS:NZ	1:B:618[A]:LYS:HB2	2.29	0.47
1:B:874:ASN:HD22	1:B:874:ASN:C	2.23	0.47
1:B:614:ARG:HD3	3:B:4:CHD:O26	2.16	0.46
1:A:252[A]:LYS:HA	1:A:252[A]:LYS:CE	2.46	0.46
1:A:374:ASN:HD22	1:A:375:PRO:HD2	1.82	0.45
1:B:702:SER:OG	5:B:384:HOH:O	2.20	0.45
1:B:857:ALA:HB1	1:B:862[B]:VAL:HG21	1.98	0.45
1:B:915:LYS:HE2	1:B:915:LYS:HB3	1.82	0.45
1:B:874:ASN:HD22	1:B:875:PRO:CD	2.30	0.44
1:B:874:ASN:ND2	1:B:876:LEU:H	2.15	0.44
1:A:114:ARG:NE	3:A:2:CHD:O26	2.44	0.44
1:A:323[B]:CYS:SG	1:A:360[B]:CYS:SG	3.15	0.44
1:B:789[A]:GLU:HG2	1:B:793:TYR:OH	2.17	0.44
3:A:3:CHD:H232	3:A:3:CHD:H211	1.84	0.43
1:A:226:ARG:HD3	1:A:279:GLU:OE1	2.19	0.43
1:B:829:ASN:HD22	1:B:864:ASN:HB2	1.84	0.43
3:B:4:CHD:H232	3:B:4:CHD:H211	1.87	0.42
1:B:592:LEU:HD11	3:B:6:CHD:H7	2.00	0.42
1:B:565:ARG:CG	1:B:565:ARG:NH1	2.83	0.42
1:B:816:ASP:HB3	1:B:852:TYR:CE1	2.54	0.42
1:A:243:LYS:HG3	5:A:630:HOH:O	2.20	0.41
3:B:6:CHD:C24	3:B:6:CHD:H211	2.50	0.41
1:A:423:LEU:HA	1:A:423:LEU:HD22	1.75	0.41
1:A:329:ASN:HD22	1:A:364:ASN:HB2	1.85	0.41
1:B:922:GLN:HG2	1:B:923:LEU:HD23	2.03	0.41
3:B:4:CHD:H112	3:B:4:CHD:H12A	1.82	0.41
1:B:716:LYS:HA	1:B:716:LYS:HD3	1.89	0.41
1:B:883:ASP:HB2	5:B:328:HOH:O	2.21	0.40
1:B:807:PRO:HD2	5:B:429:HOH:O	2.20	0.40
1:A:316:ASP:HB3	1:A:352:TYR:CE1	2.56	0.40
3:A:1:CHD:H222	3:A:1:CHD:H183	2.01	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	369/359 (103%)	361 (98%)	8 (2%)	0	100	100
1	B	371/359 (103%)	362 (98%)	9 (2%)	0	100	100
All	All	740/718 (103%)	723 (98%)	17 (2%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	335/323 (104%)	326 (97%)	9 (3%)	40	23
1	B	337/323 (104%)	326 (97%)	11 (3%)	33	16
All	All	672/646 (104%)	652 (97%)	20 (3%)	38	19

All (20) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	144	VAL
1	A	208	ARG
1	A	212	GLN
1	A	213	VAL
1	A	220	LYS
1	A	252[A]	LYS
1	A	252[B]	LYS
1	A	404	PRO

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Mol	Chain	Res	Type
1	A	423	LEU
1	B	565	ARG
1	B	614	ARG
1	B	645	LYS
1	B	713	VAL
1	B	717	PRO
1	B	719	MET
1	B	862[A]	VAL
1	B	862[B]	VAL
1	B	904	PRO
1	B	915	LYS
1	B	923	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (18) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	139	GLN
1	A	153	ASN
1	A	212	GLN
1	A	235	GLN
1	A	295	ASN
1	A	329	ASN
1	A	354	GLN
1	A	374	ASN
1	A	390	GLN
1	A	398	GLN
1	A	421	GLN
1	B	704	ASN
1	B	731	HIS
1	B	829	ASN
1	B	874	ASN
1	B	888	HIS
1	B	898	GLN
1	B	921	GLN

5.3.3   RNA ⓘ

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)

9 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#|Z| > 2$	Counts	RMSZ	$\#|Z| > 2$
2	FES	B	501	1	0,4,4	-	-	-		
3	CHD	B	6	-	32,32,32	2.76	9 (28%)	51,51,51	3.00	19 (37%)
2	FES	A	501	1	0,4,4	-	-	-		
3	CHD	B	4	-	32,32,32	1.79	4 (12%)	51,51,51	3.00	24 (47%)
4	GOL	A	424	-	5,5,5	0.72	0	5,5,5	3.17	2 (40%)
3	CHD	A	3	-	32,32,32	1.89	2 (6%)	51,51,51	2.20	13 (25%)
3	CHD	B	5	-	32,32,32	2.09	3 (9%)	51,51,51	2.11	12 (23%)
3	CHD	A	1	-	32,32,32	2.87	7 (21%)	51,51,51	2.89	16 (31%)
3	CHD	A	2	-	32,32,32	2.20	9 (28%)	51,51,51	3.36	22 (43%)

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
3	CHD	B	6	-	1/1/12/12	4/9/74/74	0/4/4/4
2	FES	B	501	1	-	-	0/1/1/1
2	FES	A	501	1	-	-	0/1/1/1
3	CHD	B	4	-	1/1/12/12	4/9/74/74	0/4/4/4

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	GOL	A	424	-	-	1/4/4/4	-
3	CHD	B	5	-	1/1/12/12	4/9/74/74	0/4/4/4
3	CHD	A	3	-	1/1/12/12	4/9/74/74	0/4/4/4
3	CHD	A	1	-	1/1/12/12	4/9/74/74	0/4/4/4
3	CHD	A	2	-	1/1/12/12	4/9/74/74	0/4/4/4

All (34) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	1	CHD	C23-C24	-10.63	1.26	1.50
3	B	6	CHD	C23-C24	-9.83	1.27	1.50
3	A	1	CHD	C22-C20	-8.81	1.32	1.54
3	B	6	CHD	C22-C20	-7.94	1.34	1.54
3	B	5	CHD	C22-C20	-7.85	1.35	1.54
3	B	5	CHD	C23-C24	-7.23	1.33	1.50
3	A	3	CHD	C22-C20	-7.18	1.36	1.54
3	A	2	CHD	C22-C20	-6.99	1.37	1.54
3	B	4	CHD	C22-C20	-6.21	1.39	1.54
3	A	2	CHD	C23-C24	-6.08	1.36	1.50
3	A	3	CHD	C23-C24	-6.04	1.36	1.50
3	B	4	CHD	C23-C24	-4.94	1.39	1.50
3	B	6	CHD	C11-C12	4.03	1.59	1.53
3	B	6	CHD	C8-C14	3.23	1.60	1.53
3	A	1	CHD	C6-C7	3.15	1.58	1.52
3	A	1	CHD	C8-C14	3.14	1.59	1.53
3	A	2	CHD	C22-C23	-3.08	1.43	1.52
3	A	1	CHD	C22-C23	-3.00	1.43	1.52
3	B	6	CHD	C11-C9	2.90	1.58	1.53
3	A	2	CHD	O12-C12	2.75	1.48	1.43
3	B	6	CHD	C22-C23	-2.73	1.44	1.52
3	B	6	CHD	O12-C12	2.68	1.48	1.43
3	B	6	CHD	C10-C5	2.64	1.59	1.55
3	A	2	CHD	C20-C17	-2.60	1.49	1.54
3	A	1	CHD	C18-C13	2.57	1.58	1.54
3	B	5	CHD	C22-C23	-2.43	1.45	1.52
3	A	2	CHD	C11-C12	2.34	1.57	1.53
3	A	1	CHD	C10-C5	2.24	1.58	1.55
3	B	4	CHD	C1-C2	2.23	1.57	1.53
3	A	2	CHD	C13-C14	-2.20	1.51	1.55
3	A	2	CHD	O25-C24	2.20	1.29	1.22
3	A	2	CHD	C8-C14	2.14	1.58	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	4	CHD	C13-C14	-2.13	1.51	1.55
3	B	6	CHD	C6-C7	2.03	1.56	1.52

All (108) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	2	CHD	C23-C22-C20	12.85	138.47	114.46
3	B	6	CHD	C13-C17-C20	-11.62	105.42	119.48
3	B	6	CHD	C21-C20-C22	10.69	126.88	110.34
3	A	2	CHD	C21-C20-C17	9.51	127.17	112.88
3	A	1	CHD	C21-C20-C22	9.33	124.78	110.34
3	A	1	CHD	C13-C17-C20	-9.18	108.36	119.48
3	B	4	CHD	C21-C20-C17	7.94	124.80	112.88
3	A	2	CHD	C22-C23-C24	7.47	132.42	112.49
3	A	3	CHD	C21-C20-C22	7.17	121.43	110.34
3	A	2	CHD	C21-C20-C22	7.10	121.33	110.34
3	B	4	CHD	C21-C20-C22	6.91	121.03	110.34
3	B	4	CHD	C23-C22-C20	6.60	126.79	114.46
3	A	3	CHD	C23-C22-C20	6.42	126.44	114.46
3	B	4	CHD	C17-C13-C12	-6.38	111.93	117.67
3	A	1	CHD	C21-C20-C17	6.33	122.39	112.88
3	B	5	CHD	C21-C20-C17	6.33	122.38	112.88
3	B	4	CHD	C6-C5-C4	-6.03	104.33	111.23
3	B	5	CHD	C21-C20-C22	6.01	119.63	110.34
3	B	5	CHD	C6-C5-C4	-5.99	104.38	111.23
3	A	1	CHD	O26-C24-O25	5.60	137.72	123.33
4	A	424	GOL	O3-C3-C2	-5.50	85.61	110.38
3	B	6	CHD	C21-C20-C17	5.05	120.46	112.88
3	B	6	CHD	C23-C22-C20	4.83	123.47	114.46
3	A	1	CHD	C23-C22-C20	4.81	123.44	114.46
3	A	3	CHD	C21-C20-C17	4.79	120.07	112.88
3	B	4	CHD	C22-C23-C24	4.67	124.94	112.49
3	B	6	CHD	O26-C24-O25	4.60	135.16	123.33
3	B	4	CHD	C5-C4-C3	-4.53	105.87	112.71
3	A	2	CHD	O12-C12-C13	4.53	118.67	111.02
3	A	1	CHD	C19-C10-C9	-4.40	105.27	111.18
4	A	424	GOL	C3-C2-C1	4.33	127.67	111.80
3	A	2	CHD	C1-C10-C5	4.21	113.79	107.75
3	A	2	CHD	C17-C13-C12	-4.13	113.95	117.67
3	A	2	CHD	C15-C14-C13	4.10	107.52	103.54
3	B	4	CHD	O3-C3-C4	-4.04	101.81	109.84
3	A	3	CHD	C17-C13-C12	-3.97	114.09	117.67

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	3	CHD	C22-C20-C17	3.93	118.48	110.33
3	B	4	CHD	C11-C9-C8	3.85	116.60	110.89
3	B	5	CHD	C15-C14-C13	3.79	107.22	103.54
3	A	1	CHD	C16-C17-C20	3.79	117.92	112.18
3	A	2	CHD	O3-C3-C4	-3.79	102.30	109.84
3	B	6	CHD	C19-C10-C9	-3.73	106.16	111.18
3	B	5	CHD	C17-C13-C14	-3.72	96.38	100.11
3	B	5	CHD	C22-C20-C17	3.69	117.98	110.33
3	A	1	CHD	O3-C3-C4	-3.64	102.59	109.84
3	B	4	CHD	C17-C13-C14	-3.57	96.53	100.11
3	A	3	CHD	C22-C23-C24	3.51	121.86	112.49
3	A	1	CHD	C4-C3-C2	3.47	114.85	110.62
3	A	1	CHD	C5-C6-C7	3.40	118.44	114.40
3	B	4	CHD	C1-C10-C5	3.37	112.59	107.75
3	A	2	CHD	C6-C5-C4	-3.29	107.47	111.23
3	B	6	CHD	C5-C6-C7	3.26	118.28	114.40
3	B	4	CHD	C15-C14-C13	3.26	106.70	103.54
3	B	4	CHD	C13-C17-C20	3.24	123.40	119.48
3	B	4	CHD	C18-C13-C12	3.23	112.29	109.06
3	A	2	CHD	C1-C10-C9	-3.22	106.33	111.34
3	A	1	CHD	C22-C23-C24	3.20	121.02	112.49
3	B	4	CHD	C4-C3-C2	3.14	114.45	110.62
3	B	6	CHD	C22-C23-C24	3.10	120.76	112.49
3	A	3	CHD	C11-C12-C13	-2.97	108.24	111.26
3	B	5	CHD	C23-C22-C20	2.96	119.98	114.46
3	A	1	CHD	O25-C24-C23	-2.93	113.79	123.09
3	A	2	CHD	C18-C13-C12	2.87	111.93	109.06
3	A	3	CHD	C4-C5-C10	2.86	115.70	112.66
3	A	2	CHD	C17-C13-C14	-2.84	97.27	100.11
3	B	4	CHD	C1-C10-C9	-2.84	106.93	111.34
3	B	6	CHD	C6-C5-C10	-2.76	109.72	112.66
3	A	1	CHD	C17-C13-C14	-2.74	97.36	100.11
3	B	6	CHD	C4-C5-C10	2.74	115.58	112.66
3	A	3	CHD	C6-C5-C10	2.72	115.56	112.66
3	A	2	CHD	C2-C1-C10	2.67	117.25	112.74
3	B	4	CHD	C16-C15-C14	-2.64	99.97	105.14
3	A	1	CHD	C1-C2-C3	-2.63	107.00	110.48
3	B	6	CHD	C18-C13-C12	-2.56	106.50	109.06
3	A	3	CHD	C14-C13-C12	2.53	109.73	107.42
3	B	6	CHD	C14-C13-C12	2.52	109.72	107.42
3	B	6	CHD	O25-C24-C23	-2.52	115.11	123.09
3	A	2	CHD	C13-C17-C20	2.50	122.52	119.48

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	B	6	CHD	C11-C9-C8	2.49	114.58	110.89
3	B	5	CHD	C6-C5-C10	2.49	115.31	112.66
3	B	4	CHD	C19-C10-C1	2.49	112.26	108.31
3	A	1	CHD	O3-C3-C2	2.46	116.60	110.17
3	B	4	CHD	C6-C5-C10	2.44	115.25	112.66
3	A	3	CHD	C9-C11-C12	-2.43	111.11	114.29
3	B	6	CHD	O3-C3-C4	-2.43	105.00	109.84
3	B	4	CHD	C14-C8-C9	-2.41	106.39	109.75
3	B	5	CHD	C1-C10-C9	-2.40	107.61	111.34
3	A	2	CHD	C4-C3-C2	2.39	113.54	110.62
3	A	2	CHD	C16-C15-C14	-2.38	100.48	105.14
3	B	6	CHD	C17-C13-C12	-2.36	115.55	117.67
3	B	6	CHD	C16-C17-C20	2.36	115.74	112.18
3	A	3	CHD	C18-C13-C17	2.34	114.86	111.20
3	B	5	CHD	C16-C17-C13	2.29	105.76	103.54
3	A	2	CHD	C5-C6-C7	2.22	117.04	114.40
3	B	4	CHD	C19-C10-C5	-2.22	106.72	110.44
3	A	2	CHD	C19-C10-C9	-2.20	108.22	111.18
3	A	2	CHD	C1-C2-C3	-2.20	107.57	110.48
3	B	5	CHD	C13-C17-C20	-2.18	116.84	119.48
3	B	6	CHD	C1-C10-C5	2.17	110.86	107.75
3	A	1	CHD	C13-C14-C8	-2.17	111.97	114.72
3	A	2	CHD	C6-C7-C8	-2.15	109.16	111.50
3	B	5	CHD	C22-C23-C24	2.15	118.21	112.49
3	A	3	CHD	C16-C15-C14	-2.11	101.02	105.14
3	B	4	CHD	C2-C1-C10	2.06	116.22	112.74
3	B	4	CHD	C10-C9-C8	-2.06	109.54	111.84
3	A	2	CHD	O12-C12-C11	-2.04	104.97	109.12
3	B	4	CHD	O26-C24-O25	-2.04	118.09	123.33
3	B	6	CHD	C13-C14-C8	-2.01	112.17	114.72

All (6) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
3	A	1	CHD	C20
3	A	2	CHD	C20
3	A	3	CHD	C20
3	B	4	CHD	C20
3	B	5	CHD	C20
3	B	6	CHD	C20

All (25) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	2	CHD	C13-C17-C20-C21
3	B	4	CHD	C13-C17-C20-C21
3	A	1	CHD	C21-C20-C22-C23
3	A	2	CHD	C21-C20-C22-C23
3	A	3	CHD	C21-C20-C22-C23
3	B	4	CHD	C21-C20-C22-C23
3	B	5	CHD	C21-C20-C22-C23
3	B	6	CHD	C21-C20-C22-C23
3	A	2	CHD	C16-C17-C20-C21
3	B	4	CHD	C16-C17-C20-C21
3	A	3	CHD	C16-C17-C20-C22
3	B	5	CHD	C16-C17-C20-C22
3	A	3	CHD	C13-C17-C20-C22
3	B	5	CHD	C13-C17-C20-C22
3	A	1	CHD	C13-C17-C20-C22
3	B	6	CHD	C13-C17-C20-C22
3	B	6	CHD	C16-C17-C20-C22
3	A	3	CHD	C20-C22-C23-C24
3	B	4	CHD	C20-C22-C23-C24
3	A	2	CHD	C20-C22-C23-C24
3	A	1	CHD	C16-C17-C20-C22
4	A	424	GOL	O1-C1-C2-O2
3	B	6	CHD	C13-C17-C20-C21
3	A	1	CHD	C13-C17-C20-C21
3	B	5	CHD	C20-C22-C23-C24

There are no ring outliers.

6 monomers are involved in 15 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	6	CHD	5	0
3	B	4	CHD	4	0
4	A	424	GOL	1	0
3	A	3	CHD	1	0
3	A	1	CHD	3	0
3	A	2	CHD	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 CHD B 6

Bond lengths

Bond angles

Torsions

Rings

Ligand CHD B 4

Bond lengths

Bond angles

Torsions

Rings

Ligand CHD A 3

Bond lengths

Bond angles

Torsions

Rings

Ligand CHD B 5

Bond lengths

Bond angles

Torsions

Rings
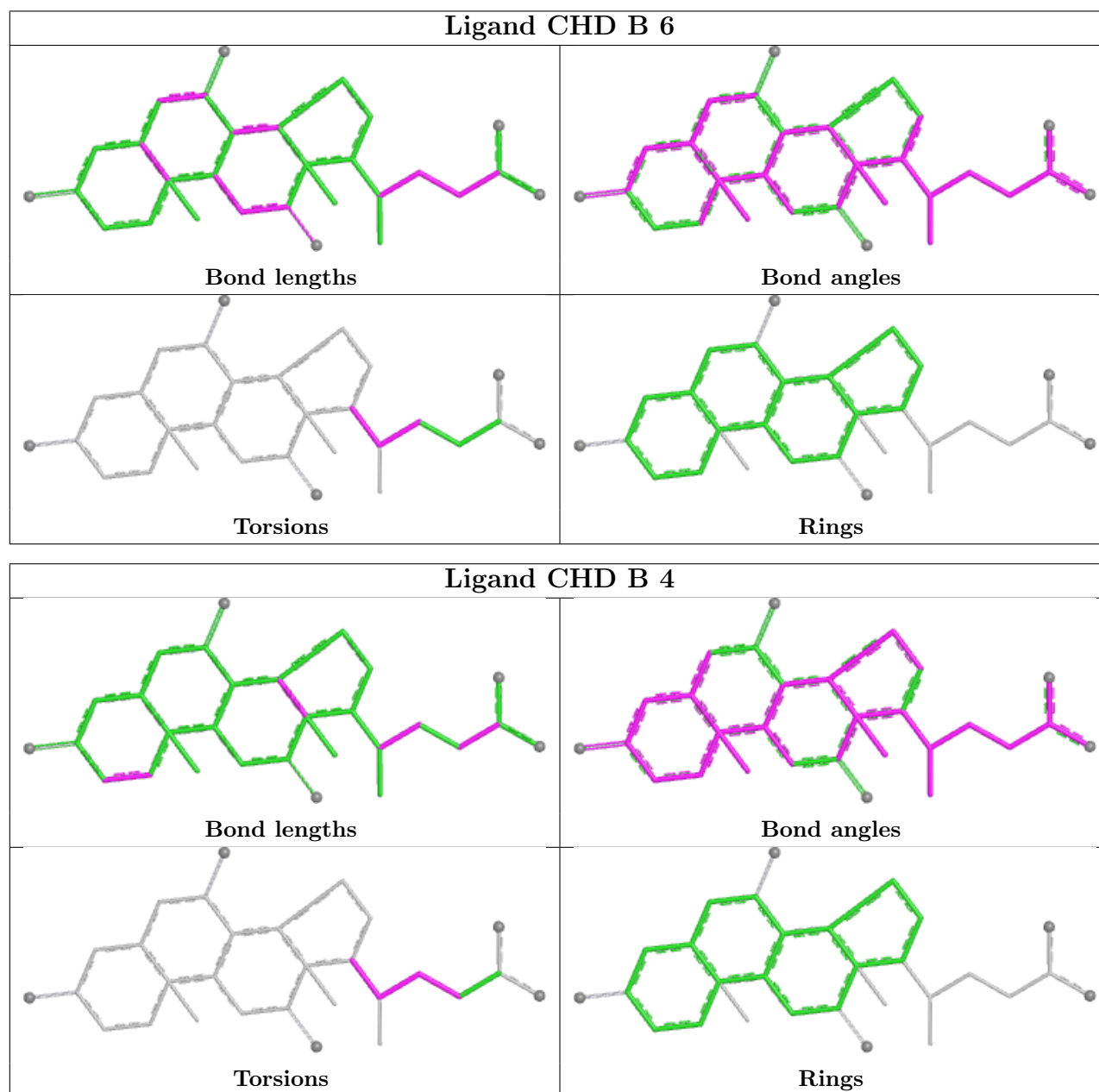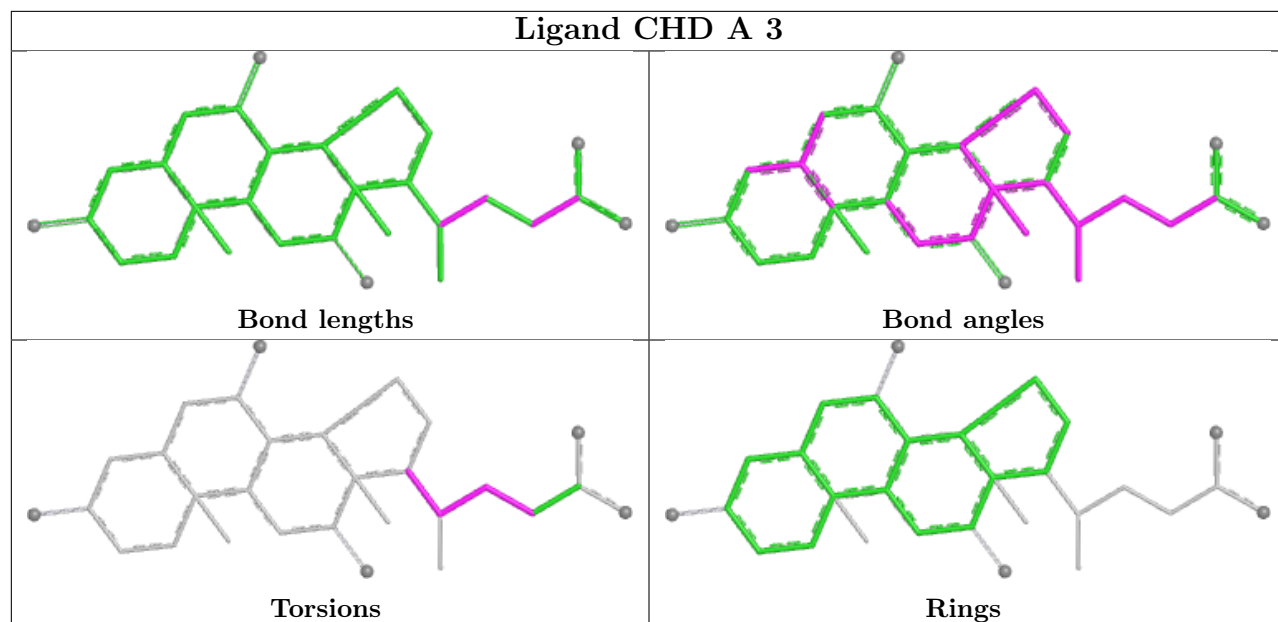
Ligand CHD A 1

Ligand CHD A 2
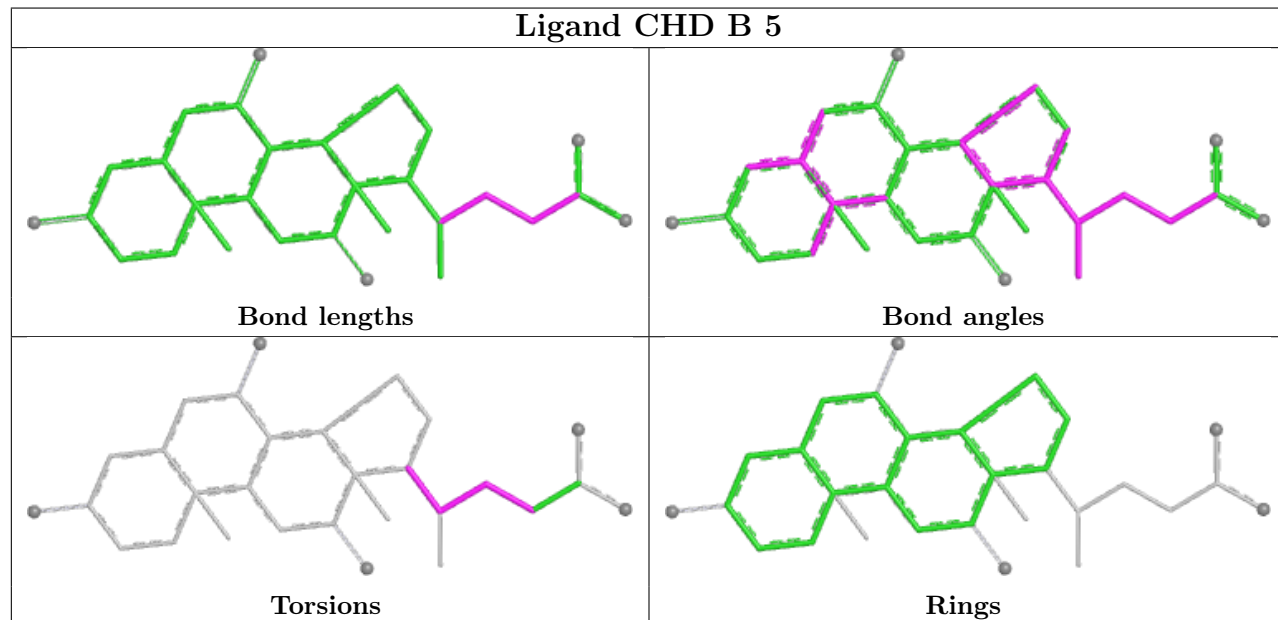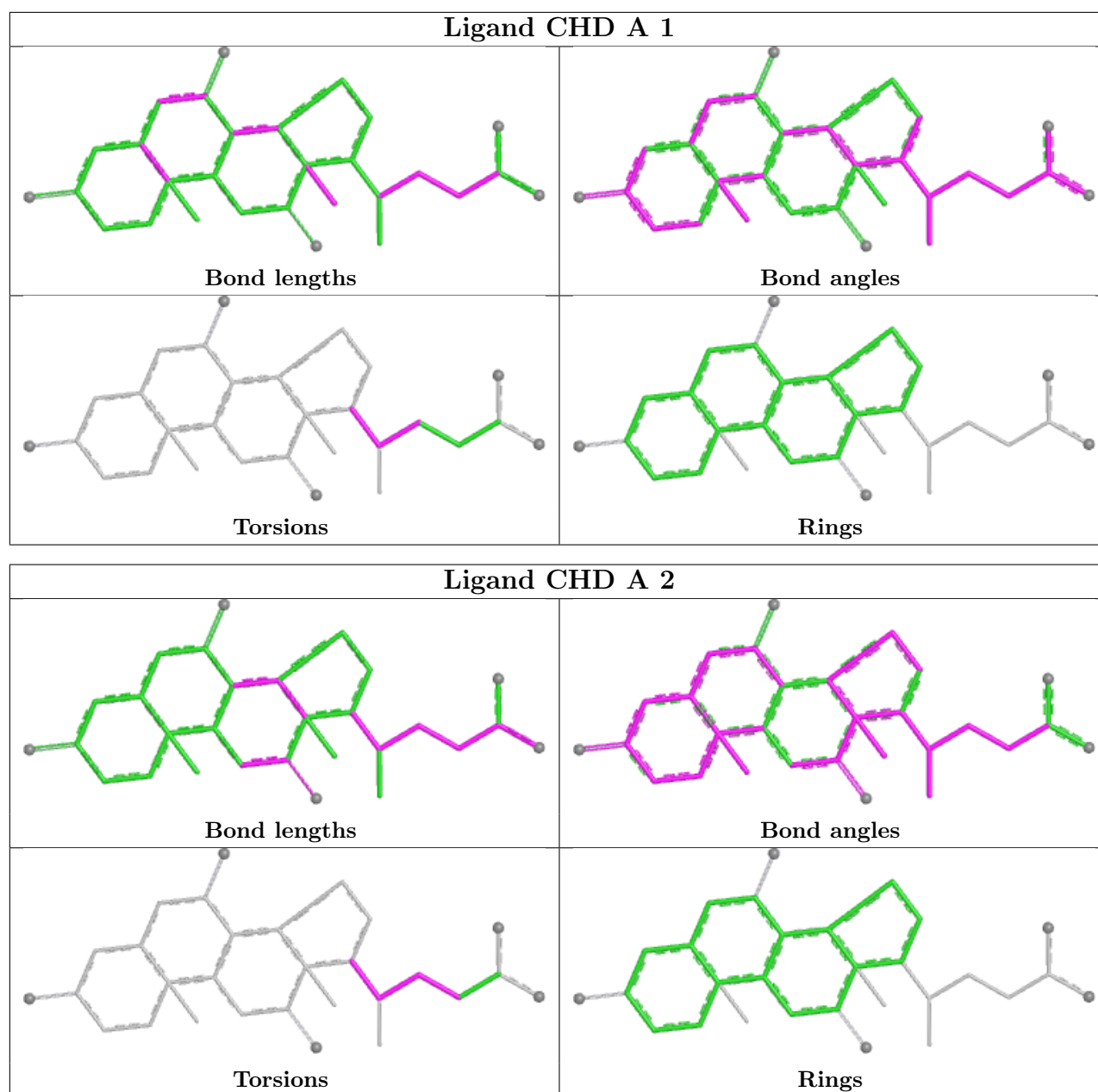
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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	359/359 (100%)	-0.38	7 (1%)	66	69	5, 13, 31, 52	12 (3%)
1	B	359/359 (100%)	-0.42	7 (1%)	66	69	5, 13, 32, 51	14 (3%)
All	All	718/718 (100%)	-0.40	14 (1%)	66	69	5, 13, 32, 52	26 (3%)

All (14) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	923	LEU	4.5
1	A	423	LEU	3.6
1	A	213	VAL	3.5
1	B	713	VAL	3.2
1	B	714	GLY	3.0
1	B	597	ASP	2.9
1	A	212	GLN	2.8
1	B	598	LEU	2.7
1	A	65	ARG	2.5
1	B	679	ARG	2.5
1	A	214	GLY	2.4
1	A	96	ARG	2.4
1	B	712	GLN	2.2
1	A	97	ASP	2.1

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

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

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

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	GOL	A	424	6/6	0.81	0.16	29,34,37,40	0
3	CHD	B	5	29/29	0.88	0.12	29,32,68,70	0
3	CHD	A	3	29/29	0.89	0.12	25,30,65,69	0
3	CHD	B	4	29/29	0.90	0.11	17,26,44,52	0
3	CHD	B	6	29/29	0.91	0.11	14,18,35,43	0
3	CHD	A	2	29/29	0.91	0.10	18,24,37,43	0
3	CHD	A	1	29/29	0.93	0.09	10,17,38,41	0
2	FES	B	501	4/4	1.00	0.02	11,11,12,13	0
2	FES	A	501	4/4	1.00	0.02	10,11,11,13	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 CHD B 5:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)
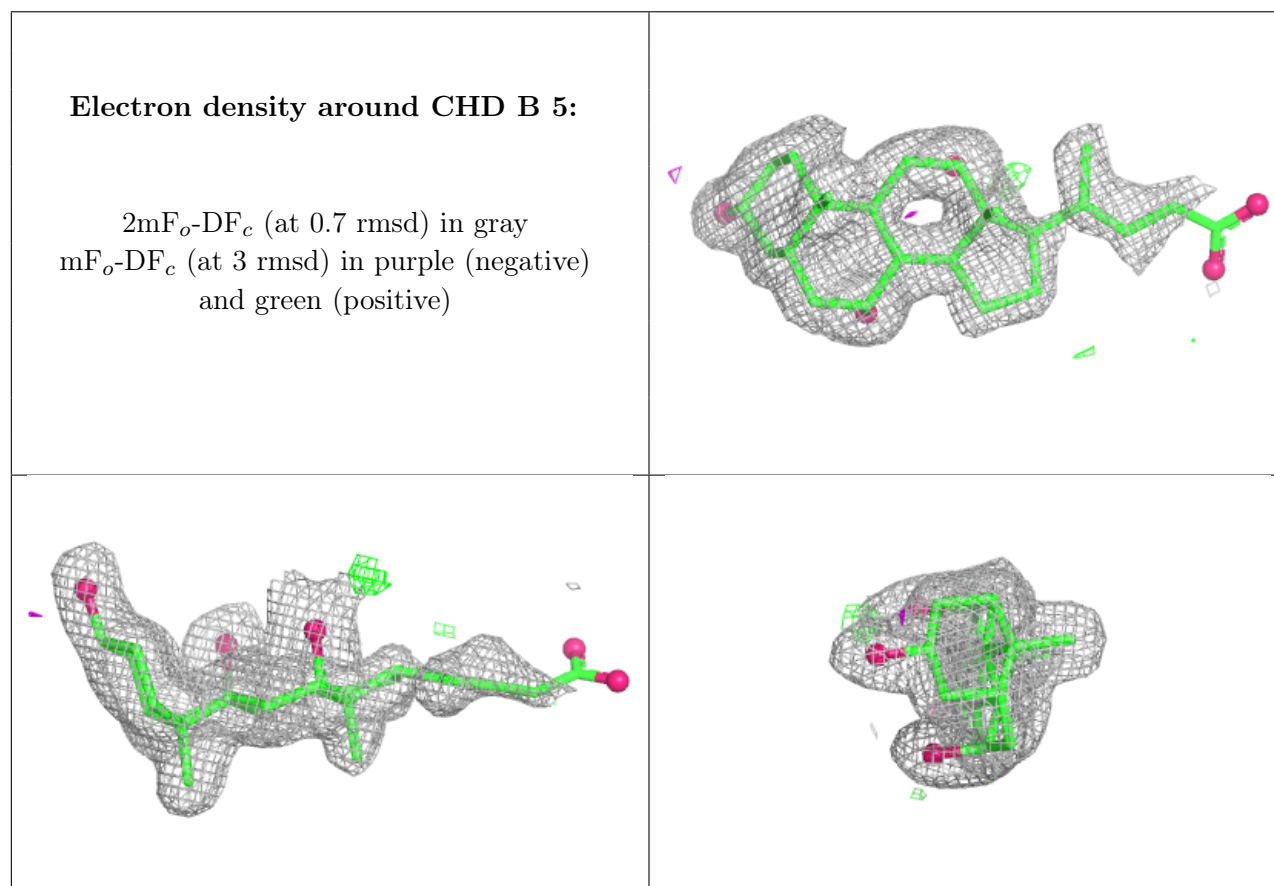
Electron density around CHD A 3:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
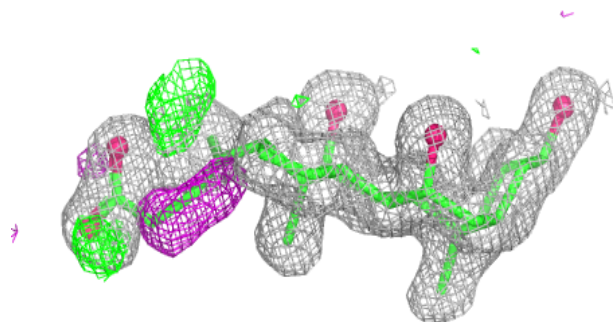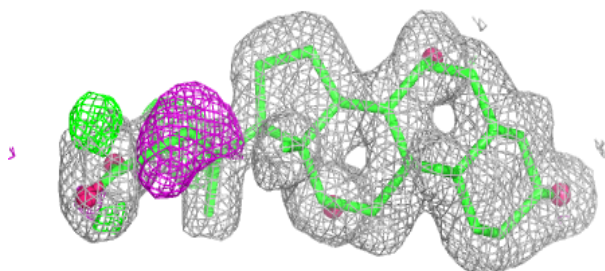mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
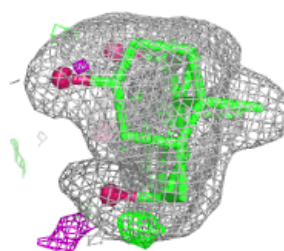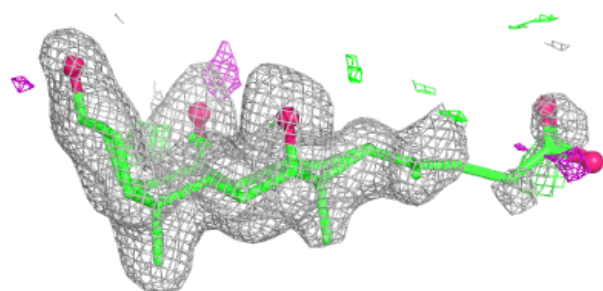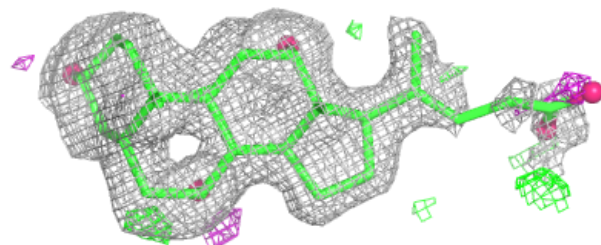
Electron density around CHD B 4:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
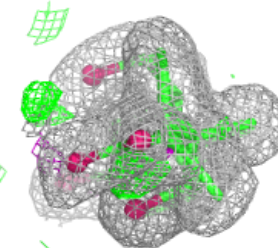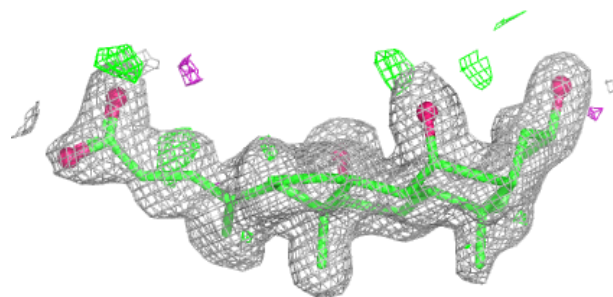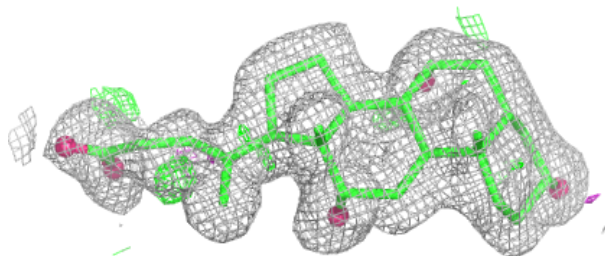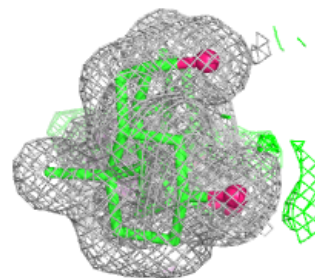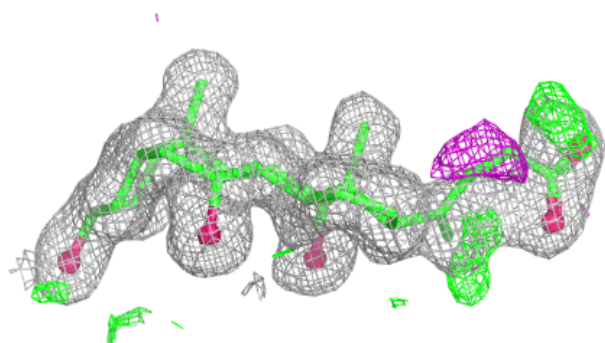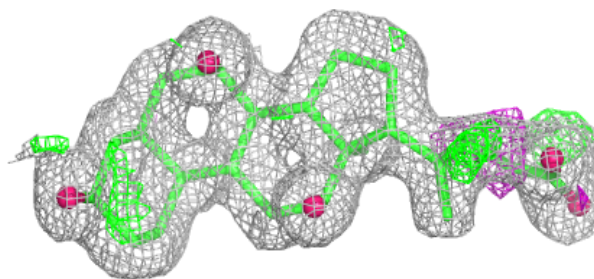mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
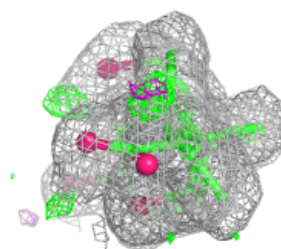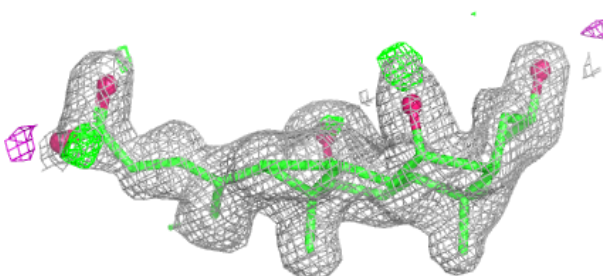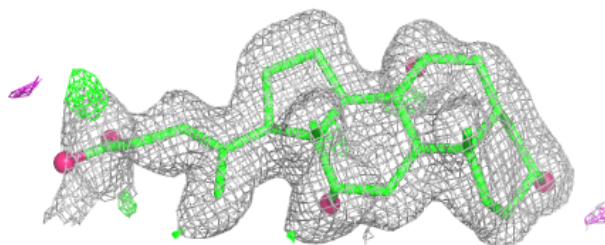
Electron density around CHD B 6:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
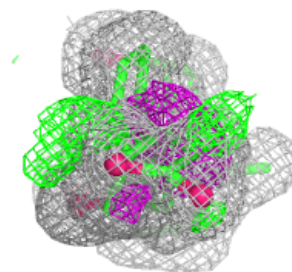
Electron density around CHD A 2:

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

Electron density around CHD A 1:

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

6.5　Other polymers ⓘ

There are no such residues in this entry.