



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 05:11 PM UTC

PDB ID : 5BTA / pdb_00005bta
Title : Crystal structure of a topoisomerase II complex
Authors : Blower, T.R.; Williamson, B.H.; Kerns, R.J.; Berger, J.M.
Deposited on : 2015-06-02
Resolution : 2.55 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

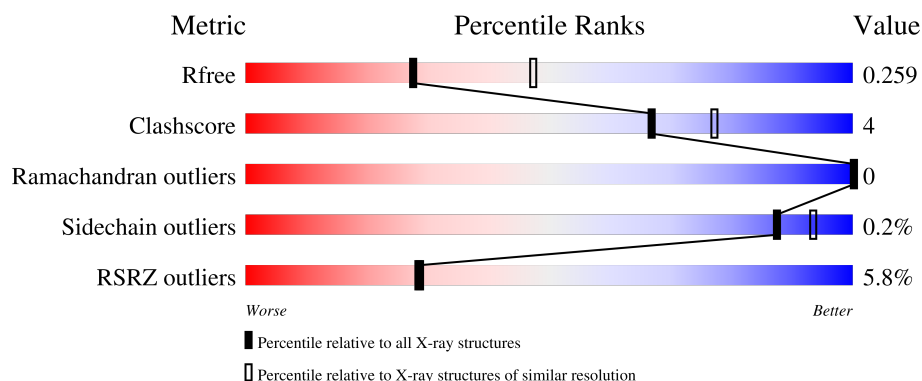
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.55 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.



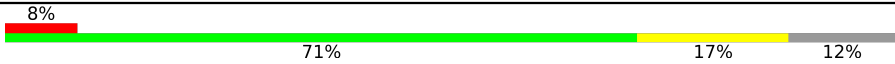
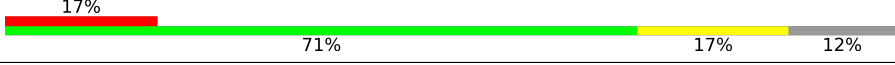
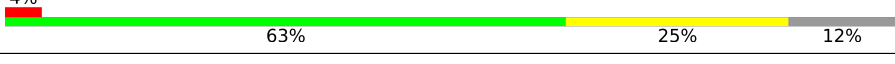
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1091 (2.54-2.54)
Clashscore	190562	1120 (2.54-2.54)
Ramachandran outliers	187476	1106 (2.54-2.54)
Sidechain outliers	187428	1106 (2.54-2.54)
RSRZ outliers	180081	1091 (2.54-2.54)

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	503	5% 92% 5%
1	C	503	4% 89% 7%
2	B	253	6% 92% 5%
2	D	253	7% 93% 5%
3	E	24	38% 71% 17% 12%

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Mol	Chain	Length	Quality of chain
3	H	24	
4	F	24	
4	G	24	

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
1	PTR	A	129	-	-	X	-
1	PTR	C	129	-	-	X	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 25975 atoms, of which 12516 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 DNA gyrase subunit A.

Mol	Chain	Residues	Atoms							ZeroOcc	AltConf	Trace
1	A	487	Total	C	H	N	O	P	S	0	0	0
			7671	2383	3840	701	733	1	13			
1	C	487	Total	C	H	N	O	P	S	0	0	0
			7671	2383	3840	701	733	1	13			

There are 10 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	90	SER	ALA	engineered mutation	UNP P9WG47
A	501	ILE	-	expression tag	UNP P9WG47
A	502	GLY	-	expression tag	UNP P9WG47
A	503	SER	-	expression tag	UNP P9WG47
A	504	GLY	-	expression tag	UNP P9WG47
C	90	SER	ALA	engineered mutation	UNP P9WG47
C	501	ILE	-	expression tag	UNP P9WG47
C	502	GLY	-	expression tag	UNP P9WG47
C	503	SER	-	expression tag	UNP P9WG47
C	504	GLY	-	expression tag	UNP P9WG47

- Molecule 2 is a protein called DNA gyrase subunit B.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	B	245	Total	C	H	N	O	S	0	0	0
			3906	1217	1974	348	360	7			
2	D	247	Total	C	H	N	O	S	0	0	0
			3930	1224	1984	351	364	7			

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	423	SER	-	expression tag	UNP P9WG45
B	424	ASN	-	expression tag	UNP P9WG45

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Chain	Residue	Modelled	Actual	Comment	Reference
B	425	ALA	-	expression tag	UNP P9WG45
D	423	SER	-	expression tag	UNP P9WG45
D	424	ASN	-	expression tag	UNP P9WG45
D	425	ALA	-	expression tag	UNP P9WG45

- Molecule 3 is a DNA chain called DNA substrate 24-mer GGTCATGAATGACTATGCAC GTAA.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	E	21	Total	C	H	N	O	P	0	21	0
			623	196	213	74	120	20			
3	H	21	Total	C	H	N	O	P	0	21	0
			616	196	206	74	120	20			

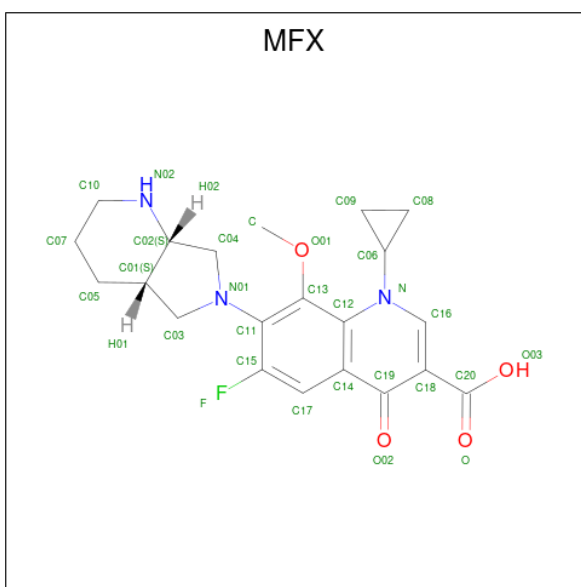
- Molecule 4 is a DNA chain called DNA substrate 24-mer TTACGTGCATAGTCATTCAT GACC.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
4	F	21	Total	C	H	N	O	P	0	21	0
			621	196	211	74	120	20			
4	G	21	Total	C	H	N	O	P	0	21	0
			612	196	202	74	120	20			

- Molecule 5 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	1	Total	Mg	0	0
			1	1		
5	B	1	Total	Mg	0	0
			1	1		
5	C	1	Total	Mg	0	0
			1	1		
5	D	1	Total	Mg	0	0
			1	1		

- Molecule 6 is 1-cyclopropyl-6-fluoro-8-methoxy-7-[(4aS,7aS)-octahydro-6H-pyrrolo[3,4-b]pyridin-6-yl]-4-oxo-1,4-dihydroquinoline-3-carboxylic acid (CCD ID: MFX) (formula: C₂₁H₂₄FN₃O₄).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
6	G	1	Total	C	F	H	N	O	0	0
			52	21	1	23	3	4		
6	H	1	Total	C	F	H	N	O	0	0
			52	21	1	23	3	4		

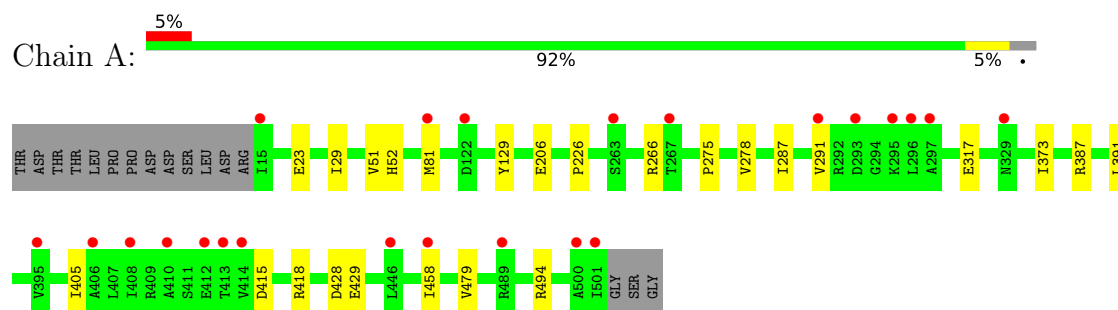
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	71	Total	O	0	0
			71	71		
7	B	35	Total	O	0	0
			35	35		
7	C	60	Total	O	0	0
			60	60		
7	D	25	Total	O	0	0
			25	25		
7	E	4	Total	O	0	0
			4	4		
7	F	10	Total	O	0	0
			10	10		
7	G	6	Total	O	0	0
			6	6		
7	H	6	Total	O	0	0
			6	6		

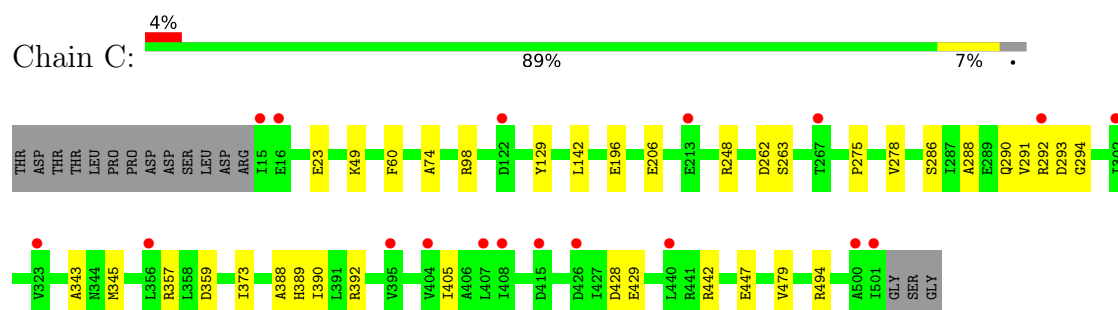
3 Residue-property plots [i](#)

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.

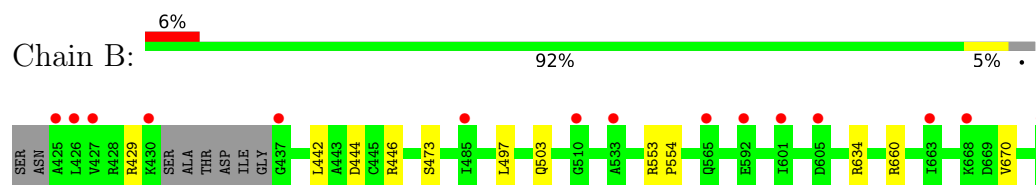
• Molecule 1: DNA gyrase subunit A



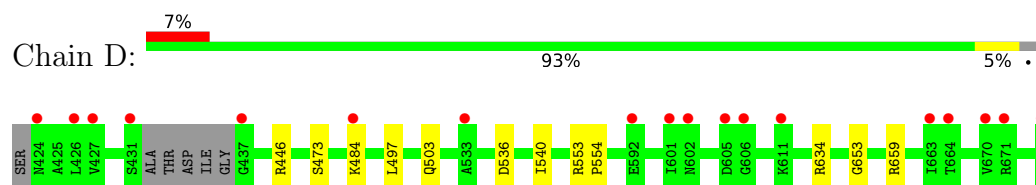
• Molecule 1: DNA gyrase subunit A



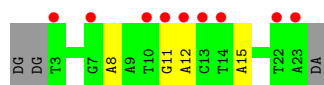
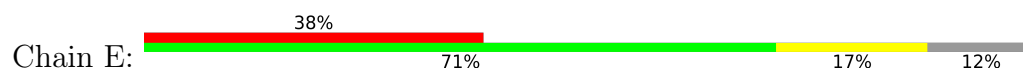
• Molecule 2: DNA gyrase subunit B



• Molecule 2: DNA gyrase subunit B



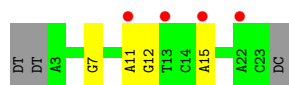
• Molecule 3: DNA substrate 24-mer GGTCATGAATGACTATGCACGTAA



- Molecule 3: DNA substrate 24-mer GGTCATGAATGACTATGCACGTAA



- Molecule 4: DNA substrate 24-mer TTACGTGCATAGTCATTCATGACC



- Molecule 4: DNA substrate 24-mer TTACGTGCATAGTCATTCATGACC



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	108.34Å 83.20Å 129.76Å 90.00° 108.55° 90.00°	Depositor
Resolution (Å)	49.46 – 2.55 49.46 – 2.55	Depositor EDS
% Data completeness (in resolution range)	94.7 (49.46-2.55) 93.8 (49.46-2.55)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.01 (at 2.54Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.223 , 0.251 0.230 , 0.259	Depositor DCC
R_{free} test set	3402 reflections (3.96%)	wwPDB-VP
Wilson B-factor (Å ²)	56.7	Xtriage
Anisotropy	0.128	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 61.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	25975	wwPDB-VP
Average B, all atoms (Å ²)	83.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.65% 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: PTR, MFX, MG

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	0.30	0/3872	0.66	0/5243
1	C	0.34	0/3872	0.66	1/5243 (0.0%)
2	B	0.30	0/1960	0.62	0/2634
2	D	0.30	0/1974	0.63	0/2653
3	E	0.18	0/458	0.45	0/704
3	H	0.21	0/458	0.48	0/704
4	F	0.18	0/458	0.45	0/704
4	G	0.21	0/458	0.46	0/704
All	All	0.30	0/13510	0.62	1/18589 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	390	ILE	N-CA-C	-5.29	104.89	112.35

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	3831	3840	3840	32	0
1	C	3831	3840	3840	38	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	B	1932	1974	1973	8	0
2	D	1946	1984	1984	8	0
3	E	410	213	213	8	0
3	H	410	206	206	8	0
4	F	410	211	211	7	0
4	G	410	202	202	10	0
5	A	1	0	0	0	0
5	B	1	0	0	0	0
5	C	1	0	0	0	0
5	D	1	0	0	0	0
6	G	29	23	22	7	0
6	H	29	23	22	5	0
7	A	71	0	0	3	0
7	B	35	0	0	1	0
7	C	60	0	0	1	0
7	D	25	0	0	0	0
7	E	4	0	0	0	0
7	F	10	0	0	0	0
7	G	6	0	0	0	0
7	H	6	0	0	0	0
All	All	13459	12516	12513	87	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 (87) 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:C:129:PTR:O3P	4:G:11[B]:DA:C5'	1.88	1.21
1:A:266:ARG:NH1	7:A:701:HOH:O	1.78	1.12
1:C:129:PTR:O3P	3:E:11[A]:DG:C5'	2.03	1.06
1:A:129:PTR:O1P	3:H:11[B]:DG:C5'	2.06	1.03
1:A:81:MET:CE	1:C:74:ALA:CB	2.36	1.03
1:A:81:MET:HE1	1:C:74:ALA:CB	1.91	1.01
1:A:129:PTR:O1P	4:F:11[A]:DA:C5'	2.10	0.97
1:C:129:PTR:O3P	3:E:11[A]:DG:H4'	1.67	0.95
1:A:129:PTR:O1P	3:H:11[B]:DG:H4'	1.69	0.93
1:A:287:ILE:O	1:A:291:VAL:HG23	1.69	0.91
1:C:129:PTR:O3P	3:E:11[A]:DG:C4'	2.19	0.90
1:C:291:VAL:O	1:C:294:GLY:N	2.04	0.90
1:A:129:PTR:O1P	4:F:11[A]:DA:H4'	1.73	0.86

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:81:MET:HE1	1:C:74:ALA:HB2	1.58	0.86
1:A:129:PTR:O1P	3:H:11[B]:DG:C4'	2.24	0.85
2:D:653:GLY:O	2:D:659:ARG:NH2	2.11	0.83
1:A:81:MET:CE	1:C:74:ALA:HB3	2.07	0.82
1:C:98:ARG:NH1	4:F:7[A]:DG:OP1	2.16	0.79
1:C:129:PTR:O3P	4:G:11[B]:DA:C4'	2.24	0.79
1:C:357:ARG:NH1	1:C:359:ASP:OD1	2.17	0.79
4:G:15[B]:DA:C4	6:G:101:MFX:H03	2.19	0.77
1:A:129:PTR:O1P	4:F:11[A]:DA:C4'	2.29	0.76
2:D:484:LYS:NZ	2:D:536:ASP:O	2.20	0.74
1:C:129:PTR:O3P	4:G:11[B]:DA:H4'	1.86	0.74
3:H:15[B]:DA:O4'	6:H:101:MFX:H02	1.91	0.71
1:C:98:ARG:NH1	3:H:7[B]:DG:OP1	2.25	0.69
1:A:81:MET:HE3	1:C:74:ALA:HB3	1.76	0.66
1:A:266:ARG:HD3	7:A:701:HOH:O	1.97	0.65
3:E:15[A]:DA:C4	6:G:101:MFX:H03	2.33	0.64
4:F:15[A]:DA:O4'	6:H:101:MFX:H02	1.98	0.63
2:B:660:ARG:NH2	7:B:801:HOH:O	2.32	0.62
3:H:15[B]:DA:N3	6:H:101:MFX:H03	2.17	0.59
4:G:15[B]:DA:N3	6:G:101:MFX:H03	2.18	0.59
3:E:15[A]:DA:N3	6:G:101:MFX:H03	2.20	0.57
1:A:266:ARG:HD3	1:A:317:GLU:OE2	2.05	0.57
1:C:286:SER:O	1:C:290:GLN:HG3	2.05	0.57
1:A:266:ARG:CD	7:A:701:HOH:O	2.53	0.56
1:A:415:ASP:OD1	1:A:418:ARG:NH2	2.39	0.56
1:A:81:MET:HE3	1:C:74:ALA:CB	2.31	0.56
1:C:291:VAL:C	1:C:294:GLY:H	2.10	0.56
1:C:262:ASP:OD1	1:C:263:SER:N	2.36	0.54
2:B:446:ARG:NH1	2:B:473:SER:OG	2.41	0.54
4:G:7[B]:DG:N2	3:H:18[B]:DC:O2	2.42	0.53
2:D:497:LEU:O	2:D:503:GLN:NE2	2.41	0.52
4:F:15[A]:DA:N3	6:H:101:MFX:H03	2.25	0.51
2:D:659:ARG:NH1	4:G:19[B]:DA:OP1	2.43	0.51
1:A:52:HIS:NE2	4:G:8[B]:DC:OP1	2.41	0.51
6:G:101:MFX:HB	6:G:101:MFX:N01	2.24	0.51
1:A:81:MET:CE	1:C:74:ALA:HB2	2.24	0.51
1:C:248:ARG:NH1	4:G:21[B]:DG:OP1	2.44	0.51
1:A:23:GLU:OE1	2:B:634:ARG:NH1	2.44	0.50
1:A:81:MET:HE1	1:C:74:ALA:HB1	1.87	0.50
1:A:428:ASP:OD1	1:A:429:GLU:N	2.44	0.49
1:A:51:VAL:HG11	3:E:8[A]:DA:H5'	1.96	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:428:ASP:OD1	1:C:429:GLU:N	2.48	0.47
2:B:429:ARG:NH1	2:B:442:LEU:O	2.49	0.46
1:C:442:ARG:HA	1:C:447:GLU:HB3	1.96	0.46
1:A:391:LEU:HD12	1:A:458:ILE:HD12	1.98	0.46
1:C:388:ALA:O	1:C:392:ARG:HG3	2.16	0.45
4:G:15[B]:DA:N3	6:G:101:MFX:C03	2.79	0.45
1:A:373:ILE:HD12	1:A:479:VAL:HG22	1.99	0.45
1:C:389:HIS:O	1:C:389:HIS:CD2	2.70	0.44
2:B:497:LEU:O	2:B:503:GLN:NE2	2.50	0.44
1:C:196:GLU:OE2	1:C:494:ARG:NH1	2.51	0.44
1:C:343:ALA:HB1	1:C:345:MET:HE3	2.00	0.44
1:C:23:GLU:OE1	2:D:634:ARG:NH1	2.50	0.44
1:C:288:ALA:O	1:C:292:ARG:HG3	2.18	0.44
2:D:484:LYS:HZ2	2:D:540:ILE:HG13	1.82	0.44
2:D:446:ARG:NH2	2:D:473:SER:OG	2.51	0.43
1:C:49:LYS:NZ	7:C:706:HOH:O	2.50	0.43
1:A:275:PRO:HG2	1:A:278:VAL:HG21	2.00	0.43
1:A:405:ILE:HD13	1:C:405:ILE:HG21	2.00	0.43
1:A:387:ARG:HG2	1:A:458:ILE:CD1	2.49	0.42
1:A:226:PRO:O	1:A:494:ARG:NH2	2.52	0.42
1:C:275:PRO:HG2	1:C:278:VAL:HG21	2.02	0.42
1:C:373:ILE:HD12	1:C:479:VAL:HG22	2.01	0.42
2:B:553:ARG:N	2:B:554:PRO:CD	2.83	0.42
3:E:12[A]:DA:N6	4:F:12[A]:DG:O6	2.53	0.42
1:A:81:MET:CE	1:C:74:ALA:HB1	2.40	0.41
1:C:60:PHE:HB2	1:C:142:LEU:HD13	2.02	0.41
1:C:291:VAL:C	1:C:293:ASP:N	2.77	0.41
2:B:429:ARG:HG2	2:B:444:ASP:HB2	2.02	0.41
3:H:15[B]:DA:C2	6:H:101:MFX:H03	2.55	0.41
1:C:290:GLN:O	1:C:294:GLY:N	2.54	0.41
2:D:553:ARG:N	2:D:554:PRO:CD	2.84	0.41
3:E:15[A]:DA:N3	6:G:101:MFX:C03	2.84	0.41
1:A:29:ILE:HG21	2:B:670:VAL:HG11	2.02	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	484/503 (96%)	464 (96%)	20 (4%)	0	100	100
1	C	484/503 (96%)	467 (96%)	17 (4%)	0	100	100
2	B	241/253 (95%)	234 (97%)	7 (3%)	0	100	100
2	D	243/253 (96%)	235 (97%)	8 (3%)	0	100	100
All	All	1452/1512 (96%)	1400 (96%)	52 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	407/421 (97%)	406 (100%)	1 (0%)	87	93
1	C	407/421 (97%)	406 (100%)	1 (0%)	87	93
2	B	205/211 (97%)	205 (100%)	0	100	100
2	D	207/211 (98%)	207 (100%)	0	100	100
All	All	1226/1264 (97%)	1224 (100%)	2 (0%)	87	93

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	206	GLU
1	C	206	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	161	GLN
1	A	207	ASN
1	A	277	GLN
1	A	336	GLN
1	A	449	GLN
2	B	560	HIS
2	B	666	ASN
1	C	207	ASN
1	C	277	GLN
1	C	334	HIS
1	C	336	GLN
1	C	385	ASN
1	C	490	HIS
2	D	525	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues 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	$\# Z > 2$
1	PTR	A	129	1	15,16,17	0.97	0	17,22,24	1.00	0
1	PTR	C	129	1	15,16,17	0.97	0	17,22,24	0.99	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
1	PTR	A	129	1	-	0/10/11/13	0/1/1/1
1	PTR	C	129	1	-	1/10/11/13	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	C	129	PTR	O-C-CA-CB

There are no ring outliers.

2 monomers are involved in 12 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	A	129	PTR	6	0
1	C	129	PTR	6	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 6 ligands modelled in this entry, 4 are monoatomic - leaving 2 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	$\# Z > 2$
6	MFx	H	101	5	33,33,33	3.73	12 (36%)	45,50,50	2.46	12 (26%)
6	MFx	G	101	5	33,33,33	3.69	12 (36%)	45,50,50	2.80	16 (35%)

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
6	MXF	H	101	5	-	5/14/35/35	0/5/5/5
6	MXF	G	101	5	-	3/14/35/35	0/5/5/5

All (24) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	H	101	MXF	C01-C02	-10.26	1.35	1.53
6	G	101	MXF	C01-C02	-9.51	1.37	1.53
6	H	101	MXF	C04-N01	-9.41	1.32	1.46
6	G	101	MXF	C12-N	8.94	1.53	1.40
6	H	101	MXF	C12-N	8.75	1.52	1.40
6	G	101	MXF	C03-N01	7.80	1.58	1.46
6	G	101	MXF	C04-N01	-7.47	1.35	1.46
6	G	101	MXF	C04-C02	7.11	1.64	1.52
6	H	101	MXF	C16-N	6.57	1.45	1.34
6	G	101	MXF	C16-N	6.06	1.44	1.34
6	H	101	MXF	C03-N01	5.53	1.55	1.46
6	H	101	MXF	C04-C02	5.37	1.61	1.52
6	H	101	MXF	C16-C18	3.64	1.47	1.38
6	G	101	MXF	C16-C18	3.51	1.47	1.38
6	G	101	MXF	C03-C01	3.39	1.57	1.53
6	H	101	MXF	C02-N02	3.38	1.52	1.47
6	H	101	MXF	C07-C05	-3.26	1.45	1.53
6	G	101	MXF	C07-C05	-2.89	1.45	1.53
6	G	101	MXF	C18-C20	2.59	1.52	1.48
6	H	101	MXF	C18-C20	2.35	1.52	1.48
6	H	101	MXF	C03-C01	2.34	1.56	1.53
6	G	101	MXF	O01-C13	2.29	1.42	1.38
6	H	101	MXF	O01-C13	2.20	1.42	1.38
6	G	101	MXF	C02-N02	2.11	1.50	1.47

All (28) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	G	101	MXF	C08-C06-N	10.48	135.44	118.87
6	H	101	MXF	C08-C06-N	9.42	133.77	118.87
6	H	101	MXF	C10-N02-C02	6.57	115.72	111.62
6	G	101	MXF	C10-N02-C02	6.23	115.51	111.62
6	G	101	MXF	C13-C11-C15	4.90	120.70	115.92

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	G	101	MFX	C03-N01-C11	-4.61	116.18	123.36
6	G	101	MFX	C18-C16-N	-4.37	119.18	124.42
6	H	101	MFX	C03-N01-C11	-4.22	116.80	123.36
6	H	101	MFX	C13-C11-N01	-4.08	111.81	122.45
6	G	101	MFX	C04-N01-C11	-3.93	117.25	123.36
6	G	101	MFX	C14-C19-C18	3.87	120.53	115.64
6	H	101	MFX	C07-C05-C01	3.84	118.75	111.89
6	G	101	MFX	C13-C11-N01	-3.59	113.09	122.45
6	H	101	MFX	C14-C19-C18	3.28	119.78	115.64
6	H	101	MFX	C18-C16-N	-3.20	120.58	124.42
6	G	101	MFX	C17-C15-C11	-3.04	118.82	123.34
6	G	101	MFX	C04-N01-C03	-2.96	107.34	111.64
6	G	101	MFX	C09-C06-N	2.94	123.51	118.87
6	G	101	MFX	C03-C01-C02	-2.88	98.98	103.97
6	H	101	MFX	C15-C11-N01	2.86	130.00	121.93
6	H	101	MFX	F-C15-C11	2.84	122.96	118.28
6	G	101	MFX	C13-C12-N	-2.67	120.07	123.05
6	H	101	MFX	C09-C06-N	2.62	123.01	118.87
6	G	101	MFX	C07-C05-C01	2.55	116.43	111.89
6	G	101	MFX	F-C15-C11	2.47	122.35	118.28
6	H	101	MFX	C13-C11-C15	2.32	118.17	115.92
6	H	101	MFX	C04-N01-C03	-2.24	108.38	111.64
6	G	101	MFX	O02-C19-C18	-2.07	119.74	123.07

There are no chirality outliers.

All (8) torsion outliers are listed below:

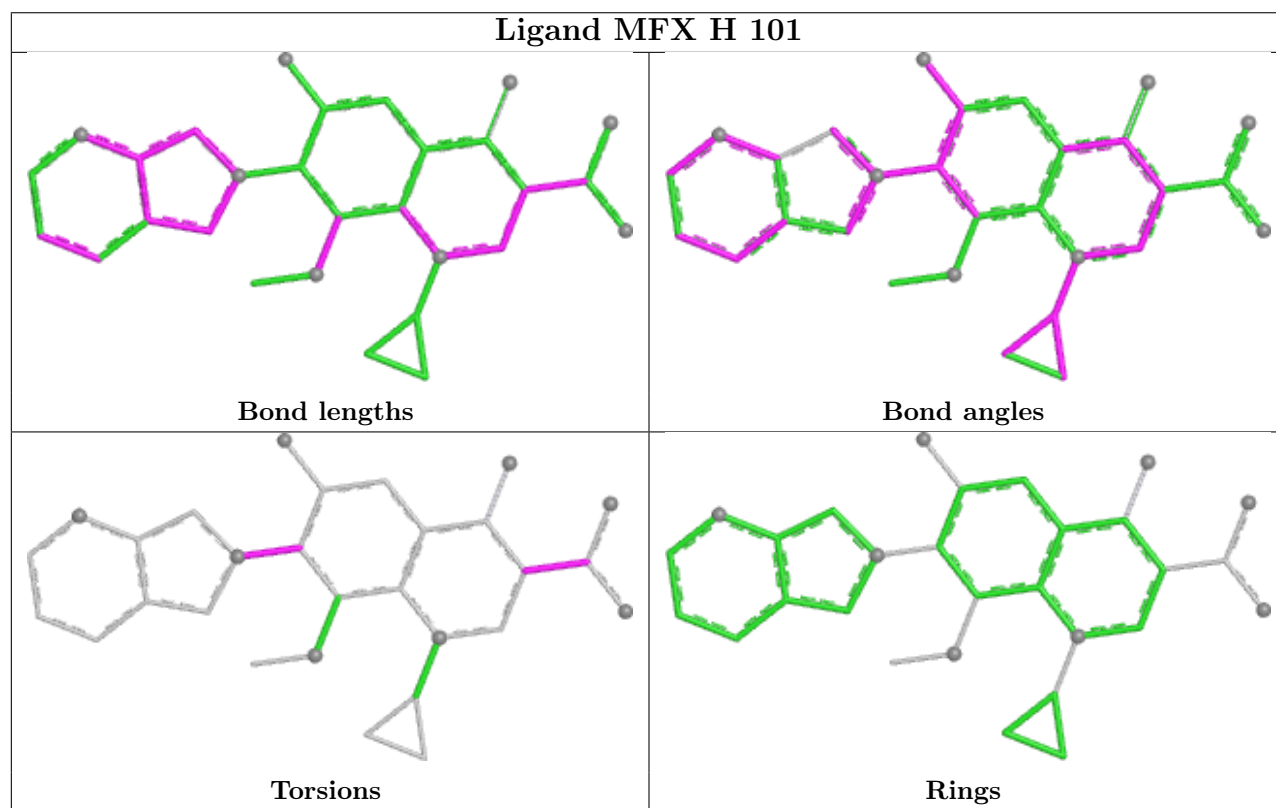
Mol	Chain	Res	Type	Atoms
6	G	101	MFX	C15-C11-N01-C03
6	G	101	MFX	C13-C11-N01-C04
6	H	101	MFX	C19-C18-C20-O
6	H	101	MFX	C19-C18-C20-O03
6	H	101	MFX	C16-C18-C20-O03
6	H	101	MFX	C16-C18-C20-O
6	G	101	MFX	C15-C11-N01-C04
6	H	101	MFX	C15-C11-N01-C03

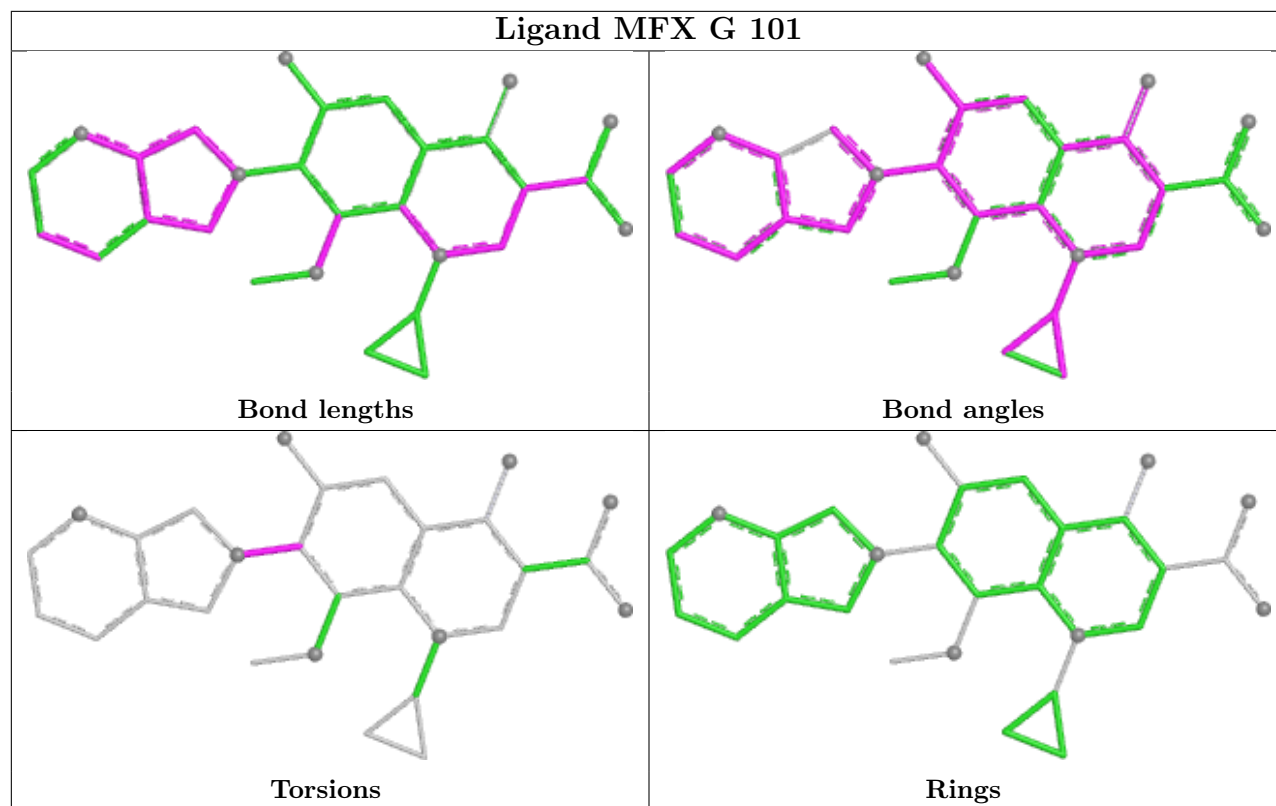
There are no ring outliers.

2 monomers are involved in 12 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	H	101	MFX	5	0
6	G	101	MFX	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	486/503 (96%)	0.47	23 (4%) 36 36	43, 71, 124, 188	0
1	C	486/503 (96%)	0.52	18 (3%) 45 46	40, 72, 125, 191	0
2	B	245/253 (96%)	0.66	15 (6%) 27 26	52, 80, 122, 151	0
2	D	247/253 (97%)	0.64	18 (7%) 21 20	51, 77, 113, 148	0
3	E	21/24 (87%)	1.65	9 (42%) 0 0	40, 57, 97, 110	21 (100%)
3	H	21/24 (87%)	0.16	2 (9%) 14 13	19, 32, 71, 97	21 (100%)
4	F	21/24 (87%)	1.42	4 (19%) 3 2	39, 65, 94, 132	21 (100%)
4	G	21/24 (87%)	0.30	1 (4%) 35 35	15, 27, 85, 94	21 (100%)
All	All	1548/1608 (96%)	0.57	90 (5%) 29 28	15, 74, 124, 191	84 (5%)

All (90) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	426	LEU	5.4
1	C	500	ALA	5.2
1	C	501	ILE	4.9
1	A	501	ILE	4.8
2	B	427	VAL	4.4
2	D	431	SER	4.1
2	D	484	LYS	4.1
2	D	601	ILE	4.0
1	A	500	ALA	3.9
2	B	426	LEU	3.9
1	A	291	VAL	3.9
2	D	663	ILE	3.8
1	A	296	LEU	3.7
2	B	601	ILE	3.7
2	D	427	VAL	3.6
2	B	663	ILE	3.6

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Mol	Chain	Res	Type	RSRZ
2	B	430	LYS	3.6
1	A	15	ILE	3.6
4	G	23[B]	DC	3.5
2	B	605	ASP	3.4
1	C	15	ILE	3.4
4	F	13[A]	DT	3.3
2	D	437	GLY	3.2
1	A	414	VAL	3.2
2	B	675	VAL	3.2
2	B	425	ALA	3.1
2	B	485	ILE	3.0
2	D	605	ASP	3.0
3	H	3[B]	DT	3.0
3	E	12[A]	DA	2.9
3	E	23[A]	DA	2.9
2	B	437	GLY	2.9
2	D	675	VAL	2.8
2	D	670	VAL	2.8
1	A	267	THR	2.8
2	D	533	ALA	2.8
2	D	602	ASN	2.7
3	E	11[A]	DG	2.7
1	A	295	LYS	2.7
1	C	404	VAL	2.7
3	E	22[A]	DT	2.7
1	A	297	ALA	2.7
2	B	565	GLN	2.7
1	C	395	VAL	2.6
2	D	424	ASN	2.5
1	A	412	GLU	2.5
3	E	14[A]	DT	2.5
2	B	592	GLU	2.5
3	E	7[A]	DG	2.5
2	D	664	THR	2.5
1	A	489	ARG	2.4
3	E	3[A]	DT	2.4
2	D	611	LYS	2.4
1	A	410	ALA	2.4
1	C	122	ASP	2.3
1	A	406	ALA	2.3
2	B	533	ALA	2.3
3	E	13[A]	DC	2.3

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Mol	Chain	Res	Type	RSRZ
1	C	16	GLU	2.3
2	D	606	GLY	2.3
1	C	267	THR	2.3
1	A	263	SER	2.3
4	F	22[A]	DA	2.3
4	F	15[A]	DA	2.2
1	A	413	THR	2.2
1	A	446	LEU	2.2
1	C	302	ILE	2.2
3	H	22[B]	DT	2.2
1	A	293	ASP	2.2
1	C	213	GLU	2.1
1	C	426	ASP	2.1
1	A	395	VAL	2.1
1	A	329	ASN	2.1
1	A	408	ILE	2.1
2	D	592	GLU	2.1
1	C	415	ASP	2.1
1	A	81	MET	2.1
1	C	440	LEU	2.1
1	A	458	ILE	2.1
1	C	407	LEU	2.1
4	F	11[A]	DA	2.0
2	D	671	ARG	2.0
1	C	356	LEU	2.0
2	B	668	LYS	2.0
3	E	10[A]	DT	2.0
1	C	292	ARG	2.0
1	C	323	VAL	2.0
2	B	510	GLY	2.0
1	C	408	ILE	2.0
1	A	122	ASP	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [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
1	PTR	A	129	16/17	0.94	0.10	50,52,76,78	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
1	PTR	C	129	16/17	0.94	0.10	54,59,77,81	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

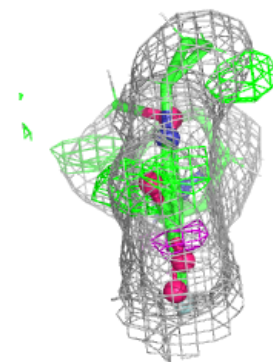
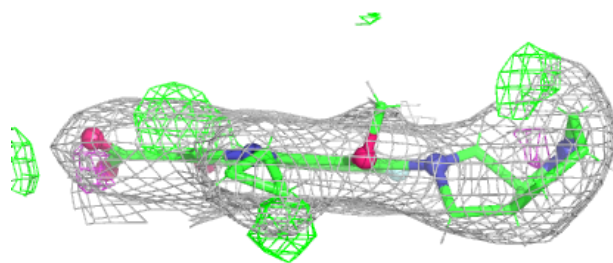
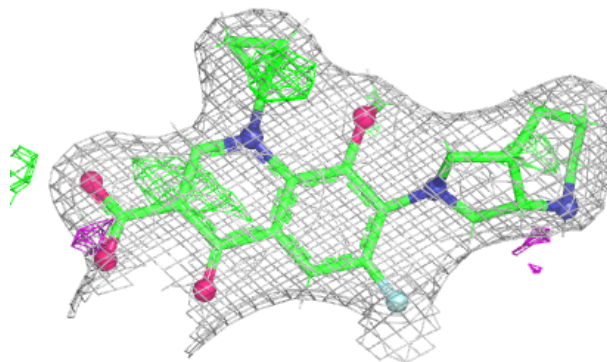
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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
6	MFX	H	101	29/29	0.91	0.13	51,62,77,90	0
6	MFX	G	101	29/29	0.93	0.12	46,57,72,300	0
5	MG	A	601	1/1	0.95	0.06	63,63,63,63	0
5	MG	D	701	1/1	0.96	0.06	43,43,43,43	0
5	MG	C	601	1/1	0.98	0.04	52,52,52,52	0
5	MG	B	701	1/1	0.99	0.06	53,53,53,53	0

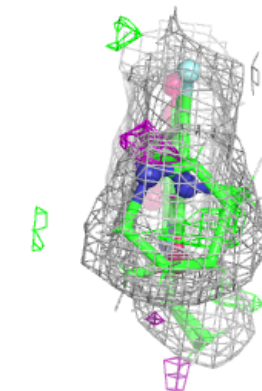
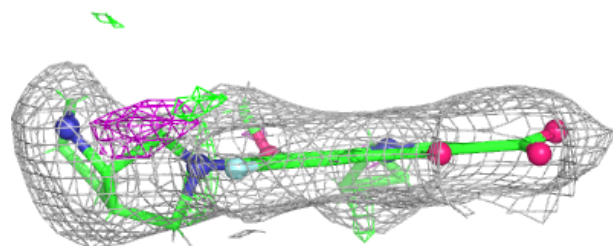
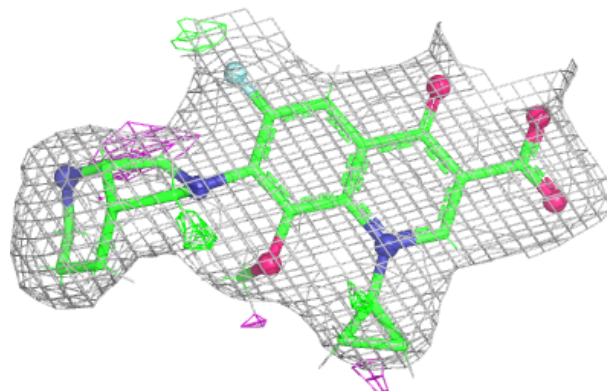
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around MFX H 101:

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

**Electron density around MFX G 101:**

$2mF_o-DF_c$ (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.