



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 02:02 AM UTC

PDB ID : 2EWN / pdb_00002ewn
Title : Ecoli Biotin Repressor with co-repressor analog
Authors : Wood, Z.A.; Weaver, L.H.; Matthews, B.W.
Deposited on : 2005-11-04
Resolution : 2.80 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

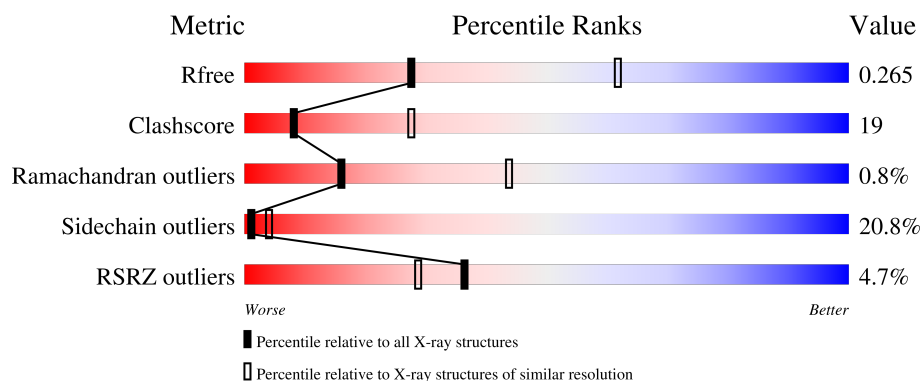
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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	3866 (2.80-2.80)
Clashscore	190562	4276 (2.80-2.80)
Ramachandran outliers	187476	4196 (2.80-2.80)
Sidechain outliers	187428	4198 (2.80-2.80)
RSRZ outliers	180081	3869 (2.80-2.80)

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	321	4% 65% 28% 6% ..
1	B	321	5% 44% 42% 12% ..

2 Entry composition [i](#)

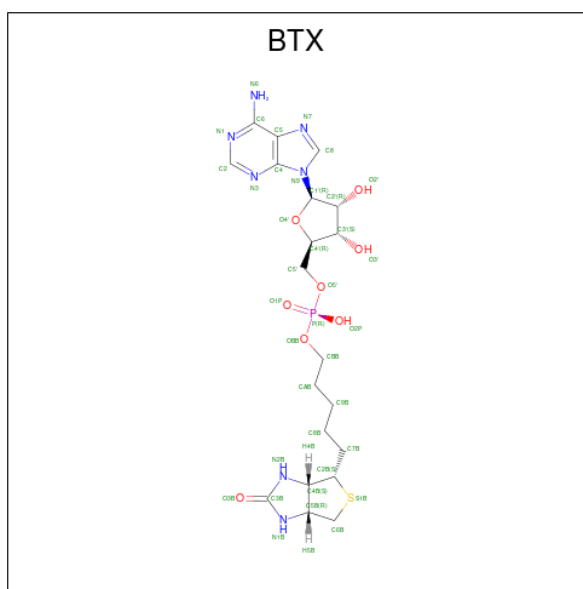
There are 3 unique types of molecules in this entry. The entry contains 5036 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 BirA bifunctional protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	318	Total	C	N	O	S	0	0	0
			2455	1565	434	448	8			
1	B	317	Total	C	N	O	S	0	0	0
			2454	1565	434	447	8			

- Molecule 2 is ((2R,3S,4R,5R)-5-(6-AMINO-9H-PURIN-9-YL)-3,4-DIHYDROXY-TETRAHYDROFURAN-2-YL)METHYL 5-((3AS,4S,6AR)-2-OXO-HEXAHYDRO-1H-THIENO[3,4-D]IMIDAZOL-4-YL)PENTYL HYDROGEN PHOSPHATE (CCD ID: BTX) (formula: C₂₀H₃₀N₇O₈PS).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P S	0	0
			37	20	7	8	1 1		
2	B	1	Total	C	N	O	P S	0	0
			37	20	7	8	1 1		

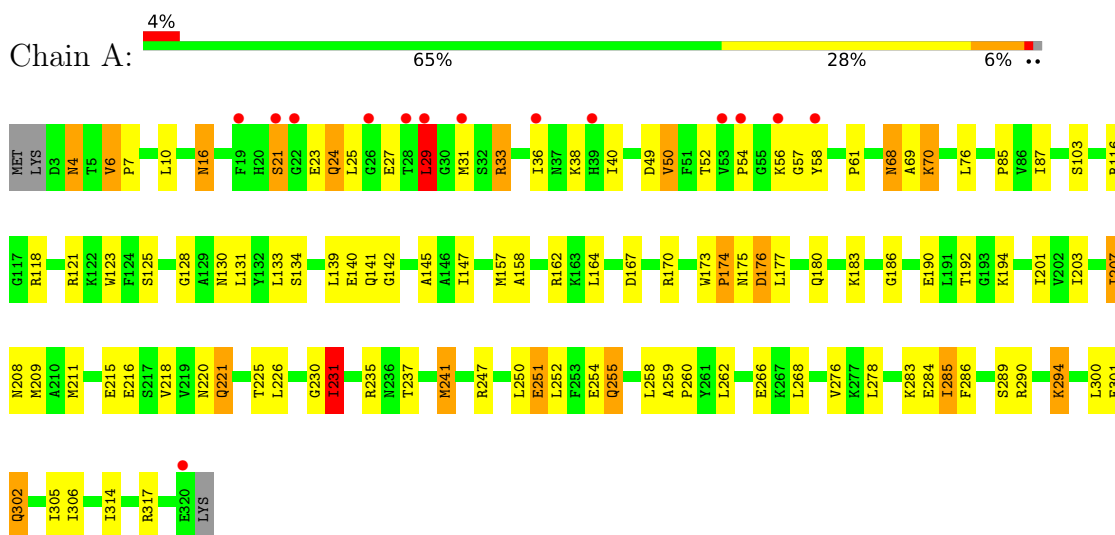
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	42	Total 42	O 42	0	0
3	B	11	Total 11	O 11	0	0

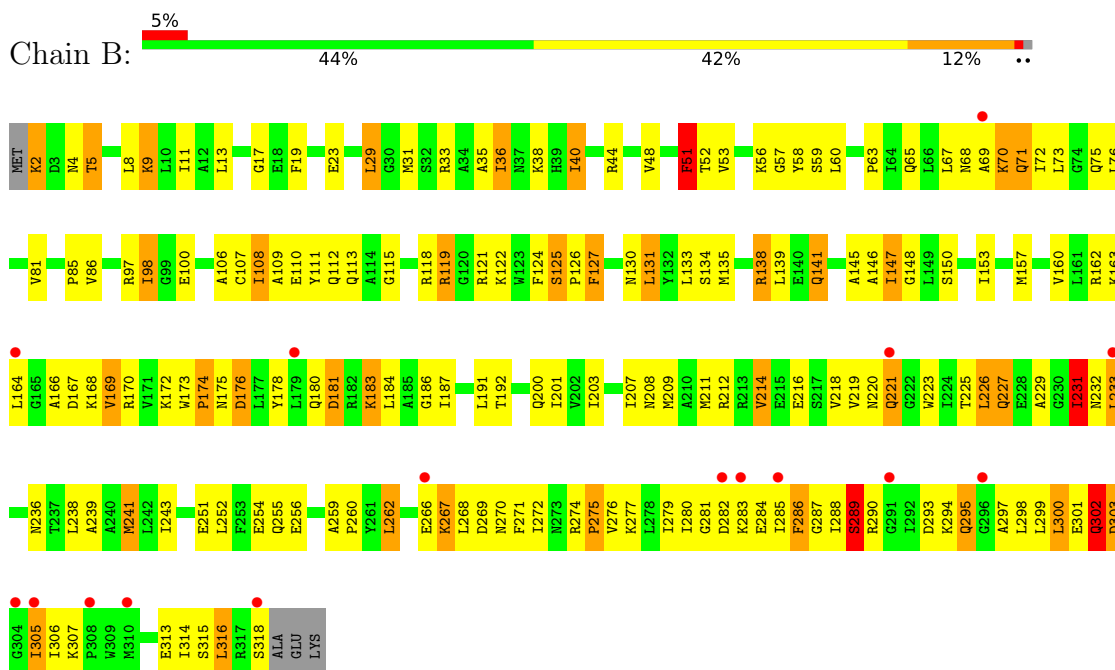
3 Residue-property plots [i](#)

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

• Molecule 1: BirA bifunctional protein



• Molecule 1: BirA bifunctional protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	152.19Å 152.19Å 93.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.85 – 2.80 29.85 – 2.80	Depositor EDS
% Data completeness (in resolution range)	94.2 (29.85-2.80) 94.1 (29.85-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.81 (at 2.68Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.213 , 0.264 0.212 , 0.265	Depositor DCC
R_{free} test set	1487 reflections (4.95%)	wwPDB-VP
Wilson B-factor (Å ²)	58.1	Xtriage
Anisotropy	0.001	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 49.7	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	0.94	EDS
Total number of atoms	5036	wwPDB-VP
Average B, all atoms (Å ²)	65.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.96% 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

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: BTX

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	0.63	0/2495	1.17	17/3371 (0.5%)
1	B	0.64	0/2494	1.28	40/3368 (1.2%)
All	All	0.63	0/4989	1.23	57/6739 (0.8%)

There are no bond length outliers.

All (57) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	221	GLN	OE1-CD-NE2	-10.78	111.82	122.60
1	A	24	GLN	OE1-CD-NE2	-10.43	112.17	122.60
1	A	302	GLN	OE1-CD-NE2	-10.28	112.32	122.60
1	B	180	GLN	OE1-CD-NE2	-10.13	112.47	122.60
1	B	113	GLN	OE1-CD-NE2	-9.89	112.71	122.60
1	B	75	GLN	OE1-CD-NE2	-9.77	112.83	122.60
1	B	295	GLN	OE1-CD-NE2	-9.57	113.03	122.60
1	B	141	GLN	OE1-CD-NE2	-9.47	113.13	122.60
1	B	302	GLN	OE1-CD-NE2	-9.36	113.24	122.60
1	A	218	VAL	N-CA-C	-8.60	104.17	111.56
1	B	218	VAL	N-CA-C	-7.59	105.28	111.81
1	A	167	ASP	N-CA-C	7.42	120.25	111.71
1	A	24	GLN	CG-CD-NE2	7.16	127.13	116.40
1	B	113	GLN	CG-CD-NE2	7.15	127.13	116.40
1	B	51	PHE	CA-CB-CG	7.09	120.89	113.80
1	B	180	GLN	CG-CD-NE2	7.03	126.94	116.40
1	B	221	GLN	CG-CD-NE2	7.02	126.94	116.40
1	A	302	GLN	CG-CD-NE2	7.01	126.92	116.40
1	A	251	GLU	N-CA-C	-6.95	103.63	111.14
1	B	229	ALA	N-CA-C	-6.75	103.38	111.69
1	B	300	LEU	N-CA-C	6.73	119.90	107.99
1	B	295	GLN	CG-CD-NE2	6.65	126.37	116.40

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	142	GLY	CA-C-N	6.43	126.93	119.47
1	A	142	GLY	C-N-CA	6.43	126.93	119.47
1	B	302	GLN	CG-CD-NE2	6.36	125.94	116.40
1	B	141	GLN	CG-CD-NE2	6.31	125.87	116.40
1	B	286	PHE	N-CA-C	6.13	119.19	109.81
1	B	127	PHE	N-CA-C	6.01	119.32	110.30
1	B	75	GLN	CG-CD-NE2	5.94	125.32	116.40
1	A	116	ARG	N-CA-C	5.92	118.19	109.24
1	B	5	THR	N-CA-C	5.92	117.40	111.07
1	A	4	ASN	N-CA-C	5.90	119.61	111.71
1	A	50	VAL	CB-CA-C	-5.86	103.65	110.91
1	B	289	SER	N-CA-C	5.77	118.62	109.50
1	B	109	ALA	N-CA-C	5.71	118.52	109.50
1	B	60	LEU	N-CA-C	-5.65	101.79	110.32
1	B	40	ILE	N-CA-C	-5.63	104.88	110.62
1	B	254	GLU	N-CA-C	-5.57	105.29	111.36
1	B	226	LEU	N-CA-C	-5.45	105.42	111.36
1	B	239	ALA	N-CA-C	-5.41	105.46	111.36
1	B	115	GLY	N-CA-C	-5.38	104.23	111.54
1	B	231	ILE	N-CA-C	5.37	116.20	108.48
1	B	287	GLY	N-CA-C	5.33	117.38	110.45
1	B	125	SER	N-CA-C	5.29	118.26	109.79
1	A	231	ILE	N-CA-C	5.26	115.67	107.99
1	B	146	ALA	N-CA-C	5.17	116.61	111.07
1	B	181	ASP	N-CA-C	5.15	118.82	111.92
1	B	255	GLN	N-CA-C	5.06	118.60	112.23
1	A	255	GLN	N-CA-C	5.05	117.90	111.69
1	A	164	LEU	CA-C-N	-5.05	117.42	123.08
1	A	164	LEU	C-N-CA	-5.05	117.42	123.08
1	B	4	ASN	N-CA-C	5.04	119.53	113.17
1	A	201	ILE	N-CA-C	5.04	115.74	108.48
1	B	201	ILE	N-CA-C	5.01	115.70	108.48
1	B	220	ASN	CA-C-N	5.01	129.16	121.19
1	B	220	ASN	C-N-CA	5.01	129.16	121.19
1	B	184	LEU	N-CA-C	-5.01	107.30	113.41

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	2455	0	2524	65	0
1	B	2454	0	2530	133	0
2	A	37	0	29	8	0
2	B	37	0	29	4	0
3	A	42	0	0	1	0
3	B	11	0	0	0	0
All	All	5036	0	5112	196	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 19.

All (196) 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:68:ASN:HD21	1:A:70:LYS:HG3	1.10	1.11
1:B:231:ILE:CD1	1:B:233:LEU:HD22	1.84	1.07
1:B:138:ARG:HG2	1:B:138:ARG:HH11	1.23	1.00
1:B:231:ILE:HD13	1:B:233:LEU:HD22	1.48	0.93
1:A:130:ASN:HD21	1:A:211:MET:HE3	1.31	0.93
1:A:25:LEU:HB3	1:A:36:ILE:HD11	1.54	0.90
1:A:68:ASN:ND2	1:A:70:LYS:HG3	1.89	0.88
1:B:231:ILE:HD11	1:B:233:LEU:HD22	1.55	0.88
1:B:170:ARG:HB2	1:B:270:ASN:HB2	1.59	0.85
1:A:25:LEU:HB3	1:A:36:ILE:CD1	2.08	0.81
1:B:306:ILE:HG22	1:B:306:ILE:O	1.80	0.79
1:B:138:ARG:HG2	1:B:138:ARG:NH1	1.98	0.78
1:A:33:ARG:HA	1:A:36:ILE:HG22	1.66	0.76
1:A:192:THR:HG22	1:B:192:THR:HG22	1.68	0.75
1:A:68:ASN:HD22	1:A:68:ASN:C	1.94	0.75
1:A:118:ARG:NH2	2:A:501:BTX:H112	2.01	0.75
1:B:262:LEU:HD11	1:B:294:LYS:HA	1.68	0.74
1:B:119:ARG:HH11	1:B:119:ARG:HG3	1.54	0.73
1:B:135:MET:CE	1:B:243:ILE:HG23	2.18	0.73
1:B:68:ASN:H	1:B:236:ASN:HD21	1.34	0.73
1:B:162:ARG:HG2	1:B:169:VAL:HG13	1.72	0.72

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:2:LYS:NZ	1:B:2:LYS:HB3	2.03	0.71
1:A:121:ARG:HD2	2:A:501:BTX:H5'2	1.74	0.69
1:B:164:LEU:HD13	1:B:233:LEU:HD21	1.74	0.68
1:B:221:GLN:HG3	2:B:500:BTX:O2'	1.96	0.66
1:B:170:ARG:HB3	1:B:268:LEU:O	1.95	0.66
1:A:230:GLY:C	1:A:231:ILE:HD13	2.23	0.64
1:A:130:ASN:ND2	1:A:211:MET:HE3	2.10	0.64
1:B:130:ASN:HD21	1:B:211:MET:HE3	1.62	0.64
1:B:138:ARG:HH11	1:B:138:ARG:CG	2.03	0.64
1:B:170:ARG:HD2	1:B:270:ASN:HA	1.81	0.63
1:B:170:ARG:CB	1:B:270:ASN:HB2	2.29	0.62
1:B:259:ALA:HB3	1:B:260:PRO:HD3	1.82	0.62
1:A:49:ASP:O	1:A:61:PRO:HD3	1.99	0.62
1:B:51:PHE:HD2	1:B:51:PHE:H	1.45	0.62
1:A:175:ASN:O	1:A:176:ASP:HB2	1.99	0.62
1:B:119:ARG:HH11	1:B:119:ARG:CG	2.11	0.61
1:B:19:PHE:CD2	1:B:56:LYS:HB3	2.35	0.61
1:A:40:ILE:HG21	1:A:58:TYR:CE2	2.36	0.60
1:B:162:ARG:HG2	1:B:169:VAL:CG1	2.30	0.60
1:A:276:VAL:HG21	1:A:314:ILE:HD11	1.83	0.60
1:B:231:ILE:HD13	1:B:233:LEU:CD2	2.29	0.59
1:B:68:ASN:HD21	1:B:70:LYS:HG2	1.68	0.59
1:B:17:GLY:HA3	1:B:63:PRO:HG3	1.84	0.59
1:B:173:TRP:O	1:B:314:ILE:HG22	2.03	0.58
1:A:208:ASN:HB3	1:A:225:THR:HG22	1.86	0.58
1:B:209:MET:O	1:B:227:GLN:HB2	2.04	0.58
1:B:121:ARG:HD2	2:B:500:BTX:H5'2	1.86	0.58
1:A:21:SER:HA	1:A:57:GLY:HA3	1.86	0.57
1:A:33:ARG:HA	1:A:36:ILE:CG2	2.34	0.57
1:B:231:ILE:C	1:B:231:ILE:HD12	2.30	0.57
1:B:124:PHE:CD2	1:B:211:MET:HE2	2.41	0.56
1:B:302:GLN:O	1:B:303:ASP:HB2	2.04	0.56
1:A:10:LEU:HD21	1:A:40:ILE:CD1	2.35	0.56
1:B:126:PRO:HG3	1:B:211:MET:HE2	1.88	0.56
1:B:127:PHE:C	1:B:127:PHE:CD1	2.83	0.56
1:B:223:TRP:CD1	1:B:223:TRP:N	2.74	0.56
1:A:68:ASN:HD21	1:A:70:LYS:CG	2.00	0.56
1:B:162:ARG:HA	1:B:166:ALA:O	2.07	0.55
1:B:301:GLU:HB2	1:B:306:ILE:HG12	1.88	0.55
1:B:147:ILE:CG2	1:B:148:GLY:N	2.69	0.55
1:B:274:ARG:O	1:B:276:VAL:HG13	2.06	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:119:ARG:CG	1:B:119:ARG:NH1	2.69	0.54
1:A:259:ALA:HB3	1:A:260:PRO:HD3	1.89	0.54
1:B:68:ASN:C	1:B:68:ASN:HD22	2.16	0.54
1:B:223:TRP:CD1	1:B:223:TRP:H	2.25	0.54
1:B:314:ILE:HG12	1:B:315:SER:N	2.22	0.54
1:B:164:LEU:CD1	1:B:233:LEU:HD21	2.38	0.54
1:B:226:LEU:HB3	1:B:231:ILE:HG13	1.89	0.53
1:A:16:ASN:HD22	1:A:16:ASN:H	1.56	0.53
1:B:277:LYS:HE3	1:B:279:ILE:HD11	1.89	0.53
1:B:108:ILE:CD1	1:B:131:LEU:CD2	2.87	0.52
1:A:25:LEU:CB	1:A:36:ILE:CD1	2.85	0.52
1:B:72:ILE:HD11	1:B:236:ASN:HD22	1.74	0.52
1:B:108:ILE:HD11	1:B:131:LEU:CD2	2.39	0.52
1:A:121:ARG:CD	2:A:501:BTX:H5'2	2.40	0.52
1:B:124:PHE:CE2	1:B:211:MET:HE2	2.45	0.51
1:B:178:TYR:OH	1:B:183:LYS:HE3	2.10	0.51
1:A:139:LEU:HD13	1:A:145:ALA:HB3	1.93	0.51
1:A:170:ARG:HB3	1:A:268:LEU:O	2.10	0.51
1:B:72:ILE:CD1	1:B:236:ASN:HD22	2.24	0.51
1:B:160:VAL:O	1:B:163:LYS:HG2	2.11	0.51
1:B:284:GLU:O	1:B:285:ILE:HG13	2.11	0.51
1:B:118:ARG:NH2	2:B:500:BTX:H112	2.26	0.50
1:B:130:ASN:HB3	1:B:207:ILE:O	2.10	0.50
1:B:175:ASN:O	1:B:176:ASP:HB2	2.12	0.50
1:B:19:PHE:CE2	1:B:53:VAL:HB	2.46	0.50
1:B:135:MET:HE2	1:B:243:ILE:HG23	1.92	0.50
1:B:288:ILE:O	1:B:300:LEU:HD12	2.11	0.49
1:B:166:ALA:HB1	1:B:169:VAL:CG1	2.42	0.49
1:B:31:MET:HG3	1:B:36:ILE:HD13	1.95	0.49
1:A:27:GLU:C	1:A:29:LEU:H	2.21	0.49
1:B:172:LYS:HD3	1:B:178:TYR:CE1	2.47	0.49
1:A:157:MET:HE3	1:A:207:ILE:HD11	1.95	0.49
1:B:186:GLY:HA3	2:B:500:BTX:H102	1.95	0.48
1:A:186:GLY:HA3	2:A:501:BTX:H102	1.94	0.48
1:B:9:LYS:HB2	1:B:9:LYS:NZ	2.28	0.48
1:B:44:ARG:HA	1:B:48:VAL:O	2.12	0.48
1:A:6:VAL:HB	1:A:7:PRO:HD3	1.96	0.48
1:B:52:THR:HA	1:B:57:GLY:O	2.13	0.48
1:B:72:ILE:HD11	1:B:236:ASN:HA	1.95	0.48
1:A:250:LEU:O	1:A:254:GLU:HB2	2.13	0.47
1:B:138:ARG:NH1	1:B:138:ARG:CG	2.65	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:172:LYS:HD3	1:B:178:TYR:HE1	1.79	0.47
1:A:16:ASN:HD22	1:A:16:ASN:N	2.12	0.47
1:B:31:MET:CG	1:B:36:ILE:HD13	2.45	0.47
1:B:166:ALA:CB	1:B:169:VAL:HG11	2.45	0.47
1:B:139:LEU:HD13	1:B:145:ALA:HB3	1.97	0.47
1:B:214:VAL:HG11	1:B:219:VAL:HB	1.97	0.47
1:A:221:GLN:HE21	1:A:221:GLN:HB2	1.48	0.47
1:B:214:VAL:CG1	1:B:219:VAL:HB	2.44	0.47
1:A:157:MET:HE2	1:A:177:LEU:HD11	1.96	0.47
1:B:134:SER:HA	1:B:203:ILE:O	2.15	0.46
1:A:10:LEU:HD21	1:A:40:ILE:HD13	1.97	0.46
1:B:8:LEU:O	1:B:11:ILE:HG22	2.15	0.46
1:A:317:ARG:HA	3:A:528:HOH:O	2.15	0.46
1:B:293:ASP:OD2	1:B:297:ALA:HB3	2.16	0.46
1:A:186:GLY:CA	2:A:501:BTX:H102	2.45	0.46
1:B:51:PHE:CD2	1:B:51:PHE:N	2.82	0.46
1:B:52:THR:HG22	1:B:58:TYR:CD2	2.50	0.46
1:A:241:MET:HE2	1:A:241:MET:HB2	1.73	0.46
1:B:124:PHE:CD2	1:B:211:MET:CE	2.98	0.46
1:B:31:MET:CG	1:B:36:ILE:CD1	2.93	0.46
1:A:140:GLU:OE1	1:B:281:GLY:HA2	2.14	0.46
1:A:68:ASN:ND2	1:A:68:ASN:C	2.66	0.46
1:B:231:ILE:HD12	1:B:232:ASN:N	2.31	0.46
1:A:33:ARG:CA	1:A:36:ILE:HG22	2.39	0.45
1:A:301:GLU:HB2	1:A:306:ILE:HG12	1.97	0.45
1:A:285:ILE:HD11	1:A:300:LEU:CD2	2.47	0.45
1:B:68:ASN:HB3	1:B:71:GLN:HB2	1.98	0.45
1:A:118:ARG:HH22	2:A:501:BTX:H112	1.80	0.45
1:B:208:ASN:HB3	1:B:225:THR:HG22	1.98	0.45
1:B:172:LYS:HG3	1:B:271:PHE:CE1	2.52	0.45
1:A:247:ARG:O	1:A:251:GLU:HG2	2.17	0.45
1:B:269:ASP:O	1:B:272:ILE:HG22	2.17	0.45
1:A:286:PHE:HD2	1:A:317:ARG:HD2	1.82	0.45
1:B:267:LYS:H	1:B:267:LYS:HG2	1.58	0.45
1:A:209:MET:HG2	1:A:226:LEU:HD12	2.00	0.44
1:A:209:MET:SD	1:A:235:ARG:HG2	2.57	0.44
1:A:285:ILE:HG13	1:A:302:GLN:NE2	2.32	0.44
1:B:175:ASN:O	1:B:176:ASP:CB	2.65	0.44
1:A:33:ARG:O	1:A:33:ARG:HG2	2.17	0.44
1:A:123:TRP:CE3	2:A:501:BTX:H9B1	2.53	0.44
1:A:262:LEU:HD11	1:A:294:LYS:HA	1.98	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:173:TRP:HA	1:B:174:PRO:HA	1.89	0.44
1:B:19:PHE:HE2	1:B:53:VAL:HB	1.83	0.44
1:B:157:MET:HE2	1:B:187:ILE:HD11	1.99	0.44
1:B:8:LEU:HD23	1:B:8:LEU:HA	1.87	0.44
1:B:67:LEU:HD13	1:B:108:ILE:HG12	2.00	0.44
1:B:176:ASP:OD2	1:B:183:LYS:HE2	2.17	0.44
1:B:68:ASN:HD22	1:B:69:ALA:N	2.16	0.44
1:A:158:ALA:O	1:A:162:ARG:HG3	2.18	0.43
1:B:301:GLU:HA	1:B:305:ILE:O	2.18	0.43
1:A:134:SER:HA	1:A:203:ILE:O	2.17	0.43
1:B:147:ILE:HG22	1:B:148:GLY:N	2.32	0.43
1:B:31:MET:HE2	1:B:35:ALA:HB1	1.99	0.43
1:B:98:ILE:HD13	1:B:200:GLN:HB3	2.01	0.43
1:B:126:PRO:CD	1:B:211:MET:CE	2.97	0.43
1:B:289:SER:C	1:B:290:ARG:HG2	2.43	0.42
1:B:162:ARG:CZ	1:B:167:ASP:O	2.67	0.42
1:A:175:ASN:O	1:A:176:ASP:CB	2.64	0.42
1:B:238:LEU:O	1:B:238:LEU:HG	2.17	0.42
1:B:68:ASN:HB3	1:B:71:GLN:CB	2.49	0.42
1:B:241:MET:HB2	1:B:241:MET:HE2	1.67	0.42
1:B:286:PHE:CD1	1:B:286:PHE:N	2.87	0.42
1:A:121:ARG:HD3	2:A:501:BTX:O3'	2.20	0.42
1:B:68:ASN:ND2	1:B:70:LYS:HG2	2.33	0.42
1:A:157:MET:CE	1:A:207:ILE:HD11	2.50	0.41
1:A:173:TRP:HA	1:A:174:PRO:HA	1.83	0.41
1:B:68:ASN:H	1:B:236:ASN:ND2	2.10	0.41
1:A:131:LEU:HD12	1:A:131:LEU:HA	1.78	0.41
1:B:11:ILE:HD12	1:B:11:ILE:HA	1.93	0.41
1:B:86:VAL:HG22	1:B:111:TYR:HD2	1.85	0.41
1:B:233:LEU:HD12	1:B:233:LEU:HA	1.82	0.41
1:B:40:ILE:HG13	1:B:58:TYR:CE2	2.55	0.41
1:B:73:LEU:HD23	1:B:73:LEU:HA	1.89	0.41
1:B:131:LEU:HD23	1:B:131:LEU:HA	1.84	0.41
1:B:275:PRO:O	1:B:316:LEU:HD13	2.21	0.41
1:B:81:VAL:HG22	1:B:106:ALA:HB3	2.03	0.41
1:A:21:SER:HA	1:A:57:GLY:CA	2.50	0.41
1:B:2:LYS:HB3	1:B:2:LYS:HZ3	1.82	0.41
1:B:13:LEU:HA	1:B:13:LEU:HD23	1.80	0.41
1:B:299:LEU:HD23	1:B:299:LEU:HA	1.80	0.41
1:A:68:ASN:HD22	1:A:69:ALA:N	2.17	0.40
1:B:112:GLN:HB2	1:B:125:SER:CB	2.51	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:162:ARG:CG	1:B:169:VAL:HG13	2.47	0.40
1:B:29:LEU:HD13	1:B:29:LEU:HA	1.75	0.40
1:B:288:ILE:HG22	1:B:289:SER:N	2.35	0.40
1:A:118:ARG:O	1:A:121:ARG:HG3	2.21	0.40
1:A:289:SER:O	1:A:290:ARG:HD3	2.21	0.40
1:B:227:GLN:HE21	1:B:227:GLN:HB3	1.61	0.40
1:B:231:ILE:HD13	1:B:233:LEU:HD13	2.04	0.40
1:B:19:PHE:CG	1:B:56:LYS:HB3	2.57	0.40
1:B:85:PRO:O	1:B:110:GLU:HB2	2.22	0.40
1:A:278:LEU:HD23	1:A:285:ILE:HD13	2.03	0.40
1:B:126:PRO:CG	1:B:211:MET:CE	2.99	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	316/321 (98%)	293 (93%)	20 (6%)	3 (1%)	14	41
1	B	315/321 (98%)	284 (90%)	29 (9%)	2 (1%)	21	51
All	All	631/642 (98%)	577 (91%)	49 (8%)	5 (1%)	16	44

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	176	ASP
1	A	29	LEU
1	A	176	ASP
1	B	275	PRO
1	A	128	GLY

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	254/258 (98%)	208 (82%)	46 (18%)	2	6
1	B	255/258 (99%)	195 (76%)	60 (24%)	1	3
All	All	509/516 (99%)	403 (79%)	106 (21%)	1	4

All (106) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	4	ASN
1	A	6	VAL
1	A	16	ASN
1	A	21	SER
1	A	23	GLU
1	A	24	GLN
1	A	29	LEU
1	A	31	MET
1	A	33	ARG
1	A	38	LYS
1	A	50	VAL
1	A	52	THR
1	A	54	PRO
1	A	56	LYS
1	A	68	ASN
1	A	70	LYS
1	A	76	LEU
1	A	85	PRO
1	A	87	ILE
1	A	103	SER
1	A	125	SER
1	A	133	LEU
1	A	141	GLN
1	A	147	ILE
1	A	174	PRO
1	A	180	GLN
1	A	183	LYS

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Mol	Chain	Res	Type
1	A	190	GLU
1	A	194	LYS
1	A	207	ILE
1	A	215	GLU
1	A	216	GLU
1	A	220	ASN
1	A	221	GLN
1	A	231	ILE
1	A	237	THR
1	A	241	MET
1	A	252	LEU
1	A	255	GLN
1	A	258	LEU
1	A	266	GLU
1	A	283	LYS
1	A	284	GLU
1	A	285	ILE
1	A	294	LYS
1	A	305	ILE
1	B	2	LYS
1	B	5	THR
1	B	9	LYS
1	B	23	GLU
1	B	29	LEU
1	B	33	ARG
1	B	36	ILE
1	B	38	LYS
1	B	51	PHE
1	B	59	SER
1	B	65	GLN
1	B	70	LYS
1	B	71	GLN
1	B	76	LEU
1	B	97	ARG
1	B	98	ILE
1	B	100	GLU
1	B	107	CYS
1	B	108	ILE
1	B	119	ARG
1	B	122	LYS
1	B	131	LEU
1	B	133	LEU

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Mol	Chain	Res	Type
1	B	138	ARG
1	B	141	GLN
1	B	147	ILE
1	B	150	SER
1	B	153	ILE
1	B	168	LYS
1	B	169	VAL
1	B	174	PRO
1	B	181	ASP
1	B	183	LYS
1	B	191	LEU
1	B	212	ARG
1	B	214	VAL
1	B	216	GLU
1	B	227	GLN
1	B	231	ILE
1	B	233	LEU
1	B	241	MET
1	B	251	GLU
1	B	252	LEU
1	B	256	GLU
1	B	262	LEU
1	B	266	GLU
1	B	267	LYS
1	B	280	ILE
1	B	282	ASP
1	B	283	LYS
1	B	289	SER
1	B	295	GLN
1	B	298	LEU
1	B	302	GLN
1	B	303	ASP
1	B	305	ILE
1	B	307	LYS
1	B	313	GLU
1	B	316	LEU
1	B	318	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	16	ASN

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Mol	Chain	Res	Type
1	A	20	HIS
1	A	37	ASN
1	A	68	ASN
1	A	130	ASN
1	A	221	GLN
1	A	302	GLN
1	B	4	ASN
1	B	68	ASN
1	B	113	GLN
1	B	200	GLN
1	B	227	GLN
1	B	232	ASN
1	B	236	ASN
1	B	273	ASN
1	B	295	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

2 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	BTX	B	500	-	41,41,41	1.92	12 (29%)	59,60,60	2.15	21 (35%)
2	BTX	A	501	-	41,41,41	1.74	9 (21%)	59,60,60	1.88	17 (28%)

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	BTX	B	500	-	-	8/20/57/57	0/5/5/5
2	BTX	A	501	-	-	6/20/57/57	0/5/5/5

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	500	BTX	OBB-CBB	-5.46	1.23	1.44
2	B	500	BTX	C2-N1	4.95	1.42	1.33
2	A	501	BTX	C2-N3	4.21	1.41	1.33
2	B	500	BTX	C4-N3	3.95	1.41	1.34
2	B	500	BTX	C2-N3	3.83	1.40	1.33
2	A	501	BTX	C2-N1	3.68	1.40	1.33
2	A	501	BTX	C3'-C4'	-3.63	1.43	1.53
2	A	501	BTX	C4-N3	3.53	1.41	1.34
2	A	501	BTX	OBB-CBB	-3.42	1.31	1.44
2	B	500	BTX	P-OBB	-2.86	1.48	1.59
2	A	501	BTX	C6-N1	2.86	1.43	1.35
2	A	501	BTX	P-OBB	-2.73	1.48	1.59
2	B	500	BTX	C6-N1	2.65	1.43	1.35
2	B	500	BTX	C2B-S1B	-2.46	1.78	1.82
2	B	500	BTX	C5B-N1B	2.33	1.49	1.46
2	A	501	BTX	C5'-C4'	-2.32	1.44	1.51
2	A	501	BTX	O4'-C1'	2.28	1.47	1.42
2	B	500	BTX	C8-N7	2.22	1.35	1.31
2	B	500	BTX	O3B-C3B	2.21	1.28	1.23
2	B	500	BTX	C2'-C3'	-2.09	1.47	1.53
2	B	500	BTX	C3'-C4'	-2.03	1.47	1.53

All (38) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	501	BTX	N3-C2-N1	-6.40	118.90	128.58

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	500	BTX	N3-C2-N1	-6.08	119.38	128.58
2	B	500	BTX	P-OBB-CBB	4.61	143.21	121.26
2	B	500	BTX	O3'-C3'-C4'	4.14	122.97	111.08
2	B	500	BTX	C2B-C4B-C5B	-3.96	104.05	108.89
2	B	500	BTX	O4'-C4'-C3'	-3.67	97.87	105.15
2	B	500	BTX	OBB-CBB-CAB	3.55	121.88	109.28
2	A	501	BTX	N9-C8-N7	-3.49	108.99	113.94
2	B	500	BTX	N9-C8-N7	-3.47	109.01	113.94
2	B	500	BTX	C5B-C6B-S1B	-3.26	101.57	106.06
2	A	501	BTX	O3'-C3'-C4'	3.18	120.23	111.08
2	A	501	BTX	P-OBB-CBB	3.17	136.36	121.26
2	A	501	BTX	C5B-C6B-S1B	-3.09	101.80	106.06
2	A	501	BTX	C5-N7-C8	3.05	108.24	103.45
2	A	501	BTX	C2B-C4B-C5B	-3.02	105.20	108.89
2	A	501	BTX	C5-C4-N3	-2.87	122.77	126.72
2	B	500	BTX	C5-N7-C8	2.81	107.87	103.45
2	A	501	BTX	O4'-C4'-C5'	2.72	118.05	109.33
2	B	500	BTX	C9B-C8B-C7B	2.71	123.82	113.62
2	B	500	BTX	C2B-C4B-N2B	2.61	116.11	113.34
2	A	501	BTX	C2-N3-C4	2.59	118.16	111.83
2	B	500	BTX	C2'-C3'-C4'	-2.58	97.63	102.61
2	B	500	BTX	C2'-C1'-N9	2.51	119.55	113.30
2	A	501	BTX	C2-N1-C6	2.49	122.82	118.73
2	B	500	BTX	C5-C4-N3	-2.48	123.30	126.72
2	A	501	BTX	C6-C5-C4	2.43	120.50	117.18
2	B	500	BTX	C4-N9-C1'	-2.38	121.06	126.63
2	B	500	BTX	C2-N1-C6	2.38	122.64	118.73
2	A	501	BTX	N3-C4-N9	2.35	131.16	127.17
2	B	500	BTX	O4'-C1'-C2'	-2.30	101.70	106.62
2	B	500	BTX	C6-C5-C4	2.25	120.26	117.18
2	B	500	BTX	C2-N3-C4	2.25	117.32	111.83
2	A	501	BTX	C2'-C1'-N9	2.22	118.82	113.30
2	B	500	BTX	C4-N9-C8	2.20	108.04	105.74
2	A	501	BTX	O4'-C1'-C2'	-2.13	102.05	106.62
2	A	501	BTX	N2B-C3B-N1B	2.06	111.23	108.85
2	A	501	BTX	C4-N9-C8	2.04	107.88	105.74
2	B	500	BTX	O4'-C4'-C5'	2.03	115.83	109.33

There are no chirality outliers.

All (14) torsion outliers are listed below:

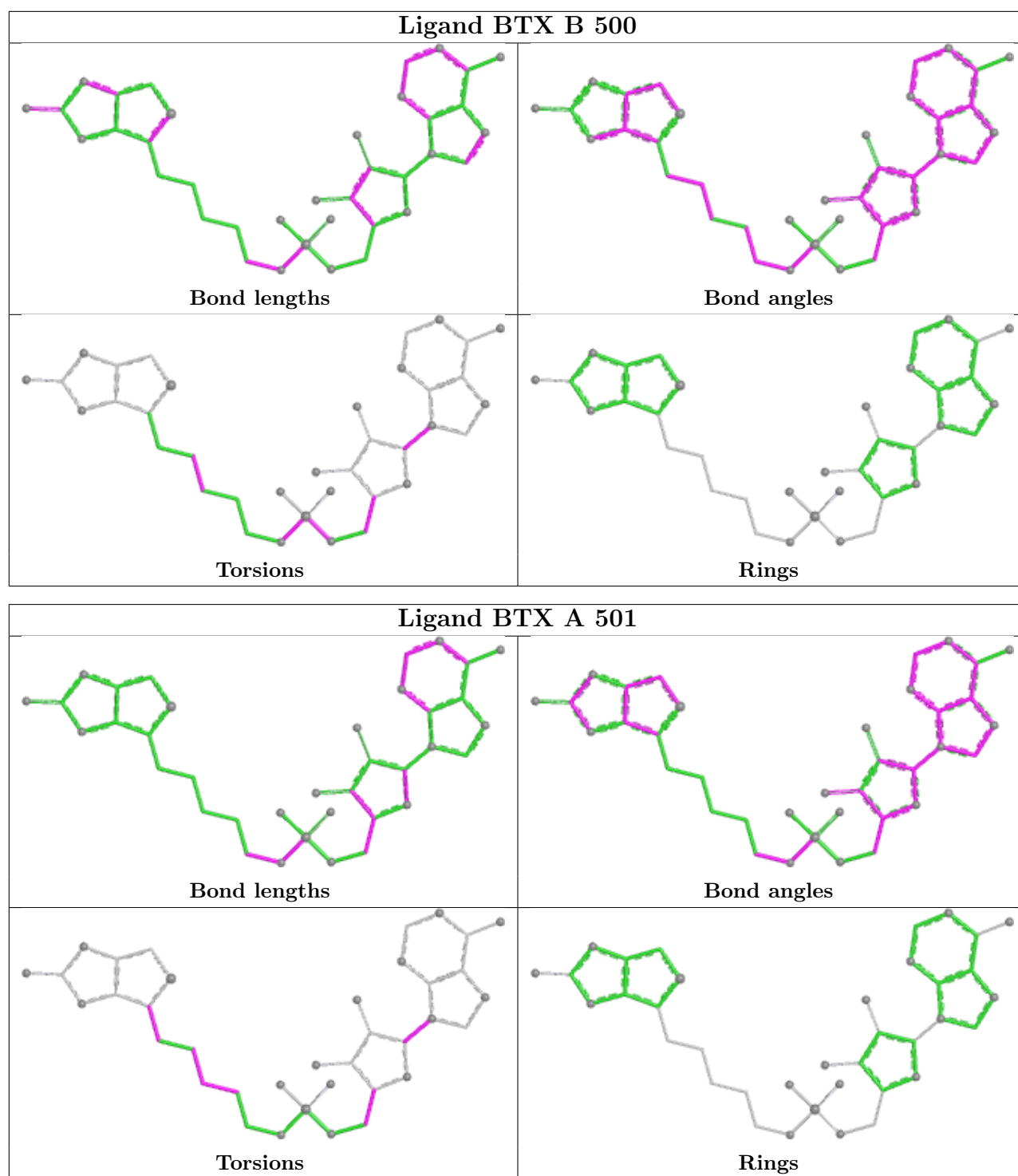
Mol	Chain	Res	Type	Atoms
2	A	501	BTX	O4'-C4'-C5'-O5'
2	A	501	BTX	C4B-C2B-C7B-C8B
2	B	500	BTX	C5'-O5'-P-O1P
2	B	500	BTX	CBB-OBB-P-O1P
2	A	501	BTX	C3'-C4'-C5'-O5'
2	B	500	BTX	O4'-C4'-C5'-O5'
2	A	501	BTX	C8B-C9B-CAB-CBB
2	B	500	BTX	C3'-C4'-C5'-O5'
2	A	501	BTX	C7B-C8B-C9B-CAB
2	B	500	BTX	C7B-C8B-C9B-CAB
2	B	500	BTX	C2'-C1'-N9-C8
2	A	501	BTX	C2'-C1'-N9-C8
2	B	500	BTX	O4'-C1'-N9-C8
2	B	500	BTX	C2'-C1'-N9-C4

There are no ring outliers.

2 monomers are involved in 12 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	500	BTX	4	0
2	A	501	BTX	8	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 ⓘ

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	318/321 (99%)	-0.03	14 (4%) 39 31	27, 53, 121, 140	0
1	B	317/321 (98%)	0.48	16 (5%) 34 26	35, 68, 117, 150	0
All	All	635/642 (98%)	0.22	30 (4%) 36 29	27, 60, 118, 150	0

All (30) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	54	PRO	4.4
1	A	320	GLU	3.8
1	A	53	VAL	3.6
1	B	310	MET	3.3
1	A	22	GLY	3.2
1	B	221	GLN	3.0
1	B	282	ASP	2.9
1	B	291	GLY	2.8
1	A	31	MET	2.8
1	A	28	THR	2.8
1	B	233	LEU	2.8
1	B	318	SER	2.7
1	B	266	GLU	2.7
1	B	285	ILE	2.6
1	B	69	ALA	2.6
1	A	36	ILE	2.6
1	A	19	PHE	2.5
1	A	39	HIS	2.5
1	A	26	GLY	2.4
1	B	283	LYS	2.4
1	B	308	PRO	2.4
1	B	164	LEU	2.4
1	B	296	GLY	2.3
1	B	305	ILE	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	304	GLY	2.2
1	B	179	LEU	2.2
1	A	56	LYS	2.1
1	A	58	TYR	2.1
1	A	21	SER	2.0
1	A	29	LEU	2.0

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

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

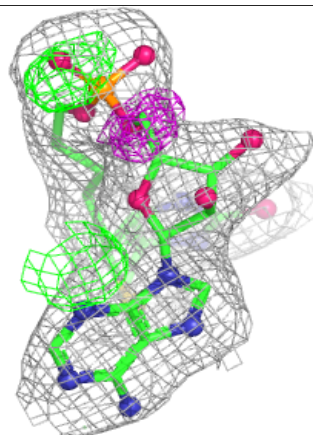
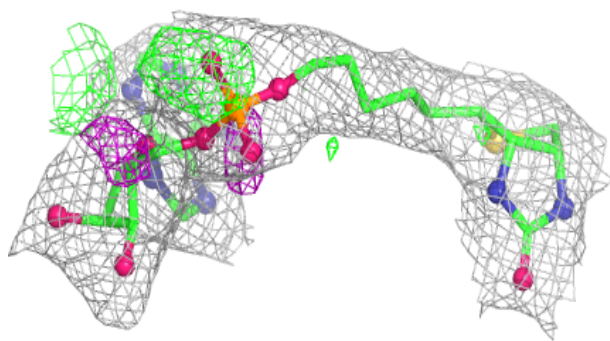
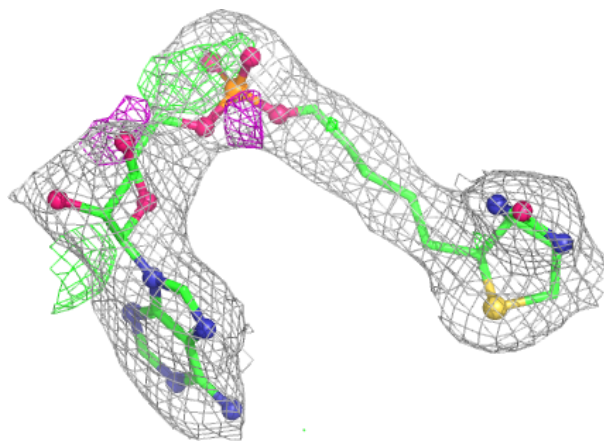
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	BTX	B	500	37/37	0.95	0.09	29,45,53,57	0
2	BTX	A	501	37/37	0.97	0.07	26,35,42,44	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.

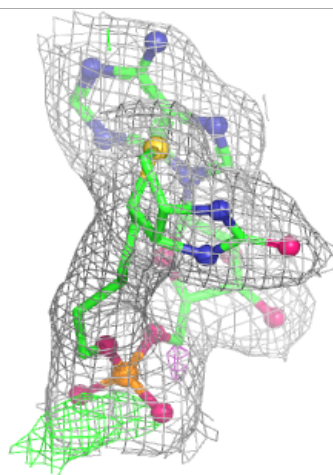
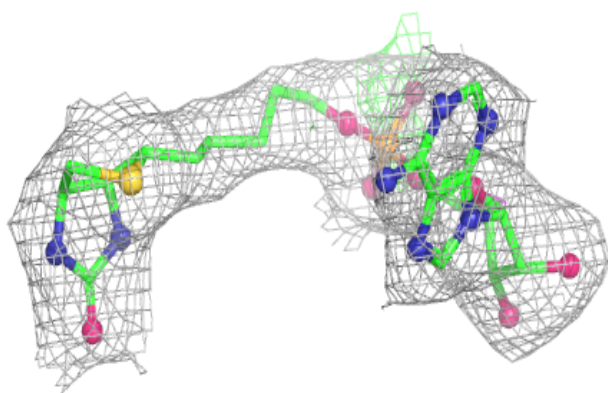
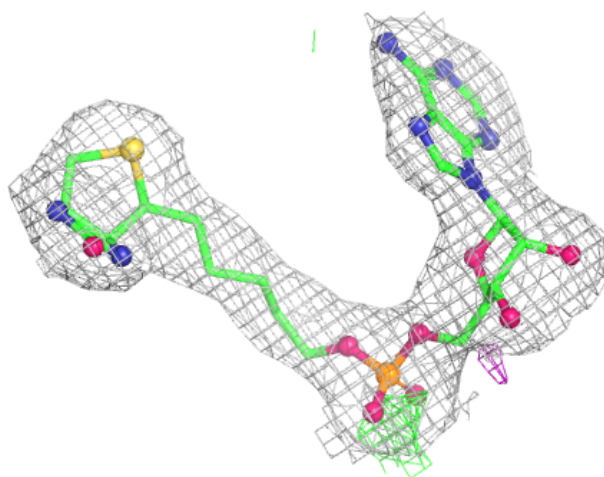
Electron density around BTX B 500:

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



Electron density around BTX 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.