



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 18, 2026 – 10:24 am BST

PDB ID : 5M29 / pdb_00005m29
Title : Structure of cobinamide-bound BtuF, the periplasmic vitamin B12 binding protein in E.coli
Authors : Mireku, S.A.; Ruetz, M.; Zhou, T.; Korkhov, V.M.; Kraeutler, B.; Locher, K.P.
Deposited on : 2016-10-12
Resolution : 1.50 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	:	1.8.4, CSD as541be (2020)
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	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

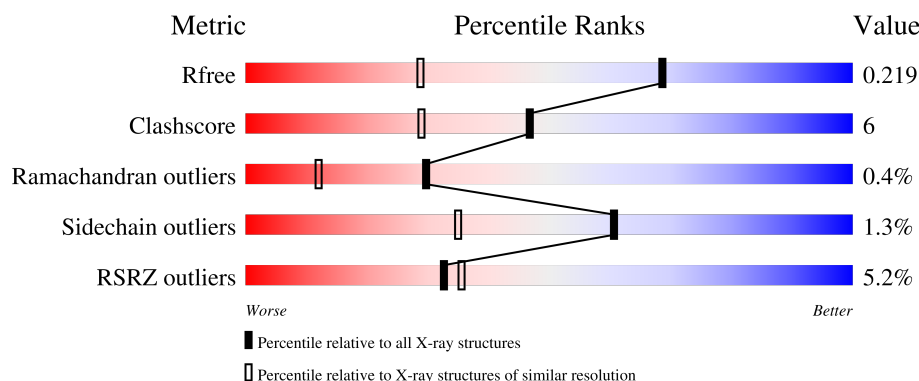
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.50 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	4037 (1.50-1.50)
Clashscore	190562	4235 (1.50-1.50)
Ramachandran outliers	187476	4153 (1.50-1.50)
Sidechain outliers	187428	4150 (1.50-1.50)
RSRZ outliers	180081	4039 (1.50-1.50)

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	290	4% 71% 8% 21%
1	B	290	4% 73% 6% 21%

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	CYN	B	302	-	-	X	-
4	GOL	A	304	-	-	X	-

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 4273 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 Vitamin B12-binding protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	229	Total	C	N	O	S	0	3	0
			1794	1141	313	336	4			
1	B	229	Total	C	N	O	S	0	2	0
			1787	1137	314	332	4			

There are 90 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-2	MET	-	initiating methionine	UNP P37028
A	-1	LYS	-	expression tag	UNP P37028
A	0	LYS	-	expression tag	UNP P37028
A	1	THR	-	expression tag	UNP P37028
A	2	ALA	-	expression tag	UNP P37028
A	3	ILE	-	expression tag	UNP P37028
A	4	ALA	-	expression tag	UNP P37028
A	5	ILE	-	expression tag	UNP P37028
A	6	ALA	-	expression tag	UNP P37028
A	7	VAL	-	expression tag	UNP P37028
A	8	ALA	-	expression tag	UNP P37028
A	9	LEU	-	expression tag	UNP P37028
A	10	ALA	-	expression tag	UNP P37028
A	11	GLY	-	expression tag	UNP P37028
A	12	PHE	-	expression tag	UNP P37028
A	13	ALA	-	expression tag	UNP P37028
A	14	THR	-	expression tag	UNP P37028
A	15	VAL	-	expression tag	UNP P37028
A	16	ALA	-	expression tag	UNP P37028
A	17	GLN	-	expression tag	UNP P37028
A	18	ALA	-	expression tag	UNP P37028
A	19	ALA	-	expression tag	UNP P37028
A	20	SER	-	expression tag	UNP P37028
A	21	MET	-	expression tag	UNP P37028
A	267	SER	-	expression tag	UNP P37028

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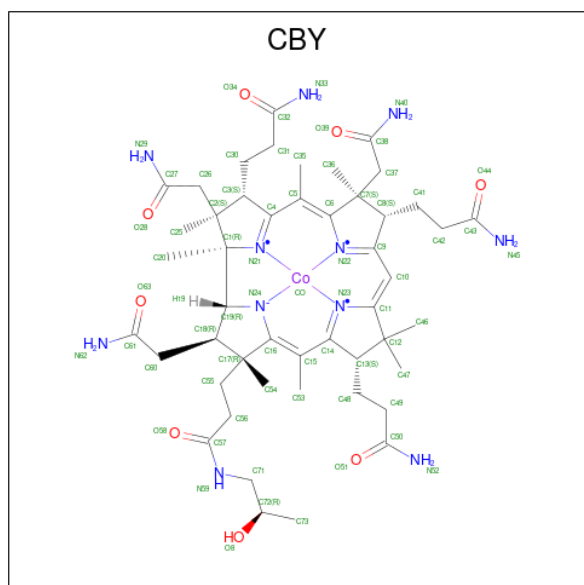
Chain	Residue	Modelled	Actual	Comment	Reference
A	268	GLY	-	expression tag	UNP P37028
A	269	SER	-	expression tag	UNP P37028
A	270	LEU	-	expression tag	UNP P37028
A	271	GLU	-	expression tag	UNP P37028
A	272	VAL	-	expression tag	UNP P37028
A	273	LEU	-	expression tag	UNP P37028
A	274	PHE	-	expression tag	UNP P37028
A	275	GLN	-	expression tag	UNP P37028
A	276	GLY	-	expression tag	UNP P37028
A	277	PRO	-	expression tag	UNP P37028
A	278	GLY	-	expression tag	UNP P37028
A	279	GLY	-	expression tag	UNP P37028
A	280	SER	-	expression tag	UNP P37028
A	281	HIS	-	expression tag	UNP P37028
A	282	HIS	-	expression tag	UNP P37028
A	283	HIS	-	expression tag	UNP P37028
A	284	HIS	-	expression tag	UNP P37028
A	285	HIS	-	expression tag	UNP P37028
A	286	HIS	-	expression tag	UNP P37028
A	287	END	-	expression tag	UNP P37028
B	-2	MET	-	initiating methionine	UNP P37028
B	-1	LYS	-	expression tag	UNP P37028
B	0	LYS	-	expression tag	UNP P37028
B	1	THR	-	expression tag	UNP P37028
B	2	ALA	-	expression tag	UNP P37028
B	3	ILE	-	expression tag	UNP P37028
B	4	ALA	-	expression tag	UNP P37028
B	5	ILE	-	expression tag	UNP P37028
B	6	ALA	-	expression tag	UNP P37028
B	7	VAL	-	expression tag	UNP P37028
B	8	ALA	-	expression tag	UNP P37028
B	9	LEU	-	expression tag	UNP P37028
B	10	ALA	-	expression tag	UNP P37028
B	11	GLY	-	expression tag	UNP P37028
B	12	PHE	-	expression tag	UNP P37028
B	13	ALA	-	expression tag	UNP P37028
B	14	THR	-	expression tag	UNP P37028
B	15	VAL	-	expression tag	UNP P37028
B	16	ALA	-	expression tag	UNP P37028
B	17	GLN	-	expression tag	UNP P37028
B	18	ALA	-	expression tag	UNP P37028
B	19	ALA	-	expression tag	UNP P37028

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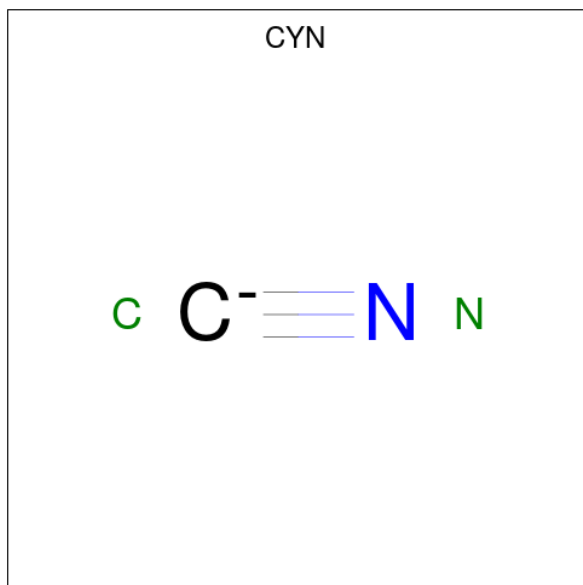
Chain	Residue	Modelled	Actual	Comment	Reference
B	20	SER	-	expression tag	UNP P37028
B	21	MET	-	expression tag	UNP P37028
B	267	SER	-	expression tag	UNP P37028
B	268	GLY	-	expression tag	UNP P37028
B	269	SER	-	expression tag	UNP P37028
B	270	LEU	-	expression tag	UNP P37028
B	271	GLU	-	expression tag	UNP P37028
B	272	VAL	-	expression tag	UNP P37028
B	273	LEU	-	expression tag	UNP P37028
B	274	PHE	-	expression tag	UNP P37028
B	275	GLN	-	expression tag	UNP P37028
B	276	GLY	-	expression tag	UNP P37028
B	277	PRO	-	expression tag	UNP P37028
B	278	GLY	-	expression tag	UNP P37028
B	279	GLY	-	expression tag	UNP P37028
B	280	SER	-	expression tag	UNP P37028
B	281	HIS	-	expression tag	UNP P37028
B	282	HIS	-	expression tag	UNP P37028
B	283	HIS	-	expression tag	UNP P37028
B	284	HIS	-	expression tag	UNP P37028
B	285	HIS	-	expression tag	UNP P37028
B	286	HIS	-	expression tag	UNP P37028
B	287	END	-	expression tag	UNP P37028

- Molecule 2 is COB(II)INAMIDE (CCD ID: CBY) (formula: $C_{48}H_{72}CoN_{11}O_8$).



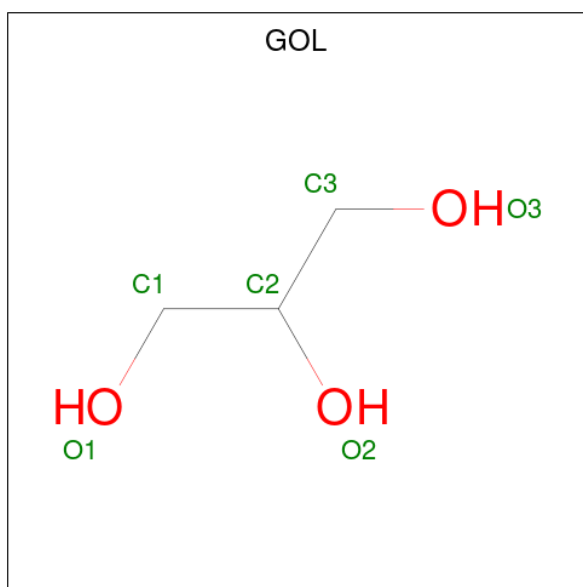
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	Co	N	O	0	0
			68	48	1	11	8		
2	B	1	Total	C	Co	N	O	0	0
			68	48	1	11	8		

- Molecule 3 is CYANIDE ION (CCD ID: CYN) (formula: CN).



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

- Molecule 4 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).

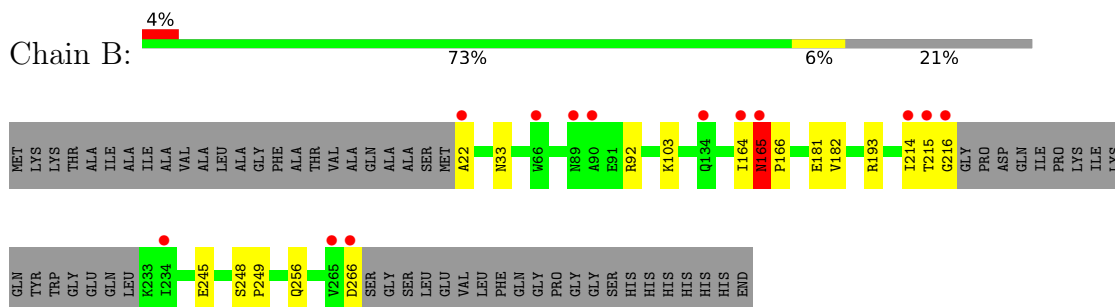
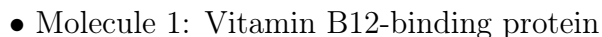


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			6	3	3		
4	A	1	Total	C	O	0	0
			6	3	3		
4	B	1	Total	C	O	0	0
			6	3	3		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	278	Total	O	0	0
			278	278		
5	B	254	Total	O	0	0
			254	254		

- Molecule 1: Vitamin B12-binding protein



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	138.15Å 90.56Å 50.84Å 90.00° 110.90° 90.00°	Depositor
Resolution (Å)	29.39 – 1.50 29.39 – 1.50	Depositor EDS
% Data completeness (in resolution range)	96.0 (29.39-1.50) 96.0 (29.39-1.50)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.57 (at 1.50Å)	Xtriage
Refinement program	REFMAC 5.8.0071, PHENIX 1.8.2-1309	Depositor
R, R_{free}	0.179 , 0.213 0.188 , 0.219	Depositor DCC
R_{free} test set	4481 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	22.9	Xtriage
Anisotropy	0.510	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 46.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.025 for -h-2*k,l	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	4273	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.50% 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: CBY, GOL, CYN

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	1.20	3/1838 (0.2%)	1.12	6/2505 (0.2%)
1	B	1.22	2/1831 (0.1%)	1.08	2/2495 (0.1%)
All	All	1.21	5/3669 (0.1%)	1.10	8/5000 (0.2%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1
1	B	0	2
All	All	0	3

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	33	ASN	N-CA	-6.21	1.38	1.46
1	A	111	SER	CA-C	-5.85	1.45	1.52
1	A	78	LYS	N-CA	5.73	1.50	1.46
1	A	30	SER	N-CA	-5.48	1.40	1.45
1	B	181	GLU	N-CA	5.42	1.52	1.46

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	30	SER	O-C-N	7.17	126.88	121.65
1	A	256[A]	GLN	CA-C-N	6.41	129.11	120.65
1	A	256[A]	GLN	C-N-CA	6.41	129.11	120.65
1	A	256[B]	GLN	CA-C-N	6.41	129.11	120.65

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	256[B]	GLN	C-N-CA	6.41	129.11	120.65
1	A	248	SER	CB-CA-C	5.91	117.97	110.76
1	B	214	ILE	CA-C-N	5.22	131.17	121.62
1	B	214	ILE	C-N-CA	5.22	131.17	121.62

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	165	ASN	Peptide
1	B	165	ASN	Peptide
1	B	215	THR	Peptide

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	1794	0	1812	15	0
1	B	1787	0	1812	18	0
2	A	68	0	72	3	0
2	B	68	0	72	7	0
3	A	2	0	0	1	0
3	B	4	0	0	2	0
4	A	12	0	16	8	0
4	B	6	0	8	1	0
5	A	278	0	0	7	1
5	B	254	0	0	5	0
All	All	4273	0	3792	43	1

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 6.

All (43) 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:B:164:ILE:O	1:B:165:ASN:C	2.26	0.78

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:301:CBY:H20B	3:B:302:CYN:C	2.16	0.75
1:B:164:ILE:O	1:B:165:ASN:O	2.03	0.75
4:A:304:GOL:C1	1:B:193:ARG:HD2	2.16	0.75
1:A:212:ILE:HG13	1:A:234:ILE:HD11	1.73	0.71
1:B:165:ASN:HB3	1:B:166:PRO:CD	2.22	0.69
4:A:304:GOL:H12	1:B:193:ARG:CD	2.23	0.67
4:A:304:GOL:C1	1:B:193:ARG:CD	2.73	0.67
2:A:301:CBY:H20B	3:A:302:CYN:C	2.25	0.66
1:A:103:LYS:HG2	5:A:574:HOH:O	1.97	0.64
1:A:103:LYS:CG	5:A:574:HOH:O	2.45	0.63
1:B:22:ALA:HA	5:B:475:HOH:O	1.99	0.62
4:A:304:GOL:H12	1:B:193:ARG:HD3	1.80	0.62
2:B:301:CBY:C35	2:B:301:CBY:H36	2.29	0.61
1:A:173:GLU:OE1	5:A:401:HOH:O	2.16	0.60
1:A:194:VAL:HG11	4:A:304:GOL:O2	2.02	0.60
1:A:164:ILE:HD12	1:A:165:ASN:N	2.19	0.57
2:A:301:CBY:H36	2:A:301:CBY:C35	2.35	0.57
1:B:165:ASN:HB3	1:B:166:PRO:HD2	1.86	0.57
2:A:301:CBY:H36	2:A:301:CBY:H35A	1.89	0.55
1:B:165:ASN:HB2	5:B:411:HOH:O	2.08	0.54
2:B:301:CBY:H36	2:B:301:CBY:H35A	1.88	0.54
4:A:304:GOL:H12	1:B:193:ARG:HD2	1.87	0.52
1:B:256:GLN:OE1	5:B:401:HOH:O	2.18	0.51
1:B:103:LYS:NZ	5:B:407:HOH:O	2.44	0.50
5:A:441:HOH:O	4:B:304:GOL:H32	2.12	0.49
1:B:216:GLY:HA2	5:B:596:HOH:O	2.12	0.49
1:A:103:LYS:HG3	5:A:574:HOH:O	2.10	0.47
1:B:245:GLU:OE1	2:B:301:CBY:H37	2.13	0.47
1:A:164:ILE:O	1:A:165:ASN:C	2.57	0.47
2:B:301:CBY:C20	3:B:302:CYN:C	2.91	0.47
4:A:304:GOL:H11	1:B:193:ARG:CD	2.45	0.46
1:A:238:PRO:HD2	5:A:404:HOH:O	2.15	0.46
1:A:264:GLN:N	1:A:264:GLN:OE1	2.49	0.45
2:B:301:CBY:H13	2:B:301:CBY:H53	1.88	0.45
1:B:248:SER:HB2	1:B:249:PRO:CD	2.47	0.45
2:B:301:CBY:C35	2:B:301:CBY:C36	2.95	0.44
1:B:165:ASN:CB	1:B:166:PRO:CD	2.95	0.43
1:A:156:LYS:NZ	1:A:265:VAL:O	2.45	0.42
1:A:153:LYS:HD3	1:A:153:LYS:HA	1.80	0.42
1:A:197:PRO:HB3	4:A:304:GOL:O2	2.20	0.41
1:A:69:MET:HE2	1:A:69:MET:HB3	1.97	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:201:ARG:HD3	5:A:552:HOH:O	2.21	0.41

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

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
5:A:644:HOH:O	5:A:644:HOH:O[2_454]	1.99	0.21

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	228/290 (79%)	223 (98%)	4 (2%)	1 (0%)	30	12
1	B	227/290 (78%)	219 (96%)	7 (3%)	1 (0%)	30	12
All	All	455/580 (78%)	442 (97%)	11 (2%)	2 (0%)	30	12

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	165	ASN
1	A	90	ALA

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	194/235 (83%)	192 (99%)	2 (1%)	68	45
1	B	193/235 (82%)	190 (98%)	3 (2%)	55	28
All	All	387/470 (82%)	382 (99%)	5 (1%)	61	35

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	262	LEU
1	A	266	ASP
1	B	92	ARG
1	B	182	VAL
1	B	266	ASP

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

Mol	Chain	Res	Type
1	A	142	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

8 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	$\# Z > 2$
3	CYN	B	303	-	0,1,1	-	-	-		
4	GOL	A	303	-	5,5,5	0.70	0	5,5,5	1.81	1 (20%)
4	GOL	A	304	-	5,5,5	0.93	0	5,5,5	1.16	1 (20%)
4	GOL	B	304	-	5,5,5	1.11	1 (20%)	5,5,5	0.51	0
2	CBY	A	301	5	65,75,75	1.11	3 (4%)	106,125,125	1.42	17 (16%)
3	CYN	B	302	-	0,1,1	-	-	-		
3	CYN	A	302	-	0,1,1	-	-	-		
2	CBY	B	301	-	65,75,75	1.09	2 (3%)	106,125,125	1.53	15 (14%)

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
4	GOL	A	303	-	-	0/4/4/4	-
4	GOL	A	304	-	-	2/4/4/4	-
4	GOL	B	304	-	-	4/4/4/4	-
2	CBY	A	301	5	-	5/40/191/191	-
2	CBY	B	301	-	-	6/40/191/191	-

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	301	CBY	C14-N23	6.06	1.46	1.30
2	B	301	CBY	C14-N23	6.04	1.46	1.30
2	B	301	CBY	C9-N22	3.18	1.38	1.30
4	B	304	GOL	O3-C3	2.16	1.51	1.42
2	A	301	CBY	C16-C15	-2.10	1.33	1.42
2	A	301	CBY	C9-N22	2.01	1.35	1.30

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	301	CBY	C19-C1-N21	6.72	110.20	101.67
2	B	301	CBY	C20-C1-N21	-5.35	101.49	110.27
2	A	301	CBY	C19-C1-N21	4.54	107.44	101.67

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	301	CBY	C20-C1-N21	-4.11	103.53	110.27
2	A	301	CBY	C11-N23-C14	-3.99	104.80	106.31
4	A	303	GOL	C3-C2-C1	-3.70	97.31	111.70
2	A	301	CBY	C17-C16-C15	3.64	132.26	126.73
2	B	301	CBY	C54-C17-C55	3.61	115.20	109.25
2	B	301	CBY	C55-C17-C18	-3.06	105.23	111.15
2	B	301	CBY	C1-C2-C3	3.04	105.47	101.60
2	B	301	CBY	C17-C16-C15	3.01	131.31	126.73
2	B	301	CBY	C7-C6-C5	-2.95	123.42	128.07
2	A	301	CBY	C17-C16-N24	-2.81	106.14	110.87
2	A	301	CBY	C1-C2-C3	2.80	105.17	101.60
2	A	301	CBY	C7-C6-C5	-2.79	123.68	128.07
2	B	301	CBY	C48-C13-C12	-2.72	108.99	116.63
2	A	301	CBY	C18-C17-C16	2.64	104.56	100.33
2	B	301	CBY	C12-C11-N23	-2.63	108.64	111.48
2	B	301	CBY	C12-C11-C10	2.62	125.93	123.54
2	B	301	CBY	C31-C30-C3	-2.62	107.17	114.73
2	B	301	CBY	C41-C8-C9	-2.30	107.13	111.19
2	A	301	CBY	C5-C6-N22	2.27	127.34	123.88
2	A	301	CBY	C20-C1-C2	-2.24	109.55	113.28
2	B	301	CBY	C17-C16-N24	-2.23	107.11	110.87
2	A	301	CBY	C56-C57-N59	-2.18	112.75	116.42
2	B	301	CBY	C11-N23-C14	-2.17	105.49	106.31
2	A	301	CBY	C7-C37-C38	2.13	120.66	114.25
2	A	301	CBY	C48-C13-C12	-2.06	110.85	116.63
2	B	301	CBY	C5-C6-N22	2.06	127.02	123.88
2	A	301	CBY	C48-C13-C14	2.06	114.42	109.63
2	A	301	CBY	C55-C17-C18	-2.05	107.18	111.15
2	A	301	CBY	C1-C19-C18	-2.05	118.78	121.81
2	A	301	CBY	C35-C5-C6	2.03	125.66	122.43
4	A	304	GOL	O3-C3-C2	2.00	119.81	110.20

There are no chirality outliers.

All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	301	CBY	N59-C71-C72-O8
2	B	301	CBY	N59-C71-C72-C73
2	B	301	CBY	N59-C71-C72-O8
4	B	304	GOL	O1-C1-C2-O2
4	B	304	GOL	O1-C1-C2-C3
4	B	304	GOL	C1-C2-C3-O3

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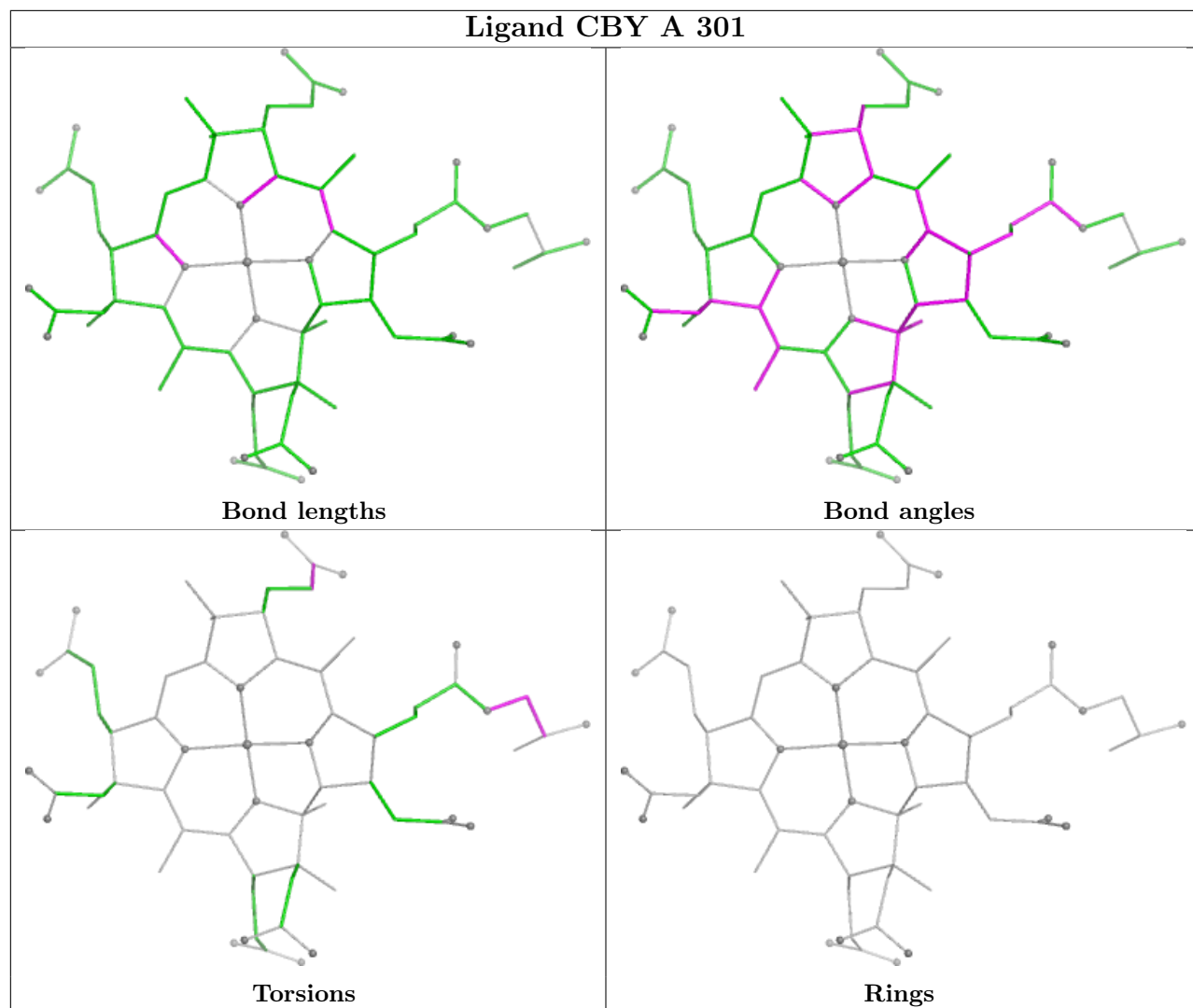
Mol	Chain	Res	Type	Atoms
4	B	304	GOL	O2-C2-C3-O3
2	B	301	CBY	C48-C49-C50-O51
2	A	301	CBY	N59-C71-C72-C73
2	B	301	CBY	C48-C49-C50-N52
4	A	304	GOL	O1-C1-C2-C3
2	A	301	CBY	C48-C49-C50-O51
4	A	304	GOL	O1-C1-C2-O2
2	A	301	CBY	C48-C49-C50-N52
2	B	301	CBY	C55-C56-C57-O58
2	A	301	CBY	C72-C71-N59-C57
2	B	301	CBY	C55-C56-C57-N59

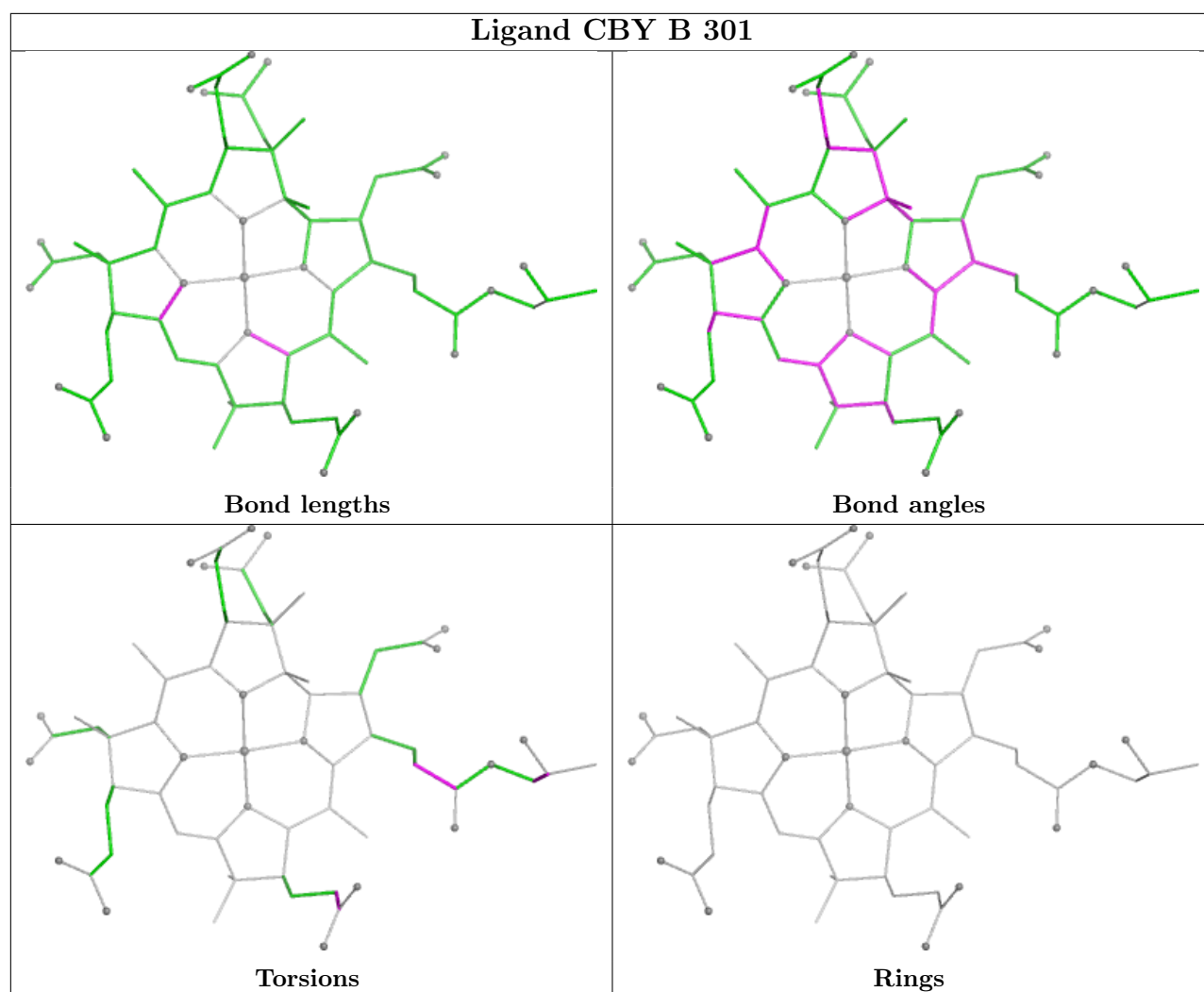
There are no ring outliers.

6 monomers are involved in 19 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	304	GOL	8	0
4	B	304	GOL	1	0
2	A	301	CBY	3	0
3	B	302	CYN	2	0
3	A	302	CYN	1	0
2	B	301	CBY	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	229/290 (78%)	0.32	11 (4%) 35 39	10, 26, 57, 93	3 (1%)
1	B	229/290 (78%)	0.26	13 (5%) 29 32	15, 27, 53, 98	2 (0%)
All	All	458/580 (78%)	0.29	24 (5%) 33 35	10, 27, 57, 98	5 (1%)

All (24) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	89	ASN	4.5
1	B	164	ILE	4.1
1	A	22	ALA	4.0
1	A	89	ASN	3.9
1	A	90	ALA	3.0
1	A	234	ILE	3.0
1	B	216	GLY	2.9
1	A	265	VAL	2.7
1	A	216	GLY	2.7
1	B	265	VAL	2.7
1	A	87	GLY	2.6
1	B	234	ILE	2.6
1	A	233	LYS	2.5
1	B	90	ALA	2.5
1	A	130	ASP	2.5
1	B	134	GLN	2.5
1	A	266	ASP	2.5
1	B	165	ASN	2.4
1	B	22	ALA	2.4
1	B	266	ASP	2.3
1	A	165	ASN	2.3
1	B	215	THR	2.3
1	B	66	TRP	2.1
1	B	214	ILE	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 oligosaccharides in this entry.

6.4 Ligands ⓘ

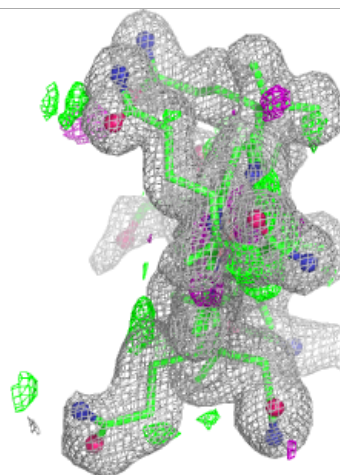
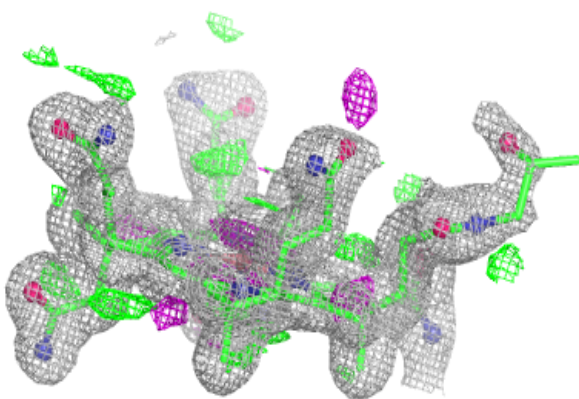
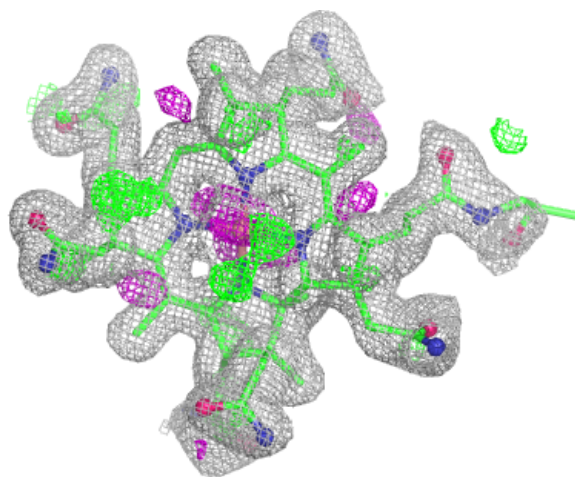
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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	B	304	6/6	0.72	0.15	34,40,42,45	0
4	GOL	A	304	6/6	0.80	0.17	41,45,46,66	0
3	CYN	B	302	2/2	0.85	0.14	21,21,21,25	2
4	GOL	A	303	6/6	0.90	0.10	27,36,37,38	0
3	CYN	B	303	2/2	0.92	0.10	12,12,12,18	1
3	CYN	A	302	2/2	0.94	0.10	30,30,30,30	0
2	CBY	B	301	68/68	0.96	0.09	19,26,58,78	0
2	CBY	A	301	68/68	0.97	0.08	16,24,54,84	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.

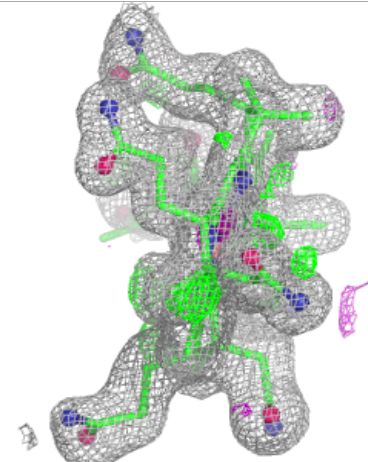
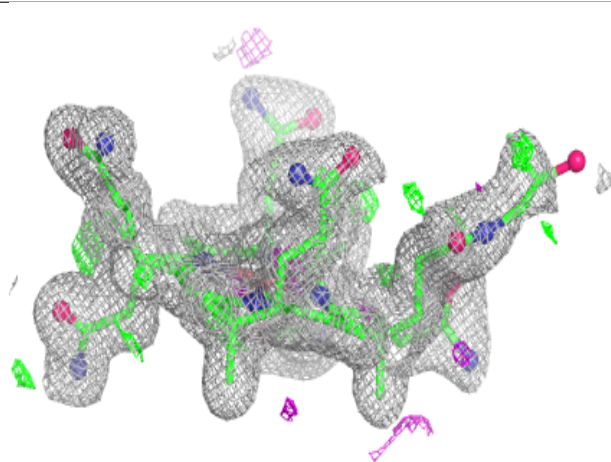
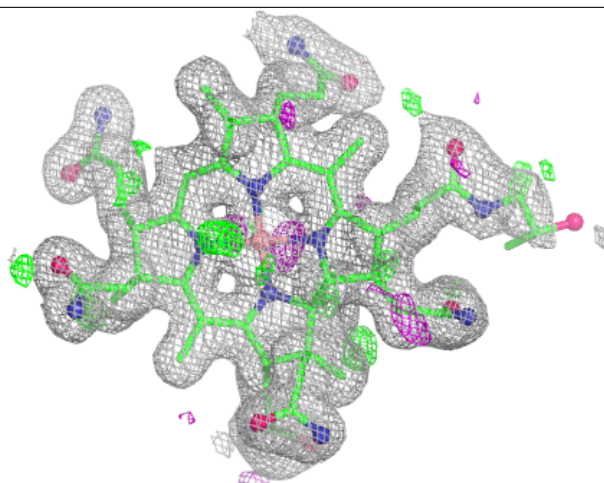
Electron density around CBY B 301:

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



Electron density around CBY A 301:

$2mF_o-DF_c$ (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.