



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 04:50 AM UTC

PDB ID : 2R45 / pdb_00002r45
Title : Crystal structure of Escherichia coli Glycerol-3-phosphate Dehydrogenase in complex with 2-phospho-d-glyceric acid
Authors : Yeh, J.I.; Du, S.; Chinte, U.
Deposited on : 2007-08-30
Resolution : 2.30 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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

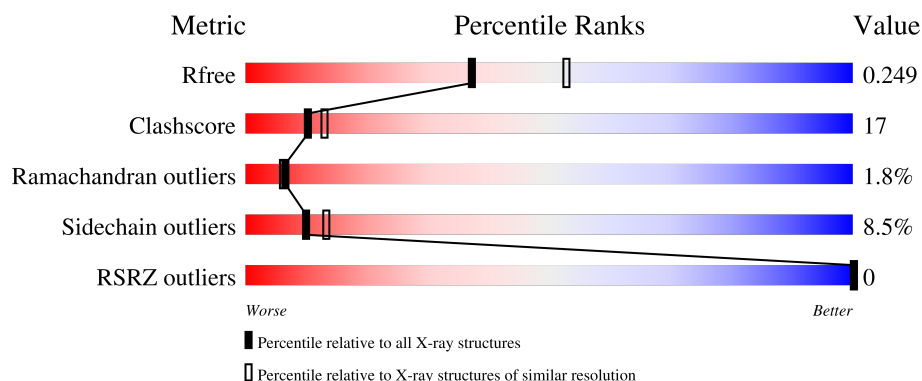
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	501	 67% 27% 6% ..
1	B	501	 69% 23% 6% 2% ..

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
8	2PG	A	700	X	X	X	-
8	2PG	B	700	X	-	X	-

2 Entry composition [i](#)

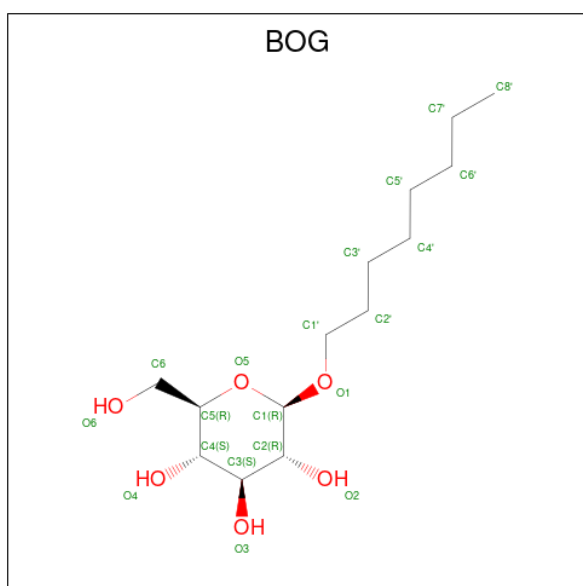
There are 9 unique types of molecules in this entry. The entry contains 8627 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Aerobic glycerol-3-phosphate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	495	Total	C	N	O	S	0	0	0
			3962	2515	705	729	13			
1	B	495	Total	C	N	O	S	0	0	0
			3962	2515	705	729	13			

- Molecule 2 is octyl beta-D-glucopyranoside (CCD ID: BOG) (formula: $C_{14}H_{28}O_6$).



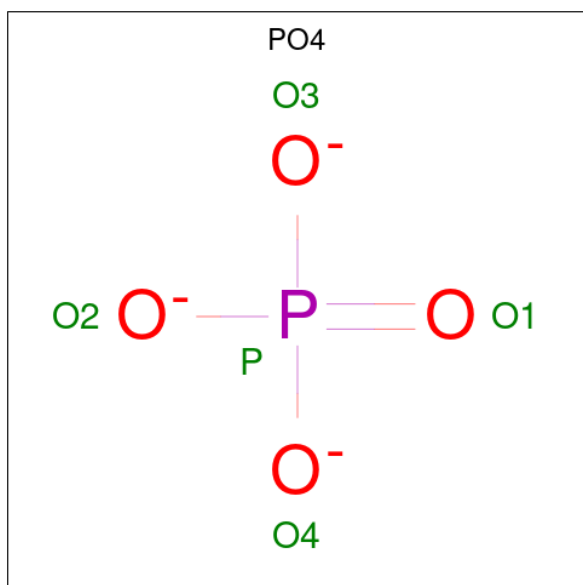
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			20	14	6		
2	A	1	Total	C	O	0	0
			20	14	6		
2	A	1	Total	C	O	0	0
			20	14	6		
2	A	1	Total	C	O	0	0
			20	14	6		

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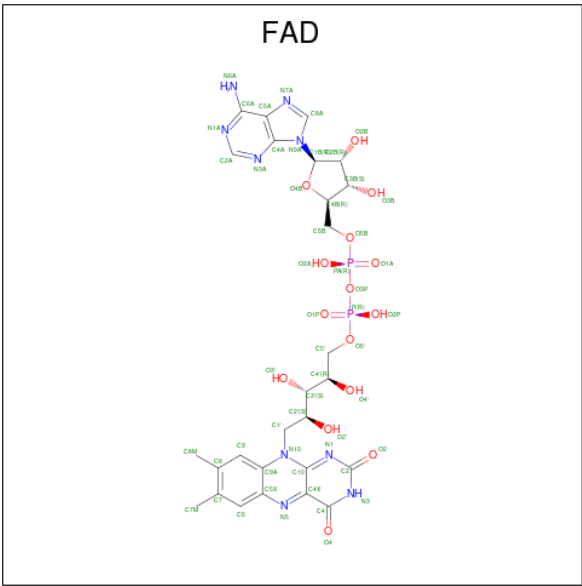
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total	C	O	0	0
			20	14	6		
2	B	1	Total	C	O	0	0
			20	14	6		

- Molecule 3 is PHOSPHATE ION (CCD ID: PO4) (formula: O₄P).



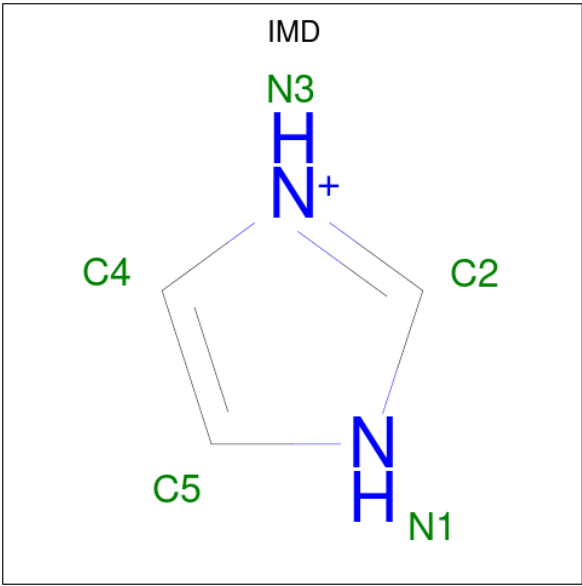
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	P	0	0
			5	4	1		
3	A	1	Total	O	P	0	0
			5	4	1		
3	A	1	Total	O	P	0	0
			5	4	1		
3	A	1	Total	O	P	0	0
			5	4	1		
3	B	1	Total	O	P	0	0
			5	4	1		
3	B	1	Total	O	P	0	0
			5	4	1		
3	B	1	Total	O	P	0	0
			5	4	1		

- Molecule 4 is FLAVIN-ADENINE DINUCLEOTIDE (CCD ID: FAD) (formula: $C_{27}H_{33}N_9O_{15}P_2$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
4	A	1	Total 53	C 27	N 9	O 15	P 2	0	0
4	B	1	Total 53	C 27	N 9	O 15	P 2	0	0

- Molecule 5 is IMIDAZOLE (CCD ID: IMD) (formula: $C_3H_5N_2$).



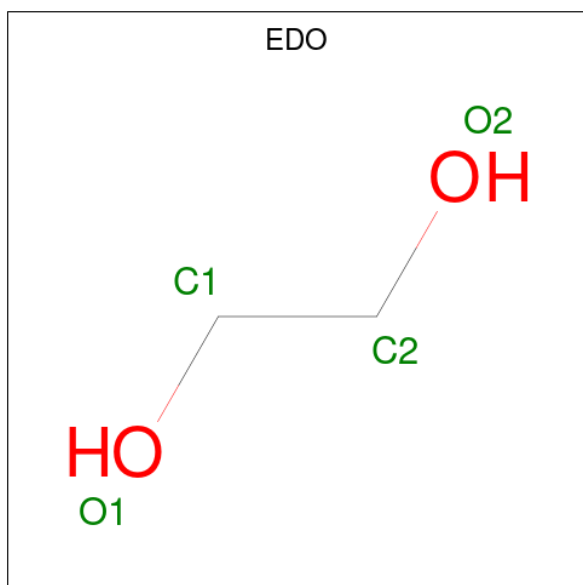
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	N	0	0
			5	3	2		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total	C	N	0	0
			5	3	2		
5	B	1	Total	C	N	0	0
			5	3	2		

- Molecule 6 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



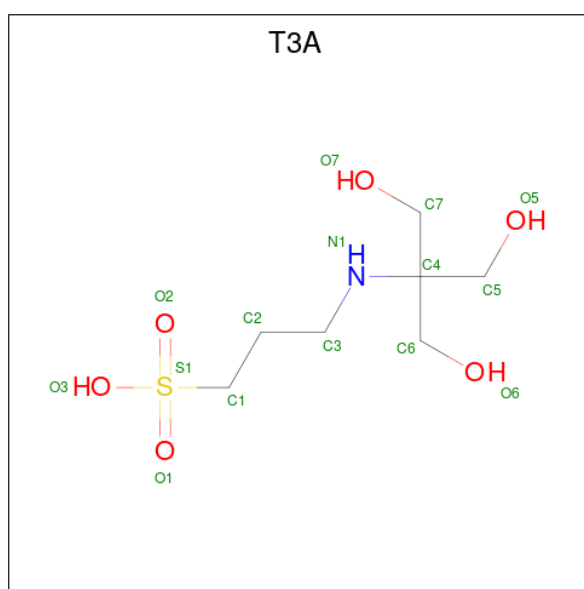
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	1	Total	C	O	0	0
			4	2	2		
6	A	1	Total	C	O	0	0
			4	2	2		
6	A	1	Total	C	O	0	0
			4	2	2		
6	A	1	Total	C	O	0	0
			4	2	2		
6	A	1	Total	C	O	0	0
			4	2	2		
6	B	1	Total	C	O	0	0
			4	2	2		
6	B	1	Total	C	O	0	0
			4	2	2		

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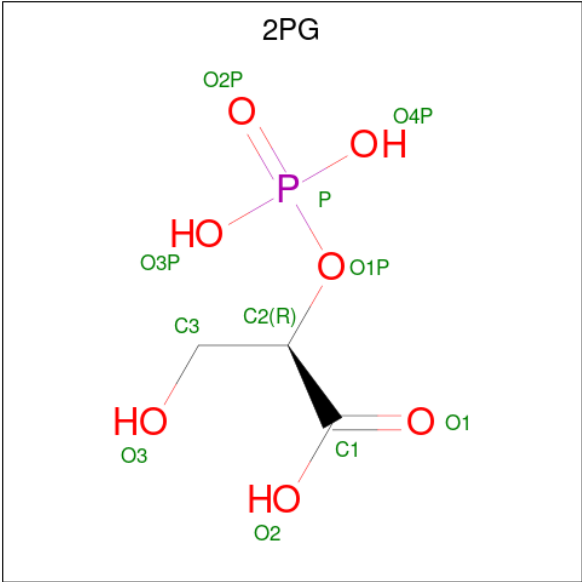
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	B	1	Total	C	O	0	0
			4	2	2		
6	B	1	Total	C	O	0	0
			4	2	2		
6	B	1	Total	C	O	0	0
			4	2	2		
6	B	1	Total	C	O	0	0
			4	2	2		
6	B	1	Total	C	O	0	0
			4	2	2		

- Molecule 7 is N-(TRIS(HYDROXYMETHYL)METHYL)-3-AMINOPROPANESULFONIC ACID (CCD ID: T3A) (formula: $C_7H_{17}NO_6S$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
7	A	1	Total	C	N	O	S	0	0
			15	7	1	6	1		
7	B	1	Total	C	N	O	S	0	0
			15	7	1	6	1		

- Molecule 8 is 2-PHOSPHOGLYCERIC ACID (CCD ID: 2PG) (formula: $C_3H_7O_7P$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	A	1	Total	C	O	P	0	0
			11	3	7	1		
8	B	1	Total	C	O	P	0	0
			11	3	7	1		

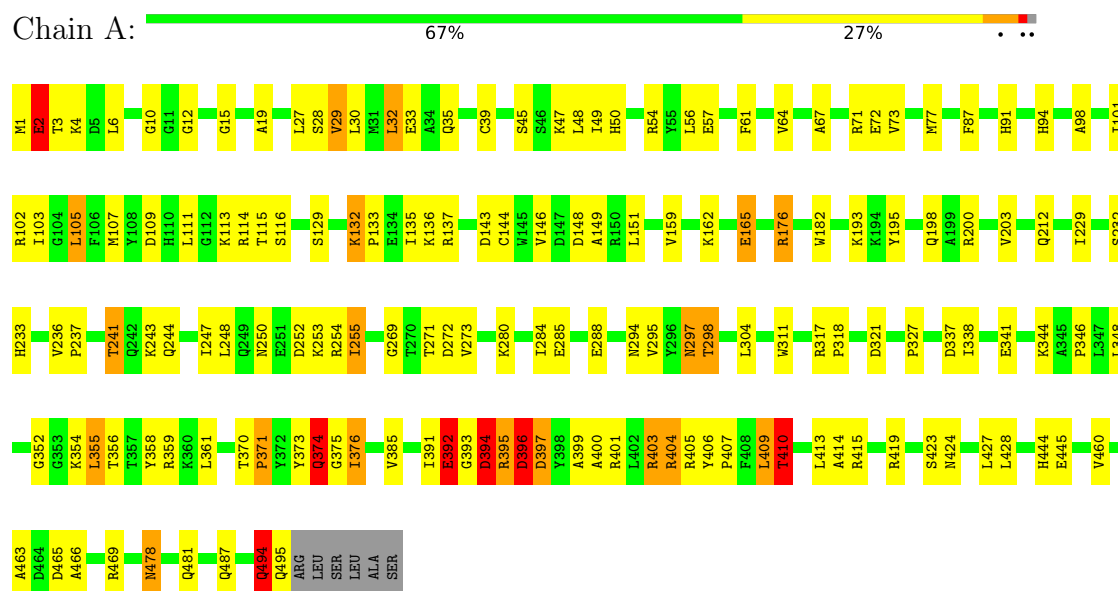
- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	152	Total	O	0	0
			152	152		
9	B	153	Total	O	0	0
			153	153		

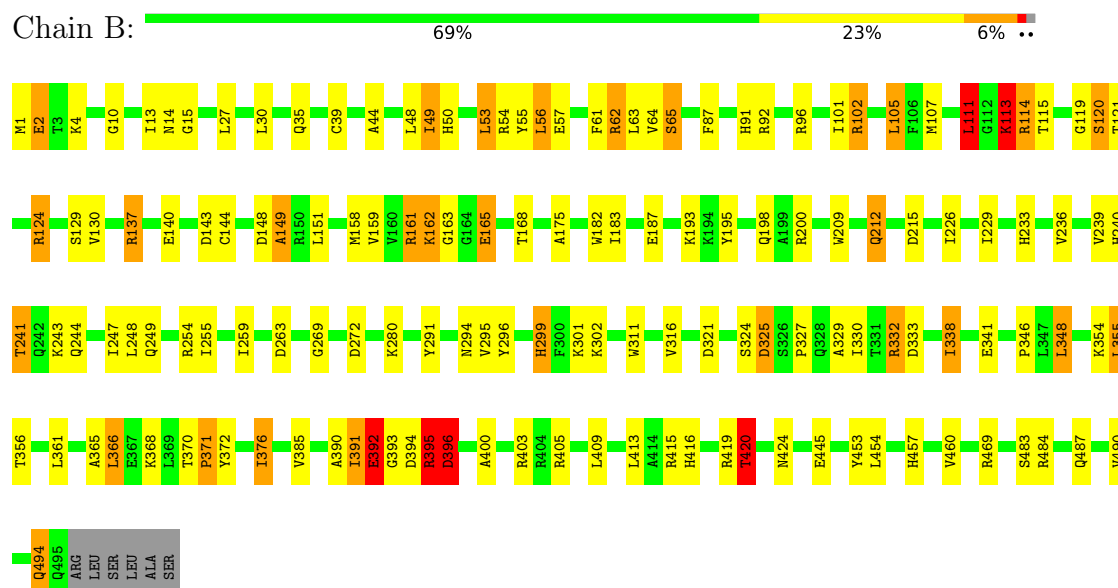
3 Residue-property plots

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

• Molecule 1: Aerobic glycerol-3-phosphate dehydrogenase



• Molecule 1: Aerobic glycerol-3-phosphate dehydrogenase



4 Data and refinement statistics

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α , β , γ	113.74Å 113.91Å 193.07Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	10.00 – 2.30 10.00 – 2.30	Depositor EDS
% Data completeness (in resolution range)	98.5 (10.00-2.30) 98.1 (10.00-2.30)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.39 (at 2.31Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.190 , 0.270 0.186 , 0.249	Depositor DCC
R_{free} test set	2754 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	37.2	Xtriage
Anisotropy	0.051	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 19.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.478 for k,h,-l	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	8627	wwPDB-VP
Average B, all atoms (Å ²)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.75% 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: FAD, 2PG, IMD, PO4, BOG, T3A, EDO

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	1.45	18/4057 (0.4%)	1.30	15/5494 (0.3%)
1	B	1.47	18/4057 (0.4%)	1.29	19/5494 (0.3%)
All	All	1.46	36/8114 (0.4%)	1.29	34/10988 (0.3%)

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	3
1	B	0	1
All	All	0	4

The worst 5 of 36 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	35	GLN	CA-C	12.82	1.58	1.52
1	B	259	ILE	CA-CB	9.10	1.61	1.54
1	A	295	VAL	CA-CB	-8.05	1.44	1.54
1	A	385	VAL	CA-CB	8.01	1.64	1.54
1	B	391	ILE	CA-CB	7.91	1.64	1.54

The worst 5 of 34 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	132	LYS	CA-C-N	8.48	130.45	119.84
1	A	132	LYS	C-N-CA	8.48	130.45	119.84
1	B	420	THR	CB-CA-C	7.67	122.70	111.65
1	B	236	VAL	CA-C-N	-7.65	111.90	119.78

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	236	VAL	C-N-CA	-7.65	111.90	119.78

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	373	TYR	Peptide
1	A	391	ILE	Peptide
1	A	394	ASP	Peptide
1	B	391	ILE	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	3962	0	3911	139	0
1	B	3962	0	3911	137	0
2	A	80	0	112	13	0
2	B	40	0	56	7	0
3	A	25	0	0	2	0
3	B	20	0	0	1	0
4	A	53	0	29	7	0
4	B	53	0	31	2	0
5	A	10	0	10	2	0
5	B	5	0	5	0	0
6	A	28	0	42	10	0
6	B	32	0	48	6	0
7	A	15	0	16	0	0
7	B	15	0	16	1	0
8	A	11	0	4	4	0
8	B	11	0	4	4	0
9	A	152	0	0	11	0
9	B	153	0	0	6	0
All	All	8627	0	8195	282	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 17.

The worst 5 of 282 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:494:GLN:CB	1:A:495:GLN:HB2	1.55	1.34
1:B:13:ILE:HG12	1:B:355:LEU:HD12	1.22	1.14
1:A:1:MET:HA	1:A:3:THR:H	1.08	1.13
1:B:119:GLY:O	1:B:120:SER:HB3	1.44	1.08
1:A:54:ARG:HA	2:A:900:BOG:H61	1.36	1.07

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	493/501 (98%)	457 (93%)	26 (5%)	10 (2%)	6	5
1	B	493/501 (98%)	450 (91%)	35 (7%)	8 (2%)	7	7
All	All	986/1002 (98%)	907 (92%)	61 (6%)	18 (2%)	6	6

5 of 18 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	2	GLU
1	A	392	GLU
1	B	325	ASP
1	A	321	ASP
1	A	374	GLN

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	414/419 (99%)	385 (93%)	29 (7%)	14	19
1	B	414/419 (99%)	373 (90%)	41 (10%)	7	9
All	All	828/838 (99%)	758 (92%)	70 (8%)	10	13

5 of 70 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	332	ARG
1	B	341	GLU
1	B	396	ASP
1	A	404	ARG
1	A	403	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 26 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	50	HIS
1	B	155	ASN
1	B	494	GLN
1	B	110	HIS
1	B	212	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

39 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$
6	EDO	B	910	-	3,3,3	1.09	0	2,2,2	0.31	0
8	2PG	A	700	-	9,10,10	3.01	5 (55%)	12,14,14	3.61	5 (41%)
3	PO4	B	902	-	4,4,4	0.89	0	6,6,6	0.76	0
7	T3A	A	7066	-	14,14,14	2.37	2 (14%)	19,19,19	2.13	8 (42%)
3	PO4	A	1952	-	4,4,4	0.53	0	6,6,6	0.98	0
2	BOG	A	800	-	20,20,20	0.47	0	25,25,25	0.58	0
6	EDO	A	1960	-	3,3,3	0.62	0	2,2,2	0.21	0
6	EDO	B	907	-	3,3,3	0.56	0	2,2,2	0.38	0
6	EDO	A	1963	-	3,3,3	0.81	0	2,2,2	0.54	0
3	PO4	A	1953	-	4,4,4	0.77	0	6,6,6	0.60	0
3	PO4	B	903	-	4,4,4	1.24	1 (25%)	6,6,6	1.09	0
6	EDO	A	7067	-	3,3,3	0.87	0	2,2,2	0.08	0
6	EDO	B	906	-	3,3,3	0.80	0	2,2,2	0.72	0
6	EDO	A	1957	-	3,3,3	0.40	0	2,2,2	0.71	0
6	EDO	A	1961	-	3,3,3	0.37	0	2,2,2	0.81	0
2	BOG	A	1950	-	20,20,20	1.11	1 (5%)	25,25,25	1.55	5 (20%)
6	EDO	B	911	-	3,3,3	0.67	0	2,2,2	0.23	0
6	EDO	B	909	-	3,3,3	0.49	0	2,2,2	0.30	0
2	BOG	B	900	-	20,20,20	0.77	1 (5%)	25,25,25	1.69	6 (24%)
2	BOG	B	800	-	20,20,20	0.46	0	25,25,25	0.58	0
6	EDO	B	908	-	3,3,3	0.92	0	2,2,2	0.55	0
3	PO4	B	904	-	4,4,4	0.86	0	6,6,6	0.46	0
7	T3A	B	7066	-	14,14,14	2.30	3 (21%)	19,19,19	2.68	11 (57%)
6	EDO	A	1959	-	3,3,3	1.06	0	2,2,2	0.66	0
6	EDO	A	1962	-	3,3,3	0.74	0	2,2,2	0.03	0
4	FAD	B	600	-	58,58,58	1.62	11 (18%)	85,89,89	2.01	24 (28%)
3	PO4	A	1951	-	4,4,4	0.86	0	6,6,6	0.68	0
3	PO4	A	1954	-	4,4,4	0.94	0	6,6,6	0.88	0
5	IMD	A	1956	-	5,5,5	0.90	0	5,5,5	0.66	0
6	EDO	B	7067	-	3,3,3	0.69	0	2,2,2	0.64	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	IMD	A	1958	-	5,5,5	0.76	0	5,5,5	0.63	0
4	FAD	A	600	-	58,58,58	1.17	6 (10%)	85,89,89	1.76	16 (18%)
3	PO4	B	901	-	4,4,4	0.95	0	6,6,6	0.59	0
6	EDO	B	905	-	3,3,3	0.51	0	2,2,2	1.21	0
2	BOG	A	1949	-	20,20,20	1.08	1 (5%)	25,25,25	2.36	9 (36%)
5	IMD	B	912	-	5,5,5	0.94	0	5,5,5	0.36	0
3	PO4	A	1955	-	4,4,4	0.69	0	6,6,6	1.41	1 (16%)
2	BOG	A	900	-	20,20,20	0.80	1 (5%)	25,25,25	1.73	7 (28%)
8	2PG	B	700	-	9,10,10	2.85	4 (44%)	12,14,14	3.05	3 (25%)

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
8	2PG	A	700	-	1/1/3/3	5/11/11/11	-
6	EDO	B	910	-	-	1/1/1/1	-
7	T3A	A	7066	-	-	6/18/18/18	-
2	BOG	A	800	-	-	7/11/31/31	0/1/1/1
6	EDO	A	1960	-	-	1/1/1/1	-
6	EDO	B	907	-	-	1/1/1/1	-
6	EDO	A	1963	-	-	1/1/1/1	-
6	EDO	A	7067	-	-	1/1/1/1	-
6	EDO	B	906	-	-	1/1/1/1	-
6	EDO	A	1957	-	-	1/1/1/1	-
6	EDO	A	1961	-	-	1/1/1/1	-
2	BOG	A	1950	-	-	10/11/31/31	0/1/1/1
6	EDO	B	911	-	-	1/1/1/1	-
6	EDO	B	909	-	-	0/1/1/1	-
2	BOG	B	900	-	-	4/11/31/31	0/1/1/1
2	BOG	B	800	-	-	8/11/31/31	0/1/1/1
6	EDO	B	908	-	-	0/1/1/1	-
7	T3A	B	7066	-	-	3/18/18/18	-
6	EDO	A	1959	-	-	1/1/1/1	-
6	EDO	A	1962	-	-	0/1/1/1	-
4	FAD	B	600	-	-	2/34/50/50	0/6/6/6
5	IMD	A	1956	-	-	-	0/1/1/1
6	EDO	B	7067	-	-	0/1/1/1	-
5	IMD	A	1958	-	-	-	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	FAD	A	600	-	-	5/34/50/50	0/6/6/6
6	EDO	B	905	-	-	0/1/1/1	-
2	BOG	A	1949	-	-	9/11/31/31	0/1/1/1
5	IMD	B	912	-	-	-	0/1/1/1
2	BOG	A	900	-	-	9/11/31/31	0/1/1/1
8	2PG	B	700	-	1/1/3/3	5/11/11/11	-

The worst 5 of 36 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	A	7066	T3A	C1-S1	-7.95	1.66	1.77
7	B	7066	T3A	C1-S1	-7.78	1.66	1.77
8	B	700	2PG	O1-C1	5.23	1.37	1.22
8	A	700	2PG	C2-C1	5.04	1.58	1.52
8	A	700	2PG	O1-C1	4.89	1.36	1.22

The worst 5 of 95 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
8	A	700	2PG	P-O1P-C2	9.67	145.22	123.04
8	B	700	2PG	P-O1P-C2	8.91	143.47	123.04
4	A	600	FAD	O2B-C2B-C3B	7.70	136.50	111.82
4	B	600	FAD	N3A-C2A-N1A	-7.69	116.94	128.58
4	B	600	FAD	O4-C4-N3	-5.51	109.75	120.11

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
8	A	700	2PG	C2
8	B	700	2PG	C2

5 of 83 torsion outliers are listed below:

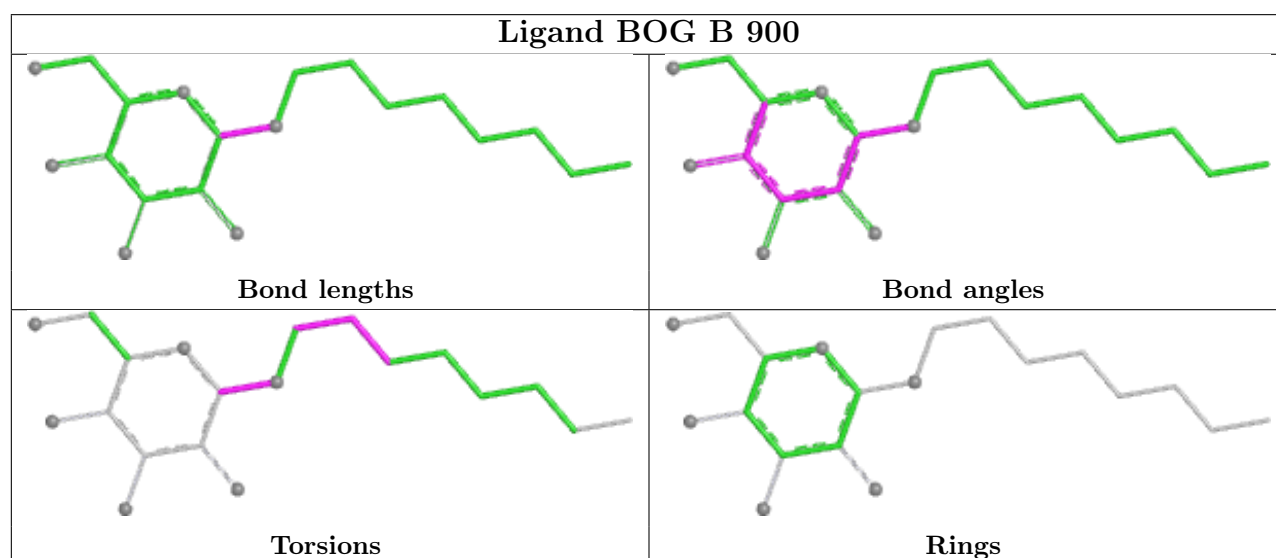
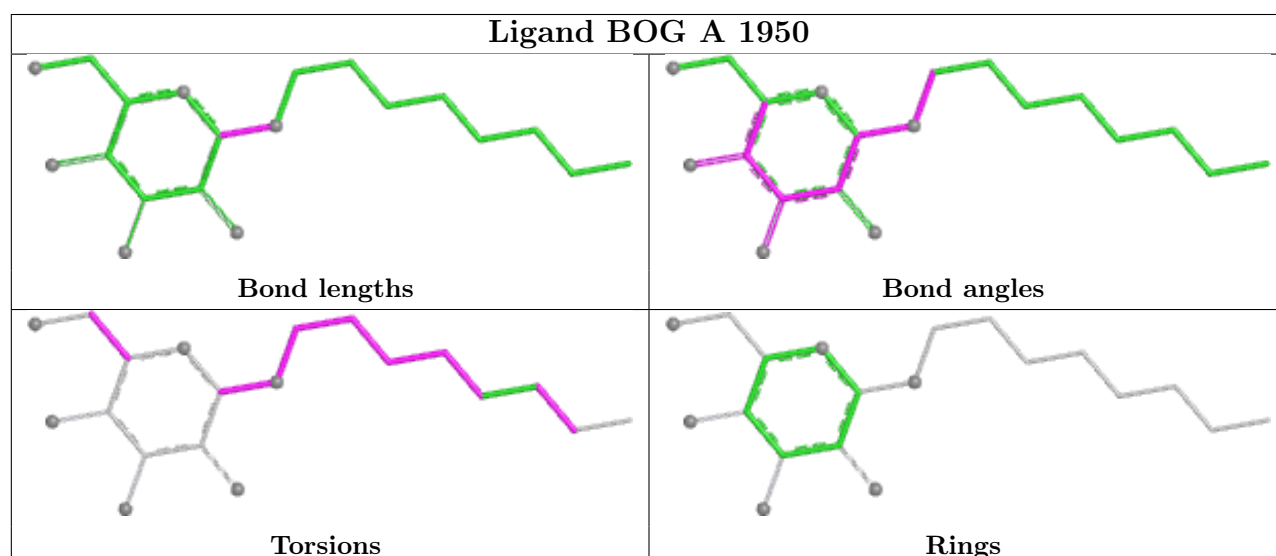
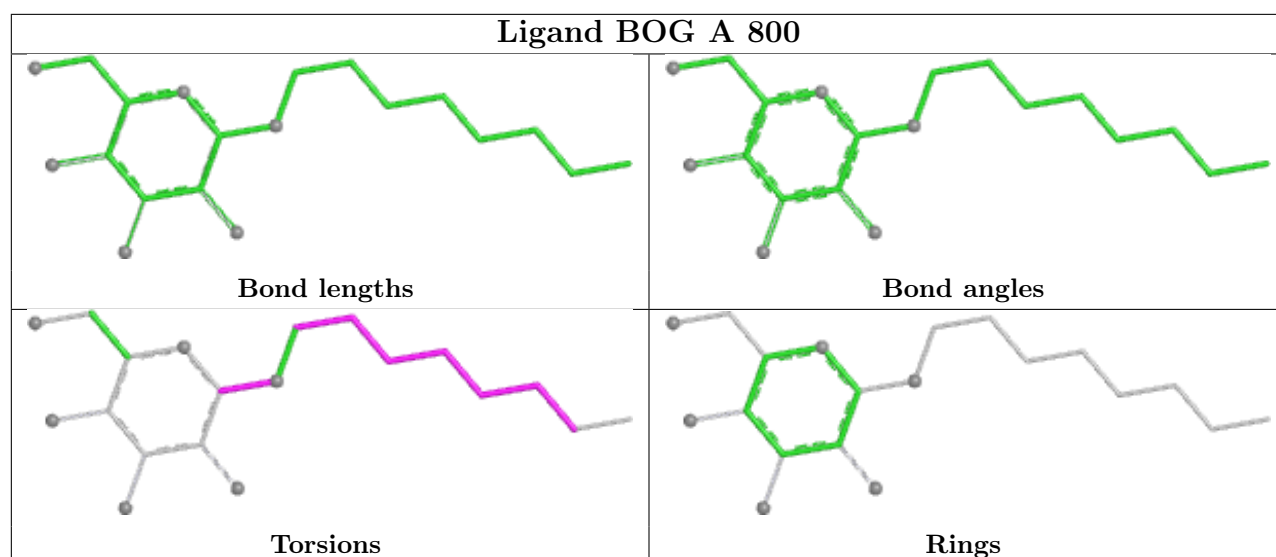
Mol	Chain	Res	Type	Atoms
2	A	900	BOG	C2-C1-O1-C1'
2	A	1950	BOG	O5-C1-O1-C1'
4	A	600	FAD	C5B-O5B-PA-O2A
4	A	600	FAD	C5B-O5B-PA-O3P
7	A	7066	T3A	C6-C4-C5-O5

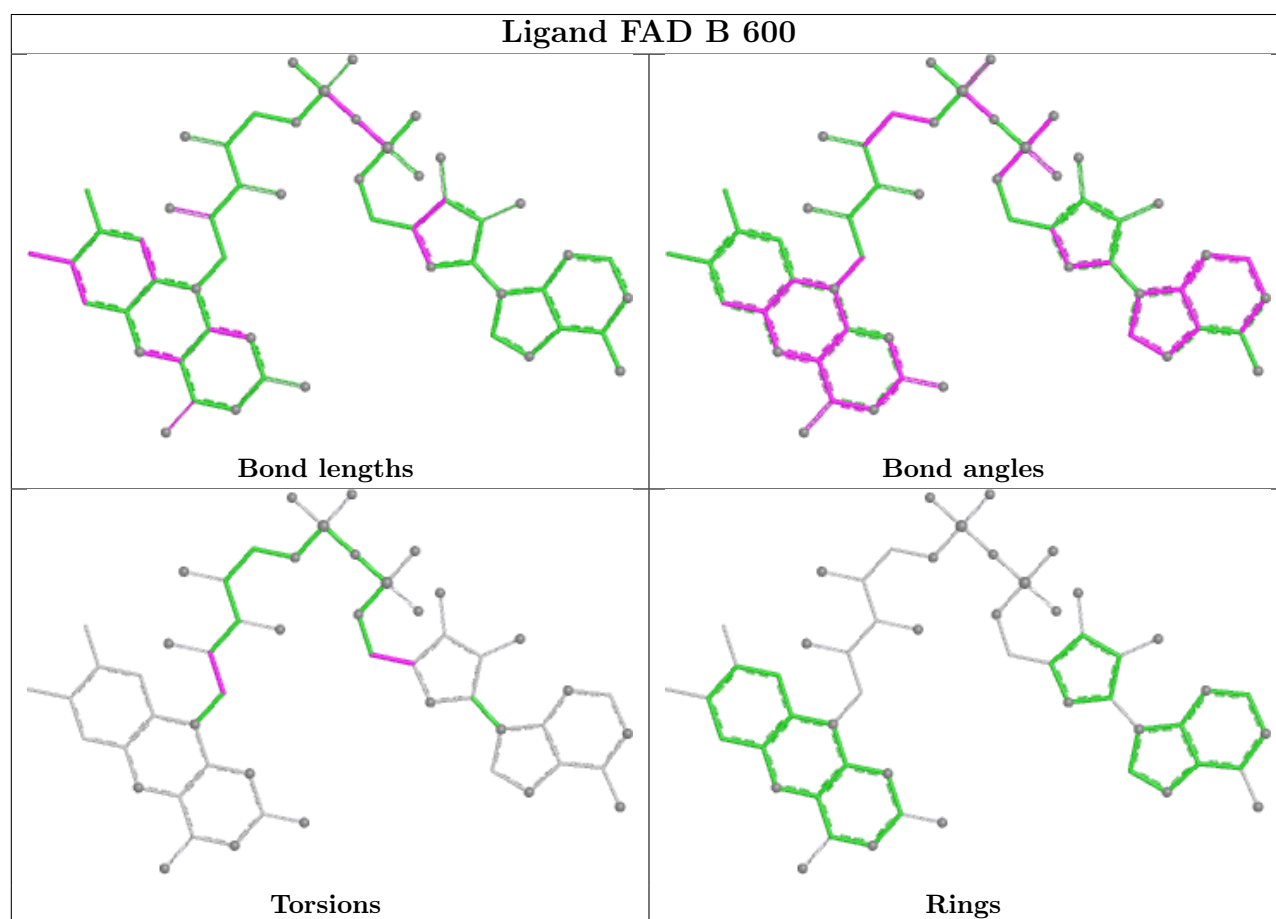
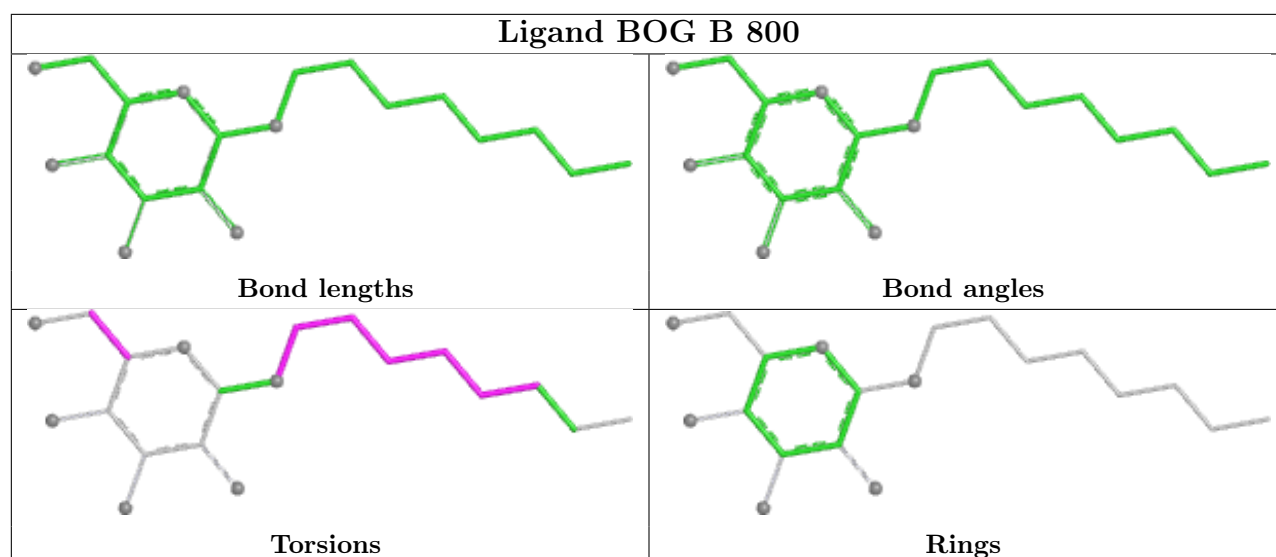
There are no ring outliers.

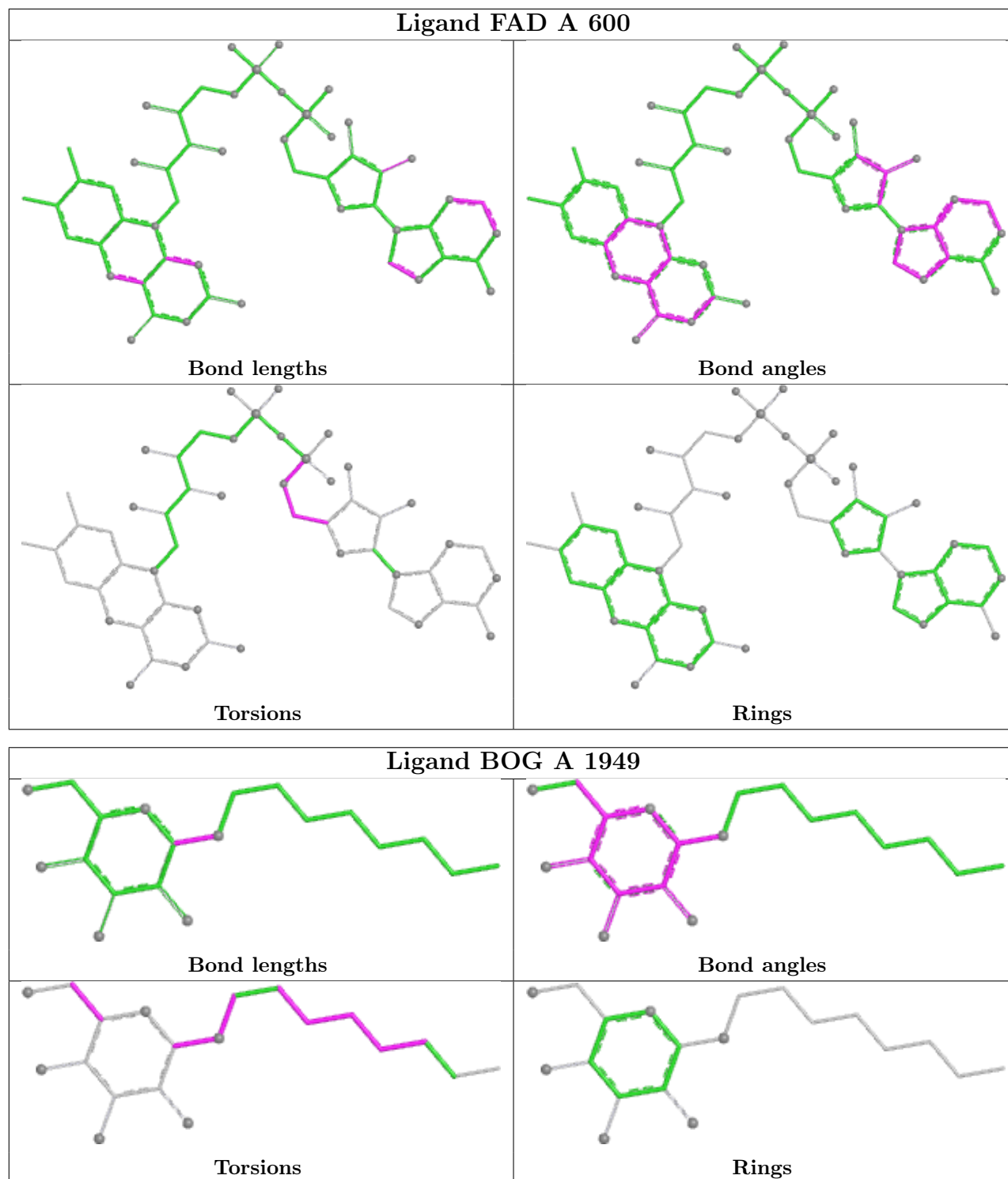
24 monomers are involved in 59 short contacts:

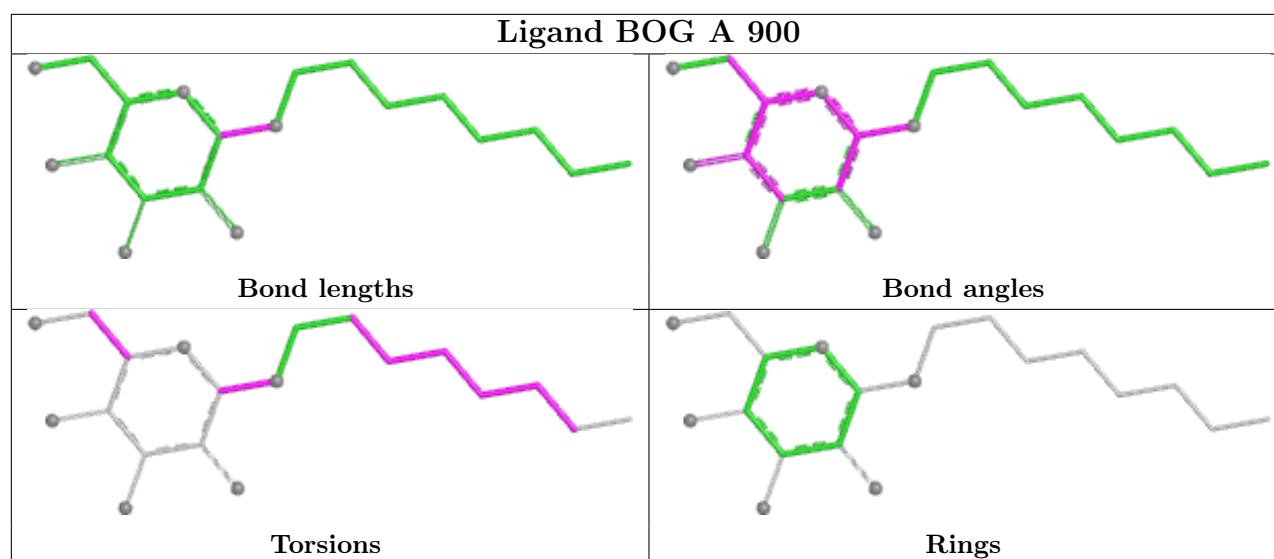
Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	B	910	EDO	2	0
8	A	700	2PG	4	0
2	A	800	BOG	3	0
6	A	1960	EDO	2	0
6	B	907	EDO	1	0
6	A	7067	EDO	1	0
6	A	1957	EDO	2	0
6	A	1961	EDO	2	0
6	B	909	EDO	1	0
2	B	900	BOG	6	0
2	B	800	BOG	1	0
7	B	7066	T3A	1	0
6	A	1959	EDO	1	0
6	A	1962	EDO	2	0
4	B	600	FAD	2	0
3	A	1954	PO4	1	0
5	A	1956	IMD	2	0
6	B	7067	EDO	2	0
4	A	600	FAD	7	0
3	B	901	PO4	1	0
2	A	1949	BOG	5	0
3	A	1955	PO4	1	0
2	A	900	BOG	6	0
8	B	700	2PG	4	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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	495/501 (98%)	-1.68	0 100 100	18, 36, 57, 89	0
1	B	495/501 (98%)	-1.68	0 100 100	18, 36, 57, 87	0
All	All	990/1002 (98%)	-1.68	0 100 100	18, 36, 57, 89	0

There are no RSRZ outliers to report.

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(Å ²)	Q<0.9
2	BOG	A	800	20/20	0.96	0.06	108,112,114,114	0
2	BOG	A	1950	20/20	0.97	0.04	88,91,94,94	0
2	BOG	B	800	20/20	0.97	0.04	101,105,108,108	0
6	EDO	B	910	4/4	0.97	0.05	54,55,55,55	0
2	BOG	B	900	20/20	0.98	0.05	100,105,106,107	0
6	EDO	A	1963	4/4	0.98	0.03	57,58,58,59	0
6	EDO	A	7067	4/4	0.98	0.03	45,47,48,50	0

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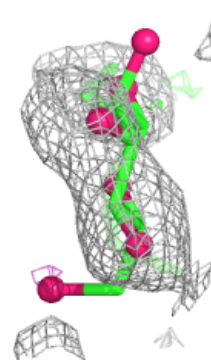
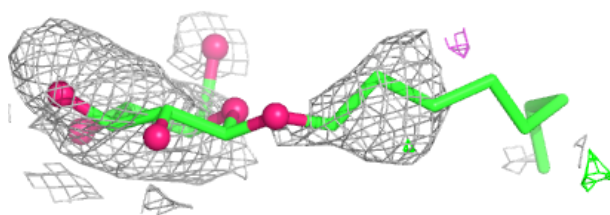
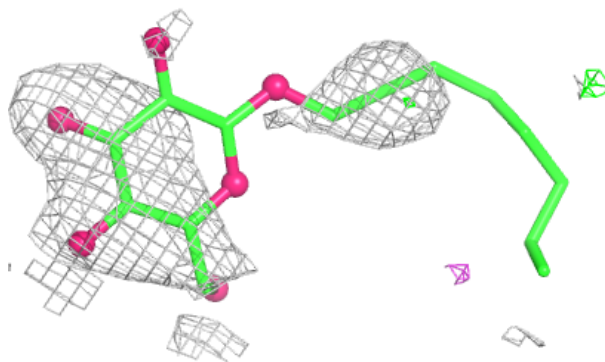
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
6	EDO	B	909	4/4	0.98	0.04	55,57,60,64	0
2	BOG	A	1949	20/20	0.98	0.04	77,93,97,98	0
6	EDO	B	911	4/4	0.98	0.03	53,55,59,59	0
3	PO4	A	1955	5/5	0.99	0.03	77,79,81,82	0
3	PO4	B	901	5/5	0.99	0.04	98,98,98,99	0
3	PO4	B	902	5/5	0.99	0.03	79,81,82,83	0
3	PO4	B	903	5/5	0.99	0.03	54,59,61,61	0
3	PO4	B	904	5/5	0.99	0.02	73,74,78,80	0
5	IMD	A	1956	5/5	0.99	0.03	62,64,65,66	0
5	IMD	A	1958	5/5	0.99	0.04	79,80,81,81	0
5	IMD	B	912	5/5	0.99	0.03	64,65,68,68	0
6	EDO	A	1957	4/4	0.99	0.02	47,50,52,55	0
6	EDO	A	1959	4/4	0.99	0.03	31,39,39,44	0
6	EDO	A	1960	4/4	0.99	0.03	44,46,47,49	0
6	EDO	A	1961	4/4	0.99	0.05	63,65,65,65	0
6	EDO	A	1962	4/4	0.99	0.02	40,41,46,47	0
2	BOG	A	900	20/20	0.99	0.04	89,96,99,100	0
3	PO4	A	1951	5/5	0.99	0.04	83,84,87,87	0
6	EDO	B	905	4/4	0.99	0.03	37,40,44,45	0
6	EDO	B	906	4/4	0.99	0.02	46,48,56,60	0
6	EDO	B	907	4/4	0.99	0.04	53,53,55,55	0
6	EDO	B	908	4/4	0.99	0.03	30,42,45,46	0
3	PO4	A	1952	5/5	0.99	0.05	49,55,56,58	0
3	PO4	A	1953	5/5	0.99	0.02	75,75,76,77	0
3	PO4	A	1954	5/5	0.99	0.03	89,90,90,90	0
6	EDO	B	7067	4/4	0.99	0.03	49,49,49,50	0
7	T3A	A	7066	15/15	0.99	0.03	31,45,50,54	0
4	FAD	B	600	53/53	1.00	0.02	16,22,26,29	0
4	FAD	A	600	53/53	1.00	0.02	14,23,26,35	0
7	T3A	B	7066	15/15	1.00	0.02	30,42,52,53	0
8	2PG	A	700	11/11	1.00	0.03	34,39,48,49	0
8	2PG	B	700	11/11	1.00	0.03	32,42,48,49	0

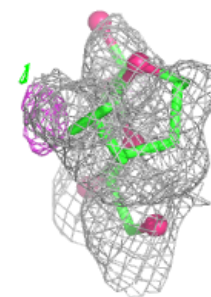
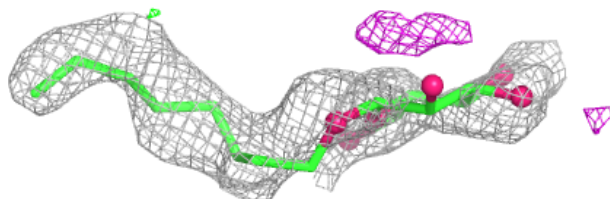
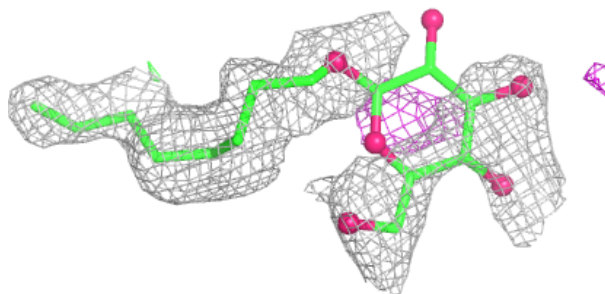
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around BOG A 800:

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

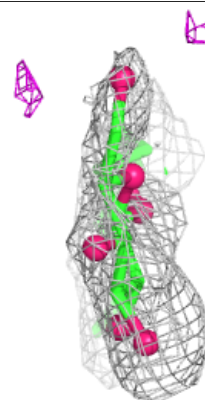
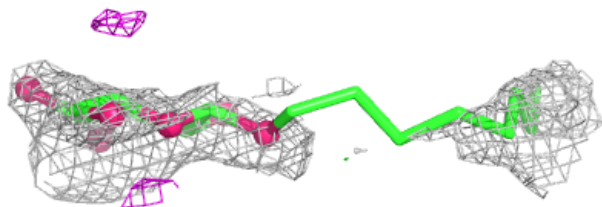
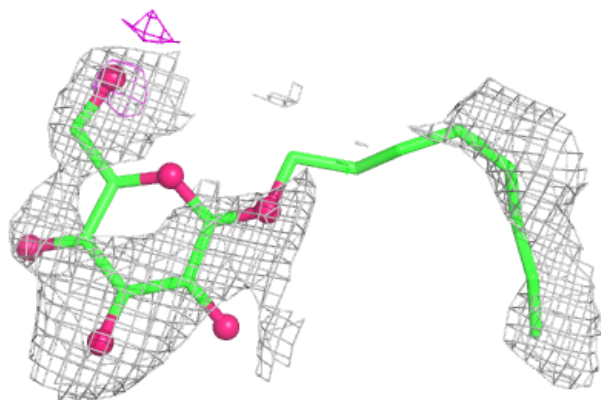
**Electron density around BOG A 1950:**

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

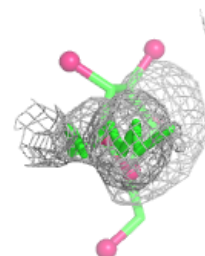
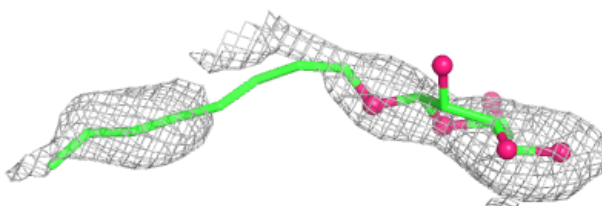
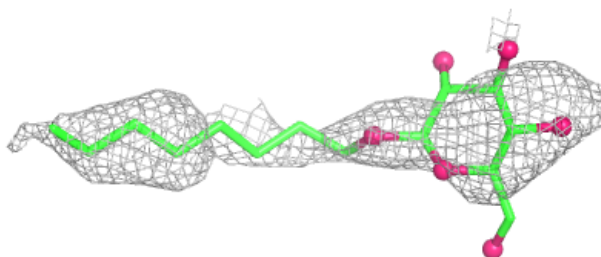


Electron density around BOG B 800:

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

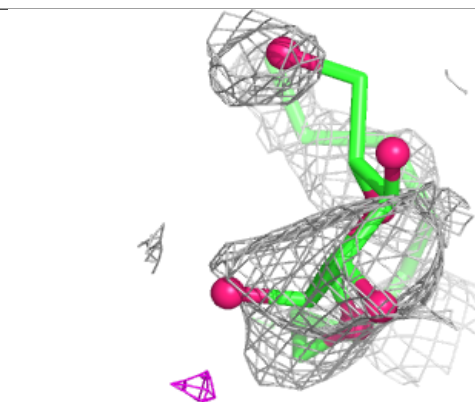
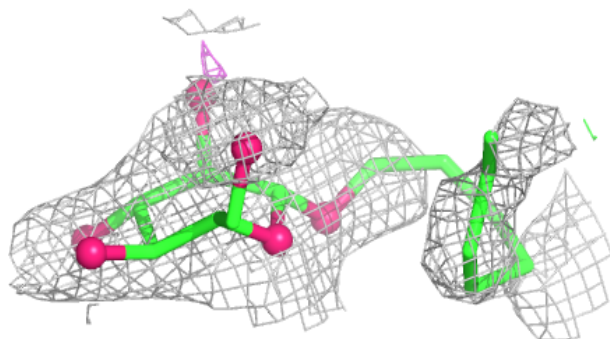
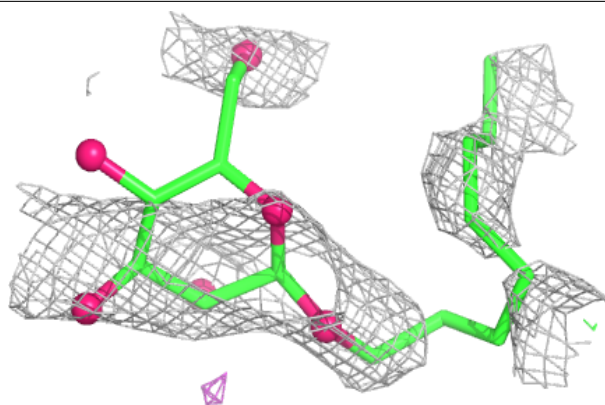
**Electron density around BOG B 900:**

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and green (positive)

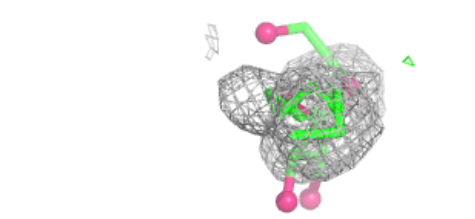
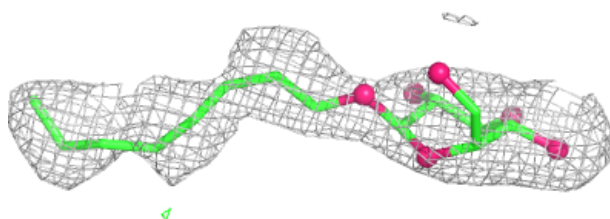
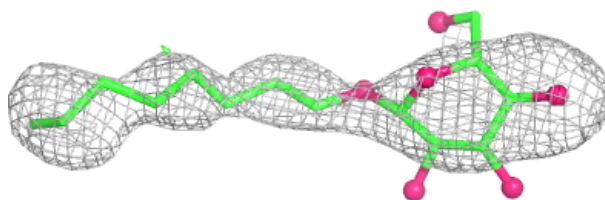


Electron density around BOG A 1949:

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

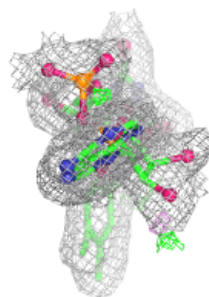
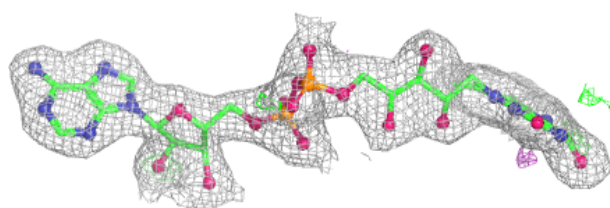
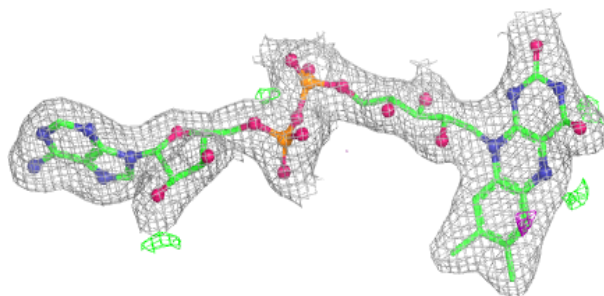
**Electron density around BOG A 900:**

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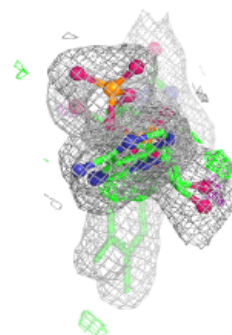
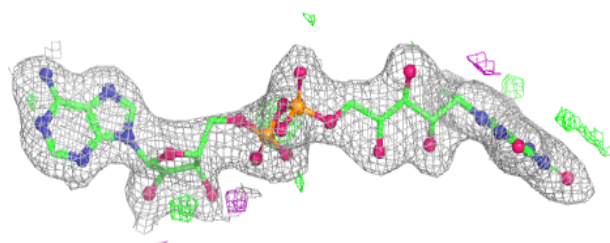
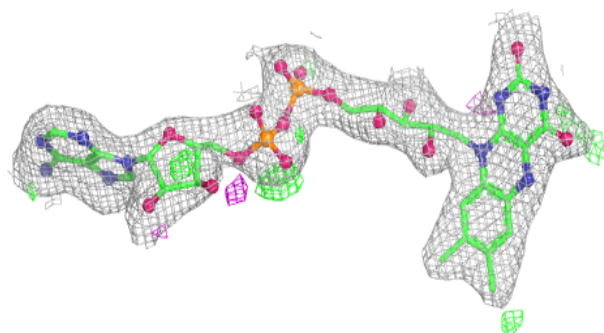


Electron density around FAD B 600:

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

**Electron density around FAD A 600:**

$2mF_o-DF_c$ (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.