WORLDWIDE PDB
PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report (i)

Oct 25, 2023 – 05:30 AM EDT

PDB ID	:	2ZTL
Title	:	Closed conformation of D-3-hydroxybutyrate dehydrogenase complexed with NAD+ and L-3-hydroxybutyrate
Authors	:	Nakashima, K.; Nakajima, Y.; Ito, K.; Yoshimoto, T.
Deposited on	:	2008-10-07
Resolution	:	1.80 Å(reported)

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

|		
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 1.80 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.
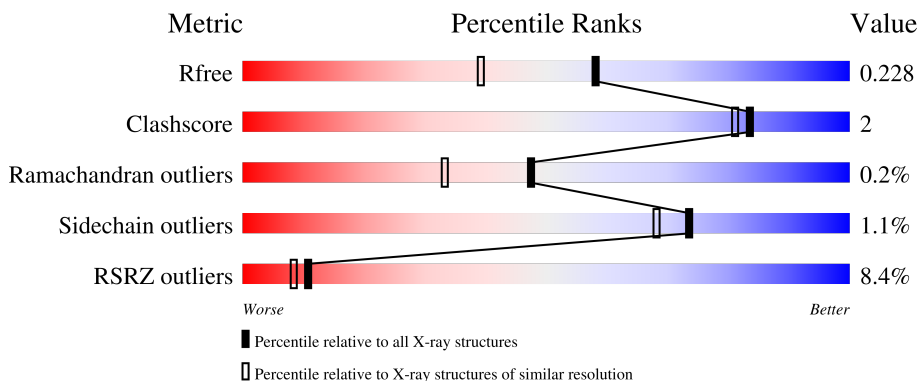
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	5950 (1.80-1.80)
Clashscore	141614	6793 (1.80-1.80)
Ramachandran outliers	138981	6697 (1.80-1.80)
Sidechain outliers	138945	6696 (1.80-1.80)
RSRZ outliers	127900	5850 (1.80-1.80)

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 <=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.

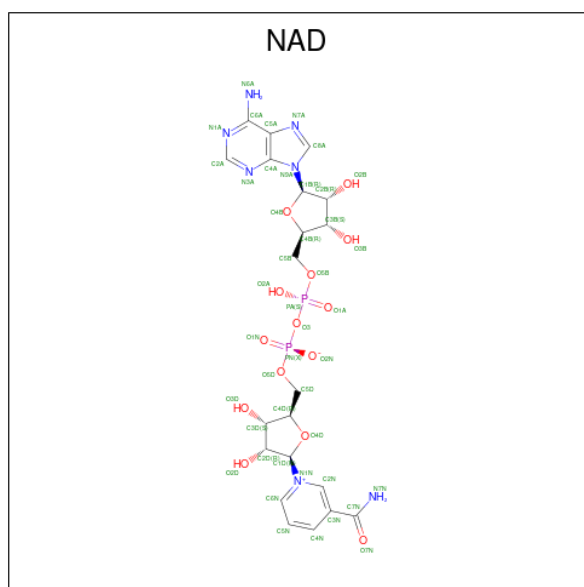| Mol	Chain	Length	Quality of chain
1	A	260	5% / 94% / 6%
1	B	260	18% / 89% / 10% ·
1	C	260	4% / 97% / ·
1	D	260	7% / 94% / 6%

2 Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 8588 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 D(-)-3-hydroxybutyrate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	260	Total	C	N	O	S	0	3	0
			1896	1192	336	364	4			
1	B	260	Total	C	N	O	S	0	0	0
			1864	1171	332	358	3			
1	C	260	Total	C	N	O	S	0	1	0
			1882	1183	334	361	4			
1	D	260	Total	C	N	O	S	0	4	0
			1898	1194	335	365	4			

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	B	1	Total	C	N	O	P	0	0
			44	21	7	14	2		

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	C	1	Total	C	N	O	P	0	0
			44	21	7	14	2		
2	D	1	Total	C	N	O	P	0	0
			44	21	7	14	2		

- Molecule 3 is (3S)-3-HYDROXYBUTANOIC ACID (three-letter code: 3HL) (formula: $C_4H_8O_3$).
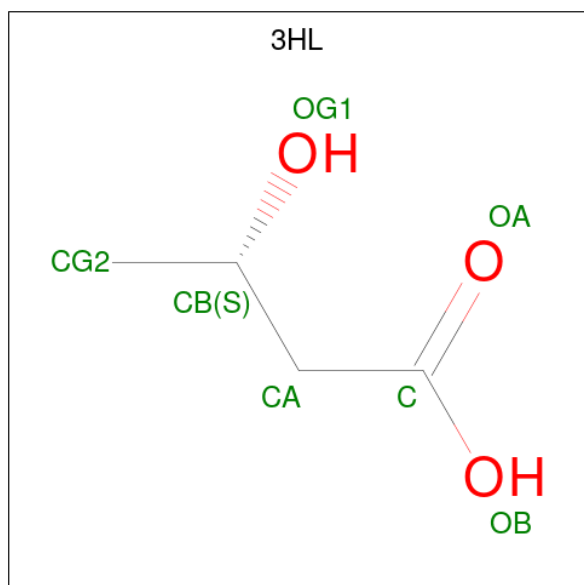
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			7	4	3		
3	B	1	Total	C	O	0	0
			7	4	3		
3	C	1	Total	C	O	0	0
			7	4	3		
3	D	1	Total	C	O	0	0
			7	4	3		

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Mg	0	0
			1	1		
4	B	1	Total	Mg	0	0
			1	1		

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	D	1	Total 6	C 3	O 3	0	0

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	226	Total 226	O 226	0	0
6	B	120	Total 120	O 120	0	0
6	C	254	Total 254	O 254	0	0
6	D	236	Total 236	O 236	0	0

3 Residue-property plots ⓘ

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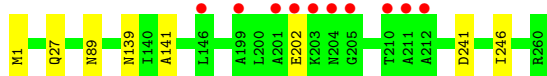
- Molecule 1: D(-)-3-hydroxybutyrate dehydrogenase
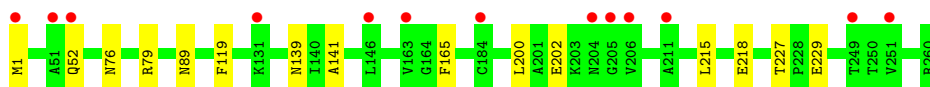
Chain A:

- Molecule 1: D(-)-3-hydroxybutyrate dehydrogenase

Chain B:

- Molecule 1: D(-)-3-hydroxybutyrate dehydrogenase

Chain C:

- Molecule 1: D(-)-3-hydroxybutyrate dehydrogenase

Chain D:
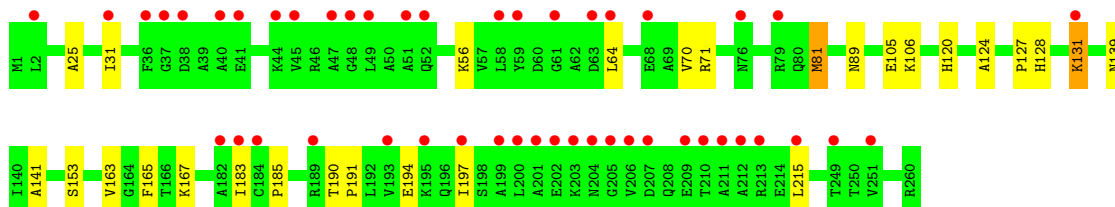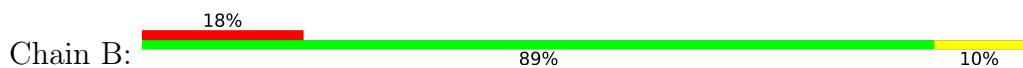
4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	74.02Å 106.38Å 165.17Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.80 44.72 – 1.80	Depositor EDS
% Data completeness (in resolution range)	99.6 (20.00-1.80) 99.4 (44.72-1.80)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	5.48 (at 1.79Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.198 , 0.229 0.198 , 0.228	Depositor DCC
R_{free} test set	6101 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å^2)	20.9	Xtriage
Anisotropy	0.309	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 50.1	EDS
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	8588	wwPDB-VP
Average B, all atoms (Å^2)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.45% of the height of the origin peak. No significant pseudotranslation is detected.*

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[1]Intensities estimated from amplitudes.
[2]Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: MG, GOL, NAD, 3HL

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	0.69	0/1931	0.67	0/2619
1	B	0.58	0/1890	0.62	0/2568
1	C	0.77	0/1911	0.72	1/2592 (0.0%)
1	D	0.75	0/1936	0.69	0/2626
All	All	0.70	0/7668	0.68	1/10405 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	C	241	ASP	CB-CG-OD1	6.56	124.20	118.30

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	1896	0	1937	9	0
1	B	1864	0	1884	19	0
1	C	1882	0	1922	4	0
1	D	1898	0	1943	9	0
2	A	44	0	26	1	0
2	B	44	0	26	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	44	0	26	1	0
2	D	44	0	26	0	0
3	A	7	0	7	0	0
3	B	7	0	7	0	0
3	C	7	0	7	0	0
3	D	7	0	7	0	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	D	6	0	8	0	0
6	A	226	0	0	3	0
6	B	120	0	0	1	0
6	C	254	0	0	0	0
6	D	236	0	0	2	0
All	All	8588	0	7826	38	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 2.

All (38) 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:25:ALA:HB2	1:B:31:ILE:HD11	1.38	1.03
1:A:227:THR:OG1	1:A:229[B]:GLU:HG3	1.81	0.81
1:B:25:ALA:HB2	1:B:31:ILE:CD1	2.16	0.73
1:B:25:ALA:CB	1:B:31:ILE:HD11	2.19	0.69
1:B:190:THR:HB	1:B:191:PRO:HD2	1.75	0.67
1:A:218:GLU:OE1	6:A:1319:HOH:O	2.13	0.65
1:B:128:HIS:O	1:B:131:LYS:HG3	2.02	0.60
1:A:227:THR:CB	1:A:229[B]:GLU:HG3	2.37	0.54
1:B:64:LEU:HD22	1:B:70:VAL:HG22	1.90	0.53
1:B:89:ASN:HB2	1:B:139:ASN:HD22	1.77	0.48
1:A:89:ASN:HB2	1:A:139:ASN:HD22	1.77	0.48
1:D:190:THR:HB	1:D:191:PRO:HD2	1.96	0.48
1:C:89:ASN:HB2	1:C:139:ASN:HD22	1.78	0.47
1:A:119:PHE:HA	1:A:165:PHE:CZ	2.51	0.47
1:B:163:VAL:HG12	1:B:167:LYS:HE3	1.97	0.45
1:B:120:HIS:HE1	6:D:1269:HOH:O	1.99	0.45
1:A:52:GLN:NE2	6:A:1256:HOH:O	2.50	0.44
1:D:52:GLN:NE2	6:D:1619:HOH:O	2.50	0.44
1:D:163:VAL:HG12	1:D:167:LYS:HE3	1.98	0.43
1:B:194:GLU:HA	1:B:197:ILE:HD12	2.00	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:10:THR:O	1:D:90:ASN:HB3	2.19	0.43
1:B:56:LYS:HB3	1:B:81:MET:HE1	2.01	0.42
1:A:1:MET:N	6:A:1495:HOH:O	2.52	0.42
1:B:105:GLU:HG3	1:B:106:LYS:H	1.85	0.42
1:B:165:PHE:CE1	1:D:153:SER:HB2	2.55	0.42
1:B:183:ILE:O	1:B:185:PRO:HD3	2.20	0.42
1:A:141:ALA:O	2:A:300:NAD:H6N	2.19	0.42
1:D:150:ALA:O	1:D:151:ASN:HB2	2.19	0.42
1:B:105:GLU:HG2	6:B:1609:HOH:O	2.20	0.42
1:C:141:ALA:O	2:C:300:NAD:H6N	2.19	0.42
1:B:81:MET:HE2	1:B:81:MET:HB3	2.01	0.42
1:D:110:ILE:O	1:D:114:ASN:HB2	2.21	0.41
1:B:153:SER:HB2	1:D:165:PHE:CE1	2.56	0.41
1:C:1:MET:HA	1:C:27:GLN:HE21	1.86	0.41
1:A:76[B]:ASN:OD1	1:A:79:ARG:NH2	2.51	0.41
1:B:71:ARG:HE	1:B:120:HIS:HD2	1.67	0.41
1:C:246:ILE:HG12	1:D:253:VAL:HG22	2.03	0.41
1:B:124:ALA:O	1:B:127:PRO:HD2	2.22	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	261/260 (100%)	253 (97%)	8 (3%)	0	100	100
1	B	258/260 (99%)	250 (97%)	7 (3%)	1 (0%)	34	21
1	C	259/260 (100%)	250 (96%)	9 (4%)	0	100	100
1	D	262/260 (101%)	256 (98%)	5 (2%)	1 (0%)	34	21
All	All	1040/1040 (100%)	1009 (97%)	29 (3%)	2 (0%)	47	33

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	141	ALA
1	D	141	ALA

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	190/187 (102%)	187 (98%)	3 (2%)	62	54
1	B	183/187 (98%)	180 (98%)	3 (2%)	62	54
1	C	188/187 (100%)	187 (100%)	1 (0%)	88	87
1	D	191/187 (102%)	190 (100%)	1 (0%)	88	87
All	All	752/748 (100%)	744 (99%)	8 (1%)	73	68

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	200	LEU
1	A	202	GLU
1	A	215	LEU
1	B	81	MET
1	B	131	LYS
1	B	215	LEU
1	C	202	GLU
1	D	215	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	89	ASN
1	A	132	GLN
1	A	139	ASN
1	B	89	ASN
1	B	120	HIS
1	B	139	ASN
1	C	27	GLN

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Mol	Chain	Res	Type
1	C	89	ASN
1	C	139	ASN
1	D	27	GLN
1	D	52	GLN
1	D	89	ASN
1	D	139	ASN

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 monosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 11 ligands modelled in this entry, 2 are monoatomic - leaving 9 for Mogul analysis.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
5	GOL	D	902	-	5,5,5	0.52	0	5,5,5	1.14	0
3	3HL	B	301	-	6,6,6	0.72	0	6,7,7	0.91	0
3	3HL	D	301	-	6,6,6	0.84	0	6,7,7	1.03	0
2	NAD	D	300	-	42,48,48	1.68	3 (7%)	50,73,73	1.60	5 (10%)
3	3HL	C	301	-	6,6,6	0.75	0	6,7,7	1.19	0
2	NAD	B	300	-	42,48,48	1.72	3 (7%)	50,73,73	1.35	6 (12%)
3	3HL	A	301	-	6,6,6	0.78	0	6,7,7	0.79	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
2	NAD	C	300	-	42,48,48	1.57	3 (7%)	50,73,73	1.71	6 (12%)
2	NAD	A	300	-	42,48,48	1.76	6 (14%)	50,73,73	1.64	5 (10%)

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
5	GOL	D	902	-	-	3/4/4/4	-
3	3HL	B	301	-	-	4/4/4/4	-
3	3HL	D	301	-	-	4/4/4/4	-
2	NAD	D	300	-	-	5/26/62/62	0/5/5/5
3	3HL	C	301	-	-	4/4/4/4	-
2	NAD	B	300	-	-	4/26/62/62	0/5/5/5
3	3HL	A	301	-	-	4/4/4/4	-
2	NAD	C	300	-	-	6/26/62/62	0/5/5/5
2	NAD	A	300	-	-	6/26/62/62	0/5/5/5

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	300	NAD	O7N-C7N	8.57	1.40	1.24
2	A	300	NAD	O7N-C7N	8.18	1.39	1.24
2	D	300	NAD	O7N-C7N	7.99	1.39	1.24
2	C	300	NAD	O7N-C7N	7.85	1.39	1.24
2	A	300	NAD	C2A-N3A	4.29	1.39	1.32
2	D	300	NAD	C2A-N3A	4.13	1.38	1.32
2	B	300	NAD	C2A-N3A	4.08	1.38	1.32
2	D	300	NAD	C2A-N1A	3.13	1.39	1.33
2	C	300	NAD	C2A-N3A	3.12	1.37	1.32
2	B	300	NAD	C2A-N1A	2.92	1.39	1.33
2	A	300	NAD	O4D-C1D	2.71	1.44	1.41
2	A	300	NAD	C2A-N1A	2.40	1.38	1.33
2	A	300	NAD	O4B-C1B	2.35	1.44	1.41
2	C	300	NAD	C2N-N1N	2.22	1.37	1.35
2	A	300	NAD	C2B-C1B	-2.07	1.50	1.53

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	300	NAD	N3A-C2A-N1A	-6.81	118.03	128.68
2	A	300	NAD	N3A-C2A-N1A	-6.79	118.07	128.68
2	D	300	NAD	N3A-C2A-N1A	-6.47	118.57	128.68
2	B	300	NAD	N3A-C2A-N1A	-5.97	119.35	128.68
2	C	300	NAD	O7N-C7N-C3N	-5.41	113.15	119.63
2	D	300	NAD	C3N-C7N-N7N	5.05	123.81	117.75
2	A	300	NAD	C3N-C7N-N7N	4.93	123.66	117.75
2	C	300	NAD	C3N-C7N-N7N	4.54	123.20	117.75
2	A	300	NAD	O7N-C7N-C3N	-3.96	114.89	119.63
2	B	300	NAD	C3N-C7N-N7N	2.84	121.16	117.75
2	A	300	NAD	C2A-N1A-C6A	2.76	123.48	118.75
2	D	300	NAD	C2A-N1A-C6A	2.74	123.44	118.75
2	D	300	NAD	O7N-C7N-N7N	-2.46	119.09	122.58
2	B	300	NAD	O2N-PN-O1N	2.40	124.11	112.24
2	A	300	NAD	O2N-PN-O1N	2.36	123.91	112.24
2	C	300	NAD	O4D-C1D-C2D	-2.31	103.55	106.93
2	D	300	NAD	O7N-C7N-C3N	-2.12	117.09	119.63
2	B	300	NAD	PN-O3-PA	-2.11	125.58	132.83
2	B	300	NAD	C1B-N9A-C4A	-2.09	122.97	126.64
2	C	300	NAD	C2N-C3N-C4N	2.08	120.62	118.26
2	B	300	NAD	C4A-C5A-N7A	-2.07	107.24	109.40
2	C	300	NAD	C4A-C5A-N7A	-2.02	107.29	109.40

There are no chirality outliers.

All (40) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	300	NAD	O4D-C1D-N1N-C2N
2	A	300	NAD	O4D-C1D-N1N-C6N
2	B	300	NAD	C5D-O5D-PN-O2N
2	B	300	NAD	O4D-C1D-N1N-C2N
2	C	300	NAD	C5D-O5D-PN-O2N
2	C	300	NAD	O4D-C1D-N1N-C2N
2	D	300	NAD	C5D-O5D-PN-O2N
2	D	300	NAD	O4D-C1D-N1N-C2N
3	A	301	3HL	C-CA-CB-OG1
3	A	301	3HL	C-CA-CB-CG2
3	B	301	3HL	C-CA-CB-OG1
3	B	301	3HL	C-CA-CB-CG2
3	C	301	3HL	C-CA-CB-OG1
3	C	301	3HL	C-CA-CB-CG2
3	D	301	3HL	C-CA-CB-OG1
3	D	301	3HL	C-CA-CB-CG2

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Mol	Chain	Res	Type	Atoms
5	D	902	GOL	O1-C1-C2-C3
5	D	902	GOL	O1-C1-C2-O2
2	A	300	NAD	C5D-O5D-PN-O3
2	B	300	NAD	C5D-O5D-PN-O3
2	C	300	NAD	C5D-O5D-PN-O3
2	D	300	NAD	C5D-O5D-PN-O3
5	D	902	GOL	O2-C2-C3-O3
2	C	300	NAD	C5D-O5D-PN-O1N
3	A	301	3HL	OB-C-CA-CB
3	A	301	3HL	OA-C-CA-CB
3	B	301	3HL	OB-C-CA-CB
3	C	301	3HL	OA-C-CA-CB
3	C	301	3HL	OB-C-CA-CB
3	D	301	3HL	OA-C-CA-CB
3	D	301	3HL	OB-C-CA-CB
2	A	300	NAD	O4B-C4B-C5B-O5B
3	B	301	3HL	OA-C-CA-CB
2	C	300	NAD	O4B-C4B-C5B-O5B
2	A	300	NAD	C2D-C1D-N1N-C6N
2	B	300	NAD	O4B-C4B-C5B-O5B
2	D	300	NAD	O4B-C4B-C5B-O5B
2	C	300	NAD	PA-O3-PN-O2N
2	A	300	NAD	C5D-O5D-PN-O2N
2	D	300	NAD	C5D-O5D-PN-O1N

There are no ring outliers.

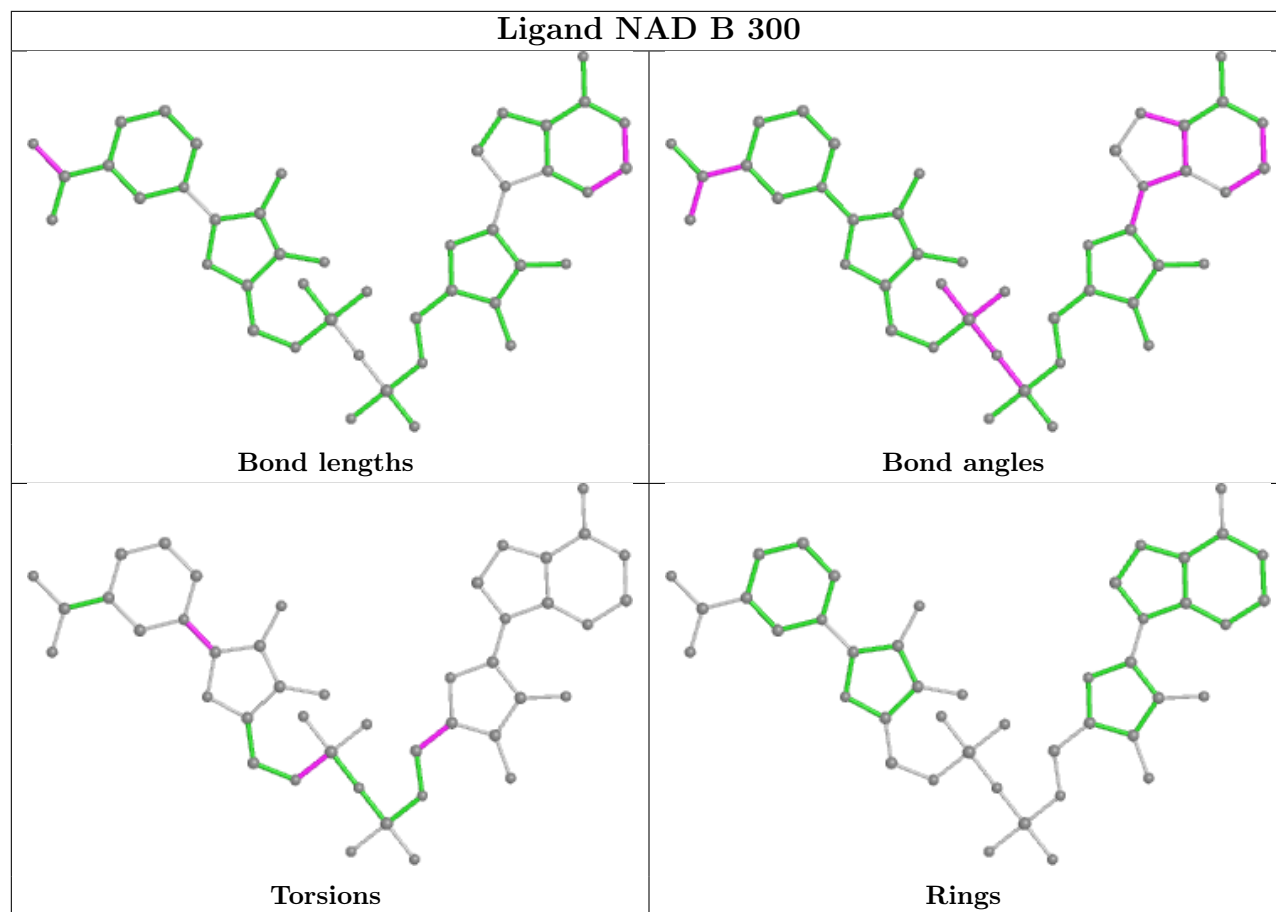2 monomers are involved in 2 short contacts:

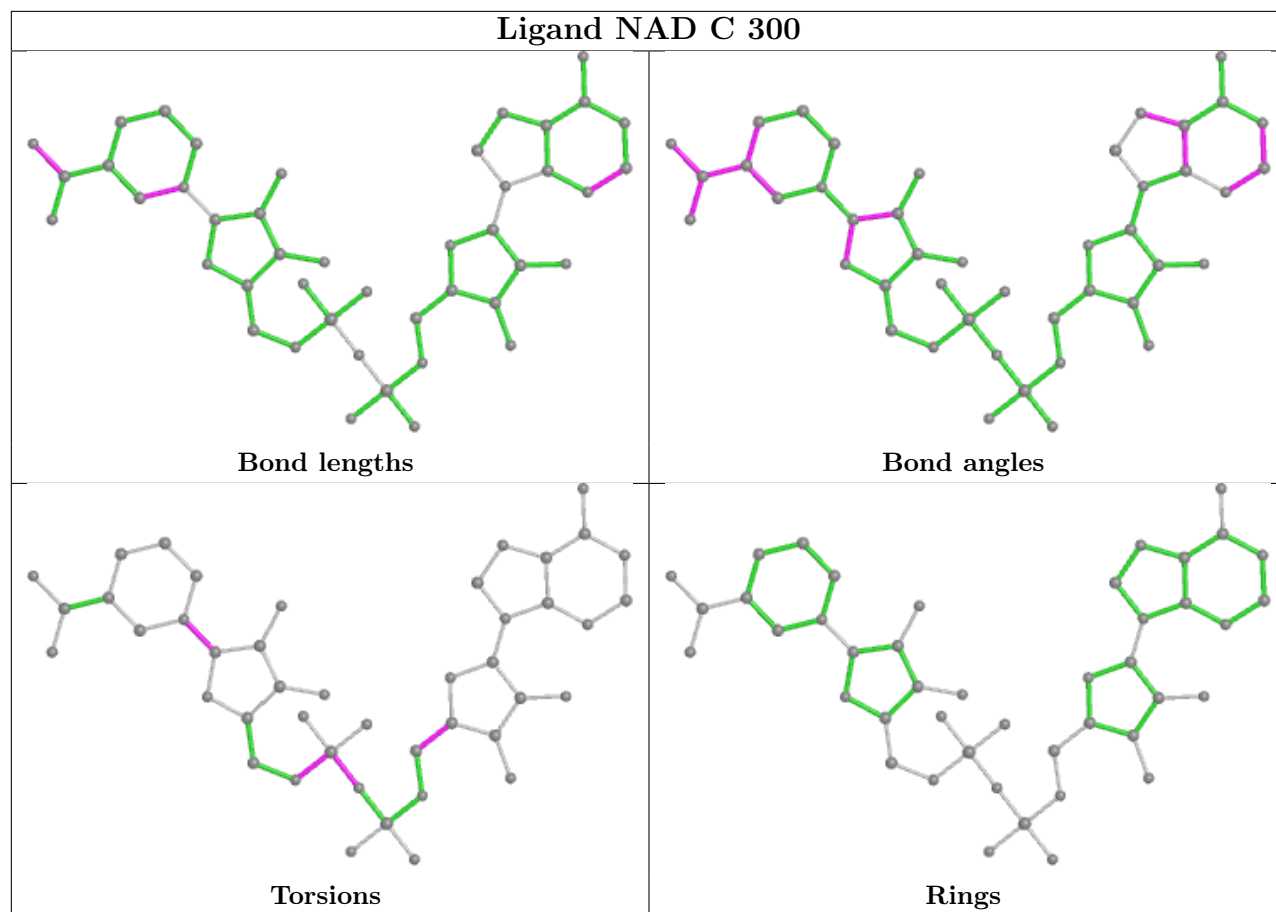| Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	300	NAD	1	0
2	A	300	NAD	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier.
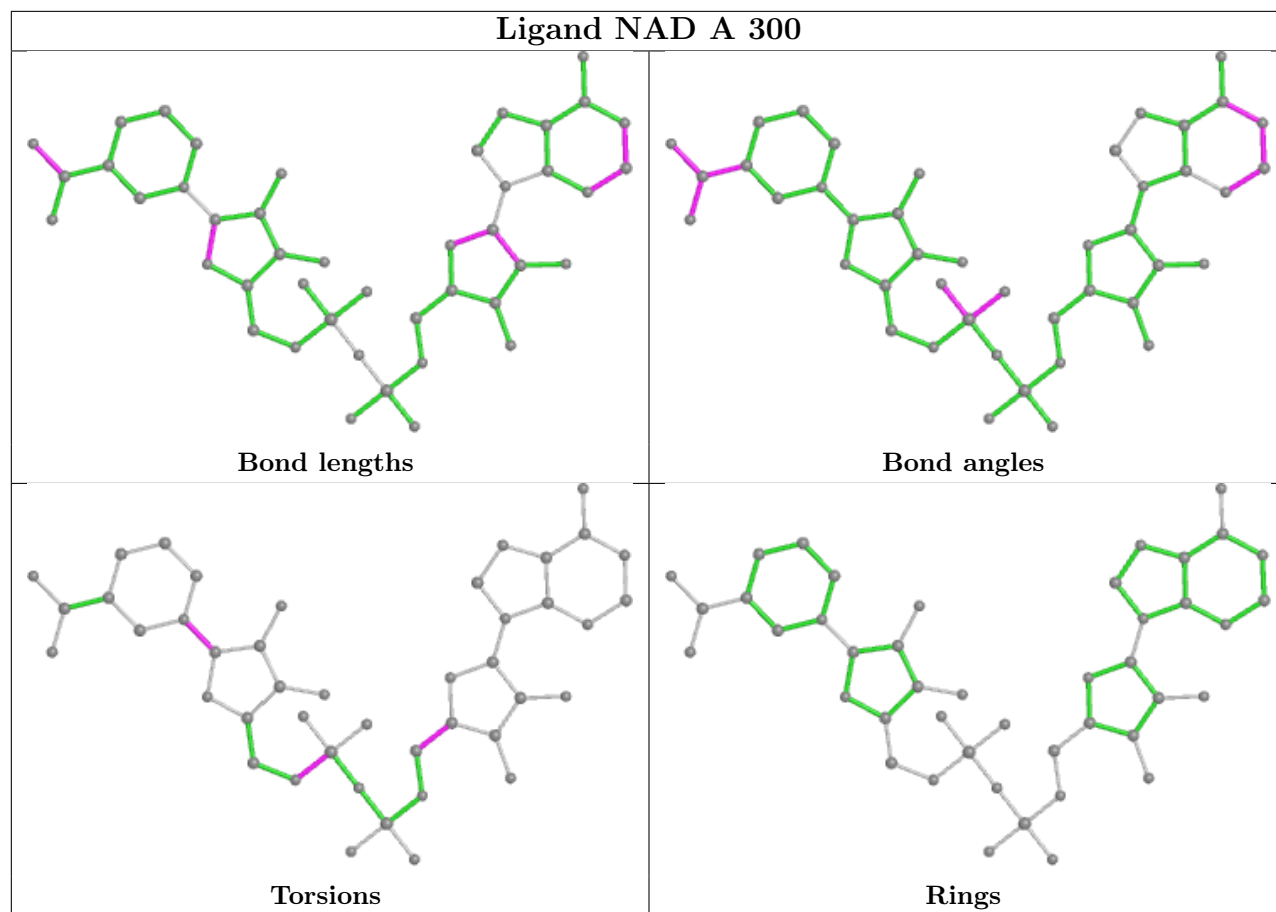
The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand NAD D 300

Ligand NAD B 300

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD C 300

Bond lengths

Bond angles

Torsions

Rings

Ligand NAD A 300

Bond lengths

Bond angles

Torsions

Rings
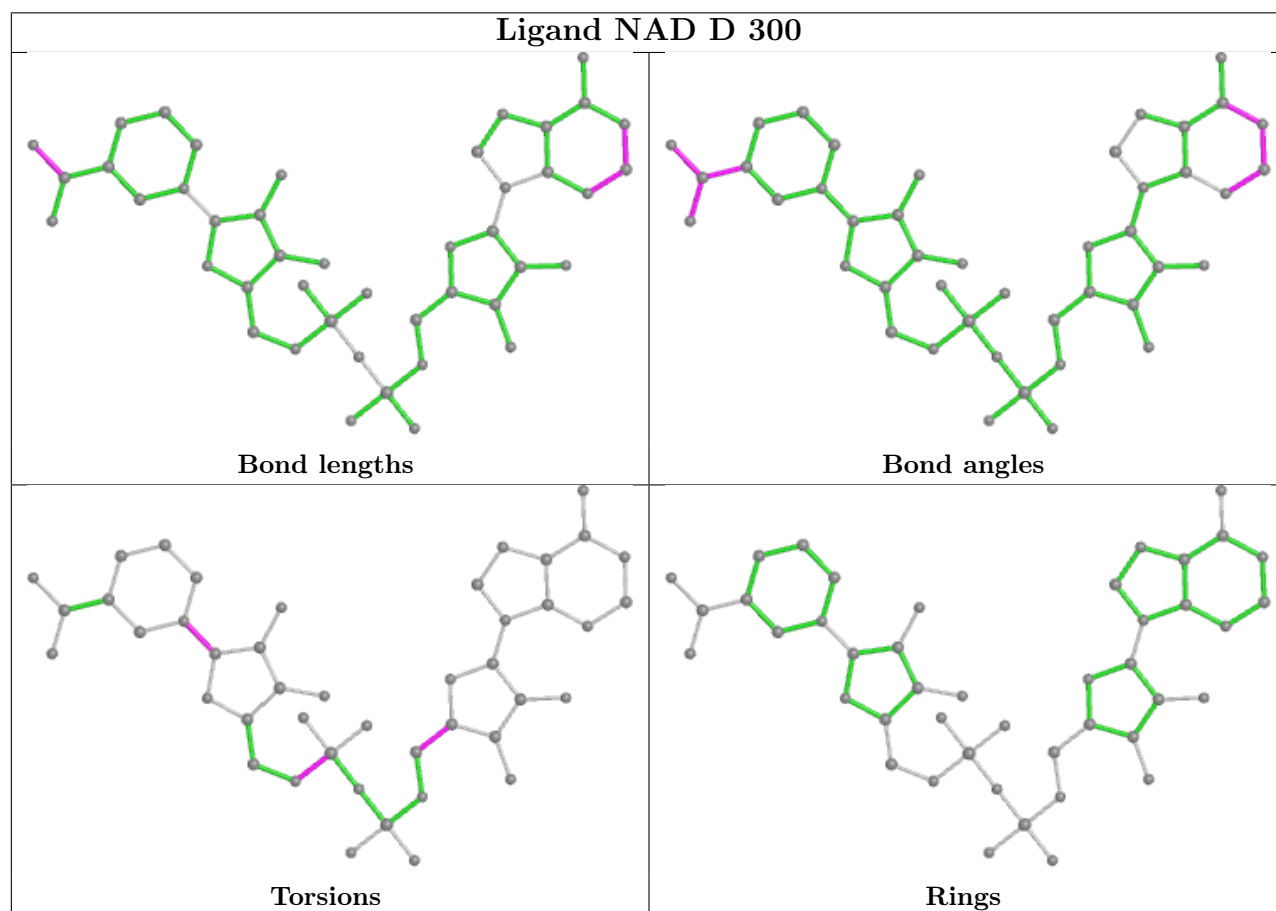
5.7 Other polymers ⓘ

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(Å²)	Q<0.9
1	A	260/260 (100%)	0.14	13 (5%)	28	23	13, 24, 41, 52	0
1	B	260/260 (100%)	1.07	47 (18%)	1	0	20, 35, 58, 62	0
1	C	260/260 (100%)	0.04	10 (3%)	40	35	11, 18, 40, 55	0
1	D	260/260 (100%)	0.10	17 (6%)	18	15	14, 22, 43, 56	0
All	All	1040/1040 (100%)	0.34	87 (8%)	11	8	11, 24, 51, 62	0

All (87) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	211	ALA	5.9
1	B	204	ASN	5.6
1	B	201	ALA	5.5
1	D	211	ALA	5.0
1	D	202	GLU	4.8
1	D	205	GLY	4.7
1	B	205	GLY	4.7
1	D	210	THR	4.6
1	B	200	LEU	4.5
1	D	200	LEU	4.3
1	B	51	ALA	4.3
1	B	49	LEU	4.2
1	D	206	VAL	4.2
1	D	199	ALA	4.0
1	C	205	GLY	3.9
1	B	40	ALA	3.6
1	B	64	LEU	3.6
1	B	37	GLY	3.6
1	D	207	ASP	3.5
1	B	47	ALA	3.5
1	B	210	THR	3.4

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Mol	Chain	Res	Type	RSRZ
1	B	251	VAL	3.4
1	B	79	ARG	3.3
1	B	31	ILE	3.3
1	D	198	SER	3.2
1	C	210	THR	3.2
1	B	207	ASP	3.1
1	B	58	LEU	3.1
1	A	131	LYS	3.1
1	D	201	ALA	3.0
1	D	204	ASN	3.0
1	B	38	ASP	3.0
1	B	197	ILE	3.0
1	B	44	LYS	2.9
1	C	204	ASN	2.9
1	B	36	PHE	2.9
1	C	203	LYS	2.8
1	B	41	GLU	2.8
1	B	199	ALA	2.8
1	B	212	ALA	2.8
1	C	212	ALA	2.7
1	A	251	VAL	2.7
1	D	212	ALA	2.6
1	B	203	LYS	2.6
1	D	197	ILE	2.6
1	B	52	GLN	2.6
1	B	206	VAL	2.6
1	A	146	LEU	2.6
1	C	199	ALA	2.6
1	A	163	VAL	2.6
1	B	131	LYS	2.5
1	C	211	ALA	2.5
1	A	1	MET	2.5
1	B	209	GLU	2.5
1	D	209	GLU	2.5
1	B	63	ASP	2.5
1	D	146	LEU	2.5
1	A	211	ALA	2.4
1	B	68	GLU	2.4
1	B	59	TYR	2.4
1	C	201	ALA	2.4
1	A	249	THR	2.3
1	B	213	ARG	2.3

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Mol	Chain	Res	Type	RSRZ
1	A	184	CYS	2.3
1	B	183	ILE	2.3
1	B	195	LYS	2.3
1	C	202	GLU	2.2
1	A	204	ASN	2.2
1	B	193	VAL	2.2
1	A	205	GLY	2.2
1	B	2	LEU	2.2
1	A	51	ALA	2.2
1	B	202	GLU	2.2
1	B	76	ASN	2.1
1	B	61	GLY	2.1
1	B	189	ARG	2.1
1	B	45	VAL	2.1
1	A	52	GLN	2.1
1	B	249	THR	2.1
1	B	215	LEU	2.1
1	C	146	LEU	2.1
1	B	48	GLY	2.1
1	D	195	LYS	2.1
1	B	182	ALA	2.1
1	A	206	VAL	2.0
1	D	203	LYS	2.0
1	B	184	CYS	2.0

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

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

6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.

6.4 Ligands ⓘ

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	NAD	B	300	44/44	0.86	0.14	34,39,43,45	0
3	3HL	B	301	7/7	0.89	0.17	35,37,40,41	0
3	3HL	D	301	7/7	0.91	0.13	33,35,37,38	0
3	3HL	C	301	7/7	0.93	0.10	27,28,29,30	0
4	MG	B	401	1/1	0.93	0.07	23,23,23,23	0
4	MG	A	406	1/1	0.95	0.06	21,21,21,21	0
5	GOL	D	902	6/6	0.95	0.09	18,22,24,27	0
2	NAD	A	300	44/44	0.97	0.07	16,20,25,29	0
2	NAD	D	300	44/44	0.97	0.07	21,24,29,32	0
3	3HL	A	301	7/7	0.97	0.08	22,25,26,26	0
2	NAD	C	300	44/44	0.98	0.06	16,19,24,29	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.
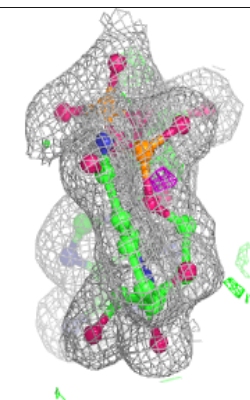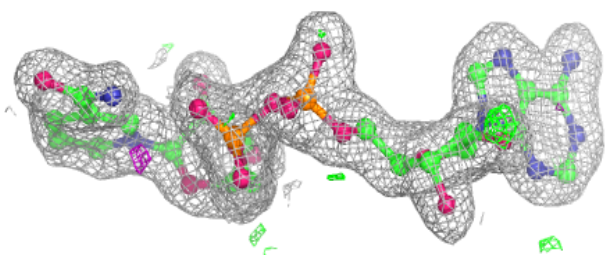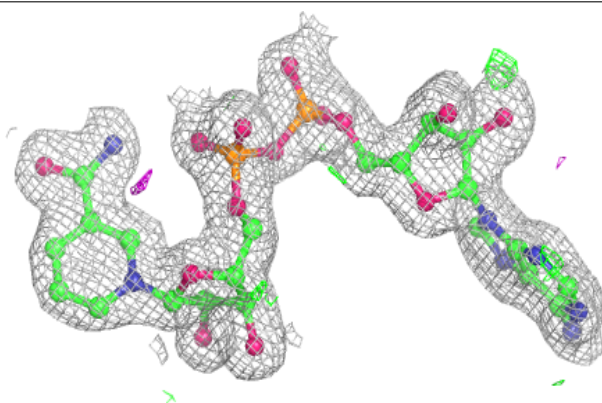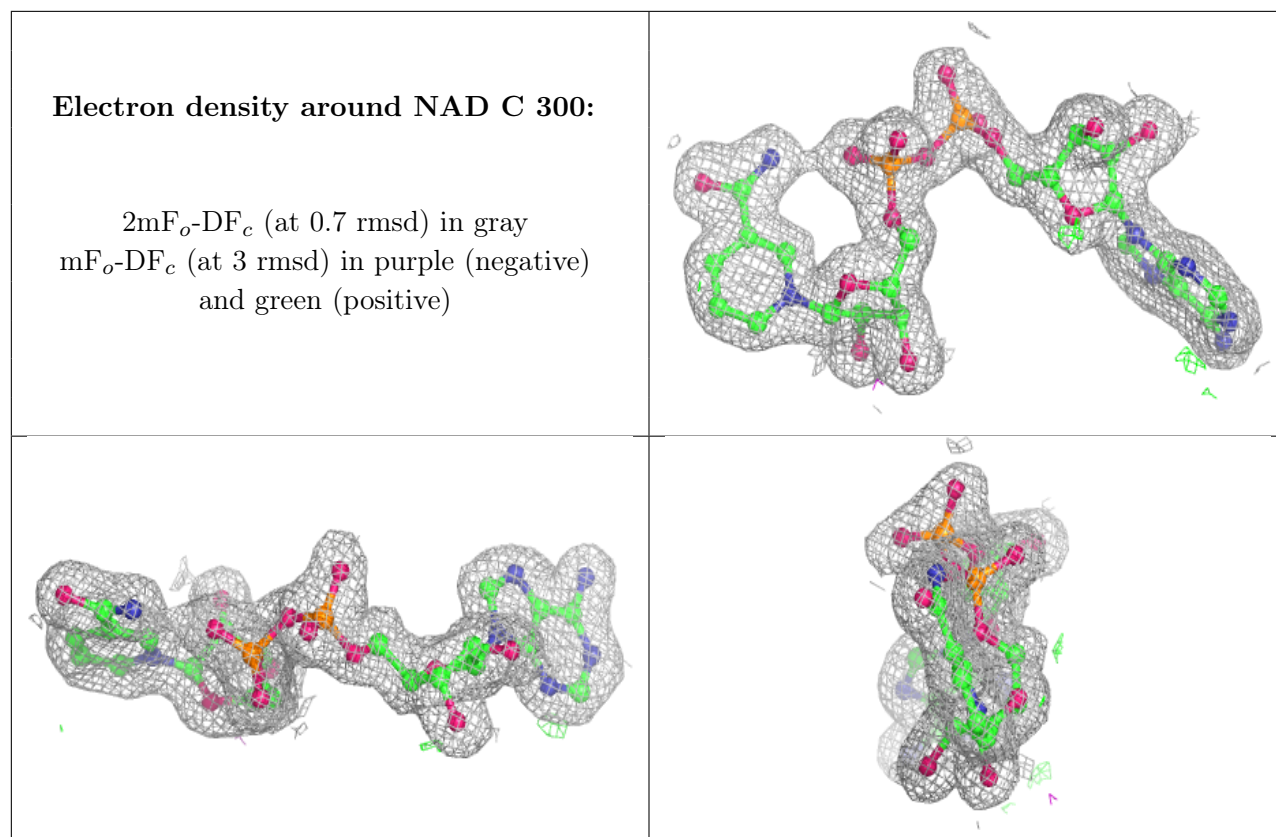

Electron density around NAD B 300:

$2\text{mF}_o\text{-DF}_c$ (at 0.7 rmsd) in gray
$\text{mF}_o\text{-DF}_c$ (at 3 rmsd) in purple (negative) and green (positive)
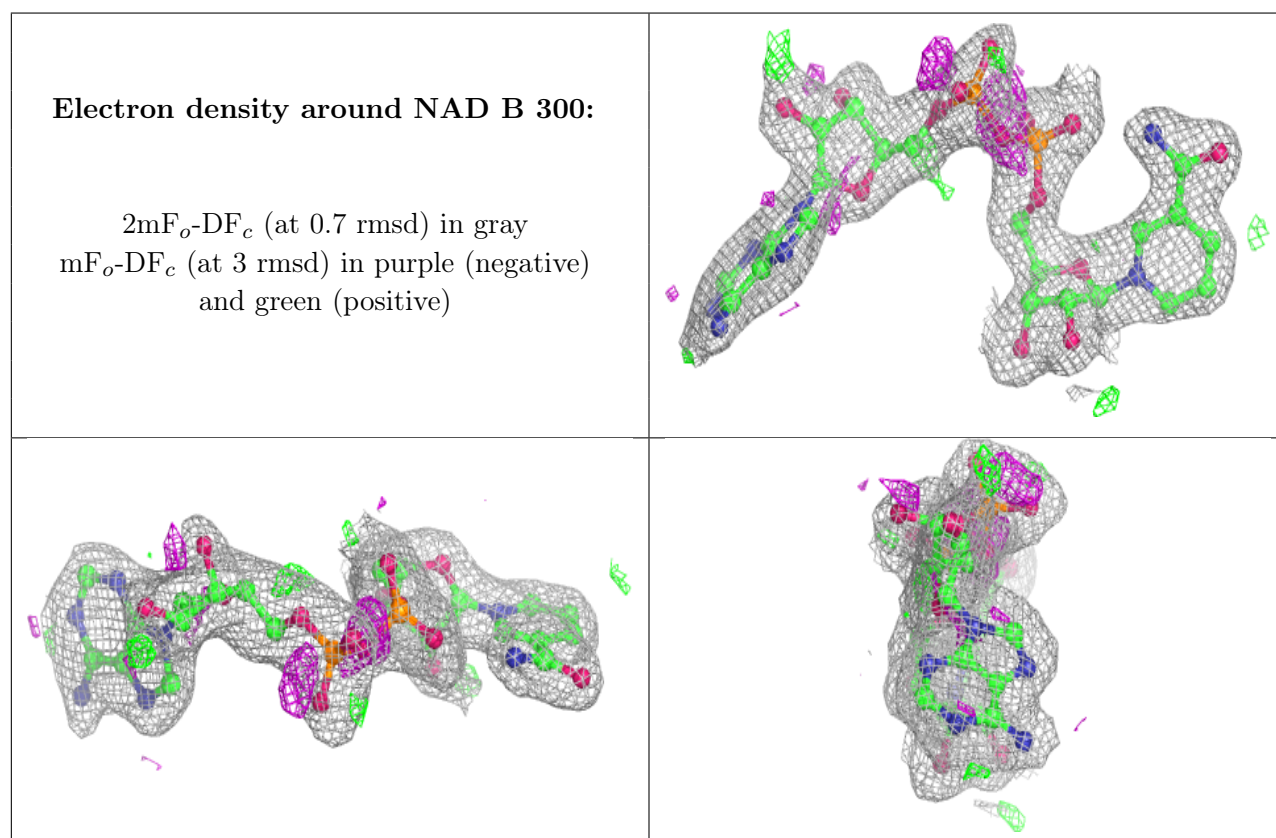
Electron density around NAD A 300:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
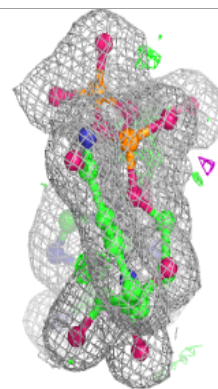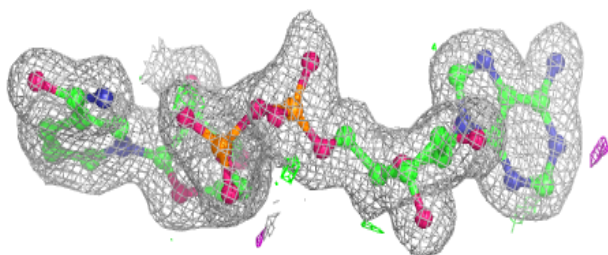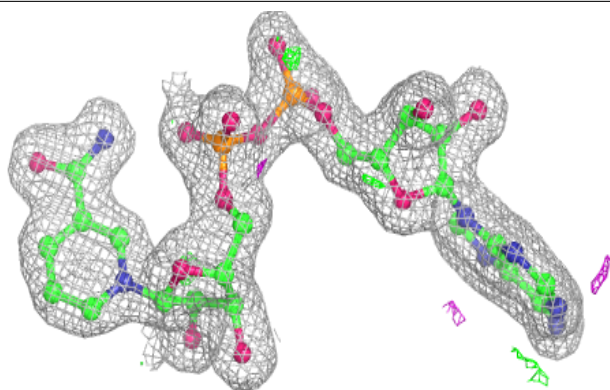
Electron density around NAD D 300:

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

Electron density around NAD C 300:

$2mF_o$-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 ⓘ

There are no such residues in this entry.