



# Full wwPDB X-ray Structure Validation Report ⓘ

Dec 15, 2024 – 02:22 AM EST

PDB ID : 1DRU  
Title : ESCHERICHIA COLI DHPR/NADH COMPLEX  
Authors : Reddy, S.G.; Scapin, G.; Blanchard, J.S.  
Deposited on : 1996-06-28  
Resolution : 2.20 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](mailto: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>.

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

MolProbity : 4.02b-467  
Mogul : 2022.3.0, CSD as543be (2022)  
Xtrriage (Phenix) : **NOT EXECUTED**  
EDS : **NOT EXECUTED**  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.40

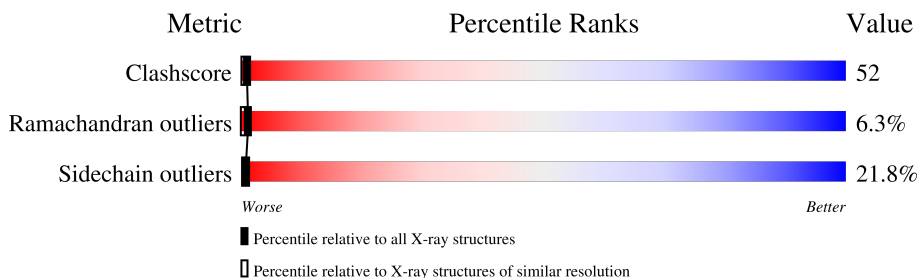
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.20 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))
Clashscore	180529	6634 (2.20-2.20)
Ramachandran outliers	177936	6560 (2.20-2.20)
Sidechain outliers	177891	6561 (2.20-2.20)

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  $\geq 3$ , 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  $\leq 5\%$ .

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	273	 43% 38% 13% ..

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 2081 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 DIHYDRODIPICOLINATE REDUCTASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	270	1974	1227	357	380	10	0	0	0

- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: C<sub>21</sub>H<sub>27</sub>N<sub>7</sub>O<sub>14</sub>P<sub>2</sub>).



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

- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	63	Total 63 O 63	0	0

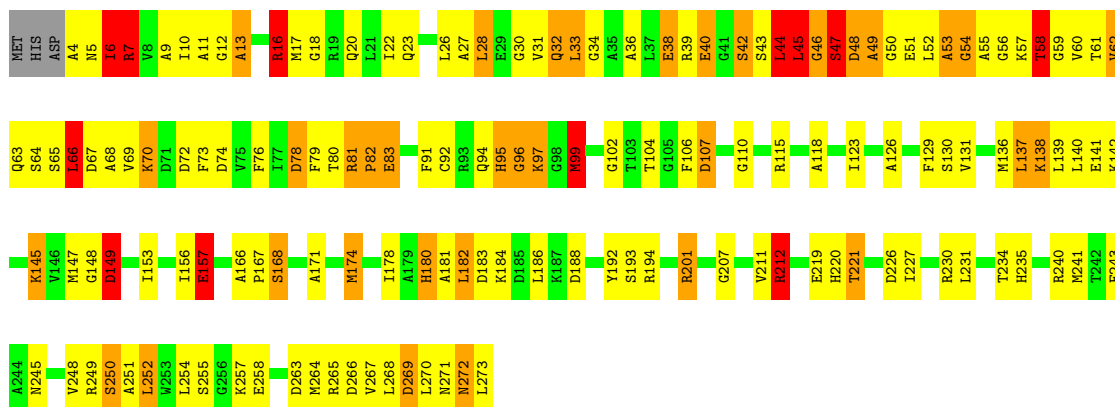
### 3 Residue-property plots

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. 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. 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.

Note EDS was not executed.

- Molecule 1: DIHYDRODIPICOLINATE REDUCTASE

Chain A: 



## 4 Data and refinement statistics

Xtrriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	81.20Å 84.50Å 91.90Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 2.20	Depositor
% Data completeness (in resolution range)	85.0 (20.00-2.20)	Depositor
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	0.08	Depositor
Refinement program	TNT	Depositor
R, $R_{free}$	0.192 , (Not available)	Depositor
Estimated twinning fraction	No twinning to report.	Xtrriage
Total number of atoms	2081	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	31.0	wwPDB-VP

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

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

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	1.04	1/2000 (0.1%)	1.54	31/2696 (1.1%)

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	2

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	248	VAL	CA-CB	-5.69	1.42	1.54

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	212	ARG	NE-CZ-NH1	-12.48	114.06	120.30
1	A	166	ALA	C-N-CD	-12.41	93.30	120.60
1	A	240	ARG	NE-CZ-NH1	9.42	125.01	120.30
1	A	201	ARG	NE-CZ-NH1	-8.28	116.16	120.30
1	A	149	ASP	O-C-N	8.21	135.83	122.70
1	A	230	ARG	NE-CZ-NH1	-7.93	116.34	120.30
1	A	269	ASP	CB-CG-OD2	-7.81	111.28	118.30
1	A	66	LEU	CB-CG-CD2	-7.40	98.42	111.00
1	A	7	ARG	NE-CZ-NH2	7.35	123.97	120.30
1	A	48	ASP	O-C-N	7.07	134.01	122.70
1	A	186	LEU	CB-CG-CD2	6.88	122.70	111.00
1	A	81	ARG	NE-CZ-NH1	-6.55	117.03	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	107	ASP	N-CA-C	-6.26	94.11	111.00
1	A	4	ALA	O-C-N	-6.18	112.82	122.70
1	A	147	MET	CG-SD-CE	6.17	110.06	100.20
1	A	166	ALA	C-N-CA	6.14	147.81	122.00
1	A	174	MET	CG-SD-CE	-5.65	91.16	100.20
1	A	99	MET	CG-SD-CE	5.59	109.15	100.20
1	A	188	ASP	CB-CG-OD1	-5.58	113.28	118.30
1	A	240	ARG	NE-CZ-NH2	-5.47	117.57	120.30
1	A	78	ASP	CB-CG-OD1	5.29	123.06	118.30
1	A	166	ALA	O-C-N	5.24	131.06	121.10
1	A	16	ARG	NE-CZ-NH2	5.22	122.91	120.30
1	A	149	ASP	CA-C-N	-5.17	105.81	117.20
1	A	182	LEU	CB-CG-CD2	-5.13	102.28	111.00
1	A	48	ASP	CA-C-N	-5.12	105.94	117.20
1	A	188	ASP	CB-CG-OD2	5.11	122.90	118.30
1	A	74	ASP	CB-CG-OD2	-5.10	113.71	118.30
1	A	269	ASP	CB-CG-OD1	5.05	122.84	118.30
1	A	33	LEU	CA-CB-CG	-5.03	103.74	115.30
1	A	137	LEU	CA-CB-CG	5.02	126.85	115.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	157	GLU	Mainchain
1	A	16	ARG	Sidechain

## 5.2 Too-close contacts [\(i\)](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1974	0	1944	207	0
2	A	44	0	26	9	0
3	A	63	0	0	4	0
All	All	2081	0	1970	207	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 52.

All (207) 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:45:LEU:H	1:A:45:LEU:CD1	1.40	1.33
1:A:48:ASP:O	1:A:51:GLU:CB	1.77	1.31
1:A:16:ARG:HG2	2:A:301:NAD:O1N	1.42	1.17
1:A:48:ASP:H	1:A:62:VAL:HG12	1.02	1.16
1:A:48:ASP:H	1:A:62:VAL:CG1	1.67	1.08
1:A:45:LEU:H	1:A:45:LEU:HD12	1.19	1.07
1:A:48:ASP:N	1:A:62:VAL:HG12	1.70	1.05
1:A:16:ARG:HG3	1:A:17:MET:N	1.69	1.04
1:A:66:LEU:HB3	1:A:91:PHE:CE2	1.91	1.04
1:A:45:LEU:H	1:A:45:LEU:HD13	1.19	1.02
1:A:45:LEU:CD1	1:A:45:LEU:N	2.18	1.00
1:A:70:LYS:HB2	1:A:70:LYS:NZ	1.75	0.99
1:A:70:LYS:HB2	1:A:70:LYS:HZ2	1.30	0.96
1:A:47:SER:HA	1:A:62:VAL:HG13	1.47	0.96
1:A:174:MET:HE1	1:A:220:HIS:HB3	1.50	0.93
1:A:47:SER:HB2	1:A:61:THR:HB	1.51	0.90
1:A:250:SER:HB3	1:A:267:VAL:HG21	1.51	0.90
1:A:45:LEU:HD13	1:A:45:LEU:N	1.83	0.89
1:A:5:ASN:O	1:A:32:GLN:HG3	1.75	0.87
1:A:20:GLN:HE21	1:A:241:MET:HG2	1.39	0.86
1:A:31:VAL:HG13	1:A:252:LEU:HD23	1.57	0.83
1:A:47:SER:CB	1:A:61:THR:HB	2.07	0.83
1:A:272:ASN:HD22	1:A:272:ASN:H	1.26	0.83
1:A:16:ARG:HG2	2:A:301:NAD:PN	2.18	0.82
1:A:174:MET:CE	1:A:220:HIS:HB3	2.08	0.82
1:A:66:LEU:HB3	1:A:91:PHE:CD2	2.14	0.82
1:A:47:SER:HB2	1:A:61:THR:CB	2.11	0.81
1:A:136:MET:HE3	1:A:235:HIS:HB2	1.62	0.81
1:A:16:ARG:CG	2:A:301:NAD:O1N	2.27	0.80
1:A:138:LYS:HE2	1:A:270:LEU:O	1.81	0.80
1:A:142:LYS:O	1:A:145:LYS:HB2	1.80	0.80
1:A:48:ASP:CB	1:A:60:VAL:O	2.30	0.79
1:A:148:GLY:O	1:A:149:ASP:HB2	1.83	0.79
1:A:136:MET:CE	1:A:235:HIS:HB2	2.12	0.78
1:A:39:ARG:HH11	1:A:39:ARG:HG2	1.47	0.77
1:A:73:PHE:CE1	1:A:97:LYS:HG2	2.19	0.77
1:A:39:ARG:HG2	1:A:39:ARG:NH1	2.01	0.75
1:A:50:GLY:HA3	1:A:55:ALA:C	2.08	0.73

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:65:SER:HB3	1:A:68:ALA:HB2	1.69	0.73
1:A:22:ILE:HB	1:A:53:ALA:HB2	1.68	0.73
1:A:42:SER:O	1:A:44:LEU:HD23	1.88	0.73
1:A:58:THR:C	1:A:60:VAL:H	1.92	0.72
1:A:102:GLY:O	2:A:301:NAD:H2N	1.90	0.72
1:A:13:ALA:O	1:A:52:LEU:HD13	1.91	0.71
1:A:50:GLY:HA3	1:A:55:ALA:O	1.90	0.70
1:A:45:LEU:HD12	1:A:45:LEU:N	1.94	0.70
1:A:42:SER:HB2	3:A:450:HOH:O	1.90	0.70
1:A:245:ASN:HB3	3:A:444:HOH:O	1.93	0.68
1:A:20:GLN:NE2	1:A:241:MET:HG2	2.09	0.67
1:A:65:SER:HB3	1:A:68:ALA:CB	2.23	0.67
1:A:69:VAL:HG12	1:A:73:PHE:HE2	1.59	0.66
1:A:31:VAL:HG13	1:A:252:LEU:CD2	2.26	0.66
1:A:269:ASP:O	1:A:272:ASN:ND2	2.29	0.66
1:A:73:PHE:HE1	1:A:97:LYS:HG2	1.61	0.65
1:A:47:SER:HB2	1:A:61:THR:CG2	2.27	0.65
1:A:265:ARG:HB3	1:A:271:ASN:HD21	1.60	0.65
1:A:49:ALA:C	1:A:51:GLU:N	2.50	0.64
1:A:65:SER:O	1:A:68:ALA:HB3	1.97	0.64
1:A:174:MET:HE1	1:A:220:HIS:CB	2.26	0.64
1:A:49:ALA:C	1:A:51:GLU:H	2.01	0.63
1:A:42:SER:C	1:A:44:LEU:H	2.01	0.63
1:A:211:VAL:O	1:A:212:ARG:HD3	1.99	0.63
1:A:58:THR:O	1:A:60:VAL:N	2.32	0.62
1:A:69:VAL:HG12	1:A:73:PHE:CE2	2.35	0.61
1:A:7:ARG:HA	1:A:32:GLN:O	1.99	0.61
1:A:5:ASN:O	1:A:6:ILE:C	2.38	0.61
1:A:7:ARG:HB2	1:A:73:PHE:HA	1.80	0.61
1:A:47:SER:HA	1:A:62:VAL:CG1	2.28	0.61
1:A:5:ASN:OD1	1:A:30:GLY:HA2	2.01	0.60
1:A:58:THR:C	1:A:60:VAL:N	2.54	0.60
1:A:272:ASN:HD22	1:A:272:ASN:N	1.96	0.58
1:A:16:ARG:HG3	1:A:17:MET:H	1.61	0.58
1:A:50:GLY:HA2	1:A:55:ALA:H	1.68	0.58
1:A:138:LYS:HG3	1:A:270:LEU:HB3	1.84	0.58
1:A:50:GLY:HA2	1:A:55:ALA:N	2.18	0.57
1:A:11:ALA:HB2	1:A:76:PHE:CZ	2.40	0.57
1:A:12:GLY:HA2	2:A:301:NAD:O3B	2.04	0.57
1:A:241:MET:HE3	1:A:245:ASN:ND2	2.19	0.57
1:A:263:ASP:HB2	3:A:446:HOH:O	2.06	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:53:ALA:O	1:A:55:ALA:N	2.37	0.56
1:A:265:ARG:HB3	1:A:271:ASN:ND2	2.20	0.56
1:A:36:ALA:O	1:A:62:VAL:HA	2.06	0.56
1:A:33:LEU:HG	1:A:60:VAL:HG11	1.88	0.55
1:A:47:SER:HB3	1:A:61:THR:HB	1.88	0.55
1:A:28:LEU:HB3	1:A:31:VAL:CG2	2.36	0.55
1:A:180:HIS:CD2	1:A:180:HIS:C	2.80	0.55
1:A:174:MET:CE	1:A:220:HIS:CB	2.82	0.54
1:A:104:THR:HG22	3:A:453:HOH:O	2.08	0.54
1:A:95:HIS:O	1:A:97:LYS:N	2.42	0.53
1:A:52:LEU:C	1:A:54:GLY:H	2.11	0.53
1:A:136:MET:HE1	1:A:235:HIS:HB2	1.88	0.53
1:A:269:ASP:C	1:A:271:ASN:H	2.11	0.53
1:A:46:GLY:O	1:A:48:ASP:N	2.42	0.53
1:A:272:ASN:H	1:A:272:ASN:ND2	2.00	0.53
1:A:241:MET:CE	1:A:245:ASN:ND2	2.72	0.53
1:A:28:LEU:HB3	1:A:31:VAL:HG21	1.90	0.53
1:A:42:SER:OG	1:A:44:LEU:HD22	2.09	0.53
1:A:194:ARG:HH22	1:A:207:GLY:HA3	1.74	0.53
1:A:20:GLN:HE21	1:A:241:MET:CG	2.16	0.52
1:A:67:ASP:O	1:A:70:LYS:HG2	2.08	0.52
1:A:6:ILE:HG22	1:A:6:ILE:O	2.09	0.52
1:A:194:ARG:NH2	1:A:207:GLY:HA3	2.24	0.52
1:A:34:GLY:HA3	1:A:72:ASP:O	2.09	0.52
1:A:48:ASP:N	1:A:62:VAL:CG1	2.47	0.52
1:A:250:SER:HB3	1:A:267:VAL:CG2	2.32	0.51
1:A:263:ASP:O	1:A:266:ASP:HB2	2.10	0.51
1:A:107:ASP:OD1	1:A:110:GLY:N	2.42	0.51
1:A:52:LEU:O	1:A:54:GLY:N	2.39	0.51
1:A:156:ILE:HD12	1:A:156:ILE:N	2.26	0.51
1:A:44:LEU:HD23	1:A:44:LEU:H	1.76	0.50
1:A:20:GLN:HG3	1:A:241:MET:SD	2.51	0.50
1:A:23:GLN:HG3	1:A:53:ALA:HB1	1.94	0.50
1:A:180:HIS:C	1:A:183:ASP:H	2.15	0.50
1:A:47:SER:HB2	1:A:61:THR:HG22	1.94	0.50
1:A:22:ILE:CG2	1:A:53:ALA:CB	2.90	0.50
1:A:92:CYS:O	1:A:95:HIS:O	2.29	0.50
1:A:5:ASN:O	1:A:6:ILE:O	2.30	0.50
1:A:69:VAL:CG1	1:A:73:PHE:CE2	2.94	0.50
1:A:107:ASP:O	1:A:110:GLY:N	2.44	0.50
1:A:45:LEU:HB2	1:A:52:LEU:HD21	1.94	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:272:ASN:ND2	1:A:272:ASN:N	2.60	0.49
1:A:268:LEU:HB3	1:A:270:LEU:CD2	2.42	0.49
1:A:49:ALA:CA	1:A:57:LYS:O	2.61	0.49
1:A:22:ILE:CB	1:A:53:ALA:HB2	2.41	0.49
1:A:18:GLY:O	1:A:22:ILE:HD12	2.13	0.49
1:A:16:ARG:CG	2:A:301:NAD:PN	2.96	0.49
1:A:33:LEU:O	1:A:60:VAL:HG21	2.13	0.49
1:A:5:ASN:HB2	1:A:30:GLY:O	2.12	0.48
1:A:16:ARG:NE	2:A:301:NAD:O1N	2.46	0.48
1:A:180:HIS:CD2	1:A:181:ALA:N	2.82	0.48
1:A:69:VAL:CG1	1:A:73:PHE:CD2	2.97	0.48
1:A:254:LEU:HA	1:A:254:LEU:HD23	1.48	0.48
1:A:44:LEU:HD11	1:A:64:SER:OG	2.13	0.48
1:A:221:THR:HB	1:A:234:THR:OG1	2.14	0.47
1:A:47:SER:CA	1:A:62:VAL:HG13	2.33	0.47
1:A:269:ASP:C	1:A:271:ASN:N	2.65	0.47
1:A:131:VAL:HG22	1:A:268:LEU:HD21	1.97	0.47
1:A:99:MET:HG3	1:A:123:ILE:HG12	1.97	0.47
1:A:42:SER:C	1:A:44:LEU:HD23	2.34	0.47
1:A:46:GLY:O	1:A:47:SER:C	2.52	0.47
1:A:53:ALA:C	1:A:55:ALA:H	2.17	0.46
1:A:78:ASP:OD1	1:A:80:THR:OG1	2.26	0.46
1:A:69:VAL:O	1:A:72:ASP:HB2	2.15	0.46
1:A:92:CYS:HB3	1:A:97:LYS:O	2.14	0.46
1:A:43:SER:O	1:A:44:LEU:C	2.54	0.46
1:A:168:SER:HG	1:A:171:ALA:H	1.63	0.46
1:A:178:ILE:O	1:A:181:ALA:HB3	2.16	0.46
1:A:126:ALA:HB3	1:A:129:PHE:CE2	2.51	0.46
1:A:67:ASP:O	1:A:70:LYS:CG	2.64	0.45
1:A:50:GLY:CA	1:A:55:ALA:N	2.79	0.45
1:A:136:MET:HB2	1:A:136:MET:HE2	1.43	0.45
1:A:9:ALA:HB2	1:A:73:PHE:CG	2.52	0.45
1:A:44:LEU:H	1:A:44:LEU:CD2	2.29	0.45
1:A:138:LYS:O	1:A:141:GLU:HB2	2.17	0.45
1:A:43:SER:C	1:A:45:LEU:N	2.66	0.45
1:A:220:HIS:O	1:A:234:THR:HA	2.17	0.45
1:A:43:SER:O	1:A:45:LEU:N	2.50	0.45
1:A:145:LYS:HD2	1:A:145:LYS:HA	1.54	0.45
1:A:168:SER:OG	1:A:220:HIS:HE1	2.00	0.45
1:A:38:GLU:HA	1:A:38:GLU:OE1	2.18	0.44
1:A:53:ALA:C	1:A:55:ALA:N	2.70	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:44:LEU:CD2	1:A:44:LEU:N	2.81	0.44
1:A:251:ALA:O	1:A:254:LEU:HB2	2.17	0.44
1:A:9:ALA:O	1:A:10:ILE:HD13	2.18	0.44
1:A:118:ALA:HA	1:A:123:ILE:HD12	2.00	0.44
1:A:31:VAL:HG23	1:A:31:VAL:O	2.17	0.44
1:A:63:GLN:OE1	1:A:69:VAL:HG23	2.17	0.44
1:A:167:PRO:HG3	1:A:192:TYR:HD1	1.83	0.44
1:A:6:ILE:HG13	1:A:255:SER:OG	2.18	0.44
1:A:139:LEU:O	1:A:142:LYS:HB2	2.17	0.44
1:A:269:ASP:O	1:A:271:ASN:N	2.50	0.44
1:A:6:ILE:HG21	1:A:6:ILE:HD12	1.68	0.44
1:A:42:SER:C	1:A:44:LEU:N	2.70	0.44
1:A:182:LEU:HA	1:A:182:LEU:HD23	1.60	0.44
1:A:226:ASP:CG	1:A:227:ILE:H	2.20	0.44
1:A:67:ASP:HA	1:A:70:LYS:HG2	1.99	0.44
1:A:39:ARG:NH1	1:A:39:ARG:CG	2.73	0.43
1:A:69:VAL:O	1:A:72:ASP:N	2.45	0.43
1:A:48:ASP:CA	1:A:62:VAL:HG12	2.47	0.43
1:A:171:ALA:O	1:A:174:MET:HB2	2.19	0.43
1:A:69:VAL:HG13	1:A:73:PHE:HD2	1.84	0.42
1:A:157:GLU:HA	1:A:219:GLU:O	2.19	0.42
1:A:81:ARG:HB3	1:A:83:GLU:HG2	2.01	0.42
1:A:153:ILE:O	1:A:201:ARG:NH2	2.52	0.42
1:A:106:PHE:HB3	1:A:110:GLY:HA3	2.02	0.42
1:A:95:HIS:O	1:A:96:GLY:C	2.58	0.42
1:A:264:MET:O	1:A:268:LEU:HB2	2.20	0.42
1:A:66:LEU:HA	1:A:66:LEU:HD13	1.76	0.42
1:A:136:MET:CE	1:A:235:HIS:CB	2.92	0.42
1:A:80:THR:O	1:A:81:ARG:HD2	2.20	0.41
1:A:66:LEU:CB	1:A:91:PHE:CD2	2.95	0.41
1:A:79:PHE:O	2:A:301:NAD:H52N	2.20	0.41
1:A:50:GLY:O	1:A:51:GLU:C	2.58	0.41
1:A:180:HIS:HD2	1:A:181:ALA:N	2.17	0.41
1:A:33:LEU:HD12	1:A:33:LEU:HA	1.62	0.41
1:A:50:GLY:CA	1:A:55:ALA:C	2.83	0.41
1:A:180:HIS:O	1:A:183:ASP:N	2.44	0.41
1:A:22:ILE:CG2	1:A:53:ALA:HB2	2.50	0.41
1:A:62:VAL:HG23	1:A:63:GLN:N	2.35	0.41
1:A:52:LEU:HD23	1:A:52:LEU:HA	1.75	0.41
1:A:268:LEU:HB2	1:A:270:LEU:HG	2.03	0.41
1:A:92:CYS:HB3	1:A:97:LYS:HB3	2.03	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:40:GLU:HB3	1:A:64:SER:HB3	2.03	0.40
1:A:82:PRO:HA	1:A:106:PHE:CE2	2.56	0.40
1:A:268:LEU:HB3	1:A:270:LEU:HD21	2.01	0.40
1:A:65:SER:HB3	1:A:68:ALA:HB3	2.01	0.40
1:A:79:PHE:C	2:A:301:NAD:H4D	2.41	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	268/273 (98%)	228 (85%)	23 (9%)	17 (6%)	<b>1</b> <b>0</b>

All (17) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	6	ILE
1	A	46	GLY
1	A	47	SER
1	A	58	THR
1	A	149	ASP
1	A	13	ALA
1	A	27	ALA
1	A	44	LEU
1	A	45	LEU
1	A	53	ALA
1	A	54	GLY
1	A	56	GLY
1	A	59	GLY
1	A	96	GLY
1	A	168	SER
1	A	26	LEU

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Mol	Chain	Res	Type
1	A	49	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	193/201 (96%)	151 (78%)	42 (22%)	<b>1</b> <b>0</b>

All (42) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	6	ILE
1	A	7	ARG
1	A	16	ARG
1	A	28	LEU
1	A	32	GLN
1	A	38	GLU
1	A	40	GLU
1	A	42	SER
1	A	44	LEU
1	A	45	LEU
1	A	47	SER
1	A	58	THR
1	A	62	VAL
1	A	66	LEU
1	A	70	LYS
1	A	82	PRO
1	A	83	GLU
1	A	94	GLN
1	A	95	HIS
1	A	97	LYS
1	A	99	MET
1	A	115	ARG
1	A	130	SER
1	A	137	LEU
1	A	138	LYS

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Mol	Chain	Res	Type
1	A	140	LEU
1	A	145	LYS
1	A	157	GLU
1	A	180	HIS
1	A	184	LYS
1	A	193	SER
1	A	212	ARG
1	A	221	THR
1	A	231	LEU
1	A	243	PHE
1	A	249	ARG
1	A	250	SER
1	A	252	LEU
1	A	257	LYS
1	A	258	GLU
1	A	272	ASN
1	A	273	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	20	GLN
1	A	32	GLN
1	A	88	HIS
1	A	180	HIS
1	A	197	HIS
1	A	220	HIS
1	A	245	ASN
1	A	271	ASN
1	A	272	ASN

### 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](#)

1 ligand is 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	NAD	A	301	-	42,48,48	3.02	9 (21%)	50,73,73	2.43	15 (30%)

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	NAD	A	301	-	-	16/26/62/62	0/5/5/5

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	301	NAD	PN-O3	-11.05	1.47	1.59
2	A	301	NAD	PA-O3	-8.58	1.50	1.59
2	A	301	NAD	O7N-C7N	8.22	1.39	1.24
2	A	301	NAD	C3N-C7N	-7.91	1.38	1.50
2	A	301	NAD	C4N-C3N	-3.93	1.33	1.39
2	A	301	NAD	C2N-C3N	-2.93	1.34	1.39
2	A	301	NAD	O4D-C1D	2.30	1.43	1.40
2	A	301	NAD	C2A-N3A	2.23	1.35	1.32
2	A	301	NAD	O4B-C1B	2.03	1.43	1.40

All (15) bond angle outliers are listed below:



Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	301	NAD	O3-PN-O1N	-7.95	86.80	110.70
2	A	301	NAD	C6N-N1N-C2N	-6.52	116.33	121.88
2	A	301	NAD	C2N-C3N-C4N	-5.47	111.90	118.26
2	A	301	NAD	O4B-C1B-N9A	4.20	114.32	108.75
2	A	301	NAD	C3N-C7N-N7N	-3.97	112.84	117.74
2	A	301	NAD	C5N-C4N-C3N	3.76	124.06	120.36
2	A	301	NAD	C1B-N9A-C4A	3.54	132.87	126.64
2	A	301	NAD	C5A-C6A-N6A	3.44	125.55	120.31
2	A	301	NAD	O7N-C7N-N7N	3.31	127.40	122.62
2	A	301	NAD	O2N-PN-O3	3.26	116.09	107.27
2	A	301	NAD	O2A-PA-O3	3.24	116.03	107.27
2	A	301	NAD	O2N-PN-O1N	2.65	124.78	112.44
2	A	301	NAD	O3-PA-O1A	-2.42	103.43	110.70
2	A	301	NAD	O5D-C5D-C4D	2.30	116.81	108.99
2	A	301	NAD	C6N-N1N-C1D	2.11	123.88	119.73

There are no chirality outliers.

All (16) torsion outliers are listed below:

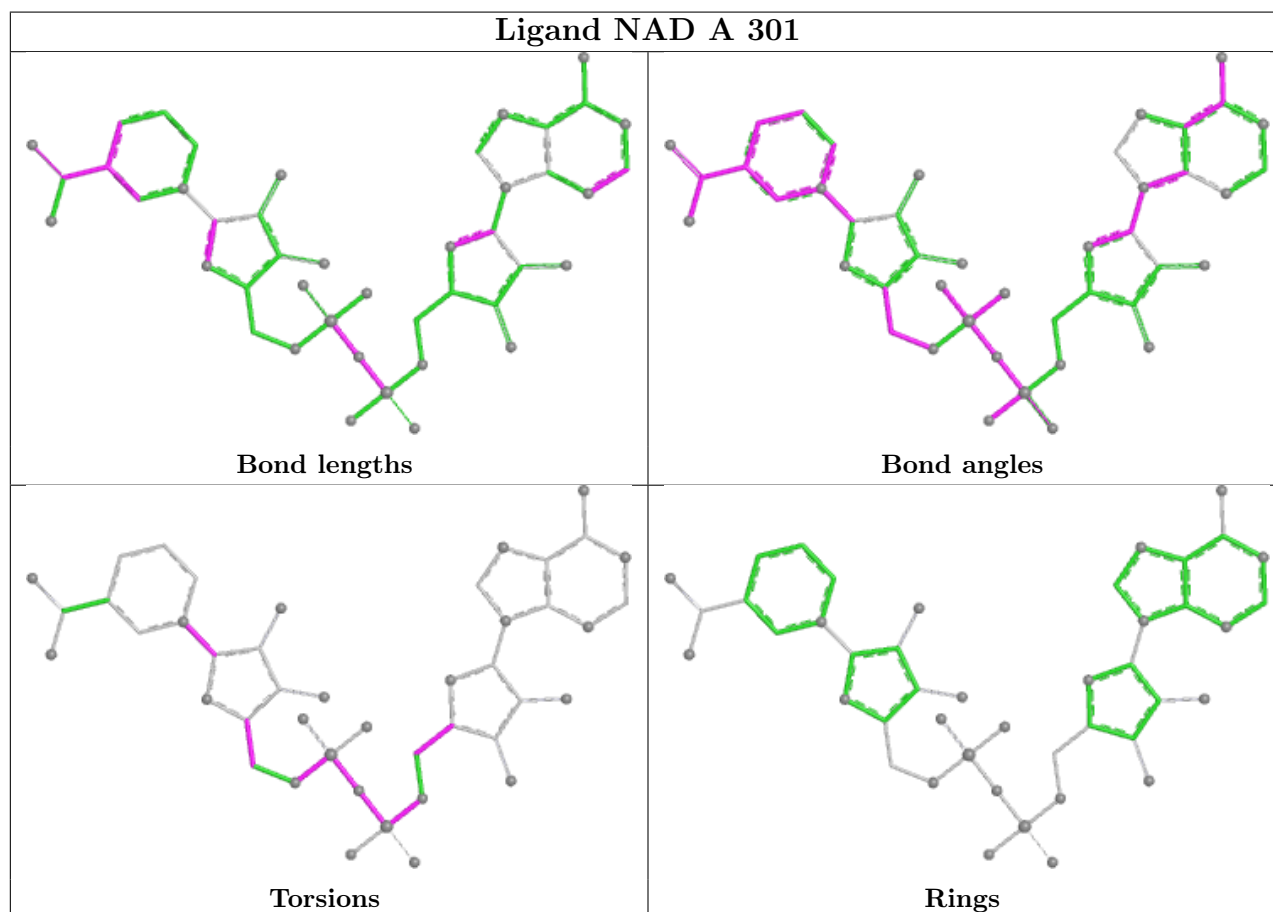
Mol	Chain	Res	Type	Atoms
2	A	301	NAD	C5B-O5B-PA-O3
2	A	301	NAD	O4B-C4B-C5B-O5B
2	A	301	NAD	C3B-C4B-C5B-O5B
2	A	301	NAD	C5D-O5D-PN-O3
2	A	301	NAD	C5D-O5D-PN-O2N
2	A	301	NAD	O4D-C1D-N1N-C2N
2	A	301	NAD	O4D-C1D-N1N-C6N
2	A	301	NAD	C2D-C1D-N1N-C2N
2	A	301	NAD	O4D-C4D-C5D-O5D
2	A	301	NAD	C3D-C4D-C5D-O5D
2	A	301	NAD	PN-O3-PA-O5B
2	A	301	NAD	C5B-O5B-PA-O1A
2	A	301	NAD	C5D-O5D-PN-O1N
2	A	301	NAD	PA-O3-PN-O1N
2	A	301	NAD	C2D-C1D-N1N-C6N
2	A	301	NAD	PA-O3-PN-O2N

There are no ring outliers.

1 monomer is involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	301	NAD	9	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](#)

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

### 6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

### 6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

### 6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.