



# wwPDB X-ray Structure Validation Summary Report ⓘ

Feb 1, 2016 – 02:16 PM GMT

PDB ID : 3WMX  
Title : GalE-like L-Threonine dehydrogenase from *Cupriavidus necator* (holo form)  
Authors : Nakano, S.; Okazaki, S.; Tokiwa, H.; Asano, Y.  
Deposited on : 2013-11-29  
Resolution : 2.50 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](mailto:validation@mail.wwpdb.org)  
A user guide is available at  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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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 : 1.7 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

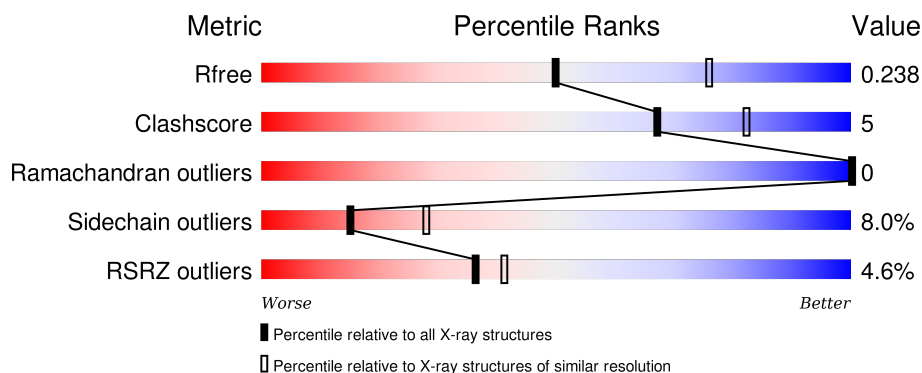
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.50 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))
$R_{free}$	91344	3553 (2.50-2.50)
Clashscore	102246	4242 (2.50-2.50)
Ramachandran outliers	100387	4156 (2.50-2.50)
Sidechain outliers	100360	4158 (2.50-2.50)
RSRZ outliers	91569	3562 (2.50-2.50)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. 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	358	
1	B	358	
1	C	358	
1	D	358	

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	THR	A	402	-	-	-	X
3	THR	B	402	-	-	-	X

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 9738 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 NAD dependent epimerase/dehydratase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	310	Total	C	N	O	S	0	0	0
			2385	1511	415	447	12			
1	B	308	Total	C	N	O	S	0	0	0
			2371	1502	412	445	12			
1	C	308	Total	C	N	O	S	0	0	0
			2372	1503	412	445	12			
1	D	304	Total	C	N	O	S	0	0	0
			2351	1491	407	441	12			

There are 160 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-19	MET	-	EXPRESSION TAG	UNP Q0K312
A	-18	GLY	-	EXPRESSION TAG	UNP Q0K312
A	-17	SER	-	EXPRESSION TAG	UNP Q0K312
A	-16	SER	-	EXPRESSION TAG	UNP Q0K312
A	-15	HIS	-	EXPRESSION TAG	UNP Q0K312
A	-14	HIS	-	EXPRESSION TAG	UNP Q0K312
A	-13	HIS	-	EXPRESSION TAG	UNP Q0K312
A	-12	HIS	-	EXPRESSION TAG	UNP Q0K312
A	-11	HIS	-	EXPRESSION TAG	UNP Q0K312
A	-10	HIS	-	EXPRESSION TAG	UNP Q0K312
A	-9	SER	-	EXPRESSION TAG	UNP Q0K312
A	-8	SER	-	EXPRESSION TAG	UNP Q0K312
A	-7	GLY	-	EXPRESSION TAG	UNP Q0K312
A	-6	LEU	-	EXPRESSION TAG	UNP Q0K312
A	-5	VAL	-	EXPRESSION TAG	UNP Q0K312
A	-4	PRO	-	EXPRESSION TAG	UNP Q0K312
A	-3	ARG	-	EXPRESSION TAG	UNP Q0K312
A	-2	GLY	-	EXPRESSION TAG	UNP Q0K312
A	-1	SER	-	EXPRESSION TAG	UNP Q0K312
A	0	HIS	-	EXPRESSION TAG	UNP Q0K312
A	319	ASP	-	EXPRESSION TAG	UNP Q0K312

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Chain	Residue	Modelled	Actual	Comment	Reference
A	320	PRO	-	EXPRESSION TAG	UNP Q0K312
A	321	ALA	-	EXPRESSION TAG	UNP Q0K312
A	322	ALA	-	EXPRESSION TAG	UNP Q0K312
A	323	ASN	-	EXPRESSION TAG	UNP Q0K312
A	324	LYS	-	EXPRESSION TAG	UNP Q0K312
A	325	ALA	-	EXPRESSION TAG	UNP Q0K312
A	326	ARG	-	EXPRESSION TAG	UNP Q0K312
A	327	LYS	-	EXPRESSION TAG	UNP Q0K312
A	328	GLU	-	EXPRESSION TAG	UNP Q0K312
A	329	ALA	-	EXPRESSION TAG	UNP Q0K312
A	330	GLU	-	EXPRESSION TAG	UNP Q0K312
A	331	LEU	-	EXPRESSION TAG	UNP Q0K312
A	332	ALA	-	EXPRESSION TAG	UNP Q0K312
A	333	ALA	-	EXPRESSION TAG	UNP Q0K312
A	334	ALA	-	EXPRESSION TAG	UNP Q0K312
A	335	THR	-	EXPRESSION TAG	UNP Q0K312
A	336	ALA	-	EXPRESSION TAG	UNP Q0K312
A	337	GLU	-	EXPRESSION TAG	UNP Q0K312
A	338	GLN	-	EXPRESSION TAG	UNP Q0K312
B	-19	MET	-	EXPRESSION TAG	UNP Q0K312
B	-18	GLY	-	EXPRESSION TAG	UNP Q0K312
B	-17	SER	-	EXPRESSION TAG	UNP Q0K312
B	-16	SER	-	EXPRESSION TAG	UNP Q0K312
B	-15	HIS	-	EXPRESSION TAG	UNP Q0K312
B	-14	HIS	-	EXPRESSION TAG	UNP Q0K312
B	-13	HIS	-	EXPRESSION TAG	UNP Q0K312
B	-12	HIS	-	EXPRESSION TAG	UNP Q0K312
B	-11	HIS	-	EXPRESSION TAG	UNP Q0K312
B	-10	HIS	-	EXPRESSION TAG	UNP Q0K312
B	-9	SER	-	EXPRESSION TAG	UNP Q0K312
B	-8	SER	-	EXPRESSION TAG	UNP Q0K312
B	-7	GLY	-	EXPRESSION TAG	UNP Q0K312
B	-6	LEU	-	EXPRESSION TAG	UNP Q0K312
B	-5	VAL	-	EXPRESSION TAG	UNP Q0K312
B	-4	PRO	-	EXPRESSION TAG	UNP Q0K312
B	-3	ARG	-	EXPRESSION TAG	UNP Q0K312
B	-2	GLY	-	EXPRESSION TAG	UNP Q0K312
B	-1	SER	-	EXPRESSION TAG	UNP Q0K312
B	0	HIS	-	EXPRESSION TAG	UNP Q0K312
B	319	ASP	-	EXPRESSION TAG	UNP Q0K312
B	320	PRO	-	EXPRESSION TAG	UNP Q0K312
B	321	ALA	-	EXPRESSION TAG	UNP Q0K312

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Chain	Residue	Modelled	Actual	Comment	Reference
B	322	ALA	-	EXPRESSION TAG	UNP Q0K312
B	323	ASN	-	EXPRESSION TAG	UNP Q0K312
B	324	LYS	-	EXPRESSION TAG	UNP Q0K312
B	325	ALA	-	EXPRESSION TAG	UNP Q0K312
B	326	ARG	-	EXPRESSION TAG	UNP Q0K312
B	327	LYS	-	EXPRESSION TAG	UNP Q0K312
B	328	GLU	-	EXPRESSION TAG	UNP Q0K312
B	329	ALA	-	EXPRESSION TAG	UNP Q0K312
B	330	GLU	-	EXPRESSION TAG	UNP Q0K312
B	331	LEU	-	EXPRESSION TAG	UNP Q0K312
B	332	ALA	-	EXPRESSION TAG	UNP Q0K312
B	333	ALA	-	EXPRESSION TAG	UNP Q0K312
B	334	ALA	-	EXPRESSION TAG	UNP Q0K312
B	335	THR	-	EXPRESSION TAG	UNP Q0K312
B	336	ALA	-	EXPRESSION TAG	UNP Q0K312
B	337	GLU	-	EXPRESSION TAG	UNP Q0K312
B	338	GLN	-	EXPRESSION TAG	UNP Q0K312
C	-19	MET	-	EXPRESSION TAG	UNP Q0K312
C	-18	GLY	-	EXPRESSION TAG	UNP Q0K312
C	-17	SER	-	EXPRESSION TAG	UNP Q0K312
C	-16	SER	-	EXPRESSION TAG	UNP Q0K312
C	-15	HIS	-	EXPRESSION TAG	UNP Q0K312
C	-14	HIS	-	EXPRESSION TAG	UNP Q0K312
C	-13	HIS	-	EXPRESSION TAG	UNP Q0K312
C	-12	HIS	-	EXPRESSION TAG	UNP Q0K312
C	-11	HIS	-	EXPRESSION TAG	UNP Q0K312
C	-10	HIS	-	EXPRESSION TAG	UNP Q0K312
C	-9	SER	-	EXPRESSION TAG	UNP Q0K312
C	-8	SER	-	EXPRESSION TAG	UNP Q0K312
C	-7	GLY	-	EXPRESSION TAG	UNP Q0K312
C	-6	LEU	-	EXPRESSION TAG	UNP Q0K312
C	-5	VAL	-	EXPRESSION TAG	UNP Q0K312
C	-4	PRO	-	EXPRESSION TAG	UNP Q0K312
C	-3	ARG	-	EXPRESSION TAG	UNP Q0K312
C	-2	GLY	-	EXPRESSION TAG	UNP Q0K312
C	-1	SER	-	EXPRESSION TAG	UNP Q0K312
C	0	HIS	-	EXPRESSION TAG	UNP Q0K312
C	319	ASP	-	EXPRESSION TAG	UNP Q0K312
C	320	PRO	-	EXPRESSION TAG	UNP Q0K312
C	321	ALA	-	EXPRESSION TAG	UNP Q0K312
C	322	ALA	-	EXPRESSION TAG	UNP Q0K312
C	323	ASN	-	EXPRESSION TAG	UNP Q0K312

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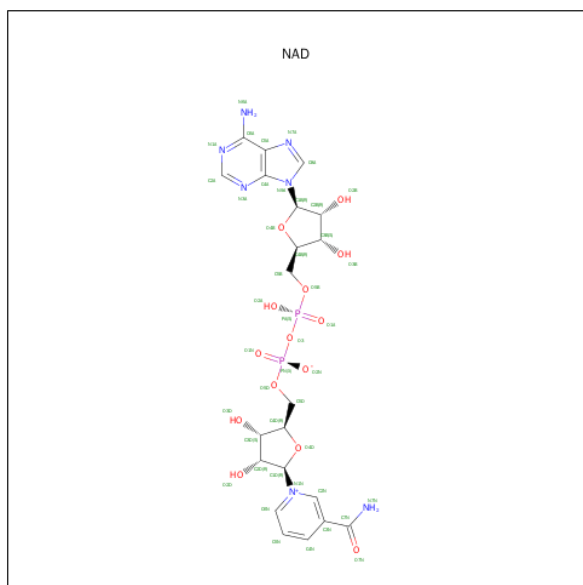
Chain	Residue	Modelled	Actual	Comment	Reference
C	324	LYS	-	EXPRESSION TAG	UNP Q0K312
C	325	ALA	-	EXPRESSION TAG	UNP Q0K312
C	326	ARG	-	EXPRESSION TAG	UNP Q0K312
C	327	LYS	-	EXPRESSION TAG	UNP Q0K312
C	328	GLU	-	EXPRESSION TAG	UNP Q0K312
C	329	ALA	-	EXPRESSION TAG	UNP Q0K312
C	330	GLU	-	EXPRESSION TAG	UNP Q0K312
C	331	LEU	-	EXPRESSION TAG	UNP Q0K312
C	332	ALA	-	EXPRESSION TAG	UNP Q0K312
C	333	ALA	-	EXPRESSION TAG	UNP Q0K312
C	334	ALA	-	EXPRESSION TAG	UNP Q0K312
C	335	THR	-	EXPRESSION TAG	UNP Q0K312
C	336	ALA	-	EXPRESSION TAG	UNP Q0K312
C	337	GLU	-	EXPRESSION TAG	UNP Q0K312
C	338	GLN	-	EXPRESSION TAG	UNP Q0K312
D	-19	MET	-	EXPRESSION TAG	UNP Q0K312
D	-18	GLY	-	EXPRESSION TAG	UNP Q0K312
D	-17	SER	-	EXPRESSION TAG	UNP Q0K312
D	-16	SER	-	EXPRESSION TAG	UNP Q0K312
D	-15	HIS	-	EXPRESSION TAG	UNP Q0K312
D	-14	HIS	-	EXPRESSION TAG	UNP Q0K312
D	-13	HIS	-	EXPRESSION TAG	UNP Q0K312
D	-12	HIS	-	EXPRESSION TAG	UNP Q0K312
D	-11	HIS	-	EXPRESSION TAG	UNP Q0K312
D	-10	HIS	-	EXPRESSION TAG	UNP Q0K312
D	-9	SER	-	EXPRESSION TAG	UNP Q0K312
D	-8	SER	-	EXPRESSION TAG	UNP Q0K312
D	-7	GLY	-	EXPRESSION TAG	UNP Q0K312
D	-6	LEU	-	EXPRESSION TAG	UNP Q0K312
D	-5	VAL	-	EXPRESSION TAG	UNP Q0K312
D	-4	PRO	-	EXPRESSION TAG	UNP Q0K312
D	-3	ARG	-	EXPRESSION TAG	UNP Q0K312
D	-2	GLY	-	EXPRESSION TAG	UNP Q0K312
D	-1	SER	-	EXPRESSION TAG	UNP Q0K312
D	0	HIS	-	EXPRESSION TAG	UNP Q0K312
D	319	ASP	-	EXPRESSION TAG	UNP Q0K312
D	320	PRO	-	EXPRESSION TAG	UNP Q0K312
D	321	ALA	-	EXPRESSION TAG	UNP Q0K312
D	322	ALA	-	EXPRESSION TAG	UNP Q0K312
D	323	ASN	-	EXPRESSION TAG	UNP Q0K312
D	324	LYS	-	EXPRESSION TAG	UNP Q0K312
D	325	ALA	-	EXPRESSION TAG	UNP Q0K312

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Chain	Residue	Modelled	Actual	Comment	Reference
D	326	ARG	-	EXPRESSION TAG	UNP Q0K312
D	327	LYS	-	EXPRESSION TAG	UNP Q0K312
D	328	GLU	-	EXPRESSION TAG	UNP Q0K312
D	329	ALA	-	EXPRESSION TAG	UNP Q0K312
D	330	GLU	-	EXPRESSION TAG	UNP Q0K312
D	331	LEU	-	EXPRESSION TAG	UNP Q0K312
D	332	ALA	-	EXPRESSION TAG	UNP Q0K312
D	333	ALA	-	EXPRESSION TAG	UNP Q0K312
D	334	ALA	-	EXPRESSION TAG	UNP Q0K312
D	335	THR	-	EXPRESSION TAG	UNP Q0K312
D	336	ALA	-	EXPRESSION TAG	UNP Q0K312
D	337	GLU	-	EXPRESSION TAG	UNP Q0K312
D	338	GLN	-	EXPRESSION TAG	UNP Q0K312

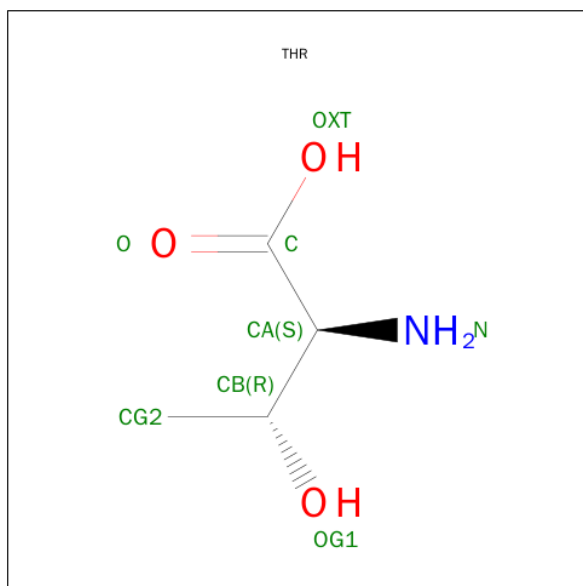
- Molecule 2 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula:  $C_{21}H_{27}N_7O_{14}P_2$ ).



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		
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 THREONINE (three-letter code: THR) (formula:  $C_4H_9NO_3$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			8	4	1	3		
3	B	1	Total	C	N	O	0	0
			8	4	1	3		

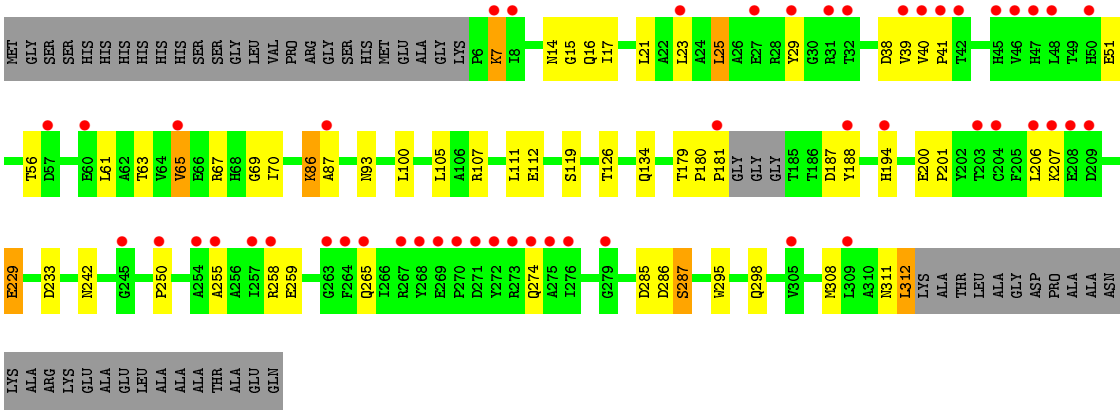
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	35	Total	O	0	0
			35	35		
4	B	17	Total	O	0	0
			17	17		
4	C	14	Total	O	0	0
			14	14		
4	D	1	Total	O	0	0
			1	1		



- Molecule 1: NAD dependent epimerase/dehydratase





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	91.60 Å 88.11 Å 113.60 Å 90.00° 105.47° 90.00°	Depositor
Resolution (Å)	40.87 – 2.50 40.87 – 2.50	Depositor EDS
% Data completeness (in resolution range)	100.0 (40.87-2.50) 100.0 (40.87-2.50)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	7.78 (at 2.51 Å)	Xtriage
Refinement program	REFMAC 5.7.0029	Depositor
R, $R_{free}$	0.204 , 0.239 0.209 , 0.238	Depositor DCC
$R_{free}$ test set	2997 reflections (5.21%)	DCC
Wilson B-factor (Å <sup>2</sup> )	39.8	Xtriage
Anisotropy	0.108	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 31.9	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	1 of 60473 reflections (0.002%)	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	9738	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	45.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.70% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical values of  $\langle |L| \rangle$ ,  $\langle L^2 \rangle$  for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

## 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	0.49	0/2445	0.63	0/3333
1	B	0.43	0/2431	0.60	0/3314
1	C	0.43	0/2432	0.60	0/3316
1	D	0.37	0/2410	0.59	0/3287
All	All	0.43	0/9718	0.60	0/13250

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

### 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	2385	0	2342	23	0
1	B	2371	0	2323	25	0
1	C	2372	0	2327	15	0
1	D	2351	0	2304	30	0
2	A	44	0	26	3	0
2	B	44	0	26	2	0
2	C	44	0	26	1	0
2	D	44	0	26	4	0
3	A	8	0	6	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	8	0	6	0	0
4	A	35	0	0	3	0
4	B	17	0	0	1	0
4	C	14	0	0	0	0
4	D	1	0	0	0	0
All	All	9738	0	9412	91	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 5.

The worst 5 of 91 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:313:LYS:HA	4:A:512:HOH:O	1.55	1.03
1:A:43:GLY:O	1:B:44:ARG:NH2	2.07	0.88
1:D:255:ALA:O	1:D:258:ARG:HG2	1.80	0.82
1:A:313:LYS:HG2	1:A:313:LYS:O	1.78	0.81
1:C:19:SER:OG	1:C:179:THR:HG21	1.83	0.76

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	308/358 (86%)	303 (98%)	5 (2%)	0	100	100
1	B	306/358 (86%)	300 (98%)	6 (2%)	0	100	100
1	C	306/358 (86%)	299 (98%)	7 (2%)	0	100	100
1	D	300/358 (84%)	291 (97%)	9 (3%)	0	100	100
All	All	1220/1432 (85%)	1193 (98%)	27 (2%)	0	100	100

There are no Ramachandran outliers to report.

### 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	245/278 (88%)	228 (93%)	17 (7%)	19	35
1	B	244/278 (88%)	226 (93%)	18 (7%)	17	31
1	C	244/278 (88%)	225 (92%)	19 (8%)	16	29
1	D	243/278 (87%)	220 (90%)	23 (10%)	11	20
All	All	976/1112 (88%)	899 (92%)	77 (8%)	15	28

5 of 77 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	313	LYS
1	C	94	LEU
1	D	233	ASP
1	C	7	LYS
1	C	39	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 23 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	134	GLN
1	C	14	ASN
1	D	265	GLN
1	B	274	GLN
1	C	33	ASN

### 5.3.3 RNA ⓘ

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 carbohydrates in this entry.

## 5.6 Ligand geometry [i](#)

6 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z  > 2$	Counts	RMSZ	$\# Z  > 2$
2	NAD	A	401	-	38,48,48	0.80	1 (2%)	47,73,73	1.89	9 (19%)
3	THR	A	402	-	4,7,7	0.60	0	3,9,9	0.44	0
2	NAD	B	401	-	38,48,48	0.74	1 (2%)	47,73,73	1.85	9 (19%)
3	THR	B	402	-	4,7,7	0.62	0	3,9,9	0.85	0
2	NAD	C	401	-	38,48,48	0.80	1 (2%)	47,73,73	1.64	7 (14%)
2	NAD	D	401	-	38,48,48	0.86	2 (5%)	47,73,73	1.98	8 (17%)

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	401	-	-	0/22/62/62	0/5/5/5
3	THR	A	402	-	-	0/4/8/8	0/0/0/0
2	NAD	B	401	-	-	0/22/62/62	0/5/5/5
3	THR	B	402	-	-	0/4/8/8	0/0/0/0
2	NAD	C	401	-	-	0/22/62/62	0/5/5/5
2	NAD	D	401	-	-	0/22/62/62	0/5/5/5

All (5) bond length outliers are listed below:



Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	401	NAD	O4B-C1B	2.02	1.43	1.41
2	A	401	NAD	C5A-C4A	2.38	1.45	1.40
2	B	401	NAD	C5A-C4A	2.53	1.46	1.40
2	C	401	NAD	C5A-C4A	2.60	1.46	1.40
2	D	401	NAD	C5A-C4A	2.88	1.47	1.40

The worst 5 of 33 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	401	NAD	N3A-C2A-N1A	-8.69	122.24	128.89
2	D	401	NAD	N3A-C2A-N1A	-8.11	122.69	128.89
2	A	401	NAD	N3A-C2A-N1A	-7.53	123.13	128.89
2	C	401	NAD	N3A-C2A-N1A	-7.35	123.27	128.89
2	A	401	NAD	PN-O3-PA	-4.24	120.82	132.73

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

5 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	NAD	3	0
3	A	402	THR	1	0
2	B	401	NAD	2	0
2	C	401	NAD	1	0
2	D	401	NAD	4	0

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	310/358 (86%)	-0.30	0 100 100	19, 28, 50, 81	0
1	B	308/358 (86%)	-0.05	0 100 100	25, 39, 65, 94	0
1	C	308/358 (86%)	0.02	6 (1%) 70 73	22, 36, 62, 90	0
1	D	304/358 (84%)	0.94	51 (16%) 2 2	30, 71, 99, 123	0
All	All	1230/1432 (85%)	0.15	57 (4%) 36 41	19, 39, 86, 123	0

The worst 5 of 57 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	258	ARG	5.5
1	D	254	ALA	5.1
1	D	23	LEU	4.6
1	D	47	HIS	4.5
1	D	272	TYR	4.4

### 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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95<sup>th</sup> 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	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
3	THR	A	402	8/8	0.88	0.25	4.56	37,50,52,58	0
3	THR	B	402	8/8	0.90	0.22	2.12	45,67,71,74	0
2	NAD	A	401	44/44	0.98	0.13	-0.28	18,22,27,29	0
2	NAD	B	401	44/44	0.98	0.13	-0.54	20,26,35,37	0
2	NAD	D	401	44/44	0.92	0.16	-0.55	47,66,75,88	0
2	NAD	C	401	44/44	0.97	0.13	-0.67	23,29,33,35	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.