



Full wwPDB X-ray Structure Validation Report i

Mar 1, 2014 – 01:33 AM GMT

PDB ID : 1SOW
Title : T. gondii bradyzoite-specific LDH (LDH2) in complex with NAD and oxalate
Authors : Kavanagh, K.L.; Wilson, D.K.
Deposited on : 2004-03-15
Resolution : 1.90 Å(reported)

This is a full wwPDB validation report for a publicly released PDB entry.
We welcome your comments at validation@mail.wwpdb.org
A user guide is available at <http://wwpdb.org/ValidationPDFNotes.html>

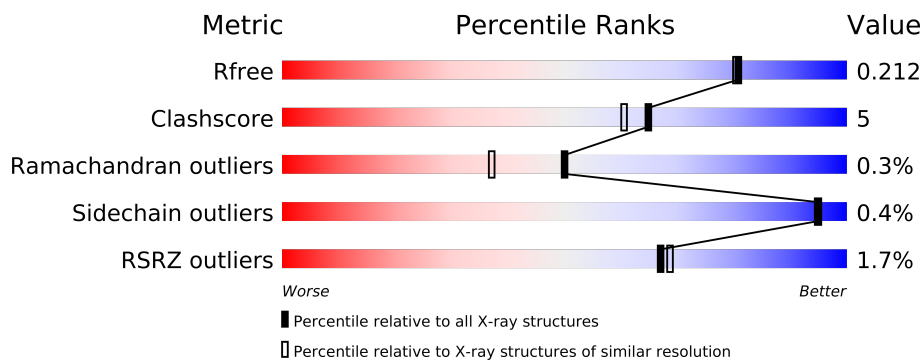
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.15 2013
Xtriage (Phenix) : dev-1323
EDS : stable22639
Percentile statistics : 21963
Refmac : 5.8.0049
CCP4 : 6.3.0 (Settle)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)
Validation Pipeline (wwPDB-VP) : stable22683

1 Overall quality at a glance



The reported resolution of this entry is 1.90 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}	66092	3684 (1.90-1.90)
Clashscore	79885	4465 (1.90-1.90)
Ramachandran outliers	78287	4413 (1.90-1.90)
Sidechain outliers	78261	4414 (1.90-1.90)
RSRZ outliers	66119	3686 (1.90-1.90)

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 ≥ 3 , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	328	
1	B	328	

2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 5329 atoms, of which 0 are hydrogen and 0 are deuterium.

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.

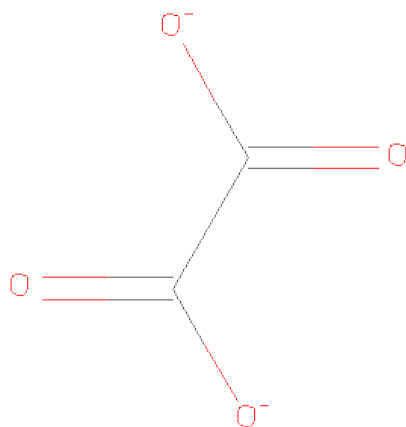
- Molecule 1 is a protein called L-lactate dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	322	Total	C	N	O	S	0	0	0
			2447	1551	419	458	19			
1	B	323	Total	C	N	O	S	0	0	0
			2451	1553	420	459	19			

There are 6 discrepancies between the modelled and reference sequences:

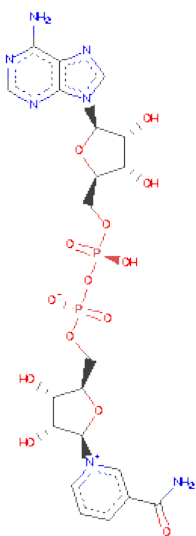
Chain	Residue	Modelled	Actual	Comment	Reference
A	209A	ASN	SER	SEE REMARK 999	UNP Q27797
A	333	PRO	-	CLONING ARTIFACT	UNP Q27797
A	334	GLY	-	CLONING ARTIFACT	UNP Q27797
B	209A	ASN	SER	SEE REMARK 999	UNP Q27797
B	333	PRO	-	CLONING ARTIFACT	UNP Q27797
B	334	GLY	-	CLONING ARTIFACT	UNP Q27797

- Molecule 2 is OXALATE ION (three-letter code: OXL) (formula: C_2O_4).



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

- Molecule 3 is NICOTINAMIDE-ADENINE-DINUCLEOTIDE (three-letter code: NAD) (formula: $C_{21}H_{27}N_7O_{14}P_2$).



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

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	142	Total	O	0	0
			142	142		
4	B	189	Total	O	0	0
			189	189		

4 Data and refinement statistics

Property	Value	Source
Space group	P 3 2 1	Depositor
Cell constants a, b, c, α , β , γ	140.71 Å 140.71 Å 74.74 Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	30.00 – 1.90 29.02 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.7 (30.00-1.90) 99.7 (29.02-1.90)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.98 (at 1.91 Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.185 , 0.212 0.186 , 0.212	Depositor DCC
R_{free} test set	3378 reflections (5.04%)	DCC
Wilson B-factor (Å ²)	25.7	Xtriage
Anisotropy	0.203	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 37.1	EDS
Estimated twinning fraction	0.021 for -h,-k,l	Xtriage
L-test for twinning	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.34$	Xtriage
Outliers	0 of 67007 reflections	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5329	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 3.17% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: OXL, 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	0.48	0/2484	0.67	0/3353
1	B	0.52	0/2488	0.69	0/3358
All	All	0.50	0/4972	0.68	0/6711

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

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

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	38	TYR	Sidechain
1	B	38	TYR	Sidechain

5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the

chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2447	0	2513	37	0
1	B	2451	0	2516	16	0
2	A	6	0	0	0	0
2	B	6	0	0	0	0
3	A	44	0	26	2	0
3	B	44	0	26	1	0
4	A	142	0	0	2	0
4	B	189	0	0	0	0
All	All	5329	0	5081	53	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 5.

All (53) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:230:GLU:OE2	1:A:234:LYS:HE3	1.81	0.79
1:A:210(B):ARG:HH22	1:A:221:GLU:HG2	1.47	0.79
1:A:290:PRO:HB2	1:A:303:ILE:HB	1.73	0.70
1:A:319:VAL:O	1:A:323:VAL:HG23	1.93	0.68
1:B:142:LEU:O	1:B:146:VAL:HG23	1.94	0.67
1:A:312:GLN:O	1:A:316:ARG:HG3	1.96	0.66
1:A:210(B):ARG:NH2	1:A:221:GLU:HG2	2.12	0.65
1:A:105(B):LYS:HG3	4:A:536:HOH:O	1.97	0.64
1:A:210(B):ARG:HH22	1:A:221:GLU:CG	2.14	0.60
1:B:147:LYS:O	1:B:151:GLU:HG2	2.02	0.59
1:A:176:ILE:HD13	1:A:206:VAL:HG11	1.86	0.57
1:B:279:TYR:CE2	1:B:289:LEU:HD22	2.41	0.56
1:B:58:MET:HB3	1:B:59:PRO:HD3	1.87	0.56
1:A:138:VAL:O	3:A:401:NAD:H2N	2.07	0.55
1:B:103(E):SER:OG	1:B:106:GLU:HG3	2.06	0.55
1:B:138:VAL:O	3:B:501:NAD:H2N	2.07	0.54
1:A:323:VAL:O	1:A:326:LYS:HG2	2.08	0.53
1:A:142:LEU:O	1:A:146:VAL:HG23	2.08	0.53
1:A:41:VAL:HG13	1:A:70:THR:HG22	1.92	0.51
1:A:58:MET:HB3	1:A:59:PRO:HD3	1.92	0.51
1:A:147:LYS:O	1:A:151:GLU:HG3	2.10	0.50
1:B:330:ALA:O	1:B:331:LEU:HD23	2.11	0.50
1:B:290:PRO:HB2	1:B:303:ILE:HB	1.94	0.50
1:A:157:LYS:HD3	1:A:274:TYR:CE2	2.49	0.47
1:B:41:VAL:HG13	1:B:70:THR:HG22	1.97	0.47

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:81:ALA:HB1	1:A:87:LYS:HG3	1.97	0.47
1:B:172:PHE:CD2	1:B:189:ALA:HB1	2.50	0.46
1:A:324:GLU:HG3	1:A:325(A):LEU:N	2.30	0.45
1:A:102:LYS:HA	1:A:112:LEU:HD21	1.98	0.45
1:B:142:LEU:HG	1:B:164:ALA:HB2	1.97	0.45
1:A:97:THR:HB	3:A:401:NAD:H51N	1.98	0.45
1:A:110:ASN:HB2	1:A:325(A):LEU:HD11	1.99	0.45
1:A:314:CYS:HA	1:A:317:LYS:HE3	1.99	0.45
1:A:210(B):ARG:HG3	1:A:214:LYS:HE3	1.98	0.45
1:B:121:ARG:O	1:B:125:GLN:HG2	2.18	0.44
1:A:143:ASP:OD2	1:A:194:THR:HA	2.18	0.44
1:A:16:THR:HG21	1:A:19:ARG:HD2	1.99	0.44
1:A:249:ALA:HB3	1:A:250:PRO:HD3	1.99	0.43
1:A:58:MET:SD	1:A:62:LYS:HE3	2.59	0.43
1:A:165:ASN:HB3	1:A:270:PRO:HB2	2.01	0.43
1:A:273:VAL:O	1:A:286:PHE:HA	2.18	0.43
1:B:53:ASP:HB3	1:B:59:PRO:HG2	2.01	0.42
1:B:278:GLU:C	1:B:280:GLY:N	2.72	0.42
1:A:171:ARG:HD3	1:A:235:ALA:HB3	2.02	0.42
1:A:210(B):ARG:O	1:A:214:LYS:HG3	2.20	0.41
1:B:85:TYR:O	1:B:88:ILE:HG12	2.19	0.41
1:A:103(D):LYS:HG3	4:A:461:HOH:O	2.20	0.41
1:A:86:GLU:HA	1:A:130:TYR:CD2	2.56	0.41
1:A:314:CYS:HA	1:A:317:LYS:CE	2.51	0.41
1:A:124:ALA:HA	1:A:149:PHE:CE1	2.56	0.41
1:B:249:ALA:N	1:B:250:PRO:CD	2.84	0.41
1:A:36:MET:SD	1:A:95:ILE:HG21	2.61	0.40
1:A:218:LYS:HA	1:A:218:LYS:HD3	1.76	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	320/328 (98%)	310 (97%)	9 (3%)	1 (0%)	50 37

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	321/328 (98%)	312 (97%)	8 (2%)	1 (0%)	50	37
All	All	641/656 (98%)	622 (97%)	17 (3%)	2 (0%)	50	37

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	164	ALA
1	A	164	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	265/268 (99%)	264 (100%)	1 (0%)	95	95
1	B	265/268 (99%)	264 (100%)	1 (0%)	95	95
All	All	530/536 (99%)	528 (100%)	2 (0%)	95	95

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	324	GLU
1	B	318	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	84	GLN
1	B	110	ASN

5.3.3 RNA ⓘ

There are no RNA chains 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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

4 ligands are modelled in this entry.

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

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
3	NAD	A	401	-	48,48,48	1.75	12 (25%)	73,73,73	1.79	13 (17%)
2	OXL	A	402	-	0,5,5	0.00	-	0,6,6	0.00	-
3	NAD	B	501	-	48,48,48	1.82	14 (29%)	73,73,73	1.80	12 (16%)
2	OXL	B	502	-	0,5,5	0.00	-	0,6,6	0.00	-

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
3	NAD	A	401	-	-	0/30/62/62	0/3/5/5
2	OXL	A	402	-	-	0/0/4/4	0/0/0/0
3	NAD	B	501	-	-	0/30/62/62	0/3/5/5
2	OXL	B	502	-	-	0/0/4/4	0/0/0/0

All (26) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	501	NAD	C2N-N1N	4.83	1.41	1.35
3	A	401	NAD	C2N-N1N	4.55	1.41	1.35

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	501	NAD	C4N-C3N	4.54	1.47	1.39
3	A	401	NAD	C4N-C3N	4.16	1.46	1.39
3	A	401	NAD	C2D-C1D	-4.05	1.47	1.53
3	B	501	NAD	C2D-C1D	-3.98	1.47	1.53
3	A	401	NAD	C2A-N1A	3.76	1.41	1.33
3	B	501	NAD	C2A-N3A	3.51	1.39	1.32
3	B	501	NAD	C2A-N1A	3.45	1.40	1.33
3	A	401	NAD	C4A-N3A	3.36	1.40	1.35
3	A	401	NAD	C2A-N3A	3.09	1.38	1.32
3	B	501	NAD	C6N-N1N	2.94	1.43	1.35
3	A	401	NAD	O4D-C1D	2.83	1.45	1.41
3	B	501	NAD	C4A-N3A	2.74	1.39	1.35
3	B	501	NAD	C6N-C5N	2.67	1.44	1.38
3	A	401	NAD	C6N-N1N	2.66	1.43	1.35
3	B	501	NAD	O4D-C1D	2.61	1.45	1.41
3	A	401	NAD	PA-O1A	-2.58	1.41	1.51
3	B	501	NAD	C3B-C4B	2.46	1.59	1.53
3	B	501	NAD	C5N-C4N	2.38	1.44	1.39
3	A	401	NAD	C3B-C4B	2.36	1.59	1.53
3	B	501	NAD	C8A-N9A	2.30	1.40	1.36
3	A	401	NAD	O4B-C4B	2.29	1.50	1.45
3	B	501	NAD	O4B-C4B	2.25	1.50	1.45
3	A	401	NAD	C3D-C4D	2.13	1.58	1.53
3	B	501	NAD	PA-O1A	-2.10	1.43	1.51

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	501	NAD	O4B-C1B-N9A	8.02	115.90	108.44
3	A	401	NAD	O4B-C1B-N9A	7.38	115.30	108.44
3	A	401	NAD	N3A-C2A-N1A	-7.26	122.64	128.71
3	B	501	NAD	N3A-C2A-N1A	-7.24	122.66	128.71
3	B	501	NAD	O4D-C1D-N1N	-3.78	104.08	107.95
3	B	501	NAD	C2D-C1D-N1N	3.72	120.15	113.86
3	A	401	NAD	C2D-C1D-N1N	3.60	119.95	113.86
3	A	401	NAD	C1B-N9A-C4A	-3.59	120.43	126.64
3	A	401	NAD	C8A-N9A-C1B	3.40	133.08	126.38
3	A	401	NAD	O5B-C5B-C4B	-3.34	96.69	108.94
3	B	501	NAD	O5B-C5B-C4B	-3.30	96.82	108.94
3	A	401	NAD	O4D-C1D-N1N	-3.15	104.73	107.95
3	B	501	NAD	C8A-N9A-C1B	2.97	132.23	126.38
3	B	501	NAD	C1B-N9A-C4A	-2.87	121.68	126.64

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	501	NAD	C2N-C3N-C4N	2.81	121.49	118.31
3	B	501	NAD	C5A-C6A-N6A	2.69	126.79	120.72
3	A	401	NAD	C5A-C6A-N6A	2.66	126.74	120.72
3	A	401	NAD	C2N-C3N-C4N	2.54	121.19	118.31
3	A	401	NAD	O7N-C7N-C3N	-2.38	116.90	119.58
3	B	501	NAD	N3A-C4A-N9A	2.36	129.69	125.43
3	A	401	NAD	C4D-O4D-C1D	-2.23	107.32	109.75
3	B	501	NAD	C5N-C6N-N1N	-2.22	116.70	120.43
3	A	401	NAD	N3A-C4A-N9A	2.19	129.38	125.43
3	A	401	NAD	C3N-C7N-N7N	2.18	120.25	117.77
3	B	501	NAD	C5N-C4N-C3N	-2.04	117.67	120.32

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

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(Å ²)	Q<0.9
1	A	322/328 (98%)	-0.03	7 (2%) 59 60	18, 28, 45, 70	0
1	B	323/328 (98%)	-0.16	4 (1%) 75 78	18, 24, 40, 63	0
All	All	645/656 (98%)	-0.10	11 (1%) 67 69	18, 26, 43, 70	0

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	331	LEU	4.5
1	A	329	ALA	4.3
1	B	331	LEU	3.7
1	B	15	GLY	3.5
1	A	16	THR	3.1
1	A	17	VAL	2.9
1	A	323	VAL	2.7
1	A	326	LYS	2.6
1	A	330	ALA	2.4
1	B	330	ALA	2.2
1	B	138	VAL	2.1

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

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

6.3 Carbohydrates ⓘ

There are no carbohydrates 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. 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, 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	RSR	LLDF	B-factors(\AA^2)	Q<0.9
3	NAD	B	501	44/44	0.09	-	20,24,28,31	0
2	OXL	A	402	6/6	0.09	-	30,31,33,33	0
3	NAD	A	401	44/44	0.10	-	25,30,33,35	0
2	OXL	B	502	6/6	0.08	-	23,24,25,25	0

6.5 Other polymers

There are no such residues in this entry.