WORLDWIDE wwPDB PROTEIN DATA BANK

Full wwPDB X-ray Structure Validation Report ⓘ

Jun 12, 2024 – 11:11 PM EDT

PDB ID	:	3MOI
Title	:	The crystal structure of the putative dehydrogenase from Bordetella bronchiseptica RB50
Authors	:	Zhang, R.; Evdokimova, E.; Egorova, O.; Savchenko, A.; Edwards, A.; Joachimiak, A.; Midwest Center for Structural Genomics (MCSG)
Deposited on	:	2010-04-22
Resolution	:	2.50 Å(reported)

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

|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.20.1
EDS	:	2.36.2
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)	:	2.36.2

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	Percentile Ranks	Value
Rfree		0.229
Clashscore		16
Ramachandran outliers		0.8%
Sidechain outliers		12.3%
RSRZ outliers		1.6%

Worse *Better*

▌ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution
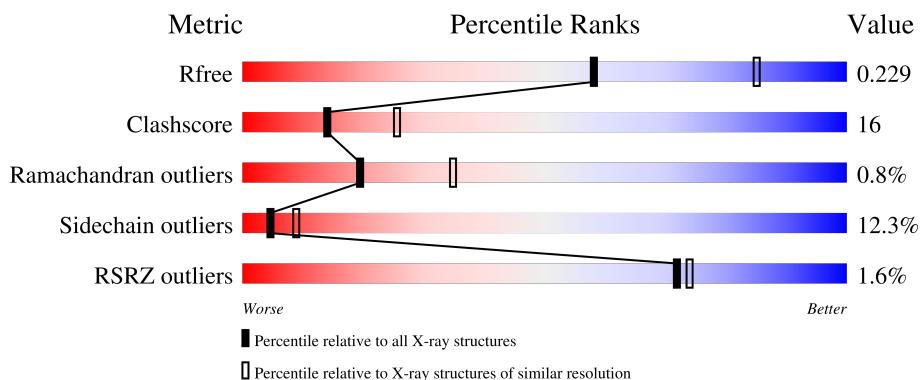
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R$_{free}$	130704	4661 (2.50-2.50)
Clashscore	141614	5346 (2.50-2.50)
Ramachandran outliers	138981	5231 (2.50-2.50)
Sidechain outliers	138945	5233 (2.50-2.50)
RSRZ outliers	127900	4559 (2.50-2.50)

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 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	387	2% 71% 23% • • •

2 Entry composition ⓘ

There are 2 unique types of molecules in this entry. The entry contains 2979 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 Probable dehydrogenase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	381	2934	1821	541	551	21	0	0	0

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
2	A	45	45	45	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: Probable dehydrogenase
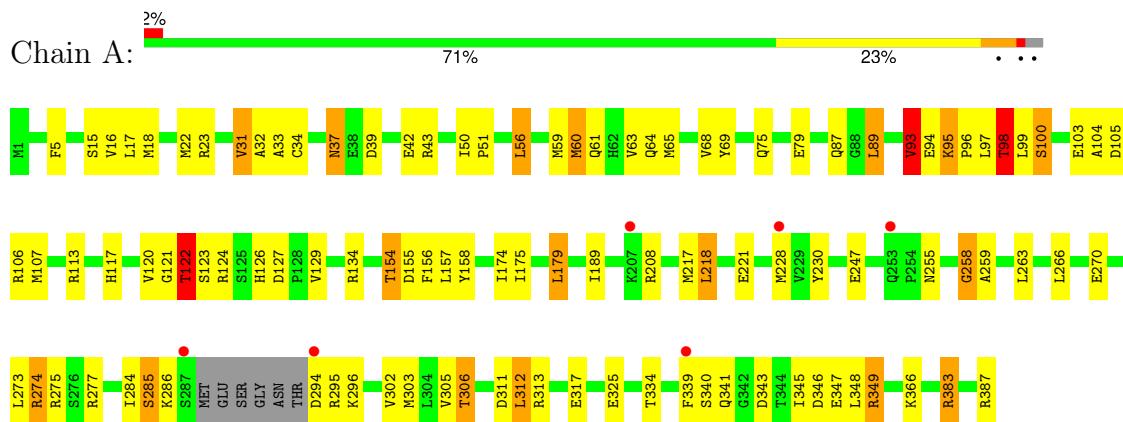
4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α, β, γ	122.63Å 122.63Å 79.42Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	63.60 – 2.50 44.14 – 2.50	Depositor EDS
% Data completeness (in resolution range)	99.9 (63.60-2.50) 99.9 (44.14-2.50)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.01 (at 2.51Å)	Xtriage
Refinement program	REFMAC 5.5.0102	Depositor
R, R_{free}	0.197 , 0.236 0.197 , 0.229	Depositor DCC
R_{free} test set	1230 reflections (5.10%)	wwPDB-VP
Wilson B-factor (Å^2)	62.5	Xtriage
Anisotropy	0.087	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.34 , 40.3	EDS
L-test for twinning[2]	$< |L| > = 0.49, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.027 for -h,-k,l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	2979	wwPDB-VP
Average B, all atoms (Å^2)	40.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.18% 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 ⓘ

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	1.06	4/2991 (0.1%)	1.14	21/4041 (0.5%)

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	221	GLU	CD-OE1	5.79	1.32	1.25
1	A	79	GLU	CD-OE2	5.63	1.31	1.25
1	A	221	GLU	CG-CD	5.31	1.59	1.51
1	A	113	ARG	CG-CD	5.18	1.64	1.51

All (21) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	383	ARG	NE-CZ-NH2	-11.89	114.36	120.30
1	A	60	MET	CG-SD-CE	-10.74	83.02	100.20
1	A	387	ARG	NE-CZ-NH2	-10.14	115.23	120.30
1	A	383	ARG	NE-CZ-NH1	9.59	125.09	120.30
1	A	134	ARG	NE-CZ-NH2	-8.96	115.82	120.30
1	A	387	ARG	NE-CZ-NH1	8.94	124.77	120.30
1	A	93	VAL	CB-CA-C	-7.49	97.18	111.40
1	A	134	ARG	NE-CZ-NH1	7.23	123.92	120.30
1	A	349	ARG	NE-CZ-NH1	6.31	123.45	120.30
1	A	217	MET	CG-SD-CE	-6.29	90.13	100.20
1	A	349	ARG	NE-CZ-NH2	-6.04	117.28	120.30
1	A	274	ARG	NE-CZ-NH2	-5.97	117.32	120.30
1	A	98	THR	CB-CA-C	-5.82	95.88	111.60
1	A	65	MET	CG-SD-CE	-5.77	90.97	100.20
1	A	89	LEU	CB-CG-CD1	-5.68	101.34	111.00
1	A	113	ARG	NE-CZ-NH1	5.51	123.06	120.30
1	A	122	THR	N-CA-CB	5.47	120.69	110.30
1	A	106	ARG	NE-CZ-NH1	5.34	122.97	120.30
1	A	383	ARG	CG-CD-NE	-5.18	100.93	111.80
1	A	65	MET	CA-CB-CG	5.15	122.06	113.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	313	ARG	NE-CZ-NH2	-5.08	117.76	120.30

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	2934	0	2880	91	0
2	A	45	0	0	6	0
All	All	2979	0	2880	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 16.

All (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:33:ALA:CA	1:A:59:MET:HE1	1.87	1.03
1:A:33:ALA:C	1:A:59:MET:HE3	1.82	0.98
1:A:33:ALA:N	1:A:59:MET:HE1	1.79	0.97
1:A:33:ALA:N	1:A:59:MET:CE	2.37	0.87
1:A:33:ALA:CA	1:A:59:MET:CE	2.51	0.87
1:A:266:LEU:HD12	2:A:429:HOH:O	1.72	0.86
1:A:339:PHE:O	1:A:343:ASP:OD2	1.96	0.84
1:A:33:ALA:HA	1:A:59:MET:HE1	1.59	0.83
1:A:154:THR:HG22	1:A:156:PHE:H	1.45	0.82
1:A:60:MET:HE1	1:A:89:LEU:HD12	1.60	0.81
1:A:33:ALA:C	1:A:59:MET:CE	2.49	0.80
1:A:157:LEU:O	1:A:208:ARG:NH1	2.15	0.80
1:A:56:LEU:HD21	1:A:60:MET:HE3	1.68	0.76
1:A:56:LEU:HD21	1:A:60:MET:CE	2.18	0.74
1:A:218:LEU:HD21	1:A:228:MET:HE1	1.70	0.73
1:A:306:THR:CG2	2:A:432:HOH:O	2.37	0.72
1:A:306:THR:HB	1:A:311:ASP:OD1	1.89	0.72

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:32:ALA:C	1:A:59:MET:HE1	2.11	0.70
1:A:98:THR:HG21	1:A:103:GLU:CB	2.23	0.69
1:A:98:THR:HG21	1:A:103:GLU:HB2	1.75	0.68
1:A:56:LEU:CD2	1:A:60:MET:CE	2.71	0.68
1:A:266:LEU:C	1:A:266:LEU:HD13	2.16	0.66
1:A:37:ASN:HD21	1:A:39:ASP:HB3	1.60	0.66
1:A:218:LEU:CD2	1:A:228:MET:CE	2.73	0.66
1:A:117:HIS:HD2	2:A:416:HOH:O	1.80	0.65
1:A:37:ASN:HD22	1:A:37:ASN:C	2.01	0.63
1:A:56:LEU:CD2	1:A:60:MET:HE3	2.28	0.63
1:A:154:THR:CG2	1:A:156:PHE:H	2.11	0.62
1:A:218:LEU:HD21	1:A:228:MET:CE	2.29	0.62
1:A:104:ALA:HA	1:A:107:MET:HE3	1.82	0.61
1:A:154:THR:HG21	1:A:230:TYR:OH	2.01	0.61
1:A:33:ALA:O	1:A:59:MET:HE3	1.99	0.60
1:A:154:THR:CG2	1:A:155:ASP:N	2.64	0.60
1:A:218:LEU:HD22	1:A:228:MET:CE	2.34	0.57
1:A:18:MET:HE3	1:A:345:ILE:HD11	1.87	0.56
1:A:189:ILE:HD11	1:A:303:MET:CE	2.36	0.55
1:A:18:MET:HE3	1:A:22:MET:HG3	1.89	0.55
1:A:98:THR:CG2	1:A:103:GLU:OE1	2.55	0.55
1:A:103:GLU:O	1:A:107:MET:HE2	2.06	0.55
1:A:122:THR:HG21	1:A:341:GLN:NE2	2.22	0.54
1:A:189:ILE:HD11	1:A:303:MET:HE1	1.88	0.54
1:A:126:HIS:HE1	1:A:347:GLU:OE2	1.91	0.54
1:A:69:TYR:OH	1:A:94:GLU:OE2	2.26	0.53
1:A:294:ASP:OD2	1:A:294:ASP:O	2.27	0.53
1:A:123:SER:H	1:A:126:HIS:HD2	1.57	0.53
1:A:103:GLU:C	1:A:107:MET:HE2	2.29	0.52
1:A:306:THR:HG23	2:A:432:HOH:O	2.06	0.52
1:A:5:PHE:CD2	1:A:22:MET:HE1	2.45	0.51
1:A:129:VAL:HG13	2:A:415:HOH:O	2.10	0.51
1:A:305:VAL:HB	1:A:312:LEU:HB2	1.91	0.51
1:A:68:VAL:HG23	1:A:89:LEU:HD13	1.93	0.50
1:A:56:LEU:CD2	1:A:60:MET:HE2	2.42	0.50
1:A:56:LEU:HD21	1:A:60:MET:HE2	1.93	0.50
1:A:218:LEU:CD2	1:A:228:MET:HE1	2.35	0.49
1:A:154:THR:HG23	1:A:155:ASP:N	2.28	0.48
1:A:56:LEU:HD22	1:A:60:MET:CE	2.43	0.48
1:A:93:VAL:O	1:A:121:GLY:HA3	2.13	0.48
1:A:334:THR:HG23	1:A:334:THR:O	2.13	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:124:ARG:NH2	1:A:247:GLU:OE1	2.47	0.48
1:A:127:ASP:OD1	1:A:340:SER:OG	2.30	0.48
1:A:259:ALA:O	1:A:263:LEU:HD13	2.14	0.47
1:A:266:LEU:HD13	1:A:266:LEU:O	2.14	0.47
1:A:5:PHE:CG	1:A:22:MET:HE1	2.51	0.46
1:A:56:LEU:HD22	1:A:60:MET:HG3	1.97	0.45
1:A:158:TYR:O	1:A:259:ALA:HB1	2.16	0.45
1:A:32:ALA:HB1	1:A:59:MET:HE2	1.98	0.45
1:A:98:THR:HG21	1:A:103:GLU:HB3	1.97	0.45
1:A:228:MET:HE2	1:A:228:MET:HB2	1.73	0.45
1:A:37:ASN:C	1:A:37:ASN:ND2	2.68	0.44
1:A:174:ILE:HD12	1:A:179:LEU:HD13	1.97	0.44
1:A:37:ASN:HD21	1:A:39:ASP:CB	2.29	0.44
1:A:334:THR:O	1:A:334:THR:CG2	2.65	0.44
1:A:105:ASP:OD1	1:A:366:LYS:NZ	2.42	0.43
1:A:34:CYS:N	1:A:59:MET:HE3	2.31	0.43
1:A:175:ILE:HA	1:A:179:LEU:HD22	2.00	0.43
1:A:208:ARG:NH2	1:A:270:GLU:OE2	2.52	0.43
1:A:218:LEU:CD2	1:A:228:MET:HE3	2.48	0.43
1:A:31:VAL:HG13	1:A:63:VAL:HG11	2.00	0.43
1:A:18:MET:HE1	1:A:345:ILE:HG13	2.01	0.42
1:A:50:ILE:HB	1:A:51:PRO:HD2	2.01	0.42
1:A:346:ASP:OD1	1:A:349:ARG:NH2	2.53	0.42
1:A:306:THR:HG22	2:A:432:HOH:O	2.15	0.42
1:A:37:ASN:HD22	1:A:39:ASP:N	2.18	0.41
1:A:95:LYS:HA	1:A:96:PRO:C	2.39	0.41
1:A:255:ASN:ND2	1:A:258:GLY:HA2	2.36	0.41
1:A:37:ASN:ND2	1:A:39:ASP:HB3	2.31	0.41
1:A:98:THR:HB	1:A:100:SER:H	1.85	0.41
1:A:18:MET:CE	1:A:345:ILE:HD11	2.49	0.41
1:A:37:ASN:ND2	1:A:39:ASP:N	2.69	0.41
1:A:103:GLU:HB3	1:A:107:MET:HE1	2.03	0.40
1:A:60:MET:SD	1:A:87:GLN:HG3	2.61	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	377/387 (97%)	356 (94%)	18 (5%)	3 (1%)	19	35

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	258	GLY
1	A	122	THR
1	A	285	SER

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	308/314 (98%)	270 (88%)	38 (12%)	4	9

All (38) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	15	SER
1	A	16	VAL
1	A	17	LEU
1	A	23	ARG
1	A	31	VAL
1	A	37	ASN
1	A	42	GLU
1	A	43	ARG

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Mol	Chain	Res	Type
1	A	56	LEU
1	A	61	GLN
1	A	64	GLN
1	A	75	GLN
1	A	93	VAL
1	A	95	LYS
1	A	97	LEU
1	A	98	THR
1	A	99	LEU
1	A	100	SER
1	A	120	VAL
1	A	154	THR
1	A	179	LEU
1	A	218	LEU
1	A	273	LEU
1	A	274	ARG
1	A	275	ARG
1	A	277	ARG
1	A	284	ILE
1	A	285	SER
1	A	286	LYS
1	A	295	ARG
1	A	296	LYS
1	A	302	VAL
1	A	306	THR
1	A	312	LEU
1	A	317	GLU
1	A	325	GLU
1	A	348	LEU
1	A	383	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	37	ASN
1	A	117	HIS
1	A	126	HIS
1	A	178	GLN
1	A	242	HIS
1	A	255	ASN
1	A	256	HIS

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 ⓘ

There are no ligands in this entry.

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	381/387 (98%)	-0.19	6 (1%)	72	74	26, 38, 59, 84	0

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	287	SER	6.7
1	A	294	ASP	2.5
1	A	339	PHE	2.2
1	A	253	GLN	2.1
1	A	207	LYS	2.1
1	A	228	MET	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 ⓘ

There are no ligands in this entry.

6.5 Other polymers ⓘ

There are no such residues in this entry.

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