



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 1, 2024 – 01:44 am BST

PDB ID : 9FYN
Title : Lacto-N-biosidase from *Trueperella pyogenes*
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Deposited on : 2024-07-03
Resolution : 1.79 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

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>.

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

MolProbity : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 3.0
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4 : 9.0.003 (Gargrove)
Density-Fitness : 1.0.11
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.39

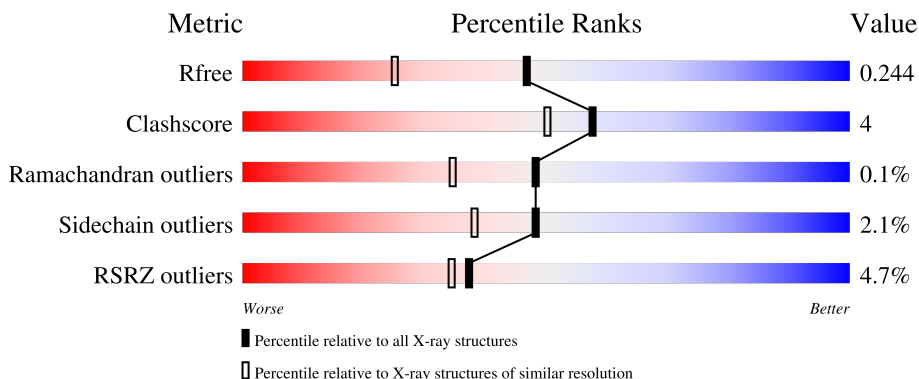
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.79 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}	164625	7108 (1.80-1.80)
Clashscore	180529	8162 (1.80-1.80)
Ramachandran outliers	177936	8077 (1.80-1.80)
Sidechain outliers	177891	8076 (1.80-1.80)
RSRZ outliers	164620	7108 (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 $\leq 5\%$. 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	771	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 11957 atoms, of which 5770 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 lacto-n-biosidase GH20.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	759	11651	3719	5770	999	1145	18	0	0	0

- Molecule 2 is NICKEL (II) ION (three-letter code: NI) (formula: Ni).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	2	Total	Ni	0	0
			2	2		

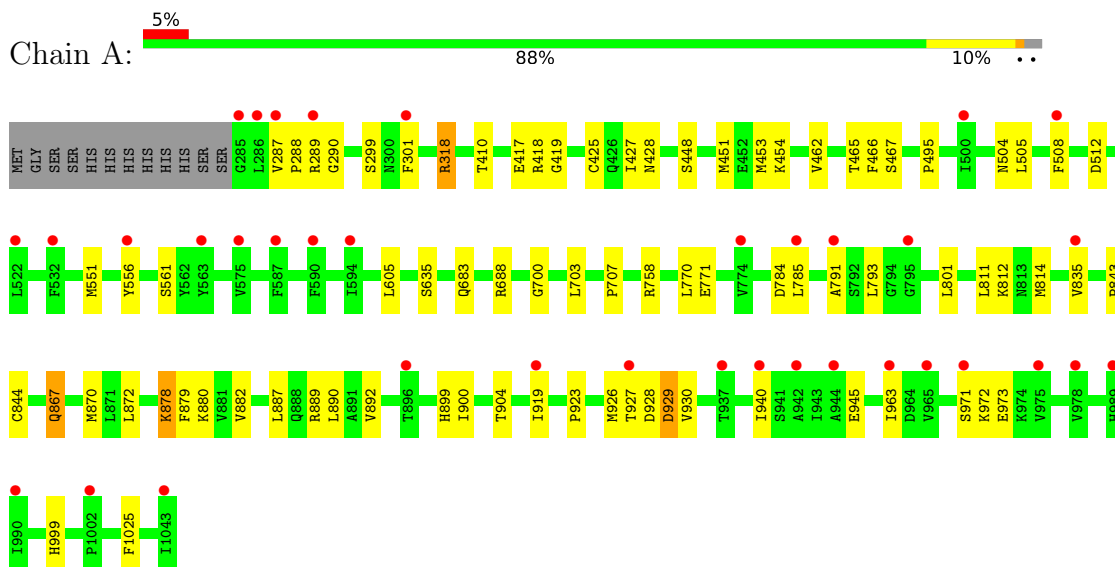
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	304	Total	O	0	0
			304	304		

3 Residue-property plots [i](#)

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: lacto-n-biosidase GH20



4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	90.79Å 93.63Å 93.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	41.88 – 1.79 41.88 – 1.79	Depositor EDS
% Data completeness (in resolution range)	98.5 (41.88-1.79) 85.2 (41.88-1.79)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	0.34 (at 1.79Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.206 , 0.244 0.206 , 0.244	Depositor DCC
R_{free} test set	73850 reflections (2.63%)	wwPDB-VP
Wilson B-factor (Å ²)	34.4	Xtriage
Anisotropy	0.281	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 41.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.002 for -h,l,k 0.006 for -l,-k,-h 0.012 for k,h,-l 0.000 for k,l,h 0.000 for l,h,k	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	11957	wwPDB-VP
Average B, all atoms (Å ²)	72.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.86% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 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:
NI

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	0.35	1/6012 (0.0%)	0.52	1/8165 (0.0%)

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	929	ASP	CG-OD2	-5.20	1.13	1.25

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	929	ASP	CB-CG-OD1	5.32	123.09	118.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	418	ARG	Peptide
1	A	758	ARG	Sidechain

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	5881	5770	5770	51	0
2	A	2	0	0	0	0
3	A	304	0	0	2	1
All	All	6187	5770	5770	51	1

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 4.

All (51) 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:882:VAL:HG22	1:A:889:ARG:HG3	1.71	0.71
1:A:290:GLY:O	3:A:1201:HOH:O	2.09	0.71
1:A:890:LEU:HD11	1:A:919:ILE:HD11	1.77	0.65
1:A:940:ILE:HD12	1:A:940:ILE:O	2.00	0.62
1:A:462:VAL:CG1	1:A:505:LEU:HD21	2.31	0.60
1:A:462:VAL:HG23	1:A:900:ILE:HD13	1.85	0.58
1:A:428:ASN:O	1:A:887:LEU:HD13	2.04	0.58
1:A:793:LEU:HD21	1:A:892:VAL:CG1	2.34	0.57
1:A:892:VAL:CG2	1:A:929:ASP:OD2	2.52	0.57
1:A:466:PHE:CG	1:A:467:SER:HA	2.43	0.53
1:A:928:ASP:N	1:A:928:ASP:OD1	2.41	0.53
1:A:900:ILE:HD11	1:A:904:THR:CG2	2.39	0.52
1:A:892:VAL:HG22	1:A:929:ASP:OD2	2.10	0.51
1:A:505:LEU:HD13	1:A:508:PHE:CE2	2.47	0.50
1:A:892:VAL:HG23	1:A:929:ASP:OD2	2.12	0.49
1:A:945:GLU:HA	1:A:945:GLU:OE1	2.11	0.49
1:A:971:SER:OG	1:A:972:LYS:N	2.45	0.48
1:A:299:SER:OG	1:A:410:THR:O	2.31	0.48
1:A:801:LEU:HD22	1:A:811:LEU:CD2	2.44	0.48
1:A:878:LYS:HB3	1:A:930:VAL:HG21	1.96	0.48
1:A:419:GLY:HA2	1:A:448:SER:O	2.14	0.47
1:A:793:LEU:HD21	1:A:892:VAL:HG12	1.94	0.47
1:A:923:PRO:HD2	1:A:926:MET:HE2	1.96	0.47
1:A:454:LYS:NZ	1:A:465:THR:OG1	2.47	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:451:MET:HG2	1:A:453:MET:HG2	1.96	0.47
1:A:770:LEU:HD21	1:A:879:PHE:CZ	2.51	0.46
1:A:551:MET:HG2	1:A:605:LEU:HD11	1.98	0.46
1:A:927:THR:HG22	1:A:929:ASP:H	1.80	0.46
1:A:835:VAL:HG21	1:A:899:HIS:CG	2.51	0.45
1:A:504:ASN:O	1:A:505:LEU:HD23	2.17	0.45
1:A:870:MET:SD	1:A:872:LEU:HD21	2.57	0.45
1:A:289:ARG:HG2	1:A:301:PHE:CD2	2.53	0.44
1:A:505:LEU:HD13	1:A:508:PHE:HE2	1.81	0.44
1:A:791:ALA:CB	1:A:919:ILE:HD13	2.47	0.44
1:A:835:VAL:HG21	1:A:899:HIS:ND1	2.33	0.44
1:A:812:LYS:HD2	1:A:844:CYS:SG	2.58	0.43
1:A:287:VAL:HA	1:A:288:PRO:C	2.38	0.43
1:A:318:ARG:NH2	3:A:1213:HOH:O	2.47	0.43
1:A:784:ASP:OD2	1:A:784:ASP:N	2.52	0.42
1:A:425:CYS:O	1:A:427:ILE:N	2.51	0.42
1:A:504:ASN:C	1:A:505:LEU:HD23	2.39	0.42
1:A:791:ALA:HB3	1:A:919:ILE:HG21	1.99	0.42
1:A:880:LYS:HG2	1:A:889:ARG:HH21	1.85	0.42
1:A:900:ILE:HD11	1:A:904:THR:HG22	2.01	0.42
1:A:451:MET:HG2	1:A:453:MET:CG	2.51	0.41
1:A:785:LEU:HD11	1:A:919:ILE:HD12	2.02	0.41
1:A:878:LYS:N	1:A:878:LYS:HD2	2.36	0.41
1:A:963:ILE:HG21	1:A:1025:PHE:CE1	2.56	0.41
1:A:417:GLU:O	1:A:700:GLY:HA3	2.22	0.40
1:A:495:PRO:HG2	1:A:556:TYR:CD1	2.57	0.40
1:A:843:PRO:O	1:A:867:GLN:NE2	2.53	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:A:1256:HOH:O	3:A:1430:HOH:O[3_555]	2.08	0.12

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	757/771 (98%)	724 (96%)	32 (4%)	1 (0%)	48 34

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	707	PRO

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	626/637 (98%)	613 (98%)	13 (2%)	48 38

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	318	ARG
1	A	512	ASP
1	A	561	SER
1	A	635	SER
1	A	683	GLN
1	A	688	ARG
1	A	703	LEU
1	A	771	GLU
1	A	814	MET
1	A	867	GLN
1	A	878	LYS
1	A	973	GLU
1	A	999	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	683	GLN

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](#)

Of 2 ligands modelled in this entry, 2 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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

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	759/771 (98%)	0.46	36 (4%) 37 34	34, 70, 118, 151	0

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	285	GLY	6.2
1	A	286	LEU	4.7
1	A	287	VAL	3.8
1	A	301	PHE	3.6
1	A	289	ARG	3.6
1	A	940	ILE	3.2
1	A	500	ILE	3.0
1	A	919	ILE	3.0
1	A	532	PHE	2.9
1	A	563	TYR	2.9
1	A	587	PHE	2.9
1	A	1043	ILE	2.8
1	A	575	VAL	2.7
1	A	989	HIS	2.7
1	A	927	THR	2.7
1	A	942	ALA	2.6
1	A	594	ILE	2.5
1	A	795	GLY	2.4
1	A	791	ALA	2.4
1	A	896	THR	2.3
1	A	522	LEU	2.3
1	A	590	PHE	2.3
1	A	508	PHE	2.2
1	A	971	SER	2.2
1	A	978	VAL	2.2
1	A	975	VAL	2.2
1	A	944	ALA	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	774	VAL	2.2
1	A	1002	PRO	2.2
1	A	963	ILE	2.1
1	A	835	VAL	2.1
1	A	965	VAL	2.1
1	A	556	TYR	2.1
1	A	990	ILE	2.0
1	A	785	LEU	2.0
1	A	937	THR	2.0

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 monosaccharides 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. 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(\AA^2)	Q<0.9
2	NI	A	1101	1/1	0.98	0.05	66,66,66,66	0
2	NI	A	1102	1/1	0.98	0.08	75,75,75,75	0

6.5 Other polymers [i](#)

There are no such residues in this entry.