



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 11:26 AM UTC

PDB ID : 1QNO / pdb_00001qno
Title : The 3-D structure of a Trichoderma reesei b-mannanase from glycoside hydrolase family 5
Authors : Sabini, E.; Schubert, H.; Murshudov, G.; Wilson, K.S.; Siika-Aho, M.; Penttila, M.
Deposited on : 1999-10-20
Resolution : 2.00 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

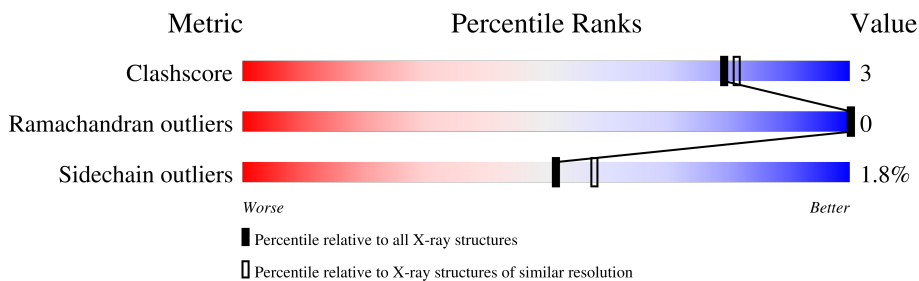
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	344	 82% 17% .

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 3147 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 ENDO-1,4-B-D-MANNANASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	344	Total	C	N	O	S	0	4	0
			2677	1692	447	528	10			

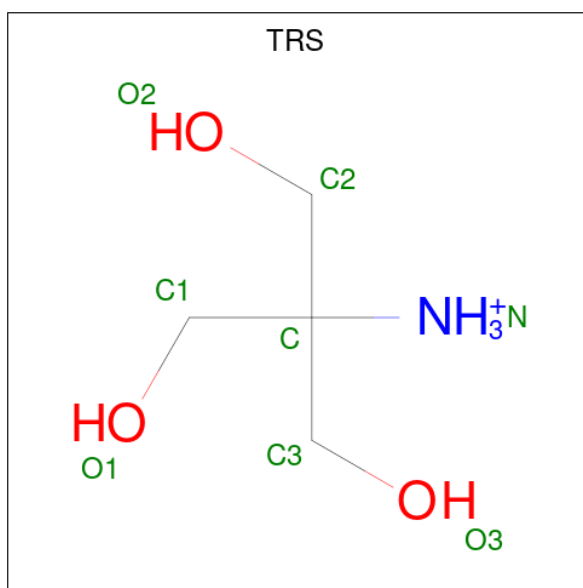
- Molecule 2 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: $C_8H_{15}NO_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			14	8	1	5		
2	A	1	Total	C	N	O	0	0
			14	8	1	5		
2	A	1	Total	C	N	O	0	0
			14	8	1	5		
2	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 3 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (CCD ID: TRS)

(formula: $C_4H_{12}NO_3$).



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

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	406	Total	O	0	0
			406	406		

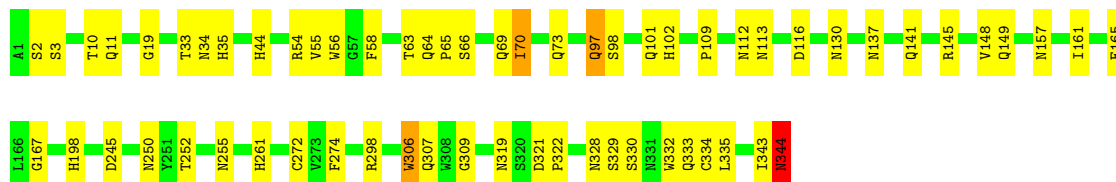
3 Residue-property plots [i](#)

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. 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: ENDO-1,4-B-D-MANNANASE

Chain A:  82% 17%



4 Data and refinement statistics

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

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	50.01Å 54.27Å 60.24Å 90.00° 111.31° 90.00°	Depositor
Resolution (Å)	20.00 – 2.00	Depositor
% Data completeness (in resolution range)	97.8 (20.00-2.00)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	0.03	Depositor
Refinement program	REFMAC	Depositor
R, R_{free}	0.126 , 0.200	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	3147	wwPDB-VP
Average B, all atoms (Å ²)	12.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

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

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	0.99	1/2777 (0.0%)	1.79	56/3799 (1.5%)

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	102	HIS	ND1-CE1	5.32	1.37	1.32

All (56) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	130	ASN	OD1-CG-ND2	-13.52	109.08	122.60
1	A	306	TRP	O-C-N	-13.23	107.60	122.55
1	A	157	ASN	OD1-CG-ND2	-10.08	112.52	122.60
1	A	306	TRP	CA-C-O	-8.88	112.09	122.13
1	A	97	GLN	CB-CG-CD	8.80	127.56	112.60
1	A	306	TRP	N-CA-CB	8.03	122.29	110.49
1	A	130	ASN	CA-CB-CG	-7.94	104.66	112.60
1	A	333	GLN	OE1-CD-NE2	-7.92	114.69	122.60
1	A	145	ARG	CD-NE-CZ	7.64	135.10	124.40
1	A	298	ARG	CD-NE-CZ	7.61	135.05	124.40
1	A	309	GLY	CA-C-O	-7.53	115.07	120.94
1	A	35	HIS	CA-CB-CG	-7.27	106.53	113.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	149	GLN	CA-C-O	-7.22	112.89	120.55
1	A	116	ASP	CA-CB-CG	-7.00	105.59	112.60
1	A	19	GLY	CA-C-O	-6.92	114.90	121.96
1	A	157	ASN	CB-CG-OD1	6.75	134.31	120.80
1	A	130	ASN	CB-CG-OD1	6.67	134.13	120.80
1	A	66	SER	CA-C-O	6.65	126.47	120.02
1	A	98	SER	CA-C-O	6.59	127.41	120.42
1	A	11	GLN	OE1-CD-NE2	6.50	129.10	122.60
1	A	70	ILE	CB-CG1-CD1	-6.46	100.23	113.80
1	A	73	GLN	OE1-CD-NE2	-6.39	116.21	122.60
1	A	298	ARG	NE-CZ-NH1	6.39	127.89	121.50
1	A	328	ASN	OD1-CG-ND2	-6.34	116.26	122.60
1	A	274	PHE	CA-CB-CG	6.28	120.08	113.80
1	A	198	HIS	N-CA-C	6.18	119.77	109.95
1	A	245	ASP	CB-CA-C	-6.17	100.55	110.79
1	A	34	ASN	OD1-CG-ND2	-6.10	116.50	122.60
1	A	330	SER	CA-CB-OG	-6.06	98.98	111.10
1	A	141	GLN	O-C-N	5.86	128.83	122.15
1	A	261	HIS	CA-CB-CG	-5.73	108.07	113.80
1	A	307	GLN	N-CA-CB	5.72	120.34	111.24
1	A	334	CYS	CA-C-O	-5.59	114.94	120.70
1	A	167	GLY	CA-C-N	-5.53	115.65	122.84
1	A	167	GLY	C-N-CA	-5.53	115.65	122.84
1	A	255	ASN	CA-CB-CG	-5.49	107.11	112.60
1	A	298	ARG	NH1-CZ-NH2	-5.46	112.20	119.30
1	A	97	GLN	N-CA-CB	-5.35	101.97	109.94
1	A	319	ASN	CA-CB-CG	5.31	117.91	112.60
1	A	137	ASN	CA-C-O	5.31	126.60	120.60
1	A	250	ASN	OD1-CG-ND2	-5.29	117.31	122.60
1	A	113	ASN	OD1-CG-ND2	5.26	127.86	122.60
1	A	344	ASN	CA-CB-CG	5.21	117.81	112.60
1	A	44	HIS	CA-CB-CG	5.20	119.00	113.80
1	A	64	GLN	OE1-CD-NE2	5.18	127.78	122.60
1	A	148	VAL	N-CA-CB	5.15	116.23	110.51
1	A	332	TRP	N-CA-C	-5.14	105.57	111.07
1	A	333	GLN	CA-CB-CG	5.14	124.37	114.10
1	A	329	SER	CA-C-N	5.12	127.14	120.28
1	A	329	SER	C-N-CA	5.12	127.14	120.28
1	A	161	ILE	O-C-N	-5.10	117.12	122.68
1	A	97	GLN	CG-CD-OE1	5.09	130.98	120.80
1	A	335	LEU	N-CA-C	5.05	119.60	113.38
1	A	54	ARG	O-C-N	-5.04	117.47	123.22

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	274	PHE	CA-C-N	5.03	129.23	120.68
1	A	274	PHE	C-N-CA	5.03	129.23	120.68

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	306	TRP	Peptide,Mainchain

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	2677	0	2455	14	0
2	A	56	0	52	0	0
3	A	8	0	12	0	0
4	A	406	0	0	3	0
All	All	3147	0	2519	14	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 3.

All (14) 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:THR:HG23	1:A:70:ILE:HD11	1.70	0.73
1:A:33:THR:CG2	1:A:70:ILE:HD11	2.24	0.68
1:A:252:THR:HG23	4:A:2312:HOH:O	2.01	0.60
1:A:65:PRO:HB2	1:A:69:GLN:HB2	1.89	0.55
1:A:97:GLN:HG3	4:A:2153:HOH:O	2.07	0.54
1:A:2:SER:O	1:A:3:SER:OG	2.22	0.54
1:A:343:ILE:O	1:A:344:ASN:C	2.51	0.53
1:A:109:PRO:HA	1:A:165:GLU:O	2.15	0.47
1:A:101:GLN:NE2	4:A:2158:HOH:O	2.45	0.43
1:A:2:SER:O	1:A:3:SER:CB	2.66	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:321:ASP:HB2	1:A:322:PRO:CD	2.49	0.42
1:A:55:VAL:O	1:A:109:PRO:HD2	2.21	0.41
1:A:58:PHE:CE1	1:A:112:ASN:HB2	2.55	0.41
1:A:344:ASN:C	1:A:344:ASN:ND2	2.80	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	341/344 (99%)	333 (98%)	8 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	286/282 (101%)	280 (98%)	6 (2%)	47	52

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	10	THR
1	A	56	TRP

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Mol	Chain	Res	Type
1	A	63[A]	THR
1	A	63[B]	THR
1	A	272	CYS
1	A	344	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	101	GLN
1	A	291	GLN
1	A	307	GLN
1	A	331	ASN
1	A	344	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](#)

5 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	NAG	A	431	1	14,14,15	1.03	1 (7%)	17,19,21	1.59	4 (23%)
2	NAG	A	430	1	14,14,15	0.96	1 (7%)	17,19,21	1.61	5 (29%)
2	NAG	A	432	1	14,14,15	1.20	1 (7%)	17,19,21	2.06	2 (11%)
2	NAG	A	433	1	14,14,15	1.36	2 (14%)	17,19,21	2.12	6 (35%)
3	TRS	A	801	-	7,7,7	1.59	1 (14%)	9,9,9	1.50	3 (33%)

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	NAG	A	431	1	-	0/6/23/26	0/1/1/1
2	NAG	A	430	1	-	0/6/23/26	0/1/1/1
2	NAG	A	432	1	-	0/6/23/26	0/1/1/1
2	NAG	A	433	1	-	0/6/23/26	0/1/1/1
3	TRS	A	801	-	-	0/9/9/9	-

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	432	NAG	O7-C7	-3.36	1.15	1.23
2	A	433	NAG	O7-C7	-3.14	1.16	1.23
2	A	430	NAG	O7-C7	-2.70	1.17	1.23
3	A	801	TRS	O2-C2	2.63	1.50	1.42
2	A	431	NAG	O7-C7	-2.48	1.17	1.23
2	A	433	NAG	C2-N2	2.25	1.50	1.46

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	432	NAG	O5-C1-C2	7.21	122.44	111.29
2	A	433	NAG	C2-N2-C7	-4.42	116.98	122.90
2	A	433	NAG	O3-C3-C2	-4.14	100.80	109.40
2	A	433	NAG	C1-O5-C5	3.39	116.73	112.19
2	A	431	NAG	O5-C1-C2	3.21	116.26	111.29
2	A	431	NAG	O7-C7-C8	2.94	127.29	122.05
2	A	430	NAG	C6-C5-C4	-2.59	106.66	113.02
2	A	431	NAG	C8-C7-N2	-2.58	111.84	116.12
2	A	430	NAG	O3-C3-C2	-2.56	104.09	109.40
2	A	433	NAG	O5-C5-C6	-2.45	102.90	107.66

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	801	TRS	O3-C3-C	-2.40	104.20	110.88
2	A	430	NAG	O5-C1-C2	2.36	114.94	111.29
3	A	801	TRS	C1-C-N	-2.36	102.16	108.17
2	A	433	NAG	O4-C4-C5	-2.30	103.66	109.32
2	A	431	NAG	C1-C2-N2	-2.24	106.91	110.43
2	A	430	NAG	C4-C3-C2	-2.20	107.80	111.02
2	A	433	NAG	O6-C6-C5	-2.12	104.12	111.33
3	A	801	TRS	C3-C-N	2.12	113.57	108.17
2	A	432	NAG	C1-O5-C5	2.11	115.01	112.19
2	A	430	NAG	O4-C4-C5	-2.03	104.33	109.32

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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.