



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 6, 2024 – 12:11 PM EDT

PDB ID : 8TDA
Title : Structure of Bacteroides thetaiotaomicron 3-Keto-2-hydroxy-glucal-hydratase BT2
Authors : Lazarski, A.C.; Worrall, L.J.; Strynadka, N.C.J.
Deposited on : 2023-07-02
Resolution : 1.46 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 : 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

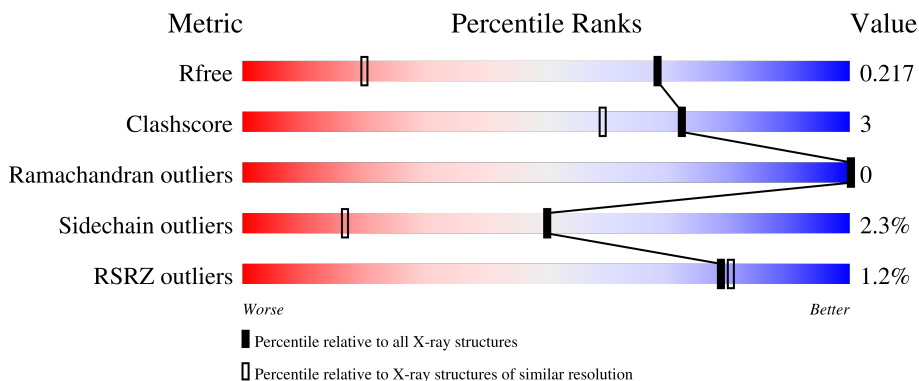
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.46 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}	130704	1156 (1.46-1.46)
Clashscore	141614	1202 (1.46-1.46)
Ramachandran outliers	138981	1178 (1.46-1.46)
Sidechain outliers	138945	1178 (1.46-1.46)
RSRZ outliers	127900	1139 (1.46-1.46)

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	281	 83% 7% • 9%
1	B	281	 84% 5% • 9%

2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 4618 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 secreted glycosyl hydrolase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	256	Total	C	N	O	S	0	0	0
			2026	1283	341	395	7			
1	B	256	Total	C	N	O	S	0	2	0
			2041	1292	344	398	7			

There are 34 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	10	MET	-	expression tag	UNP Q8A5T1
A	11	GLY	-	expression tag	UNP Q8A5T1
A	12	SER	-	expression tag	UNP Q8A5T1
A	13	SER	-	expression tag	UNP Q8A5T1
A	14	HIS	-	expression tag	UNP Q8A5T1
A	15	HIS	-	expression tag	UNP Q8A5T1
A	16	HIS	-	expression tag	UNP Q8A5T1
A	17	HIS	-	expression tag	UNP Q8A5T1
A	18	HIS	-	expression tag	UNP Q8A5T1
A	19	HIS	-	expression tag	UNP Q8A5T1
A	20	SER	-	expression tag	UNP Q8A5T1
A	21	SER	-	expression tag	UNP Q8A5T1
A	22	GLY	-	expression tag	UNP Q8A5T1
A	23	LEU	-	expression tag	UNP Q8A5T1
A	24	VAL	-	expression tag	UNP Q8A5T1
A	25	PRO	-	expression tag	UNP Q8A5T1
A	26	ARG	-	expression tag	UNP Q8A5T1
B	10	MET	-	expression tag	UNP Q8A5T1
B	11	GLY	-	expression tag	UNP Q8A5T1
B	12	SER	-	expression tag	UNP Q8A5T1
B	13	SER	-	expression tag	UNP Q8A5T1
B	14	HIS	-	expression tag	UNP Q8A5T1
B	15	HIS	-	expression tag	UNP Q8A5T1
B	16	HIS	-	expression tag	UNP Q8A5T1
B	17	HIS	-	expression tag	UNP Q8A5T1

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Chain	Residue	Modelled	Actual	Comment	Reference
B	18	HIS	-	expression tag	UNP Q8A5T1
B	19	HIS	-	expression tag	UNP Q8A5T1
B	20	SER	-	expression tag	UNP Q8A5T1
B	21	SER	-	expression tag	UNP Q8A5T1
B	22	GLY	-	expression tag	UNP Q8A5T1
B	23	LEU	-	expression tag	UNP Q8A5T1
B	24	VAL	-	expression tag	UNP Q8A5T1
B	25	PRO	-	expression tag	UNP Q8A5T1
B	26	ARG	-	expression tag	UNP Q8A5T1

- Molecule 2 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	2	Total K 2 2	0	0
2	B	2	Total K 2 2	0	0

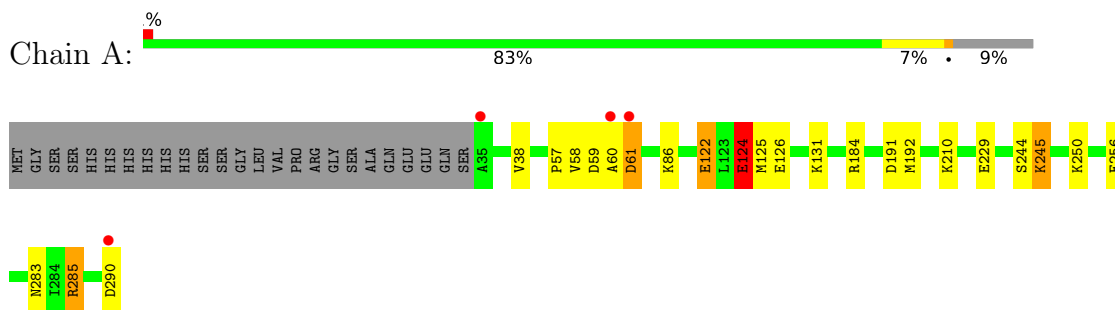
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	282	Total O 282 282	0	0
3	B	265	Total O 265 265	0	0

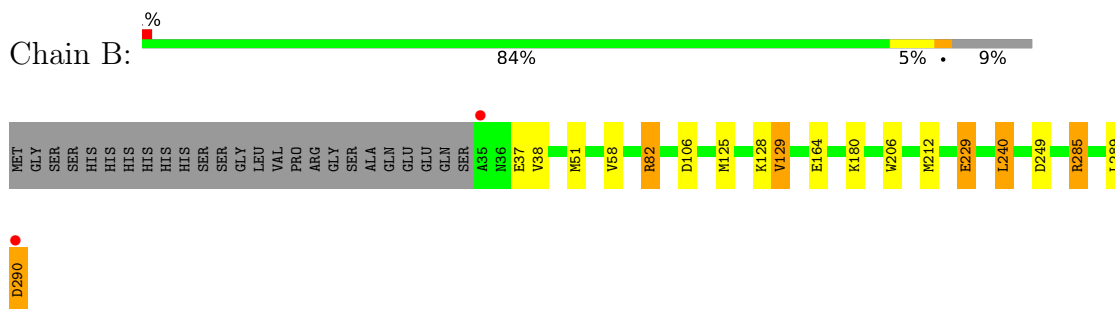
3 Residue-property plots [i](#)

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: Probable secreted glycosyl hydrolase



- Molecule 1: Probable secreted glycosyl hydrolase



4 Data and refinement statistics i

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	75.94Å 80.02Å 103.15Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	61.15 – 1.46 61.15 – 1.46	Depositor EDS
% Data completeness (in resolution range)	99.9 (61.15-1.46) 99.9 (61.15-1.46)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.35 (at 1.46Å)	Xtrriage
Refinement program	REFMAC 5.8.0425	Depositor
R, R_{free}	0.176 , 0.212 0.180 , 0.217	Depositor DCC
R_{free} test set	5252 reflections (4.80%)	wwPDB-VP
Wilson B-factor (Å ²)	21.2	Xtrriage
Anisotropy	0.344	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 40.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.044 for k,h,-l	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4618	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.88% 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:
K

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	0.71	3/2077 (0.1%)	1.20	12/2809 (0.4%)
1	B	0.69	2/2092 (0.1%)	1.13	10/2829 (0.4%)
All	All	0.70	5/4169 (0.1%)	1.16	22/5638 (0.4%)

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	B	0	2

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	124	GLU	CD-OE2	5.67	1.31	1.25
1	A	229	GLU	CD-OE2	5.42	1.31	1.25
1	B	164	GLU	CD-OE1	-5.35	1.19	1.25
1	A	122	GLU	CD-OE2	-5.28	1.19	1.25
1	B	229	GLU	CD-OE2	5.26	1.31	1.25

All (22) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	125	MET	CG-SD-CE	-18.59	70.46	100.20
1	B	285	ARG	NE-CZ-NH2	-16.81	111.90	120.30
1	A	285	ARG	NE-CZ-NH1	12.19	126.39	120.30
1	A	184	ARG	NE-CZ-NH2	-11.66	114.47	120.30
1	B	285	ARG	NE-CZ-NH1	9.92	125.26	120.30
1	B	125	MET	CG-SD-CE	-9.87	84.42	100.20

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	285	ARG	CD-NE-CZ	9.73	137.22	123.60
1	A	61	ASP	CB-CA-C	-9.51	91.39	110.40
1	B	212	MET	CG-SD-CE	8.35	113.56	100.20
1	B	82	ARG	NE-CZ-NH1	-8.00	116.30	120.30
1	A	192	MET	CG-SD-CE	-7.27	88.57	100.20
1	A	256	GLU	CG-CD-OE1	6.79	131.87	118.30
1	A	285	ARG	NE-CZ-NH2	-6.73	116.94	120.30
1	A	124	GLU	CG-CD-OE2	6.70	131.69	118.30
1	B	129	VAL	CG1-CB-CG2	6.67	121.58	110.90
1	A	256	GLU	CG-CD-OE2	-6.59	105.11	118.30
1	A	124	GLU	CG-CD-OE1	-6.51	105.28	118.30
1	B	240	LEU	CB-CG-CD1	6.43	121.93	111.00
1	B	129	VAL	CA-CB-CG2	6.34	120.41	110.90
1	B	129	VAL	CB-CA-C	-5.96	100.08	111.40
1	B	37	GLU	N-CA-CB	5.18	119.93	110.60
1	A	122	GLU	CG-CD-OE1	5.00	128.30	118.30

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	285	ARG	Sidechain
1	B	82	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	2026	0	1911	22	0
1	B	2041	0	1930	5	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
3	A	282	0	0	12	0
3	B	265	0	0	1	0
All	All	4618	0	3841	27	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 (27) 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:285:ARG:HD2	3:A:402:HOH:O	1.81	0.78
1:A:124:GLU:HG2	1:A:285:ARG:HH21	1.49	0.78
1:A:126:GLU:OE2	3:A:401:HOH:O	2.03	0.76
1:A:59:ASP:OD2	3:A:402:HOH:O	2.05	0.73
1:A:245:LYS:HE2	3:A:594:HOH:O	1.98	0.64
1:A:191:ASP:OD2	3:A:404:HOH:O	2.15	0.64
1:A:122:GLU:OE2	1:A:210:LYS:HD2	1.98	0.63
1:A:245:LYS:HG3	3:A:404:HOH:O	1.98	0.63
1:A:38:VAL:HG12	1:A:58:VAL:CG2	2.28	0.63
1:A:124:GLU:HG2	1:A:285:ARG:NH2	2.17	0.57
1:B:38:VAL:HG12	1:B:58[A]:VAL:HG22	1.88	0.55
1:A:283:ASN:ND2	3:A:407:HOH:O	2.34	0.55
1:A:244:SER:HA	3:A:418:HOH:O	2.09	0.52
1:A:124:GLU:O	1:A:124:GLU:HG3	2.10	0.50
1:A:86:LYS:HE2	3:A:456:HOH:O	2.11	0.49
1:A:124:GLU:CG	1:A:285:ARG:HH21	2.22	0.49
1:B:128:LYS:HE3	1:B:206:TRP:CE2	2.49	0.48
1:B:289:LEU:O	1:B:290:ASP:C	2.53	0.46
1:A:290:ASP:N	1:A:290:ASP:OD1	2.43	0.46
1:B:38:VAL:HG12	1:B:58[A]:VAL:CG2	2.46	0.45
1:A:131:LYS:NZ	3:A:403:HOH:O	2.11	0.45
1:A:245:LYS:HA	1:A:250:LYS:HE3	2.01	0.42
1:A:61:ASP:N	3:A:420:HOH:O	2.51	0.42
1:B:229:GLU:OE2	3:B:401:HOH:O	2.21	0.41
1:A:245:LYS:HG3	1:A:245:LYS:H	1.47	0.41
1:A:38:VAL:HG12	1:A:58:VAL:HG22	2.01	0.41
1:A:60:ALA:HB3	3:A:420:HOH:O	2.20	0.41

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	254/281 (90%)	247 (97%)	7 (3%)	0	100	100
1	B	256/281 (91%)	249 (97%)	7 (3%)	0	100	100
All	All	510/562 (91%)	496 (97%)	14 (3%)	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	213/235 (91%)	210 (99%)	3 (1%)	67	37
1	B	216/235 (92%)	209 (97%)	7 (3%)	39	8
All	All	429/470 (91%)	419 (98%)	10 (2%)	50	17

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	57	PRO
1	A	124	GLU
1	A	245	LYS
1	B	51	MET
1	B	106	ASP
1	B	129	VAL
1	B	180	LYS
1	B	240	LEU
1	B	249	ASP
1	B	290	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 4 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 [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, 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	256/281 (91%)	-0.11	4 (1%) 72 72	16, 23, 35, 62	0
1	B	256/281 (91%)	-0.14	2 (0%) 86 87	16, 23, 33, 57	0
All	All	512/562 (91%)	-0.12	6 (1%) 79 80	16, 23, 34, 62	0

All (6) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	35	ALA	6.7
1	A	35	ALA	5.6
1	A	60	ALA	3.1
1	B	290	ASP	3.1
1	A	61	ASP	2.8
1	A	290	ASP	2.2

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	K	A	302	1/1	0.99	0.04	30,30,30,30	0
2	K	B	302	1/1	0.99	0.09	29,29,29,29	0
2	K	B	301	1/1	1.00	0.08	20,20,20,20	0
2	K	A	301	1/1	1.00	0.10	21,21,21,21	0

6.5 Other polymers [i](#)

There are no such residues in this entry.