Full wwPDB X-ray Structure Validation Report (i)

Oct 13, 2022 – 04:16 am BST

PDB ID	:	8B81
Title	:	The structure of Gan1D W433A in complex with cellobiose-6-phosphate
Authors	:	Snyder, J.; Lansky, S.; Zehavi, A.; Shoham, Y.; Shoham, G.
Deposited on	:	2022-10-04
Resolution	:	1.58 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 (i) 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 (i)) were used in the production of this report:

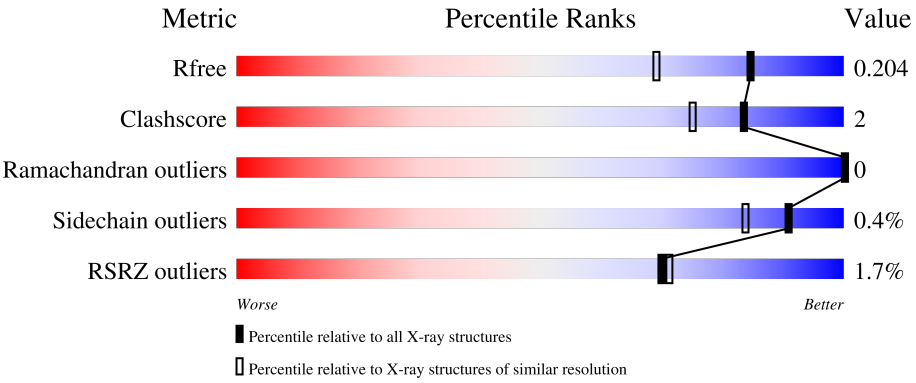
MolProbity	:	4.02b-467
Mogul	:	FAILED
Xtriage (Phenix)	:	1.13
EDS	:	2.31.2
buster-report	:	FAILED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0267
CCP4	:	7.1.010 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.31.2

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 1.58 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	5534 (1.60-1.56)
Clashscore	141614	5861 (1.60-1.56)
Ramachandran outliers	138981	5708 (1.60-1.56)
Sidechain outliers	138945	5703 (1.60-1.56)
RSRZ outliers	127900	5431 (1.60-1.56)

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	478	94% 5%
1	B	478	2% 93% 5%
2	D	2	100%
2	E	2	50% 50%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	IMD	A	504	-	-	-	X

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 8977 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.

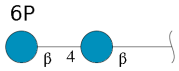
- Molecule 1 is a protein called Putative 6-phospho-beta-galactobiosidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	474	Total	C	N	O	S	0	17	0
			3961	2545	681	723	12			
1	B	474	Total	C	N	O	S	0	15	0
			3952	2540	677	719	16			

There are 2 discrepancies between the modelled and reference sequences:

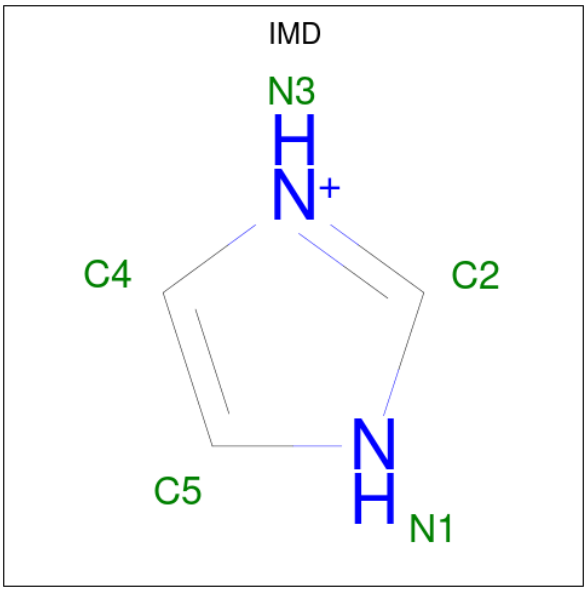
Chain	Residue	Modelled	Actual	Comment	Reference
A	433	ALA	TRP	engineered mutation	UNP W8QF82
B	433	ALA	TRP	engineered mutation	UNP W8QF82

- Molecule 2 is an oligosaccharide called 6-O-phosphono-beta-D-glucopyranose-(1-4)-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	E	2	Total	C	O	P	0	0	0
			27	12	14	1			
2	D	2	Total	C	O	P	0	0	0
			27	12	14	1			

- Molecule 3 is IMIDAZOLE (three-letter code: IMD) (formula: $C_3H_5N_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C N 5 3 2	0	0
3	A	1	Total C N 5 3 2	0	0
3	A	1	Total C N 5 3 2	0	0
3	A	1	Total C N 5 3 2	0	0

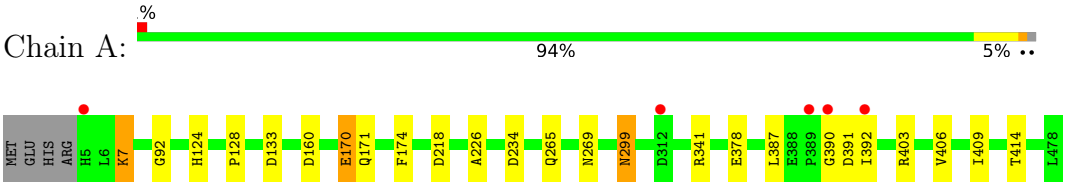
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	562	Total O 562 562	0	0
4	B	428	Total O 428 428	0	0

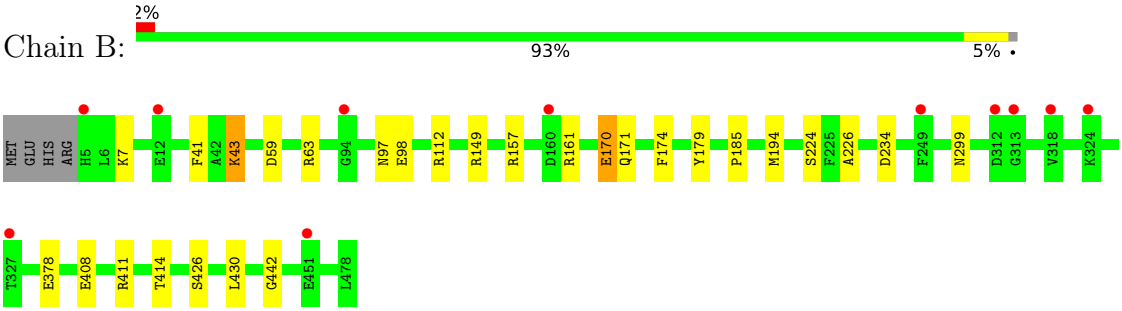
3 Residue-property plots (i)

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: Putative 6-phospho-beta-galactobiosidase

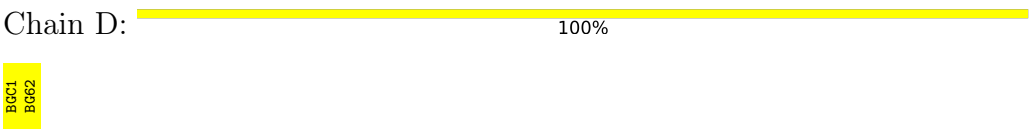


• Molecule 1: Putative 6-phospho-beta-galactobiosidase



• Molecule 2: 6-O-phosphono-beta-D-glucopyranose-(1-4)-beta-D-glucopyranose

• Molecule 2: 6-O-phosphono-beta-D-glucopyranose-(1-4)-beta-D-glucopyranose



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	107.90Å 68.38Å 149.80Å 90.00° 99.36° 90.00°	Depositor
Resolution (Å)	49.27 – 1.58 49.27 – 1.59	Depositor EDS
% Data completeness (in resolution range)	96.7 (49.27-1.58) 96.8 (49.27-1.59)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	0.97 (at 1.58Å)	Xtriage
Refinement program	PHENIX 1.15.2_3472	Depositor
R, R_{free}	0.169 , 0.201 0.173 , 0.204	Depositor DCC
R_{free} test set	2823 reflections (2.00%)	wwPDB-VP
Wilson B-factor (Å^2)	22.3	Xtriage
Anisotropy	0.644	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	(Not available) , (Not available)	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	8977	wwPDB-VP
Average B, all atoms (Å^2)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.64% of the height of the origin peak. No significant pseudotranslation is detected.*

[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

Bond lengths and bond angles in the following residue types are not validated in this section: IMD, BG6, BGC

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	0.46	2/4134 (0.0%)	0.61	0/5617
1	B	0.38	1/4119 (0.0%)	0.55	0/5596
All	All	0.42	3/8253 (0.0%)	0.58	0/11213

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	7	LYS	C-N	6.93	1.47	1.34
1	A	170	GLU	CD-OE2	-6.41	1.18	1.25
1	B	170	GLU	CD-OE2	-5.01	1.20	1.25

There are no bond angle outliers.

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	3961	0	3823	20	0
1	B	3952	0	3809	16	0
2	D	27	0	20	1	0
2	E	27	0	20	2	0
3	A	20	0	20	4	0
4	A	562	0	0	5	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	428	0	0	3	0
All	All	8977	0	7692	38	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 2.

All (38) 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:170:GLU:HG2	1:A:226:ALA:HB2	1.38	1.03
1:A:170:GLU:CD	1:A:299[B]:ASN:HD22	1.74	0.88
1:A:133:ASP:OD2	3:A:501:IMD:H2	1.89	0.72
1:A:378:GLU:OE1	2:E:2:BG6:HC3	1.93	0.69
3:A:504:IMD:N3	4:A:603:HOH:O	2.28	0.66
1:A:170:GLU:CD	1:A:299[B]:ASN:ND2	2.52	0.62
1:B:98[A]:GLU:OE2	1:B:157[A]:ARG:NH1	2.23	0.62
1:B:59:ASP:HB3	1:B:63[B]:ARG:HE	1.68	0.58
1:A:387:LEU:HD11	1:A:391:ASP:HA	1.87	0.57
3:A:504:IMD:H4	4:A:1013:HOH:O	2.05	0.57
1:B:170:GLU:HG2	1:B:226:ALA:HB2	1.88	0.56
1:A:170:GLU:CG	1:A:299[B]:ASN:HD22	2.19	0.55
1:B:224:SER:OG	1:B:299:ASN:OD1	2.22	0.53
1:B:299:ASN:HD22	1:B:378:GLU:CD	2.11	0.52
1:A:265:GLN:NE2	1:A:269:ASN:OD1	2.43	0.51
1:A:160:ASP:OD2	4:A:601:HOH:O	2.20	0.49
1:A:403:ARG:HD2	4:A:691:HOH:O	2.13	0.49
1:B:7:LYS:HG3	1:B:414:THR:HA	1.95	0.48
1:B:171:GLN:HA	1:B:174:PHE:CE2	2.48	0.48
1:B:97[A]:ASN:ND2	4:B:511:HOH:O	2.46	0.48
1:B:149[A]:ARG:NH1	4:B:502:HOH:O	2.32	0.48
1:A:234:ASP:HA	1:B:234:ASP:HA	1.95	0.47
1:A:171:GLN:HA	1:A:174:PHE:CE2	2.50	0.47
1:B:41:PHE:CD2	1:B:185:PRO:HD3	2.51	0.45
1:A:124:HIS:HE1	2:E:2:BG6:O3	2.00	0.44
1:B:43:LYS:HE3	4:B:651:HOH:O	2.18	0.43
1:A:170:GLU:HG2	1:A:226:ALA:CB	2.28	0.42
1:B:426:SER:O	1:B:442:GLY:HA2	2.19	0.42
1:B:408:GLU:OE2	1:B:411:ARG:NH1	2.53	0.42
1:A:218:ASP:C	3:A:503:IMD:H4	2.39	0.42
1:B:112:ARG:CZ	1:B:161:ARG:HG2	2.50	0.41
1:A:7:LYS:HD3	1:A:414:THR:HA	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:1:BGC:H6C2	2:D:2:BG6:O5	2.20	0.41
1:B:179:TYR:HB2	1:B:194[B]:MET:HG3	2.02	0.41
1:A:406:VAL:HA	1:A:409:ILE:HD12	2.02	0.41
1:A:390:GLY:C	1:A:392:ILE:HD12	2.42	0.40
1:A:341[B]:ARG:CZ	4:A:639:HOH:O	2.69	0.40
1:A:92:GLY:HA2	1:A:128:PRO:HG2	2.04	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	490/478 (102%)	472 (96%)	18 (4%)	0	100	100
1	B	488/478 (102%)	472 (97%)	16 (3%)	0	100	100
All	All	978/956 (102%)	944 (96%)	34 (4%)	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	418/404 (104%)	416 (100%)	2 (0%)	88	80
1	B	416/404 (103%)	414 (100%)	2 (0%)	88	80

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	834/808 (103%)	830 (100%)	4 (0%)	91 80

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	299[A]	ASN
1	A	299[B]	ASN
1	B	43	LYS
1	B	430	LEU

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)

Mogul failed to run properly - this section is therefore empty.

5.5 Carbohydrates (i)

Mogul failed to run properly - this section is therefore empty.

5.6 Ligand geometry (i)

Mogul failed to run properly - this section is therefore empty.

5.7 Other polymers (i)

Mogul failed to run properly - this section is therefore empty.

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, 95^{th} 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	474/478 (99%)	0.11	5 (1%)	80	82	15, 22, 36, 60	0
1	B	474/478 (99%)	0.27	11 (2%)	60	62	20, 27, 42, 74	0
All	All	948/956 (99%)	0.19	16 (1%)	70	71	15, 25, 40, 74	0

All (16) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	5	HIS	4.4
1	B	12	GLU	3.8
1	B	5	HIS	3.7
1	B	94	GLY	3.4
1	A	390	GLY	3.4
1	B	312	ASP	2.7
1	A	389	PRO	2.6
1	A	392	ILE	2.5
1	B	324	LYS	2.4
1	B	327	THR	2.2
1	B	451	GLU	2.1
1	B	313	GLY	2.1
1	B	249	PHE	2.1
1	B	160	ASP	2.1
1	A	312	ASP	2.0
1	B	318	VAL	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 (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, 95^{th} 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(Å^2)	Q<0.9
2	BGC	E	1	12/12	0.76	0.17	27,35,44,51	12
2	BGC	D	1	12/12	0.84	0.19	35,39,47,51	12
2	BG6	E	2	15/16	0.94	0.16	19,26,34,52	15
2	BG6	D	2	15/16	0.95	0.13	25,31,38,43	15

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, 95^{th} 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(Å^2)	Q<0.9
3	IMD	A	504	5/5	0.03	0.89	51,56,59,70	0
3	IMD	A	503	5/5	0.80	0.39	38,39,41,49	0
3	IMD	A	502	5/5	0.83	0.14	24,25,30,31	0
3	IMD	A	501	5/5	0.92	0.10	26,28,32,38	0

6.5 Other polymers (i)

There are no such residues in this entry.