wwPDB X-ray Structure Validation Summary Report (i)

Oct 23, 2021 – 10:23 AM EDT

PDB ID	:	1TCM
Title	:	CYCLODEXTRIN GLYCOSYLTRANSFERASE W616A MUTANT FROM BACILLUS CIRCULANS STRAIN 251
Authors	:	Knegtel, R.M.A.; Dijkstra, B.W.
Deposited on	:	1996-10-07
Resolution	:	2.20 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 following versions of software and data (see references (1)) were used in the production of this report:

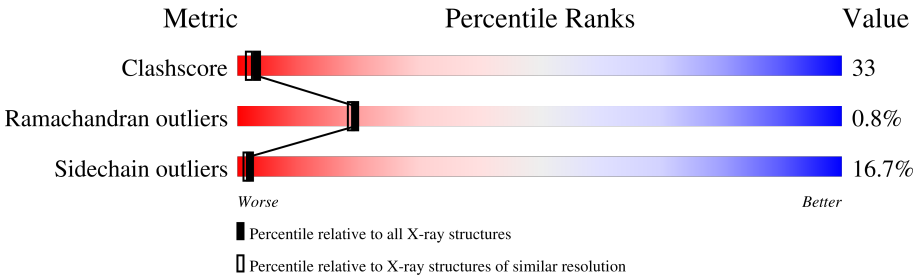
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)

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%

Mol	Chain	Length	Quality of chain
1	A	686	41% 47% 11% .
1	B	686	46% 45% 9% .

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 10779 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 CYCLODEXTRIN GLYCOSYLTRANSFERASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	686	Total	C	N	O	S	0	0	0
			5255	3313	899	1027	16			
1	B	686	Total	C	N	O	S	0	0	0
			5255	3313	899	1027	16			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	616	ALA	TRP	engineered mutation	UNP P43379
B	616	ALA	TRP	engineered mutation	UNP P43379

- Molecule 2 is CALCIUM ION (three-letter code: CA) (formula: Ca).

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

- Molecule 3 is water.

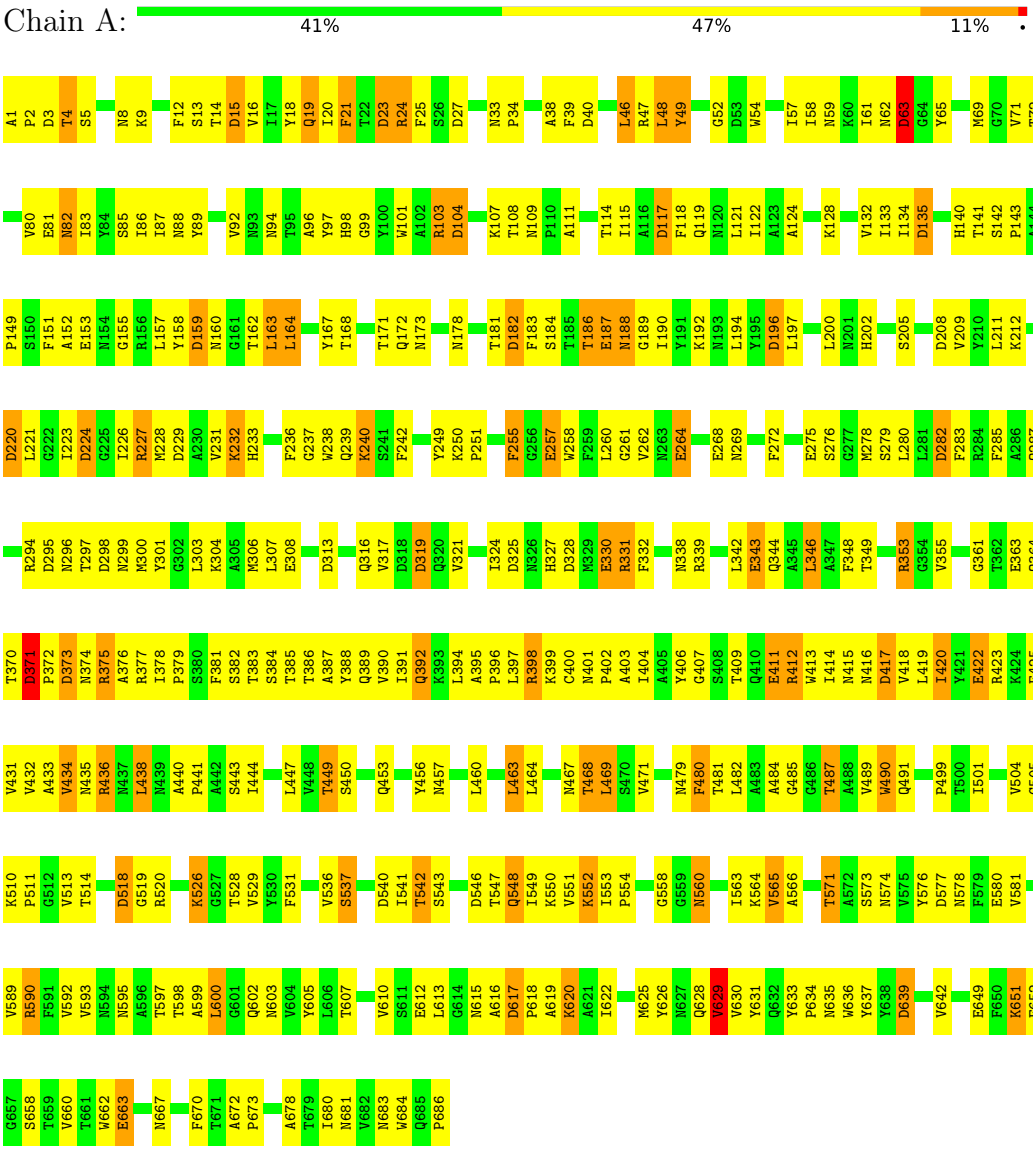
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	119	Total	O	0	0
			119	119		
3	B	146	Total	O	0	0
			146	146		

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.

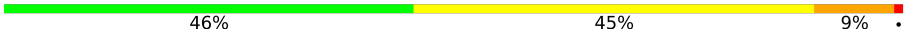
- Molecule 1: CYCLODEXTRIN GLYCOSYLTRANSFERASE

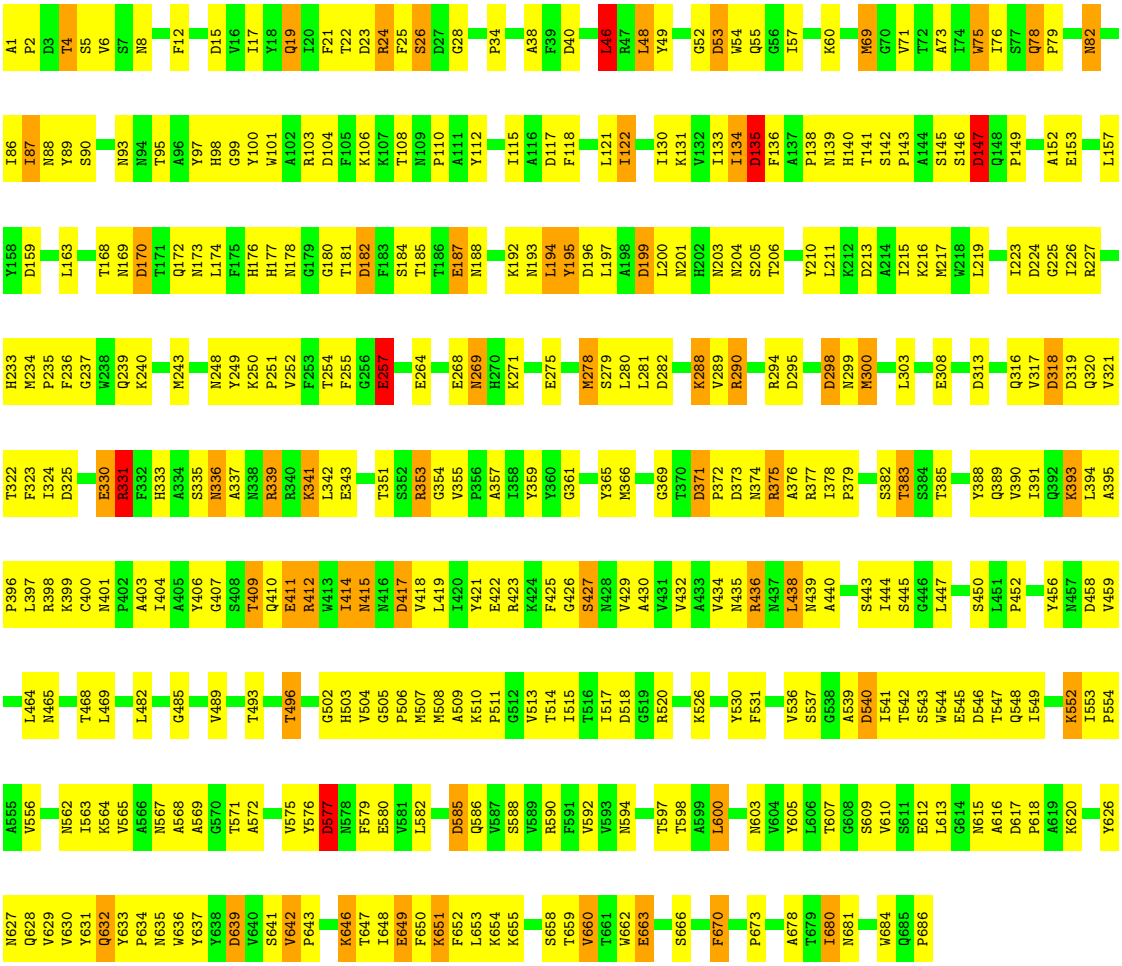
Chain A:



- Molecule 1: CYCLODEXTRIN GLYCOSYLTRANSFERASE

Chain B:




A1 P2 D3 T4 S5 V6 S7 N8 F12 D15 V16 I17 Y18 Q19 I20 F21 T22 D23 R24 F25 S26 D27 G28 P34 A38 F39 D40 L46 R47 L48 Y49 G52 D53 W54 Q55 G56 I57 K60 M69 G70 V71 T72 A73 I74 W75 I76 S77 Q78 P79 N82
I86 I87 N88 Y89 S90 N93 N94 T95 A96 Y97 H98 G99 Y100 W101 A102 R103 D104 F105 K106 K107 T108 N109 P110 A111 Y112 I115 A116 D117 F118 L121 I122 I130 K131 V132 I133 I134 D135 F136 A137 P138 N139 H140 T141 S142 P143 A144 S145 S146 D147 Q148 P149 A152 E153 L157
Y158 D159 L163 T168 N169 D170 T171 Q172 N173 L174 F176 H176 H177 N178 G179 G180 T181 D182 F183 S184 T185 T186 E187 N188 K192 N193 L194 Y195 D196 L197 A198 D199 L200 N201 H202 N203 N204 S205 T206 Y210 L211 K212 D213 A214 I215 K216 M217 W218 L219 I223 D224 G225 I226 R227
H233 M234 P235 F236 G237 W238 Q239 K240 M243 N248 Y249 K250 P251 V252 F253 T254 F255 G256 E257 E264 E268 N269 H270 K271 E275 M278 S279 L280 L281 D282 K288 V289 R290 R294 D295 D298 N299 M300 L303 E308 D313 Q316 V317 D318 D319 Q320 V321
T322 F323 I324 D325 E330 R331 F332 H333 A334 S335 N336 A337 N338 R339 R340 K341 L342 E343 T351 S352 R353 G354 V355 P356 A357 I358 Y359 Y360 G361 Y365 M366 G369 T370 D371 P372 D373 N374 R375 A376 R377 I378 P379 S382 T383 S384 T385 Y388 Q389 V390 I391 Q392 K393 L394 A395
P396 L397 R398 K399 C400 N401 P402 A403 I404 A405 Y406 G407 S408 T409 Q410 E411 R412 W413 I414 N415 N416 D417 V418 L419 I420 Y421 E422 R423 K424 F425 G426 S427 N428 V429 A430 V431 V432 A433 V434 N435 R436 N437 L438 N439 A440 S443 I444 S445 G446 L447 S450 L451 P452 Y456 N457 D458 V459
L464 N465 T468 L469 L482 G485 V489 T493 T496 G502 H503 V504 G505 P506 M507 M508 A509 K510 P511 G512 V513 T514 I515 T516 I517 D518 G519 R520 K526 Y530 F531 V536 S537 G538 A539 D540 I541 T542 S543 W544 E545 D546 T547 Q548 I549 K552 I553 P554
A555 V556 N562 I563 K564 V565 A566 N567 A568 A569 G570 T571 A572 V575 Y576 D577 N578 F579 E580 V581 L582 D585 Q586 V587 S588 V589 R590 F591 V592 V593 N594 T597 T598 A599 L600 N603 V604 Y605 L606 T607 G608 S609 V610 S611 E612 L613 G614 N615 A616 D617 P618 A619 K620 Y626
N627 Q628 V629 V630 Y631 Q632 Y633 P634 N635 W636 Y637 Y638 D639 V640 S641 V642 P643 K646 T647 I648 E649 F650 K651 F652 L653 K654 K655 S658 T659 V660 T661 W662 E663 S666 F670 P673 A678 T679 I680 N681 W684 Q685 P686

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	73.70Å 84.80Å 118.30Å 90.00° 107.00° 90.00°	Depositor
Resolution (Å)	6.50 – 2.20 6.50 – 2.20	Depositor EDS
% Data completeness (in resolution range)	(Not available) (6.50-2.20) 70.7 (6.50-2.20)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.92 (at 2.21Å)	Xtriage
Refinement program	TNT	Depositor
R, R_{free}	0.193 , 0.250 0.240 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	15.3	Xtriage
Anisotropy	0.244	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 30.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.000 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.87	EDS
Total number of atoms	10779	wwPDB-VP
Average B, all atoms (Å^2)	19.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.01% 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: CA

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	0.61	13/5383 (0.2%)	0.89	54/7336 (0.7%)
1	B	0.63	15/5383 (0.3%)	0.87	45/7336 (0.6%)
All	All	0.62	28/10766 (0.3%)	0.88	99/14672 (0.7%)

The worst 5 of 28 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	411	GLU	CD-OE2	5.76	1.31	1.25
1	A	363	GLU	CD-OE2	5.74	1.31	1.25
1	B	649	GLU	CD-OE2	5.55	1.31	1.25
1	A	343	GLU	CD-OE2	5.53	1.31	1.25
1	B	663	GLU	CD-OE2	5.48	1.31	1.25

The worst 5 of 99 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	135	ASP	CB-CG-OD2	-7.07	111.94	118.30
1	A	24	ARG	NE-CZ-NH1	6.52	123.56	120.30
1	A	313	ASP	CB-CG-OD2	-6.50	112.45	118.30
1	A	282	ASP	CB-CG-OD2	-6.44	112.50	118.30
1	B	53	ASP	CB-CG-OD2	-6.30	112.63	118.30

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	5255	0	5020	364	0
1	B	5255	0	5020	325	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
3	A	119	0	0	10	0
3	B	146	0	0	14	0
All	All	10779	0	10040	685	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 33.

The worst 5 of 685 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:413:TRP:HB3	1:A:420:ILE:HG13	1.19	1.14
1:A:38:ALA:HB2	1:A:86:ILE:HD11	1.35	1.07
1:A:285:PHE:HA	1:A:306:MET:HE1	1.40	1.04
1:A:618:PRO:HG3	1:A:662:TRP:HZ2	1.28	0.98
1:B:409:THR:HG23	1:B:423:ARG:HD3	1.48	0.95

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	684/686 (100%)	608 (89%)	72 (10%)	4 (1%)	25	26
1	B	684/686 (100%)	602 (88%)	75 (11%)	7 (1%)	15	14
All	All	1368/1372 (100%)	1210 (88%)	147 (11%)	11 (1%)	19	19

5 of 11 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	338	ASN
1	B	22	THR
1	B	539	ALA
1	A	46	LEU
1	A	629	VAL

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	555/555 (100%)	456 (82%)	99 (18%)	2 1
1	B	555/555 (100%)	469 (84%)	86 (16%)	2 2
All	All	1110/1110 (100%)	925 (83%)	185 (17%)	2 1

5 of 185 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	134	ILE
1	B	342	LEU
1	B	163	LEU
1	B	269	ASN
1	B	393	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 43 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	202	HIS
1	B	416	ASN
1	B	233	HIS
1	B	320	GLN
1	B	578	ASN

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

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

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

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

6.3 Carbohydrates

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands

Unable to reproduce the depositors R factor - this section is therefore empty.

6.5 Other polymers

Unable to reproduce the depositors R factor - this section is therefore empty.