WORLDWIDE wwPDB PROTEIN DATA BANK

wwPDB X-ray Structure Validation Summary Report ⓘ

Dec 17, 2023 – 03:07 PM EST

PDB ID	:	5BCA
Title	:	BETA-AMYLASE FROM BACILLUS CEREUS VAR. MYCOIDES
Authors	:	Oyama, T.; Kusunoki, M.; Kishimoto, Y.; Takasaki, Y.; Nitta, Y.
Deposited on	:	1999-03-12
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 ⓘ 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:

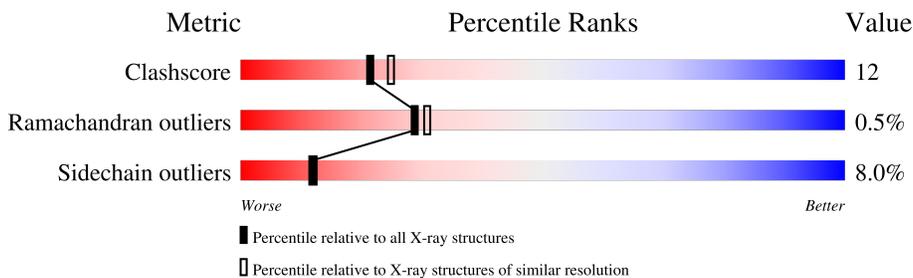|		
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.20 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	Percentile Ranks	Value
Clashscore		12
Ramachandran outliers		0.5%
Sidechain outliers		8.0%

Worse   *Better*

■ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

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%

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	516	69% 27% •
1	B	516	64% 30% 5%
1	C	516	68% 28% •
1	D	516	67% 28% 5% •

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 17232 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 PROTEIN (1,4-ALPHA-D-GLUCAN MALTOHYDROLASE.).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	516	Total	C	N	O	S	0	0	0
			4119	2645	676	781	17			
1	B	516	Total	C	N	O	S	0	0	0
			4119	2645	676	781	17			
1	C	516	Total	C	N	O	S	0	0	0
			4119	2645	676	781	17			
1	D	516	Total	C	N	O	S	0	0	0
			4119	2645	676	781	17			

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

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total	Ca	0	0
			1	1		
2	B	1	Total	Ca	0	0
			1	1		
2	C	1	Total	Ca	0	0
			1	1		
2	D	1	Total	Ca	0	0
			1	1		

- Molecule 3 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	206	Total	O	0	0
			206	206		
3	B	170	Total	O	0	0
			170	170		
3	C	191	Total	O	0	0
			191	191		
3	D	185	Total	O	0	0
			185	185		

3 Residue-property plots ⓘ

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.

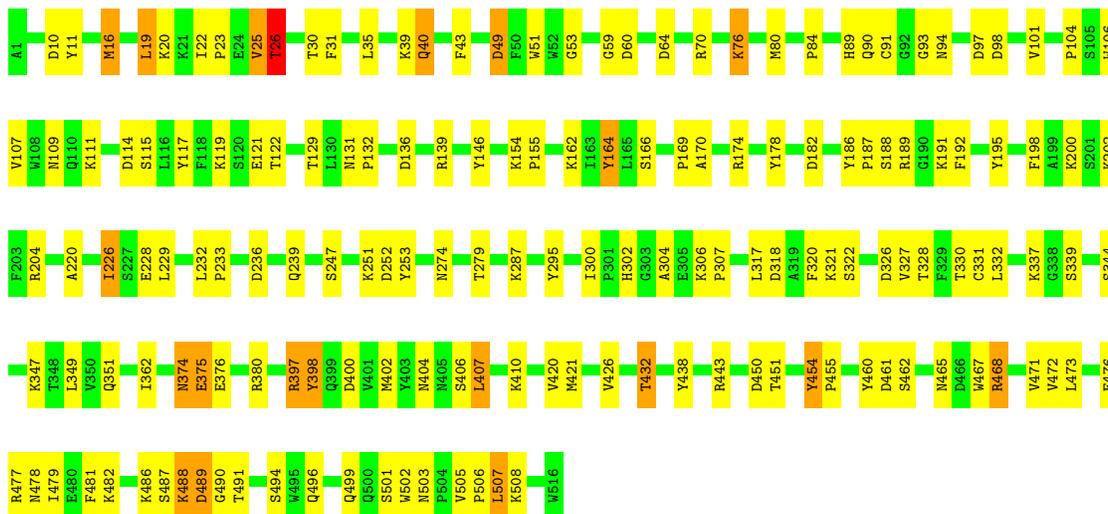• Molecule 1: PROTEIN (1,4-ALPHA-D-GLUCAN MALTOHYDROLASE.)
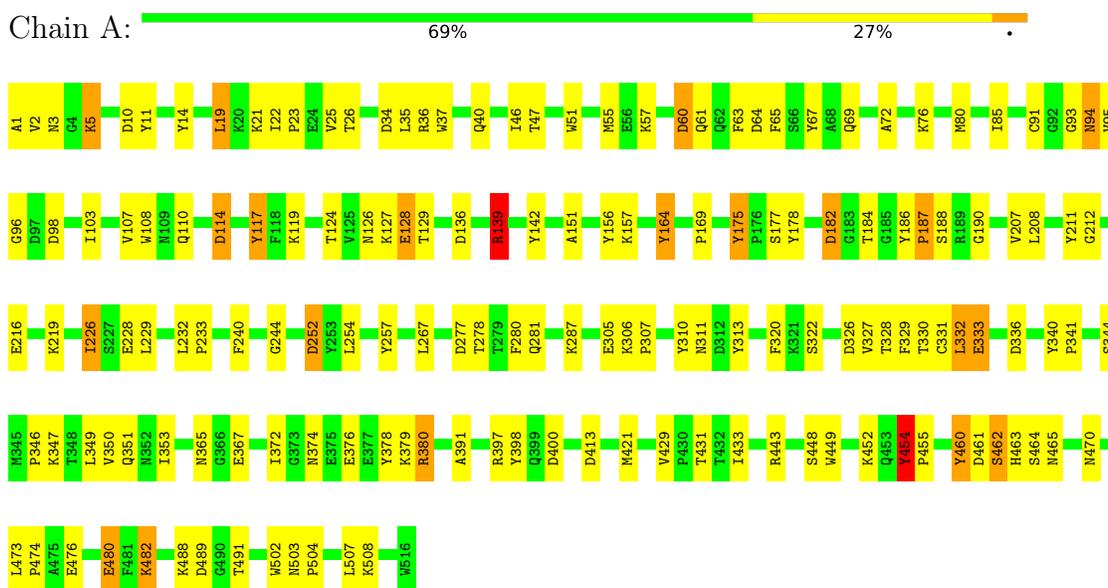
Chain A:

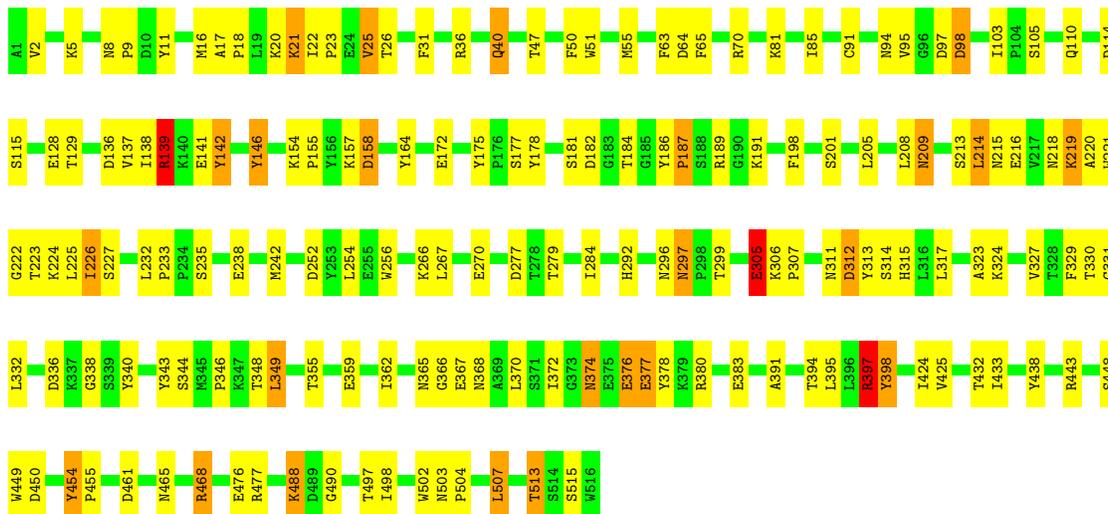• Molecule 1: PROTEIN (1,4-ALPHA-D-GLUCAN MALTOHYDROLASE.)

Chain B:

• Molecule 1: PROTEIN (1,4-ALPHA-D-GLUCAN MALTOHYDROLASE.)

Chain C:

• Molecule 1: PROTEIN (1,4-ALPHA-D-GLUCAN MALTOHYDROLASE.)

Chain D:
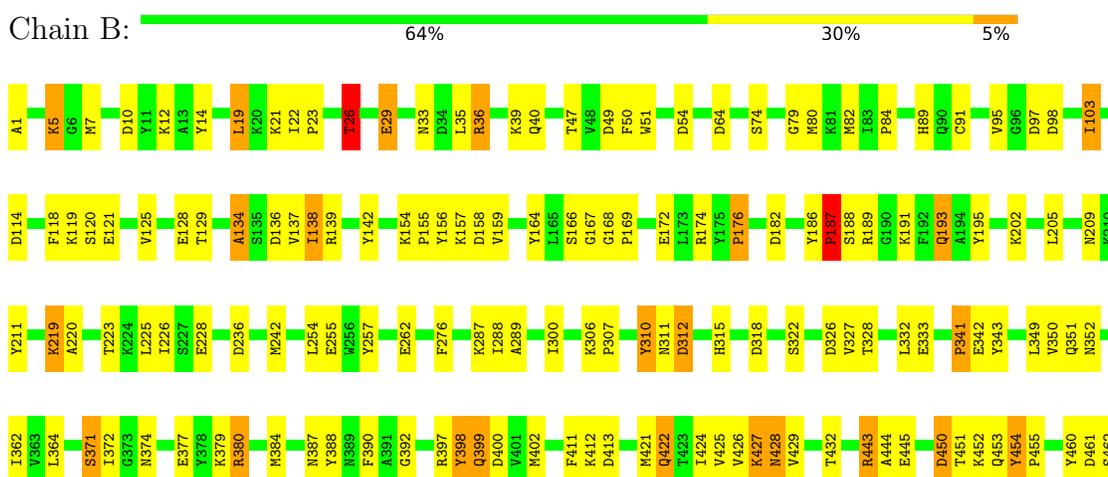
4 Data and refinement statistics ⓘ

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

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	177.90Å 112.90Å 146.20Å 90.00° 105.80° 90.00°	Depositor
Resolution (Å)	8.00 – 2.20	Depositor
% Data completeness (in resolution range)	74.0 (8.00-2.20)	Depositor
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	REFMAC	Depositor
R, R_{free}	0.186 , 0.240	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	17232	wwPDB-VP
Average B, all atoms (Å^2)	24.0	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: 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	0.74	0/4234	1.59	46/5751 (0.8%)
1	B	0.71	0/4234	1.61	52/5751 (0.9%)
1	C	0.74	0/4234	1.66	60/5751 (1.0%)
1	D	0.74	0/4234	1.63	54/5751 (0.9%)
All	All	0.73	0/16936	1.62	212/23004 (0.9%)

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	1
1	B	0	2
1	C	0	1
1	D	0	2
All	All	0	6

There are no bond length outliers.

The worst 5 of 212 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	380	ARG	NE-CZ-NH2	-21.41	109.60	120.30
1	D	380	ARG	CD-NE-CZ	17.65	148.31	123.60
1	C	189	ARG	NE-CZ-NH1	15.27	127.94	120.30
1	C	380	ARG	NE-CZ-NH2	-15.14	112.73	120.30
1	B	189	ARG	NE-CZ-NH1	13.59	127.10	120.30

There are no chirality outliers.

5 of 6 planarity outliers are listed below:

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Mol	Chain	Res	Type	Group
1	A	72	ALA	Mainchain
1	B	134	ALA	Mainchain
1	B	276	PHE	Mainchain
1	C	220	ALA	Mainchain
1	D	50	PHE	Mainchain

5.2 Too-close contacts (i)

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	4119	0	3984	83	0
1	B	4119	0	3984	115	0
1	C	4119	0	3984	92	0
1	D	4119	0	3984	100	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	206	0	0	6	0
3	B	170	0	0	3	0
3	C	191	0	0	6	0
3	D	185	0	0	9	0
All	All	17232	0	15936	389	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 12.

The worst 5 of 389 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:B:129:THR:HG21	1:B:169:PRO:HD3	1.36	1.05
1:A:489:ASP:OD1	1:A:491:THR:HG23	1.54	1.05
1:B:422:GLN:NE2	1:B:510:THR:H	1.54	1.04
1:C:164:TYR:HH	1:C:328:THR:HG1	1.04	1.02
1:D:226:ILE:HD12	1:D:227:SER:H	1.24	0.99

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	514/516 (100%)	486 (95%)	26 (5%)	2 (0%)	34	37
1	B	514/516 (100%)	490 (95%)	22 (4%)	2 (0%)	34	37
1	C	514/516 (100%)	486 (95%)	24 (5%)	4 (1%)	19	19
1	D	514/516 (100%)	475 (92%)	37 (7%)	2 (0%)	34	37
All	All	2056/2064 (100%)	1937 (94%)	109 (5%)	10 (0%)	29	31

5 of 10 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	398	TYR
1	B	428	ASN
1	C	489	ASP
1	D	219	LYS
1	C	170	ALA

5.3.2 Protein sidechains ⓘ

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	440/440 (100%)	412 (94%)	28 (6%)	17	20
1	B	440/440 (100%)	395 (90%)	45 (10%)	7	6
1	C	440/440 (100%)	409 (93%)	31 (7%)	15	16
1	D	440/440 (100%)	404 (92%)	36 (8%)	11	11
All	All	1760/1760 (100%)	1620 (92%)	140 (8%)	12	12

5 of 140 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	158	ASP
1	D	213	SER
1	D	349	LEU
1	B	228	GLU
1	B	226	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 31 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	463	HIS
1	D	311	ASN
1	C	351	GLN
1	D	352	ASN
1	D	58	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 ⓘ

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.