wwPDB X-ray Structure Validation Summary Report (i)

Oct 19, 2024 – 10:39 PM EDT

PDB ID	:	6PCZ
Title	:	Crystal structure of the bacterial cellulose synthase subunit G (BcsG) catalytic domain from Escherichia coli, selenomethionine variant
Authors	:	Anderson, A.C.; Brenner, T.; Weadge, J.T.
Deposited on	:	2019-06-18
Resolution	:	1.44 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 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:

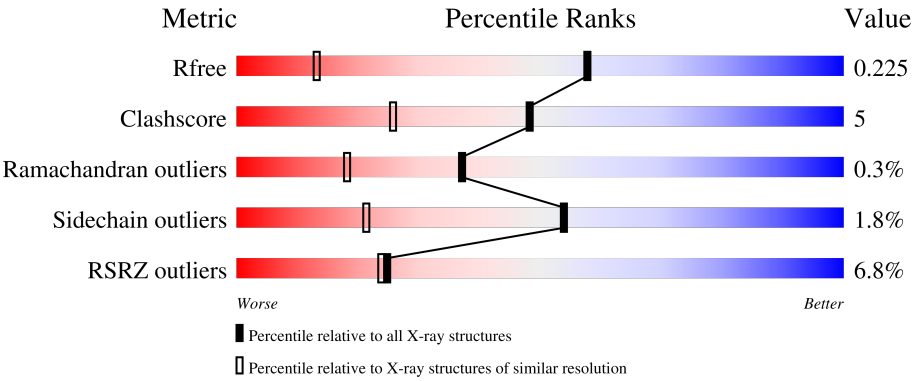
MolProbity	:	4.02b-467
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

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 1.44 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}	164625	2809 (1.46-1.42)
Clashscore	180529	3008 (1.46-1.42)
Ramachandran outliers	177936	2971 (1.46-1.42)
Sidechain outliers	177891	2971 (1.46-1.42)
RSRZ outliers	164620	2809 (1.46-1.42)

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	417	6% 81% 5% 13%
1	B	417	6% 77% 10% 13%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 6376 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 Cellulose biosynthesis protein BcsG.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	363	Total	C	N	O	S	Se	0	0	0
			2833	1802	481	539	3	8			
1	B	364	Total	C	N	O	S	Se	0	0	0
			2838	1805	482	540	3	8			

There are 42 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	143	MSE	-	initiating methionine	UNP P37659
A	144	GLY	-	expression tag	UNP P37659
A	145	SER	-	expression tag	UNP P37659
A	146	SER	-	expression tag	UNP P37659
A	147	HIS	-	expression tag	UNP P37659
A	148	HIS	-	expression tag	UNP P37659
A	149	HIS	-	expression tag	UNP P37659
A	150	HIS	-	expression tag	UNP P37659
A	151	HIS	-	expression tag	UNP P37659
A	152	HIS	-	expression tag	UNP P37659
A	153	SER	-	expression tag	UNP P37659
A	154	SER	-	expression tag	UNP P37659
A	155	GLY	-	expression tag	UNP P37659
A	156	LEU	-	expression tag	UNP P37659
A	157	VAL	-	expression tag	UNP P37659
A	158	PRO	-	expression tag	UNP P37659
A	159	ARG	-	expression tag	UNP P37659
A	160	GLY	-	expression tag	UNP P37659
A	161	SER	-	expression tag	UNP P37659
A	162	HIS	-	expression tag	UNP P37659
A	163	MSE	-	expression tag	UNP P37659
B	143	MSE	-	initiating methionine	UNP P37659
B	144	GLY	-	expression tag	UNP P37659
B	145	SER	-	expression tag	UNP P37659
B	146	SER	-	expression tag	UNP P37659

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Chain	Residue	Modelled	Actual	Comment	Reference
B	147	HIS	-	expression tag	UNP P37659
B	148	HIS	-	expression tag	UNP P37659
B	149	HIS	-	expression tag	UNP P37659
B	150	HIS	-	expression tag	UNP P37659
B	151	HIS	-	expression tag	UNP P37659
B	152	HIS	-	expression tag	UNP P37659
B	153	SER	-	expression tag	UNP P37659
B	154	SER	-	expression tag	UNP P37659
B	155	GLY	-	expression tag	UNP P37659
B	156	LEU	-	expression tag	UNP P37659
B	157	VAL	-	expression tag	UNP P37659
B	158	PRO	-	expression tag	UNP P37659
B	159	ARG	-	expression tag	UNP P37659
B	160	GLY	-	expression tag	UNP P37659
B	161	SER	-	expression tag	UNP P37659
B	162	HIS	-	expression tag	UNP P37659
B	163	MSE	-	expression tag	UNP P37659

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total Zn 1 1	0	0
2	B	1	Total Zn 1 1	0	0

- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Mg 1 1	0	0

- Molecule 4 is water.

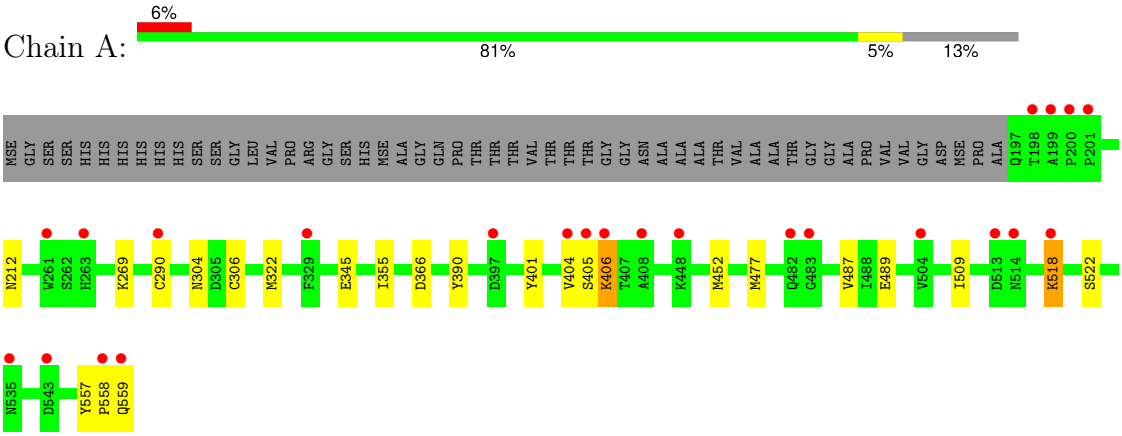
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	385	Total O 385 385	0	0
4	B	317	Total O 317 317	0	0

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.

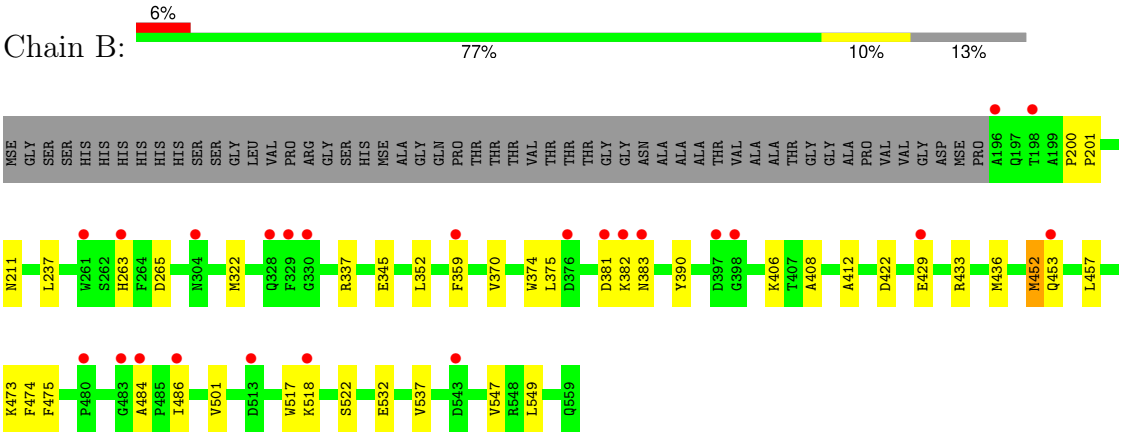
• Molecule 1: Cellulose biosynthesis protein BcsG

Chain A:



• Molecule 1: Cellulose biosynthesis protein BcsG

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	78.71Å 94.58Å 105.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	45.97 – 1.44 45.97 – 1.44	Depositor EDS
% Data completeness (in resolution range)	100.0 (45.97-1.44) 100.0 (45.97-1.44)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.40 (at 1.44Å)	Xtriage
Refinement program	PHENIX (1.13_2998: ???)	Depositor
R, R_{free}	0.196 , 0.208 0.215 , 0.225	Depositor DCC
R_{free} test set	7125 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	19.1	Xtriage
Anisotropy	0.129	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.30 , 25.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	6376	wwPDB-VP
Average B, all atoms (Å^2)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.36% 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: ZN, MG

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	0.40	0/2900	0.61	0/3933
1	B	0.42	0/2905	0.61	0/3940
All	All	0.41	0/5805	0.61	0/7873

There are no bond length outliers.

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	2833	0	2746	28	0
1	B	2838	0	2749	31	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	1	0	0	0	0
4	A	385	0	0	7	0
4	B	317	0	0	4	0
All	All	6376	0	5495	59	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 5.

The worst 5 of 59 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:452:MSE:HE3	1:A:557:TYR:CE2	1.93	1.03
1:B:486:ILE:HD11	1:B:517:TRP:HB3	1.51	0.92
1:A:452:MSE:CE	1:A:557:TYR:CD2	2.54	0.90
1:A:404:VAL:HG12	1:A:406:LYS:HD2	1.58	0.86
1:A:404:VAL:CG1	1:A:406:LYS:HD2	2.07	0.85

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	361/417 (87%)	354 (98%)	7 (2%)	0	100 100
1	B	362/417 (87%)	349 (96%)	11 (3%)	2 (1%)	22 6
All	All	723/834 (87%)	703 (97%)	18 (2%)	2 (0%)	37 18

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	382	LYS
1	B	484	ALA

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	311/337 (92%)	308 (99%)	3 (1%)	73 46
1	B	311/337 (92%)	303 (97%)	8 (3%)	41 10
All	All	622/674 (92%)	611 (98%)	11 (2%)	54 21

5 of 11 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	359	PHE
1	B	452	MSE
1	B	522	SER
1	B	518	LYS
1	B	337	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	303	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)

Of 3 ligands modelled in this entry, 3 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

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	355/417 (85%)	0.50	24 (6%)	25	24	12, 20, 32, 39	0
1	B	356/417 (85%)	0.74	24 (6%)	25	24	15, 24, 34, 39	0
All	All	711/834 (85%)	0.62	48 (6%)	25	24	12, 22, 34, 39	0

The worst 5 of 48 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	359	PHE	6.8
1	A	406	LYS	5.4
1	B	484	ALA	5.2
1	A	559	GLN	5.1
1	B	261	TRP	5.0

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

There are no monosaccharides in this entry.

6.4 Ligands

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	ZN	A	601	1/1	0.99	0.33	20,20,20,20	0
2	ZN	B	601	1/1	0.99	0.48	20,20,20,20	0
3	MG	A	602	1/1	0.99	0.05	20,20,20,20	0

6.5 Other polymers (i)

There are no such residues in this entry.