Full wwPDB X-ray Structure Validation Report ⓘ

May 21, 2020 – 08:40 am BST

PDB ID	:	2FB5
Title	:	Structural Genomics; The crystal structure of the hypothetical membrane spanning protein from Bacillus cereus
Authors	:	Zhang, R.; Zhou, M.; Ginell, S.; Abdullah, J.; Collart, F.; Joachimiak, A.; Midwest Center for Structural Genomics (MCSG)
Deposited on	:	2005-12-08
Resolution	:	1.99 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 following versions of software and data (see references ①) were used in the production of this report:

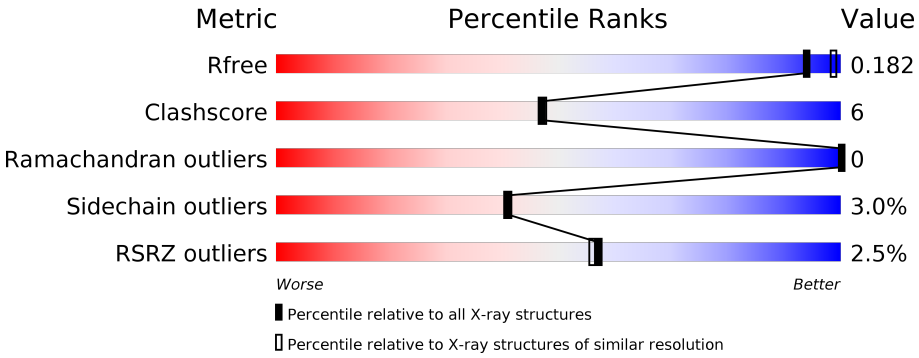
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

1 Overall quality at a glance (i)

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

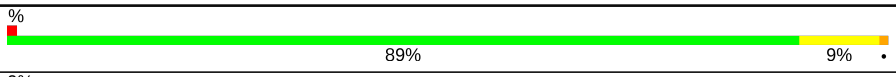
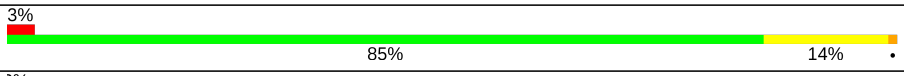
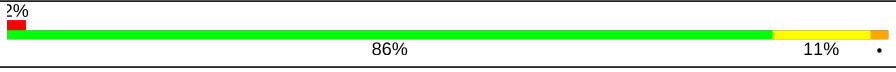
The reported resolution of this entry is 1.99 Å.

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	8085 (2.00-2.00)
Clashscore	141614	9178 (2.00-2.00)
Ramachandran outliers	138981	9054 (2.00-2.00)
Sidechain outliers	138945	9053 (2.00-2.00)
RSRZ outliers	127900	7900 (2.00-2.00)

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 on 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	205	
1	B	205	
1	C	205	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 5577 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 hypothetical Membrane Spanning Protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	204	Total	C	N	O	S	0	0	0
			1577	995	266	309	7			
1	B	204	Total	C	N	O	S	0	0	0
			1577	995	266	309	7			
1	C	204	Total	C	N	O	S	0	0	0
			1577	995	266	309	7			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	ALA	-	CLONING ARTIFACT	GB 30022961
A	2	SER	-	CLONING ARTIFACT	GB 30022961
A	3	ASN	-	CLONING ARTIFACT	GB 30022961
A	4	ALA	-	CLONING ARTIFACT	GB 30022961
B	1	ALA	-	CLONING ARTIFACT	GB 30022961
B	2	SER	-	CLONING ARTIFACT	GB 30022961
B	3	ASN	-	CLONING ARTIFACT	GB 30022961
B	4	ALA	-	CLONING ARTIFACT	GB 30022961
C	1	ALA	-	CLONING ARTIFACT	GB 30022961
C	2	SER	-	CLONING ARTIFACT	GB 30022961
C	3	ASN	-	CLONING ARTIFACT	GB 30022961
C	4	ALA	-	CLONING ARTIFACT	GB 30022961

- Molecule 2 is water.

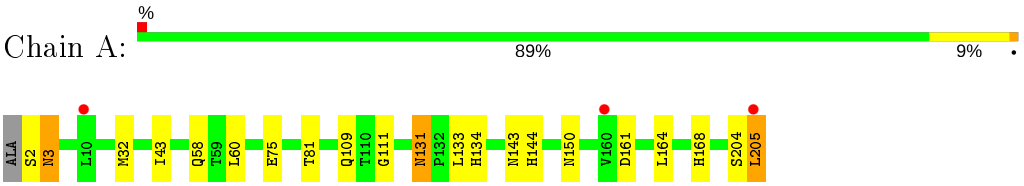
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	286	Total	O	0	0
			286	286		
2	B	282	Total	O	0	0
			282	282		
2	C	278	Total	O	0	0
			278	278		

3 Residue-property plots (i)

These plots are drawn for all protein, RNA and DNA 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.

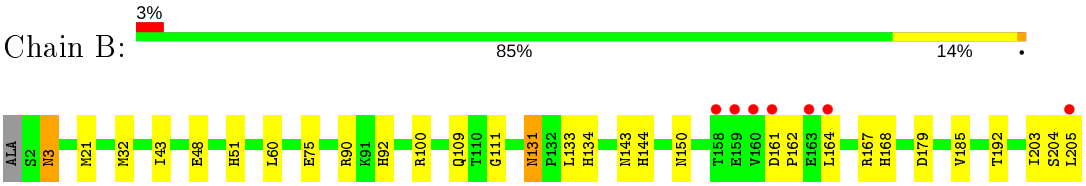
- Molecule 1: hypothetical Membrane Spanning Protein

Chain A:



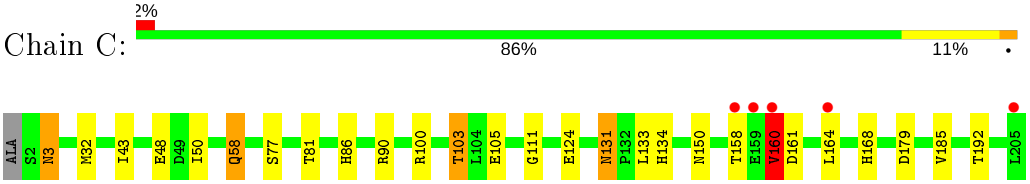
- Molecule 1: hypothetical Membrane Spanning Protein

Chain B:



- Molecule 1: hypothetical Membrane Spanning Protein

Chain C:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	109.61Å 109.61Å 77.48Å 90.00° 90.07° 90.00°	Depositor
Resolution (Å)	77.62 – 1.99 27.41 – 1.99	Depositor EDS
% Data completeness (in resolution range)	98.7 (77.62-1.99) 98.7 (27.41-1.99)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.33 (at 1.99Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.182 , 0.215 0.184 , 0.182	Depositor DCC
R_{free} test set	3076 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	24.4	Xtriage
Anisotropy	0.418	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 39.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.51$, $< L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.022 for k,h,-l 0.008 for -k,-h,-l 0.009 for -1/2*h-1/2*k-l,1/2*h+1/2*k-l,1/2*h-1/2*k 0.015 for -1/2*h-1/2*k+l,1/2*h+1/2*k+l,-1/2*h+1/2*k 0.014 for -1/2*h+1/2*k+l,-1/2*h+1/2*k-l,-1/2*h-1/2*k 0.021 for -1/2*h+1/2*k-l,-1/2*h+1/2*k+l,1/2*h+1/2*k 0.478 for -1/2*h+1/2*k-l,1/2*h-1/2*k-l,-1/2*h-1/2*k 0.477 for -1/2*h-1/2*k-l,-1/2*h-1/2*k+l,-1/2*h+1/2*k 0.019 for -1/2*h-1/2*k+l,-1/2*h-1/2*k-l,1/2*h-1/2*k 0.008 for -1/2*h+1/2*k+l,1/2*h-1/2*k+l,1/2*h+1/2*k 0.017 for -h,-k,l	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	5577	wwPDB-VP
Average B, all atoms (Å^2)	30.0	wwPDB-VP

[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.

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.03% of the height of the origin peak. No significant pseudotranslation is detected.*

5 Model quality

5.1 Standard geometry

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	0.47	0/1602	0.58	0/2176
1	B	0.45	0/1602	0.59	0/2176
1	C	0.46	0/1602	0.58	0/2176
All	All	0.46	0/4806	0.58	0/6528

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	C	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	C	160	VAL	Peptide

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	1577	0	1593	15	0
1	B	1577	0	1593	21	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	C	1577	0	1593	23	0
2	A	286	0	0	3	0
2	B	282	0	0	4	0
2	C	278	0	0	5	0
All	All	5577	0	4779	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 6.

All (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:B:21:MET:HG3	1:B:60:LEU:HD12	1.49	0.94
1:C:103:THR:HG23	1:C:105:GLU:OE1	1.79	0.82
1:C:58:GLN:HG3	2:C:344:HOH:O	1.80	0.81
1:B:21:MET:HG3	1:B:60:LEU:CD1	2.14	0.77
1:B:203:ILE:HD12	1:B:205:LEU:HD21	1.66	0.77
1:B:111:GLY:H	1:B:150:ASN:HD22	1.37	0.72
1:C:111:GLY:H	1:C:150:ASN:HD22	1.38	0.71
1:A:58:GLN:HG3	2:A:343:HOH:O	1.90	0.71
1:C:77:SER:O	1:C:81:THR:HG23	1.90	0.71
1:C:103:THR:CG2	1:C:105:GLU:OE1	2.39	0.69
1:A:111:GLY:H	1:A:150:ASN:HD22	1.41	0.69
1:B:168:HIS:HE1	2:B:208:HOH:O	1.76	0.68
1:A:131:ASN:O	1:A:134:HIS:HD2	1.76	0.67
1:A:2:SER:HB2	1:A:75:GLU:OE2	1.95	0.66
1:B:21:MET:CG	1:B:60:LEU:CD1	2.76	0.64
1:C:168:HIS:HE1	2:C:229:HOH:O	1.81	0.63
1:B:131:ASN:O	1:B:134:HIS:HD2	1.82	0.63
1:C:111:GLY:H	1:C:150:ASN:ND2	1.97	0.62
1:B:144:HIS:HD2	2:B:207:HOH:O	1.81	0.62
1:A:58:GLN:HG2	1:A:204:SER:HB3	1.80	0.62
1:C:131:ASN:ND2	1:C:133:LEU:H	1.99	0.61
1:B:111:GLY:H	1:B:150:ASN:ND2	1.99	0.60
1:A:131:ASN:ND2	1:A:133:LEU:H	2.00	0.59
1:C:81:THR:HG21	2:C:271:HOH:O	2.04	0.58
1:A:168:HIS:HE1	2:A:216:HOH:O	1.86	0.58
1:A:144:HIS:HD2	2:A:206:HOH:O	1.89	0.56
1:B:131:ASN:ND2	1:B:133:LEU:H	2.03	0.56
1:C:131:ASN:O	1:C:134:HIS:HD2	1.90	0.55
1:B:161:ASP:HB3	1:B:164:LEU:HG	1.89	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:111:GLY:H	1:A:150:ASN:ND2	2.02	0.54
1:C:32:MET:HE3	1:C:50:ILE:HD11	1.90	0.54
1:C:32:MET:HE3	1:C:50:ILE:CD1	2.39	0.53
1:C:161:ASP:HB3	1:C:164:LEU:HG	1.91	0.52
1:A:2:SER:CB	1:A:75:GLU:OE2	2.58	0.51
1:A:81:THR:HG23	1:A:205:LEU:HD13	1.92	0.51
1:C:160:VAL:HA	2:C:426:HOH:O	2.11	0.51
1:C:32:MET:CE	1:C:50:ILE:CD1	2.88	0.50
1:C:158:THR:C	1:C:160:VAL:H	2.14	0.50
1:C:86:HIS:HD2	1:C:124:GLU:OE2	1.94	0.50
1:B:109:GLN:NE2	2:B:462:HOH:O	2.41	0.50
1:B:3:ASN:HD22	1:B:3:ASN:C	2.15	0.49
1:A:161:ASP:HB3	1:A:164:LEU:HG	1.96	0.48
1:C:90:ARG:NH1	2:C:384:HOH:O	2.46	0.48
1:A:3:ASN:HD22	1:A:3:ASN:C	2.17	0.48
1:C:185:VAL:HG22	1:C:192:THR:HG22	1.97	0.47
1:C:3:ASN:C	1:C:3:ASN:HD22	2.20	0.46
1:B:100:ARG:HD3	1:B:179:ASP:O	2.17	0.45
1:B:32:MET:HG3	1:B:43:ILE:HB	1.98	0.44
1:C:32:MET:HG3	1:C:43:ILE:HB	1.98	0.44
1:B:75:GLU:HB2	1:B:143:ASN:HD21	1.83	0.44
1:B:90:ARG:HD3	1:B:92:HIS:CE1	2.53	0.44
1:B:185:VAL:HG22	1:B:192:THR:HG22	2.01	0.43
1:C:100:ARG:HD3	1:C:179:ASP:O	2.18	0.43
1:B:161:ASP:HA	1:B:162:PRO:HD3	1.85	0.43
1:C:111:GLY:N	1:C:150:ASN:HD22	2.13	0.43
1:A:75:GLU:HB2	1:A:143:ASN:HD21	1.85	0.42
1:B:51:HIS:HB2	2:B:470:HOH:O	2.20	0.41
1:B:21:MET:HG2	1:B:60:LEU:CD1	2.51	0.40
1:A:32:MET:HG3	1:A:43:ILE:HB	2.02	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	202/205 (98%)	197 (98%)	5 (2%)	0	100	100
1	B	202/205 (98%)	199 (98%)	3 (2%)	0	100	100
1	C	202/205 (98%)	197 (98%)	5 (2%)	0	100	100
All	All	606/615 (98%)	593 (98%)	13 (2%)	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	175/175 (100%)	170 (97%)	5 (3%)	42	43
1	B	175/175 (100%)	170 (97%)	5 (3%)	42	43
1	C	175/175 (100%)	169 (97%)	6 (3%)	37	36
All	All	525/525 (100%)	509 (97%)	16 (3%)	41	41

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	ASN
1	A	60	LEU
1	A	109	GLN
1	A	131	ASN
1	A	205	LEU
1	B	3	ASN
1	B	48	GLU
1	B	131	ASN
1	B	167	ARG
1	B	204	SER
1	C	3	ASN
1	C	48	GLU
1	C	58	GLN

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Mol	Chain	Res	Type
1	C	103	THR
1	C	131	ASN
1	C	160	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (24) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	3	ASN
1	A	51	HIS
1	A	131	ASN
1	A	134	HIS
1	A	143	ASN
1	A	144	HIS
1	A	150	ASN
1	A	168	HIS
1	B	3	ASN
1	B	115	ASN
1	B	131	ASN
1	B	134	HIS
1	B	143	ASN
1	B	144	HIS
1	B	150	ASN
1	B	168	HIS
1	C	3	ASN
1	C	51	HIS
1	C	86	HIS
1	C	115	ASN
1	C	131	ASN
1	C	134	HIS
1	C	150	ASN
1	C	168	HIS

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

There are no carbohydrates in this entry.

5.6 Ligand geometry

There are no ligands in this entry.

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

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	204/205 (99%)	0.28	3 (1%)	73	72	19, 27, 42, 64	0
1	B	204/205 (99%)	0.24	7 (3%)	45	44	19, 27, 41, 63	0
1	C	204/205 (99%)	0.33	5 (2%)	57	56	19, 26, 42, 63	0
All	All	612/615 (99%)	0.28	15 (2%)	57	56	19, 27, 42, 64	0

All (15) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	160	VAL	6.1
1	C	205	LEU	5.3
1	A	205	LEU	4.6
1	B	158	THR	4.5
1	C	160	VAL	4.3
1	B	205	LEU	3.1
1	B	160	VAL	3.0
1	B	164	LEU	2.7
1	C	159	GLU	2.4
1	C	164	LEU	2.3
1	C	158	THR	2.2
1	B	161	ASP	2.2
1	B	159	GLU	2.2
1	B	163	GLU	2.2
1	A	10	LEU	2.1

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 carbohydrates in this entry.

6.4 Ligands

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.