



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 24, 2024 – 04:41 PM EDT

PDB ID : 5UYT
Title : Crystal structure of ice binding protein from an Antarctic bacterium Flavobacteriaceae
Authors : Wang, C.; Pakhomova, S.; Newcomer, M.E.; Christner, B.C.; Luo, B.-H.
Deposited on : 2017-02-24
Resolution : 1.75 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 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
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
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)	:	2.37.1

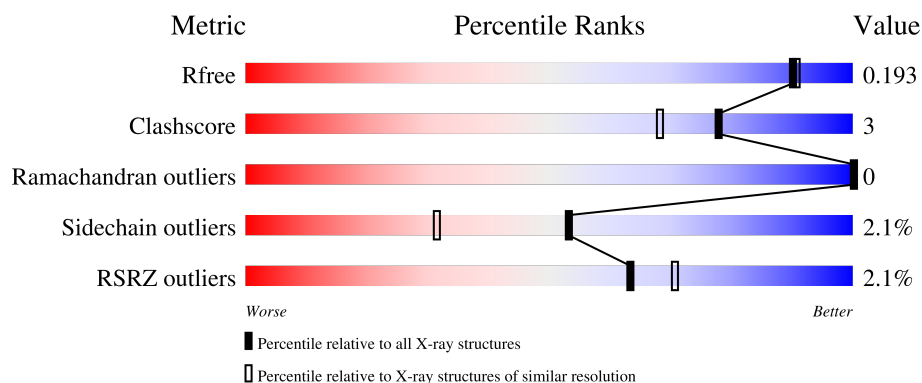
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.75 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	2340 (1.76-1.76)
Clashscore	141614	2466 (1.76-1.76)
Ramachandran outliers	138981	2437 (1.76-1.76)
Sidechain outliers	138945	2437 (1.76-1.76)
RSRZ outliers	127900	2298 (1.76-1.76)

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 $\leq 5\%$. 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	518	<div> <div>%</div> <div> <div></div> <div>75%</div> <div>6%</div> <div>•</div> <div>18%</div> </div> </div>
1	B	518	<div> <div>2%</div> <div> <div></div> <div>77%</div> <div>•</div> <div>•</div> <div>18%</div> </div> </div>

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 6727 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.

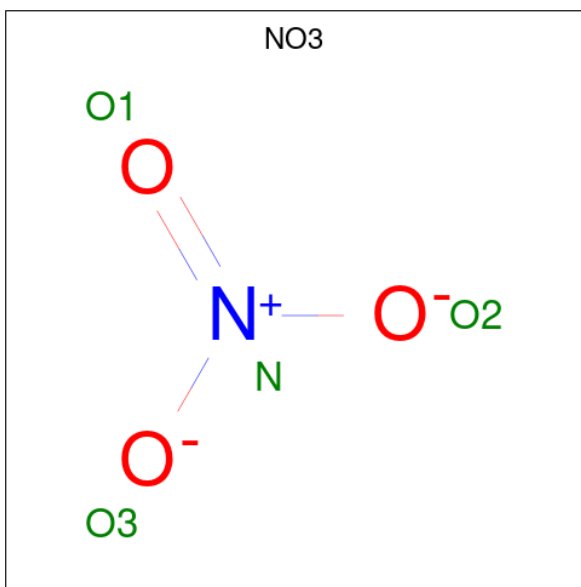
- Molecule 1 is a protein called Ice-binding protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	423	Total	C	N	O	S	0	5	0
			3019	1898	507	607	7			
1	B	424	Total	C	N	O	S	0	4	0
			3020	1895	509	609	7			

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	22	MET	-	initiating methionine	UNP B3GGB1
A	534	HIS	-	expression tag	UNP B3GGB1
A	535	HIS	-	expression tag	UNP B3GGB1
A	536	HIS	-	expression tag	UNP B3GGB1
A	537	HIS	-	expression tag	UNP B3GGB1
A	538	HIS	-	expression tag	UNP B3GGB1
A	539	HIS	-	expression tag	UNP B3GGB1
B	22	MET	-	initiating methionine	UNP B3GGB1
B	534	HIS	-	expression tag	UNP B3GGB1
B	535	HIS	-	expression tag	UNP B3GGB1
B	536	HIS	-	expression tag	UNP B3GGB1
B	537	HIS	-	expression tag	UNP B3GGB1
B	538	HIS	-	expression tag	UNP B3GGB1
B	539	HIS	-	expression tag	UNP B3GGB1

- Molecule 2 is NITRATE ION (three-letter code: NO3) (formula: NO₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	N	O	0	0
			4	1	3		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	367	Total	O	0	0
			367	367		
3	B	317	Total	O	0	0
			317	317		

4 Data and refinement statistics

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α , β , γ	119.83Å 119.83Å 367.76Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	36.08 – 1.75 36.08 – 1.75	Depositor EDS
% Data completeness (in resolution range)	99.5 (36.08-1.75) 99.6 (36.08-1.75)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.67 (at 1.75Å)	Xtriage
Refinement program	REFMAC 5.8.0073	Depositor
R, R_{free}	0.168 , 0.191 0.173 , 0.193	Depositor DCC
R_{free} test set	2071 reflections (2.03%)	wwPDB-VP
Wilson B-factor (Å ²)	19.1	Xtriage
Anisotropy	0.110	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 44.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.27$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	6727	wwPDB-VP
Average B, all atoms (Å ²)	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.82% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: NO3

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	0/3074	0.72	1/4213 (0.0%)
1	B	0.59	0/3072	0.71	0/4209
All	All	0.60	0/6146	0.71	1/8422 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	131	ASP	CB-CG-OD1	5.28	123.05	118.30

There are no chirality outliers.

There are no planarity outliers.

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	3019	0	3035	21	0
1	B	3020	0	3026	14	0
2	A	4	0	0	0	0
3	A	367	0	0	3	0
3	B	317	0	0	1	0
All	All	6727	0	6061	35	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 3.

All (35) 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:209:THR:O	1:A:210:THR:HG22	1.75	0.87
1:A:209:THR:O	1:A:210:THR:CG2	2.35	0.74
1:A:39:ALA:HB3	1:A:210:THR:HB	1.68	0.73
1:A:300:LEU:HD11	1:A:405:ILE:HG23	1.70	0.73
1:B:209:THR:O	1:B:210:THR:HG23	1.95	0.67
1:A:341:LEU:CD1	1:A:345[B]:VAL:HG23	2.25	0.66
1:B:209:THR:O	1:B:210:THR:CG2	2.44	0.65
1:B:204:GLY:HA2	1:B:223:PRO:HD3	1.84	0.58
1:A:323:GLY:HA2	1:A:345[B]:VAL:HG22	1.85	0.58
1:A:341:LEU:HD11	1:A:345[B]:VAL:HG23	1.85	0.57
1:B:224:ILE:O	1:B:225:LEU:HB2	2.05	0.55
1:A:323:GLY:HA2	1:A:345[B]:VAL:CG2	2.37	0.55
1:B:204:GLY:CA	1:B:223:PRO:HD3	2.39	0.52
1:B:39:ALA:HB3	1:B:210:THR:HB	1.93	0.51
1:A:304:TYR:CE1	1:A:407:ASN:HB2	2.46	0.50
1:A:165:CYS:HB3	1:A:223:PRO:HB2	1.96	0.48
1:A:420:GLU:HG3	3:A:947:HOH:O	2.17	0.45
1:A:443:CYS:SG	1:A:445:LEU:HG	2.56	0.45
1:B:24:ALA:HA	1:B:25:PRO:HD2	1.88	0.44
1:A:224:ILE:O	1:A:225:LEU:HB2	2.18	0.44
1:B:197:GLN:O	1:B:200:VAL:HG23	2.17	0.44
1:B:288:ASN:HB2	1:B:289:PRO:CD	2.48	0.44
1:A:288:ASN:HB2	1:A:289:PRO:CD	2.48	0.43
1:B:38:THR:O	1:B:57:ASN:HB3	2.18	0.43
1:A:175:VAL:HG11	1:A:187:VAL:HG11	2.00	0.43
1:A:179:THR:HG23	3:A:760:HOH:O	2.18	0.43
1:B:124:LEU:HB3	1:B:154:THR:HG21	2.01	0.42
1:A:399:LYS:HE3	3:A:967:HOH:O	2.18	0.42
1:A:415:THR:HA	1:A:433:PHE:O	2.19	0.42
1:A:288:ASN:HB2	1:A:289:PRO:HD2	2.03	0.41
1:A:411:VAL:HB	1:A:430:ILE:HG12	2.03	0.41
1:B:420:GLU:HG3	3:B:781:HOH:O	2.21	0.41
1:B:415:THR:HA	1:B:433:PHE:O	2.21	0.40
1:A:436:ASN:HD22	1:A:436:ASN:C	2.24	0.40
1:B:198:SER:HA	1:B:216:THR:O	2.22	0.40

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	426/518 (82%)	417 (98%)	9 (2%)	0	100	100
1	B	426/518 (82%)	416 (98%)	10 (2%)	0	100	100
All	All	852/1036 (82%)	833 (98%)	19 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	322/395 (82%)	316 (98%)	6 (2%)	57	37
1	B	321/395 (81%)	314 (98%)	7 (2%)	52	29
All	All	643/790 (81%)	630 (98%)	13 (2%)	53	34

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	56	THR
1	A	210	THR
1	A	242	VAL
1	A	288	ASN
1	A	387	LYS
1	A	436	ASN
1	B	56	THR
1	B	112	THR

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	B	210	THR
1	B	225	LEU
1	B	288	ASN
1	B	400	PHE
1	B	436	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	49	HIS
1	A	107	ASN
1	A	325	ASN
1	A	370	ASN
1	A	436	ASN
1	A	438	GLN
1	B	155	GLN
1	B	370	ASN
1	B	408	ASN
1	B	436	ASN
1	B	438	GLN

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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand is modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and

the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
2	NO3	A	601	-	1,3,3	0.27	0	0,3,3	-	-

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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, 95th 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	423/518 (81%)	-0.27	6 (1%) 75 82	13, 25, 43, 63	0
1	B	424/518 (81%)	-0.13	12 (2%) 53 58	14, 27, 54, 69	0
All	All	847/1036 (81%)	-0.20	18 (2%) 63 71	13, 26, 50, 69	0

All (18) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	96	ILE	4.2
1	B	446	LEU	4.2
1	B	96	ILE	3.6
1	B	94	ALA	3.5
1	B	107	ASN	3.3
1	A	104	LEU	3.2
1	B	95	ALA	3.2
1	B	23	GLN	3.1
1	B	24	ALA	2.9
1	A	445	LEU	2.8
1	B	104	LEU	2.6
1	B	103	PRO	2.5
1	A	100	THR	2.4
1	A	117	PHE	2.4
1	B	117	PHE	2.3
1	B	119	GLY	2.2
1	A	23	GLN	2.1
1	B	106	GLY	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no monosaccharides in this entry.

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, 95th 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(\AA^2)	Q<0.9
2	NO3	A	601	4/4	0.98	0.11	21,23,26,26	0

6.5 Other polymers [i](#)

There are no such residues in this entry.