



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2024 – 12:07 pm GMT

PDB ID : 8CQN
Title : Crystal structure of Borrelia burgdorferi paralogous family 12 outer surface protein BBK01
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Deposited on : 2023-03-06
Resolution : 2.70 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
Xtriage (Phenix) : 1.13
EDS : 2.36
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) : 2.36

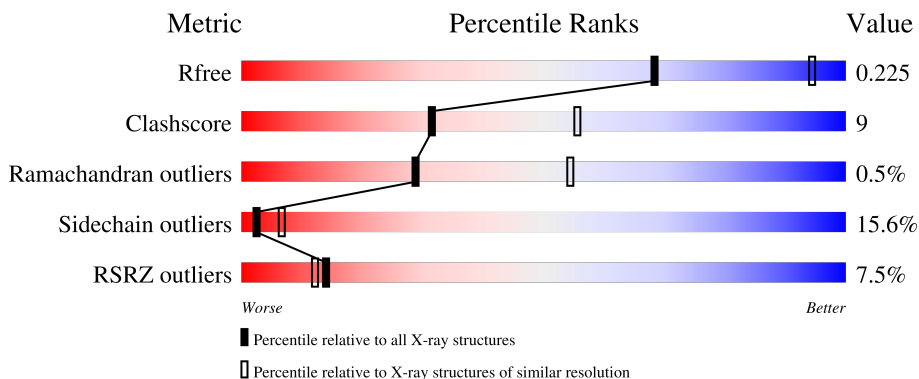
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 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	2808 (2.70-2.70)
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)
RSRZ outliers	127900	2737 (2.70-2.70)

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	275	 2% 51% 13% 33%
1	B	275	 8% 49% 15% 32%

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 3004 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 Lipoprotein, putative.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	185	1497	939	262	292	4	0	0	0
1	B	187	1507	943	266	294	4	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-82	GLY	-	expression tag	UNP O50805
A	-81	ALA	-	expression tag	UNP O50805
A	-80	MET	-	expression tag	UNP O50805
A	-79	GLY	-	expression tag	UNP O50805
B	-82	GLY	-	expression tag	UNP O50805
B	-81	ALA	-	expression tag	UNP O50805
B	-80	MET	-	expression tag	UNP O50805
B	-79	GLY	-	expression tag	UNP O50805

4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	99.07Å 52.13Å 95.02Å 90.00° 90.40° 90.00°	Depositor
Resolution (Å)	46.14 – 2.70 46.14 – 2.70	Depositor EDS
% Data completeness (in resolution range)	98.3 (46.14-2.70) 98.3 (46.14-2.70)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.43 (at 2.69Å)	Xtrriage
Refinement program	REFMAC 5.8.0238	Depositor
R, R_{free}	0.212 , 0.244 0.204 , 0.225	Depositor DCC
R_{free} test set	749 reflections (5.61%)	wwPDB-VP
Wilson B-factor (Å ²)	50.2	Xtrriage
Anisotropy	0.083	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 44.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.013 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	3004	wwPDB-VP
Average B, all atoms (Å ²)	64.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.19% 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](#)

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	0.76	0/1509	0.89	1/2018 (0.0%)
1	B	0.79	0/1518	0.92	1/2029 (0.0%)
All	All	0.78	0/3027	0.90	2/4047 (0.0%)

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	29	ASN	CB-CA-C	6.95	124.31	110.40
1	B	74	ASN	CB-CA-C	-6.73	96.94	110.40

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	1497	0	1564	26	1
1	B	1507	0	1576	36	0
All	All	3004	0	3140	55	1

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 9.

All (55) 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:74:ASN:O	1:B:78:ILE:HG12	1.46	1.15
1:A:81:LEU:HD13	1:B:189:LEU:CD1	2.15	0.76
1:B:68:MET:C	1:B:71:PRO:HD3	2.07	0.75
1:B:74:ASN:O	1:B:78:ILE:CG1	2.33	0.74
1:A:34:GLU:HA	1:A:37:ARG:HG2	1.73	0.70
1:B:70:ASN:N	1:B:71:PRO:CD	2.57	0.66
1:A:81:LEU:CD1	1:B:189:LEU:HD12	2.25	0.66
1:B:116:PHE:CE2	1:B:120:GLN:NE2	2.65	0.65
1:A:88:ASN:HD22	1:A:88:ASN:N	1.95	0.64
1:A:81:LEU:HD13	1:B:189:LEU:HD12	1.80	0.64
1:B:88:ASN:HA	1:B:91:ILE:CG2	2.27	0.64
1:B:74:ASN:OD1	1:B:74:ASN:N	2.30	0.64
1:A:35:LEU:HB3	1:A:109:ILE:CD1	2.31	0.61
1:B:84:LEU:O	1:B:88:ASN:N	2.34	0.59
1:B:62:ASN:O	1:B:66:SER:N	2.35	0.58
1:A:60:ILE:HD13	1:B:186:LEU:HD22	1.86	0.58
1:B:62:ASN:O	1:B:64:LYS:N	2.37	0.57
1:A:184:THR:O	1:A:187:GLU:HB3	2.04	0.57
1:B:16:ASP:OD1	1:B:20:LYS:HE2	2.04	0.57
1:A:35:LEU:HB3	1:A:109:ILE:HD11	1.88	0.56
1:B:75:ARG:HG2	1:B:75:ARG:HH11	1.71	0.55
1:B:167:GLU:CB	1:B:168:PRO:HD3	2.36	0.55
1:A:167:GLU:HB2	1:A:168:PRO:HD3	1.90	0.54
1:A:35:LEU:CB	1:A:109:ILE:HD11	2.38	0.53
1:A:22:LEU:HA	1:A:26:ILE:HG13	1.88	0.53
1:B:83:GLN:O	1:B:87:ASN:HB2	2.09	0.53
1:B:16:ASP:CG	1:B:20:LYS:HE2	2.28	0.52
1:A:69:GLU:O	1:A:70:ASN:ND2	2.44	0.51
1:A:63:LYS:HE3	1:B:190:ASN:HD21	1.75	0.50
1:B:62:ASN:O	1:B:65:THR:N	2.44	0.50
1:A:183:LYS:HE3	1:B:56:VAL:HG11	1.94	0.49
1:A:173:GLU:O	1:A:177:GLU:HG2	2.13	0.48
1:B:93:SER:O	1:B:96:GLU:N	2.47	0.47
1:A:111:SER:O	1:A:114:PHE:HB3	2.14	0.46
1:A:143:LEU:HD13	1:B:125:GLU:HB3	1.98	0.46
1:A:69:GLU:C	1:A:70:ASN:HD22	2.20	0.46
1:B:167:GLU:HB3	1:B:168:PRO:HD3	1.97	0.45
1:A:66:SER:O	1:A:69:GLU:HG2	2.17	0.45
1:B:70:ASN:N	1:B:71:PRO:HD3	2.30	0.45
1:A:35:LEU:HB3	1:A:109:ILE:HD12	1.97	0.45
1:A:37:ARG:HG3	1:A:38:GLU:N	2.32	0.44
1:B:62:ASN:C	1:B:64:LYS:H	2.20	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:62:ASN:C	1:B:66:SER:HB2	2.38	0.44
1:B:181:HIS:O	1:B:184:THR:HB	2.18	0.44
1:B:88:ASN:HA	1:B:91:ILE:HG22	1.97	0.44
1:A:90:LYS:O	1:A:91:ILE:C	2.56	0.43
1:B:180:LYS:O	1:B:183:LYS:HG2	2.17	0.43
1:B:75:ARG:HG2	1:B:75:ARG:NH1	2.34	0.43
1:B:83:GLN:O	1:B:87:ASN:N	2.34	0.43
1:B:39:VAL:HG11	1:B:106:GLU:HB2	2.01	0.43
1:B:84:LEU:HD23	1:B:84:LEU:HA	1.76	0.43
1:A:88:ASN:N	1:A:88:ASN:ND2	2.65	0.42
1:A:136:ASN:HD22	1:A:136:ASN:HA	1.55	0.41
1:A:121:LYS:HB3	1:A:122:ARG:NH2	2.36	0.41
1:B:118:ASN:O	1:B:122:ARG:HG2	2.21	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:54:TYR:OH	1:A:150:ASP:OD1[4_556]	2.13	0.07

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	183/275 (66%)	170 (93%)	13 (7%)	0	100	100
1	B	185/275 (67%)	172 (93%)	11 (6%)	2 (1%)	14	34
All	All	368/550 (67%)	342 (93%)	24 (6%)	2 (0%)	29	54

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	63	LYS
1	B	70	ASN

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	169/252 (67%)	145 (86%)	24 (14%)	3 8
1	B	170/252 (68%)	141 (83%)	29 (17%)	2 5
All	All	339/504 (67%)	286 (84%)	53 (16%)	2 7

All (53) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	26	ILE
1	A	28	LYS
1	A	31	LYS
1	A	34	GLU
1	A	67	LEU
1	A	69	GLU
1	A	72	LYS
1	A	75	ARG
1	A	77	LYS
1	A	80	LYS
1	A	81	LEU
1	A	88	ASN
1	A	92	ASP
1	A	122	ARG
1	A	126	SER
1	A	128	ILE
1	A	153	SER
1	A	173	GLU
1	A	176	LYS
1	A	177	GLU
1	A	183	LYS
1	A	186	LEU

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Mol	Chain	Res	Type
1	A	187	GLU
1	A	188	SER
1	B	37	ARG
1	B	48	LEU
1	B	50	LYS
1	B	56	VAL
1	B	64	LYS
1	B	65	THR
1	B	68	MET
1	B	69	GLU
1	B	70	ASN
1	B	72	LYS
1	B	73	ASN
1	B	74	ASN
1	B	76	ASP
1	B	77	LYS
1	B	80	LYS
1	B	83	GLN
1	B	84	LEU
1	B	87	ASN
1	B	89	LEU
1	B	91	ILE
1	B	93	SER
1	B	110	SER
1	B	111	SER
1	B	122	ARG
1	B	133	SER
1	B	138	SER
1	B	167	GLU
1	B	171	ARG
1	B	172	LYS

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	10	ASN
1	A	62	ASN
1	A	70	ASN
1	A	74	ASN
1	A	79	ASN
1	A	88	ASN
1	A	97	GLN

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Mol	Chain	Res	Type
1	A	136	ASN
1	B	120	GLN
1	B	136	ASN
1	B	190	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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

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, 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	185/275 (67%)	0.21	6 (3%) 47 48	27, 54, 99, 119	0
1	B	187/275 (68%)	0.56	22 (11%) 4 3	29, 56, 140, 187	0
All	All	372/550 (67%)	0.38	28 (7%) 14 12	27, 55, 131, 187	0

All (28) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	68	MET	10.6
1	B	66	SER	10.4
1	B	78	ILE	6.1
1	B	65	THR	5.7
1	B	81	LEU	5.6
1	B	69	GLU	5.5
1	B	74	ASN	5.0
1	B	61	ASN	4.8
1	B	79	ASN	4.8
1	B	73	ASN	4.5
1	B	70	ASN	4.2
1	B	62	ASN	3.8
1	A	30	SER	3.7
1	B	82	THR	3.7
1	B	64	LYS	3.6
1	A	29	ASN	3.5
1	B	60	ILE	3.3
1	A	189	LEU	3.1
1	B	71	PRO	2.9
1	A	186	LEU	2.9
1	B	75	ARG	2.7
1	B	80	LYS	2.7
1	B	67	LEU	2.5
1	B	76	ASP	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	21	TYR	2.4
1	A	184	THR	2.3
1	B	86	GLN	2.3
1	B	29	ASN	2.1

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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.