



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 04:07 PM UTC

PDB ID : 5BQ9 / pdb_00005bq9
Title : Crystal structure of uncharacterized protein lpg1496 *Legionella pneumophila* subsp. *pneumophila*
Authors : Chang, C.; Morar, M.; Evdokimova, E.; Savchenko, A.; Joachimiak, A.; Midwest Center for Structural Genomics (MCSG)
Deposited on : 2015-05-28
Resolution : 2.28 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

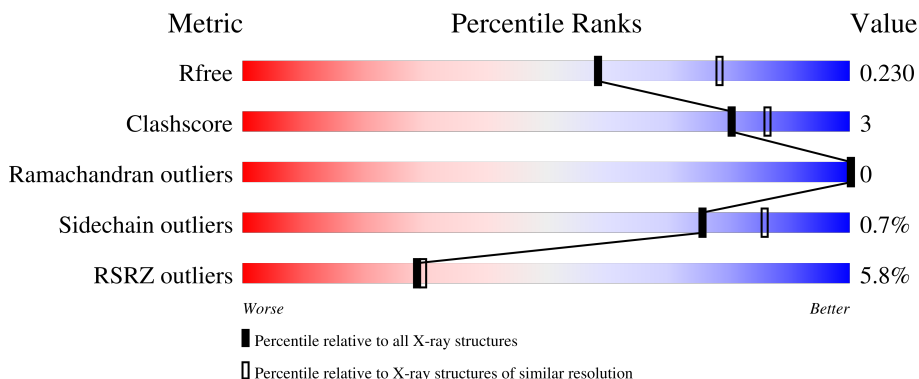
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

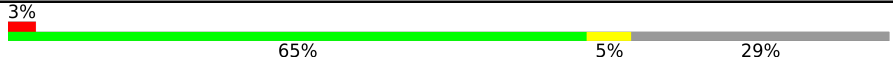
The reported resolution of this entry is 2.28 Å.

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}	180053	9078 (2.30-2.26)
Clashscore	190562	9802 (2.30-2.26)
Ramachandran outliers	187476	9690 (2.30-2.26)
Sidechain outliers	187428	9691 (2.30-2.26)
RSRZ outliers	180081	9085 (2.30-2.26)

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	604	
1	B	604	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 6949 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 Uncharacterized protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	429	Total	C	N	O	S	Se	0	0	0
			3347	2150	563	619	6	9			
1	B	437	Total	C	N	O	S	Se	0	2	0
			3404	2191	576	621	7	9			

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	ASN	-	expression tag	UNP Q5ZVE4
A	-4	LEU	-	expression tag	UNP Q5ZVE4
A	-3	TYR	-	expression tag	UNP Q5ZVE4
A	-2	PHE	-	expression tag	UNP Q5ZVE4
A	-1	GLN	-	expression tag	UNP Q5ZVE4
A	0	GLY	-	expression tag	UNP Q5ZVE4
B	-5	ASN	-	expression tag	UNP Q5ZVE4
B	-4	LEU	-	expression tag	UNP Q5ZVE4
B	-3	TYR	-	expression tag	UNP Q5ZVE4
B	-2	PHE	-	expression tag	UNP Q5ZVE4
B	-1	GLN	-	expression tag	UNP Q5ZVE4
B	0	GLY	-	expression tag	UNP Q5ZVE4

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	98	Total	O	0	0
			98	98		
2	B	100	Total	O	0	0
			100	100		



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	74.44Å 76.62Å 76.69Å 90.00° 96.66° 90.00°	Depositor
Resolution (Å)	32.36 – 2.28 32.36 – 2.28	Depositor EDS
% Data completeness (in resolution range)	90.9 (32.36-2.28) 98.1 (32.36-2.28)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.07 (at 2.29Å)	Xtriage
Refinement program	PHENIX	Depositor
R, R_{free}	0.180 , 0.226 0.184 , 0.230	Depositor DCC
R_{free} test set	1912 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å ²)	28.9	Xtriage
Anisotropy	0.019	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 54.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.021 for l,-k,h	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	6949	wwPDB-VP
Average B, all atoms (Å ²)	45.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.94% 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

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	0.27	0/3426	0.67	0/4628
1	B	0.28	0/3484	0.67	0/4705
All	All	0.27	0/6910	0.67	0/9333

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	3347	0	3267	17	0
1	B	3404	0	3299	19	0
2	A	98	0	0	0	0
2	B	100	0	0	1	0
All	All	6949	0	6566	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:433:LYS:HG2	1:A:438:GLY:HA2	1.65	0.78

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:126:ILE:HG22	1:B:128:THR:H	1.57	0.69
1:A:547:ILE:HG23	1:A:552:ASP:HB3	1.76	0.68
1:B:547:ILE:HG23	1:B:552:ASP:HB3	1.76	0.68
1:B:409:MSE:SE	1:B:500:MSE:HB2	2.50	0.61
1:A:24:GLU:O	1:A:28:ASN:ND2	2.32	0.60
1:B:468:ILE:HD11	1:B:478:LEU:HD12	1.86	0.58
1:A:40:LEU:HB3	1:A:82:LYS:HD2	1.89	0.53
1:A:460:VAL:HG11	1:A:478:LEU:HD21	1.95	0.49
1:A:553:ARG:HD2	1:A:555:MSE:HE3	1.95	0.49
1:A:14:PRO:HG3	1:A:70:ILE:HG13	1.95	0.48
1:A:328:PRO:HD3	1:A:348:MSE:SE	2.64	0.48
1:B:347:ASN:ND2	2:B:608:HOH:O	2.45	0.47
1:A:4:LYS:HE3	1:A:6:ILE:HD11	1.97	0.47
1:A:400:LYS:NZ	1:A:470:SER:O	2.31	0.47
1:B:524:ASP:O	1:B:528:ARG:HG3	2.15	0.46
1:B:14:PRO:HG3	1:B:70:ILE:HG13	1.97	0.46
1:A:409:MSE:SE	1:A:500:MSE:HB3	2.66	0.45
1:B:6:ILE:HB	1:B:17:LYS:HB3	1.98	0.45
1:A:381:ILE:HG12	1:A:539:LEU:HD21	2.00	0.44
1:B:13:LYS:HD2	1:B:58:ALA:HB3	2.00	0.44
1:B:26:LYS:NZ	1:B:49:GLY:O	2.51	0.44
1:B:90:LEU:HD13	1:B:102:ILE:HD13	2.00	0.44
1:B:326:LYS:HD3	1:B:352:TRP:CD2	2.54	0.43
1:A:34:LYS:HE2	1:A:46:LEU:HB3	2.00	0.43
1:A:418:ASN:OD1	1:A:420:MSE:HB2	2.19	0.42
1:B:26:LYS:NZ	1:B:51:GLY:O	2.52	0.42
1:A:531:GLY:HA3	1:B:324:LYS:HG2	2.02	0.42
1:B:552:ASP:OD1	1:B:553:ARG:N	2.53	0.42
1:A:516:LYS:O	1:A:520:LEU:HB2	2.20	0.41
1:B:96:LYS:H	1:B:99:HIS:HD2	1.68	0.41
1:A:90:LEU:HD21	1:A:109:ILE:HD13	2.02	0.41
1:B:2:VAL:HG11	1:B:5:ILE:HG23	2.03	0.41
1:B:328:PRO:O	1:B:333:LYS:HE3	2.21	0.40
1:B:518[B]:ASN:HA	1:B:522:MSE:HB2	2.03	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	425/604 (70%)	408 (96%)	17 (4%)	0	100	100
1	B	433/604 (72%)	414 (96%)	19 (4%)	0	100	100
All	All	858/1208 (71%)	822 (96%)	36 (4%)	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	357/514 (70%)	355 (99%)	2 (1%)	78	87
1	B	356/514 (69%)	353 (99%)	3 (1%)	73	84
All	All	713/1028 (69%)	708 (99%)	5 (1%)	76	86

All (5) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	419	ASP
1	A	420	MSE
1	B	106	HIS
1	B	348	MSE
1	B	419	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	315	ASN
1	B	347	ASN
1	B	403	GLN
1	B	406	GLN
1	B	458	ASN
1	B	581	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 oligosaccharides 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	420/604 (69%)	0.17	16 (3%)	44 46	15, 38, 94, 112	0
1	B	428/604 (70%)	0.29	33 (7%)	19 20	9, 37, 94, 126	2 (0%)
All	All	848/1208 (70%)	0.23	49 (5%)	29 30	9, 38, 94, 126	2 (0%)

All (49) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	128	THR	4.6
1	B	228	SER	3.9
1	B	130	THR	3.8
1	B	21	VAL	3.7
1	B	129	GLY	3.5
1	A	61	TYR	3.4
1	B	42	LEU	3.3
1	A	0	GLY	3.2
1	B	491	GLY	3.2
1	B	29	PHE	3.2
1	B	131	PRO	3.1
1	B	88	PHE	3.0
1	B	38	SER	2.9
1	A	134	VAL	2.9
1	B	105	ASP	2.8
1	A	62	PRO	2.8
1	B	-3	TYR	2.8
1	A	119	VAL	2.8
1	B	83	VAL	2.8
1	B	134	VAL	2.7
1	B	227	ILE	2.7
1	B	104	LYS	2.6
1	B	53	SER	2.6
1	B	39	GLU	2.6

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Mol	Chain	Res	Type	RSRZ
1	B	133	ILE	2.6
1	B	127	PRO	2.5
1	B	132	VAL	2.5
1	B	3	THR	2.5
1	A	584	SER	2.5
1	A	105	ASP	2.5
1	B	33	VAL	2.4
1	B	103	PHE	2.4
1	B	109	ILE	2.4
1	B	74	GLY	2.3
1	B	11	ASN	2.3
1	A	22	SER	2.3
1	A	48	GLN	2.3
1	A	12	GLY	2.2
1	A	27	SER	2.2
1	B	298	ASP	2.2
1	A	70	ILE	2.1
1	A	8	VAL	2.1
1	A	583	GLN	2.1
1	A	73	GLY	2.1
1	B	0	GLY	2.1
1	B	90	LEU	2.1
1	B	119	VAL	2.1
1	B	-2	PHE	2.0
1	A	11	ASN	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 oligosaccharides 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.