



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 14, 2026 – 11:22 AM UTC

PDB ID : 5F7L / pdb_00005f7l
Title : Blood group antigen binding adhesin BabA of Helicobacter pylori strain 17875
in complex with Nanobody Nb-ER14
Authors : Moonens, K.; Gideonsson, P.; Subedi, S.; Romao, E.; Oscarson, S.; Muylder-
mans, S.; Boren, T.; Remaut, H.
Deposited on : 2015-12-08
Resolution : 2.74 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 ⓘ 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

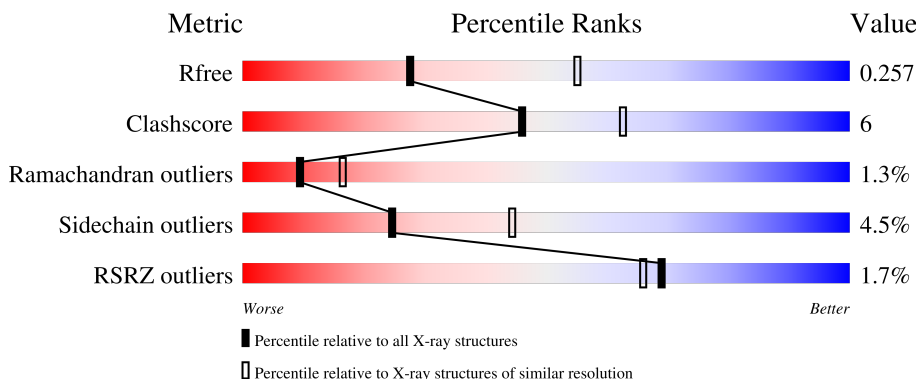
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.74 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	1819 (2.76-2.72)
Clashscore	190562	1866 (2.76-2.72)
Ramachandran outliers	187476	1830 (2.76-2.72)
Sidechain outliers	187428	1831 (2.76-2.72)
RSRZ outliers	180081	1819 (2.76-2.72)

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	466	5% 68% 11% 20%
1	C	466	69% 11% 20%
2	B	129	5% 77% 14% 6%
2	D	129	2% 77% 17%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard

residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	SO4	A	503	-	-	X	-

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 7573 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 Adhesin binding fucosylated histo-blood group antigen.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	375	Total	C	N	O	S	0	0	0
			2789	1714	482	580	13			
1	C	375	Total	C	N	O	S	0	0	0
			2794	1720	482	579	13			

There are 60 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	3	ALA	-	expression tag	UNP O52269
A	4	SER	-	expression tag	UNP O52269
A	5	TRP	-	expression tag	UNP O52269
A	6	SER	-	expression tag	UNP O52269
A	7	HIS	-	expression tag	UNP O52269
A	8	PRO	-	expression tag	UNP O52269
A	9	GLN	-	expression tag	UNP O52269
A	10	PHE	-	expression tag	UNP O52269
A	11	GLU	-	expression tag	UNP O52269
A	12	LYS	-	expression tag	UNP O52269
A	13	SER	-	expression tag	UNP O52269
A	14	GLY	-	expression tag	UNP O52269
A	15	GLY	-	expression tag	UNP O52269
A	16	GLY	-	expression tag	UNP O52269
A	17	GLY	-	expression tag	UNP O52269
A	18	GLY	-	expression tag	UNP O52269
A	19	LEU	-	expression tag	UNP O52269
A	20	VAL	-	expression tag	UNP O52269
A	21	PRO	-	expression tag	UNP O52269
A	22	ARG	-	expression tag	UNP O52269
A	23	GLY	-	expression tag	UNP O52269
A	24	SER	-	expression tag	UNP O52269
A	461	GLY	-	expression tag	UNP O52269
A	462	SER	-	expression tag	UNP O52269
A	463	HIS	-	expression tag	UNP O52269

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Chain	Residue	Modelled	Actual	Comment	Reference
A	464	HIS	-	expression tag	UNP O52269
A	465	HIS	-	expression tag	UNP O52269
A	466	HIS	-	expression tag	UNP O52269
A	467	HIS	-	expression tag	UNP O52269
A	468	HIS	-	expression tag	UNP O52269
C	3	ALA	-	expression tag	UNP O52269
C	4	SER	-	expression tag	UNP O52269
C	5	TRP	-	expression tag	UNP O52269
C	6	SER	-	expression tag	UNP O52269
C	7	HIS	-	expression tag	UNP O52269
C	8	PRO	-	expression tag	UNP O52269
C	9	GLN	-	expression tag	UNP O52269
C	10	PHE	-	expression tag	UNP O52269
C	11	GLU	-	expression tag	UNP O52269
C	12	LYS	-	expression tag	UNP O52269
C	13	SER	-	expression tag	UNP O52269
C	14	GLY	-	expression tag	UNP O52269
C	15	GLY	-	expression tag	UNP O52269
C	16	GLY	-	expression tag	UNP O52269
C	17	GLY	-	expression tag	UNP O52269
C	18	GLY	-	expression tag	UNP O52269
C	19	LEU	-	expression tag	UNP O52269
C	20	VAL	-	expression tag	UNP O52269
C	21	PRO	-	expression tag	UNP O52269
C	22	ARG	-	expression tag	UNP O52269
C	23	GLY	-	expression tag	UNP O52269
C	24	SER	-	expression tag	UNP O52269
C	461	GLY	-	expression tag	UNP O52269
C	462	SER	-	expression tag	UNP O52269
C	463	HIS	-	expression tag	UNP O52269
C	464	HIS	-	expression tag	UNP O52269
C	465	HIS	-	expression tag	UNP O52269
C	466	HIS	-	expression tag	UNP O52269
C	467	HIS	-	expression tag	UNP O52269
C	468	HIS	-	expression tag	UNP O52269

- Molecule 2 is a protein called Nanobody Nb-ER14.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	121	Total	C	N	O	S	0	0	0
			918	568	156	187	7			
2	D	124	Total	C	N	O	S	0	0	0
			944	583	163	191	7			

- Molecule 3 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		
3	C	1	Total	O	S	0	0
			5	4	1		
3	C	1	Total	O	S	0	0
			5	4	1		
3	C	1	Total	O	S	0	0
			5	4	1		
3	C	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	33	Total	O	0	0
			33	33		
4	B	11	Total	O	0	0
			11	11		
4	C	35	Total	O	0	0
			35	35		

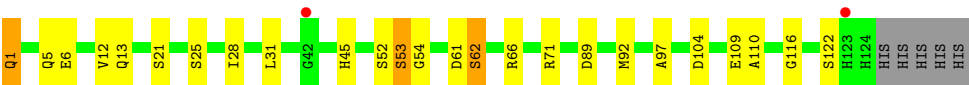
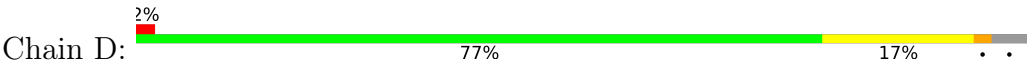
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	D	9	Total	O	0	0
			9	9		



● Molecule 2: Nanobody Nb-ER14



4 Data and refinement statistics

Property	Value	Source
Space group	P 2 ₁ 2 ₁ 2 ₁	Depositor
Cell constants a, b, c, α , β , γ	42.40Å 133.72Å 201.62Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.40 – 2.74 47.40 – 2.74	Depositor EDS
% Data completeness (in resolution range)	99.0 (47.40-2.74) 99.5 (47.40-2.74)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.80 (at 2.73Å)	Xtriage
Refinement program	REFMAC 5.8.0049	Depositor
R, R_{free}	0.212 , 0.265 (Not available) , 0.257	Depositor DCC
R_{free} test set	1647 reflections (5.25%)	wwPDB-VP
Wilson B-factor (Å ²)	43.1	Xtriage
Anisotropy	0.414	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 41.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	7573	wwPDB-VP
Average B, all atoms (Å ²)	44.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 48.34 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 8.7212e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: SO4

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	0.91	0/2826	1.06	4/3838 (0.1%)
1	C	0.92	0/2832	1.07	6/3846 (0.2%)
2	B	0.90	0/935	0.97	1/1267 (0.1%)
2	D	0.91	0/963	0.99	1/1305 (0.1%)
All	All	0.91	0/7556	1.04	12/10256 (0.1%)

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	A	0	1

There are no bond length outliers.

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	177	ASN	N-CA-CB	-6.50	101.60	110.95
2	B	43	LYS	N-CA-C	6.49	118.40	110.41
1	C	192	GLU	N-CA-C	-6.39	101.66	110.35
1	C	178	ASN	N-CA-CB	-6.39	101.28	110.80
1	C	171	LEU	CA-C-N	-5.84	114.73	120.98

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	176	GLU	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	2789	0	2718	30	1
1	C	2794	0	2722	28	0
2	B	918	0	874	15	0
2	D	944	0	893	16	0
3	A	15	0	0	2	0
3	C	25	0	0	0	0
4	A	33	0	0	1	0
4	B	11	0	0	0	0
4	C	35	0	0	3	1
4	D	9	0	0	0	0
All	All	7573	0	7207	85	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 6.

The worst 5 of 85 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:116:THR:HG22	3:A:503:SO4:O1	1.63	0.99
1:C:241:THR:CG2	1:C:243:VAL:HG12	1.99	0.92
2:D:1:GLN:N	2:D:1:GLN:OE1	2.06	0.89
1:A:381:THR:O	1:A:382:GLY:O	1.92	0.87
2:B:1:GLN:OE1	2:B:1:GLN:N	2.07	0.86

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:383:THR:CG2	4:C:601:HOH:O[3_544]	2.11	0.09

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	369/466 (79%)	343 (93%)	21 (6%)	5 (1%)	9	15
1	C	369/466 (79%)	347 (94%)	19 (5%)	3 (1%)	16	29
2	B	119/129 (92%)	113 (95%)	4 (3%)	2 (2%)	7	12
2	D	122/129 (95%)	116 (95%)	3 (2%)	3 (2%)	4	7
All	All	979/1190 (82%)	919 (94%)	47 (5%)	13 (1%)	9	16

5 of 13 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	242	ARG
1	A	382	GLY
2	B	53	SER
2	D	53	SER
2	B	62	SER

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	308/381 (81%)	291 (94%)	17 (6%)	19	35
1	C	308/381 (81%)	296 (96%)	12 (4%)	28	50
2	B	98/106 (92%)	94 (96%)	4 (4%)	27	48
2	D	101/106 (95%)	97 (96%)	4 (4%)	28	49
All	All	815/974 (84%)	778 (96%)	37 (4%)	24	44

5 of 37 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	260	GLN
2	D	13	GLN
1	C	268	THR
1	C	323	SER
1	A	298	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 29 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	123	ASN
2	D	45	HIS
1	C	196	ASN
1	C	379	ASN
1	C	157	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](#)

8 ligands are 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
3	SO4	C	503	-	4,4,4	0.40	0	6,6,6	0.35	0
3	SO4	A	501	-	4,4,4	0.50	0	6,6,6	0.62	0
3	SO4	C	504	-	4,4,4	0.55	0	6,6,6	0.26	0
3	SO4	C	505	-	4,4,4	0.50	0	6,6,6	0.50	0
3	SO4	A	503	-	4,4,4	0.54	0	6,6,6	0.45	0
3	SO4	C	501	-	4,4,4	0.41	0	6,6,6	0.37	0
3	SO4	A	502	-	4,4,4	0.51	0	6,6,6	0.27	0
3	SO4	C	502	-	4,4,4	0.62	0	6,6,6	0.53	0

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.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	503	SO4	2	0

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	375/466 (80%)	0.06	5 (1%) 75 74	22, 40, 70, 83	0
1	C	375/466 (80%)	0.05	4 (1%) 78 77	24, 41, 69, 98	0
2	B	121/129 (93%)	0.24	6 (4%) 34 34	29, 43, 69, 75	0
2	D	124/129 (96%)	0.32	2 (1%) 70 68	28, 45, 72, 89	0
All	All	995/1190 (83%)	0.11	17 (1%) 69 66	22, 41, 70, 98	0

The worst 5 of 17 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	460	PHE	4.0
1	C	58	ALA	3.5
2	B	104	ASP	2.9
1	A	205	SER	2.7
2	D	42	GLY	2.7

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](#)

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($\text{\AA}^2$)	Q<0.9
3	SO4	C	502	5/5	0.77	0.16	73,76,93,94	0
3	SO4	C	505	5/5	0.78	0.17	90,92,99,100	0
3	SO4	C	503	5/5	0.84	0.17	82,85,89,95	0
3	SO4	A	502	5/5	0.85	0.14	77,80,82,84	0
3	SO4	C	504	5/5	0.90	0.17	67,70,77,78	0
3	SO4	A	503	5/5	0.90	0.11	56,57,62,65	0
3	SO4	A	501	5/5	0.91	0.13	68,70,78,82	0
3	SO4	C	501	5/5	0.96	0.09	44,48,54,54	0

6.5 Other polymers [i](#)

There are no such residues in this entry.