



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 03:10 PM UTC

PDB ID : 3HLR / pdb_00003hhr
Title : Donor strand complemented FaeG of F4ad fimbriae
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Deposited on : 2009-05-28
Resolution : 2.30 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
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

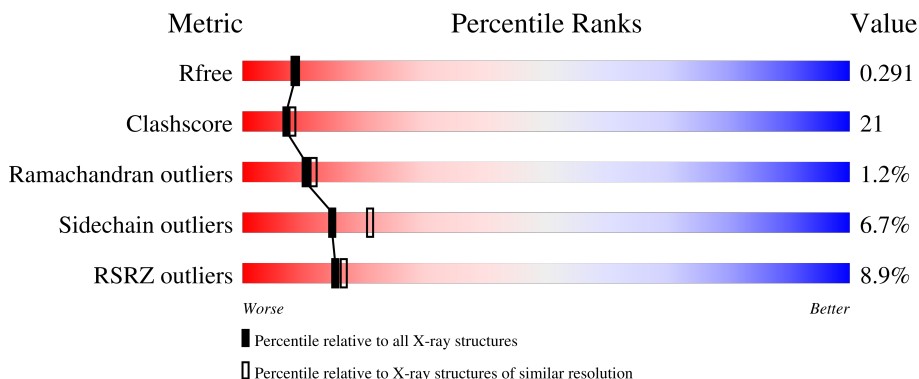
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	276	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2077 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 K88 fimbrial protein AD.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	258	Total	C	N	O	S	0	0	0
			1883	1186	318	375	4			

There are 13 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	MET	-	expression tag	UNP P14191
A	1	GLY	-	expression tag	UNP P14191
A	18	SER	ASN	SEE REMARK 999	UNP P14191
A	245	GLY	-	linker	UNP P14191
A	246	GLY	-	linker	UNP P14191
A	247	GLY	-	linker	UNP P14191
A	248	GLY	-	linker	UNP P14191
A	249	GLY	-	linker	UNP P14191
A	250	GLY	-	linker	UNP P14191
A	251	GLY	-	linker	UNP P14191
A	252	GLY	-	linker	UNP P14191
A	253	GLY	-	linker	UNP P14191
A	254	GLY	-	linker	UNP P14191

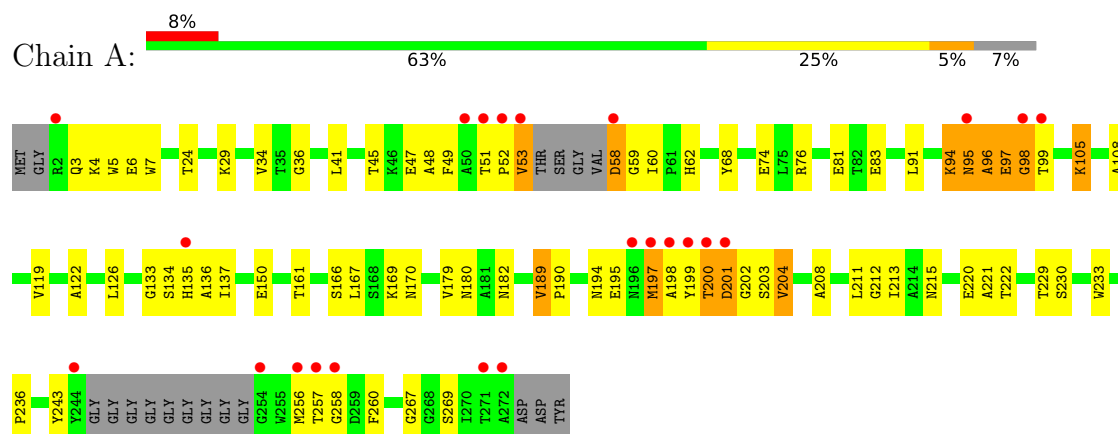
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	194	Total	O	0	0
			194	194		

3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide 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: K88 fimbrial protein AD



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	37.29Å 39.73Å 76.37Å 90.00° 101.24° 90.00°	Depositor
Resolution (Å)	29.16 – 2.30 29.16 – 2.30	Depositor EDS
% Data completeness (in resolution range)	95.9 (29.16-2.30) 95.8 (29.16-2.30)	Depositor EDS
R_{merge}	0.16	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.31 (at 2.00Å)	Xtriage
Refinement program	PHENIX (phenix.refine)	Depositor
R, R_{free}	0.235 , 0.294 0.230 , 0.291	Depositor DCC
R_{free} test set	718 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	19.9	Xtriage
Anisotropy	0.297	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 37.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.057 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	2077	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.99% 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	0.34	0/1916	0.77	2/2602 (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.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	A	189	VAL	CA-C-N	5.04	125.05	120.21
1	A	189	VAL	C-N-CA	5.04	125.05	120.21

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	94	LYS	Peptide

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	1883	0	1832	77	0
2	A	194	0	0	11	0
All	All	2077	0	1832	77	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 21.

All (77) 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:258:GLY:HA2	1:A:260:PHE:H	1.12	1.09
1:A:36:GLY:H	1:A:215:ASN:HD22	1.03	0.98
1:A:258:GLY:HA2	1:A:260:PHE:N	1.81	0.95
1:A:256:MET:O	1:A:257:THR:HG22	1.67	0.93
1:A:201:ASP:CG	1:A:202:GLY:HA2	1.96	0.91
1:A:211:LEU:HB3	2:A:429:HOH:O	1.78	0.83
1:A:6:GLU:HA	1:A:257:THR:HB	1.65	0.78
1:A:97:GLU:O	1:A:99:THR:N	2.18	0.77
1:A:94:LYS:HD2	1:A:98:GLY:HA2	1.70	0.74
1:A:74:GLU:OE1	1:A:76:ARG:HD2	1.88	0.73
1:A:51:THR:CB	1:A:199:TYR:H	2.03	0.71
1:A:83:GLU:HA	1:A:150:GLU:O	1.92	0.69
1:A:3:GLN:CG	1:A:257:THR:HG21	2.28	0.63
1:A:36:GLY:N	1:A:215:ASN:HD22	1.87	0.63
1:A:41:LEU:HB3	2:A:429:HOH:O	1.98	0.63
1:A:36:GLY:H	1:A:215:ASN:ND2	1.87	0.61
1:A:3:GLN:HG3	1:A:257:THR:HG21	1.82	0.61
1:A:74:GLU:CD	1:A:76:ARG:HH11	2.07	0.61
1:A:48:ALA:HB1	1:A:204:VAL:HG13	1.83	0.60
1:A:201:ASP:CB	1:A:202:GLY:HA2	2.28	0.60
1:A:236:PRO:HG2	2:A:447:HOH:O	2.02	0.60
1:A:94:LYS:O	1:A:95:ASN:HB2	2.02	0.60
1:A:256:MET:HB3	1:A:260:PHE:HD1	1.67	0.60
1:A:94:LYS:HD2	1:A:98:GLY:CA	2.31	0.58
1:A:136:ALA:HB2	1:A:194:ASN:HD21	1.69	0.57
1:A:62:HIS:HE1	1:A:134:SER:HB2	1.70	0.56
1:A:199:TYR:HB3	1:A:203:SER:HB2	1.87	0.56
1:A:256:MET:HE2	1:A:257:THR:O	2.05	0.56
1:A:3:GLN:O	1:A:4:LYS:HB2	2.06	0.55
1:A:6:GLU:HA	1:A:257:THR:CB	2.37	0.54
1:A:200:THR:HA	1:A:201:ASP:OD1	2.07	0.54
1:A:256:MET:HB3	1:A:260:PHE:CD1	2.43	0.54

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:243:TYR:CE2	1:A:258:GLY:HA3	2.44	0.53
1:A:269:SER:HB3	2:A:377:HOH:O	2.08	0.53
1:A:179:VAL:HG11	1:A:204:VAL:HG21	1.90	0.52
1:A:68:TYR:HB2	2:A:404:HOH:O	2.09	0.52
1:A:52:PRO:O	1:A:53:VAL:HG13	2.09	0.52
1:A:48:ALA:HB1	1:A:204:VAL:CG1	2.40	0.51
1:A:256:MET:HE1	2:A:322:HOH:O	2.10	0.51
1:A:195:GLU:HG3	1:A:197:MET:H	1.74	0.51
1:A:126:LEU:HD22	1:A:169:LYS:HG3	1.93	0.50
1:A:170:ASN:HB3	2:A:384:HOH:O	2.10	0.50
1:A:52:PRO:HG3	1:A:198:ALA:CB	2.41	0.50
1:A:133:GLY:HA3	1:A:135:HIS:CE1	2.47	0.50
1:A:5:TRP:C	1:A:257:THR:OG1	2.56	0.49
1:A:7:TRP:HD1	1:A:257:THR:HA	1.77	0.49
1:A:119:VAL:HB	2:A:424:HOH:O	2.12	0.49
1:A:243:TYR:HE2	1:A:258:GLY:HA3	1.77	0.49
1:A:41:LEU:N	2:A:429:HOH:O	2.45	0.49
1:A:81:GLU:HA	1:A:81:GLU:OE1	2.12	0.48
1:A:95:ASN:O	1:A:96:ALA:HB3	2.12	0.48
1:A:51:THR:HA	1:A:52:PRO:HA	1.68	0.47
1:A:51:THR:C	1:A:198:ALA:HA	2.40	0.47
1:A:5:TRP:C	1:A:257:THR:HG1	2.21	0.47
1:A:179:VAL:HG12	1:A:180:ASN:ND2	2.30	0.47
1:A:122:ALA:HA	1:A:182:ASN:O	2.15	0.46
1:A:34:VAL:HG21	1:A:213:ILE:HG21	1.97	0.46
1:A:220:GLU:O	1:A:220:GLU:HG3	2.15	0.45
1:A:189:VAL:HA	1:A:190:PRO:HD3	1.79	0.45
1:A:60:ILE:HG23	1:A:137:ILE:HG22	1.98	0.44
1:A:45:THR:HG22	1:A:49:PHE:HE2	1.82	0.44
1:A:233:TRP:CZ3	1:A:267:GLY:HA2	2.53	0.43
1:A:200:THR:HA	1:A:201:ASP:CB	2.47	0.43
1:A:5:TRP:O	1:A:257:THR:OG1	2.37	0.43
1:A:161:THR:HB	1:A:166:SER:HB3	2.00	0.43
1:A:167:LEU:HB2	1:A:208:ALA:HB2	2.00	0.42
1:A:24:THR:OG1	1:A:29:LYS:HB3	2.19	0.42
1:A:211:LEU:CB	2:A:429:HOH:O	2.51	0.42
1:A:29:LYS:HD2	1:A:221:ALA:O	2.20	0.41
1:A:52:PRO:HG3	1:A:198:ALA:HB2	2.01	0.41
1:A:233:TRP:CH2	1:A:267:GLY:HA2	2.55	0.41
1:A:108:ALA:HB1	1:A:212:GLY:O	2.19	0.41
1:A:256:MET:O	1:A:257:THR:CG2	2.54	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:135:HIS:HD2	2:A:398:HOH:O	2.03	0.41
1:A:105:LYS:HZ3	1:A:220:GLU:CD	2.29	0.40
1:A:94:LYS:O	1:A:95:ASN:CB	2.68	0.40
1:A:58:ASP:HB3	1:A:59:GLY:H	1.58	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	252/276 (91%)	237 (94%)	12 (5%)	3 (1%)	10	12

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	95	ASN
1	A	98	GLY
1	A	96	ALA

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	193/204 (95%)	180 (93%)	13 (7%)	15	21

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

Mol	Chain	Res	Type
1	A	47	GLU
1	A	53	VAL
1	A	58	ASP
1	A	91	LEU
1	A	97	GLU
1	A	105	LYS
1	A	197	MET
1	A	200	THR
1	A	201	ASP
1	A	204	VAL
1	A	222	THR
1	A	229	THR
1	A	230	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	25	ASN
1	A	148	ASN
1	A	180	ASN
1	A	215	ASN
1	A	238	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](#)

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	258/276 (93%)	0.75	23 (8%) 15 17	12, 22, 41, 58	0

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	257	THR	7.0
1	A	256	MET	6.2
1	A	258	GLY	4.7
1	A	95	ASN	4.5
1	A	53	VAL	4.0
1	A	199	TYR	3.7
1	A	200	THR	3.5
1	A	271	THR	3.1
1	A	196	ASN	3.1
1	A	197	MET	2.9
1	A	50	ALA	2.9
1	A	51	THR	2.8
1	A	58	ASP	2.6
1	A	52	PRO	2.6
1	A	198	ALA	2.3
1	A	98	GLY	2.2
1	A	254	GLY	2.2
1	A	99	THR	2.2
1	A	272	ALA	2.1
1	A	201	ASP	2.1
1	A	135	HIS	2.1
1	A	244	TYR	2.0
1	A	2	ARG	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.