



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 11:32 AM UTC

PDB ID : 8TV8 / pdb_00008tv8
Title : Crystal structure of nontypeable Haemophilus influenzae SapA
Authors : Tanaka, K.J.; Buechel, E.R.; Rivera, K.G.; Pinkett, H.W.
Deposited on : 2023-08-17
Resolution : 2.25 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

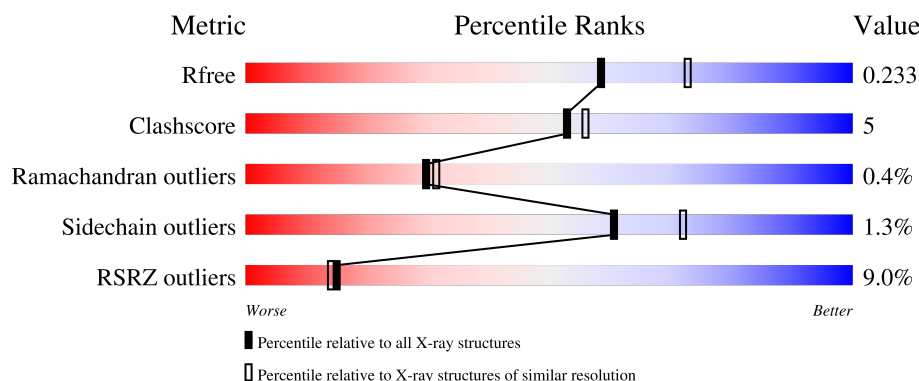
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.25 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	1898 (2.26-2.26)
Clashscore	190562	2005 (2.26-2.26)
Ramachandran outliers	187476	1965 (2.26-2.26)
Sidechain outliers	187428	1966 (2.26-2.26)
RSRZ outliers	180081	1898 (2.26-2.26)

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	564	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4266 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 ABC-type transport system, periplasmic component, involved in antimicrobial peptide resistance.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	513	Total	C	N	O	S	0	0	0
			4152	2656	711	771	14			

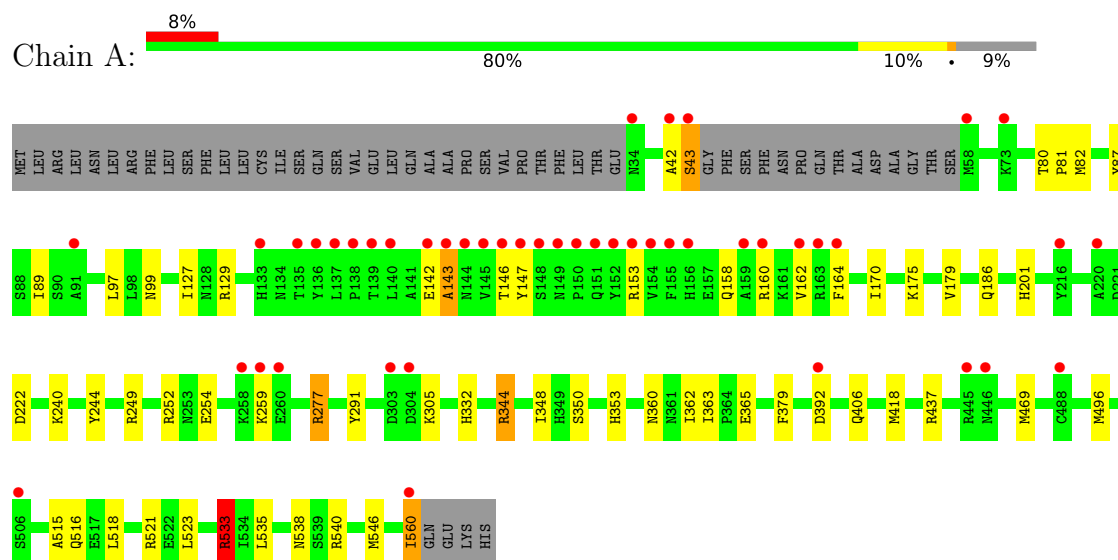
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	114	Total	O	0	0
			114	114		

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: ABC-type transport system, periplasmic component, involved in antimicrobial peptide resistance



4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	119.75Å 119.75Å 129.59Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.01 – 2.25 44.01 – 2.25	Depositor EDS
% Data completeness (in resolution range)	99.9 (44.01-2.25) 99.9 (44.01-2.25)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.19 (at 2.24Å)	Xtriage
Refinement program	REFMAC 5.8.0352	Depositor
R, R_{free}	0.197 , 0.225 0.205 , 0.233	Depositor DCC
R_{free} test set	2322 reflections (5.13%)	wwPDB-VP
Wilson B-factor (Å ²)	52.0	Xtriage
Anisotropy	0.036	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 44.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	4266	wwPDB-VP
Average B, all atoms (Å ²)	57.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.45% 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	0.68	1/4252 (0.0%)	1.11	9/5777 (0.2%)

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	5

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	533	ARG	CD-NE	-5.86	1.38	1.46

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	353	HIS	CB-CA-C	-7.67	101.00	111.89
1	A	291	TYR	O-C-N	-7.00	118.31	121.53
1	A	533	ARG	CB-CG-CD	-6.96	95.30	111.30
1	A	277	ARG	CB-CG-CD	-5.64	98.33	111.30
1	A	277	ARG	NE-CZ-NH2	-5.41	114.33	119.20
1	A	365	GLU	CB-CG-CD	5.34	121.67	112.60
1	A	392	ASP	CB-CA-C	-5.25	100.28	110.46
1	A	533	ARG	NE-CZ-NH2	-5.16	114.55	119.20
1	A	244	TYR	CB-CA-C	5.14	117.55	109.84

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	129	ARG	Sidechain
1	A	277	ARG	Sidechain
1	A	344	ARG	Sidechain
1	A	437	ARG	Sidechain
1	A	533	ARG	Sidechain

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	4152	0	4097	40	0
2	A	114	0	0	1	0
All	All	4266	0	4097	40	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 5.

All (40) 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:99:ASN:HD21	1:A:186:GLN:HE21	1.22	0.86
1:A:540:ARG:NH1	1:A:560:ILE:O	2.09	0.85
1:A:344:ARG:HH22	1:A:360:ASN:HD21	1.25	0.84
1:A:80:THR:HG22	1:A:82:MET:HE3	1.68	0.75
1:A:81:PRO:O	1:A:82:MET:HE2	1.87	0.73
1:A:99:ASN:ND2	1:A:186:GLN:HE21	1.89	0.70
1:A:344:ARG:HH22	1:A:360:ASN:ND2	1.89	0.70
1:A:170:ILE:O	1:A:175:LYS:HE3	1.97	0.64
1:A:496:MET:HE3	1:A:515:ALA:HB1	1.80	0.63
1:A:362:ILE:HB	1:A:469:MET:HE3	1.85	0.58
1:A:160:ARG:O	1:A:164:PHE:N	2.33	0.57
1:A:362:ILE:H	1:A:516:GLN:NE2	2.02	0.57
1:A:362:ILE:HB	1:A:469:MET:CE	2.35	0.56
1:A:240:LYS:HD2	1:A:249:ARG:HH11	1.71	0.56
1:A:170:ILE:HD12	1:A:201:HIS:CE1	2.41	0.56
1:A:496:MET:CE	1:A:515:ALA:CB	2.84	0.55
1:A:350:SER:HB2	1:A:418:MET:HE1	1.90	0.54

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:332:HIS:HE1	1:A:521:ARG:O	1.93	0.52
1:A:362:ILE:H	1:A:516:GLN:HE21	1.57	0.52
1:A:42:ALA:O	1:A:43:SER:C	2.53	0.52
1:A:127:ILE:CG2	1:A:179:VAL:HG21	2.40	0.51
1:A:305:LYS:NZ	1:A:538:ASN:HD21	2.08	0.51
1:A:147:TYR:CD2	1:A:153:ARG:HD2	2.47	0.49
1:A:252:ARG:HD2	1:A:254:GLU:OE2	2.13	0.49
1:A:175:LYS:NZ	2:A:608:HOH:O	2.46	0.49
1:A:535:LEU:HD23	1:A:546:MET:HE2	1.94	0.49
1:A:127:ILE:HG21	1:A:179:VAL:HG21	1.94	0.48
1:A:535:LEU:C	1:A:535:LEU:HD12	2.38	0.48
1:A:518:LEU:C	1:A:518:LEU:HD23	2.39	0.48
1:A:81:PRO:O	1:A:82:MET:CE	2.59	0.47
1:A:363:ILE:H	1:A:516:GLN:NE2	2.12	0.47
1:A:158:GLN:O	1:A:162:VAL:HG23	2.15	0.46
1:A:80:THR:CG2	1:A:82:MET:HE3	2.44	0.46
1:A:496:MET:HE2	1:A:515:ALA:CB	2.45	0.46
1:A:533:ARG:HA	1:A:533:ARG:HD3	1.71	0.45
1:A:142:GLU:O	1:A:143:ALA:CB	2.65	0.43
1:A:379:PHE:CD2	1:A:523:LEU:HD11	2.54	0.43
1:A:363:ILE:H	1:A:516:GLN:HE22	1.67	0.43
1:A:406:GLN:NE2	1:A:406:GLN:HA	2.36	0.40
1:A:87:TYR:HA	1:A:97:LEU:O	2.21	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	509/564 (90%)	492 (97%)	15 (3%)	2 (0%)	30	31

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	143	ALA
1	A	222	ASP

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	457/502 (91%)	451 (99%)	6 (1%)	61 72

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	43	SER
1	A	89	ILE
1	A	146	THR
1	A	259	LYS
1	A	348	ILE
1	A	560	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (19) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	99	ASN
1	A	156	HIS
1	A	186	GLN
1	A	201	HIS
1	A	212	GLN
1	A	226	GLN
1	A	238	GLN
1	A	255	ASN
1	A	296	GLN
1	A	310	GLN
1	A	332	HIS
1	A	360	ASN
1	A	406	GLN
1	A	425	GLN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	447	GLN
1	A	450	ASN
1	A	504	HIS
1	A	516	GLN
1	A	538	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	513/564 (90%)	0.53	46 (8%) 15 14	35, 53, 95, 148	0

All (46) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	164	PHE	6.7
1	A	136	TYR	6.4
1	A	143	ALA	5.9
1	A	145	VAL	5.6
1	A	144	ASN	5.1
1	A	155	PHE	4.8
1	A	150	PRO	4.7
1	A	43	SER	4.3
1	A	220	ALA	3.9
1	A	146	THR	3.8
1	A	216	TYR	3.6
1	A	147	TYR	3.4
1	A	152	TYR	3.4
1	A	154	VAL	3.3
1	A	140	LEU	3.3
1	A	138	PRO	3.2
1	A	258	LYS	3.2
1	A	151	GLN	3.1
1	A	149	ASN	3.1
1	A	137	LEU	3.1
1	A	163	ARG	3.1
1	A	260	GLU	3.0
1	A	160	ARG	2.9
1	A	148	SER	2.9
1	A	303	ASP	2.8
1	A	42	ALA	2.6
1	A	162	VAL	2.6

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	133	HIS	2.6
1	A	58	MET	2.5
1	A	73	LYS	2.5
1	A	560	ILE	2.5
1	A	34	ASN	2.4
1	A	153	ARG	2.4
1	A	506	SER	2.4
1	A	135	THR	2.4
1	A	159	ALA	2.3
1	A	142	GLU	2.3
1	A	91	ALA	2.2
1	A	156	HIS	2.2
1	A	446	ASN	2.2
1	A	259	LYS	2.0
1	A	139	THR	2.0
1	A	488	CYS	2.0
1	A	445	ARG	2.0
1	A	304	ASP	2.0
1	A	392	ASP	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.