



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 05:29 PM UTC

PDB ID : 7AHL / pdb_00007ahl
Title : ALPHA-HEMOLYSIN FROM STAPHYLOCOCCUS AUREUS
Authors : Song, L.; Hobaugh, M.; Shustak, C.; Cheley, S.; Bayley, H.; Gouaux, J.E.
Deposited on : 1996-12-02
Resolution : 1.89 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
Xtriage (Phenix) : **NOT EXECUTED**
EDS : **NOT EXECUTED**
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.49

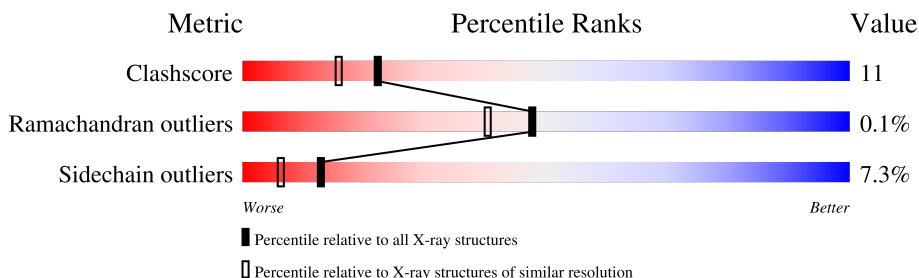
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.89 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))
Clashscore	190562	8410 (1.90-1.90)
Ramachandran outliers	187476	8333 (1.90-1.90)
Sidechain outliers	187428	8333 (1.90-1.90)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	293	72% 23% 5%
1	B	293	68% 28% .
1	C	293	77% 20% .
1	D	293	69% 27% .
1	E	293	74% 22% .
1	F	293	70% 28% .
1	G	293	74% 23% .

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 22778 atoms, of which 5571 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 ALPHA-HEMOLYSIN.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	293	Total	C	H	N	O	S	0	0	0
			2891	1466	556	397	465	7			
1	B	293	Total	C	H	N	O	S	0	0	0
			2909	1472	564	401	465	7			
1	C	293	Total	C	H	N	O	S	0	0	0
			2909	1472	564	401	465	7			
1	D	293	Total	C	H	N	O	S	0	0	0
			2896	1466	559	399	465	7			
1	E	293	Total	C	H	N	O	S	0	0	0
			2911	1472	566	401	465	7			
1	F	293	Total	C	H	N	O	S	0	0	0
			2904	1469	563	400	465	7			
1	G	293	Total	C	H	N	O	S	0	0	0
			2904	1469	563	400	465	7			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	118	Total	H	O	0	0
			354	236	118		
2	B	128	Total	H	O	0	0
			384	256	128		
2	C	119	Total	H	O	0	0
			357	238	119		
2	D	122	Total	H	O	0	0
			366	244	122		
2	E	126	Total	H	O	0	0
			378	252	126		
2	F	92	Total	H	O	0	0
			276	184	92		
2	G	113	Total	H	O	0	0
			339	226	113		

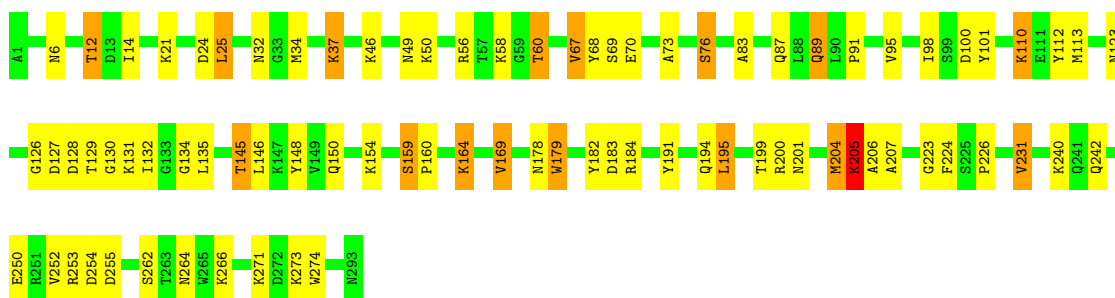
3 Residue-property plots

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. 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. 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.

Note EDS was not executed.

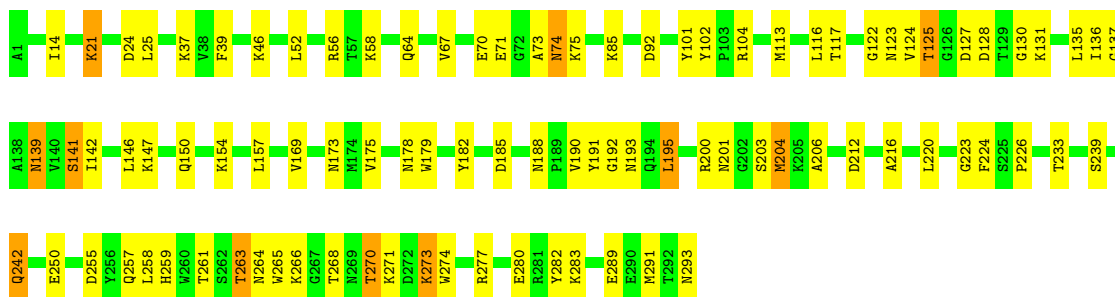
• Molecule 1: ALPHA-HEMOLYSIN

Chain A: 



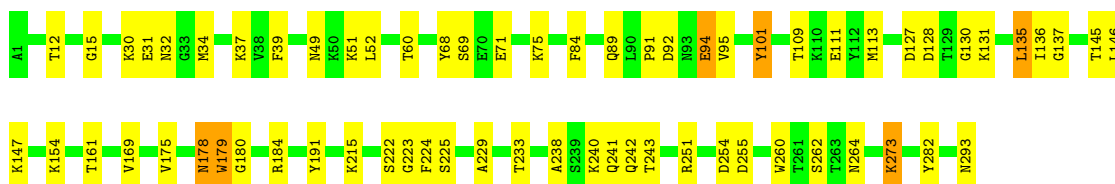
• Molecule 1: ALPHA-HEMOLYSIN

Chain B: 



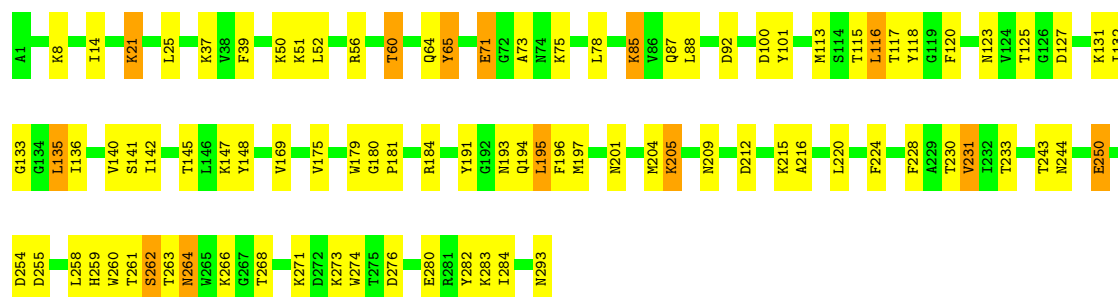
• Molecule 1: ALPHA-HEMOLYSIN

Chain C: 



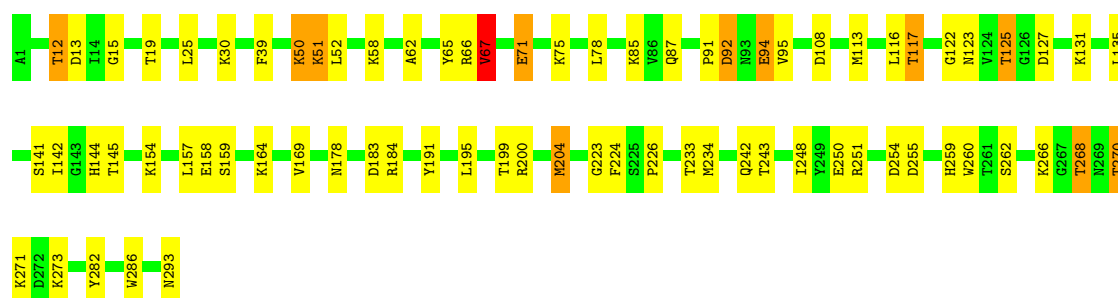
• Molecule 1: ALPHA-HEMOLYSIN

Chain D:  69% 27% .



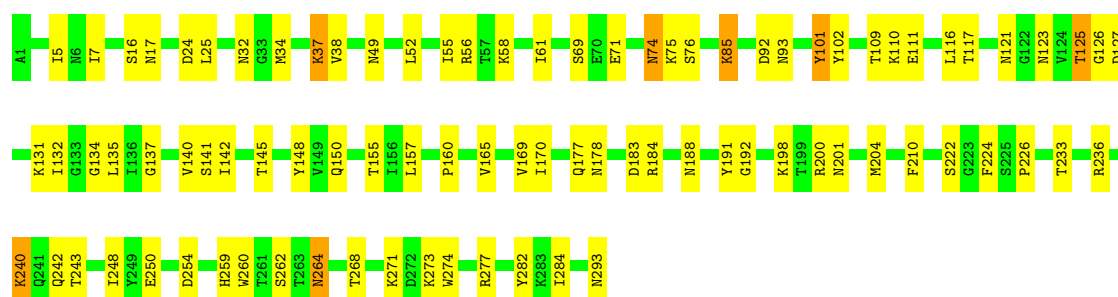
• Molecule 1: ALPHA-HEMOLYSIN

Chain E:  74% 22% .



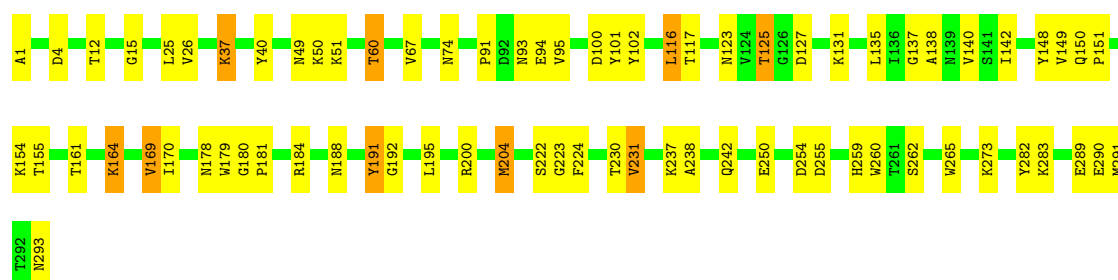
• Molecule 1: ALPHA-HEMOLYSIN

Chain F:  70% 28% .



• Molecule 1: ALPHA-HEMOLYSIN

Chain G:  74% 23% .



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	151.92Å 136.76Å 135.12Å 90.00° 91.40° 90.00°	Depositor
Resolution (Å)	8.00 – 1.89	Depositor
% Data completeness (in resolution range)	93.3 (8.00-1.89)	Depositor
R_{merge}	0.08	Depositor
R_{sym}	0.08	Depositor
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.199 , 0.257	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	22778	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

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	0.62	1/2387 (0.0%)	1.00	8/3232 (0.2%)
1	B	0.61	0/2397	0.95	8/3243 (0.2%)
1	C	0.62	0/2397	0.97	5/3243 (0.2%)
1	D	0.60	0/2389	0.98	7/3235 (0.2%)
1	E	0.64	1/2397 (0.0%)	0.97	7/3243 (0.2%)
1	F	0.57	0/2393	0.97	8/3239 (0.2%)
1	G	0.61	0/2393	1.00	8/3239 (0.2%)
All	All	0.61	2/16753 (0.0%)	0.98	51/22674 (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	B	0	1
1	F	0	1
1	G	0	1
All	All	0	3

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	67	VAL	CA-CB	5.97	1.60	1.53
1	E	67	VAL	CA-CB	5.46	1.59	1.53

The worst 5 of 51 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	E	92	ASP	N-CA-C	7.15	121.11	112.38
1	B	271	LYS	N-CA-C	6.99	120.36	110.50
1	G	161	THR	N-CA-C	-6.56	99.86	109.18
1	A	205	LYS	N-CA-C	-6.40	101.00	110.48

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Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	G	191	TYR	N-CA-C	6.37	121.19	113.17

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	102	TYR	Sidechain
1	F	102	TYR	Sidechain
1	G	102	TYR	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	2335	556	2248	63	0
1	B	2345	564	2270	65	0
1	C	2345	564	2270	51	0
1	D	2337	559	2248	70	0
1	E	2345	566	2270	58	0
1	F	2341	563	2259	62	0
1	G	2341	563	2259	50	0
2	A	118	236	0	5	1
2	B	128	256	0	4	0
2	C	119	238	0	5	0
2	D	122	244	0	4	0
2	E	126	252	0	6	0
2	F	92	184	0	2	0
2	G	113	226	0	7	0
All	All	17207	5571	15824	341	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 11.

The worst 5 of 341 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:113:MET:HG3	1:A:145:THR:HG23	1.50	0.92
1:F:260:TRP:NE1	1:F:262:SER:HA	1.92	0.84
1:E:282:TYR:CD2	1:E:293:ASN:HB3	2.14	0.82
1:B:125:THR:HG23	1:C:135:LEU:HD22	1.61	0.82
1:E:260:TRP:NE1	1:E:262:SER:HA	1.96	0.81

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)
2:A:338:HOH:H1	2:A:338:HOH:H1[2_656]	1.34	0.26

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	291/293 (99%)	272 (94%)	19 (6%)	0	100	100
1	B	291/293 (99%)	274 (94%)	16 (6%)	1 (0%)	36	29
1	C	291/293 (99%)	273 (94%)	18 (6%)	0	100	100
1	D	291/293 (99%)	272 (94%)	17 (6%)	2 (1%)	18	10
1	E	291/293 (99%)	273 (94%)	18 (6%)	0	100	100
1	F	291/293 (99%)	271 (93%)	20 (7%)	0	100	100
1	G	291/293 (99%)	274 (94%)	17 (6%)	0	100	100
All	All	2037/2051 (99%)	1909 (94%)	125 (6%)	3 (0%)	48	40

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	262	SER
1	B	73	ALA

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Mol	Chain	Res	Type
1	D	92	ASP

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	257/259 (99%)	235 (91%)	22 (9%)	10	4
1	B	259/259 (100%)	239 (92%)	20 (8%)	12	5
1	C	259/259 (100%)	241 (93%)	18 (7%)	14	7
1	D	257/259 (99%)	239 (93%)	18 (7%)	14	7
1	E	259/259 (100%)	241 (93%)	18 (7%)	14	7
1	F	258/259 (100%)	241 (93%)	17 (7%)	15	8
1	G	258/259 (100%)	239 (93%)	19 (7%)	13	6
All	All	1807/1813 (100%)	1675 (93%)	132 (7%)	13	6

5 of 132 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	G	37	LYS
1	G	116	LEU
1	G	242	GLN
1	C	89	GLN
1	C	75	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 59 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	259	HIS
1	G	178	ASN
1	E	17	ASN
1	G	177	GLN
1	F	242	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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates [i](#)

EDS was not executed - this section is therefore empty.

6.4 Ligands [i](#)

EDS was not executed - this section is therefore empty.

6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.