



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 07:24 PM UTC

PDB ID : 6LNW / pdb_00006lnw
Title : Crystal structure of accessory secretory protein 1,2 and 3 in *Streptococcus pneumoniae*
Authors : Guo, C.; Feng, Z.; Zuo, G.
Deposited on : 2020-01-02
Resolution : 2.90 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

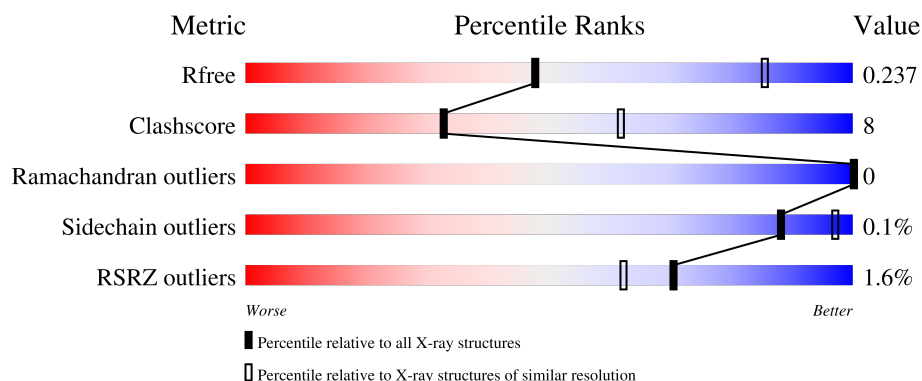
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

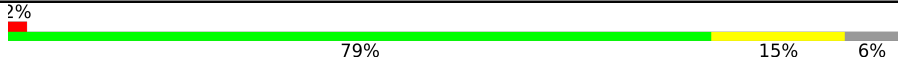
The reported resolution of this entry is 2.90 Å.

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	2481 (2.90-2.90)
Clashscore	190562	2690 (2.90-2.90)
Ramachandran outliers	187476	2623 (2.90-2.90)
Sidechain outliers	187428	2625 (2.90-2.90)
RSRZ outliers	180081	2481 (2.90-2.90)

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 $\leq 5\%$. 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	526	
2	B	511	
3	C	154	

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6497 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 Accessory secretory protein Asp1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	495	Total	C	N	O	S	0	0	0
			4155	2682	688	774	11			

- Molecule 2 is a protein called Accessory secretory protein Asp2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	129	Total	C	N	O	S	0	0	0
			1059	685	171	199	4			

- Molecule 3 is a protein called Accessory secretory protein Asp3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	143	Total	C	N	O	S	0	0	0
			1193	780	191	220	2			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	147	LEU	-	expression tag	UNP A0A0H2URJ0
C	148	GLU	-	expression tag	UNP A0A0H2URJ0
C	149	HIS	-	expression tag	UNP A0A0H2URJ0
C	150	HIS	-	expression tag	UNP A0A0H2URJ0
C	151	HIS	-	expression tag	UNP A0A0H2URJ0
C	152	HIS	-	expression tag	UNP A0A0H2URJ0
C	153	HIS	-	expression tag	UNP A0A0H2URJ0
C	154	HIS	-	expression tag	UNP A0A0H2URJ0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	56	Total	O	0	0
			56	56		

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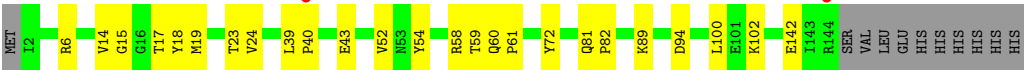
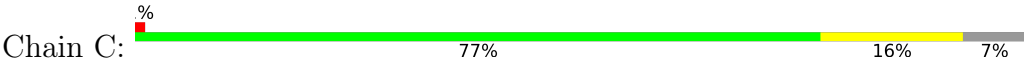
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	14	Total	O	0	0
			14	14		
4	C	20	Total	O	0	0
			20	20		

THR
THR
PHE
GLY
LEU
SER
TYR
MET
LYS
ASP
GLU
GLU
MET
ASP
PRO
GLN
ALA
TYR
GLU
GLN
LEU
VAL
SER
TYR
LEU
CYS
ASN
THR
GLY
ALA
LYS
ILE
LEU
SER
LYS
GLY
THR
ALA
GLY
ARG
HIS
ASN
ASP
ASP
THR
THR
THR
ASN
ILE
SER
TRP
PHE
LEU
HIS
PHE
TYR
ARG
MET
VAL
LEU

GLU
THR
PHE
GLY
ARG
GLU
LYS
ARG

● Molecule 3: Accessory secretory protein Asp3



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	101.16Å 101.16Å 196.85Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	42.94 – 2.90 42.94 – 2.90	Depositor EDS
% Data completeness (in resolution range)	99.8 (42.94-2.90) 99.8 (42.94-2.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.53 (at 2.90Å)	Xtriage
Refinement program	REFMAC 5.8.0189	Depositor
R, R_{free}	0.197 , 0.242 0.190 , 0.237	Depositor DCC
R_{free} test set	1310 reflections (4.94%)	wwPDB-VP
Wilson B-factor (Å ²)	38.5	Xtriage
Anisotropy	0.005	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 23.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.026 for -h,-k,l	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	6497	wwPDB-VP
Average B, all atoms (Å ²)	33.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.77% 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	0.37	0/4262	0.57	0/5768
2	B	0.61	1/1086 (0.1%)	0.65	1/1469 (0.1%)
3	C	0.43	0/1227	0.64	0/1663
All	All	0.43	1/6575 (0.0%)	0.59	1/8900 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	142	SER	C-O	-5.67	1.17	1.23

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	146	LEU	N-CA-C	-5.32	104.38	111.87

There are no chirality outliers.

There are no planarity outliers.

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	4155	0	4001	65	0
2	B	1059	0	1016	22	0
3	C	1193	0	1174	29	0
4	A	56	0	0	5	0
4	B	14	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	C	20	0	0	0	0
All	All	6497	0	6191	100	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 8.

All (100) 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)
2:B:144:GLN:HG2	3:C:23:THR:HG22	1.17	1.17
2:B:144:GLN:HG2	3:C:23:THR:CG2	1.84	1.07
1:A:177:GLU:OE1	1:A:195:ILE:HD11	1.76	0.84
2:B:144:GLN:CG	3:C:23:THR:HG22	2.08	0.75
1:A:190:VAL:HG22	1:A:205:TYR:HB2	1.69	0.74
1:A:341:GLN:HG2	1:A:476:PHE:HB3	1.68	0.74
1:A:507:GLN:HG3	1:A:510:LEU:HD23	1.69	0.73
1:A:21:PRO:HB3	1:A:124:GLU:HG2	1.70	0.73
3:C:17:THR:HB	3:C:19:MET:HE3	1.73	0.71
1:A:227:GLN:NE2	4:A:603:HOH:O	2.25	0.70
1:A:455:LEU:HD11	1:A:473:VAL:HG22	1.75	0.68
1:A:409:LEU:N	4:A:605:HOH:O	2.26	0.68
1:A:74:TYR:CE2	1:A:219:TYR:HD2	2.12	0.68
3:C:89:LYS:HD2	3:C:102:LYS:HE3	1.77	0.67
1:A:80:MET:HE1	1:A:212:VAL:HA	1.81	0.63
1:A:108:PRO:HA	3:C:58:ARG:NH2	2.13	0.62
1:A:229:ILE:HG13	1:A:251:PRO:HG2	1.81	0.62
1:A:487:LEU:HG	1:A:491:ASN:OD1	1.99	0.62
1:A:74:TYR:CE2	1:A:219:TYR:CD2	2.87	0.62
3:C:59:THR:HG22	3:C:60:GLN:H	1.64	0.62
3:C:81:GLN:HB3	3:C:82:PRO:HD3	1.82	0.61
1:A:21:PRO:HB3	1:A:124:GLU:CG	2.31	0.61
2:B:197:LYS:HG3	2:B:208:GLU:HB2	1.83	0.61
1:A:103:GLU:OE1	2:B:196:ARG:NH2	2.34	0.60
1:A:114:GLN:HG2	1:A:119:LYS:HA	1.84	0.59
1:A:312:ARG:HH11	1:A:312:ARG:HG2	1.68	0.59
1:A:74:TYR:CD2	1:A:219:TYR:CE2	2.90	0.59
2:B:185:LYS:HE3	2:B:189:CYS:O	2.03	0.59
1:A:74:TYR:CD2	1:A:219:TYR:CD2	2.91	0.59
1:A:183:ARG:HD3	1:A:191:GLU:OE1	2.03	0.59
1:A:95:ASP:OD2	3:C:6:ARG:NH1	2.39	0.55
2:B:177:ILE:HD12	2:B:251:GLN:HG3	1.89	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:338:ALA:HB1	1:A:433:LEU:HD12	1.87	0.55
1:A:108:PRO:HA	3:C:58:ARG:HH22	1.70	0.55
1:A:322:SER:HB2	1:A:352:THR:HG22	1.89	0.54
3:C:18:TYR:CE2	3:C:43:GLU:HG2	2.42	0.54
2:B:166:ALA:O	3:C:58:ARG:HD3	2.07	0.54
3:C:94:ASP:HB3	3:C:100:LEU:HD21	1.90	0.53
1:A:270:ASP:OD1	1:A:297:ARG:NH2	2.42	0.53
1:A:65:ARG:HG3	1:A:418:LEU:HD11	1.91	0.52
2:B:143:TYR:CE1	3:C:14:VAL:HG21	2.44	0.52
1:A:51:LEU:HD21	1:A:219:TYR:CE1	2.45	0.52
1:A:74:TYR:CG	1:A:219:TYR:HE2	2.28	0.52
1:A:295:PRO:C	1:A:297:ARG:H	2.18	0.52
1:A:74:TYR:CG	1:A:219:TYR:CE2	2.97	0.51
1:A:99:ASP:OD2	1:A:115:LYS:NZ	2.44	0.51
2:B:178:GLU:HA	2:B:221:LEU:O	2.12	0.50
1:A:60:ARG:NH2	4:A:608:HOH:O	2.40	0.49
1:A:6:PRO:HD2	1:A:51:LEU:O	2.12	0.49
1:A:94:ARG:HH22	2:B:132:GLN:HB3	1.78	0.49
3:C:19:MET:HE1	3:C:24:VAL:CG2	2.42	0.49
2:B:143:TYR:CD1	3:C:14:VAL:HG21	2.48	0.48
2:B:144:GLN:HG2	3:C:23:THR:HG21	1.88	0.48
2:B:154:GLU:OE2	2:B:241:ARG:HD2	2.14	0.48
1:A:336:ASN:N	1:A:336:ASN:OD1	2.47	0.48
2:B:174:THR:C	2:B:175:LEU:HD22	2.38	0.48
2:B:252:ARG:HH11	2:B:252:ARG:HG3	1.79	0.47
1:A:189:GLN:HB2	1:A:205:TYR:O	2.14	0.47
3:C:17:THR:O	3:C:19:MET:HG2	2.15	0.47
1:A:9:TYR:CD1	1:A:54:ALA:HB2	2.50	0.46
3:C:39:LEU:HD12	3:C:40:PRO:HD2	1.95	0.46
1:A:246:LEU:HD23	1:A:246:LEU:HA	1.73	0.46
1:A:312:ARG:NH2	4:A:601:HOH:O	2.23	0.46
1:A:112:ILE:HD11	2:B:204:ASP:HB3	1.97	0.46
1:A:486:ARG:H	1:A:486:ARG:HG2	1.65	0.46
2:B:208:GLU:OE2	2:B:226:ARG:NH2	2.49	0.46
1:A:121:ALA:HA	1:A:135:GLN:O	2.16	0.46
1:A:326:PHE:CD2	1:A:342:VAL:HG21	2.51	0.46
1:A:315:ARG:NH1	4:A:606:HOH:O	2.28	0.45
1:A:112:ILE:HD13	1:A:122:LYS:HG3	1.98	0.45
1:A:65:ARG:HD3	1:A:128:GLU:OE2	2.16	0.45
1:A:368:GLU:O	1:A:372:ILE:HG13	2.16	0.45
3:C:52:VAL:HG22	3:C:61:PRO:HD3	1.98	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:C:59:THR:HG22	3:C:60:GLN:N	2.31	0.44
2:B:127:PHE:HB3	2:B:129:PRO:HD2	2.00	0.44
1:A:475:GLU:O	1:A:478:LYS:HB3	2.16	0.44
1:A:131:ILE:HG13	3:C:60:GLN:HG2	2.00	0.44
1:A:316:SER:O	1:A:428:ARG:NH2	2.51	0.44
1:A:145:MET:HB3	1:A:145:MET:HE2	1.57	0.43
1:A:82:ASP:HB2	1:A:199:ARG:CZ	2.49	0.43
1:A:128:GLU:OE1	1:A:128:GLU:N	2.52	0.42
1:A:33:ASP:N	1:A:33:ASP:OD1	2.53	0.42
1:A:341:GLN:HG2	1:A:476:PHE:CB	2.43	0.42
1:A:455:LEU:HD23	1:A:470:LEU:HB2	2.02	0.41
1:A:23:TYR:HE2	1:A:124:GLU:OE2	2.04	0.41
1:A:220:LEU:HD23	1:A:224:VAL:HG21	2.03	0.41
1:A:51:LEU:HD21	1:A:219:TYR:CZ	2.55	0.41
1:A:517:ILE:O	1:A:521:LYS:HG3	2.20	0.41
1:A:9:TYR:HD1	1:A:54:ALA:HB2	1.85	0.41
2:B:143:TYR:O	3:C:23:THR:HA	2.20	0.41
2:B:144:GLN:HA	3:C:23:THR:HG22	2.03	0.41
3:C:14:VAL:O	3:C:15:GLY:C	2.64	0.41
3:C:19:MET:HE1	3:C:24:VAL:HG21	2.02	0.41
3:C:54:TYR:CD2	3:C:54:TYR:C	2.98	0.41
1:A:340:LEU:HD12	1:A:340:LEU:HA	1.86	0.41
3:C:72:TYR:CE1	3:C:142:GLU:HG2	2.56	0.41
3:C:19:MET:HE1	3:C:24:VAL:HG23	2.02	0.40
1:A:341:GLN:CG	1:A:476:PHE:HB3	2.43	0.40
1:A:227:GLN:HB3	1:A:521:LYS:NZ	2.36	0.40
2:B:178:GLU:HB2	2:B:220:ALA:HB1	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	491/526 (93%)	476 (97%)	15 (3%)	0	100	100
2	B	127/511 (25%)	125 (98%)	2 (2%)	0	100	100
3	C	141/154 (92%)	130 (92%)	11 (8%)	0	100	100
All	All	759/1191 (64%)	731 (96%)	28 (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	455/481 (95%)	455 (100%)	0	100	100
2	B	113/442 (26%)	112 (99%)	1 (1%)	70	90
3	C	132/143 (92%)	132 (100%)	0	100	100
All	All	700/1066 (66%)	699 (100%)	1 (0%)	88	97

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	144	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	44	GLN
1	A	317	GLN
1	A	522	ASN

5.3.3 RNA ⓘ

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](#)

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	495/526 (94%)	-0.25	9 (1%) 67 59	14, 32, 70, 139	0
2	B	129/511 (25%)	-0.42	1 (0%) 82 77	15, 27, 49, 79	0
3	C	143/154 (92%)	-0.50	2 (1%) 73 65	13, 22, 50, 76	0
All	All	767/1191 (64%)	-0.33	12 (1%) 70 62	13, 29, 64, 139	0

All (12) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	510	LEU	4.5
1	A	523	VAL	4.3
1	A	74	TYR	4.3
1	A	524	LYS	3.9
3	C	144	ARG	3.4
1	A	505	THR	3.2
1	A	487	LEU	2.9
2	B	180	TRP	2.6
3	C	40	PRO	2.6
1	A	521	LYS	2.1
1	A	237	HIS	2.0
1	A	312	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.