



wwPDB X-ray Structure Validation Summary Report ⓘ

Jul 27, 2026 – 06:05 PM EDT

PDB ID : 9YJT / pdb_00009yjt
Title : The structure of the periplasmic chaperone Skp from *Neisseria meningitidis* in space group P21
Authors : Dubey, S.; Noinaj, N.
Deposited on : 2025-10-04
Resolution : 3.14 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)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

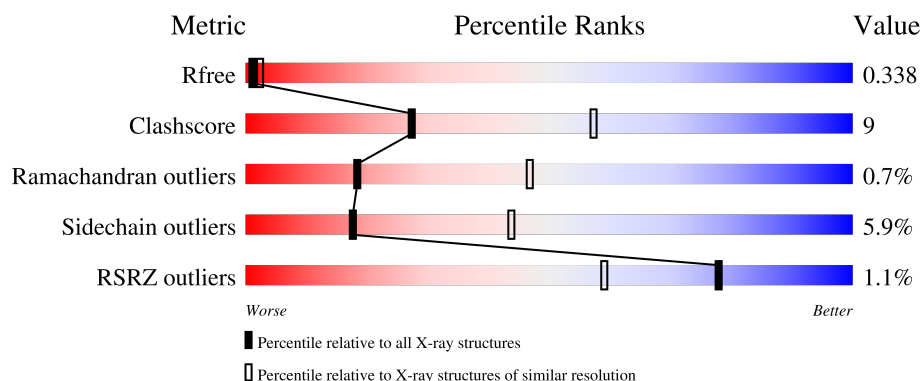
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.14 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	2351 (3.18-3.10)
Clashscore	190562	2452 (3.18-3.10)
Ramachandran outliers	187476	2324 (3.18-3.10)
Sidechain outliers	187428	2324 (3.18-3.10)
RSRZ outliers	180081	2351 (3.18-3.10)

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	146	2% 66% 25% 8%
1	B	146	71% 23% . .
1	C	146	71% 24% . .
1	D	146	% 65% 29% . .
1	E	146	68% 26% 5%

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Mol	Chain	Length	Quality of chain
1	F	146	63%29%7%
1	G	146	70%23%5%
1	H	146	62%27%7%
1	I	146	%60%36%.
1	J	146	3%84%9%7%
1	K	146	3%82%13%5%
1	L	146	3%80%16%.

2 Entry composition

There is only 1 type of molecule in this entry. The entry contains 13145 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 Outer membrane protein H.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	K	139	Total	C	N	O	S	0	0	0
			1070	670	190	209	1			
1	A	135	Total	C	N	O	S	0	0	0
			1070	664	192	213	1			
1	B	141	Total	C	N	O	S	0	0	0
			1131	704	205	221	1			
1	C	140	Total	C	N	O	S	0	0	0
			1120	701	199	219	1			
1	D	140	Total	C	N	O	S	0	0	0
			1122	700	202	219	1			
1	E	139	Total	C	N	O	S	0	0	0
			1083	673	194	215	1			
1	F	136	Total	C	N	O		0	0	0
			1068	665	190	213				
1	G	139	Total	C	N	O	S	0	0	0
			1078	669	194	214	1			
1	H	136	Total	C	N	O	S	0	0	0
			1049	649	187	212	1			
1	I	141	Total	C	N	O	S	0	0	0
			1137	708	205	223	1			
1	J	136	Total	C	N	O	S	0	0	0
			1086	680	195	210	1			
1	L	143	Total	C	N	O		0	0	0
			1131	707	199	225				

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
K	21	GLY	-	expression tag	UNP A0A0H5QDK9
K	22	ALA	-	expression tag	UNP A0A0H5QDK9
K	23	MET	-	expression tag	UNP A0A0H5QDK9
A	21	GLY	-	expression tag	UNP A0A0H5QDK9
A	22	ALA	-	expression tag	UNP A0A0H5QDK9

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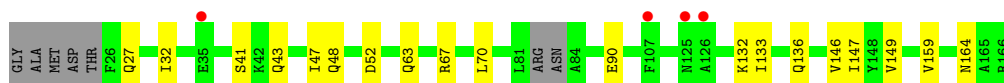
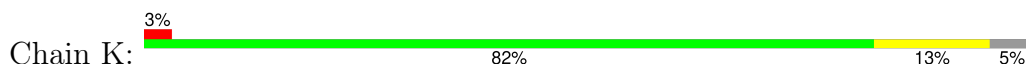
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Chain	Residue	Modelled	Actual	Comment	Reference
A	23	MET	-	expression tag	UNP A0A0H5QDK9
B	21	GLY	-	expression tag	UNP A0A0H5QDK9
B	22	ALA	-	expression tag	UNP A0A0H5QDK9
B	23	MET	-	expression tag	UNP A0A0H5QDK9
C	21	GLY	-	expression tag	UNP A0A0H5QDK9
C	22	ALA	-	expression tag	UNP A0A0H5QDK9
C	23	MET	-	expression tag	UNP A0A0H5QDK9
D	21	GLY	-	expression tag	UNP A0A0H5QDK9
D	22	ALA	-	expression tag	UNP A0A0H5QDK9
D	23	MET	-	expression tag	UNP A0A0H5QDK9
E	21	GLY	-	expression tag	UNP A0A0H5QDK9
E	22	ALA	-	expression tag	UNP A0A0H5QDK9
E	23	MET	-	expression tag	UNP A0A0H5QDK9
F	21	GLY	-	expression tag	UNP A0A0H5QDK9
F	22	ALA	-	expression tag	UNP A0A0H5QDK9
F	23	MET	-	expression tag	UNP A0A0H5QDK9
G	21	GLY	-	expression tag	UNP A0A0H5QDK9
G	22	ALA	-	expression tag	UNP A0A0H5QDK9
G	23	MET	-	expression tag	UNP A0A0H5QDK9
H	21	GLY	-	expression tag	UNP A0A0H5QDK9
H	22	ALA	-	expression tag	UNP A0A0H5QDK9
H	23	MET	-	expression tag	UNP A0A0H5QDK9
I	21	GLY	-	expression tag	UNP A0A0H5QDK9
I	22	ALA	-	expression tag	UNP A0A0H5QDK9
I	23	MET	-	expression tag	UNP A0A0H5QDK9
J	21	GLY	-	expression tag	UNP A0A0H5QDK9
J	22	ALA	-	expression tag	UNP A0A0H5QDK9
J	23	MET	-	expression tag	UNP A0A0H5QDK9
L	21	GLY	-	expression tag	UNP A0A0H5QDK9
L	22	ALA	-	expression tag	UNP A0A0H5QDK9
L	23	MET	-	expression tag	UNP A0A0H5QDK9

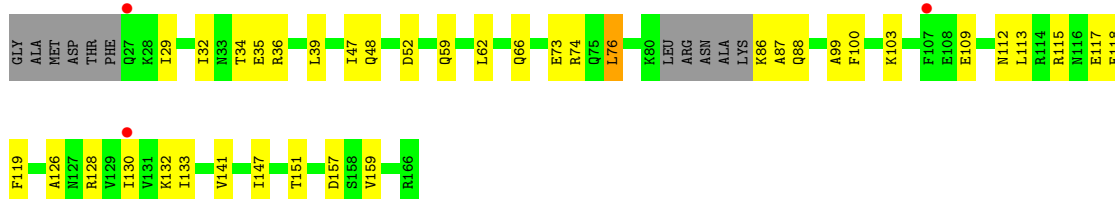
3 Residue-property plots [i](#)

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.

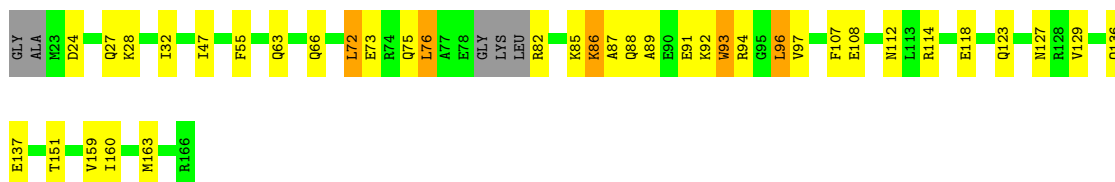
- Molecule 1: Outer membrane protein H



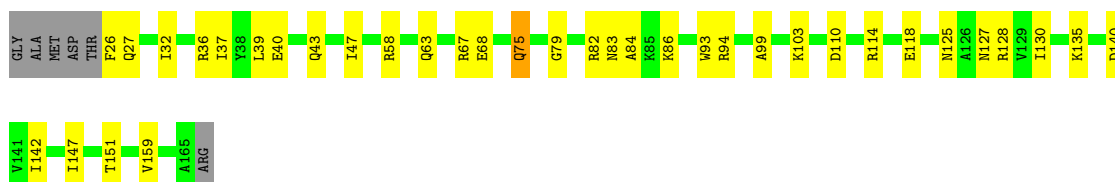
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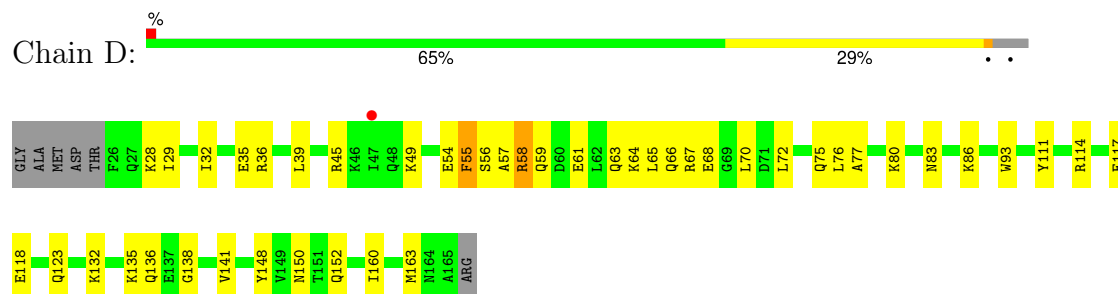
- Molecule 1: Outer membrane protein H



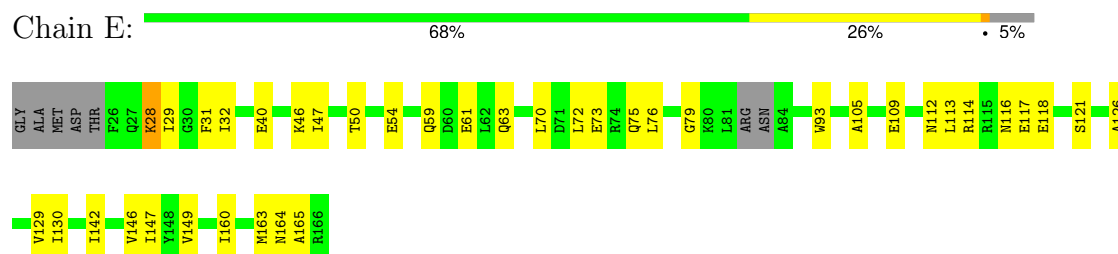
- Molecule 1: Outer membrane protein H



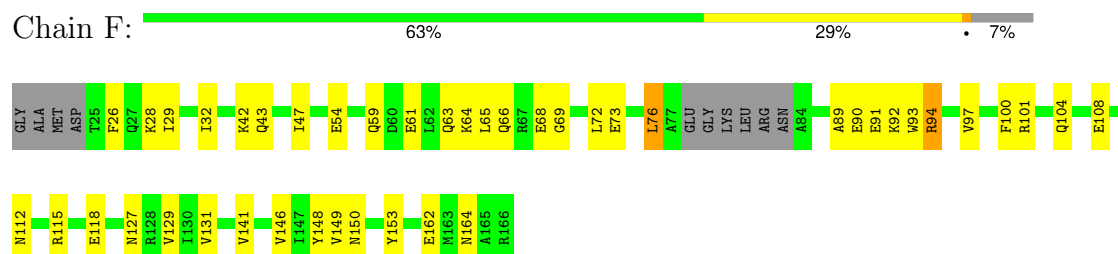
- Molecule 1: Outer membrane protein H



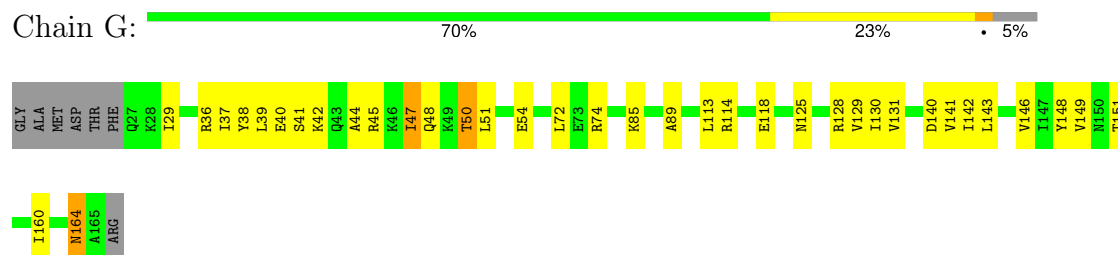
- Molecule 1: Outer membrane protein H



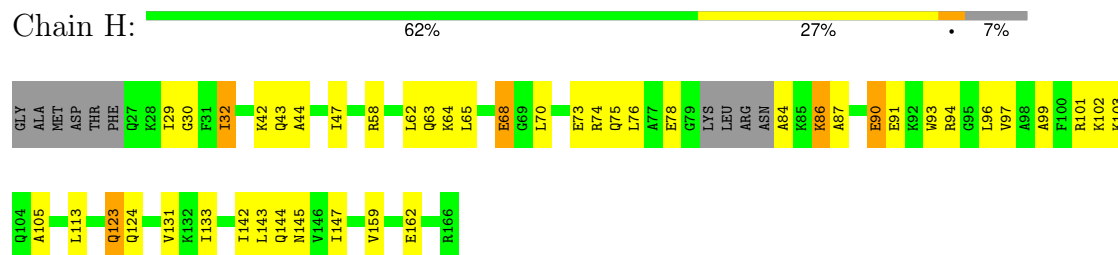
- Molecule 1: Outer membrane protein H



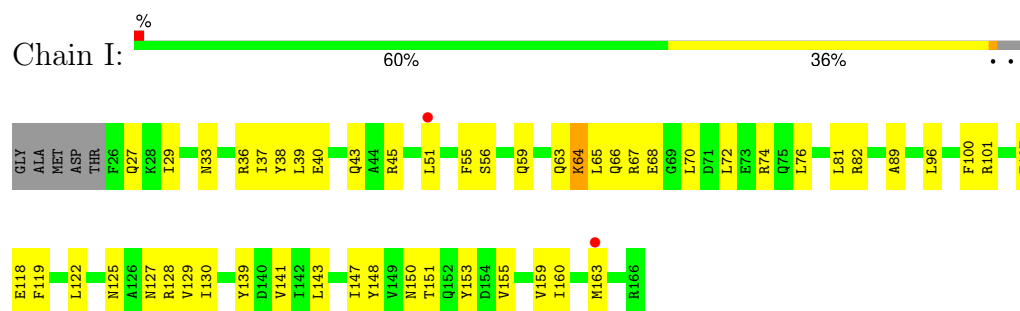
- Molecule 1: Outer membrane protein H



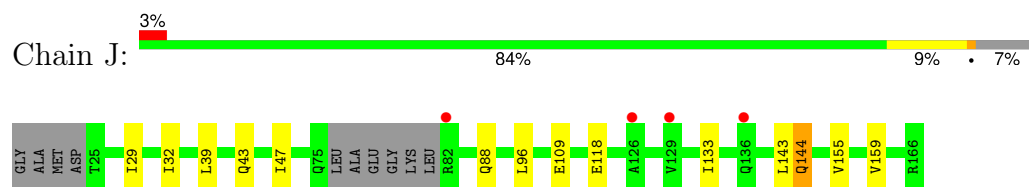
- Molecule 1: Outer membrane protein H



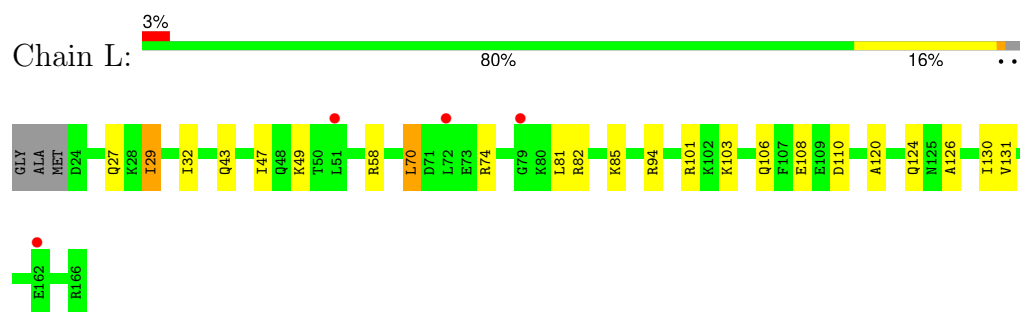
- Molecule 1: Outer membrane protein H



- Molecule 1: Outer membrane protein H



- Molecule 1: Outer membrane protein H



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	84.46Å 103.07Å 128.72Å 90.00° 103.43° 90.00°	Depositor
Resolution (Å)	47.66 – 3.14 47.66 – 3.14	Depositor EDS
% Data completeness (in resolution range)	95.6 (47.66-3.14) 95.9 (47.66-3.14)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.46 (at 3.12Å)	Xtriage
Refinement program	PHENIX 1.20_4459+SVN	Depositor
R, R_{free}	0.278 , 0.337 0.277 , 0.338	Depositor DCC
R_{free} test set	2000 reflections (5.33%)	wwPDB-VP
Wilson B-factor (Å ²)	84.6	Xtriage
Anisotropy	0.852	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.27 , 81.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	13145	wwPDB-VP
Average B, all atoms (Å ²)	117.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.95% 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	0.12	0/1078	0.30	0/1448
1	B	0.15	0/1141	0.34	0/1531
1	C	0.14	0/1132	0.31	0/1522
1	D	0.14	0/1133	0.33	0/1522
1	E	0.15	0/1091	0.30	0/1468
1	F	0.16	0/1077	0.37	0/1448
1	G	0.12	0/1087	0.30	0/1462
1	H	0.20	0/1057	0.46	0/1424
1	I	0.15	0/1149	0.34	0/1544
1	J	0.12	0/1097	0.27	0/1472
1	K	0.12	0/1081	0.26	0/1457
1	L	0.14	0/1143	0.31	0/1540
All	All	0.14	0/13266	0.33	0/17838

There are no bond length outliers.

There are no bond angle outliers.

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	1070	0	1030	20	0
1	B	1131	0	1101	25	0
1	C	1120	0	1086	20	0
1	D	1122	0	1098	30	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	E	1083	0	1038	25	0
1	F	1068	0	1012	22	0
1	G	1078	0	1025	26	0
1	H	1049	0	983	32	0
1	I	1137	0	1099	33	0
1	J	1086	0	1051	11	0
1	K	1070	0	997	10	0
1	L	1131	0	1079	12	0
All	All	13145	0	12599	235	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 9.

The worst 5 of 235 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:G:38:TYR:HA	1:G:41:SER:HB2	1.60	0.83
1:G:45:ARG:HA	1:G:48:GLN:HB3	1.64	0.79
1:E:29:ILE:HD11	1:G:29:ILE:HD12	1.66	0.76
1:F:47:ILE:HD12	1:F:118:GLU:HB3	1.67	0.76
1:E:112:ASN:O	1:E:116:ASN:ND2	2.21	0.73

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	131/146 (90%)	121 (92%)	9 (7%)	1 (1%)	16	44
1	B	137/146 (94%)	125 (91%)	11 (8%)	1 (1%)	18	47
1	C	138/146 (94%)	131 (95%)	6 (4%)	1 (1%)	18	47

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	D	138/146 (94%)	128 (93%)	7 (5%)	3 (2%)	5	21
1	E	135/146 (92%)	130 (96%)	4 (3%)	1 (1%)	18	47
1	F	132/146 (90%)	123 (93%)	8 (6%)	1 (1%)	16	44
1	G	137/146 (94%)	123 (90%)	14 (10%)	0	100	100
1	H	132/146 (90%)	120 (91%)	12 (9%)	0	100	100
1	I	139/146 (95%)	130 (94%)	7 (5%)	2 (1%)	9	31
1	J	132/146 (90%)	131 (99%)	1 (1%)	0	100	100
1	K	135/146 (92%)	134 (99%)	1 (1%)	0	100	100
1	L	141/146 (97%)	134 (95%)	6 (4%)	1 (1%)	18	47
All	All	1627/1752 (93%)	1530 (94%)	86 (5%)	11 (1%)	18	47

5 of 11 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	56	SER
1	F	94	ARG
1	A	87	ALA
1	D	55	PHE
1	D	76	LEU

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	108/126 (86%)	102 (94%)	6 (6%)	19	45
1	B	115/126 (91%)	108 (94%)	7 (6%)	17	43
1	C	113/126 (90%)	108 (96%)	5 (4%)	25	52
1	D	114/126 (90%)	108 (95%)	6 (5%)	20	47
1	E	107/126 (85%)	104 (97%)	3 (3%)	38	62
1	F	105/126 (83%)	97 (92%)	8 (8%)	12	35
1	G	105/126 (83%)	98 (93%)	7 (7%)	15	39

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	H	102/126 (81%)	87 (85%)	15 (15%)	3	12
1	I	115/126 (91%)	107 (93%)	8 (7%)	14	37
1	J	109/126 (86%)	106 (97%)	3 (3%)	38	62
1	K	101/126 (80%)	99 (98%)	2 (2%)	48	68
1	L	113/126 (90%)	106 (94%)	7 (6%)	16	42
All	All	1307/1512 (86%)	1230 (94%)	77 (6%)	18	44

5 of 77 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	H	143	LEU
1	L	29	ILE
1	I	27	GLN
1	I	128	ARG
1	L	94	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 27 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	63	GLN
1	F	75	GLN
1	J	59	GLN
1	F	43	GLN
1	F	125	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

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	135/146 (92%)	0.07	3 (2%) 62 41	84, 117, 215, 231	0
1	B	141/146 (96%)	-0.00	0 100 100	61, 96, 189, 219	0
1	C	140/146 (95%)	-0.05	0 100 100	64, 88, 148, 155	0
1	D	140/146 (95%)	0.11	1 (0%) 84 68	75, 142, 199, 208	0
1	E	139/146 (95%)	0.00	0 100 100	66, 87, 165, 215	0
1	F	136/146 (93%)	0.01	0 100 100	70, 100, 182, 191	0
1	G	139/146 (95%)	0.07	0 100 100	88, 141, 196, 203	0
1	H	136/146 (93%)	0.04	0 100 100	78, 110, 204, 256	0
1	I	141/146 (96%)	0.14	2 (1%) 73 53	72, 105, 147, 157	0
1	J	136/146 (93%)	0.31	4 (2%) 53 32	72, 107, 171, 185	0
1	K	139/146 (95%)	0.19	4 (2%) 53 32	66, 100, 181, 193	0
1	L	143/146 (97%)	0.07	4 (2%) 55 33	75, 114, 167, 178	0
All	All	1665/1752 (95%)	0.08	18 (1%) 78 59	61, 109, 189, 256	0

The worst 5 of 18 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	L	51	LEU	3.8
1	L	72	LEU	3.7
1	K	126	ALA	3.6
1	K	125	ASN	3.6
1	J	126	ALA	3.2

6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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.