



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 06:39 AM UTC

PDB ID : 5DSV / pdb_00005dsv
Title : Crystal structure of human proteasome alpha7 tetradecamer
Authors : Satoh, T.; Thammaporn, R.; Seetaha, S.; Kato, K.
Deposited on : 2015-09-17
Resolution : 3.75 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 : 9.0.010 (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

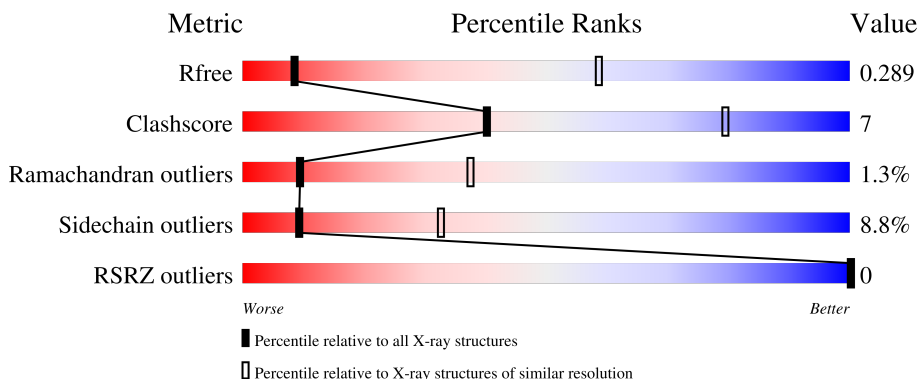
1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.75 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	1029 (3.90-3.62)
Clashscore	190562	1061 (3.90-3.62)
Ramachandran outliers	187476	1014 (3.90-3.62)
Sidechain outliers	187428	1009 (3.90-3.62)
RSRZ outliers	180081	1028 (3.90-3.62)

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	255	68% 25% . .
1	B	255	68% 25% . .
1	C	255	65% 24% . 8%
1	D	255	67% 26% . .
1	E	255	68% 25% . .

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Mol	Chain	Length	Quality of chain
1	F	255	 67% 25% . .
1	G	255	 67% 25% . 5%
1	H	255	 67% 24% . 6%
1	I	255	 69% 24% . .
1	J	255	 69% 23% . 6%
1	K	255	 70% 22% . .
1	L	255	 69% 25% . .
1	M	255	 69% 22% . 6%
1	N	255	 72% 22% . .

2 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 26493 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 Proteasome subunit alpha type-3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	244	1908	1209	325	363	11	0	0	0
1	B	245	1914	1212	326	365	11	0	0	0
1	C	234	1825	1155	312	348	10	0	0	0
1	D	244	1908	1209	325	363	11	0	0	0
1	E	245	1914	1212	326	365	11	0	0	0
1	F	244	1908	1209	325	363	11	0	0	0
1	G	242	1894	1200	323	360	11	0	0	0
1	H	239	1863	1179	318	355	11	0	0	0
1	I	244	1905	1207	325	362	11	0	0	0
1	J	239	1863	1179	318	355	11	0	0	0
1	K	244	1905	1207	325	362	11	0	0	0
1	L	245	1914	1212	326	365	11	0	0	0
1	M	239	1864	1178	318	357	11	0	0	0
1	N	244	1908	1209	325	363	11	0	0	0

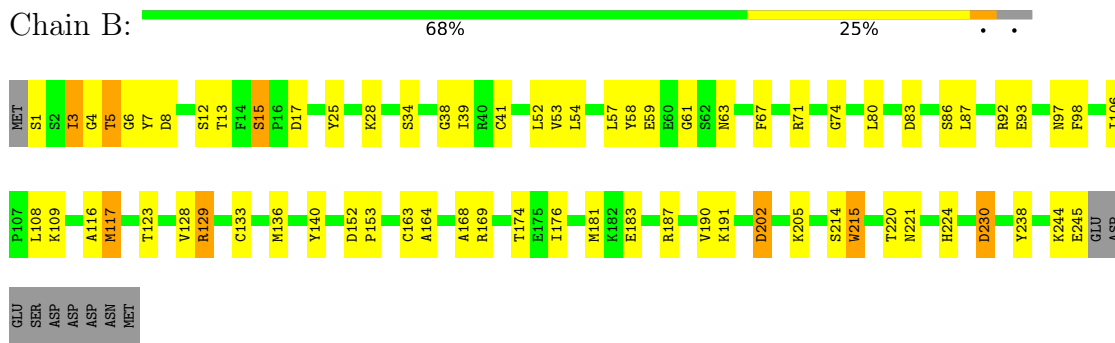
3 Residue-property plots [i](#)

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.

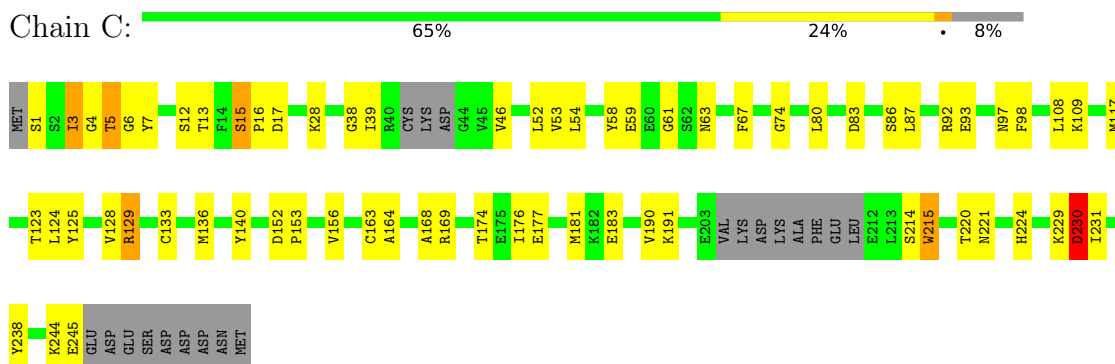
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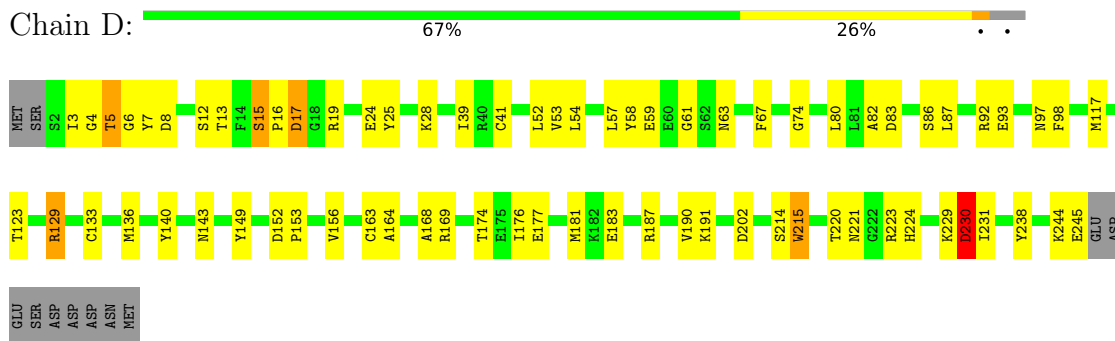
- Molecule 1: Proteasome subunit alpha type-3



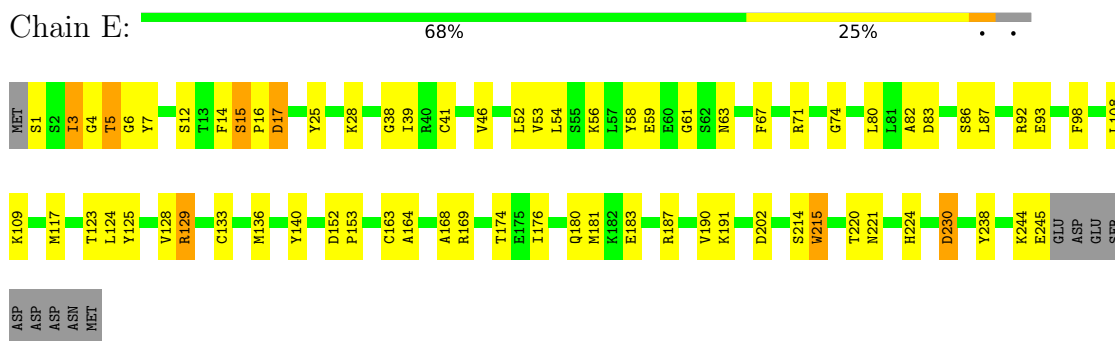
- Molecule 1: Proteasome subunit alpha type-3



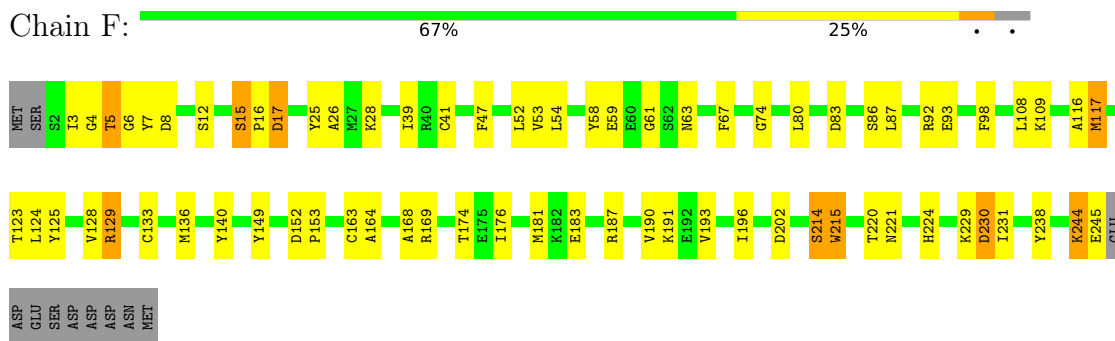
- Molecule 1: Proteasome subunit alpha type-3



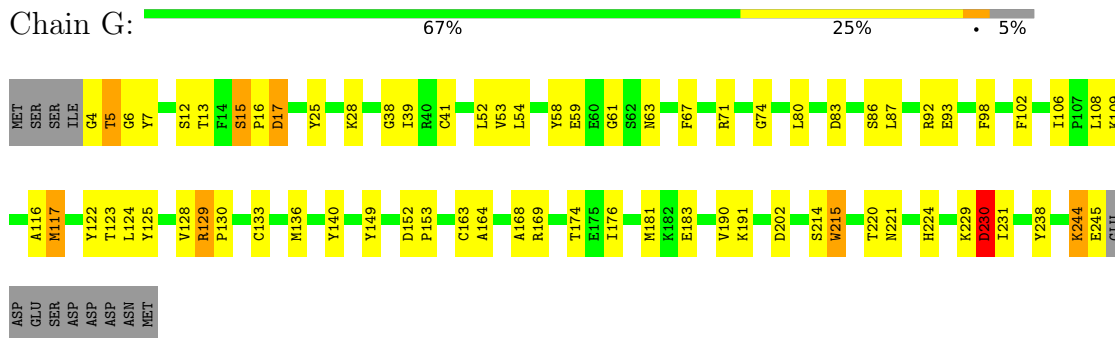
- Molecule 1: Proteasome subunit alpha type-3



- Molecule 1: Proteasome subunit alpha type-3

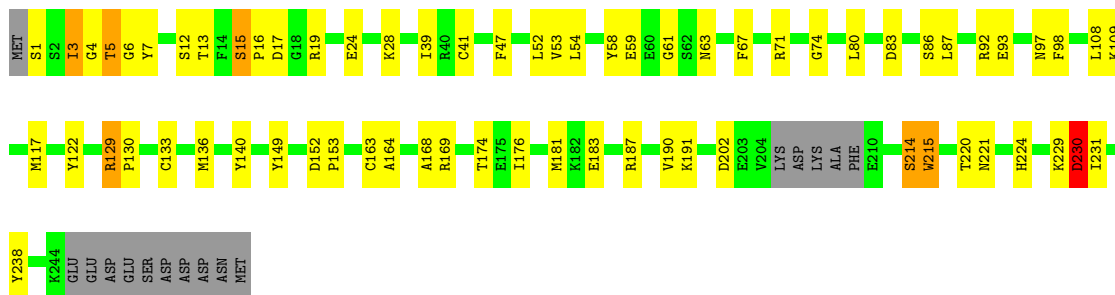


- Molecule 1: Proteasome subunit alpha type-3



• Molecule 1: Proteasome subunit alpha type-3

Chain H:  67% 24% 6%



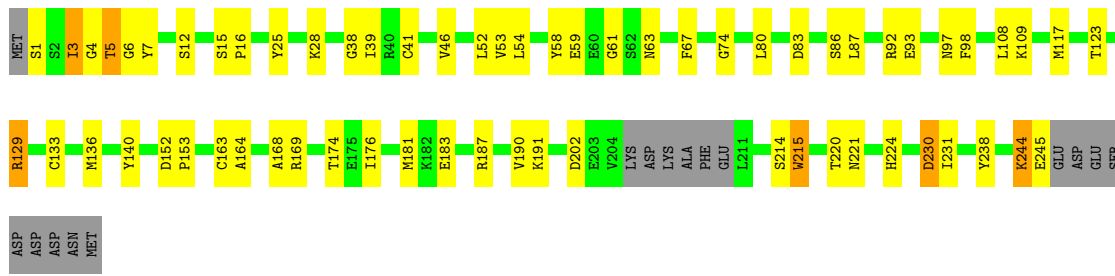
• Molecule 1: Proteasome subunit alpha type-3

Chain I:  69% 24%



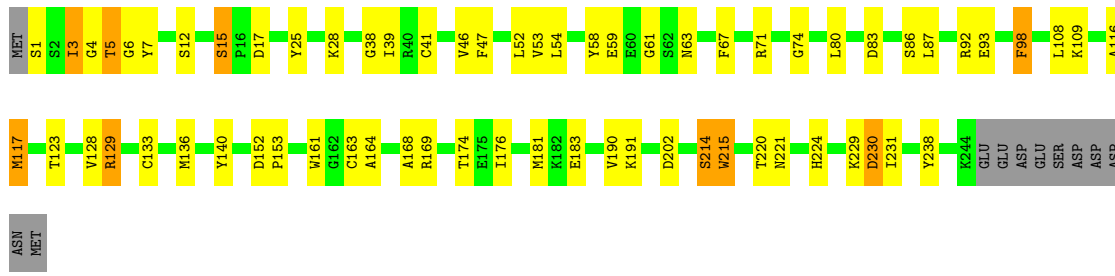
• Molecule 1: Proteasome subunit alpha type-3

Chain J:  69% 23% 6%

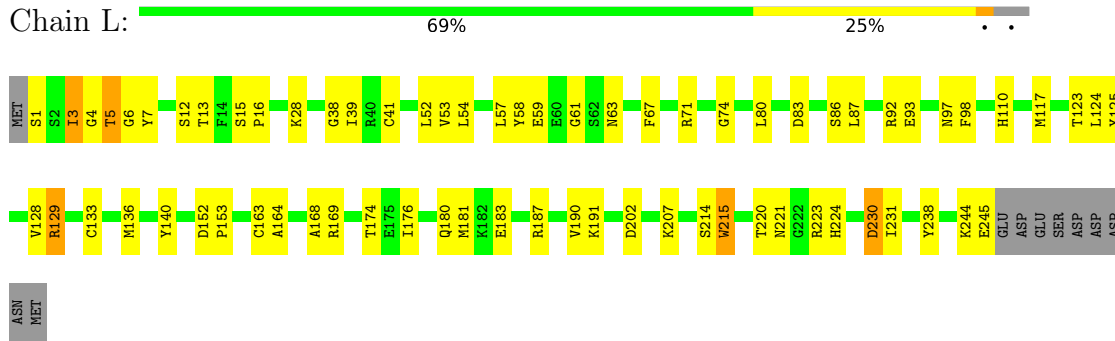


• Molecule 1: Proteasome subunit alpha type-3

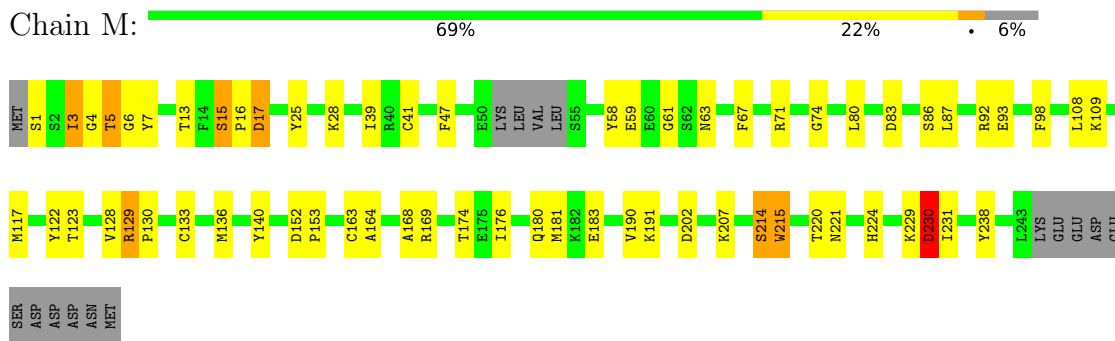
Chain K:  70% 22%



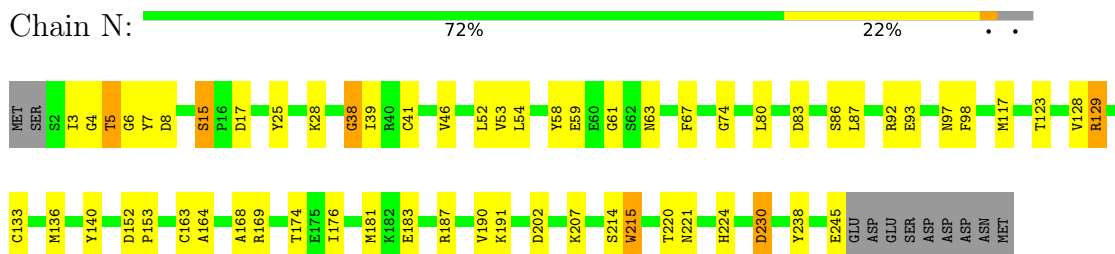
- Molecule 1: Proteasome subunit alpha type-3



- Molecule 1: Proteasome subunit alpha type-3



- Molecule 1: Proteasome subunit alpha type-3



4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	132.48Å 132.48Å 444.56Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 3.75 20.00 – 3.75	Depositor EDS
% Data completeness (in resolution range)	96.5 (20.00-3.75) 96.5 (20.00-3.75)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.05 (at 3.71Å)	Xtrriage
Refinement program	REFMAC 5.8.0069	Depositor
R, R_{free}	0.209 , 0.291 0.211 , 0.289	Depositor DCC
R_{free} test set	2039 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å ²)	126.1	Xtrriage
Anisotropy	0.003	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.26 , 78.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.51$, $\langle L^2 \rangle = 0.35$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	26493	wwPDB-VP
Average B, all atoms (Å ²)	153.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.47% 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

5.1 Standard geometry

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	0.73	0/1943	0.92	1/2616 (0.0%)
1	B	0.72	0/1949	0.91	2/2624 (0.1%)
1	C	0.68	0/1857	0.90	1/2499 (0.0%)
1	D	0.69	0/1943	0.91	1/2616 (0.0%)
1	E	0.73	0/1949	0.92	1/2624 (0.0%)
1	F	0.75	0/1943	0.92	1/2616 (0.0%)
1	G	0.76	0/1929	0.91	2/2597 (0.1%)
1	H	0.64	0/1896	0.89	0/2553
1	I	0.64	0/1940	0.88	0/2612
1	J	0.65	0/1896	0.89	0/2553
1	K	0.67	0/1940	0.90	1/2612 (0.0%)
1	L	0.70	0/1949	0.90	2/2624 (0.1%)
1	M	0.69	1/1898 (0.1%)	0.90	1/2555 (0.0%)
1	N	0.67	0/1943	0.90	1/2616 (0.0%)
All	All	0.70	1/26975 (0.0%)	0.90	14/36317 (0.0%)

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	16
1	B	0	15
1	C	0	14
1	D	0	15
1	E	0	14
1	F	0	13
1	G	0	15
1	H	0	14
1	I	0	13
1	J	0	13
1	K	0	11

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Mol	Chain	#Chirality outliers	#Planarity outliers
1	L	0	15
1	M	0	15
1	N	0	14
All	All	0	197

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	M	207	LYS	CA-C	6.21	1.61	1.52

The worst 5 of 14 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	L	128	VAL	CB-CA-C	-6.25	101.89	110.90
1	G	128	VAL	CB-CA-C	-5.98	102.29	110.90
1	E	128	VAL	CB-CA-C	-5.88	102.43	110.90
1	D	143	ASN	CB-CA-C	-5.80	100.83	110.68
1	M	128	VAL	CB-CA-C	-5.71	101.88	110.55

There are no chirality outliers.

5 of 197 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	13	THR	Peptide
1	A	3	ILE	Peptide
1	A	38	GLY	Peptide
1	A	4	GLY	Peptide
1	A	58	TYR	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	1908	0	1891	37	0
1	B	1914	0	1899	28	0
1	C	1825	0	1807	28	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	1908	0	1891	31	0
1	E	1914	0	1899	32	0
1	F	1908	0	1891	30	0
1	G	1894	0	1875	31	0
1	H	1863	0	1848	28	0
1	I	1905	0	1893	27	0
1	J	1863	0	1848	23	0
1	K	1905	0	1893	32	0
1	L	1914	0	1899	30	0
1	M	1864	0	1835	28	0
1	N	1908	0	1891	20	0
All	All	26493	0	26260	346	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 7.

The worst 5 of 346 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:102:PHE:HZ	1:K:98:PHE:CE2	1.84	0.94
1:A:102:PHE:HZ	1:K:98:PHE:HE2	1.22	0.86
1:A:102:PHE:CZ	1:K:98:PHE:HE2	1.94	0.85
1:A:71:ARG:HD3	1:L:71:ARG:HD3	1.64	0.79
1:A:71:ARG:HB3	1:L:71:ARG:NH1	1.99	0.76

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	242/255 (95%)	213 (88%)	26 (11%)	3 (1%)	10 39

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	243/255 (95%)	215 (88%)	25 (10%)	3 (1%)	10	39
1	C	228/255 (89%)	201 (88%)	24 (10%)	3 (1%)	9	37
1	D	242/255 (95%)	213 (88%)	26 (11%)	3 (1%)	10	39
1	E	243/255 (95%)	213 (88%)	27 (11%)	3 (1%)	10	39
1	F	242/255 (95%)	213 (88%)	26 (11%)	3 (1%)	10	39
1	G	240/255 (94%)	212 (88%)	25 (10%)	3 (1%)	9	37
1	H	235/255 (92%)	209 (89%)	23 (10%)	3 (1%)	9	37
1	I	242/255 (95%)	214 (88%)	25 (10%)	3 (1%)	10	39
1	J	235/255 (92%)	207 (88%)	25 (11%)	3 (1%)	9	37
1	K	242/255 (95%)	213 (88%)	26 (11%)	3 (1%)	10	39
1	L	243/255 (95%)	215 (88%)	24 (10%)	4 (2%)	7	34
1	M	235/255 (92%)	209 (89%)	24 (10%)	2 (1%)	14	43
1	N	242/255 (95%)	213 (88%)	25 (10%)	4 (2%)	7	33
All	All	3354/3570 (94%)	2960 (88%)	351 (10%)	43 (1%)	9	37

5 of 43 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	53	VAL
1	C	53	VAL
1	D	53	VAL
1	E	53	VAL
1	F	53	VAL

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	201/212 (95%)	182 (90%)	19 (10%)	8	30
1	B	202/212 (95%)	183 (91%)	19 (9%)	8	30
1	C	192/212 (91%)	177 (92%)	15 (8%)	11	36

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	D	201/212 (95%)	183 (91%)	18 (9%)	9	32
1	E	202/212 (95%)	184 (91%)	18 (9%)	9	32
1	F	201/212 (95%)	183 (91%)	18 (9%)	9	32
1	G	199/212 (94%)	182 (92%)	17 (8%)	10	33
1	H	197/212 (93%)	179 (91%)	18 (9%)	9	32
1	I	201/212 (95%)	183 (91%)	18 (9%)	9	32
1	J	197/212 (93%)	179 (91%)	18 (9%)	9	32
1	K	201/212 (95%)	184 (92%)	17 (8%)	10	33
1	L	202/212 (95%)	184 (91%)	18 (9%)	9	32
1	M	196/212 (92%)	180 (92%)	16 (8%)	10	34
1	N	201/212 (95%)	183 (91%)	18 (9%)	9	32
All	All	2793/2968 (94%)	2546 (91%)	247 (9%)	9	33

5 of 247 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	G	92	ARG
1	M	93	GLU
1	I	12	SER
1	M	86	SER
1	N	92	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 49 such sidechains are listed below:

Mol	Chain	Res	Type
1	H	170	GLN
1	K	110	HIS
1	I	110	HIS
1	J	22	GLN
1	K	170	GLN

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	244/255 (95%)	-0.86	0 100 100	78, 123, 190, 244	0
1	B	245/255 (96%)	-0.88	0 100 100	84, 132, 192, 207	0
1	C	234/255 (91%)	-0.76	0 100 100	91, 159, 220, 253	0
1	D	244/255 (95%)	-0.78	0 100 100	84, 169, 226, 265	0
1	E	245/255 (96%)	-0.88	0 100 100	81, 127, 199, 260	0
1	F	244/255 (95%)	-0.87	0 100 100	75, 119, 193, 213	0
1	G	242/255 (94%)	-0.88	0 100 100	72, 124, 190, 232	0
1	H	239/255 (93%)	-0.82	0 100 100	112, 166, 220, 239	0
1	I	244/255 (95%)	-0.82	0 100 100	110, 180, 241, 272	0
1	J	239/255 (93%)	-0.76	0 100 100	101, 172, 235, 268	0
1	K	244/255 (95%)	-0.82	0 100 100	84, 144, 197, 247	0
1	L	245/255 (96%)	-0.81	0 100 100	93, 144, 209, 249	0
1	M	239/255 (93%)	-0.81	0 100 100	94, 152, 212, 258	0
1	N	244/255 (95%)	-0.74	0 100 100	98, 161, 235, 364	0
All	All	3392/3570 (95%)	-0.82	0 100 100	72, 148, 220, 364	0

There are no RSRZ outliers to report.

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

There are no ligands in this entry.

6.5 Other polymers

There are no such residues in this entry.