



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 7, 2026 – 06:14 AM UTC

PDB ID : 5KWD / pdb_00005kwd
Title : Computationally Designed Symmetric Homotetramer
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Deposited on : 2016-07-17
Resolution : 2.75 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

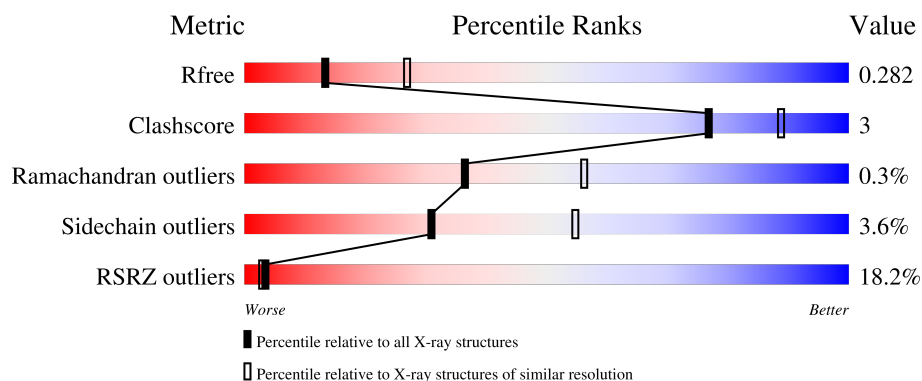
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.75 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	1009 (2.76-2.76)
Clashscore	190562	1044 (2.76-2.76)
Ramachandran outliers	187476	1024 (2.76-2.76)
Sidechain outliers	187428	1024 (2.76-2.76)
RSRZ outliers	180081	1009 (2.76-2.76)

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	160	13% 95% ..
1	B	160	14% 89% 11%
1	C	160	28% 90% 8% ..
1	D	160	18% 92% 7% ..

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 9188 atoms, of which 4434 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 Ankyrin repeat-containing protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	160	Total	C	H	N	O	S	0	0	0
			2329	743	1132	219	233	2			
1	B	160	Total	C	H	N	O	S	0	0	0
			2289	729	1105	216	237	2			
1	C	158	Total	C	H	N	O	S	0	0	0
			2248	720	1088	209	229	2			
1	D	159	Total	C	H	N	O	S	0	0	0
			2286	730	1109	210	235	2			

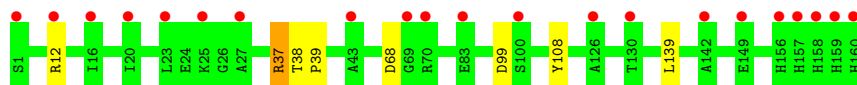
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	9	Total	O	0	0
			9	9		
2	B	12	Total	O	0	0
			12	12		
2	C	4	Total	O	0	0
			4	4		
2	D	11	Total	O	0	0
			11	11		

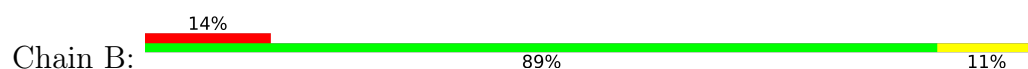
3 Residue-property plots [i](#)

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.

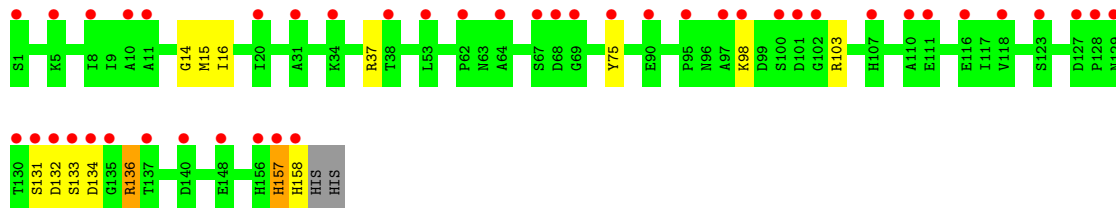
- Molecule 1: Ankyrin repeat-containing protein



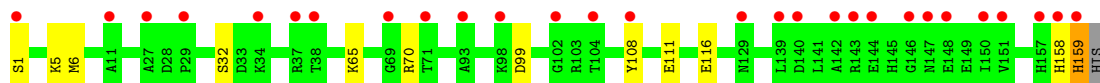
- Molecule 1: Ankyrin repeat-containing protein



- Molecule 1: Ankyrin repeat-containing protein



- Molecule 1: Ankyrin repeat-containing protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	77.77Å 89.47Å 99.08Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	66.40 – 2.75 66.40 – 2.75	Depositor EDS
% Data completeness (in resolution range)	99.7 (66.40-2.75) 99.7 (66.40-2.75)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.78 (at 2.73Å)	Xtriage
Refinement program	PHENIX (1.10_2155: ???)	Depositor
R, R_{free}	0.229 , 0.281 0.230 , 0.282	Depositor DCC
R_{free} test set	1851 reflections (9.98%)	wwPDB-VP
Wilson B-factor (Å ²)	38.2	Xtriage
Anisotropy	1.001	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.46 , 67.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	9188	wwPDB-VP
Average B, all atoms (Å ²)	54.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.90% 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	0.15	0/1219	0.29	0/1654
1	B	0.13	0/1204	0.27	0/1634
1	C	0.14	0/1181	0.29	0/1609
1	D	0.16	0/1198	0.31	0/1628
All	All	0.15	0/4802	0.29	0/6525

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	1197	1132	1163	5	0
1	B	1184	1105	1137	9	0
1	C	1160	1088	1099	6	0
1	D	1177	1109	1125	8	0
2	A	9	0	0	1	0
2	B	12	0	0	5	0
2	C	4	0	0	0	0
2	D	11	0	0	2	0
All	All	4754	4434	4524	27	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 3.

All (27) 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:B:119:LYS:NZ	2:B:201:HOH:O	1.93	0.86
1:D:5:LYS:NZ	2:D:201:HOH:O	2.12	0.82
1:B:99:ASP:OD2	1:B:108:TYR:OH	1.97	0.81
1:D:1:SER:N	2:D:202:HOH:O	2.13	0.81
1:D:70:ARG:NH1	1:D:108:TYR:OH	2.13	0.81
1:B:1:SER:N	2:B:202:HOH:O	2.15	0.75
1:D:158:HIS:HB2	1:D:159:HIS:O	1.88	0.73
1:B:37:ARG:NH2	2:B:203:HOH:O	2.20	0.73
1:D:158:HIS:HB2	1:D:159:HIS:C	2.19	0.67
1:A:37:ARG:NH2	1:A:68:ASP:OD2	2.31	0.64
1:D:158:HIS:N	1:D:159:HIS:HA	2.14	0.62
1:D:116:GLU:OE1	1:D:116:GLU:N	2.33	0.59
1:A:12:ARG:NH1	2:A:203:HOH:O	2.34	0.59
1:C:37:ARG:NH2	1:C:75:TYR:OH	2.39	0.56
1:C:14:GLY:O	1:C:16:ILE:N	2.39	0.56
1:C:157:HIS:O	1:C:158:HIS:HB2	2.08	0.54
1:C:132:ASP:N	1:C:136:ARG:O	2.42	0.52
1:B:78:GLU:O	1:B:112:ASN:ND2	2.43	0.51
1:B:37:ARG:CZ	2:B:203:HOH:O	2.57	0.50
1:B:98:LYS:HE3	1:B:102:GLY:O	2.11	0.50
1:B:70:ARG:NH2	2:B:204:HOH:O	2.23	0.49
1:A:38:THR:HB	1:A:39:PRO:HD2	1.95	0.49
1:C:132:ASP:OD1	1:C:133:SER:N	2.46	0.47
1:D:99:ASP:OD2	1:D:108:TYR:OH	2.35	0.44
1:A:99:ASP:OD2	1:A:108:TYR:OH	2.30	0.43
1:A:99:ASP:O	1:B:133:SER:OG	2.33	0.42
1:C:98:LYS:HA	1:C:103:ARG:O	2.21	0.41

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	158/160 (99%)	155 (98%)	3 (2%)	0	100	100
1	B	158/160 (99%)	150 (95%)	7 (4%)	1 (1%)	21	38
1	C	156/160 (98%)	152 (97%)	3 (2%)	1 (1%)	21	38
1	D	157/160 (98%)	154 (98%)	3 (2%)	0	100	100
All	All	629/640 (98%)	611 (97%)	16 (2%)	2 (0%)	36	56

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	159	HIS
1	C	15	MET

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	121/129 (94%)	119 (98%)	2 (2%)	53	71
1	B	121/129 (94%)	115 (95%)	6 (5%)	22	42
1	C	114/129 (88%)	110 (96%)	4 (4%)	32	56
1	D	118/129 (92%)	113 (96%)	5 (4%)	26	49
All	All	474/516 (92%)	457 (96%)	17 (4%)	31	55

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	37	ARG
1	A	139	LEU
1	B	2	THR
1	B	6	MET
1	B	32	SER
1	B	54	LEU
1	B	57	GLU
1	B	157	HIS
1	C	131	SER

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Mol	Chain	Res	Type
1	C	134	ASP
1	C	136	ARG
1	C	157	HIS
1	D	6	MET
1	D	32	SER
1	D	65	LYS
1	D	111	GLU
1	D	159	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	81	HIS
1	A	114	HIS
1	B	81	HIS
1	C	91	HIS
1	D	48	HIS
1	D	114	HIS

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 ⓘ

There are no ligands in this entry.

5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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	160/160 (100%)	1.15	21 (13%) 7 6	32, 46, 67, 82	0
1	B	160/160 (100%)	1.25	23 (14%) 6 5	40, 57, 72, 74	0
1	C	158/160 (98%)	1.61	44 (27%) 1 1	37, 59, 77, 88	0
1	D	159/160 (99%)	1.30	28 (17%) 4 3	36, 53, 72, 88	0
All	All	637/640 (99%)	1.33	116 (18%) 3 3	32, 54, 73, 88	0

All (116) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	100	SER	6.6
1	D	159	HIS	5.5
1	D	146	GLY	5.0
1	C	1	SER	4.6
1	C	135	GLY	4.4
1	C	156	HIS	4.1
1	C	133	SER	4.0
1	B	120	LEU	3.9
1	D	29	PRO	3.9
1	D	147	ASN	3.8
1	C	132	ASP	3.7
1	B	98	LYS	3.6
1	D	93	ALA	3.6
1	C	148	GLU	3.6
1	A	159	HIS	3.6
1	C	158	HIS	3.6
1	D	158	HIS	3.6
1	A	158	HIS	3.5
1	A	1	SER	3.5
1	D	150	ILE	3.5
1	C	129	ASN	3.4

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Mol	Chain	Res	Type	RSRZ
1	B	138	PRO	3.3
1	C	102	GLY	3.3
1	D	129	ASN	3.3
1	B	159	HIS	3.3
1	C	131	SER	3.3
1	C	90	GLU	3.2
1	A	126	ALA	3.2
1	C	75	TYR	3.2
1	A	23	LEU	3.1
1	C	137	THR	3.1
1	A	160	HIS	3.0
1	C	128	PRO	3.0
1	A	130	THR	3.0
1	B	160	HIS	2.9
1	C	34	LYS	2.9
1	A	156	HIS	2.9
1	C	68	ASP	2.8
1	D	37	ARG	2.8
1	B	30	ASN	2.8
1	C	134	ASP	2.7
1	D	38	THR	2.7
1	D	151	VAL	2.7
1	C	62	PRO	2.7
1	D	144	GLU	2.7
1	A	69	GLY	2.6
1	C	69	GLY	2.6
1	C	64	ALA	2.6
1	C	130	THR	2.6
1	D	102	GLY	2.6
1	A	100	SER	2.5
1	D	1	SER	2.5
1	C	20	ILE	2.5
1	C	127	ASP	2.5
1	D	157	HIS	2.5
1	B	130	THR	2.5
1	C	140	ASP	2.5
1	C	97	ALA	2.5
1	C	110	ALA	2.5
1	B	133	SER	2.4
1	C	67	SER	2.4
1	C	118	VAL	2.4
1	D	27	ALA	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	16	ILE	2.4
1	A	157	HIS	2.4
1	C	157	HIS	2.4
1	D	140	ASP	2.4
1	B	145	HIS	2.4
1	C	31	ALA	2.3
1	C	53	LEU	2.3
1	B	75	TYR	2.3
1	C	111	GLU	2.3
1	D	148	GLU	2.3
1	B	136	ARG	2.3
1	D	143	ARG	2.3
1	D	139	LEU	2.3
1	D	11	ALA	2.3
1	D	142	ALA	2.3
1	C	107	HIS	2.3
1	B	147	ASN	2.3
1	A	12	ARG	2.3
1	C	95	PRO	2.3
1	C	101	ASP	2.3
1	B	31	ALA	2.2
1	C	8	ILE	2.2
1	C	38	THR	2.2
1	B	18	VAL	2.2
1	C	5	LYS	2.2
1	B	148	GLU	2.2
1	A	70	ARG	2.2
1	C	123	SER	2.2
1	A	25	LYS	2.2
1	B	121	LEU	2.2
1	A	20	ILE	2.2
1	A	142	ALA	2.2
1	C	116	GLU	2.2
1	D	108	TYR	2.2
1	C	11	ALA	2.1
1	B	46	ASN	2.1
1	D	98	LYS	2.1
1	B	51	ILE	2.1
1	A	27	ALA	2.1
1	D	104	THR	2.1
1	B	69	GLY	2.1
1	D	69	GLY	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	149	GLU	2.1
1	C	98	LYS	2.1
1	B	54	LEU	2.1
1	C	10	ALA	2.0
1	B	65	LYS	2.0
1	D	34	LYS	2.0
1	D	71	THR	2.0
1	B	157	HIS	2.0
1	A	83	GLU	2.0
1	A	43	ALA	2.0
1	B	158	HIS	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.