



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 05:14 PM UTC

PDB ID : 6EKL / pdb_00006ekl
Title : Crystal structure of mammalian Rev7 in complex with human Chromosome a
 ligment-maintaining phosphoprotein 1
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Deposited on : 2017-09-26
Resolution : 1.60 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

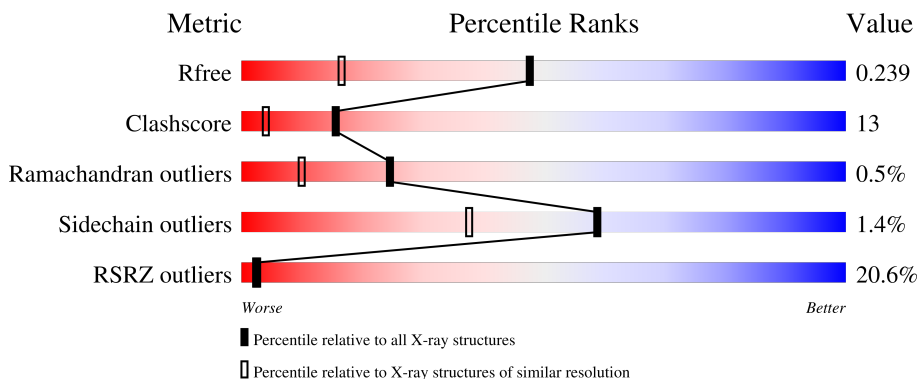
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.60 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	4673 (1.60-1.60)
Clashscore	190562	4931 (1.60-1.60)
Ramachandran outliers	187476	4831 (1.60-1.60)
Sidechain outliers	187428	4830 (1.60-1.60)
RSRZ outliers	180081	4672 (1.60-1.60)

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	211	19% 71% 24% • 5%
2	B	29	21% 66% 10% 24%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 1834 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 Mitotic spindle assembly checkpoint protein MAD2B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	201	Total	C	N	O	S	0	0	0
			1640	1058	276	298	8			

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	11	SER	PHE	engineered mutation	UNP Q9D752
A	12	ALA	GLY	engineered mutation	UNP Q9D752
A	132	LYS	VAL	engineered mutation	UNP Q9D752
A	133	VAL	CYS	engineered mutation	UNP Q9D752
A	135	LYS	ALA	engineered mutation	UNP Q9D752

- Molecule 2 is a protein called Chromosome alignment-maintaining phosphoprotein 1.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
2	B	22	Total	C	N	O	0	0	0
			161	108	27	26			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	327	MET	-	initiating methionine	UNP Q96JM3

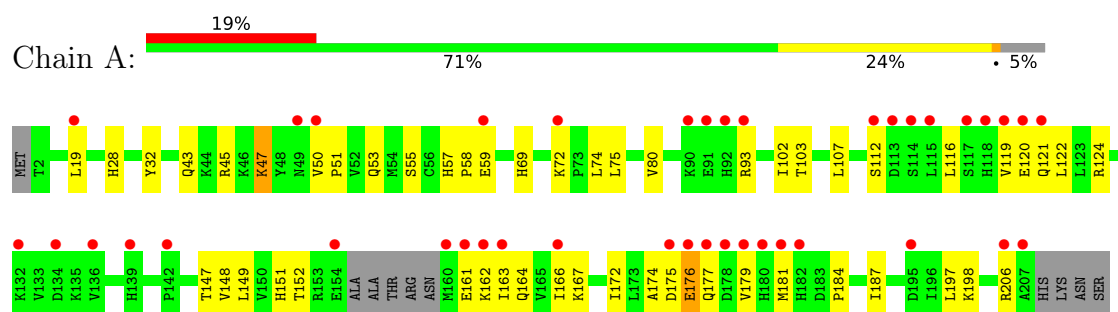
- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	30	Total	O	0	0
			30	30		
3	B	3	Total	O	0	0
			3	3		

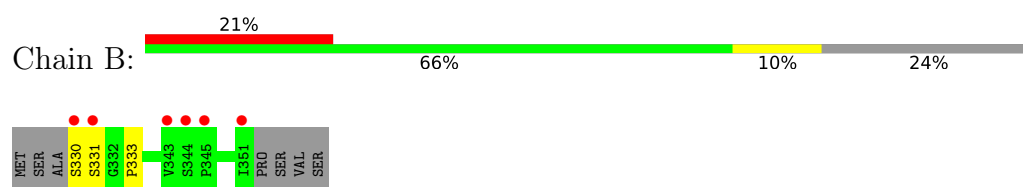
3 Residue-property plots [i](#)

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: Mitotic spindle assembly checkpoint protein MAD2B



- Molecule 2: Chromosome alignment-maintaining phosphoprotein 1



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	47.28Å 51.84Å 126.18Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	23.41 – 1.60 23.41 – 1.60	Depositor EDS
% Data completeness (in resolution range)	99.2 (23.41-1.60) 98.9 (23.41-1.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.10	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.84 (at 1.60Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.233 , 0.241 0.233 , 0.239	Depositor DCC
R_{free} test set	2052 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å ²)	18.8	Xtriage
Anisotropy	0.453	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 34.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	1834	wwPDB-VP
Average B, all atoms (Å ²)	24.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.06% 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	0.32	0/1673	0.82	0/2272
2	B	0.36	0/171	0.98	0/237
All	All	0.33	0/1844	0.84	0/2509

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

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	1640	0	1691	49	0
2	B	161	0	163	5	0
3	A	30	0	0	0	0
3	B	3	0	0	1	0
All	All	1834	0	1854	49	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 13.

All (49) 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:28:HIS:HD2	1:A:55:SER:H	1.17	0.91

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:161:GLU:HB2	1:A:164:GLN:HE21	1.47	0.78
1:A:152:THR:OG1	2:B:331:SER:HB3	1.85	0.77
1:A:74:LEU:HB3	1:A:80:VAL:HG23	1.67	0.75
1:A:121:GLN:HG3	1:A:124:ARG:NH2	2.01	0.74
1:A:47:LYS:HA	1:A:47:LYS:HE3	1.70	0.74
1:A:121:GLN:HG3	1:A:124:ARG:HH21	1.53	0.73
1:A:28:HIS:CD2	1:A:55:SER:H	2.07	0.71
1:A:161:GLU:HB2	1:A:164:GLN:NE2	2.06	0.69
1:A:103:THR:OG1	1:A:198:LYS:HB2	1.94	0.67
1:A:50:VAL:HG13	1:A:51:PRO:HD2	1.78	0.65
1:A:19:LEU:HD23	1:A:75:LEU:HD22	1.80	0.64
1:A:43:GLN:NE2	1:A:45:ARG:HE	1.97	0.62
1:A:74:LEU:HB3	1:A:80:VAL:CG2	2.31	0.61
1:A:162:LYS:C	1:A:163:ILE:HD12	2.26	0.61
1:A:57:HIS:CE1	1:A:59:GLU:HB2	2.39	0.57
1:A:69:HIS:HA	1:A:72:LYS:HE3	1.89	0.55
1:A:187:ILE:HD12	1:A:187:ILE:N	2.22	0.54
1:A:43:GLN:CD	1:A:45:ARG:HE	2.16	0.53
1:A:163:ILE:HD12	1:A:163:ILE:N	2.23	0.53
1:A:74:LEU:CB	1:A:80:VAL:HG23	2.39	0.51
1:A:176:GLU:HA	1:A:179:VAL:HG22	1.94	0.50
1:A:152:THR:HG1	2:B:331:SER:HB3	1.75	0.50
1:A:175:ASP:O	1:A:179:VAL:HG22	2.12	0.49
1:A:166:ILE:HG22	1:A:167:LYS:HG2	1.94	0.49
1:A:50:VAL:CG1	1:A:51:PRO:HD2	2.43	0.48
1:A:151:HIS:CE1	2:B:333:PRO:HB3	2.49	0.48
1:A:175:ASP:OD1	1:A:177:GLN:HB3	2.15	0.46
1:A:74:LEU:CB	1:A:80:VAL:CG2	2.93	0.46
1:A:107:LEU:C	1:A:107:LEU:HD12	2.40	0.45
1:A:163:ILE:HG13	1:A:172:ILE:HG22	1.98	0.45
1:A:57:HIS:HE1	1:A:59:GLU:HB2	1.80	0.45
1:A:32:TYR:CD2	1:A:53:GLN:HG3	2.52	0.45
1:A:116:LEU:O	1:A:119:VAL:HG12	2.17	0.43
1:A:152:THR:O	2:B:330:SER:HB2	2.18	0.43
1:A:58:PRO:HG2	1:A:59:GLU:OE1	2.18	0.43
1:A:119:VAL:HG13	1:A:120:GLU:N	2.33	0.43
1:A:147:THR:HG23	3:B:402:HOH:O	2.19	0.43
1:A:147:THR:HG22	1:A:148:VAL:N	2.34	0.42
1:A:181:MET:HE2	1:A:206:ARG:HB2	2.00	0.42
1:A:181:MET:O	1:A:184:PRO:HD3	2.20	0.41
1:A:176:GLU:HA	1:A:179:VAL:CG2	2.49	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:50:VAL:HG21	1:A:124:ARG:HG3	2.02	0.41
1:A:93:ARG:HH11	1:A:206:ARG:NH2	2.18	0.41
1:A:19:LEU:HD21	1:A:102:ILE:HD13	2.01	0.41
1:A:19:LEU:HD23	1:A:75:LEU:CD2	2.48	0.41
1:A:122:LEU:C	1:A:122:LEU:HD23	2.46	0.41
1:A:149:LEU:HD11	1:A:179:VAL:HG12	2.02	0.41
1:A:174:ALA:HB3	2:B:333:PRO:HG2	2.02	0.40

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	197/211 (93%)	194 (98%)	2 (1%)	1 (0%)	24	10
2	B	20/29 (69%)	20 (100%)	0	0	100	100
All	All	217/240 (90%)	214 (99%)	2 (1%)	1 (0%)	24	10

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	112	SER

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	193/201 (96%)	190 (98%)	3 (2%)	55	33
2	B	18/24 (75%)	18 (100%)	0	100	100
All	All	211/225 (94%)	208 (99%)	3 (1%)	59	38

All (3) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	47	LYS
1	A	176	GLU
1	A	197	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	13	GLN
1	A	28	HIS
1	A	62	GLN
1	A	104	GLN
1	A	164	GLN
1	A	180	HIS
1	A	200	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 ⓘ

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	201/211 (95%)	0.97	40 (19%) 3 2	11, 21, 46, 62	0
2	B	22/29 (75%)	1.38	6 (27%) 1 1	14, 22, 32, 48	0
All	All	223/240 (92%)	1.01	46 (20%) 2 2	11, 21, 46, 62	0

All (46) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	330	SER	8.7
1	A	178	ASP	6.7
1	A	118	HIS	6.0
1	A	161	GLU	5.3
1	A	179	VAL	5.3
1	A	113	ASP	5.0
1	A	207	ALA	5.0
1	A	163	ILE	4.6
1	A	177	GLN	4.3
1	A	160	MET	4.2
1	A	59	GLU	4.1
2	B	351	ILE	3.8
1	A	139	HIS	3.7
1	A	182	HIS	3.6
1	A	93	ARG	3.6
1	A	120	GLU	3.6
1	A	180	HIS	3.5
1	A	175	ASP	3.5
1	A	162	LYS	3.4
1	A	117	SER	3.4
1	A	154	GLU	3.3
1	A	166	ILE	3.2
1	A	181	MET	3.2
2	B	344	SER	3.1

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Mol	Chain	Res	Type	RSRZ
1	A	114	SER	3.0
2	B	331	SER	3.0
1	A	19	LEU	2.9
1	A	176	GLU	2.9
2	B	343	VAL	2.9
1	A	134	ASP	2.9
1	A	91	GLU	2.9
1	A	121	GLN	2.8
1	A	206	ARG	2.8
1	A	50	VAL	2.7
1	A	195	ASP	2.7
1	A	90	LYS	2.6
1	A	72	LYS	2.5
2	B	345	PRO	2.5
1	A	115	LEU	2.4
1	A	49	ASN	2.4
1	A	119	VAL	2.4
1	A	92	HIS	2.4
1	A	142	PRO	2.3
1	A	112	SER	2.1
1	A	132	LYS	2.1
1	A	136	VAL	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.