wwPDB X-ray Structure Validation Summary Report (i)

Feb 1, 2016 – 05:14 AM GMT

PDB ID	:	2PY9
Title	:	Protein-RNA Interaction involving KH1 domain from Human Poly(C)-Binding Protein-2
Authors	:	James, T.L.; Du, Z.; Lee, J.K.
Deposited on	:	2007-05-15
Resolution	:	2.56 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
http://wwpdb.org/validation/2016/XrayValidationReportHelp
with specific help available everywhere you see the (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

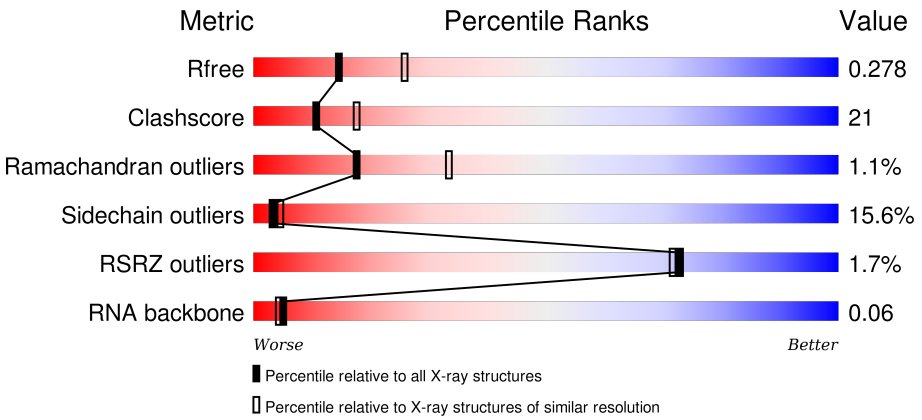
MolProbity	:	4.02b-467
Mogul	:	1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20026688
Percentile statistics	:	20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac	:	5.8.0135
CCP4	:	6.5.0
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	trunk26865

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 2.56 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}	91344	3324 (2.60-2.52)
Clashscore	102246	3729 (2.60-2.52)
Ramachandran outliers	100387	3673 (2.60-2.52)
Sidechain outliers	100360	3673 (2.60-2.52)
RSRZ outliers	91569	3333 (2.60-2.52)
RNA backbone	2183	1048 (3.00-2.12)

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 on the lower bar indicate the fraction of residues that contain outliers for >=3, 2, 1 and 0 types of geometric quality criteria. 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 <=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	E	12	8%, 50%, 50%
1	F	12	8%, 58%, 33%
2	A	73	%, 51%, 38%, •, 5%, •
2	B	73	%, 60%, 26%, 7%, • 5%

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Mol	Chain	Length	Quality of chain
2	C	73	% 60% 26% 8% 5%
2	D	73	% 59% 22% 7% 7% 5%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 2669 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 RNA chain called 12-mer C-rich strand of human telomeric RNA.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	E	12	245	112	42	80	11	0	0	0
1	F	12	245	112	42	80	11	0	0	0

- Molecule 2 is a protein called Poly(rC)-binding protein 2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	S	Se			
2	A	72	550	346	98	102	1	3	0	0	0
2	B	69	526	331	93	98	1	3	0	0	0
2	C	69	526	331	93	98	1	3	0	0	0
2	D	69	526	331	93	98	1	3	0	0	0

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	10	LYS	-	CLONING ARTIFACT	UNP Q15366
A	20	MSE	MET	MODIFIED RESIDUE	UNP Q15366
A	39	MSE	MET	MODIFIED RESIDUE	UNP Q15366
A	74	MSE	MET	MODIFIED RESIDUE	UNP Q15366
B	10	LYS	-	CLONING ARTIFACT	UNP Q15366
B	20	MSE	MET	MODIFIED RESIDUE	UNP Q15366
B	39	MSE	MET	MODIFIED RESIDUE	UNP Q15366
B	74	MSE	MET	MODIFIED RESIDUE	UNP Q15366
C	10	LYS	-	CLONING ARTIFACT	UNP Q15366
C	20	MSE	MET	MODIFIED RESIDUE	UNP Q15366
C	39	MSE	MET	MODIFIED RESIDUE	UNP Q15366
C	74	MSE	MET	MODIFIED RESIDUE	UNP Q15366
D	10	LYS	-	CLONING ARTIFACT	UNP Q15366

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Chain	Residue	Modelled	Actual	Comment	Reference
D	20	MSE	MET	MODIFIED RESIDUE	UNP Q15366
D	39	MSE	MET	MODIFIED RESIDUE	UNP Q15366
D	74	MSE	MET	MODIFIED RESIDUE	UNP Q15366

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	9	9	9	0	0
			Total	O		
3	B	14	14	14	0	0
			Total	O		
3	C	11	11	11	0	0
			Total	O		
3	D	10	10	10	0	0
			Total	O		
3	E	3	3	3	0	0
			Total	O		
3	F	4	4	4	0	0

3 Residue-property plots (i)

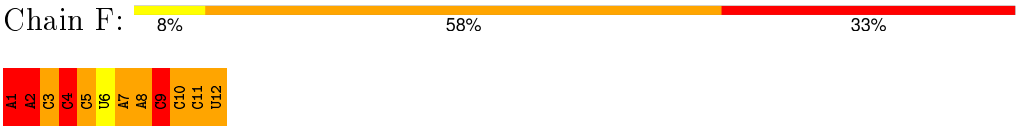
These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according 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: 12-mer C-rich strand of human telomeric RNA

Chain E:

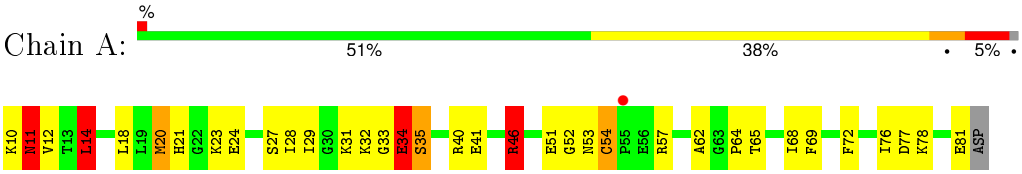
- Molecule 1: 12-mer C-rich strand of human telomeric RNA

Chain F:



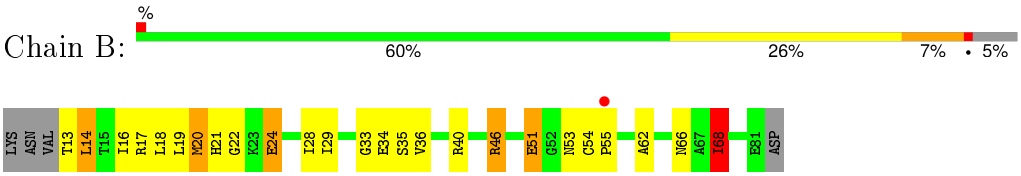
- Molecule 2: Poly(rC)-binding protein 2

Chain A:



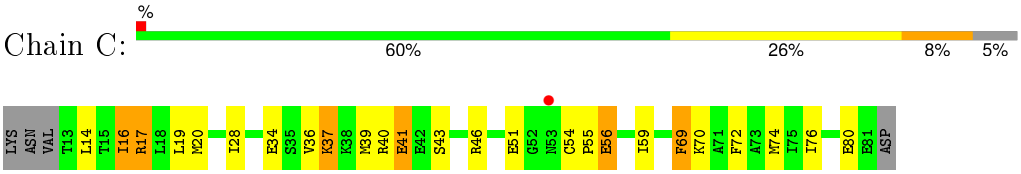
- Molecule 2: Poly(rC)-binding protein 2

Chain B:



- Molecule 2: Poly(rC)-binding protein 2

Chain C:



- Molecule 2: Poly(rC)-binding protein 2

Chain D:

LYS
ASN
VAL
T13
L14
T15
I16
R17
L18
L19
M20
H21
E24
G33
K37
K38
M39
R40
E41
R46
E51
G52
N53
C54
P55
E56
T65
F69
F72
A73
M74
I75
I76
D77
K78
E81
ASP

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α, β, γ	92.01Å 58.70Å 71.50Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.00 – 2.56 71.50 – 2.56	Depositor EDS
% Data completeness (in resolution range)	94.2 (40.00-2.56) 94.2 (71.50-2.56)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	0.10	Depositor
$< I/\sigma(I) >$ [1]	3.11 (at 2.55Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, R_{free}	0.218 , 0.269 0.236 , 0.278	Depositor DCC
R_{free} test set	591 reflections (5.07%)	DCC
Wilson B-factor (Å^2)	52.1	Xtriage
Anisotropy	0.279	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 32.5	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Outliers	0 of 12252 reflections	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	2669	wwPDB-VP
Average B, all atoms (Å^2)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 15.59% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ for acentric reflections are 0.5, 0.375 respectively for untwinned datasets, and 0.333, 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	E	2.45	12/272 (4.4%)	4.09	88/420 (21.0%)
1	F	2.48	17/272 (6.2%)	3.83	72/420 (17.1%)
2	A	1.66	8/551 (1.5%)	1.46	10/729 (1.4%)
2	B	1.48	3/527 (0.6%)	1.53	6/697 (0.9%)
2	C	1.41	5/527 (0.9%)	1.49	8/697 (1.1%)
2	D	1.52	6/527 (1.1%)	1.49	7/697 (1.0%)
All	All	1.75	51/2676 (1.9%)	2.31	191/3660 (5.2%)

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
2	D	0	2

The worst 5 of 51 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	54	CYS	CB-SG	-10.44	1.64	1.82
2	D	51	GLU	CB-CG	-9.70	1.33	1.52
1	F	8	A	N9-C4	9.40	1.43	1.37
2	A	41	GLU	CG-CD	8.82	1.65	1.51
1	E	2	A	P-O5'	8.63	1.68	1.59

The worst 5 of 191 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	E	10	C	O5'-P-OP2	-18.63	88.34	110.70
1	F	4	C	O4'-C1'-N1	15.28	120.42	108.20
1	E	10	C	O4'-C1'-C2'	-14.44	91.36	105.80
2	B	46	ARG	NE-CZ-NH1	13.51	127.05	120.30
1	F	11	C	O4'-C1'-N1	13.32	118.86	108.20

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	D	52	GLY	Peptide
2	D	53	ASN	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	E	245	0	132	10	0
1	F	245	0	132	9	0
2	A	550	0	588	30	0
2	B	526	0	560	21	0
2	C	526	0	560	27	0
2	D	526	0	560	24	0
3	A	9	0	0	3	0
3	B	14	0	0	1	0
3	C	11	0	0	3	0
3	D	10	0	0	2	0
3	E	3	0	0	0	0
3	F	4	0	0	0	0
All	All	2669	0	2532	109	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 21.

The worst 5 of 109 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:A:46:ARG:CG	2:A:46:ARG:HH11	1.64	1.10
2:A:46:ARG:HG2	2:A:46:ARG:HH11	0.87	1.03
2:C:56:GLU:HB3	3:C:86:HOH:O	1.57	1.02
2:A:46:ARG:HG2	2:A:46:ARG:NH1	1.65	1.00
2:A:18:LEU:HD23	2:B:18:LEU:HD23	1.45	0.97

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
2	A	70/73 (96%)	63 (90%)	5 (7%)	2 (3%)	6 8
2	B	67/73 (92%)	64 (96%)	3 (4%)	0	100 100
2	C	67/73 (92%)	63 (94%)	4 (6%)	0	100 100
2	D	67/73 (92%)	60 (90%)	6 (9%)	1 (2%)	13 24
All	All	271/292 (93%)	250 (92%)	18 (7%)	3 (1%)	17 33

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	D	52	GLY
2	A	11	ASN
2	A	65	THR

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
2	A	60/58 (103%)	51 (85%)	9 (15%)	3 5
2	B	57/58 (98%)	47 (82%)	10 (18%)	2 3
2	C	57/58 (98%)	51 (90%)	6 (10%)	8 14
2	D	57/58 (98%)	46 (81%)	11 (19%)	2 2
All	All	231/232 (100%)	195 (84%)	36 (16%)	3 4

5 of 36 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	53	ASN
2	C	17	ARG
2	D	53	ASN
2	B	68	ILE
2	C	37	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
2	A	11	ASN
2	B	53	ASN
2	B	66	ASN
2	D	53	ASN

5.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	E	12/12 (100%)	8 (66%)	3 (25%)
1	F	12/12 (100%)	5 (41%)	2 (16%)
All	All	24/24 (100%)	13 (54%)	5 (20%)

5 of 13 RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	E	2	A
1	E	3	C
1	E	4	C
1	E	5	C
1	E	7	A

All (5) RNA pucker outliers are listed below:

Mol	Chain	Res	Type
1	E	1	A
1	E	2	A
1	E	3	C
1	F	1	A
1	F	9	C

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 carbohydrates 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	E	12/12 (100%)	0.23	1 (8%)	14	12	39, 52, 76, 81	0
1	F	12/12 (100%)	-0.06	0	100	100	44, 48, 63, 82	0
2	A	69/73 (94%)	0.07	1 (1%)	78	77	18, 31, 47, 56	0
2	B	66/73 (90%)	-0.00	1 (1%)	76	75	19, 31, 46, 60	0
2	C	66/73 (90%)	0.08	1 (1%)	76	75	21, 33, 49, 57	0
2	D	66/73 (90%)	0.16	1 (1%)	76	75	23, 34, 49, 63	0
All	All	291/316 (92%)	0.08	5 (1%)	73	71	18, 33, 53, 82	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	D	53	ASN	5.9
1	E	1	A	3.1
2	A	55	PRO	2.5
2	B	55	PRO	2.3
2	C	53	ASN	2.1

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 carbohydrates 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.