Full wwPDB X-ray Structure Validation Report (i)

Nov 1, 2023 – 02:01 PM JST

PDB ID	:	5I9F
Title	:	Crystal structure of designed pentatricopeptide repeat protein dPPR-U10 in complex with its target RNA U10
Authors	:	Shen, C.; Zhang, D.; Guan, Z.; Zou, T.; Yin, Y.
Deposited on	:	2016-02-20
Resolution	:	2.19 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 (i) 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 (1)) were used in the production of this report:

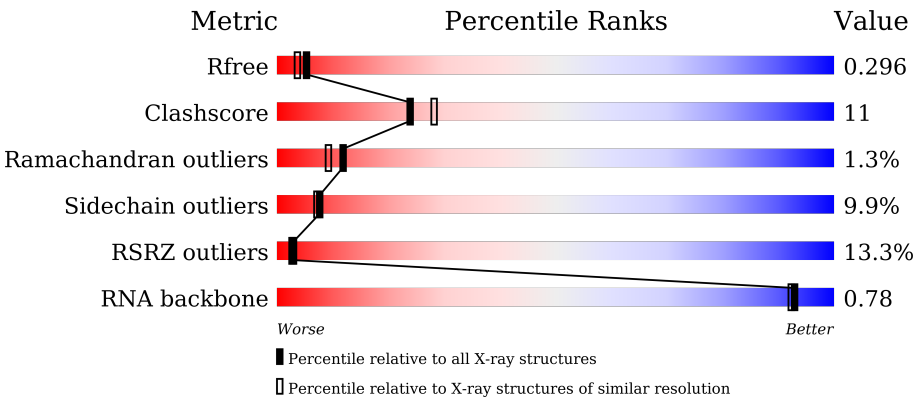
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.19 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}	130704	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)
RNA backbone	3102	1032 (2.60-1.80)

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 <=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	460	12%; 62%; 20%; •; 16%
2	F	18	39%; 22%; 39%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 3270 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 pentatricopeptide repeat protein dPPR-U10.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	388	2990	1924	462	583	21	0	0	0

- Molecule 2 is a RNA chain called RNA (5'-R(*GP*GP*GP*GP*UP*UP*UP*UP*UP*UP*UP*UP*UP*UP*CP*CP*CP*C)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	F	11	204	90	20	83	11	0	0	0

- Molecule 3 is water.

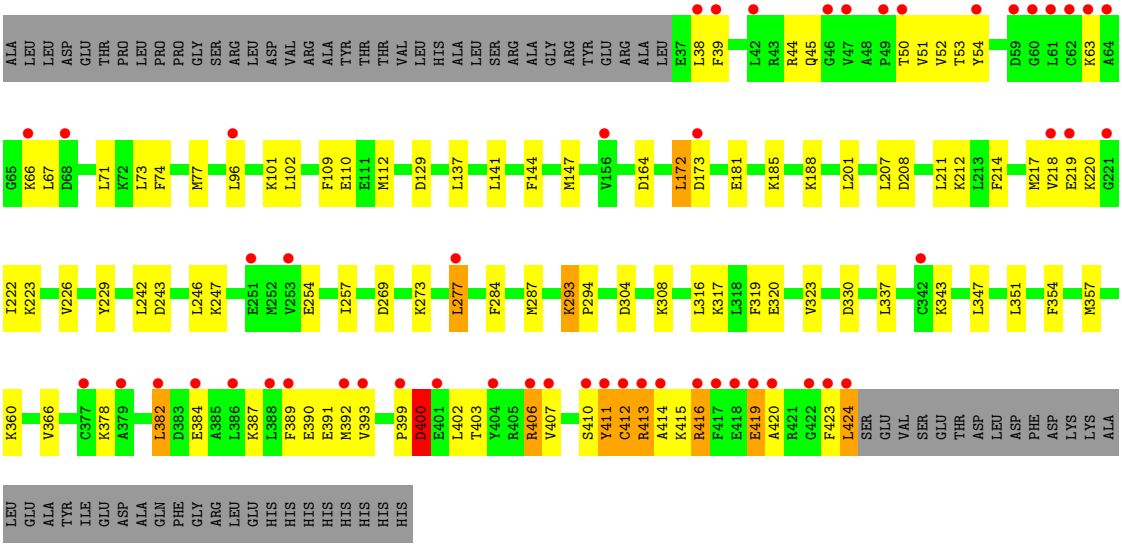
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
3	A	62	62	62	0	0
			Total	O		
3	F	14	14	14	0	0

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.

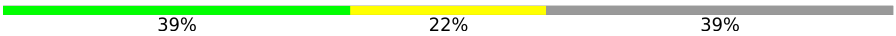
• Molecule 1: pentatricopeptide repeat protein dPPR-U10

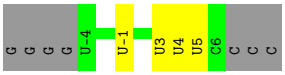
Chain A:



• Molecule 2: RNA (5'-R(*GP*GP*GP*GP*UP*UP*UP*UP*UP*UP*UP*UP*UP*UP*CP*CP*CP*C)-3')

Chain F:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	52.73Å 85.27Å 95.10Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.90 – 2.19 38.90 – 2.19	Depositor EDS
% Data completeness (in resolution range)	98.6 (38.90-2.19) 91.0 (38.90-2.19)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.02 (at 2.20Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.250 , 0.299 0.251 , 0.296	Depositor DCC
R_{free} test set	1089 reflections (4.89%)	wwPDB-VP
Wilson B-factor (Å^2)	40.1	Xtriage
Anisotropy	0.490	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.41 , 67.5	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	3270	wwPDB-VP
Average B, all atoms (Å^2)	55.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 12.04% 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, 0.333 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	0.55	0/3025	0.61	0/4071
2	F	1.19	3/223 (1.3%)	1.18	1/343 (0.3%)
All	All	0.62	3/3248 (0.1%)	0.67	1/4414 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	F	3	U	O3'-P	-5.99	1.53	1.61
2	F	4	U	O3'-P	-5.98	1.53	1.61
2	F	5	U	O3'-P	-5.62	1.54	1.61

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	F	-1	U	OP1-P-OP2	5.03	127.14	119.60

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	2990	0	3082	71	0
2	F	204	0	100	0	0
3	A	62	0	0	11	0
3	F	14	0	0	0	0
All	All	3270	0	3182	71	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 11.

All (71) 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:399:PRO:O	1:A:403:THR:OG1	1.87	0.93
1:A:420:ALA:O	1:A:424:LEU:CD2	2.20	0.89
1:A:420:ALA:O	1:A:424:LEU:HD21	1.72	0.86
1:A:391:GLU:OE2	3:A:501:HOH:O	1.94	0.85
1:A:44:ARG:HH11	1:A:44:ARG:HG3	1.46	0.80
1:A:101:LYS:NZ	3:A:504:HOH:O	2.15	0.79
1:A:378:LYS:NZ	3:A:505:HOH:O	2.15	0.78
1:A:330:ASP:OD2	3:A:502:HOH:O	2.01	0.77
1:A:416:ARG:HB2	1:A:419:GLU:HB2	1.71	0.72
1:A:44:ARG:HG3	1:A:44:ARG:NH1	2.01	0.71
1:A:424:LEU:N	1:A:424:LEU:HD23	2.06	0.70
1:A:407:VAL:HG21	1:A:423:PHE:CZ	2.27	0.69
1:A:390:GLU:OE2	3:A:503:HOH:O	2.10	0.69
1:A:67:LEU:HD21	1:A:96:LEU:HD23	1.74	0.68
1:A:411:TYR:HB3	1:A:420:ALA:HB2	1.76	0.67
1:A:343:LYS:NZ	3:A:510:HOH:O	2.30	0.64
1:A:403:THR:O	1:A:407:VAL:HG22	2.02	0.60
1:A:304:ASP:OD2	3:A:506:HOH:O	2.17	0.57
1:A:389:PHE:HE1	1:A:399:PRO:HB3	1.69	0.57
1:A:129:ASP:OD2	3:A:507:HOH:O	2.17	0.57
1:A:243:ASP:O	1:A:247:LYS:HG2	2.04	0.57
1:A:412:CYS:O	1:A:414:ALA:N	2.38	0.57
1:A:308:LYS:NZ	3:A:512:HOH:O	2.38	0.56
1:A:414:ALA:N	1:A:415:LYS:HA	2.21	0.54
1:A:172:LEU:HD11	1:A:201:LEU:HD23	1.91	0.53
1:A:420:ALA:O	1:A:424:LEU:HD23	2.08	0.53
1:A:382:LEU:H	1:A:382:LEU:HD13	1.73	0.53
1:A:44:ARG:HH11	1:A:44:ARG:CG	2.17	0.51
1:A:219:GLU:OE2	3:A:508:HOH:O	2.18	0.51
1:A:412:CYS:O	1:A:415:LYS:HA	2.11	0.51
1:A:389:PHE:O	1:A:393:VAL:HG23	2.11	0.50
1:A:284:PHE:O	1:A:287:MET:HG2	2.10	0.50
1:A:414:ALA:HB3	1:A:415:LYS:HA	1.94	0.49
1:A:164:ASP:OD2	3:A:509:HOH:O	2.20	0.48
1:A:214:PHE:O	1:A:217:MET:HG2	2.13	0.48
1:A:319:PHE:O	1:A:323:VAL:HG23	2.14	0.48
1:A:392:MET:CE	1:A:399:PRO:HA	2.44	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:414:ALA:H	1:A:415:LYS:HA	1.78	0.48
1:A:214:PHE:O	1:A:218:VAL:HG23	2.14	0.47
1:A:354:PHE:O	1:A:357:MET:HB3	2.13	0.47
1:A:71:LEU:O	1:A:74:PHE:HB3	2.14	0.47
1:A:414:ALA:H	1:A:415:LYS:CA	2.28	0.46
1:A:384:GLU:HA	1:A:387:LYS:HE2	1.98	0.46
1:A:50:THR:HG23	1:A:52:VAL:N	2.31	0.45
1:A:229:TYR:CE2	1:A:257:ILE:HD12	2.51	0.45
1:A:366:VAL:HG21	1:A:400:ASP:HB3	1.98	0.45
1:A:181:GLU:O	1:A:185:LYS:HG2	2.17	0.45
1:A:50:THR:HG23	1:A:52:VAL:H	1.83	0.44
1:A:293:LYS:HD2	1:A:294:PRO:O	2.18	0.44
1:A:218:VAL:C	1:A:220:LYS:H	2.21	0.43
1:A:54:TYR:CD1	1:A:77:MET:HB3	2.53	0.43
1:A:392:MET:HE1	1:A:399:PRO:HA	2.00	0.43
1:A:399:PRO:O	1:A:403:THR:CB	2.66	0.43
1:A:277:LEU:H	1:A:277:LEU:HG	1.48	0.43
1:A:109:PHE:O	1:A:112:MET:HG2	2.19	0.42
1:A:50:THR:HG22	1:A:53:THR:OG1	2.18	0.42
1:A:269:ASP:OD1	1:A:273:LYS:NZ	2.41	0.42
1:A:402:LEU:O	1:A:406:ARG:HB2	2.20	0.42
1:A:246:LEU:HD23	1:A:246:LEU:HA	1.88	0.42
1:A:407:VAL:HG21	1:A:423:PHE:CE1	2.54	0.42
1:A:208:ASP:O	1:A:212:LYS:HG3	2.20	0.42
1:A:293:LYS:HE3	1:A:293:LYS:HB3	1.87	0.41
1:A:144:PHE:O	1:A:147:MET:HG2	2.20	0.41
1:A:38:LEU:HD12	1:A:38:LEU:HA	1.93	0.41
1:A:211:LEU:HD23	1:A:211:LEU:HA	1.87	0.41
1:A:351:LEU:HD23	1:A:351:LEU:HA	1.80	0.41
1:A:414:ALA:N	1:A:415:LYS:CA	2.84	0.41
1:A:423:PHE:CD1	1:A:423:PHE:C	2.94	0.41
1:A:137:LEU:O	1:A:141:LEU:HG	2.21	0.40
1:A:389:PHE:CD2	1:A:423:PHE:HE2	2.39	0.40
1:A:424:LEU:CD2	1:A:424:LEU:N	2.75	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	386/460 (84%)	361 (94%)	20 (5%)	5 (1%)	12 9

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	45	GLN
1	A	66	LYS
1	A	400	ASP
1	A	412	CYS
1	A	413	ARG

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	324/393 (82%)	292 (90%)	32 (10%)	8 7

All (32) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	39	PHE
1	A	51	VAL
1	A	63	LYS
1	A	73	LEU
1	A	102	LEU
1	A	110	GLU

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Mol	Chain	Res	Type
1	A	172	LEU
1	A	173	ASP
1	A	188	LYS
1	A	207	LEU
1	A	222	ILE
1	A	223	LYS
1	A	226	VAL
1	A	242	LEU
1	A	254	GLU
1	A	277	LEU
1	A	293	LYS
1	A	316	LEU
1	A	317	LYS
1	A	320	GLU
1	A	337	LEU
1	A	347	LEU
1	A	360	LYS
1	A	382	LEU
1	A	400	ASP
1	A	406	ARG
1	A	410	SER
1	A	411	TYR
1	A	413	ARG
1	A	416	ARG
1	A	419	GLU
1	A	424	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA (i)

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
2	F	9/18 (50%)	0	0

There are no RNA backbone outliers to report.

There are no RNA pucker outliers to report.

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 monosaccharides 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	388/460 (84%)	0.89	53 (13%) 3 2	34, 53, 86, 107	0
2	F	11/18 (61%)	-0.39	0 100 100	38, 40, 60, 77	1 (9%)
All	All	399/478 (83%)	0.86	53 (13%) 3 3	34, 53, 86, 107	1 (0%)

All (53) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	423	PHE	9.2
1	A	424	LEU	7.7
1	A	46	GLY	7.2
1	A	382	LEU	6.5
1	A	418	GLU	6.2
1	A	416	ARG	4.5
1	A	47	VAL	4.5
1	A	414	ALA	4.3
1	A	386	LEU	4.2
1	A	393	VAL	4.1
1	A	407	VAL	4.1
1	A	39	PHE	3.9
1	A	422	GLY	3.8
1	A	389	PHE	3.6
1	A	411	TYR	3.6
1	A	64	ALA	3.6
1	A	96	LEU	3.5
1	A	401	GLU	3.4
1	A	419	GLU	3.4
1	A	410	SER	3.4
1	A	218	VAL	3.2
1	A	42	LEU	3.1
1	A	392	MET	3.0
1	A	66	LYS	3.0

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Mol	Chain	Res	Type	RSRZ
1	A	221	GLY	2.9
1	A	417	PHE	2.8
1	A	38	LEU	2.8
1	A	420	ALA	2.7
1	A	413	ARG	2.6
1	A	388	LEU	2.6
1	A	342	CYS	2.6
1	A	68	ASP	2.6
1	A	384	GLU	2.6
1	A	62	CYS	2.6
1	A	404	TYR	2.5
1	A	173	ASP	2.5
1	A	49	PRO	2.4
1	A	63	LYS	2.4
1	A	253	VAL	2.4
1	A	50	THR	2.4
1	A	251	GLU	2.4
1	A	277	LEU	2.3
1	A	59	ASP	2.2
1	A	406	ARG	2.2
1	A	412	CYS	2.2
1	A	399	PRO	2.2
1	A	219	GLU	2.2
1	A	156	VAL	2.1
1	A	54	TYR	2.1
1	A	379	ALA	2.1
1	A	377	CYS	2.1
1	A	60	GLY	2.1
1	A	61	LEU	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 monosaccharides 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.