wwPDB X-ray Structure Validation Summary Report (i)

Jun 16, 2024 – 09:59 PM EDT

PDB ID	:	5NW5
Title	:	Crystal structure of the Rif1 N-terminal domain (RIF1-NTD) from Saccharomyces cerevisiae in complex with DNA
Authors	:	Bunker, R.D.; Reinert, J.K.; Shi, T.; Thoma, N.H.
Deposited on	:	2017-05-05
Resolution	:	6.50 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 (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:

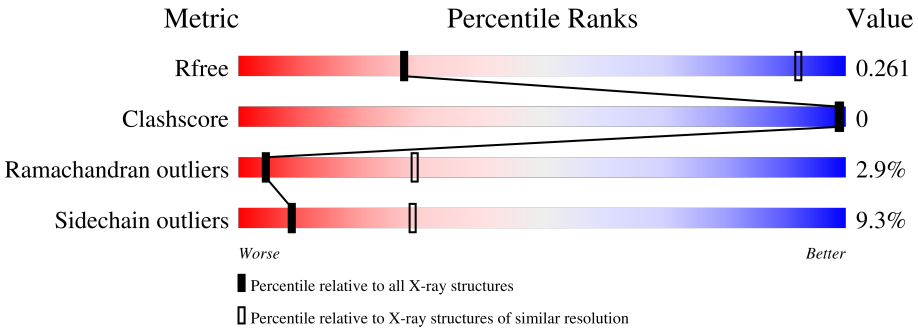
MolProbity	:	4.02b-467
Xtriage (Phenix)	:	1.13
EDS	:	2.37.1
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.37.1

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 6.50 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	1000 (9.00-3.90)
Clashscore	141614	1064 (9.00-3.90)
Ramachandran outliers	138981	1012 (9.00-3.88)
Sidechain outliers	138945	1010 (9.00-3.84)

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%

Mol	Chain	Length	Quality of chain
1	A	1226	76% 12% • 12%
1	B	1226	76% 11% • 12%
2	C	30	67% 33%
3	D	30	63% 37%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 37748 atoms, of which 18886 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 Telomere length regulator protein RIF1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	1085	Total	C	H	N	O	S	0	0	0
			17916	5717	9096	1455	1614	34			
1	B	1085	Total	C	H	N	O	S	0	0	0
			17914	5717	9096	1453	1614	34			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	96	GLY	-	expression tag	UNP P29539
A	97	GLY	-	expression tag	UNP P29539
A	98	GLY	-	expression tag	UNP P29539
A	99	ARG	-	expression tag	UNP P29539
B	96	GLY	-	expression tag	UNP P29539
B	97	GLY	-	expression tag	UNP P29539
B	98	GLY	-	expression tag	UNP P29539
B	99	ARG	-	expression tag	UNP P29539

- Molecule 2 is a DNA chain called DNA (60-MER).

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	C	30	Total	C	H	N	O	P	0	0	0
			959	300	332	150	148	29			

- Molecule 3 is a DNA chain called DNA (30-MER).

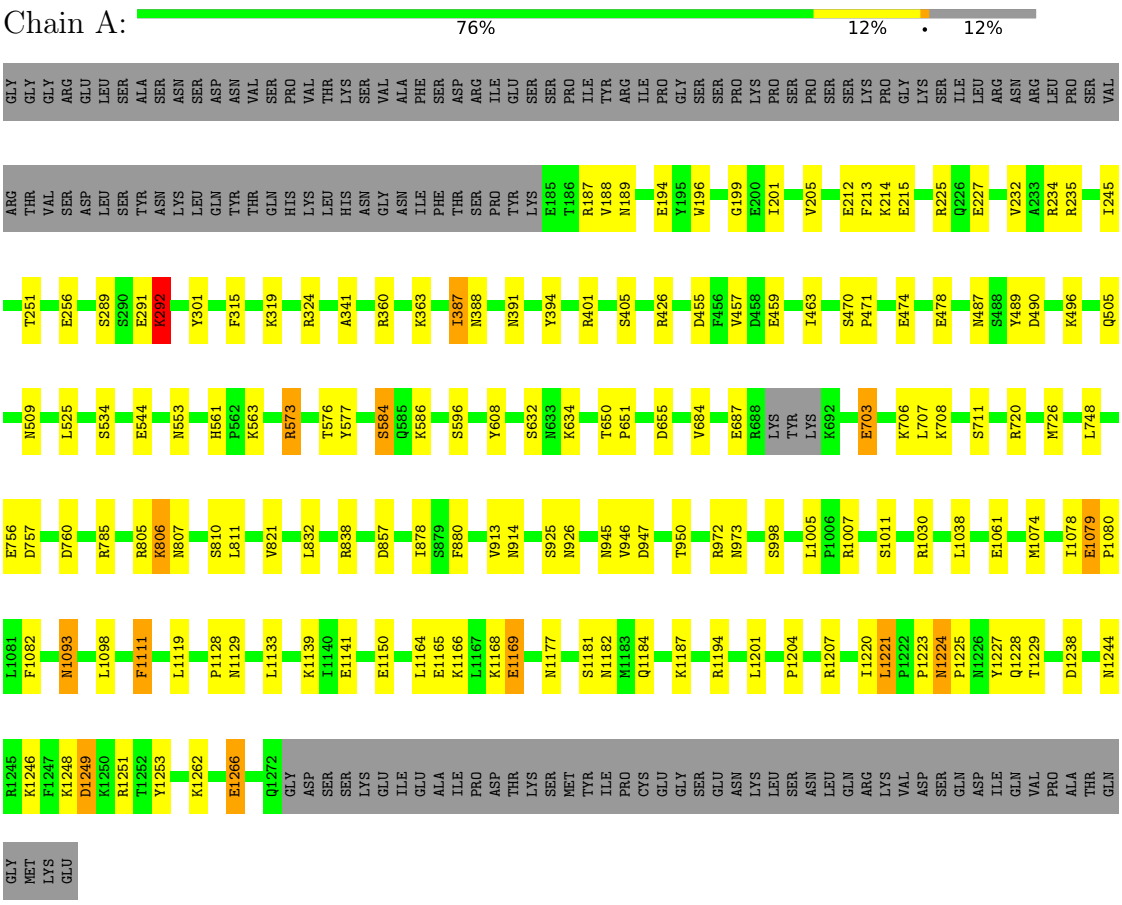
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	D	30	Total	C	H	N	O	P	0	0	0
			959	300	362	60	208	29			

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. 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. 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.

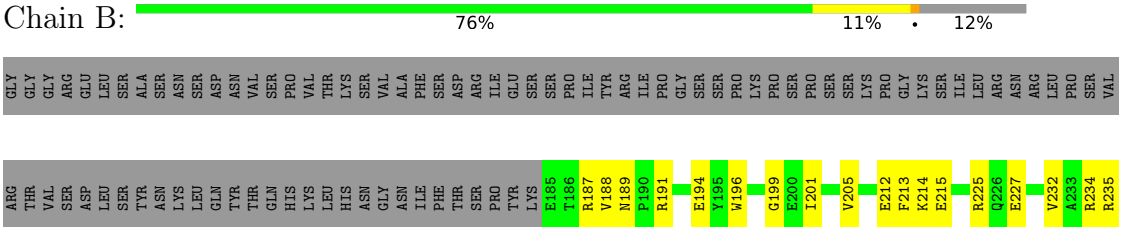
• Molecule 1: Telomere length regulator protein RIF1

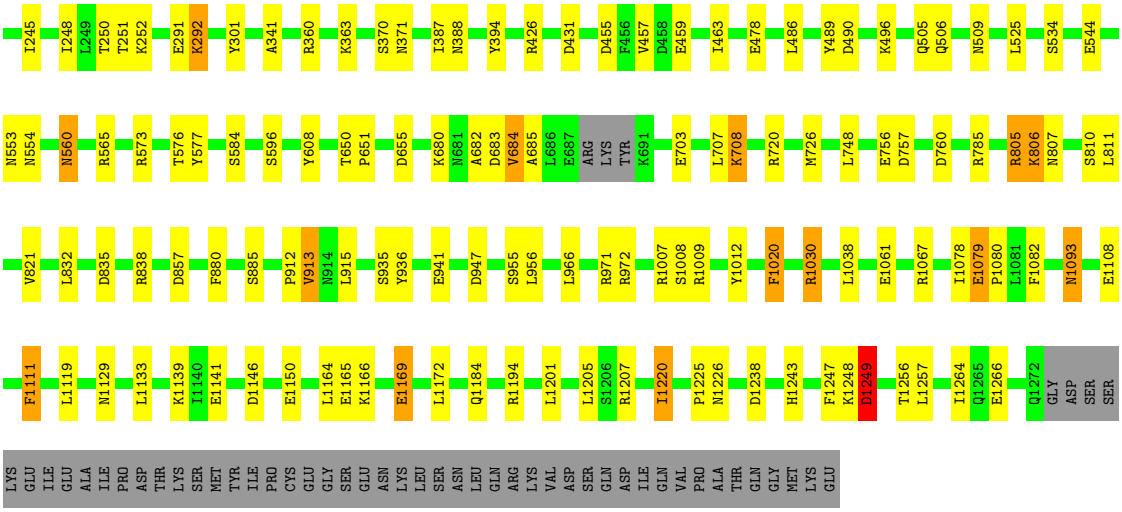
Chain A:



• Molecule 1: Telomere length regulator protein RIF1

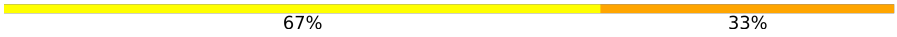
Chain B:





• Molecule 2: DNA (60-MER)

Chain C:



• Molecule 3: DNA (30-MER)

Chain D:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	92.14Å 169.80Å 390.16Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	43.23 – 6.50 43.23 – 6.50	Depositor EDS
% Data completeness (in resolution range)	70.2 (43.23-6.50) 70.2 (43.23-6.50)	Depositor EDS
R_{merge}	0.34	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.59 (at 6.66Å)	Xtriage
Refinement program	PHENIX (dev_2205: AMBER)	Depositor
R, R_{free}	0.253 , 0.277 0.254 , 0.261	Depositor DCC
R_{free} test set	622 reflections (7.01%)	wwPDB-VP
Wilson B-factor (Å^2)	388.4	Xtriage
Anisotropy	0.395	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.29 , 268.0	EDS
L-test for twinning[2]	$< \|L\| > = 0.36$, $< L^2 > = 0.19$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.82	EDS
Total number of atoms	37748	wwPDB-VP
Average B, all atoms (Å^2)	327.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.43% 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	0.74	0/8995	1.05	21/12178 (0.2%)
1	B	0.74	0/8993	1.05	23/12175 (0.2%)
2	C	1.68	1/716 (0.1%)	3.04	114/1102 (10.3%)
3	D	1.94	5/656 (0.8%)	2.54	48/1012 (4.7%)
All	All	0.86	6/19360 (0.0%)	1.28	206/26467 (0.8%)

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	8
1	B	0	6
2	C	0	10
3	D	0	11
All	All	0	35

The worst 5 of 6 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	26	DA	N7-C5	5.64	1.42	1.39
3	D	28	DT	C5-C7	5.30	1.53	1.50
3	D	12	DT	C5-C7	5.15	1.53	1.50
3	D	14	DT	C5-C7	5.14	1.53	1.50
3	D	20	DT	C5-C7	5.02	1.53	1.50

The worst 5 of 206 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	26	DA	N1-C6-N6	-14.64	109.82	118.60
2	C	25	DA	N1-C6-N6	-11.64	111.62	118.60
2	C	5	DA	N1-C6-N6	-11.63	111.62	118.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	C	7	DA	N1-C6-N6	-11.21	111.87	118.60
2	C	13	DA	N1-C6-N6	-11.04	111.98	118.60

There are no chirality outliers.

5 of 35 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	196	TRP	Peptide
1	A	301	TYR	Sidechain
1	A	394	TYR	Sidechain
1	A	561	HIS	Sidechain
1	A	573	ARG	Sidechain

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	8820	9096	9094	11	0
1	B	8818	9096	9094	5	0
2	C	627	332	332	0	0
3	D	597	362	362	0	0
All	All	18862	18886	18882	16	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 0.

The worst 5 of 16 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:1224:ASN:H	1:A:1225:PRO:HD3	1.80	0.47
1:A:703:GLU:OE1	1:A:706:LYS:HE3	2.15	0.47
1:A:1111:PHE:CG	1:A:1139:LYS:HE3	2.50	0.46
1:A:584:SER:OG	1:A:586:LYS:HE2	2.17	0.44
1:A:650:THR:HB	1:A:651:PRO:HD3	2.00	0.44

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	1081/1226 (88%)	930 (86%)	120 (11%)	31 (3%)	4 29
1	B	1081/1226 (88%)	924 (86%)	125 (12%)	32 (3%)	4 28
All	All	2162/2452 (88%)	1854 (86%)	245 (11%)	63 (3%)	4 29

5 of 63 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	227	GLU
1	A	391	ASN
1	A	457	VAL
1	A	806	LYS
1	A	913	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	1020/1148 (89%)	926 (91%)	94 (9%)	9 29
1	B	1020/1148 (89%)	925 (91%)	95 (9%)	9 29
All	All	2040/2296 (89%)	1851 (91%)	189 (9%)	9 29

5 of 189 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	490	ASP

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Mol	Chain	Res	Type
1	B	821	VAL
1	B	509	ASN
1	B	680	LYS
1	B	935	SER

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

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 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

6.1 Protein, DNA and RNA chains

Unable to reproduce the depositors R factor - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

Unable to reproduce the depositors R factor - this section is therefore empty.

6.3 Carbohydrates

Unable to reproduce the depositors R factor - this section is therefore empty.

6.4 Ligands

Unable to reproduce the depositors R factor - this section is therefore empty.

6.5 Other polymers

Unable to reproduce the depositors R factor - this section is therefore empty.