



Full wwPDB X-ray Structure Validation Report ⓘ

Oct 9, 2023 – 10:31 PM EDT

PDB ID : 7R9G
Title : Catalytically inactive yeast Pseudouridine Synthase, PUS1, bound to RNA
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Deposited on : 2021-06-29
Resolution : 2.40 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtrriage (Phenix) : 1.13
EDS : 2.35.1
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) : 2.35.1

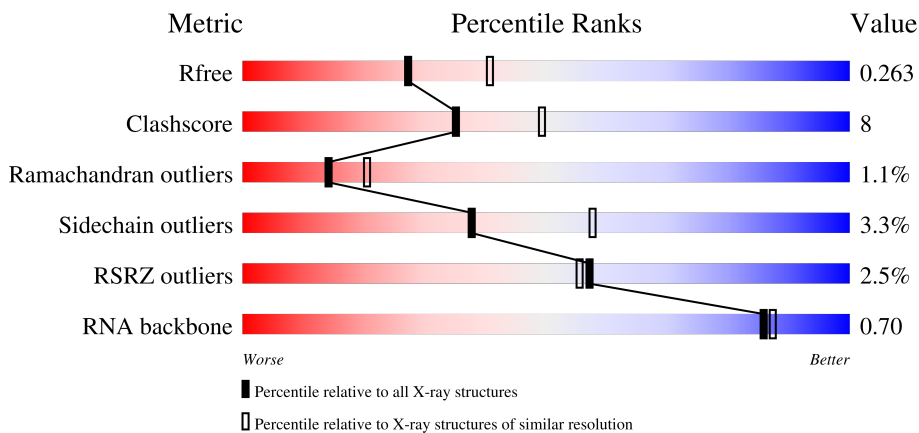
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)
RNA backbone	3102	1174 (2.80-2.00)

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	544	 2% 57% 13% 29%
2	B	18	 50% 17% 33%

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 3241 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 tRNA pseudouridine synthase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	386	2931	1887	481	548	15	0	1	0

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	134	ALA	ASP	engineered mutation	UNP Q12211

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

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	B	12	254	115	47	81	11	0	0	0

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total O S 5 4 1	0	0

- Molecule 4 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total Cl 1 1	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	47	Total O 47 47	0	0
5	B	3	Total O 3 3	0	0

4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	104.19Å 98.34Å 72.24Å 90.00° 102.80° 90.00°	Depositor
Resolution (Å)	49.17 – 2.40 49.17 – 2.40	Depositor EDS
% Data completeness (in resolution range)	99.5 (49.17-2.40) 94.1 (49.17-2.40)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.98 (at 2.39Å)	Xtrriage
Refinement program	PHENIX 1.18	Depositor
R, R_{free}	0.222 , 0.264 0.224 , 0.263	Depositor DCC
R_{free} test set	1993 reflections (7.21%)	wwPDB-VP
Wilson B-factor (Å ²)	50.2	Xtrriage
Anisotropy	0.465	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 55.9	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	3241	wwPDB-VP
Average B, all atoms (Å ²)	65.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.39% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: SO4, CL

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	0.67	0/2995	0.57	0/4053
2	B	0.26	0/284	0.81	0/441
All	All	0.64	0/3279	0.60	0/4494

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	2931	0	2677	48	0
2	B	254	0	131	1	0
3	A	5	0	0	1	0
4	A	1	0	0	0	0
5	A	47	0	0	1	0
5	B	3	0	0	0	0
All	All	3241	0	2808	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 8.

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:428:GLN:NE2	1:A:432:ASP:OD2	1.72	1.22
1:A:223:LEU:HD13	1:A:491:THR:HG22	1.36	1.04
1:A:380:ARG:NH1	1:A:490:LEU:O	1.91	1.03
1:A:101:GLU:OE2	1:A:129:ARG:HD3	1.59	1.01
1:A:80:MET:CE	1:A:171:ASP:HB3	2.10	0.82
1:A:80:MET:HE3	1:A:171:ASP:HB3	1.65	0.77
1:A:101:GLU:OE2	1:A:129:ARG:CD	2.32	0.75
1:A:246:THR:HA	1:A:248:GLU:HG2	1.74	0.69
1:A:344:THR:HG23	1:A:346:TRP:HE1	1.64	0.62
1:A:280:GLU:OE1	1:A:284:ARG:NH2	2.32	0.62
1:A:223:LEU:CD1	1:A:491:THR:HG22	2.23	0.60
1:A:101:GLU:OE2	1:A:129:ARG:CG	2.50	0.59
1:A:196:THR:OG1	1:A:345:GLU:HB3	2.06	0.56
1:A:248:GLU:OE2	1:A:248:GLU:HA	2.06	0.55
1:A:267:GLU:HG3	1:A:270:TYR:H	1.72	0.53
1:A:89:HIS:HA	1:A:135:LYS:HG3	1.91	0.52
1:A:296:LYS:NZ	1:A:376:CYS:O	2.33	0.52
1:A:326:ARG:NH1	1:A:355:SER:OG	2.43	0.52
1:A:171:ASP:OD1	1:A:172:ILE:N	2.42	0.51
2:B:8:G:H2'	2:B:9:A:C8	2.46	0.51
1:A:128:MET:HE1	1:A:180:ASP:HA	1.93	0.50
1:A:215:SER:HB3	1:A:491:THR:HG23	1.94	0.50
1:A:198:SER:HB3	1:A:457:PHE:CE2	2.47	0.50
1:A:215:SER:HB3	1:A:491:THR:CG2	2.41	0.50
1:A:298:ARG:HG2	1:A:333:VAL:HB	1.95	0.49
1:A:318:ASP:HB3	1:A:321:GLU:HG3	1.94	0.49
1:A:305:LEU:O	1:A:308:HIS:NE2	2.42	0.47
1:A:456:PHE:CZ	1:A:460:ILE:HD11	2.49	0.47
1:A:143:LEU:HD23	1:A:181:CYS:SG	2.56	0.46
1:A:108:PHE:HB3	1:A:114:ILE:HG12	1.97	0.46
1:A:296:LYS:HG2	1:A:372:THR:HG23	1.97	0.46
1:A:398:LEU:HD11	1:A:443:ILE:HA	1.97	0.46
1:A:340:GLY:HA3	1:A:444[A]:TYR:CE1	2.51	0.45
1:A:269:LEU:HD12	1:A:269:LEU:HA	1.50	0.45
1:A:97:ASN:HA	1:A:98:PRO:HD3	1.82	0.45
1:A:155:ILE:O	1:A:159:ILE:HG13	2.17	0.45
1:A:429:ASP:OD1	1:A:430:GLU:N	2.50	0.45
1:A:431:VAL:HG12	1:A:435:LYS:HG3	1.98	0.44
1:A:451:ASN:ND2	5:A:709:HOH:O	2.44	0.44
1:A:490:LEU:HA	1:A:490:LEU:HD12	1.58	0.44
1:A:128:MET:HB3	1:A:128:MET:HE3	1.90	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:152:ASP:HB3	1:A:155:ILE:HB	1.99	0.43
1:A:200:ILE:HD11	1:A:287:TYR:CG	2.53	0.43
1:A:129:ARG:HE	1:A:129:ARG:HB2	1.75	0.43
1:A:301:THR:HB	1:A:331:ILE:HG21	2.01	0.43
1:A:314:THR:OG1	1:A:315:LEU:N	2.52	0.42
1:A:204:PRO:HA	1:A:209:TYR:CD2	2.54	0.42
1:A:246:THR:CA	1:A:248:GLU:HG2	2.45	0.41
1:A:188:ARG:NH2	3:A:601:SO4:O4	2.53	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	377/544 (69%)	352 (93%)	21 (6%)	4 (1%)	14 20

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	245	SER
1	A	246	THR
1	A	428	GLN
1	A	494	GLY

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	273/470 (58%)	264 (97%)	9 (3%)	38 57

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	128	MET
1	A	245	SER
1	A	246	THR
1	A	247	GLU
1	A	267	GLU
1	A	366	SER
1	A	403	GLU
1	A	485	SER
1	A	490	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	B	11/18 (61%)	1 (9%)	0

All (1) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
2	B	6	G

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](#)

Of 2 ligands modelled in this entry, 1 is monoatomic - leaving 1 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. 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 $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	SO4	A	601	-	4,4,4	0.14	0	6,6,6	0.04	0

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	601	SO4	1	0

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	386/544 (70%)	0.12	10 (2%) 56 54	30, 63, 96, 116	0
2	B	12/18 (66%)	-0.28	0 100 100	53, 78, 94, 111	0
All	All	398/562 (70%)	0.10	10 (2%) 57 55	30, 63, 96, 116	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	269	LEU	5.7
1	A	419	TYR	3.5
1	A	266	ASN	3.3
1	A	276	TYR	2.7
1	A	126	GLY	2.4
1	A	417	PHE	2.4
1	A	427	TYR	2.3
1	A	125	ASN	2.2
1	A	444[A]	TYR	2.2
1	A	123	LYS	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](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	SO4	A	601	5/5	0.98	0.13	60,62,67,69	0
4	CL	A	602	1/1	0.99	0.11	52,52,52,52	0

6.5 Other polymers [i](#)

There are no such residues in this entry.