



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 11, 2024 – 02:43 AM EST

PDB ID : 3BJE  
Title : Crystal structure of Trypanosoma brucei nucleoside phosphorylase shows uridine phosphorylase activity  
Authors : Larson, E.T.; Merritt, E.A.; Structural Genomics of Pathogenic Protozoa Consortium (SGPP)  
Deposited on : 2007-12-03  
Resolution : 1.44 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](mailto: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>.

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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)  
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

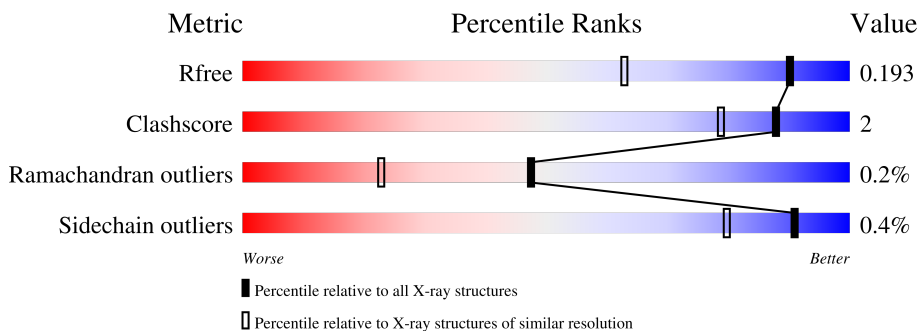
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.44 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	2021 (1.46-1.42)
Clashscore	141614	2086 (1.46-1.42)
Ramachandran outliers	138981	2047 (1.46-1.42)
Sidechain outliers	138945	2047 (1.46-1.42)

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  $\geq 3$ , 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  $\leq 5\%$ .

Mol	Chain	Length	Quality of chain
1	A	349	91% (green), 6% (yellow), 6% (grey)
1	B	349	88% (green), 6% (yellow), 6% (grey)

## 2 Entry composition i

There are 5 unique types of molecules in this entry. The entry contains 5601 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.

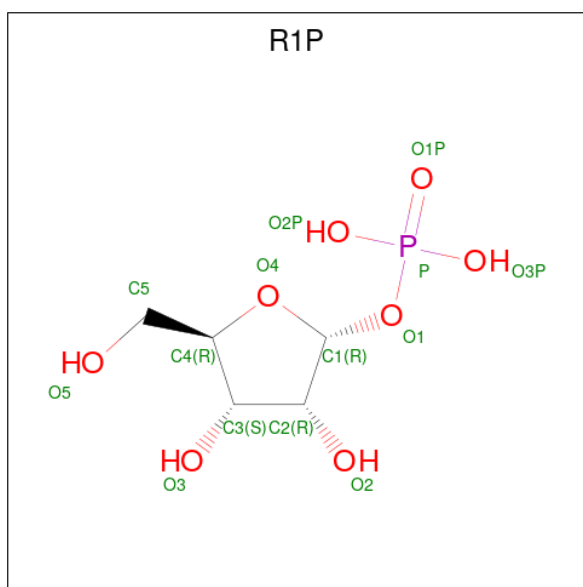
- Molecule 1 is a protein called Nucleoside phosphorylase, putative.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	327	2521	1568	450	484	19	0	5	0
1	B	327	2526	1573	444	489	20	0	8	0

There are 16 discrepancies between the modelled and reference sequences:

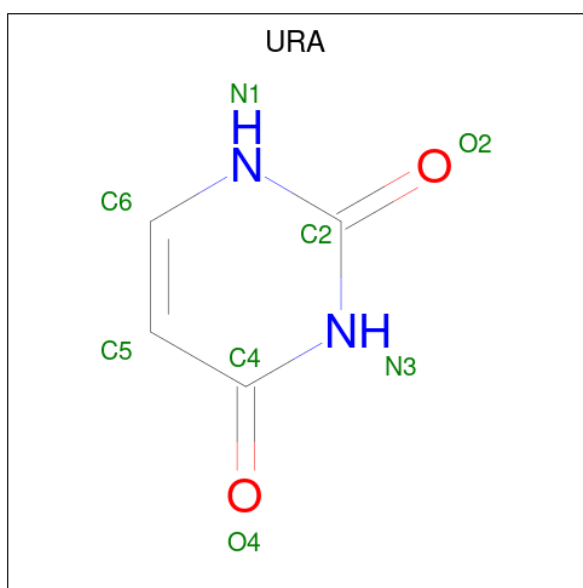
Chain	Residue	Modelled	Actual	Comment	Reference
A	-7	MET	-	expression tag	UNP Q57VZ2
A	-6	ALA	-	expression tag	UNP Q57VZ2
A	-5	HIS	-	expression tag	UNP Q57VZ2
A	-4	HIS	-	expression tag	UNP Q57VZ2
A	-3	HIS	-	expression tag	UNP Q57VZ2
A	-2	HIS	-	expression tag	UNP Q57VZ2
A	-1	HIS	-	expression tag	UNP Q57VZ2
A	0	HIS	-	expression tag	UNP Q57VZ2
B	-7	MET	-	expression tag	UNP Q57VZ2
B	-6	ALA	-	expression tag	UNP Q57VZ2
B	-5	HIS	-	expression tag	UNP Q57VZ2
B	-4	HIS	-	expression tag	UNP Q57VZ2
B	-3	HIS	-	expression tag	UNP Q57VZ2
B	-2	HIS	-	expression tag	UNP Q57VZ2
B	-1	HIS	-	expression tag	UNP Q57VZ2
B	0	HIS	-	expression tag	UNP Q57VZ2

- Molecule 2 is 1-O-phosphono-alpha-D-ribofuranose (three-letter code: R1P) (formula: C<sub>5</sub>H<sub>11</sub>O<sub>8</sub>P).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	O	P	0	0
			14	5	8	1		
2	B	1	Total	C	O	P	0	0
			14	5	8	1		

- Molecule 3 is URACIL (three-letter code: URA) (formula:  $C_4H_4N_2O_2$ ).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			8	4	2	2		
3	B	1	Total	C	N	O	0	0
			8	4	2	2		

- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total 1	Ca 1	0	0

- Molecule 5 is water.

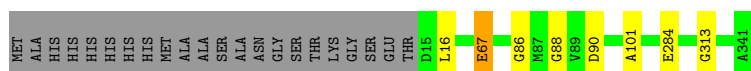
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	234	Total 238	O 238	0	4
5	B	267	Total 271	O 271	0	4

### 3 Residue-property plots


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: Nucleoside phosphorylase, putative

Chain A:  91% 6%



- Molecule 1: Nucleoside phosphorylase, putative

Chain B:  88% 6% 6%



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	63.02Å 95.39Å 63.48Å 90.00° 105.91° 90.00°	Depositor
Resolution (Å)	35.38 – 1.44 35.38 – 1.44	Depositor EDS
% Data completeness (in resolution range)	94.7 (35.38-1.44) 94.7 (35.38-1.44)	Depositor EDS
$R_{merge}$	0.08	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.34 (at 1.44Å)	Xtrriage
Refinement program	REFMAC refmac_5.2.0019	Depositor
R, $R_{free}$	0.155 , 0.184 0.164 , 0.193	Depositor DCC
$R_{free}$ test set	6072 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	14.8	Xtrriage
Anisotropy	0.314	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 44.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.018 for l,-k,h	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	5601	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	21.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.87% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: CA, URA, R1P

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	0.48	1/2572 (0.0%)	0.66	0/3468
1	B	0.50	1/2589 (0.0%)	0.68	0/3492
All	All	0.49	2/5161 (0.0%)	0.67	0/6960

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	67	GLU	CD-OE2	6.14	1.32	1.25
1	B	29	CYS	CB-SG	-5.04	1.73	1.81

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	2521	0	2537	7	0
1	B	2526	0	2542	16	0
2	A	14	0	0	0	0
2	B	14	0	0	0	0
3	A	8	0	3	0	0
3	B	8	0	3	0	0
4	B	1	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	238	0	0	0	0
5	B	271	0	0	2	0
All	All	5601	0	5085	20	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 2.

All (20) 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:B:32[A]:ASP:OD1	5:B:753:HOH:O	1.95	0.84
1:B:254[B]:MET:HE3	5:B:739:HOH:O	1.79	0.82
1:B:16:LEU:HD21	1:B:101:ALA:CB	2.14	0.77
1:A:67:GLU:HG3	1:A:86:GLY:HA3	1.74	0.69
1:B:16:LEU:HD21	1:B:101:ALA:HB1	1.73	0.69
1:B:67:GLU:HG3	1:B:86:GLY:HA3	1.80	0.63
1:A:67:GLU:HB3	1:B:67:GLU:HB3	1.81	0.62
1:B:16:LEU:HD21	1:B:101:ALA:HB2	1.82	0.61
1:A:16:LEU:HD21	1:A:101:ALA:CB	2.32	0.59
1:B:187:VAL:HG11	1:B:198:ILE:CD1	2.34	0.58
1:A:16:LEU:HD21	1:A:101:ALA:HB2	1.87	0.56
1:B:187:VAL:HG11	1:B:198:ILE:HD13	1.93	0.51
1:B:18:ILE:HG21	1:B:107:MET:HE3	1.95	0.49
1:B:212:CYS:SG	1:B:233:ILE:HD11	2.57	0.45
1:A:90:ASP:OD2	1:B:88:GLY:HA3	2.19	0.43
1:A:16:LEU:HD21	1:A:101:ALA:HB1	2.00	0.42
1:A:88:GLY:HA3	1:B:90:ASP:OD2	2.20	0.41
1:B:39:ILE:HG13	1:B:338:LEU:HD22	2.03	0.41
1:B:41:VAL:O	1:B:84:SER:HA	2.21	0.41
1:B:187:VAL:CG1	1:B:198:ILE:CD1	3.00	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	330/349 (95%)	322 (98%)	7 (2%)	1 (0%)	41	19
1	B	333/349 (95%)	325 (98%)	8 (2%)	0	100	100
All	All	663/698 (95%)	647 (98%)	15 (2%)	1 (0%)	47	23

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	313	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	273/284 (96%)	272 (100%)	1 (0%)	91	80
1	B	276/284 (97%)	275 (100%)	1 (0%)	91	80
All	All	549/568 (97%)	547 (100%)	2 (0%)	91	80

All (2) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	284	GLU
1	B	284	GLU

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](#)

Of 5 ligands modelled in this entry, 1 is monoatomic - leaving 4 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	URA	B	501	-	8,8,8	1.67	2 (25%)	9,10,10	2.80	5 (55%)
2	R1P	B	401	-	13,14,14	0.90	0	20,21,21	1.83	4 (20%)
2	R1P	A	401	-	13,14,14	0.84	0	20,21,21	1.63	4 (20%)
3	URA	A	501	-	8,8,8	1.82	3 (37%)	9,10,10	2.59	3 (33%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	URA	B	501	-	-	-	0/1/1/1
2	R1P	B	401	-	-	0/6/23/23	0/1/1/1
2	R1P	A	401	-	-	0/6/23/23	0/1/1/1
3	URA	A	501	-	-	-	0/1/1/1

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	501	URA	C2-N3	-2.73	1.32	1.37
3	B	501	URA	C4-N3	-2.55	1.34	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	501	URA	C5-C4	-2.29	1.38	1.43
3	B	501	URA	C6-N1	-2.05	1.32	1.36
3	A	501	URA	O2-C2	2.04	1.27	1.23

All (16) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	401	R1P	O1-C1-C2	5.84	116.60	106.72
3	B	501	URA	C4-N3-C2	-4.87	120.87	125.70
2	A	401	R1P	O1-C1-C2	4.86	114.95	106.72
3	B	501	URA	N1-C2-N3	4.60	120.35	115.13
3	A	501	URA	C4-N3-C2	-4.39	121.35	125.70
3	A	501	URA	N1-C2-N3	4.09	119.76	115.13
3	A	501	URA	C5-C4-N3	3.34	119.84	114.84
3	B	501	URA	O2-C2-N1	-2.96	119.54	122.79
3	B	501	URA	C5-C4-N3	2.70	118.88	114.84
2	B	401	R1P	O1-P-O1P	-2.67	99.10	109.39
2	A	401	R1P	O1-P-O1P	-2.49	99.77	109.39
3	B	501	URA	C6-N1-C2	-2.32	120.98	122.40
2	B	401	R1P	O4-C1-O1	2.26	113.66	109.18
2	A	401	R1P	O4-C1-O1	2.24	113.63	109.18
2	B	401	R1P	O4-C1-C2	-2.21	102.12	104.98
2	A	401	R1P	O3P-P-O2P	2.10	115.67	107.64

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

## 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.