



# Full wwPDB X-ray Structure Validation Report ⓘ

Jan 3, 2023 – 04:02 PM EST

PDB ID : 7TFZ  
Title : [T:Ag<sup>+</sup>/Hg<sup>2+</sup>:T<sup>-</sup>-(pH8.5-pH11; 5s)] Metal-mediated DNA base pair in tensegrity triangle grown at pH 8.5 and soaked in pH 11 for 5s  
Authors : Lu, B.; Vecchioni, S.; Seeman, N.C.; Sha, R.; Ohayon, Y.P.  
Deposited on : 2022-01-07  
Resolution : 6.13 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>.

---

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Xtriage (Phenix) : 1.13  
EDS : 2.31.2  
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) : 2.31.2

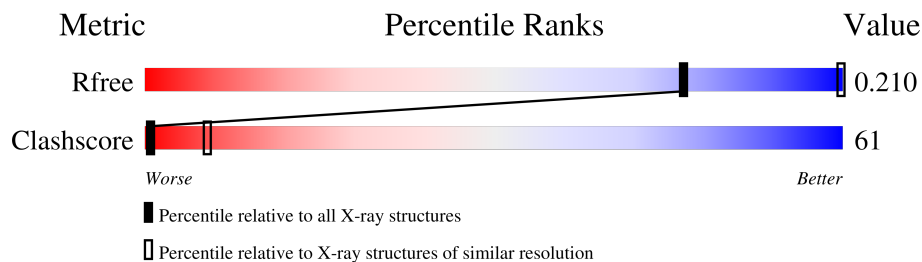
# 1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 6.13 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	1003 (8.40-3.88)
Clashscore	141614	1051 (8.30-3.90)

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	21	
2	B	7	
3	C	7	
4	D	7	

## 2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 858 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 DNA chain called DNA (5'-D(\*GP\*AP\*GP\*CP\*AP\*GP\*CP\*CP\*TP\*GP\*TP\*TP\*TP\*GP\*GP\*AP\*CP\*AP\*TP\*CP\*A)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
1	A	21	429	205	80	124	20	0	0	0

- Molecule 2 is a DNA chain called DNA (5'-D(P\*CP\*CP\*AP\*TP\*AP\*CP\*A)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
2	B	7	140	67	26	40	7	0	0	0

- Molecule 3 is a DNA chain called DNA (5'-D(P\*GP\*GP\*CP\*TP\*GP\*CP\*T)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
3	C	7	144	68	25	44	7	0	0	0

- Molecule 4 is a DNA chain called DNA (5'-D(P\*CP\*TP\*GP\*AP\*TP\*GP\*T)-3').

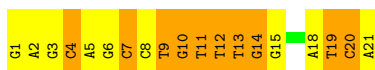
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	P			
4	D	7	145	69	24	45	7	0	0	0

### 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. 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.

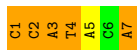
- Molecule 1: DNA (5'-D(\*GP\*AP\*GP\*CP\*AP\*GP\*CP\*CP\*TP\*GP\*TP\*TP\*TP\*GP\*GP\*AP\*CP\*AP\*TP\*CP\*A)-3')

Chain A:  10% 43% 48%



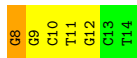
- Molecule 2: DNA (5'-D(P\*CP\*CP\*AP\*TP\*AP\*CP\*A)-3')

Chain B:  14% 14% 71%




- Molecule 3: DNA (5'-D(P\*GP\*GP\*CP\*TP\*GP\*CP\*T)-3')

Chain C:  29% 57% 14%



- Molecule 4: DNA (5'-D(P\*CP\*TP\*GP\*AP\*TP\*GP\*T)-3')

Chain D:  57% 43%



## 4 Data and refinement statistics

Property	Value	Source
Space group	H 3	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	107.22Å 107.22Å 85.27Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	38.74 – 6.13 53.61 – 5.85	Depositor EDS
% Data completeness (in resolution range)	70.2 (38.74-6.13) 58.3 (53.61-5.85)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	-0.81 (at 5.74Å)	Xtrriage
Refinement program	PHENIX 1.19.2_4158	Depositor
R, $R_{free}$	0.203 , 0.214 0.203 , 0.210	Depositor DCC
$R_{free}$ test set	34 reflections (5.44%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	156.6	Xtrriage
Anisotropy	1.511	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 377.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.46$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.059 for h,-h-k,-l	Xtrriage
$F_o, F_c$ correlation	0.88	EDS
Total number of atoms	858	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	440.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 13.06% 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](#)

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	1.83	14/481 (2.9%)	1.69	16/741 (2.2%)
2	B	1.93	3/156 (1.9%)	1.72	4/237 (1.7%)
3	C	1.14	0/160	1.29	1/245 (0.4%)
4	D	1.73	3/161 (1.9%)	1.60	5/245 (2.0%)
All	All	1.74	20/958 (2.1%)	1.62	26/1468 (1.8%)

All (20) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	3	DA	N9-C4	-11.61	1.30	1.37
4	D	1	DC	OP3-P	-10.74	1.48	1.61
1	A	19	DT	C1'-N1	8.40	1.60	1.49
1	A	11	DT	C3'-O3'	7.90	1.54	1.44
1	A	19	DT	C3'-O3'	7.75	1.54	1.44
1	A	10	DG	C3'-O3'	-6.71	1.35	1.44
2	B	2	DC	C3'-O3'	-6.58	1.35	1.44
1	A	18	DA	C3'-O3'	6.47	1.52	1.44
4	D	2	DT	C1'-N1	6.28	1.57	1.49
1	A	14	DG	N9-C4	6.11	1.42	1.38
2	B	3	DA	C5-C6	-6.08	1.35	1.41
4	D	7	DT	C3'-O3'	-6.02	1.36	1.44
1	A	14	DG	N3-C4	5.91	1.39	1.35
1	A	20	DC	C1'-N1	5.88	1.56	1.49
1	A	12	DT	C5'-C4'	5.83	1.57	1.51
1	A	18	DA	C5'-C4'	5.73	1.57	1.51
1	A	18	DA	P-O5'	5.43	1.65	1.59
1	A	12	DT	C3'-O3'	5.25	1.50	1.44
1	A	12	DT	O5'-C5'	5.19	1.55	1.42
1	A	13	DT	C4-C5	-5.01	1.40	1.45

All (26) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	4	DC	O4'-C4'-C3'	-8.75	100.75	106.00
4	D	7	DT	O4'-C4'-C3'	-8.13	101.12	106.00
1	A	12	DT	O5'-P-OP1	-8.00	98.50	105.70
1	A	12	DT	O4'-C4'-C3'	-7.91	101.25	106.00
2	B	7	DA	O4'-C1'-N9	7.89	113.52	108.00
1	A	7	DC	O4'-C1'-N1	7.43	113.20	108.00
1	A	13	DT	N3-C4-O4	7.20	124.22	119.90
4	D	3	DG	O4'-C1'-N9	7.07	112.95	108.00
2	B	2	DC	O5'-P-OP1	6.73	118.78	110.70
1	A	12	DT	O4'-C1'-N1	6.61	112.63	108.00
1	A	9	DT	N3-C4-O4	6.55	123.83	119.90
1	A	12	DT	C1'-O4'-C4'	-6.19	103.91	110.10
1	A	14	DG	N3-C4-N9	5.71	129.43	126.00
2	B	1	DC	C1'-O4'-C4'	-5.68	104.42	110.10
1	A	7	DC	C1'-O4'-C4'	-5.55	104.55	110.10
4	D	7	DT	C4'-C3'-C2'	-5.51	98.14	103.10
1	A	13	DT	C5-C4-O4	-5.46	121.08	124.90
3	C	8	DG	O4'-C4'-C3'	-5.45	102.32	104.50
1	A	19	DT	P-O3'-C3'	5.44	126.23	119.70
1	A	12	DT	P-O3'-C3'	5.35	126.12	119.70
1	A	9	DT	C5-C4-O4	-5.34	121.16	124.90
2	B	4	DT	N3-C4-O4	5.27	123.06	119.90
4	D	2	DT	N3-C4-O4	5.23	123.04	119.90
1	A	19	DT	N3-C4-O4	5.14	122.98	119.90
1	A	11	DT	O4'-C1'-N1	5.13	111.59	108.00
4	D	7	DT	OP1-P-OP2	-5.12	111.92	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	429	0	238	47	0
2	B	140	0	79	25	0
3	C	144	0	80	16	0
4	D	145	0	81	12	0

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	858	0	478	78	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 61.

All (78) 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)
4:D:6:DG:H2''	4:D:7:DT:H5''	1.30	1.07
1:A:13:DT:N3	2:B:3:DA:N1	2.18	0.89
1:A:12:DT:O4	2:B:4:DT:N3	2.16	0.79
2:B:7:DA:H1'	3:C:8:DG:H1'	1.65	0.78
1:A:4:DC:H2'	1:A:5:DA:C8	2.22	0.75
1:A:13:DT:H2''	1:A:14:DG:N7	2.06	0.70
1:A:13:DT:N3	2:B:3:DA:C2	2.59	0.69
4:D:5:DT:H6	4:D:5:DT:H5'	1.60	0.67
1:A:14:DG:H2''	1:A:15:DG:C8	2.30	0.66
1:A:13:DT:C4	2:B:3:DA:N1	2.63	0.65
1:A:12:DT:H2''	1:A:13:DT:H5'	1.78	0.65
1:A:8:DC:H5''	1:A:8:DC:H6	1.63	0.64
1:A:2:DA:H1'	1:A:3:DG:OP2	1.97	0.64
1:A:2:DA:OP2	1:A:2:DA:H8	1.81	0.64
1:A:10:DG:H2'	1:A:11:DT:C6	2.36	0.60
2:B:1:DC:C2	4:D:7:DT:N3	2.70	0.59
3:C:11:DT:H2'	3:C:12:DG:C8	2.38	0.59
2:B:1:DC:C4	4:D:7:DT:C4	2.91	0.58
1:A:1:DG:H2'	1:A:1:DG:N3	2.20	0.57
1:A:12:DT:O4	2:B:4:DT:C4	2.58	0.57
2:B:4:DT:C4	2:B:5:DA:C6	2.93	0.56
1:A:9:DT:H2'	1:A:10:DG:C8	2.41	0.56
1:A:3:DG:H2''	1:A:4:DC:O5'	2.05	0.54
1:A:1:DG:H3'	1:A:2:DA:C8	2.42	0.54
1:A:2:DA:H2''	1:A:3:DG:H8	1.73	0.54
1:A:20:DC:C2	1:A:21:DA:N7	2.75	0.54
1:A:20:DC:C2	1:A:21:DA:C8	2.96	0.53
2:B:3:DA:C6	2:B:4:DT:C4	2.95	0.53
1:A:12:DT:H2''	1:A:13:DT:C5'	2.39	0.53
3:C:8:DG:H2'	3:C:8:DG:N3	2.24	0.53
3:C:11:DT:H2''	3:C:12:DG:C5'	2.39	0.52
3:C:11:DT:H2''	3:C:12:DG:H5'	1.91	0.52
1:A:20:DC:H2''	1:A:21:DA:H5''	1.93	0.50

*Continued on next page...*



*Continued from previous page...*

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:5:DA:C4	1:A:6:DG:C8	3.01	0.49
4:D:2:DT:H2''	4:D:3:DG:C5'	2.42	0.49
2:B:1:DC:C4	4:D:7:DT:O4	2.66	0.49
2:B:3:DA:C2	2:B:4:DT:C2	3.01	0.48
1:A:12:DT:C6	1:A:13:DT:H72	2.48	0.48
1:A:8:DC:H5''	1:A:8:DC:C6	2.46	0.48
1:A:13:DT:H2''	1:A:14:DG:C8	2.47	0.48
1:A:11:DT:H2''	1:A:12:DT:OP1	2.15	0.47
1:A:13:DT:O4	2:B:3:DA:N1	2.48	0.47
3:C:8:DG:H2'	3:C:9:DG:C8	2.50	0.47
1:A:12:DT:C4	2:B:5:DA:C2	3.03	0.46
2:B:1:DC:N3	4:D:7:DT:C4	2.83	0.46
1:A:20:DC:H2''	1:A:21:DA:H8	1.81	0.46
1:A:7:DC:C2	1:A:8:DC:C5	3.04	0.45
2:B:3:DA:C5	2:B:4:DT:C4	3.05	0.45
4:D:5:DT:H5'	4:D:5:DT:C6	2.47	0.45
2:B:7:DA:C4	3:C:8:DG:H1'	2.52	0.45
2:B:7:DA:C2	3:C:8:DG:N3	2.85	0.45
1:A:21:DA:C2	4:D:3:DG:C2	3.05	0.45
1:A:15:DG:P	1:A:15:DG:H3'	2.57	0.44
1:A:8:DC:C2	3:C:9:DG:C2	3.05	0.44
1:A:2:DA:H2''	1:A:3:DG:C8	2.50	0.44
3:C:8:DG:N3	3:C:9:DG:C8	2.85	0.44
1:A:12:DT:H2'	1:A:13:DT:C7	2.48	0.44
1:A:6:DG:C4	1:A:7:DC:C6	3.06	0.44
1:A:13:DT:H6	1:A:13:DT:H2''	1.56	0.44
2:B:2:DC:H2''	2:B:3:DA:N7	2.32	0.44
3:C:9:DG:N2	3:C:10:DC:C2	2.86	0.43
1:A:14:DG:H2''	1:A:15:DG:H8	1.81	0.43
2:B:7:DA:N3	3:C:8:DG:H1'	2.34	0.43
4:D:3:DG:H1'	4:D:4:DA:C8	2.53	0.43
2:B:7:DA:C1'	3:C:8:DG:H1'	2.41	0.43
1:A:3:DG:H2''	1:A:4:DC:O4'	2.19	0.42
2:B:4:DT:H2''	2:B:5:DA:C5'	2.50	0.42
1:A:14:DG:C5	1:A:15:DG:C6	3.08	0.42
3:C:8:DG:C2	3:C:9:DG:C4	3.08	0.42
1:A:8:DC:C2	3:C:9:DG:N2	2.88	0.41
1:A:19:DT:H2''	1:A:20:DC:O4'	2.20	0.41
1:A:12:DT:O4	2:B:4:DT:O4	2.37	0.41
2:B:1:DC:H5'	4:D:7:DT:O3'	2.21	0.41
2:B:3:DA:C5	2:B:4:DT:C5	3.09	0.41

*Continued on next page...*

*Continued from previous page...*

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:13:DT:H2''	1:A:14:DG:C5	2.55	0.41
4:D:2:DT:O4'	4:D:2:DT:P	2.79	0.41
1:A:11:DT:C4	1:A:12:DT:H73	2.55	0.40
1:A:9:DT:N3	3:C:8:DG:N2	2.69	0.40

There are no symmetry-related clashes.

## 5.3 Torsion angles [i](#)

### 5.3.1 Protein backbone [i](#)

There are no protein molecules in this entry.

### 5.3.2 Protein sidechains [i](#)

There are no protein molecules in this entry.

### 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

There are no chain breaks in this entry.

## 6 Fit of model and data [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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

### 6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

### 6.3 Carbohydrates [i](#)

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

### 6.4 Ligands [i](#)

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

### 6.5 Other polymers [i](#)

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